Edinburgh Marina Granton Harbour Ltd

Edinburgh Marina
Volume 1: Environmental Impact Assessment Report

September 2018

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PREFACE

This Environmental Impact Assessment Report (EIAR) has been prepared under the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) ("the Marine EIA Regulations") and the Environmental Impact Assessment (Miscellaneous Amendments Relating to Harbours, Highways and Transport) Regulations 2017 ("the Miscellaneous EIA Regulations).

The proposed development is part of the Granton Harbour Regeneration Development; a development that was granted Outline Planning Permission (now Planning Permission in Principle) by City of Edinburgh Council in 2003 under planning application reference 01/00802/OUT, as detailed by the Report of Handling[1].

The proposed marine works associated with the wider Edinburgh Marina development comprise:

- Harbour dredging.
- Length of stone revetment to harbour;
- Length of vertical quay wall to harbour;
- Backfilling of land protected by quay wall and stone revetment;
- Formation of marina; and
- Extension to existing north mole breakwater.

This EIAR reports the findings of an Environmental Impact Assessment (EIA) which has been co-ordinated and written by EnviroCentre Ltd, with specialist input from the following consultants. All authors contributing to this EIAR are competent experts in the context of the EIA Regulations. Further information verifying the expertise of the project team is found within section 1.7 of this EIAR.

Table 1: Project Team

Project Role	Organisation/Consultant
Cameron Planning	Planning Consultant
EnviroCentre Ltd	EIA Co-ordination, Marine Ecology and Water Environment
Fairhurst Consulting Engineers	Project Engineering
DHI Water Environments (UK) Ltd	Wave Disturbance Modelling
Wilson+Gunn	Architect

This EIAR comprises the following elements:

- Volume 1: Environmental Impact Assessment Report
  - Providing a detailed description of the proposed development and its potentially significant environmental effects, detailing alternative options where applicable, reporting the findings of the EIA, as well as any proposed mitigation measures and providing other relevant background information
- Volume 2: Figures
  - Including figures and plans relating to individual chapters of Volume 1
- Volume 3: Technical Appendices
  - Containing detailed technical reports and baseline studies which act as background reports to Volume 1.
- Non-Technical Summary (NTS) – this provides an overview of the proposed development and summarises the findings of the EIA and any key mitigation measures proposed, in an easily accessible format;

[1] http://citydev-portal.edinburgh.gov.uk/idoxpa-web/files/00DB0FD94CC20316931B1A365C15AA5D/pdf/01_00802_OUT-REPORT_OF_HANDLING-3759387.pdf (accessed 17/04/2018)

The following documents have also been prepared to support the application. These form part of the overall submission, but they do not form a physical part of the EIAR:

- Applications for Marine Licences – these applications for dredging and construction in the marine environment are required to consent activities below Mean Low Water Springs (MLWS) and are accompanied by a Best Practicable Environmental Option (BPEO) appraisal;
- Pre-Application Consultation Statement, required under Regulation 7(b) of the Marine Licensing (Pre-Application Consultation) (Scotland) Regulations 2013 (Technical Appendix 1-1); and
- Planning Statement – providing an assessment of the development relative to Scotland's National Marine Plan (Technical Appendix 1-2).

Electronic copies of the NTS are available for free from the following contact, whilst digital copies of the full EIAR on disc can be obtained for £10.00. Full hard copies of the EIAR can be supplied for £500.00 per copy.

[Redacted]
Cameron Planning
29 East Argyle Street
Helensburgh
G84 7EJ

1 INTRODUCTION

1.1 Introduction

EnviroCentre has been appointed by Edinburgh Marina Granton Harbour Ltd in respect of Environmental Impact Assessment in relation to a proposed new development at Edinburgh Marina within the existing Granton Harbour, the location of which is indicated by Figure 1, contained within Volume 2 of this EIAR. This Environmental Impact Assessment Report (EIAR) comprises the written findings of the EIA process. The EIA has been prepared under relevant EIA legislation to accompany applications for marine construction and dredging and disposal licences

The relevant Regulations which underpin this EIAR are listed below and these are further discussed within section 1.4, and within Chapter 3: EIA Methodology and Scoping of this EIAR.

- The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) ('the Marine EIA Regulations'); and
- The Environmental Impact Assessment (Miscellaneous Amendments Relating to Harbours, Highways and Transport) Regulations 2017 (the 'Miscellaneous EIA Regulations').

The Marine Works Licence applications that this Environmental Impact Assessment Report relates to seek consent for the formation of a new marina comprising space for 340 vessels and associated facilities at Edinburgh Marina, Granton, via a Marine Licence Application for Construction Projects. The proposed development includes provision for reclamation, dredging, construction of a quay wall, pontoons and an extension to the existing breakwater. The associated marina facilities have the benefit of planning permission as noted in section 1.2 below. The dredging works included disposal at sea and are subject to a Marine Licence Application for Dredging and Sea Disposal.

Edinburgh Marina, Granton, is located approximately 4km to the north of the centre of Edinburgh Refer to Drawing No. The proposed marine works comprise the construction of a harbour quay wall, incorporating a 225m length of sloping masonry revetment wall and a 110m length of vertical sheet extension to an existing quay wall and associated backfilling; the laying out of a 340 berth marina including pontoon piles; construction of a 50m extension to existing north mole and harbour dredging. Accordingly, the EIAR is concerned with providing environmental evidence to support the marine licencing process. Full description of the proposed development is contained within Chapter 2: Proposed Development of this EIAR, with the regulatory context set out within section 1.4 and Chapter 3: EIA Methodology and Scoping.

1.2 Planning History and Need for the Proposed Development

As stated within the Edinburgh Local Development Plan (LDP) (2016), North Edinburgh has seen over 40 years of decline in industrial activity and port-related use of land. The redevelopment of the Edinburgh Waterfront will accommodate the city's growth needs, particularly for new housing. The Granton Harbour development has been designated within the LDP as a housing-led mixed use development on land owned by Forth Ports Limited and others.

The proposed development is part of the Granton Harbour regeneration development; a development that was granted Outline Planning Permission (now Planning Permission in Principle) by City of Edinburgh Council in 2003 under planning application reference 01/00802/OUT, as detailed by the Report of Handling[2].

The application was accompanied by an Environmental Statement (ES) produced by Robert Turley Associate on behalf of Forth Properties Ltd. The application was granted permission subject to a number of planning conditions including one requiring all Reserved Matters Applications to be submitted within 15 years from the date of permission, i.e. by June 2018. Since the original planning permission was granted, a series of revisions to the proposed site layout and development have remained as originally approved. As such, a number of Matters Specified in Conditions (MSC) applications, formerly Reserved Matters Applications, have been submitted and approved for various development plots, and some development plot approvals have already been implemented.

A Formal Screening Request was submitted by Cameron Planning for a Marine Licence application for the Marina Development and associated works: MSC planning permission was granted pursuant to the original permission in April 2017 for, *"the formation of a new Marina Office with associated retail and café space, and new community boat yard with associated dry stack".* Marine Scotland provided a Screening Opinion on the 16th October 2017 and concluded that the proposed works fall under paragraphs 1(e), 10(m), and 12(a) of Schedule 2 of the EIA Regulations and as such, an EIA must be carried out.

Marine Scotland provided a Screening Opinion on the 16th October 2017 and concluded that the proposed works fall under paragraphs 1(e), 10(m), and 12(a) of Schedule 2 of the EIA Regulations and as such, an EIA must be carried out.

The proposed marine works associated with the Granton Harbour development comprises:

- 225m length of stone revetment to harbour;
- 110m length of vertical quay wall to harbour;
- Backfilling of land protected by quay wall (c.1050m3) and stone revetment (c.5000m3);
- Formation of 340 berth marina;
- 50m extension to existing north mole breakwater; and
- Harbour dredging.

In discussion with Marine Scotland, a second screening request was submitted on the 28th November 2017. Marine Scotland provided a second Screening Opinion on the 5th February 2018 concluding that the proposed development is likely to have significant effects on the environment and therefore requires an EIA.

At a meeting with Victoria Bell and Louise Wilcox in Marine Scotland offices on 14th February 2018 advice was provided that the EIA should focus on the principal issues identified in the 5th February, 2018 EIA Screening Opinion, specifically sediment transportation and coastal processes alongside assessment work relative to the Habitat Regulations Appraisal process.

The EIA Scoping Report submitted to Marine Scotland on 10th April 2018 was based upon the Screening Opinion and subsequent Marine Scotland advice and set out the proposed EIA methodology upon which we requested a formal notification from Marine Scotland within a five week time period as specified under regulation 14 (7) of the EIA Regulations.

An EIA Scoping Opinion was issued on 14th June 2018 with detailed information provided in the specialist topic sections. The Scoping opinion scoped in the following:

- Marine Ecology – Mammals & Non Native Species

[2] http://citydev-portal.edinburgh.gov.uk/idoxpa-web/files/00DB0FD94CC20316931B1A365C15AA5D/pdf/01_00802_OUT-REPORT_OF_HANDLING-3759387.pdf

- Water Environment & Coastal Processes – Waves
- Water Environment & Coastal Processes – Sediment Transport
- Water Environment & Coastal Processes – Water Quality
- Marine Ecology - Otters
- Marine Ecology – Ornithology
- Noise (marine)
- Major Accidents
- Cumulative Assessment
- Navigation

For further details of the Marine Scoping Opinion, refer to Chapter 3.

This EIAR sets out the environmental studies and assessment undertaken to provide an examination of the likely significant effects

1.3 The Applicant

Edinburgh Marina Granton Harbour Ltd are progressing the Marina development which will regenerate and restore Granton to a dynamic and inspiring place to live, work and visit, while returning it to being a jewel in Scotland's historic coastline.

1.4 Regulatory Context

The continued management and development of the Edinburgh Marina area is subject to European and national legislation of which the following is the principal legislation relevant to the current development programme:

- The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017
- The Marine (Scotland) Act 2010 (Marine Licences) – to be consented by Marine Scotland for the deposit or removal of a substance or object below the mean high water springs mark.

Marine (Scotland) Act 2010.

Under Section 20(1) of the Marine (Scotland) Act 2010 (from 0 -12nm), a marine licence from Scottish Ministers is required if organisations intend to carry out certain acts in the Scottish marine area.

Marine licences are required for the construction works, the deposit of the pontoons, the dredging and the deposit of dredge spoil (sea disposal).

Chapter 3: EIA Methodology and Scoping discusses how the views of all consultees have been factored into assessment, as well as in more detail within each individual chapter. Each chapter discusses those impacts which are related to the marine environment, to the terrestrial environment, or both.

1.5 Objectives and EIA Context

The purpose of an EIA is to identify and evaluate the likely significant effects of a proposed development on the environment and to identify measures to mitigate or manage any significant adverse effects before a planning application or marine licence is determined. The EIA process provides an opportunity to 'design out' adverse effects wherever possible. Where adverse effects cannot be designed out, mitigation measures can be proposed to avoid, compensate or reduce significant environmental effects to an acceptable level. EIA is an iterative

process which allows feedback from stakeholder consultation and the results from baseline studies to be fed into the design process of the development.

The EIA carried out in relation to the proposed development has been undertaken by specialist environmental and technical consultants on the basis of project information supplied by the Applicant and their engineers and following consultation with statutory consultees, other bodies and members of the public.

The objectives of the EIAR are:

- To establish a robust environmental baseline upon which to base environmental assessment, incorporating field surveys, desk study and consultation;
- To provide an assessment of the potential environmental impacts of the proposed development and to determine which of these, if any, are likely to result in a significant effect on the receiving environment; and
- Where significant effects are predicted, to determine mitigation measures to reduce the residual effects to acceptable levels.

The results and findings of the EIA are presented in this EIAR. The environmental information presented is derived through a systematic process of identification, prediction and evaluation of the likely significant environmental effects of the proposed development.

Schedule 4 of the Marine EIA Regulations requires that the following information is provided:

- A description of the location of development, its physical characteristics and land-use requirements during construction and operation;
- A description of the main characteristics of the operational phase of the development;
- An estimate of residues and emissions produced during the construction and operation phases;
- A description of reasonable alternatives, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects;
- A description of the relevant aspects of the current state of the environment and an outline of the likely evolution thereof without implementation of the development as far as reasonable;
- A description of environmental receptors likely to be significantly affected by the development;
- A description of the likely significant effects of the development on the environment;
- A description of the forecasting methods or evidence used to identify and assess the significant effects;
- A description of the measures envisaged to mitigate significant effects;
- A description of expected significant adverse effects deriving from the vulnerability of the development to risks of major accidents and/or disaster; and
- A non-technical summary of the aforementioned information.

This EIAR meets these requirements within each technical chapter, with the primary description of development comprising Chapter 2: Proposed Development, and a description of how the EIA Regulations have been addressed within Chapter 3: EIA Methodology and Scoping.

1.6 Key Terms

To ensure clarity and consistency through the EIAR, the following key terms have been used:

- **'the proposed development'** refers to the construction of the proposed development as described in Chapter 2: Proposed Development;
- '**the site'** is the land and sea bound by the red-line boundary in which the proposed development lies, and is illustrated within Drawing No. SK112C and 770288-001 within Volume 2 of this EIAR;

- The **'Study area'** is the area over which desk based or field assessments have been undertaken and are identified within each chapter. The core study area varies depending on the nature of the potential effects within each discipline, as informed by professional guidance and best practice regarding EIA. All of the core study areas cover the site, and are described within the methodology section of the relevant chapters within this EIAR.
- **Environmental Clerk of Works (EnvCoW)** is an environmental or construction professional with direct responsibility for monitoring environmental compliance with planning consents, environmental permits, legislation and mitigation.
- **Ecological Clerk of Works (ECoW)** is a fundamental role on sites where ecological receptors are potentially affected by development. An ECoW should only be appointed when specifically referring to an ecologist, as the term does not include references to other environmental specialists, such as hydrologists, landscape architects, archaeologists, geologists, etc.
- **Operational activities.** During the operational phase of the marina, there will be an increase in vessel traffic, mooring activities, and use of the marina facilities which is a potential source of noise. However, the site is already subject to high levels of human activity and boat traffic which has resulted in many species becoming habituated to this kind of disturbance.
  Operational activities could also include vessel refuelling and storage of Oil, Fuel, Site Vehicle Use and Storage
- **Maintenance activities.** Maintenance activities refer to routine day to day maintenance works that will be required within the marina and associated equipment, and could include maintenance dredging.

1.7 The Project Team

The EIAR has been undertaken by a team of competent experts as per Regulation 6(5) of the Marine EIA Regulations and Regulation 3, Schedule 1, 3(f)(i) of the Miscellaneous EIA Regulations. As per the EIA Regulations, the EIA Report is accompanied by a statement outlining relevant expertise or qualifications sufficient to demonstrate this is the case.

Accordingly, Table 1.1 details those with responsibility for undertaking this EIA Report, along with their relevant qualifications and expertise.

Table 1-1: Competent Expertise

Item / Role	Lead Author and Reviewer	Number of years' experience	Qualifications and Professional Memberships
Inputs to EIA Process			
EIA Project Manager / Co-ordinator	[Redacted]	19	BSc (Hons) (First Class), PhD, Chartered Member of the Institute of Logistics and Transport (CMILT), Member of the Institution of Environmental Sciences (MIEnvSc)
EIA Reviewer	[Redacted]	17	BSc, MSc, Fellow of the Geological Society Chartered Scientist (CSci)
Engineering Input	[Redacte	30	BSc, Chartered Engineer, Member of the Institution of Civil Engineers
Volume 1: Environmental Impact Assessment Report			
Chapter 1: Introduction	[Redacted]	19	BSc (Hons) (First Class), PhD, Chartered Member of the Institute of Logistics and Transport (CMILT), Member of the
Chapter 2: Proposed Development			

Item / Role	Lead Author and Reviewer	Number of years' experience	Qualifications and Professional Memberships
Chapter 3: EIA Methodology and Scoping			Institution of Environmental Sciences (MIEnvSc)
Chapter 4: Water Environment	[Redacted]	7	BSc, MSc
	[Redacted]	20	BEng, PhD, Member of the British Hydrological Society
Chapter 5 Ecology	[Redacted]	19	BSc (Hons), Member of the Association of Environmental and Ecological Clerks of Work (MAEECoW)
	[Redacted]	13	BSc (Hons), MSc Associate Member of Chartered Institute of Ecology and Environmental Management (ACIEEM)
	[Redacted]	4	BSc (Hons), Member of the Chartered Institute of Ecology and Environmental Management (MCIEEM)
	[Redacted]	19	BSc (Hons) (First Class), PhD, Chartered Member of the Institute of Logistics and Transport (CMILT), Member of the Institution of Environmental Sciences (MIEnvSc)
	[Redacted]	32	BSc (Hons), MSc (Distinction), Vice President for Scotland of the Chartered Institute of Ecology and Environmental Management, Fellow of The Chartered Institute of Ecology and Environmental Management (FCIEEM), Chartered Ecologist (CEcol),
Chapter6: Other Issues	[Redacted]	19	BSc (Hons) (First Class), PhD, Chartered Member of the Institute of Logistics and Transport (CMILT), Member of the Institution of Environmental Sciences (MIEnvSc
Chapter 7: Schedule of Mitigation			
Chapter 8: Conclusions			

1.8 Structure of the EIAR

The EIAR is presented within three volumes, which are set out within Table 1-2:

Table 1-2: Structure of the ES

Item	Description	Author
Volume 1: Environmental Impact Assessment Report		
Chapter 1: Introduction	This chapter sets the context for the EIA and introduces the development in a broad context	EnviroCentre
Chapter 2: Proposed Development	This chapter sets out the development description upon which the environmental assessment is based, as well as examining design and alternatives considered.	EnviroCentre (Engineering design by Fairhurst)
Chapter 3: EIA Methodology and Scoping	This chapter introduces the EIA methodology by which the proposed development was designed, along with an outline of how the EIAR has responded to comments throughout Scoping and consultation.	EnviroCentre
Chapter 4: Water Environment	Chapter 4 assesses the impact of the proposed development upon the water environment, including water quality and pollution, coastal processes and wave modelling.	EnviroCentre, (Wave Disturbance Modelling inputs by DHI Water Environments (UK) Ltd
Chapter 5: Ecology	This chapter assesses effects upon marine ecology from engineering works in the water environment, and is informed in part by underwater noise modelling.	EnviroCentre
Chapter 6: Other Issues	This chapter covers areas of the environment which are important to note but have not been identified as having potentially significant effects throughout the Scoping process (as detailed within Chapter 3: EIA Methodology and Scoping). These include socio-economics, population and human health, utilities and recreation.	EnviroCentre with input from the Applicant
Chapter 7: Cumulative Effects	This chapter addresses the cumulative effect of the proposed development	EnviroCentre
Chapter 8: Schedule of Mitigation	This chapter sets out a summary of all mitigation measures proposed within the EIAR within a schedule which can then be used to inform planning conditions and/or a construction environmental management plan (CEMP).	EnviroCentre with input from the Applicant
Chapter 9: Conclusions	This chapter summarises the key findings of the EIAR, discusses CEMP principles, and provides a Statement of Significance in relation to the proposed development.	EnviroCentre
Volume 2: Figures	This volume provides the figures relevant to each chapter within Volume 1 and is provided as a standalone volume to aid comparative assessment.	All

Item	Description	Author
Volume 3: Technical Appendices	This volume provides the relevant technical background papers and studies which have informed each chapter.	All
Non-Technical Summary (NTS)	The NTS provides an overview of the proposed development, and summarises the findings of the EIAR in an understandable and easy to read format.	All

The following documents have also been prepared to accompany the application, which do not form part of the EIAR but are nevertheless associated with it.

- **Applications for Marine Licences** – these applications for dredging and construction in the marine environment are required to consent activities below Mean Low Water Springs (MLWS) and are accompanied by a Best Practicable Environmental Option (BPEO) appraisal.
- **Pre-Application Consultation Report** –fulfilling statutory requirements in this regard (Technical Appendix 1.1; and
- **Planning Statement** – Consideration of Scotland's National Marine Plan (Technical Appendix 1.2).

2 PROPOSED DEVELOPMENT

2.1 Site Description

This chapter sets out the details of the proposed development upon which this EIAR is based. It is supplemented by Figure A-P-00-G7-005 H within Volume 2 of this EIAR which illustrates the site layout

The information within this chapter has been supplied by the project team and prepared by EnviroCentre.

2.1.1 Site Location and Description

At present, the site comprises predominantly reclaimed land from the sea, consisting of vacant brownfield land which is scheduled for development under the approved 2003 masterplan and a number of subsequent Matters Specified in Conditions (MSC) permissions. The overall topography of the surrounding area is generally flat, with the proposed marine works development situated at the edge, and within the extents of the harbour.

Edinburgh Marina sits within the Granton Harbour regeneration development area, approximately 4km north of Edinburgh City Centre and fronting the Firth of Forth. It is approximately 9.5Ha, bounded to the north by the Western Breakwater, to the east by the Eastern Harbour and to the south by wider regeneration proposals and developments. The nearest residential development is situated on Merlin Avenue, approximately 90m south of the proposed development.

Within the wider area there is a combination of brownfield land, commercial/industrial and residential premises, which will be developed as part of the Granton Waterfront Development. Granton Waterfront is split into four development quarters of (1) Central Development Area, (2) North Shore, (3) Forth Quarter, and (4) Granton Harbour.

2.1.2 Historic Granton Harbour

Granton forms part of Edinburgh's waterfront along the Firth of Forth, and is historically, an industrial area having a large harbour. Granton Harbour was first constructed in the late 1830's, and has since had a number berths constructed over the intervening 180 years. The berths were protected from the waves in the Forth Estuary by the construction of the West and East Breakwaters. Figure 2-1 illustrates the number of berths and dredged pockets within the west harbour by 1937. The West Harbour has been steadily reclaimed since trade through the berths declined.

2.1.3 Existing Use

Granton Harbour lies on the Firth of Forth, about a 1.6km west of Newhaven and 4km north of Edinburgh city centre. Edinburgh Marina is a jointly occupied by two yacht clubs, The Royal Forth Yacht Club and Forth Corinthian Yacht Club.

There are presently 110 moorings in the harbour, plus room for 30 visitors on the pontoons, a total of 140 spaces. Currently around 100 yachts use the East Harbour, which is out with the proposed development area.

Access is currently available for local residents and visitors to only part of the Middle Pier, and the Eastern Breakwater. The redevelopment will greatly enhance access, with safe well-lit routes the complete length of the Middle Pier, both east and west breakwaters, the quaysides to the east and west Harbour.

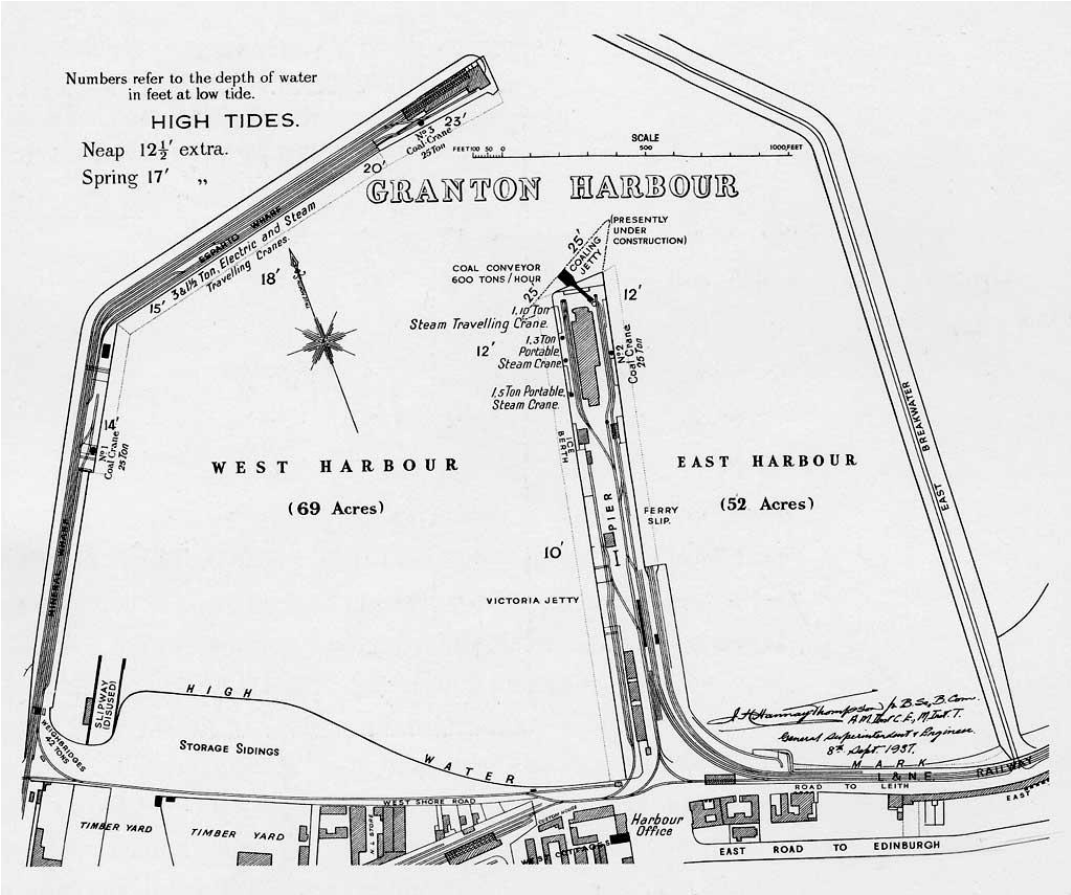


Figure 2-1 Granton Harbour Historic Plan[3]

2.1.4 Granton Harbour Today

The key features and extent of Granton Harbour are illustrated in Figure 2-2 below and show the extent of the current land reclamation and development west of Middle Pier.

Figure 2-2 Granton Harbour Site
(Source: Google Earth Pro)

[3] ARUP (2015). Granton Harbour Development, Preliminary Marine Engineering Desk Study Assessment

The Arup *Preliminary Marine Engineering Desk Study Assessment* (February 2015) indicates that the south boundary of the current west basin is formed by a vertical sheet pile wall constructed to retain reclaimed land. The west boundary is formed by a non-engineered, informal fill slope which lies at a varying angle along its length. The fill slope is over-steepened near the ground surface level suggesting undercutting under wave action during storm events.

The north boundary is formed by the existing listed Western Breakwater structure. This breakwater structure was upgraded during the development works in the mid-2000s. The aim of the upgrade was to strengthen the structure and provided protection to the planned adjacent property development from tidal flooding from overtopping of waves in extreme north westerly storm events.

The extreme eastern end of the Western Breakwater is known as the North Mole.

2.1.5 Physical information

The harbour lies in the Forth Estuary tidal area and is subject to variations from tidal waters. The Fairhurst Report "*Edinburgh Marina –Feasibility Study for extension of North Revetment Wall Inception Report (May 2015)*" states that Granton is a Secondary Non-Harmonic port. The tide type is Semi-Diurnal. Predictions based on Leith which is a standard port.

The Arup *Preliminary Marine Engineering Desk Study Assessment* (February 2015) indicates that siltation rates in Granton Harbour can be reasonably significant, on the order of 300mm and 500mm. Studies indicate annual sedimentation to be on the order of 0.75m/yr. However, sedimentation depends strongly on the type and dimensions of the structure used for wave protection, so the sedimentation rate may change when the new structure is built.

The historic deep area at Granton Harbour, referred to as the access channel, coincides with the area where the breakwater requires to be extended. The future dredging level is indicated at – 2.5m CD but due to the likely rate of sedimentation Arup recommended this to be -3.5m CD.

2.1.6 Geology

The typical geology of Granton Harbour consists of soft alluvial silts overlying stiff glacial till which overlies bedrock comprising inter-bedded strata of sandstone and mudstone. The levels of the top of the glacial till strata are consistently between -5.5mOD to -6.5mOD, except in the locations near the former wharves where the glacial till deposits have been dredged to a greater depth (around -10mOD) to form berth pockets to accommodate the types of ships that utilised the facilities (Arup, 2015).

A number of boreholes have been drilled to a sufficient depth to prove the underlying rock. The depths to rock vary considerably across the site, ranging from -6.5mOD to -20mOD.

2.2 Description of the Proposed Development

2.2.1 Need for the Proposed Development

The wider Granton Waterfront Development is a 60-acre development along the Firth of Forth comprising 1,800 homes, 186-bed spa hotel and 18,500sq/m retail, leisure and commercial space and a 340-berth marina. The new Edinburgh Marina development will include a wide range of high-end leisure and accommodation facilities, situated adjacent to Edinburgh's first ever purpose-built luxury marina.

Edinburgh Marina has been designed to surpass the 5 Gold Anchors rating of the Yacht Harbour Association. Once operational, the marina will offer 340 full-serviced berths, with visitor berths and additional dry berths for boats up to 30m in length. Edinburgh Marina will offer 24 hour access to the sea. Marine services and an extensive chandlery will be located in the new marina office sited within the fully equipped new boatyard. The marina has been designed to accommodate the full-size range of yachts and cruisers, including some of the largest of the world's superyachts – the first time this has been possible on Scotland's east coast.

Development associated with the proposed marina element of the Granton Harbour Regeneration Scheme, comprises the construction of a harbour wall, incorporating a 225m length of sloping masonry revetment wall and a 110m length of vertical sheet extension to existing quay wall and backfilling; the laying out of a 340 berth marina; construction of an extension to existing north mole and harbour dredging. Figure 2 contained within Appendix A provides the Masterplan layout for the Granton Harbour Regeneration Scheme. These elements benefit from the original outline planning permission, with the adjoining boatyard and marina office now having detailed planning permission. There are currently, (September 2018) further applications in relation to the marina office and boatyard and also the aparthotel and public realm works to the north of that development; these are pending determination.

The proposed development is the redevelopment of the existing harbour area to accommodate a new marina.

2.2.2 Summary of Component Parts

The proposed development encompasses four aspects of the marine works:

Harbour Dredging – To ensure efficient operation of the existing harbour, the harbour bed needs to be dredged to the required depth. The potential for environmental impact during dredging works and as part of sea disposal of sediment material will be addressed as part of the Marine Scotland Dredging Licence Application and the supporting Best Practicable Environmental Option (BPEO) Report.

As part of the separate Marine Scotland Licence application, a Sediment Risk Assessment will be undertaken along with a BPEO assessment for the dredging and disposal associated with the Edinburgh Marina Project (Refer to Drawing No. 115875/0101 in Volume 2 of this EIAR).

Quay Wall Works – the existing quay wall is dilapidated and poorly defined. The proposed quay wall works aims to formalise the water/land margin, providing the public with context to this area of wider regeneration development. The location and extent of the proposed quay wall and revetment works are demonstrated in Drawing 115875/021 contained within Volume 2 of this EIAR. The northern section of the works will reconstruct the sloping masonry revetment, maintaining the connection to the existing northern breakwater, and will be 225m in length. The southern section of the works will comprise of a vertical quay wall with associated sheet piling that will be 110m in length and situated adjacently to the proposed boatyard.

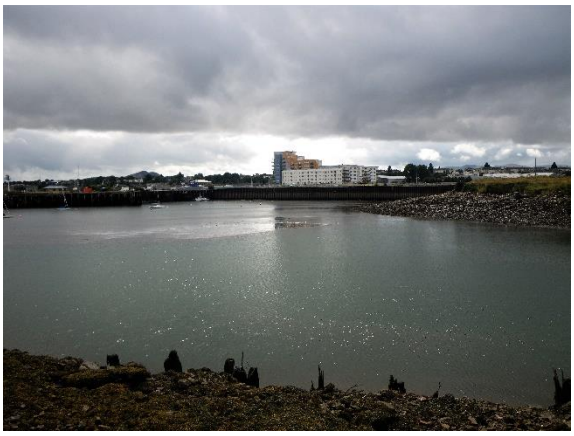
From the original planning application that was granted planning permission in principle in 2003, there is to be an area of backfill to the west of the revetment and quay wall. This will form the public realm associated with the new hotel and serviced apartments on Plot 35 of the masterplan (The current planning application reference is 17/05306/AMC). The material to be used to backfill the quay wall has been previously stockpiled on site, and the site to the west and south-west will be regraded to form the approved surface finish levels.

North Mole Extension – Granton Harbour is a long-established harbour which is protected by an existing sea wall to the north. Drawing 115875/0027, contained within Volume 2 of this EIAR, demonstrates the spatial relationship within the site boundary. The proposed marine works comprise further extension to the existing North Mole structure in order to better protect the harbour mouth from excessive wave action. The proposed linear extent of the North Mole extension is 50m. The extension will be vertical faced on the harbour side and

sloping masonry on the seaward side as illustrated in Drawing 115875/0027, contained within Volume 2. A method statement for the North Mole Extension is contained within Volume 3, Technical Appendix 2.1 of this EIAR. The north mole is a partially Listed Building, at its western extremity, and as such, any works to this section require to be considered under Listed Building Regulations. It is understood that any works proposed to this western section will fall under repairs and maintenance to the existing structure.

New Marina – The proposed marina comprises 340 number of berths of different sizes to accommodate varying sized vessels, the proposed layout as detailed by Figure A-P-00-G7-005H, contained within Volume 2 of this EIAR. The linear extent of the berth is 4,407m and the marina development will extend approximately 32.1% of the available useable water area within the harbour. The marina area will extend to approximately 22,879m^2. The marina will be formed through a series of floating berths and pontoons that will rise and fall with the tide (Refer to Drawing No. 115875-0001-A and A-P-00-G7-005H within Volume 2: Figures of this EIAR).

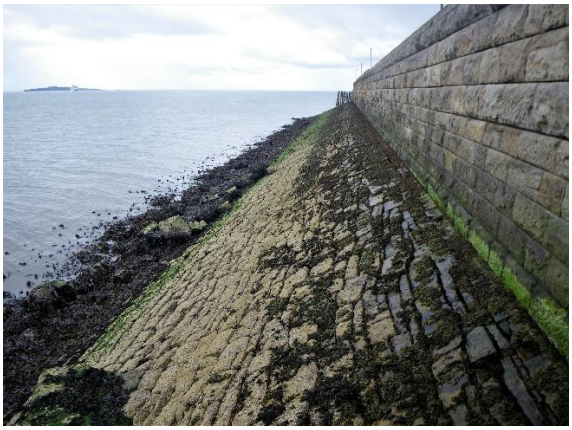
At present, methods of construction and their timing are not formalised in detail. To ensure that risks of adverse impacts are identified and kept to acceptable limits, construction management plans will be a requirement within construction contracts for individual developers.



Edinburgh Marina from North Mole looking south

Edinburgh Marina – Looking towards North Mole

North Mole – Harbour Side

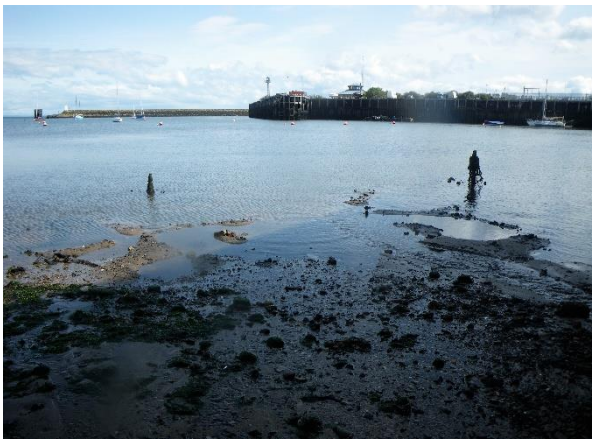


North Mole – Firth of Forth Side

Location of Western Revetment from North Mole

North Mole from the Proposed Revetment

Southern Quay Wall looking east to Middle Pier



Looking east towards Middle Pier

2.3 Construction Methodology

Fairhurst were commissioned by Granton Central Developments Ltd to prepare a high level civil engineering statement[4] setting out the likely method of construction and various aspects of civil engineering works to support the development and provide protection for Edinburgh Marina and Granton Harbour. These comprise an extension to the North Mole breakwater, an internal quay wall and an internal harbour revetment. General layout arrangements are demonstrated on Drawing No's. A-P-00-G7-005H and 115875-0100 within Volume 2: of this EIAR (Refer also to Technical Appendix 2-1: Civil Engineering Method Statement).

2.3.1 Assumptions

Typical geology of Granton Harbour consists of soft alluvial silts overlying stiff glacial till which overlies bedrock comprising inter-bedded strata of sandstone and mudstone. Detailed Geotechnical Investigation is required to inform the detailed design. This will be provided to the Contractor to inform the Temporary Works design as required.

A Bathymetric Survey of the current bed levels has been carried out to inform the design, identify the current extent of dredging and inform the construction methodology (Refer to Technical Appendix 4.1). The methodology may vary depending on the preferred approach of the Contractor, the availability of marine plant and the

[4] Fairhurst, Edinburgh Marina Civil Engineering Method Statement North Mole Extension, Inner Revetment and Quay Wall 14th September 2018

comparative cost of temporary works. However, this statement is considered to be a reasonable and practical approach to the Works that highlights the likely interface with the Forth.

2.3.2 Dredging

The typical geology of Granton Harbour consists of soft alluvial silts overlying stiff glacial till which overlies bedrock comprising inter-bedded strata of sandstone and mudstone (Arup, 2015).

It is anticipated that dredging works will be undertaken during the early stages of construction. However, conditions and circumstances may dictate that some will occur in later in the construction programme and so options for phasing of these works will be clarified once a contractor has been appointed.

Sediment sampling was undertaken in November 2017 and discussions have been ongoing with Marine Scotland since this time regarding the various options available due to the presence of some contaminants of concern in exceedance of Revised Action Level 2. Sediments sampled within the proposed dredge area are reported as primarily silt.

With reference to the Granton Harbour Dredging 2018; Best Practicable Environmental Option Report (EnviroCentre Document Number 8192 (June 2018)), dredging will be undertaken within the western harbour to facilitate the development of the proposed marina.

Based on the dredging plan for the harbour volume split is as follows based on chemical quality (Table 2-1).

Table 2-1: Dredge Volumes

Dredge	Volume (m^3)	Comment
Total Dredge Nett Volume	241,365	Total proposed dredge volume
Dredge Volume for Areas for surface to 1.2m Dredge	86,980	Proposed for Sea Disposal
Dredge Volume from below 1.2mto base of dredge plus Area around VC8 & VC9 with Shallow Contamination	154,385	Land Based Disposal Options
Total Infill (Nett) Volume	19,322	

Multiple contaminants of concern were recorded above Revised Action Level1 including

- Metals
- PAHs
- PCBs
- Petroleum Hydrocarbons

Mercury was recorded in exceedance of Revised Action Level 2 in multiple locations.

Further review of the information and discussion with a view to segregating the material with exceedances above REV AL2 was undertaken and communicated with Marine Scotland. The key points being that if all material with mercury concentrations >RAL2 are excluded for sea disposal i.e. the material is dredged to a fixed depth of 1.6m the average concentration is 1.06 mg/kg which is also <RAL 2.

On this basis, it was proposed that the upper 1.2m of material would be dredged, excluding a large buffer around VC 8 and VC9 where shallow mercury contamination was also encountered with a view to disposing this material at sea on the basis that sufficient supporting evidence could be provided to justify this in the presence of REV AL1 exceedances. All remaining material would be taken to land for a land based disposal solution.

2.3.2.1 Backhoe Dredger

At the moment of writing it is advised, by Fairhurst Consulting Engineers, that Backhoe dredging will be utilised to effectively remove 'stiffer' consolidated material, as well as boulders and weathered/weaker rock outcrop and

looser material will be dredged directly from the seafloor by the BHD. The dredged material would be deposited on a separate barge which would transport the dredged material to the reclamation and disposal area.

Figure 2-3 shows the typical backhoe dredger arrangement with a long reach excavator positioned on a barge; it also shows the self-propelled disposal barge that is used to take the dredged material to the disposal ground.

The dredging barge is stabilised on spud legs, so it does not require anchors and can be easily and rapidly moved.

Where it is not possible to reuse dredged materials elsewhere in the works, material will be disposed of at an approved disposal at sea site.

Figure 2-3 Typical Backhoe Dredger

2.3.3 Quay Wall Construction

2.3.3.1 Description

On the west side of the marina basin, a quay wall is to be formed. This will be a continuation of the existing quay wall along the south boundary. The proposed form of construction is a tied sheet pile wall with insitu reinforced concrete capping beam with metal parapet. The form of construction will be similar to the existing.

2.3.3.2 Construction Methodology

The wall is formed from driven sheet piles. The existing sheet pile wall was installed from a barge and it is likely that the same methodology would be used for the additional length of wall. A barge would be positioned at high water and stabilised on jack up legs. From this platform, the sheet pile wall can be installed tying into the existing wall. Individual sheet pile sections are lowered vertically into the sea bed, interlocked with the adjacent pile sections. Piles are usually driven to staged depths to maintain the continuity and allow adjustments. After being driven to full depth, the top of the piles are cut off to the design level. At this stage, the piles will be free standing but not capable of being backfilled. Ties will be installed between the piles and a secure anchorage point on shore. These will be buried reinforced concrete blocks that will resist the thrust from the wall when it is backfilled.

The wall will be backfilled with suitable material available from elsewhere on the site. The top of the wall is completed by a reinforced concrete capping beam that is cast in-situ to tie the top of the piles together. It will also support to the metal pedestrian parapet that will provide edge protection.

2.3.4 North Mole Extension

2.3.4.1 Form of Construction

The North Mole extension requires a vertical internal face for a length of 50m to maximise space available for the marina. An inclined seaward face of rock armour will provide protection from wave action. Several forms of construction are possible for this structural layout but it is anticipated that a reinforced concrete wall would be formed, resting on the seabed with a natural rock faced revetment to the seaward side. The Reinforced concrete wall would be assembled from hollow pre-cast concrete boxes that can be filled on site with concrete and or ballast rock. The concrete wall will extend for 50m, beyond which a 25m rock revetment will provide additional protection.

2.3.4.2 Construction methodology

For the purposes of this method statement, it is assumed that all works will be carried out using marine based plant. However, subject to an assessment of the existing Esparto Wharf and North Mole it may be possible to create an access to allow some of the work to be undertaken by land, reducing marine based activity.

The overall steps in the construction process are

i. Locally reduce the level of the seabed to design dredge level
ii. Excavate further to the design formation level for the concrete wall
iii. Place a regulating layer of stone to land the concrete units on
iv. Place precast concrete foundation blocks
v. Build up the precast concrete wall units, sealing the joints as they are placed to control subsequent wet concrete placement
vi. Place any binding reinforcement and drop in pre-formed reinforcement cages
vii. Fill concrete units with underwater mix concrete
viii. Backfill around concrete wall externally to revetment founding level, internally to bed level.
ix. Construct revetment on outer face of concrete wall, and for an additional 25m along the line of the wall.

2.3.4.3 Local Dredging

The area of the Western Harbour will be dredged to a finished dredge level sufficient for the planned operation of the marina. The depth varies across the marina with shallower waters for smaller craft closed to the shore.

Dredging in advance of the north mole is likely to be by backhoe dredger. Sediment testing has been undertaken across the marina site with some material identified as suitable for disposal at sea site at an approved site and the remainder brought ashore for disposed or treatment and reuse.

2.3.4.4 Base Formation

The wall of the breakwater is expected to be founded approximately 4.5m below final dredge level subject to geotechnical investigation and design. A trench will be excavated from the dredge level to the base formation level with sloped sides of a gradient dependent on the geotechnical properties of the bed material. Figure 2.4 below represents this construction phase.

A 250mm thick layer of Type 1 material will be placed on the base of the excavation and then levelled to allow placement of the reinforced concrete foundation units. These solid units provide a solid and stable foundation from which the wall can be supported. Divers will be employed to direct the placement and levelling of the units.

Once placed, a local bathymetric survey will be undertaken to confirm the base is at the correct level to receive the precast units making up the wall.

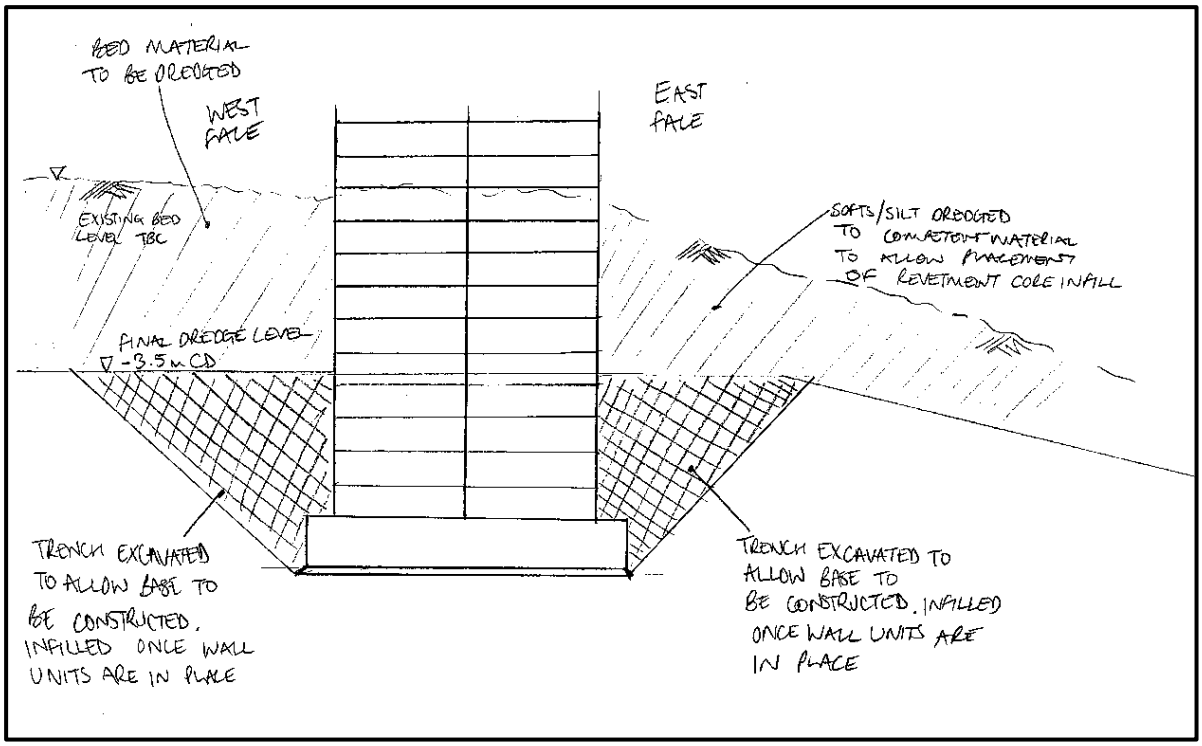


Figure 2-4: Potential construction within a trench to sound formation

2.3.4.5 Precast Unit Construction and Placement

In order to minimise the time of construction on site and the associated cost of marine based plant, the wall will be constructed from precast units, which can be fabricated off site. The units will be transported to site by road or sea, depending on the location of the fabrication site.

The wall consists a reinforced concrete foundation approximately 7.5m wide and totalling a length of 50m. This will be made up of individual precast units sized to suit placement by crane from a barge and will be keyed together. Hollow units to form the bulk of the wall will be lifted and placed by crane from a barge with divers directing placement of the units, which lock together. This will form a sealed cofferdam into which concrete will be pumped in lifts.

2.3.4.6 Breakwater Construction

Following the construction of the breakwater wall, the rock infill forming the core of the revetment to the east of the wall will be placed using a long reach excavator from a barge. Some reinstatement of bed material may be possible if material properties permit prior to build up of the core of the breakwater.

Prior to placement of the secondary rock layer, consisting typically 300kg sized rock, divers will place a layer of geotextile to prevent material washout. The larger primary rock armour will then be placed on top to provide the full level of wave protection. The rock will be placed using a barge mounted long reach excavator. It is assumed that all rock will be delivered to site by sea and will be placed directly from the delivery barge to the revetment.

2.3.4.7 Wave Wall

In order to provide additional protection along the top of the structure, a precast reinforced concrete wave wall will be placed. The wave wall units will be lifted into place by barge mounted crane or telehandler and secure in place.

2.3.4.8 Finished Walkway

Behind the wave wall, a paved surface will be installed to form the walkway. Fixtures such as lighting can be installed, with service ducts having been cast into the final lift of precast concrete boxes.

2.3.5 Marina revetment

2.3.5.1 Description

The west boundary of the marina basin is formed with a natural stone faced revetment that will enclose and protect an area of reclaimed land. The core of the revetment is expected to be a combination of material recovered from elsewhere on the site and imported structural fill. The facing rocks will be imported to site by road. Along the top of the revetment, a concrete capping detail with integral channel for planting and parapet along the top provides the transition

2.3.5.2 Construction Methodology

The revetment can be constructed using land based plant and machinery working progressively along the line of the revetment until completed. The fill behind the revetment can be placed behind once the revetment is structurally sufficient to protect the infill.

The revetment needs to be founded on a sound strata and so the first operation will be excavation of the bed sediments down to a suitable formation level. The core can then be built up in layers before being sealed behind within a geotextile. This will protect the integrity of the core and prevent future washout of material. The rock armour facing will then be placed on the outer face of the revetment and if the bed was excavated below dredge level, some bed material can be reinstated up to this level. Infill behind the revetment will comprise material from elsewhere on the site that has been tested for suitability. The reclaimed area will be suitable for car parking and landscaping.

2.3.6 Construction Phasing

It should be noted that a detailed construction method statement has not yet been finalised, and as such it is estimated that the marina development as described in 2.3.2 to 2.3.5 above would take 14 months to construct. The proposed development will be indicatively phased as follows within Table 2-2. Any assumptions used within the relevant assessments throughout this EIAR have also been included. Where timing is Month 1-3 for example, this implies a 3 month construction period.

Table 2-2: Construction Phasing and Assumptions

Proposed Development Component	Timing	Assumptions
Dredging and Reclamation	Month 1-3	The options outlined above within section 2.3.2 suggest that backhoe dredging will be used. Dredging would operate between 07.00 and 20.00. The fill material would then be compacted using vibrating rollers during daytime hours.
Construct quay wall and foundations	Month 3-6	Assumed that work would be undertaken from Monday morning (07.00) to Saturday lunchtime (13.00), with potential for night-time working. However within this time the actual construction period would be determined by low tide, and restricted to periods between 12.00 and 16.00 and 0.00 and 4.00 over a 4 day period, every 2 weeks.

Proposed Development Component	Timing	Assumptions
Piling	Month 3-6	This would take place between 07.00 and 19.00 Monday to Friday and 07.00 to 13.00 on Saturdays.
North Moll Extension and Breakwater	Month 7-8	This would take place between 07.00 and 19.00 Monday to Friday and 07.00 to 13.00 on Saturdays.
Place rock armouring	Month 8-10	This would take place between 07.00 and 19.00 Monday to Friday and 07.00 to 13.00 on Saturdays.
Construct pontoons	Month 10 -14	This would take place between 07.00 and 18.00 Monday to Friday, and 07.00 to 13.00 on Saturdays.
Services to pontoons	Month 15	This would take place between 07.00 and 20.00 Monday to Friday, and 07.00 to 13.00 on Saturdays.

2.4 Alternatives Considered and Design Evolution

The Marine EIA Regulations contain a requirement to look at alternatives considered in respect of decisions made which are relevant to the design, siting and assessment of the proposed development.

2.4.1 Design Envelope

The design envelope to a certain extent is dictated by the physical geography of the location, existing approved design parameters and the rest of the approved Granton Harbour development.

The proposed development is required in a specific location for a specific purpose, therefore due to the established location and the established infrastructure present within the existing harbour at this site location, no alternative sites for the proposed development can been considered.

2.4.2 Alternatives Considered

Alternative considerations can be multi-faceted, including alternative developments, alternative locations, alternative development components and alternative construction methods, including a 'do nothing' scenario. The below offers a synopsis of alternatives considered throughout the development process.

2.4.2.1 Do Nothing

Under a 'do nothing' scenario, environmental baseline would continue to develop upon current parameters, with climate change forecasts bringing gradual increases in sea levels and marine mammal behaviour, with the visual baseline maintaining the appearance of Granton Harbour but with greater separation between Granton Harbour and the terrestrial environment (than 'with development').

The 'do nothing' scenario was not considered a viable option within the EIA, given the need case for the proposed development as highlighted within section 2.2.1.

2.4.2.2 Alternative Locations

The works are part of a wider regeneration scheme that has planning permission, the marina is located in the existing harbour as are the new quay walls and breakwater which protects the harbour, and as such the works could not practically be implemented in a different location to the same effect.

Accordingly, no alternative location was considered viable and was considered within this EIAR.

2.4.2.3 Alternative Development Components and Methods

Design evolution has occurred throughout project inception, which allows examination of alternatives within this. Key design changes or selected options include:

- Disposal and Recycling/Re-use options;
- North Mole Design
- Pontoon Berths

2.4.3 Dredge Disposal and Re-use

The proposed disposal routes for dredge materials are to be split with 37% of the total volume considered for sea based disposal subject to agreement and the remaining 63% to be brought to land for a land based disposal option.

Since the material below 1.2m is not considered suitable for a sea based disposal it will need to come to land for disposal. As such the material will be subject to land based re-use or disposal. These activities will be undertaken under appropriate SEPA licenses with respect to waste regulation. Initially it is proposed that the dredge arisings are brought onto the Granton development site for dewatering and stockpiling, prior to subsequent re-use and/or land based disposal.

3 EIA METHODOLOGY AND SCOPING

3.1 Introduction

The purpose of an EIA is to identify and evaluate the likely significant effects of a proposed development on the environment and to identify measures to mitigate or manage any significant adverse effects before a planning application is determined. The EIA process provides an opportunity to 'design out' adverse effects wherever possible. Where adverse effects cannot be designed out, mitigation measures can be proposed to avoid, compensate or reduce significant environmental effects to an acceptable level. EIA is an iterative process which allows feedback from stakeholder consultation and the results from baseline studies to be fed into the design process of the proposed development.

As the proposed development contains elements which are below Mean High Water Spring (MHWS), consents will be required from Marine Scotland under the Marine EIA Regulations.

In determining the requirement for an EIA, Schedule 1 of the Marine EIA Regulations sets out the types of development for which EIA is a mandatory requirement, whilst Schedule 2 lists the projects where the need for EIA is judged on a case-by-case basis, depending on whether a proposal is likely to cause significant environmental effects or is located in a sensitive area as defined by the EIA Regulations.

In this instance, the proposed development is considered to constitute Schedule 2 development as defined by the EIA Regulations as it falls under paragraphs 1(e), 10(m) and 12(a) (of both marine and onshore 2017 EIA Regulations), which state the following:

- Paragraph 1(e) -*"Reclamation of land from the sea";*
- Paragraph 10(m) -*"Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works";* and
- Paragraph 12(a) - *"marinas with an area of enclosed water surface exceeding 1,000m²"*.

By virtue of its nature, size and location, the proposed development could potentially have (if unmitigated) significant adverse effects on the environment. The proposed development has been subject to a Screening Decision by Marine Scotland, and due to the size and potential impacts generated by the proposed development EIA will be required. Schedule 4 of the EIA Regulations specifies the information that should be included in an EIAR, and this chapter discusses where and how the EIAR meets the requirements of the EIA Regulations and the scoping exercise.

3.2 General EIA Methodology

Whilst each environmental topic discussed within the EIAR establishes its own methodology based upon good practice and relevant industry guidance, there is a basic methodological framework which is applied to EIA chapters.

This EIAR identifies, describes and assesses the likely significant impacts and their effects of the proposed development on the environment, both direct and indirect. The EIA process involves the following key stages:

- Baseline Studies – identification of existing environmental conditions through review of existing information, monitoring and field studies as required, to provide a baseline against which to assess the likely impacts of the proposed development;
- Potential impacts – identification of potential impacts and their resulting effects across the construction and operational phase (decommissioning of the proposed development itself is inappropriate to the proposed development), in relation to the design mitigation already implemented and where applicable, taking alternatives into account;
- Significance Assessment – evaluation of the effects, resulting from the identified potential impacts, to determine their significance, both positively and negatively, and incorporating cumulative effects;
- Mitigation and Monitoring – the identification of measures to avoid, reduce or compensate likely significant effects and the steps taken to monitor these potential environmental effects; and
- Residual Effects – identification of residual effects assuming successful implementation of mitigation.

For consistency where possible, the same headings have been used within the technical sections of this EIAR.

3.3 EIA Regulations 2017

As the proposed development is seeking consent under the Marine EIA Regulations and the Scoping process was commenced after the date the new Regulations were adopted, 16th May 2017, the 2017 Regulations supersede the 2011 Regulations across all elements of this project.

Following guidance set out in the Scottish Government's Planning Advice Note 1/2017, this EIAR follows the amendments and additions to the EIA Regulations. Notable additions to the EIA Regulations include:

- The requirement for the EIA to be based upon the Scoping Opinion which was provided (Regulation 6(3));
- A requirement to consider a *comparison* of environmental effects when considering alternatives (Regulation 6(2) (d));
- A replacement of the environmental factors to be considered as been amended from 'human being' to 'population and human health', and 'flora and fauna' replaced by 'biodiversity' (Schedule 4(4)).
- Discussion of the relevant baseline and predicted evolution of that baseline in the absence of the proposed development (Schedule 4(3));
- Cumulative assessment should take place in relation to existing and/or approved development (Schedule 3(1)(b)); and
- The requirement for a Competent Authority (i.e. Marine Scotland) to include a 'reasoned conclusion' on the significant effects upon the environment within the Decision Notice published (Regulation 23(2)).

This EIAR discusses each of these points in turn within the relevant assessments, where applicable. It is the aim of the EIAR to allow sufficient information to allow both Competent Authorities to meet a 'reasoned conclusion' on the significance of effects.

3.4 The EIA Process

3.4.1 Sensitivity/Importance of Receptors

The sensitivity of the baseline conditions/receptors was defined according to the relative importance of existing environmental features on or in the vicinity of the site, or by the sensitivity of receptors which would potentially be affected by the proposed development.

Criteria for the determination of sensitivity (e.g. high, medium or low) or of importance (e.g. international, national, regional or authority area) were established for each topic assessment based on prescribed guidance, legislation, statutory designation and/or professional judgement. The criteria for each environmental parameter are provided in the relevant specialist chapters of this EIAR and may differ between technical topics dependent upon guidance which defines that approach (e.g. Chartered Institute of Ecology and Environmental Management).

3.4.2 Magnitude of Impact/Change

The methods for predicting the nature and magnitude of potential impacts vary according to the subject area. Quantitative methods of assessment can predict values that can be compared against published thresholds and indicative criteria in Government guidance and standards. However, it is not always possible to ascribe values to environmental assessments and therefore qualitative assessments are used. Such assessments rely on previous experience and professional judgement. The methodologies used for assessing each topic area are described within the specialist chapters of this EIAR.

In general terms, the magnitude of impact on environmental baseline conditions was identified through detailed consideration of the proposed development, taking due cognisance of any legislative or policy standards or guidelines, and/or the following factors:

- The degree to which the environment is affected, e.g. whether the quality is enhanced or impaired;
- The scale or degree of change from the existing situation;
- Whether the impact is temporary or permanent, indirect or direct, short-term, medium-term or long-term; and
- Any in-combination effects and potential cumulative effects.

In some cases the likelihood of impact occurrence may also be relevant and, where this is a determining feature of the assessment, this is clearly stated.

3.4.3 Significance of Effect

Significant effects are predicted where important resources, or numerous or sensitive receptors, could be subject to impacts of considerable magnitude. Effects are unlikely to be significant where low value or non-sensitive resources are subject to minor effects.

The criteria for determining the significance of an effect has been developed giving due regard to the following, where applicable;

- Sensitivity, importance or value of the resource or receptor;
- Extent and magnitude and duration of the impact; and
- Performance against environmental quality standards.

The criteria and assessment methodology used for each topic considered within this EIAR are set out within the 'Methodology' section of the respective EIAR chapter.

Unless otherwise stated, reported effects are considered to be adverse. It is however possible that some effects may be positive and these are stated and explained where appropriate.

The EIAR reports on the significance of the environmental effects as per the EIA Regulations. Although a significant effect does not always have to equate to an unacceptable effect, in order to ensure impartiality the

EIAR does not comment on acceptability. The Planning Statement which accompanies this application (but is separate to the EIA process) makes a judgement on the acceptability of significant effects.

3.4.4 Design Mitigation and Residual Effects

There is a widely accepted strategy for mitigation outlined in Planning Advice Note (PAN) 1/2013 (and continued within Planning Circular 1/2017) which has been followed when considering the environmental effects of the proposed development. This comprises (in order of preference): avoidance, reduction and offsetting. Through the evolution of the design, the Applicant has sought to identify appropriate mitigation measures and strategies as part of the proposed development.

Design mitigation is integral to providing an environmentally robust development whereby suggestions for mitigation have been taken into the design prior to 'design freeze'. This in-built mitigation represents, where applicable, environmental good practice and places a responsibility upon the Applicant to provide environmentally sustainable design solutions. Design rationale is further discussed within the Design and Access Statement which accompanies the wider application, along with a section within each EIAR chapter that comments on design mitigation incorporated into the development, and therefore individual assessments, before assessment is carried out. Therefore, where design mitigation has been employed, the impact assessment is carried out with this design mitigation in place as it forms a constituent part of the proposed development. Residual effects are generally then the effects that follow the assessment of proposed development with design incorporated.

Where complete avoidance of significant effects was not feasible during refinement of the site design, additional measures are identified in the relevant specialist chapters to reduce or offset effects where practical to do so. If no design mitigation has been identified, the assessment assumes no design mitigation and therefore effects are prior to any mitigation.

Residual effects of the proposed development are those that remain, assuming successful implementation of the identified mitigation measures. All remaining effects of the proposed development, following the application of mitigation measures, are summarised clearly and their significance stated, within the 'Residual Effects' section of each specialist chapter.

Where applicable, the EIAR also reports measures for enhancement which would be enshrined by planning/marine licence condition.

3.4.5 Cumulative Effects

Consideration of cumulative effects is a requirement of the EIA Regulations. By definition these are effects that result from incremental changes caused by past, present and reasonably foreseeable actions together with the proposed development. There are different types of cumulative effects (such as in-combination and sequential effects) and typically cumulative impact assessment is a key part of the EIA process which are assessed throughout each chapter. The sites which are incorporated into cumulative assessment are clearly highlighted within each technical chapter.

Cumulative assessment was discussed within the EIA Scoping Opinions issued by Marine Scotland. Phasing of the terrestrial elements of the wider Granton Waterfront Development are currently unknown. Granton Central Development Ltd has recently submitted (March 2018) a planning application (reference 18/01428/PPP) under section 42 of the Planning Act 1997 to amend condition 1 of outline permission 01/00802/OUT. The applicant wishes to extend the time period for submitting applications for the approval of matters specified in conditions by 5 years to 23 June 2023. Refer to Chapter 7, for fuller discussion of cumulative Effects

3.5 Screening and Scoping as part of the EIA Process

Schedule 1 of the Marine EIA Regulations lists developments for which an EIA must be undertaken where there are likely to be significant effects on the environment by virtue of factors such as the nature, size or location of a proposed development. Given the size and scale of the proposed development, the Applicant made the decision to seek an EIA Screening Opinion and Scoping Opinion.

The sections below therefore sets out the EIA Screening and Scoping process and accordingly documents how the EIAR was shaped into what is currently included and offers rationale to why other topics have been excluded, based on the likelihood of likely potential significant effects.

3.5.1 Screening Requests and Responses

An initial Screening Request was submitted by Cameron Planning for a Marine Licence application for the Marina Development and associated works (letter dated 16th August 2017). Planning permission was first granted for the mixed use regeneration of the Granton Harbour area by City of Edinburgh Council in 2003, reference 01/00802/OUT. The planning permission included the formation of a new marina within Granton Harbour and included in the approved works the formation of new quay walls, associated sheet piling and dredging of the harbour. A subsequent Matters Specified in Condition (MSC) planning permission was granted pursuant to the original parent permission in April 2017 for, *"the formation of a new Marina Office with associated retail and café space, and new community boat yard with associated dry stack",* reference 16/04409/AMC Marine Scotland provided an initial Screening Opinion on the 16th October 2017 and concluded an EIA must be carried out in respect of the proposed works.

The proposed marine works associated with the Granton Harbour development comprise:

- Length of stone revetment to harbour;
- Length of vertical quay wall to harbour;
- Backfilling of land protected by quay wall and stone revetment;
- Formation of marina;
- Extension to existing north mole breakwater; and
- Harbour dredging.

EnviroCentre prepared a second Screening Request on the 28th November 2017, submitted by Cameron Planning, which re-screened and provided additional environmental information regarding the proposed works. A Screening Opinion, dated 5th February 2018 determined that the proposed works could potentially have significant effect on the environment and as such, an EIA would be required.

3.5.2 Scoping Requests and Responses

A request for a formal Scoping Opinion was submitted to Marine Scotland on 10 April 2018 under Part 4 (14), of the EIA Regulations. This was accompanied by an EIA Scoping Report provided to assist the Marine Scotland and statutory and non-statutory consultees to form an opinion upon the likelihood of potentially significant environmental effects and hence the topics to be assessed in the EIA (i.e. those topics where significant environmental effects could potentially result if unmitigated). The Scoping Report also provided an opportunity for consultees to comment upon suggested methodologies for technical assessment.

A Scoping Opinion was provided by Marine Scotland dated 14 June 2018 and is included within Technical Appendix 3.1 of this EIAR.

The primary issues addressed throughout the Scoping Responses from Marine Scotland are set out within Table 3.1 below, along with discussion of where these issues have been addressed, or where applicable why they have been Scoped out of the EIA. Further information is available within each technical chapter regarding where this information is held within that chapter.

Table 3-1: Summary of Scoping Responses

Environmental Topic	Consultee	Scoping Comment	How and where addressed
Water Environment			
Waves	Marine Scotland, Forth Ports, SNH	Consideration of waves from a NW direction and wave attenuation in the eastern harbour have not been satisfactorily assessed by the wave modelling study. A potential oversight in the wave modelling study was raised in that it focuses on swell and wind waves from a NE direction. There are concerns about the effect of shallow water on waves from a NW direction and also about the reflection of waves on the location of the pilot vessels on the centre pier. Study only looks at the effect of wave attenuation in the western harbour and does not assess effects in the eastern harbour.	Chapter 4: Water Environment and Coastal Processes and Technical Appendix 4-2: deals with waves as a result of the development.
Sediment Transport	Marine Scotland, Forth Ports, RYA SNH	Fundamental issue that has not been sufficiently addressed, in particular in relation to increased sedimentation and the effect of this on navigation and nearby geodiversity features. Coastal changes and sedimentation as a result of the western breakwater extension is a fundamental issue and they do not believe that this has been sufficiently studied. Any potential increase in sedimentation rates in areas could cause issues for safety of navigation	Chapter 4: Water Environment and Coastal Processes deals with sediment transport
Water Quality	Marine Scotland	Sediment risk assessment is required due to contamination identified in pre-dredge sampling.	Chapter 4: Water Environment and Coastal Processes deals
Ecology			
Ornithology	Marine Scotland, SNH, RSPB, Edinburgh City Council	Insufficient details about the potential impact of the proposed works and possible mitigation measures for breeding and non-breeding birds have been provided. Edinburgh City Council are concerned that breeding birds would not be covered by the HRA. It is possible that consideration of the methods and timing of the works could be used to mitigate the impact of the works and these could form part of Construction Environmental Management Plans (CEMP). The RSPB suggest that the scoping report lacks the evidence to support claims that any impacts on birds are unlikely to be significant. They are concerned that the temporal scale of monthly bird counts would be insufficient to identify short-term disruptive changes that may occur as a result of the construction works.	Chapter 5: Marine Ecology and Ornithology, associated Technical Appendix 5-4: Habitat Regulation Appraisal (HRA)

Marine Mammals & Non-Native Species	Marine Scotland, SNH, RYA	Disturbance could be caused to marine mammals and insufficient detail has been provided about potential mitigation measures. Without further details about the marine mammal protection plan the impacts on EPS cannot be fully considered. The applicant has also provided insufficient information to determine whether or not an EPS licence would be required. Need for appropriate biosecurity measures to be implemented due to the risk of Invasive Non-Native Species. This is especially relevant given the recent infestation of *Undaria* seaweed at Port Edgar.	Chapter 5: Marine Ecology and Ornithology, and associated Technical Appendix 5- 2: MMPP and Technical Appendix 5-5: Underwater Noise Qualitative Assessment
Otter	City of Edinburgh Council	we would expect that surveys for otters and consideration of breeding birds would be included as part the EIA	Chapter 5: Marine Ecology and Ornithology, and Technical Appendix: 5-1 Otter Report
Underwater Noise			
Underwater Noise	Marine Scotland	The scoping report does not address marine noise and in particular underwater noise produced by the piling works	Chapter 5: Marine Ecology and Ornithology, and associated underwater noise Technical Appendix 5-5: Underwater Noise Qualitative Assessment
Navigation Risk Assessment			
Other Issues	Forth Ports, RYA and the MCA	Forth Ports have commented that the increased vessel traffic density combined with the reduction in visibility of incoming and outgoing traffic due to the breakwater extension should be considered from a navigational safety perspective. The same concern was raised by the RYA and MCA who also considered that navigation should be scoped in to the EIA report. No evidence has been provided in the scoping report to conclude no major accident risk therefore scoped in and should be scoped into the EIAR. Major Accidents also scoped into the EIAR	Chapter 6: Other Issues

3.6 Final Content and Structure of the EIA Report

Accordingly based on the above summary of consultation responses and initial baseline collection, it was possible to complete the EIA with a clear focus on the main topics requiring full and detailed impact assessment. These topics are listed below and this Volume contains a chapter for each:

- The Water Environment
- Marine Ecology;
- Other Issues;
- Cumulative Effects, and
- Schedule of Mitigation

For clarity, air quality, noise, Flooding cultural heritage and Landscape & Visual have been scoped out of EIA assessment.

A sediment risk assessment has not been included as requested by the scoping opinion, as much of the dredge material is now being disposed of on land, and following consultation with Marine Scotland they are satisfied that the assessments carried out are sufficient and a full sediment risk assessment is not required.

The chapters which are scoped in are supported by technical assessment reports where necessary and which comprise Volume 3: Technical Appendices of the EIAR. Those environmental topics which are not considered at EIA level given the either the level of project information available at this stage, or based upon an unlikely event of significant effects, are included for information within Chapter 6: Other Issues. This includes discussion of human health and population, navigation, air quality, terrestrial noise, natural disasters and major disasters. Chapter 7 addresses cumulative effects.

The EIAR also contains chapters on the schedule of mitigation associated with the EIA (Chapter 8) and a brief chapter (Chapter 9: Conclusions) which summarises the EIA and contains a statement of significance.

4 WATER ENVIRONMENT & COASTAL PROCESSES

4.1 Introduction

This chapter of the EIAR provides an assessment of the implications of the proposed development on the water environment and coastal processes. The water environment is considered to encompass hydrology, hydrogeology and water quality, whilst coastal processes are considered to encompass tides, waves and associated sediment transport processes.

The Water Framework Directive (WFD) (Council Directive 2000/60/EC) aims to protect and enhance water bodies within Europe and covers all estuarine and coastal waters out to 1 nautical mile. This requires that there is no deterioration in the quality of surface or groundwater bodies and aims to achieve good ecological status or potential. The implications of the WFD must be considered when assessing this project and the details of how compliance will be achieved provided in the EIA.

Details of the site and the proposed development are provided in Chapter 2: Proposed Development, this EIA focuses on the marine elements of a wider development. The assessment will identify sensitive issues within the site by establishing the current baseline and examining the proposed development within this context.

This chapter is supplemented by the following appendices within Volume 3 of this EIAR, along with the relevant figures within Volume 2:

- Technical Appendix 4.1: Bathymetric Survey
- Technical Appendix 4.2: Wave Disturbance Modelling
- Technical Appendix 4-3: BPEO

4.2 Scoping and Consultation

A scoping opinion was received from Marine Scotland on the 14th June 2018. A summary of the relevant scoping responses is set out below in Table 4-1, with details of how the scoping consultation has been taken into consideration when conducting this assessment.

Table 4-1: Summary of Consultation Responses

Topic	Organisation	Consultation Response	How and where addressed
Tides	Marine Scotland	The Scottish Ministers have concluded that tides can be scoped out of the EIA report on the basis of the assessment provided in the scoping report and the wave modelling study.	Scoped out of assessment. Outlined in sections 4.5.8 and 4.6.1.

Topic	Organisation	Consultation Response	How and where addressed
Waves	Forth Ports	Raised a potential oversight in the wave modelling study in that it focuses on swell and wind waves from a NE direction. They have concerns about the effect of shallow water on waves from a NW direction and also about the reflection of waves on the location of the pilot vessels on the centre pier.	Wave modelling study has been updated to include assessment of waves from the NW, as described in sections 4.5.9 and Technical Appendix 4.2, Volume 3 of the EIAR.
	SNH	Suggest that the wave study only looks at the effect of wave attenuation in the western harbour and does not assess effects in the eastern harbour.	The wave modelling study includes assessment of eastern harbour as described in sections 4.5.9 and Technical Appendix 4.2, Volume 3 of the EIAR.
	Marine Scotland	The Scottish Ministers support the work which has already been done with the wave modelling study however waves have been scoped in to consider the additional potential impacts that should be considered, as highlighted in the consultation responses.	Assessment of waves is included within sections 4.5.9 and Technical Appendix 4.2, Volume 3 of the EIAR.
Sediment Transport	Forth Ports	Have said that coastal changes and sedimentation as a result of the western breakwater extension is a fundamental issue and they do not believe that this has been sufficiently studied. Any potential increase in sedimentation rates in areas could cause issues for safety of navigation.	Assessment of sediment transport is included within sections 4.5.10, 4.6.5.2, and 4.6.6.3 of this Chapter.

Topic	Organisation	Consultation Response	How and where addressed
	RYA	The RYA concur with the opinion that the evidence presented is not sufficient to demonstrate that there will be no increase in sedimentation in the eastern harbour as a result of the proposed works. They are also concerned about the closure of the western harbour that would result from the use of a silt curtain and the impact this would have on existing users.	Assessment of sediment transport is included within sections 4.5.10, 4.6.5.2, and 4.6.6.3 of this Chapter.
	SNH	SNH also raised concerns that sediment transport has not been adequately assessed in the wave modelling study and that further consideration is required in relation to nearby geodiversity features.	Assessment of sediment transport is included within sections 4.5.10, 4.6.5.2, and 4.6.6.3 of this Chapter.
	Marine Scotland	The Scottish Ministers have concluded that sediment transport and potential effects on the Firth of Forth SSSI have not been adequately addressed by the study already undertaken and thus sediment transport should be scoped in to the EIA report.	Assessment of sediment transport is included within sections 4.5.10, 4.6.5.2, and 4.6.6.3 of this Chapter.
Flooding	SEPA	SEPA have confirmed in their consultation response that their previous advice still stands, i.e. that they have no concerns regarding increased flood risk.	As outlined in sections 4.5.8, 4.5.11 and 4.6.1 of this Chapter.

Topic	Organisation	Consultation Response	How and where addressed
	Marine Scotland	The Scottish Ministers concur with the applicant and the consultees that the proposed works are unlikely to alter the flood risk and thus flooding can be scoped out of the EIA report.	As outlined in sections 4.5.8, 4.5.11 and 4.6.1 of this Chapter.
Water Quality	Marine Scotland	On the basis of the pre-dredge sample analysis carried out by the applicant, the Scottish Ministers concur with the applicant that water quality should be scoped in to the EIA report which should include the sediment risk assessment.	Assessment of water quality is included within sections 4.5.6, 4.6.5.1 and 4.6.6.1 of this Chapter.

4.3 Policy, Legislation and Guidance

The assessment for the water environment and coastal processes has been undertaken with reference to the following relevant planning policy, legislation and guidance.

4.3.1 Relevant Planning Policy

- Scottish Planning Policy (SPP) (2014);
- UK Marine Policy Statement (2011);
- Scotland's National Marine Plan (2015);
- Edinburgh Local Development Plan (2016).

4.3.2 Relevant Legislation

- Water Framework Directive (WFD) 2000;
- Water Environment and Water Services (Scotland) Act 2003;
- Marine (Scotland) Act 2010;
- Coast Protection Act 1949;
- Flood Risk Management (Scotland) Act 2009;
- Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR);
- Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2013 (CAR);
- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (The Habitats Directive); and
- Environmental Impact Assessment (EIA) Directive (2014/52/EU);
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017;
- The Marine Works (Environmental Impact Assessment) Regulations (Scotland) 2017; and

- The Environmental Impact Assessment (Miscellaneous Amendments Relating to Harbour, Highways and Transport) Regulations 2017

4.3.3 Relevant Guidance

- Guidelines for Water Pollution Prevention from Civil Engineering Contracts;
- Pollution Prevention Guidance 1 (PPG): General guide to the prevention of pollution;
- PPG3: Use and design of oil separators in surface water drainage systems (to be read in conjunction with 'Oil Separator Manufacturers – Version 7 – November 19th 2007);
- PPG 6: Working at construction and demolition sites;
- PPG 7: Refuelling facilities;
- PPG 18: Managing for water and major spillages;
- PPG 22: Incident response – dealing with spills;
- PPG26: Storage & handling of drums & intermediate bulk containers;
- Guidance for Pollution Prevention (GPP) 2: Above ground oil storage tanks;
- GPP 5: Works and maintenance in or near water;
- GPP 8: Safe storage and disposal of used oils;
- GPP 21: Pollution incident response planning;
- WAT-SG-26: Good Practice Guide – Sediment Management;
- WAT-SG-29: Good Practice Guide – Construction Methods;
- The Green Guide For Marinas;
- The Green Guide to Pump Out Systems;
- The Green Guide to Boat Washdown Systems; and
- CIRIA C753 – The SuDS Manual.

4.4 Methodology

4.4.1 General

The assessment follows standard EIA procedures which include:

- Desk based review of the design of the proposed development in relation to the local water environment and coastal processes;
- Consultation with key stakeholders to obtain relevant information and to ensure their concerns are addressed within the study;
- Establishing the existing baseline conditions:
  - Review topography and ground conditions at the site and environs;
  - Review of hydrology, catchment characteristics, and water quality conditions;
  - Review of coastal processes including bathymetry, tidal levels, river and tidal flow currents, wave action, bed sediment type and distribution, sediment transport and deposition, geology;
  - Wave modelling study to establish baseline and design conditions (Technical Appendix 4.2 within Volume 3); and
  - Reporting of baseline conditions to provide a basis for assessment of the potential impact.
- Impact Assessment:
  - Identification of sensitive receptors and environmental constraints;
  - Identification of potential impacts;
  - Assessment of impact magnitude;
  - Identification and assessment of mitigation measures to reduce or avoid any potential impacts of the proposed development; and

- Statement of residual effects.

Potential impacts arising from the proposed development have been predicted and evaluated. The observed baseline data was used along with professional opinion to qualitatively assess the potential impacts and the significance to receptors.

4.4.2 Assessment Criteria

The assessment criteria set out in Table 4-2 and Table 4-3 has been used to develop a matrix to assess the significance of effects from the proposed development on the local water environment (Table 4-4). The assessment of residual effects also takes into consideration the probability of the effect occurring (certain, likely, possible or unlikely) and the duration of the effect (short (less than 2 years), medium (2 – 5 years), long term (more than 5 years) or permanent.

All direct and indirect impacts causing moderate or major effects as identified in Table 4-4 are considered to be significant.

Table 4-2: Criteria for Assessing Receptor Sensitivity

Receptor Sensitivity	Description
Low	Receptors with a high capacity to accommodate change, low value or poor condition and no significant uses, for example: • Receptor is not an internationally, nationally or locally designated site. • Not classified as a surface water body for the River Basin Management Plan (RBMP). • Surface water body not significant in terms of fish spawning and no other sensitive aquatic ecological receptors e.g. freshwater pearl mussels. • Surface water body not used for abstraction. • Surface water body not used for recreation directly related to water quality e.g. angling, swimming, watersports. • Surface water body not used by commercial or recreational vessels. • Low or very low productivity aquifer with no identified abstractions.
Medium	Receptors with a moderate capacity to accommodate change, medium value or condition and limited use, for example: • Receptor is not an internationally or nationally designated site. May be a locally designated site. • Salmonid species may be present and surface water body may be locally important for spawning. No other sensitive aquatic ecological receptors e.g. freshwater pearl mussels. • Surface water body used for private water supply or medium scale industrial/ agricultural abstractions. • Surface water body used for occasional or local recreation e.g. local angling clubs. • Navigable surface water body used by commercial or recreational vessels. • Moderate productivity aquifer. • Groundwater body supports identified private water supplies or medium scale industrial/ agricultural abstractions.

Receptor Sensitivity	Description
High	Receptors with a low capacity to accommodate change, high value or condition and significant use, for example: • Receptor is an internationally or nationally designated site. • Surface water body supports sensitive aquatic ecological receptors e.g. freshwater pearl mussels. • Surface water body used for public water supply or large scale industrial/ agricultural abstractions. • Surface water body important for recreation directly related to water quality e.g. swimming, watersports, angling. • High or very high productivity aquifer. • Groundwater body supports public water supply or large scale industrial/ agricultural abstractions.

Table 4-3: Criteria for Assessing Impact Magnitude

Definition	Impact Magnitude
Negligible	Very light change from baseline conditions. Change barely distinguishable, approximating to the 'no change' situation.
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of the baseline condition will be similar to pre-development circumstances/patterns.
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post-development character/ composition/ attributes of baseline will be partially changed.
High	Total loss or major alteration to key elements/features of the baseline (pre-development) conditions such that post-development character/composition/attributes will be fundamentally changed.

Table 4-4: Criteria for Assessing Effects

Sensitivity of Receptor	Magnitude of Impact	Predicted Effect
High	High	Major
High	Medium	
Medium	High	
High	Low	Moderate
Low	High	
Medium	Medium	
Medium	Low	Minor
Low	Medium	
Low	Low	
High, Medium or Low	Negligible	Negligible

4.5 Baseline

4.5.1 Site Description

Granton Harbour is located on the south coast of the Firth of Forth, around 2km west of Leith as shown in Figure 770288-001, Volume 2 of the EIAR. The harbour has two basins, referred to as the western and eastern harbours, these are formed by two breakwaters, known as the western and eastern breakwaters, separated by a large central pier. All of these key elements of harbour infrastructure were constructed between 1830 and 1870.

The western harbour has been historically (post-1945) partially infilled and is now of significantly smaller extent than the eastern harbour. The eastern harbour is used for yacht mooring, including on pontoons installed along the eastern face of the central pier. Intertidal mudflats are present in the southern part of the eastern harbour. The proposed development site is located in the western harbour and entrance channel as shown in Drawing No. A-P-00-G7-007 Rev Z-5H, Volume 2 of the EIAR.

Granton Harbour has been subject to varying dredge regimes since construction. The admiralty chart from 1860[5] indicates water depths in the navigation channel of between 2.8 – 3.2m, which would correspond to around -2 to -2.5mCD. During the 1930s the navigation channel and berths were dredged to around -7mCD (around -10mOD). More recently dredging has been undertaken by the two sailing clubs which use Granton Harbour to ensure access at all states of tide to the berths in the eastern harbour.

4.5.2 Designated Areas

Designated areas within 5km of the proposed development include (refer to Chapter 5 and Drawing No. 770003-008, Volume 2 of the EIAR, and include:

- Firth of Forth Special Protection Area (SPA), Ramsar Site, and Site of Special Scientific Interest (SSSI);
- Forth Islands (SPA).

Within Granton Harbour the SPA Ramsar Site and SSSI designation protected features fall into three groups, birds, wetlands and geodiversity, associated with the intertidal mudflats and coastline bedrock on the southern margin of the eastern harbour. The designations are also associated with the coastline to the east of the eastern breakwater, and west of the western breakwater. The proposed development is not within any of these designated areas.

The geodiversity protected feature in this location is Arthropoda (excluding insects & trilobites), fossils present within the local bedrock.

Further details of designated areas are presented in the Habitats Regulations Appraisal (HRA), Technical Appendix 5-4, Volume 3 of the EIAR, and within Chapter 5 of the EIAR.

4.5.3 Bathymetry

A multi-beam bathymetric survey of Western Granton Harbour was undertaken by Aspect Land & Hydrographic Surveys Ltd on 19th May 2017. The existing dredging regime maintains access to the harbour, resulting in a deeper access channel extending from the western breakwater tip at the harbour mouth, towards the central pier. Existing bathymetry within this channel ranges in depth between 3 and 4 metres below chart datum. The bathymetry shallows into both the eastern and western harbours. The western harbour bed lies at levels

[5] National Library of Scotland: https://maps.nls.uk/geo/explore/#zoom=15&lat=55.9856&lon=-3.2247&layers=101942630&b=1

generally below chart datum with limited intertidal areas present, whilst the eastern harbour has significant intertidal areas above chart datum. The bathymetric survey is further described in Technical Appendix 4-1, Volume 3 of the EIAR.

4.5.4 Geology and Sediment

Granton Harbour is underlain by sedimentary bedrock cycles (sandstones and mudstones) of the Gullane Formation. These rocks were formed in the Carboniferous Period in a coastal setting (swamps, estuaries and deltas)[6].

Within the western harbour sub-tidal sediment predominantly consists of silts (Technical Appendix 4-3, Volume 3 of the EIAR), whilst the narrow intertidal harbour fringe is coarser material derived from historic infill associated with land reclamation. Previous site investigations indicate that silt deposits within the harbour are underlain by glacial till, the top of which was found to occur between -5.5mOD and -6.5mOD (-8.4mCD and -9.4mCD). Bedrock (as described above) is found at varying depths below the glacial till deposits (up to -20mOD or -22.9mCD).

Within the eastern harbour sub-tidal sediment also predominantly consists of silts. The eastern harbour has not been subject to land reclamation processes and exhibits significant intertidal extents, with silt again the dominant sediment. Dredging has been historically undertaken within Granton Harbour, most recently for access to the eastern face of the central pier.

A narrow coastal fringe of sandy beach deposits are present along the eastern harbour southern shoreline, with bedrock outcrops associated with the SSSI designation (see section 4.5.2), consistent with the coastline immediately to the east of the harbour, and representative of the pre-harbour coastal sediment character.

4.5.5 Hydrology and Hydrogeology

A review of Ordnance Survey mapping for the site indicates that there are no fresh-water inflows to the harbour, and no watercourses in the immediate vicinity. A pond is associated with recent development on reclaimed land in the former western harbour.

British Geological Survey (BGS) mapping shows Granton Harbour to be underlain by a multi-layered moderately productive aquifer. The aquifer will yield up to 10l/s locally through fracture flow[7].

4.5.6 Water Quality, Sediment Quality and Water Body Status

The coastal waters of the Firth of Forth at Granton Harbour are classified under the Water Framework Directive (WFD) monitoring programme as a coastal waterbody. The waterbody is classified as being of overall 'Good' status in 2016, with an overall chemistry status of 'Pass', and a hydromorphological status of 'Good'.

Sediment quality within the subtidal silt of the western harbour has been assessed during a recent sampling exercise as part of the Best Practicable Environmental Option (BPEO) report (Technical Appendix 4-3, Volume 3 of the EIAR).). Sediment cores were collected at 11 locations, producing a total of 31 samples for chemical analysis. All 31 samples exceed Marine Scotland Revised Action Level 1 (RAL1) levels for certain contaminants including metals, Tributyl Tin (TBT), Polyaromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCB) and Total Hydrocarbons (THC). Additionally 13 of the 31 samples recorded mercury levels above RAL2. Contaminated sediment is located at depth, associated with historical deposition, whilst recently deposited sediment towards the surface is considered to be 'clean'.

[6] British Geological Survey 1:50,000 scale geology: http://mapapps.bgs.ac.uk/geologyofbritain/home.html
[7] BGS. Geoindex Onshore: http://mapapps2.bgs.ac.uk/geoindex/home.html

Further details on sediment sampling and analysis are presented in the Best Practicable Environmental Option (BPEO) report (Technical Appendix 4-3, Volume 3 of the EIAR).

4.5.7 Tidal Water Levels

Granton is a secondary tidal port, the closest standard port is Leith. The astronomical tidal range for Leith is shown in Table 4-5 where the highest astronomical tide is 6.3 metres above Chart Datum (mCD) which is equivalent to 3.4 metres above Ordnance Datum (mAOD).

Table 4-5: Tidal Levels at Leith

Tide Condition	Chart Datum (mCD)*	Ordnance Datum (mOD)**
Highest astronomical tide (HAT)	6.3	3.4
Mean high water springs (MHWS)	5.6	2.7
Mean high water neaps (MHWN)	4.4	1.5
Mean sea level (MSL)	3.2	0.3
Mean low water neaps (MLWN)	2.0	-0.9
Mean low water springs (MLWS)	0.8	-2.1
Lowest astronomical tide (LAT)	-0.1	-3.0
Chart Datum (CD)	0	-2.9

* Admiralty Tide Tables (UKHO, 2018)
** Chart Datum correction for Ordnance Datum is -2.9m (relative to OD at Newlyn)

A tidal gauge is present at the entrance to Leith docks. The ten highest recorded levels up to December 2012 have occurred between September and March, with the highest recorded level being 6.54mCD on the 9th of February 1997[8].

4.5.8 Tidal Currents

Tidal currents within the Firth of Forth are generally weak. To the east of Leith current velocities are low, with the highest local velocities occurring during the spring flood tide (0.5m/s). Closer inshore, and around the sand flats of Drum Sands to the west of Granton Harbour, current velocities are negligible. Tidal flow is aligned to the coastline, with the flood tide flowing west and ebb tide to the east. In the vicinity of Granton Harbour the breakwaters of Granton Harbour and Leith Docks act to push the main longshore currents offshore[9].

The RYA scoping response to this EIA highlights that the main tidal stream on the flood tide is directly from the entrance to Leith docks to the mouth of Granton Harbour, and that during peak tidal flow vessels require to 'aim off to avoid being swept beyond the entrance'.

4.5.9 Waves

A wave modelling study has been undertaken by DHI (UK) Ltd to assess existing wave conditions within Granton Harbour, and look at the impact of development proposals (Technical Appendix 4.2, Volume 3 of the EIAR). The modelling study has involved the development of a spectral wave model for the Firth of Forth to transform offshore wave data to the harbour site, and a boussinesq wave model to investigate the penetration of waves into the harbour, and associated diffraction and reflection.

The existing alignment of the Granton Harbour breakwaters leaves the harbour exposed to wave penetration during storm conditions. The harbour is subject to wave action associated with local wind conditions and swell

[8] National Tidal and Sea Level Facility: http://www.ntslf.org/data/hilev?port=Leith
[9] Ramsay, D. L., & Brampton, A. H. (2000). Coastal Cells in Scotland: Cell 1 - St Abb's Head to Fife Ness (No. RSM No 143). SNH.

conditions originating from the outer firth and North Sea. Modelling results indicate that the worst conditions are expected from the north-east (45 – 90°N wind direction and a 90 – 225°N wave direction), whilst the assessment has also considered wave action generated over a smaller fetch from the north-west. Model results indicate that during a 1 in 200 year storm event from the north-east, a significant wave height of 3.2m with peak period of 7.2s would be a representative wave condition approaching the harbour mouth (see Figure 3.6, Technical Appendix 4.2, Volume 3 of the EIAR).

Given the orientation of the breakwaters and harbour mouth, the eastern harbour is more sheltered and subject to less significant wave action than the western harbour during storm conditions. Wave action is most significant at the harbour mouth, reducing further into the more sheltered waters of the harbour.

4.5.10 Sediment Processes

On the southern shore of the Firth of Forth wave action drives a net western longshore transport of beach sediment. However, in the vicinity of the site the eastern breakwater of Granton Harbour acts as a barrier to westward transport of beach material. This results in a deficit of material to the west of Granton Harbour. Fine material transported in suspension into Granton Harbour settles out within the low energy environment of the harbour, creating intertidal mudflats as evident in the eastern harbour[10]. Re-suspension of finer material occurs with tidal currents, and during periods of wave activity.

Sediment deposition rates are observed to be greatest in recently and historically dredged areas, whilst gradual accumulation occurs elsewhere, including within the SSSI designated area of the eastern harbour. Comparison of recent bathymetric survey from 2017 (see section 4.5.3) with an earlier survey dating from 2003 indicates that deposition depths within the western harbour over a 14 year period range between 2 and 4.5 metres. The greatest deposition depths are observed to have occurred within the deeper dredge pockets, associated with the main navigation channel, historic berths associated with the former Esparto Wharf to the north, and the Middle Pier to the south. Based on the observed deposition depths it is suggested that sedimentation rates within the western harbour can range from 0.14 to 0.32 metres per year, with sedimentation rate a function of water depth.

Review of the Dynamic Coast: Scotland's Nation Coastal Change Assessment (NCCA) indicates that the coastline in the vicinity of the site is stable, with no significant erosion or deposition identified from historic mapping, and significant change in the local coastline since 1890 is limited to land reclamation within the western harbour[11]. However, as outlined above, the presence of the Granton Harbour breakwaters prevents the westward transport of beach material, and therefore there is a deficit of sediment supply further west. It can be expected that some local erosion will occur as a result of this supply deficit where preventative engineering measures are not present. Evidence of such erosion can be observed at the small beach to the west of General's Rock.

4.5.11 Flood Risk

A review of Ordnance Survey mapping for the site indicates that there are no fresh-water inflows to the harbour, and no watercourses in the immediate vicinity. A pond is associated with recent development on reclaimed land in the former western harbour. The SEPA Flood Risk Management Maps show the site is not at risk of fluvial or surface water flooding.

[10] Ramsay, D. L., & Brampton, A. H. (2000). Coastal Cells in Scotland: Cell 1 - St Abb's Head to Fife Ness (No. RSM No 143). SNH.
[11] The Scottish Government (2017). Dynamic Coast: Scotland's National Coastal Change Assessment. Retrieved from http://www.dynamiccoast.com/webmap.html

SEPA Flood Risk Management Maps show that given the coastal nature of the site it is located within an area at high-risk from coastal flooding. For high risk coastal flood zones a flood event is considered likely to occur on average once in every ten years, or a 10% chance of happening in any one year.

Extreme sea levels have been predicted around the whole UK coastline and published by the Environmental Agency/Department for Environmental Food and Rural Affairs[12]. These extreme levels include the effects of both tides and storm surge but not the effect of amplification within estuaries or sea lochs. In order to provide better estimates around the Scottish coastline, SEPA have updated the original estimates[13]. The SEPA derived extreme sea levels, predicted at a point adjacent to Granton Harbour, are 3.98m Above Ordnance Datum (AOD) for the 1 in 200 year return period event and 4.2mAOD for the 1 in 1,000 year return period event, as shown in Table 4-6).

Table 4-6: Granton Harbour Extreme Sea Levels (SEPA Dataset)

Return Period (Years)	Water Level (mCD)	Water Level (mAOD)
2	6.34	3.44
5	6.44	3.54
10	6.51	3.61
50	6.70	3.80
100	6.79	3.89
200	6.88	3.98
1000	7.10	4.20

4.5.12 Future Projections and Effects of Climate Change

The UK government has published a range of climate projection reports and data for use in the assessment of climate change risks. At the time of writing the latest set of comprehensive reports produced by the UK Climate Projections was published in 2009 (UKCP09)[14], and provides relative sea level rise projections at a 25km grid resolution.

Within the SEPA Flood Modelling Guidance for Responsible Authorities[15], given subsequent developments in scientific understanding following the publication of UKCP09, SEPA have adopted the UKCP09 2080 high emissions scenario, 95%ile value of relative sea level rise for the production of their national coastal hazard maps. The projected sea level rise to 2080 near Granton for this scenario is 0.556m relative to 1990 levels.

4.6 Impact Assessment

4.6.1 Scope of Assessment

The following topics have been scoped out of further assessment on the basis of consultation responses (see Table 4-1) and the baseline assessment:

- Hydrology;
- Flood risk; and
- Tidal currents.

[12] McMillan, A., Batstone, C., Worth, D., Tawn, J., Horsburgh, K. & Lawless, M. (2011). Coastal flood boundary conditions for UK mainland and islands; Project: SC060064/TR2: Design sea levels. Bristol: Environment Agency.
[13] SEPA (2014). Scottish Coastal Flood Boundary (CFB) Dataset.
[14] UKCP09 (n.d.). UK Climate Projections. http://ukclimateprojections.metoffice.gov.uk/21678: Environment Agency & Met Office.
[15] SEPA (n.d.). Flood Modelling Guidance for Responsible Authorities version 1.1.

4.6.2 Sensitive Receptors

The sensitive receptors to potential impacts on the water environment and coastal processes from the proposed development have been identified as:

- The coastal waters of the Firth of Forth;
- Designated sites in the vicinity of the site:
  - Firth of Forth Site of Special Scientific Interest (SSSI);
  - Firth of Forth Wetland of International Importance (Ramsar); and
  - Forth Islands Special Protection Area (SPA).

4.6.3 Receptor Sensitivity

On the basis of the baseline assessment, Table 4-7 identifies the receptor sensitivity using the criteria outlined in Table 4-2.

Table 4-7: Receptor Sensitivity

Receptor	Sensitivity	Comment
Coastal waters of the Firth of Forth	Medium	Classified waterbody under the WFD. Not an internationally or nationally designated site. Navigable waterbody used by commercial & recreational vessels.
Firth of Forth Site of Special Scientific Interest (SSSI)	High	Internationally or nationally designated site.
Firth of Forth Wetland of International Importance (Ramsar)	High	Internationally or nationally designated site.
Forth Islands Special Protection Area (SPA)	High	Internationally or nationally designated site.

4.6.4 Potential Impacts

This section identifies the potential environmental impacts on the water environment and coastal processes, at and around the site during the construction and operational phases of the proposed development.

The proposed works will involve the following key activities which have the potential to impact the water environment within the site and environs:

- Dredging of navigation channel and marina basin;
- Construction activities (breakwater and pontoons); and
- Marina Operations.

The potential impacts on the water environment and coastal processes include:

- Water Environment:
  - Contamination of coastal water and sediments through spillages, leakages and/or sediment transfer (oils, fuels and suspended solids).
- Coastal Processes:
  - Changes in local wave climate.
  - Changes in local sediment transport regime.

The potential interactions between water environment impacts and ecology are assessed within Chapter 5: Marine Ecology.

The following sections consider the potential impacts and provide an assessment of likely level of significance.

4.6.5 Construction Phase

The potential impacts identified are assessed under the following headings:

- Water and sediment quality;
- Wave climate; and
- Sediment transport.

The degree of potential environmental impact is provided as appropriate.

4.6.5.1 Water and Sediment Quality

Sediment Discharge and Dispersion from Dredging Works

The proposed dredging works could potentially cause plumes of suspended solids and a reduction in water quality with a resultant impact on aquatic life.

As outlined in section 0 and Technical Appendix 4-3, Volume 3 of the EIA, the sampling information available indicates that the bed sediments within the proposed dredge pocket consist of silts. As highlighted in section 0, and Technical Appendix 4-3, Volume 3 of the EIA, contaminated sediment is present within the proposed dredge pocket. The key contaminants with potential to impact water quality are considered to be metals as these have the potential to dissolve/desorb from sorption sites, whereas the organic contaminants (PAHs and PCBs) have a greater affinity for the organic materials which they are bound to, and are more likely to remain strongly bound to the sediment, or if they become dissolved, quickly adsorbed onto organic matter. Although there are contaminants of concern, it is considered that the levels will not contribute to an overall degradation of water quality as the potential for dilution in the Firth of Forth is very considerable.

The key potential impact is considered to be an increase in turbidity/suspended solids during the dredging activity and during disposal, although this is likely to cause localised degradation in water quality, it is considered that this will be a short term, localised event.

Overall it is considered that prior to mitigation the magnitude of impact of sediment discharge and dispersion from dredging works will be low within the dredge area and immediate surrounds.

Pollution Incidences

During construction there is a risk of accidental pollution incidences affecting the water environment (i.e. coastal waters and sediment) from the following sources:

- Spillage or leakage of oils and fuels stored on site;
- Spillage or leakage of oils and fuels from construction machinery or site vehicles;
- Spillage of oil or fuel from refuelling machinery on site;
- Suspended solids from construction works; and
- The use of concrete and cement in construction works.

The main risk is considered to be posed by refuelling activities. Oil or fuel spillages to the water environment would be detrimental to water/sediment quality and could affect fauna and flora. Concrete (specifically the cement component) is generally highly alkaline and any spillage to the water environment and/or soils could be

detrimental to water/sediment quality, fauna and flora. Suspended solids generated during construction works could lead to an increase in turbidity and resultant degradation in water quality.

The effect of the potential pollution incidences during construction on water quality would be dependent on the scale and nature of the incident, therefore the magnitude of impact prior to mitigation may range from low to high.

4.6.5.1 Wave Climate

The proposed development, including the capital dredge requirement, could result in alterations to the local wave climate within Granton Harbour, and immediate surrounds of the Firth of Forth. A wave modelling study has been undertaken by DHI (UK) Ltd, involving both Spectral and Boussinesq wave modelling using the MIKE by DHI software platform, to assess existing wave conditions within Granton Harbour, and look at the impact of the development proposals (Technical Appendix 4.2, Volume 3 of the EIAR).

As outlined in Section 4.5.9, the proposed development site is exposed to wave penetration during storm events, particularly waves generated over a large fetch from the outer firth to the north-east. Lower magnitude waves generated over a shorter fetch to the north-west can also penetrate Granton Harbour.

The wave disturbance modelling undertaken for the proposed construction indicates that the new breakwater will result in a reduction in significant wave height within the western harbour of up to -1m compared with existing conditions during a 1 in 50 year storm event from the north-east (see Figure 4.5, Technical Appendix 4.2, Volume 3 of the EIAR). Smaller reductions in significant wave height (-0.1 to -0.5m) are predicted in the vicinity of the middle pier, whilst negligible change is predicted within the eastern harbour (-0.1 to +0.1m). Immediately outside the Granton Harbour entrance modelling indicates that wave reflection from the new breakwater will produce minor increases in significant wave height during a 1 in 50 year storm from the north-east. During a 1 in 1 year storm event from the north-east a similar pattern of impact, but of lower magnitude, is observed for all areas of the harbour (see Figure 4.6, Technical Appendix 4.2, Volume 3 of the EIAR).

Wave disturbance modelling of storm events from the north-west has also been undertaken to assess the impact of the proposed breakwater. During a 1 in 50 year storm event from the north-west the modelling results indicate that the breakwater construction will result in slight reductions in significant wave height within both the western (-0.05 to -0.3m) and eastern (-0.05 to -0.1m) harbours as a result of attenuation of wave energy (see Figure 4.9, Technical Appendix 4.2, Volume 3 of the EIAR). The breakwater will produce a slight increase in significant wave height within the approaches to the harbour as a result of wave reflection. During a 1 in 1 year storm event from the north-west a similar pattern of impact, but of lower magnitude, is observed for all areas of the harbour (see Figure 4.10, Technical Appendix 4.2, Volume 3 of the EIAR).

The wave modelling study (Technical Appendix 4.2, Volume 3 of the EIAR) makes several recommendations in relation to possible further modelling and design refinement. These recommendations include clarification that the modelling undertaken has not parameterized the floating pontoons, but highlighting that it is anticipated that the presence of a floating pontoon grid will further reduce wave height in the area of interest. It is noted that any future upgrades of the middle pier should take into account the potential impact on the proposed marina through wave reflection. The study highlights that alternative breakwater designs including an extended breakwater length would further reduce wave activity and produce improved conditions within the proposed marina. It is stated that further refinement of the pontoon layout, and/or berthing arrangements, could improve conditions for occupants during periods of increased wave activity. It is however considered that these recommendations do not impact this assessment. This assessment has considered impact relating to the proposed development, whilst the recommendations relate to alternative designs, possible future works, and operational mitigation.

Further details of the wave modelling methodology and results is presented within Technical Appendix 4.2, Volume 3 of the EIAR.

Overall, the impact of the proposed development on the wave climate within Granton Harbour is considered to be of negligible magnitude.

4.6.5.2 Sediment Transport

Coastal sediment transport is driven by wave action and tidal currents. As outlined in section 4.5.10, the existing Granton Harbour breakwaters form a barrier to the westward longshore transport of beach sediment, whilst fine sediment (silt) is transported in suspension into the harbour. Silt drops out of suspension within the sheltered waters of the harbour, with significant intertidal deposits particularly apparent in the eastern harbour. Deposition rates within the harbour are considered to be a function of water depth, with higher rates of deposition observed in deeper berths.

The proposed development is limited to the western harbour, and extension of the western breakwater further into Granton Harbour. Given that the development is confined to the existing sheltered extents of Granton Harbour, and will therefore not extend out further into the Firth of Forth, it is considered that there will be no significant impacts to tidal currents out with the harbour. Additionally, the proposed alignment of the breakwater extension maintains the existing harbour entrance width, and connectivity with the eastern harbour, whilst the proposed dredge will result in entrance channel depths in line with those currently and previously observed within Granton Harbour. Therefore it is considered that there will also be no significant impacts to tidal currents within the harbour extents. Through the scoping consultation process further consideration of the impact on tidal currents has been scoped out of the EIA.

As described in section 0 above, the results of the wave modelling study undertaken for this EIA (Technical Appendix 4.2, Volume 3 of the EIA) highlight that the proposed breakwater extension is likely to reduce significant wave heights within the western harbour, and have negligible impact on significant wave height within the eastern harbour.

In the absence of significant impacts to the drivers of sediment transport, it is considered that there are unlikely to be significant impacts to ongoing sediment transport processes. It is anticipated that the existing processes of transport of silt under suspension into Granton Harbour, and deposition within both the eastern and western harbours, would continue to occur. Deposition rates would be expected to continue to be a function of water depth, as currently observed, and re-suspension of surface layers to occur with tidal and wave action.

Overall, the impact of the proposed development on sediment transport processes within Granton Harbour is considered to be of negligible magnitude.

4.6.6 Operational Phase

The potential impacts identified are assessed under the following headings:

- Water and sediment quality;
- Wave climate; and
- Sediment transport.

The degree of potential environmental impact is provided as appropriate.

4.6.6.1 Water and Sediment Quality

During the operational phase there is likely to be a requirement for maintenance dredging, given the existing supply of fine sediment into the harbour. Should maintenance dredging be required the potential impacts would be of a similar nature to those of the capital dredge during construction. However, it is anticipated that any maintenance dredge arising would likely be both smaller in volume, and uncontaminated or ‘clean’. The source

of existing contamination is understood to be historic, with existing contaminated sediment situated at depth, below more recently deposited 'clean' sediment.

The potential risk of pollution from accidental spillages will remain during the operational phase.

The impacts on water quality would therefore range from low to high magnitude prior to mitigation measures.

4.6.6.2 Wave Climate

The impact of the proposed development during the operational phase on the wave climate within Granton Harbour is considered to be the same as during the construction phase. Therefore the magnitude of impact on the wave climate is considered to be negligible.

4.6.6.3 Sediment Transport

The impact of the proposed development during the operational phase on sediment transport within Granton Harbour is considered to be the same as during the construction phase. Therefore the magnitude of impact on sediment transport is considered to be negligible.

4.6.7 Cumulative Assessment

In addition to the proposed marina works within the marine environment (assessed above), there are related terrestrial proposals as part of a wider proposed development at Granton Harbour. These terrestrial proposals are part of separate planning applications, and are therefore not assessed within this EIA. However, the terrestrial components of the wider development will be designed and operated in line with current best practice guidance, and will be subject to appropriate mitigation measures, in order to prevent significant impacts to the water environment.

Overall it is considered that the cumulative impacts of the proposed development and the above wider developments would not significantly impact the water environment or coastal processes of the Firth of Forth. The cumulative effects are therefore considered to be of negligible magnitude. It is however recommended that the Construction Environmental Management Plan (CEMP) and associated site monitoring plan takes into consideration the presence of the above proposals and related mitigation.

4.7 Mitigation and Monitoring

Mitigation aims to avoid, manage, control and further minimise environmental impacts. Two forms of mitigation are applicable to the potential impacts predicted:

- Design led active mitigation; and
- Procedural and best practice mitigation.

4.7.1 Design Mitigation

Design led mitigation that has been applied can be summarised as follows:

- Wave modelling has been undertaken to refine the design of the proposed development, and inform the impact assessment (Refer to Technical Appendix 4-2, Volume 3 of this EIAR).
- Site investigation has determined the nature of dredge sediments, dredge material will be disposed offshore to a designated disposal ground where it is considered suitable. Any contaminated portion of the dredge arising will be taken off site for land based disposal under licence. Further details of site

investigation and dredge disposal are presented in the Best Practicable Environmental Option (BPEO) report, Technical Appendix 4-3, Volume 3 of the EIAR.

4.7.2 Construction Phase Mitigation

4.7.2.1 Dredging Mitigation

The BPEO (Technical Appendix 4-3, Volume 3) identifies the key proposed mitigation measures for the dredge works as follows:

- Dredging method to be designed to limit release of sediment during works.
- Physical Barrier – a physical silt barrier will be placed between dredging within the western harbour and Eastern harbours/Firth of Forth.
- Turbidity Monitoring – to ensure that material is not being widely displaced. A baseline would need to be established for contaminant levels within the eastern harbour sediments as well as baseline turbidity levels prior to dredging to enable direct comparisons.

4.7.2.2 General Management

A Construction Environmental Management Plan (CEMP) will be developed to ensure that the mitigation measures outlined in the EIA are followed during the proposed construction works. The CEMP will include pollution prevention measures (e.g. Pollution Prevention Plan), and will be in place during construction and operation. The CEMP will remain a live document and will be continually updated as the work progresses. The CEMP will be developed as a practical tool to facilitate the management of environmental mitigation measures and to provide a clear roadmap of the key roles and responsibilities during construction. All mitigation measures will be incorporated into the CEMP, which will include detailed Construction Method Statements (CMS). The CEMP will be submitted prior to commencement of the works for approval by City of Edinburgh Council (CEC), in consultation with SEPA and other relevant agencies.

A suitably qualified Environmental Clerk of Works (EnvCoW) will monitor the construction works to ensure that the CEMP and associated mitigation measures are being implemented effectively.

Best practice will be adopted throughout all phases of development, following current guidance as listed in Section 4.3. The programme of works, including timing, direction and method of capital dredge, will be planned, monitored and managed to minimise the potential negative environmental impacts. Proposed dredge mitigation includes the use of a silt curtain to isolate the western harbour during dredging operations.

A pollution incident response plan will be set out in the CEMP relating to the construction of the proposed development, statutory requirements and identification of areas of highest sensitivity. This will provide site spill response procedures, emergency contact details and equipment inventories and their location. All staff will be made aware of this document and its content during site induction. A copy will be available in the site office at all times.

It is anticipated that a monitoring plan will be implemented. The aim of this will be to characterise the baseline conditions prior to construction works commencing and to continue throughout the construction phase to confirm that the mitigation measures are performing as expected. The monitoring plan will be established and implemented with the agreement of SEPA and Marine Scotland, and will be incorporated into the CEMP.

It is considered that the following elements would be included within the agreed monitoring plan:

- Regular visual inspection of:
    - Harbour waters, more frequent during periods of dredging activity, in order to monitor levels of sediment suspension and dispersion.

- Water quality monitoring: A monitoring plan, covering baseline, construction and post-construction will be agreed with SEPA and Marine Scotland.
- Monitoring as required to satisfy the conditions of any future discharge licence(s) or other environmental legislation.
- Monitoring following any pollution incidents.
- On-going liaison with SEPA and Marine Scotland as required during construction.

All activities with potential to affect the water environment require to be authorised under the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR). The level of authorisation required is dependent on the anticipated environmental risk posed by the activity to be carried out. These activities could include construction drainage.

4.7.2.3 Concrete

There is unlikely to be concrete batching undertaken on-site. However, in the case that batching was to be undertaken on-site the following mitigation measures would be implemented to minimise the potential impact of concrete batching on the water environment in line with PPG6:

- Concrete batching will take place on an impermeable designated area and at least 10m from any waterbody.
- Equipment and vehicles will be washed out in a designated area that has been specifically designed to contain wet concrete/ wash water.
- A closed loop system will be used for wash waters. Wash waters will be stored in a contained lined pond for settlement before being reused (e.g. for mixing and washing).
- No discharge of wash waters will occur on-site. All excess wash water that cannot be reused will be disposed of off-site.

The following mitigation is proposed for concrete handling and placement:

- Pouring of concrete will take place within well shuttered pours to prevent egress of concrete from the pour area.
- Pouring of concrete during adverse weather conditions will be avoided.
- The CEMP will include a Pollution Incident Response Plan, and drivers of vehicles carrying concrete will be informed so as to raise awareness of potential effects of concrete and of the procedures for clean-up of any accidental spills.

Concrete acidity (pH) will be as close to neutral (or site-specific pH) as practicable as a further precaution against spills or leakage.

4.7.2.4 Oil, Fuel, Site Vehicle Use and Storage

The risk of oil contamination will be minimised by good site working practice (further described below) but should a higher risk of oil contamination be identified then installation of an oil separator will be considered.

The storage of oil is considered a Controlled Activity which will be deemed to be authorised if it complies with the Regulations. The mitigation measures to minimise any risk of contaminant release are in line with SEPA PPG and GPP documents and include the following:

- Storage:
    - Storage for oil and fuels on site will be designed to be compliant with GPP 2 and 8.
    - The storage and use of loose drums of fuel on site will be not permitted.
    - The bund will provide storage of at least 110% of the tank's maximum capacity.
- Refuelling and maintenance:

- Fuelling and maintenance of vehicles and machinery, and cleaning of tools, will be carried out in a designated area where possible in line with PPG 7.
- Multiple spill kits will be kept on site.
- Drip trays will be used while refuelling.
- Regular inspection and maintenance of vehicles, tanks and bunds will be undertaken.

Emergency procedure: The Pollution Incident Response Plan will include measures to deal with accidental spillages.

4.7.3 Operational Phase Mitigation

4.7.3.1 General Management

An Environmental Management Plan (EMP) will be in place throughout the operational phase. Best practice will be followed throughout the operational phase, with reference to the SEPA Guidance for Pollution Prevention (GPPs), and best practice outlined in The Green Blue: The Green Guide for Marinas, as outlined in Section 4.3.3.

A Pollution Incident Response Plan will be prepared for the operational phase, and included within the EMP, taking full consideration of best practice, statutory requirements and identification of areas of highest sensitivity. This will provide site spill response procedures, emergency contact details and equipment inventories and their location. All operation staff will be made aware of this document, and its contents, and it will be available in the marina office. Appropriate spill kits and absorbent materials will be stored in a suitable location which is easy to access. Staff/contractors will be trained in the use of spill kits and other pollution control equipment and the operation of pollution control devices.

Pump out facilities will be provided to enable berth holders and visitors to empty holding tanks.

4.7.3.2 Oil, Fuel, Site Vehicle Use and Storage

Fuel, oil and chemical storage will be sited on an impervious base within a bund and secured area. All wastes will be stored in designated areas that are bunded to contain any spillage. Refuelling facilities will be inspected regularly and the maintenance record will be available for inspection, whilst fuel collars and drip trays will be in operation to reduce the risk of spillages. Weekly inspections will be undertaken of oil storage bunds, tanks and pipework for signs of damage. The boat hoist will be inspected on a weekly basis to check for signs of hydraulic oil and fuel leakage.

4.8 Residual Effects

The residual effects expected to arise following implementation of the mitigation measures detailed above are summarised within Table 4-8. These residual effects reflect receptor sensitivity, the post-mitigation magnitude and detail the resultant effect on each receptor. The residual effects are considered to be either minor or negligible, and accordingly no significant effects have been identified.

Table 4-8: Residual Effects

Effect	Receptor	Receptor Sensitivity	Source of Impact	Type of Effect	Duration	Probability of Occurrence	Magnitude of Impact Pre-mitigation	Magnitude of Impact Post-mitigation	Residual Effect (Post-mitigation)
Construction Phase									
Sediment discharge and dispersion	Coastal waters & sediment of Firth of Forth	Medium	Construction including capital dredge	Negative	Short	Possible	Low	Low	Minor
	Designated sites	High	Construction including capital dredge	Negative	Short	Unlikely	Low	Negligible	Negligible
Pollution incidences	Coastal waters & sediment of Firth of Forth	Medium	Construction oils, fuels & concrete	Negative	Short	Possible	Low – High	Low	Minor
Changes to wave climate	Coastal waters & sediment of Firth of Forth	Medium	Construction including capital dredge	Negative	Permanent	Likely	Negligible	Negligible	Negligible
	Designated sites	High	Construction including capital dredge	Negative	Permanent	Unlikely	Negligible	Negligible	Negligible
Changes to sediment transport	Coastal waters & sediment of Firth of Forth	Medium	Construction including capital dredge	Negative	Permanent	Likely	Negligible	Negligible	Negligible
	Designated sites	High	Construction including capital dredge	Negative	Permanent	Unlikely	Negligible	Negligible	Negligible
Operational Phase									
Sediment discharge	Coastal waters & sediment of Firth of Forth	Medium	Operational activities including maintenance dredging	Negative	Short	Possible	Low	Negligible	Negligible

Effect	Receptor	Receptor Sensitivity	Source of Impact	Type of Effect	Duration	Probability of Occurrence	Magnitude of Impact Pre-mitigation	Magnitude of Impact Post-mitigation	Residual Effect (Post-mitigation)
	Designated sites	High	Operational activities including maintenance dredging	Negative	Short	Unlikely	Negligible	Negligible	Negligible
Pollution incidences	Coastal waters & sediment of Firth of Forth	Medium	Operation oils & fuels	Negative	Short	Possible	Low – High	Low	Minor
Changes to wave climate	Coastal waters & sediment of Firth of Forth	Medium	Operational activities including maintenance dredging	Negative	Permanent	Likely	Negligible	Negligible	Negligible
	Designated sites	High	Operational activities including maintenance dredging	Negative	Permanent	Unlikely	Negligible	Negligible	Negligible
Changes to sediment transport	Coastal waters & sediment of Firth of Forth	Medium	Operational activities including maintenance dredging	Negative	Permanent	Likely	Negligible	Negligible	Negligible
	Designated sites	High	Operational activities including maintenance dredging	Negative	Permanent	Unlikely	Negligible	Negligible	Negligible

4.9 Statement of Significance

Overall the effects of the proposed development on the water environment and coastal processes are not considered to be significant.

5 MARINE ECOLOGY AND ORNITHOLOGY

5.1 Introduction

EnviroCentre Ltd was commissioned by Granton Central Developments Ltd to undertake an Ecological Impact Assessment (EcIA) of the Edinburgh Marina development proposal in order to identify and describe any likely significant effects to be anticipated upon the site's ecology and that of the wider area. This chapter lists the specialist studies undertaken and utilised to inform this assessment. The EcIA has been completed according to guidance produced by the Chartered Institute of Ecology and Environmental Management (CIEEM) by experienced and competent ecologists who are all Members of CIEEM and follow its Code of Professional Conduct. The primary author of the chapter is Douglas Blease, Principal Ecologist for EnviroCentre Ltd.

The following Technical Appendices informing the assessment are included in this document and can be found within Volume 3 of this EIAR:

- Technical Appendix 5-1: Otter Survey;
- Technical Appendix 5-2: Marine Mammal Protection Plan;
- Technical Appendix 5-3: Marine Non-native Species Survey
- Technical Appendix 5-4: Habitat Regulations Appraisal
- Technical Appendix 5-5: Underwater Noise

5.1.1 Site Details

Drawings SK112C and 770288-001 and within Volume 3 of this EIAR show the site boundary, which is referred to as 'the site' throughout this chapter.

For a description of the site Refer to Chapter 2 of this EIAR.

5.1.2 Proposed Development

A description of the proposed development can be found in Chapter 2.

5.1.3 Objectives

The purpose of this chapter is to:

- Identify and describe all potentially significant ecological effects associated with the proposed development;
- Set out the mitigation measures required to ensure compliance with nature conservation legislation and to address any potentially significant ecological effects;
- Identify how mitigation measures will be secured;
- Provide an assessment of the significance of any residual effects; and
- Set out the requirements for post-construction monitoring.

5.2 Scoping and Consultation

A scoping report[16] was submitted by EnviroCentre Ltd to Granton Central Developments Ltd in April 2018 which included a Marine and Terrestrial Ecology section which was subdivided into four sub categories: Ornithology, Terrestrial & Marine Ecology and Fish. It was proposed that ornithology, marine mammals and fish were included within Habitats Regulations Assessment (HRA) only and that terrestrial ecology was excluded from the EcIA process as embedded mitigation would be sufficient to minimise effects to the presence of terrestrial ecology. No designated sites were scoped into the assessment.

Following submission of the Scoping Report to Marine Scotland a formal Scoping opinion was issued, and Table 5-1 below summarises the responses to scoping which ultimately defines the agreed breadth of this EcIA.

Table 5-1: Summary of Consultation Responses

Environmental Topic	Consultee	Scoping Comment	How and where addressed
Ornithology	Marine Scotland	Insufficient details about the potential impact of the proposed works and possible mitigation measures for breeding and non-breeding birds have been provided.	**Scoped in.** An HRA has been undertaken to assess potential on qualifying features of designated sites. This can be found in Technical Appendix 5.4, Volume 3. In addition an assessment has been made on potential impacts to breeding birds
	Edinburgh City Council	Edinburgh City Council are concerned that breeding birds would not be covered by the HRA. It is possible that consideration of the methods and timing of the works could be used to mitigate the impact of the works and these could form part of Construction Environmental Management Plans ("CEMP") however in the absence of further information regarding mitigation.	
	SNH	The Scoping Report makes no mention of breeding birds outside of the context of HRA, which will include the Forth Islands SPA, a breeding colony designation. It is possible that non-SPA bird species make use of the land and structures around the application area for breeding. The EIA Report should include an assessment of and/ or mitigation measures relating to the possible presence of breeding birds.	
	RSPB	The RSPB suggest that the scoping report lacks the evidence to support claims that any impacts on birds are unlikely to be significant. They are concerned that the temporal scale of monthly bird counts would be insufficient to identify short-term disruptive changes that may occur as a result of the construction works.	
Marine Mammals	Marine Scotland	Disturbance could be caused to marine mammals and insufficient detail has been provided about potential mitigation	

[16] EnvCRPT8065 Edinburgh Marina Scoping Report April 2018.

Environmental Topic	Consultee	Scoping Comment	How and where addressed
		measures. No assessment of invasive non-native species has been provided.	**Scoped in**. A marine mammal protection plan has been formulated and marine mammals have been considered within the EcIA and Technical Appendix 5-2, Volume 3
	SNH	Without further details about the marine mammal protection plan the impacts on EPS cannot be fully considered. The applicant has also provided insufficient information to determine whether or not an EPS licence would be required.	
Non-Native Species	RYA	Need for appropriate biosecurity measures to be implemented due to the risk of Invasive Non-Native Species. This is especially relevant given the recent infestation of *Undaria* seaweed at Port Edgar.	**Scoped in.** A site survey for Invasive Non-Native Species (*Undaria* seaweed) was undertaken, and is presented in Technical Appendix 5.3 and is considered within the EcIA.
Terrestrial Ecology	City of Edinburgh Council	Otter, an EPS, do still need to be assessed to fully understand the impacts of this development on ecology.	**Scoped in.** EnviroCentre conducted a targeted survey for otter within the site boundary plus at least 200m. The findings are presented in Technical Appendix 5-1 and are considered within the EcIA.
Fish	Marine Scotland/ SNH/ Scottish Ministers	Nearest protected site for fish is 65km from the proposed development.	**Scoped out.** Due to the acceptable distances between the development site and known sensitive areas for migratory fish, and that the development is unlikely to impact on pelagic fish, it is agreed that fish shall be scoped out of this assessment.

The final scope of the ecological impact assessment includes the following elements, which are further described in the sections below:

- A description of the zone of influence of the proposed development;
- The identification of key ecological impacts that should be addressed through project design; and
- A list of the important ecological features to be considered in the EcIA.

5.2.1 Zone of Influence

The CIEEM Guidelines identify the zone of influence as the area over which ecological features may be subject to significant effects as a result of the proposed development and associated activities. This is likely to extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries. Activities associated with the construction, operation (best and worst-case operating conditions), decommissioning and restoration phases should be separately identified. The zone of influence will vary for different ecological features depending on their sensitivity to an environmental change. It may be appropriate to identify different zones of influence for different features. The features affected could include habitats, species, and ecosystems and the processes on which they depend.

The scoping exercise identified the important ecological features. The zone of influence has been set for each one (see section 5.2.7 below).

5.2.2 Key Potential Ecological Impacts

The proposed development would comprise phases of construction followed by operation of the developed marina. These phases could potentially have a significant negative impact on ecology in the absence of effective mitigation. Table 5-2 lists the key potential ecological impacts to be expected at each phase:

Table 5-2: Phase of Works and Potential Impact

Phase	Potential Ecological Impact
Construction	• Underwater noise from vessel movement during dredging (refer to Technical Appendix 5-4: Habitats Regulations Appraisal and Technical Appendix 5-5: Underwater Noise, Qualitative Assessment); • Underwater noise from piling (refer to Technical Appendix 5-5: Underwater Noise, Qualitative Assessment); • Displacement and disturbance arising from vessel movements and loss of habitat (refer to Technical Appendix 5-4: Habitats Regulations Appraisal) • Onshore and near-coastal activities which could affect localised otter activity associated with the shoreline and existing harbour infrastructure; • Pollution to a water body (fuel leaks and spills/ sediment runoff/ erosion); • Sediment dispersal; • Acoustic disturbance and vibration from construction activities; • Areas for plant maintenance and for storage of oils, fuels and chemicals; • Structural works for new construction and engineering; and • Lighting.
Operational	• Onshore activities; • Maintenance dredging; • Underwater noise; and • Increase in vessel movement.

5.2.3 Noise from anthropogenic sources

EnviroCentre Limited has undertaken a review of literature and guidance relating to underwater noise and marine mammals. The review of literature and guidance was required to inform an Ecological Impact Assessment (EcIA) for the proposed Edinburgh Marina Development (Refer to Technical Appendix 5-5: Underwater Noise, Qualitative Assessment, and also Technical Appendix 5-4: Habitats Regulations Appraisal)

Marine construction noise at Edinburgh Marina could be generated in the audible frequency range of fish and sea mammals. Acoustic impacts will occur due to the noise generated by vessel operations, dredging, placement of rock and piling.

It is anticipated that construction generated noise will be intermittent and temporary i.e. only during the construction phase.

Vessel movements are predicted to be highest during the excavation of the marina basin, construction of the quay wall extension to the North Mole and placement of rock. During this period small vessels (e.g. a safety launch) will be active for approximately the same period.

Intensity will vary during this period but will peak during the dredging, piling and placement of rock when the noise generated by these activities will combine with that of construction vessel e.g. tenders and vessels.

5.2.4 Underwater noise descriptors: Measured or received levels

Noise descriptors that are commonly used in underwater acoustics to present measured or received levels include the following:

- Sound pressure level (SPL) – Average noise level over the measurement period expressed in dB re 1 µPa. For impulsive sources, such as impact piling and blasts, the measurement period is the time period that contains 90% of the sound energy (Southall et al. 2007). Continuous sources, such as vibropiling and shipping, are commonly described in terms of an SPL.
- Sound exposure level (SEL) – Total noise energy over the measurement period expressed in dB re 1 µPa2 ·s. The SEL is commonly used for impulsive sources because it allows a comparison of the energy contained in impulsive signals of different duration and peak levels.
- Peak level – Maximum noise level recorded during the measurement period expressed in dB re 1 µPa. The peak level is commonly used as a descriptor for impulsive sources.
- Peak-to-peak level – Difference between the maximum and minimum noise level recorded during the measurement period, expressed in dB re 1 µPa. The peak-to-peak level is used as a descriptor for impulsive sources.

SPLs and SELs can be presented either as overall levels or as frequency dependent levels showing the frequency content of a source.

Overall SPLs and SELs present the total average noise and energy level of a source within a given frequency bandwidth, which usually is the band that contains most of the signal's energy. Frequency dependent representations include spectral density levels, one-third octave band levels, or octave band levels. Spectral density levels give a greater frequency resolution, which is sometimes desirable for identifying narrowband sources such as rotating machinery, and are expressed in unit of dB re 1 μPa^2 /Hz. One-third octave and octave band levels are expressed in units of dB re 1 µPa.

The sound generated by such vessels will typically be the same as that given for other small vessels operating in the area e.g. in the range 151 to 170 (dB re 1µPa) at 0.037 to 50 KHz.

Excavation of sediment will be carried out with a backhoe dredger which will work for approximately three months on site. The extension to North Mole and rock placement will most likely be undertaken from the existing breakwater using terrestrial plant where possible.

The following discusses examples of underwater noise generated from marine plant during construction. Measurements of noise from a working trailer suction hopper dredger indicated that, whilst dredging, a sound

level of 120 to 140 dB was recorded underwater (Clarke et al 2004)[17]. The operation of a clam dredger is estimated to peak at 124 dB re 1 µPa. Measurement of sound during construction work (drilling and excavation) in Fraserburgh Harbour, for example, recorded a mean sound level (SL) of 177.8 dB/µPa/m (Urquhart and Hall 2005)[18]. In the same study the peak SL recorded during rock blasting was estimated as 246.4 dB (relative to 1 µPa at 1 m) and the rms level for the whole 3.8 s period of the double blast as 238.1 dB. ***Blasting is not part of this project***, these data are provided as a conservative worst case for noise disturbance as discussed below.

The broadband peak sound pressure level during pile-driving was 189 dB0-p re 1 µPa (SEL =166 dB re 1 µPa2. s) at 400 m distance, resulting in a peak broadband source level of 228 dB0-p re 1 µPa at 1 m (SEL = 206 dB re 1 µPa2. s at 1 m) (Thompson et al 2006)[19]. Piling methods are not yet known, but if piling is completed by vibropiling to 'refusal' (estimated at 60 minutes per pile) then a short period of impact piling directly (estimated at 1 minute per pile. Consequently the period of the highest noise generation will be for short period for each pile.

Noise can have a number of different effects on organisms as follows:

- Physical damage - e.g. permanent hearing threshold shift, temporary hearing threshold shift;
- Behavioural – e.g. gross interruption/modification of normal behaviour (i.e. behaviour acutely changed for a period of time) and behavioural modification, displacement from area (short or long term);
- Masking of communication with con-specifics and other biologically important noises;
- Interference with ability to acoustically interpret environment;
- Indirect – e.g. reduced availability of prey; and
- Increased vulnerability to predation or other hazards, such as collisions with fishing gear, strandings etc.

The severity of these effects depends on the character, frequency and power of the noise produced, local conditions which affect attenuation and the sensitivity of species.

5.2.5 Physical Damage due to Noise

Urquhart and Hall (2005) provide estimates of a 'danger zone' for bottle-nosed dolphins (*Tursiops truncatus*) of 1600m for blasting (as an example of extreme noise) and 280m for excavation and drilling within which temporary threshold shift (TTS) may occur. In the case of the Edinburgh Marina there is no it is unlikely that the construction will not generate noise of this magnitude. However these data give a conservative indication of the distances at which TSS may occur.

TTS in fish has been recorded at sound pressure levels of greater than 140 (dB re1µPa) for various species and permanent threshold shift at between 153 and 180 dB re 1 µPa in marine species including cod (*Gadus morhua)* and clupeids (the herring family) (Thompson et al 2006).

5.2.6 Behavioural Effects

The main behavioural effects of noise are startle behaviour and masking of vocalisations or echolocation. Based on the attenuation of in water pile driving noise with distance from the source the potential distances at which fish may exhibit startle behaviours were estimated to range from 80m (source noise 144 dB re 1 µPa) to 800m

[17] Clarke D, Dickerson C., Reine K. 2004 Characterisation of Sounds Produced by Dredgers US Army Corps of Engineers
[18] Urquhart D. and Hall C. 2005 A study of underwater noise generated during civil engineering works at Fraserburgh Harbour. Fisheries Research Services Collaborative Report No 07/05
[19] Thomsen F., Ludemann K., Kafemann R. And Piper W (2006). Effects of offshore wind farm nose on marine mammals and fish COWRIE Ltd

(source noise =164 dB re 1 µPa) (Mitson and Knudson 2003)[20]. Noise effects due to pile driving have been investigated and Nedwell et al (2003b)[21] calculated theoretical zones where significant avoidance may occur as 1.4 km for salmon. In this case the piling noise will be attenuated significantly and these distances will be greatly reduced.

Construction noise may mask behaviourally important sounds in certain species e.g. salmon. Sound produced by fish is typically only detectable over short distances e.g. less than 100m. There is therefore potential for such sounds to be masked by the construction noise generated by vessel operations, excavations, rock placement and piling.

Hearing in fish is variable between species. Nedwell et al (2003) [22] estimates that significant avoidance reactions will occur generally in fish at 90 dBht (species) that is 90dB above the threshold of hearing for that particular species. Hearing thresholds for representative fish species are given below in Table 4-1.

Based on the attenuation of noise with distance from the source, the potential distances at which fish may exhibit startle behaviours have been estimated to range from 80m (source noise 144 dB re 1 µPa) to 800m (source noise =164 dB re 1 µPa) (Mitson and Knudson 2003) [23].

It is predicted that, particularly during peak construction period, sound levels from different construction activities e.g. piling, dredging, rock placement and vessel movement may combine be close to or occasionally in excess of the threshold at which avoidance behaviour is estimated to occur i.e. 90 dB re 1 µPa above the hearing threshold for a given species. Startle response is likely to be confined to immediate vicinity of the sound source.

There are no reported audiograms of lamprey. However, given that they lack specialist hearing structures, they are considered to be hearing generalists. There is potential however that lamprey may be able to hear infrasound. The hearing of lamprey is complicated by the fact that they do not have otolith organs and no known work has been undertaken on the response of lamprey to sound in relation to their statoliths or labyrinth organs. Work has been undertaken on cephalopods however, which also have statolith organs for the detection of linear accelerations including gravity (Packard et al., 1990)[24]. This investigation confirmed that cephalopods could detect the kinetic component of low frequency sounds and it is believed that the statoliths are the sensory organs involved (Packard et al., 1990). It was stated within this article that ' gross acceleration of the whole animal, as occurs in an underwater sound field, is an ideal stimulus for the statolith organ'. On this basis it is considered likely that lamprey will be sensitive to infrasound. Studies have however shown that sea lamprey respond to frequencies between 20 and 100 Hz (Lenhardt and Sismour, 1995)[25].

Table 5-3 Hearing Threshold for Representative Fish Species

Species	Hearing Threshold (dB re 1 µPa)
Sea Lamprey	75 at 100 Hz
Atlantic Salmon (*Salmo salar*)	95 at 160 Hz

[20] Mitson R.B. and Knudson H. P. 2003. Causes and effects of underwater noise on fish abundance estimation. Aquatic Living Resources Vol 16 p255-263
[21] Nedwell J. R. Langworthy J and Howell D (2003b) Assessment of sub sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife ; initial measurements of understated noise during construction of offshore Windfarms and comparison with background noise COWRIE report No 544 R 0424 68 pp
[22] Nedwell J., Turnpenny A., Langworthy J and Edwards B. 2003a. Measurements of underwater noise during piling at the Red Funnel Terminal Southampton and observations of its effect on caged fish. Subacoustech Ltd Report for Red Funnel
[23] Mitson R.B. and Knudson H. P.(2003). Causes and effects of underwater noise on fish abundance estimation. Aquatic Living Resources Vol 16 p255-263
[24] Packard, A., Karlsen, H. E., Sand, O., 1990. Low frequency hearing in cephalopods. Journal of Comparative Physiology A. Vol. 166, 501 - 505.
[25] Lenhardt, M.L. and Sismour, E., 1995. Hearing in the sea lamprey (Petromyzon marinus) and the long nose gar (*Lepisosteus spatula*). Assoc. Res. Otolaryngol. Abs: 259. The Association for Research in Otolaryngology.

Construction noise may also mask behaviourally important sounds in certain species e.g. salmon. Sound produced by fish is typically only detectable over short distances e.g. less than 100m. There is therefore potential for such sounds to be masked by the construction noise generated by piling, vessel operations and excavations.

It is anticipated therefore that there could be a local reduction in the abundance of prey species such as fish, and this would be greatest within 100 m. The study area is already subject to regular vessel movement so some degree of acclimatisation to vessel noise is anticipated.

Cetacean echo location is at a higher frequency (120 – 150 kHz), than the majority of construction noise (e.g. vessel movement) (Thomsen et al 2006) except pile driving which is discussed below.

Pile driver noise could therefore interfere with environmental sounds that cetaceans and seals listen to and underwater noise could startle or displace animals and prey as discussed above. Data analysed as part of an offshore wind development reported that – as a result of piling activities - harbour porpoises either avoided the construction area to a large extent or the animals used their echolocation signals much less due to noise from construction activities (Carstensen et al (2006)[26]. A review of noise effects of piling on harbour porpoise by (Thompson et al 2006) indicated that mild behavioural reactions can be expected to occur between 7 and 20 km distant from piling activity. At 9 kHz, pile driving noise is capable of masking strong vocalisations within 10–15km and weak vocalisations up to approximately 40 km (David 2006)[27]. The masking radius reduces as the frequency increases: 6 km at 50 kHz and 1.2km at 115 kHz. The impacts of masking are expected to be limited by the intermittent nature of pile driver noise which in this case will be greatly reduced due to the design and piling method, the dolphin's directional hearing, their ability to adjust vocalisation amplitude and frequency, and the structured content of their signals. Startle response due to sudden noise (e.g. from rock placement) cannot be discounted but is likely to be intermittent, occasional and of low importance.

Seals are not as sensitive to noise as cetaceans. Like cetaceans, seals use noise to communicate and to identify prey (by listening for prey generated noise) but they do not echolocate. Götz (2008)[28] identified that seals become habituated to continuous noise sources but are most affected by sudden noise which causes a startle response. Seal calls are however in the same frequency band as some construction generated noise and masking of seal calls is therefore possible.

Potentially seals may detect source level of 175 dB re 1µPa @ 1m at distances of 1.4 km to 2.9 km in low ambient noise conditions (Terhune et al. 2002)[29] although at these distances the sound it not likely to be sufficient to cause a startle response.

Based on the above behavioural effects on individual cetaceans and seals it is estimated to be confined to the duration of the construction operations and be intermittent. The most significant effects will be for animals that are within 500 m of the site. In addition the area where the most severe noise effects will occur is not recognised to be of particular importance for seals or cetaceans.

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[26] Carstensen J, Henriksen OD and Teilmann J (2006). *Impacts of offshore wind farm construction on* harbour porpoises: acoustic monitoring of echolocation activity using porpoise detectors (T-PODs) Marine Ecological Press Series, Vol. 321: 295–308

[27] David J.A (2006) Likely sensitivity of bottlenose dolphins to pile-driving noise. Water and Environment Journal 20 p48-54

[28] Götz, T., 2008 Aversiveness of sound in marine mammals : Psycho-physiological basis, behavioural Correlates and potential applications. Phd Thesis University of St Andrews

[29] Terhune, J.M., Hoover, C.L. & Jacobs, S.R. (2002) Potential detection and deterrence ranges by harbour seals of underwater acoustic harassment devices (AHD) in the Bay of Fundy, Canada. Journal of the World Aquaculture Society, 33, 176-183.

5.2.7 Important Ecological Features

The Important Ecological Features (IEFs) scoped into this assessment are those predicted to be affected by the impacts listed against phases of work in section 5.2.2. The IEFs with a short description of their local status and the respective Zones of Influence of the potential impacts are listed in Table 5-4 below.

Table 5-4: IEFs and Respective Zone of Influence

IEF	Local Status	Zone of Influence (of potential impact)
Birds	The Firth of Forth Site of Special Scientific Interest (SSSI/SPA/RAMSAR) which applies to a portion of the existing harbour and the coastline immediately to the east and west of the harbour extents and includes the following qualifying features Bar-tailed godwit (*Limosa lapponica*), Common scoter (*Melanitta nigra*), Cormorant (*Phalacrocorax carbo*), Curlew (*Numenius arquata*), Dunlin (*Calidris alpina alpina*), Eider (*Somateria mollissima*), Golden plover (*Pluvialis apricaria*), Goldeneye (*Bucephala clangula*), Great crested grebe (*Podiceps cristatus*), Grey plover (*Pluvialis squatarola*), Knot (*Calidris canutus*), Lapwing (*Vanellus vanellus*), Mallard (*Anas platyrhynchos*), Pink-footed goose (*Anser brachyrhynchus*), Redshank (*Tringa totanus*), Sandwich tern (*Sterna sandvicensis*), Shelduck (*Tadorna tadorna*), Slavonian grebe (*Podiceps auritus*), Turnstone (*Arenaria interpres*). The Forth Islands Special Protection Area (SPA) which lies approximately 500m north west from the proposed development area and includes the following qualifying features: Knot, Oystercatcher (*Haematopus ostralegus*), Redshank (*Tringa totanus*) and Dunlin. The Leith Docks SPA is located 3.82km east of the proposed development area and is designated for Common tern (*Sterna hirundo*).	Within the construction site boundary and immediate environs considering only birds which commonly utilise infrastructure such as harbour walls and sheltered waters found in harbour areas.
Harbour porpoise; Bottlenose dolphin; Minke whale; Humpback whale; Grey seal; and Harbour seal	Refer to baseline information for detail.	Within the site boundary plus 500m mitigation zone as a pre-agreed radius around the piling site prior to any piling (based on the JNCC Guidance).
Otter	Otter are active within the site boundary. Nearby habitat continues along the coastline eastwards to the Water of Leith, westwards towards Birnie Rock and Drum Sands; and likely beyond these locations.	All works within the site and activities affecting approximately 200m beyond the existing Eastern Breakwater; and at least 200m beyond the Western Breakwater.

IEF	Local Status	Zone of Influence (of potential impact)
Invasive species (marine)	*Undaria* seaweed known to occur at Port Edgar to the west of the site.	Within the site and the potential to transport/spread marine invasive species within and beyond the Firth of Forth.

5.3 Policy, Legislation and Guidance

The compilation of this chapter has taken cognisance of the legislation, planning policies, conservation initiatives and general guidance presented in Table 5-5 below.

Table 5-5: Legislation, Planning Policies, Conservation Initiatives and General Guidance Related to Ecology

Scope	Document
International	• International Union for the Conservation of Nature (IUCN) Red List of Threatened Species
European	• Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (The Habitats Directive) • Water Framework Directive (WFD) 2000/60/EC of the European Parliament • Environmental Impact Assessment (EIA) Directive (2014/52/EU) on assessing the potential effects of projects on the environment
National (UK)	• Wildlife and Countryside Act 1981 (as amended) (WCA)
Scottish	• The Conservation (Natural Habitats, &c.) Amendments (Scotland) Regulations 2007 (The Habitats Regulations) • The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 • The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) • The Environmental Impact Assessment (Miscellaneous Amendments Relating to Harbours, Highways and Transport) Regulations 2017 • The Nature Conservation (Scotland) Act 2004 (NCA) • The Wildlife and Natural Environment (Scotland) Act 2011 (WANE)
Planning Policy & Other Advice Documents	• BS 42020:2013: Biodiversity Code of Practice for Planning and Development 2013 • National Marine Plan 2015 • Scottish Biodiversity List • Edinburgh Biodiversity Action Plan 2016-2018 • The Scottish Biodiversity Strategy 2004 and 2013 • Scottish Planning Policy (SPP) 2014 • Edinburgh Local Plan (adopted November 2016) • CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition

The regulatory and policy context most relevant to ecology is described below.

5.3.1 International Union for the Conservation of Nature (IUCN) Red List of Threatened Species

The IUCN Red List provides taxonomic, conservation status and distribution information on plants, fungi and animals that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those plants and animals that are facing a higher risk of global extinction (i.e. those listed as Critically

Endangered, Endangered and Vulnerable). The IUCN Red List also includes information on plants, fungi and animals that are categorized as Extinct or Extinct in the Wild; on taxa that cannot be evaluated because of insufficient information (i.e., are Data Deficient); and on plants, fungi and animals that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme (i.e., are Near Threatened).

5.3.2 Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (The Habitats Directive)

Adopted in 1992, the Habitats Directive 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 and establishes the EU wide Natura 2000 ecological network of protected areas, safeguarded against potentially damaging developments.

Over 1,000 animal and plant species, as well as 200 habitat types, listed in the Directive's Annexes are protected in various ways:

- Annex II species (about 900): core areas of their habitat are designated as Sites of Community Importance (SCIs) and included in the Natura 2000 network. These sites must be managed in accordance with the ecological needs of the species.
- Annex IV species (over 400, including many Annex II species): a strict protection regime must be applied across their entire natural range within the EU, both within and outside Natura 2000 sites.
- Annex V species (over 90): Member States must ensure that their exploitation and taking in the wild is compatible with maintaining them in a favourable conservation status.

5.4 Methodology

5.4.1 Desk Study

In order to inform the scoping report a desk study was undertaken using the following sources:

- A review of bird survey data gathered at monthly intervals between 2004 and 2012 for Granton Harbour;
- SNH Sitelink[30] for details of site designated sites within 5km and their qualifying features;
- A list of Seal Haul-out sites in Scotland[31] and
- Information on marine mammals known to occur within the Firth of Forth from the following sources:
    - The Joint Nature Conservation Committee (JNCC)[32 & 33];
    - Seawatch Foundation[34];
    - Scottish Natural Heritage (SNH)[35];
    - Cetacean Research and Rescue Unit[36]

[30] SNH Sitelink available at: https://gateway.snh.gov.uk/sitelink/ accessed 1/11/2017
[31] List of seal Haul-out sites available at: http://www.gov.scot/Topics/marine/marineenvironment/species/19887/20814/haulouts/list accessed 01/11/2017
[32] JNCC Statutory Nature Conservation Agency Protocol for Minimising the Risk of Injury to Marine Mammals from Piling Noise (2010) available at: http://jncc.defra.gov.uk/pdf/JNCC_Guidelines_Piling%20protocol_August%202010.pdf last accessed 21/08/2018
[33] Reid, J B, Evans, P G H, and Northridge, S P. JNCC Atlas of Cetacean Distribution in north-west European waters (2003) available at: http://jncc.defra.gov.uk/page-2713#download last accessed 21/08/2018
[34] Seawatch Foundation Cetaceans of Western Scotland available at: http://seawatchfoundation.org.uk/wp-content/uploads/2012/07/WesternScotland.pdf last accessed 21/08/2018
[35] SNH About Scotland's Nature: Marine Mammals available at: http://www.snh.gov.uk/about-scotlands-nature/species/mammals/marine-mammals/ last accessed 21/08/2018
[36] Cetacean Research and Rescue Unit website available at: http://www.crru.org.uk/index.asp last accessed 22/08/2018

  - Scottish Government[37 & 38]; and
  - Whale and Dolphin Conservation (WDC)[39].
- Technical Appendix 5.2: Marine Mammal Protection Plan;
- Technical Appendix 5.4: Habitat Regulations Appraisal; and
- Technical Appendix 5.5: Underwater Noise.

For details on targeted desk studies to inform field studies please refer to the relevant Technical Appendices.

5.4.2 Field Studies

The following baseline studies, included in this document as Technical Appendices, were conducted to inform this assessment:

- Technical Appendix 5.1: Otter survey; and
- Technical Appendix 5.3: Marine Non-Native Species Survey;

Survey and reporting was conducted by members of CIEEM. Methods of each study met the relevant guidelines and are detailed in each respective Technical Appendix. The following limitations have been listed as pertinent to the survey effort:

- Baseline studies are generally considered valid for a period of 12 months;
- It should be noted that the baseline is limited by the reliability of third party information and the geographical availability of biological and/or ecological records and data. The absence of species from biological records cannot be taken to represent actual absence. Species distribution patterns should be interpreted with caution as they may reflect survey/reporting effort rather than actual distribution;
- During survey for invasive species and otter, access to internal harbour walls to the south and east and external walls to the north and east were limited due to water depth. These areas were viewed from a distance using binoculars.

5.4.3 Evaluation of Important Ecological Features (IEFs)

European, national and local governments and specialist organisations have together identified a large number of sites, habitats and species that provide the key focus for biodiversity conservation in the UK and Ireland, supported by policy and legislation. These provide an objective starting point for identifying the IEFs that need to be considered.

Table 5-6 shows a procedure for determining the geographical level of importance of IEFs. Where a feature is important at more than one level in the table, its overriding importance is that of the highest level. Usually only the highest level of legal protection is listed.

Table 5-6: Geographical Level of Importance to be Applied to Ecological Features

Level of Importance	Sites	Habitats	Species
International	Designated, candidate or proposed SAC, SPAs and Ramsar sites; UNESCO (Ecological) World Heritage	A viable area of habitat included in Annex I of the EC Habitats Directive; a habitat area that is critical for a part	A European Protected Species; an IUCN Red Data Book species that is globally Vulnerable, Endangered or

[37] Information for the National Marine Plan: Seals available at: https://www.gov.scot/Publications/2011/03/16182005/54 last accessed 22/08/2018
[38] Firth of Forth Banks Complex Designation Summary available at: https://www.gov.scot/Topics/marine/marine-environment/mpanetwork/developing/DesignationOrders/FOFDOrder last accessed 22/08/2018
[39] WDC species guides available at: http://uk.whales.org/species-guide last accessed 21/08/2018

Level of Importance	Sites	Habitats	Species
	Sites; UNESCO Biosphere Reserves; Biogenetic Reserves.	of the life cycle of an internationally important species.	Critically Endangered; a Category An internationally important bryophyte assemblage[40].
National (UK)	SSSI/Areas of Scientific Interest (ASSI); National Nature Reserves (NNR); Nature Conservation Review Sites; Marine Conservation Zones (MCZ) (UK offshore).	A viable area of priority habitat listed in the UK Biodiversity Action Plan (UKBAP)[41]; an area of habitat fulfilling the criteria for designation as an SSSI/ASSI or MCZ; a habitat area that is critical for a part of the life cycle of a nationally important species.	An IUCN Red Data Book species that is Vulnerable, Endangered or Critically Endangered in the UK; a species that is Rare in the UK (<15 10km grid squares); a priority species in the UKBAP[42]; a Schedule 5 (animal) or Schedule 8 (plant) species included in the Wildlife and Countryside Act 1981; a Category A nationally important bryophyte assemblage[43].
National (Scotland)	National Parks; MPA; Marine Consultation Areas	Habitats of principal importance for biodiversity in Scotland[44].	Species of principal importance for biodiversity in Scotland[45].
Regional	Regional Parks	Regional Local Biodiversity Action Plan (LBAP)[46] habitats noted as requiring protection.	A species that is Nationally Scarce in the UK (present in 16-100 10km grid squares); a species that is included in the Regional LBAP; an assemblage of regionally scarce species.
County / Metropolitan	Local Nature Reserves; Wildlife Trust Reserves; Woodland Trust Sites; Royal Society for the Protection of Birds Sites; Local Wildlife Sites.	Regional LBAP habitats noted as requiring protection; semi-natural, ancient woodland >0.25ha in extent.	A species that is included in the Regional LBAP; an assemblage of species that are scarce at the county level.
Local		Semi-natural, ancient woodland <0.25ha in extent; diverse or ecologically valuable hedgerow network; semi-natural habitats that are unique or important in the	Species as defined by Local Authority lists.

[40] Averis, A.B.G, Genney, D.R, Hodgetts, N.G, Rothero, G.P. & Bainbridge, I.P. 2012. Bryological assessment for hydroelectric schemes in the west highlands – 2nd edition. Scottish Natural Heritage Commissioned Report No. 449b (available online at www.snh.org.uk/pdfs/publications/commissioned_reports/449b.pdf)

[41] The UK BAP lists of priority habitats and species have been superseded by the country biodiversity lists, but they are a useful reference source.

[42] The UK BAP lists of priority habitats and species have been superseded by the country biodiversity lists, but they are a useful reference source.

[43] Averis, A.B.G, Genney, D.R, Hodgetts, N.G, Rothero, G.P. & Bainbridge, I.P. 2012. Bryological assessment for hydroelectric schemes in the west highlands – 2nd edition. Scottish Natural Heritage Commissioned Report No. 449b (available online at www.snh.org.uk/pdfs/publications/commissioned_reports/449b.pdf)

[44] These are all the habitats that were identified as requiring action in the UKBAP and continue to be regarded as conservation priorities in the subsequent UK Post-2010 Biodiversity Framework, including any additions.

[45] These are all the species that were identified as requiring action in the UKBAP and continue to be regarded as conservation priorities in the subsequent UK Post-2010 Biodiversity Framework, including any additions.

[46] Edinburgh Local Biodiversity Action Plan http://www.edinburgh.gov.uk/info/20065/conservation/247/biodiversity_in_edinburgh

Level of Importance	Sites	Habitats	Species
		local area; flushes, springs and base rich rock that support bryophyte assemblages that are widespread but localised to these habitats.	

5.4.3.1 Ornithology

The importance of each species is determined through consideration of three factors. Firstly, its legal protection; secondly, its conservation status; and finally, the population size at the site as a percentage of the European and national population sizes.

These three factors are described in more detail below.

Legal Protection of Bird Species

Wild birds within the UK are protected under both European and national legislation. On a European scale, The Birds Directive, or European Directive 2009/147/EC (the codified version of EEC Directive 79/409/EEC as amended), relates to the conservation of all species of naturally occurring birds in the wild state. It covers the protection, management and control of these species and applies to birds, their eggs, nests and habitats.

It requires measures to be taken to address the factors that may affect the numbers of birds, namely, the repercussions of man's activities and, in particular, the destruction and pollution of their habitats, in order to maintain populations at a level that corresponds to ecological, scientific and cultural requirements. The Directive requires, in particular, that species mentioned in Annex 1 shall be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution. Those species that are the subject of special conservation measures under the Directive are referred to as Annex 1 species.

Part I of Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) lists those birds that are protected by special penalties at all times, and provides the highest level of protection in the UK. Part II lists birds that are protected by special penalties during the close season. Those species that are protected by special penalties under the Act are referred to as Part I of Schedule 1, or Part II of Schedule 1 species.

Conservation Status of Bird Species

Wild birds may be listed as Priority Species in Biodiversity Action Plans at national (UK BAP) and local (LBAP) levels. These plans are non-statutory, but aim to describe the biological diversity of the UK, and to set out detailed measures for their conservation, in order to contribute to fulfilling the UK's international and national obligations.

The global conservation status of birds is defined in the IUCN Red List Categories and Criteria[47]. The general aim of this system is to provide an explicit, objective framework for the classification of species according to their extinction risk. This is the world's most comprehensive inventory of the global conservation status of species and those categorised as Threatened may be further categorised on a decreasing scale as Critically Endangered, Endangered or Vulnerable.

Those species not considered as Threatened may be categorised as Near Threatened when close to qualifying, or if likely to qualify in the future. A species at the lowest level of threat is categorised as Least Concern, and

[47] IUCN. (2001). IUCN Red List Categories and Criteria: Version 3.1. IUCN. Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK. ii + 30 pp.

widespread and abundant species are included in this category. When there is inadequate information to make an assessment, a species may be categorised as Data Deficient.

The European conservation status of birds is determined by Birdlife International in their European Red List of Birds[48], which identifies priority species in order that conservation action can be taken to improve their status taken from the IUCN Red List assessment of regional extinction risk. Such birds are described as European Red List of Birds Species (ERLOB).

The national conservation status of birds is determined by their listing on the Red, Amber and Green lists of Birds of Conservation Concern (BoCC), as defined by Eaton *et al*.[49]. The criteria used to assign a species to one of these lists reflect each species' global, European and UK status and measure the importance of the UK populations in international terms.

BoCC Red List species are either globally Threatened using IUCN criteria; have suffered a severe decline since 1800 without substantial recent recovery; have suffered a severe decline in breeding or non-breeding population of more than 50% over 25 years; or suffered a severe decline in breeding range of more than 50%, measured by birds present in 10 km squares, over 25 years.

BoCC Amber List species must have been identified as an ERLOB; or have been Red listed for historical decline in a previous review, but with a substantial recent recovery; or have a moderate (25%-50%) decline in breeding or non-breeding populations or breeding range over the past 25 years; or have a UK breeding population of fewer than 300 pairs, non-breeding population of fewer than 900 individuals; or have at least 50% of the UK breeding or non-breeding population found in 10 or fewer sites; or be species of international importance with at least 20% of the European breeding or non-breeding population found in the UK.

BoCC Green List species comprise all regularly occurring species that do not qualify under any of the Red or Amber criteria. The Green list also includes those species listed as recovering from historical decline in the last review that have continued to recover and do not qualify under any of the other criteria.

Population Size at the Site

To establish the importance of the population size at the site, the size of the European and national populations need to be estimated. In determining the size of the UK population, reference is made to the websites of three organisations: the RSPB[50], the British Trust for Ornithology (BTO)[51] and the Joint Nature Conservation Committee (JNCC)[52]. Scottish populations are determined using The Birds of Scotland[53]. Where there is variation between the estimates provided by these organisations, the range of estimates is provided.

Table 5-7 shows a procedure for determining the geographical level of importance of bird species. Where a feature is important at more than one level in the table, its overriding importance is that of the highest level. Usually only the highest level of legal protection is listed.

[48] BirdLife International (2015). European Red List of Birds. Office for Official Publications of the European Communities, Luxembourg.
[49] Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (2015). Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. British Birds 108, 708–746. Available online at http://www.britishbirds.co.uk/wp-content/uploads/2014/07/BoCC4.pdf
[50] RSPB (2012). http://www.rspb.org.uk/wildlife/birdguide/name. (Accessed on 13/09/18)
[51] BTO (2012). http://www.bto.org/about-birds/birdfacts/find-a-species. (Accessed on 13/09/18)
[52] JNCC (2012). http://jncc.defra.gov.uk/page-1419. (Accessed on 13/09/18)
[53] Forrester, R.W., Andrews I.J., McInerny C.J., Murray R.D., McGowan R.Y., Zonfrillo B., Betts M.W., Jardine D.W. & Grundy D.S. (eds). 2012. *The Birds of Scotland. Digital Version.* The Scottish Ornithologists Club, Aberlady.

Table 5-7: Geographical Level of Importance of Ecological Features (Ornithology)

Level of Importance	Assessment Criteria		
	Legal protection	**Conservation status**	**Population size**
International	Any species within Annex 1 of the EU Birds Directive[54]	Any species which is listed as Critically Endangered or Endangered on the IUCN Red List[55]	Supporting greater than 1% of EC population
National (UK/England)	Any species within Schedule 1 of the Wildlife and Countryside Act[56]	Any species that is listed as a Priority Species in the UKBAP[57]; any species on the BoCC Red List	Supporting greater than 1% of UK population
National (Scotland)		Any species on the Scottish Biodiversity List[58]	Supporting greater than 5% of the Scottish population
National (Ireland & Northern Ireland)		Any species on the Birds of Conservation Concern in Ireland 2014-19 (BoCCI)[59]	Supporting greater than 5% of the Irish population
National (Wales)		Any species considered to be in decline in The State of Birds in Wales 2011 (SBW)[60]	Supporting greater than 5% of the welsh population
Regional		Any species on the BoCC Amber List	Supporting greater than 0.5% of UK population
County		Any species that is listed as a Priority Species in the LBAP	Supporting greater than 0.05% of UK population
Local		BoCC Green List; or species with no conservation concern; common and widespread throughout the UK	Supporting less than 0.05% of UK population

5.4.4 Impact Assessment

The assessment of impacts accounts for the avoidance and mitigation measures which have been embedded within design and describes how the baseline conditions would change as a result of the project and its associated activities and from other developments. The term 'impact' is used commonly throughout the EIA process and is usually defined as a change experienced by a receptor (this can be positive, neutral or negative). The term 'effect' is commonly used at the conclusion of the EIA process and is usually defined as the consequences for the receptor of an impact after mitigation measures have been taken into account. The EIA Regulations specifically require all likely significant effects to be considered. Therefore, impacts and effects are described separately and the effects for the IEFs are assessed as being either significant or not according to the importance of the IEF.

Assessment Criteria - **Magnitude**

The CIEEM guidance states that when describing changes/activities and positive or negative impacts on ecosystem structure and function, reference should be made to the following parameters:

[54] Birds Directive http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0147&from=EN
[55] IUCN Red List http://www.iucnredlist.org/
[56] WCA 1981 Schedule 1 http://www.legislation.gov.uk/ukpga/1981/69/pdfs/ukpga_19810069_en.pdf
[57] Insert UKBAP reference and weblink if appropriate
[58] Scottish Biodiversity List http://www.gov.scot/Topics/Environment/Wildlife-Habitats/16118/Biodiversitylist/SBL
[59] BoCCI http://www.birdwatchireland.ie/LinkClick.aspx?fileticket=WpxRLyul9cA%3d&tabid=178
[60] SBW https://www.rspb.org.uk/Images/statewales_english_tcm9-300742.pdf

- Magnitude;
- Extent;
- Duration;
- Reversibility; and
- Timing and frequency.

Magnitude: refers to the size, amount, intensity and volume of an impact, determined on a quantitative basis if possible, but typically expressed in terms of relative severity, such as major, moderate, low or negligible. Extent, duration, reversibility, timing and frequency of the impact can be assessed separately but they tie in to determine the overall magnitude.

Extent: the area of which the impact occurs. When the IEF is the habitat itself, magnitude and extent may be synonymous.

Duration: the time for which the impact is expected to last prior to recovery or replacement of the IEF. This is defined in relation to ecological characteristics, rather than human timeframes. The duration of an activity may differ from the duration of the resulting impact caused by the activity and this is taken into account.

Reversibility: an irreversible (permanent) impact is one from which recovery is not possible within a reasonable timescale or for which there is no reasonable chance of action being taken to reverse it. A reversible (temporary) impact is one from which spontaneous recovery is possible or for which effective mitigation is possible and an enforceable commitment has been made.

Timing and frequency: the number of times an activity occurs will influence the resulting impact. The timing of an activity or change may cause an impact if it happens to coincide with critical life-stages or seasons.

Criteria for describing the magnitude of an impact are presented in Table 5-8 below:

Table 5-8: Criteria for Describing Magnitude of Impact

Magnitude	Description
Major	Total or major loss or alteration to the IEF, such that it will be fundamentally changed and may be lost from the site altogether; and/or loss of a very high or high proportion of the known population or range of the IEF.
Moderate	Loss or alteration to the IEF, such that it will be partially changed; and/or loss of a moderate proportion of the known population or range of the IEF.
Low	Minor shift away from the existing or predicted future baseline conditions. Change arising from the loss or alteration will be discernible but the condition of the IEF will be similar to the pre-development conditions; and/or having a minor impact on the known population or range of the IEF.
Negligible	Very slight change from the existing or predicted future baseline conditions. Change barely discernible, approximating to the 'no change' situation; and/or having a negligible impact on the known population or range of the IEF.

Assessment Criteria – **Significance**

Significance is a concept related to the weight that is attached to effects when decisions are made. For the purposes of EcIA, a 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for IEFs. In broad terms, significant effects encompass effects on the structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution).

Significant effects are quantified with reference to an appropriate geographic scale (see Table 5-6 above). The CIEEM guidance has one 'level of importance' and a geographical 'scale of significance'. This is to deal with the

fact that the geographical scale at which the effect is significant is not necessarily the same as the geographic level of importance of the IEF.

Professional judgement is used to determine the significance of effects.

Assessment Criteria – **Confidence in Predictions**

CIEEM does not cover levels of confidence in predictions, therefore an approach has been adopted based on river conservation evaluation[61]. A simple, qualitative index based on professional judgement is assigned to each predicted effect as follows:

A: high confidence.
B: intermediate confidence.
C: low confidence.

Factors influencing confidence include:

- The frequency and effort of field sampling;
- Constraints to the field survey;
- The completeness of the data (field and desk);
- The age of the data (although recent data are not necessarily always more reliable than old data);
- The state of scientific knowledge relating to the predicted effects of development activities on the IEF (the accuracy of the magnitude assessment); and
- The accuracy of the assessment of significance.

Cumulative Assessment

Significant cumulative effects can result from the individually insignificant but collectively significant effects of actions taking place over a period of time or concentrated in a location, for example:

- Additive / incremental: multiple activities/projects (each with potentially insignificant effects) added together to give rise to a significant effect due to their proximity in time and space; or
- Associated / connected - a development activity 'enables' another development activity e.g. phased development as part of separate planning applications. Associated developments may include different aspects of the project which may be authorised under different consent processes.

The combined magnitude of impact and significance is assessed for each IEF if construction events take place simultaneously.

Assessment Criteria – **Success of Mitigation**

The word 'mitigation' has developed a wider meaning and common usage in environmental assessment than its strict meaning related to reducing the severity of something. Mitigation can sometimes be used as a generic term for a wide range of counter-acting measures, all of which, as the Directive and Regulations prescribe, are intended to *prevent, reduce and where possible offset any significant adverse effect on the environment*. Mitigation can be used to encompass measures intended to avoid, cancel or reduce adverse effects (this is the 'mitigation hierarchy').

Mitigation and compensation measures often carry a degree of uncertainty. The following objective scale is used for the success of mitigation:

- Certain/near certain: probability estimated at 95% chance or higher.

[61] SERCON: System for Evaluating Rivers for Conservation, Version 2, Technical Manual. Scottish Natural Heritage (2001).

- Probable: probability estimated above 50% but below 95%.
- Unlikely: probability estimated above 5% but less than 50%.
- Extremely unlikely: probability estimated at less than 5%.

5.5 Baseline Summary

5.5.1 Designated Sites

Table 5-9 provides a list of scoped in designated sites for nature conservation within 5km of the site and states their ecological and hydrological linkages to the site.

Table 5-9: Designated Sites

Site Name	Designation	Distance from the site	Designated Feature	Linkage to the site
Firth of Forth	SSSI SPA RAMSAR	0.06km East, 0.1km West, 2.87km North East,	Bar-tailed Godwit (*Limosa lapponica*) – non-breeding Common Scoter (*Melanitta nigra*) – non-breeding Cormorant (*Phalacrocorax carbo*), non-breeding Curlew (*Numenius arquata*), non-breeding Dunlin (*Calidris alpina alpina*), non-breeding Eider (*Somateria mollissima*), non-breeding Golden plover (*Pluvialis apricaria*), non-breeding Goldeneye (*Bucephala clangula),* non-breeding Great crested grebe (*Podiceps cristatus*), non-breeding Grey plover (*Pluvialis squatarola*), non-breeding Knot (*Calidris canutus*), non-breeding Lapwing (*Vanellus vanellus*), non-breeding Long-tailed duck (*Clangula hyemalis*), non-breeding Mallard (*Anas platyrhynchos*), non-breeding Oystercatcher (*Haematopus ostralegus*), non-breeding Pink-footed goose (*Anser brachyrhynchus*), non-breeding Red-breasted merganser (*Mergus serrator*), non-breeding Red-throated diver (*Gavia stellata*), non-breeding Redshank (*Tringa totanus*), non-breeding Ringed plover *(Charadrius hiaticula*), non-breeding Sandwich tern (*Sterna sandvicensis*), passage Scaup (*Aythya marila*), non-breeding Shelduck (*Tadorna tadorna*), non-breeding Slavonian grebe (*Podiceps auritus*), non-breeding Turnstone (*Arenaria interpres*), non-breeding Velvet scoter (*Melanitta fusca*), non-breeding Waterfowl assemblage, non-breeding Wigeon (*Anas penelope*), non-breeding	Connected ecologically and hydrologically
Forth Islands	SPA	0.5km North West	Arctic Tern (*Sterna paradiaea)* – breeding Common Tern (*Sterna hirundo*) – breeding Cormorant (*Phalacrocorax carbo*) – breeding Gannet (*Morus bassanus*) – breeding Guillemot (*Uria aalge*) – breeding Herring Gull (*Larus argentatus*) – breeding Kittiwake (*Rissa tridactyla*) – breeding Lesser Black-Backed Gull (*Larus fuscus*)- breeding Puffin (*Fratercula arctica*) – breeding Razorbill (*Alca torda*) – breeding Rosearte Tern (*Sterna dougallii*)– breeding Sandwich Tern (*Sterna sandvicensis*) – breeding	Connected hydrologically (and thus ecologically for sea birds commuting through the wider landscape)

			Seabird assemblage Shag ((*Phalacrocorax arisotelis*) – breeding	
Imperial Dock Lock, Leith	SPA	3.82km East	Common Tern (*Sterna hirundo)* - breeding	Connected hydrologically (and thus ecologically for sea birds commuting through the wider landscape)
Arthur's Seat Volcano	SSSI	3.82km South East, 3.86km South East, 4.82km South East	Carboniferous – Permian Igneous Lowland acid grassland Lowland calcareous grassland Vascular plant assemblage	None
Inchmickery	SSSI	3.84km North West	Fulmar (*Fulmarus glacialis)* – breeding Herring Gull (*Larus argentatus)* – breeding Lesser Black-Backed Gull (*Larus fuscus)* – breeding Shag (*Phalacrocorax arisotelis)* - breeding	Connected hydrologically (and thus ecologically for sea birds commuting through the wider landscape)

5.5.2 Birds

Bird surveys were undertaken monthly between 2004 and 2012 as a planning condition for a previous development application at Granton Harbour.

Accumulations of wading species are known to forage on the adjacent exposed mussel beds at low tide, and to roost on the harbour wall and breakwaters at high tide. Various species of sea duck are known to congregate offshore in the bay. Numbers fluctuate throughout the year, but are highest during the non-breeding winter period (October to March) when Arctic species are present.

The most commonly recorded species are Knot, Oystercatcher, Redshank and Dunlin all of which are qualifying species for the Firth of Forth SSSI/SPA/RAMSAR and the Forth Islands (SPA) which lies approximately 500m from the proposed development area.

During surveys undertaken in 2011/12, small numbers of waders were recorded roosting on the north breakwater within Granton West Harbour, with peak numbers of Oystercatcher being 38 and Dunlin 33. The survey demonstrated that Granton East Harbour is an important roosting and feeding site for waders, particularly Knot (with a peak of 900 recorded). The two most populated roosts for species are located on pontoons provided by Forth Ports Limited specifically to minimise any disturbance to the birds.

The area from Granton East Harbour to the sub-station (which forms a part of Wardie Bay) supports wildfowl species such as Goldeneye (peak of 481), Eider (peak of 6) and Red-breasted Merganser (peak of 10).

Although no formal breeding bird survey was undertaken, it is likely that few species breed at the site. Gull species, such and Herring Gull and Lesser Black-backed Gull and potentially Oystercatcher.

5.5.3 Marine Mammals

A range of marine mammals are known to be active in the Firth of Forth but the available data[62] has not presented any records of marine mammals within the site boundary.

5.5.3.1 Bottlenose Dolphins

The most commonly sighted cetacean in the Firth of Forth, more specifically the area surrounding Granton, appears to be bottlenose dolphin, however there are scarce estimates of the temporal and/or spatial distribution of the species in The Firth of Forth available. Very high numbers of sightings of bottlenose dolphins *(Tursiops truncatus)* exist on the northeast and eastern coast of Scotland; namely within the Moray Firth SAC which is designated for bottlenose dolphin. Generally however, the frequency of sightings decreases once reaching the Firth of Forth and surrounding area. Nonetheless it is thought that the range of the population of bottlenose dolphin, resident of the Moray Firth, extends as far down as the Firth of Forth, and in which case would still be protected as a feature of the SAC whether in the site or not.

There are occasional sightings of bottlenose dolphins in the Firth of Forth and East Lothian area, particularly between May and December. During summer of 2017, 38 individual bottlenose dolphin sightings were recorded, the closest of which was from Portobello beach, approximately 6km east of Granton where ten animals were observed. However, the majority of sightings come from further along the coast to the east, towards Gullane and Dunbar where the Firth becomes much wider. Since July 2018, 24 bottlenose dolphin sightings have been recorded within 40km of the site; 8 animals off the coast of Kinghorn approximately 9km north, one animal approximately 47km north east off the Isle of May, 8 and 15 off the coast of Anstruther, approximately 40km north.

5.5.3.2 Harbour Porpoise

Harbour porpoise *(Phocoena phocoena)* are occasionally observed in the south east of Scotland where they occur in small numbers in nearshore waters along the coasts of Tayside and East Lothian, and in the Firth of Forth. Most sightings occur between July and September, although no sightings were recorded within or in proximity to The Firth of Forth via Sea Watch Foundation during summer 2017 or 2018.

5.5.3.3 Minke Whale

Minke whale *(Balaenoptera acutorostrata)* are recorded in small numbers in the Firth of Forth and offshore between June and September. One sighting of an individual minke whale was recorded in July 2017, the animal was identified from The Isle of May which is approximately 47km to the north east of Granton. The closest recorded sighting of minke whale to the site since during the summer of 2018 was off the coast of Pittenween, approximately 39km to the north east of Granton.

5.5.3.4 Humpback Whales

Humpback Whales have been sighted in the Firth of Forth in the same locations for the last two years, between Kinghorn and Inchmickery Island, which is approximately 6km north west of Granton, likely foraging on sprats and herring.

5.5.3.5 Grey Seal

Grey seal pup production in the Firth of Forth is steadily increasing; in 2010 approximately 2000 pups were born on the Isle of May 40km to the north east, approximately 1700 on the coast at Fast Castle 60km (straight line) to the east and approximately 250 on Inchkeith Island 7km to the north.

[62] Seawatch Foundation Recent Sightings available at: http://www.seawatchfoundation.org.uk/recentsightings/ last accessed 07/09/2019

5.5.3.6 Harbour Seal

Harbour seal numbers along the east coast are thought to be declining and they are not frequently observed in the Firth of Forth. However, because seals range widely in their search for food (40-50km), single seals of either species might be spotted anywhere along the Scottish coastline.

5.5.3.7 Firth of Forth Banks Complex MPA

The Firth of Forth Banks Complex MPA lies approximately 47km offshore, to the north east of the site and covers a highly productive and biologically rich area of sand and gravel banks which are considered significant to the health of Scotland's seas by supporting populations of small fish and creating conditions ideal for several types of fish to breed. This source of food attracts many larger types of fish, seabirds, and marine mammals such as dolphins and porpoises.

Taking into account the lack of information regarding distribution of cetaceans within the Firth of Forth as well as the potential of The Firth of Forth Banks Complex to attract marine mammals, it is suggested that the following species have the potential to be present within the zone of influence of the development: Bottlenose dolphin, harbour porpoise, grey seal, harbour seal and minke whale.

5.5.4 Otter

Otter are present in the landscape, evident by the discovery of spraints at various locations within the site boundary. No confirmed otter holts or temporary resting sites (couches) were noted however there is opportunity for otter to rest at the site. Given the freshwater habitats of the River Almond to the west and Water of Leith to the east, where otter are known to be present, it is likely that otter are regularly active along this coastline exploiting food resources presented within the intertidal zone (Refer to Technical Appendix 5-1: Otter Survey).

5.5.5 Invasive Non-Native Species

The Royal Yachting Association note that the invasive species *Undaria* is present at Port Edgar which is approximately 11km west of the site. A desk study revealed that the following species were scoped into survey effort as it was considered they could be present in the local area:

- Japanese kelp, or Wakame (*Undaria pinnatifada*);
- Japanese wireweed (*Sargassum muticum*);
- Darwin's barnacle (*Austrominius modestus*);
- Green sea-fingers (*Codium fragile subsp. fragile*);
- Red algae (*Heterosiphonia japonica*);
- Japanese skeleton shrimp *(Caprella mutica*);
- Leathery sea squirt (*Syela clava*);
- Carpet sea-squirt *(Didemnum vexillum*);
- Pacific oyster (*Crassostrea gigas*); and
- Zebra mussel (*Dreissena polymorpha*).

No evidence of Invasive Non-Native Species were discovered within or adjacent to the site boundary.

5.5.6 Prediction of Future Baseline

If development does not occur, and there are no other external changes to the local environment, it is predicted that the ecological baseline will remain the same as it is now, with any changes in ecological populations occurring naturally.

5.5.7 Climate Change[63]

Coastal habitats are complex, dynamic and interdependent. They are important in providing sea defences, areas for recreation, biodiversity and a range of other ecosystem services.

Increased air and sea-surface temperatures have resulted in changes in the distribution of marine and coastal species. Both warmer and colder-water species are shifting northwards. Changes in the phenology of coastal species have been observed, with the rates of change in marine species being considerably greater than those in terrestrial and freshwater systems. Recent advances in the phenology of species have not all occurred at the same rate, in some cases resulting in mismatches of timing of annual cycles of animals and their food organisms.

Rising sea levels have been associated with the loss of coastal habitats. Predicted future rises will have significant impacts on coastal and intertidal habitats, including changing geomorphological processes, further habitat loss and increasing the vulnerability of infrastructure. However, coastal systems are dynamic and have the potential to adapt to rising sea levels, but only if there is an adequate supply of sediment to allow accretion and if there is landward space for the coast to roll-back into. Sea defences and other coastal management interrupt the movement of sediment between systems and prevent natural coastal realignment.

Future changes are hard to predict because it is difficult to separate the impacts of rising sea levels from those of coastal management, including sea defences. Coastal zone management and adaptation, and the interactions with other climate drivers, nutrient deposition and habitat management, will have significant influence on the quantity, quality and location of future coastal habitats

5.6 Evaluation

The evaluations have been applied only to those IEFs which have been scoped in to the assessment and those where there is the potential for impacts that could result in significant adverse ecological effects as a result of the proposed development. The IEFs and the evaluations are presented in Table 5-10 below.

Table 5-10: Evaluation of Important Ecological Features

IEF	Present on site?	Present in wider area?	Level of Importance	Justification
Firth of Forth SSSI/SPA/RAMSAR	No	Yes	International	Special Protection Area/RAMSAR
Forth Islands SPA	No	Yes	International	Special Protection Area
Leith Docks SPA	No	Yes	International	Special Protection Area
Breeding Birds	Yes	Yes	National	Potential for the presence of Red listed species of Conservation Concern (Herring Gull)
Harbour Porpoise	No	Yes	International	European Protected Species
Bottlenose dolphin	No	Yes	International	European Protected Species
Minke whale	No	Yes	International	European Protected Species
Humpback whale	No	Yes	International	European Protected Species
Grey seal	No	Yes	County	Scarce at a county level.
Harbour seal	No	Yes	National (UK)	Harbour Seal are a priority species on the UKBAP.

[63] Taken from the Biodiversity Report Card source paper on coastal and intertidal habitats available at: http://www.nerc.ac.uk/research/partnerships/ride/lwec/report-cards/ (Accessed August 2018).

Otter	Yes	Yes	International (UK)	European Protected Species.
Invasive Non-Native Species	No	Yes	*n/a*	*Not evaluated due to negative biodiversity importance.*

5.7 Assessment of Ecological Impacts

The following assessment takes account of all avoidance and mitigation measures embedded within the design proposal as well as proven or standard mitigation included as recommendations following baseline study presented within the Technical Appendices of this document. However a lack of construction and operational detail as well as underwater noise predictions emanating from literature review reduces the level of confidence in assessment for certain IEFs.

5.7.1 Predicted Negative Construction Impacts

5.7.1.1 Firth of Forth SSSI/SPA/RAMSAR

Nature of impact

As stated in the HRA (Technical Appendix 5-4: Habitats Regulations Appraisal), potential impacts include disturbance through activities such as through dredging, piling (more specifically impact piling), movement of rock armour and increased vessel movements. This could potentially impact on qualifying species, such as Redshank, Knot, Dunlin, Oystercatcher, Bar-tailed Godwit, Turnstone, Golden Plover and Shelduck which could forage in East Granton Harbour and surrounding waters. The proposed development may lead to contamination of coastal water and sediments from accidental pollution incidents (See Chapter 4: Water Environment and Coastal Processes). The main risk is posed by refuelling activities. Oil spillages to the water environment would be detrimental to both water and sediment quality and could affect qualifying species that may be present in the open water surrounding the harbour.

Duration of impact

The duration of this impact would be during the construction period. Following construction there is no reason why the future baseline will not be similar to pre-development conditions thus any impact is temporary.

Importance of IEF

The Firth of Forth SPA is of International importance.

Magnitude

The Firth of Forth SSSI/SPA/RAMSAR comprises an area of 6317.69ha, extending from Alloa to the coasts of Fife and East Lothian. Many of the qualifying species populations are large and the waterfowl assemblage exceeds 90,000 individuals. Granton Harbour does not support significant populations of these species.

The majority of potential impacts are of a temporary nature and would not affect population numbers in the long term. It is possible that any qualifying species using the site would become habituated to both noise disturbance and increased vessel traffic during construction. If this is not the case, it is considered that there is sufficient alternative foraging habitat which could accommodate qualifying species within the SPA so as not to affect the integrity of the site.

Potential pollution incidents would be controlled through mitigation set out in the CEMP.

Therefore the magnitude of impacts are considered Low, with only a minor shift from existing baseline conditions.

Significance of effect

The effects of construction works on the Firth of Forth SSSI/SPA/RAMSAR are not significant.

Confidence in Assessment

Through the findings of the HRA process, this is assessed as A: High Confidence

5.7.1.2 Forth Islands SPA

Nature of impact

As stated in the HRA (Technical Appendix 5-4: Habitats Regulations Appraisal), given the distance of the islands from the proposed development, potential impacts through disturbance are not likely to affect breeding qualifying species on these islands. There is the potential for disturbance and displacement away from foraging areas in the vicinity of construction works for the qualifying species. The proposed development may lead to contamination of coastal water and sediments from accidental pollution incidents (See Chapter 4: Water Environment and Coastal Processes). The main risk is posed by refuelling activities. Oil spillages to the water environment would be detrimental to both water and sediment quality and could affect qualifying species that may be present in the open water surrounding the harbour.

Duration of impact

The duration of this impact would be during the construction period. Following construction there is no reason why the future baseline will not be similar to pre-development conditions thus any impact is temporary.

Importance of IEF

The Forth Islands SPA is of International importance.

Magnitude

The majority of potential impacts are of a temporary nature and would not affect population numbers in the long term. It is possible that any qualifying species using the site would become habituated to both noise disturbance and increased vessel traffic during construction. If this is not the case, it is considered that there is sufficient alternative foraging habitat which could accommodate qualifying species of the SPA so as not to affect the integrity of the site.

Potential pollution incidents would be controlled through mitigation set out in the CEMP.

Therefore the magnitude of impacts are considered negligible.

Significance of effect

The effects of construction works on the Forth Islands SPA are not significant.

Confidence in Assessment

Through the findings of the HRA process, this is assessed as A: High Confidence

5.7.1.3 Leith Docks SPA

Nature of impact

As stated in the HRA (Technical Appendix 5-4: Habitats Regulations Appraisal), given the distance of Leith Docks (3.82km) from the proposed development, potential impacts through disturbance will not affect breeding qualifying species at this site. There is the potential for disturbance and displacement away from foraging areas in the vicinity of construction works for the qualifying species. The proposed development may lead to contamination of coastal water and sediments from accidental pollution incidents (See Chapter 4: Water Environment and Coastal Processes). The main risk is posed by refuelling activities. Oil spillages to the water environment would be detrimental to both water and sediment quality and could affect qualifying species that may be present in the open water surrounding the harbour.

Duration of impact

The duration of this impact would be during the construction period. Following construction there is no reason why the future baseline will not be similar to pre-development conditions thus any impact is temporary.

Importance of IEF

The Leith Docks SPA is of International importance.

Magnitude

The majority of potential impacts are of a temporary nature and would not affect population numbers in the long term. It is possible that any qualifying species using the site would become habituated to both noise disturbance and increased vessel traffic during construction. If this is not the case, it is considered that there is sufficient alternative foraging habitat which could accommodate qualifying species of the SPA so as not to affect the integrity of the site.

Potential pollution incidents would be controlled through mitigation set out in a CEMP (Refer to Schedule of Mitigation (Chapter 7).

Therefore the magnitude of impacts are considered negligible.

Significance of effect

The effects of construction works on the Leith Docks SPA are not significant.

Confidence in Assessment

Through the findings of the HRA process, this is assessed as A: High Confidence

5.7.1.4 Breeding Birds

Nature of impact

There is the potential for birds to be displaced from their preferred nesting areas in the vicinity of the proposed development through the increase in noise and visual disturbance created during the construction activity.

Duration of impact

The duration of this impact will be temporary during the construction phase, depending on the levels of construction activity within the marina, and the preferred locations of birds to establish a nest. However, due to the small number of nesting birds present within the harbour, and the number of appropriate nesting locations along the Lothian coast, most nesting birds are only likely to be displaced a short distance.

Importance of IEF

Herring Gull is listed on the BoCC Red List, as a species of high conservation concern, and is considered to be of National importance.

Oystercatcher and Lesser Black-backed Gull are listed on the BoCC Amber List, and are therefore considered to be of Regional importance, although Lesser Black-backed Gull is one of the commonest breeding birds in the urban environment around Edinburgh, as well as the islands within the Forth.

Other breeding species may include Rock Pipit (*Anthus petrosus*), which has no conservation concern, is frequently encountered in rocky environments along the East coast of Scotland, and is considered to be of Local importance.

Magnitude

The magnitude of impact on the limited nesting bird assemblage is considered negligible.

Significance of effect

The effects of the operational phase on breeding birds are not significant.

Confidence in Assessment

Through the findings of the HRA process, this is assessed as A: High Confidence

5.7.1.5 Harbour porpoise

Nature of impact

There is the potential to affect this species through the increase in turbidity and transmission of underwater noise and vibration when dredging and piling. Underwater noise can affect the behaviour of species which use echolocation to navigate, communicate and hunt.

Pollution events would also affect water quality and species which harbour porpoise feed upon which can lead to illness or fatality.

Duration of impact

The duration is temporary, likely to last for a period of 6-8 months during construction and within restricted working times and often determined by tide times.

Importance of IEF

Harbour porpoise is of international importance.

Magnitude

As the impacts are temporary in nature and only likely to affect a radius of 500m the magnitude of impact is negligible.

Significance of effect

The effect of construction will be Not Significant.

Confidence in assessment

Given a lack of construction information coupled with a lack of detailed noise modelling, but on the assumption that such detail shall follow to further inform the design process, the assessment is given with B: Intermediate Confidence.

5.7.1.6 Bottlenose dolphin

Nature of impact

There is the potential to affect this species through the increase in turbidity and transmission of underwater noise and vibration when dredging and piling. Underwater noise can affect the behaviour of species which use echolocation to navigate, communicate and hunt.

Pollution events would also affect water quality and species which bottlenose dolphin feed upon which can lead to illness or fatality.

Duration of impact

The duration of dredging and piling is temporary, likely to last for a period of 6-8 months during construction and within restricted working times and often determined by tide times.

Importance of IEF

Bottlenose dolphin is of international importance.

Magnitude

As the impacts are temporary in nature and only likely to affect a radius of 500m the magnitude of impact is negligible.

Significance of effect

The effect of construction will be Not Significant.

Confidence in assessment

Given a lack of construction information coupled with a lack of detailed noise modelling, but on the assumption that such detail shall follow to further inform the design process, the assessment is given with B: Intermediate Confidence.

5.7.1.7 Minke whale

Nature of impact

There is the potential to affect this species through the increase in turbidity and transmission of underwater noise and vibration when dredging and piling. Underwater noise can affect the behaviour of species which use echolocation to navigate, communicate and hunt.

Pollution events would also affect water quality and species which minke whale feed upon which can lead to illness or fatality.

Duration of impact

The duration of dredging and piling is temporary, likely to last for a period of 6-8 months during construction and within restricted working times and often determined by tide times.

Importance of IEF

Minke whale is of international importance.

Magnitude

As the impacts are temporary in nature and only likely to affect a radius of 500m the magnitude of impact is negligible.

Significance of effect

The effect of construction will be Not Significant.

Confidence in assessment

Given a lack of construction information coupled with a lack of detailed noise modelling, but on the assumption that such detail shall follow to further inform the design process, the assessment is given with B: Intermediate Confidence.

5.7.1.8 Humpback whale

Nature of impact

There is the potential to affect this species through the increase in turbidity and transmission of underwater noise and vibration when dredging and piling. Underwater noise can affect the behaviour of species which use echolocation to navigate, communicate and hunt.

Pollution events would also affect water quality and species which Humpback whale feed upon which can lead to illness or fatality.

Duration of impact

The duration of dredging and piling is temporary, likely to last for a period of 6-8 months during construction and within restricted working times and often determined by tide times.

Importance of IEF

Humpback whale is of international importance.

Magnitude

As the impacts are temporary in nature and only likely to affect a radius of 500m the magnitude of impact is negligible.

Significance of effect

The effect of construction will be Not Significant.

Confidence in assessment

Given a lack of construction information coupled with a lack of detailed noise modelling, but on the assumption that such detail shall follow to further inform the design process, the assessment is given with B: Intermediate Confidence.

5.7.1.9 Grey seal

Nature of impact

There is the potential to affect this species through the increase in turbidity and transmission of underwater noise and vibration when dredging and piling. Underwater noise can affect the behaviour of species which use echolocation to navigate, communicate and hunt.

Pollution events would also affect water quality and species which Grey seal feed upon which can lead to illness or fatality.

Duration of impact

The duration of dredging and piling is temporary, likely to last for a period of 6-8 months during construction and within restricted working times and often determined by tide times.

Importance of IEF

Grey seal is of county/metropolitan importance.

Magnitude

As the impacts are temporary in nature and only likely to affect a radius of 500m the magnitude of impact is negligible.

Significance of effect

The effect of construction will be Not Significant.

Confidence in assessment

Given a lack of construction information coupled with a lack of detailed noise modelling, but on the assumption that such detail shall follow to further inform the design process, the assessment is given with B: Intermediate Confidence.

5.7.1.10 Harbour seal

Nature of impact

There is the potential to affect this species through the increase in turbidity and transmission of underwater noise and vibration when dredging and piling. Underwater noise can affect the behaviour of species which use echolocation to navigate, communicate and hunt.

Pollution events would also affect water quality and species which harbour seal feed upon which can lead to illness or fatality.

Duration of impact

The duration of dredging and piling is temporary, likely to last for a period of 6-8 months during construction and within restricted working times and often determined by tide times.

Importance of IEF

Harbour seal is of national (UK) importance.

Magnitude

As the impacts are temporary in nature and only likely to affect a radius of 500m the magnitude of impact is negligible.

Significance of effect

The effect of construction will be Not Significant.

Confidence in assessment

Given a lack of construction information coupled with a lack of detailed noise modelling, but on the assumption that such detail shall follow to further inform the design process, the assessment is given with B: Intermediate Confidence.

5.7.1.11 Otter

Nature of impact

During construction the current behaviour of otter which includes accessing the site, depositing spraint and potentially resting would be impacted from onshore and near coastal activities, pollution events, lighting and traffic movements. Otter may also be foraging and socialising within the sheltered areas associated with the harbour and again, this activity would be dissuaded by the construction and dredging processes. It is possible that landscape scale dispersal, between such habitats as The Water of Leith and The River Almond, using the coastline may be hindered at times of coastline construction or dredging.

Duration of impact

The duration of this impact would be during the construction period and within this timeframe only during daytime working hours of 07:00 to 20:00 (assumed until formal construction programme developed). When the site is inactive within the construction period, otter would be able to resume normal passage along the coastline. Following construction there is no reason why the future baseline will not be similar to pre-development conditions thus any impact is temporary.

Importance of IEF

Otter are of international importance.

Magnitude

The magnitude of impact during construction is considered to be Low as partial disruption to current site access by otter will be a minor shift from the existing baseline conditions. Construction works shall cease during night time hours when otter are most active and which mitigation can be applied to minimise impacts during the timing of certain aspects of construction.

Significance of effect

Not significant. The type and structure and function of the coastal habitat which otter are exploiting will not change and there will be no risk to the conservation status of the species.

Confidence in assessment

Due to the recent and thorough gathering of field evidence, minimal constraints to survey and knowledge of the species applied, this assessment is made with A: High Confidence.

5.7.2 Predicted Negative Operational Impacts

5.7.2.1 Firth of Forth SSSI/SPA/RAMSAR

As stated in the HRA, potential impacts include disturbance through an increase in human presence and increased vessel movements. This could potentially impact on qualifying species, such as Redshank, Knot, Dunlin,

Oystercatcher, Bar-tailed Godwit, Turnstone, Golden Plover and Shelduck which could forage in East Granton Harbour and surrounding waters.

Duration of impact

The duration of this impact would be permanent

Importance of IEF

The Firth of Forth SSSI/SPA/RAMSAR is of International importance

Magnitude

The Firth of Forth SPA comprises an area of 6317.69ha, extending from Alloa to the coasts of Fife and East Lothian. Many of the qualifying species populations are large and the waterfowl assemblage exceeds 90,000 individuals. Granton Harbour does not support significant populations of these species.

There is already a variety of marine traffic associated with the existing harbour and the eastern harbour, and an increase in vessel movements is likely to be habituated to by birds. Even if this is not the case, it is considered that there is sufficient alternative foraging habitat which could accommodate qualifying species of the SPA so as not to affect the integrity of the site.

Therefore the magnitude of impacts are considered Low, with only a minor shift from existing baseline conditions.

Significance of effect

The effects of operational impacts (i.e. increased vessel movements) on the Firth of Forth SSSI/SPA/RAMSAR are not significant.

Confidence in Assessment

Through the findings of the HRA process, this is assessed as A: High Confidence

5.7.2.2 Forth Islands SPA

Nature of impact

There is the potential for disturbance and displacement away from foraging areas in the vicinity of the proposed development through the increase in human presence and vessels movements for the qualifying species.

Duration of impact

The duration of this impact would be during the operational phase would be permanent.

Importance of IEF

The Forth Islands SPA is of International importance.

Magnitude

There is already a variety of marine traffic associated with the existing harbour and the eastern harbour, and an increase in vessel movements is likely to be tolerated by birds. Even if this is not the case, it is considered that there is sufficient alternative foraging habitat which could accommodate qualifying species of the SPA so as not to affect the integrity of the site.

Therefore the magnitude of impacts are considered negligible.

Significance of effect

The effects of the operational phase on the Forth Islands SPA are not significant.

Confidence in Assessment

Through the findings of the HRA process, this is assessed as A: High Confidence

5.7.2.3 Leith Docks SPA

Nature of impact

There is the potential for disturbance and displacement away from foraging areas in the vicinity of the proposed development through the increase in human presence and vessels movements for the qualifying species.

Duration of impact

The duration of this impact would be during the operational phase would be permanent.

Importance of IEF

The Leith Docks SPA is of International importance.

Magnitude

There is already a variety of marine traffic associated with the existing harbour and the eastern harbour, and an increase in vessel movements is likely to be tolerated by birds. Even if this is not the case, it is considered that there is sufficient alternative foraging habitat which could accommodate qualifying species of the SPA so as not to affect the integrity of the site.

Therefore the magnitude of impacts are considered negligible.

Significance of effect

The effects of the operational phase on the Leith Docks SPA are not significant.

Confidence in Assessment

Through the findings of the HRA process, this is assessed as A: High Confidence

5.7.2.4 Breeding Birds

Nature of impact

There is the potential for disturbance and displacement away from nesting areas in the vicinity of the proposed development through the increase in human presence and vessel movements.

Duration of impact

The duration of this impact has the potential to be permanent for some species during the operational phase, depending on the levels of activity within the marina, and the preferred locations of birds to establish a nest. However, due to the small number of nesting birds present within the harbour, and the number of appropriate nesting locations along the Lothian coast, most nesting birds are only likely to be displaced a short distance.

Importance of IEF

Herring Gull is listed on the BoCC Red List, as a species of high conservation concern, and is considered to be of National importance.

Oystercatcher and Lesser Black-backed Gull are listed on the BoCC Amber List, and are therefore considered to be of Regional importance, although Lesser Black-backed Gull is one of the commonest breeding birds in the urban environment around Edinburgh, as well as the islands within the Forth.

Other breeding species may include Rock Pipit (*Anthus petrosus*), which has no conservation concern, is frequently encountered in rocky environments along the East coast of Scotland, and is considered to be of Local importance.

Magnitude

The magnitude of impact on the limited nesting bird assemblage is considered negligible.

Significance of effect

The effects of the operational phase on breeding birds are not significant.

Confidence in Assessment

Through the findings of the HRA process, this is assessed as A: High Confidence

5.7.2.5 Harbour porpoise

Nature of impact

The operation of the harbour would require scheduled maintenance dredging and would see an increase in the frequency of vessel movements, potentially also an increase in the size of vessels. This would increase the risk of collision with this species which would cause injury or fatality.

Duration of impact

The duration of impact would be temporary (dredging); and permanent (vessel use).

Importance of IEF

Harbour porpoise is of international importance.

Magnitude

The magnitude of the impact is deemed Low.

Significance of effect

The effects of the operational phase on harbour porpoise are not significant.

Confidence in assessment

As there is a lack of predicted operational information at this stage of the proposals, the assessment is given with B: Intermediate Confidence.

5.7.2.6 Bottlenose dolphin

Nature of impact

The operation of the harbour would require scheduled maintenance dredging and would see an increase in the frequency of vessel movements, potentially also an increase in the size of vessels. This would increase the risk of collision with this species which would cause injury or fatality.

Duration of impact

The duration of impact would be temporary (dredging); and permanent (vessel use).

Importance of IEF

Bottlenose dolphin is of international importance.

Magnitude

The magnitude of the impact is deemed Low.

Significance of effect

The effects of the operational phase on bottlenose dolphin are not significant.

Confidence in assessment

As there is a lack of predicted operational information at this stage of the proposals, the assessment is given with B: Intermediate Confidence.

5.7.2.7 Minke whale

Nature of impact

The operation of the harbour would require scheduled maintenance dredging and would see an increase in the frequency of vessel movements, potentially also an increase in the size of vessels. This would increase the risk of collision with this species which would cause injury or fatality.

Duration of impact

The duration of impact would be temporary (dredging); and permanent (vessel use).

Importance of IEF

Minke whale is of international importance.

Magnitude

The magnitude of the impact is deemed Low.

Significance of effect

The effects of the operational phase on minke whale are not significant.

Confidence in assessment

The assessment is given with A: High Confidence.

5.7.2.8 Humpback whale

Nature of impact

The operation of the harbour would require scheduled maintenance dredging and would see an increase in the frequency of vessel movements, potentially also an increase in the size of vessels. This would increase the risk of collision with this species which would cause injury or fatality.

Duration of impact

The duration of impact would be temporary (dredging); and permanent (vessel use).

Importance of IEF

Humpback whale is of international importance.

Magnitude

The magnitude of the impact is deemed Low.

Significance of effect

The effects of the operational phase on Humpback whale are not significant.

Confidence in assessment

As there is a lack of predicted operational information at this stage of the proposals, the assessment is given with B: Intermediate Confidence.

5.7.2.9 Grey seal

Nature of impact

The operation of the harbour would require scheduled maintenance dredging and would see an increase in the frequency of vessel movements, potentially also an increase in the size of vessels. This would increase the risk of collision with this species which would cause injury or fatality.

Duration of impact

The duration of impact would be temporary (dredging); and permanent (vessel use).

Importance of IEF

Grey seal is of county/metropolitan importance.

Magnitude

The magnitude of the impact is deemed Low.

Significance of effect

The effects of the operational phase on Grey seal are not significant.

Confidence in assessment

As there is a lack of predicted operational information at this stage of the proposals, the assessment is given with B: Intermediate Confidence.

5.7.2.10 Harbour seal

Nature of impact

The operation of the harbour would require scheduled maintenance dredging and would see an increase in the frequency of vessel movements, potentially also an increase in the size of vessels. This would increase the risk of collision with this species which would cause injury or fatality.

Duration of impact

The duration of impact would be temporary (dredging); and permanent (vessel use).

Importance of IEF

Harbour seal is of international importance.

Magnitude

The magnitude of the impact is deemed Low.

Significance of effect

The effects of the operational phase on harbour seal are not significant.

Confidence in assessment

As there is a lack of predicted operational information at this stage of the proposals, the assessment is given with B: Intermediate Confidence.

5.7.2.11 Otter

Nature of impact

It is anticipated that human activity and utilisation of the marina and its surrounds will increase as a result of this development becoming operational. This increase may result in a reduction of otter activity at certain locations where human activity may be concentrated. Otter activity in and around the marina may be impacted during times of maintenance dredging.

Passage via the site between local habitats is likely to continue. Any opportunistic resting at the site in the future may be reduced dependant on available sheltering resources.

Duration of impact

Otter are known to become accustomed to human presence and activities over time and as such a return to otter being active across the site is expected. Therefore the duration of operational impact will be long term but eventually returning close to similar baseline conditions.

Importance of IEF

Otter are of international importance.

Magnitude

The magnitude of impact is considered to be Negligible as a very slight change from existing baseline conditions is expected.

Significance of effect

Not significant.

Confidence in assessment

As the fieldwork was conducted with minimal limitations and coupled with strong assumptions on how otter utilise local freshwater habitats in conjunction with the coastal environment, this assessment is given with A: High Confidence.

5.7.3 Cumulative Assessment

In addition to the proposed marina works within the marine environment (assessed above), there are related terrestrial proposals as part of a wider proposed development at Granton. These terrestrial proposals are part of separate planning applications, and are therefore not assessed within this EIA. However, the terrestrial components of the wider development will be designed and operated in line with current best practice guidance, and will be subject to appropriate mitigation measures, in order to prevent significant impacts to the water environment.

5.8 Mitigation and Monitoring

- An Ecological Clerk of Works (ECoW) and Marine Mammal Observer (MMO) shall be appointed to audit and provide advice throughout the construction duration. Site attendance frequency will be agreed with statutory consultees.
- The possible occasional presence of otter, marine mammals and a range of bird species on site and in the wider landscape will be included in tool box talks and site induction for construction staff operating in this area;
- Works associated with land above the high water mark shall be preceded by a pre-works check for otter resting sites and nesting birds;
- If an otter is observed within the proposed working areas, guidance will be sought from the appointed ECoW and do not commence works until the otter has dispersed. All observations of otter shall be recorded and submitted to local biological records centres (Refer to Technical Appendix 5-1 Otter Survey);
- Should an otter resting site be discovered, prior to or during works, said works shall be assessed by the ECoW with regards to the need for additional mitigation species disturbance licensing (Refer to Technical Appendix 5-1 Otter Survey);Potential otter holts and shelters should be checked prior to works commencing by a qualified ecologist;
- The removal of boulders and concrete with the potential to shelter otter must be supervised by a qualified ecologist;
- All site contractors should be made aware of the potential presence of otter in the locale, and in the event that otter is discovered on site, all work in that area must stop immediately and a suitably qualified ecologist contacted;
- The development design seeks to retain or create new otter sheltering habitat wherever possible;
- Works and related site mobilisations will commence no earlier than one hour after dawn and will cease no later than one hour before sunset to avoid times where otter are likely to be active;
- Temporary lights used during construction must be fitted with shades to prevent light spillage outside the working area. Temporary lights must not illuminate scrub and scattered trees as lighting can affect commuting and foraging success of otter and other species;
- Any trenches or pits made during construction must be covered when unattended or a shallow angled plank inserted to allow animals to escape, should they become trapped inside them. The ends of any pipeline must be capped when unattended, or at the end of each working day to prevent animal access;
- Scottish Environment Protection Agency (SEPA) Guidance for Pollution Prevention (GPPs) would be followed;
- In the event that any protected species is discovered all work in that area must stop immediately and a suitably qualified Ecologist contacted. Details of the SNH Area Officer and Scottish Society for the Prevention of Cruelty to Animals (SSPCA) relevant Officer could be held in site emergency procedure documents.
- Refer to Technical Appendix 5-2: Marine Mammal Protection Plan for the Marine Mammal Mitigation Protocol
- Artificial lighting shall be directed towards the working areas only in order to minimise the effects on otter which can be more active between dusk and dawn;

- Pollution of the marine environment will be prevented in order to safeguard water quality and marine life which otter rely on within these habitats; and
- The ECoW and MMO will keep accurate records of site observation monitoring, including compliance and non-compliance details.

5.8.1 Construction Phase Mitigation

- Timing and duration – Avoid conducting piling activities during times when marine mammals and fish are likely to be breeding, calving, feeding, or resting in biologically important habitats located within the potential noise impact footprint.
- Piling method – Use low noise piling methods where practicable, such as vibropiling, instead of impact piling methods where possible. Vibropiling methods produce lower noise levels and are not impulsive in character. This reduces the likelihood of hearing injury to occur within marine mammals. The piling method should be optimised taking into account time on-site and likely noise levels.
- Soft start - The use of a 'soft start' or 'ramping up' process, in which pile driving energy is gradually increased to normal operating levels, gives nearby animals an opportunity to vacate the area before sound levels increase to an extent that may cause injury. There is some concern that this technique may actually attract animals, and so should be used with this is mind and always with trained marine mammal observers present (Jefferson et al. 2009). Also, it is likely that behavioural changes and possibly masking will still occur for nearby animals (Madsen et al. 2006).
- Contract documentation – Include the standard management and mitigation procedures, and any additional measures to be put in place, in the contract documentation.
- Trained team – Ensure that a suitably qualified person is available during piling activities to conduct the standard operational procedures outlined below. A suitably qualified person should have qualifications in ecology or environmental sciences and demonstrated experience with the identification and management of marine mammals. A briefing on environmental matters, including information on guidelines, marine mammal identification and legal obligations should be provided to all staff involved in the piling activities. Likely marine mammal concentration areas, key feeding sites, and other aggregation areas should be identified during the planning stage and this information should be provided to trained team members and the marine mammal observer to improve the identification and observation of marine mammals.
- Bubble curtains - Demonstrated to significantly lower both pile driving sound pressure levels and peak frequencies. Typically a bubble curtain consists of a perforated hose that is anchored to the sea floor around the area where piling is taking place. Compressed air is pumped through the hose and a 'curtain' of bubbles produced. Bubble screens can reduce the sound pressure levels up to a biologically significant 25dB in the frequency range of concern for marine mammals. Other variations of bubble curtains such as screens and jackets are commonly used to reduce pile driving noise at offshore wind-farms (Evans 2008) and are worth considering.
- The following good practice guidelines will be adhered to and incorporated into the CMS:
    - GGP5: Works and maintenance in or near water;
    - PPG 6: Working at construction and demolition sites;
    - PPG 7: Safe Storage – The safe operation of refuelling facilities;
    - GPP21: Pollution and incident response planning; and
    - PPG22: Incident response – dealing with spills.
- An Ecological Clerk of Works (ECoW) will be employed throughout the construction phase to audit adherence to the mitigation outlined in the CMS.
- The following good practice guidelines shall be adhered to and incorporated into the CEMP:
    - GGP 5: Works and maintenance in or near water;
    - PPG 6: Working at construction and demolition sites;
    - PPG 7: Safe Storage – The safe operation of refuelling facilities;
    - GPP 21: Pollution and incident response planning; and
    - PPG 22: Incident response – dealing with spills.

Bubble curtains can be used to significantly lower both pile driving sound pressure levels and peak frequencies (Refer to Technical Appendix 5.5: Habitats Regulation Appraisal, Volume 3). Typically a bubble curtain consists of a perforated hose that is anchored to the sea floor around the area where piling is taking place. Compressed air is pumped through the hose and a 'curtain' of bubbles produced. Bubble screens can reduce the sound pressure levels up to a biologically significant 25dB in the frequency range of concern for marine mammals. Other variations of bubble curtains such as screens and jackets are commonly used to reduce pile driving noise at offshore wind-farms and are worth considering.

A draft Marine Mammal Protection Protocol (MMPP) has been developed based upon current construction and noise information and will be refined once full construction methods have been developed (Refer to Technical Appendix 5-2: Marine Mammal Protection Plan, Volume 3). The MMPP will be implemented so that the dredging and piling works do not cause injury or unnecessary disturbance to marine mammals. The following information has been designed with reference to current JNCC guidance 'Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise' (August 2010)[64].

Impact piling protocol during the day and in sea conditions up to Sea State 4

The standard JNCC protocol is outlined below[65] (please see Section 5.8.3 for deviations to this protocol to be followed during times of sea states exceeding 4 or during periods of darkness and/or low visibility i.e. fog):

1. Impact piling will not commence during periods of darkness or poor visibility (such as fog) or during periods when the sea state is not conducive to visual mitigation (above sea state 4 is considered not conducive[66]) as there is a greater risk of failing to detect the presence of marine mammals[67]. Harbour porpoise have small dorsal fins, therefore the Marnie Mammal Observer (MMO) shall take additional precautions if the sea state exceeds 2. As works are scheduled to commence during the winter period it is likely that sea state 2 will be exceeded on a regular basis. An elevated platform for the MMO to monitor from would be beneficial when the sea state is 2 or above, the impact piling works could also be scheduled on a day where the sea is expected to be calm.

2. The mitigation zone will be monitored visually by the MMO for an agreed period prior to the commencement of piling. This will be a minimum of 30 minutes.

3. The MMO will scan the waters using binoculars or a spotting scope and by making visual observations. Sightings of marine mammals will be appropriately recorded in terms of date, time, position, weather conditions, sea state, species, number, adult/juvenile, behavior, range etc. on the JNCC standard forms. Communication between the MMO and the contractor and the start/end times of the activities will also be recorded on the forms.

4. Piling will not commence if marine mammals are detected within the mitigation zone or until 20 minutes after the last visual detection. The MMO will track any marine mammals detected and ensure they are satisfied the animals have left the mitigation zone before they advise the crew to commence piling activities.

5. A soft-start will be employed, with the gradual ramping up of piling power incrementally over a set time period until full operational power is achieved. The soft-start duration will be a period of not less than 20 minutes. This will allow for any marine mammals to move away from the noise source.

[64] It should be noted that this protocol does not document measures to mitigate disturbance effects, but has been developed to reduce to negligible levels of risk of injury or death to marine mammals in close proximity to piling operations.
[65] There is a 'variation of standard piling protocol' allowed in the guidance if required.
[66] Detection of marine mammals, particularly porpoises, decreases as sea state increases. According to the JNCC guidance ideally sea states of 2 or less are required for optimal visual detection.
[67] There is a 'variation of standard piling protocol' allowed in the guidance if required.

6. If a marine mammal enters the mitigation zone during the soft-start then, whenever possible, the piling operation will cease, or at least the power will not be further increased until the marine mammal exits the mitigation zone and there is no further detection for 20 minutes.

7. When piling at full power this will continue if a marine mammal is detected in the mitigation zone (as it is deemed to have entered voluntarily).

8. If there is a pause in the piling operations for a period of greater than 10 minutes, then the pre-piling search and soft-start procedure will be repeated before piling recommences. If a watch has been kept during the piling operation, the MMO should be able to confirm the presence or absence of marine mammals, and it may be possible to commence the soft-start immediately. If there has been no watch, the complete pre-piling search and soft-start procedure will be undertaken.

To prevent the need for the pre-piling search and therefore delays to the piling operations a noise generator could be deployed, which is a metal, spring loaded hammer device which creates a continuous underwater noise, mimicking the sound of the impact hammer; which would in turn deter marine mammals from entering the mitigation zone. This should be used for no longer than 1 hour, or in exceptional circumstances 2 hours (i.e. a breakdown of machinery), after which the standard soft-start procedure will commence. All uses of the noise generator should be logged and handed to the MMO to include in the deck forms.

Passive Acoustic Monitoring (PAM) is of little value for monitoring species with low vocalisation rates, such as seals and baleen whales, including minke whales which are often encountered in inshore waters, which is why ADD are recommended in this instance.

As per the JNCC guidance, reports detailing the piling activity and marine mammal mitigation (the MMO reports) will be sent to Marine Scotland at the conclusion of piling activity. Reports will include:

- Completed MMRFs;
- Date and location of the piling activities;
- A record of all occasions when piling occurred, including details of the duration of the pre-piling search and soft-start procedures, and any occasions when piling activity was delayed or stopped due to presence of marine mammals;
- Details of watches made for marine mammals, including details of any sightings, and details of the piling activity during the watches;
- Details of any problems encountered during the piling activities including instances of non-compliance with the agreed piling protocols; and
- Any recommendations for amendment of the protocols.

5.8.2 Impact piling and dredging protocol in darkness and at high sea states

The following protocol has been designed for use when:

- Impact piling operations are to commence during hours of low visibility/night-time; and/or
- The sea state exceeds 4.

Should works at Edinburgh Marina be scheduled during the winter months, it is anticipated that piling works will be programmed during periods of low visibility or darkness. Impact piling at Edinburgh Marina presents low risks to marine mammals due to the short duration of the works, the breakwater structure providing a buffer for the noise and the low probability of large numbers of marine mammals occupying the working area; wherever possible the standard JNCC MMO protocol will be adhered to. During periods when conditions are not conducive to visual monitoring, a soft-start must be conducted, meaning a gradual ramp-up of power over a period of not less than 20 minutes.

The requirement of an MMO for dredging is not considered necessary due to the small TTS zones associated with the noise generated. Instead, contractors should be made aware that marine mammals may be present within the working area.

Construction techniques and methodologies would be fully incorporated into a Construction Environmental Management Plan (CEMP) (including a Pollution Prevention Plan) and be fully developed once a competent construction contractor is appointed.

If any dead cetacean is observed during construction or operation, it should be reported to the Scottish Marine Animal Stranding Scheme (SMASS) (www.strandings.org) and live marine mammal strandings will be reported to British Divers Marine Live Rescue (www.bdmlr.org.uk).

5.8.3 Operational Phase Mitigation

As for construction dredging, the requirement of an MMO for maintenance dredging is not considered necessary due to the small TTS zones associated with the noise generated.

Leaflets on good practice to avoid disturbance to and / or collision with marine mammals could be made available to marina users.

5.8.4 Success of Mitigation

The above mitigation measures are assessed as having a certain/near certain level of success. The measures have been devised based on expert research SMRU Consulting have carried out. SMRU Consulting was set up in 2006 as the commercial arm of the academic Sea Mammal Research Unit (SMRU) at the University of St Andrews. Although separate entities, they work closely together, and jointly bridge the gap between the academic and commercial worlds. The academic Sea Mammal Research Unit carries out interdisciplinary marine mammal research and provides the UK's main science capability in the field of marine mammal biology.

5.9 Residual Effects

Table 5-11 below summarises the description of residual effects to be expected following implementation of the mitigation detailed within Section 5.8.

Table 5-11: Summary of Effects on Important Ecological Features

IEF	Importance of IEF	Nature of Impact	Duration of Impact	Magnitude of Impact	Significance of Effect	Confidence in Assessment
Construction Phase						
Harbour porpoise	International	Dredging (increased turbidity and sedimentation)	Temporary	Negligible	Not significant	B: intermediate
Bottlenose dolphin	International	Dredging (increased turbidity and sedimentation)	Temporary	Negligible	Not significant	B: intermediate
Minke whale	International	Dredging (increased turbidity and sedimentation)	Temporary	Negligible	Not significant	B: intermediate
Humpback whale	International	Dredging (increased turbidity and sedimentation)	Temporary	Negligible	Not significant	B: intermediate
Grey seal	County/Metropolitan	Dredging (increased turbidity and sedimentation)	Temporary	Negligible	Not significant	B: intermediate
Harbour seal	National (UK)	Dredging (increased turbidity and sedimentation)	Temporary	Negligible	Not significant	B: intermediate
Otter	International	Dredging (increased turbidity and sedimentation)	Temporary	Negligible	Not significant	A: high
Harbour porpoise	International	Underwater noise (piling and dredging)	Temporary	Low	Not significant	B: intermediate
Bottlenose dolphin	International	Underwater noise (piling and dredging)	Temporary	Low	Not significant	B: intermediate
Minke whale	International	Underwater noise (piling and dredging)	Temporary	Low	Not significant	B: intermediate
Humpback whale	International	Underwater noise (piling and dredging)	Temporary	Low	Not significant	B: intermediate
Grey seal	County/Metropolitan	Underwater noise (piling and dredging)	Temporary	Low	Not significant	B: intermediate
Harbour seal	County/Metropolitan	Underwater noise (piling and dredging)	Temporary	Low	Not significant	B: intermediate
Otter	International	Underwater noise (piling and dredging)	Temporary	Low	Not significant	A: high
Birds	International	Pollution to water	Temporary	Negligible	Not significant	A: high
Harbour porpoise	International	Pollution to water	Temporary	Negligible	Not significant	B: intermediate
Bottlenose dolphin	International	Pollution to water	Temporary	Negligible	Not significant	B: intermediate

Minke whale	International	Pollution to water	Temporary	Negligible	Not significant	B: intermediate
Humpback whale	International	Pollution to water	Temporary	Negligible	Not significant	B: intermediate
Grey seal	County/Metropolitan	Pollution to water	Temporary	Negligible	Not significant	B: intermediate
Harbour seal	National (UK)	Pollution to water	Temporary	Negligible	Not significant	B: intermediate
Otter	International	Pollution to water	Temporary	Negligible	Not significant	A: high
Birds	International	Onshore activities	Temporary	Negligible	Not significant	A: high
Otter	International	Onshore activities	Temporary	Negligible	Not significant	A: high
Operational Phase						
Harbour porpoise	International	Maintenance dredging	Temporary	Low	Not significant	B: intermediate
Bottlenose dolphin	International	Maintenance dredging	Temporary	Low	Not significant	B: intermediate
Minke whale	International	Maintenance dredging	Temporary	Low	Not significant	B: intermediate
Humpback whale	International	Maintenance dredging	Temporary	Low	Not significant	B: intermediate
Grey seal	County/Metropolitan	Maintenance dredging	Temporary	Low	Not significant	B: intermediate
Harbour seal	National (UK)	Maintenance dredging	Temporary	Low	Not significant	B: intermediate
Otter	International	Maintenance dredging	Temporary	Low	Not significant	A: high
Harbour porpoise	International	Increased vessel movement	Permanent	Low	Not significant	B: intermediate
Bottlenose dolphin	International	Increased vessel movement	Permanent	Low	Not significant	B: intermediate
Minke whale	International	Increased vessel movement	Permanent	Low	Not significant	B: intermediate
Humpback whale	International	Increased vessel movement	Permanent	Low	Not significant	B: intermediate
Grey seal	County/Metropolitan	Increased vessel movement	Permanent	Low	Not significant	B: intermediate
Harbour seal	National (UK)	Increased vessel movement	Permanent	Low	Not significant	B: intermediate
Birds	International	Onshore activities	Permanent	Low	Not significant	A: high
Otter	International	Onshore activities	Permanent	Low	Not significant	A: high

5.10 Statement of Significance

This chapter concludes that by following the above described mitigation, which has been proposed based upon a review of draft engineering design and predicted construction techniques, adverse effects will not be significant.

6 OTHER ISSUES

6.1 Introduction

This chapter provides a summary and assessment where applicable of additional potential environmental effects or features which are relevant to the proposed development but have not been scoped into the full EIA given significant effects were not deemed to be likely. These include effects or information associated with socio-economics, air quality, navigation, population and human health, natural disasters and utilities. It is not the purpose of this chapter to draw conclusions on the level of significance based upon detailed methodology (as per the other chapters outlined throughout this EIAR), but instead offer a synopsis of relevant information, an approach which has been agreed with Marine Scotland as per Technical Appendix 3.1 within Volume 3 of this EIAR, alongside a relevant level of assessment specific to each feature of this chapter.

6.1.1 Scoping and Consultation

This chapter has been prepared based upon advice and consultation with the relevant consultees as illustrated within Table 3-1 has been prepared under the requirements of the EIA Regulations in that it corresponds with, and is based upon, the Scoping Opinion.

6.2 Exportation of Dredge Material by Road

6.2.1 Introduction

Vehicular access to the site is proposed from the existing roundabout junction of Granton Square, with a second access on West Harbour Road. Close liaison with the traffic management section of City of Edinburgh Council should be made in relation to the agreed routes and hours of working for construction vehicles.

6.2.2 Baseline Conditions

The proposed development is to upgrade the existing Granton Harbour (Edinburgh Marina) and associated Vessel Berths (Pontoons). The works include the exportation of circa 154,385m^3 of dredge material to land over a 3 year period.

6.2.3 Potentially Significant Effects during Construction

Based on the dredging plan for the harbour which is provided in Appendix 2 of the Granton Harbour Dredging 2018 Best Practicable Environmental Option Report (September 2018), the volume split is as follows based on chemical quality (Table 6-1)

Table 6-1 Dredge Volumes

Dredge	Volume (m^3)	Comment
Total Dredge Nett Volume	241,365	Total proposed dredge volume
Dredge Volume for Areas for surface to 1.2m Dredge	86,980	Proposed for Sea Disposal
Dredge Volume from below 1.2mto base of dredge plus Area around VC8 & VC9 with Shallow Contamination	154,385	Land Based Disposal Options
Total Infill (Nett) Volume	19,322	

The trip generation associated with the haulage of circa 154,385m^3 of dredge material, has been estimated using the first principle. The calculation is based on a disposal period of 3 years, over 4 phases of dredging/ drying. This gives a total of 18 months for the haulage of materials.

Table 6-2 summarises the predicted trip generation associated with the proposed development (assumed to be 11 hr day (8am-7pm) 6 days per week (5.5 hours Saturday and 5.5 hours Sunday).

Table 6-2 Predicted Trip Generation

Description		Export	
Volume	154,385	m^3	
Density	1.8	t/m^3	
Tonnage	277,893	tonnes	
Payload	20	tonnes	
Months	18	13,895/18mth = 772 trips	
Weeks/month	4	193 trips per week	
Total Weeks	72		
Days/Week	6	32 trips day	
	In	**Out**	**2-way**
Trips/Day	32	32	64
	In	Out	2-way
Trips/Hour	2.9	2.9	6
Peak Adjustment	**1.2**		
	In	**Out**	**2-way**
Peak Trips/Day	39	39	78
	In	**Out**	**2-way**
Peak Trips/Hour	3.5	3.5	7

The results in Table 6-2 show that the proposed development will generate an average of 64 (32in/32out) HGV movements per day or 5 (2.9in/2.9out) HGV movements per hour. Based on a daily variation of 20%, this equates to 78 (39in/39out) HGV movements per day or 7 (3.5in/3.5out) HGV movements per hour.

Overall, it is not considered that the proposed development will have any material traffic and transportation impacts to the surrounding road network, in terms of both the additional number of HGV movements and the haulage route to be used by the HGV's.

6.2.4 Mitigation

It is considered that there are no residual effects associated with the construction phase of the proposed development that cannot be addressed through the preparation of an approved construction management plan.

6.3 Air Quality

6.3.1 Introduction

The site is situated on the northern boundary of the City of Edinburgh Council boundary area in a predominately industrial area. The development has the potential to impact local air quality in a number of ways with the key issues in relation to air quality being traffic emissions from the local road network both surrounding and accessing the site and dust emissions during the construction phase.

6.3.2 Baseline Conditions

In order to inform the screening request, 1km background air quality concentration maps were obtained from the Scottish Air Quality and DEFRA websites. The 2016 measured annual average concentrations of NO_2, PM_{10} and $PM_{2.5}$ are 15.86µg/m^3, 10.28µg/m^3 and 6.50µg/m^3 respectively for background square (323500, 677500).

This indicates there was good air quality within the vicinity of the site with concentrations well below the relevant National Air Quality Objectives of 40µg/m^3, 18µg/m^3 and 10µg/m^3 respectively.

The 2017 Air Quality Annual Progress Report for the City of Edinburgh Council identifies six Air Quality Management Areas (AQMA) designated within the Council area; Centre, Glasgow Road, St Johns Road, Great Junction, Inverleith Road, and Salamander Street. The nearest AQMA to the development is the Inverleith Road AQMA which is located ~2km to the South East of the site.

The automatic monitoring station closest to the proposed development is Salamander Street (Site ID 8) is located approximately 3.5km east of the site at NGR 327615, 676333 and is therefore not considered to be representative of site conditions.

The monitoring location closest to the proposed development is the NO_2 diffusion tube at Trinity Crescent (Site ID 14), located approximately 1.2km east of the site at NGR 324896, 676991). City of Edinburgh Councils 2017 Annual Progress Report lists the annual mean concentration for NO_2 for 2016 as 27.5µg/m^3 and details a steady decrease in 2010 to 21.5 µg/m^3 in 2016.

6.3.3 Potentially Significant Effects during Construction

Potential exists for an increase in traffic in the vicinity of the surrounding road network and in turn increases in the pollutants NO_2, PM_{10} and $PM_{2.5}$ which are most commonly associated with traffic emissions. It is estimated that the marina development will not lead to a significant increase in road traffic on the surrounding roads. Further to this, with data indicating that air quality is good in the vicinity of the site it is anticipated that any increase in exhaust emissions would have a negligible effect on air quality at sensitive receptors. This will therefore not be assessed.

The main impact on air quality is considered to occur during the construction phase when fugitive dust can be generated through construction activities. Dust associated with the proposed marina development will be addressed within the Cumulative Effects section, and procedures to minimise dust arising during the construction phase will be addressed within a Construction Environmental Management Plan (CEMP).

While at present traffic generation is not expected to change significantly, if any of the criteria identified above is met then we would re-consult with City of Edinburgh Council Environmental Health Department to define the scope of the air quality assessment. However, AQ is not considered to lead to significant environmental effects and therefore no further study will be undertaken as part of the EIA.

6.3.4 Potentially Significant Effects post-Completion

Potential exists for an increase in traffic in the vicinity of the surrounding road network and in turn increases in the pollutants NO_2, PM_{10} and $PM_{2.5}$ which are most commonly associated with traffic emissions. This has the potential to impact both existing and future residents.

It is estimated that the marina development will not lead to a significant increase in road traffic on the surrounding road network. Further to this, with data indicating that air quality is good in the vicinity of the site it is anticipated that any increase in exhaust emissions would have a negligible effect on air quality at sensitive receptors.

6.3.5 Design and Mitigation

Construction of the proposed development is considered to be a temporary impact and can be controlled through developing a site-specific Dust Management Plan as part of a Construction Environmental Management Plan (CEMP). The dust impact assessment requires specific information on site operations during construction, including preparatory earthworks, general construction and the potential for trackout during construction of the proposed development. Currently this information is still being finalised. It is therefore proposed to defer the construction dust assessment and formulation of a construction dust management plan until such time as details on construction have been finalised.

In line with the decision notice associated with the outline planning application 01/00802/OUT which was granted, with conditions, the following mitigation will be included where required:

- Close liaison with the traffic management section of City of Edinburgh Council should be made in relation to the agreed routes and hours of working for construction vehicles.
- Haul routes to be located away from off-site sensitive properties and to be watered regularly (wet suppression of dust) to ensure that any deposit of material on the local road network is minimised;
- All site vehicles and plant to have upward-facing exhausts to minimise surface dust resuspension - Bunds or screens may be constructed as wind breaks, to reduce wind speeds. Earth bunds should be seeded as soon as possible prior to which they are to be maintained damp;
- The aggregate stocking area should be located away from sensitive areas and residential properties; - Stockpiles should also be watered and water curtains on any additionally be used at the site boundaries near sensitive properties;
- Off-site vehicles to be sheeted, their wheels and bodies to be cleaned and the access road to be hard-surfaced and maintained damp; - Early paving of permanent roads;
- Minimisation of drop heights, and the use of chutes to discharge material close to where it is required - Vehicle wheel and chassis cleaning - Imposition of speed limits, to reduce dust emissions from ground surfaces

6.4 Terrestrial Noise

The primary purpose of this exercise is to undertake a sufficient level of assessment to identify any environmental effects of the proposed development associated with noise on the site and surrounding area.

6.4.1 Baseline Conditions

The site is located within the wider Granton Harbour Masterplan area, comprising of a mix of residential and industrial/commercial uses. EnviroCentre carried out early morning and daytime baseline noise monitoring approximately 50m to the south of Plot 8B, as part of a noise assessment carried out for a detailed planning

application for Plot 8C, on behalf of Granton Central Developments in August 2017 (refer to EnviroCentre Report No. 7880, dated 21st September 2017). The baseline noise environment in the area surrounding the site was noted to comprise of the following significant sources summarised below in order of dominance (i.e. greatest first);

Early Morning

- Bird calls from seagulls;
- Distant and local road traffic; and
- Air traffic overhead.

Daytime

- Construction activity (from Plots 26 & 27 of Granton Harbour Masterplan);
- Distant Scrapyard noise;
- Local traffic;
- Bird calls from seagulls; and
- Air traffic overhead.

A summary of the baseline noise monitoring results are shown in Table 6-3. For a full summary of results and measurement locations, please refer to EnviroCentre Report No. 7880, dated 21st September 2017.

Table 6-3: Summary of Baseline Noise Monitoring Results; Approx. 50m South of Plots 8A & 8B

Measurement Position	Start time/ Duration (hrs:mins:secs)	LAeq (dBA)	LAF10 (dBA)	LAF90 (dBA)	LAFMax (dBA)
B1	06:40/ 0:30:00	49.8	51.6	44.4	79.6
	10:20/ 01:00:00	51.8	53.7	46.9	79.1

The daytime baseline noise environment is predicted to be slightly lower than that measured in the absence of temporary construction activity from Plots 26 & 27.

6.4.2 Potentially Significant Effects during Construction

There is the potential for noise generated by the proposed development during the marina construction phase to impact on surrounding noise sensitive receptors.

It is anticipated that approximately 154,385 m^3 of dredged material will be leaving the site by road, and this will be addressed by the Marine Scotland Dredge Licence application.

The proposed development includes the creation of a new marina, extension and backfilling of the quay wall, extension of the western breakwater, also known as the north mole, and dredging.

The degree of impact during the construction phase will therefore depend upon;

- The nature of construction activities being carried out; this includes the type and size of machinery/plant involved, combinations of activities happening simultaneously and HGV routes in and around the site;
- Location of construction activities relative to the closest noise sensitive receptors;
- Duration of proposed activities;
- Construction site operating times; and
- Extent of noise mitigation measures in place.

Noise generating activities during the construction phase are understood to include;

- Dredging of an area of the sea bed within. It is understood this may be carried out by a backhoe dredger or suction dredger or on a hopper barge;
- Land reclamation;
- Extension of the western breakwater, also known as the north mole;
- Piling of steel tubes into the sea bed as part of the extension and backfilling of the quay wall;
- Creation of a new marina, including piling for pontoons; and,
- HGV and construction plant movements in and around the site.

The closest existing noise sensitive receptors are the multi-storey flats located on Hesperus Broadway, approximately 80m to the south-west of the south-western corner of Plot 8B. The closest ***future*** noise sensitive receptors are noted as being the proposed flats within development Plot 8C, located approximately 20m from the southern boundary of Plot 8B, and the proposed apartment hotel/flats located within development Plots 29 & 35 to the west.

Certain construction activities have the potential to impact upon existing and proposed noise sensitive receptors. The assessment of construction noise requires detailed information on activities, items of plant, locations, operating times etc. Once this information is known construction activities, if required, can be assessed in a construction noise assessment, the results of which can be used to inform a construction noise management plan. Construction noise will therefore be excluded at this stage.

6.4.3 Potentially Significant Effects post-Completion

There is the potential for noise generated by the proposed development during the operational phase to impact on surrounding noise sensitive receptors.

The significance of operational noise from the marina at Plots 8A & 8B, at the closest existing and proposed sensitive receptors was considered by EnviroCentre as part of the noise assessments carried out for detailed planning applications for Plots 8C & 7B, and Plots 29 & 35 of the Granton Harbour Masterplan (refer to EnviroCentre Report Nos. 7880 & 7881, dated 21st September 2017). The operational noise was found to meet the Council's noise criteria at the most exposed existing and proposed sensitive receptors with open windows.

It is acknowledged that during the construction phase of the marina development it will be necessary to undertake some piling activities as part of the extension and backfilling of the quay wall, dredging etc. This impact will be a short term temporary activity that will introduce a new noise source to the local area in addition to other usual construction activities associated with transport and tipping of fill material.

The proposed development is set within an existing operational harbour where boats are moored and there is limited commercial fishing activity i.e. crabs, accordingly, it is not considered that the proposed marina development will have a significant environmental impact in terms of noise.

Taking the above into account it is considered that noise will not be significant and a Construction Environmental Management Plan based on best practice noise control could be agreed with the authorities and this approach would be appropriate in this instance.

6.4.4 Design and Mitigation

In line with the decision notice associated with the outline planning application 01/00802/OUT which was granted, with conditions, the following noise mitigation measures will be included where required:

- Noise levels generated will be controlled by practicable means through contract specification, local authority control and the use of temporary barriers and 'quiet' plant.
- A construction noise management plan, can help mitigate any effects at the most exposed sensitive receptors.
- Acoustic double glazing

6.5 Population and Human Health

With reference to the Marine Works (Environmental Impact) (Scotland) Regulations 2017, assessment should be proportionate. Therefore, the focus of population and human health issues within EIA focuses on whether the potential impacts are likely to be significant. Where they are found likely to be significant, effort should focus on identifying and gaining commitment to avoiding or reducing any adverse effects and to enhancing beneficial effects. It should be noted that the potential effects on human health at Granton Harbour will principally be associated with noise & vibration and air quality. As noted within sections 6.3 (air quality) and 6.4 (noise) these will be short term impacts, and the effects on "Population and Human Health" will not be significant.

6.6 Navigation

This section assesses the potential impacts on navigation from the construction and operation of the proposed development. In addition, it also proposes mitigation measures which can be applied to further reduce the significance or likelihood of significant effects. Ensuring the safe operation of the harbour with particular respect to existing marine traffic.

Granton Harbour was funded and developed by the 5th Duke of Buccleuch, who owned the site. Construction of the middle pier began in 1837. Construction of Granton pier was completed by 1845.

In 1961 the harbour owners claimed 25 acres of land from the Western Harbour by infilling. This project took ten years.

A bill was presented in parliament and in January 1968 Forth Ports Authority took over the management of most of the ports of the Firth of Forth. At this time Granton was one of two ports in Britain making a profit. When nationalised it employed 86 people, but by 1970 this had been reduced to two[68].

The port was nationalised and came under the control of the new Forth Ports Authority from 1 January 1968, as did other ports on the Firth of Forth. Much of the Western Harbour has been infilled and has recently been used as the site for new properties under the same planning permission that approved the proposed marina development.

6.6.1 Baseline

At present, the site comprises of predominantly reclaimed land from the sea, consisting of vacant brownfield land which is scheduled for development under the approved 2003 masterplan and a number of subsequent reserved matters and MSC permissions. The overall topography of the surrounding area is generally flat, with the proposed marine works development situated at the edge, and within the extents of the harbour.

The proposed development is within the Granton Harbour regeneration development area, approximately 4km north of Edinburgh City Centre and fronting the Firth of Forth. It is approximately 9.5Ha, bounded to the north

[68] http://www.fcyc.org.uk/?page_id=169

by the Western Breakwater, to the east by the Eastern Harbour and to the south by wider regeneration proposals and developments.

6.6.2 Potential Effects

The potential impact on navigation associated with placing a structure such as the proposed marina and breakwater within the harbour is mainly related to potential obstruction, reduced space for manoeuvre, and increased traffic.

Outside the main marina, the North Mole Extension will act to mark the edge of the navigation channel and thus have a positive impact.

During construction, including the dredging of material for the reclamation, Notices to Mariners will be issued to inform other users of the marine works and any impact on navigation.

In the long term yachts and other small craft use of the marina will increase due to vessels approaching and departing from the marina. This increase has the potential to conflict with established shipping and ferry movements in the Firth of Forth and vessels accessing/egressing the eastern harbour.

6.6.3 Navigational Impact Assessment

The sensitive receptors have been identified as vessels approaching and leaving the harbour, in particular recreational vessels using the eastern harbour.

Large commercial vessels do not access the proposed marina site. Smaller vessels will use the navigational channel with plenty of room for manoeuvre through the marina entrance

The proposed works comprise dredging/disposal, quay wall works, marina comprising 340 berths of different sizes to accommodate varying sized vessels, extension to North Mole breakwater, backfilling of land protected by quay wall and stone revetment form the south western boundary of the marina and will effectively form the harbour edge. The size of the marina basin is dictated by the existing breakwater, the linear extent of the North Mole extension is 50m. The extension will be vertical faced on the harbour side and sloping masonry on the seaward side.

Construction

The marina footprint will be dredged prior to commencing the quay wall works, extending the north Mole breakwater and marina construction. It is understood that a backhoe dredger will be used and dredged material will be disposed of at the Harbour's usual disposal site, or if unsuitable for disposal at sea, either used within the wider masterplan area where possible or transported off site by road to an appropriately licenced disposal site.

Given the location of the north mole extension it may be necessary to operate the construction plant from the inner part of the construction area after it has been dredged to a sufficient depth.

This has the potential to be an impact of moderate magnitude on occasion during the construction period as it may affect the management of the harbour directly and has the potential to affect vessel movements. However, for the most part the magnitude of impact will be low.

During construction it will be necessary to operate a floating piling rig and a barge to take piles to the rig. The western harbour will be closed off during construction and boats currently moored moved to the eastern harbour

Operation

The main effect on navigation when the marina is completed will be the requirement for vessels to be made aware of the changes. This will form part of the updated pilotage directions and new navigation lights. A Stakeholder Agreement has been agreed to be developed to ensure that all stakeholder interests are taken into account once the marina is operational; in addition the Marina operator will develop an Operational Management Plan in liaison with all stakeholders.

The provision of three new marks on the approach to Edinburgh Marina shall comprise:

- A port hand buoy to the south of Leith Roads - Red can shape with red can topmark and red flashing light visible for 2 miles.
- A starboard hand buoy to the south of Leith Roads - Green conical shape with green conical topmark and green flashing light visible for 2 miles.
- A starboard hand beacon on the end of the 50m North Mole extension - Green pole with green conical topmark and fixed green light visible for 1 mile.

Sailing Directions

The routing for vessels will be from the Hound Point Fairway Buoy and south along the Leith Channel and on into Leith Roads using the existing navigation aids as provided by Forth Ports. From Leith Roads vessels will head in a south-south westerly direction towards Edinburgh Marina (Granton Harbour), where the entrance channel will be marked by a new port and new starboard hand buoy.

The routing and navigation aids are all as generally shown on the extracts of charts shown below.

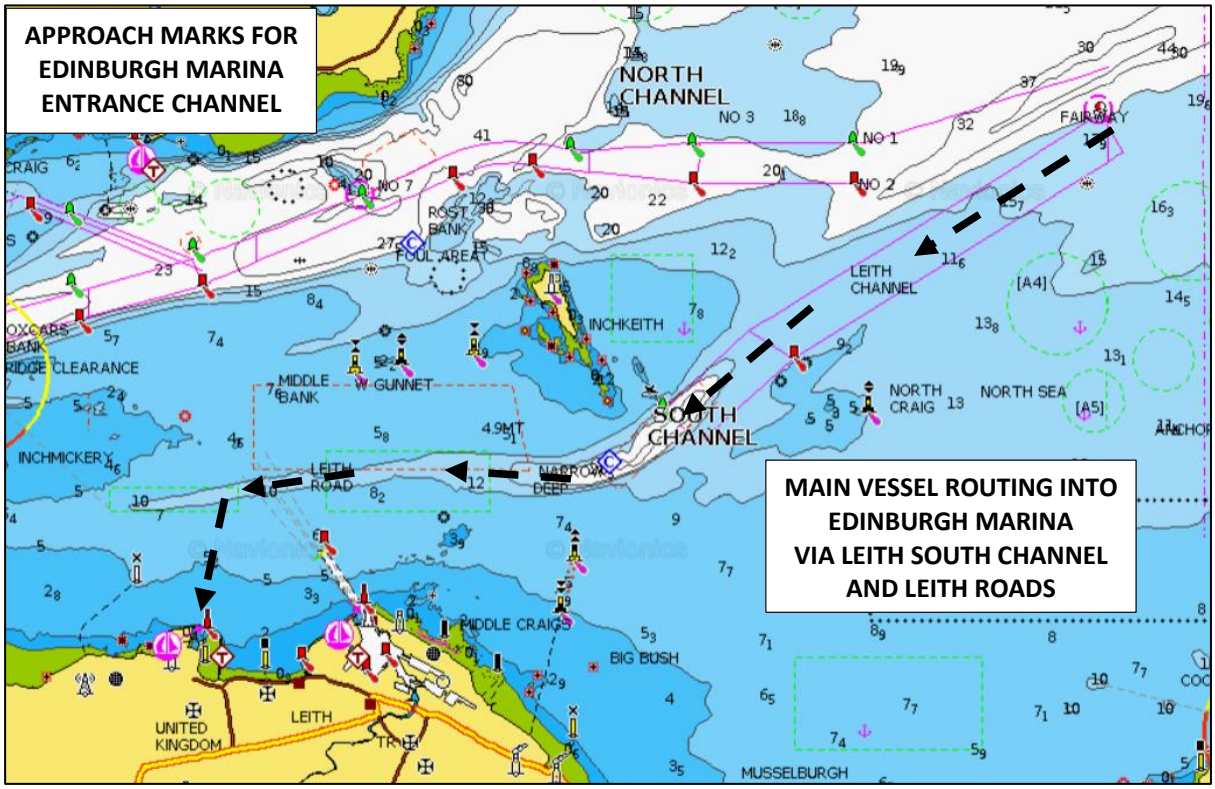

Figure 6-1 Main route from Hound Point Fairway Buoy to Leith Roads © Navionics

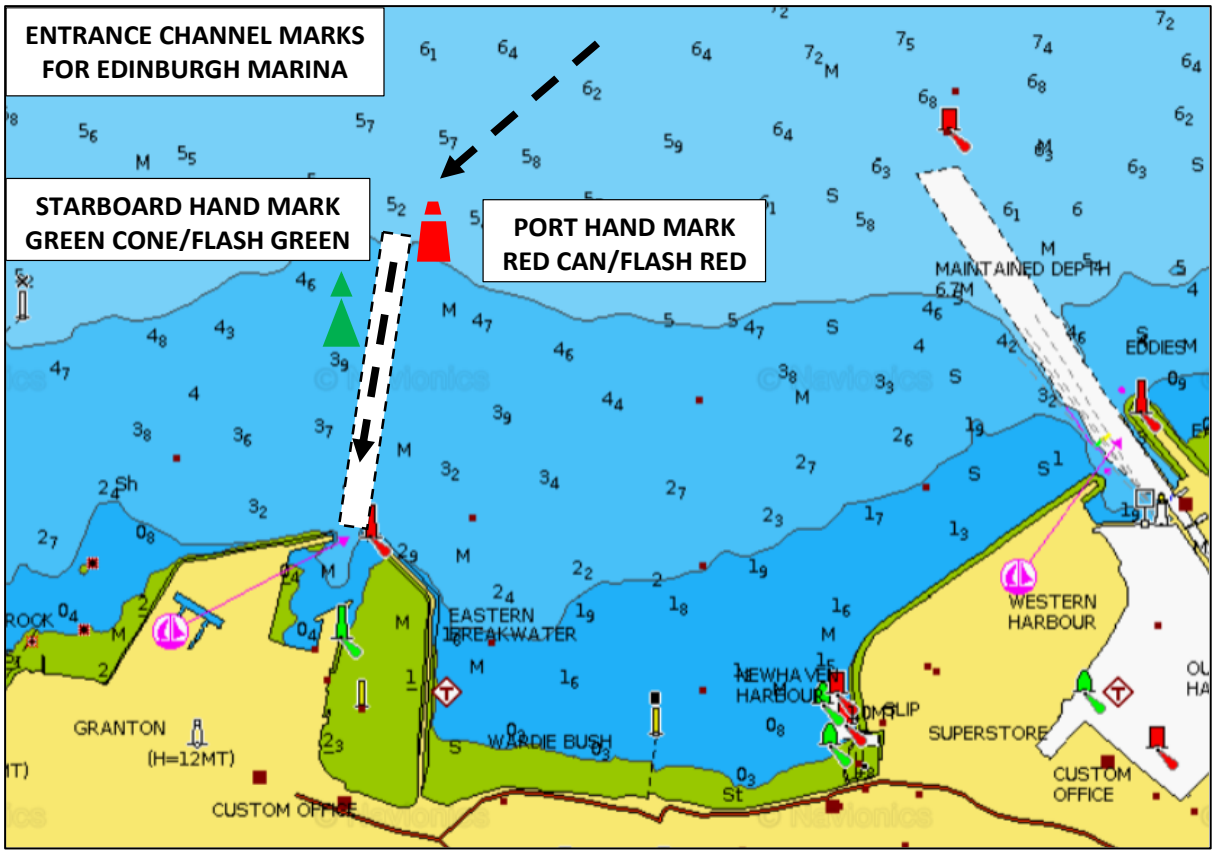

Figure 6-2 Approach Channel route from Leith Roads to Marina Entrance © Navionics

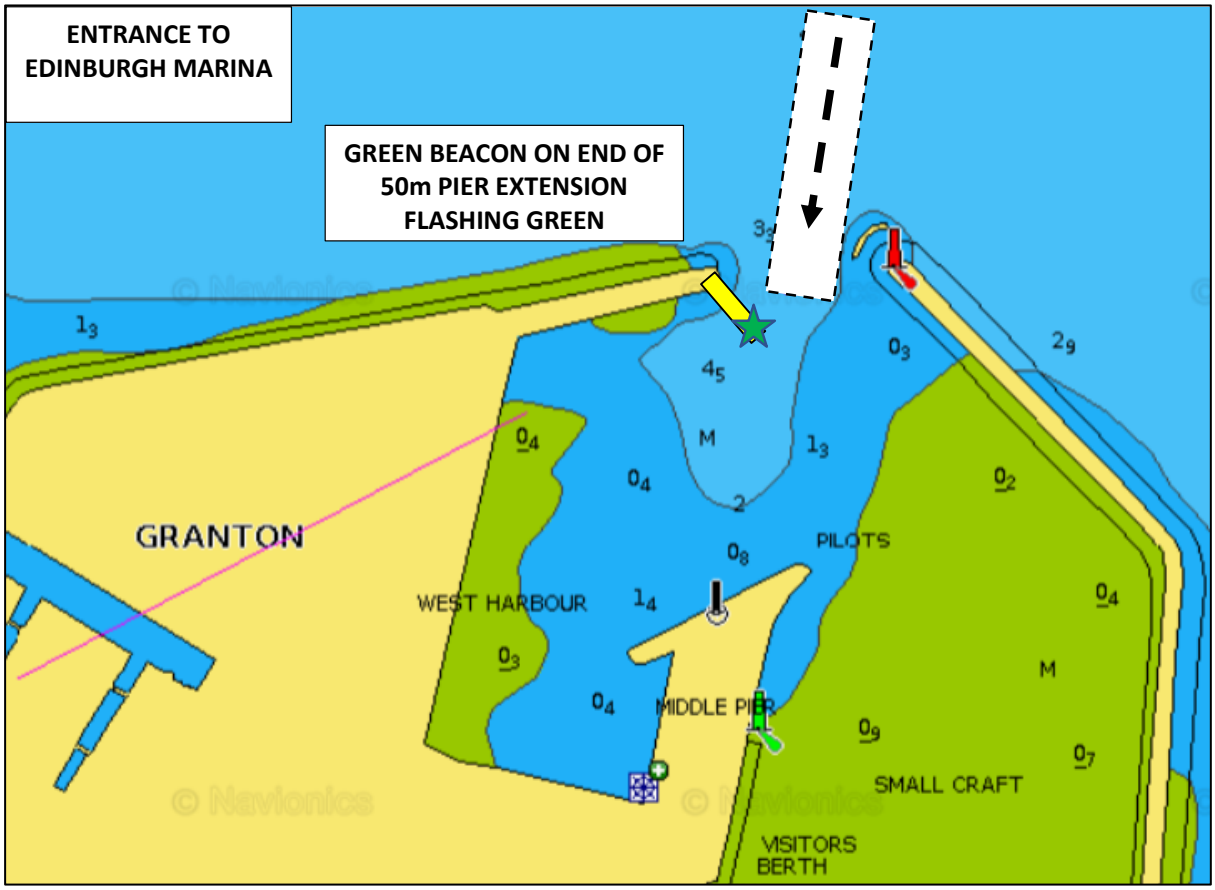

Figure 6-3 Lights and marks at Marina Entrance © Navionic

6.6.4 Assessment of Impact Significance

The quay wall works and piling activities are assessed as having a low to moderate impact on navigation within the harbour for the short term as it will be necessary for vessels to operate in the navigation channel. The actual approach will depend on the detailed design and preferred approach of the main contractor for the works.

6.6.5 Mitigation

A Construction Environmental Management Plan will incorporate navigation and the mitigation below (where appropriate).

Mitigation with regard to the marina construction commences with the requirement for the successful contractors to provide full methods, risk assessments and mitigation measures and to agree and amend these as necessary.

Mitigation relates to correct lighting and buoyage during and post construction. New navigation lights shall be installed as appropriate and buoyage may be deployed to ensure marina traffic follows a visible and shallow entry angle into the main shipping channel.

Health and Safety during construction will be followed in accordance with The Construction (Design and Management) Regulations 2015.

The following recommendations are generic and will be specified according to the construction method and type of plant deployed.

Moving the piling barge/rig

To be handled be a competent vessel and crew at all times, advised to harbour and other traffic and co-ordinated prior to commencement through a single contact.

Obstruction of channel

- Ensure barge/jackup is on the 'non' channel side of the sheet pile installation if possible.

Foundering of barge in the channel

- As above and additionally contractor emergency procedures to be in place, dovetailing with harbour emergency procedures;
- Contractor insurance;
- Barge surveys; and
- Best operating practice for the barge.

Collision with other vessels while engaged in dredging/disposal/piling

- Navigational and minimum ambient lighting on barge;
- Local Notice to Mariners;
- Publicity in local press for recreational users, who are most likely to be affected.
- Communication issues
- VHF ch12 continuous monitoring; and
- Mobile numbers of single contact point with emergency action responsibility on barge and vice versa with Harbour contacts.

Support vessels

- Control of movement by harbour;
- VHF ch12 continuous monitoring; and
- Contractor methods and risk assessed boarding and transfer methods to barge/shore for all weather conditions.

Wave/wash of passing vessels affecting passenger transfers or barge

- Pre-planned and co-ordinated movements to lessen risk by contractor.

Damage to piling mid construction by vessels

- Contractor to advise on fragility of structure when not complete and proposed mitigation should irreparable damage be a risk.

Damage to vessels by piles mid construction

- Lighting or other highlighting of danger areas to be used particularly during darkness;
- Local Notice to Mariners; and
- Publicity in local press for recreational users.

Contact with vessels passing by the operation of piling

- Methods and risk assessments to be provided, agreed and adhered to (e.g. barge mounted crane jib extending into navigational channel and the like).
- The piling operation to be arranged in such a way that no physical encroachment can be made into the navigational channel.

In addition to the foregoing, the marina operator is committed to complying with the Port Marine Safety Code and 2018 Guide to Good Practice on Port Marine Operations.

6.7 Climate Change

Climate change has taken a prominent position within policy and legislation at a national level, with the Climate Change (Scotland) Act 2009 creating a long-term framework for ensuring reduction in Scottish greenhouse gas emissions of 80% by 2050.

Under Schedule 4(4), the EIA Regulations require *"a description of the factors specified in 4(3) likely to be significant affected by the development… (Including) climate (for example greenhouse gas emissions, impacts relevant to adaption)". In addition, Schedule 4(5) (f) of the EIA Regulations requires a "description of the likely significant effects of the development on the environment resulting from…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".*

It is considered that the proposed development would not result in a significant effect upon climate given the nature of the development. Any increase in emissions created during either construction or operation is likely to be negligible, and pollution and emissions control would be discussed within a detailed Construction Environmental Management Plan (CEMP). Discussion of the vulnerability of the project to climate change is primarily concerned with the water environment, including flood risk. Flooding is being scoped out of the EIA as it does not constitute a significant environmental aspect.

6.8 Natural Disasters

The proposed development is not located within an area of significant seismic activity, nor are climatic factors prone to creating disasters such as tsunamis, hurricanes or catastrophic flooding. Accordingly consideration of natural disasters was scoped out of the EIA.

6.9 Major Accidents

An assessment has been undertaken of any potentially significant adverse effects on the environment deriving from the vulnerability of the development to risks of major accidents relevant to the project

Given a number of proposed design and operational measures, which are considered and reported in the assessment, it is not anticipated that the Scheme is vulnerable to any major accidents and/ or disasters which could result in significant effects on the environment.

As major accidents and disasters can potentially result in significant adverse environmental effects, it is prudent for them to be considered at the planning stage of a development. Through identifying major accidents and disasters at an early stage, it is possible to prevent such events from occurring, reduce the risk of this happening, or decrease the extent of their potential harm in the local area and on local communities.

The structure of this chapter does not confirm to the typical chapter structure used elsewhere in this Environmental Impact Assessment Report (EIAR) as it is recognised that existing legislation and health and safety requirements already identify risks and help protect human beings and the environment[69].

Legislation

Paragraph 18 of Directive 2014/52/EU[70] states:

"*In order to ensure a high level of protection of the environment, precautionary actions need to be taken for certain projects which, because of their vulnerability to major accidents, and/or natural disasters (such as flooding, sea level rise, or earthquakes) are likely to have significant adverse effects on the environment. For such projects, it is important to consider their vulnerability (exposure and resilience) to major accidents and/or disasters, the risk of those accidents and/or disasters occurring and the implications for the likelihood of significant adverse effects on the environment*."

The above has been transposed into UK law under Schedule 4 (9) of the 2017 EIA Regulations[71] which require:

"*A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned*".

Edinburgh Marina

The site is set within the wider Granton Development Area, and considered to be at negligible risk of Major Accidents.

The Proposed Development will be designed to current best practice, in respect of safety and design.

[69] Examples include the Construction Design and Management (CDM) 2015 Regulations
[70] EU Directive 2014/52EU amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment
[71] The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended)

During construction, activities will be controlled through a Construction Environmental Management Plan (CEMP) which will ensure compliance with the Construction (Design and Management) Regulations 2015.

It is therefore considered that while there is always a potential risk that a major accident, fire or natural disaster could result in a significant environmental impact, given the nature of the Proposed Development, this risk can be appropriately mitigated though embedded design measures and through compliance with statutory design guidelines.

Table 6-3 shows a summary of potential effects in response to major accidents.

Table 6-4: Assessment of Potential Effects – Major Accidents

Summary description of the identified impact	Probability of Risk	Potential Severity	Significance and Nature of Effect	Additional Mitigation	Confidence Level
Risks from spills, fire or explosion	Unlikely	Severe	Low/Moderate	While no significant impacts have been identified during construction, activities will be controlled through a CEMP which will ensure compliance with the health and safety Construction Regulations	High
Handling of hazardous materials	Unlikely	Severe	Low/Moderate		High
Risks of vessel accidents (including spillages and pollution incidents) (Construction)	Unlikely	Severe	Low/Moderate		High
Risks from spills, fire or explosion	Unlikely	Severe	Low/Moderate	None Required	High
Risks of vessel accidents (including spillages and pollution incidents) (Operation)	Unlikely	Severe	Low/Moderate	None Required	High

7 CUMULATIVE EFFECTS

7.1 Potential for Cumulative Effects

Terrestrial Effects

There are likely to be in-combination effects arising from the other works planned as part of the Granton Harbour Regeneration Programme. Cumulatively, the proposed Edinburgh Marina development is part of a wider series of proposed developments by the Applicant which aims to realise the aspirations of previous Masterplans. The requirements include the need for comprehensive proposals which maximise the development potential of the area, the provision of mixed use sustainable neighbourhoods, a mix of house types, sizes and affordability and the provision of open space, retail, leisure and tourism attractions.

The proposals are a key part of the redevelopment of over 60 acres (24ha) of land stretching along the Firth of Forth and will provide new jobs, new housing, new facilities and a rejuvenated link between Edinburgh city centre and the Forth estuary. At the heart of the regeneration is the building of over 1,800 new homes, all-suite Spa Hotel, together with a local centre with up to 18,500 sq. m of new retail, leisure and commercial space including a new medical facility at Chestnut Yard.

Terrestrial developments are unlikely to have any cumulative effects with the development proposed, particularly given the location of the proposed development within an already developed harbour, and the marina development being entirely created from the harbour and Firth of Forth corridor rather than land side.

Marine Effects

Based on a dredging plan for the harbour which is provided in Appendix 2 of the Best Practicable Environmental Option Report (Refer to Volume 3, BPEO Technical Appendix 4-3) the dredge volume split at Granton Harbour is as follows based on chemical quality (Table 7-1).

Table 7-1: Dredge Volumes

Dredge	Volume (m^3)	Comment
Total Dredge Volume	241,365	Total proposed dredge volume
Dredge Volume for Areas for surface to 1.2m Dredge	86,980	Proposed for Sea Disposal
Dredge Volume from below 1.2m to base of dredge plus Area around VC8 & VC9 with Shallow Contamination	154,385	Land Based Disposal Options

There are multiple disposal grounds in proximity to the site which are summarised below in Table 7-2. They are provided in order of distance closest to Granton Harbour. The information below was provided by Marine Scotland.

Table 7.2: Summary of Disposal Sites

Site ID	2018 Licensed Capacity	2017 Deposited volumes	2016 Deposited volumes
FO038 – Narrow Deep and Narrow Deep B	No set capacity	0	0
FO041 – Oxcars Main	No set capacity	84,185 tonnes	159,057 tonnes
FO042 – Oxcars Ext A	No set capacity	87,610 tonnes	0
FO043 – Oxcars Ext B	No set capacity	407,720 tonnes	0
FO044 – Bo'Ness	No set capacity	1,074,335 tonnes	0

The closest disposal site to Granton Harbour is FO038 Narrow Deep and Narrow Deep (B).

Review of available information has highlighted that although several chemical contaminants exceed RAL1 within the sediments which have been identified for a sea based disposal (0-1.2m below surface), assessment of key receptors identified from the Water Framework Directive assessment for estuarine and coastal waters concluded that there is a low risk to the key receptor of Water Quality. The chemical levels in the sediment are not considered likely to have a significant impact on the sediment quality already located within the disposal grounds and it is recognised that this part of the sea floor is a sacrificial site for the disposal of dredge material. The preferred disposal site would be FO038 Narrow Deep due to its proximity to Granton Harbour.

The potential for cumulative effects is a matter for consideration under the EIA Regulations. Cumulative effects of the dredging and sea disposal aspects of the works at Granton assessed against dredging operations taking place in the wider Firth of Forth, for example Leith which uses the same disposal site as proposed for Granton and Rosyth have been reviewed. Table 7-3 provides a summary of those two projects.

Table 7-3 Dredge material from Rosyth and Leith Maintenance Dredge

Location of Dredge	Type of Dredge	Amount of Dredge Material	Disposal Site
Forth Ports - Rosyth	Maintenance	520,000 wet tonnes	Oxcars Main FO041, Oxcars Ext A FO042, Oxcars Ext B FO043
Forth Ports - Leith	Maintenance	130,000 wet tonnes	Narrow Deep B FO038

The other point to consider as part of this assessment of cumulative effects is the proposed volume total in comparison to the total volumes of sediment disposed of within the various licensed disposal site within the Firth of Forth. Data supplied by Marine Scotland indicated that just under 1.25 million tonnes (wet) of dredged material were disposed of within the licensed sites in 2017.

In comparison, the proposed material for disposal form Granton Harbour is 86,980m^3, assuming a bulk density of 1.8, would equate to 156,564 tonnes wet of material.

Given the small scale dredge and disposal volumes going to sea and the similar chemical composition of other dredge operations within the Firth of Forth, the dredge and disposal operations associated with Granton Harbour are unlikely to have any cumulative effects either by volume or chemical composition.

8 SCHEDULE OF MITIGATION

8.1 Introduction

This chapter presents a summary of the mitigation and enhancement measures identified by the specialist environmental studies through the EIA process. It indicates how these mitigation measure have or would be implemented.

The mitigation and enhancement measures included in this EIAR would be implemented during one or more of the following three broad phases of the proposed development:

- Measures incorporated during the design process;
- Measures required through the construction phase; and
- Measures likely to be required during post-construction.

Table 8.1 below provides a summary of the mitigation measures proposed for each issue identified by the EIA process. The measures are divided into the categories outlined above. It should be noted that the tables present a summary only; further details on the mitigation and enhancement measures are included within each chapter and the associated reports are included within Volume 3: Technical Appendices of this EIAR.

The Schedule is designed to provide a comprehensive summary of all construction or physical mitigation measures that would require to be carried through into the construction and operation of the proposed development, to ensure that the environmental assessment outcomes discussed throughout this EIAR are reached, e.g. to ensure that significant adverse effects are avoided where applicable and possible.

It should be noted that enhancement measures have been suggested where appropriate throughout this EIAR, however these are not items which have been included within the Schedule, given that whilst they are actions or features which are encouraged, they are not mitigation which is required to alleviate potentially significant effects.

8.2 Mitigation Measures

Mitigation detailed in each technical chapter has been summarised below in Table 8-1.

Table 8-1: Schedule of Mitigation

Feature / Topic	Mitigation	Timing
Chapter 4: Water Environment and Coastal Processes		
Design	Design led mitigation that has been applied can be summarised as follows: • Site investigation has determined the nature of dredge sediments, dredge material will be disposed offshore to a designated disposal ground where it is considered suitable. Any contaminated portion of the dredge arising will be taken off site for land based disposal under licence. Further details of site investigation and dredge disposal are presented in the Best Practicable Environmental Option (BPEO) report (Technical Appendix 4-3, Volume 3 of the EIAR). • Wave modelling has been undertaken to refine the design of the proposed development, and inform the impact assessment.	**Design**
CEMP	A Construction Environmental Management Plan (CEMP) will be developed to ensure that the mitigation measures outlined in the EIA are followed during the proposed construction works. The CEMP will include surface water management and pollution prevention measures (e.g. Pollution Prevention Plan), and will be in place during construction and operation. The CEMP will remain a live document and will be continually updated as the work progresses. The CEMP will be developed as a practical tool to facilitate the management of environmental mitigation measures and to provide a clear roadmap of the key roles and responsibilities during construction. All mitigation measures will be incorporated into the EMP, which will include detailed Construction Method Statements (CMS). The EMP will be submitted prior to commencement of the proposed development for approval by regulators.	**Construction**
EnvCOW	A suitably qualified Environmental Clerk of Works (EnvCoW) will monitor the construction works to ensure that the CEMP and associated mitigation measures are being implemented effectively.	**Construction**
Best Practice	Best practice will be adopted throughout all phases of development, following current guidance as listed in Chapter 4: Water, Soils and Coastal Processes. The programme of works, including timing, direction and method of capital dredge, will be planned, monitored and managed to minimise the potential negative environmental impacts.	**Construction**
Pollution Incident Response Plan	A pollution incident response plan will be set out in the CEMP relating to the construction of the proposed development, statutory requirements and identification of areas of highest sensitivity. This will provide site spill response procedures, emergency contact details and equipment inventories and their location. All staff will be made aware of this document and its content during site induction. A copy will be available in the site office at all times.	**Construction**
Construction Monitoring Plan	It is anticipated that a monitoring plan will be implemented. The aim of this will be to characterise the baseline conditions prior to construction works commencing and to continue throughout the construction phase to confirm that the mitigation measures are performing as expected. The monitoring plan will be established and implemented with the agreement of SEPA and Marine Scotland and will be incorporated into the CEMP. It is considered that the following elements would be included within the agreed monitoring plan: • Regular visual inspection of: ○ Harbour waters, more frequent during periods of dredging activity, in order to monitor levels of sediment suspension and dispersion.	**Construction**

	• Water quality monitoring: A monitoring plan, covering baseline, construction and post-construction will be agreed with SEPA and Marine Scotland. • Monitoring as required to satisfy the conditions of any future discharge licence(s) or other environmental legislation. • Monitoring following any pollution incidents. • On-going liaison with SEPA and Marine Scotland as required during construction. All activities with potential to affect the water environment require to be authorised under the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR). The level of authorisation required is dependent on the anticipated environmental risk posed by the activity to be carried out. These activities could include construction drainage.	
Concrete	There is unlikely to be concrete batching undertaken on-site. However, in the case that batching was to be undertaken on-site the following mitigation measures would be implemented to minimise the potential impact of concrete batching on the water environment in line with PPG6: • Concrete batching will take place on an impermeable designated area and at least 10m from any watercourse. • Equipment and vehicles will be washed out in a designated area that has been specifically designed to contain wet concrete/ wash water. • A closed loop system will be used for wash waters. Wash waters will be stored in a contained lined pond for settlement before being reused (e.g. for mixing and washing). • No discharge of wash waters will occur on-site. All excess wash water that cannot be reused will be disposed of off-site. The following mitigation is proposed for concrete handling and placement: • Pouring of concrete will take place within well shuttered pours to prevent egress of concrete from the pour area. • Pouring of concrete during adverse weather conditions will be avoided. • The CEMP will include a Pollution Incident Response Plan, and drivers of vehicles carrying concrete will be informed so as to raise awareness of potential effects of concrete and of the procedures for clean-up of any accidental spills. Concrete acidity (pH) will be as close to neutral (or site-specific pH) as practicable as a further precaution against spills or leakage.	**Construction**

Oil, Fuel, Site Vehicle Use and Storage	The risk of oil contamination will be minimised by good site working practice (further described below) but should a higher risk of oil contamination be identified then installation of an oil separator will be considered.
	The storage of oil is considered a Controlled Activity which will be deemed to be authorised if it complies with the Regulations. The mitigation measures to minimise any risk of contaminant release are in line with SEPA PPG and GPP documents and include the following:
	• Storage:
	  ○ Storage for oil and fuels on site will be designed to be compliant with GPP 2 and 8.
	  ○ The storage and use of loose drums of fuel on site will be not permitted.
	  ○ The bund will provide storage of at least 110% of the tank's maximum capacity.
	• Refuelling and maintenance:
		Construction

	○ Fuelling and maintenance of vehicles and machinery, and cleaning of tools, will be carried out in a designated area where possible in line with PPG 7. ○ Multiple spill kits will be kept on site. ○ Drip trays will be used while refuelling. ○ Regular inspection and maintenance of vehicles, tanks and bunds will be undertaken. Emergency procedure: The Pollution Incident Response Plan will include measures to deal with accidental spillages.	
	Fuel, oil and chemical storage will be sited on an impervious base within a bund and secured area. All wastes will be stored in designated areas that are bunded to contain any spillage. Refuelling facilities will be inspected regularly and the maintenance record will be available for inspection, whilst fuel collars and drip trays will be in operation to reduce the risk of spillages. Weekly inspections will be undertaken of oil storage bunds, tanks and pipework for signs of damage. The boat hoist will be inspected on a weekly basis to check for signs of hydraulic oil and fuel leakage.	**Construction**
Pollution Incident Response Plan	A Pollution Incident Response Plan will be prepared for the operational phase, and included within the EMP, taking full consideration of best practice, statutory requirements and identification of areas of highest sensitivity. This will provide site spill response procedures, emergency contact details and equipment inventories and their location. All operation staff will be made aware of this document, and its contents, and it will be available in the marina office. Appropriate spill kits and absorbent materials will be stored on site in a location easy to access. Staff/contractors will be trained in the use of spill kits and other pollution control equipment and the operation of pollution control devices.	**Construction**
Surface Water Management	Pump out facilities will be provided to enable berth holders and visitors to empty holding tanks.	**Operation**
Chapter 5: Marine Ecology		
Otters	Despite no signs of otter during field visits and anecdotally in the local area, the possible presence of otter on site and in the wider landscape should be included in tool box talks and site induction for construction staff operating in this area.	**Construction**
	Works associated with land above the high water mark should be preceded by a pre-works check for otter resting sites. If an otter is observed within the proposed working areas, seek guidance from an Ecological Clerk of Works (ECOW) and do not commence works until the otter has dispersed.	**Construction**
	Should an otter resting site be discovered, prior to or during works, said works should be assessed with regards to the need for additional mitigation species disturbance licensing.	**Construction**
	Artificial lighting should be directed towards the working areas only in order to minimise the effects on otter which can be more active between dusk and dawn.	**Construction**
	Pollution of the marine environment should be prevented in order to safeguard water quality and marine life which otter rely on within these habitats.	**Construction/ Operation**

Construction Method Statement (CMS)	Construction Method Statement (CMS) detailing pollution prevention measures will be agreed with the regulatory authority prior to works commencing, as part of the wider CEMP. The following good practice guidelines shall be adhered to and incorporated into the CMS: o GGP 5: Works and maintenance in or near water; o PPG 6: Working at construction and demolition sites; o PPG 7: Safe Storage – The safe operation of refuelling facilities; o GPP 21: Pollution and incident response planning; and o PPG 22: Incident response – dealing with spills	**Construction**
Marine Mammal Protection Protocol (MMPP) – general measures	The Marine Mammal Observation Protocol (MMOP) (Technical Appendix 5.2) would be implemented so that the impact piling works do not cause injury or unnecessary disturbance to marine mammals.	**Construction**
	A suitably qualified Marine Mammal Observer (MMO), competent in the identification of marine mammals, will be present during the impact piling. The MMO will undertake observation for marine mammals within the mitigation zone before and during impact piling. The MMO will advise the contractors and crews on the implementation of the procedures set out in the agreed protocol, to ensure compliance with those procedures.	**Construction**
	The MMO will be equipped with binoculars (10X42 or similar) and/or a spotting scope (20-60 zoom or equivalent), a copy of the agreed protocol and the Marine Mammal Recording Form (MMRF).	**Construction**
	The JNCC guidance defines the mitigation zone as a pre-agreed radius around the piling site prior to any piling. This is the area where a MMO keeps watch for marine mammals (and delays the start of activity should any marine mammals be detected). The extent of this zone represents the area in which a marine mammal could be exposed to sound that could cause injury and will be determined by factors such as the pile diameter, the water depth, the nature of the activities (for example whether drilling will also take place) and the effect of the substrate on noise transmission. The radius of the mitigation zone should be no less than 500 metres, and this is measured from the pile location. The MMO should be located on the most appropriate viewing platform to ensure effective coverage of the mitigation zone.	**Construction**
	Piling will not commence during periods of darkness or poor visibility (such as fog), or during periods when the sea state is not conducive to visual mitigation (above sea state 4 is considered not conducive), as there is a greater risk of failing to detect the presence of marine mammals[72].	**Construction**
	The mitigation zone will be monitored visually by the MMO for an agreed period prior to the commencement of piling. This will be a minimum of 30 minutes. Piling will not commence if marine mammals are detected within the mitigation zone or until 20 minutes after the last visual or acoustic detection. The MMO will track any marine mammals detected and ensure they are satisfied the animals have left the mitigation zone before they advise the crew to commence piling activities.	**Construction**
	Passive Acoustic Monitoring (PAM) is of little value for monitoring species with low vocalisation rates, such as seals and baleen whales, including minke whales which are often encountered in inshore waters, which is why ADD are recommended in this instance.	**Construction**

[72] There is a 'variation of standard piling protocol' allowed in the guidance if required.

	A soft-start will be employed, with the gradual ramping up of piling power incrementally over a set time period until full operation power is achieved. The soft-start duration will be a period of not less than 20 minutes. This will allow for any marine mammals to move away from the noise source.	**Construction**
	If a marine mammal enters the mitigation zone during the soft-start then, whenever possible, the piling operation will cease, or at least the power will not be further increased until the marine mammal exits the mitigation zone and there is no further detection for 20 minutes.	**Construction**
	When piling at full power this will continue if a marine mammal is detected in the mitigation zone (as it is deemed to have entered voluntarily).	**Construction**
	If there is a pause in the piling operations for a period of greater than 10 minutes, then the pre-piling search and soft-start procedure will be repeated before piling recommences. If a watch has been kept during the piling operation, the MMO should be able to confirm the presence or absence of marine mammals, and it may be possible to commence the soft-start immediately. If there has been no watch, the complete pre-piling search and soft-start procedure will be undertaken. To prevent the need for the pre-piling search and therefore delays to the piling operations, a noise generator could be deployed to create a continuous underwater noise which mimics the sound of the impact hammer; which would in turn deter marine mammals from entering the mitigation zone. This should be used for no longer than 1 hour, or in exceptional circumstances 2 hours (i.e. a breakdown of machinery), after which the standard soft-start procedure will commence. All uses of the noise generator should be logged and handed to the MMO to include in the deck forms.	**Construction**
	As per the JNCC guidance, reports detailing the piling activity and marine mammal mitigation (the MMO reports) will be sent to Marine Scotland at the conclusion of piling activity. Reports will include: • Completed Marine Mammal Recording Forms; • Date and location of the piling activities; • A record of all occasions when piling occurred, including details of the duration of the pre-piling search and soft-start procedures, and any occasions when piling activity was delayed or stopped due to presence of marine mammals; • Details of watches made for marine mammals, including details of any sightings, and details of the piling activity during the watches; • Details of any problems encountered during the piling activities including instances of non-compliance with the agreed piling protocols; and • Any recommendations for amendment of the protocols.	**Construction**
	The requirement of an MMO for dredging is not considered necessary due to the small TTS zones associated with the noise generated. Instead, contractors should be made aware that marine mammals may be present within the working area.	**Construction**
	Construction techniques and methodologies would be fully incorporated into a Construction Environmental Management Plan (CEMP) (including a Pollution Prevention Plan) and be fully developed once a contractor is appointed.	**Construction**

	If any dead cetacean is observed during construction or operation, it should be reported to the Scottish Marine Animal Stranding Scheme (SMASS) (www.strandings.org) and live marine mammal strandings will be reported to British Divers Marine Live Rescue (www.bdmlr.org.uk).	**Construction**
MMPP - in darkness and at high sea states	During periods when conditions are not conducive to visual monitoring, a soft-start must be conducted, meaning a gradual ramp-up of power over a period of not less than 20 minutes.	**Construction**
Operation Phase	Leaflets will be created to provide additional advice to marina users to avoid disturbance to and/or collision with marine mammals or basking sharks which should include, but is not limited to the following: • Keep a safe distance. Never get closer than 100m (200m if another boat is present) if within 100m, switch the engine to neutral; • Never drive head on to, or move between, scatter or separate marine mammals or sharks. If unsure of their movements, simply stop and put the engine into neutral; • Spend no longer than 15 minutes near the animals; • Special care must be taken with mothers and young; • Maintain a steady direction and a slow 'no wake' speed; and • Avoid sudden changes in speed.	**Operation**
Chapter 6: Other Issues		
Air Quality	Construction of the proposed development is considered to be a temporary impact and can be controlled through developing a site-specific Dust Management Plan as part of a Construction Environmental Management Plan (CEMP). The dust impact assessment requires specific information on site operations during construction, including preparatory earthworks, general construction and the potential for trackout during construction of the proposed development. Currently this information is still being finalised. It is therefore proposed to defer the construction dust assessment and formulation of a construction dust management plan until such time as details on construction have been finalised. In line with the decision notice associated with the outline planning application 01/00802/OUT which was granted, with conditions, the following mitigation will be included where required: • Close liaison with the traffic management section of City of Edinburgh Council should be made in relation to the agreed routes and hours of working for construction vehicles. • Haul routes to be located away from off-site sensitive properties and to be watered regularly (wet suppression of dust) to ensure that any deposit of material on the local road network is minimised; • All site vehicles and plant to have upward-facing exhausts to minimise surface dust resuspension - Bunds or screens may be constructed as wind breaks, to reduce wind speeds. Earth bunds should be seeded as soon as possible prior to which they are to be maintained damp;	**Construction**

	• The aggregate stocking area should be located away from sensitive areas and residential properties; - Stockpiles should also be watered and water curtains on any additionally be used at the site boundaries near sensitive properties; • Off-site vehicles to be sheeted, their wheels and bodies to be cleaned and the access road to be hard-surfaced and maintained damp; - Early paving of permanent roads; • Minimisation of drop heights, and the use of chutes to discharge material close to where it is required - Vehicle wheel and chassis cleaning - Imposition of speed limits, to reduce dust emissions from ground surfaces	
Terrestrial Noise	In line with the decision notice associated with the outline planning application 01/00802/OUT which was granted, with conditions, the following noise mitigation measures will be included where required: • Noise levels generated will be controlled by practicable means through contract specification, local authority control and the use of temporary barriers and 'quiet' plant. • A construction noise management plan, can help mitigate any effects at the most exposed sensitive receptors. • Acoustic double glazing	**Construction**
Navigation	Mitigation with regard to the marina construction commences with the requirement for the successful contractors to provide full methods, risk assessments and mitigation measures and to agree and amend these as necessary. Mitigation relates to correct lighting and buoyage during and post construction. New navigation lights shall be installed as appropriate and buoyage may be deployed to ensure marina traffic follows a visible and shallow entry angle into the main shipping channel. Health and Safety during construction will be followed in accordance with The Construction (Design and Management) Regulations 2015. The following recommendations are generic and will be specified according to the construction method and type of plant deployed. *Moving the piling barge/rig* To be handled be a competent vessel and crew at all times, advised to harbour and other traffic and co-ordinated prior to commencement through a single contact. *Obstruction of channel* • Ensure barge/jackup is on the 'non' channel side of the sheet pile installation if possible. *Foundering of barge in the channel* • As above and additionally contractor emergency procedures to be in place, dovetailing with harbour emergency procedures; • Contractor insurance; • Barge surveys; and • Best operating practice for the barge.	**Construction**

	Collision with other vessels while engaged in dredging/disposal/piling • Navigational and minimum ambient lighting on barge; • Local Notice to Mariners; • Publicity in local press for recreational users, who are most likely to be affected. • Communication issues • VHF ch12 continuous monitoring; and • Mobile numbers of single contact point with emergency action responsibility on barge and vice versa with Harbour contacts. *Support vessels* • Control of movement by harbour; • VHF ch12 continuous monitoring; and • Contractor methods and risk assessed boarding and transfer methods to barge/shore for all weather conditions. *Wave/wash of passing vessels affecting passenger transfers or barge* • Pre-planned and co-ordinated movements to lessen risk by contractor. *Damage to piling mid construction by vessels* • Contractor to advise on fragility of structure when not complete and proposed mitigation should irreparable damage be a risk. *Damage to vessels by piles mid construction* • Lighting or other highlighting of danger areas to be used particularly during darkness; • Local Notice to Mariners; and • Publicity in local press for recreational users. *Contact with vessels passing by the operation of piling* • Methods and risk assessments to be provided, agreed and adhered to (e.g. barge mounted crane jib extending into navigational channel and the like). • The piling operation to be arranged in such a way that no physical encroachment can be made into the navigational channel. In addition to the foregoing, the marina operator is committed to complying with the Port Marine Safety Code and 2018 Guide to Good Practice on Port Marine Operations. Navigation will be included within the CEMP when it is prepared.	
Technical Appendix 1.1: Pre-Application Consultation Report		
No formal mitigation proposed		

Technical Appendix 1-2: Planning Statement	
No formal mitigation proposed	
Technical Appendix 2-1: Civil Engineering Method Statement	
No formal mitigation proposed	
Technical Appendix 4.1: Bathymetric Survey	
No formal mitigation proposed	
Technical Appendix 4.2: Wave Disturbance Modelling	
No formal mitigation proposed	
Technical Appendix 4-3: BPEO	
The key proposed mitigation measures for the dredge works are as follows: • Dredging method to be designed to limit release of sediment during works. • Physical Barrier – a physical silt barrier will be placed between dredging within the western harbour and Eastern harbours/Firth of Forth. • Turbidity Monitoring – to ensure that material is not being widely displaced. A baseline would need to be established for contaminant levels within the eastern harbour sediments as well as baseline turbidity levels prior to dredging to enable direct comparisons.	**Construction**
Technical Appendix 5-1: Otter Survey	
The following mitigation measures are recommended to minimise the effects on otters: • Potential otter holts and shelters should be checked prior to works commencing by a qualified ecologist; • The removal of boulders and concrete with the potential to shelter otter must be supervised by a qualified ecologist; • All site contractors should be made aware of the potential presence of otter in the locale, and in the event that otter is discovered on site, all work in that area must stop immediately and a suitably qualified ecologist contacted; • The development design seeks to retain or create new otter sheltering habitat wherever possible; • Works and related site mobilisations will commence no earlier than one hour after dawn and will cease no later than one hour before sunset to avoid times where otter are likely to be active; • Temporary lights used during construction must be fitted with shades to prevent light spillage outside the working area. Temporary lights must not illuminate scrub and scattered trees as lighting can affect commuting and foraging success of otter and other species; • Any trenches or pits made during construction must be covered when unattended or a shallow angled plank inserted to allow animals to escape, should they become trapped inside them. The ends of any pipeline must be capped when unattended, or at the end of each working day to prevent animal access; • Scottish Environment Protection Agency (SEPA) Guidance for Pollution Prevention (GPPs) would be followed; and • In the event that any protected species is discovered all work in that area must stop immediately and a suitably qualified Ecologist contacted. Details of the SNH Area Officer and Scottish Society for the Prevention of Cruelty to Animals (SSPCA) relevant Officer could be held in site emergency procedure documents.	**Construction**

Assuming mitigation is applied, no loss of resting site, or permanent loss of important foraging and/or commuting habitat is anticipated to occur that could significantly affect the local population and distribution of otter.	
Technical Appendix 5-2: Marine Mammal Protection Plan	

Marine Mammal Observer Protocol – Impact Piling **Marine Mammal Observer:** A suitably qualified Marine Mammal Observer (MMO), competent in the identification of marine mammals at sea, will be present during the impact piling. The MMO will undertake observation for marine mammals within the mitigation zone before and during impact piling and will be dedicated to that one task for the duration of any watch. The MMO will advise the contractors and crews on the implementation of the procedures set out in the agreed protocol, to ensure compliance with those procedures. The JNCC guidance provides the following definitions of an MMO: **MMO**: Individual responsible for conducting visual watches for marine mammals. It may be requested that observers are trained, dedicated and/or experienced. **Trained MMO**: Has been on a JNCC recognised course. **Dedicated MMO**: Trained observer whose role on board a vessel is to conduct visual watches for marine mammals. **Experienced MMO**: Trained observer with three years of field experience observing for marine mammals, and practical experience of implementing the JNCC guidelines. The MMO will be land based and will be Trained. The identity and credentials of the MMO will be agreed with Marine Scotland. **MMO Equipment:** The MMO will be equipped with binoculars (10X42 or similar) and/or a spotting scope (20-60 zoom or equivalent), a copy of the agreed protocol and the Marine Mammal Recording Form (MMRF), which is a Microsoft Excel spreadsheet containing embedded worksheets named Cover Page, Operations, Effort and Sightings. A Microsoft Word document named Deck forms is also available, and the MMO may prefer to use this when observing before transferring the details to the Excel spreadsheets. Although these forms were developed for seismic surveys, they can be used for piling operations, although many columns will not be applicable. The ability to determine the range of marine mammals is a key skill for MMOs, therefore a hand-held rangefinder will be used to verify the range. All MMO forms, including a guide to completing the forms; and instructions on how to make a rangefinder are available on the JNCC website: http://jncc.defra.gov.uk/marine/seismic_survey **Communication:** The contractor will be responsible for the communication channels between those providing the mitigation service and the crews working on the piling. A formal chain of communication from the MMO to the contractor, who will start/stop piling, will be established. In order to confirm the chain of communication and command the MMO will attend any relevant pre-mobilisation meetings. **Mitigation Zone:** The JNCC guidance defines the mitigation zone as a pre-agreed radius around the piling site prior to any piling. This is the area where a MMO keeps watch for marine mammals (and delays the start of activity should any marine mammals be detected). The extent of this zone represents the area in which a marine mammal could be exposed to sound that could cause injury and will be determined by factors such	**Construction**

as the pile diameter, the water depth, the nature of the activities (for example whether drilling will also take place) and the effect of the substrate on noise transmission. The radius of the mitigation zone should be no less than 500 metres, and this is measured from the pile location. The mitigation zone is calculated following a review of underwater noise modelling; and reflects the risk zones of PTS and TTS for the species of concern, therefore cannot be defined at this time. The MMO should be located on the most appropriate viewing platform to ensure effective coverage of the mitigation zone, during periods of rough seas, an elevated vantage point would be beneficial. **Impact Piling Protocol** The standard JNCC protocol is outlined below[73] (please see the Acoustic Deterrent Device (ADD) protocol to be followed during times of sea states exceeding 4 (or 2 if deemed necessary by the MMO) or during periods of darkness and/or low visibility i.e. fog): 1. The MMO will not initiate this protocol during periods of darkness or poor visibility (such as fog) or during periods when the sea state is not conducive to visual mitigation (above sea state 4 is considered not conducive[74]) as there is a greater risk of failing to detect the presence of marine mammals. Harbour porpoise have small dorsal fins, therefore the MMO shall take additional precautions if the sea state exceeds 2. As works will occur over the winter period it is likely that sea state 2 will be exceeded on a regular basis. An elevated platform for the MMO to monitor from would be beneficial when the sea state is 2 or above, the impact piling works could also be scheduled on a day where the sea is expected to be calm. 2. The mitigation zone will be monitored visually by the MMO for an agreed period prior to the commencement of piling. This will be a minimum of 30 minutes. 3. The MMO will scan the waters using binoculars or a spotting scope and by making visual observations. Sightings of marine mammals will be appropriately recorded in terms of date, time, position, weather conditions, sea state, species, number, adult/juvenile, behavior, range etc. on the JNCC standard forms. Communication between the MMO and the contractor and the start/end times of the activities will also be recorded on the forms. 4. Piling will not commence if marine mammals are detected within the mitigation zone or until 20 minutes after the last visual detection. The MMO will track any marine mammals detected and ensure they are satisfied the animals have left the mitigation zone before they advise the crew to commence piling activities.	

[73] There is a 'variation of standard piling protocol' allowed in the guidance if required.
[74] Detection of marine mammals, particularly porpoises, decreases as sea state increases. According to the JNCC guidance ideally sea states of 2 or less are required for optimal visual detection.

5. A soft-start will be employed, with the gradual ramping up of piling hammer power incrementally over a set time period until full operational power is achieved. The soft-start duration will be a period of not less than 20 minutes. This will allow for any marine mammals to move away from the noise source. 6. If a marine mammal enters the mitigation zone during the soft-start then, whenever possible, the piling operation will cease, or at least the power will not be further increased until the marine mammal exits the mitigation zone and there is no further detection for 20 minutes. 7. When piling at full power this will continue if a marine mammal is detected in the mitigation zone (as it is deemed to have entered voluntarily[75]). 8. If there is a pause in the piling operations for a period of greater than 10 minutes, then the pre-piling search and soft-start procedure will be repeated before piling recommences. If a watch has been kept during the piling operation, the MMO should be able to confirm the presence or absence of marine mammals, and it may be possible to commence the soft-start immediately. If there has been no watch, the complete pre-piling search and soft-start procedure will be undertaken. To prevent the need for the pre-piling search and therefore delays to the piling operations a noise generator could be deployed, which is a metal, spring loaded hammer device which creates a continuous underwater noise, mimicking the sound of the impact hammer; which would in turn deter marine mammals from entering the mitigation zone. This should be used for no longer than 1 hour, or in exceptional circumstances 2 hours (i.e. a breakdown of machinery), after which the standard soft-start procedure will commence. All uses of the noise generator should be logged and handed to the MMO to include in the deck forms. Passive Acoustic Monitoring (PAM) is of little value for monitoring species with low vocalisation rates, such as seals and baleen whales, including minke whales which are often encountered in inshore waters, which is why ADD are recommended in this instance.	
Technical Appendix 5-3: Marine Non-Native Species Survey	
Works should adhere to the Code of Practice on Non-Native Species (2012). Assuming the following mitigation is applied, no introduction or spread of NNS is anticipated to occur that could significantly affect the ecological integrity of the site: • Development and implementation of a Marine Biosecurity Plan specific to construction and also operation of the completed development; • An Environmental/Ecological Clerk of Works (ECoW) team will be appointed to monitor compliance, produce auditable records and provide onsite advice; • All relevant staff receive a copy of the site/ operation biosecurity plan summary and instructions sheet; • ECoW to receive training in NNS identification;	**Construction**

[75] The guidance states that there is no scientific evidence for this voluntary hypothesis; instead it is based on a common sense approach. Factors such as food availability may result in marine mammals approaching piling operations; in particular, the availability of prey species stunned by loud underwater noise may attract seals into the vicinity.

• Identification of commonly found NNS will also be outlined in toolbox talks given to staff by the ECoW; • All staff will be encouraged to report any 'suspect' marine plant or animal to the Environmental Manager or EcoW; • Measures will be in place to preserve water quality and prevent watercourse pollution following SEPA Guidelines for Pollution Prevention (GPPs); • Routine inspections of equipment and vessels for NNS and biosecurity measures taken if NNS found at site or on equipment; and • Inspection of any 'high risk' vessels or materials entering the harbour during construction and operation.	
Technical Appendix 5-4: Habitats Regulation Appraisal	
The following mitigation will be employed to avoid and minimise the risk of a pollution event occurring both during the construction and operational phases of the proposed development: • *Timing and duration* – Avoid conducting piling activities during times when marine mammals and fish are likely to be breeding, calving, feeding, or resting in biologically important habitats located within the potential noise impact footprint. • *Piling method* – Use low noise piling methods where practicable, such as vibropiling, instead of impact piling methods where possible. Vibropiling methods produce lower noise levels and are not impulsive in character. This reduces the likelihood of hearing injury to occur within marine mammals. The piling method should be optimised taking into account time on-site and likely noise levels. • *Soft start* - The use of a 'soft start' or 'ramping up' process, in which pile driving energy is gradually increased to normal operating levels, gives nearby animals an opportunity to vacate the area before sound levels increase to an extent that may cause injury. There is some concern that this technique may actually attract animals, and so should be used with this is mind and always with trained marine mammal observers present (Jefferson et al. 2009). Also, it is likely that behavioural changes and possibly masking will still occur for nearby animals (Madsen et al. 2006). • *Contract documentation* – Include the standard management and mitigation procedures, and any additional measures to be put in place, in the contract documentation. • *Trained team* – Ensure that a suitably qualified person is available during piling activities to conduct the standard operational procedures outlined below. A suitably qualified person should have qualifications in ecology or environmental sciences and demonstrated experience with the identification and management of marine mammals. A briefing on environmental matters, including information on guidelines, marine mammal identification and legal obligations should be provided to all staff involved in the piling activities. Likely marine mammal concentration areas, key feeding sites, and other aggregation areas should be identified during the planning stage and this information should be provided to trained team members and the marine mammal observer to improve the identification and observation of marine mammals. • *Bubble curtains* - Demonstrated to significantly lower both pile driving sound pressure levels and peak frequencies. Typically a bubble curtain consists of a perforated hose that is anchored to the sea floor around the area where piling is taking place. Compressed air is	**Construction**

pumped through the hose and a 'curtain' of bubbles produced. Bubble screens can reduce the sound pressure levels up to a biologically significant 25dB in the frequency range of concern for marine mammals. Other variations of bubble curtains such as screens and jackets are commonly used to reduce pile driving noise at offshore wind-farms and are worth considering.
• *Construction Environment Management Plan (CEMP)* - detailing pollution prevention measures will be agreed with the regulatory authority prior to works commencing;
• The following good practice guidelines will be adhered to and incorporated into the CMS:
  ○ GGP5: Works and maintenance in or near water;
  ○ PPG 6: Working at construction and demolition sites;
  ○ PPG 7: Safe Storage – The safe operation of refuelling facilities;
  ○ GPP21: Pollution and incident response planning; and
  ○ PPG22: Incident response – dealing with spills.
• An Ecological Clerk of Works (ECoW) will be employed throughout the construction phase to audit adherence to the mitigation outlined in the CMS.
 	
Mitigation Impacts of Underwater Noise
 	
The construction period during which underwater noise impacts will be generated is three months. During this period however construction activities will generally occur between 0700 and 1900 and so will be short term and intermittent. However as there is the potential for disturbance on cetaceans, basking sharks if present, the project will commit to following relevant provisions of the Guidelines For Minimising Acoustic Disturbance To Marine Mammals from Seismic Surveys (JNCC 2004). Principally this will include the following:
• Providing an observer who will monitor the surrounding sea area for indications of cetaceans and/ basking sharks.
• Noise generating activity will be suspended if sensitive species pass within 500 m of the site.
• Where practicable a soft start will be used when beginning potentially noisy underwater work.
 	
The construction programme should take consideration of the most sensitive periods within the salmonid migration period of May to August in order to avoid disturbance. The programme will be agreed with the relevant regulator to minimise impacts	

Technical Appendix 5-5: Underwater Noise, Qualitative Assessment	
Planning of piling activities The planning stage of piling activities should consider the following:	**Construction**

• *Timing and duration* – Avoid conducting piling activities during times when marine mammals are likely to be breeding, calving, feeding, or resting in biologically important habitats located within the potential noise impact footprint. • *Piling method* – Use low noise piling methods, such as vibro-piling, instead of impact piling methods where possible. Vibro-piling methods produce lower noise levels and are not impulsive in character. This reduces the likelihood of hearing injury to occur within marine mammals. The piling method should be optimised taking into account time on-site and likely noise levels. • *Soft start* - The use of a 'soft start' or 'ramping up' process, in which pile driving energy is gradually increased to normal operating levels, gives nearby animals an opportunity to vacate the area before sound levels increase to an extent that may cause injury. There is some concern that this technique may actually attract animals, and so should be used with this is mind and always with trained marine mammal observers present (Jefferson et al. 2009). Also, it is likely that behavioural changes and possibly masking will still occur for nearby animals (Madsen et al. 2006). • *Contract documentation* – Include the standard management and mitigation procedures, and any additional measures to be put in place, in the contract documentation. • *Trained team* – Ensure that a suitably qualified person is available during piling activities to conduct the standard operational procedures outlined below. A suitably qualified person should have qualifications in ecology or environmental sciences and demonstrated experience with the identification and management of marine mammals. A briefing on environmental matters, including information on guidelines, marine mammal identification and legal obligations should be provided to all staff involved in the piling activities. Likely marine mammal concentration areas, key feeding sites, and other aggregation areas should be identified during the planning stage and this information should be provided to trained team members and the marine mammal observer to improve the identification and observation of marine mammals. • *Bubble curtains* - Demonstrated to significantly lower both pile driving sound pressure levels and peak frequencies. Typically a bubble curtain consists of a perforated hose that is anchored to the sea floor around the area where piling is taking place. Compressed air is pumped through the hose and a 'curtain' of bubbles produced. Bubble screens can reduce the sound pressure levels up to a biologically significant 25dB in the frequency range of concern for marine mammals. Other variations of bubble curtains such as screens and jackets are commonly used to reduce pile driving noise at offshore wind-farms and are worth considering.	

9 CONCLUSIONS

9.1 Introduction

The predicted environmental effects related to the construction and operation of the proposed development at Edinburgh Marina have been considered throughout the design and subsequent assessment of the development layout. The views of statutory consultees have been taken into account as presented in Chapter 3: EIA Methodology and Scoping. The final design of the proposed development has been subject to a detailed EIA which has sought to minimise the effects resulting from the proposed development. Mitigation measures are detailed within their respective specific chapters of this EIAR and summaries within Chapter 7: Schedule of Mitigation of this EIAR.

9.2 Water Environment and Coastal Processes

Assessment of the impacts of the proposed development on the water environment and coastal processes in the study area was undertaken and detailed within Chapter4. Overall, the effects of the proposed development on the water environment, soils and coastal processes are **not significant**. The post-mitigation magnitude of any residual effects are detailed within Chapter 4 and are considered either minor or negligible in this respect. Accordingly, no significant adverse effects have been identified.

9.3 Marine Ecology and Ornithology

Assessment of the impacts of the proposed development on the Ecology in the study area was undertaken and detailed within Chapter 5. Overall, the effects of the proposed development on ecology and ecological processed processes are **not significant**. The post-mitigation magnitude of any residual effects are detailed within Chapter 5 and are considered either minor or negligible in this respect. Accordingly, no significant adverse effects have been identified.

9.4 Other Issues

A range of other issues were explored, such as exportation of dredge material by road, air quality, terrestrial noise, population and human health, navigation, climate change, natural disasters and major accidents. **No significant effects** are predicted under any of these topics.

9.5 Cumulative Effects

The cumulative effects associated with the proposed development were assessed and **No significant effects** are predicted