1 INTRODUCTION

1.1 Introduction

1.1 Scrabster Harbour (Figure 1.1) is located in Scrabster on the north coast of Caithness and has a grid reference centre point of ND10437 70310. Scrabster is situated 1.5 miles northwest of Thurso, the largest town in Caithness, provides a ferry link to Orkney and is ideally located for access to the North Sea and Atlantic Ocean.

Figure 1.1: Scrabster Harbour

1.2 The existing St Ola Pier was constructed in 1972 and has fallen into declining use due to ongoing corrosion of steel piling and lack of load bearing capacity for imposed deck loads. The existing Pier is situated within the centre of the harbour and incorporates a 100 metre long berth to the south-west, a linkspan and a further 115 metre berth which was used by the Orkney Ferry prior to the Queen Elizabeth Pier being constructed in 2003.

1.3 The outer side of the pier currently has no berthing because of a 1.5 metre high sea protection wall. The proposed redevelopment of St Ola Pier aims to ensure the ongoing structural integrity of the pier. It also seeks to provide an enhanced straight berthing face on the inner side of the pier for use by oil and gas supply vessels, and for new additional berthing on the outer side of the pier for cruise ships of up to 250 metres long.

1.4 The proposed redevelopment is described in detail in Chapter 2, Volume I, but in summary comprises:

- Installation of new piled quay wall and pier deck to expand the existing pier. The renovated pier will be approximately 280 metres long with straight berthing faces. Some demolition works to the existing pier will be required to facilitate these works;
- The outer side of the pier will be dredged to achieve a depth of approximately -9.0 metres Chart Datum (CD). The inner side of the pier will be dredged to provide a consistent berth depth of -7.5 metres CD. The total volume of dredge material generated by the works is approximately 172,000m3.
- Reclamation Area with Revetment facing: the reclamation and revetment area will be approximately of 0.84ha at the root of the pier to provide storage for cargo handling; and
- A water and fuel supply will be provided on the St. Ola Pier. The fuel pipe will either be routed from the existing supply on the Jubilee Pier, or from a new tank(s) proposed for the reclamation area.

1.2 The Need for Project

1.5 Scrabster Harbour benefits from a strategic location, modern infrastructure and high quality, reliable services. The harbour operates across a range of sectors including cargo, cruise, ferries, fishing, oil and gas and marine renewables. The harbour offers extensive facilities, with 24/7, 365 days a year access to the port. Scrabster Harbour possesses a strong local supply chain and is one of the UK's top whitefish and shellfish landing ports.

1.6 Scrabster Harbour is a Trust port, overseen by Scrabster Harbour Trust which was established in 1841. The Trust exists for the benefit of stakeholders which includes pot users, which includes port users, employees, the local community and businesses and local / national government. Scrabster Harbour Trust is responsible for maintaining the balance between generating economic activity and safeguarding the environment.

1.7 The Trust has invested in the region of £20 million in the past 7 years; as a result Port revenues have grown by 58% between 2012 and 2018 with 100% of surpluses reinvested in the Port.

1.8 Scrabster Harbour Trust commissioned an independent Economic Impact Assessment report in 2017, which found the harbour currently generates £25 million gross value added (GVA) in Caithness and supports over 400 jobs. The figures show an increase from 339 jobs to 403 jobs since the last economic assessment in 2009, underlining the growing role of the Harbour to the Caithness economy.

1.9 The Scrabster Harbour Trust Business Strategy 2019 is focused on both the growth in energy related port activity (oil and gas, marine renewables), cruise ship activity and the retention and growth of ferry, fishing and general cargo.

1.10 The Strategy seeks to deliver:

- Higher quay and laydown utilisation;
- Increased quay and laydown area space;
- Increased vessel numbers and cargo throughput.

1.11 The Trust seek to deliver the Strategy through the following works streams:

- Port Infrastructure – the maintenance and improvement of port infrastructure will be progressed with the refurbishment of the Ola Quay being the short term priority.
- Property acquisition – The Trust will seek to secure additional properties at the Harbour.
- Land reclamation – The feasibility of additional land reclamation will be pursued.
- Reconfiguration – The existing harbour estate layout will be examined to ensure space is best configured.

1.12 The proposed redevelopment is consistent with and forms part of the wider Strategy with the project expected to generate the following outputs (assessed at Year 5 following construction, FY 2025-2026):

- Short term employment and local business benefits over construction period
- 6% increase in total vessel arrivals at Scrabster
- 20% increase in total vessel tonnage at Scrabster
- 18% increase in port revenues
- Generation of 46.3 FTE jobs, with associated increase in GVA and total economic output of the Harbour
- Additional 30,000 cruise passengers arriving at Scrabster, on vessels carrying a total of 10,500 crew
- Cruise passenger and crew spend in Caithness of £1.83 million per annum.
- Further opportunities for local supply chain development in the energy and tourism sectors.

1.3 The Need for EIA

1.13 An Environmental Impact Assessment (EIA) Screening Opinion on the proposed redevelopment issued from Marine Scotland Licensing Operations Team (MSLOT) in March 2018, determining the proposed redevelopment to be EIA development under The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (the EIA Regulations) transposing EC Directive 2011/92/EU as amended by Directive 2014/52/EU, and as such an Environmental Impact Assessment must be carried out.

1.14 Upon submission of an EIA Scoping Report in July 2018 by Scrabster Harbour Trust (SHT) accompanying a request for a Scoping Opinion, a subsequent EIA Scoping Opinion was received from MSLOT in September 2018. That scoping opinion was adopted by the Scottish Ministers, under regulation 14 of the EIA Regulations and forms the basis of this EIA Report (EIAR). Certain environmental topics were scoped out as part of this formal scoping process (refer Table 1.2 and subsection on Scoping).

1.15 The EIAR details the findings of this EIA process and highlights the anticipated significant environmental issues identified for both the construction and operational phases of the proposed development.

1.16 The EIAR comprises a description of:

- the proposed redevelopment of St Ola Pier;
- the reasonable alternatives studied by the applicant; and
- relevant aspects of the environment and likely significant effects of the proposed redevelopment on the environment, as required by the EIA Regulations and in particular Schedule 4 thereto.

1.4 Scoping

1.17 As noted above, an EIA Scoping Opinion was issued from MSLOT in September 2018. That Scoping Opinion is contained in EIAR Volume II, Appendix 1.1. The Scottish Ministers consulted on the scoping report and the responses received were taken into account in adopting the Scoping Opinion. Table 1.1 summarises the Scoping Opinion and summarises the Scottish Ministers' advice on whether topics were to be scoped in or out.

Table 1.1: Environmental Topics and the Scoping Opinion (scoped in or out)

Topic	Reason for Scoping in / out
Coastal Processes	Scoped OUT. Issues relating to water quality should be included in the water quality chapter.
Flood Risk	Scoped OUT. SEPA have confirmed that a flood risk assessment is not required.
Marine Biodiversity (including Fisheries, Marine Mammals and Benthic Ecology)	Scoped IN. Multiple potential impact pathways on this receptor from the construction phase of the works, in particular underwater noise.
Water Quality	Scoped IN. Potential impacts from dredging works on water quality. Works are in the vicinity of Thurso designated bathing waters.
Terrestrial Biodiversity (including Ornithology and Otters)	Scoped IN. Proximity of North Caithness Cliffs SPA which could be impacted by noise, light and pollution from the construction works. Potential for otters to use the shoreline and harbour area.
Transportation	Scoped IN. Request by Transport Scotland for a transport statement to assess the potential impacts associated with increased traffic from the development. Also the need to assess the impact of increased vessel traffic.
Air Quality and Climate	Scoped IN. Requirement for an air quality assessment and mitigation plans to address emissions from plant and vehicles and dust levels.

Noise and Vibration	Scoped IN. Requirement to assess the need for mitigation of impact of noise from plant/equipment, vessels and road traffic both in-air and underwater.
Waste Management	Scoped OUT. Site Waste Management Plan to be included in Construction Environment Management Plan and disposal of dredge arisings to be discussed in Best Practicable Environmental Option document.
Soils, Geology and Contamination	Scoped IN. Ground investigation works to inform potential re-use of dredge arisings. Pre-dredge sample analysis required to determine contaminant levels.
Cultural Heritage	Scoped OUT. Sufficient assessment provided in scoping report and no concerns raised by Historic Environment Scotland.
Landscape and Visual	Scoped OUT. No issues raised by consultees and sufficient assessment provided by applicant in scoping report.
Population, Human Health and Socioeconomics	Scoped OUT. Population and human health issues to be covered within specialist chapters elsewhere in the EIA report.
Major Disasters and Accidents	Scoped OUT. Impact on receptors to be addressed in specialist chapters elsewhere in the EIA report.
Material Assets	Scoped OUT. Potentially significant effects on material assets are to be covered elsewhere in the EIA report.
Cumulative Impacts	Scoped OUT. Cumulative impacts to be assessed for each receptor in the specialist chapters of the EIA report.
Navigation	Scoped IN. Review of existing Safety Management System required to take account of effects of the development on vessel traffic as required by the MCA.

1.18 The Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013, prescribe the marine licensable activities that are subject to pre-application consultation and, in combination with the Marine (Scotland) Act 2010, set out the nature of the pre-application process. The legislation came into force on 1st January 2014 and applies to all relevant marine licence applications submitted to Marine Scotland's Licensing Operations Team (MSLOT) on or after 6 April 2014. The redevelopment project exceeds the trigger for public consultation as outlined within the aforementioned Regulations (i.e. extension or improvement or any works which exceed 1000 square meters) and therefore a formal pre-application consultation was considered necessary in advance of the submission of the marine licence application.

1.19 A pre-application programme was undertaken in line with the aforementioned requirements including pre-notification to statutory consultees, public notice of and undertaking of a pre-application consultation event. The details of the pre-application process are included within the Pre-Application Consultation (PAC) Report, included in EIAR Volume II, Appendix 1.3. The report has also been submitted in support of the marine licence application.

1.5 Structure of the EIAR

1.20 Informed by the Scoping Opinion, the objective of the EIAR is to present the environmental information that has emerged from the EIA scoping process in a concise, comprehensive and objective manner so that it can be effectively communicated to competent authorities, interested parties and the public. The EIAR for the proposed redevelopment has been prepared following consultation with statutory bodies, non-statutory bodies and stakeholders, desk studies and site surveys, as well as a collation of baseline data on the existing environment and an environmental assessment of the impact of the proposed redevelopment.

1.21 Information contained in the EIAR is presented in the following way:

- Non-Technical Summary
- Volume I Main Report (See Table 1.2)
- Volume II Technical Appendices
- Volume III Design Drawings and Figures not included in Volume I

1.22 Volume I of the EIAR contains the following chapters:

Table 1.2: Structure of Volume I of the EIAR

Chapter	Topic
1	Introduction
2	Project Description
3	Alternatives
4	Waste
5	Traffic and Transportation
6	Air Quality and Climate
7	Noise and Vibration
8	Geology, Hydrogeology and Contamination
9	Coastal Processes
10	Water Quality
11	Marine Biodiversity
12	Terrestrial Biodiversity and Ornithology
13	Interactions

1.23 This structure facilitates incorporation into the EIAR those environmental topics both highlighted by and scoped in by the Scottish Ministers' Scoping Opinion, and as specified in the EIA Regulations and allows those topics to be comprehensively assessed, as summarised in Table 1.3.

Table 1.3: Where Topics specified in the EIA Regulations and considered in the EIA Scoping Opinion are addressed in the EIAR

Environmental Topic Scoped In	EIAR Reference
Marine Biodiversity (including Fisheries, Marine Mammals and Benthic Ecology)	Chapter 11 Marine Biodiversity
Water Quality	Chapter 9 Coastal Processes Chapter 10 Water Quality Chapter 11 Marine Biodiversity Chapter 12 Terrestrial Biodiversity and Ornithology
Terrestrial Biodiversity (including Ornithology and Otters)	Chapter 12 Terrestrial Biodiversity and Ornithology
Transportation	Chapter 5 Trafic and Transportation
Air Quality and Climate	Chapter 6 Air Quality and Climate
Noise and Vibration	Chapter 7 Noise and Vibration Chapter 11 Marine Biodiversity
Soils, Geology and Contamination	Chapter 4 Waste (Outline Site Waste Management Plan - Appendix 4.2, Volume II) Chapter 8 Geology, Hydrogeology and Contamination Chapter 10 Water Quality
Navigation	Chapter 2 Project Description (Navigation Risk Assessment - Appendix 2.3, Volume II)

1.6 EIA Methodology

1.24 The methodology for undertaking the EIA process provides for a staged approach, which can be summarised as follows:

- Scoping / consultation exercise: to compile relevant background data and identify issues and constraints;
- Baseline surveys - including walk-over visits, detailed specialist surveys and discussions with relevant statutory and other consultees to determine the nature and extent of the existing environment;
- Identification of potential significant effects - predicting the likely significant environmental effects (direct, indirect, secondary and cumulative) of the proposed development during construction and operational phases as well as setting the scene for identifying appropriate mitigation for the development during construction and operational phases;
- Interactions of the foregoing and cumulative effects - predicting the likely significant effects of various environmental aspects in tandem from the proposed development and from the proposed development in tandem with other approved developments in the study area;
- Mitigation and Monitoring - description of mitigation proposals including those which have been incorporated into the project design as it evolves, including regular review and evaluation, to mitigate the identified significant environmental effects; where necessary, monitoring will be

required during construction and operational phases to demonstrate effectiveness of mitigation measures included in the EIAR.

- Residual effects - consideration of the residual effects remaining after mitigation;
- Reporting - preparation of the EIAR, including a Non-Technical Summary (NTS).

Assessment of Environmental Effects

1.25 The assessment of whether the proposed development is likely to have a significant impact on the environment has been undertaken through a variety of methods:

- Professional judgment and experience based on published guidance criteria;
- Assessment of both temporary and permanent effects (direct, indirect, secondary and residual);
- Assessment of interaction and cumulative effects;
- Assessment of duration and reversibility of these effects;
- Assessment against local, regional and national planning policy;
- Consultation with statutory and non-statutory consultees.

1.26 Table 1.4 provides a standardised method of defining sensitivity or value of a receptor. Table 1.5 provides a standardised method of defining a magnitude of effect. Significance of effect is determined in each specialist assessment chapter by correlating the magnitude of the impact to the sensitivity of the receptor or resource. Both sensitivity/value and magnitude must be taken into account in determining the significance of effect (Table 1.6)

Table 1.4: Definition of Sensitivity or Value

Sensitivity	Typical Descriptors
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

Table 1.5: Definition of Magnitude

Sensitivity	Typical Descriptors
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse).
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Table 1.6: Assessment Matrix

Sensitivity	Magnitude of Impact				
	No Change	**Negligible**	**Low**	**Medium**	**High**
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
Very High	No change	Minor	Moderate or Major	Major or Substantial	Substantial

1.27 In instances where assessments do not adhere to the significance criteria stated above, this is due to specific tailored approaches to assessment of significance that are required by professional institutions of which the assessors are members and/or approaches that have been refined and agreed through previous experience.

1.28 In all instances, assessments contained in this EIAR follow a structured layout and contain an assessment of significance that is clearly set out and rationalised in each topic chapter.

1.29 Each topic chapter provides an explanation of any assumptions and limitations that have been recognised in the preparation of the EIAR and identifies the predicted effects on identified receptors with regard to that specific environmental consideration.

1.7 Cumulative Effects

1.30 This EIAR considers and assesses the potential for cumulative effects arising from the redevelopment of St Ola Pier in association with other developments.

1.31 The cumulative effects of a development refer to the way in which an environmental resource may be subject to a particular type of impact from more than one proposed development. The impacts from multiple projects may overlap or act in combination at a particular location or upon a particular resource, thereby leading to more significant environmental impacts than if the impacts were considered in isolation.

1.32 The EIA Directive 2014/52/EU specifies at Annex III that "the likely significant effects of projects on the environment must be considered […] taking into account [*inter alia*] the cumulation of the impact with the impact of other existing and/or approved projects"; and at Annex IV that "a description of the likely significant effects of the project on the environment resulting from, inter alia […] the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources" is required.

1.33 This obligation is mirrored in Schedule 4 to The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

1.34 Cumulative effects are assessed in each chapter in respect of impacts resulting from the accumulation of impacts generated by the proposed redevelopment on the same receptors and the impacts potentially arising from adjacent or nearby developments together with those predicted for the proposed redevelopment. A list of projects considered for their potential to generate significant cumulative effects is contained at EIAR Volume II, Appendix 1.2.

1.35 The following guidelines and publications were considered when determining the other projects to be considered for their potential to generate cumulative effects with the proposed redevelopment:

- Scottish Natural Heritage Environmental Impact Assessment Handbook (v5) (2018)
- Scottish Government Planning Circular 1/2017: Environmental Impact Assessment Regulations (2017)
- The Planning Inspectorate Advice Note 17: Cumulative Effects Assessment (2015)
- European Commission (EC) Guidelines for the Assessment of Indirect and Cumulative Impacts (1999)

1.36 The first step in determining cumulative effects comprised the identification of a list of other projects which may have the potential to overlap with the proposed redevelopment based on available information.

1.37 The scope of the other projects that have been considered as part of this cumulative assessment have been identified through a desk study involving general internet searches and in particular, scrutiny of consenting authority websites. The projects were either registered on the Highland

Council planning website or MSLOT website, or are other developments that SHT have proposed. Other projects for which a development consent application has been submitted or consent granted were included. Potential future projects which have not submitted an application for consent were not included.

1.38 Those other projects whose impacts could foreseeably overlap with the construction or operation of the proposed redevelopment or where construction impacts may be consecutive but cumulative, were considered. The cut-off date for sourcing information on the other projects considered was 12 April 2019.

1.8 Professional Team and Quality Management

1.39 The EIA Regulations require that the EIAR must be prepared by competent experts in order to ensure completeness and quality of the EIA Report. All experts employed by SHT to prepare the individual assessments have the appropriate qualifications and level of experience with their given field to undertake the relevant surveys and assessments.

1.40 A summary of the competent experts that have been involved in the preparation of this EIAR are included in Appendix 1.3.

1.41 This EIAR has been completed using the quality controls and procedures within the RPS Quality Management System to British Standard ISO 9001 and has ensured that all surveyors, assessors, co-ordinators and reviewers associated with the preparation of this EIAR have the appropriate qualifications and experience.

1.42 The EIAR has been subject to rigorous internal RPS peer review to ensure compliance with EIA Regulations.

2 PROJECT DESCRIPTION

2.1 Location of the Proposed Redevelopment

2.1 Scrabster is located on the north coast of Caithness and has a grid reference centre point of ND10437 70310. Scrabster is situated 1.5 miles northwest of Thurso, the largest town in Caithness, provides a ferry link to Orkney and is ideally located for access to the North Sea and Atlantic Ocean.

2.2 Scrabster Harbour falls within the boundary of the Highland Council. The location and layout of the Harbour are shown in Figures 2.1 and 2.2 respectively.

Figure 2.1: Location of Scrabster Harbour

2.3 St. Ola Pier is located at the centre of a busy operational harbour. It was constructed in 1972 and incorporates a 100m long berth face to the southwest, a linkspan and a further 115m berth which was used by the Orkney Ferry prior to the Queen Elizabeth Pier being constructed in 2003.

2.4 The inner pier is constructed with sheet pile walls, singly or doubly tied. The area of the pier either side of the ro-ro ramp is formed of a reinforced concrete open deck suspended on an arrangement of universal bearing piles (UBPs) and tubular piles. There is a sheet piled buttress and dolphin structure located at the vessel end of the ro-ro ramp. The outer pier is constructed using continuous sheet-pile walls along both sides, tied across the pier at a low level, but is

hollow from a level of approximately +4mCD to the underside of a suspended deck slab. The deck slab bears on a series of tubular piles as well as onto the sheet pile wall head around its perimeter. Raking piles and anchors are also present within this outer end of the structure providing lateral restraint. The end of the pier is semi-circular and formed of straight-web sheets.

2.5 The northeast side of St. Ola Pier currently has no berthage because of a 1.5m sea protection wall. Due to the age of pier it is in need of upgrade. The proposed redevelopment aims to ensure the ongoing structural integrity of the pier while also providing additional berthage for use, particularly by oil and gas supply vessels and cruise ships.

Figure 2.2: Scrabster Harbour Layout

2.2 Description of the Proposed Redevelopment

2.6 This chapter should be read in conjunction with the accompanying marine licence application(s) and design drawings:

- IBM0727-RPS-00-XX-DR-C-0150 Location of Works
- M0727-RPS-00-ID-DR-C-2000 Illustrative General Arrangement

- M0727-RPS-00-ID-DR-C-2001 Illustrative Sections
- M0727-RPS-00-ID-DR-C-2002 Illustrative Quay Furniture
- M0727-RPS-00-XX-DR-C-0100 Marine Licence Harbour Limits
- M0727-RPS-00-XX-DR-C-0151 Location of Dredging Works
- M0727-RPS-00-XX-DR-C-0152 Transportation Plan

2.7 The proposed project is a redevelopment of the existing St. Ola Pier (see Figure 2.2) which has fallen into declining use due to ongoing corrosion of steel piling and lack of load bearing capacity for imposed deck loads.

2.8 The opportunity afforded by redevelopment is being used to provide an enhanced straight berthing face on the inner side for service and cargo vessels with a new berth on the outside face; particularly for cruise vessels of up to 250m long.

2.9 The pier will be widened locally to accommodate straight berthing faces with resulting parallel berthing faces at approximately 32m apart.

2.10 Partial demolition of the existing pier will be required to allow for the construction of the new pier walls and decking. Pier quay walls will likely comprise steel tubular piles with interlocking steel sheet piles. It is proposed that any concrete broken out as part of the demolition works will be crushed to allow for reuse within the works, as engineering fill (subject to meeting performance criteria).

2.11 The renovated pier will be circa. 280m long and fully enclosed around the perimeter. An enclosed structure will allow for beneficial reuse of both dredge spoil and crushed recycled concrete if suitable. There will be a concrete deck with drainage captured through full retention interceptors as well as a number of centrally positioned lighting masts capable of providing 50 lux.

2.12 The outer face will be dredged to provide a depth of -9m CD to accommodate cruise vessels and the inner face will be dredged to provide a consistent berth depth of -7.5m CD.

2.13 The works may also include for reclamation and revetment of 0.84ha (plan area of both) at the root of the pier. The reclamation area will provide storage space for cargo handling, and may house a number of fuel tank(s) in the future which will allow for the refuelling of vessels on St. Ola Pier. The reclaimed area would reuse the rock armour from the existing revetment on the newly reclaimed seaward face with a small additional requirement for extra rock armouring.

2.14 The volume of dredge material generated by the works is approximately 172,000m^3 of sandy gravel and clay. It is proposed that dredge material will be re-used within the reclaimed area and within the redeveloped pier structure (if deemed suitable by the works contractor). Alternatively dredge spoil may be disposed at a sea disposal site indicated in Best Practicable Environmental Option (BPEO) Report, Appendix 2.1, Volume II; or disposed at a licenced waste facility on land and off-site; or a combination of these solutions (subject to Contractor's chosen methodology). For the purposes of environmental assessment of the marine environment, it is assumed that the total volume of dredged material generated by these works

(172,000m^3) shall be disposed at sea in the Scrabster dump site. For the purposes of traffic assessment, an additional scenario has been assumed whereby all of the dredged material is transported off site by road during the construction period.

2.15 Notwithstanding the above assumptions for the purposes of environmental assessment, the Design & Build tender will include a requirement that the detailed design will accommodate as much reuse of dredged material into the reclamation areas and into the body of the pier as is economically feasible.

2.16 A water and fuel supply will be provided on the St. Ola Pier. The fuel pipe will either be routed from the existing supply on the Jubilee Pier, or from a new tank(s) proposed for the reclamation area.

2.17 If the fuel supply is routed from Jubilee Pier, both water and fuel lines will be routed in a trench either along the seabed within the inner berth directly on to the St. Ola Pier, or on to the seabed to the root of the opposite Ice Pier and behind the existing ferry terminal building on to St. Ola Pier on land.

2.18 If the fuel supply is proposed from the new tank(s), the fuel line will be routed across land onto St. Ola Pier. In the case that the fuel supply is coming from the new tank(s), the water supply will be taken from an existing supply on the Queen Elizabeth Pier. The water line will also be routed across land onto St. Ola Pier. For EIA purposes both of the fuel supply route options outlined have been assess in the appropriate EIAR chapters.

2.19 In the case that the new fuel tank(s) option was pursued, the scope of SHT's works will be restricted to ensuring the reclamation area can accommodate the tank(s), and installing the necessary pipework and associated infrastructure to allow the import/export of fuel on the redeveloped quay. The actual tank(s) would be erected and operated by a third party at a later date. The tank(s) would be for the storage and supply of marine gas oil only. The fuel tank(s) will be 15m in diameter, 15m high with associated pipework. The tank(s) will be suitably bunded. The tank(s) will service vessels operating on the redeveloped St Ola Pier. A full retention oil separator will be installed to mitigate for potential impacts of fuel/ oil spillage or leakage and this will be maintained in accordance with the manufacturer's instructions by experienced personnel. Any potential spillages will be deal with in accordance with the Scarbster Harbour Trust Oil Spill Contingency Plan which is inluded in Appendix 2.3, Volume II.

2.20 All services will be buried within the pier and located within a covered trench which will allow for maintenance and access.

2.21 3 nr export (bunkering) points are proposed on each berth, with 1 nr fuel import point on each berth.

2.22 The works will require service connections to allow for power and water to service the redeveloped key. A minimum 400V shore power supply will be provided from the existing transformer located behind St. Ola Pier on the shoreside. A number of high mast lights will be provided to ensure adequate working light for all activities.

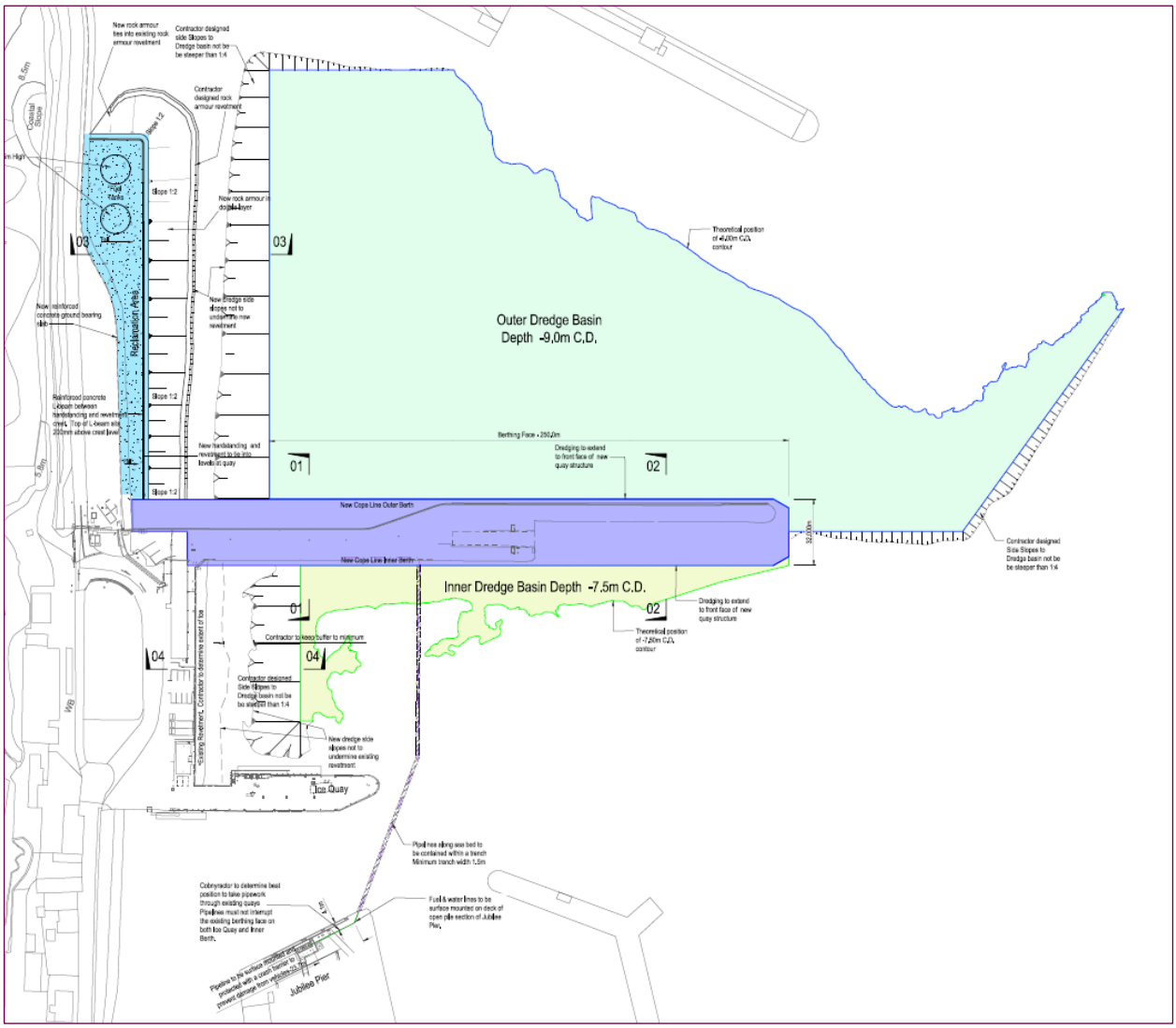


Figure 2.3: General Arrangement of Proposed Works

2.3 Elements of the Works

2.3.1 Demolition and Site Clearance

2.23 An element of demolition will be required to allow for the construction of new elements of the works. As it is proposed that the existing structure will be encapsulated within the new pier extents, the existing piling will be retained. However, the existing concrete decking and capping beams will be removed/broken out to accommodate the proposed works.

2.24 The existing concrete deck and concrete capping beam will be broken out to allow for installation of the new tie rod system and will allow for infilling of the new structure and construction of new concrete decking and capping beams.

2.25 As the existing structure varies in construction, the extent of demolition required will vary along the length of the existing pier.

2.26 Additionally, the existing pier layout varies in width and extents and as such the volume of infilling required will vary along the length of structure. The plan extents of the new structure outside of the existing pier can be seen in Figure 2.3.

2.27 A typical section through the existing outer berthing jetty has been included in Figure 2.4 showing the extents of the new structure encompassing the existing construction.

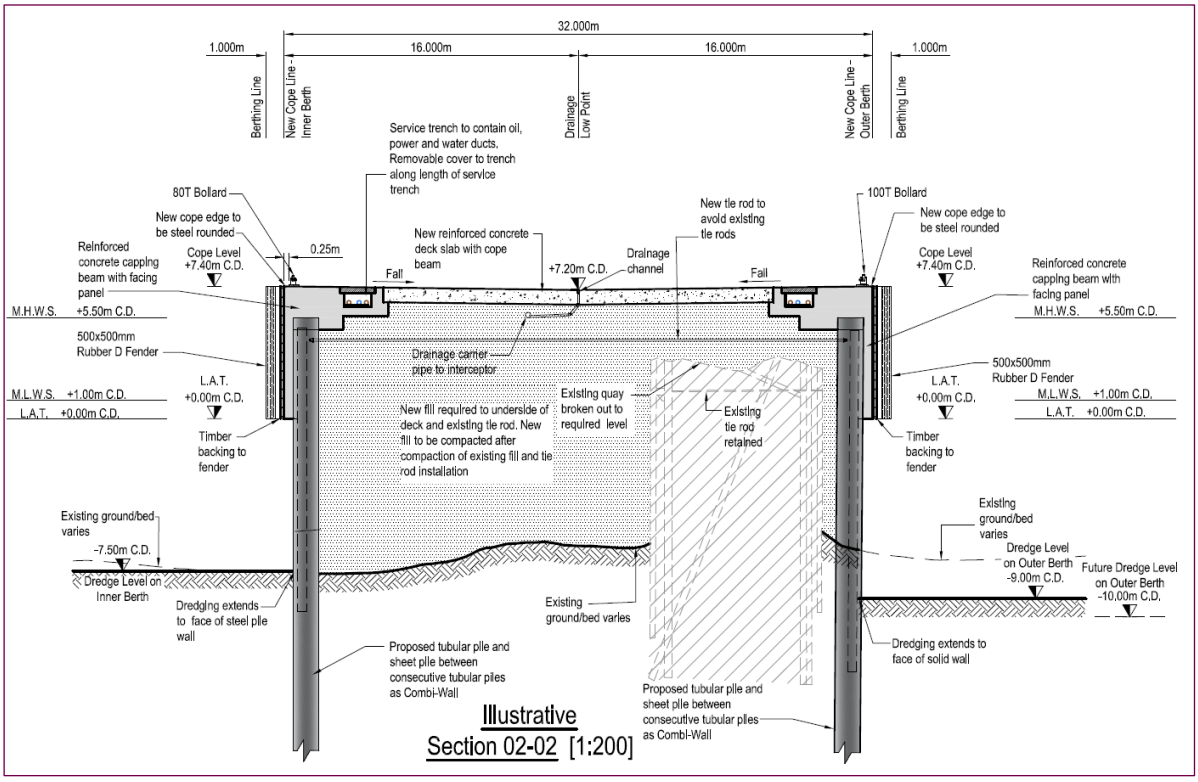


Figure 2.4: Typical Section Through Outer Structure Showing Existing Structure Encased by New Structure

2.28 Where appropriate, the material generated from the breaking out of the existing deck and capping beam will be screened and re-used onsite, within the pier structure, proposed reclamation or revetment.

2.29 All other material will be disposed offsite in accordance with all relevant statutory requirements and regulations. Demolition of the concrete structures will be carried out by means of excavator mounted rock breaker, concrete sawing, or a combination of these methods.

2.3.2 Pier Walls

2.30 A closed wall pier structure has been specified for the reconstructed pier. It is likely that this will comprise steel combi-wall piling (tubular steel piles with intermittent interlocking steel piles). If steel piles are proposed it is likely they will be impact driven, and given the anticipated conditions on site (presence of significant layers of boulder clay) some pre-augering may be completed to aid in pile installation.

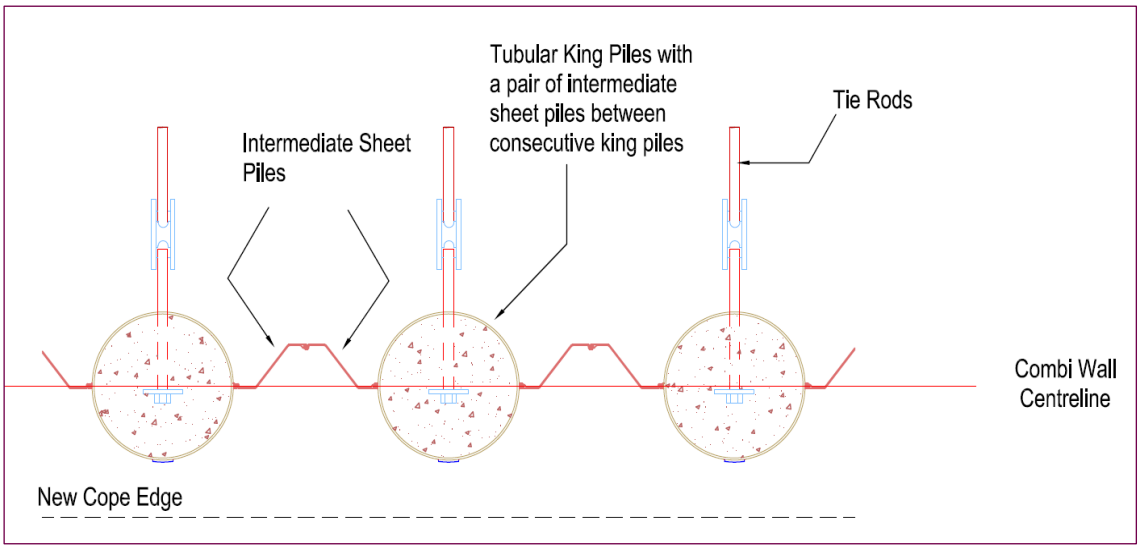


Figure 2.5: Typical Combi-Wall Arrangement

2.31 However, it is possible that the Contractor may choose to construct the redeveloped pier using some form of concrete pile solution. The new quay facing will encase the existing structure as shown on Figure 2.5.

2.32 It is anticipated that a degree of the piling works will be completed from the existing pier, with the structure being used as temporary platform for the works. Where it is not possible to work from the existing pier, it is likely that the contractor will employ a jack-up barge to complete marine piling. A typical jack-up barge completing pile installation can be seen in Figure 2.6. The ferry will continue to operate throughout the construction period and all marine piling and jack-up barge movements will be cognisant of this.

2.33 The jack-up barge will likely be tug assisted.

Figure 2.6: Typical Jack-Up Barge Completing Marine Piling

2.34 The pier walls will be required to incorporate a concrete capping beam to spread horizontal loading along the length of each berthing face. It is likely that a tie rod solution will be employed by the Contractor to provide lateral restraint to the new structure. The existing tie rods will likely be left in place to maintain the stability of the existing structure during construction, particularly as the existing structure will likely be used as temporary works. Any new tie rods will likely be placed above the position of the existing ties.

2.3.3 Concrete Pier Decking

2.35 A reinforced concrete deck will be provided to support the general deck loading and heavy lift area.

2.36 Compaction of the existing fill within the structure will be required prior to placement of any new fill and of the concrete decking to avoid excessive settlement and cracking. Compaction of the fill will likely be completed by means of a compaction roller.

2.3.4 Dredging

2.37 The outer face will be dredged to a depth of -9m CD to accommodate cruise vessels and the inner side will be dredged to provide a consistent berth depth of -7.5m CD. Dredge spoil will be reused within the reclamation or within the new pier structure if suitable. Material which is not suitable for reuse within the works will be disposed of at the sea disposal site outlined in Appendix 2.1, Volume II, or disposed at a licenced waste facility on land and off-site; or a combination of these solutions.

2.38 In line with Marine Scotland Licencing Operations, dredged material must be analysed in order to assess suitability for disposal at sea. A detailed description of the sediment analysis of the

dredge material has been provided in Chapter 10 Water Quality (Section 10.21), Volume II. Marine Scotland require submission of a BEPO report which assesses and identifies the most suitable method of disposal. The BEPO report has been prepared and is included in Appendix 2.1, Volume II.

2.39 The dredging will likely be completed by a backhoe dredger (Figure 2.7) given that a degree of the spoil is proposed to be repurposed within the works. If the material is not suitable for reuse in the works it is possible that the dredging will be completed by Trailing Suction Hopper Dredger (Figure 2.8). For the purpose of the EIAR, to be conservative, it has been assumed that the dredging will be undertaken over the shortest time possible using a 4000m^3 Trailer Suction Hopper Dredger (see EIAR Chapter 9 Coastal Processes, Volume II, for more details).

2.40 Split hopper barges will likely be used for the disposal of dredge material at the dumpsite, if this is the method of disposal proposed by the contractor.

Figure 2.7: Typical Backhoe Dredger

Figure 2.8: Typical Trailing Suction Hopper Dredger

2.3.5 Reclamation

2.41 A reclamation laydown area will be constructed at the base of the St. Ola Pier, which will be protected by a rock armour revetment. The area of new pavement formed on the reclamation area will be circa 4,000 m^2. The fill material used in the reclamation and revetment will consist of reused site won fill/dredge fill (if suitable) or imported fill, or a combination of both. Material is to be placed and compacted within the reclamation area, and a reinforced concrete pavement constructed up to finished level.

2.3.6 Revetment

2.42 A rock armour revetment is to be placed to the front of the reclamation area. The existing rock armour facing of the current revetment will be removed prior to reclamation construction and stored for reuse in the new revetment if suitable. The remainder of the rock armour required for the new revetment will be imported inert stone. It is possible that a geotextile membrane will be laid between the fill and rock armour material as part of the revetment construction.

2.43 It is anticipated that rock armour to the front of the revetment will be placed by land side machinery. The revetment will be constructed to the shore side of the reclamation area, with an anticipated slope of approx. 1:1.5.

2.44 Due to the anticipated size of the main armour, the material will likely be procured from overseas and transported to site by barge. It is anticipated that the rock armour will be landed on one of the existing piers, St. Ola, Jubilee or Ice Pier and then stored within the Contractors compound for use. Smaller underlayer armour or infill may be sourced locally and would likely be brought to site by road.

2.45 Foundations for barriers or fencing will be precast, lifted into position and placed behind the rock armour and backfilled.

2.3.7 Reclamation Surfacing

2.46 The reclaimed area will be surfaced using a heavy duty concrete pavement and tie in with the existing ground level on the ferry roadway. Transition slabs may be required at the interface of the reclaimed area and the existing road.

2.3.8 Storm Water Drainage

2.47 Storm water runoff on the pier will be collected by a central drainage channel, and likely a number of gullies on the seaward end discharging into the harbour waters through 2 nr. full retention separators.

2.48 Storm water runoff from the reclamation area will be collected by a drainage channel located toward the seaward face, this run off will be discharged into the harbour waters via a full retention separators.

2.49 Any existing outfalls located within the current revetment will be extended through the reclamation and new revetment to maintain functionality during construction, and after completion of the new reclamation and revetment.

2.3.9 M & E Services

Pier

2.50 Water supply will provided to the St. Ola Pier from the existing supply on Jubilee Pier or from the supply on Queen Elizabeth Pier. If routed from Jubilee Pier the supply will be either taken along the seabed on to the opposite Ice Quay and behind the existing ferry terminal building onto St. Ola Pier, or routed directly along the seabed from the Jubilee Pier on to the St. Ola Pier. If the water supply is coming from the QE Pier, the supply will be routed along land onto St. Ola Pier.

2.51 Quayside lighting shall be provided to the whole of the new pier area. Lighting of 50 lux (average) shall be provided on pier deck but shall be switchable to 10 lux when not in use. Lighting columns will be in the in the region of 30-35m in height from the pier deck, with approximately 5 nr. required along the length of the pier. The design of the lighting columns and their locations shall be such that the effect on storage areas and traffic movement is minimised with columns positioned along the centreline of the pier. The lighting intensity shall be designed to give acceptable lighting levels for the planned activities within each operational area of the new pier.

2.52 Lighting festoons shall be capable of being lowered to ground level for maintenance and cleaning. Energy efficient bulbs shall be installed in all lighting installations. The location of Navigation light(s) shall be agreed with the Harbour Master, and the Northern Lighthouse Board. The lighting will be designed to prevent direct glare into surrounding properties and illumination of the night sky.

2.53 A shore power supply of 50 Amp supply at 400V 3 phase will be provided from the existing transformer located to directly opposite the base of the pier on the landside. The power supply will be routed to a cabinet located at the approximate midpoint of the pier.

2.54 Fuel export (bunkering) and import facilities are proposed for the new pier. It is proposed that there will be 3 nr. bunkering points on each berth, and 1 nr import point on each berth. Power shall be required to each of these points.

Reclamation

2.55 3 nr. Water supply points will be provided on the reclamation area connecting to the existing supply from either the Jubilee Pier or QE Pier.

2.56 Lighting of 50 lux (average) shall be provided on the reclamation area, switchable to 10 lux when not in use. Lighting columns will be between 30-35m height from the reclamation ground level with approximately 5 nr. columns required on the reclamation. Lighting columns will be positioned toward the seaward end of the reclamation, whilst ensuring the required lighting levels are provided across the entire reclamation area.

2.57 3 nr. power supply points shall be required on the reclamation area to allow for future connections should they be required.

2.3.10 Fencing and Security

2.58 International Ship and Port Facility Security Code (ISPS) compliant security fencing and access gates will be provided at the base of the St. Ola Pier.

2.59 Double access gates will be provided to allow for two-way harbour traffic, including lorries, cranes, coach traffic and reach stackers. A personnel access gate will also be required at the pier entrance. A single security barrier will be provided at the base of the pier as well as a security cabin. The security cabin will be minimum 3.9m x 2.4m x 2.4m ht.

2.60 The existing fencing between the Queen Elizabeth Pier ferry roadway and the rest of the harbour shall be extended to ensure the security of the new reclamation area. A single leaf access gate and a personnel gate are proposed between the reclamation area and the St. Ola Pier.

2.61 CCTV cameras shall be provided at the shore side of the pier, the midpoint and pier end. All CCTV will connect in with the existing SHT security camera system.

2.4 Construction Activities

2.4.1 Construction Period

2.62 The construction period proposed is January 2020 – June 2021.

2.4.2 Working Hours

2.63 During the construction stage of the proposed works hours will be 08:00 to 19:00 Monday to Friday, and 08:00 to 13:30 Saturday. Working outside these hours may occasionally be necessary for operational or safety reasons, and will be subject to agreement with the Project Manager and SHT.

2.64 It is anticipated that dredging works will be undertaken on a 24 hour basis.

2.65 Ferry operations and other harbour activities will continue during the construction works.

2.4.3 Temporary Site Compound

2.66 An area will be allocated by SHT to accommodate the Contractor's compound for plant and materials within the existing Scrabster Harbour, the proposed area is shown in Figure 2.9. The site compound will be used for temporary storage of construction materials. The Contractor's compound will be secured by the Contractor.

2.67 It is proposed that the Contractor will be offered a portion of the existing ferry terminal building, likely being an office and toilet facilities. As such the Contractor will have no requirement to plumb in toilet facilities of his own at Scrabster Harbour. It is proposed that contractor parking will be provided adjacent to the existing ferry terminal building.

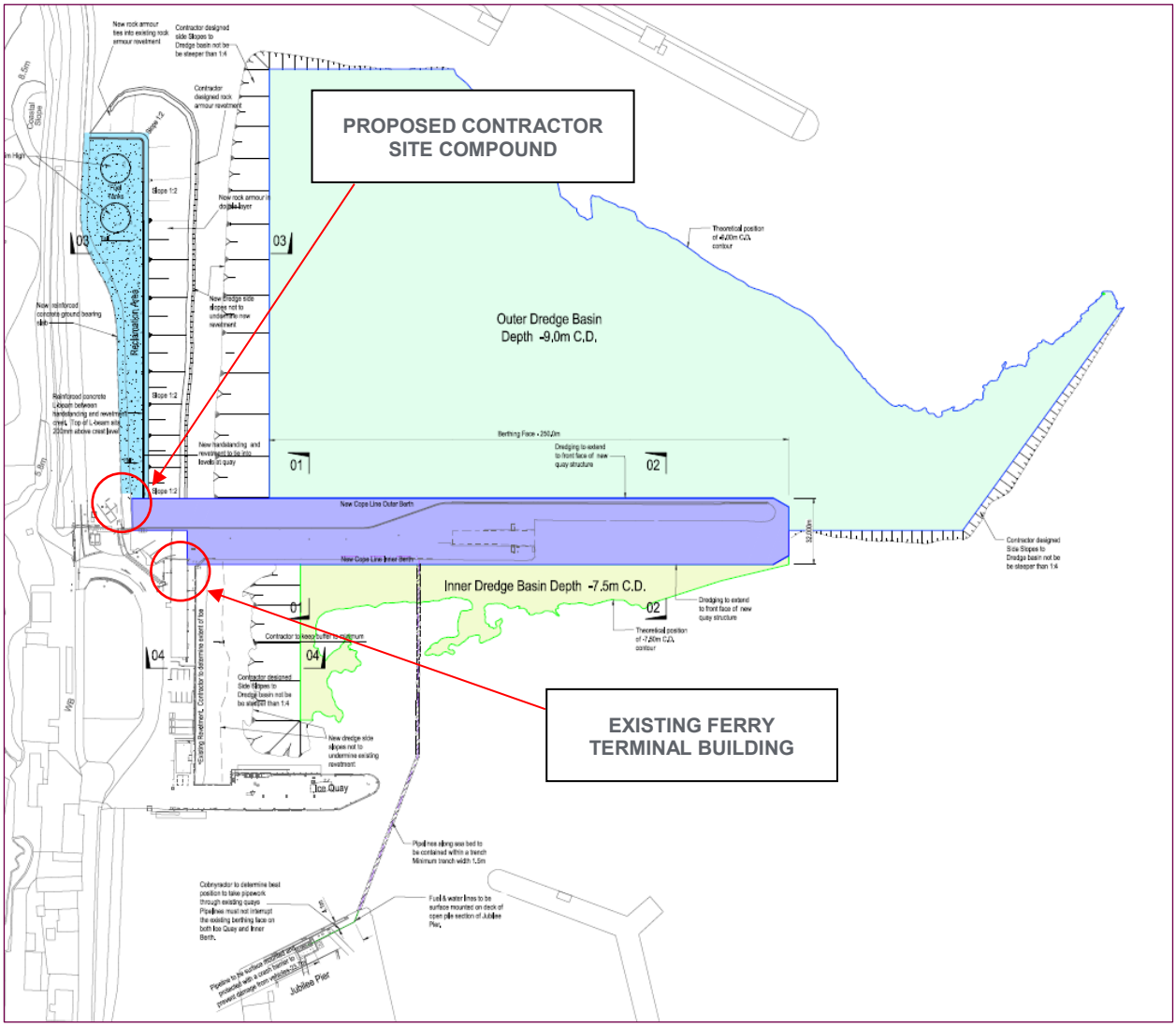


Figure 2.9: Proposed Contractor Site Compound

2.4.4 Site Access

2.68 It is envisaged that harbour activities will continue to operate throughout the works, including the Northlink Ferry from Scrabster to Orkney. This includes the RNLI and any other small craft which regularly use the harbour.

2.69 Access to the site will be via the A9 trunk road, the harbour is the terminal point of this road. Construction related traffic will likely to arrive from the Thurso direction, as it is the main commuter road from southern towns within Scotland. Suitable traffic management and other systems will be put in place by the Contractor as required to minimise disruption to existing activities within the harbour during the construction period.

2.70 Shipping and fishing vessels may be interrupted the construction work. It will be the responsibility of the Contractor to liaise with the Harbour Master to ensure disruption to harbour operations is kept to a minimum.

2.5 Construction and Environmental Management

2.5.1 Pollution Control

2.71 The construction works will involve Civil and Marine Engineering works and Mechanical and Electrical works.

2.72 All machinery used during the construction phase of the works will be required to be in good working order and free from oil and hydraulic fluid leakages. If machinery maintenance has to take place, it will be carried out at least 100m away from the sea. Fuel for machinery will be required to be stored in a secure and bunded area.

2.73 Certain elements of the works may be constructed using reinforced in-situ concrete. No losses of concrete (cement) to the sea will be permitted during this phase of the works.

2.74 The proposed dredging works will be undertaken in a manner which will minimize the suspended solids loading within the water column.

2.5.2 Site Safety

2.75 Safety will be of prime importance during the construction works. The works will be subject to the CDM Regulations 2015 and the Health and Safety at Work Act 1974.

2.76 All aspects of design and construction will be reviewed with regards to health and safety, risk assessments will be carried out. The Principal Designer will prepare Pre-Construction information for the project. The Principal Contractor will be appointed and required to produce a Construction Phase Plan for the project. The Principal Contractor will be responsible for planning, management; monitoring and coordination of health and safety in the construction phase the project.

2.5.3 Waste Disposal

2.77 Contractors working on site during the works will be responsible for the collection, control and disposal of all wastes generated by the works. An indication of the types of waste likely to be generated by the works and the most appropriate method of disposal are presented in Table 2.1 below.

Table 2.1: Waste generated by Construction Works

Activity	Waste Generated	Disposal/Treatment Recommendations
General Construction Waste	Demolition Waste, Reinforced Concrete	Off site if not possible to reuse within the reclamation area or pier works.
	Waste oils	Collected by waste recycling contractor
	Other waste	Collected in skips for disposal by licensed waste contractor.
General Office	Paper, packaging, canteen etc.	Collected in covered skips/large bins for disposal by a licensed waste contractor.
Dredging	Dredge Spoil	Disposal at sea dumpsite if not suitable for reuse within the reclamation area or pier works. Or taken offsite to landfill.

2.6 Operational Activities

2.78 Operational stage activities, in addition to the conventional cargoes already handled at St. Ola Pier, are anticipated to principally include the berthing of oil and gas vessels in addition to cruise vessels.

2.6.1 Berthing of Oil and Gas Vessels

2.79 Berthing of oil, gas and renewables supply vessels is anticipated, with associated refuelling and fresh water bunkering in addition to handling of related goods, materials and equipment. Fuel import will also be proposed on the pier with vessels bringing marine gas oil to the new tank(s) on the reclamation area. Refuelling of vessels will take place on the pier, with the supply coming from the tank(s) houses on the reclamation area. The proposed pier has 4 new export (refuelling) points, in addition to 2 new import points for marine gas oil. This type of berthing is typical of activity currently happening at Scrabster Harbour and it is not anticipated that there will be a significant change in the volume or nature of berthing.

2.6.2 Berthing of Cruise Vessels

2.80 With the newly increased dredge depth on the outer berth of the redeveloped pier the harbour will be capable of accommodating larger cruise vessels up to 250m. SHT are targeting up to 30 additional cruise ships per annum with the berthing of cruise vessels and associated tourist traffic visiting John O'Groats, the Castle of Mey and various whisky distilleries located in the highlands.

2.81 A Navigational Risk Assessment has been prepared by request of MSLOT, and is included as Appendix 2.3, Volume II.

2.82 Associated coaches and taxi parking, laydown and pick-up will be accommodated on the renovated pier itself and will not require additional parking facilities beyond the pier boundary. No road network upgrades are proposed as part of this project for transit of goods to service supply vessels or cruise vessels.

3 ALTERNATIVES

3.1 Alternative Sites

3.1 As the redevelopment of St. Ola Pier relates specifically to the refurbishment and redevelopment of the St. Ola Pier there are no alternative sites to be considered for the project. An alternative site located outside the harbour even if feasible would result in significantly greater environmental effects than refurbishing the existing St. Ola Pier as it would require the installation and operation of harbour infrastructure in a new location where none presently exists.

3.2 The proposed redevelopment is driven by the need to ensure the ongoing structural integrity of the existing pier. Whilst doing so the opportunity has been taken to provide additional berthage for use, particularly by oil and gas supply vessels and cruise ships.

3.3 Due to the advanced level of pile deterioration, restrictions have been applied to quayside activities on the inner pier. Whilst the outer pier is in significantly better condition, the pier as a whole cannot be utilised to its full potential without remedial works/refurbishment.

3.2 Alternative Construction Methods

3.4 During the outline proposal stage of the project a number of construction methods were considered for the redeveloped pier.

3.5 The following were considered for the pier redevelopment:

- A closed face pier solution
- An open piled pier solution
- A partially open pile/closed faced pier solution.

3.6 Consideration was given to the anticipated ground conditions on site, the existing structure, effects on harbour wave climate, and also the most favourable structural option from a berthing perspective.

3.7 It was anticipated that an open pile structure would be excessively costly to construct in comparison to a closed face structure. Additionally, an open piles structure would not allow for beneficial reuse of dredge spoil/crushed concrete within the structure.

3.8 On the basis of these considerations a closed face pier structure was selected as the preferred construction solution for the redeveloped pier.

3.3 Alternative Layouts

3.9 As part of the optioneering phase for the project a number of layouts were considered for the redeveloped pier. Whilst the most critical outcome of the project is to reinstate St. Ola Pier to a condition in which the pier can be fully utilised, SHT also wishes to enhance the existing facilities creating a multi-purpose redeveloped quay. These critical factors formed the scoring criteria for each layout option.

3.10 A number of layouts were considered, including a scenario in which the existing pier was repaired. The options considered have been presented below. Options were scored on the basis of the following criteria:

- Additional pier/storage area
- Sufficient cruise vessel berthage
- Future potential of inner & outer harbour
- Discrete quayside working area/dual working berths
- Navigational impact & marine safety
- Potential constraints on dredging and disposal/reclamation
- Impact of construction works
- Environmental factors & sustainability
- Estimated cost

3.3.1 'Option 0' - Basecase

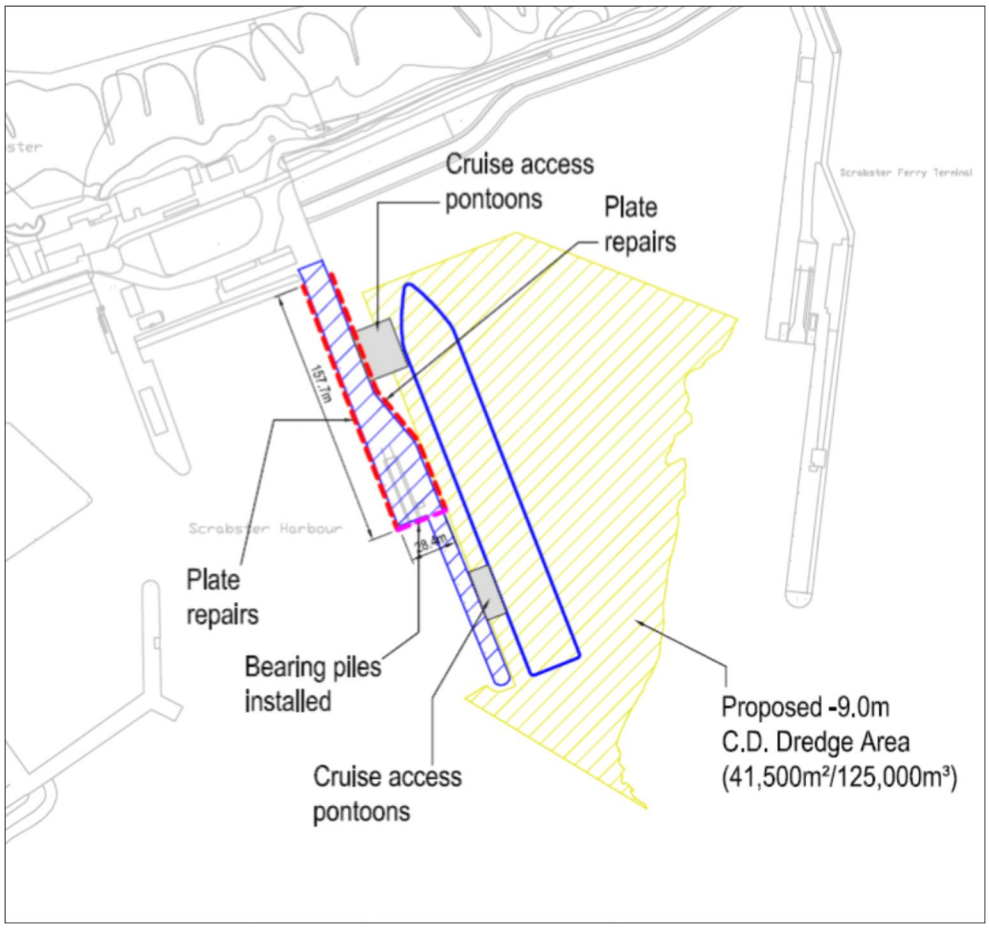


Figure 3.1: Option 0 Layout

3.11 In addition to four new pier layouts, a baseline 'Option 0' was appraised (Figure 3.1). Within the baseline option, a repair scenario was considered in which the highly corroded inner section of the existing structure was repaired using diver installed plates. In addition to plating repairs of the sheet piles, bearing piles and a new concrete deck were included within the inner section to allow for a comparable level of surcharge loading with the new options. As the outer berth is in relatively good condition it was considered 'as-is' for the purposes of the baseline option. In order to present a comparable level of functionality with other options, the existing structure was required to provide access pontoons to accommodate cruise facilities.

3.3.2 'Option 1' Layout

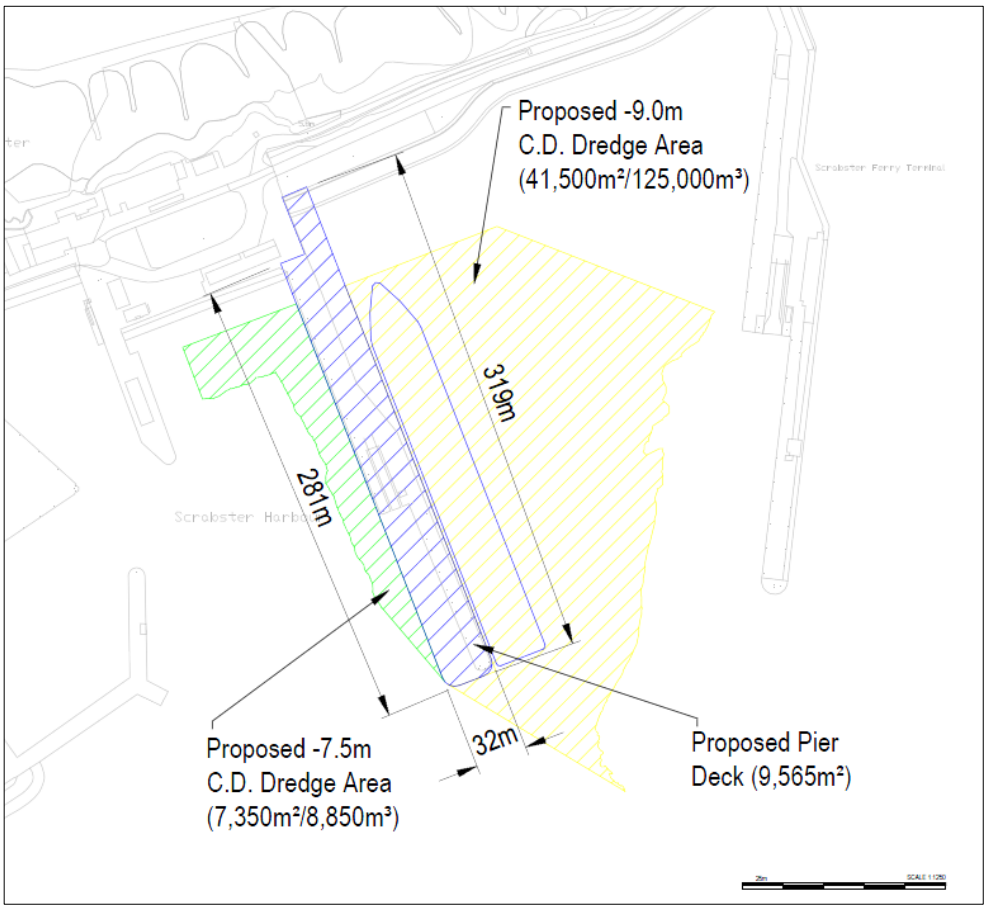


Figure 3.2: Option 1 Layout

3.12 Option 1 (refer Figure 3.2) provided a uniform pier, 32m wide encapsulating the existing structure within the new layout. Two parallel berthing faces will be provided in the inner and outer basins. The proposed deck area will provide 9,565m^2 of pier working area. This layout option provides two full length berthing faces.

3.3.3 'Option 2' Layout

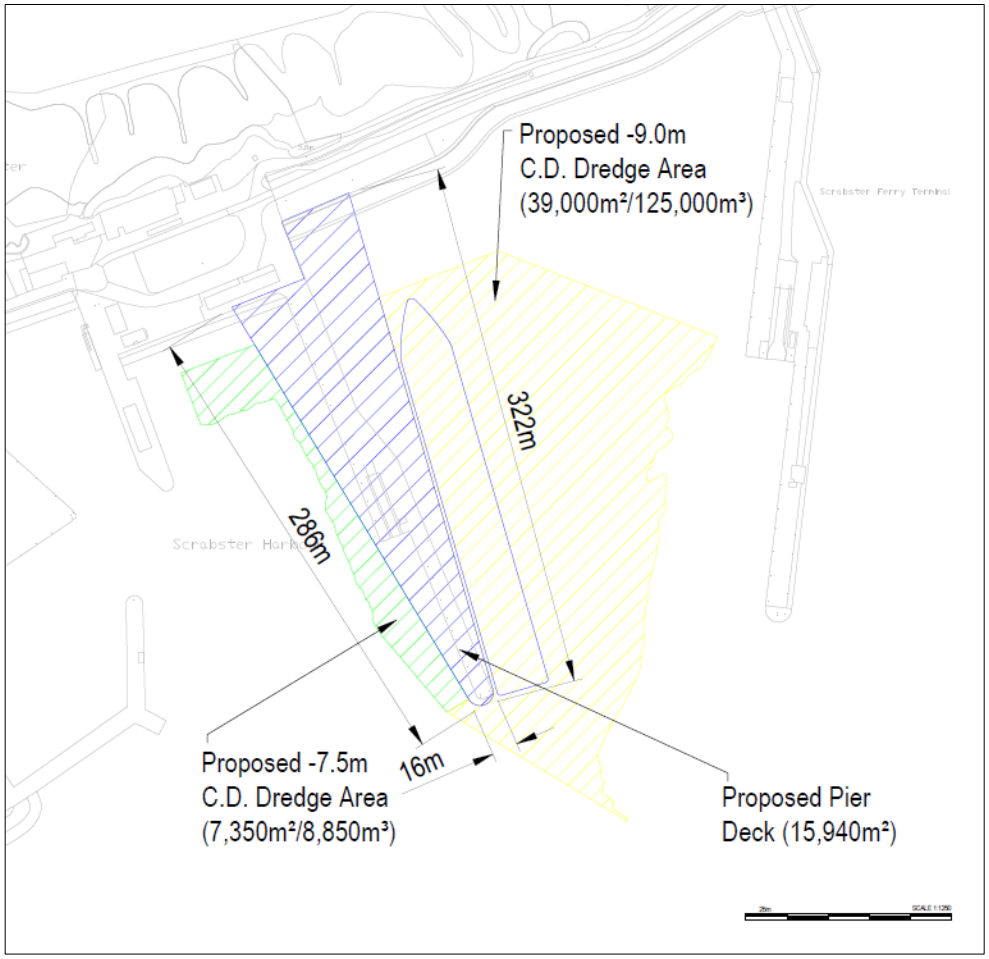


Figure 3.3: Option 2 Layout

3.13 Option 2 layout (refer Figure 3.3) encapsulates the existing layout with a tapering 'v' shaped pier. This layout provided a considerable increase in pier working area, with the new deck providing 15,940m^2 of deck space. The tapering layout serves to provide increased storage area toward the shore, whilst avoiding encroachment on the navigational width at the pier head.

3.3.4 'Option 3' Layout

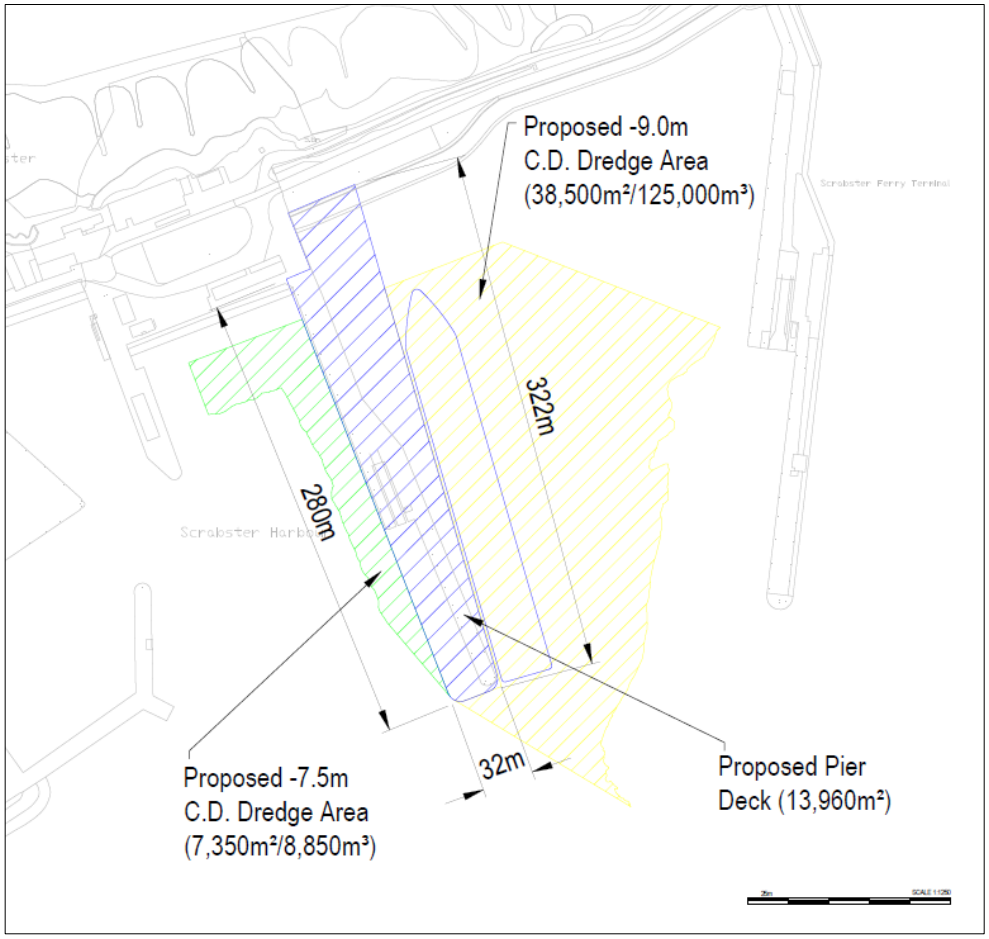


Figure 3.4: Option 3 Layout

3.14 Option 3 provided a parallel berthing face on the inner basin, and a diagonal outer berthing face allowing for increased width on the inner end of the pier. The proposed layout for Option 3 provided a deck area of 13,960m^2. Option 3, provided increased storage area on the inner end of the pier and avoided impacting the inner berth pocket.

3.3.5 'Option 4' Layout

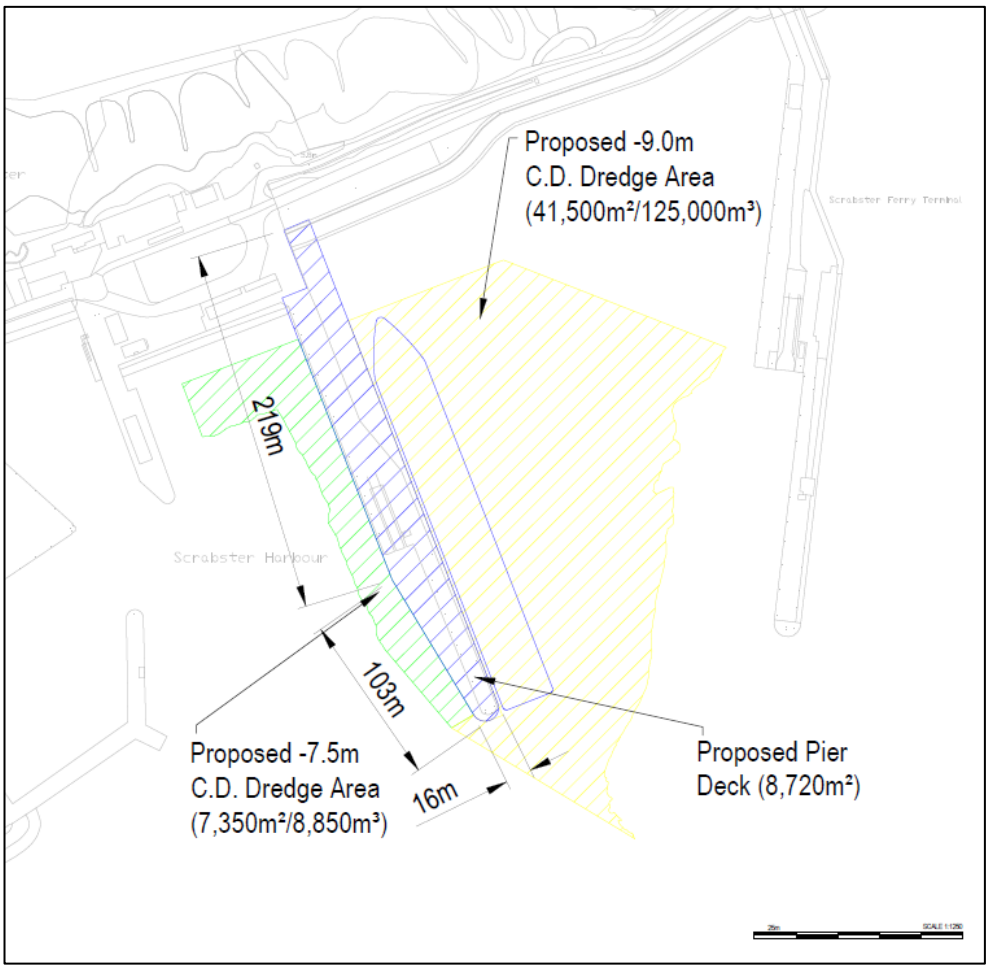


Figure 3.5: Option 4 Layout

3.15 Option 4 layout (refer Figure 3.5) encapsulates the existing layout with a straight berth on the outer face, and a kinked face on the inner berth. Given that SHT do not anticipate vessels larger than 150m within the inner basin this option was considered feasible. Option 4 avoided encroaching in the inner and outer basin, and also maintained the existing navigational width for both the inner and outer harbour. Option 4 presented the least deck space of all the options with 8,720m^2.

3.3.6 Outcome of Optioneering

3.16 On the basis of the scoring criteria Option 1 was selected as the chosen pier layout for the redevelopment. Option 1 provided the level of functionality required for the proposed operations of the redeveloped pier, whilst offering a cost effective solution which would allow for the repurposing of the dredge spoil within the structure. Option 1 also provided minimum impact on the existing harbour and it was anticipated that this layout would have little effect on the harbour wave climate.

3.4 Access & Storage Enhancement

3.17 In addition to the optioneering exercise completed for the pier, consideration was given to increasing the storage capacity within the harbour. The Harbour Master indicated that an increase

in general storage would be more useful than additional pier area as this could be used without impeding berthing & general pier operations. In order to provide an additional storage area, and potential access benefits two reclamation options were considered. The addition of a reclamation to the project would also provide further potential for beneficial reuse of both dredge spoil and crushed broken out concrete arising from the demolition works.

3.18 The area at the base of the St. Ola Pier extending toward the QE Pier was considered for land reclamation providing considerable storage area with minimum impact to existing operations. During workshop discussions SHT highlighted the value of greater harbour storage and access areas, particularly with a view to possibly relocating the ferry marshalling area which currently exists between the old Ice Pier and St. Ola.

3.19 Increased access to the QE Pier could be achieved through land reclamation running parallel to the ferry access road. The existing revetment could be removed and the existing revetment area reclaimed to allow for widening of the ferry access road. A sketch developed during the outline design stage for the reclamation areas initially considered can be seen in Figure 3.6.

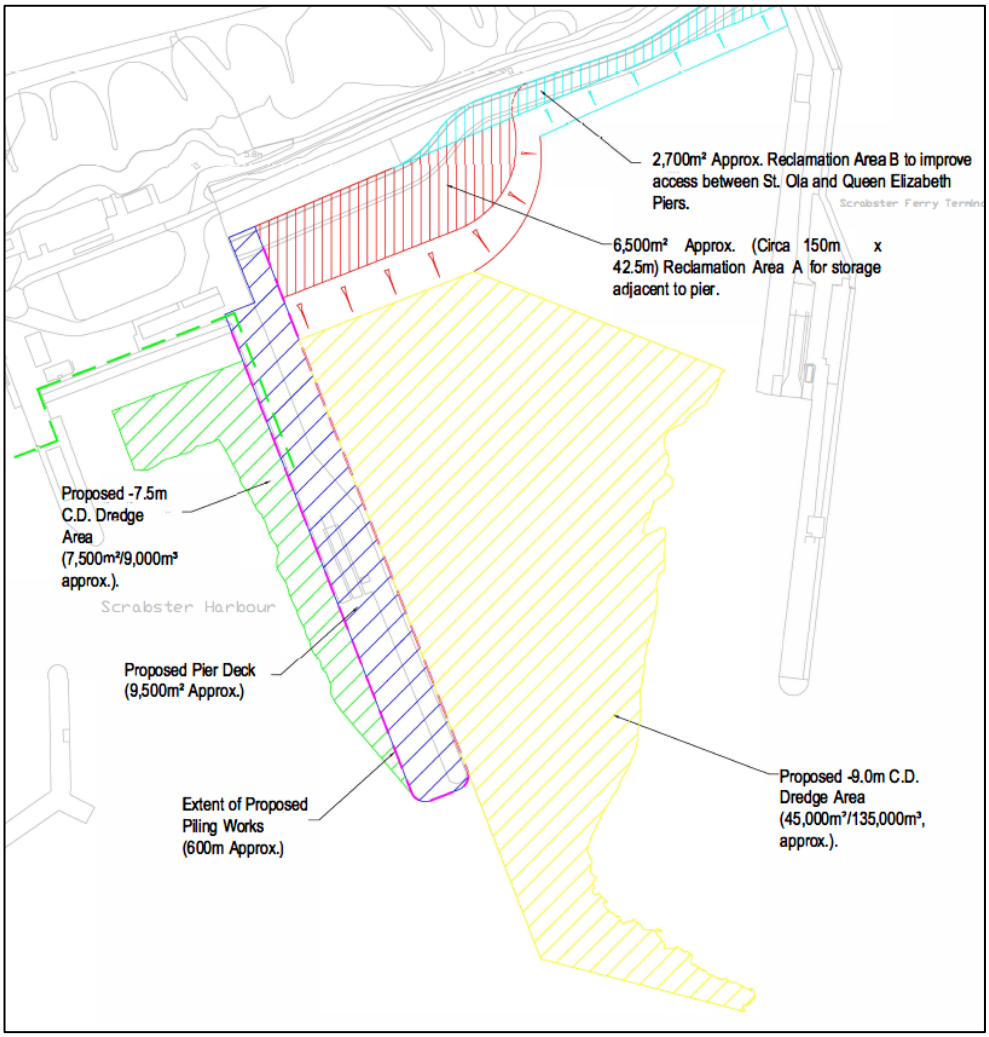


Figure 3.6: Land Reclamation Areas Considered at Outline Design Stage

3.20 A cost-benefit analysis of the proposed areas suggested that the reclamation access area toward the QE Pier was of limited value and was subsequently removed from the scope of the works.

The reclamation area at the root of the pier has been resized to ensure the reclamation slope is not undermined by the neighbouring dredge side slopes. The reclamation area proposed for the works can be seen in Figure 2.3 of Chapter 2, Volume II.

4 WASTE

4.1 Introduction

4.1 This Chapter assesses the likely significant waste effects of the proposed redevelopment of St. Ola Pier at Scrabster Harbour, in terms of waste related activities during the construction works and once fully operational. It describes the anticipated wastes that will be generated during the demolition and construction phases and anticipates the waste arisings at operational phase. It also outlines the waste management policies, practices and programmes that will be employed at the Harbour. Effects from the forecasted waste generation have been assessed in the context of the effects on waste management infrastructure and legislation, policy and strategy targets. Mitigation measures are proposed where significant environmental effects have been identified.

4.2 Assessment Methodology

4.2 This assessment comprises the following stages:

- A review of applicable legislation and policy;
- A review of the proposed scheme design was undertaken in consultation with the project design team to estimate the waste generation during the various phases;
- Consideration of potential interactions between proposals and the current site conditions, and identification of possible impacts;
- Assessment of effects, within the context of the receiving waste management environment and in accordance with the definition as set out in Table 4.1;
- Identification of measures and solutions to avoid, minimise or mitigate potential impacts; and
- Assessment of residual impacts, taking account of mitigation measures.

4.3 The methodology for assessing the significance of effects associated with the generation of waste is based upon an assessment of the quantity and types of waste that are likely to be produced during construction and operation of the development and how this deviates from baseline conditions.

4.4 The significance of effects in relation to waste management likely to occur during the construction and operation phases of the development is determined using the predominantly qualitative process described below. The criteria have been developed to be specific to this scheme while emulating the current principles of waste management, and in particular the waste management hierarchy.

Table 4.1: Glossary of Terms Used to Explain the Quality and Significance of Impacts

Significance Criteria	Definition
Major Adverse Effect	Substantial deterioration compared to the current scenario – severe or irreversible adverse environmental or human health effects associated with waste management. Significant increase in waste sent to landfill.
Moderate Adverse Effect	Noticeable deterioration compared to the current scenario – long-term minor or short-term moderate adverse environmental or human health effects associated with waste management. Slight or moderate increase in waste sent to landfill.
Minor Adverse Effect	Slight deterioration compared to the current scenario – short-term minor adverse environmental or human health effects associated with waste management. Minor increase in waste sent to landfill.
Neutral	No noticeable alterations to the current scenario due to waste management. No discernible effects due to waste management.
Minor Beneficial Effect	Slight improvement compared to the current scenario – short-term minor improvement in environmental and human health associated with waste management. Minor increase in waste generation or minor increase in reuse and recycling levels. Slight or moderate local scale reduction in use of landfill.
Moderate Beneficial Effect	Noticeable improvement compared to the current scenario – long-term minor or short term moderate improvement in environmental or human health effects associated with waste management. Slight or moderate decrease in waste generation or moderate increase in reuse and recycling levels. Slight or moderate reduction in use of landfill.
Major Beneficial Effect	Substantial improvement compared to the current scenario – significant improvement in environmental or human health effects associated with waste management. Significant decrease in waste generation, landfill disposal or major increase in recycling and reuse levels.

4.3 Review of Legislation and Policy

4.5 A review of the operational waste types generated at the Harbour was undertaken in preparation for this chapter. This data was used to estimate waste types that will be generated from the construction and operational phases of the proposed development.

4.6 SHT currently operates a Waste Management Plan which was reviewed as part of this process, in addition to an extensive document review of the following to assist in identifying current and future requirements for waste management:

- National and Regional Policies and Strategies such as:
  - Scotland's Zero Waste Plan
- National and European Legislation including:
  - The Environmental Protection (Duty of Care) (Scotland) Regulations 2014
  - The Waste (Scotland) Regulations 2012
  - The Waste (Scotland) Regulations 2011
  - The Waste (Scotland) Regulations 2005
  - The Waste Management Licensing (Scotland) Regulations 2011
  - The Waste Batteries (Scotland) Regulations 2009

- The Criteria And Procedures For The Acceptance Of Waste At Landfills (Scotland) Direction 2005
- The Criteria and Procedures for the Acceptance of Waste at Landfills (Mercury) (Scotland) Direction 2013
- Environment Act 1995
- Environmental Protection Act 1990
- Environment Protection (Waste Recycling Payments) (Scotland) Regulations 2000
- The Landfill (Scotland) Regulations 2003
- The Landfill (Scotland) Amendment Regulations 2003
- The Landfill (Scotland) Amendment Regulations 2013
- The Special Waste Regulations 1996
- The Controlled Waste Regulations 1992
- The Special Waste Amendment (Scotland) Regulations 2004
- The Special Waste Amendment (Scotland) Amendment Regulations 2004
- Pollution Prevention and Control Act 1999
- The Pollution Prevention and Control (Scotland) Regulations 2012
- Waste and Emissions Trading Act 2003
- The Landfill Allowances Scheme (Scotland) Regulations 2005
- The Producer Responsibility Obligations (Packaging Waste) Regulations 2007
- The End-of-Life Vehicles (Storage and Treatment) (Scotland) Regulations 2003
- The Litter (Fixed Penalties) (Scotland) Order 2013
- The Litter (Fixed Penalty Notices) (Scotland) Order 2014
- The Controlled Waste (Fixed Penalty Notices) (Scotland) Order 2014
- European Communities (Waste Directive) Regulations, 2011;
- Industrial Emissions Directive (2010/75/EU);
- Waste Framework Directive (2008/98/EC).

4.7 Other guidelines from Scottish Natural Heritage such as *A handbook on Environmental Impact Assessment [2013]* have been referred to also in the preparation of this assessment.

4.8 Specifically in relation to the waste management requirements at port and harbour facilities the following were also considered:

- EU Directive 2000/59/EC on port reception facilities for ship generated wastes and cargo residues
- Directive 2002/84/EC amending the Directives on maritime safety and the prevention of pollution from ships
- Commission Directive 2007/71/EC of 13 December 2007 amending Annex II of Directive 2000/59/EC of the European Parliament and the Council on port reception facilities for ship-generated waste and cargo residues

- Commission Directive (EU) 2015/2087 amending Annex II to Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues
- Directive 2005/35/EC on ship-source pollution and on the introduction of penalties for infringements
- Directive 2009/123/EC amending Directive 2005/35/EC on ship-source pollution and on the introduction of penalties for infringements
- MARPOL 73/78, International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978
- A guide to good practice – IMO Consolidated Guidance for port Reception Facility Providers and Users.

4.3.1 National Waste Policy in Scotland

4.9 The statutory basis for waste management policy in Scotland comes from the revised Waste Framework Directive (2008/98/EC) (rWFD). The main impact on waste management in Scotland arising from the revised WFD was the transposition and implementation of a new waste hierarchy and its application as a priority order in waste prevention, waste management licensing and waste policy.

4.10 The Zero Waste Plan, launched in June 2010, set out actions to deliver important changes to how Scotland treats and manages waste. The Plan is an economic strategy and a resource strategy - not simply a waste strategy. It aims to maximise the value of all the material resources we use in our economy, helping to create new business opportunities as well as savings to existing businesses and local authorities in how they manage waste. To support this aim, the plan includes ambitious recycling targets, including a 70% recycling rate for household and all other waste streams by 2025. These Regulations set in place statutory measures to support delivery of the Zero Waste Plan.

(a) prevention;

(b) preparing for re-use;

(c) recycling;

(d) other recovery, e.g. energy recovery; and

(e) disposal

4.11 In Scotland, the Scottish Government is responsible for the regulatory and legislative framework and providing policy advice and guidance. The Scottish Environment Protection Agency can take enforcement action on large scale and hazardous fly-tipping and Local Authorities will investigate small scale incidents. Local Authorities and the Police can issue fixed penalty notices to offenders, they can also report incidents directly to the Procurator Fiscal for further action if the fine isn't paid.

4.12 In addition to the Waste (Scotland) Regulations 2012 the Scottish Government launched a consultation, Safeguarding Scotland's Resources – A Programme for the Efficient Use of our Materials, which acts as Scotland's Waste Prevention Programme and sought views on a range of proposals to reduce waste and promote resource efficiency. This proposed an overall target of a 5% reduction in all waste by 2015, and a longer term vision of a 15% reduction in all waste by 2025.

4.3.2 Scrabster Harbour Trust Waste Management Plan

4.13 SHT are fully committed to providing adequate waste reception facilities for Scrabster Harbour and have developed a Waste Management Plan. The current Waste Management Plan is contained in Appendix 4.1, Volume II. The Waste Management Plan objectives are:

- To bring to the attention of Port users their responsibilities under relevant legislation;
- To inform Port users of the facilities available to them at Scrabster Harbour for disposal of waste; and
- To ensure that the facilities provided comply with current legislation and meet the needs of Port users.

4.3.3 Characteristics of Current Wastes

4.14 In relation to current waste management operations, Euro Bins for use by vessels are provided on all quays, as shown in Figure 4.1, Volume III, and special waste can be disposed of by arrangement with the port authority or through the vessel's agents. Table 4.2 lists the details on weight of waste managed at Scrabster Harbour in recent years.

4.15 All vessels landing waste at Scrabster Harbour (other than those with approved exemptions from the MCA) must give notification of waste disposal to Port Control:

- where Scrabster is known to be the next port of call at 24 hours before arrival;
- as soon as possible after Scrabster as a destination is known;
- where the duration of the voyage is less than 24 hours, at latest on departure from the previous port.

Table 4.2: Details on weight of waste managed at Scrabster Harbour

Notified Waste	
Notified Waste	**Tonnes**
2012	43.38
2013	43.00
2014	48.94
2015	46.90
2016	39.72
2017	48.41
Average	45.06

4.3.4 Method of Management

4.16 The reception and management route of waste at the Harbour is managed as per SHT's Waste Management Plan as outlined in Table 4.3. All waste generated and/or received at the Harbour is

currently managed and disposed by licenced waste contractors. The management / disposal route is at the discretion of the approved contractor.

4.17 The Scottish waste sites and capacity reports provide information about the numbers and types of waste management activities holding a Waste Management Licence (WML) or Pollution Prevention Control (PPC) permit issued by SEPA. It also provides the sites annual capacity, which is the tonnage of waste a regulated site is licensed or permitted to handle in a given year and the remaining capacity for landfills.

Table 4.3: Types of waste produced and current management route

Types of waste produced and current management route		
Waste Type	**Details**	**Management Route**
Ship waste	International catering waste This includes swill and other waste on board ships and will be varied and in the main bulky. This includes packaging, bottles, cartons, wood, paper, and many other items.	International catering waste must not be mixed with normal waste and must be discharged to a separate enclosed container. ICW cannot be sent to local landfill sites and must be transported to a suitable reception facility in Central Scotland. This must be arranged through the vessel's agent and at the vessel's cost. As amounts of ICW will not normally make this viable, it is recommended that vessels retain their ICW on board for discharge at a port with appropriate facilities.
	Hazardous waste This includes all types of HNS as defined under Annexes of Marpol.	Provision for this service will be arranged directly through vessel's agent with a suitable contractor.
Port waste	General waste	Port waste is segregated and disposed of accordingly. There are 12 locations for waste recycling and disposal at the Port as set out below and illustrated in Figure 4.1 (Volume III) serviced by Highland Council. • Queen Elizabeth Lay By Berth - 1 x 1100 litre General Waste Bin, 2 x 1100 litre Recycling Bin • St Ola Quay – 2 x 1100 litre General Waste Bin, 1 x 1100 litre Recycling Bin • Old Ferry Terminal Building - 1 x 1100 litre General Waste Bin, 1 x 1100 litre Recycling Bin • Ice Quay - 1 x 1100 litre General Waste Bin, 1 x 1100 litre Recycling Bin • Shore Quay Car Park - 1 x 1100 litre General Waste Bin, 1 x 1100 litre Recycling Bin • Business Centre - 1 x 1100 litre General Waste Bin, 1 x 1100 litre Recycling Bin • Fish Market - 1 x 1100 litre General Waste Bin, 1 x 1100 litre Recycling Bin • Tanker Berth - 1 x 1100 litre General Waste Bin, 1 x 1100 litre Recycling Bin, 1 x 10 cubic yard General Waste Skip • Fuel Berth - 1 x 1100 litre General Waste Bin, 1 x 1100 litre Recycling Bin • Harbour Office - 1 x 240 litre General Waste Bin, 1 x 240 litre Recycling Bin • St Ola Quay - Bottle Bank • Fish Dock - 2 x 2,500 litre Waste Oil Tanks
	Waste oils and filters	Waste oil is disposed of in 2 x 2500 litre tanks in a bunded area in the fuel Berth. Waste oil and oil filters are managed by OSS Group
Cargo waste	This is waste associated with the load / discharge of cargo.	

4.3.5 Disposal Infrastructure

4.18 Table 4.4 lists information on operational waste sites in the vicinity of the redevelopment.

Table 4.4: Capacity of Currently Authorised Landfills

Permit or Licence Number	Operator Organisation	Type of Site	Annual Capacity on Permit (tonnes)	Total Capacity of Permit (tonnes)	Remaining Capacity as at 31/12/15	Rate of infill as at 31/12/15 (tonnes)	Estimated date for ceasing infill as at 31/12/2015 (tonnes)
			Capacity on Permit		Capacity as at 31 December 2015		
PPC/A/1004362	William Thompson & Sons Ltd	Inert	240,000	2,400,000	200,000	50,000	Dec-2020
PPC/A/1008691	Joss (Aberdeen) Limited	Inert	100,000	1,500,000	1,401,027	n/k	n/k
PPC/A/1008856	Chap Quarries (Aberdeen) Ltd	Inert	75,000	n/k	835,000	17,003	Dec-2020
PPC/A/1008876	D Geddes (Contractors) Ltd	Inert	24,999	129,810	347,185	3,000	Dec-2050
PPC/A/1008878	D Geddes (Contractors) Ltd	Inert	75,000	253,178	1,134,206	150,000	Dec-2035
PPC/A/1008879	D Geddes (Contractors) Ltd	Inert	24,999	53,067	1,100	3,000	Dec-2016
PPC/A/1008883	A & M Smith Skip Hire Limited	Inert	25,000	156,000	-	-	Jan-1900
PPC/A/1008897	Levenseat Ltd	Inert	75,000	1,500,000	30,000	5,000	Dec-2021
PPC/A/1008926	Tayside Contracts	Inert	15,000	135,000	131,428	3,275	Dec-2025
PPC/A/1009964	Geddes Group Limited	Inert	75,000	1,875,270	1,869,226	4,000	Dec-2034

Permit or Licence Number	Operator Organisation	Type of Site	Annual Capacity on Permit (tonnes)	Total Capacity of Permit (tonnes)	Remaining Capacity as at 31/12/15	Rate of infill as at 31/12/15 (tonnes)	Estimated date for ceasing infill as at 31/12/2015 (tonnes)
PPC/A/1010715	Orkney Islands Council	Inert	5,000	125,000	89,720	2,950	May-2045
PPC/A/1010943	William Hamilton & Sons (Contractors) Ltd	Inert	230,000	740,000	427,000	50,000	Jan-2025
PPC/A/1024099	John Gunn & Sons Limited	Inert	25,000	85,000	71,419	5,000	Dec-2029
PPC/A/1098705	Inland Engineering Services	Inert	100,000	400,000	217,000	50,000	Dec-2019
PPC/A/1000105	Tarbolton Landfill Limited	Non-Hazardous	147,000	2,500,000	220,000	35,000	Dec-2021
PPC/A/1000112	Scottish Borders Council	Non-Hazardous	170,000	1,000,000	504,496	65,000	Dec-2020
PPC/A/1000120	Angus Council	Non-Hazardous	145,000	3,240,000	n/k	n/k	n/k
PPC/A/1000148	The Highland Council	Non-Hazardous	65,000	913,000	250,000	39,000	Nov-2024
PPC/A/1003256	Savoch Quarry & Recycling Limited	Non-Hazardous	24,999	100,000	67,000	3,000	n/k
PPC/A/1004251	The Highland Council	Non-Hazardous	25,000	126,000	70,000	12,000	Feb-2027
PPC/A/1004259	J & M Murdoch & Sons Limited	Non-Hazardous	90,000	552,750	277,500	n/k	n/k
PPC/A/1004275	Comhairle nan Eilean Siar	Non-Hazardous	50,000	1,500,000	1,344,479	20,500	n/k
PPC/A/1004280	Shanks Argyll & Bute Limited	Non-Hazardous	20,515	398,000	278,329	12,040	Sep-2031
PPC/A/1004281	Shanks Argyll & Bute Limited	Non-Hazardous	36,500	720,000	440,752	24,128	Sep-2031

Permit or Licence Number	Operator Organisation	Type of Site	Annual Capacity on Permit (tonnes)	Total Capacity of Permit (tonnes)	Remaining Capacity as at 31/12/15	Rate of infill as at 31/12/15 (tonnes)	Estimated date for ceasing infill as at 31/12/2015 (tonnes)
PPC/A/1004300	Central Demolition (Recycling) Ltd	Non-Hazardous	77,400	5,000,000	500,000	70,000	Dec-2021
PPC/A/1008888	Argyll & Bute Council	Non-Hazardous	1,000	27,000	12,945	55	Dec-2025
PPC/A/1020313	BAE Systems Properties Ltd	Non-Hazardous	100,000	n/k	33,492	10,000	Dec-2025
PPC/A/1022141	Argyll & Bute Council	Non-Hazardous	8,320	90,000	29,200	1,800	Dec-2063
PPC/A/1025163	Argyll & Bute Council	Non-Hazardous	9,815	90,000	77,800	2,200	Dec-2063
PPC/A/1025270	Armstrong Waste Management Ltd	Non-Hazardous	24,999	249,990	n/k	n/k	n/k
PPC/E/0020001	Levenseat Ltd	Non-Hazardous	150,000	1,900,000	750,000	50,000	Dec-2045
PPC/E/0020059	Avondale Environmental Ltd	Non-Hazardous	720,000	8,350,000	1,227,922	230,000	Mar-2021
PPC/E/0020083	Fife Council	Non-Hazardous	382,500	7,946,400	2,970,451	103,000	Dec-2032
PPC/E/0020085	Fife Council	Non-Hazardous	282,500	2,701,000	543,756	93,674	n/k
PPC/N/0020010	SITA UK Limited	Non-Hazardous	355,000	5,400,000	2,636,397	250,000	Jan-2024
PPC/N/0020028	Moray Council	Non-Hazardous	120,000	1,320,000	145,000	32,000	Aug-2020
PPC/N/0050027	Shetland Islands Council	Non-Hazardous	70,000	1,000,000	786,000	17,000	Jan-2060
PPC/N/0050031	Locheil Logistics Ltd	Non-Hazardous	24,000	590,000	482,000	12,500	Dec-2040

Permit or Licence Number	Operator Organisation	Type of Site	Annual Capacity on Permit (tonnes)	Total Capacity of Permit (tonnes)	Remaining Capacity as at 31/12/15	Rate of infill as at 31/12/15 (tonnes)	Estimated date for ceasing infill as at 31/12/2015 (tonnes)
PPC/W/0020008	Smith Skip Ltd	Non-Hazardous	75,000	750,000	152,286	35,000	Dec-2021
PPC/W/0020019	Barr Environmental Ltd	Non-Hazardous	250,000	5,500,000	3,010,000	120,000	May-2025
PPC/W/0020026	Barr Environmental Ltd	Non-Hazardous	250,000	4.760,000	2,850,000	120,000	Aug-2022
PPC/W/0020041	FCC Waste Services (UK) Ltd	Non-Hazardous	1,300,000	35,000,000	13,620,000	400,000	May-2038
PPC/W/0020046	Patersons of Greenoakhill Ltd	Non-Hazardous	500,000	1,800,000	1,300,000	180,000	Dec-2022

Table Note

4.19 There are a number of landfills licensed to accept non-hazardous waste. Table 4.5 lists information on operational landfill sites with capacity to accept various materials for disposal from the redevelopment

Table 4.5: Waste Sites Capacity

Permit of Licence No	Operator Organisation	Site Activity	Licensed Waste Type			
				Waste Inputs to Site	Waste Treated / Recovered on Site	Waste Outputs from Site
PPC/A/1004266	Iberdrola SA	Landfill	Industrial	327,522.00	-	366.00
PPC/A/1098705	Inland Engineering Services	Landfill	Inert	1,127.48	-	0.00
PPC/A/1004362	William Thompson & Son Ltd	Landfill	Inert	92,464.00	-	-
PPC/A/1008856	Chap Quarries (Aberdeen) Ltd	Landfill	Inert	17,001.96	-	-
PPC/A/1008876	D Geddes (Contractors) Ltd	Landfill	Inert	881.00	-	-
PPC/A/1008878	D Geddes (Contractors) Ltd	Landfill	Inert	21,503.00	-	0.00
PPC/A/1008879	D Geddes (Contractors) Ltd	Landfill	Inert	3,136.00	-	-
PPC/A/1008926	Tayside Contracts	Landfill	Inert	3,274.88	-	-
PPC/A/1009964	Geddes Group Limited	Landfill	Inert	869.26	-	-
PPC/A/1010715	Orkney Islands Council	Landfill	Inert	2,950.60	-	-
PPC/A/1024099	John Gunn & Sons Ltd	Landfill	Inert	4,718.19	2,192.83	565.42
PPC/A/1036720	WH Malcolm Ltd	Landfill	Inert	230,005.70	-	-
PPC/A/1004252	Scottish Water Contracting	Landfill	Industrial / Inert	3,236.20	-	-
PPC/E/0020086	Avondale Environmental Ltd	Landfill	Commercial / Industrial / Special	33,115.71	-	3,652.00
PPC/A/1010943	William Hamilton & Sons (Contractors) Ltd	Landfill / Composting	Commercial / Industrial / Inert	111,747.00	83,307.00	32.62
PPC/A/1008691	Joss (Aberdeen) Limited	Landfill / Other treatment	Inert	82,793.00	42,623.00	-

Permit of Licence No	Operator Organisation	Site Activity	Licensed Waste Type			
PPC/A/1008881	J Fairburn & Sons	Landfill / Other treatment	Inert	37,518.50	2,687.00	-
PPC/A/1008897	Levenseat Ltd	Landfill / Other treatment	Industrial / Inert	284.96	-	0.00
PPC/A/1003207	Drem Landfill Limited	Landfill / Transfer station	Industrial / Inert	18,787.52	6,479.52	7,604.52
PPC/A/1003159	Charles River Laboratories Preclinical Services Edinburgh Ltd	Incineration	Industrial	376.82	-	-
PPC/A/1017440	SLG Technology Ltd	Incineration	Industrial	9,536.00	-	-
PPC/E/0020004	Borders General Hospital NHS Trust	Incineration	Special	494.38	-	-
WML/N/0050300	Scottish Agricultural College	Incineration	Industrial	16.62	-	0.62
PPC/A/1003170	EPR Scotland Limited	Co-incineration	Commercial / Industrial	121,182.00	-	4,924.95
PPC/A/1011415	E.ON UK Renewables Limited	Co-incineration	Industrial	69,206.14	-	-
PPC/A/1096556	RWE Markinch Limited	Co-incineration	Commercial / Industrial	240,971.29	-	11,443.13
WML/W/0220256	The Coach House Trust	Composting	Commercial	21,422.26	20,662.82	3,678.66
WML/L/1031536	Scottish Water	Composting / Other treatment	Industrial	380.00	380.00	505.07
PPC/A/1000166	National Oilwell Varco UK Ltd	Other treatment	Industrial / Special	19,447.39	19,447.39	19,987.28
PPC/A/1003203	Veolia Es (UK) Limited	Other treatment	Commercial / Industrial / Special	2,940.97	-	1,604.21
PPC/A/1004470	Augean Treatment Limited	Other treatment	Commercial / Industrial / Special / Inert	17,403.40	7,740.37	7,478.52
PPC/A/1004491	Clearwater 2010 Limited	Other treatment	Commercial / Industrial / Special	12,102.30	6,177.03	12,615.15
PPC/A/1008834	Calachem Limited	Other treatment	Industrial / Other special	151,272.94	151,272.94	2,598.27

Permit of Licence No	Operator Organisation	Site Activity	Licensed Waste Type			
PPC/A/1012479	Ayr Environmental Services Operations Ltd	Other treatment	Industrial	73,019.00	275,470.00	35,502.00
PPC/A/1016807	William Tracey Limited	Other treatment	Commercial / Industrial / Special / Special asbestos	15,837.71	13,546.84	7,614.12
PPC/A/1016835	OSS Group Ltd	Other treatment	Commercial / Industrial / Special	3,605.84	-	2,352.50
PPC/A/1017062	The Oil and Pipelines Agency	Other treatment	Industrial / Special	3,022.30	3,024.00	22.30
PPC/A/1019535	Healthcare Environmental Services Ltd	Other treatment	Commercial / Industrial / Special	12,738.67	11,855.00	12,738.67
PPC/A/1023330	Total Waste Management Alliance Limited	Other treatment	Industrial	4,576.00	-	3,695.97
PPC/A/1035666	Baker Hughes Limited	Other treatment	Industrial / Special	13,057.10	11,918.81	9,787.13
PPC/A/1036676	Dundas Chemical Company (MOSSPARK) Ltd	Other treatment	Industrial	-	-	-
PPC/A/1038071	Augean North Sea Services Limited	Other treatment	Industrial / Special	17,617.38	16,781.90	17,066.48
PPC/A/1068337	Mitchell Thomson, Robslee Drive, Giffnock	Other treatment	Special	9,283.20	9,283.20	318.40
PPC/A/1098369	Taylors Industrial Services Limited	Other treatment	Industrial	26,298.80	-	26,298.80
PPC/A/1103677	Augean North Sea Services Limited	Other treatment	Commercial / Industrial / Special	209.19	49.10	34.82
PPC/A/1107786	Enviroco Limited	Other treatment	Industrial / Special	7,612.42	-	6,577.18
PPC/W/0020001	SMW Ltd	Other treatment	Industrial	2,325,652.83	2,325,652.83	51,958.27
PPC/W/0020064	Dundas Chemical Company	Other treatment	Industrial	-	-	-

Permit of Licence No	Operator Organisation	Site Activity	Licensed Waste Type			
WML/E/0020156	C S Clean Systems Uk	Other treatment	Commercial / Industrial	4.18	-	10.00
WML/L/1018845	ILM Highland	Other treatment	Special	2,001.00	128.00	1,791.00
WML/L/1022346	Alisrose Limited	Other treatment	Industrial	97,723.00	97,723.00	145.00
WML/L/1023905	Grant Construction Services (Fife) Ltd	Other treatment	Industrial	419.52	419.52	24.00
WML/L/1078194	Scottish Water	Other treatment	Industrial	470.00	470.00	505.07
WML/L/1085597	Scottish Borders Council	Other treatment	Industrial	1,117.48	-	558.72
WML/L/1085598	Scottish Borders Council	Other treatment	Industrial	1,923.39	-	1,312.82
WML/L/1087243	Midlothian Council Road Services	Other treatment	Industrial	-	-	-
WML/L/1099346	Doocey Recycling Limited	Other treatment	Commercial	42,033.60	42,033.95	62,640.01
WML/L/1101353	SAUR Services Glasgow Ltd	Other treatment	Industrial	1,869.09	1,869.09	1,869.09
WML/L/1117120	Viridor Waste Management Ltd	Other treatment	Commercial	123,990.17	117,860.00	18,327.09
WML/W/0000124	Scottish Water	Other treatment	Industrial	170,739.39	170,739.39	355.24
WML/W/0020117	Plastic Technology Services Ltd	Other treatment	Commercial / Industrial	9,289.00	8,327.00	178.00
WML/W/0020162	Scottish Water	Other treatment	Industrial	22,733.97	22,733.97	3,678.02
WML/W/0020167	Glasgow City Council	Other treatment	Commercial	9,660.00	-	2,415.00
WML/W/0220085	Scottish Water	Other treatment	Industrial	10,914.12	10,914.12	2,497.01
WML/W/0220109	Cannon Hygiene Ltd	Other treatment	Special	172.55	-	196.42
WML/L/1123155	SERCO Limited	Other treatment	Industrial	235.54	235.54	235.54

4.4 Likelihood of Impacts

4.20 Partial demolition of the existing pier will be required and therefore this will generate concrete waste. The proposed harbour redevelopment will generate construction related waste and once operational the redevelopment will facilitate an increased number of berthing opportunities and the likelihood of increased waste arising associated with the additional port capacity during the operational phase.

4.4.1 Description of Significant Impacts

4.21 The predicted waste management impacts are assessed in accordance with Table 4.3. Potential effects of the proposed redevelopment associated with waste generation and management is considered for two distinct phases:

a. Construction Phase; and

b. Operational Phase.

4.4.2 Construction Phase Impacts

4.22 Localised demolition of the existing concrete deck structure and capping beams will be necessary. The localised demolition will generate Construction, Demolition and Excavation (C, D & E) type waste materials. It has been estimated that the demolition works will generate approximately 7,400m^3 of concrete / demolition waste from the decking and capping beam.

4.23 Dredging of 172,000m^3 of sandy gravel and clay materials is also required.

4.24 There is the potential for quantities of materials to be deposited in landfill sites rather than being reused or recycled, unless site waste management plans are implemented and adhered to. The use of non-permitted waste contractors or unlicensed facilities could give rise to inappropriate management of waste and result in environmental impacts/pollution. Therefore, it is essential that all waste materials are dealt with in accordance with regional policies, national legislation, and that site management procedures are in place to ensure the appropriate management of waste segregation, storage, handling, and transportation.

4.25 Typical waste materials arise from site management practices during the construction phase, for example, excess materials and packaging, over-ordering materials, off-cuts, damaged materials and poor storage during the construction phase. Typically, construction waste is ‘cleaner’ than demolition waste. Packaging waste can make up a significant part of this waste stream. In terms of waste arising from the construction compound, general office waste such as paper, packaging and canteen waste will be collected in covered skips/large bins for disposal by a licensed waste contractor. Sewage from the temporary site toilets will be emptied under contract for disposal at an appropriate facility.

4.26 A number of different waste types are predicted to be generated on site and are detailed in Table 4.6.

Table 4.6: Predicted Waste Streams to be Generated and Associated Management Options and Strategy

Work Stream	Waste	Waste Type	Waste Management Option	Waste Management Strategy
Demolition	Concrete	Inert	Reuse onsite or disposal	Crushed to allow for reuse within the construction works as engineered fill
Dredging	Gravel & larger pockets of course material	Non-hazardous	Reuse on-site	Where feasible these dredged materials will be reused on-site
	Sandy gravel and clay sediments	Non-hazardous	Disposal at offshore site	The majority of the dredged material will be disposed of at the authorised offshore disposal site Scrabster Spoil Ground, located within the area bounded by the joining points: 58 38.22'N 003 29.82'W 58 38.10'N 003 29.44'W 58 38.03'N 003 29.54'W 58 38.15'N 003 29.91'W It is also anticipated that there will be some reuse of dredged material into the reclamation areas and into the body of the pier if economically feasible.
	Drill cuttings	Non-hazardous	Disposal at offshore site	Drill cutting waste is likely to be generated during the dredging phase, however oil based drilling muds will not be used.
	Various waste oils & lubricants	Special	Treatment as Special waste Residual waste to Special waste facility	All Special waste must be source segregated before treatment and / or disposal and then independent moved to a secure collection point. It is then collected by a specialist contractor and transferred
Construction	Concrete	Inert	Re-use on site Return to supplier Recycle on site Recover off-site Residual waste to landfill	Concrete will be batched on site. Care will be taken to ensure waste is minimised during this process. Investigations will be undertaken to identify if any excess concrete can be re-used in new batches. Awareness will be raised about the importance of effective handling. If additional concrete has to be delivered to the site a take-back scheme will be established for excess concrete with suppliers. Investigations will also be undertaken to determine whether concrete can be crushed on-site for use as aggregate of fill material where it is not possible to re-use it in its current form. Where this is not feasible the concrete waste shall be recovered off site
	Other inert	Inert	Recovered off-site where feasible Residual waste to landfill	All inert waste shall be segregated for off-site recycling or recovery.
	Metals	Non-hazardous	Recycle off-site	All metals shall be segregated for off-site recycling
	Plastics	Non-hazardous	Recycle off-site	Plastics shall be segregated for off-site recycling
	Paper & cardboard	Non-hazardous	Recycle off-site	Paper and cardboard shall be segregated for off-site recycling

Timber	Non-hazardous	Recycle off-site	Storage pallets shall be returned where possible Wood waste will be segregated into a separate container so that off-site recycling can occur
Glass	Non-hazardous	Recycle off-site	Glass will be segregated into a separate container so that off-site recycling can occur
Mixed waste	Non-hazardous	Materials Recovery Facility (MRF)	Residual waste must be placed into a skip labelled mixed waste. Investigations shall be undertaken to identify potential recovery options for all waste.
Paint tins	Special	Treatment as Special waste Recovery where feasible Residual waste to Special waste disposal facility	Empty paint tins arisings on site will be segregated in stockpiles on site away from all water courses and water bodies. All Special Waste must be source segregated before treatment and/or disposal and then independently moved to a secure collection point. It is then collected by a specialist contractor and transferred for suitable treatment and/or disposal.
Various waste oils & lubricants	Special	Treatment as Special Waste Residual waste to Special Waste Disposal Facility	All Special Waste must be source segregated before treatment and/or disposal and then independently moved to a secure collection point. It is then collected by a specialist contractor and transferred for suitable treatment and/or disposal. Special waste shall be recycled where possible.

4.4.3 Summary of Construction Phase Impacts

4.27 In terms of the overall impact of the construction phase of the proposed redevelopment there is the potential to have a minor adverse effect due to the increase in waste being generated and the potential for this waste to be sent to landfill over a short-term duration, however the intention will be to achieve a high rate of diversion from landfill through reuse, recycling and recovery throughout the construction phase.

4.4.4 Summary of Operational Phase Impacts

4.28 The Port of Scrabster harbour provides the interface to the land waste management and disposal system for ships and boats. Operational waste from vessels, if not properly managed, could potentially end up in the sea where the potential for contamination or pollution occurs. Waste management at the port is currently operated to best practice guidance and in accordance with the SHT Waste Management Plan.

4.29 It is imperative that the current port waste management strategy, policies and procedures consider any additional waste that may arise. The current systems may require revision in order to reflect the potential for potential upscale in operational waste arisings coming from ship generated waste and cargo residues. Therefore in terms of the overall impact of the works on the operational phase the scheme has the potential to have a moderate adverse effect to the anticipated slight increase in waste sent to landfill.

4.5 Mitigation & Monitoring Measures

4.30 In order to mitigate against the potential impacts that the proposed redevelopment could have on the production of waste during each phase, mitigation measures will be put in place to ensure that all waste is dealt with in a sustainable and legislatively compliant manner. These measures are set out below for the various phases of the development.

4.5.1 Construction Phase

Duty of Care

4.31 Contractors working on site during the works will have a duty of care and be responsible for the collection, control and disposal of all wastes generated by their works. SHT and their appointed contractor will ensure that all waste materials leaving the site will be transported via road via a registered and licensed carrier and arrive at a licensed / permitted site. Waste will only be disposed or recovered through licenced operators and in accordance with national waste legislation.

Site Waste Management Plan (SWMP)

4.32 Construction waste will be managed as part of a SWMP, prepared and implemented by the appointed contractor for the duration of the construction works. The SWMP will contain procedures for the management of waste and assist with providing a complete audit trail. The SWMP will be a live document and will be subject to revision throughout the course of the construction phase. An outline SWMP is included as Appendix 4.2, Volume II.

4.33 The SWMP will:

- include specific details on the projected waste types and subsequent management;

- identify and capture the decisions made in the design process to reduce waste generation;
- identify the methodologies for waste management at each stage of the project;
- Identify how the waste will be dealt with (i.e. disposal, re-use on/off site etc.); and
- Identify potential end markets e.g. reuse, recycling facilities, waste treatment facilities and disposal sites.

4.34 The SWMP will specify procedures for:

- On-site segregation of waste at source where practical;
- On-site segregation of waste materials into appropriate categories;
- On-site segregation of non-hazardous waste materials into appropriate categories such as:
  - Metals;
  - Timber.
- On-site segregation of any hazardous waste materials into appropriate categories such as:
  - Any contaminated soils;
  - Waste oil and fuels;
  - Paints, glues, adhesives and other known hazardous substances.

4.35 The SWMP will additionally specify:

- Measures to ensure monitoring and updating of records under Duty of Care requirements;
- Measures to avoid over-ordering and generation of surplus waste materials;
- Measures to ensure appropriate staff training and levels of awareness in relation to waste management;
- Measures and procedures to monitor waste flows on site;
- Steps to be taken with materials suppliers to reduce the amount of packaging or to participate in a packaging take-back scheme;
- Implement a 'just in time' materials delivery systems to avoid materials being stockpiled, which increases the risk of the damage and disposal as waste;
- All waste materials will be stored in skips or other suitable receptacles in designated areas of the site. The waste storage area(s) will be assigned and all construction staff provided with training regarding the waste management procedures on commencement of the project.

4.36 All waste leaving site will be recycled, recovered or reused where possible, with the exception of those waste streams for which appropriate facilities are currently not available.

4.37 Waste streams will be collected by an appropriately licensed and permitted private waste contractor, appointed by the contractor for recycling, recovery or disposal at suitably licensed facilities.

Reuse of Demolished Material on Site

4.38 In order to divert waste from landfill, possibilities for reuse of inert demolition material as fill on site will be considered, following appropriate testing to ensure materials are suitable for their proposed end purpose. This demolished material will be concrete from the existing deck structures and will be approximately 7,400m^3 of material. Should there be no suitable reuse option on site this material will be removed off-site for disposal.

4.39 No monitoring is proposed at the Construction Phase.

4.5.2 Operational Phase

SHT Waste Management Plan

4.40 The current SHT Waste Management Plan underpins all waste related operations at Scrabster Harbour. SHT will continue to review and implement any required changes in this port waste management plan in order to avoid and minimise the potential effects of ship and boat generated wastes once the redevelopment is operational. SHT will continue to provide adequate reception facilities and remove, as far as is practicable, any disincentives to landing waste in the port. SHT will continue to encourage the responsible management of waste, including minimisation and recycling, at the point of generation on ships, reception in ports/harbours, transportation and disposal, and ensure that port and harbour employees and users dispose of wastes responsibly in facilities provided.

4.41 No monitoring is required at the Operational Phase.

4.6 Cumulative Effects

4.42 Other projects (as outlined in Appendix 1.2. Volume II) have been considered for their potential to result in cumulative waste effects arising from the redevelopment of St. Ola Pier and those other projects, taking into account the location, scale and characteristics of those other projects.

4.43 There are no anticipated cumulative effects associated with waste management predicted as a result of the proposed redevelopment when considered along with the other projects listed in EIAR Volume II, Appendix 1.2.

4.44 There are a range of suitable licensed waste sites with capacity to accommodate waste arisings from the proposed redevelopment and other proposed developments considered cumulatively.

4.7 Residual Impact

4.7.1 Construction Phase

4.45 A carefully planned approach to waste management and adherence to a SWMP during the construction and installation phase will ensure that the waste effects on the environmental will be short term and imperceptible, and will not be significant. There is available capacity within the existing waste management infrastructure in the region to manage C, D and E waste from the

proposed development works. Therefore the residual impact of the construction phase in relation to waste management is predicted to be neutral. This is summarised in Table 4.7.

4.7.2 Operational Phase

4.46 From a waste management point of view the site will return to the baseline situation as it is anticipated that due to recycling and reuse policies, procedures and the implementation of the Waste Management Plan waste will continue to be managed as per legal requirements. While there may be a minor increase in waste arisings, they are capable of being managed under the existing SHT Waste Management Plan. There will be no discernible change to waste management practices required once the proposed redevelopment is operational. The residual impact of the operational phase in relation to waste management is predicted to be neutral. This is summarised in Table 4.7.

Table 4.7: Summary of Impacts

Phase	Receptor	Predicted Effect	Adverse /Beneficial	Permanent /Temporary	Mitigation Measures	Residual Effect
Construction Phase	Environment	Minor	Adverse	Temporary	4.5.1	Neutral
Operational Phase	Environment	Moderate	Adverse	Permanent	4.5.2	Neutral

4.8 Conclusions

4.47 By implementing the mitigation measures set out in this Chapter and by managing wastes in accordance with the waste management hierarchy and best practice guidance, and the Waste Management Plan, wastes generated during the distinct phases of the works the proposed redevelopment will have no adverse effect on waste management in the area.

4.48 It is concluded that the proposed redevelopment, which includes the safe and proper management of waste streams will have a neutral effect on the environment in relation to waste management.

5 TRAFFIC AND TRANSPORTATION

5.1 Introduction

5.1 This Chapter takes cognisance of Chapter 4 of 'Transport Assessment Guidance' issued by Transport Scotland relating to Transport Statements, and also addresses the comments received at the EIA scoping stage, by The Highland Council and Transport Scotland.

5.2 Scrabster Harbour has existing transport arrangements that are well established at the Port including vehicular access and circulation, walking, cycling and public transport.

5.3 The existing access and configuration arrangements at the port access and circulation area remain as they are today with the proposed redevelopment in place. These will accommodate non-cruise related users, including the increase in oil & gas berthage related to the proposed redevelopment.

5.4 The parking, laydown and pick-up facilitates for the coaches and taxis relating to the cruise calls will be accommodated on the renovated pier and will not require additional parking facilities beyond the pier boundary.

5.5 This Chapter gives details on the current facilities available for all transport modes and demonstrates that the existing arrangements combined with the renovated pier will accommodate the additional traffic and people generated by the proposed redevelopment.

5.1.2 Existing Site Layout

5.6 The existing layout of Scrabster Harbour, the existing port accesses, and approach road are presented in Figure 5.1 below.

5.7 Scrabster Harbour has existing transport arrangements that are well established at the Port including vehicular access, internal circulation, walking, cycling and public transport. This Chapter gives details on the current arrangements for all of the modes and demonstrates that the existing arrangements combined with the renovated pier will accommodate the additional traffic and people generated by the proposed redevelopment.

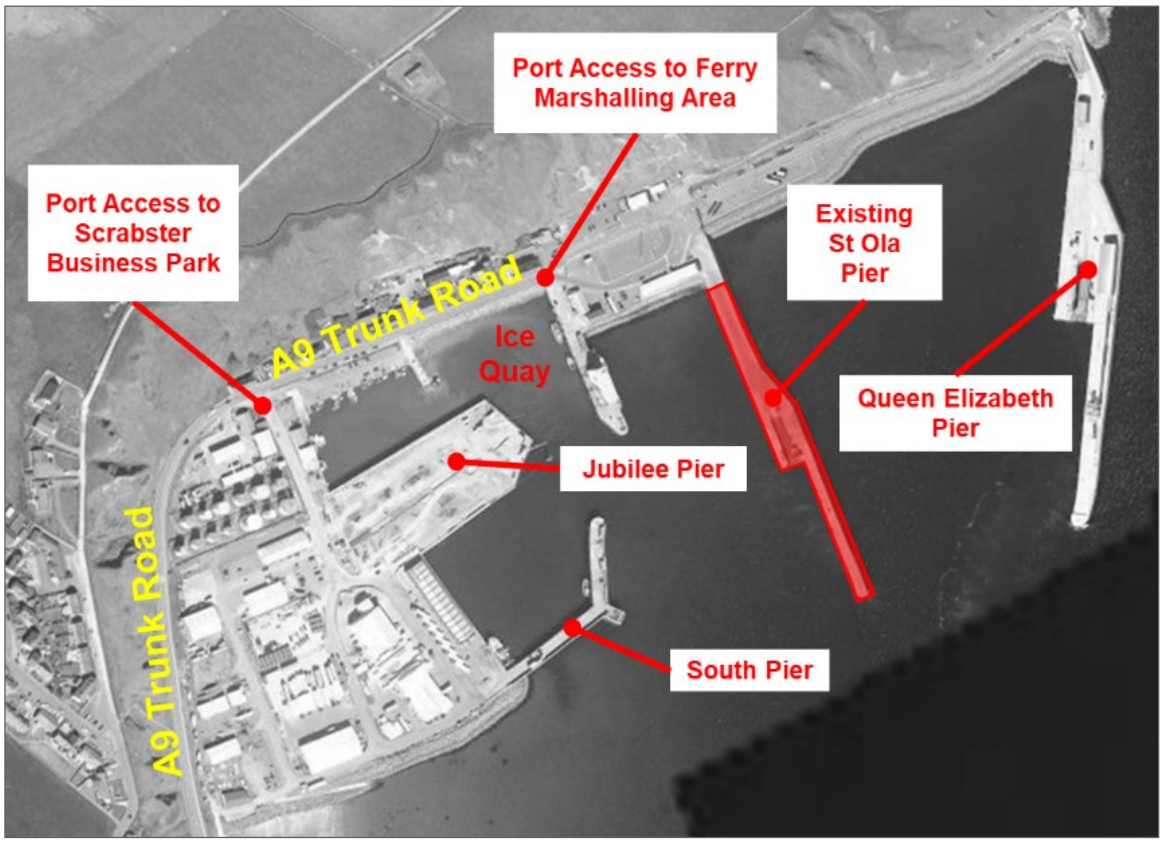


Figure 5.1 Existing Layout of Scrabster Harbour Including Existing Accesses and Approach Road

5.1.3 Proposed Redevelopment

5.8 Chapter 2, Volume I describes in detail the characteristics of the proposed redevelopment. Figure 5.2 highlights the additional usable surface areas (in yellow) that the proposed redevelopment will deliver.

5.9 Importantly, Figure 5.2 highlights that the existing access and configuration arrangements at the port remain as existing within the redevelopment proposals, and are proposed to accommodate the non-cruise users.

5.10 The parking, laydown and pick-up facilitates for the coaches and taxis relating to the cruise calls will be accommodated on the renovated pier and will not require additional parking facilities beyond the pier boundary.

5.11 This Chapter will demonstrate that the volumes of additional traffic that will be generated by the redevelopment are relatively modest and are expected be accommodated within the port.

5.12 Aspects of the proposed redevelopment that may impact on transportation are:

- Construction related traffic movements during the construction period;
- Transportation activity relating to the 30 additional cruise calls per year and the increase in the number of passengers and crew for each of the existing cruise calls during the operational period;
- Traffic increase due to the increased berthing activity for oil & gas vessels during the operational period.

5.13 These are considered in detail within this Chapter.

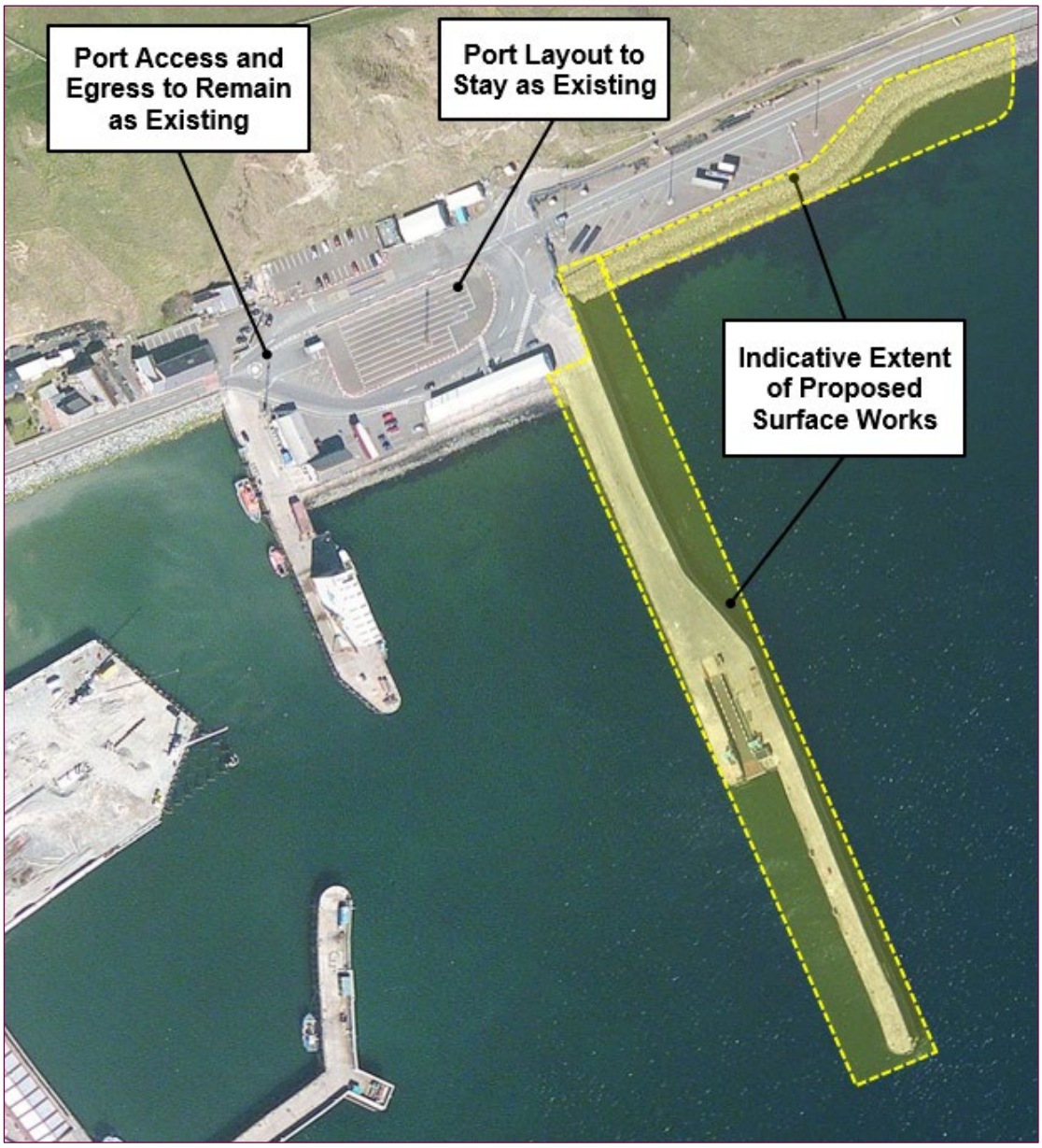


Figure 5.2 Indicative Extent of Proposed Surface Works

5.2 Methodology

5.2.1 Scope of Assessment

5.14 A screening and scoping process were undertaken for the EIAR.

The Highland Council

5.15 Scoping correspondence was received from The Highland Council's Transport Planning Department on the 15 Feb 2018, see EIAR Volume II, Appendix 5.1. The Highland Council determined that a Transportation Assessment was not considered necessary regarding the Council's transportation interests and requested a Transport Statement (TS).

5.16 The TS has taken account and addresses the specific concerns raised by The Highland Council in their Screening Opinion response, which are summarised as follows:

- The increase in vehicular traffic and in particular HGV traffic during operation and construction due to the redevelopment. This should be compared against the base line condition for the immediate access route to verify the assumption that the proposals will not have a significant impact. If the impact is shown to be significant then further consultation with the Council on local roads issues will be carried out as requested;
- Access, turning and parking provision to mitigate any increase in vehicular traffic. In particular it should consider if any upgraded facilities for public transport and coaches are required to service additional cruise ships;
- Appropriate links and facilities for pedestrians and cyclists within the redevelopment connecting to the external network;
- The Council has an interest in ensuring appropriate transportation links by sustainable modes to Thurso and other destinations to safeguard health and road safety and to encourage economic benefits for the local community. The Caithness and Sutherland emerging Local Development Plan notes that there are congestion and HGV problems within Thurso due to the historic nature of the road layout and single bridge crossing of the river within the town.

Transport Scotland

5.17 The A9 Trunk Road, which provides access to the proposed redevelopment, is under the authority of Transport Scotland. The scoping correspondence was received from Transport Scotland dated the 1 August 2018 and is included in EIAR Volume II, Appendix 5.2.

5.18 Transport Scotland agree that a Transport Assessment is not required and a TS will be carried out. This Chapter will therefore take cognisance of Chapter 4 of 'Transport Assessment Guidance' issued by Transport Scotland which states:

5.19 "A (TS) should identify the main transport issues relating to a proposed development. This will normally include details of the existing conditions and for the proposed development. The TS will identify the existing transport infrastructure, travel characteristics associated with the site and the proposed measures to improve the infrastructure and services to encourage sustainable travel to the site. Detailed accessibility analysis and assessment of the traffic impacts will not be required."

5.20 Transport Scotland have requested that an assessment of the potential environmental impacts associated with the increased traffic be provided. The transport related matters have been addressed within this Chapter as requested, and the traffic flows have been prepared and forwarded for assessment within Chapters 6 and 7, Volume I.

5.21 Transport Scotland have also requested that the worst case scenario be considered whereby all of the dredged material (172,000m^3 of sandy gravel & clay) is transported off site by road during the construction period. This has been carried out and in included further below in the Construction Flows section.

5.2.2 Accessibility Assessment

5.22 An accessibility assessment was undertaken to establish the existing transport provision serving Scrabster Harbour and its surrounds. The assessment considers travel by sustainable modes of transport including walking, cycling and public transport; and provides an assessment of available infrastructure and service provision.

5.23 Assessment of the existing facilities associated with the four main modes of transport (walking, cycling, public transport and private vehicle) is discussed in detail in the following sections.

5.3 Baseline

5.3.1 Pedestrian Facilities

5.24 The nearest pedestrian facilities to Scrabster Harbour are located on the A9 trunk road and are mostly well lit and relatively well maintained as shown in Figure 5.3 below.

5.25 The footway is sufficiently wide with a width of approximately 2.3m and provides an entirely off-road connection to Scrabster Ferry Terminal from Thurso.

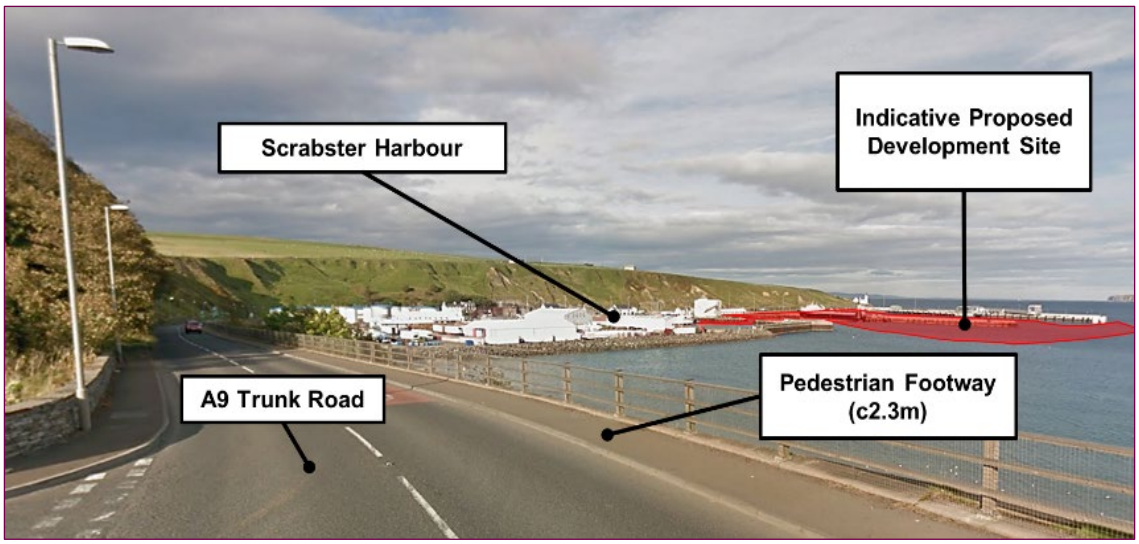


Figure 5.3 Pedestrian Facilities on A9 Trunk Road in the vicinity of Scrabster Harbour

5.26 The pedestrian footway runs along the northbound side of the A9 trunk road and terminates at the access to Scrabster Ferry Terminal. Figure 5.4 below shows the extent of the A9 trunk road serviced by a footpath between Scrabster Harbour and Thurso town centre.

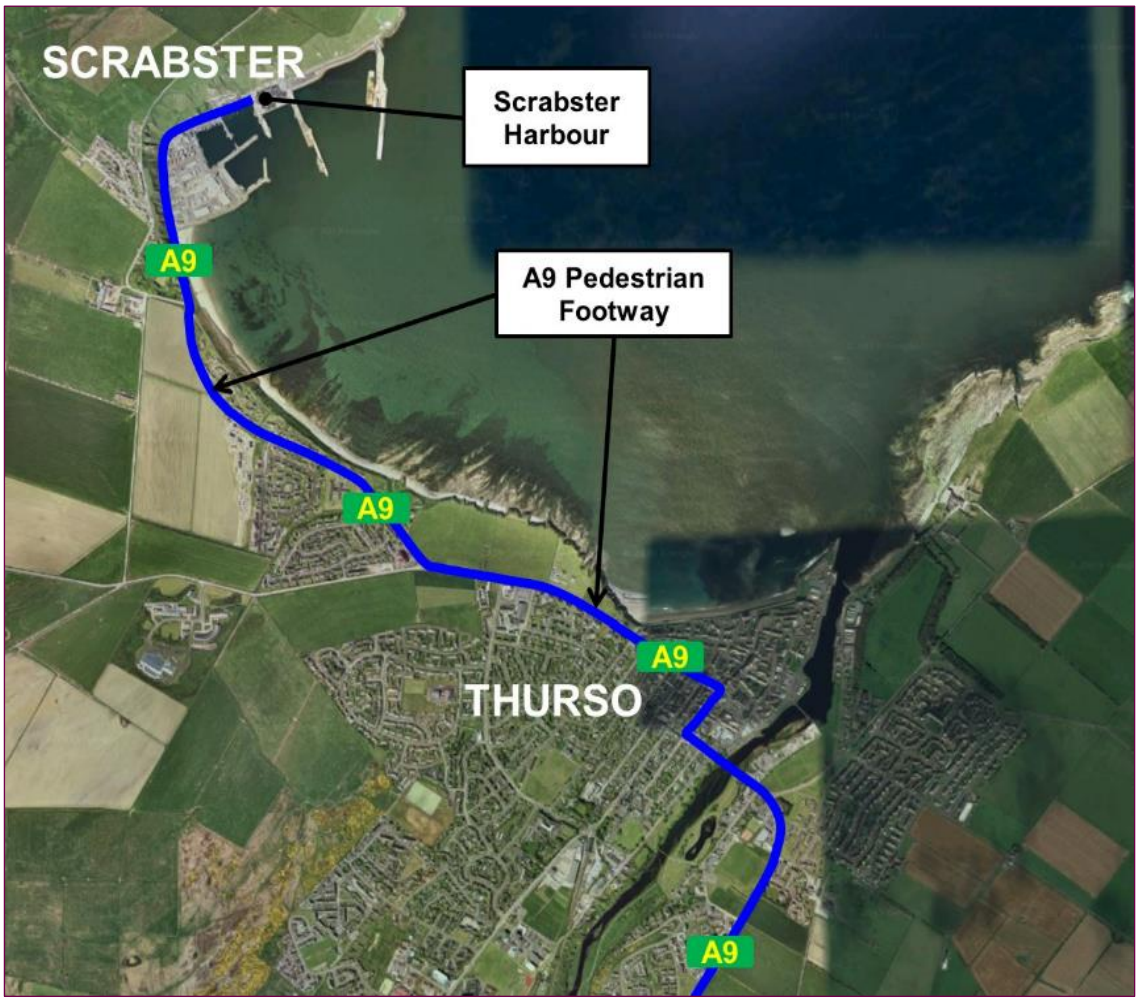


Figure 5.4 A9 Pedestrian Footway between Scrabster and Thurso

5.27 At the Harbour, the A9 footway terminates at the connection to an internal segregated passenger walkway that guides passengers to the terminal building, and is shown in Figure 5.5 below.

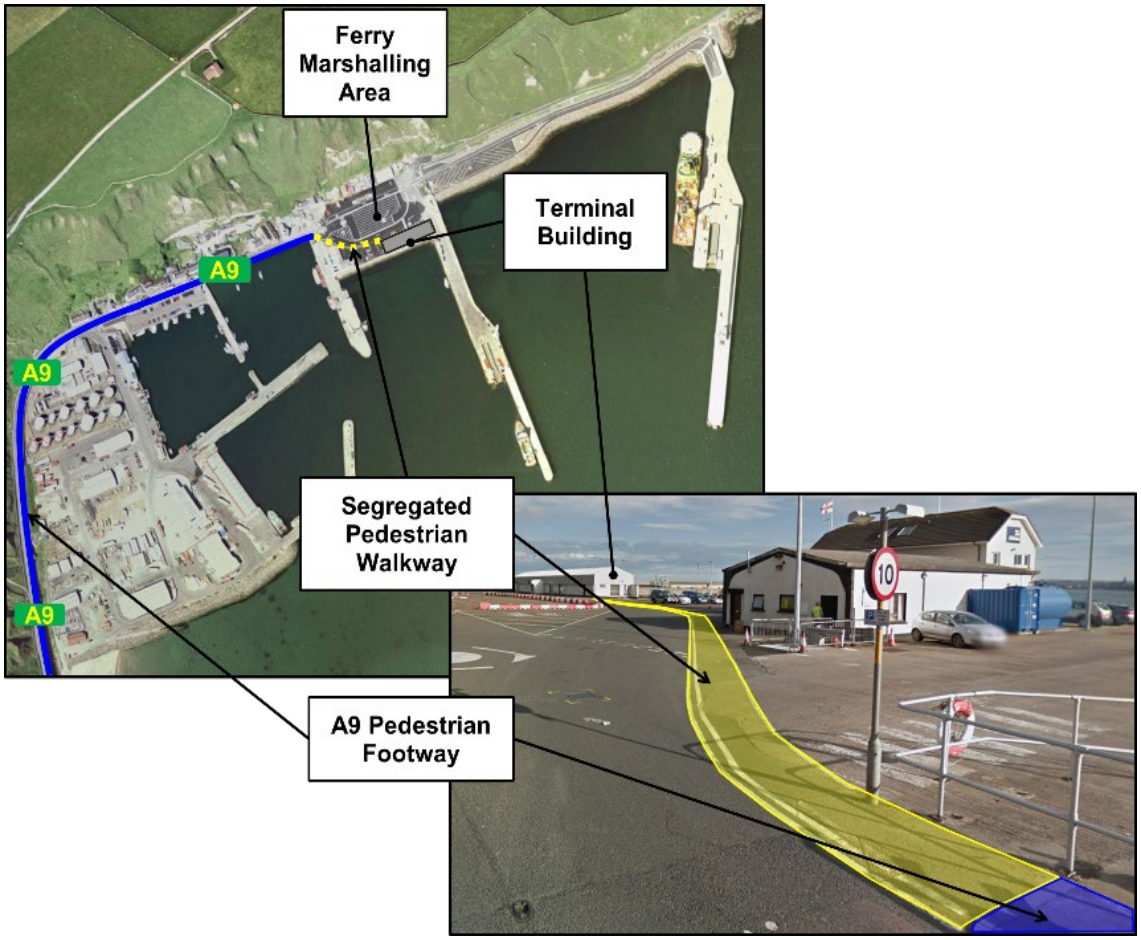


Figure 5.5 Ferry Passenger Walkway at Scrabster Harbour

5.28 It is clear from the information presented that Scrabster Harbour is well serviced by the current pedestrian facilities.

5.3.2 Cycling Facilities

5.29 The National Cycle Network (NCN) Route 1 is the only designated NCN route in the Highlands region of Scotland, and it passes close to the port as is demonstrated on the Sustrans network map shown in Figure 5.6 below.

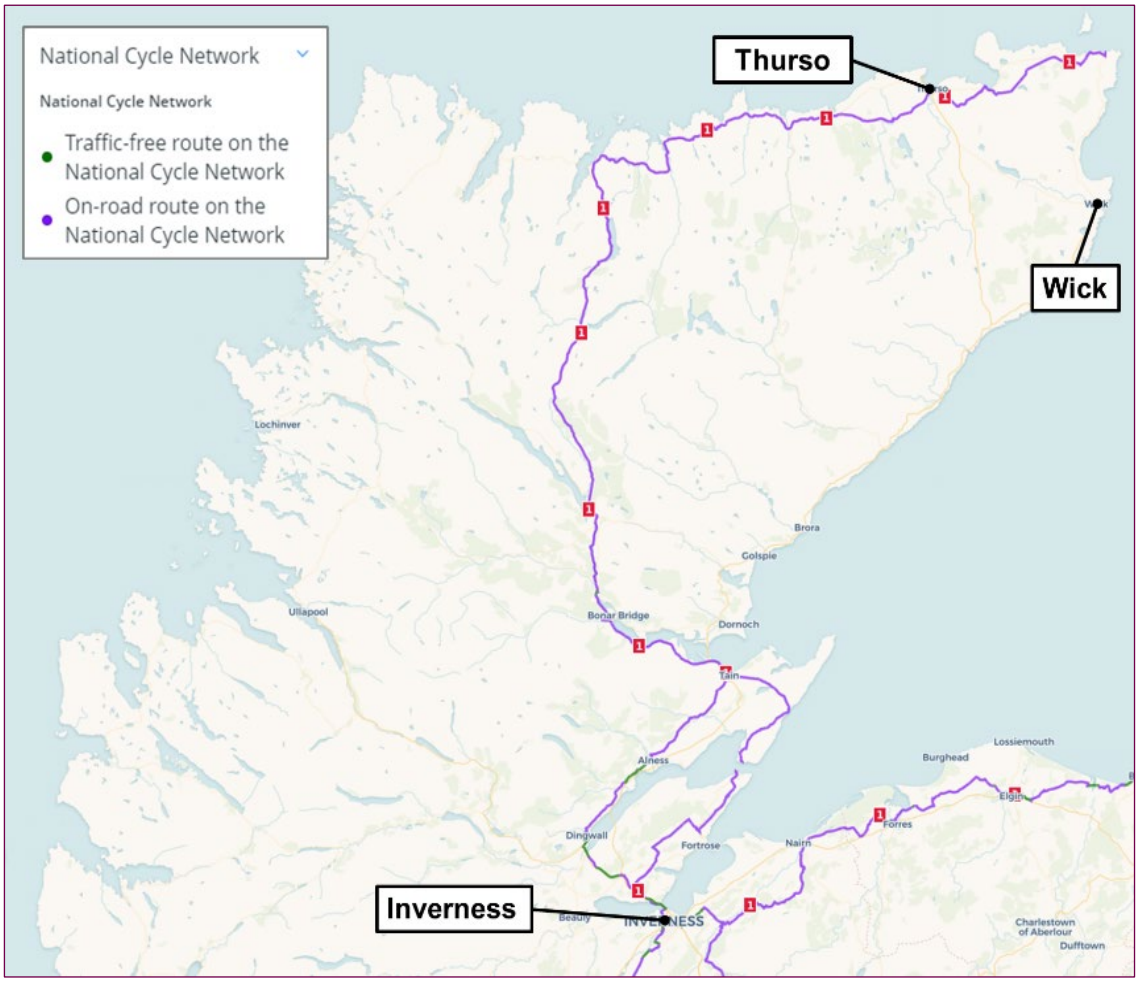


Figure 5.6 Sustrans NCN Route 1 – Northern Scotland, Highlands Region

5.30 Scrabster and Thurso are within an acceptable cycling distance from the site, and most ferry companies, including NorthLink Ferries permit taking a bicycle on-board free of charge.

5.31 Bicycle hire is available at 'The Bike Shop' on High Street in Thurso, see Figure 5.8, with daily bicycle hire available.

5.32 It is considered that current cycling facilitates servicing Scrabster Harbour are adequate.

Figure 5.7 Designated Cycling Facilities in the vicinity of the Scrabster Harbour

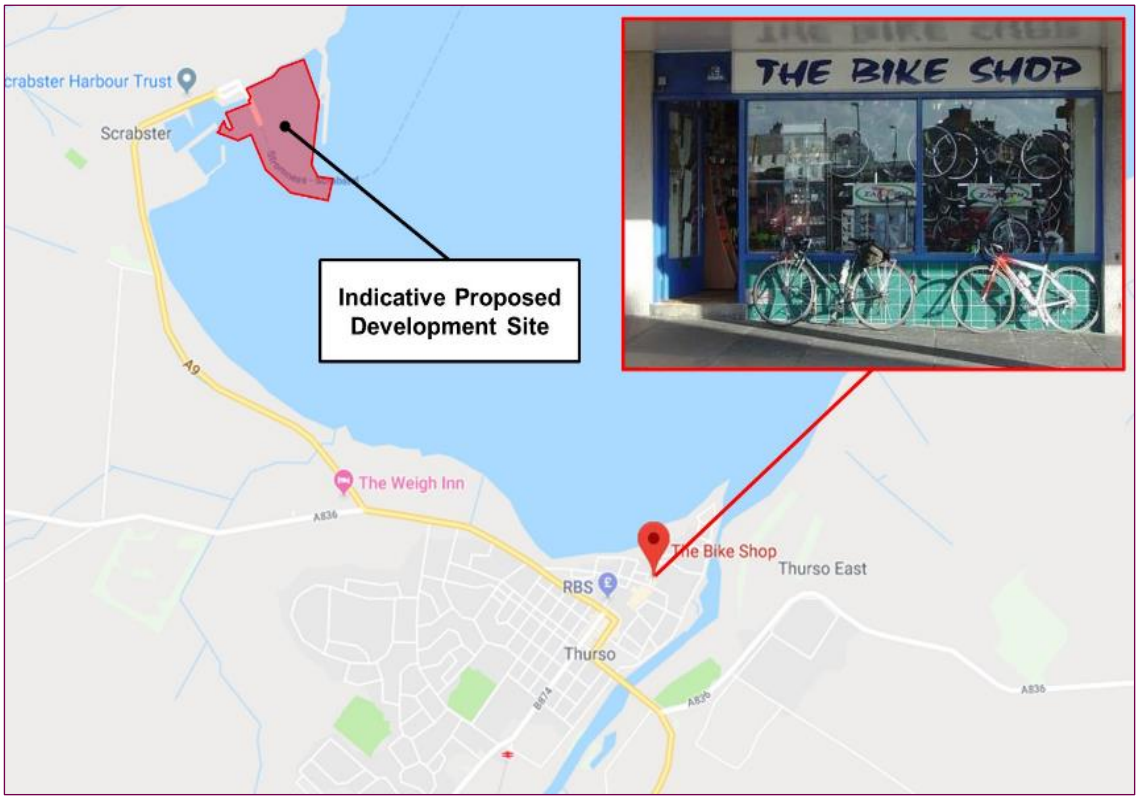


Figure 5.8 The Bike Shop, High Street, Thurso

5.3.3 Public Transport Facilities

5.33 Scrabster Harbour and its surrounds are currently serviced by bus, rail and ferry facilities.

5.34 Figure 5.9 shows the location of Thurso Bus Depot, Thurso Rail Station and Scrabster Ferry Terminal in relation to Scrabster Harbour.

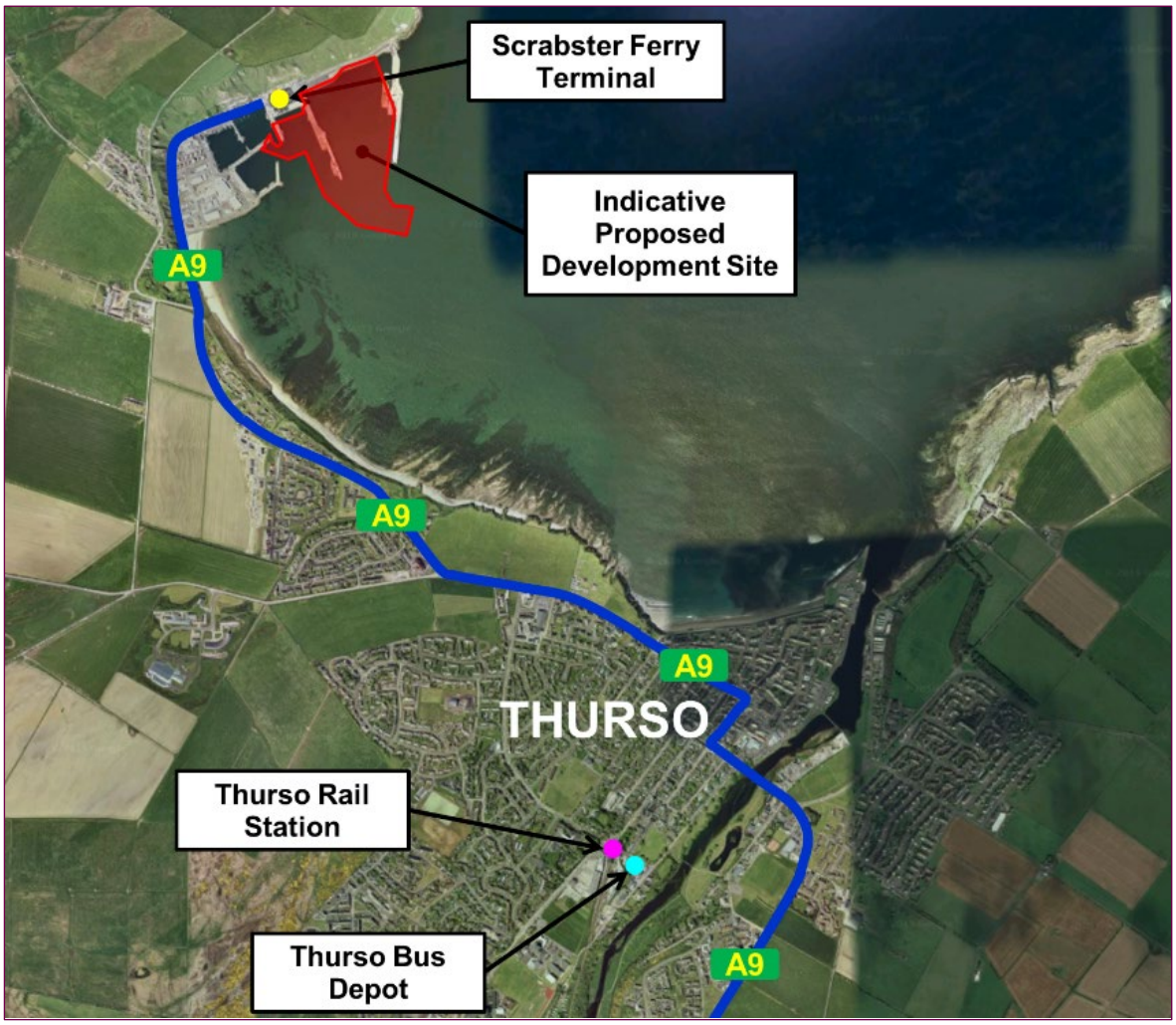


Figure 5.9 Location of Public Transport Hubs within the vicinity of Scrabster Harbour and its surrounds

Bus Facilities

5.35 Stagecoach is the main bus operator throughout the Caithness region. The X99 and 82 services run to and from Scrabster Ferry Terminal. A summary of the bus services available in April 2019 are shown in Table 5.1 below.

Table 5.1 Summary of Stagecoach Services serving Scrabster Harbour

Service Number	Route	Number of Services (per day)		
		Monday – Friday	Saturday	Sunday
82	Scrabster – Thurso – Wick	2	-	-
82	Wick – Thurso – Scrabster	2	-	-
X99	Scrabster - Thurso	3	3	2
X99	Thurso - Scrabster	3	3	2

5.36 Real-time bus information is provided on all routes and can be accessed via the Stagecoach website (www.stagecoachbus.com) or app. Figure 5.10 is an example of real-time bus information on the Stagecoach website.

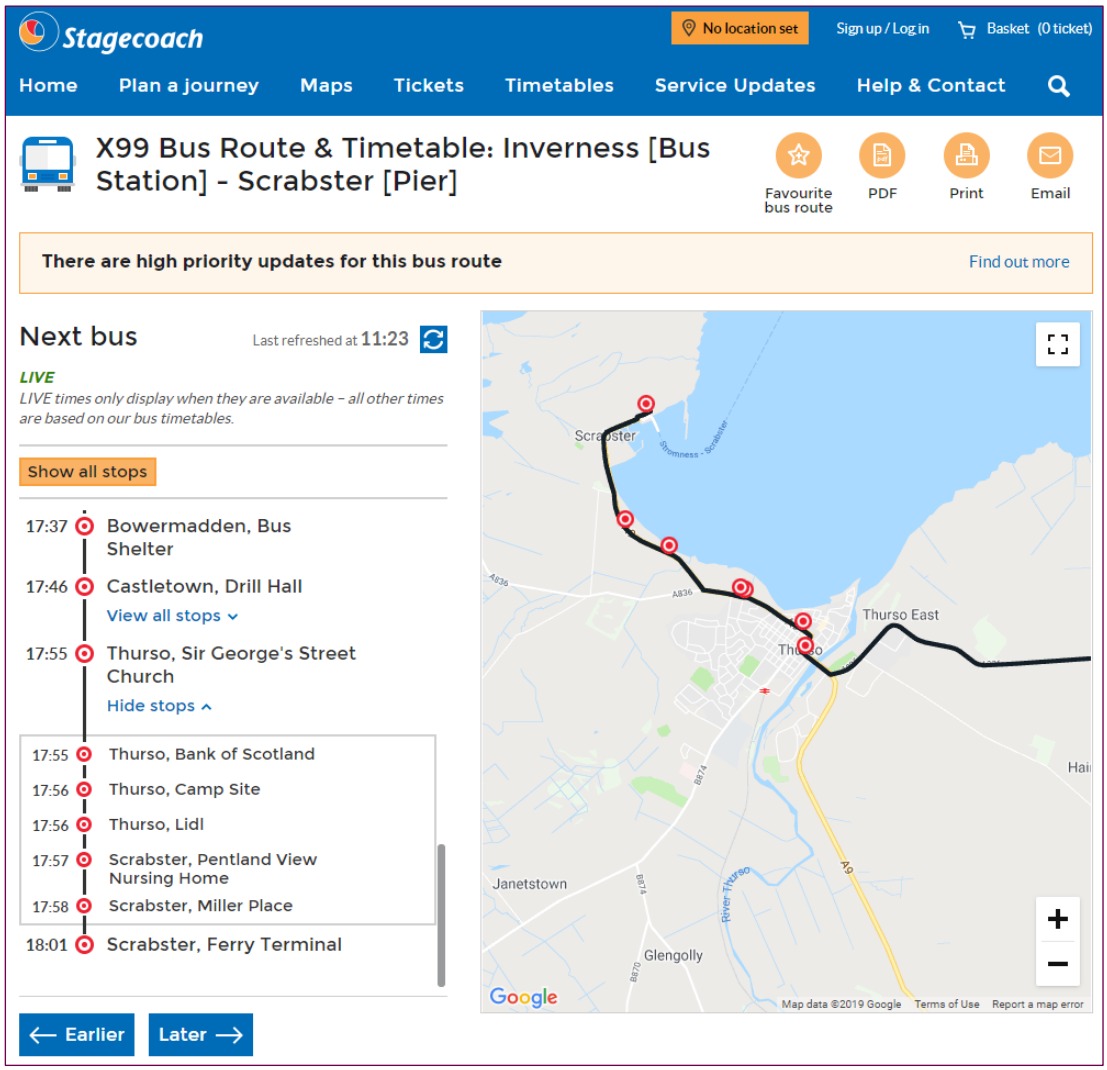


Figure 5.10 Example of Real-time Bus Service Information at www.stagecoachbus.com

5.37 The locations of the nearest bus stops to Scrabster Harbour are displayed in Figure 5.11. The bus stop at Scrabster Ferry Terminal is a flagged stop with a marked bus parking space, indicated in Figure 5.11. Buses arrive and depart from this stop at Scrabster Ferry Terminal.

5.38 Approximately 1.3 km from Scrabster Harbour is a southbound sheltered bus stop located at the access to Miller Place on the A9 trunk road. Figures 5.12 to 5.13 present examples of the bus facilities on the A9 within the vicinity of Scrabster Harbour.

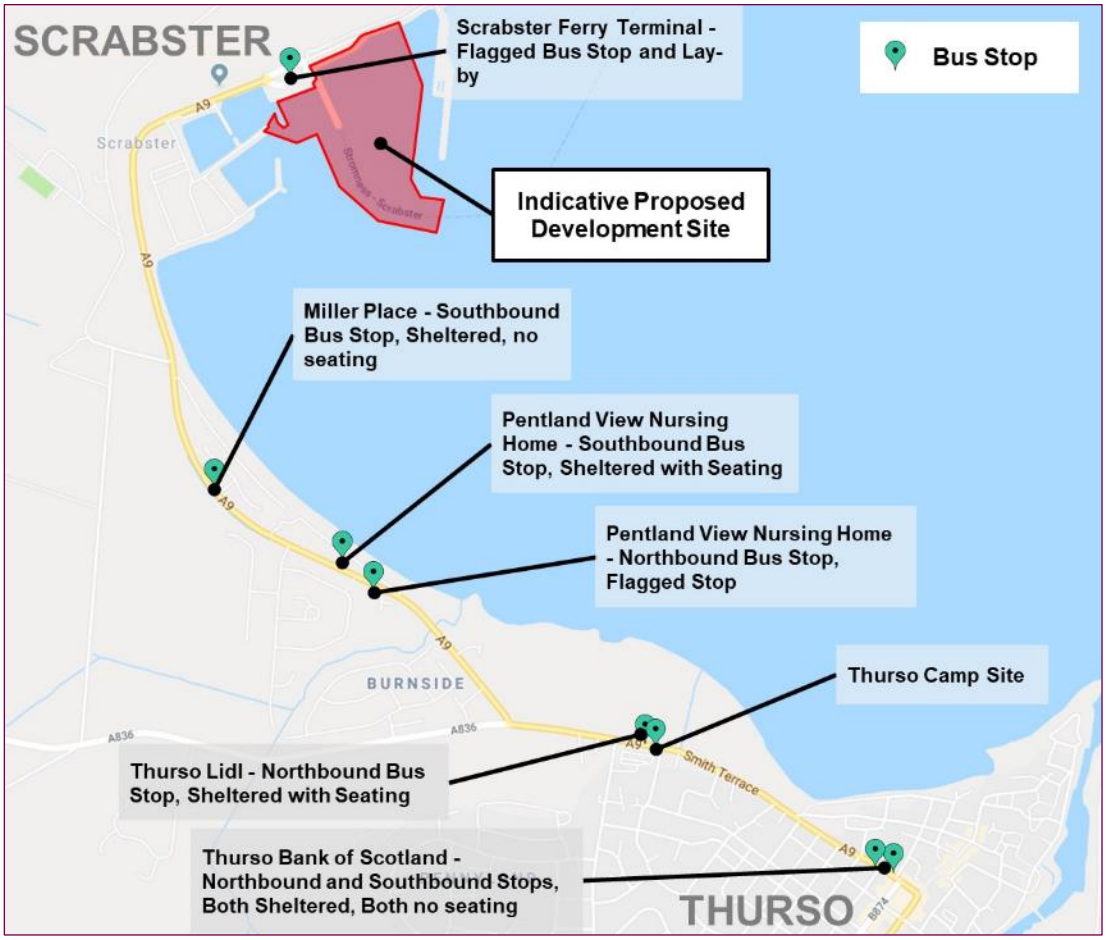


Figure 5.11 Bus Stop Locations in the vicinity of Scrabster Harbour

Figure 5.12 Bus Stop Facilities on A9 in the vicinity of Scrabster Harbour

Figure 5.13 Bus Stop Facilities on A9 in the vicinity of Scrabster Harbour

5.39 Thurso Bus Depot is located on Lovers Lane, approximately 2.3 miles from Scrabster Harbour. Figure 5.14 below shows the location of Thurso Bus Depot in the context of Thurso.

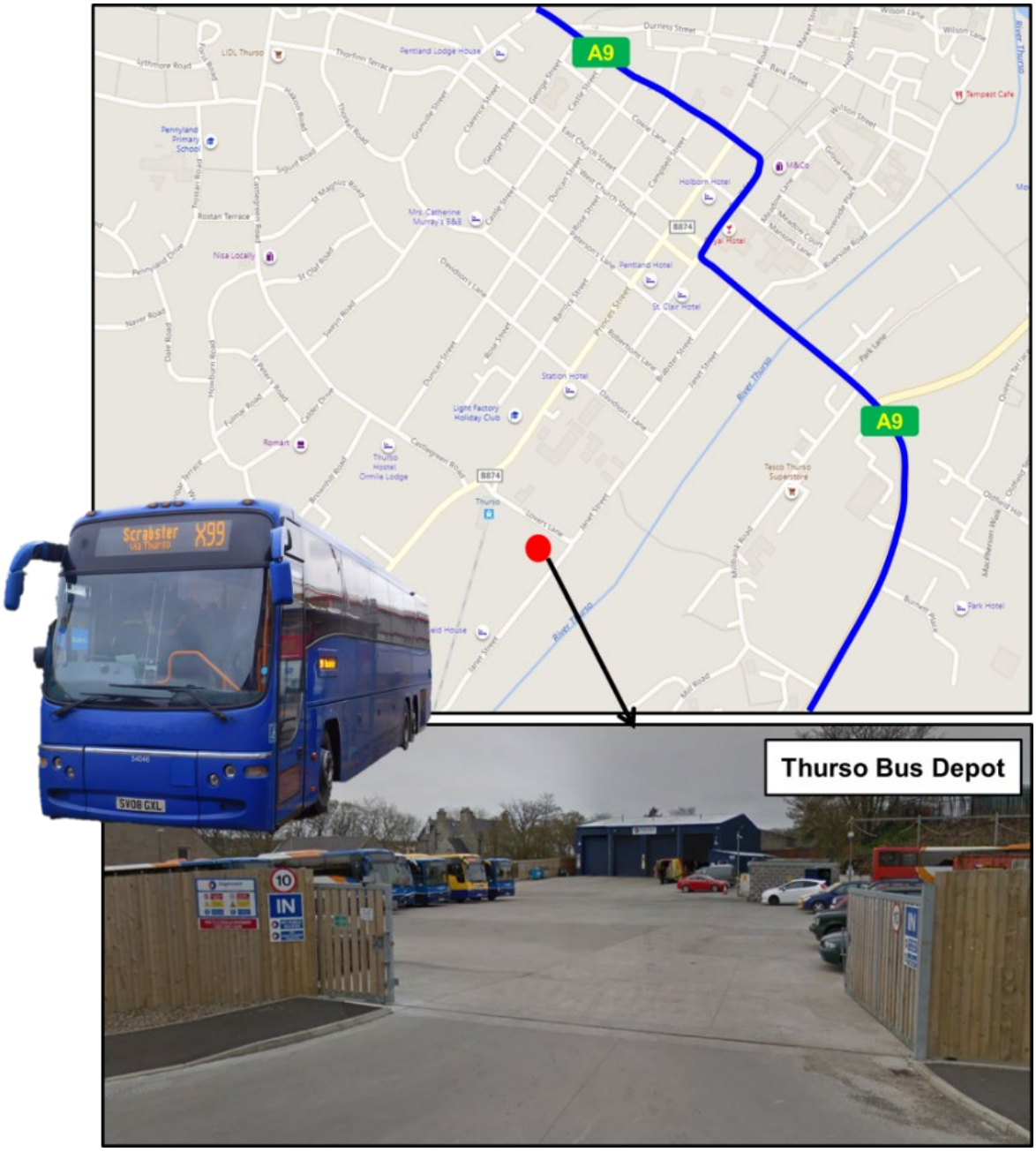


Figure 5.14 Thurso Rail Station

Rail Facilities

5.40 Thurso Rail Station is the northernmost railway station of the National Rail network, as is depicted in Figure 5.15.

5.41 ScotRail operate rail services between Thurso, Wick and Inverness. Figure 5.15 displays a diagram of the stations serviced by Scotrail within the Northern Highlands of Scotland. This is known as the Far North Line, a rural railway line entirely within the Highland council area of Scotland.

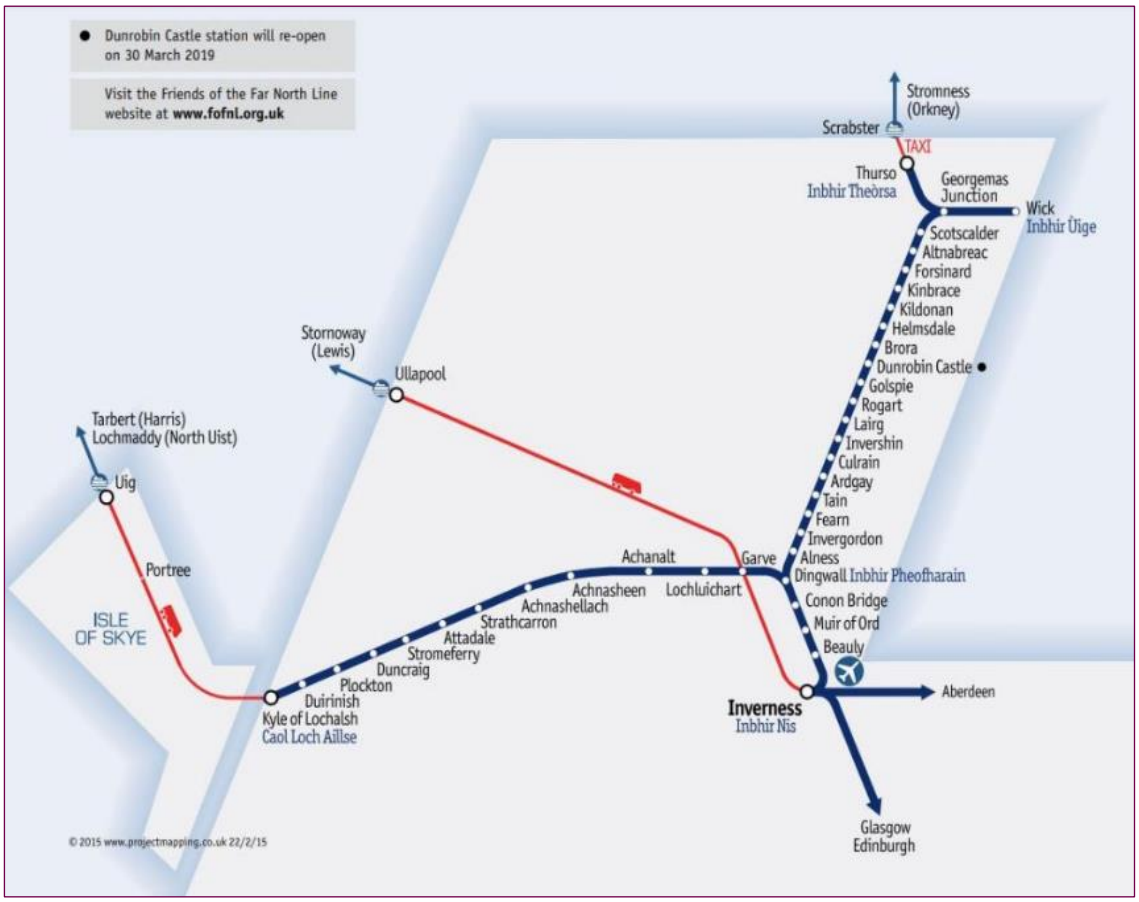


Figure 5.15 ScotRail North Highlands Rail Line and Stations

5.42 Thurso Rail Station is located on Lovers Lane, approximately 2.3 miles from Scrabster Harbour. The location of Thurso Rail Station, in the context of Thurso, is shown in Figure 5.16.

Figure 5.16 ScotRail North Highlands Rail Line and Stations

5.43 There are four trains a day between Thurso, Wick and Inverness, Monday to Saturday, and one on Sundays. Table 5.2 summarises the frequency of rail services available in April 2019 at Thurso Rail Station.

Table 5.2 ScotRail Train Schedule between Thurso, Wick and Inverness

Route	Number of Services (per day)	
	Monday – Saturday	Sunday
Northbound: Inverness – Thurso - Wick	4	1
Southbound: Wick – Thurso - Inverness	4	1

5.44 ScotRail work in partnership with some ferry companies, including Serco NorthLink Ferries Ltd., to provide combined 'Rail and Sail' tickets. Rail and Sail tickets are one ticket that includes both train and ferry travel. This removes the need to book in advance for ferries or queue at ferry ticket offices (however, the ticket will be subject to availability based on ferry capacity).

5.45 For Rail and Sail ticket holders travelling to or from Stromness, the connecting taxi service between Scrabster and Thurso Railway Station is included in the price and can be booked in advance.

5.46 Figure 5.17 outlines the northbound and southbound ScotRail services available in April 2019 between Inverness and Scrabster Harbour that coincide with ferry times to Stromness.

Inverness - Scrabster and Stromness

Mondays to Saturdays

		A SO	B SO	
Inverness	d	0700	0700	1400
Thurso	a	1059	1059	1750
Scrabster	d	1200	1315	1900
Stromness	a	1330	1445	2030

No Sunday rail connected sailings in this direction

Stromness and Scrabster - Inverness

Mondays to Saturdays

		SX	B SO	A SO	B SO
Stromness	d	0630	0630	0900	1100
Scrabster	a	0800	0800	1030	1230
Thurso	d	0834	0834	1306	1306
Inverness	a	1226	1226	1702	1702

Sundays

0900
1030
1229
1616

A - Except 6 & 20 Apr and 18 May
B - 6 & 20 Apr and 18 May only
SO - Saturdays Only
SX - Saturdays Expected

Figure 5.17 ScotRail Connecting Services between Inverness, Scrabster and Stromness

Ferry Services

5.47 NorthLink Ferries run a ferry service between Scrabster and Stromness on the Orkney Islands on the MV Hamnavoe. The ferry timetable available in the 2019 tourism season between Stromness and Scrabster is shown in Table 5.3 below.

5.48 During the off-peak season (September to May) there are two sailings per day Monday to Friday, one in the morning and one in the evening.

5.49 During the peak season (May to August) there are three sailings per day Monday to Friday. The third service sails in the afternoon.

5.50 The ferry link between Scrabster and Stromness is a 90 minute journey one-way.

Table 5.3 MV Hamnavoe Timetable

	Arrival at Scrabster Harbour from Stromness	Departure from Scrabster Harbour to Stromness	Arrival at Scrabster Harbour from Stromness	Departure from Scrabster Harbour to Stromness
Weekday Off Peak (May – Sep)	08:00	08:45	08:00	08:45
	18:15	19:00	18:15	19:00
Weekday Peak (May – Aug)	08:00	08:45	08:00	08:45
	12:30	13:15	12:30	13:15
	18:00	19:00	18:00	19:00
Weekend	10:30	12:00	10:30	12:00
	18:15	19:00	18:15	19:00

Cruise Services

5.51 Several cruise ships also dock in Scrabster Harbour. The provisional 2019 Cruise Schedule is shown in Table 5.4 below.

Table 5.4 Provisional 2019 Scrabster Harbour Cruise Schedule

Ship	Cruise Line	Gross Tonnage	Date	Origin - Destination	Passengers
Marco Polo	Cruise and Maritime Voyages (CMV)	22,050	22-May-19	Newcastle – Kirkwall	800
Prinsendam	Holland America	39,051	7-Jun-19	Stornoway - Invergordon	800
Seabourn Quest	Seabourn	32,477	26-Jun-19	Lerwick – Invergordon	500
Deutschland	Phoenix Reisen	22,496	2-Jul-19	Leith – Fort William	600
Hebridean Princess	Hebridean Island Cruises	2,112	12-Jul-19	Stornoway - Stromness	90

Hebridean Princess	Hebridean Island Cruises	2,112	4-Aug-19	Lyness - Invergordon	90
Seabourn Ovation	Seabourn	40,1350	12-Aug-19	Lerwick - Invergordon	650
Amadea	Phoenix Reisen	28,956	16-Sep-19	Leith – Fort William	600

5.52 The proposed traffic movements associated with the cruise calls is considered in detail in the Operational Traffic Flows section further below in the Chapter.

Taxi Services

5.53 There are numerous taxi services operating in the Caithness region. Some offer private hire and tours.

5.54 It is possible for passengers on cruise ships to book a taxi tour prior to landing at Scrabster Harbour, which will collect them from the terminal and leave them back at the end of the tour. Again this is considered in detail further in the Chapter.

5.3.4 Private Vehicle Facilities

5.55 Vehicular access to Scrabster Harbour and the proposed redevelopment site is provided by the A9 Trunk Road. It is a single carriageway and is depicted in Figure 5.18.

5.56 The A9 Trunk Road is the primary access road to the Scottish Highlands, as is shown in Figure 5.19 below, and it terminates at Scrabster Harbour.

5.57 In the vicinity of Scrabster Harbour, the A9 Trunk Road is approximately 5.3 m wide and is subject to a 40mph speed limit with a pedestrian footway as described previously in the Chapter. The posted speed limit on the A9 reduces to 30mph beyond signage entrance gateway to Scrabster Harbour.

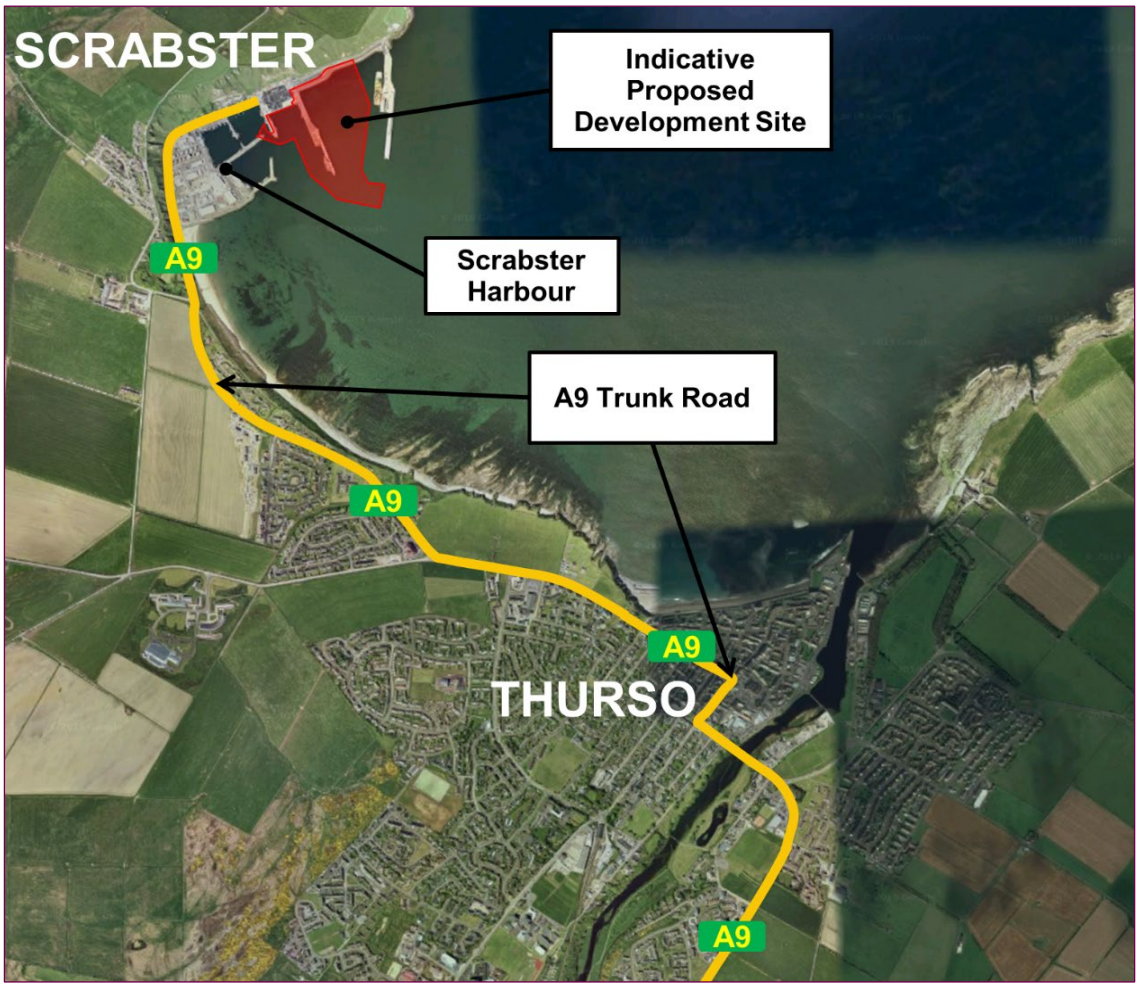


Figure 5.18 A9 Trunk Road in the vicinity of Scrabster Harbour

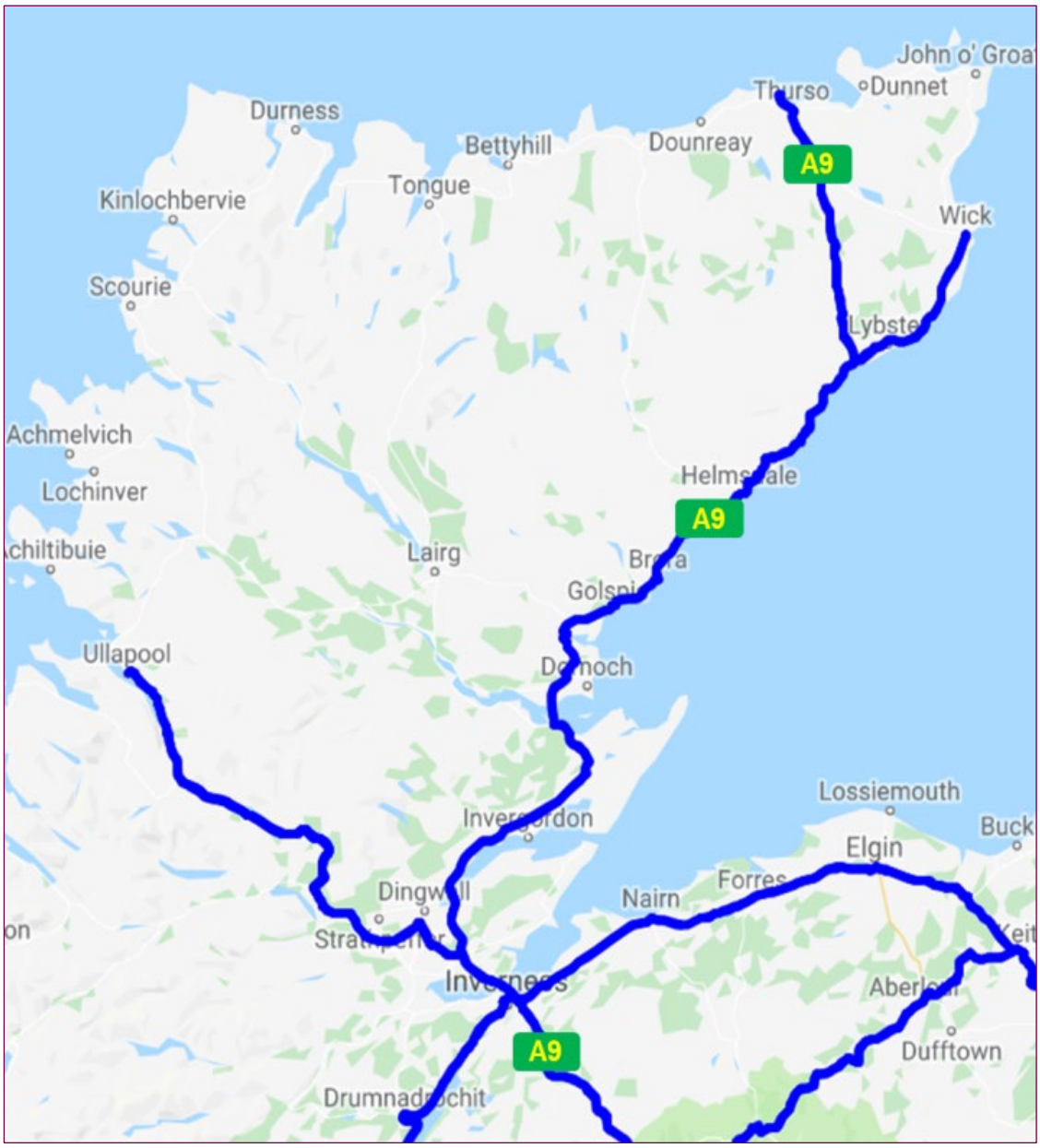


Figure 5.19 A9 Trunk Road from trafficscotland.org

5.58 It is clear from the information presented that Scrabster Harbour is well serviced by the existing private vehicle facilities.

5.3.5 Car Parking Facilities

5.59 Parking is available beside the ferry marshalling area where you pay on exit. Additional parking is available in the 'Pay and Display' car park in front of Scrabster Hotel. The locations of the car parks are presented in Figure 5.20.

5.60 The total number of available spaces in the Ferry Car Park is 32 plus 2 disabled parking spaces. 55 plus 3 disabled parking spaces are available at the Scrabster Hotel Car Park, giving a total number of parking spaces of 87 plus 5 disabled parking spaces.

5.61 Both car parks are operated by the Harbour Trust and the charge is £10 per week. Booking is not required as the car parks do not normally exceed their capacity. Overspill parking areas can be made available on request from the harbour office.

5.62 A drop-off point is located outside the main entrance of the terminal building and there is a drop-off space marked for the use of disabled passengers.

5.63 It is considered that the current car parking and circulation facilities at Scrabster Harbour will be adequate to serve the Harbour. The proposed redevelopment is not anticipated to affect current private car patterns at the Harbour. It is focused on enhancing berthage for cruise and oil & gas operations, with the parking, laydown and pick-up facilitates for the coaches and taxis relating to the cruise calls beings accommodated on the renovated pier. The project does not require additional parking facilities beyond the pier boundary.

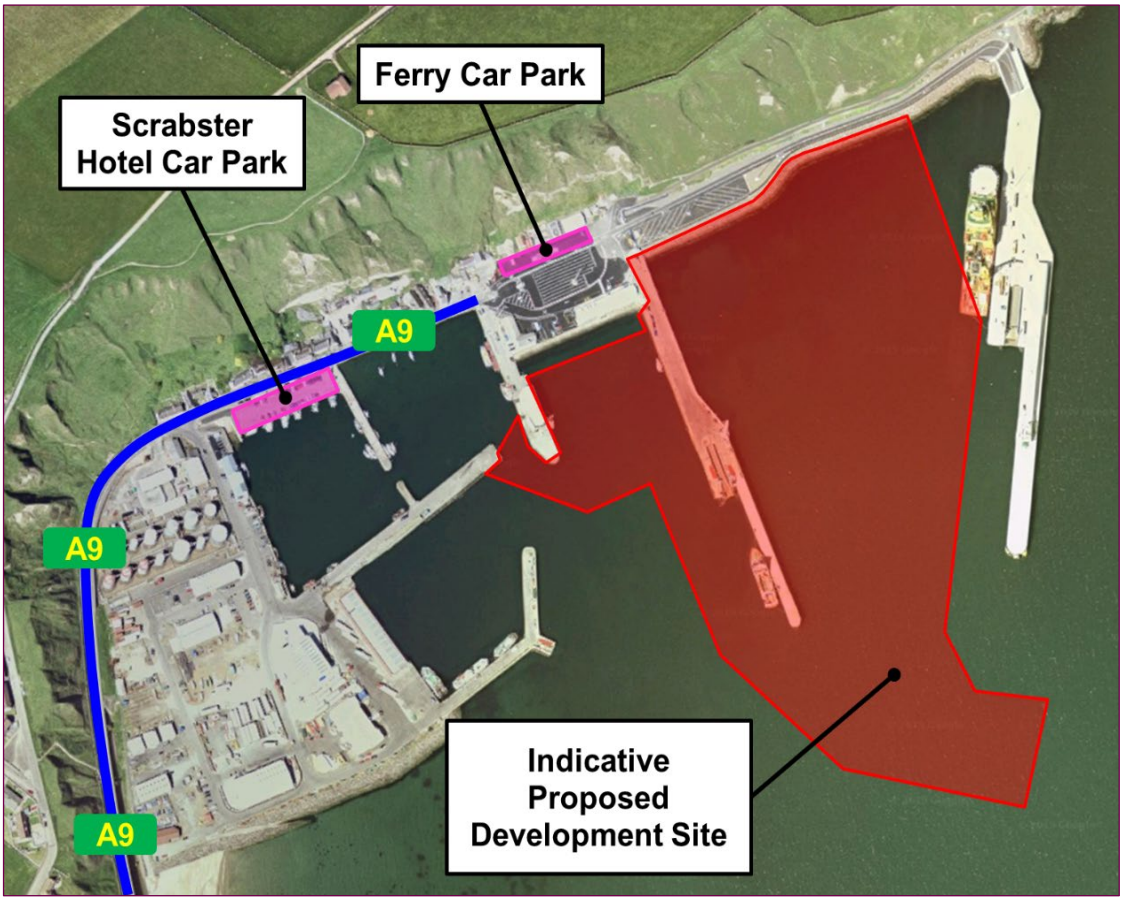


Figure 5.20 Car Parking Facilities, Scrabster Harbour

Summary of Accessibility Assessment

5.64 The accessibility assessment demonstrates the extent of the existing transport provision serving Scrabster Harbour and its surrounds.

5.65 The assessment determines that the site is accessible by sustainable modes of transport including walking, cycling and public transport; and provides an assessment of available infrastructure and service provision.

5.66 This Chapter demonstrates that the volumes of additional traffic generated by the redevelopment are relatively modest and are expected be accommodated within the Harbour.

5.67 It is considered that the current car parking and circulation facilities at Scrabster Harbour will be adequate to serve the Harbour. The proposed redevelopment is not anticipated to affect current private car patterns at the Harbour. It is focused on enhancing berthage for cruise and oil & gas operations, with the parking, laydown and pick-up facilitates for the coaches and taxis relating to the cruise calls beings accommodated on the renovated pier and will not require additional parking facilities beyond the pier boundary.

5.3.6 Baseline Traffic Conditions

5.3.6.1 Existing Traffic Flows Information

5.68 Automatic Traffic Count data (ATC) from the Counter 20801 was obtained from the Department for Transport to establish the existing traffic flows on the A9 in the vicinity of Scrabster Harbour. This is the nearest counter point to Scrabster Harbour and is located as indicated in Figure 5.21 below.

5.69 Transport Scotland provided supplementary information for this counter that included an hourly breakdown of the two-way vehicle flows for every day in 2018.

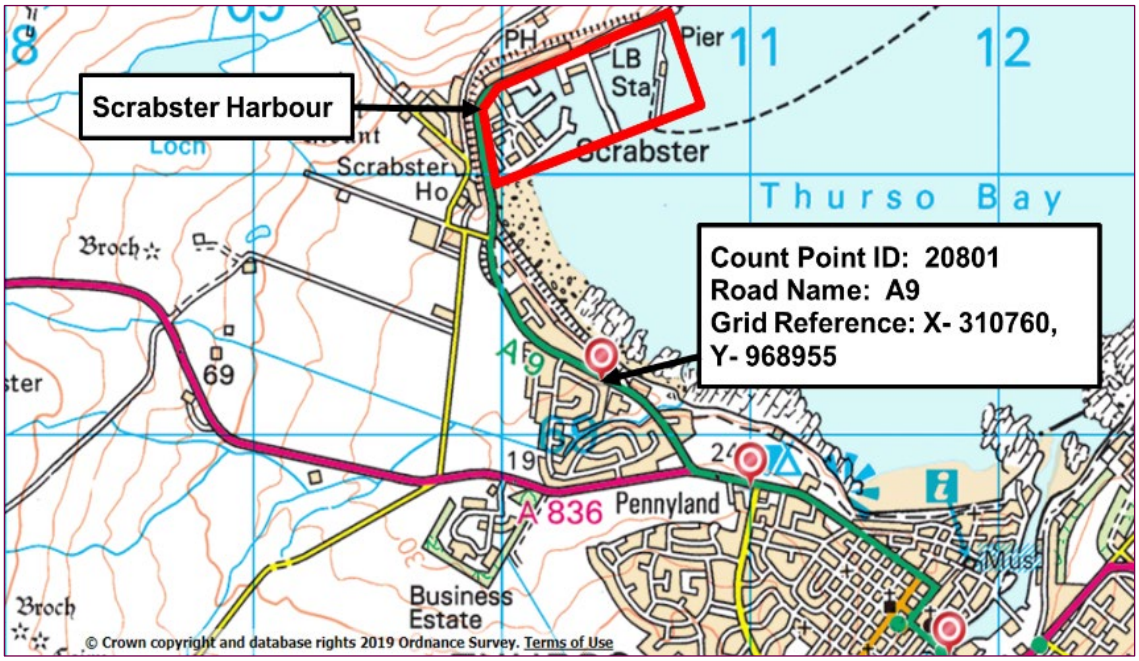


Figure 5.21 Location of ATC Counter on A9 in the vicinity of Scrabster Harbour

5.70 In addition to the traffic data, information regarding cruise and ferry schedules, festivals and events held in and around Scrabster or on the Orkney Islands, was gathered to identify the traffic volumes during peak periods.

5.71 The ferry schedule for the MV Hamnavoe operated by Northlink Ferries, and included in Table 5.3 above, was obtained from the Northlink Ferries website: https://www.northlinkferries.co.uk/timetables/.

5.72 The cruise schedule for 2018 was provided on request from SHT and is included in Table 5.5 below. The provisional 2019 cruise schedule, presented in Table 5.4 above, was obtained from the Scrabster Harbour website: http://www.scrabster.co.uk/sectors/ferries/.

5.73 SHT provided traffic data information relating to the oil & gas berthage activities with associated HGVs. SHT also provided data on the operation and management of the existing cruise passengers at the Harbour.

Table 5.5 Scrabster Harbour 2018 Cruise Schedule

Date	Ship	Gross Tonnage	From	To	Length (m)	Total Passengers
01-May-18	*Astoria*	16,144	Ullapool	Lerwick	160	482
02-May-18	*Hamburg*	15,067	Invergordon	Portrush	144	300
09-Jun-18	*Island Sky*	4,200	Aberdeen	Lerwick	102	69
01-Jul-18	*Silver Wind*	17,235	Ullapool	Iceland	156	262
13-Jul-18	*Gann*	6,257	Stornoway	Bergen	109	255
19-Jul-18	*Aegean Odyssey*	12,094	Iceland	Rosyth	141	307
31-Jul-18	*Aegean Odyssey*	12,094	Portree	Rosyth	141	275
13-Aug-18	*Seabourn Ovation*	40,350	Invergordon	Lerwick	210	573
15-Aug-18	*Saga Pearl*	18,627	Campbeltown	Leith	164	389
22-Aug-18	*Boudicca*	28,388	Greenland	Dover	207	614
23-Aug-18	*Hebridean Sky*	4,200	Lerwick	Stornoway	91	100
29-Aug-18	*Albatros*	28,518	Iceland	Bremerhavn	205	764

5.74 Information regarding festivals and events was gathered from various webpages including:

- https://hoyorkney.com
- https://whatsonhighlands.com
- www.highland.gov.uk
- www.orkneyfolkfestival.com
- www.scotlandinfo.eu
- www.shetland.org
- www.visitscotland.com

5.75 A summary of the main festivals and events held on the Orkney Islands and the Shetland Islands is provided in Table 5.6 below.

Table 5.6 Summary of the Main Events and Festivals on Orkney and Shetland, 2018

Date	Festival / Event
30-Jan-2018	Up Helly Aa Festival, Shetland
24-27 May-2018	36th Orkney Folk Festival
26-May-2018	Orkney's Farmer Market
15-21 Jul-2018	Stromness Shopping Week
27-29 Jul-2018	Hoy Hoolie (biannual event)

5.3.6.2 Existing Traffic Profile on A9

2018 A9 Traffic Data

5.76 The monthly breakdown of A9 traffic in 2018 is presented in Table 5.7.

5.77 Table 5.7 shows that the AADT on the A9 in 2018 is 3,223 vehicles.

5.78 The 2018 data provided by Transport Scotland was for vehicles and didn't include vehicle classification or HGV proportions, however the 2017 counted survey data from the Department from Transport does give vehicle classification, and shows that there were 3.7% Heavy Goods Vehicles (HGV) and Buses & Coaches on the A9. This is evidenced in Table 5.8 below.

Table 5.7 Monthly Breakdown of Total Vehicles on A9, 2018

Month	Total Vehicles Northbound	Total Vehicles Southbound	Total Two-way Flow	Avery Daily Traffic
Jan	42,796	41,673	84,469	2,725
Feb	41,548	41,624	83,172	2,970
Mar	46,888	46,467	93,355	3,011
Apr	48,372	47,468	95,840	3,195
May	55,725	55,055	110,780	3,574
Jun	53,819	54,076	107,895	3,597
Jul	55,594	54,967	110,561	3,566
Aug	**56,557**	**56,701**	**113,258**	**3,653**
Sep	50,303	50,258	100,561	3,352
Oct	47,867	47,729	95,596	3,084
Nov	45,884	46,002	91,886	3,063
Dec	43,947	45,034	88,981	2,870
Average Annual Daily Traffic (AADT)				**3,223**

Table 5.8 AADT Vehicle Classification Data on the A9, 2017, from Department for Transport Counted Survey

Year	AADT 2017
Count Method	Counted
Pedal Cycles	15
Two Wheeled Motor Vehicles	9
Cars & Taxis	2644
Buses & Coaches	25
Light Goods Vehicles (LGV)	367
Heavy Goods Vehicles (HGV)	92
All Motor Vehicles	3137
Proportion of HGV & Buses/Coaches	**117 (3.7%)**

5.79 Figure 5.22 shows the annual profile for two-way traffic movements on the A9 in 2018.

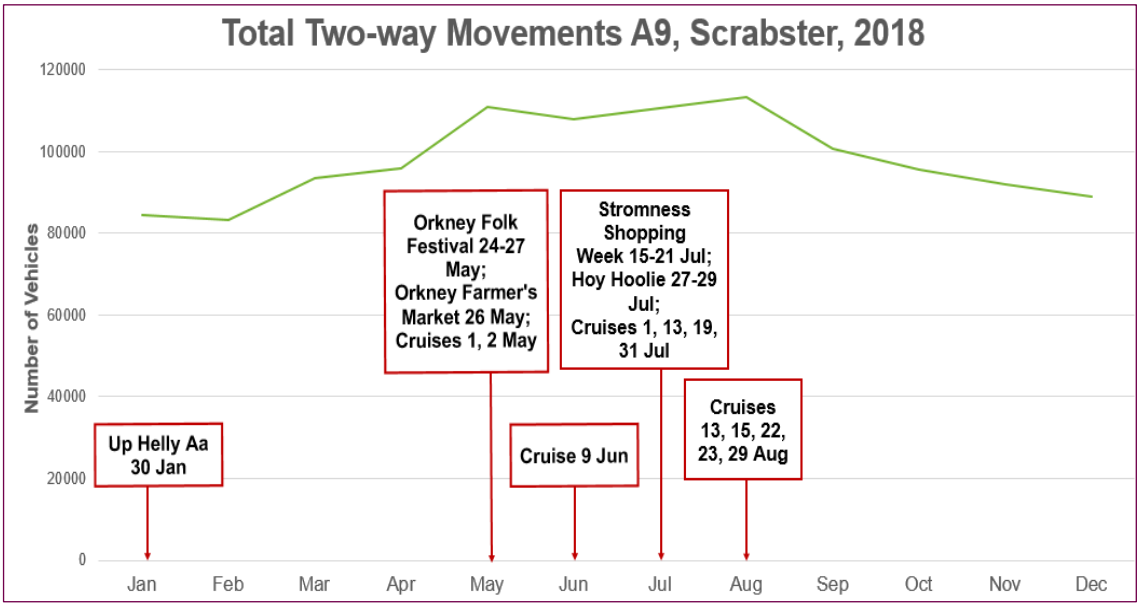


Figure 5.22 Total Two-way Traffic on A9 in the vicinity of Scrabster, 2018

5.80 Figure 5.22 shows the peak and off-peak periods with the highest vehicle numbers recorded between May and September, and gradually falling from September onwards. The month with the highest recorded number of vehicles recorded on the A9 in 2018 is August which coincides with five cruise arrivals throughout the month. This is illustrated in further detail in Figure 5.23 below.

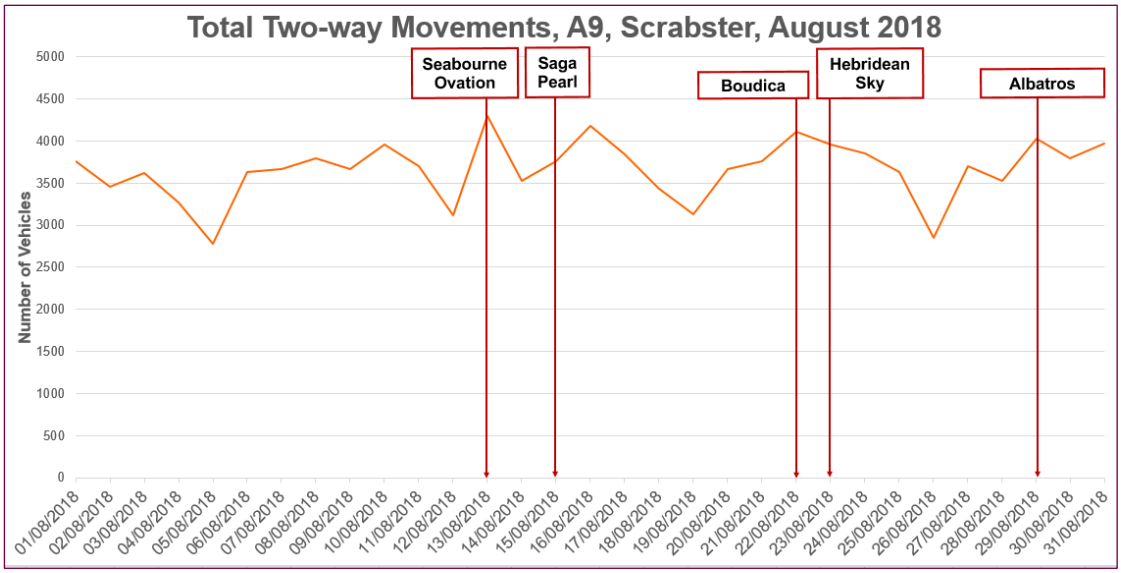


Figure 5.23 Total Two-way Traffic Profile on A9 and Cruises that docked in Scrabster Harbour during August 2018

5.81 There are no main events or festivals on Orkney or Shetland during the month of August, hence it is evident that the traffic peak on the A9 related to the summer peak combined with the cruise calls.

5.82 Figure 5.23 indicates that the highest number of vehicles was recorded on Monday 13 August 2018. This traffic volume coincides with the docking of the Seabourne Ovation at Scrabster Harbour, which had 573 passengers as shown in Table 5.5 above.

5.83 The second highest number of vehicles recorded was on Thursday 24 May 2018. The traffic volume recorded on this day coincides with the 36th Orkney Folk Festival held on the Orkney Islands on the 25 - 27 May 2018 (as per Table 5.6 above).

5.84 Table 5.9 summarises the two busiest days for A9 traffic in 2018 and the typical day in 2018. These are the base traffic flows that will be used to assess proposed traffic flows in the next section of the Chapter.

Table 5.9 AADT and Two Busiest Traffic Days in 2018

Scenario	Date	Day	Total Vehicles Northbound	Total Vehicles Northbound	Total Two-way Flow
Busiest traffic day of the year, Cruise berthed at Scrabster Harbour (573 Passengers)	13 Aug 2018	Monday	2,109	2,185	**4,294**
Second busiest traffic day of the year, no Cruise berthed at Scrabster Harbour, Orkney Folk Festival held on the Orkney Islands	24 May 2018	Thursday	2,148	2,044	**4,192**
Typical Day (ADDT)	**3,223** Two-way AADT with **3.7%** Heavy Vehicles				

Collision Statistics

5.85 Traffic collision data was obtained from www.crashmap.co.uk. The location and date of the recorded incidents are presented in Figure 5.24 below.

5.86 There has only been one incident of slight severity recorded on the A9 that occurred in 2014, hence in the past three years there have been no recorded traffic collisions on the A9, in the vicinity of Scrabster Harbour.

Figure 5.24 Location of Most Recent Traffic Collision Recorded on A9 in the Vicinity of Scrabster Harbour (https://www.crashmap.co.uk/)

5.87 Typically three traffic collisions over a three year period is the threshold that would warrant further investigation by the local highway authority to assess for the possibility of a fundamental safety issue. The level of traffic collisions recorded at this location on the A9 does not reach this threshold and therefore does not require further investigation of the safety of the road.

Traffic Growth Rates

5.88 National Roads Traffic Forecast (NRTF) medium growth rates have been used for predict further year base traffic flows. RPS attempted to find a localised growth rate from the traffic data procured from Department for Transport and Transport Scotland, however the combination of counted and estimated historic traffic patterns resulted in an erratic pattern that could not be relied on for an accurate estimate of future year growth. Hence the medium NRFT growth rates were used and are summarised in Table 5.10 below.

Table 5.10 NRFT Traffic Growth Rates

Year	NRFTMedium TrafficGrowth Rates
2018-2020	2.4%
2018-2021	3.6%

5.89 The year 2020 represents a year during which construction will take place and the proposed year of opening of the redevelopment is 2021.

5.4 Assessment

5.4.1 Operational Traffic Flows

5.90 This section of the Chapter establishes the operational traffic generated by the proposed redevelopment and assesses the likely impact compared to the base traffic flows.

5.91 Aspects of the proposed redevelopment that may impact on transportation when the redevelopment is operational are:

- Transportation activity relating to the 30 additional cruise calls per year and the increase in the number of passengers for each of the existing cruise calls during the operational period;
- Traffic increase due to the increased berthing activity for oil & gas vessels during the operational period.

5.4.2 Cruise Calls

5.92 Table 5.5 shows that there were 12 cruise calls in 2018. The proposals hope to increase the number of cruise calls by 30, to a total of about 42 per year. The proposals are also intended to accommodate cruise vessels up to 250m length, which typically have capacity for up to 1,000 passengers and 350 crew, a total of 1,350 people.

5.93 There is a shuttle bus service for cruise passengers that shuttle between the Harbour and Thurso every half hour when the cruise is in berth. This is an existing service which will continue at the same frequency when the proposed redevelopment is operational. Both passengers and crew can avail of the shuttle bus. The shuttle bus can be a 22, 41 or 51 seater depending on the size of the cruise vessel. To provide a robust assessment a 22 seater shuttle bus has been considered in this assessment.

5.94 A cruise call typically lasts about 12 hours, normally 07:00 to 19:00. The service runs on a loop every half hour typically between 0900 and 1700 , hence there are 32 shuttle bus services available for cruise passengers and crew, 16 southbound from the Harbour and 16 northbound returning from the town.

- *16 Services each direction x 22 Seats = 352 Returning Passengers & Crew*

5.95 Hence the shuttle bus can accommodate over 350 of the 1,350 passengers and crew. There is surplus space on the current service to accommodate this additional demand. Note that if the shuttle bus was a 41 or 51 seater, 656 and 816 passengers and crew could be accommodated respectively for the same frequency of bus service.

5.96 This is an existing service on the road network for the existing 12 cruises per year. Hence this bus will add an additional 960 bus trips to the network per year for the 30 additional cruise calls.

- *30 Additional Cruise Calls x 32 Shuttle Bus Services = Additional 960 Shuttle Bus Services per year*

5.97 Coaches are used to bring the cruise passengers on excursions. Normally there are morning excursions and an afternoon excursions. The same coaches return to the Harbour for the turnaround about lunchtime, described as follows.

- *10 Coaches arrive to the Harbour in the AM.*
- *The 10 Coaches load (50 Seats x 10 Coaches = 500 Passengers).*
- *The 10 Coaches depart from the Harbour heading outbound for an AM excursion.*
- *The 10 Coaches return from the excursion about lunchtime. The 500 Passengers disembark and another 500 Passengers board.*
- *The 10 Coaches depart from the Harbour heading outbound for an afternoon excursion.*
- *The 10 Coaches return from the excursion in the PM. The 500 Passengers disembark.*
- *The 10 Coaches depart the Harbour.*

5.98 Hence a total of 10 coaches will accommodate 1,000 cruise passengers on excursions, generating 60 coach movements per cruise call.

5.99 This is a robust assessment as the cruise companies work on a basis of only 40-50% of passengers taking an organised excursion, which equates to only 400 to 500 passengers.

5.100 There are already existing coach services on the road network for the existing 12 cruises calls per year. Hence an additional 1,800 coach trips will be added to the road network per year for the 30 additional cruise calls.

- *30 Additional Cruise Calls x 60 Coach Trips = Additional 1,800 Coach Trips per Year*

5.101 Some cruise passengers choose to organise their own excursions by private taxi, but these are relatively small numbers, assumed to be about 10 per additional cruise call. Assuming that each taxi has 4 passengers, this provides capacity for 40 passengers.

- *10 Taxis x 4 Passengers = 40 Passengers*

5.102 Assuming the worst case that each taxi will arrive empty and depart empty per commission, this results in 1,200 additional taxi trips per year on the road network.

- *10 Taxis x 30 Additional Cruise Calls = 300 Taxi Movements x 4 Trips = 1,200 Taxi Trips*

5.103 Hence over 1,350 passengers and crew per cruise call (352 shuttle bus + 1,000 coach + 40 taxi) can be accommodated by the traffic movements described above, adding an additional 3,960 vehicles to the road network per year (960 shuttle bus + 1,800 coach + 1,200 taxi).

5.104 The assessment described above is additionally robust for the following reasons:

- As described above walking, hiking, cycling and public transport services are also available at the Harbour. By considering that all the cruise passengers and crew travel by the vehicles described above a robust assessment is provided;
- The assessment above assumes that all additional 30 cruise calls have the full capacity of 1,350 passengers and crew. As this is unlikely, hence an additionally robust assessment has been provided.
- The cruise companies work on a basis of only 40-50% of passengers taking an organised excursion, which equates to only 400 to 500 passengers. The assessment above is based on capacity for 1,000 passengers on excursions.
- The shuttle bus can be a 22, 41 or 51 seater depending on the size of the cruise vessel. To provide a robust assessment a 22 seater shuttle bus has been considered in this assessment.
- As will be demonstrated below, the assessment is based on the year 2021 when the construction phase is complete and the redevelopment is operational. Although the construction will be completed in 2021, SHT have estimated that it will take 5 years of growth post construction before 30 additional cruise vessels to be realised. The assessment of percentage impacts on generated traffic flows against 2021 based year therefore provides an additionally robust assessment.

5.105 The parking, laydown and pick-up facilitates for the coaches and taxis will be accommodated on the renovated pier and will not require additional parking facilities beyond the pier boundary. Hence the proposals won't have an impact on the existing operational space of the Harbour.

5.4.3 Oil & Gas Berthage

5.106 Table 5.11 below shows the number of vessels over the last 12 months associated with the oil & gas berthage at the Harbour.

Table 5.11 Oil & Gas Activity, Number of Berthages and HGV.

Month	No. of Vessels Arrivals	No. of HGVs
May 2018	6	14
June 2018	11	22
July 2018	14	14
August 2018	16	33
September 2018	9	25
October 2018	8	15
November 2018	9	12
December 2018	10	22
January 2019	7	11
February 2019	3	2
March 2019	7	14
April 2019	6	36
Total	**106**	**220**

5.107 Table 5.11 shows that there are currently 106 berthages per year relating to oil & gas, generating 220 HGVs movements per year. It is anticipated that the number of berthages relating to oil & gas could double per year, increasing from approximately 1 every 3 days to 1 every 2 days. The number of HGVs would also double, increasing by 220 movements per year, or 440 HGV trips per year.

5.4.4 Summary of Generated Operational Traffic Flows

5.108 Table 5.12 summarises the generated operational traffic flows described above, which equate to a total of 4,600 vehicles per year.

Table 5.12 Summary of Annual Operational Generated Traffic

Generator		Trips (i.e. 2-way Flows) Per Year (Vehicles)
Cruise	Shuttle Bus	960
	Coach	1,800
	Taxi	1,200
Oil & Gas	Berthage	440 HGVs
Total		**4,400**

5.4.5 Impact of Generated Operational Traffic Flows

5.109 These operational generated flows will be compared against the base traffic flows to establish the impact on the road network.

Impact on AADT

5.110 Table 5.9 above demonstrated that the existing AADT in 2018 was 3,223.

5.111 Applying NRTF medium growth rates from Table 5.10 estimates an AADT of 3,339 in the year of opening 2021.

- *3,223 Vehicles per day x NRFT Medium Rate 1.036% = 3,339 Vehicles per day*

5.112 4,400 generated vehicles per year equates to 13 additional vehicles per day.

- *4,400 Vehicles / 365 Days = 12.1 Vehicles per day*

5.113 Therefore the proposed AADT in the year 2021 when the redevelopment is operational is 3,351. This is summarised in Table 5.13 below, and the heavy vehicles have been assessed in the same manner.

Table 5.13 Impact on AADT

Year	2018			2021		
Scenario	***AADT***	***Heavy Vehicles (Buses, Coaches HGVS)***	***HGV***	***AADT***	***Heavy Vehicles (Buses, Coaches HGVS)***	***HGV***
Existing	3,223	119	92	3,339	124	95
Generated	/	/	/	13	9	2
Proposed	/	/	/	3,351	132	97
% Impact	/	/	/	**0.36%**	**7.1%**	**1.3%**

**NB Vehicles are rounded to whole numbers*

5.114 Table 5.13 shows the percentage impact on the AADT is 0.36%, which is a negligible.

5.115 The percentage impact in heavy vehicles is 7.1%, and particularly the percentage impact in HGVs is 1.3%, which is comfortably below 30% threshold requested for consideration by Transport Scotland, confirming that further assessment is not required.

Impact on the Day with the Highest Traffic Volumes in 2018 – Cruise Call Day

5.116 Table 5.9 above showed that day with the highest traffic volumes in 2018 was Monday 13 August, when 4,294 AADT occurred on the A9 and a cruise call with 573 passengers was berthed at the Harbour.

5.117 573 passengers can be comfortably accommodated by approximately 4 coaches and 4 taxis and the existing shuttle bus. Had the cruise call had 1,350 passengers and crew on that day an additional 6 coaches and 6 taxis would have been required, adding 60 additional trips (36 coach trips and 24 taxi trips) to the road network on that day. This equates to 4,354 two-way flows, just 1.4% of the AADT that day, which is a negligible impact on the road network.

Impact on the Day with the Second Highest Traffic Volumes 2018 – Non-Cruise Call Day

5.118 Table 5.9 above also showed the day with the second highest traffic volumes in 2018 was Thursday 24 May, when 4,192 AADT occurred on the A9. No cruise was berthed that day, however the Orkney Folk Festival was being held.

5.119 If a cruise with 1,350 passengers and crew was also berthed that day, 132 additional vehicle trips (32 shuttle bus trips, 60 coach trips and 40 taxi trips) would have been generated to the Harbour. This would equate to 4,324 2-way vehicle trips which is 3.1% of the AADT that day, providing a minimal impact on the road network.

5.120 Again, it is highlighted that the assessment above is based on the year 2021 when the construction phase is complete and the redevelopment is operational. Although the construction will be completed in 2021, SHT have estimated that it will take 5 years of growth post construction before 30 additional cruise vessels and the doubling of the oil & gas berthage to be realised. The assessment of percentage impacts on generated traffic flows against 2021 based year therefore provides an additionally robust assessment.

5.121 In summary, the following has been demonstrated using a very robust assessment:

- On a typical day the proposed redevelopment will have a negligible 0.36% percentage impact on the AADT. The percentage impact in heavy vehicles is 7.1%, and particularly the percentage impact in HGVs is 1.3%, which is comfortably below the 30% threshold requested for consideration by Transport Scotland, confirming that further assessment is not required;
- On the worst traffic day, a day when a cruise is already berthed, the proposed redevelopment will have an impact in the region of 1.4% on the AADT, again this is negligible;
- On an existing day when the traffic flows are at their peak and a cruise isn't currently berthed within the Harbour, the proposed redevelopment will have a slightly higher impact of 3.1%, providing a minimal impact on the road network.

Construction Traffic Flows

5.122 Construction traffic flows have been estimated by assessing the 20 Month construction programme and the activity schedule to generate construction traffic. The calculation is based on the working hours contained in Chapter 2, Volume I, which are 08:00 to 19:00 Monday to Friday and 08:00 to 13:30 Saturday, equating to 11 hours per day for 5.5 days per week.

5.123 The results are presented in Figure 5.25 which shows that on average during the construction period there will be 1,300 construction vehicles generated by the site per month, with 5.4 construction vehicles generated per hour during the working hours.

5.124 The maximum peak will occur during the import of fill material to the site, which will occur for 4 months and will generate 15.4 construction vehicles per hour during the working hours.

5.125 The scoping response from Transport Scotland requested that a worst case scenario be considered whereby all of the dredged material (172,000m^3 of sandy gravel & clay) is transported off site by road during the construction period. This has sensitivity testing has been carried out and is included in Figure 5.26.

The results show that the maximum peak is the same as above, occurring during the import of fill material for 4 months and will generating 15.4 construction vehicles per hour during the working hours. The difference will be a 7 month period that generates a peak of 13.8 construction vehicles per hour. This has the effect of increasing the average generated construction vehicles from 1,300 to 2,324 per month, or an average of 9.6 per hour during the working hours.

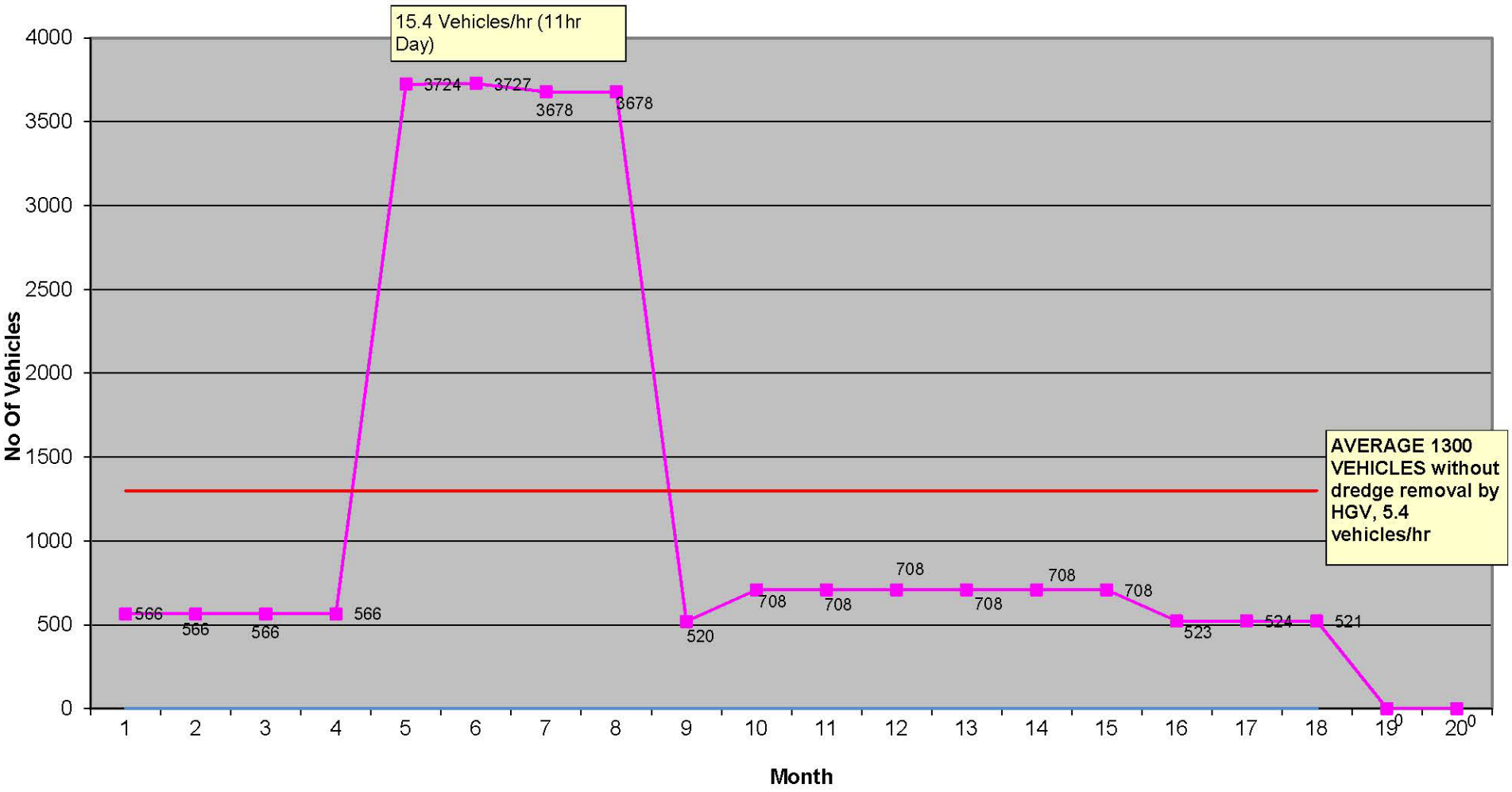


Figure 5.25 Construction Traffic Flows

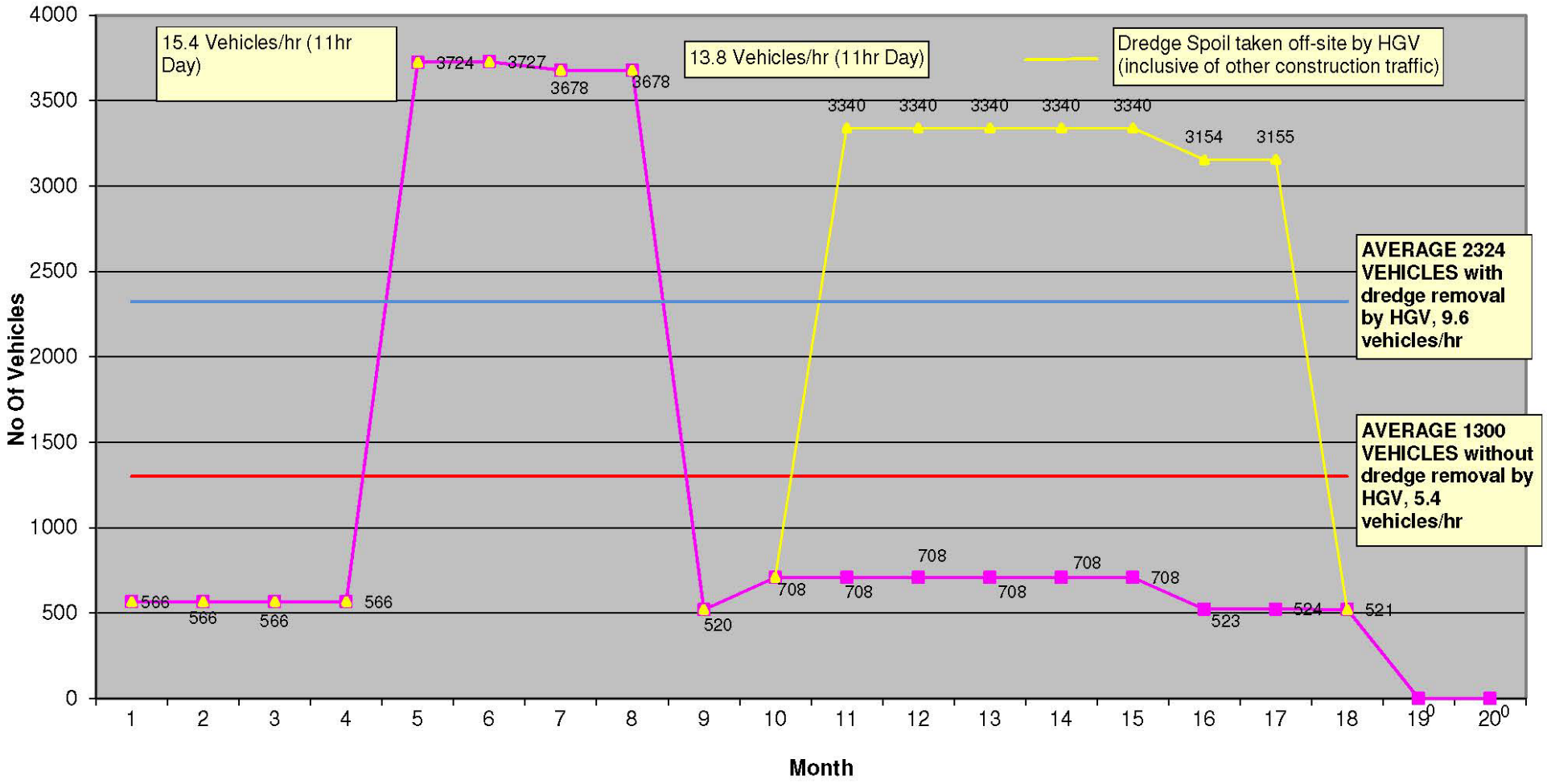


Figure 5.26 Construction Traffic Flows, Sensitivity Test, All Dredge Material Removed by Road

5.5 Mitigation and Monitoring

5.126 Some local members of the public have previously raised concerns in relation to major development at the Harbour regarding the prevention of material and debris falling from construction-related heavy vehicles. Mitigation relating to vehicle movements and vehicle emissions is set out in a Dust Management Plan in EIAR Volume II, Appendix 6.3, Volume II and includes measures to prevent material and debris falling from construction-related heavy vehicles.

5.127 A Construction Traffic Management Plan will be put in place and maintained throughout the construction period. The Contractor will liaise with the Local Authority in implementing its Construction Traffic Management Plan.

5.6 Cumulative Impacts

5.128 An assessment has been carried out of the committed projects identified for the proposed redevelopment and finds that the other projects identified for consideration in EIAR Volume II, Appendix 1.2 do not have notable traffic movements associated with them and that cumulative traffic impacts do not arise.

5.7 Summary and Conclusions

5.129 RPS was commissioned by SHT to prepare a TS within this EIAR for the proposed redevelopment of the existing St Ola Pier at Scrabster Harbour.

5.130 This Chapter takes cognisance of Chapter 4 of 'Transport Assessment Guidance' issued by Transport Scotland relating to TS's, and also addresses the comments received at scoping stage by The Highland Council and Transport Scotland.

5.131 Aspects of the proposed redevelopment that may impact on transportation are:

- Construction related traffic movements during the construction period;
- Transportation activity relating to the 30 additional cruise calls per year and the increase in the number of passengers and crew for each of the existing cruise calls during the operational period;
- Traffic increase due to the increased berthing activity for oil & gas vessels during the operational period.

5.132 The existing access and configuration arrangements at the port access and circulation area remain as existing within the redevelopment proposals. These will accommodate non-cruise related users, including the increase in oil & gas berthage related to the proposed redevelopment. The parking, laydown and pick-up facilitates for the coaches and taxis relating to the cruise calls will be accommodated on the renovated pier and will not require additional parking facilities beyond the pier boundary.

5.133 Scrabster Harbour has existing transport arrangements that are well established at the Port including vehicular access and circulation, walking, cycling and public transport. Details were provided on the current facilities available for all transport modes and demonstrated that the

existing arrangements combined with the renovated pier are expected to accommodate the additional traffic and people generated by the proposed redevelopment.

5.134 Automatic traffic count data (ATC) from the Counter 20801 was obtained from the Department for Transport to establish the existing traffic flows on the A9. Transport Scotland provided supplementary information for this counter that included an hourly breakdown of the two-way vehicle flows for every day in 2018. SHT provided traffic data information relating to the oil & gas berthage activities and information on the operation and management of the existing cruise passengers at the Harbour. Other transportation information was sourced online.

5.135 The two-way ADDT on the A9 in 2018 was 3,223 with 3.7% Heavy Vehicles. The day with the highest traffic volumes in 2018 was Monday 13 August, when 4,294 AADT occurred on the A9 and a cruise call with 573 passengers was berthed at the Harbour. The day with the second highest traffic volumes in 2018 was Thursday 24 May, when 4,192 AADT occurred on the A9. There was no cruise berthed that day, however the Orkney Folk Festival was being held.

5.136 There has only been one incident of slight severity recorded on the A9 that occurred in 2014, hence in the past three years there have been no recorded traffic collisions on the A9, in the vicinity of Scrabster Harbour. These levels are comfortably below the threshold that would indicate a fundamental safety issue on the local road network.

5.137 National Roads Traffic Forecast (NRTF) medium growth rates have been used to predict further year base traffic flows.

5.138 The report has demonstrated that over 1,350 passengers and crew per cruise call can be accommodated by 352 on the shuttle bus, 1,000 by coach and 40 by taxi. The 30 additional cruise calls per year adds an additional 3,960 vehicles to the road network per year (960 shuttle bus trips, 1,800 coach trips and 1,200 taxi trips).

5.139 It is anticipated that the number of berthages relating to oil & gas could double per year, increasing from approximately 1 every 3 days to 1 every 2 days. The number of HGVs would also double, increasing by 220 movements per year, or 440 HGV trips per year.

5.140 The assessment provided in the Chapter is additionally robust for the following reasons:

- Walking, hiking, cycling and public transport services are also available at the Harbour. By considering that all the cruise passengers and crew travel by vehicle a robust assessment is provided;
- The assessment assumes that all additional 30 cruise calls have the full capacity of 1,350 passengers and crew. As this is unlikely, hence an additionally robust assessment has been provided;
- The cruise companies work on a basis of only 40-50% of passengers taking an organised excursion, which equates to only 400 to 500 passengers. The assessment is based on capacity for 1,000 passengers on excursions.
- The shuttle bus can be a 22, 41 or 51 seater depending on the size of the cruise vessel. To provide a robust assessment a 22 seater shuttle bus has been considered in this assessment.
- The assessment above is based on the year 2021 when the construction phase is complete and the redevelopment is operational. Although the construction will be completed in 2021,

SHT have estimated that it will take 5 years of growth post construction before 30 additional cruise vessels and the doubling of the oil & gas berthage to be realised. The assessment of percentage impacts on generated traffic flows against 2021 based year therefore provides an additionally robust assessment.

5.141 This report demonstrates that:

- On a typical day the proposed redevelopment will have a negligible 0.36% percentage impact on the AADT. The percentage impact in heavy vehicles is 7.1%, and particularly the percentage impact in HGVs is 1.3%, which is comfortably below the 30% threshold requested for consideration by Transport Scotland, confirming that further assessment is not required;
- On the worst traffic day, a day when a cruise is already berthed, the proposed redevelopment will have an impact in the region of 1.4% on the AADT, again this is negligible;
- On an existing day when the traffic flows are at their peak and a cruise isn't currently berthed within the Harbour, the proposed redevelopment will have a slightly higher impact of 3.1%, providing a minimal impact on the road network.

5.142 Construction traffic flows have been estimated by assessing a 20 month construction programme and activity schedule to generate construction traffic. The calculation is based on the working hours contained in Chapter 2, Volume II, equating to 11 hours per day for 5.5 days per week.

5.143 The results show that on average during the construction period there will be 1,300 construction vehicles generated by the site per month, with 5.4 construction vehicles generated per hour during the working hours.

5.144 The scoping response from Transport Scotland requested that a worst case scenario be considered whereby all of the dredged material (172,000m^3 of sandy gravel & clay) is transported off site by road during the construction period. This has sensitivity testing has been carried out and the results show that this has the effect of increasing the average generated construction vehicles from 1,300 to 2,324 per month, or an average of 9.6 per hour during the working hours.

5.145 Some local members of the public have previously raised concerns in relation to previous development at the Harbour regarding the prevention of material and debris falling from construction-related heavy vehicles. Mitigation relating to vehicle movements and vehicle emissions is set out in a Dust Management Plan at EIAR Volume II, Appendix 6.3, Volume II and includes measures to prevent material and debris falling from construction-related heavy vehicles.

5.146 Committed schemes identified for consideration do not have notable traffic movements associated with them, hence a cumulative traffic impacts do not arise.

6 AIR QUALITY AND CLIMATE

6.1 Introduction

6.1 This Chapter presents the assessment of the effects on air quality and climate for the proposed redevelopment. The effects of 'Local' and 'Regional' air quality have been undertaken in accordance with the methodology for a 'Simple' assessment, as stated within the Design Manual for Roads and Bridges (DMRB) Advice Note 207/07, published by the Highways Agency (HA) (Highways Agency, 2007), and related Interim Advice Notes (IANs).

6.2 The incomplete combustion of fuel in vehicle engines results in the presence of hydrocarbons (HC) such as benzene (C_6H_6) and 1,3-butadiene (C_4H_6), and sulphur dioxide (chemical formula SO_2), carbon monoxide (chemical formula CO), and particulate matter (size fractions PM_{10} and $PM_{2.5}$) in exhaust emissions. In addition, at high temperature and pressures found within vehicle engines, some of the nitrogen in the air and fuel is oxidised to form NOx, mainly in the form of nitric oxide (chemical formula NO), which is then converted to nitrogen dioxide in the atmosphere. Nitrogen dioxide is associated with adverse effects on human health. Better emission control technology and fuel specifications ae expected to reduce emissions per vehicle in the long-term.

6.3 This Chapter summarises the levels of atmospheric pollution in the coastal area and also provides details on the latest available Highland Council's air quality reports. The air quality assessment considers the likely impacts of the proposal on the local environment and ascertains whether or not the proposed St. Ola Pier redevelopment will lead to a breach of relevant threshold levels of particular atmospheric pollution concentrations. This chapter also summarises the levels of atmospheric pollution in the vicinity of the scheme and also provides details on the local authorities recorded atmospheric pollution and background estimates. Changes in road traffic associated with any scheme has the potential to increase air pollution.

6.4 The impact of the proposal on air quality considers demolition, construction and operational phases of the proposed redevelopment. The Chapter also suggests mitigation measures during the demolition and construction phase to ameliorate potential impacts of fugitive dust and construction machinery emissions.

6.5 The principal objective being to indicate whether there is likely to be a significant air quality impact associated with the proposed redevelopment ('Do-Something') in comparison with the (no change) 'Do-Minimum' scenario for the future year of opening.

6.6 This chapter has the following supporting technical appendices:

- Volume II Appendix 6.1 DMRB Screening Model Inputs and Outputs;
- Volume II Appendix 6.2 Construction Phase Distance Banding Figure; and
- Volume II Appendix 6.3 Draft Dust Management Plan.

6.2 Assessment Methodology

6.7 The following section details relevant policy and guidance that has been referenced in order to undertake the assessment.

Policy Context

Air Quality, European Union and the UK

6.8 The Clean Air for Europe (CAFÉ) programme reconsidered the management of air quality within the European Union (EU) and replaced the EU Framework Directive 96/62/EC (Council of European Communities, 1996), its associated Daughter Directive 1999/30/EU (Council of European Communities, 1999), 2000/69/EC (Council of European Communities, 2000), 2002/3/EC (Council of European Communities, 2002), and the Council Decision 97/101/EC (Council of European Communities, 1997) with a single legal act, the Ambient Air Quality and Cleaner Air for European Directive 2008/50/EC (Council of European Communities, 2008). The 2008 ambient air quality directive sets legally binding limits for concentrations in outdoor air of major air pollutants that impact public health such as particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2). As well as having direct effects, these pollutants can combine in the atmosphere to form ozone (O_3), a harmful air pollutant, and potent greenhouse gas, which can be transported great distances by weather systems.

6.9 The 2008 directive replaced most of the earlier EU air quality legislation and was made law in Scotland through the Air Quality Standards (Scotland) Regulations 2010. The Regulations also incorporates the 4th air quality daughter directive (2004/107/EC) that sets targets for levels in ambient air of specific heavy metals and polycyclic aromatic hydrocarbons.

6.10 Further legislation is also in place to control emissions of air pollutants, with the main legislation being the UNECE Gothenburg Protocol. The Protocol was originally adopted by the executive body in 1999 to abate acidification, eutrophication and ground-level Ozone and sets emission ceilings for 2010 for sulphur, NOx, VOCs and ammonia. Similar ceilings have since been set in European law under the 2001 National Emission Ceilings Directive (2001/81/EC), which was subsequently made into UK law as the National Emission Ceilings Regulations 2002. The Protocol has since been amended in 2012 to include national emission reduction commitments to be achieved in 2020 and beyond.

Scottish Air Quality Legislation

6.11 The UK Government leads on the UK's input to International and European legislation relating to Air Quality, with input from the Scottish Government, and the other devolved administrations. Linking to the requirements of the EU Directives, the latest Air Quality Strategy published in July 2007 established the framework for air quality improvements across the UK. Measures agreed at the national and international level are the foundations on which the strategy is based. The strategy sets out the Air Quality Standards and Objectives which have been set to benchmark air quality in terms of protecting human health and the environment.

6.12 However, within the UK, air quality is a devolved matter, with the Scottish Government having responsibility for the development of air quality policy and legislation for Scotland. A summary of the current UK Air Quality Objectives is provided in Table 6.1.

Table 6.1: Chapter Summary of Air Quality Objectives (AQO) of the National Air Quality Strategy

Pollutant	Concentration	Measured as	To be achieved by
Benzene	3.25 µg/m^{-3}	Running annual mean	31 December 2010
1,3-Butadiene	2.25 µg/m^{-3}	Running annual mean	31 December 2003
Carbon Monoxide	10.0 mg/m^{-3}	Running 8-hour mean	31 December 2003
Lead	0.5 µg/m^{-3} 0.25 µg/m^{-3}	Annual mean Annual mean	31 December 2004 31 December 2008
Nitrogen Dioxide	40 µg/m^{-3} 200 µg/m^{-3} not to be exceeded more than 18 times a year	Annual mean 1-hour mean	31 December 2005 31 December 2005
Particles (PM_{10}) (gravimetric)	18 µg/m^{-3} 50 µg/m^{-3}, not to be exceeded more than 7 times a year	Annual mean 24 hour mean	31 December 2010 31 December 2010
Particles ($PM_{2.5}$)* (gravimetric)	10 µg/m^{-3} (limit)	Annual Mean	2020

**Note:* Authorities in Scotland Only

6.13 The assessment presented in this Chapter considers international and national legislation relevant to assess the impacts of redevelopment (and traffic volumes associated with such a redevelopment) on air quality (as presented in Table 6.1). The EU set pollutant concentration limit values in a series of Directives with statutory dates for member states to meet these targets. It is also a requirement from member states to regularly review and assess air quality in order to satisfy limit values by the required dates.

6.14 In particular, as set out in Table 6.1, the UK AQS objective for particulate matter (PM) smaller than 10µm aerodynamic diameter (PM_{10}) annual mean is 10 µg/m^{-3}. The Scottish AQS objective for the 24-hour mean PM_{10} concentration is 50 µg/m^{-3}, not to be exceeded on more than 7 days per calendar year and 18 µg/m^{-3} for annual mean. Particulate matter that is smaller than 2.5µm aerodynamic diameter ($PM_{2.5}$) is not currently included in the DMRB HA207/07 air quality guidance. In terms of nitrogen dioxide the annual mean is considered. As a proxy (and also understanding that hourly means are extremely difficult to model accurately) when the annual mean NO_2 concentration is below 60 µg/m^{-3}, it is not considered to represent a risk of exceedance of the 1-hour mean NO_2 objective (for human health). Objectives are derived from the standards and are a compromise between what is desirable purely on health grounds and what is practical in terms of feasibility and costs.

6.15 Standards are concentrations of pollutants that are considered safe for humans and the environment. In terms of vegetation and ecosystems, the UK Air Quality Objectives sets out levels for the protection of these. Table 6.2 details the concentrations.

Table 6.2: UK Air Quality Objectives for protection of vegetation and ecosystems - July 2007

Pollutant	Concentration	Measured as	To be achieved by
Oxides of Nitrogen (for protection of vegetation & ecosystems)	30 µg/m^{-3}	Annual Mean	31 December 2000
Sulphur Dioxide (for protection of vegetation & ecosystems)	20 µg/m^{-3} 20 µg/m^{-3}	Annual Mean Winter Average (Oct - Mar)	31 December 2000
Ozone*	18000 µgm$^{-3.h}$	AOT40+, calculated from 1h values May-July. Mean of 5 years, starting 2010	01 January 2010

6.16 *Ozone is not currently assessed by Scottish local authorities. AOT 40 is the sum of the differences between hourly concentrations greater than 80 µg m^{-3} (=40ppb) and 80 µg m^{-3}, over a given period using only the 1-hour averages measured between 0800 and 2000.

Local Air Quality Management (LAQM)

6.17 The Air Quality Strategy establishes a framework for the improvement of air quality and focusses on measures agreed at a national and international level. However, it was recognised, that despite such strategic measures, areas of poor air quality would likely remain, and that these will best be dealt with using local measures implemented through the Local Air Quality Management (LAQM) regime. Part IV of The Environment Act 1995 sets provisions for protecting air quality in the UK and for local air quality management.

6.18 The system of Local Air Quality Management has been in place in the UK since 1997 and is currently under review. The role of the LAQM review and assessment process is to review local air quality, identify all relevant locations where the air quality objectives are being or are likely to be exceeded. Where an area of exceedance is identified, the local authority is required to declare an Air Quality Management Area (AQMA) and implement an Air Quality Action Plan to improve air quality within the areas.

6.19 Authorities will continue to appraise air quality, with the main emphasis on those pollutants shown to be challenging in respect of compliance – Nitrogen Dioxide (NO_2), Particulate Matter (PM_{10}) and Sulphur Dioxide (SO_2), whilst introducing a new role for local authorities to work towards reducing levels of $PM_{2.5}$ in England and a statutory objective for this pollutant in Scotland. At the core of LAQM delivery are three pollutant objectives; these are:

- Nitrogen Dioxide (NO_2);
- Particulate Matter (PM_{10}); and
- Sulphur Dioxide (SO_2).

6.20 All current Air Quality Management Areas (AQMAs) across the UK are declared for one or more of these pollutants, with NO_2 accounting for the majority. It is a statutory requirement for local authorities to regularly review and assess air quality in their area and take action to improve air quality when objectives set out in regulation cannot be met.

6.21 Reflecting feedback under the LAQM review process the UK Government has decided to retain Benzene, 1,3-Butadiene, Carbon Monoxide and Lead in regulations for England. In recognition of the fact that all of the objectives for these pollutants have been met for several years and are well below limit values, local authorities in England do not have to report on these pollutants unless local circumstances indicate otherwise. These pollutants remain a statutory reporting requirement in Scotland, Wales and Northern Ireland.

6.22 As of January 2016, there are more than 700 AQMAs currently declared across the UK (nearly 600 of which are in England). Of these, the vast majority (over 90%) are related to road traffic emissions, where attainment of the annual mean objective for nitrogen dioxide (NO2) is considered unlikely, sometimes in association with exceedances of the 24-hour mean PM10 objective, or in Scotland the annual mean PM10 objective. By comparison, there are very few AQMAs associated with domestic, industrial or other transport-related emissions, although in Northern Ireland a number of AQMAs have been declared as a consequence of pollution associated with the residential heating sector. (DEFRA, 2016).

6.23 Highland Council undertake air quality monitoring and reporting aligned to the LAQM guidance. The latest available information is detailed in this chapter. The study area is not within an AQMA.

Relevant Guidance

Operational Phase: Road Traffic DMRB

6.24 The Highways Agency's Design Manual for Roads and Bridges (DMRB) Vol.11 Screening Model was referenced to consider if the traffic levels associated with the redevelopment met criteria requiring assessment, either DMRB Screening Method or detailed dispersion modelling. Through the acquisition of data from monitoring locations in the UK, the DMRB model can be used to predict concentration levels of NOx, NO_2, PM_{10}, CO, benzene, and 1,3 butadiene in addition, the model can be used to 'predict the number of exceedences of 50 $\mu g/m^{-3}$ as a 24-hour mean PM_{10} concentration' (DEFRA, 2009).

6.25 The DMRB screening method can be used to estimate NO_2 and PM_{10}, concentrations for comparison with AQS standards and objectives. This is an initial test to establish whether a more detailed assessment is required. If it is predicted that the air quality criteria would be exceeded, then the DMRB advises that detailed dispersion modelling is undertaken. There are two fundamental applications of the DMRB Screening Model. The first, commonly referred to as the Local Air Quality Assessment, is the estimation of roadside air pollution concentrations, associated with new or modified road schemes. The other application, known as the Regional Impact Assessment, is an estimation of total annual emissions arising from a road scheme. The Local Air Quality Assessment, using the DMRB, allows the user to specify up to 15 separate road links. The Regional assessment can accommodate many more links.

6.26 The DMRB provides estimates of annual average concentrations of the pollutants. Values are derived from these annual averages for comparison with Air Quality Objectives and guidelines. The derivations from annual mean values are based on observed statistical frequency distributions of pollutant concentrations in the UK and take into account the normal variability in traffic activity and weather conditions that give rise to high levels of pollution.

6.27 To work effectively, the model requires the input of traffic data, namely:

- Distance from receptor to centre of roads;
- Average daily vehicle flows and speeds;
- Road type (motorway or A road, other urban roads, other roads);
- The proportion of light and heavy duty vehicles;
- Background concentrations of pollutants; and
- Present and predicted future traffic emissions (accounting for legislation).

6.28 This assessment follows the approach set out by the DMRB Volume 11, Section 3, Part 1 (HA, 2007) for a 'Simple' assessment of local air quality. Local air quality is assessed using a 'Simple' assessment method.

6.29 The current most up to date guidance for the DMRB is cross referenced as required including Interim Advice Notes (IANs) (IANs provide supplementary guidance not contained within current standards, applicable to England, these are used in connection with works on motorways and trunk roads in England. The IANs are referenced in this assessment as best practice and to ensure the most up to date guidance and any changes have been accounted for):

- 170/12_V3 Updated air quality advice on the assessment of future NOx and NO_2 projections;
- 174/13 Updated advice for evaluating significant local air quality effects;
- 175/13 Updated advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Scheme Air Quality Action Plans;
- 185/15 Updated air quality advice on the assessment of link speeds and generation of traffic data into speed-bands.

6.30 The assessment considers the effect on air quality using the following scenarios:

- Current (2018) "Base Year Scenario", using traffic flow data for 2018, traffic emission and background pollution concentration for 2018, without the proposed redevelopment;
- Opening Year (2021) "Do - Minimum Scenario", using traffic flow data, traffic emission rate factors and background pollutant concentrations for 2021, without the proposed redevelopment;
- Opening Year (2021) "Do - Something Scenario", using traffic flow data, traffic emission rate factors and background pollutant concentrations for 2021, with the proposed redevelopment;
- Design Year (2031) "Do - Minimum Scenario", using traffic flow data, traffic emission rate factors and background pollutant concentrations for 2031, without the proposed redevelopment, and;
- Design Year (2031) "Do - Something Scenario", using traffic flow data, traffic emission rate factors and background pollutant concentrations for 2031, with the proposed redevelopment.

DMRB Local Assessment Criteria

6.31 The approach to considering an assessment or screening it out follows the guidance set out by the DMRB Volume 11, Section 3, Part 1 (HA, 2007). Requirements for a local air quality assessment emanate from the following criteria being met:

- Road alignment change by 5m or more; or
- Daily traffic flows change by 1000 Annual Average Daily Traffic (AADT) or more; or
- Heavy Duty Vehicles (HDV) flows change by 200 AADT or more; or
- Daily average speed change by 10km/hr or more; or
- Peak hour speed change by 20km/hr or more.

DMRB Regional Assessment Criteria

6.32 For regional air quality, the roads/link that meet the following criteria require assessment:

- a change of more than 10% in AADT; or
- a change of more than 10% in the number of HDVs; or
- a change in daily average speed of more than 20km/hr.

Operational Phase: Emission from Vessel Movement (Non road traffic)

6.33 Due to its dependence on fossil fuel combustion and the fact that it is one of the least regulated anthropogenic emission sources, emissions from the marine transport sector can contribute a large percentage to air pollution and climate change. In international and European air quality and climate policymaking, the need for international regulation on ship emissions has been acknowledged.

6.34 Against this backdrop the current EU environmental policy process is focusing on the shipping sector from a more thematic perspective such as implementing stricter sulphur regulations in 2012, the review of air quality legislation in 2013, and the proposal on Monitoring, Reporting and Verification (MRV) of maritime carbon dioxide (CO_2) emissions in 2013.

6.35 The principal pollutants related to shipping are those from internal combustion engines. These are CO, VOC, NOx and PM derived from soot which mainly have to do with engine technology, and CO_2, SOx, heavy metals and further PM (mainly sulphate-derived) which originate from the fuel speciation. On a European scale, SO_2 and NOx emissions from national shipping can be important with respect to total national emissions. Emissions of SO_2 from marine vessels are likely to decrease in future years.

6.36 The UK Technical Guidance on Local Air Quality Management (2016) recommends that detailed assessment of air quality impacts from Ports is required only for Ports with more than 5,000 shipping movements per year. A number of large UK Ports carried out a detailed assessment of sulphur dioxide emissions from Port activities. It was concluded that exceedences of EU Air Quality limit values only occurred at very large ports.

6.37 The UK LAQM therefore recommends that detailed air quality impact assessment be carried out where there is relevant exposure (sensitive receptors) within 250m of the emissions source and there are between 5,000 to 15,000 movements per year. Based on the criteria outlined in the LAQM. TG (2016) guidance, the harbour will not result in a significant negative impact on local air

quality. This conclusion is backed up by research at a number of large Ports in the UK (Isle of Wight, Aberdeen, Portsmouth and Southampton), which concluded that emissions from shipping and associated activities did not result in a breach of Air Quality limit values.

6.38 Consequently, vessel emissions are likely to have an insignificant impact on ambient air quality as a result of the operation of the proposed redevelopment.

Operational Phase: IAQM - Land Use Planning & Development Control: Planning for Air Quality

6.39 The approach is consistent with the Environmental Protection United Kingdom (EPUK)/Institute of Air Quality Management (IAQM) Land-Use Planning & Development Control: Planning for Air Quality document, the IAQM Guidance on the assessment of dust from demolition and construction and, where relevant, Defra's Local Air Quality Management Technical Guidance: LAQM.TG(16). It includes the key elements listed below:

- Reference to official government estimates from Defra, publicly available air quality monitoring data for the area, and relevant Air Quality Review and Assessment (R&A) documents;
- Design Manual for Roads & Bridges (DMRB) Volume 11, Section 3, Part 1, HA207/07 Air Quality is referenced;
- A qualitative assessment of likely construction-phase impacts with mitigation and controls in place.

Construction Phase: IAQM (2014): Guidance on the Assessment of Dust from Demolition and Construction

6.40 Dust is the broad term used to describe particulate matter in size ranging from 1 µm -75 µm in diameter. Particulate matter greater than 75 µm in diameter are termed grit rather than dust. Dusts can therefore contain a wide range of particles of different sizes. The normal fate of suspended dust in the atmosphere is eventual deposition. The rate of deposition depends largely on the size of the dust particle and its density; combined these influence the aerodynamic and gravitational effects that dictate the distance it travels and how long it stays suspended in the air before it settles onto a particular surface. In addition, some particles may agglomerate to become larger particles; whilst others can react chemically. The effects of dust are linked to particle size and two main categories are usually considered:

- PM_{10} particles, those up to 10 µm in diameter, remain suspended in the air for long periods and are small enough to be breathed in and so can potentially impact on human health; and
- Dust, generally considered to be particles larger than 10 µm which fall out of the air quite quickly and can soil surfaces (e.g. vehicles, windowsill, laundry).

6.41 The IAQM Guidance on the assessment of dust from demolition and construction sets out 350 m as the distance from the site boundary and 50 m from the site traffic route(s) up to 500 m of the entrance, within which there could potentially be nuisance dust and PM10 effects on human receptors. For sensitive ecological receptors, the corresponding distances are 50 m in both cases. These distances are set to be deliberately conservative. EIAR Volume II, Appendix 6.2 details distance bandings for the construction phase.

6.42 Concentration-based limit values and objectives have been set for the PM_{10} suspended particle fraction, but no statutory or official numerical air quality criterion for dust annoyance has been set at a UK, European or World Health Organisation (WHO) level. Construction dust assessments have tended to be risk based, focusing on the appropriate measures to be used to keep dust impacts at an acceptable level.

6.43 The IAQM dust guidance aims to estimate the impacts of both PM10 and dust through a risk based assessment procedure. The IAQM dust guidance document states: “The impacts depend on the mitigation measures adopted. Therefore the emphasis in this document is on classifying the risk of dust impacts from a site, which will then allow mitigation measures commensurate with that risk to be identified.” (IAQM, 2014)

6.44 The IAQM dust guidance provides a methodological framework but notes that professional judgement is required to assess effects: “This is necessary, because the diverse range of projects that are likely to be subject to dust impact assessment means that it is not possible to be prescriptive as to how to assess the impacts. Also a wide range of factors affect the amount of dust that may arise, and these are not readily quantified.” (IAQM, 2014)

6.45 Consistent with the recommendations in the IAQM dust guidance, a risk-based assessment has been undertaken for the redevelopment, using the well-established source-pathway-receptor approach.

6.46 The dust impact (the change in dust levels attributable to the redevelopment activity) at a particular receptor will depend on the magnitude of the dust source and the effectiveness of the pathway (i.e. the route through the air) from source to receptor.

6.47 The effects of the dust are the results of these changes in dust levels on the exposed receptors, for example annoyance or adverse health effects. The effect experienced for a given exposure depends on the sensitivity of the particular receptor to dust. An assessment of the overall dust effect for the area as a whole has been made using professional judgement taking into account both the change in dust levels (as indicated by the Dust Impact Risk for individual receptors) and the absolute dust levels, together with the sensitivities of local receptors and other relevant factors for the area

6.48 The dust risk categories that have been determined for each of the four activities (demolition, earthworks, construction and trackout) have been used to define the appropriate site-specific mitigation measures based on those described in the IAQM dust guidance. The guidance states that provided the mitigation measures are successfully implemented; the resultant effects of the dust exposure will normally be “not significant”. The four categories relevant to the IAQM are set out below.

6.49 Demolition Activities - The IAQM guidance notes that demolition of an existing structure, breakup of hardstand and removal of any existing materials or decommissioning of a structure at end of its life fall under demolition activities to be considered at the proposed redevelopment site.

6.50 Earthworks Activities - Earthworks activities essentially involve the excavation, haulage, tipping and stockpiling of materials. Also, such activities can include the levelling of the site and landscaping works. Each site is different and as such, should be assessed on a case by case basis.

6.51 Construction Activities - Regarding the assessment of potential dust emission class; a number of key issues come into consideration. As with assessing all risk categories pertaining to a development; each site is different and as such, should be assessed on a case by case basis.

6.52 Trackout - Concerning trackout impacts and the various factors which can assist in predicting trackout effects as a consequence of the redevelopment. As a general rule, it is perceived that significant trackout can occur up to 500m from larger sites, 200m for the medium and 50m for the small sites.

Summary of Assessment

6.53 Table 6.3 gives a summary of the justification of undertaking an air quality assessment in support of the proposed redevelopment.

Table 6.3 Summary of Methodology for Assessment

Guidance Document	Assessment to be undertaken
Construction: Significance Criteria - IAQM (2014): Guidance on the Assessment of Dust from Demolition and Construction	Construction Phase - Assessment undertaken for particulate matter and dust
Operational: IAQM) "Land-Use Planning & Development Control: Planning for Air Quality (Jan 2017)"	Operational Phase - Assessment undertaken for particulate matter and nitrogen dioxide
Design Manual for Roads & Bridges (DMRB) Volume 11, Section 3, Part 1, HA207/07 Air Quality – Local Assessment	Operational Phase - Assessment undertaken for particulate matter and nitrogen dioxide
Design Manual for Roads & Bridges (DMRB) Volume 11, Section 3, Part 1, HA207/07 Air Quality – Regional Assessment	Operational Phase - Assessment undertaken for greenhouse gases

Study Area

6.54 The study area land use is dominated by harbour infrastructure and associated commercial services (such as maritime engineering and fish processing). Other land uses / operations within the harbour estate include restaurants, RNLI station, government offices and the former Fisherman's Mission building.

6.55 The wider study area, beyond the harbour estate, is largely agricultural land use with residential properties (approximately 70) at St.Clair Avenue, Holburn Place, Clett Terrace and Holburn Head; a number of residential properties are also located within the harbour, along the A9 road. Consideration shall be given to the potential impact of the proposed redevelopment upon the residential properties and ecological receptors within the study area. Scrabster Harbour falls within the boundary of the Highland Council local authority area.

6.56 The local air quality study area for the operational phase was defined in accordance with DMRB HA207/07 guidance. It encompasses human exposure locations and designated sites that lie within 200m of affected road links, i.e. those that meet the following HA207/07 local air quality screening criteria. For modelling (DMRB Screening Method) representative worst-case receptors are selected with the 200m boundary that best represents a location prone to exposure and changes in exposure due to the scheme.

6.57 In terms of the IAQM guidance the study area extends from the proposed redevelopments site boundary to 350m for demolition, earthworks and construction and 500m from the site entrance for track out.

Baseline Methodology

6.58 The following sources were considered in order to establish the baseline environment in terms of air quality and climate:

- 'Updating and Screening Assessment 2015' for The Highland Council (In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management);
- Air Quality Progress Report 2013 for The Highland Council (In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management);
- Mapped background concentrations for use in LAQM Review and Assessments undertaken by Scottish local authorities;
- Department for Environment Food & Rural Affairs (DEFRA) background levels;
- Air Pollution in Scotland 2017;
- Reducing emissions in Scotland: 2017 Progress Report.

6.59 A summary of all consultation with stakeholders or consultees (such as local planning authority) is provided in the Table 6.4. The scope and approach for the assessment presented in this chapter was agreed with and approved by both Transport Scotland and Scottish Ministers.

Table 6.4 Consultation Responses Relevant to this Chapter

Date	Consultee and Issues Raised	How/ Where Addressed
Date	**Consulteee and Issues Raised**	**How/ Where Addressed**
21 September 2018	Scottish Ministers & Transport Scotland. Address emissions from plant and vehicles and dust levels from construction activities. The findings of the assessment will be used to develop appropriate mitigation plans	Addressed using appropriate legisltaion and guidance and as addressed throughout this chapter in full.

Assessment Criteria and Assignment of Significance

Operational Phase: Significance Criteria - Land Use Planning & Development Control: Planning for Air Quality

6.60 The rationale for describing the impact of the Proposed Scheme is derived from the Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) guidance (EPUK & IAQM) "Land-Use Planning & Development Control: Planning for Air Quality (May 2015)" (paragraphs 6.25-6.39), which has replaced "Development Control: Planning for Air Quality (2010 Update)".

6.61 There is a two stage process to be followed in the assessment of air quality impacts;

- a qualitative or quantitative description of the impacts on local air quality arising from the Proposed Scheme; and
- a judgement on the overall significance of the effects of any impacts

6.62 The suggested framework for describing the impacts is set out in Table 6.3 of the EPUK & IAQM guidance document and is shown in Table 6.5. The term Air Quality Assessment Level (AQAL) has been adopted as it covers all pollutants, i.e. those with and without formal standards. AQAL is used to include air quality objectives or limit values where these exist. The Environment Agency uses a threshold criterion of 10% of the short term AQAL as a screening criterion for the maximum short term impact. The EPUK & IAQM guidance adopts this as a basis for defining an impact that is sufficiently small in magnitude to be regarded as having an insignificant effect.

Table 6.5 Impact descriptors for individual receptors

Averages	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
Long term average Concentration at receptor in assessment year	**1**	**2-5**	**6-10**	**>10**
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Moderate
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Notes to Table 6.5:

- *1. AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.*
- *2. Table 6.5 is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5%, will be described as Negligible.*
- *3. Table 6.5 is only designed to be used with annual mean concentrations.*

- *4. Descriptors for individual receptors only; the overall significance is determined using professional judgement. For example, a 'moderate' adverse impact at one receptor may not mean that the overall impact has a significant effect.*
- *5. When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme;' concentration for an increase.*
- *6. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.*
- *7. It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.*

6.63 The rationale for the assessment of significance is derived from the EPUK & IAQM Guidance (paragraphs 7.1-7.12 referring to Table 6.3) and relates to Table 6.5.

6.64 Impacts on air quality, whether adverse or beneficial, will have an effect on human health that can be judged as 'significant' or 'not significant'. An 'impact' is the change in the concentration of an air pollutant, as experienced by a receptor. This may have an 'effect' on the health of a human receptor, depending on the severity of the impact and other factors that may need to be taken into account. The impact descriptors set out in Table 6.5 are not, of themselves, a clear and unambiguous guide to reaching a conclusion on significance. These impact descriptors are intended for application at a series of individual receptors. Whilst it may be that there are 'slight', 'moderate' or 'substantial' impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances.

6.65 Any judgement on the overall significance of effect of a development will need to take into account such factors as:

- the existing and future air quality in the absence of the redevelopment;
- the extent of current and future population exposure to the impacts, and
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts.
- Other factors may be relevant in individual cases.

6.66 The impacts descriptor table acknowledges this and points to a conclusion of significant effect in cases where concentrations of a regulated pollutant are in excess of the objective value. Where the baseline concentrations are close to the objective value at a receptor, but not exceeding it, a case may be made for a developments predicted contribution being significant. It will always be difficult, however, to attribute the exceedance of an objective to any individual source.

6.67 Magnitude (scale of change) is determined by considering the predicted deviation from baseline conditions. Quantifiable assessment of magnitude has been undertaken. Impacts of the Proposed Scheme on air quality have been assessed with reference to the baseline conditions and environmental assessment criteria.

6.68 For the purpose of the modelling assessment a representative selection of sensitive receptors across the road network were chosen to represent human exposure. The AQOs only apply where members of the public are likely to be regularly present for the averaging time of the objective i.e. where people will be exposed to the pollutants. The annual mean objectives apply to all locations where people may be regularly exposed including building facades of residential properties, schools, hospitals and care homes. Therefore, for the assessment of permanent effects from the proposed redevelopment, all representative receptors are considered to be of equal 'high' sensitivity as worst case.

Construction: Significance Criteria - IAQM (2014): Guidance on the Assessment of Dust from Demolition and Construction

6.69 There are a number of sources of dust and emissions from construction activities that can release a range of particles:

- Dust - defined as all particulate matter up to 75 um in diameter and comprising both suspended and deposited dust
- PM_{10} - a mass fraction of airborne particles with an aerodynamic diameter of 10 microns or less. It is comprised of coarse particles (2.5-10 um in diameter), which are primarily from non-combustion sources and fine particles (less than 2.5 um), which includes combustion processes or are formed in the atmosphere through the chemical reaction of primary emissions of gases.

6.70 Particulate matter includes a wide range of sizes and types of particles and will vary in composition from place to place and time to time.

6.71 Most dust particles are too big to be inhaled but can cause eye, nose and throat irritation and lead to deposition on cars, windows and property. PM_{10} is of more concern to human health as the particles can enter the lungs, causing breathing and respiratory problems, with long-term health effects dominated by cardiovascular rather than respiratory problems. The PM_{10} size fraction is associated with a range of effects on health including respiratory and cardiovascular systems (i.e. asthma). Particles can also carry adhered carcinogenic compounds into the lungs. The most vulnerable people are the elderly, the very young and those with existing heart and lung conditions.

6.72 The detrimental health impacts of PM_{10} are not confined to the construction site. These particles can travel further than coarser dust and so can affect the health of people living and working in the area surrounding the site. Emissions of particles and dust from construction can also have an impact on indoor air quality in the neighbouring area. The Committee on the Medical Effects of Air pollution (COMEAP), a Department of Health expert group, has stated that it must be recognised that the indoor environment is not free of air pollutants with many pollutants generated outdoors penetrating indoors.

6.73 Dust and PM_{10} emissions can arise from a number of sources. Not only do construction activities need to be considered, but also emissions from on-road vehicles associated with the construction site and on-site machinery (off-road emissions) - including both static and non-road mobile machinery (NRMM).

6.74 The assessment of temporary nuisance effects of dust during construction follows the Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction. This guidance defines 'human' receptor and 'ecological' receptors in terms of dust and particulate matter. These are set out below:

6.75 A 'human receptor' within: 350m of the boundary of the site; or 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s);

6.76 An 'ecological receptor' within: 50m of the boundary of the site; or 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

6.77 The assessment of the risk of dust effects is made separately for each potentially adverse construction stage and takes account of:

- i. the sensitivity of the area (determined from the sensitivity of receptors and the number of receptors); and,
- ii. the scale and nature of the works, which determines the potential dust emission magnitude at that construction stage.

6.78 These two factors (i. sensitivity of the area and ii. scale and nature of the works) are combined to give the risk of dust effects. These dust effects are split for each construction stage into:

- dust soiling effects;
- effects on human health of PM_{10}; and,
- ecological effects.

6.79 The following sections breakdown the likely risk and impact for each IAQM assessment stage.

6.80 Demolition Activities: The IAQM guidance details that, when it comes to the demolition of an existing structure at the proposed replacement pier, a competent individual must assess the site and assign it to one of the three potential dust emission classes.

Table 6.6: IAQM Potential Dust Emission Classes - Demolition

Class	Description
Large	Total building volume >50,000m^3, potentially dusty construction material (e.g. concrete), on site crushing and screening, demolition activities >20m above ground level.
Medium	Total building volume 20,000m^3 – 50,000m^3, potentially dusty construction material, demolition activities 10-20m above ground level.
Small	Total building volume <20,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 m above ground, demolition during wetter months.

6.81 The potential dust emission class should be used in conjunction with Table 6.7 which assigns the redevelopment site a risk category based upon the results of Table 6.6 and the redevelopment sites distance to the nearest receptor.

Table 6.7: IAQM Potential Dust Emission Classes - Demolition

Dust Emission Classes				
Distance to nearest receptor (m)	Distance to nearest receptor (m)	Dust Emission Classes		
Dust Soiling and PM10	Ecological	Large	Medium	Small
<20	-	High Risk Site	High Risk Site	Medium Risk Site
20 – 100	<20	High Risk Site	Medium Risk Site	Low Risk Site
100 – 200	20 – 40	Medium Risk Site	Low Risk Site	Low Risk Site
200 – 350	40 – 100	Medium Risk Site	Low Risk Site	Negligible

6.82 These distances are from the dust emission source. Where this is not known then the distance should be from the site boundary. The risk is based on the distance to the nearest receptor.

6.83 Earthworks Activities: Earthworks activities essentially involve the excavation, haulage, tipping and stockpiling of materials. Also, such activities can include the levelling of the site and landscaping works. Each site is different and as such, should be assessed on a case by case basis.

Table 6.8: IAQM Potential Dust Emission Classes from Earthworks Activities

Class	Description
Large	Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes.
Medium	Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m - 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes;
Small	Total site area <2 ,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <20,000 tonnes, earthworks during wetter months.

6.84 Table 6.9 presents the risk categories for earthworks activities with no mitigation.

Table 6.9: Risk Category from Earthworks Activities

Dust Emission Classes				
Distance to nearest receptor (m)	Distance to nearest receptor (m)	Dust Emission Classes		
Dust Soiling and PM10	Ecological	Large	Medium	Small
<20	-	High Risk Site	High Risk Site	Medium Risk Site
20 – 50	-	High Risk Site	Medium Risk Site	Low Risk Site
50 – 100	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
100 – 200	20 – 40	Medium Risk Site	Low Risk Site	Negligible
200 – 350	40 – 100	Low Risk Site	Low Risk Site	Negligible

6.85 These distances are from the dust emission source. Where this is not known then the distance should be from the site boundary. The risk is based on the distance to the nearest receptor.

6.86 Construction Activities: Regarding the assessment of potential dust emission class; a number of key issues come into consideration;

- Size of the infrastructure;
- Method of construction;
- Materials used during construction; and,
- Duration of build.

Table 6.10: IAQM Potential Dust Emission Classes from Construction Activities

Class	Description
Large	Total building volume >100, 000 m^3, on site concrete batching, sandblasting;
Medium	Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching;
Small	Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

6.87 Table 6.11 below presents the dust emission class categories which should be taken into consideration when determining potential dust emission arising during construction activities.

Table 6.11: Risk Category from Construction Activities

Dust Emission Classes				
Distance to nearest receptor (m)	Distance to nearest receptor (m)	Dust Emission Classes		
Dust Soiling and PM10	Ecological	Large	Medium	Small
<20	-	High Risk Site	High Risk Site	Medium Risk Site
20 – 50	-	High Risk Site	Medium Risk Site	Low Risk Site
50 – 100	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
100 – 200	20 – 40	Medium Risk Site	Low Risk Site	Negligible
200 – 350	40 – 100	Low Risk Site	Low Risk Site	Negligible

6.88 Trackout: Concerning trackout impacts; the various factors which can assist in predicting trackout effects as a consequence of the redevelopment are;

- Vehicle size;
- Vehicle speed;
- Number of vehicles;
- Geology of the site; and,
- The duration of the activity.

6.89 As a general rule, it is perceived that significant trackout can occur up to 500m from larger sites, 200m for the medium and 50m for the small sites.

Table 6.12: IAQM Potential Dust Emission Classes from Trackout

Class	Description
Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m
Medium	10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m;
Small	<10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.

6.90 Table 6.13 presents the risk categories for trackout.

Table 6.13: Risk Category from Trackout

Dust Emission Classes				
Distance to nearest receptor (m)	Distance to nearest receptor (m)	Dust Emission Classes		
Dust Soiling and PM10	Ecological	Large	Medium	Small
<20	-	High Risk Site	Medium Risk Site	Medium Risk Site
20 – 50	<20m	Medium Risk Site	Medium Risk Site	Low Risk Site
50 – 100	20-100	Low Risk Site	Low Risk Site	Negligible

6.91 These distances are from the dust emission source. Where this is not known then the distance should be from the site boundary. The risk is based on the distance to the nearest receptor.

Receptor Sensitivity/Value

6.92 It is a requirement to identify representative locations (human receptors) in proximity to the existing and proposed redevelopment that are likely to be most affected. The location of sensitive properties was examined and representative receptor sites carefully chosen. Each receptor site was selected to illustrate the impact that the proposed redevelopment would have on local air quality, in order to represent the level of change that a receptor would experience and whether these key properties would be close to, or exceed, the NAQS limit values.

6.93 In addition, impacts on human health, some air pollutants also have an effect on vegetation and habitats. Concentrations of pollutants in air and deposition of particles can damage vegetation directly or affect plant health and productivity. The pollutant of most concern for sensitive vegetation near roads is NOx, with a set EU limit value of 30 $\mu g/m^{-3}$ (annual mean) forming the critical load level for designated conservation sites. NOx is composed of Nitric oxide (NO) and its oxidation product NO_2. Concentrations of NO_2 are higher close to roads, so vegetation in these areas is exposed to a larger source of Nitrogen (N).

6.94 Critical loads for the deposition of nitrogen, which represent the exposure below which there should be no significant harmful effects on sensitive elements of the ecosystem (according to current knowledge), have been established for certain habitats dependent on low nitrogen levels. Critical loads are expressed in deposition units of kg N ha^{-1} $year^{-1}$. Nature conservation sites that should be considered for assessment are those for which the designated features are sensitive to air pollutants, either directly or indirectly, and which could be adversely affected by the effect of the local air pollution on vegetation. Such sites include SACs, SPAs, ASSIs and Ramsar sites.

Significance of Effects

6.95 The assessment of significance is be based on the following matrices.

Table 6.14: Assessment Matrix

Sensitivity	Magnitude of Impact			
	Negligible	**Low**	**Medium**	**High**
Negligible	Negligible	Negligible or minor	Negligible or minor	Minor
Low	Negligible or minor	Negligible or minor	Minor	Minor or moderate
Medium	Negligible or minor	Minor	Moderate	Moderate or major
High	Minor	Minor or moderate	Moderate or major	Major

6.96 The broad definitions of the terms used should be in line with the following:

- Substantial: Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
- Major: These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
- Moderate: These beneficial or adverse effects may be important but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
- Minor: These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process but are important in enhancing the subsequent design of the project.
- Negligible: No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Limitations of the Assessment

6.97 Discrepancies can occur between measured concentrations and results from a dispersion model (in this case the DMRB Screening Model) due to a number of different reasons that may include:

6.98 traffic data uncertainties, including estimates of speeds, total flows and proportions of vehicle types;

- emission estimates for vehicles and other sources;
- estimates of background concentrations;
- assumed $NOx:NO_2$ conversion;
- overall model limitations; and
- the precision and accuracy of monitoring methods.

6.99 Disparities between modelling and monitoring results are likely to be as a result of a combination of all these aspects. Verification is the process by which uncertainties such as those described above are investigated and minimised. However, in this instance there is a good degree of accuracy with regard to monitored data and the level predicted by the dispersion model.

6.100 There are therefore no limitations that would affect the robustness of the assessment for EIAR purposes in terms of predicted pollution concentrations.

6.3 Baseline Environment

6.101 The section sets out the desk top baseline data collected for the assessment. Highland Council Background Information

6.102 Air quality is monitored across Highland in accordance with the UK national air quality strategy. This sets out the government's objectives to improve and protect air quality in the UK.

6.103 Local authorities have to undertake annual air quality reviews of their areas to make sure the national air quality objectives national air quality objectives will be achieved. The pollutants that must be assessed by the local authority are:

- Benzene
- Carbon monoxide
- 1,3-butadiene
- Lead
- Nitrogen dioxide
- Sulphur dioxide
- Fine particles

6.104 If the objective for a pollutant is exceeded or predicted to be exceeded by the required date for compliance, the local authority must declare the affected area an air quality management area. The authority must then draw up and implement an action plan to reduce pollution levels in the specified area. Highland Council has one air quality management area in Inverness City Centre. This is not in close proximity to the proposed redevelopment site.

2015 Highland Council Updating and Screening Assessment

6.105 This report details the findings of the 2015 round of review and assessment undertaken by the Highland Council. For the vast majority of the Highland Council Area, air quality is considered to be good. Previous rounds of review and assessment have identified an area of the city centre of Inverness with poorer air quality. An Air Quality Management Area (AQMA) has been declared for this area and the Highland Council is undertaking it’s duties in terms of Action Planning.

6.106 Monitoring carried out in 2014 and an assessment of new or significantly changed local developments has not indicated any additional areas, outside of the existing AQMA, where the UK Air Quality Objectives are unlikely to be met. A detailed assessment is therefore not required for any pollutants.

Automatic Monitoring Sites

6.107 There are currently three automatic monitoring sites in the Highland Council Area. Nitrogen dioxide is monitored at two sites being Telford Street, Inverness, a roadside site 4 metres from the A862 and Fort William, a suburban site in a mixed residential and recreational area. Small particles as PM_{10} and $PM_{2.5}$ are monitored at Telford Street, Inverness. Ozone is monitored at two sites being the aforementioned Fort William site, and Strath Viach a rural site in a remote glen five miles from the nearest road.

6.108 All three stations are part of the UK Automatic Urban and Rural Network and are managed by Bureau Veritas of behalf of DEFRA. Data from the sites is available, fully ratified, for download on the internet.

Non-Automatic Monitoring Sites

6.109 The Highland Council continues to utilise non-automatic monitoring methods for Nitrogen dioxide at a number of sites mainly in the city of Inverness. In November 2014 an additional 4 diffusion tube sites were added within the declared AQMA. There are now 6 diffusion tube monitoring sites within the Inverness City Centre AQMA. The four diffusion tube sites on Queensgate at first and second floor level were also removed in March 2014 due to difficulties with servicing these sites in the long term. A site on Academy Street was removed in July 2014 due to redevelopment of the monitoring site. There were therefore 25 diffusion tube sites operating for all or part of 2014. This includes four sites in the Ross-shire market town of Dingwall, the only diffusion tube monitoring currently undertaken by the Highland Council out with Inverness. The levels of background pollution are so low in Scrabster that no monitoring is undertaken.

Ports & Shipping

6.110 The Highland Council confirms that there are no ports or shipping that meet the specified criteria within the Local Authority area.

Summary

6.111 In summary, there were no recorded exceedances of any air quality objective in the study area.

Scottish Background Mapping

6.112 Mapped background concentrations for use in LAQM Review and Assessments undertaken by Scottish local authorities are available on the Scottish Air Quality Website. These maps differ from the UK model maps downloadable from the UK selector above and are created from a Scotland-specific model using Scottish monitoring data and Scottish meteorological data. They are available for NOx, NO_2 and PM_{10} only. All levels in the study area are within the NAQS limit values as set out in Table 6.1 of this chapter.

‘Cleaner Air for Scotland – The Road to a Healthier Future’ (CAFS)

6.113 Cleaner Air for Scotland –The ‘Cleaner Air for Scotland – The Road to a Healthier Future’ (CAFS) strategy was published by the Scottish Government in November 2015. The purpose of CAFS is to provide a national framework that sets out how the Scottish Government and its partner organisations propose to achieve further reductions in air pollution and fulfil their legal responsibilities to achieve the air quality objectives. It is acknowledged in the CAFS strategy that, although progress has been made in Scotland, areas of poorer air quality still exist in towns and cities.

6.114 The CAFS strategy sets out six main objectives and the actions required to achieve improvements in air quality. A summary of these objectives and the 40 actions stated in CAFS are set out below:

- Transport - A Scotland that reduces transport emissions by supporting the uptake of low and zero emission fuels and technologies, promoting a modal shift away from the car through active travel (walking and cycling) and reducing the need to travel;
- Health - A Scotland that protects its citizens from the harmful effects of air pollution and reduces health inequalities’
- Legislation and policy - A Scotland where all European and Scottish legal requirements relating to air quality are, as a minimum, complied with;
- Placemaking - A Scotland where air quality is not compromised by new or existing development and where places are designed to minimise air pollution and its effects;
- Communication - A Scotland where all are well informed, engaged and empowered to improve our air quality.
- Climate change - Reducing greenhouse gas (GHG) emissions and achieving renewable energy targets while delivering co-benefits for air quality.

Key Results for 2017

6.115 This section provides a summary of results from automatic and non-automatic monitoring in Scotland in 2016 – including compliance with AQS objectives.

6.116 Benzene: This hydrocarbon is a constituent of vehicle exhaust emissions. Benzene was monitored using a non-automatic pumped-tube sampler at two sites (Glasgow Kerbside and Grangemouth) as part of the UK Non-Automatic Hydrocarbon Network. Both sites had annual mean concentrations below the AQS objective for the running annual mean.

6.117 1, 3-Butadiene: 1,3-butadiene is also a constituent of vehicle exhaust emissions. This pollutant was monitored at one rural site (Auchencorth Moss in Midlothian) as part of the UK Automatic Hydrocarbon Network. There were no exceedences of the 1,3 butadiene objective in 2017.

6.118 Carbon monoxide: This gas is a product of incomplete combustion, with vehicle exhaust emissions being an important source. It was monitored at two sites in Scotland in 2017 (Edinburgh St Leonards and North Lanarkshire Croy). Outdoor concentrations of CO were well within the AQS objective, as they have been for many years.

6.119 Lead: This toxic metal is emitted from some industrial processes (although emissions are now strictly controlled). Lead is monitored at two non-automatic sites in Scotland (Auchencorth Moss and Eskdalemuir). The 2017 annual mean from both sites was well below the AQS objectives.

6.120 Nitrogen dioxide: This toxic gas is emitted from most combustion processes, including power generation, domestic heating and vehicle engines. It was monitored at 81 automatic sites in Scotland during 2017. Of these, 10 achieved less than the 75% data capture generally considered necessary to calculate a representative annual mean. This was because of instrument/sampling issues or the site starting up or closing down part way through the year.

6.121 Seven sites had annual mean NO_2 concentrations greater than the AQS objective of 40µg m^{-3}. The highest annual mean concentrations were measured at Glasgow Kerbside, located close to a busy road, which had a measured concentration of 58.5µg m^{-3}. No site exceeded the hourly AQS objective of 200µg m^{-3} on more than the 18 permitted occasions.

6.122 Sulphur dioxide: This gas is emitted when fuels containing small amounts of sulphur (such as oil and coal) are burned. This pollutant was monitored at nine sites in 2017. No site recorded more than the permitted 35 exceedances of the AQS objective for the 15-minute mean (266µg m^{-3}) during 2017. No exceedances of the 24-hour mean objective of no more than three exceedances of 125µg m^{-3} and 1-hour of no more than 24 exceedances of 350µg m^{-3} were measured at any site.

6.123 Particulate Matter as PM_{10}: Particulate matter arises from many sources. It can be directly emitted from combustion processes or formed from chemical reactions involving other pollutants. Natural sources (e.g. wind-blown dust and sea salt) also contribute. PM_{10} was monitored at 77 Scottish sites in 2017 sites using automatic monitoring and the Partisol™ daily sampler. Of these sites, nine have less than 75% data capture. No site exceeded the UK AQS objective of 40µg m^{-3} for the annual mean. However, Scotland has adopted a more stringent annual mean objective of 18µg m^{-3}. This objective was exceeded at one site in 2017 – Edinburgh Queensferry Road with a measured annual mean concentration of 22.4µg m^{-3}.

6.124 The UK AQS objective for the 24-hour mean PM_{10} concentration is 50µg m^{-3}, not to be exceeded on more than 35 days per calendar year. The more stringent Scottish objective requires that daily mean PM_{10} concentrations do not exceed 50µg m^{-3} on more than 7 days per year. One Scottish site measured more than seven exceedances – Edinburgh Queensferry Road (8 days).

6.125 Particulate Matter as $PM_{2.5}$: During 2017, the number of sites measuring the finer particle fraction, $PM_{2.5}$, increased from 27 to 41. Of these, 14 achieved less than the 75% data capture generally considered necessary to calculate a representative annual mean. This was because of instrument faults or instrument installations during the year. On the 1 April 2016, the new Scottish annual average objective of 10µg m^{-3} was introduced. This objective was not exceeded at any site.

6.126 Polycyclic Aromatic Hydrocarbons: This group of pollutants is monitored at four sites in Scotland. The AQS objective of 0.25ng m^{-3} for benzo[a]pyrene was not exceeded at any of the four sites during 2017

6.127 Ozone: This is a secondary pollutant that is formed by reactions involving other pollutant gases in the presence of sunlight and over several hours. Once formed, it may persist for several days and be transported over long distances. This makes it difficult to control by local action. It was monitored at 11 sites in Scotland during 2017. Of these, the AQS objective of 100µg m^{-3} as an 8-hour running mean not to be exceeded more than 10 days was exceeded at Peebles (11 days).

Overall Summary

6.128 In summary, there were no recorded exceedances of any air quality objective in the study area. EIAR Volume II, Appendix 6.1 details in full background data and highlights the background data used in the DMRB Screening Models and associated calculations. These are referenced in full in the associated appendix and not repeated in this chapter.

Future Air Quality and Climate Conditions

6.129 This section of the document sets out the future baseline conditions in respect to air quality and climate and considers the potential implications of the operational proposals on this future baseline. The focus will principally be on the future baseline of air quality (pollution concentrations) and climate conditions due to climate change.

6.130 The background air quality in any future scenario is largely invariant at the receptors considered, mainly because there is insufficient certainty around any estimates of future air quality. It is difficult to present values on airborne concentrations of pollutants in future years where there is little certainty attached to them, regardless of whether the redevelopment is operational or not.

6.131 The trend of airborne concentrations over the next 10 years or more are expected to be dominated by wider considerations of road traffic emissions, which in turn are determined by changes in the vehicles on the road and by national and regional policies that determine road use. The current operations associated with the pier have only a very small effect on local air quality at present, so the cessation of these operations will not result in any meaningful change in effect.

6.132 The potential implications of the expected future roadside concentrations of NO_2, PM_{10} and $PM_{2.5}$ on local roads in 2021 and any future year is not expected to be significant. In this scenario, and all other scenarios, the additional concentrations of NO_2 and PM_{10} at the roadside within the study area and affected roads will be small in magnitude and will not be significant, according to the Institute of Air Quality Management criteria.

6.4 Assessment of Construction Effects

6.133 A qualitative approach is made to predict potential impacts from the anticipated construction works associated with the proposed redevelopment. Potential fugitive release of pollutants to the atmosphere during the construction phase can be identified as being from emissions from associated machinery & plant and airborne dust from earth movement and general movement in the working areas. With respect to emissions from traffic, construction of the project would generate vehicle movements on the local road network, which would include contractors' vehicles and Heavy Goods Vehicles (HGVs), diggers, and other diesel-powered vehicles. This would result in emissions of nitrogen oxides (NOx), particulates and other combustion-related pollutants.

6.134 The main emphasis throughout this phase will be to minimise the potential dust impacts at source through appropriate site management, control mechanisms, and practices. Concentration based limit values and objectives have been set for the PM_{10} suspended particle fraction, but no statutory or official numerical air quality criterion for nuisance dust has been set at a UK, European or World Health Organisation (WHO) level. Construction dust assessments have tended to be risk based, focusing on the appropriate measures to be used to keep dust impacts at an acceptable level. This approach has continued to evolve and in 2014, the IAQM published guidance on the assessment of construction air quality effects. The following sections summarise the likely risk and impact for each IAQM assessment stage

Demolition

6.135 A 'small' dust emission class is assigned to the proposed redevelopment. Demolition of the concrete structures will be carried out by means of excavator mounted rock breaker, concrete sawing, or a combination of these methods. The risk from dust soiling and PM_{10} from demolition activities is 'medium' (with no mitigation measures in place). Risk during demolition on ecological receptors is deemed to be negligible due to no (relevant air quality) protected designated ecological areas in the immediate vicinity. There is no significant impact from demolition and the effect is negligible on the closest sensitive receptor (highly sensitive human receptor) after employing the proposed mitigation measures. Please refer to EIAR Volume II, Appendix 6.3 Draft Dust Management Plan for mitigation details.

Earthworks

6.136 The new frontage area to the pier will be constructed on the reclamation area, which will be bounded by a revetment. The fill material used in the reclamation and revetment will consist of imported fill. Site won fill and dredge material will be beneficially reused within the reclamation area if suitable. Material is to be placed and compacted up to the rear of the revetment, and a pavement constructed up to finished level. Please refer to EIAR Volume II, Appendix 6.3 Draft Dust Management Plan for mitigation details.

6.137 A 'small' earthworks class is assigned to this proposed replacement. Activities involving movement of earth and material on site will occur although the formation of bunds will be limited if at all required. Without mitigation measures in place there is a 'low' risk from earthworks activities as part of this proposed replacement at the closest receptors. The site is in a peripheral urban/coastal area and the movement of earth and soils will be limited as opposed to working on an open green field or large brown field site. Risk during earthworks on ecological receptors is deemed to be negligible due to the absence of protected and designated ecological areas in the immediate vicinity containing habitats vulnerable to change as a result of aerial emissions (such as nutrient poor and species rich coastal grasslands or saltmarsh wetland habitats). There is no significant impact from earthworks and the effect is negligible on the closest sensitive receptor (highly sensitive human receptor) after employing the proposed mitigation measures.

Construction

6.138 A rock armour revetment is to be placed to the front of the reclamation area (let-down area); it is to be faced with imported inert stone. A revetment separation membrane is to be placed to the front face of the fill material prior to construction of the revetment. Rock armour to the front of the revetment will be placed by land side machinery. Foundations for barriers or fencing will be precast, lifted into position and placed behind the rock armour and backfilled. Please refer to EIAR Volume II, Appendix 6.3 Draft Dust Management Plan for mitigation details.

6.139 The proposed redevelopment is determined to be a 'medium' class in terms of construction activities due to the volume of the proposed replacement. Without mitigation measures in place there is a 'medium' risk from construction activities as part of this proposed replacement due to the location of the closest sensitive receptors. Risk during construction on ecological receptors is deemed to be negligible due to no (relevant air quality) protected designated ecological areas in the immediate vicinity. There is no significant impact from the construction activities and the effect is negligible on the closest sensitive receptor (highly sensitive human receptor) after employing the proposed mitigation measures.

Track Out

6.140 Construction related traffic will use the main A9 access from Scrabster which is accessed from the main centre of the town. In terms of track-out and due to the number of potential HGVs per day and length of unpaved surface (the area is all hardstand) the proposed site is deemed to be 'small' considering construction traffic movement estimates and material type. There is a 'low' risk from track-out activities as part of this proposed replacement with no mitigation measures put in place. Risk during trackout on ecological receptors are deemed to be negligible due to no protected designated ecological areas in the immediate vicinity. Risk during construction on ecological receptors is deemed to be negligible due to no (relevant air quality) protected designated ecological areas in the immediate vicinity. There is no significant impact from trackout and the effect is negligible on the closest sensitive receptor (highly sensitive human receptor) after employing the proposed mitigation measures. Please refer to EIAR Volume II, Appendix 6.3 Draft Dust Management Plan for mitigation details.

Dredging

6.141 The outer face will be dredged to a depth of -9m CD to accommodate cruise vessels and the inner side will be dredged to provide a consistent berth depth of -7.5m CD. A total volume of 172,000m^3 of dredge material will be generated by the activities. Dredge spoil will be reused within the reclamation or within the new pier structure if suitable. Material which is not suitable for reuse within the works will be disposed of at the sea disposal site outlined or disposed at a licenced waste facility on land and off-site; or a combination of these solutions. It is anticipated that dredging works will be undertaken on a 24 hour basis.

6.142 No significant air quality (including odour) and climate impacts effects are predicted from the transfer and disposal of dredged material for the proposed redevelopment.

6.5 Assessment of Operational Effects

6.143 Full details of DMRB Screening Method (local assessment) predictions are detailed in EIAR Volume II, Appendix 6.1 of this EIAR. There are no predicted breaches of Nitrogen Dioxide or Particulate Matter air quality objectives for these pollutants in terms of the proposed works at selected representative receptor locations from DMRB calculations.

6.144 The DMRB HA207/07 screening method is based on a distance drop-off calculation that does not take into account local atmospheric conditions such as wind speed and direction, which directly influence the rate at which pollutants disperse. A wind speed of 2m/s is assumed and no weighting for wind direction is applied; therefore, the equations used have a tendency to overestimate the pollutant concentrations.

6.145 Pollutant concentrations are predicted to be well below the air quality objectives for annual mean NO_2 and particulate matter. Even considering the uncertainty associated within the DMRB screening calculation methodology, it is highly unlikely that the proposed redevelopment will lead to any exceedances of the air quality objectives for NO_2 and particulate matter.

6.146 In summary, there is no predicted significant impact from operational traffic emissions and the effect is negligible on the closest sensitive receptor (highly sensitive human receptor). Full DMRB model outputs and details are given in EIAR Volume II, Appendix 6.1.

6.147 Similarly, the DMRB regional assessment presented in Appendix 6.1 also highlights the negligible impact on greenhouse gases from the operational phase of the redevelopment is not Potential Changes to the Assessment as a Result of Climate Change.

6.148 Taking into account the information identified in the future baseline section above, the future changes to baseline conditions would not change any of the assessments for the operational phase set out above. Future year background values have been used in the calculations and modelling as required.

6.6 Assessment of Cumulative Effects

6.149 Cumulative impacts may arise from the combined effects of a number of different projects, in combination with the project being assessed, on a single receptor/resource. This can include multiple impacts of the same or similar type from a number of projects upon the same receptor/resource. A review took place of the planning history for the area to establish projects that might have a potential cumulative impact with the proposed replacement. The air quality and climate assessment has taken into consideration cumulative impacts that takes account of all proposed developments or those that are planned.

6.150 The contribution of airborne contaminants from site vehicles and plant during the construction phase to local air quality is predicted to be negligible, and effects transient. The cumulative impacts from the permitted projects and the planned projects on air quality and climate are predicted to be negligible.

6.151 A range of projects have been taken into consideration as part of the cumulative assessment. In conclusion no significant air quality and climate cumulative effects were predicted for the combination of any permitted or proposed projects within the vicinity of the proposed replacement. The cumulative projects considered are as follows:

- Application for scoping of engineering works to create a lay down area adjacent to Scrabster Harbour (14/02706/SCOP). This was deemed to require an EIA, however, no further information on whether the application has been pursued is available. The application was made in 2014 and was subject to AA by Jacobs, however this examined only the potential for impacts to the River Thurso SAC excluded the Caithness Cliffs SPA. It examined suspended sediments, noise and vibration and pollution risk associated with construction phase and increased pollution risk associated with shipping movements in the operational stage. Subject to mitigation it was stated that there would be no significant effect. As these works have not apparently gone ahead and in light of the AA it is unlikely that there would be potential for significant in-combination effects. The Appropriate Assessment and site layout plan are included at Annex I and II.
- A single wind turbine application was submitted and approved in 2014 (14/03753/FUL) for a location to the north-east of Thurso, at the other side of the bay from the harbour. It is unlikely that there would be potential for significant in-combination effects on air quality and climate.
- A wind farm application, submitted in 2014, refused and now under appeal review (15/00037/RBREF) (Buckies Hill Wind Farm) for five wind turbines, located upstream of the River Thurso SAC, to the south of Thurso. It is unlikely that there would be potential for significant in-combination effects on air quality and climate.
- A cluster of further wind farms have been approved or are under construction further to the south (south of Mybster) and lie in close proximity to River Thurso. This cluster includes: Achlachan, Achlachan 2, Halsary Wind Farm and Bad a Cheo Wind Farm. It is unlikely that there would be potential for significant in-combination effects on air quality and climate.
- Other applications in the area include for: single dwellings, extensions to dwellings, erection of sheds, extensions to commercial property, erection of commercial signage, construction of small scale commercial property and a housing development for which construction has been completed, in addition to various other small scale projects. It is unlikely that there would be potential for significant in-combination effects on air quality and climate.

6.7 Mitigation & Monitoring

6.152 Mitigation measures for the demolition and construction phase of the proposed redevelopment are set out in EIAR Volume II, Appendix 6.3 Draft Dust Management Plan. These mitigation and control measures will be adopted by the appointed contractor working on the proposal.

6.153 There is no mitigation in relation to the operational phase as all predictions are not significant and within recommended UK and European air quality limits.

6.154 The 2017 EIA Regulations place greater emphasis on monitoring compared with the previous Regulations. There is no proposed monitoring measures required for the proposed redevelopment. There is no future monitoring deemed necessary in relation to the operational phase of the proposed redevelopment.

6.8 Residual Effects

6.155 With the implementation of appropriate dust management measures, there are not predicted to be any significant residual impacts from construction activities. The results of the risk assessment of construction dust impacts undertaken using the IAQM dust guidance, indicates that before the implementation of mitigation and controls, the risk of dust impacts will be low/medium. Implementation of the highly-recommended mitigation measures described in the IAQM construction dust guidance should reduce the residual dust effects to a level categorised as not significant.

6.156 The proposed redevelopment is predicted to lead to some increases in annual mean NO_2 and PM_{10} pollutant concentrations at the representative human exposure receptor locations within the study area. None of these increases exceed the annual mean AQOs for these pollutants in either the "Do Minimum" or "Do Something" scenarios. Mitigation measures are not required and no significant residual impacts are predicted.

6.157 Tables of effect for the construction and operational phases is presented in Table 6.15.

Table 6.15: Summary of Likely Environmental Effects on air quality and climate

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes
Construction phase							
Demolition and Earthworks	High	movement of material potentially producing dust emissions	Short term	Medium	Minor adverse	Not significant	
Construction	High	movement of material potentially producing dust emissions	Short term	Medium	Moderate adverse	Not significant	
Trackout	High	movement of material potentially producing dust emissions	Short term	Medium	Moderate adverse	Not significant	
Emissions	High	Emisisons from construction vehicles & plant	Short term	Low	Minor adverse	Not significant	
Operational phase							
Road Traffic Volumes	High	Emissions from road vehicles	Long term	Negligible	Negligible	Not significant	
Sea Vessels	High	Emissions from sea vessels	Long term	Negligible	Negligible	Not significant	
Emissisons from plant	High	Emissions from plant	Long term	Negligible	Negligible	Not significant	
GHG emission from all sources	High	GHG and climate impact	Long term	Negligible	Negligible	Not significant	

6.158 Impact magnitude must take into account the impact duration. For the purposes of this assessment and the information presented in Table 6.15, the following definitions are used:

- Short term: A period of months, up to one year;
- Medium term: A period of more than one year, up to five years;
- Long term: A period of greater than five years.

References

Committee on Climate Change (2017) Reducing emissions in Scotland: 2017.

Department for Environment Food & Rural Affairs (DEFRA) background levels 2017 (https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2017);

Highways Agency, Transport Scotland, Welsh Assembly Government and the Department of Regional Development for Northern Ireland (2007). Design Manual for Roads and Bridges Volume 11, Section 3, Part 1, Air Quality, 2007;The Highland Council (2015) Updating and Screening Assessment 2015 for The Highland Council (In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management);

The Highland Council (2013) Air Quality Progress Report 2013 for The Highland Council (In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management);

Holman et al (2014). IAQM Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London

Moorcroft and Barrowcliffe. et al. (2017) Land-use Planning & Development Control: Planning for Air Quality. v1.2. Institute of Air Quality Management, London.

Scottish Government (2017) Air Pollution in Scotland 2017

7 NOISE AND VIBRATION

7.1 Introduction

7.1 This chapter outlines the noise and vibration impact assessment for the proposed redevelopment of St. Ola Pier. The chapter assesses the potential impacts and likely significant effects of noise and vibration associated with the demolition, construction and operations at the pier.

7.2 The specific objectives of the noise and vibration assessment are to:

- describe the existing noise baseline;
- define the assessment methodology and significance criteria used in completing the noise impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address the likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

7.3 The chapter is supported by:

- Volume II Appendix 7:1 Calibration Certificates;
- Volume II Appendix 7:2 Photographs of Noise Monitoring Locations;
- Volume II Appendix 7:3 Background Noise Monitoring Results;

Figures 7.1 – 7.3 are referenced within the text of the chapter. These figures comprise the following:

- Volume III Figure 7.1: Noise Sensitive Receptor Locations;
- Volume III Figure 7.2: Background Noise Monitoring Locations; and
- Volume III Figure 7.3: Cadna Noise Model Output.

7.2 Assessment Methodology

7.4 This noise and vibration impact assessment will comprise of the following:

- potential noise and vibration impacts associated with construction phase activities from the proposed pier redevelopment;
- potential noise and vibration impacts associated with increased traffic flows and vessel numbers at the operational stage of the pier redevelopment; and
- noise and vibration mitigation measures necessary to comply with current noise standards and guidance during both construction and operation.

7.2.1 Potential Effects Scoped Out

7.5 Operational vibration affecting noise sensitive receptors has been scoped out as there are no known significant vibration sources associated with the existing harbour. The proposed redevelopment replaces the existing pier and as such, no significant operational vibration or noise impacts will occur.

7.2.2 Planning Policy Context

7.2.2.1 Planning Advice Note

7.6 The Planning Advice Note (Scotland) PAN 1/2011 provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. It should be read in conjunction with "Planning Guidance (Scotland): Planning Policy, Technical Advice Notes and circulars.

"This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business."

7.7 It includes details of the legislation, technical standards and codes of practice for specific noise issues. The PAN promotes the principles of good acoustic design and a sensitive approach to the location of new development. It promotes the appropriate location of new potentially noisy development, and a pragmatic approach to the location of new development within the vicinity of existing noise generating uses, to ensure that quality of life is not unreasonably affected and that new development continues to support sustainable economic growth. Environmental Health Officers and/or professional acousticians should be involved at an early stage in development proposals which are likely to have significant adverse noise impacts or be affected by existing noisy developments.

7.8 The Environmental Noise (Scotland) Regulations 2006 transposed the European Directive 2002/49/EC (the Environmental Noise Directive) into Scottish law. The Regulations affect large urban areas; major transport corridors and major airports. They require Scottish Ministers and airport authorities to manage noise through a process of strategic noise mapping and noise action plans. In the areas affected by the Regulations, planning authorities have a role in helping to prevent and limit the adverse effects of environmental noise. Areas affected by the Regulations can be seen on the Scottish Noise Mapping website.

7.2.3 Relevant Guidance

7.2.3.1 British Standard 8233: 2014 Sound Insulation and Noise Reduction for Buildings – Code of Practice

7.9 BS8233:2014 provides guidance values for a range of ambient noise levels within residential properties as shown in Table 7.1 below.

Table 7.1: Internal Ambient Noise Levels

Activity	Location	7:00 to 23:00	23:00 to 07:00
Resting	Living Room	5 dB L_{Aeq},16hr	-
Dining	Dining room/area	0 dB L_{Aeq},16hr	-
g(daytime resting)	Bedroom	5 dB L_{Aeq},16hr	30 dB L_{Aeq}, 8hr

7.10 The standard allows for a further relaxation in standards of up to 5dB where "development is considered necessary or desirable". In relation to external amenity areas such as gardens and patios, the standard states that it is desirable that external noise does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$.

7.11 The noise impact assessment has been completed with a view to ensuring that the appropriate internal noise levels at the nearest noise sensitive receptors to the proposal and in the residential units included in the pier redevelopment are not exceeded as a result of activities associated with the proposed redevelopment.

7.2.3.2 British Standard BS5228:2009+A1:2014 Noise and Vibration Control on Construction and Open Sites

7.12 This British standard consists of two parts and covers the need for protection against noise and vibration of persons living and working in the vicinity of construction and open sites. The standard recommends procedures for noise and vibration control in respect of construction operations and aims to assist architects, contractors and site operatives, designers, developers, engineers, local authority environmental health officers and planners.

Part 1 of the standard provides a method of calculating noise from construction plant, including:

- Tables of source noise levels;
- Methods for summing up contributions from intermittently operating plant;
- A procedure for calculating noise propagation;
- A method for calculating noise screening effects; and
- A way of predicting noise from mobile plant, such as haul roads.

7.13 The standard also provides guidance on legislative background, community relations, training, nuisance, project supervision and control of noise and vibration. The ABC method outlined in Section E3.2 has been used for the purposes of determining whether the predicted noise levels from the construction activities will result in any significant noise impact at the nearest noise sensitive properties.

7.14 Table 7.2 outlines the applicable noise threshold limits that apply at the nearest noise sensitive receptors. The determination of what category to apply is dependent on the existing baseline ambient (L_{Aeq}) noise level (rounded to the nearest 5dB) at the nearest noise sensitive property. For daytime, if the ambient noise level is less than the Category A threshold limit, the Category A threshold limit (i.e. 65dB) applies. If the ambient noise level is the same as the Category A threshold limit, the Category B threshold limit (i.e. 70dB) applies. If the ambient noise level is more than the Category A threshold limit, the Category C threshold limit (i.e. 75dB) applies.

Table 7.2: Noise Threshold Limits at Nearest Sensitive Receptors for Construction Activities

	Threshold Limits [dB(A)]		
	Category A	Category B	Category C
Night-time (23:00 - 07:00)	45	50	55
Evening and Weekends (19:00 – 23:00 Weekdays, 13:00 – 23:00 Saturdays, 07:00 – 23:00 Sundays)	55	60	65
Weekday daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

7.2.3.3 World Health Organisation (WHO) – Guidelines for Noise

7.15 In the World Health Organisation (WHO) Guidelines for Community Noise (1999), a L_{Aeq} threshold daytime noise limit of 55 dB is suggested for outdoor living areas in order to protect the majority of people from being seriously annoyed. A second daytime limit of 50 dB is also given as a threshold limit for moderate annoyance. The guidelines suggest that an internal L_{Aeq} not greater than 30 dB for continuous noise is needed to prevent negative effects on sleep. This is equivalent to a façade level of 45 dB L_{Aeq}, assuming open windows or a free-field level of about 42 dB L_{Aeq}. If the noise is not continuous, then the internal level required to prevent negative effects on sleep is a $L_{Amax,fast}$ of 45 dB. Therefore, for sleep disturbance, the continuous level as well as the number of noisy events should be considered.

7.16 The WHO Night Noise Guidelines for Europe was published in 2009 on the back of extensive research completed by a WHO working group. Considering the scientific evidence on the threshold of night noise exposure indicated by $L_{night,outside}$ as defined in the Environmental Noise Directive [2002/49/EC], a $L_{night,outside}$ of 40dB should be the target of the night noise guideline (NNG) to protect public, including the most vulnerable groups such as children, the chronically ill and the elderly. An interim target of 55dB is recommended where the NNG cannot be achieved. These guidelines are

applicable to Member States of the European Region and may be considered as an extension to the previous WHO Guidelines for Community Noise (1999).

7.17 In 2011, the WHO published the Methodological Guidance for Estimating the Burden of Disease from Environmental Noise. This document outlines the principles of quantitative assessment of the burden of disease from environmental noise, describes the status in terms of the implementation of the European Noise Directive and reviews evidence on exposure-response relationships between noise and cardiovascular diseases.

7.18 In 2018, the WHO Regional Office for Europe has developed guidelines, based on the growing understanding of health impacts of exposure to environmental noise. The main purpose of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise originating from various sources: transportation (road traffic, railway and aircraft) noise, wind turbine noise and leisure noise. Leisure noise in this context refers to all noise sources that people are exposed to due to leisure activities, such as attending nightclubs, pubs, fitness classes, live sporting events, concerts or live music venues and listening to loud music through personal listening devices.

7.19 The 2018 guidelines are published by the WHO Regional Office for Europe. In terms of their health implications, the recommended exposure levels can be considered applicable in other regions and suitable for a global audience.

7.2.3.4 Calculation of Road Traffic Noise (CRTN) – Department of Transport

7.20 The Calculation of Road Traffic Noise (CRTN) guidance document outlines the procedures to be applied for calculating noise from road traffic. It provides guidance appropriate to the calculation of traffic noise for more general applications e.g. environmental appraisal of road schemes, highway design and land use planning. The document consists of three different sections, covering a general method for predicting noise levels at a distance from a highway, additional procedures for more specific situations and a measurement method for situations where the prediction method is not suitable. The prediction method constitutes the preferred calculation technique but in a small number of cases, traffic conditions may fall outside the scope of the prediction method and it will then be necessary to resort to measurement. The prediction method has been used in this instance to determine the likely noise impact from traffic flow increases as a result of the redevelopment of St. Ola Pier.

7.2.3.5 British Standard BS 7445-1:2003 Description and measurement of environmental noise – Part 1: Guide to quantities and procedures (BS, 7445-1).

7.21 BS 7445 provides the framework within which environmental noise should be quantified. Part 1 of the standard provides guidance to quantities and procedures in relation to environmental noise monitoring. Meteorological conditions are not prescribed but it is recommended that wind speed should not exceed 5 m /s at height of 3-11m above ground, any temperature inversions near ground, or heavy precipitation.

7.2.3.6 Vibration

7.22 The most significant potential vibration effects associated with the redevelopment are likely to result from the construction phase. Vibration threshold values discussed below are presented in the context of potential vibration effects from the construction phase. Limits of transient vibration, above which cosmetic damage could occur, are given numerically in Table 7.3 (Ref: BS5228-2:2009+A1:2014). Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 7.3, and major damage to a building structure can occur at values greater than four times the tabulated values (definitions of the damage categories are presented in BS7385-1:1990).

Table 7.3: Transient Vibration Guide Values for Cosmetic Damage (Ref BS52282:2009+A1:2014)

Type of Building	Peak Particle Velocity (PPV) (mm/s) in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings.	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
Unreinforced or light framed structures. Residential or light commercial buildings.	15 mm/s at 4 Hz increasing to 20 mm/S at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

7.23 British Standard BS 7385 (1993) Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration indicates that cosmetic damage should not occur to property if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz. These guidelines refer to relatively modern buildings and therefore, these values should be reduced to 50% or less for more sensitive buildings

7.2.4 Study Area

7.24 The proposed redevelopment site is located at the centre of Scrabster Harbour approximately 1.5 miles Northwest (NW) of Thurso the largest town in Caithness. St. Ola Pier is located in Scrabster on the north coast of Caithness. Scrabster Harbour is located on the northern shore of Thurso Bay which is the between the points of Clairdon Head and Holborn Head. The harbour, which faces southwards, is the terminal point of the A9 road.

7.25 The study area is dominated by harbour infrastructure and associated commercial services (such as maritime engineering and fish processing). Other land uses / operations within the harbour estate include restaurants, RNLI station, government offices and the Fishermans Mission.

7.26 The wider study area, beyond the harbour estate, is largely agricultural land use with residential properties (approximately 70) at St. Clair Avenue, Holburn Place, Clett Terrace, Holburn Head; the Lighthouse, and a number of residential properties are also located within the harbour, along the

A9 road. Consideration shall be given to the potential impact of the proposed redevelopment upon the residential properties and ecological within the study area.

7.27 Scrabster Harbour falls within the boundary of the Highland Council Area.

7.28 There are a number of existing noise sensitive receptors located around the site boundary. These selected noise sensitive receptors form the limit of the assessment study area. The locations of these noise sensitive receptors are shown in Figure 7.1.

7.2.5 Baseline Methodology

7.2.5.1 Baseline Noise Monitoring Survey

7.29 The complete baseline noise monitoring survey was conducted at 2 locations in the vicinity of the proposed redevelopment site in order to characterise the noise environment. The purpose of the noise monitoring was to determine the baseline noise levels at the nearest noise sensitive receptors to the proposed redevelopment and to determine the applicable BS 5228 noise threshold limit. The map showing the two different locations are illustrated in Figure 7.2.

7.30 The noise monitoring survey was carried out over a continuous 48hr period at both locations and included both attended and unattended monitoring. Noise monitoring was carried at both locations using Norsonic Nor-140 Sound Level Meters and a Norsonic Nor-1251 Acoustic Calibrator. This instrumentation conforms to the requirements for integrating averaging sound level meters (Type 1) as specified in BS EN 60804. Calibration Certificates for both sound level meters are located in EIAR Volume II, Appendix 7.1.

7.31 Each sound level meter was accurately calibrated before and after use which no drift observed.

7.32 The complete noise monitoring survey was carried out using the following equipment;

- Norsonic Nor-140 Sound Level Meter;
- Norsonic Nor-1251 Acoustic Calibrator;
- Norsonic Nor-1225 Microphone; and
- Norsonic Nor-1217 Outdoor Protection Kit.

7.33 At each NML the microphone was placed at a height of 1.2 - 1.5m above ground level, and equipped with an all-weather wind shield which also provides water resistance. The proprietary wind shield used is certified by the manufacture as meeting Type 1 / Class 1 precision standards. All noise measurements were made at a height of 1.2 – 1.5m above ground level.

7.34 The weather conditions during the attended and unattended noise monitoring were in accordance with the requirements of BS7445: Description and Measurement of Environmental Noise.

7.35 The following parameters were recorded during each monitoring period:

L_{Aeq} The continuous equivalent A-weighted sound pressure level. This is an "average" of the sound pressure level.

L_{Amax} This is the maximum A-weighed sound level measured during the sample period.

L_{Amin} This is the minimum A-weighted sound level measured during the sample period.

L_{A10} This is the A-weighted sound level that is exceeded for noise for 10% of the sample period.

L_{A90} This is the A-weighted sound level that is exceeded for 90% of the sample period.

7.2.5.2 Noise Modelling Methodology

7.36 The proposed works was modelled using CadnaA noise modelling software. The CadnaA noise modelling software package uses the ISO 9613: 1996 "Acoustics – Attenuation of sound during propagation - Part 2: General method of Calculation" propagation requirements.

7.37 The software was used to build a 3-dimensional model of all features which may affect the generation and propagation of noise in the vicinity of the proposed construction works.

7.38 The noise model is used to estimate noise levels at noise receiver locations based on an approximation of the noise sources through the physical environment which includes ground terrain, and atmospheric conditions.

7.39 The model includes multiple construction noise sources which calculate each of the noise sources via each transmission path to each noise sensitive receptor location. The total sound level at each receptor location is then calculated by summing the contribution of each noise source and transmission path.

7.40 Table 7.4 below summaries the Cadna model inputs.

Table 7.4: Summary of Cadna Model Inputs

Item	Input
Noise Source	Point Source – Construction plant or equipment
	Height 0.5m
	Sound Power Level at 500 Hz
Noise Receptor Height	1.5m (daytime and night time)
Atmospheric Conditions	Relative Humidity 70%
	Temperature 10°C
	Ground Absorption 0.5

7.2.6 Consultation

7.41 Consultations were undertaken at both EIA Screening and Scoping phases in order to provide a scope for the assessment of noise impacts, at both construction and operation stages, thereby enabling an appropriate assessment of the impact of the redevelopment to be made. As part of the EIA screening stage The Highland Council Environmental Health Department returned comments advising that the noise impact assessment will need to include an assessment of noise from all construction work, and operational stage to assess the increased use of the harbour including night time.

7.3 Assessment Criteria and Assignment of Significance

7.3.1 Receptor Sensitivity/ Value

7.42 The sensitivity of receptors to noise and vibration during construction and operation is defined below in Table 7.5. This is taken from the Scottish Governments Technical Advice Note on Assessment of Noise. The assigned sensitivities are commonly used for Noise Impact Assessment across the UK.

Table 7.5: Receptor Sensitivity

Sensitivity of Receptor	Description
High	Concert halls/ theatres, specialist vibration sensitive equipment, residential properties, educational buildings, medical facilities, care homes
Medium	Places of worship, community facilities, offices
Low	Other commercial/retail premises
Very Low	Industrial premises

7.3.2 Magnitude of Impact

7.43 Demolition and construction noise comprises both plant noise and site traffic noise. The construction noise 'magnitude of effect' for this assessment is based on the '5dB change' method in BS5228-1:2009 2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' which is summarised in Table 7.6 below. This classifies the magnitude of effect based on the sound level difference between the ambient noise level with and without construction. This is calculated by finding the difference between the baseline ambient level and the total level (construction noise plus baseline ambient level) at each location.

Table 7.6: Demolition and Construction Noise: Magnitude of Effect

Sound Level Difference between Ambient Noise and Total Noise (dB, L_{Aeq})	Total Daytime Noise Level LAeq, 12h (Ambient and Construction Noise)	Magnitude of Effect
< 0 dB	< 65 dB (lower cut-off level)	Very Low
0 - 5 dB	65 - 70 dB	Low
5 – 10 dB	70 –75 dB	Medium
> 10 dB	> 75 dB	High

7.44 Operational traffic 'magnitude of effect' is quantified by the long-term change in traffic noise level based on the guidance in the 'Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7, HD213/11-Revision 1, Noise and Vibration'.

7.45 It is generally accepted that changes in noise levels of 1 dB (A) or less are imperceptible, and changes of 1 to 3 dB(A) are not widely perceptible.

7.46 The operational traffic magnitudes of effect are given in Table 7.7 based on the DMRB 'long- term' effects.

Table 7.7: Operational Traffic: Magnitude of Effect

Change in Traffic Basic Noise Level $L_{A10,18h}$	DMRB Magnitude of Impact Classification	Magnitude of Effect
0 dB	No change	Very Low
0.1-2.9 dB	Negligible	Very Low
3-4.9 dB	Minor	Low
5-9.9 dB	Moderate	Medium
10+ dB	Major	High

7.3.3 Significance of Effects

7.47 The significance of effect is dependent on both the magnitude of impact and the sensitivity of the receptor in question. The significance is obtained from the matrix given in Table 7.8.

Table 7.8: Significance of Effects

Sensitivity of Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Minor	Negligible	Negligible
Low	Minor	Negligible	Negligible	Negligible
Very Low	Negligible	Negligible	Negligible	Negligible

7.48 In line with the guidance:

- Major adverse effects are considered to be significant and should be prevented;
- Moderate adverse effects are significant and should be mitigated, where possible;
- Minor adverse effects are not significant but should be mitigated where possible;
- Negligible adverse effects are not significant and should not require mitigation.

7.49 On the basis of the above, major and moderate adverse effects are considered significant in EIA terms.

7.4 Existing Environment

7.4.1 Baseline Environment

7.50 Baseline noise monitoring was conducted around the proposed redevelopment site in order to characterise the existing noise environment of the site and nearest noise sensitive receptors. Noise Monitoring Location (NML) 1 was located in the garden of Mill House, Scrabster and Noise Monitoring Location 2 was located adjacent to Holborn Head Lighthouse, north-east of the harbour. NML's 1 and 2 are shown in Figure 7.1.

7.51 These noise monitoring locations were carefully chosen to provide results that are representative of the existing background climate both daytime and night time. The weather conditions were dry and calm with wind speeds less than 5m/s.

7.52 Dates of unattended noise monitoring set up and collection are summarised below in Table 7.9.

Table 7.9: Summary of Noise Monitoring Survey Dates

Set Up	Collection	Noise Monitoring Location	Easting OS Ref	Northing OS Ref
07/02/2019 (09:30hrs)	09/02/2019 (10:45 hrs)	NML 1	10123	10653
07/02/2019 (09:50hrs)	09/02/2019 (13:30 hrs)	NML 2	70396	70629

7.53 The existing baseline noise environment was defined by both attended and unattended daytime and night-time noise measurements. Both attended and unattended noise measurements were undertaken between 7th – 9th February 2019.

7.54 Photographs of NML 1 and 2 are contained within EIAR Volume II, Appendix 7.2

7.55 Periods of attended monitoring were undertaken at both NML's including between 13:00 – 16:00 hrs, 20:00 – 23:00 hrs on 08/2/2019 and 23:00 -02:00hrs on 07/02/2019 -08/02/2019 at NML 1 and between 15:00 – 18:00 and 20:00 – 23:00 hrs on 07/02/2019 at NML 2.

7.56 Noise monitoring results are presented in EIAR Volume II, Appendix 7.3.

7.57 The noise monitoring results are reflective of a typical village with dominant noise sources including traffic and passing pedestrians. The dominant noise source at NML 1 was attributable to ferry traffic and local traffic on the A9; harbour activity which consisted of toploaders, lorries and cranes; plant, compressors and generators in the harbour area; and wind and wave noise.

7.58 The most dominant noise sources at NML 2 were again harbour activity which consisted of toploaders, lorries and cranes; plant noise from the harbour area; and wind and wave noise.

7.59 Statistical analysis was conducted to determine the appropriate 'typical' background sound level for day and night- time at NML's 1 and 2. EIAR Volume II, Appendix 7.3 Figures 7.3.1 – 7.3.10 illustrate the output from this statistical analysis in accordance with BS4142:2014.

7.60 Lowest and typical $L_{A90,1hr}$ measurements from the daytime (07:00-23:00) and night time L_{A90},15 minute (23:00-07:00) periods at NML 1 and 2 are detailed in Table 7.10.

Table 7.10: Lowest and Typical L_{A90} Sound Levels

Noise Monitoring Location	Daytime$L_{A90,1hr}$ dB	Night time $L_{A90, 15mins}$ dB
1 (Lowest)	42.0	37.0
1 (Typical)	48.0	41.0
2 (Lowest)	47.0	46.0
2 (Typical)	49.0	50.0

7.5 Assessment of Construction Effects

7.5.1 Impact Assessment

7.61 The predicted noise impacts are assessed in accordance with Table 7.2 BS 5228: Noise and Vibration Control on Construction and Open Sites Noise threshold limits. Based on the proposals, the potential impacts associated with noise are considered for two distinct phases:

- Demolition, Construction and Installation Phase; and
- Operational Phase.

7.62 Proposed construction working hours will be:

- Monday to Friday – 08:00 to 19:00 hrs; and
- Saturday– 08:00 to 13.30 hrs.

7.5.1.1 Construction and Demolition Effects

7.63 The proposed redevelopment will have a new berth depth of -9m CD to accommodate cruise vessels and the inner side will be dredged to provide a consistent berth depth of -7.5m CD, which will require a period of dredging. This will be carried out by either a backhoe excavator or a trailing suction hopper dredger, depending on the level of reuse of the material.

7.64 An element of demolition will be required to allow for construction of new elements of the works. As the existing structure varies in construction, the extent of demolition required will differ along the length of the existing pier. Additionally, the existing pier layout varies in width and extents and as such the level of filling will vary along the structure.

7.65 The current concrete decking will require demolition, which will be undertake by an excavator mounted rock breaker, concrete sawing or a combination of both.

7.66 The current piles and tie rods will be used and encased in the new structure. There will also be some demolition carried out at the current revetment, as this is to be removed prior to reclamation construction. This demolition will likely be completed by an excavator.

7.67 Piling will also take place during construction and will likely be combi-wall. The installation of piles will be impact hammering, with an estimated hammer energy of 240kNm. There may also be some pre augering/drilling for piles (technique used to disturb difficult ground in preparation for the installation of piles) given the presence of boulder clay. When possible the proposed piling will be completed from the existing structure, with the rest then being completed by a piling rig mounted on a barge, probably a jack up barge.

7.68 As the upper strata is predominantly sands it may be possible that piles are vibro driven through the loose strata. Some of the piling will be probably be completed from the existing structure, with the rest being completed by a piling rig mounted on a barge (probably jack-up barge). During piling there will be a large crane for handling and installation.

7.69 The anticipated construction plant and equipment associated with each activity has been summarised below in Tables 7.11 and 7.12.

Table 7.11: Summary of Construction Plant and Equipment during Demolition

Demolition	Construction Plant and Equipment
Demolition - Removal of concrete deck and capping beam	Excavator mounted rock break or concrete saw or combination of both

Table 7.12: Summary of Construction Plant and Equipment during Construction

Construction and Commissioning	Construction Plant and Equipment
Combi wall Piling and Construction	piling hammer and crane
Dredging works	BHD Dredger
Removal of revetment rock armour	Excavator

7.70 The design and build contractor will be responsible for the design and phasing of the construction works, and as such at this stage it is not known how the works will be sequenced. However to reflect a worst case construction scenario it was assumed that the following activities were occurring simultaneously:

- Breaking out existing concrete;
- Piling on outer berth;
- Dredging on inner berth;
- Generator operational;
- HGV delivery; and
- Excavator removing rock.

7.71 This overlap of construction activities would be deemed to be reflective of a worst case scenario and used to undertake noise modelling. Therefore, noise modelling was undertaken reflective of these construction activities.

7.5.1.2 Number, Type and Make of Plant and Machinery

7.72 Sound power levels (SWL) detailed in Appendix C of BS 5228:2009+A1:2014 for each specific item of plant or machinery for activities listed above in Tables 7.11 and 7.12 were obtained and are summarised in Table 7.13.

7.73 The number of items indicates how many items of specific construction plant are anticipated. The utilisation per day on site is a percentage of duration given over a 12 hour daytime period. Utilisation at 100% per day considers all plant and equipment fully operational for each construction activity. In reality, this is very unlikely to occur which is deemed to be a worst case scenario.

Table 7.13: Summary of Construction Plant, Noise Levels and Utilisations

Plant ID	Plant Item	No of items	SWL (dBA)	Utilisation Per Day on site (%)
1	Piling	1	117.5	100
2	Drop Hammer	2	126.5	100
3	Rockbreaker	3	112	100
4	Excavator	1	105	100
5	HGV Dump truck	1	108	100
6	Large Crane	1	114	100
7	3.1Kw Petrol Generator	1	111	100
8	BHD Dredger	1	100	100

7.74 Maximum worst case construction noise levels were calculated assuming that plant will be operating at fixed locations in the absence of mitigation and fully operational throughout the working day. Noise predictions at each receptor are shown below in Table 7.14 and compared with the BS 5288 noise threshold level of 65 dB.

7.75 Maximum worst case construction noise levels have been predicted based on the following concurrent activities:

- breaking out existing concrete;
- piling on the outer berth so operating a crane and a piling hammer;
- dredger operational working on the inner berth;
- operation of generator;
- excavator removing existing revetment rock armour; and
- HGV delivering imported fill.

7.76 The nearest noise sensitive receptors to the proposed construction activities have been selected and are shown in Figure 7.2.

Table 7.14: Daytime Predicted Construction Noise levels at Noise Sensitive Receptor Locations

Receptor ID	Easting	Northing	Predicted Noise Level dB	Daytrime BS 5228 Limit	Difference between BS5228 limit and predicted noise level
1	309833.8	970048.4	48.6	65	-16.4
2	309805.3	970068	48.3	65	-16.7
3	309786.5	970086	48.1	65	-16.9
4	309944.9	970095	51.0	65	-14
5	310110.5	970101.5	54.5	65	-10.5
6	310053.4	970149.6	54.4	65	-10.6
7	309980.8	970210.9	53.3	65	-11.7
8	309953	970334.1	52.8	65	-12.2
9	309972.6	970342.3	53.4	65	-11.6
10	310010.2	970358.6	54.5	65	-10.5
11	310053.4	970371.7	56.0	65	-9.0
12	310101.6	970389.5	57.5	65	-7.5
13	310142.5	970402.5	58.8	65	-6.2
14	310161.2	970412.8	59.3	65	-5.7
15	310231.2	970381.7	66.2	65	1.2
16	310187.2	970443.9	59.5	65	-5.5
17	310099.1	970568.3	53.4	65	-11.6
18	310641.3	970644.2	50.7	65	-14.3

NB: ID's 1-3, 8-10, 13-14 and 17 are residential properties

7.77 Volume II – Figure 7.3 Noise Model Output summaries the Cadna noise modelling undertaken.

7.78 Worst case predicted noise levels do not exceed the BS5228 noise threshold limit of 65 dB at any of the residential receptor locations. Therefore, no additional construction noise mitigation is required. It is unlikely that all the construction plant and equipment detailed in Table 7.13 will be operational simultaneously throughout the working day.

Table 7.15: Night time Predicted Construction Noise levels at Noise Sensitive Receptor Locations

Receptor ID	Easting	Northing	Predicted Noise Level dB	Night time BS 5228 Limit	Difference between BS5228 limit and predicted noise level
1	309833.8	970048.4	25.3	45	-19.7
2	309805.3	970068	25.1	45	-19.9
3	309786.5	970086	24.9	45	-20.1
4	309944.9	970095	27.2	45	-17.8
5	310110.5	970101.5	30	45	-15
6	310053.4	970149.6	29.6	45	-15.4
7	309980.8	970210.9	28.7	45	-16.3
8	309953	970334.1	28.6	45	-16.4
9	309972.6	970342.3	29.0	45	-16.0
10	310010.2	970358.6	29.9	45	-15.1
11	310053.4	970371.7	30.9	45	-14.1
12	310101.6	970389.5	32.1	45	-12.9
13	310142.5	970402.5	33.3	45	-11.7
14	310161.2	970412.8	33.8	45	-11.2
15	310231.2	970381.7	36.7	45	-8.3
16	310187.2	970443.9	34.4	45	-10.6
17	310099.1	970568.3	30.5	45	-14.5
18	310641.3	970644.2	31.4	45	-13.6

7.79 Worst case predicted noise levels as shown in Table 7.15 do not exceed the BS5228 night time noise threshold limit of 45 dB at any of the residential receptor locations. Therefore, no additional construction noise mitigation is required.

7.80 Construction noise sources are temporary in both location and duration. Construction effects, irrespective of phasing and sequencing of the construction works are not permanent. Construction noise impacts are considered to be not significant.

7.5.1.3 Construction Traffic

7.81 It is envisaged that all usual harbour activities will continue to operate throughout the redevelopment, including the Northlink Ferry from Scrabster to Orkney. This includes the RNLI and any other small craft which regularly use the harbour.

7.82 Access to the site will be via the A9 trunk road, the harbour is the terminal point of this road. Construction related traffic is likely to arrive from the Thurso direction, as it is the main commuter road from southern towns within Scotland. Suitable traffic management and other systems will be put in place as required to minimise disruption to existing activities within the harbour during the construction period. Thurso town itself should not be majorly affected by construction traffic; however shipping and fishing vessels may be interrupted due to the construction work.

7.83 Construction traffic flows have been estimated by assessing the 20 Month construction programme and the activity schedule to generate construction traffic. The calculation is based on the working hours contained in Chapter 2 equating to 11 hours per day for 5.5 days per week.

7.84 The results predict 5.4 construction vehicles generated per hour during the working hours. The maximum peak will occur during the import of fill material to the site, which will occur for 4 months and will generate 15.4 construction vehicles per hour during the working hours.

7.85 The Design Manual for Roads and Bridges (DMRB, Volume 11, Section 3, Part 7) states that it takes a 25% increase in traffic flows in order to get a 1dB(A) increase in traffic noise levels. Traffic flow movements associated with the construction phase of the pier redevelopment will be substantially less than 25% on all roads in the study area. Worst-case traffic flow increases as a result of the pier redevelopment will result in substantially less than a 1dB(A) increase in traffic noise levels on all significant roads in the vicinity of Scrabster.

7.86 It is generally accepted that it takes an approximate 3dB(A) increase in noise levels to be perceptible to the average person (Ref: Planning Policy Guidance Note 24 [PPG24 - Planning & Noise). On this basis, the traffic noise level increases associated with the construction phase for the pier redevelopment will be imperceptible at the nearest noise sensitive properties. Therefore, construction traffic noise is not significant.

7.5.1.4 Construction Vibration

7.87 BS 5228:2009 Part 2 provides historical data of Peak Particle Velocity at various distances as summarised below in Table 7.16. This data can be used to assess the vibration impacts at the nearest noise sensitive receptors

Table 7.16: Measured Peak Particle Velocity (PPV) at Various Plan Distances (ref: Table D.11 BS 8233)

Distance from source	8m	16m	32m
PPV for Piling	23.7mms	7.4mm	2.7mms

7.88 The nearest noise sensitive receptors are in excess of 200m from proposed piling locations. Therefore, due to distance between receptors and piling operations, vibration from piling operations will not be significant

7.6 Assessment of Operational Effects

7.6.1 Operational Traffic

7.89 Chapter 5 Traffic & Transportation details the traffic assessment undertaken for the pier redevelopment. Operational traffic flows associated with St. Ola pier are attributable to the number of vessel sailings, which are time dependent.

7.90 The redevelopment proposals that impact on transportation when the scheme is operational are:

- Transportation activity relating to the 30 additional cruise calls per year and the increase in the number of passengers for each of the existing cruise calls during the operational period;
- Traffic increase due to the increased berthing activity for oil and gas vessels during the operational period.

7.91 On a typical day the proposed scheme will have a negligible 0.38% percentage impact on the AADT. The percentage impact in heavy vehicles is 7.5%, and particularly the percentage impact in HGVs is 1.5%.

7.92 On the worst traffic day, a day when a cruise is already berthed, the proposed scheme will have an impact in the region of 1.7% on the AADT, which is negligible.

7.93 On an existing day when the traffic flows are at their peak and a cruise isn't currently berthed within the Harbour, the proposed scheme will have a slightly higher impact of 3.2%, providing a minimal impact on the road network.

7.94 The Design Manual for Roads and Bridges (DMRB) states that it takes a 25% increase in traffic flows in order to get a 1dB(A) increase in traffic noise levels. It is generally accepted that it takes an approximate 3dB(A) increase in noise levels to be perceptible to the average person (Ref: Planning Policy Guidance Note 24 [PPG24 - Planning & Noise). Following construction of the proposed redevelopment, the operational vessel sailings, numbers and sizes, are anticipated to increase by 6%. Therefore, operational traffic movements may increase, however it is unlikely there would be a 75 % increase in traffic flow, which would be needed to achieve the 3dB(A) increase in noise levels to be perceptible to the average person.

7.95 The operational traffic noise on the existing receptors is considered to have negligible effect.

7.96 The traffic noise on the existing external amenity areas of existing receptors is considered to have negligible effect in all cases.

7.97 As there is no associated plant assessed in this noise and vibration assessment the plant noise from the proposed redevelopment is considered to have negligible significance.

7.7 Mitigation & Monitoring Measures

7.7.1 Mitigation

7.98 The worst-case predicted noise levels for the various stages of the construction phase are included in Table 7.14. These predicted noise levels indicate that the nearest receptors to the pier redevelopment will experience noise levels that are below the relevant noise threshold limit as designated by the ABC Method in BS 5228:2009+A1:2014.

7.99 While predicted noise levels from the construction activities are predicted to be below the relevant noise threshold limits, best practice measures will be employed to ensure that construction phase noise levels are reduced to the lowest possible levels.

7.100 A range of measures should be taken to ensure that the quietest machinery is such as to be sensitive to the residents at the nearest properties.

7.101 Proposed construction working hours will be 08:00 to 19:00 hrs Monday to Friday and 08:00 to 13:30 hrs, Saturday & Sunday. Working outside these hours may occasionally be necessary for operational or safety reasons.

7.102 British Standard BS5228:2009+A1:2014 – Noise and vibration control on construction and open sites outlines a range of measures that can be used to reduce the impact of construction phase noise on the nearest noise sensitive receptors. These measures should be applied by the contractor where appropriate during the construction phase of the pier redevelopment.

7.103 Examples of some of the best practice measures included in BS5228 are listed below:

- ensuring that mechanical plant and equipment used for the purpose of the works are fitted with effective exhaust silencers and are maintained in good working order;
- careful selection of quiet plant and machinery to undertake the required work where available;
- all major compressors should be ‘sound reduced’ models fitted with properly lined and sealed acoustic covers which should be kept closed whenever the machines are in use;
- any ancillary pneumatic percussive tools should be fitted with mufflers or silencers of the type recommended by the manufacturers;
- machines in intermittent use should be shut down in the intervening periods between work;
- ancillary plant such as generators, compressors and pumps should be placed behind existing physical barriers, and the direction of noise emissions from plant including exhausts or engines should be placed away from sensitive locations, in order to cause minimum noise disturbance. Where possible, in potentially sensitive areas, acoustic barriers of enclosures should be utilised around noisy plant and equipment. Where noise cannot be avoided, screening and acoustic enclosures will be utilised to minimise noise transmission off the construction site.
- handling of all materials should take place in a manner which minimises noise emissions;

- audible warning systems should be switched to the minimum setting required by the Health & Safety Executive.

7.7.2 Monitoring

7.104 Background noise monitoring will be regularly undertaken during the construction process to ensure noise limits are adhered to. Excessive noise and vibration on site not only represents a major hazard to site workers but it can also annoy neighbours and in some cases disturb adjacent wildlife. Best practice will therefore be implemented in order to minimise noise and vibration and comply with the contents and recommendations of the BS 5228 “Code of Practice for Noise Control on Construction and Open sites”.

7.105 In order to minimise the likelihood of complaints, The Highland Council and affected residents should be kept informed of the works to be carried out and of any proposals for work outside normal hours. All complaints will be recorded by the appointed contractor. The appointed contractor will investigate the circumstances and ensure the necessary corrective measures are taken.

7.8 Assessment of Cumulative Effects

7.106 The cumulative construction noise from the proposed redevelopment and other projects in the area is unlikely to increase noise level significance beyond that predicted from the application site alone.

7.107 The cumulative construction vibration from the proposed redevelopment and other sites in the area is unlikely to increase vibration level significance beyond that predicted from the application site alone.

7.108 In conclusion no significant noise or vibration cumulative effects were predicted for the combination of any permitted or proposed projects within the vicinity of the proposed redevelopment.

7.109 A range of projects have been taken into consideration as part of the cumulative assessment. In conclusion no significant noise and vibration cumulative effects were predicted for the combination of any permitted or proposed projects within the vicinity of the proposed replacement.

7.110 The cumulative projects considered are as follows:

- Application for scoping of engineering works to create a lay down area adjacent to Scrabster Harbour (14/02706/SCOP). This was a SHT promoted project seeking to create expansion space for marine renewables O&M activities. The project did not progress to a stage where an application for consent has been submitted. It is unlikely that there would be potential for significant in-combination effects on noise and vibration.

- Application for disposal of 224,600m^3 (436,230 tonne) of material by bottom dumping at Scrabster Extension (FI008) sea disposal site (04062/11/1, 04062/12/1, 04062/12/2 and redevelopment of Jubilee Pier (Old Fish Pier) and associated works (04063/12/0). As this project was completed in 2013, there is no potential for cumulative effects on noise and vibration.

- Application for Dounreay Tri floating Wind Demonstration Project (06174/17/0 and 06178/17/0). This project was consented in 2016, and is currently on hold awaiting funding. It proposes to construct a two turbine offshore wind farm with an installed capacity of between 8-12 MW approximately 6 km off Dounreay, Caithness; electricity export cable to bring the power to shore immediately to the west of the Dounreay Restoration Site fence line; and associated onshore electrical infrastructure to connect the project at or near the existing Dounreay 132/33/11kV substation. It is unlikely that there would be potential for significant in-combination effects on noise and vibration.

- Application for MeyGen Tidal Project (04577/14/0, 06234/17/0, 06182/16/0 and 06102/16/0). The project was consented in January 2014. Construction stage is complete for Phase 1A (6MW), which is now operational. Remainder (c.80MW) not yet brought forward. It is unlikely that there would be potential for significant in-combination effects on noise and vibration.

- Application Ness of Duncansby Tidal Project (no reference). A proposed tidal array project located to the north of Duncansby Head, approximately 34km by sea from Scrabster Harbour. The proposals were deemed to comprise EIA development in the Scoping Opinion published on 22nd February 2013. Following this no further documentation has thus far been submitted. A proposed tidal array project located to the north of Duncansby Head, approximately 34km by sea from Scrabster Harbour. The proposals were deemed to comprise EIA development in the Scoping Opinion published on 22nd February 2013. Following this no further documentation has thus far been submitted. It is unlikely that there would be potential for significant in-combination effects on noise and vibration.

- A single wind turbine application was submitted and approved in 2014 (14/03753/FUL) for a location to the north-east of Thurso, at the other side of the bay from the harbour. It is unlikely that there would be potential for significant in-combination effects on noise and vibration.

- A wind farm application, submitted in 2014, refused and now under appeal review (15/00037/RBREF) (Buckies Hill Wind Farm) for five wind turbines, located upstream of the River Thurso SAC, to the south of Thurso. It is unlikely that there would be potential for significant in-combination effects on noise and vibration.

- A cluster of further wind farms have been approved or are under construction further to the south (south of Mybster) and lie in close proximity to River Thurso. This cluster includes: Achlachan, Achlachan 2, Halsary Wind Farm and Bad a Cheo Wind Farm. It is unlikely that there would be potential for significant in-combination effects on noise and vibration.

- Other applications in the area include for: single dwellings, extensions to dwellings, erection of sheds, extensions to commercial property, erection of commercial signage, construction of small scale commercial property and a housing development for which construction has been completed, in addition to various other small scale projects. It is unlikely that there would be potential for significant in-combination effects on noise and vibration.

7.9 Summary of Effects

7.111 During the construction phase of the proposed redevelopment, noise levels may be temporarily increased in the vicinity of some of the nearest noise sensitive properties. However, as detailed in Tables 7.17 and 7.18 construction noise predictions are below the BS5228 65dB threshold noise limit.

7.112 The implementation of the noise control measures outlined in this section will reduce these impacts as much as practicable.

7.113 The assessment of road traffic noise in the vicinity of St. Ola Pier concludes that noise impacts from increased traffic resulting from the proposed redevelopment will be negligible during both construction and operational phases.

7.114 During the operational phase, there will be no significant noise impact from the proposed redevelopment at the nearest noise sensitive receptors.

7.10 Residual Effects

7.115 With the implementation of appropriate construction noise mitigations, there are not predicted to be any significant residual impacts from construction activities.

7.116 Tables of effect for the construction and operational phases is presented in Table 7.17.

Table 7.17: Summary of Likely Environmental Effects on Noise and Vibration

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant
Demolition and Earthworks	High	Noise from demolition	Short term	Medium	Minor adverse	Not significant
Construction	High	Noise from construction activities	Short term	Medium	Moderate adverse	Not significant
Construction Vibration	High	Vibration from construction activities	Short term	Medium	Moderate adverse	Not significant
Road Traffic Noise	High	Emissions from road vehicles	Long term	Negligible	Negligible	Not significant
Sea-going Vessels	High	Emissions from sea vessels	Long term	Negligible	Negligible	Not significant

8 GEOLOGY, HYDROGEOLOGY AND CONTAMINATION

8.1 Introduction

8.1 This Chapter provides an assessment of the effects of the existing ground conditions on the proposed development and addresses the potential effects of the proposed development on the soils, geology and hydrogeology of the site and surrounding area. The assessment is based on the scheme as described in Chapter 2 of the EIAR. Where potential adverse impacts are identified, the assessment identifies mitigation measures that will be implemented to prevent, reduce or offset potential adverse effects, or enhance potential beneficial effects where possible.

8.2 A Preliminary Risk Assessment (PRA) Report has been produced by RPS in order to inform this assessment. The PRA report is contained in EIAR Volume II, Appendix 8.1.

8.3 An intrusive marine based ground investigation was undertaken by Fugro Geoservices Ltd during October and November 2018. The ground investigation report is contained in EIAR Volume II, Appendix 8.2.

8.4 An intrusive ground investigation was undertaken by Whiteford Geoservices in June 2018. The ground investigation report is contained within EIAR Volume II, Appendix 8.3

8.2 Assessment Methodology

8.5 The assessment was undertaken in accordance with the following standards:

- Investigation of Potentially Contaminated Sites - Code of Practice BS 10175:2011 + A1:2013.
- CLR 11 'Model Procedures for the Management of Land Contamination' 2004, published by the Environment Agency.

Study Area

8.6 St. Ola Pier site is located in Thurso Bay on the north coast of Scotland, at the small coastal fishing settlement of Scrabster. The study area is shown in Figure 8.1.

Baseline Methodology

8.7 Underpinning the guidance within CLR11 is a source-pathway-receptor methodology, which is used to identify Significant Pollutant Linkages (SPLs). The following definitions apply;

Source: identification of contamination source

Pathway: the means by which the contamination can come into contact with the receptor, and

Receptor: the entity which is vulnerable to harm from the contamination source.

Figure 8.1 Study Area

8.8 An important thread throughout the overall process of risk assessment is the need to formulate and develop a conceptual model for the site, which supports the identification and assessment of pollutant linkages. Development of the conceptual model forms the main part of the risk assessment, and the model is subsequently refined or revised as more information and understanding is obtained through the risk assessment process. A risk is present only when a source-pathway-receptor linkage is present and active.

8.9 In order to establish the baseline for soils and geology, a preliminary risk assessment (PRA) desk study report was compiled which utilised existing sources of information. The Desk Study examined the potential for sources of contamination and pollutant linkages to be present.

8.10 An intrusive land and marine based ground investigation was undertaken to ascertain the actual ground conditions in the area of the proposed development site.

Assessment Criteria and Assignment of Significance

8.11 The Effects of contaminated land on receptors have been assessed taking into account sensitivity of the receptor and magnitude of the effect. The sensitivity of geological receptors is determined according to the methodology shown in Table 8.1.

Table 8.1: Example Definitions of Sensitivity or Value

Sensitivity	Criteria	Typical Examples
High	High importance and rarity, international or national scale and very limited potential for substitution.	Geology: World Heritage Sites or site protected under EU or UK wildlife legislation (SAC, SPA, SSSI, Ramsar site). Soils: Agricultural land of Grade 1or 2 quality. Controlled Water: Groundwater vulnerability is classified as high; Principal aquifer providing a regionally or locally important resource or supporting site protected under wildlife legislation. Future site users: Sensitive land uses proposed such as residential housing with gardens, allotments, schools. Built Environment: Sites of international Importance, World Heritage Sites, Listed Buildings, Scheduled Monuments.
Medium	Attribute has a medium quality and rarity on local scale	Geology: Regionally Important Geological Sites (RIGS). Soils: Agricultural land of Grade 3 quality. Controlled Water: Moderate classification of groundwater vulnerability; Secondary aquifer providing water for agricultural or industrial use with limited connection to surface water. Future site users: Moderately sensitive land uses such as residential housing without gardens, commercial developments and open spaces. Built Environment: Sites with local interest for education or cultural appreciation.
Low	Attribute has a low quality and rarity on local scale	Geology: Rock exposures. Soils: Agricultural land of Grade 4&5 quality. Controlled Water: Deep Secondary aquifer with poor water quality not providing baseflow to rivers; Aquifer not used for water supplies (public or private). Future Site Users: Low sensitivity land use such as Industrial Sites, highways and rail. Built Environment: Infrastructure (e.g. Roads, railways, tramways).

Sensitivity	Criteria	Typical Examples
Negligible	Very low importance and rarity, local scale.	Geology: No rock exposures. Soils: Urban classified soils. Controlled Water: Non-aquifer/Unproductive Strata Future Site Users: No sensitive land use proposed.

8.12 The magnitude of a potential effect is independent of the sensitivity of the feature. The magnitude considers the scale of the predicted change to the baseline condition taking into account its duration (i.e. the magnitude may be moderated by the effects being temporary rather than permanent, short term rather than long term) and whether the effect is direct or indirect. Definitions for impact magnitude are described in Table 8.2

Table 8.2: Definitions of Magnitude

Magnitude	Criteria	Typical Examples
Major Adverse	Total loss or major alteration to key features of the baseline conditions such that post development character/composition of baseline condition will be fundamentally changed.	Pollution of potable sources of water abstraction. Loss of, or extensive change, to an aquifer, groundwater supported designated wetlands. Loss of, or extensive change, to nationally important geological features.
Moderate Adverse	Loss or alteration to one or more key features of the baseline conditions such that post development character/composition of baseline condition will be materially changed.	Partial loss or change to an aquifer. Partial loss of the integrity of groundwater supported designated wetlands. Permanent loss of, regionally important geological features, or substantial changes to nationally important geological features.
Minor Adverse	Results in some measurable change in attributes quality or vulnerability compared to baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character/composition of baseline condition will be similar to the pre-development situation.	Measurable impact or aquifer but of limited size or proportion, which does not lead to a reduction in the aquifer status. Minor effects on groundwater supported wetlands. Loss of, or extensive change, to locally important geological features

Magnitude	Criteria	Typical Examples
Neutral	Very little change from baseline conditions. Change is barely distinguishable approximately to a "no change" situation.	No measurable impact upon groundwater. No measurable impact on geological features.
Beneficial	Benefit to, or addition of, key characteristics, features or elements compared to baseline conditions.	Treatment or removal of contaminated soils from site Improvement to geological features

Significance of Effects

8.13 The significance of a specific potential effect is derived from both the sensitivity of the feature and the magnitude of the effect, and can be then determined using the matrix presented in Table 8.3. Effects can be beneficial, adverse or neutral and their significance Very Large, Large, Moderate, Slight or Neutral or an intermediary designation as cases dictate based on professional judgement. The significance of an impact should also be qualified based on the likelihood of an effect occurring (using a scale of certain, likely or unlikely) and the confidence in the accuracy of the assessment.

Table 8.3: Assessment Matrix

Sensitivity	Magnitude of Impact			
	Negligible	**Low**	**Medium**	**High**
Negligible	Negligible	Negligible or minor	Negligible or minor	Minor
Low	Negligible or minor	Negligible or minor	Minor	Minor or moderate
Medium	Negligible or minor	Minor	Moderate	Moderate or major
High	Minor	Minor or moderate	Moderate or major	Major

8.14 The potential significance of these effects has been assessed using Table 8.4. The rationale for the assessment of significance is based on the risk assessment process and therefore, takes account of the different sensitivities (importance) of the potential receptors.

Table 8.4: Significance Criteria

Significance Category		Description and Examples	Significance
Neutral	-	Minimal impact on geological condition, minor loss of urban soils; and No discernible negative impact with regards to contaminated land.	Not Significant
Minor	Adverse	Changes to Made Ground deposits only, moderate/ major loss/ degradation of Grade 4 or 5 soils. minor or moderate loss/ degradation of Grade 3 soils Easily preventable, non-permanent health impacts on humans; Minor low-level and localised contamination of on-site soils; Pollution of non-sensitive water resource or low long term risk of pollution to sensitive water resource; and Easily repairable damage to buildings / infrastructure.	Not Significant
	Beneficial	Remediation of localised low levels of contamination; Remediation of non-sensitive water resource contamination; and Minimal improvements to overall soil and water quality.	
Moderate	Adverse	Superficial disturbance to near surface deposits, Changes in geomorphology, large loss/ degradation of Grade 3 soils, minor loss/ degradation of Grade 1 or 2 soils. Sterilisation of low quality mineral resources. Easily preventable, permanent health impacts on humans or medium-term (chronic) risk to human health;	Significant

Significance Category		Description and Examples	Significance
		Medium long-term risk of pollution of sensitive water resources; damage to buildings / infrastructure (on or off site); and Localised damage to buildings/ infrastructure (on or off site).	
	Beneficial	Remediation of localised moderate levels of contamination; Remediation of moderate to high, localised sensitive water resource contamination; and Re-use of excavated soils on-site to avoid disposal to landfill.	
Major	Adverse	Substantial changes due to cuttings, moderate/ large loss/ degradation of Grade 1 or 2 soils; Loss of exposed designated geological features; Sterilisation of high quality mineral resource Long-term (chronic) risk to human health or short-term (acute) risk to human health; Short- term risk of pollution of sensitive water resources; Extensive damage to buildings / infrastructure (on or off site); Generation of significant quantities of waste sediment or soils for landfill ; and Contamination of offsite soils.	Significant
	Beneficial	Remediation of widespread high levels of contamination/ widespread contamination; Remediation of significant, widespread sensitive water resource contamination; and Re-use of significant quantities of excavated soils on-site to avoid disposal to landfill	

Limitations of the Assessment

8.15 The assessment is based on information provided by third parties, including publicly available information and it is assumed that databases are correct at the time of publication. The assessment is based on the ground conditions as revealed by intrusive investigations, together with the results of any field or laboratory testing or chemical analysis undertaken and other relevant data which may have been obtained including previous ground investigations.

8.3 Baseline Environment

8.16 A desk study of published material held on British Geological Survey's (online portal) was undertaken to provide an initial overview of ground conditions at the site. The following describes the findings of this preliminary research. The British Geological Survey maps are provided within the desk study in EIAR Volume II, Appendix 8.1.

8.17 The bedrock geology anticipated in the vicinity of the site is the Middle Old Red Sandstone (Undifferentiated).

8.18 The drift geology is anticipated to consist of alluvial deposits, however bounding the site to the north a strip of diamicton, clay, sand and gravel makes up the superficial deposits.

8.19 The bedrock aquifer is described as being a locally important aquifer associated with the Lower and Middle Old Red Sandstone deposits. The aquifer is moderately permeable.

8.20 A marine based ground investigation has been undertaken by Fugro Geoservices Ltd. The ground investigation report is contained within EIAR Volume II, Appendix 8.2.

8.21 The investigation comprised 16 overwater boreholes with sampling and testing.

8.22 Five (5) cable percussion boreholes (BH05 to BH08 and BH11) were advanced to depths of 5.0m below seabed level (bsl) and 7.50m bsl.

8.23 Eleven (11) combined cable percussion and rotary cored boreholes (BH01 to BH04, BH09, BH20 to BH23, BH24a and BH30) were advanced to depths of between 7.65m bsl and 26.0m bsl.

8.24 The sediment material encountered during the investigation generally comprised sand, gravel and silt.

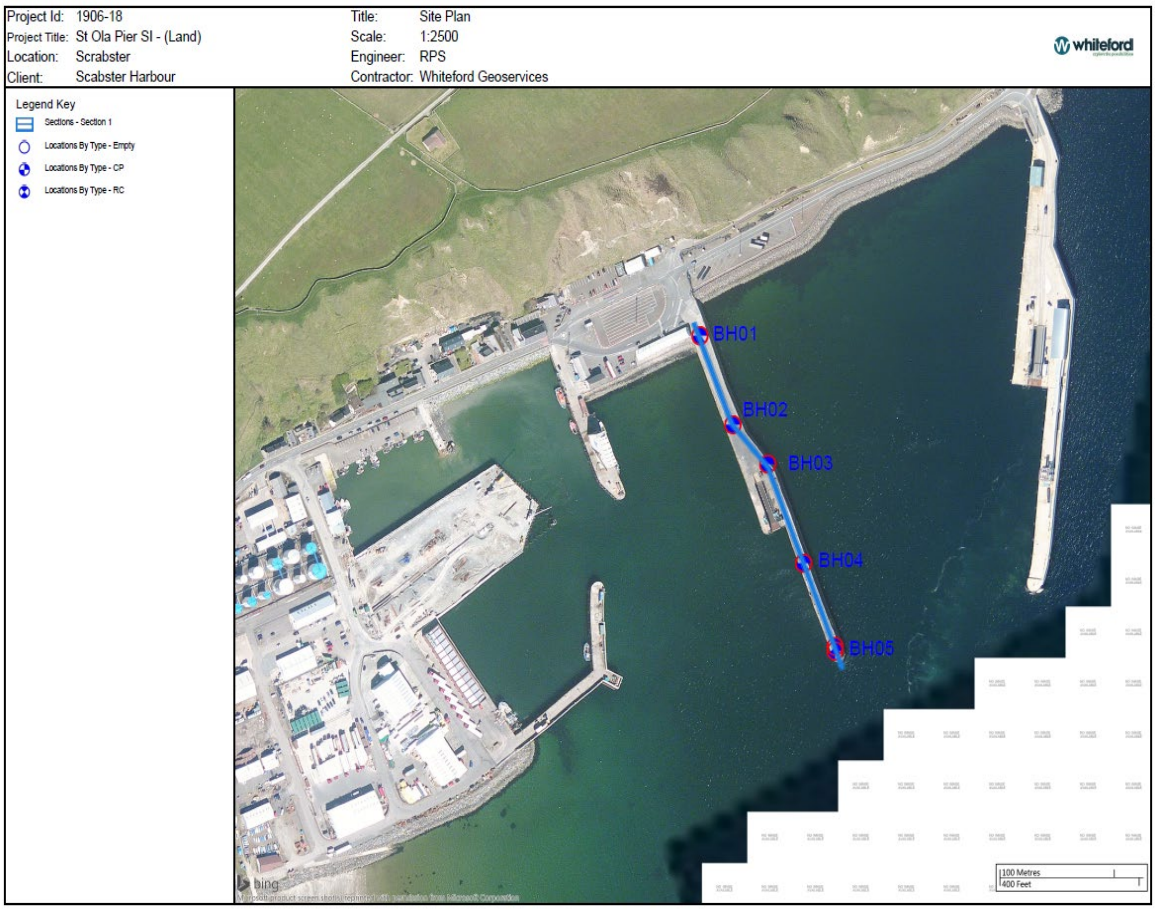
8.25 Bedrock comprising Sandstone and Siltstone was encountered beneath the sediment deposits.

8.26 A land based ground investigation was undertaken by Whiteford Geoservices in June 2018. The ground investigation report is contained within EIAR Volume II, Appendix 8.3.

8.27 The investigation comprised five (5) cable percussion boreholes with rotary follow on located along St. Ola Pier.

8.28 The boreholes were advanced to a maximum depth of 35m bgl (-30.79m OD). The borehole locations are shown in Figure 8.2.

Figure 8.2 Whiteford Geoservices Borehole Location Plan

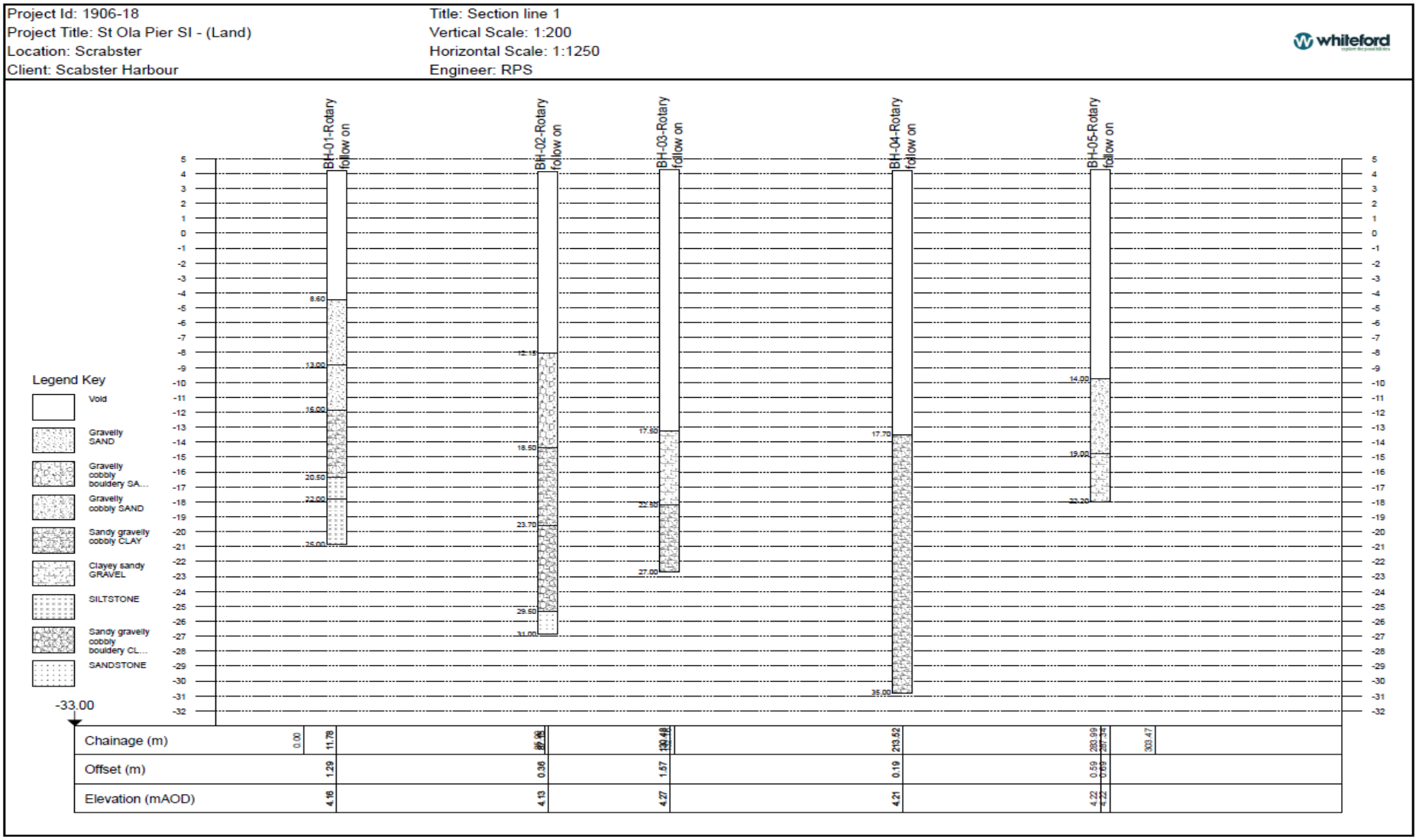


8.29 The ground conditions encountered beneath the Pier are summarised below.

- Concrete
- Void
- Made Ground - Clayey SAND and clayey GRAVEL or sandy gravelly CLAY containing some sub angular cobbles and sub angular boulders. Variable in terms of strength and composition. Contains some boulders.
- Granular Glacial Till - Predominantly granular natural soils, typified by medium dense to dense gravelly SAND. Contain some boulders.
- Cohesive Glacial Till - Predominantly cohesive natural soils or soils with significant cohesive content such as stiff sandy gravelly CLAY.
- Siltstone pertaining to the Scrabster Flagstone Formation.
- Sandstone pertaining to the Scrabster Flagstone Formation.

8.30 A schematic cross section of the ground conditions beneath St. Ola Pier is shown in Figure 8.3.

Figure 8.3: Schematic Cross Section of Ground Conditions Beneath St.Ola Pier



8.4 Assessment of Construction Effects

8.31 Construction of the proposed redevelopment will involve demolition of part of the existing pier. The existing concrete deck and concrete capping beam will be broken out to allow for installation of a new tie rod system and allow for construction of new concrete decking and capping beam.

8.32 Where appropriate, the material generated from the breaking out of the deck and capping beam will be screened and re-used onsite, particularly within the proposed reclamation and revetment areas. All other material will be disposed offsite in accordance with all relevant statutory requirements and regulations.

8.33 Construction of the new pier wall will involve the placement of steel combi wall piles.

8.34 Dredging is proposed adjacent to the proposed pier. The outer side will have a new berth depth of -9m CD to accommodate cruise vessels and the inner side will be dredged to provide a consistent berth depth of -7.5m CD. Dredge spoil will be reused within the reclamation or within the new pier structure if suitable. The volume of dredge material generated by the works is approximately 172,000m^3 of sand, gravel and silt.

8.35 A reclamation laydown area will be constructed at the base of the St. Ola Pier, which will be bounded by a rock armour revetment. The new pavement formed from the reclamation area will be circa 4,000 m2. The fill material used in the reclamation and revetment will consist of reused dredge fill or imported fill, or a combination of both.

8.36 The above construction activities will have a Neutral impact on soils, geology and hydrogeology which are considered to be low sensitivity receptors.

8.5 Assessment of Operational Effects

8.37 The operation of the proposed development will have a Neutral impact on soils, geology and hydrogeology as the operation of the Pier will not cause any change to the soils, geology and hydrogeology baseline.

Potential Changes to the Assessment as a Result of Climate Change

8.38 There are no changes to the assessment as a result of climate change.

8.6 Assessment of Cumulative Effects

8.39 Other proposed developments within the harbour area and further afield have been considered in the context of their potential for cumulative impacts on soils, geology and hydrogeology. Those projects are listed in EIAR Volume II, Appendix 1.2 to the EIAR. There are no significant environmental effects arising in the proposed redevelopment of St. Ola Pier or those other projects which could give rise to significant cumulative soils, geology and hydrogeology effects.

8.7 Mitigation and Monitoring

Construction Phase Mitigation

8.40 Mitigation measures in relation to protection of surface water quality are provided within Chapter 10 Water Quality. No additional soils or geology mitigation is required.

Monitoring

8.41 No monitoring is required.

Operational Phase Mitigation

8.42 No specific soils, geology and hydrogeology mitigation is required. Mitigation measures in relation to protection of surface water quality are provided within Chapter 10 Water Quality.

Monitoring

8.43 No future monitoring is required.

8.8 Residual Effects

8.44 The proposed redevelopment is predominantly occurring within a reclaimed marine environment and therefore the impact to the soils, geology and hydrogeology baseline during both construction and operational phases will be Neutral and Not Significant.

8.45 A summary of the likely environmental effects is presented in Table 8.5.

Table 8.5: Summary of Likely Environmental Effects on Geology, Hydrogeology and Contamination

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant
			Construction phase			
Soils and Geology	Low	Piling and dredging	short term	Neutral	Negligible	Not significant
Hydrogeology	Low	Piling and dredging	short term	Neutral	Negligible	Not significant
			Operational phase			
Soils and Geology	Low	Operation of Pier	short term	Neutral	Negligible	Not significant
Hydrogeology	Low	Operation of Pier	short term	Neutral	Negligible	Not significant

9 COASTAL PROCESSES

9.1 Introduction

9.1 The impact of the proposed redevelopment of the St. Ola Pier and associated dredging on the coastal processes around Thurso Bay and the Pentland Firth has been assessed using advanced computational modelling techniques. The analysis has been undertaken using RPS's in house suite of MIKE coastal process models which are based on software developed by the Danish Hydraulics Institute (DHI). The modules used in this study include:

- Mike21 FM – Tidal flow module
- Mike21 SW – Third generation spectral wave model
- Mike21 BW – Boussinesq harbour disturbance model
- Mike21 FM MT – Mud transport model for dredging and spoil disposal

9.2 Methodology

Tidal Regime

Tidal Model

9.2 The tidal flow model used for the simulation of flows around the Scrabster Harbour area is an existing Pentland Firth model developed by RPS in connection the assessment of tidal free stream energy farms in the Pentland Firth. This tidal model was extensively calibrated for the renewable energy studies and is driven by tidal boundaries taken from RPS's North Coast and northern North Sea model.

9.3 The extent of the tidal model of the Pentland Firth is shown in Figure 9.1 and the mesh of the model area around Scrabster Harbour, Thurso Bay and its approaches is shown in Figure 9.2.

Figure 9.1 Extent of the Pentland Firth tidal model

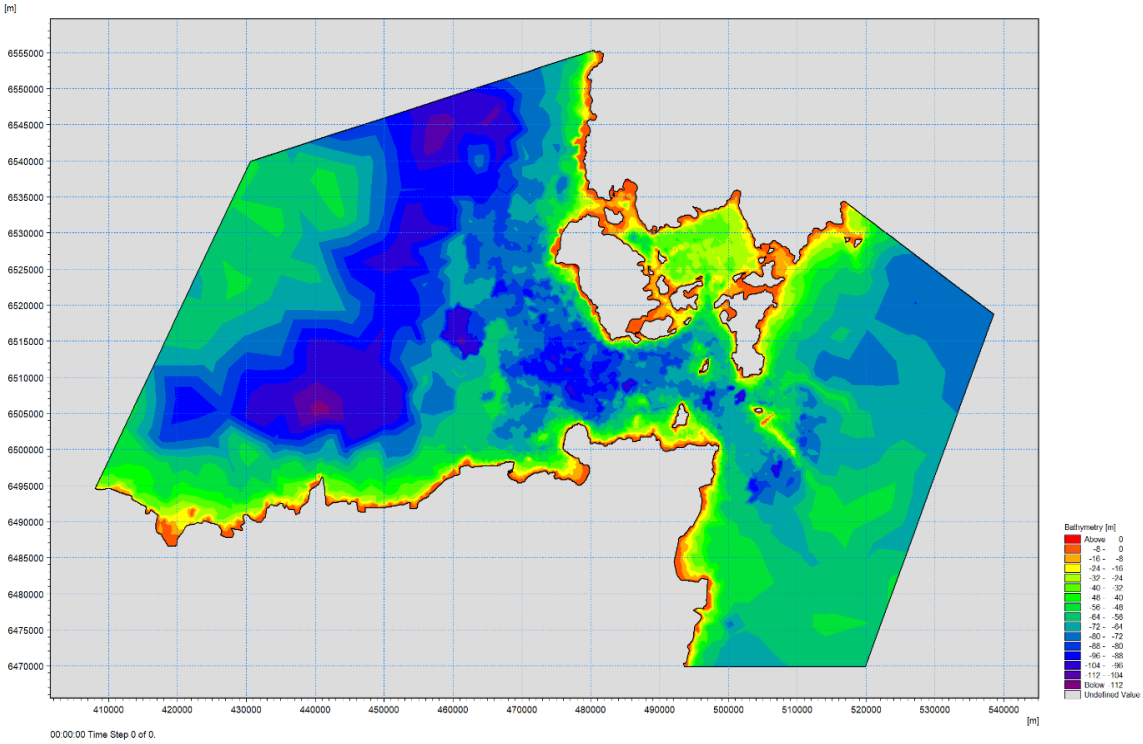
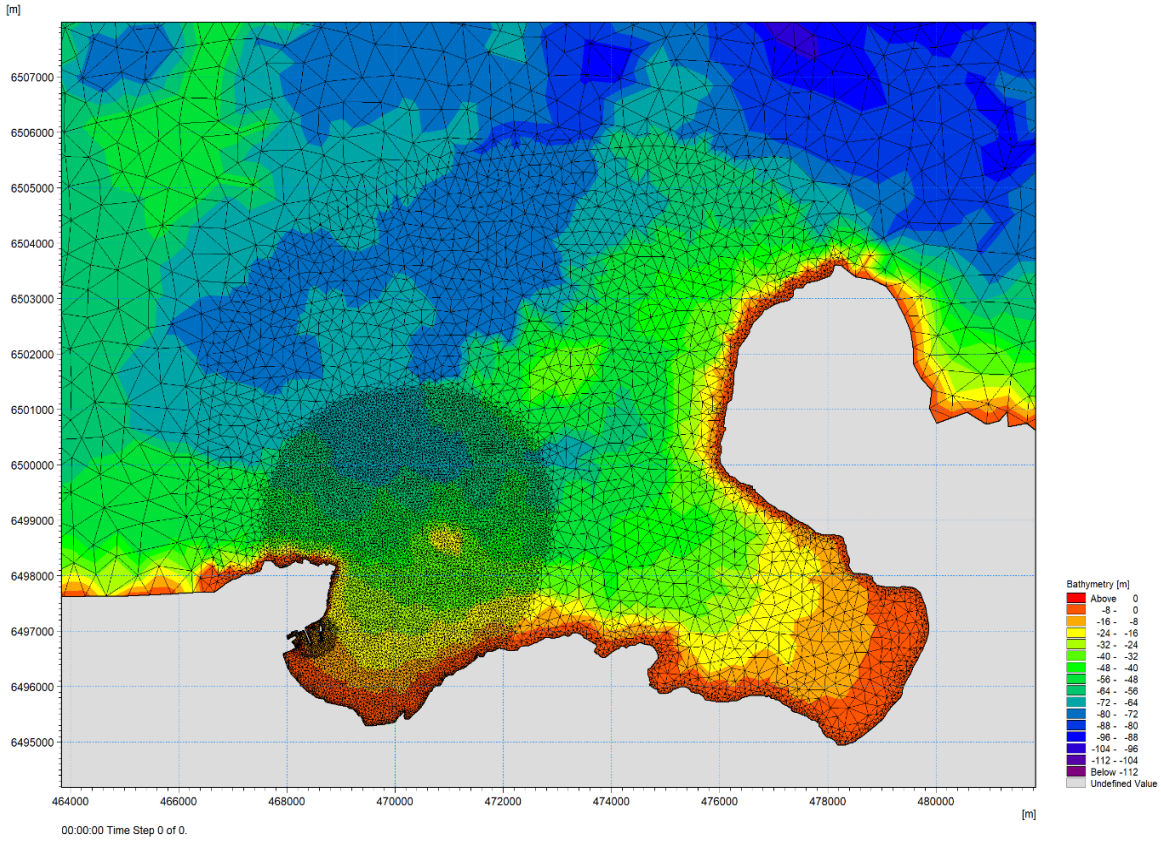


Figure 9.2 Tidal flow model mesh around Scrabster Harbour, Thurso Bay and its approaches



9.3 Baseline

Tidal Regime

Tidal and Extreme Water Levels

9.4 The tidal levels at Scrabaster Harbour to Ordnance Datum and to Chart Datum are shown in Table 9.1.

Table 9.1 Tidal levels at Scrabster Harbour

Tidal	OD	CD
Level	[m]	[m]
HAT	+2.90	+5.60
MHWS	+2.30	+5.00
MHWN	+1.30	+4.00
MSL	+0.16	+2.86
MLWN	-0.50	+2.20
MLWS	-1.70	+1.00
LAT	-2.70	0.00

9.5 The extreme water levels at Scrabster derived from the SEPA database are as shown in Table 9.2.

Table 9.2 SEPA Extreme water levels at Scrabster

Event Return	Water Level	Water Level
Period [years]	OD [m]	CD [m]
1	2.84	5.54
2	2.93	5.63
5	3.05	5.75
10	3.15	5.85
20	3.24	5.94
25	3.28	5.98
50	3.37	6.07

Event Return	Water Level	Water Level
75	3.42	6.12
100	3.45	6.15
150	3.5	6.2
200	3.53	6.23
250	3.56	6.26
300	3.58	6.28
500	3.63	6.33
1000	3.7	6.4
10000	3.95	6.65

9.6 Global warming is expected to increase the sea levels by about 0.52 metres by 2080.

Tidal Flow Regime

9.7 While the Pentland Firth is an area of high tidal energy, the tidal flows around the Scabster and Thurso Bay are relatively benign as Thurso Bay is well away from the main flows in the Pentland Firth.

9.8 Figures 1.3 and 1.4 show the typical spring flood and ebb flows around Thurso Bay and the approaches to Scrabster for the existing harbour layout. It will be noted that due to the eddy that forms to the east of Holborn head on the east going tide the tidal flow north of Scrabster harbour flows north for most of the tidal cycle. It will also be seen from these diagrams that the tidal velocities within Scrabster Harbour itself are very low.

Figure 9.3 Spring flood tidal patterns in Thurso Bay with existing Scrabster harbour layout

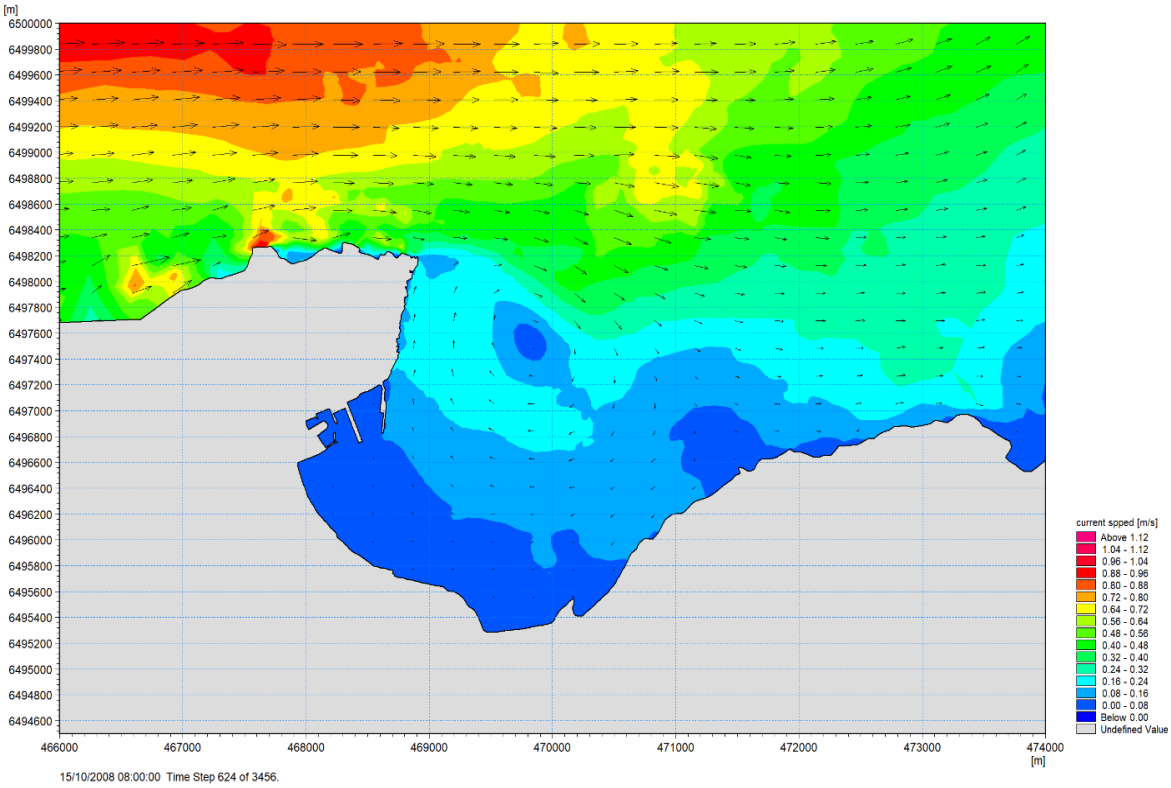
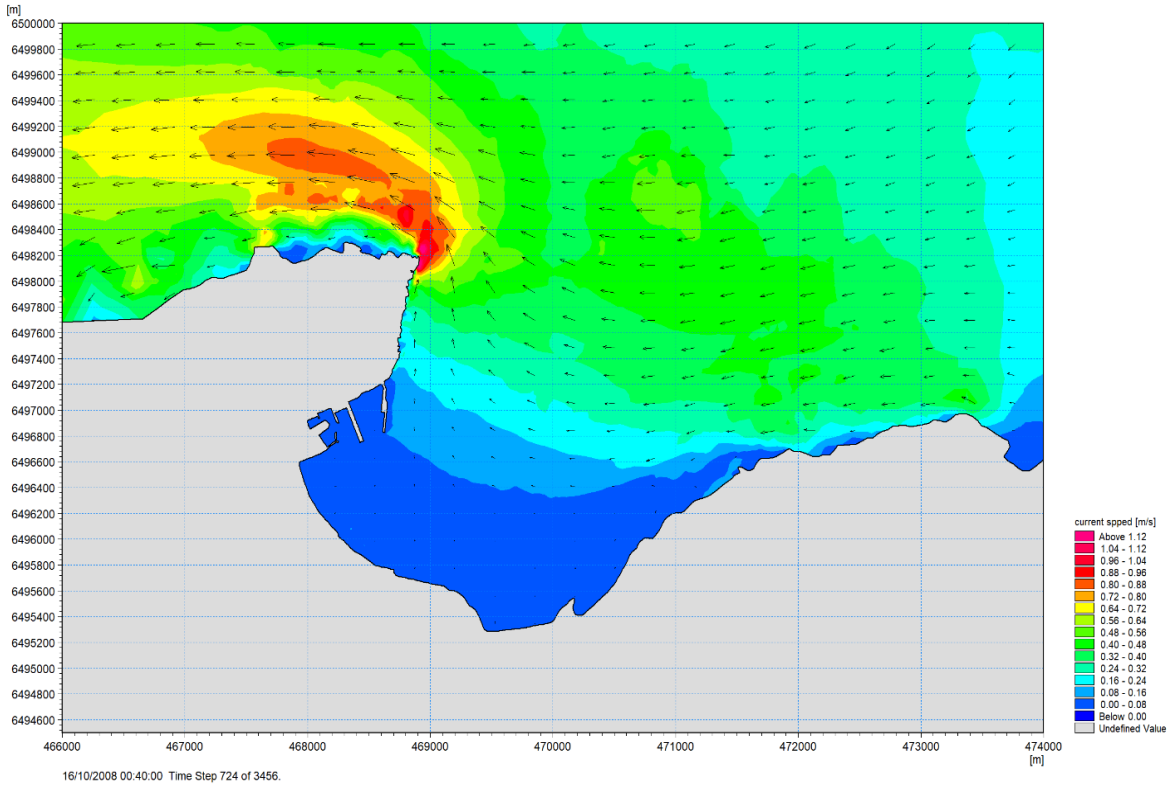


Figure 9.4 Spring ebb tidal patterns in Thurso Bay with existing Scrabster harbour layout



9.9 The typical spring flood and ebb flow patterns in Thurso Bay and Scrabster harbour with the proposed redevelopment of St. Ola Pier and dredging completed are shown in Figures 9.5 and 9.6. It will be seen that these flood and ebb flow patterns are virtually identical to those with the existing Scrabster harbour layout. This observation is confirmed by the difference plots (currents with the proposed redevelopment in place minus the currents with the existing harbour layout) for the flood and ebb flows shown in Figures 9.7 and 9.8. In these difference plots it will be seen that the only significant difference in the tidal currents is within the harbour itself and thus the proposed redevelopment of St. Ola Pier and dredging scheme will have no impact on the tidal regime away from the immediate harbour area.

Figure 9.5 Spring flood tidal patterns in Thurso Bay with proposed redevelopment layout

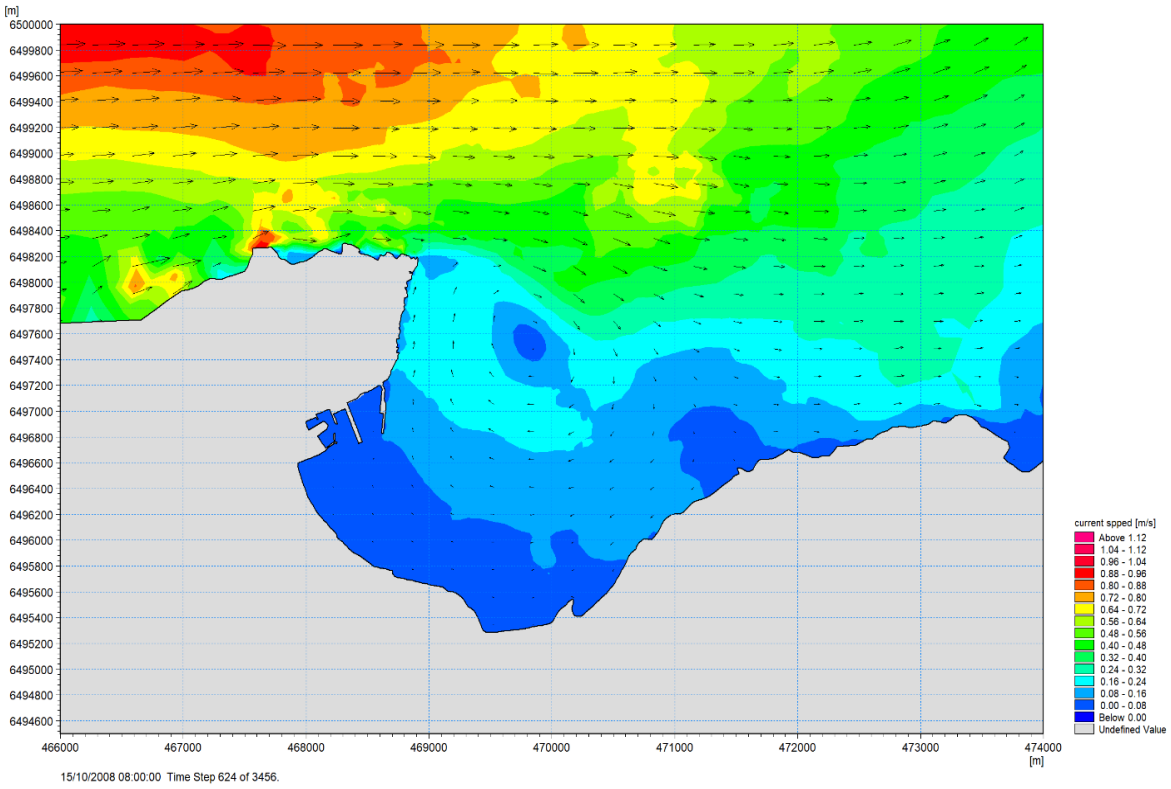


Figure 9.6 Spring ebb tidal patterns in Thurso Bay with proposed redevelopment layout

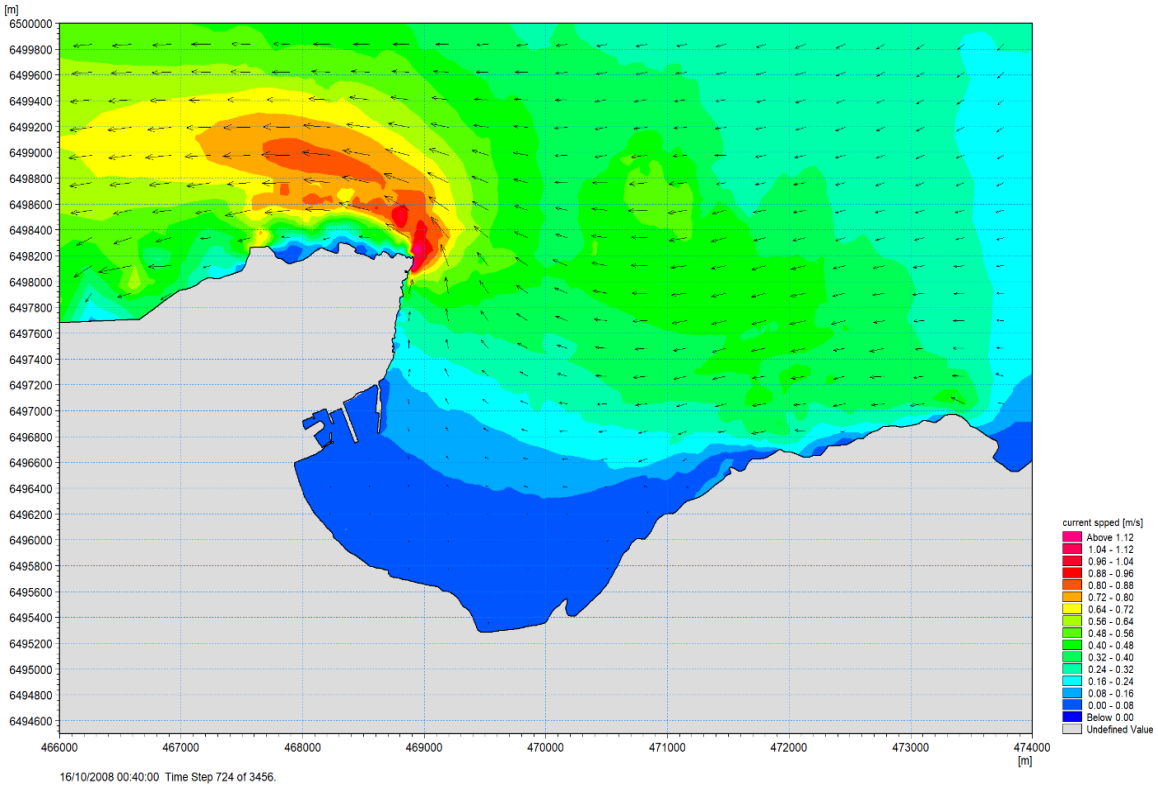


Figure 9.7 Difference in Spring flood flow – Proposed redevelopment minus existing

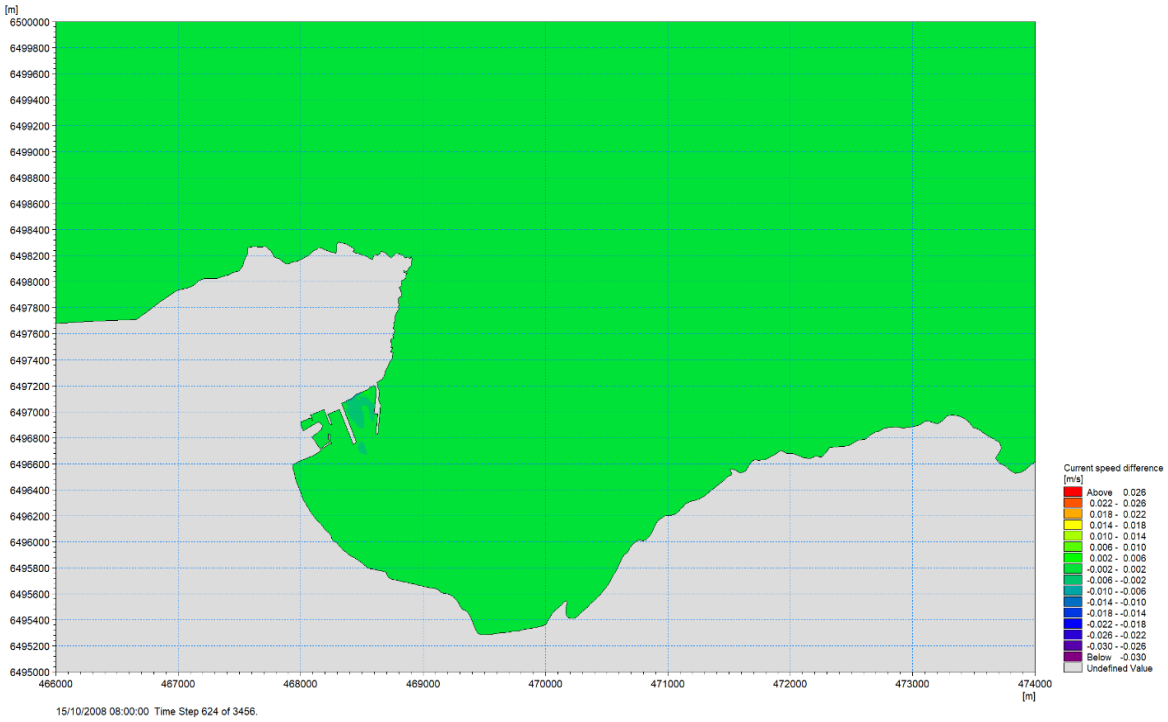
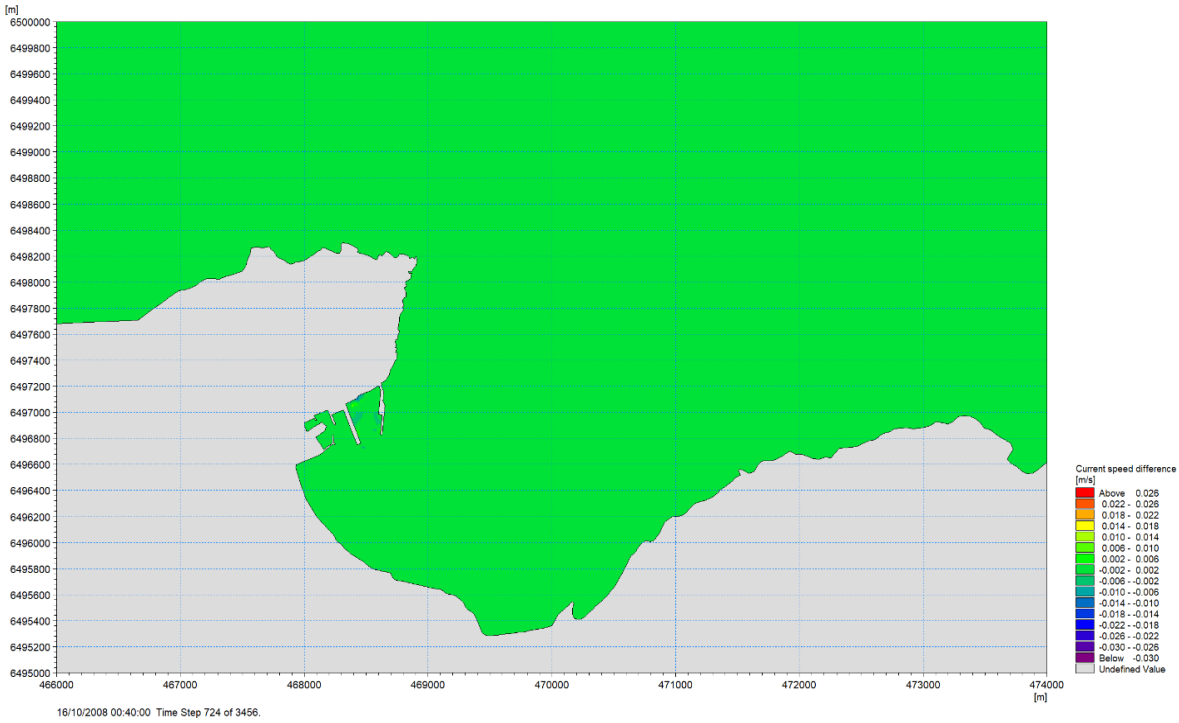


Figure 9.8 Difference in Spring ebb flow – Proposed redevelopment minus existing



Wave Climate

Masterplan II Wave Modelling

9.10 Extensive wave modelling was undertaken as part of the master planning for the phase II development at Scrabster Harbour. This master plan study included the wave modelling for a widened St. Ola Pier and dredging of the outer basin similar to that which is currently proposed for the harbour. Thus, this wave climate assessment has drawn on the modelling already completed for the masterplan study. For completeness, the relevant sections of the masterplan study modelling are included in this section of the Coastal Process Assessment where appropriate.

Offshore Wave Climate

9.11 Offshore wind and wave data for the study was taken from the European Centre for Medium-range Weather Forecasts (ECMWF) western European wave model for a point at 59oN, 4oW. The data set consisted of 3 hourly wind, swell and wind-wave data for the period December 1996 to November 2012. The data was extracted in directional sectors NW N and NE and subjected to an extreme value analysis to obtain the wind, combined wave and swell wave values for 1 in 1 and 1 in 50 year return period events.

9.12 The most arduous offshore conditions for waves approaching Scrabster were found to be with storms from the North North West. The 1 in 50 year return period values were found to be;

- Combined wave 11.18m Hm0, 16.76s Tp with wind speed 24.68m/s, or
- Swell 7.40m Hm0, 18.32s Tm.

9.13 The 1 in 1 year return period values were found to be;

- Combined wave 5.24m Hm0, 11.47s Tp with wind speed 16.61 m/s, or
- Swell 4.77m Hm0, 14.84s Tm.

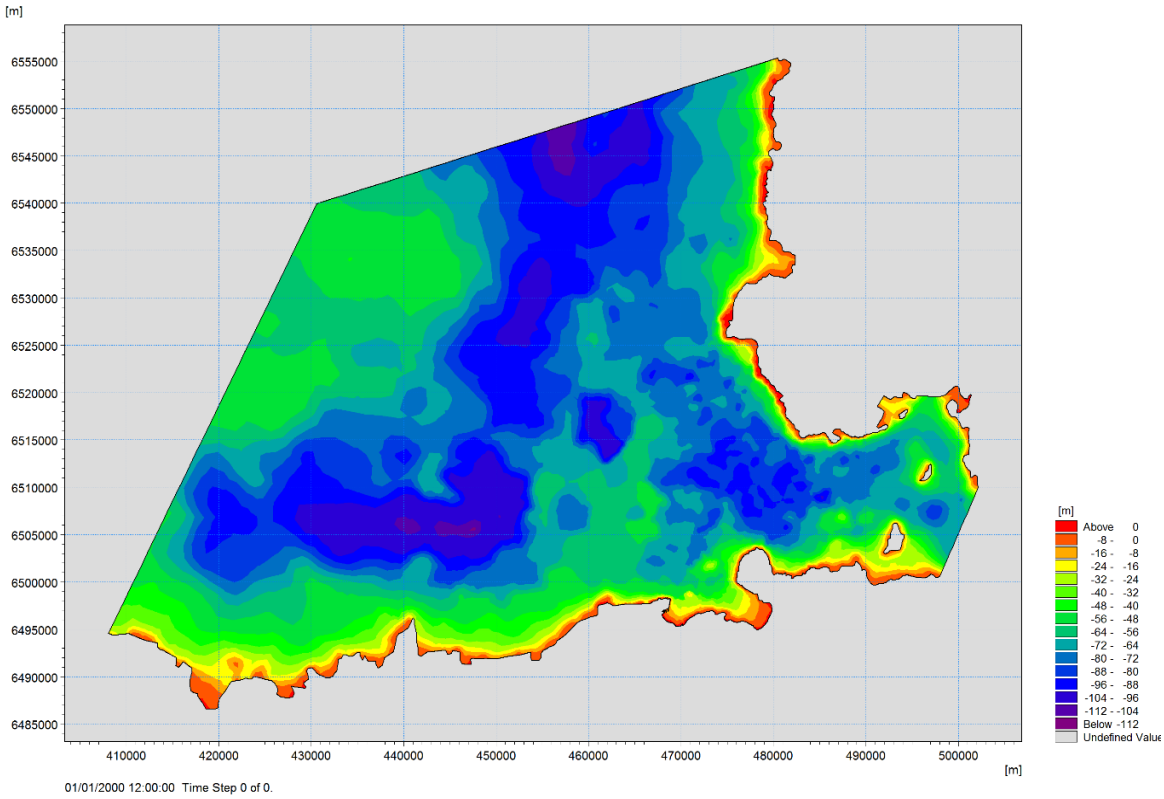
9.14 The wind speed for the restricted fetches for storms from the North East, East and South East were calculated to be;

• 1 in 50 year return period storm	NE	26.3 m/s
	E	27.3 m/s
	SE	30.0 m/s
• 1 in 1 year return period storm	NE	18.4 m/s
	E	19.2 m/s
	SE	21.3 m/s

Wave Transformation

9.15 The wave transformation from offshore to the approaches to the harbour was undertaken using a Mike21 spectral wave model. The extent and bathymetry of this spectral wave model is shown in Figure 9.9.

Figure 9.9 Extent and bathymetry of Mike21 Spectral Wave transformation model



9.16 Due to the vulnerability of the harbour at Scrabster to long wave disturbance, the Mike21 SW model was used to simulate the growth and transformation of a range of storm conditions which might result in wave resonance within the harbour basins. Most of the simulations were undertaken at high tide levels including an allowance for storm surge where appropriate. The simulations were undertaken using both single peaked storm wave spectra, which is applicable to storms where the wave climate is dominated by the high wind wave activity, as well as storms where there is both winds sea and swell present in the sea state. Simulations were also undertaken for conditions where there were only Atlantic swell waves present.

9.17 Examples of results of the wave transformation simulations are shown in Figures 9.10, 9.11 and 9.12.

Figure 9.10 Significant combined wave height and mean wave direction - 1 in 50 year return period storm from 355°

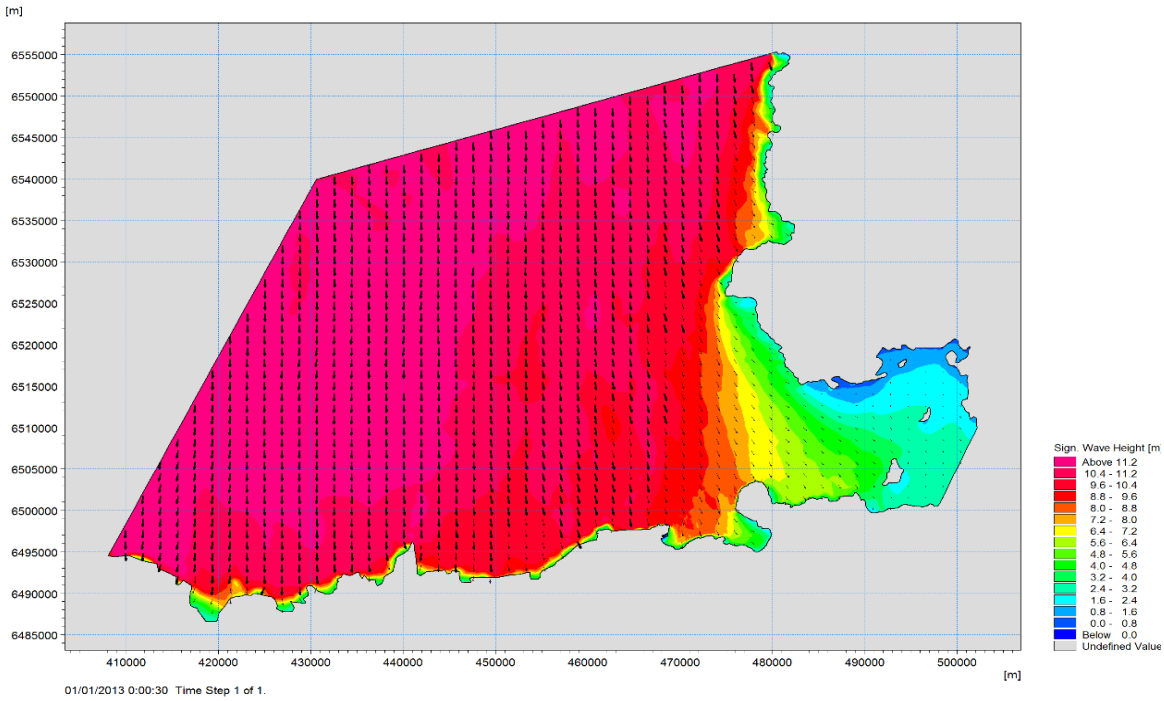


Figure 9.11 Significant combined wave height and mean wave direction - 1 in 50 year return period storm from 355° at Scrabster

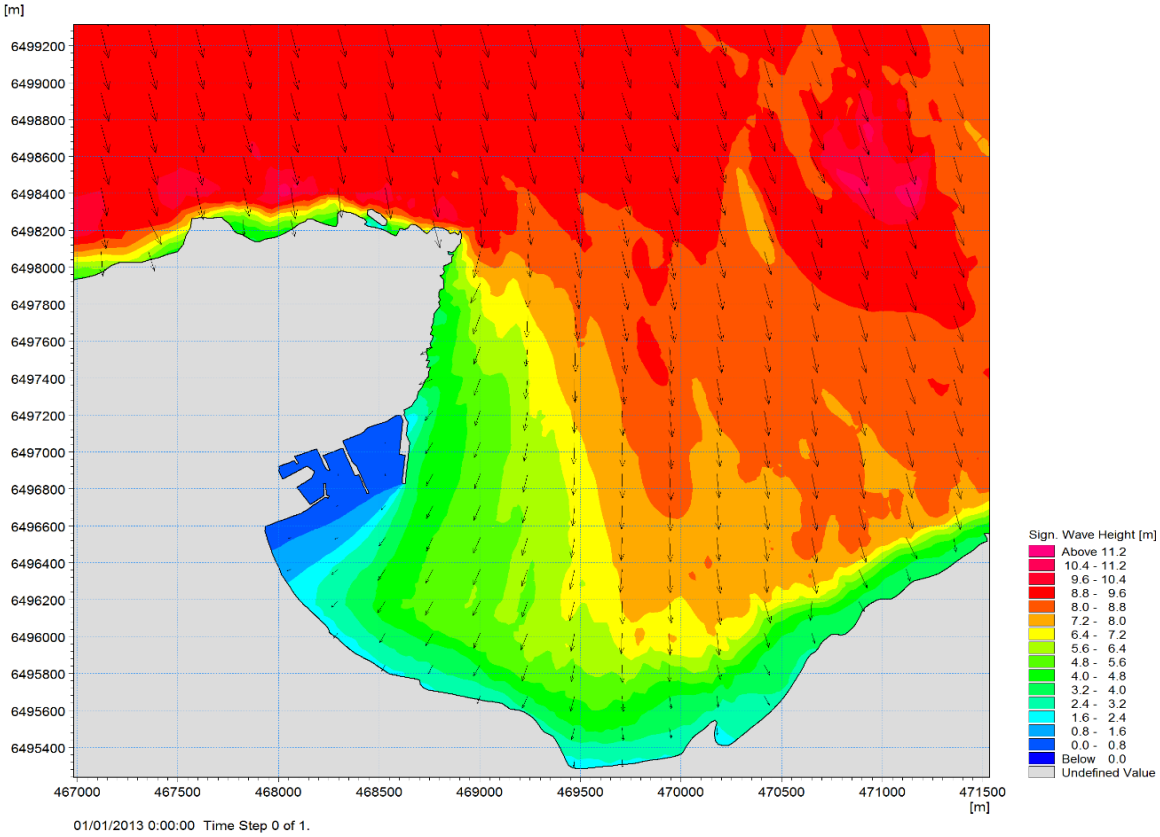
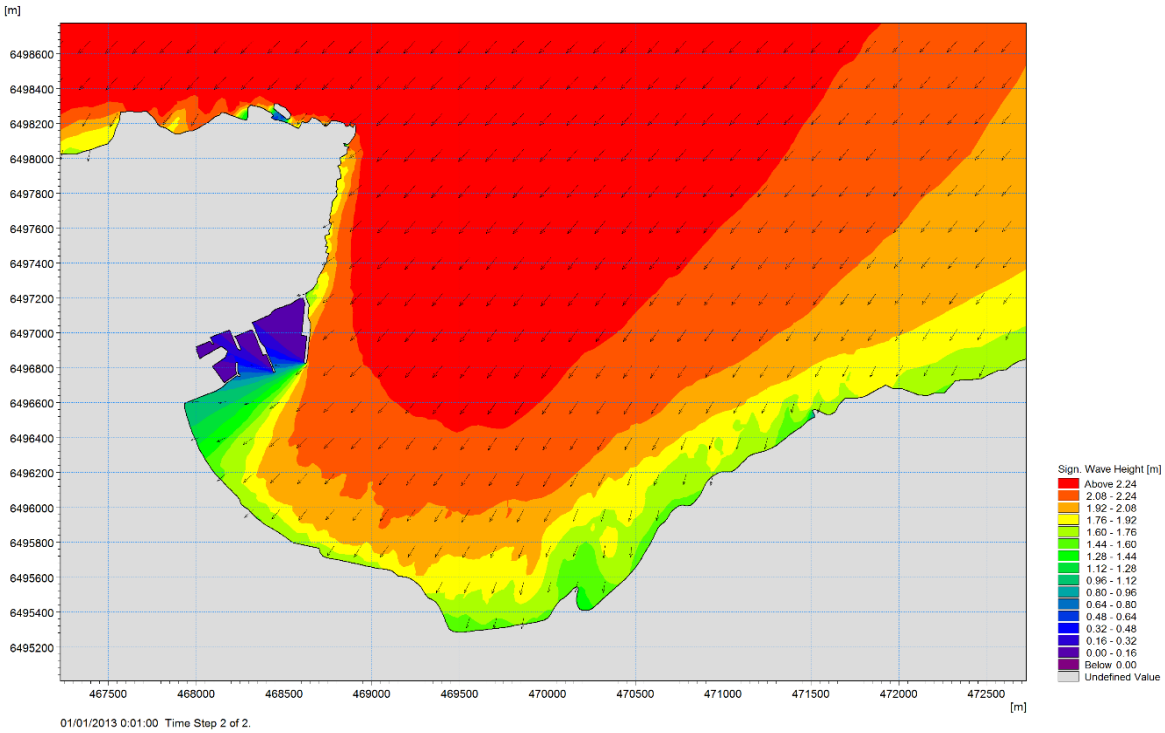


Figure 9.12 Significant combined wave height and mean wave direction - 1 in 50 year return period storm from NE at Scrabster



9.18 The wave transformation simulations showed that storm waves from the North West to North sector can be refracted around Holburn Head and approach Scrabster Harbour. During extreme storms, waves of up to 7 metres significant wave height can pass around Holburn Head but are rapidly attenuated down to about 4 meres significant wave height by the time they approach the piers at Scrabster Harbour. Long period swell from the North Atlantic can also approach the harbour area but the height of the swell generally does not exceed 3 metre with wave periods varying between about 14 to 18 seconds at the approaches to the harbour. These major storm waves usually approach the harbour area from a NNE direction.

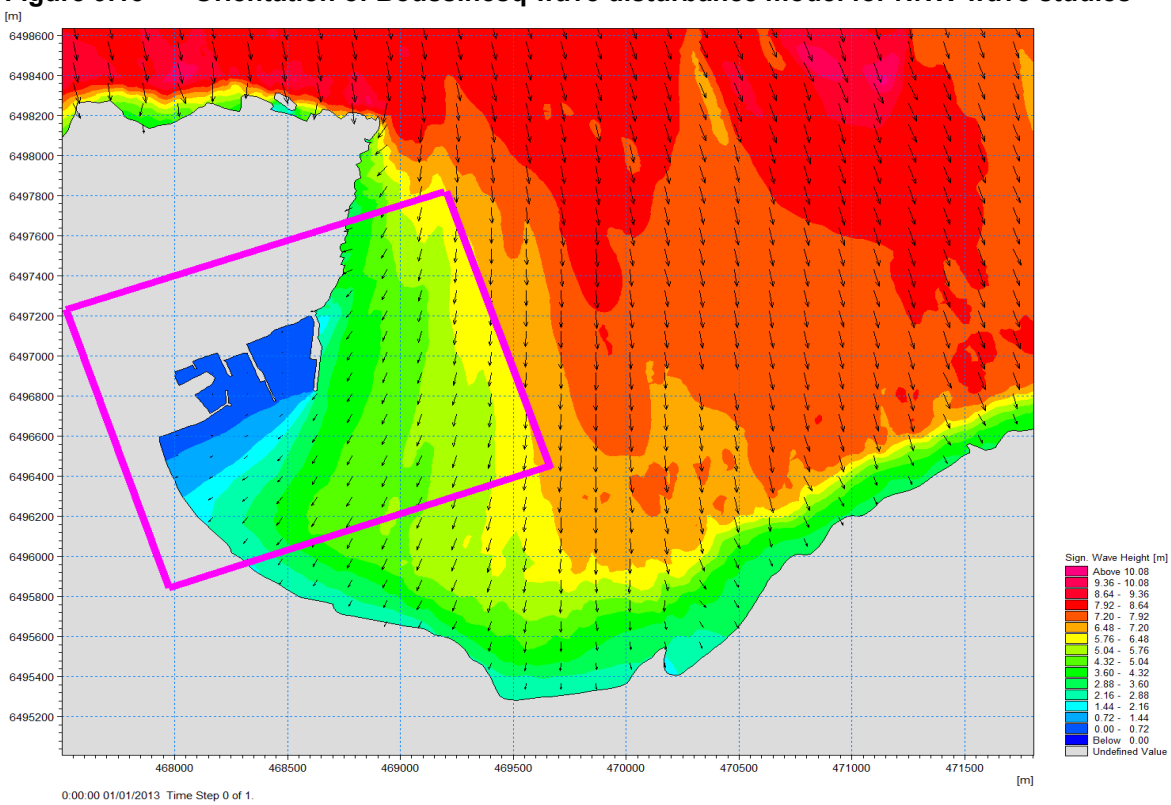
9.19 Storms from the North East are generated over the fetches across the Pentland Firth and therefore have much shorter wave periods than those which approach from the North West to North direction. Major storm waves from this direction will have significant wave heights of in excess of 2 metres with peak wave periods of about 6 seconds at the approaches to the harbour.

9.20 Storm waves which approach the harbour from the East to South East direction are generated across the short fetches from Dunnet Head, Caithness. These storm waves will typically have short wave periods of 3 seconds or less and wave heights of 1.5 metre or less at the harbour.

Harbour Disturbance

9.21 Wave disturbance modelling was undertaken to establish the wave climate in and around the harbour area. The modelling was undertaken using an advanced Boussinesq wave model with the boundary wave data taken from the results of the wave transformation modelling. The relationship of the Boussinesq wave model for the NNW wave direction simulations to the wave transformation model is shown in Figure 9.13.

Figure 9.13 Orientation of Boussinesq wave disturbance model for NNW wave studies

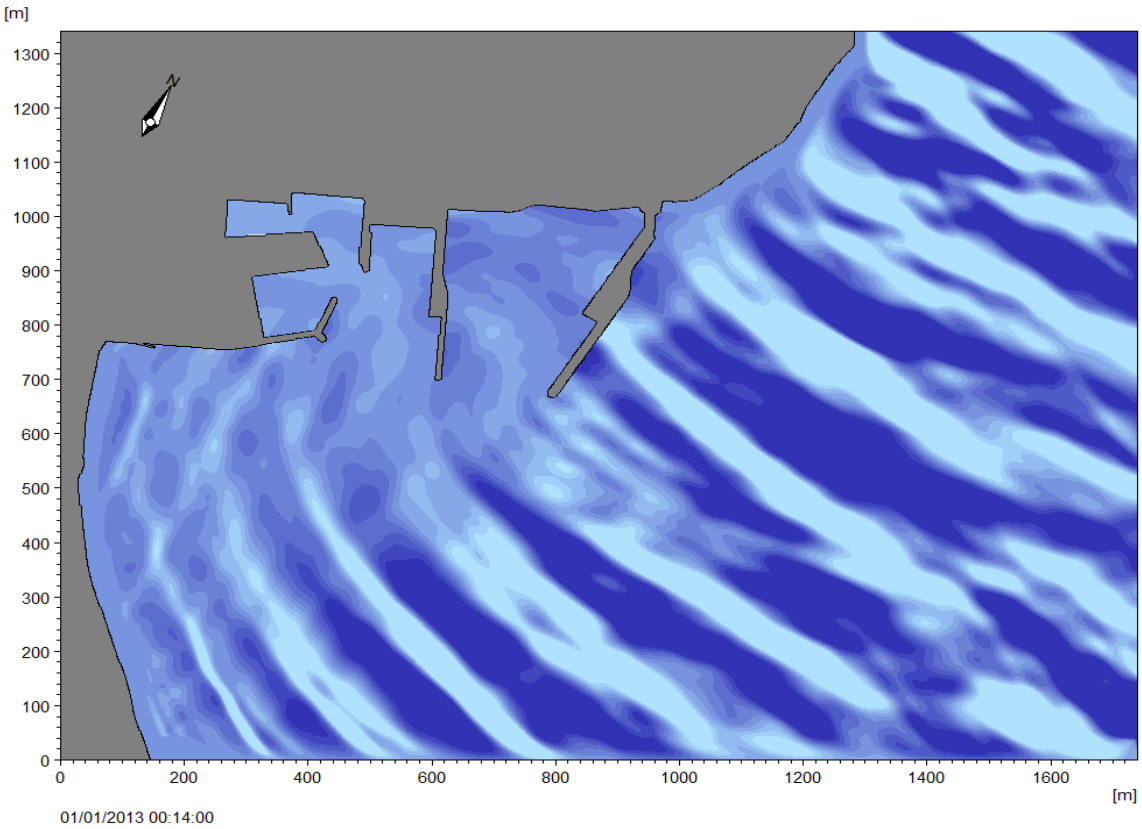


9.22 As the storm waves which approach the harbour from the East to South East direction have a very short wave period, the wave heights around the harbour basins were simulated using a spectral wave model which included diffraction and wave energy reflection from the various boundaries of the model. This approach was preferred due to the shallow water requirements in the Boussinesq wave equations with very short period waves.

9.23 The Boussinesq wave disturbance model was first run for the existing Scrabster Harbour configuration to give a baseline for the assessment of the various options. The simulations were generally undertaken at HAT level for the 1 in 50 year return period North West to North direction storms and at MHWS for the 1 in 1 year events from the North West to North sector and for the 1 in 50 year events from the North East.

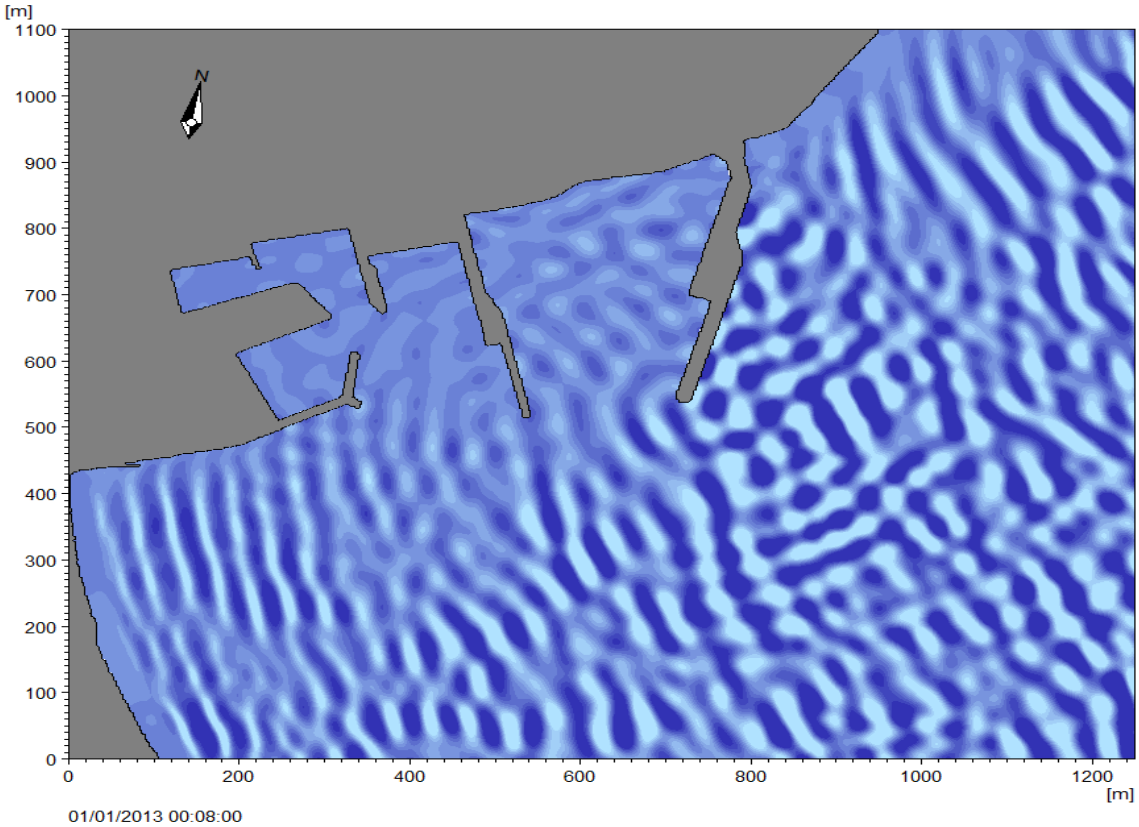
9.24 Figure 9.14 shows the wave disturbance patterns around the existing harbour during a North North Westerly combined wind-sea and swell wave event with a 7 metre high wave with spectral peak wave period of 16.5 seconds. It will be seen that the waves diffract around the end of the QE Pier and are reflected off the outer face of the existing Ola pier towards the berth on the inside of the QE Pier. A standing or resonant wave pattern develops in the outer harbour basin.

Figure 9.14 Wave disturbance patterns –Combined NNW wave 7m Hm0, 16.5s Tp



9.25 The wave length of the waves during storms from the North East are very much shorter with periods of 6.0 seconds or less, Figure 9.15. The waves are still diffracted around the end of the QE pier and reflected from the outer face of the St. Ola pier but the long period resonance in the outer harbour area is not in evidence during storms from this direction.

Figure 9.15 Wave disturbance patterns – NE wind sea 2.40m Hm0, 6.0s Tp



9.26 Simulations were also undertaken for the harbour with the redeveloped St. Ola Pier and the dredged outer harbour basin. This harbour proposal was subjected to the same range of North North West and North East storms with the existing harbour layout. The wave disturbance patterns for the harbour with the redeveloped St. Ola Pier and the dredged outer harbour are shown in Figures 9.16 and 9.17.

9.27 It will be noted that as the outer harbour suffers from some resonance effects during the longer period wave events, the dredging of the outer harbour area changes the resonance patterns due to the greater depth of the outer harbour with this proposal.

Figure 9.16 Wave disturbance patterns – redeveloped St. Ola Pier with dredged outer harbour
Combined NNW wave 7m Hm0, 16.5s Tp

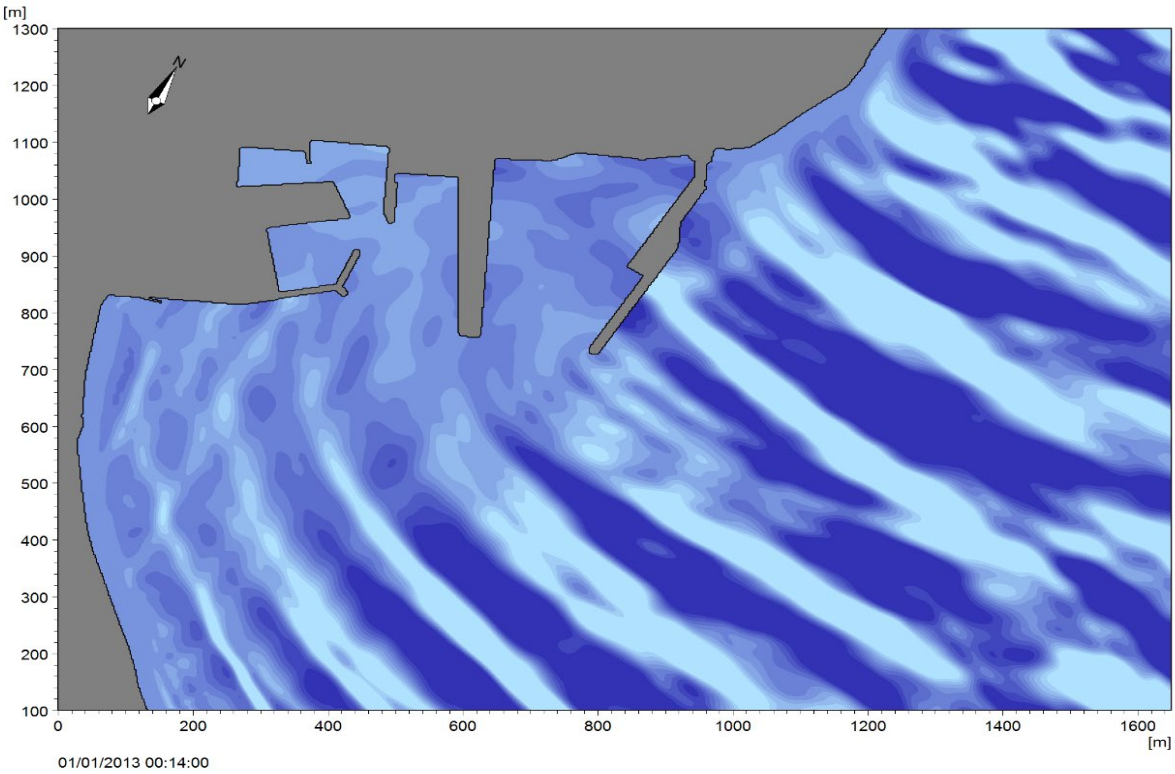
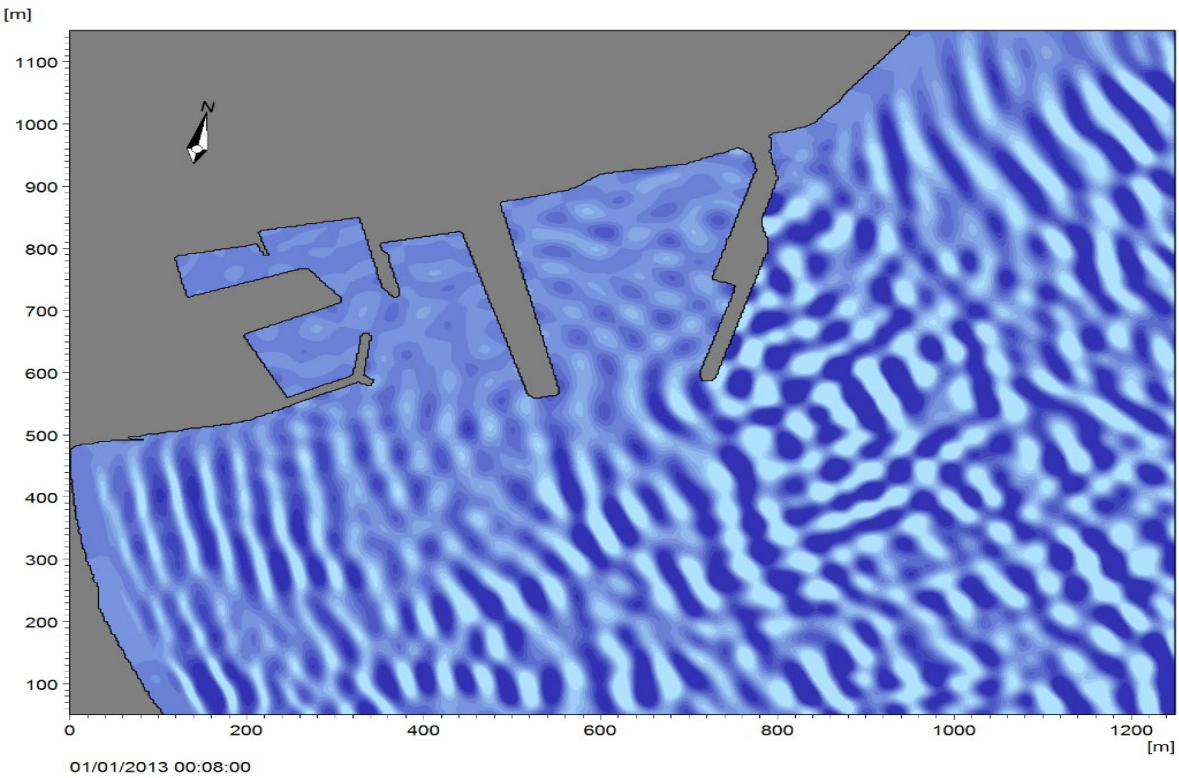


Figure 9.17 Wave disturbance patterns – redeveloped St. Ola Pier with dredged outer harbour
NE wind sea 2.40m Hm0, 6.0s Tp



Results of Wave Simulations

9.28 The performance of the existing harbour during storms from a north north westerly direction is shown in Figures 9.18 to 9.20. it will be seen that, while the wave heights around the harbour are different for the varying offshore storm intensities, the general pattern of the distribution of wave heights particularly in the outer harbour, is similar in all three diagrams. This is a result of a natural resonant mode in the outer harbour which is present during storms with relatively long period waves.

9.29 The resonance does not appear in the results of the shorter period waves with the north easterly storm though there is still reflection of incoming wave which have been diffracted around the end of the QE Pier from the outer face of the existing Ola pier, Figure 9.21.

Figure 9.18 Significant wave heights around the existing harbour 7m Hm0, 16.5s Tp from NNW at HAT

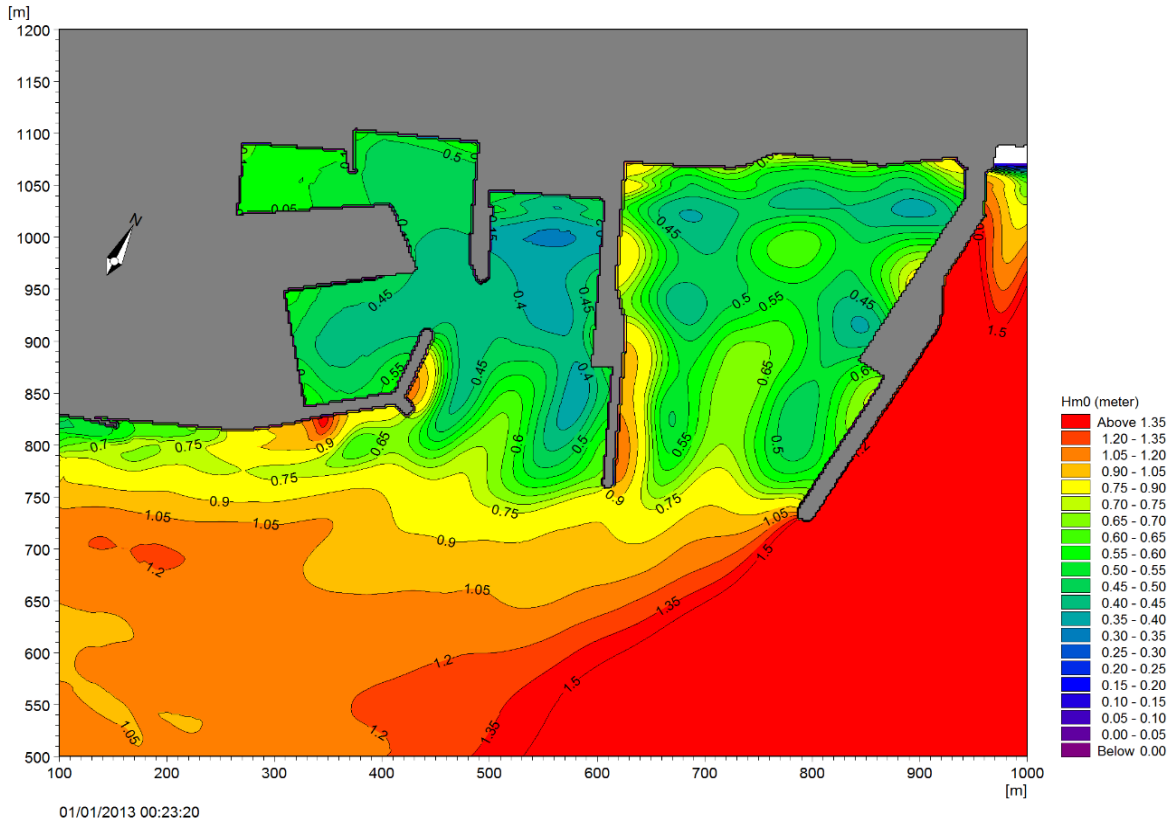


Figure 9.19 Significant wave heights around the existing harbour 4.25m Hs, 17.48s Ts from NNW at HAT

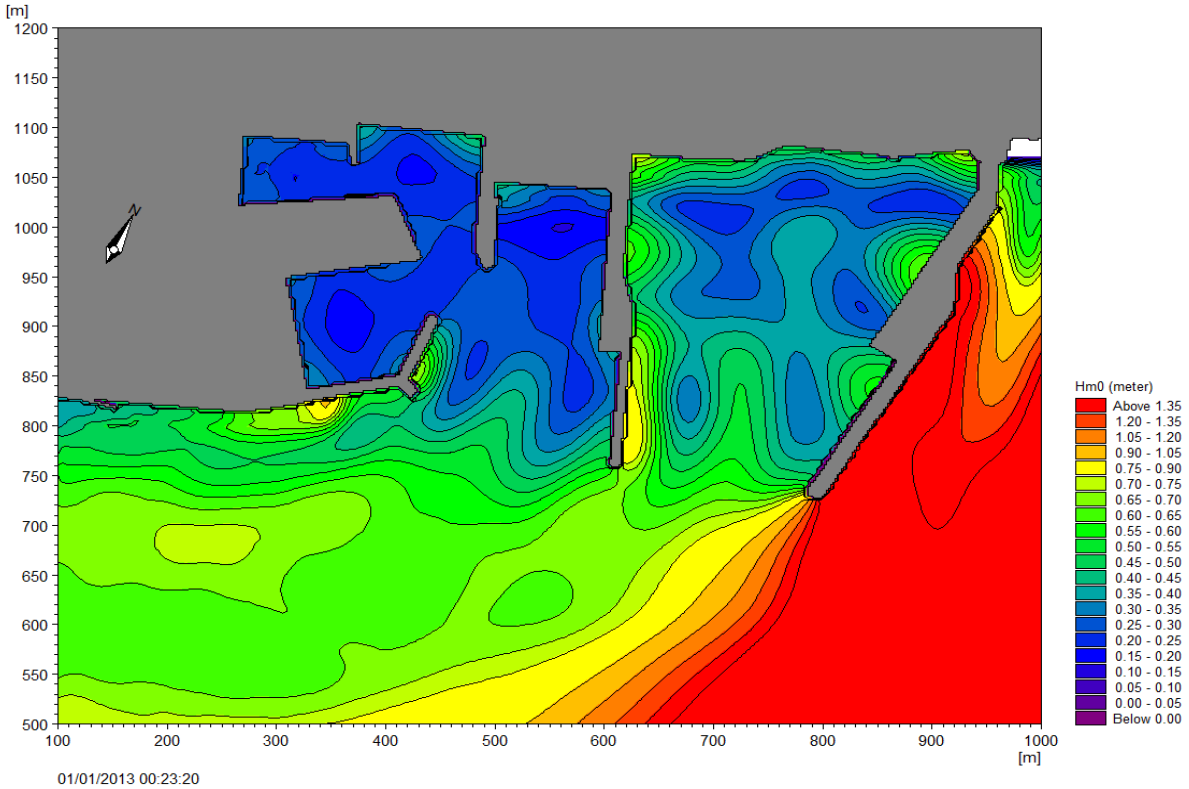


Figure 9.20 Significant swell wave heights around the existing harbour 2.80m Hs, 14.87s Ts from NNW at MHWS

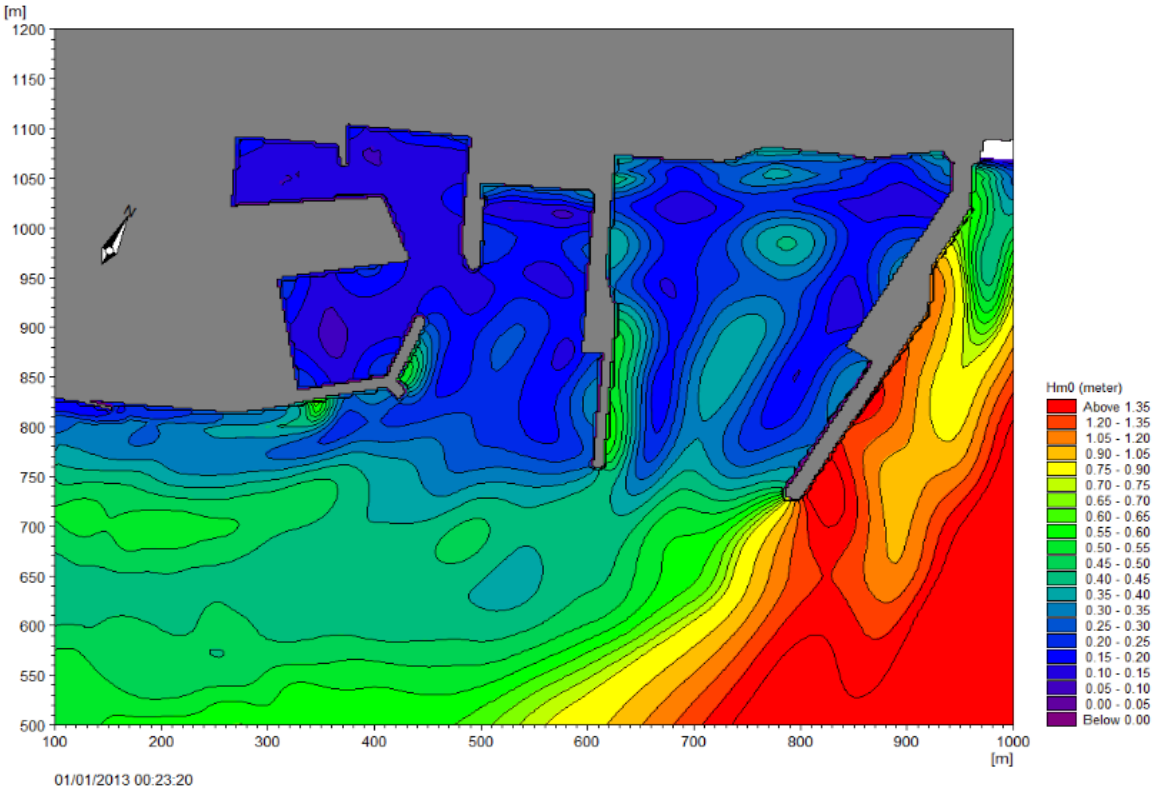
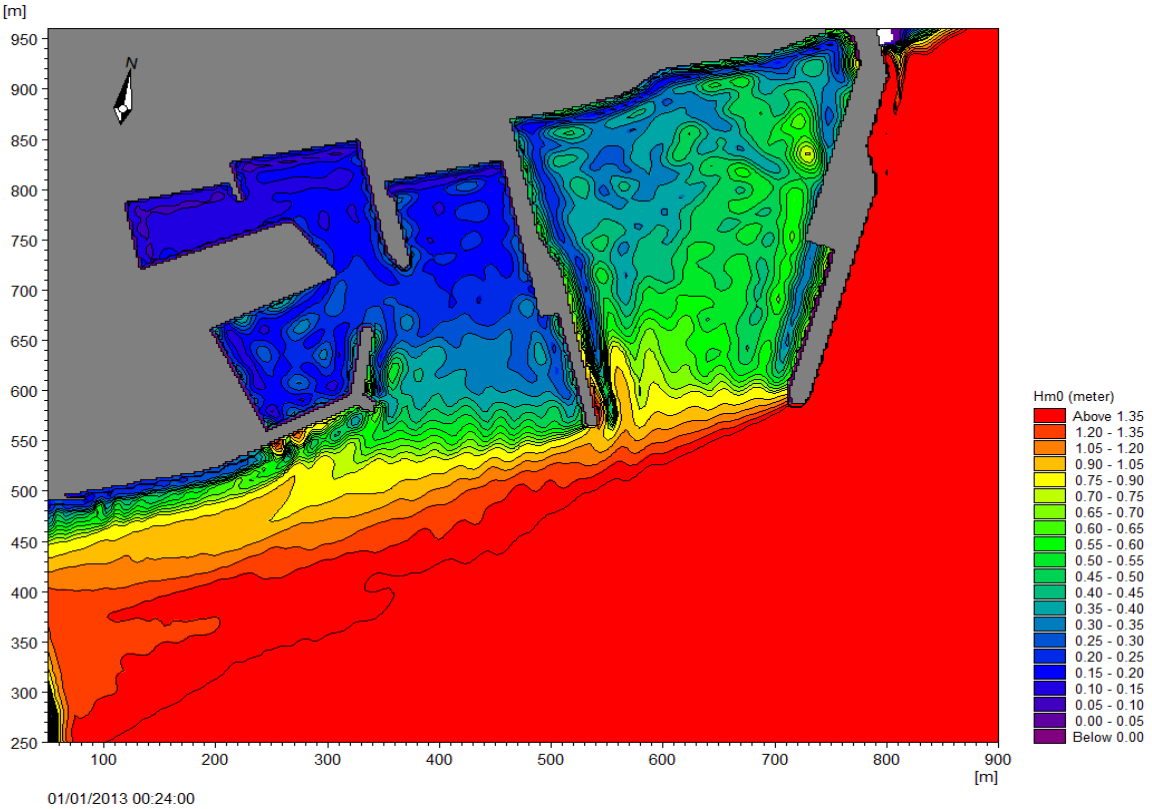


Figure 9.21 Significant wave heights around the existing harbour 2.40m Hm0, 6.0s Tp from NE at MHWS



9.30 Figures 9.22 to 9.25 show the wave heights around Scrabster harbour with the redeveloped St. Ola Pier and the dredging of the outer harbour. The results of these simulations can be compared with those for the existing harbour shown in Figures 9.18 to 9.21. As with the existing harbour, the dredged outer harbour still suffers from resonance during periods with long period swell type waves but the effect of dredging the outer basin is to make the surging at the QE pier berth slightly worse than with the existing harbour.

9.31 The simulations for the SE storms have not been shown for either the existing or the proposed redevelopment as during SE storms Scrabster harbour will be on lee shore and therefore will not affect the wave climate away from the immediate confines of the port.

Figure 9.22 Significant wave heights – redeveloped St. Ola Pier with dredged outer harbour
7m Hm0, 16.5s Tp from NNW at HAT

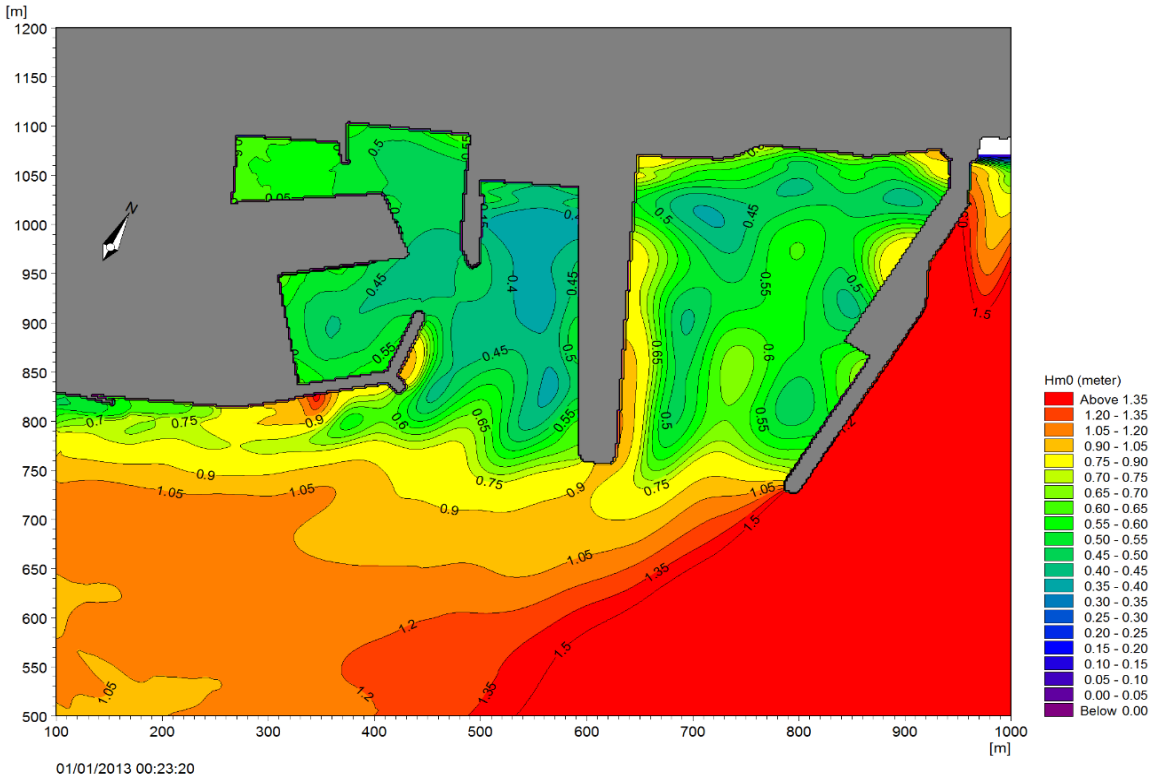


Figure 9.23 Significant wave heights – redeveloped St. Ola Pier with dredged outer harbour
4.25m Hs, 17.48s Ts from NNW at HAT

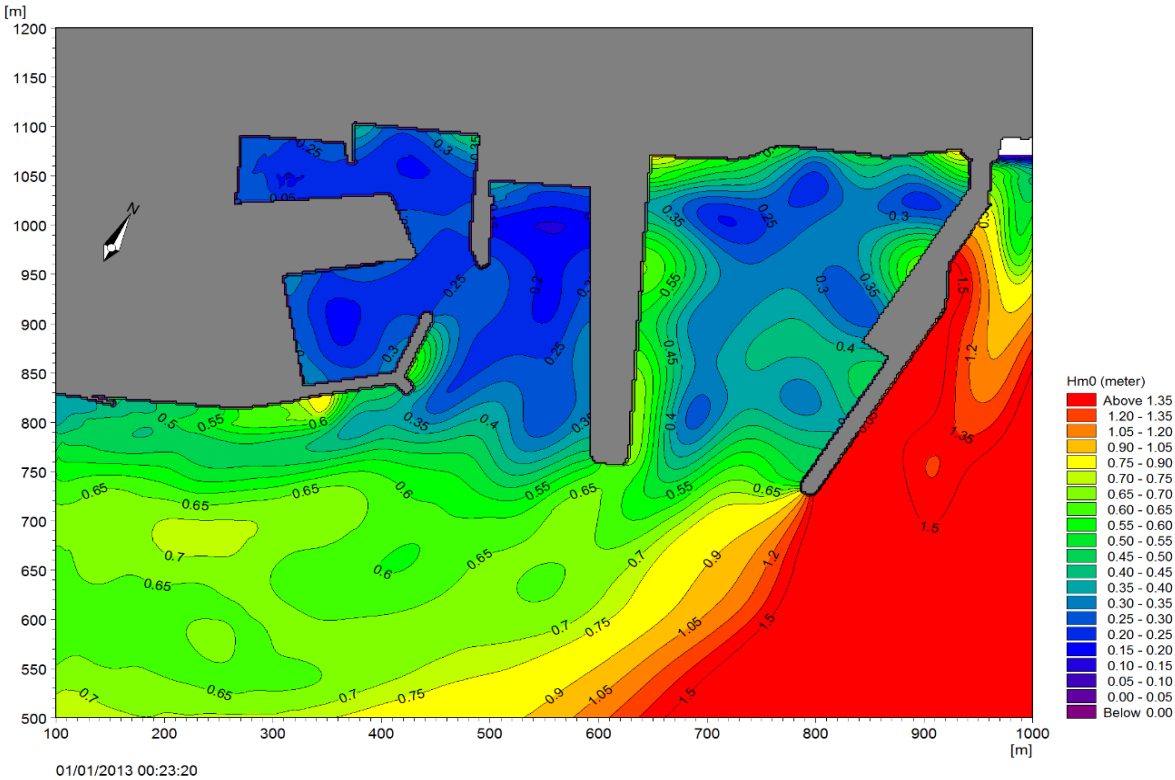


Figure 9.24 Significant wave heights – redeveloped St. Ola Pier with dredged outer harbour
2.80m Hs, 14.87s Ts from NNW at MHWS

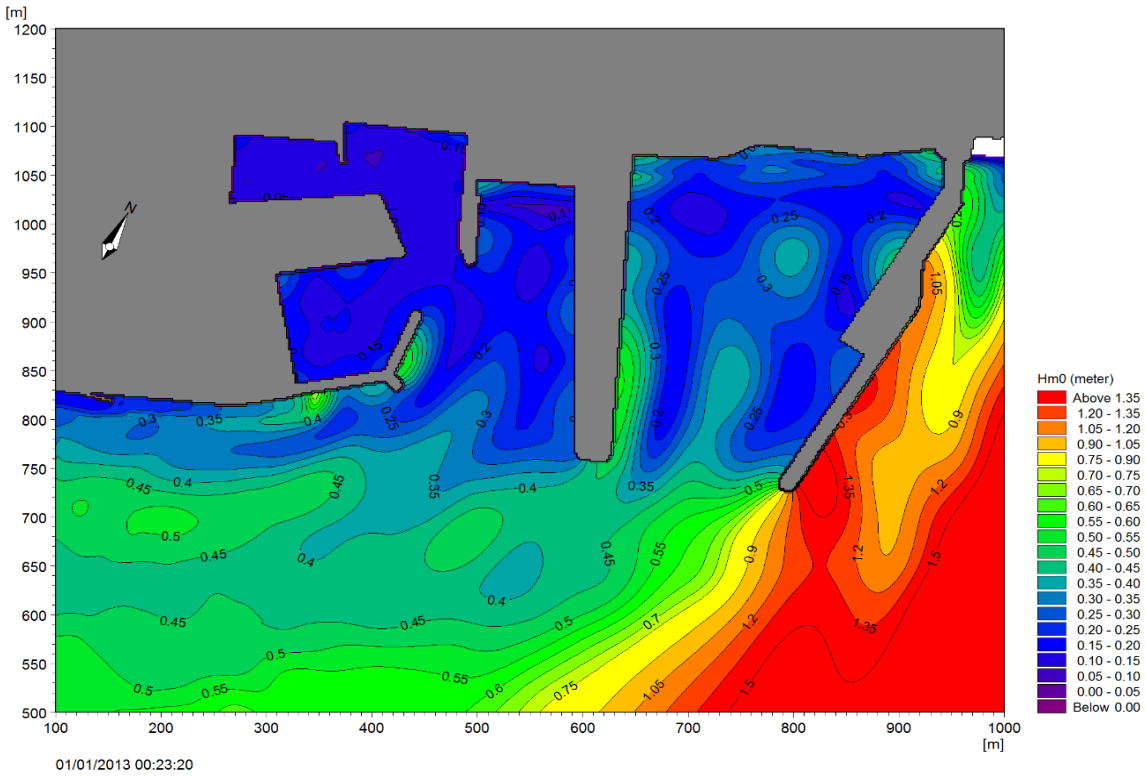
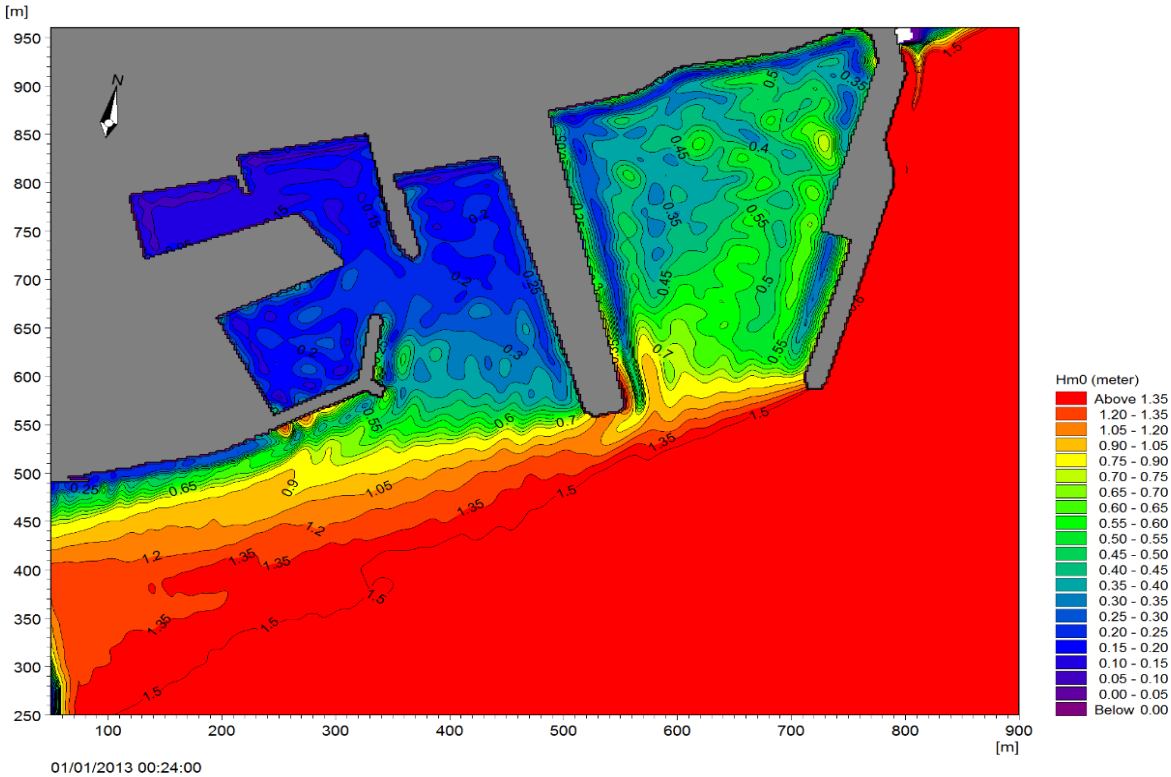


Figure 9.25 Significant wave heights – redeveloped St. Ola Pier with dredged outer harbour
2.40m Hm0, 6.0s Tp from NE at MHWS



9.32 In order assess the impact of the redeveloped St. Ola pier and the dredging of the outer basin on the wave climate, wave height difference plots showing the wave heights with the St. Ola Pier and dredging in place minus the wave heights for the existing harbour layout have been produced. The wave height difference plots are shown in Figures 9.26 to 9.29. These diagrams confirm that the dredging of the outer harbour area will alter the resonance wave patterns resulting in a slight increase in the disturbance wave heights in the outer harbour. However, the redeveloped St. Ola Pier and dredging has no significant impact on the wave climate away from the immediate harbour area as any changes that there are in the wave heights are very small at about 20mm.

Figure 9.26 Significant wave height differences – redeveloped St. Ola pier and dredging minus existing 7m Hm0, 16.5s Tp from NNW at HAT

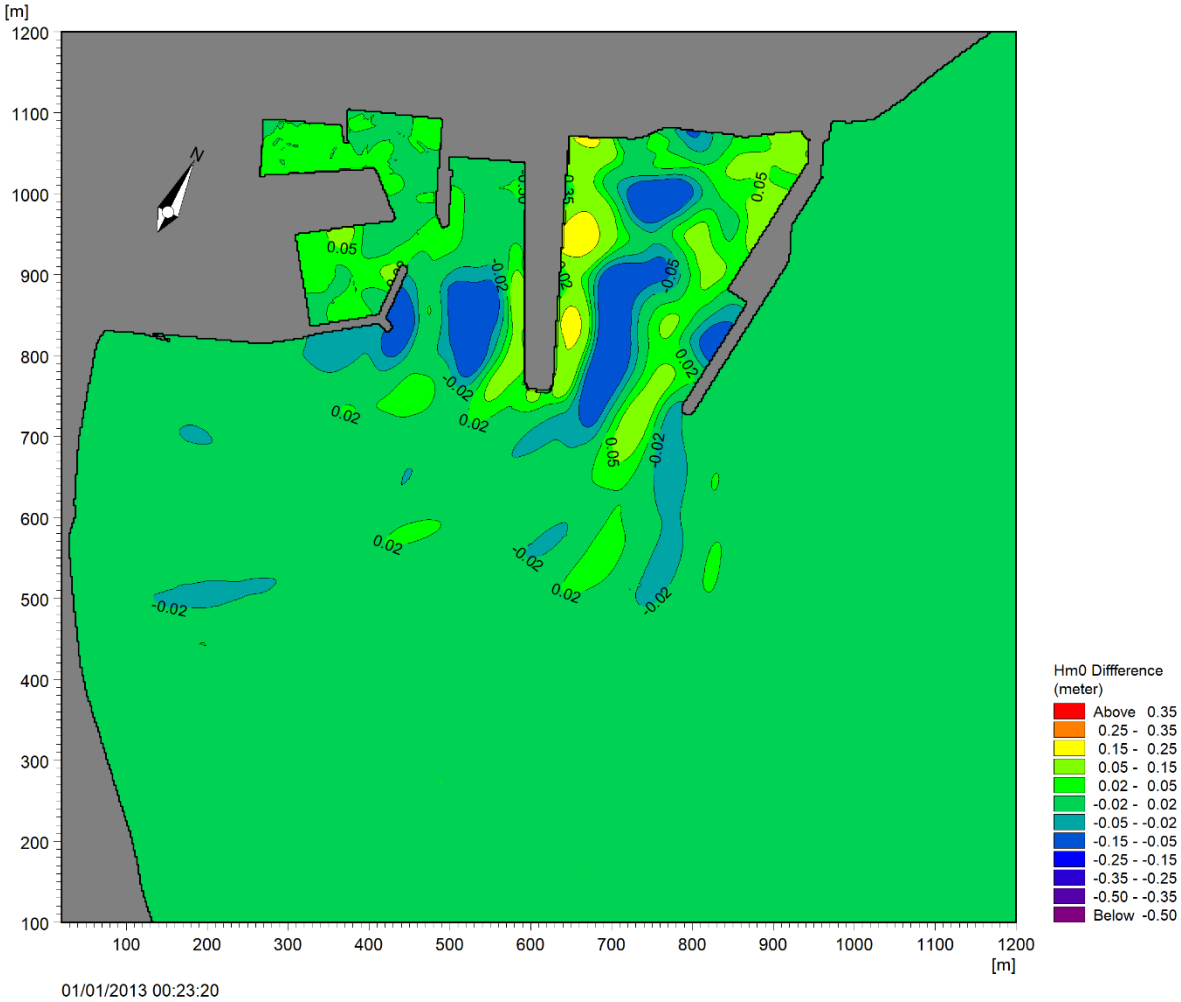


Figure 9.27 Significant wave height differences – redeveloped St. Ola pier and dredging minus existing 4.25m Hs, 17.48s Ts from NNW at HAT

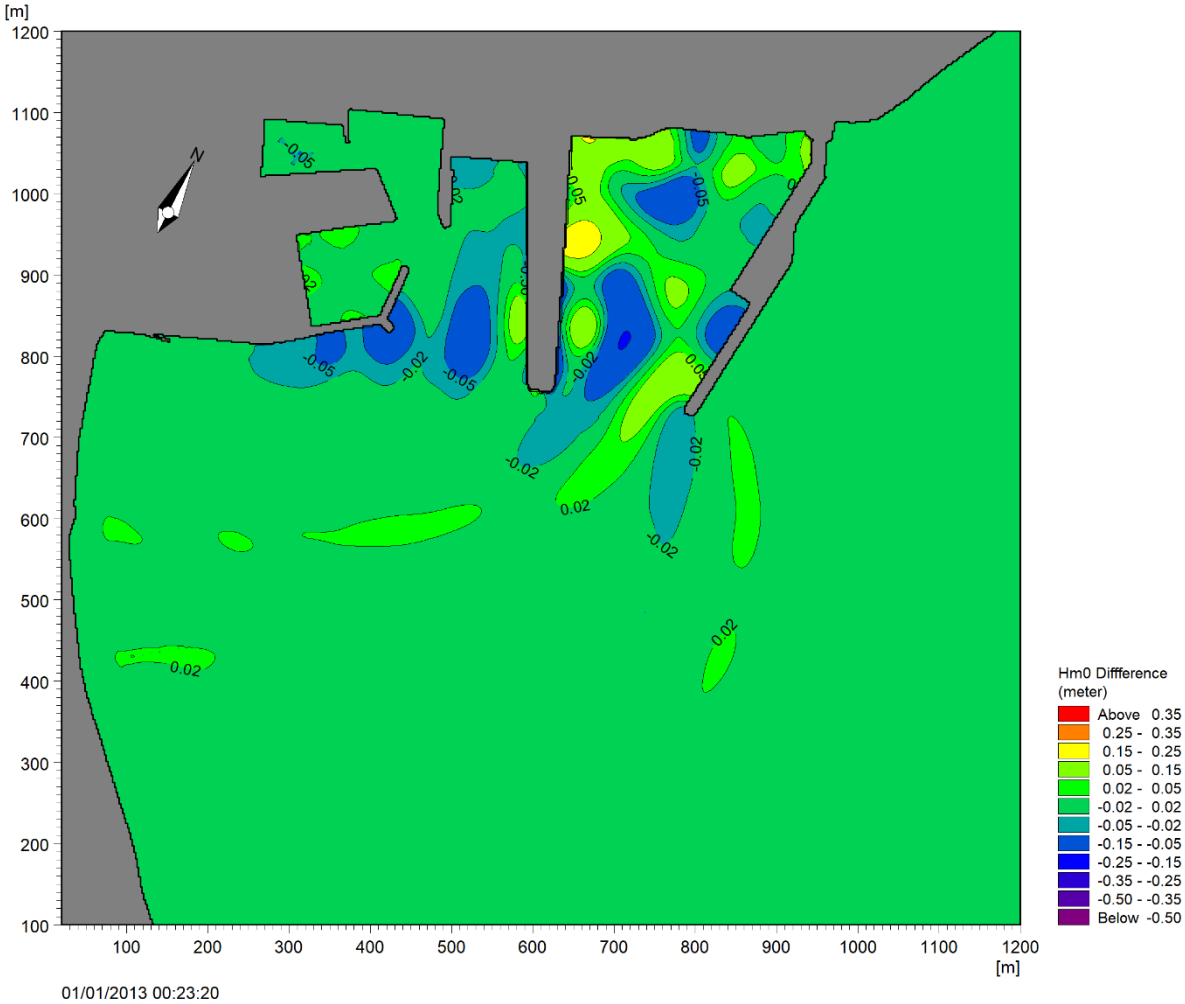


Figure 9.28 Significant wave height differences – redeveloped St. Ola pier and dredging minus existing 2.80m Hs, 14.87s Ts from NNW at MHWS

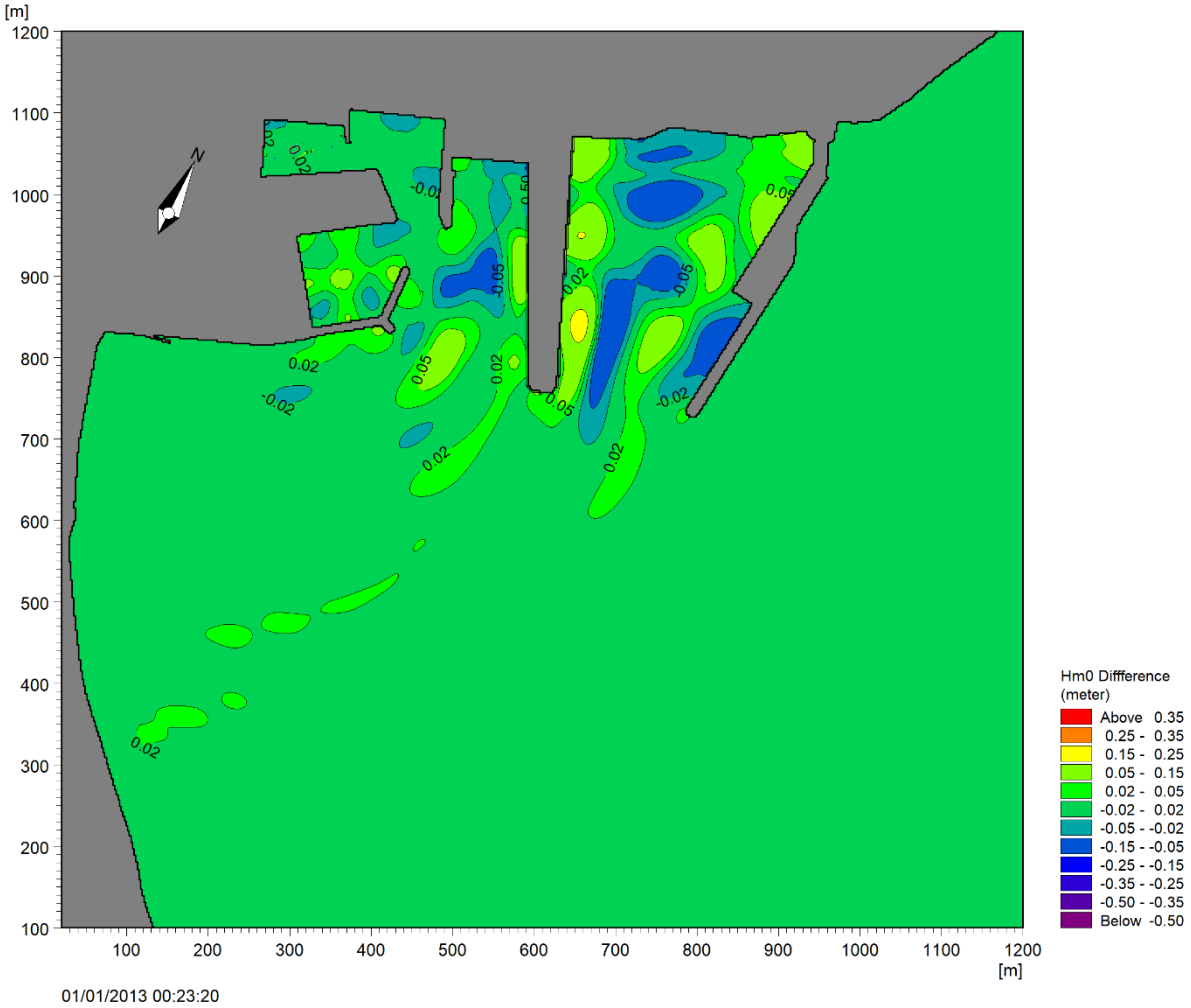
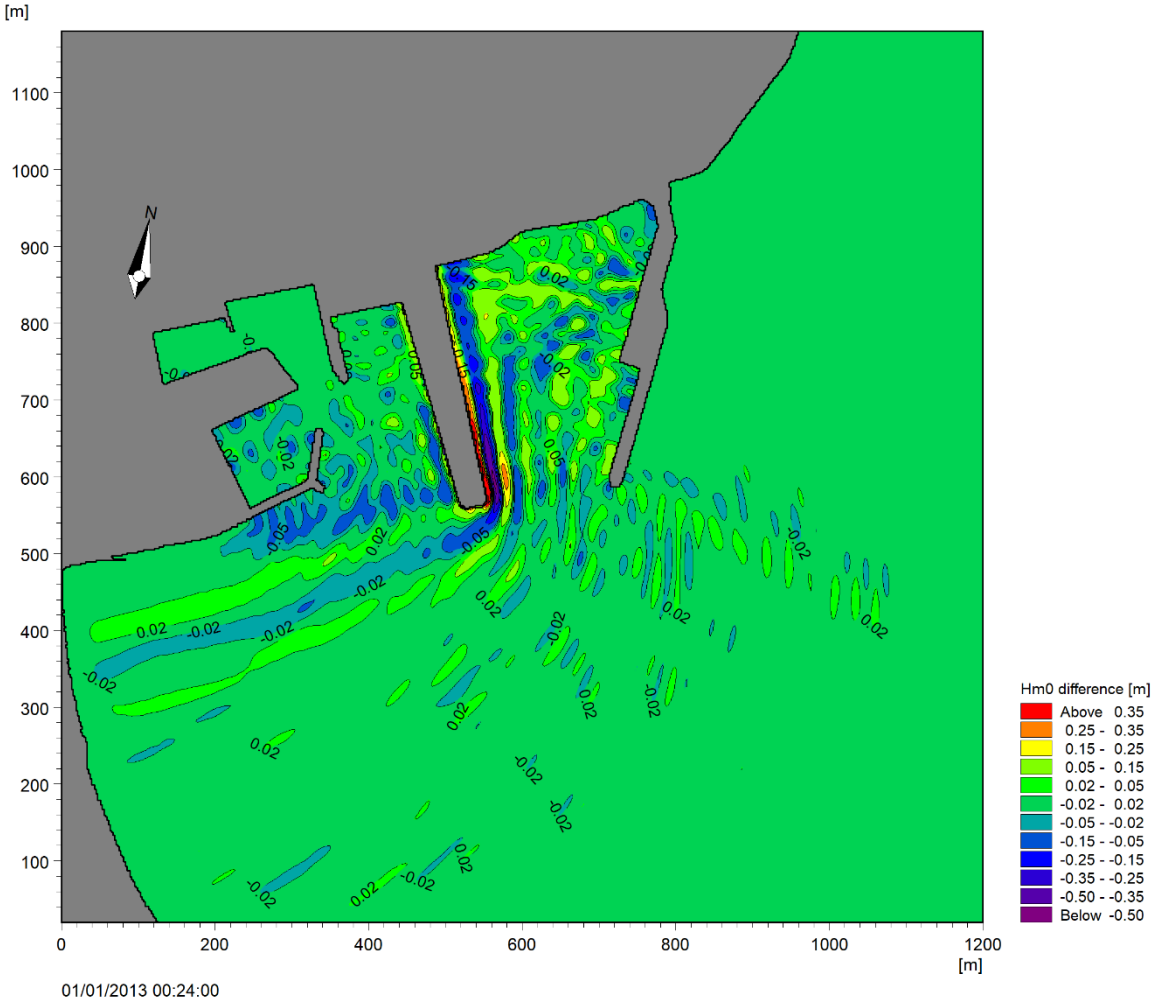


Figure 9.29 Significant wave height differences – redeveloped St. Ola pier and dredging minus existing 2.40m Hm0, 6.0s Tp from NE at MHWS



9.4 Assessment of Sediment Transport and Water Quality

Sediment Transport Regime

9.33 As noted in sections 1.2 and 1.3 the proposed St. Ola pier redevelopment, including the dredging of the outer basin, will have no significant impact on either the tidal flows or the wave climate away from the immediate area of the harbour. Thus, the proposed scheme can have no long term impact on the sediment transport regime in Thurso Bay or the Pentland Firth.

9.34 There will be some temporary changes in the suspended sediment concentrations during the construction period when dredging will be undertaken as part of the works.

Impact of Dredging on Water Quality and Sedimentation

9.35 Some 172,000 m^3 of material is to be dredged from the outer basin as part of the proposed St. Ola Pier redevelopment. Some of this material may be used as filling in the redeveloped pier. For the purposes of this assessment and to be conservative, it is assumed that all the material will be dumped at sea at the proposed sea disposal site located at:

- 58o 38.22'N, 03o 29.82'W
- 58o 38.10'N, 03o 29.44'W
- 58o 38.03'N, 03o 29.54'W
- 58o 38.15'N, 03o 29.91'W

9.36 The site investigation boreholes undertaken for this project showed that the dredged material would be a fine to medium sand with a little gravel and a small amount of silt, typically of about 8% less than 0.063 mm diameter. The grading of the dredged material in the model was designed to match the site investigation data and was represented by 8 fractions as shown in Table 9.3.

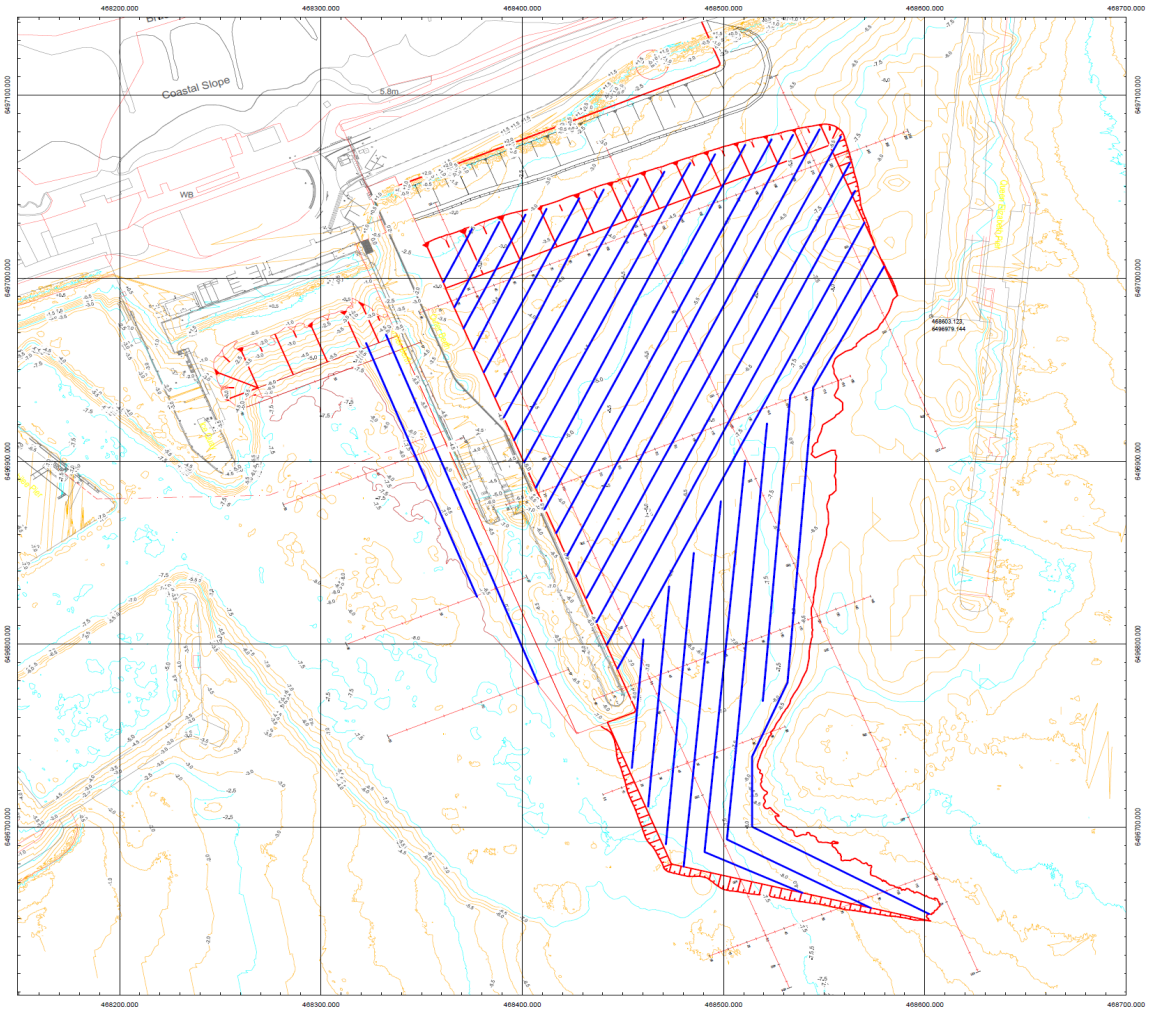
Table 9.3 Grading of dredged sediment

% Of	Grain Size
Sample	mm
6	1.500
3	0.630
7	0.250
36	0.180
28	0.120
12	0.072
4	0.050
4	0.030

9.37 As the contract for the St. Ola Pier development is to be let under “Design and Build” terms and conditions, the exact type of dredging plant that will be used for the project is unknown at this time. Thus, to be conservative, it has been assumed that the dredging will be undertaken over the shortest time possible using a 4000m3 trailer suction split hopper dredger. Such a dredger could complete the dredging in just under 6 days with 46 dumps on a three hourly basis (2 hours to dredge and 1 hour to travel and dump). It is assumed that the dumping would be undertaken using the split hopper with a dump time of 5 minutes.

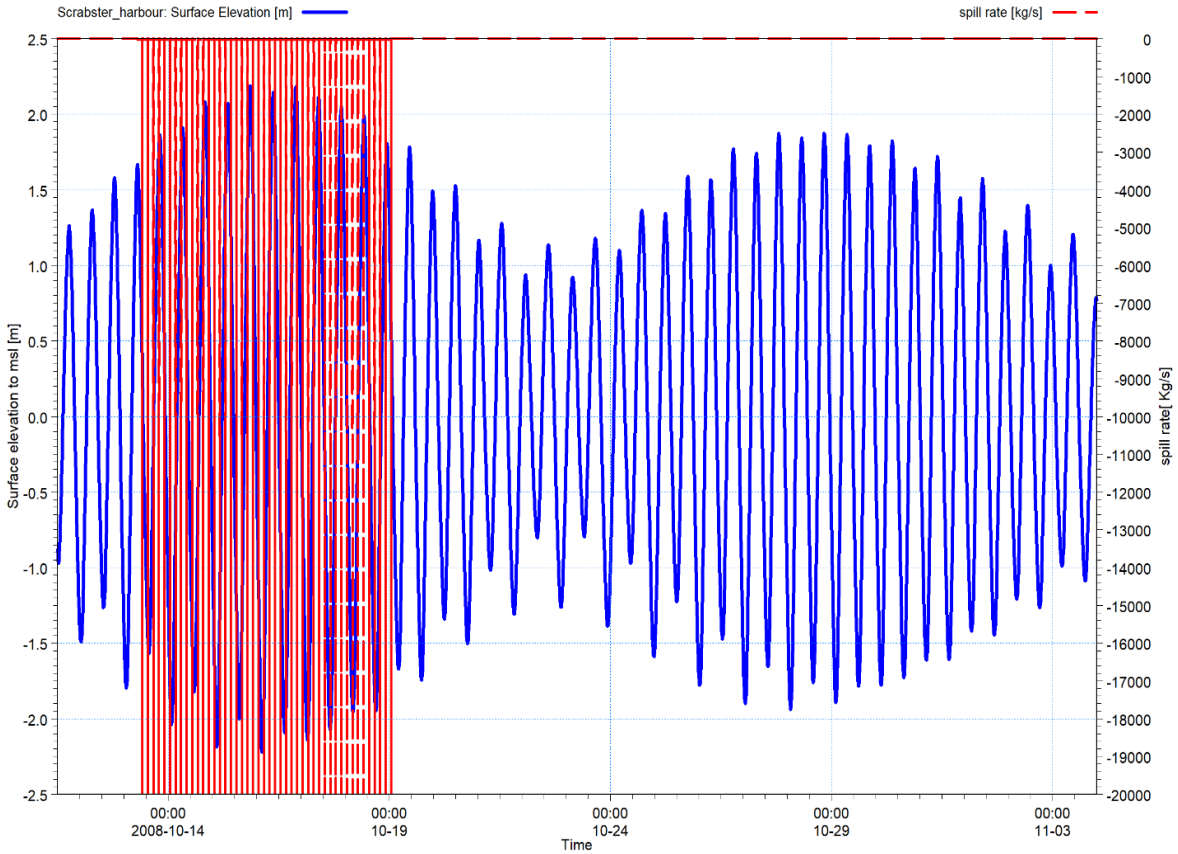
9.38 The dredging and dumping simulation has been undertaken over a period of spring tides so that there will be the maximum excursion of the dredging and dumping plumes. The losses from the dredging plant have been taken at 3%. The track of the dredger as it dredges the outer harbour basin is shown by the blue lines in Figure 9.30. The rate at which the dredger progress along these dredged lines was adjusted to match the dredging rate of 1,870 m3/hour to allow for bulking and filling in the 4000 m3 dredger hopper in 2 hours.

Figure 9.30 Assumed track of TSHD in the simulation of the dredging of the outer basin



9.39 Figure 9.31 shows the tidal cycle and the period of dredging/dumping (in red) for the 6 day dredging simulation.

Figure 9.31 Tidal curve and 6 day dredging/dumping period (shown in red)



9.40 The results of the 6 day dredging/disposal operations are shown in Figures 9.32 and 9.33 as envelopes of the maximum and mean suspended sediment concentration (SSC) in the water column. These total SSC plots are envelopes and not individual plumes. In the case of the maximum concentration envelope, this gives the maximum concentration that occurs in each cell in the model over the dredging/dumping period and thus the value may have a very short duration as the plume moves back and forth over the model domain. It is therefore necessary to examine both the maximum and mean envelopes to see the real importance of the peak value.

9.41 The deposition depths at the completion of the dredging (including a period of at least 9 days after the last dump to ensure all the material has dispersed or settled) are shown in Figure 9.34. It will be noted that the only areas where there is any significant deposition is around the dump site and inside the harbour basin otherwise the deposition depths are minimal.

Figure 9.32 Maximum envelope of SSC in the water column during 6 days of dredging/dumping

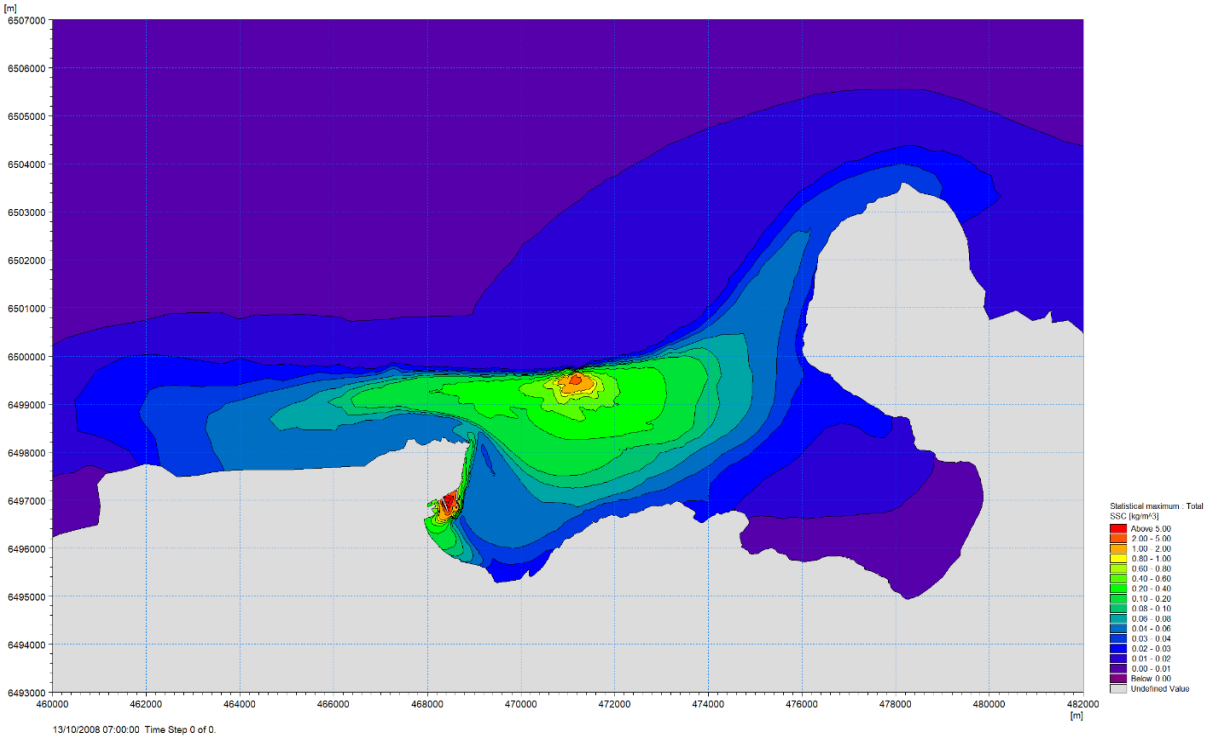


Figure 9.33 Mean envelope of SSC in the water column during 6 days of dredging/dumping

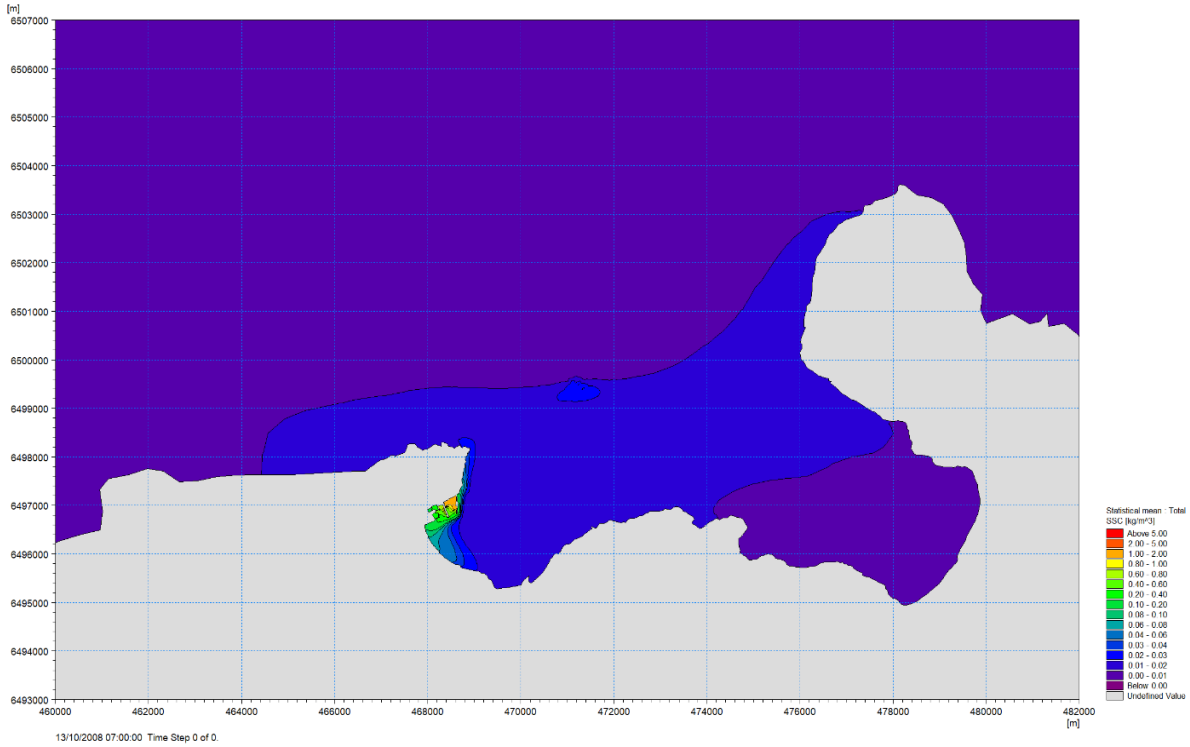
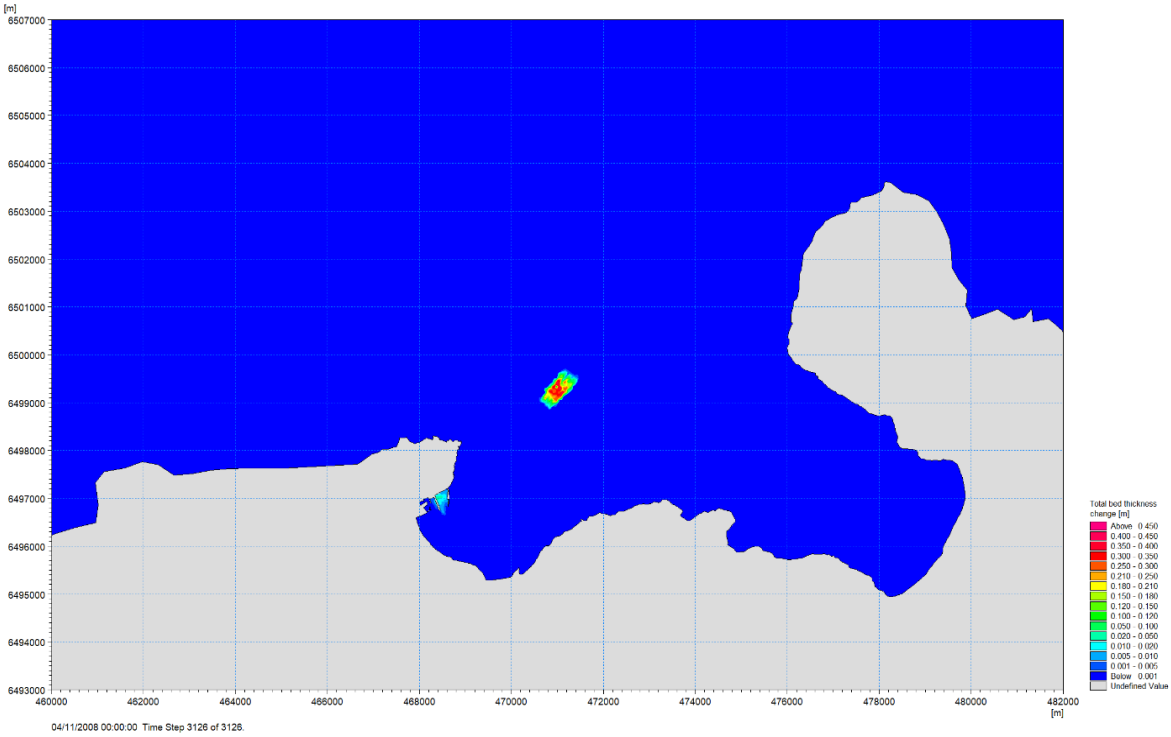
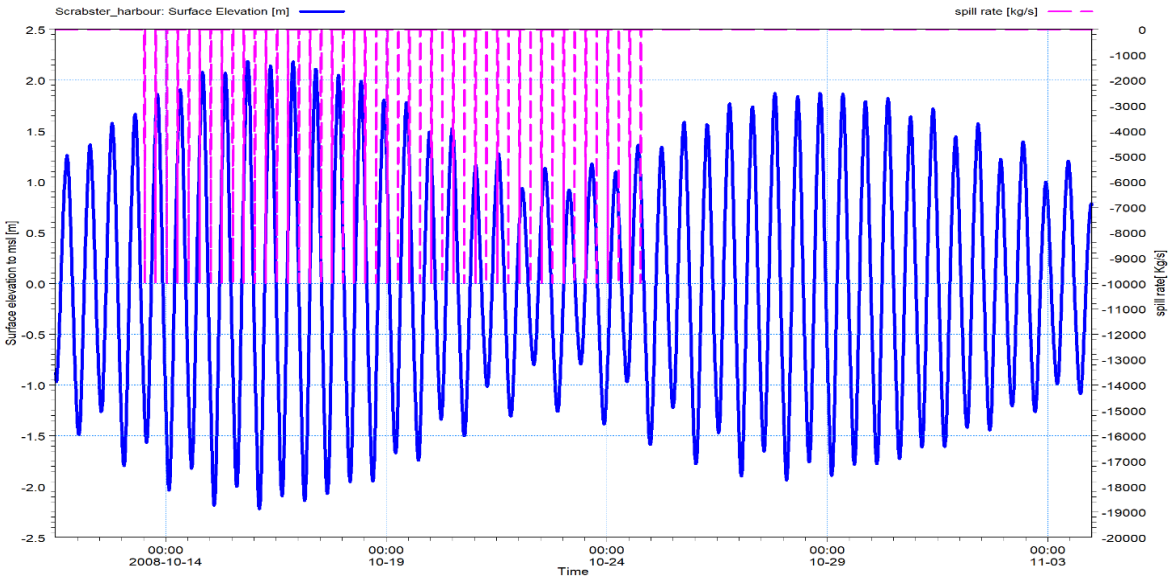


Figure 9.34 Deposition depth of dredged spoil on the sea bed on completion of 6 day dredge



9.42 As a sensitivity test, to see how critical the rate of dredging/dumping would be to the water quality, a dredging/dumping simulation was undertaken in which the rate of dredging/dumping was half that used in the simulation noted above. In this case the dredging and disposal was undertaken using 46 dumps over a 12 day period. In this simulation each dredging/dumping cycle involved the disposal of a full 4000 m3 barge load every 6 hours with a 10 minute disposal period. The length of the dredging period in relation to the tidal curve is shown in Figure 9.35.

Figure 9.35 Tidal curve and 12 day dredging/dumping period (shown in purple)



9.43 The deposition depths at the completion of the 12 day dredging simulation (including a period of at least 9 days after the last dump to ensure all the material has dispersed or settled) are shown in Figure 9.36. Not surprisingly the deposition depths are broadly similar to those with the 6 day dredge as the total quantity of material dredged and dumped is the same for both the 6 and 12 day dredging periods.

9.44 The maximum and mean envelopes of the total suspended sediment concentrations (SSC) for the 12 day dredge simulation are shown in Figures 9.37 and 9.38. It will be seen from a comparison with Figures 9.32 and 9.33 that the effect of lengthening the dredging period is to reduce the levels of SSC in the water column during the dredge/disposal operation. However, it should be noted that although the SSC levels are reduced, the effect is not a linear relationship and the elevated SSC levels will exist at the lower levels for a longer period of time.

Figure 9.36 Deposition depth of dredged spoil on the sea bed on completion of 12 day dredge

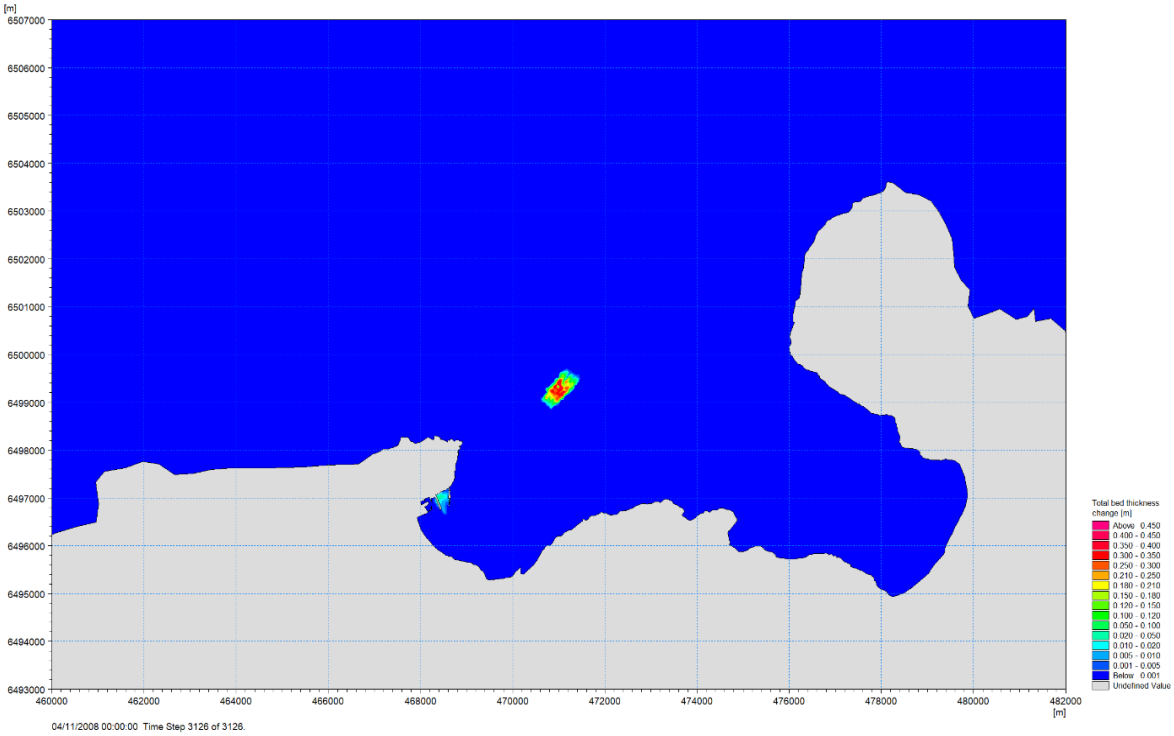


Figure 9.37 Maximum envelope of SSC in the water column during 12 days of dredging/dumping

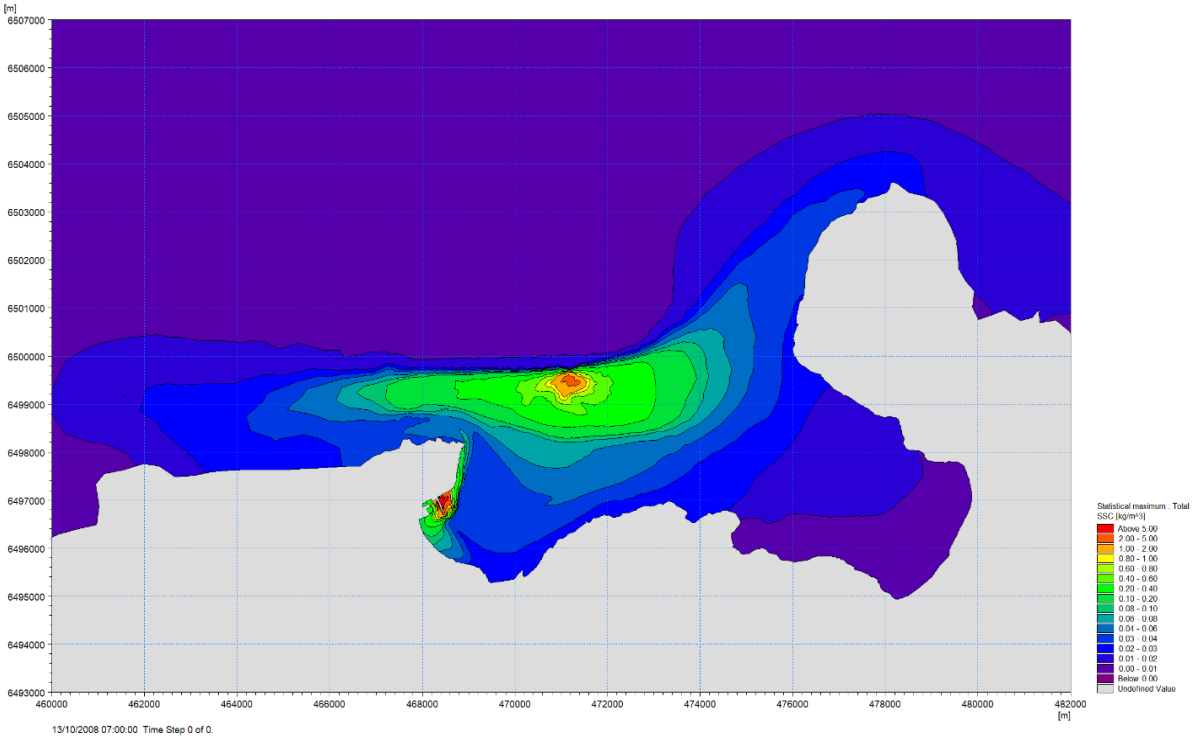
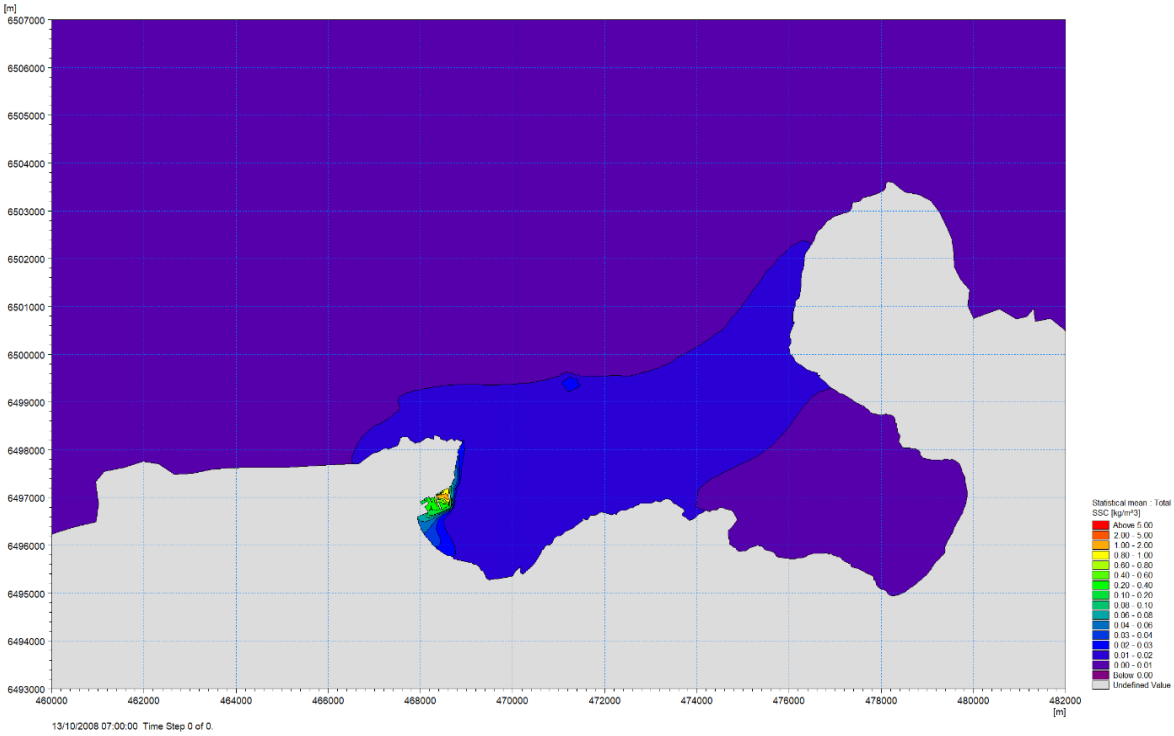


Figure 9.38 Mean envelope of SSC in the water column during 12 days of dredging/dumping



9.5 Mitigation and Monitoring

9.45 As no significant effects on the tidal regime, wave climate or sediment transport occur as a result of the construction and operation of the proposed redevelopment including dredging and disposal at sea, no mitigation is required. Pollution prevention measures at construction stage to prevent pollution of the coastal water body are proposed in EIAR Chapter 10 'Water Quality'.

9.46 No monitoring is required.

9.6 Cumulative Effects

9.47 The redeveloped St. Ola pier and outer harbour basin dredging will have no significant impact on the tidal regime or wave climate away from the immediate area around Scrabster Harbour and no effects on the sediment transport regime in Scrabster Harbour or Thurso Bay. The characteristics of the other projects identified in Appendix 1.2 of Chapter 1 of the EIAR were reviewed. None of those projects have the potential to affect tidal regime, wave climate or the sediment transport regime of Scrabster Harbour or Thurso Bay.

9.48 As such there is no possibility of cumulative effects between the proposed redevelopment and other projects on coastal processes.

9.7 Residual Effects

9.49 The coastal process model simulations have shown that the redeveloped St. Ola pier and outer harbour basin dredging will have no significant impact on either the tidal regime or the wave climate away from the immediate area around Scrabster harbour. It therefore follows that the proposal will also not affect the long term sediment transport regime in Thurso Bay or the Pentland Firth.

9.50 There will be a temporary increase in the suspended sediment concentrations in the water column around the harbour and the proposed disposal site during the dredging and disposal operations. Generally, the increase is relatively small, for example the increase in the SSC at the mouth of the Thurso River will peak at about 25 mg/l above background.

9.51 Significant deposits of dredged sediment are only expected to occur around the dump site area. Although the models show deposition in the outer harbour basin, this will be tidied up as part of the final dredging operations. Apart from in the dump site area, there will be less than 1mm of deposition on the sea bed resulting from the redeveloped St. Ola Pier and outer harbour basin dredging. This level of deposition is not significant in terms of the variations that will naturally occur with time in this area.

10 WATER QUALITY

10.1 Introduction

10.1 This chapter presents the results of the assessment for the potential impacts of the St. Ola Pier redevelopment on water quality. The assessment of impacts includes analysis and interpretation of baseline data acquired from existing water quality monitoring stations included in the Scottish Environment Protection Agency (SEPA) Water Framework Directive (WFD) monitoring programme. The potential impacts related to the construction and operational phases of the proposed redevelopment have been assessed and mitigation and monitoring measures proposed to reduce significant environmental impacts on the receiving water environment where appropriate.

10.2 A full project description is provided in Chapter 2 however the main aspects of the proposed redevelopment that have the potential to impact on water quality and the overall status of water bodies in the vicinity of the proposed redevelopment are from dredging and/ or construction activities. In general terms the construction of the proposed redevelopment and dredging activities could have the following impacts:

- Short term construction impacts particularly due to sediment release and/ or contaminant dispersal;
- Pollution from accidental spillage/ leakage; and
- Impacts on biodiversity, particularly on migrating Atlantic Salmon for which the nearby River Thurso SAC is designated.

10.3 The assessment presented is informed by and inclusive of information further described in the following EIA chapters:

- *Chapter 8 Geology, Hydrogeology and Contamination*
- *Chapter 9 Coastal Processes*
- *Chapter 11 Marine Biodiversity*
- *Chapter 12 Terrestrial Biodiversity and Ornithology*

10.2 Assessment Methodology

Planning Policy Context

10.4 This section outlines the policy context relevant to the assessment of potential impacts to water quality.

International Policy Context

EU Habitats Directive (Directive 92/43/EEC)

10.5 The key focus of the water quality assessment is to ensure that the proposed redevelopment is undertaken in a manner which is consistent with the objectives of the Water Framework Directive (2000/60/EC) (WFD). The WFD is the European legislation which was developed to establish systems to manage Europe's water environment - rivers, lochs, estuaries, coastal waters and groundwater; a fundamental requirement of the WFD is to attain good ecological and chemical water quality status and ensure that any deterioration in the status of waters is prevented. Any new development must ensure that these two fundamental requirements of the Directive are not compromised, nor are there any detrimental impacts to nearby EU designated Natura 200 sites.

National Policy Context

Marine (Scotland) Act 2010

10.6 The proposed redevelopment will be undertaken in line with the Marine (Scotland) Act 2010. This act makes provisions for those functions and activities in the marine area, including provision about marine plans, licensing of marine activities, the protection of the area and its wildlife including seals and regulation of sea fisheries; and for connected purposes.

Relevant Guidance

10.7 The Marine Scotland Licensing Operations Team (MSLOT) consider that any impact from a development that compromises the achievement of WFD objectives or causes deterioration in the status of waters, to be a significant environmental impact in terms under Part 2, Regulation 11 of the Marine Works (Environmental Impact Assessment) Scotland Regulations 2017 (as Amended). A key requirement of the WFD is that surface water bodies attain at least good surface water status, requiring ecological status to be at least good and chemical status to pass the environmental quality standards for hazardous and priority hazardous substances, and that there should be no deterioration in existing status.

10.8 The EIA scoping report identified potential impacts to water quality and has proposed that further assessment is required in line with the Water Framework Directive. The source of these impacts has been identified as dredging, potential release of contaminated sediments and potential accidental pollution events. The suitability for disposal of dredge material at sea has been discussed in Chapter 8 (*Geology, Hydrogeology and Contamination*) and is based on chemical action levels (cALs) identified by Marine Scotland (2017).

10.9 Guidance relevant to the assessment for the water quality chapter is as follows:

- Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the EIA process in Scotland (SNH, 2018);
- 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;

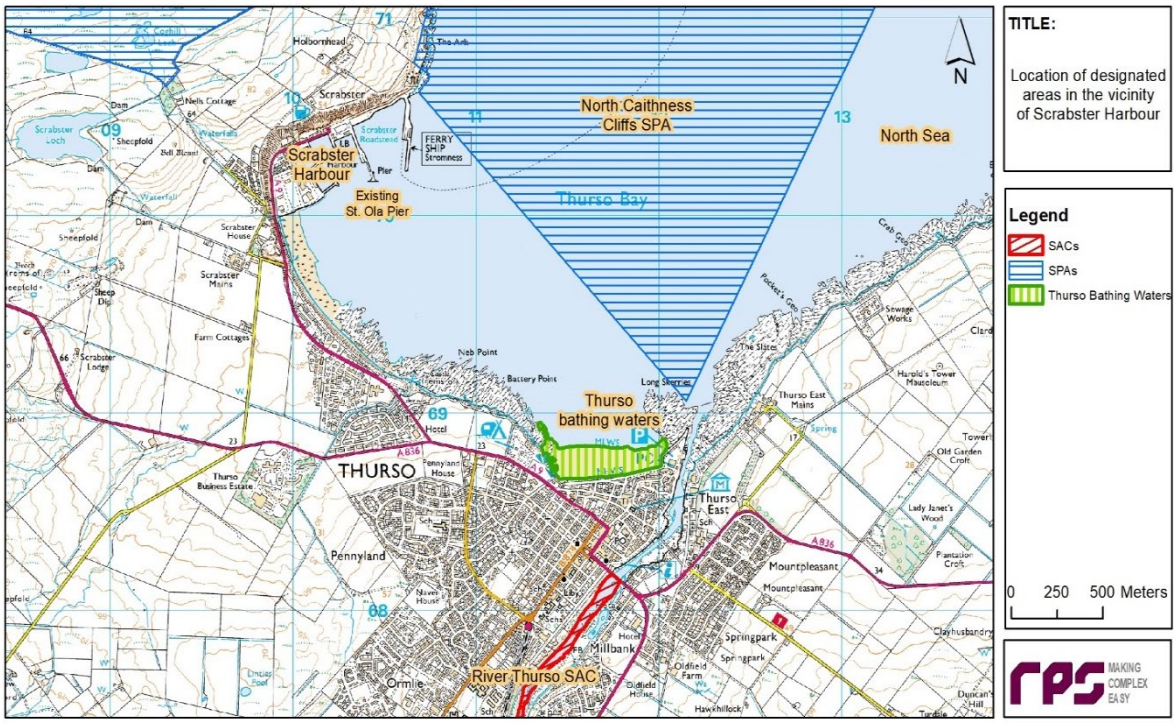
- PPG 7: Refuelling facilities;
- PPG 18: Managing for water and major spillages;
- PPG 22: Incident response – dealing with spills;
- PPG26: Storage & handling of drums & intermediate bulk containers;
- Guidance for Pollution Prevention (GPP) 2: Above ground oil storage tanks;
- GPP 5: Works and maintenance 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; and
- WAT-SG-29: Good Practice Guide – Construction Methods.

Study Area

10.10 Scrabster is located on the north coast of Caithness and is situated 1.5 miles north west of Thurso the largest town in Caithness and provides a ferry link to Orkney and is ideally situated for access to the Atlantic Ocean and the North Sea (Fig. 10.1). Scrabster Harbour falls within the boundaries of the Highland Council. St. Ola pier is situated within the centre of the busy operational harbour. The pier was constructed in 1972 and the northeast currently has no berthage due to the presence of a 1.5 m sea protection wall. The redevelopment of the pier would ensure the ongoing structural integrity of the pier while also providing additional berthage for use, particularly by oil and gas supply vessels and cruise ships.

10.11 Scrabster Harbour is an important fishing port, ferry terminal for the main Orkney crossing and operates trade links with other northern isles and northern Europe. Although it is already well established, there are designated sites in the vicinity, in particular the North Caithness Cliffs SPA and the River Thurso SAC which is designated for migrating Atlantic salmon (*Salmo salar*). SEPA also identified that the potential works are in proximity to the designated Thurso bathing beach which is an area that is also well used by surfers throughout the winter. The proposed redevelopment works have the potential to affect these nearby designated sites by noise (and vibration), sedimentation and pollution risk associated with construction and dredging activities and through accidental fuel spillage/ leakage. The status of the sites described mean that the requirements of the Conservation (Natural Habitats, &c.) Regulations 1994 as amended (the “Habitats Regulations”) apply and as such, Marine Scotland is required to consider the effect of the proposal on these sites before it can be consented (commonly known as Habitats Regulations Appraisal).

Figure 10.1: Location of Scrabster Harbour and Surrounding Designated Sites



10.12 An assessment of the proposed redevelopment in terms of current status and the WFD objectives for the Thurso coastal water body (ID: 200218) and the River Thurso SAC (ID: 20637) was undertaken, including an assessment of potential impact.

Baseline Methodology

10.13 To determine the impact of the redevelopment upon water quality of Thurso Bay and the River Thurso SAC, baseline data have been analysed from existing monitoring stations included in the Scottish Environment Protection Agency (SEPA) WFD monitoring programme, as part of their River Basin Management Plan (RBMP) reporting. In addition, sampling and analysis of dredge material was undertaken to determine suitability of the dredge material for disposal at sea or disposal at an off-site licenced landfill; or a combination of these solutions. This includes the installation of 8 sample stations at various depths in compliance with the requirements of MSLOT seabed sampling and testing. These sample locations as well as the proposed dredge areas are included in Fig. 10.2.

Consultation

Consultations were undertaken with relevant parties in order to determine the existing water quality status in the context of the Water Framework Directive (WFD) and to establish a scope for the assessment of water quality impacts, thereby enabling an appropriate assessment of the impact of the redevelopment to be made. A summary of the relevant issues identified and how these have been addressed are included in Table 10.1.

Figure 10.2: Marine sample borehole locations and dredge areas.

Table 10.1: Consultation Responses Relevant to this Chapter

Date	Consultee and Issues Raised	How/ Where Addressed
31st July 2018	Scottish Environment Protection Agency (SEPA): Proximity to Thurso designated bathing waters	Mitigation and control measures to address the impact to the Thurso bathing waters will follow the relevant legislation and guidance as addressed under '*Assessment of Construction Effects*'.
21st September 2018	Marine Scotland: Assessment of the effects on water quality from suspended sediment and possible contaminant dispersion should be included (dredging activities)	Mitigation measures to address the impact from suspended sediments and contaminant deispersion will follow best practice guidance and sound design principals. Sediment control measures will be consistent with the relevant legislation and guidance.
13th August 2018	Scottish Natural Heritage: The River Thurso SAC should be considered and in particular the impact to Atlantic salmon migrating east towards the Thurso SAC	Mitigation measures required to reduce the potential impacts to Atlantic salmon from dredging activities and suspended sediments have been included (*Assessment of Construction Effects*). These measures follow the Joint Nature Conservation Committee recommendations and guidance for minimising risk to marine wildlife (JNCC, 2010).

Assessment Criteria and Assignment of Significance

Receptor Sensitivity/ Value

10.14 The significance of effects on water quality likely to occur during the proposed redevelopment works (particularly from dredging activities) of St. Ola Pier are determined using the predominantly qualitative process described below. The criteria for determining the significance of effects is a two-stage process. The first step in the process is to determine the sensitivity of the receiving environment and then to define the magnitude of the potential impact. This section describes the criteria applied in this chapter to assign values to the receptor to assist in defining sensitivity of receptors and the magnitude of potential impacts.

Table 10.2: Sensitivity Indication

Value (Sensitivity)	Typical descriptors
Very High	**Very high importance and rarity, international scale and very limited potential for substitution.** Examples: Water body protected area, interests are of international importance and are included on the WFD Register of Protected areas, having been designated under the Habitats, Birds, Shellfish, Bathing Water, Drinking Water or Nitrate Directives. High Status Water bodies
High	**High importance and rarity, national scale, and limited potential for substitution.** Examples: Water body where the current status is good or better and no deterioration is permitted. National designation e.g. Special Area of conservation (SAC)
Medium	**High or medium importance and rarity, regional scale, limited potential for substitution.** Examples: Moderate Status with an objective of good status by 2021, regionally important resource in terms of ecology or fisheries interest
Low	**Low or medium importance and rarity, local scale.** Examples: Local potable water source supplying <50 homes. Quality Class D, WFD Status Poor. Amenity site used by small numbers of local people
Negligible	**Very low importance and rarity, local scale.** Examples: WFD Status Bad, limited amenity value or fisheries interest

Magnitude of Impact

10.15 The magnitude of the impact has also been adapted from the generic methodology for environmental assessment outlined in the Design Manual for Roads and Bridges (2011) (Table 10.3). Impacts may be considered to have no affect or be negligible to major adverse or beneficial and their magnitude has necessarily been assessed on a qualitative basis.

Table 10.3: Magnitude of Impact Indicating Type and Scale of Effect (DMRB, 2011)

Magnitude	Type and scale of effect
Major	Major alteration to water body status causing deterioration in either the ecological status including supporting elements, i.e., physico-chemical, specific pollutants and hydromorphology, chemical status or protected area status. Severe damage to key water body characteristics, features or elements (Adverse). Large scale or major improvement to water body status, extensive restoration or enhancement of water body (Beneficial).
Moderate	Water quality impact but not adversely affecting the integrity or status of the water body, partial loss or damage of certain characteristics or water body attributes (Adverse). Benefit to or addition of key characteristics or features of the water body, improvement in water status (Beneficial)
Minor	Some measureable change in water quality attributes, minor loss or alteration to one (maybe more) key characteristics (Adverse). Minor benefit to one or more key characteristics, features or elements of the water body (Beneficial)
Negligible	Very minor loss to water body characteristics, features or elements (Adverse). Very minor benefit to or positive addition of one or more water body characteristics, features or elements (Beneficial)
No change	No loss or alteration to water quality or water body status.

Significance of Effects

10.16 Applying the formula, the greater the environmental sensitivity or value of the receptor or resource, and the greater the magnitude of impact, the more significant the effect. The consequences of a highly valued environmental resource suffering a major detrimental impact would be a very significant adverse effect. Table 10.3 illustrates how the sensitivity of attributes was considered against the magnitude of impacts to determine the significance of potential impacts.

Table 10.4: Assessment Matrix

Sensitivity	Magnitude of Impact				
	No Change	Negligible	Low	Medium	High
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
Very high	No change	Minor	Moderate or Major	Major or Substantial	Substantial

10.17 Based on the importance of the receiving water body, which has been assessed to be of extremely high importance (due to the presence of Natura 2000 sites and bathing waters), and the impact significance an assessment of the potential environmental impacts of the proposed redevelopment has been made based on the matrix presented in Tables 10.1 - 10.4 above.

Limitations of the Assessment

10.18 Assumptions specific to this water quality chapter of the EIA are that the principal land uses identified in the vicinity of the proposed redevelopment location remain as they were at the time of EIA preparation, and that information provided by third parties, including publicly available information and databases are correct at the time of publication.

10.3 Baseline Environment

Designated Sites

River Thurso SAC

10.19 The River Thurso SAC has been designated for the Annex II species Atlantic Salmon (*Salmo Salar*). Salmon migrate from the Atlantic Ocean to freshwater to spawn in autumn and winter. The eggs hatch in spring and spend 2-3 years in the river before migrating to the sea. The River Thurso SAC supports a higher proportion of multi sea-winter salmon (that is those that return to spawn after one winter) than is found in many rivers further south in the species' range. This is aided by the northerly location of the river and the cooler ambient water temperature resulting in slower-growing juveniles which smolt at an older age, and tend to return as older multi sea-winter salmon. The River Thurso SAC is considered to be one of the best areas and habitats for Atlantic salmon in the United Kingdom. A scoping assessment has determined that the proposed redevelopment works at Scrabster Harbour have the potential to affect migrating Atlantic salmon by noise (and vibration), sedimentation and pollution risk associated with the construction and dredging activities.

Table 10.5: Water quality information for the River Thurso SAC from 2007- 2017

Name	Perimeter	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
River Thurso	Overall status	G	G	G	G	G	G	G	G	G	G	G
River Thurso	Pre-HMWB status		G	G	G	G	G	G	G	G	G	G
River Thurso	Overall chemistry									P	P	P
River Thurso	Priority substances									P	P	P
River Thurso	Cadmium									P	P	P
River Thurso	Lead									P	P	P
River Thurso	Nickel									P	P	P
River Thurso	Overall ecology	G	G	G	G	G	G	G	G	G	G	G
River Thurso	Physico-Chem	G	G	G	G	G	G	H	H	H	H	H
River Thurso	Dissolved Oxygen	H	H	H	H	H	H	H	H	H	H	H

Name	Perimeter	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
River Thurso	Biological elements	G	G	G	G	G	G	G	G	G	G	G
River Thurso	Invertebrate animals		H	G	H	G	H	G	G	G	G	G
River Thurso	Fish		H	H	H	H	H	G	G	G	G	G
River Thurso	Fish ecology		H	H	H	H	H	G	G	G	G	G
River Thurso	Fish barrier						H	H	H	H	H	H
River Thurso	Aquatic plants							G	H	H	H	H
River Thurso	Specific pollutants	P	P	P	P	P	P	P	P	P	P	P
River Thurso	Copper		P	P	P			P	P	P	P	P
River Thurso	Zinc	P	P	P	P	P	P	P	P	P	P	P
River Thurso	Ammonium	P	P	P	P	P	P	P	P	P	P	P
River Thurso	Hydromorphology	G	G	G	G	G	G	G	G	G	G	G
River Thurso	Morphology	G	G	G	G	G	G	G	G	G	G	G
River Thurso	Reactive phosphorus	G	H	H	H	H	H	H	H	H	H	H

(https://www.sepa.org.uk/data-visualisation/water-environment-hub/) [H= high, G= good, P= poor]

Thurso Bay bathing waters

10.20 It has also been noted that the designated Thurso Bay bathing waters are located in close proximity to the proposed redevelopment works. A review of baseline data (Table 10.6) suggests that Thurso Bay is currently also meeting its WFD objectives by achieving 'good' ecological status. It is important to therefore determine any potential impacts to Thurso Bay bathing waters and the River Thurso SAC from the redevelopment works, particularly dredging, that could prevent either site from maintaining their 'good' ecological status under the WFD.

Table 10.6: Water quality information for the Thurso Bay

Name	Perimeter	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Thurso Bay	Overall status	H	H	H	G	G	G	G	G	G	G	G
Thurso Bay	Pre-HMWB status		H	H	G	G	G	G	G	G	G	G
Thurso Bay	Overall chemistry		P	P	P	P						
Thurso Bay	Priority substances		P	P	P	P						
Thurso Bay	Cadmium		P	P								
Thurso Bay	Lead		P	P	P	P						
Thurso Bay	Nickel		P	P	P	P						
Thurso Bay	Overall ecology	H	H	H	G	G	G	G	G	G	G	G
Thurso Bay	Physico-Chem	H	H	H	H	H	H					
Thurso Bay	Dissolved Oxygen	H	H	H	H	H	H					
Thurso Bay	Dissolved inorganic N	H	H	H	H	H						
Thurso Bay	Biological elements	H	H	H	G	G	G	G	G	G	G	G
Thurso Bay	Invertebrate animals							G	G	G	G	G
Thurso Bay	Benthic invertebrates (IQI)						G	G	G	G	G	
Thurso Bay	Macroalgae		H	H	G	G	G		H	H	H	H
Thurso Bay	Macroalgae (FSL)								H	H	H	H
Thurso Bay	Macroalgae (RSL)								G	G	G	
Thurso Bay	Phytoplankton	H	H									

Name	Perimeter	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Thurso Bay	Specific pollutants	P	P	P	P	P	P					
Thurso Bay	Copper		P	P								
Thurso Bay	Zinc		P	P	P	P						
Thurso Bay	Unionised ammonia	P	P	P	P	P	P					
Thurso Bay	Hydromorphology	H	H	H	H	H	H	G	G	G	G	G
Thurso Bay	Morphology	H	H	H	H	H	H	G	G	G	G	G

(https://www.sepa.org.uk/data-visualisation/water-environment-hub/) [H= high, G= good, P= poor]

Sediment Analysis

Dredge Material

10.21 In line with Marine Scotland Licencing Operations, dredged material must be analysed in order to assess suitability for disposal at sea. The outer side of the pier will be dredged to achieve a depth of approximately -9.0 metres Chart Datum (CD) and the inner side of the pier will be dredged to provide a consistent berth depth of -7.5 metres CD (Fig.10.2). The total volume of dredged material generated by these works will be approximately 172,000 cubic metres of sandy gravel and clay. Ground investigations and sediment samples have been undertaken to determine the nature of the dredge material. Given the outcome of the analysis, where the material is not suitable for re-use within the works it will be disposed of at sea or at a licenced off-site landfill.

10.22 Chemical action levels (cALs) as determined by Marine Scotland (2017) are used as part of a 'weight of evidence' (WOE) approach to licensing the disposal of dredged material at sea. Contaminant levels in dredged material below chemical Action Level 1 (cAL1) are generally assumed to be of no concern and are unlikely to influence the licensing decision, however for samples that fall between cAL1 and cAL2, further consideration is required before a licensing decision is made.

10.23 There is currently no formal guidance or procedures in place for handling of samples between cAL1 and cAL2, however an informed decision is made by MSLOT given further assessment against: historic levels of contamination; the extent of contamination (i.e. if localised or widespread); the level of contamination (i.e. if concentrations are closer to cAL1 or cAL2); and how concentrations compare to natural background concentrations in the area.

10.24 Eight marine borehole samples (Fig. 10.2) within the proposed dredge areas were taken at various depths and analysed for a suite of parameters to determine the level of contamination within the dredged material. The intrusive investigation was undertaken following Marine Scotland requirements. The sediment samples were submitted to an accredited laboratory (Concept Life Sciences) for analysis and the results are included in EIAR Volume II, Appendix 10.1.

10.25 Based on the results of the marine sediment analysis of the parameters considered, the sampled dredge material is below the threshold values for cAL1 for 6 boreholes but falls between cAL1 and cAL2 for boreholes 20, 23 and 30 (Fig. 10.2) for both Copper, Nickel and Chromium at various depths. The results for the relevant samples and the cALs are given in Table 10.7 below:

Table 10.7: Lab analysis results for relevant cAL exceedances

Contaminant	Sample ID	Sample depth (m)	Sample concentration (mg/kg)	cAL1 (mg/kg)	cAL2 (mg/kg)
Copper	BH23	0.5-1.0	37	30	300
Nickel	BH20	0.5-1.0	41	30	150
	BH30	0.1-0.5	34	30	150
	BH30	0.6-1.15	37	30	150
Chromium	BH20	0.0-0.5	60	50	370
	BH20	0.5-1.0	95	50	370
	BH30	0.1-0.5	55	50	370
	BH30	0.6-1.15	57	50	370

10.26 Contaminant levels of Copper, Nickel and Chromium exceed the level 1 threshold values determined by Marine Scotland (2017) but are well below the chemical action level 2 threshold values. Levels of contaminants within the sediment are below that which would exclude disposal at sea from a regulatory perspective. However, given that complete re-use of the material on site is not feasible and a number of results indicate concentrations of variables between AL1 and AL2, Marine Scotland have determined that sea disposal should be considered on a case by case basis, considering factors such as:

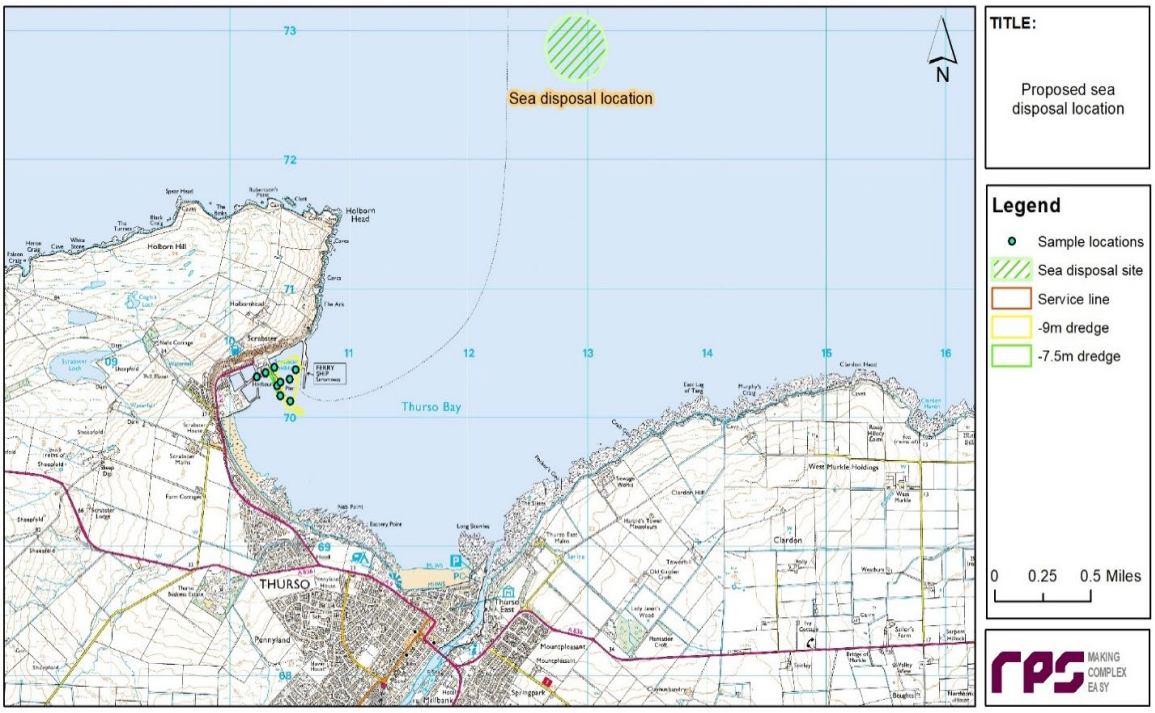
- Extent of contamination- is it localised to a small number of boreholes;
- Level of contamination compared with AL1 and AL2;
- Whether contamination is from historical port related activities or from existing activities/ sources of contamination;
- Natural background concentrations in the vicinity of the site; and
- Existing records of levels of contaminants of concern at the sea disposal site.

10.27 Marine Scotland require the above information to be presented within a Best Practicable Environmental Option (BPEO) report which is included as a technical appendix to the EIAR (at Volume II, Appendix 2.2). It assesses and identifies the most suitable method of disposal. Given all relevant information within the BPEO report, Marine Scotland will make an informed decision as to whether or not the dredge material is suitable for disposal at sea.

10.28 The proposed sea disposal site is located approximately 2 miles to the north east of the proposed redevelopment site (Fig. 10.3). Disposal already occurs at this site and on the basis that disposal at sea is consented, the modelling analysis in Chapter 9 (*Coastal Processes*) reveals that any sediment plumes generated during disposal are expected to be limited and may result in a temporary increase in turbidity. Given the distance between the dredge site and the disposal site and that the dredged material is classed as fine to medium sand with a little gravel and a small amount of silt (typically c.8% less than 0.063 mm), it is expected that natural tide and current activities would disperse fine silts widely and quickly. This would prevent smothering of seabed habitats adjacent to the disposal site. Seabed smothering caused by sediment plumes are anticipated to be minimal and there is not expected to be any significant impacts or risks from the loading or transportation phases of the operation.

10.29 In addition, the journey by vessel to and from the proposed disposal site is not expected to result in ecological impacts unless there is accidental spillage. Mitigation methods include following standard pollution prevention guidelines and GPP 21: Pollution incident response planning (NIEA/ DAERA/SEPA/ NRW, 2017) to mitigate against the potential for vessel fuel spillage.

Figure 10.3: Proposed sea disposal location boundary



10.4 Assessment of Construction Effects

10.30 The key issues identified with regards to water quality here are associated with the physical disturbance of the surrounding environment during dredging and construction. There may be a potential issue arising for sediment release which may have a negative impact on water quality on the River Thurso SAC and on the Thurso designated bathing waters, having a negative effect for these sites meeting their Water Framework Directive objectives.

Suspended Sediment and Dredging

10.31 The coastal process assessment in Chapter 9 models *inter alia* suspended sediment plumes arising from dredging of 172,000 m^3 of material from the outer basin as part of the proposed St. Ola Pier redevelopment and subsequent disposal at sea.

10.32 Simulations have shown that the proposed redevelopment of St. Ola Pier and outer harbour basin dredging will have no significant impact on either the tidal regime or the wave climate away from the immediate area around Scrabster harbour.

10.33 Modelling of the dredging and disposal activities have been undertaken using a worst case scenario simulation, where all dredged material is disposed at sea, and activities will be undertaken throughout a period of spring tides, over a duration of just less than 12 days (46 dumps on a 6 hourly basis). The suspended sediment modelling indicates that the highest concentrations are limited to the immediate vicinity of the harbour and at the sea disposal site. The maximum simulated suspended sediment concentration envelops in the vicinity of Thurso bathing waters are modelled as 0.02 - 0.03 kg/m^3 over the entire duration of the dredging and disposal activities. The mean simulated suspended sediment envelope concentration in the area outside Scrabster harbour and the sea disposal location is 0.01 - 0.02 kg/m^3 over the duration of the dredging and disposal activities.

10.34 It is therefore determined that the impact of the construction activities such as dredging of sediment will result in localised temporary increase in suspended sediments concentrations in the immediate vicinity of the harbour and the sea disposal site. However, there will be no significant impact on sedimentation within the harbour outside of the immediate area surrounding the site. The magnitude of the potential impacts arising from dredged sediment entering the aquatic environment are therefore considered to be minor with regard to localised water quality and negligible in relation to the wider coastal water body. Based on the matrix of environmental impact as present in Table 10.3 the impact, in the absence of mitigation, is considered to be moderate in the immediate area (which has no significant sensitivities) and minor in the wider water body where there are sensitive sites.

Future Monitoring

10.35 Given the temporary and localised nature of the construction and dredging activities, continuous in-situ water quality monitoring is not considered necessary as the sediment plume will remain within the immediate area with the concentrations returning to background levels in the wider water body.

Accidents and/or Disasters

10.36 During construction activities, there is potential for accidental oil/ fuel spillages on site due to increased vehicular traffic and associated fuel storage. The use of oils and chemicals on-site requires significant care and attention and will adhere to the requirements of the Water Environment (Controlled Activities) (Scotland) Regulations 2011. It is important to ensure that the following mitigation measures are adhered to reduce the potential risk from oils and chemicals:

- Fuel, oil and chemical storage must be sited on an impervious base within a bund and secured. The base and bund walls must be impermeable to the material stored and of adequate capacity. GPP2 shall be implemented to ensure safe storage of oils and chemicals;

- The safe operation of refuelling activities shall be in accordance with PPG 7 “Safe Storage – The safe operation of refuelling facilities” (Environment Agency, 2011b);
- All machinery used during the construction phase of the works will be required to be in good working order and free from oil and hydraulic fluid leakages. Where machinery maintenance has to take place, it will be carried out at the allocated Contractor's compound; and
- With regard to potential oil spills during construction, an emergency spill kit and oil spill containment equipment will be located at strategic locations adjacent to the works.

10.37 The Harbour Trust has in place an Oil Spill Contingency Plan which is adhered to by all staff including those employed to carry out works on behalf of the Harbour Trust. This plan is provided to assist the Harbour Master, or in his absence the Deputy Harbour Master of the in dealing with an accidental discharge of oil and/or HNS (Hazardous Noxious Substances). Its primary purpose is to set in motion the necessary actions to stop or minimise the discharge and to mitigate its effects. Effective planning will ensure that the necessary actions are taken in a structured, logical and timely manner.

10.5 Assessment of Operational Effects

Oil / Fuel Spillage

10.38 Upon completion of the construction of the proposed redevelopment, little will be required in terms of maintenance. Any impact from such maintenance works associated with this new proposal can be considered negligible/imperceptible. The key issues associated with the operation of the Port facilities are associated with the risk of leaks or spillage of fuel, either during storage, quayside activities and vessel refuelling. In addition care will be required during maintenance works, in order to ensure that adequate protection is given to adjacent water bodies. As a result the key mitigation measures (as currently practiced) proposed include:

- During the operational phase of the redevelopment, it is recommended that a full retention oil separator is used to mitigate the potential risk from oil/ fuel leakage/ spillage during import from or export to vessels;
- Any waste material i.e. waste oils will be collected by the waste recycling contractor;
- Adequate bunding for any fuel, oils or chemicals stored on-land in accordance with relevant GPPs and the Water Environment (Controlled Activities) (Scotland) Regulations 2011; and
- Compliance with the Oil Spill Contingency Plan;

10.39 There is an Oil Spill Contingency Plan currently in place by the Scrabster Harbour Trust. At present there are no bunded fuel tanks present at the harbour. As a result of the proposed redevelopment, bunded fuel tank(s) will be installed at the harbour. At operational stage, they shall be regularly inspected, maintained and tested for leakage in line with Control of Pollution (Oil Storage) (Scotland) Regulations 2003.

10.40 Given the small scale of the proposed redevelopment, the magnitude of the impact is considered to be minor however both the Thurso designated bathing waters and the River Thurso SAC water bodies are considered to be of very high importance and based on the rating of the environmental impact presented in Table 10.3 the impact is assessed as potentially moderate in the absence of mitigation. However with the mitigation measures proposed, the risk of accidental spillage of oil and chemicals will be acceptable and the potential impact is considered to be negligible.

10.6 Mitigation Measures

10.41 Mitigation measures will be adopted through the construction and operation phases of the redevelopment project to minimise the impact of the works on water quality. Mitigation measures required to reduce the potential impacts to Atlantic salmon from dredging activities and suspended sediments have been identified and included. These measures follow the Joint Nature Conservation Committee recommendations and guidance for minimising risk to marine wildlife (JNCC, 2010). Sediment control measures will be consistent with the following guidance:

- Technical Guidance C648: Control of Water Pollution from Linear Construction Projects, (CIRIA, 2006);
- Technical Guidance C532: Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors (CIRIA, 2001);
- GPP 5: Works and maintenance in or near water (NIEA / DAERA / SEPA / NRW, 2017);
- PPG 6: Working at construction and demolition sites (EA / NIEA / SEPA, 2012); and
- GPP 21: Pollution incident response planning (NIEA / DAERA / SEPA / NRW, 2017)

10.42 The use of oils and chemicals on-site requires significant care and attention and will adhere to the requirements of the Water Environment (Controlled Activities) (Scotland) Regulations 2011 and GPP2, Above Ground Oil Storage Tanks. It is important to ensure that the following procedures are followed to reduce the potential risk from oils and chemicals:

- No losses of concrete (cement) to the harbour waters will be permitted during the works;
- Fuel, oil and chemical storage must be sited on an impervious base within a bund and secured. The base and bund walls must be impermeable to the material stored and of adequate capacity. GPP2 shall be implemented to ensure safe storage of oils and chemicals;
- The safe operation of refuelling activities shall be in accordance with PPG 7 “Safe Storage – The safe operation of refuelling facilities” (Environment Agency, 2011b);
- With regard to potential oil spills during construction, an emergency spill kit and oil spill containment equipment will be located at strategic locations adjacent to the works; and
- The Harbour Trust have in place an Oil Spill Contingency Plan which is adhered to by all staff including those employed to carry out works on behalf of the Harbour Trust. This plan is provided to assist the Harbour Master, or in his absence the Deputy Harbour Master of the in dealing with an accidental discharge of oil and/or HNS (Hazardous Noxious Substances). Its primary purpose is to set in motion the necessary actions to stop or minimise the discharge and to mitigate its effects. Effective planning will ensure that the necessary actions are taken in a structured, logical and timely manner.

10.43 Given that there will be berthing of oil, gas and renewables supply vessels and associated refuelling, a full retention oil separator is recommended to mitigate for the potential impacts of fuel/ oil spillage or leakage. This is recommended to be maintained in accordance with the manufacturer's instructions by experienced personnel.

10.7 Future Monitoring

10.44 During the operational phase of the works mitigation measures will be put in force to minimise the potential for oil/ fuel leakage or spillage. In the unlikely event that a pollution event occurs, it is imperative that the Oil Spill Contingency Plan is adhered to in order to minimise the discharge and to mitigate its effects. A monitoring programme may be required to determine the volume, extent and dispersion of the spillage.

Potential Changes to the Assessment as a Result of Climate Change

10.45 During the operational phase of the harbour, the potential changes on the assessment as a result of climate change on water quality are expected to be minimal. River temperatures are expected to increase as a result of climate change. Research by the Scottish Government (2018) has determined that climate change may cause Scottish rivers to become less suitable for salmon. It is therefore anticipated that river temperature in the River Thurso SAC may increase, not as a consequence of the proposed redevelopment works but potentially impacting on baseline numbers of migrating salmon. It is also noted that climate change will increase the occurrence of flood events which could potentially increase sedimentation of the River Thurso SAC and the Thurso Bay bathing waters. This could have a negative impact on these sites maintaining their 'good' WFD status.

10.8 Assessment of Cumulative Effects

10.46 Five projects which could potentially give rise to in-combination effects from a water quality perspective were included for further assessment. A list of projects considered for their potential to generate significant cumulative effects is contained at EIAR Volume II, Appendix 1.2. Based on the modelled zone of impacts (see Chapter 9 Coastal Processes) for the proposed redevelopment, and the expected zone of impacts for these other projects, it was deemed that there is no potential for spatial overlap, and therefore no potential for cumulative impact.

10.47 The proposed redevelopment of St. Ola Pier currently does not coincide either temporally or spatially with any other projects and as such, is unlikely to have any cumulative impacts on water quality in the vicinity of Scrabster Harbour.

10.9 Residual Effects

10.48 The key issues in relation to water quality are associated with physical disturbance in the marine environment throughout the construction phase, particularly dredging activities and the potential impact this may have on the designated Thurso Bay bathing waters and the River Thurso SAC.

10.49 Mitigation proposed to offset or reduce the likely impacts to marine biodiversity receptors (Atlantic Salmon) within the River Thurso SAC during the construction phase includes the implementation of marine mammal mitigation under JNCC guidelines during piling operations; scheduling construction activities to avoid major night time operations (particularly impact piling) during peak salmon migration and employ soft start on piling; and implementation of pollution prevention measures to prevent impacts from accident pollution release.

10.50 Coastal process modelling of sediment plume dispersal has determined that the impact of the construction activities, i.e. dredging of sediment, will result in localised temporary increase in suspended sediments concentrations in the immediate vicinity of the harbour and the sea disposal site. However, there will be no significant impact on sedimentation within the harbour outside of the immediate area surrounding the site. The magnitude of the potential impacts arising from dredged sediment entering the aquatic environment are therefore considered to be minor with regard to localised water quality and negligible in relation to the wider coastal water body and in particular on the designated Thurso bathing waters.

10.51 Additional pressures with regards to the potential for oil/ fuel spillages both during the construction and operation phases of the redevelopment have been assessed. The use of oils and chemicals on-site requires significant care and attention and will adhere to the requirements of the Water Environment (Controlled Activities) (Scotland) Regulations 2011 and GPP2, Above Ground Oil Storage Tanks. It is important to ensure that the following procedures are followed to reduce the potential risk from oils and chemicals and mitigate against any potential impact to water quality:

- No losses of concrete (cement) to the harbour waters will be permitted during the works;
- Fuel, oil and chemical storage must be sited on an impervious base within a bund and secured. The base and bund walls must be impermeable to the material stored and of adequate capacity. GPP2 shall be implemented to ensure safe storage of oils and chemicals;
- The safe operation of refuelling activities shall be in accordance with PPG 7 “Safe Storage – The safe operation of refuelling facilities” (Environment Agency, 2011b);
- With regard to potential oil spills during construction, an emergency spill kit and oil spill containment equipment will be located at strategic locations adjacent to the works; and
- The Harbour Trust have in place an Oil Spill Contingency Plan which is adhered to by all staff including those employed to carry out works on behalf of the Harbour Trust. This plan is provided to assist the Harbour Master, or in his absence the Deputy Harbour Master of the in dealing with an accidental discharge of oil and/or HNS (Hazardous Noxious Substances). Its primary purpose is to set in motion the necessary actions to stop or minimise the discharge and to mitigate its effects. Effective planning will ensure that the necessary actions are taken in a structured, logical and timely manner.

10.52 Given that there will be berthing of oil, gas and renewables supply vessels and associated refuelling, a full retention oil separator will be installed to mitigate for the potential impacts of fuel/ oil spillage or leakage. This is to be maintained in accordance with the manufacturer's instructions by experienced personnel.

10.53 Where possible all material should be re-used on site. Where re-use is not feasible, a disposal licence will be sought for sea disposal. The proposed sea disposal site is located approximately 2 miles to the north east of the redevelopment site. A Best Practicable Environmental Option (BPEO) report will be submitted to Marine Scotland in support of a dredging licence that demonstrates the most suitable option for disposal of dredge material.

10.54 Sediment assessment of the potential dredge area has determined that levels of Chromium, Copper and Nickel for 3 out of the 8 boreholes are slightly above the chemical Action Level 1 but fall below the chemical Action Level 2 for sea disposal. Following further assessment within the BPEO report, particularly of the level of contamination, extent of contamination, comparison with natural background levels, existing sea contamination levels at the sea disposal site and assessment of historic port contamination, Marine Scotland will make an informed decision as to whether or not the dredge material is suitable for disposal at the proposal sea disposal site.

Table 10.8: Summary of Likely Environmental Effects on water quality

Receptor	Sensitivity of Receptor	Description of Impact	Short / Medium / Long Term	Magnitude of Impact	Significance of Effect	Residual Impact	Significant / Not Significant
Construction phase							
Migrating Atlantic salmon	High	Disurbance to migration habits, loss of life	Short term	Moderate	Moderate	Negligible or Minor	Not significant
River Thurso SAC	High	Sediment release- Decline in water quality	Short term	Moderate	Moderate	Negligible or Minor	Not significant
Thurso Bay bathing waters	High	Sediment release- Decline in water quality	Short term	Moderate	Moderate	Negligible or Minor	Not significant
Operational phase							
River Thurso SAC	High	Oil/ fuel spillage- Decline in water quality	Short term	Moderate	Moderate	Negligible or Minor	Not significant
Thurso bay bathing waters	High	Oil/ fuel spillage- Decline in water quality	Short term	Moderate	Moderate	Negligible or Minor	Not significant

References

Highways Agency (2008) Design Manual for Roads and Bridges. London, DFT.

JNCC (2010). Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise. JNCC, Aberdeen, UK.

Marine Scotland (2017). Pre-disposal Sampling Guidance. Version 2. Available at: https://www2.gov.scot/Resource/0052/00528031.pdf

Stevenson, A G, Tait, BAR, Richardson, A E, Smith R T, Nicholson, R A and Stewart H R. 1995. The geochemistry of sea-bed sediments of the United Kingdom Continental Shelf; the North Sea, Hebrides and west Shetland shelves, and the Malin-Hebrides sea area. British Geological Survey Technical Report WB195128C.

11 MARINE BIODIVERSITY

11.1 Introduction

11.1 This chapter of the EIAR presents the results of the Environmental Impact Assessment (EIA) for the potential impacts of the St. Ola Pier Redevelopment ('the proposed redevelopment') during construction and operational phases on marine biodiversity.

11.2 The assessment presented is informed by the following EIA chapters and technical reports:

- Chapter 9: Coastal Processes;
- Chapter 10: Water Quality;
- Appendix 11.1: Underwater Noise Assessment;
- Appendix 11.2: Benthic Technical Report; and
- Appendix 11.3: European Protected Species EPS Supporting Information Document.

11.2 Assessment Methodology

Planning Policy Context

11.3 This section outlines the policy context relevant to the assessment of potential impacts on marine biodiversity receptors.

International Policy Context

EU Habitats Directive (Directive 92/43/EEC)

11.4 All species of cetacean are listed in Annex IV (species of community interest in need of strict protection) of the EU Habitats Directive as European Protected Species (EPS) where the killing, disturbance or the destruction of these species or their habitat is banned (Article 12). Two cetacean species, the bottlenose dolphin *Tursiops truncatus* and the harbour porpoise *Phocoena phocoena*, as well as the two pinniped species, harbour seal *Phoca vitulina* and grey seal *Haligochoerus grypus* are also listed in Annex II as species whose conservation requires the designation of Special Areas of Conservation (SAC). Harbour seal and grey seal are also listed in Annex V (species of community interest whose taking in the wild and exploitation may be the subject of management measures). Designated sites identified for the marine biodiversity assessment are given in Table 11.8.

Conservation of European Wildlife and Natural Habitats Convention (Bern Convention)

11.5 The Bern Convention aims to ensure conservation and protection of wild animal species and their natural habitats and listed in Appendices II (strictly protected fauna species) and III (protected fauna species) of the Convention, to increase cooperation between contracting parties, and to regulate the exploitation of those species. The obligation of the convention is transposed into national law by means of the Wildlife and Countryside Act 1981 and the Nature Conservation (Scotland) Act 2004. Species which are considered in this assessment and listed in Appendices II and III of the Bern Convention are listed in Table 11.9.

The Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR Convention) and the Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention)

11.6 Selected species are also protected by the Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR Convention) and by the Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention). All toothed whales, or odontocetes, (except for the sperm whale) are protected under the ASCOBANS (Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas) Agreement, which is a legally binding Agreement, ratified under the Bonn Convention. Species protected under these conventions are listed in Table 11.9.

National Policy Context

UK Marine Policy Statement

11.7 The UK Marine Policy Statement (MPS) framework has been adopted by The Secretary of State, Scottish Ministers, Welsh Ministers and the Department of the Environment in Northern Ireland, which is a key step towards achieving the vision of *'sustainable development in the United Kingdom marine area.'*

National Marine Plan (Scotland)

11.8 The National Marine Plan (Scotland) provides a comprehensive overarching framework for all marine activity in Scottish waters. It aims to drive sustainable development and use of Scotland's marine area in a way which will protect and enhance the marine environment whilst promoting both existing and emerging industries

Wildlife and Countryside Act 1981

11.9 Species listed in Schedule 5 of the Wildlife and Countryside Act 1981 are protected against deliberate killing, injuring or disturbance. The Nature Conservation (Scotland) Act 2004 makes amendments to the Wildlife and Countryside Act 1981 in Scottish waters, including the addition of 'reckless' acts to species protection which make it an offence to intentionally or recklessly disturb species listed on Schedule 5. Licensing requirements under the Wildlife and Countryside Act (1981 as amended) are similar to those for European Protected Species (EPS) protected under Annex IV of the Habitats Directive. Relevant species, which are considered in this assessment are listed in Table 11.9.

UK Biodiversity Action Plan (UK BAP)

11.10 UK BAP Priority species and habitats are those identified as being the most threated and requiring conservation action. The UK Post-2010 Biodiversity framework supercedes the UK BAP, however the UK BAP remains an important reference source and has been used to drive the statutory list of priority species in Scotland (see 11.11 *et seq.*). Species of cetacean occurring regularly in UK waters are designated as UK Biodiversity Action Plan (UK BAP) species, the harbour seal and many species of fish are also designated as UK BAP species. See Table 11.9 for further details.

Scottish Biodiversity List

11.11 The Scottish Biodiversity List is a list of animals, plants and habitats that are of principal importance for biodiversity conservation in Scotland. 21 species of cetacean, one pinniped species and 54 species of fish and shellfish are included on the Scottish Biodiversity List. See Table 11.9 for species relevant to the proposed redevelopment.

Priority Marine Features

11.12 In July 2014, Scottish Ministers adopted a list of 81 priority marine features (PMF), many of which are features characteristic of the Scottish marine environment. The list helps to deliver Marine Scotland's vision for marine nature conservation. Species which are considered in this assessment and listed as PMFs are shown in Table 11.9.

Local Policy Context

Pilot Pentland Firth and Orkney Waters Marine Spatial Plan

11.13 This pilot marine spatial plan is a result of the collaboration between Marine Scotland, Orkney Islands Council and the Highland Council. The Plan, published in 2016, sets out an integrated planning policy framework to guide marine development, activities and management decisions, whilst ensuring the quality of the marine environment is protected.

11.14 This plan will be used by the Marine Scotland Licensing Operations Team (MS- LOT) as a material consideration in the determination of marine licensing and section 36 consent applications within the Pentland Firth and Orkney Waters area. The Highland Council and Orkney Islands Council have adopted the pilot Plan as non-statutory planning guidance, acknowledging the status of the Plan as a material consideration in the determination of relevant planning applications. Orkney Islands Council has also adopted the Plan as a material consideration in the determination of works licence applications in the Orkney Harbour Area.

The Caithness Biodiversity Action Plan (BAP) (2003), within which the Marine Habitats Action Plan is covered

11.15 The Caithness BAP sets out the measures needed for the protection of habitat, species or area in the Caithness area. It is designed to protect and enhance local and national priority habitats, species and areas and is a detailed five to ten-year plan specifying the actions required to meet proposed objectives and targets.

Relevant Guidance

11.16 Guidance relevant to EIA for the marine biodiversity chapter is as follows:

- CIEEM guidelines for ecological impact assessment (CIEEM, 2018);
- Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the EIA process in Scotland (SNH, 2018);
- EC Guidelines on the Implementation of the Birds and Habitats Directive in Relation to Port Developments (EC, 2011);
- SNH Priority Marine Features Guidance (SNH, 2017a);

- JNCC Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise (JNCC, 2010);
- The protection of Marine European Protected Species from injury and disturbance – Guidance for Scottish Inshore Waters (Marine Scotland, 2014); and
- MarLIN species and ecosystem sensitivities guidelines (Tyler-Walters *et al*., 2001).

Study Area

11.17 The study area for marine mammals and fish and shellfish, the 'regional marine biodiversity study area', has been defined to consider all receptors that may have connectivity with the immediate redevelopment boundary and its local surroundings. This wider study area broadly corresponds to the Caithness coast running eastwards towards the Moray Firth, northwards to encompass the Orkney Islands and as far west as Sule Skerry. The regional marine biodiversity study area is shown in Figure 11.1.

11.18 The 'local marine biodiversity study area' includes Thurso Bay, the immediate marine redevelopment boundary and its local surroundings. The area has been defined to encompass the maximum spatial extents of potential impacts on identified receptors, based on professional judgement. The local marine biodiversity study area is shown in Figure 11.2.

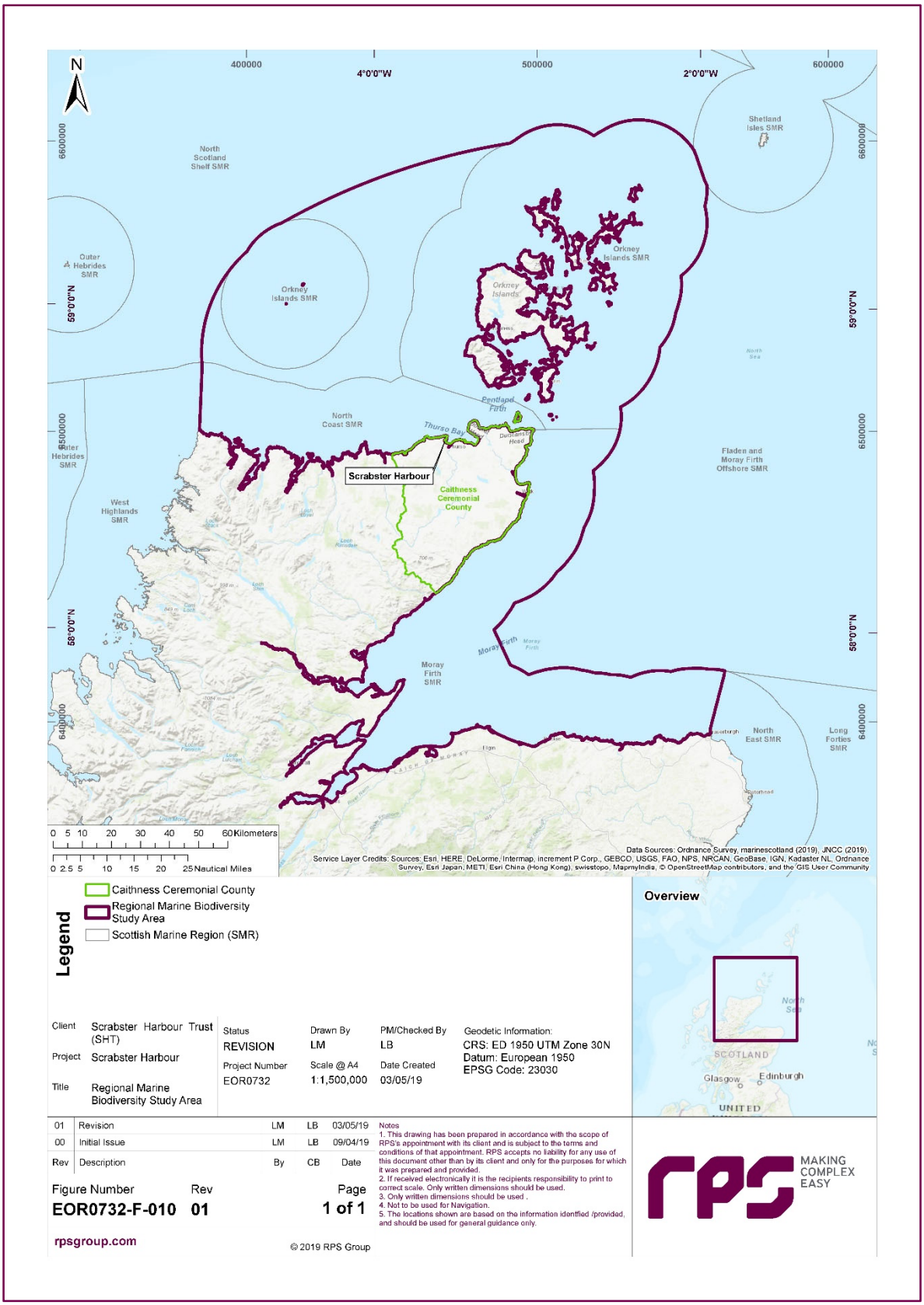


Figure 11.1: Regional marine biodiversity study area

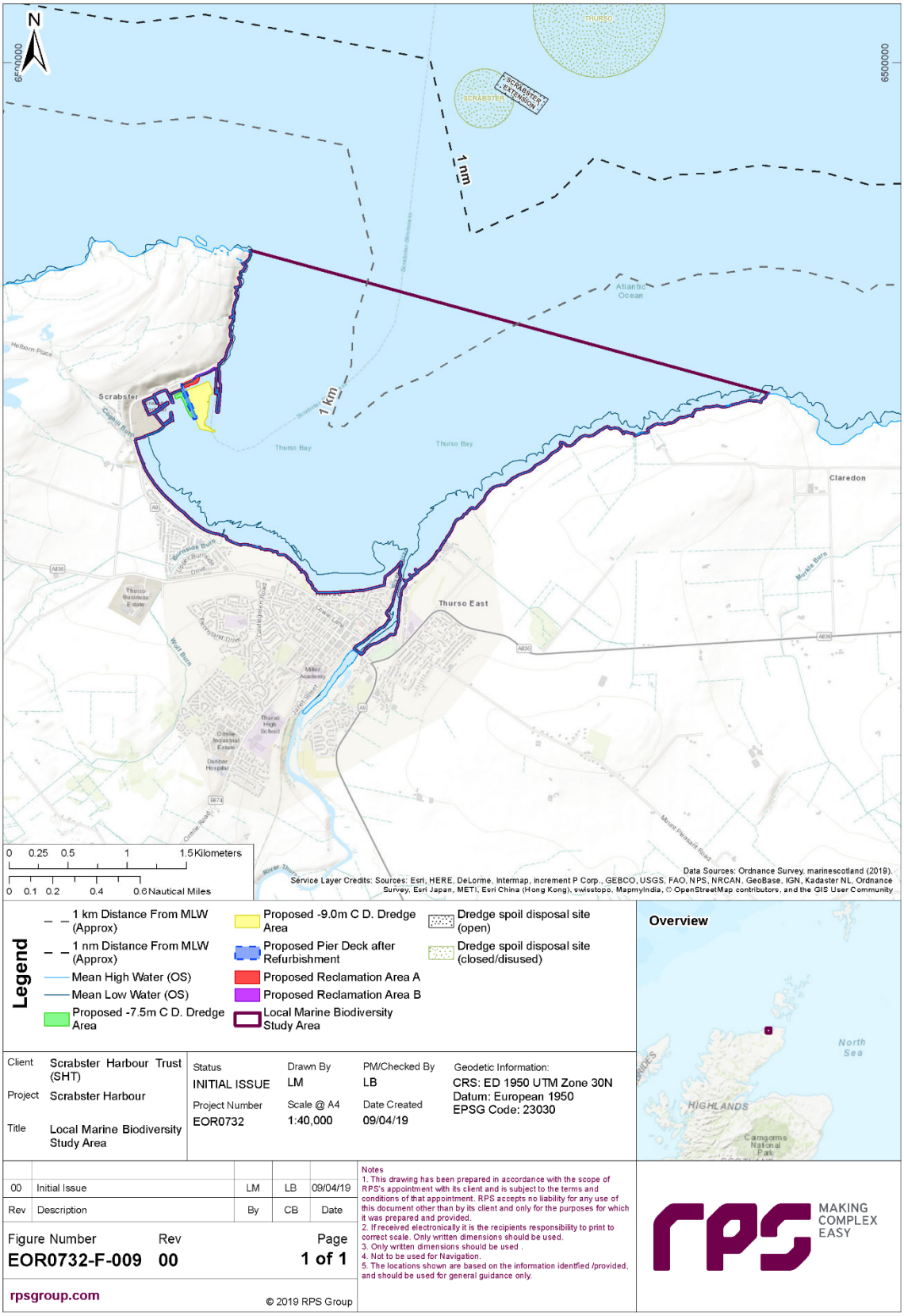


Figure 11.2: Local marine biodiversity study area

Baseline Methodology

Desktop study

11.19 Information on marine biodiversity receptors within the study area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 11.1 below.

Table 11.1: Summary of key desktop reports

Title	Source	Year	Author
Benthic ecology			
A catalogue of seabed habitats from around the British Isles.	https://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/	N/A	EMODnet
Survey of the Littoral Zone of the Coast of Great Britain	Nature Conservancy Council	1980	Bartrop *et al.*
An Examination and Assessment of the Development and Application of a Management Framework for Coastal Zone Management within the Moray Firth Coastal Zone	Institute of Offshore Engineering Heriot-Watt University	1995	Boon
Marine and coastal ecosystems. In Handbook of Ecological Restoration	Restoration in Practice	2002	Hawkins *et al.*
Synthesis of Information on the Benthos of Area SEA 5	Department of Trade and Industry	2004	Eleftheriou *et al.*
An assessment of the conservation importance of species and habitats identified during a series of recent research cruises around Scotland	Scottish Natural Heritage	2011	Moore and Roberts
Benthic survey for Phase 1 of the MeyGen tidal stream energy project, Inner Sound, Pentland Firth	MeyGen Ltd	2011	ASML
Tidal Energy Project Phase 1: Environmental Statement	https://tethys.pnnl.gov/sites/default/files/publications/MeyGen-2012-ES.pdf.	2012	MeyGen
Dock harbour walls as biodiversity hotspots	Research	2014	Derweduwen *et al.*
Fish and shellfish			
Fish and shellfish sensitivity reports	https://www.marlin.ac.uk/activity/pressures_report	n/a	Various
Fisheries sensitivity maps in British Waters.	UKOOA Ltd.	1998	Coull *et al.*
British sea fishes	Underwater World Publications Ltd.	2001	Dipper

Title	Source	Year	Author
Strategic Environmental Assessment of the fish and shellfish resources with respect to proposed offshore wind farms in the eastern Irish Sea.	https://tethys.pnnl.gov/sites/default/files/publications/Lockwood-2005.pdf	2005	Lockwood
Marine renewables SEA environmental report. Section C7 Fish and shellfish.	Scottish Government	2007	Faber Maunsell
Changes in swimming depths of Atlantic salmon *Salmo salar* post-smolts relative to light intensity.	Journal of Fish Biology	2008	Davidson *et al.*
UK Offshore Energy SEA 2 Environmental Report.	Department Of Energy & Climate Change	2009	DECC
Vertical movements of Atlantic salmon post smolts relative to measures of salinity and water temperature during the first phase of the marine migration,	Fisheries Management & Ecology,	2009	Plantalech *et al*.
Mapping the spawning and nursery grounds of selected fish for spatial planning	CEFAS	2010	Ellis *et al.*
Review of migratory routes and behaviour of Atlantic salmon, sea trout and European Eel in Scotland's coastal environment: implications for the development of marine renewables	Scottish Marine and Freshwater Science	2010	Malcolm *et al.*
Biodiversity and conservation – Elasmobranchii	http://www.marlin.ac.uk/phylumdetails.php?phylum=2341#elasmobranchii	2011	MarLIN
Tidal Energy Project Phase 1: Environmental Statement	https://tethys.pnnl.gov/sites/default/files/publications/MeyGen-2012-ES.pdf.	2012	MeyGen
Habitats Regulations Appraisal of Draft Plan for Offshore Wind Energy in Scottish Territorial Waters: Appropriate Assessment Information Review.	Marine Scotland	2011a	Marine Scotland
Final 2017 landings data by ICES rectangle	International Council for the Exploration of the Sea	2017	ICES
Fishing Effort and Quantity and Value of Landings by ICES Rectangle.	International Council for the Exploration of the Sea	2017	ICES
Atlantic Salmon	https://www.nature.scot/plants-animals-and-fungi/fish/freshwater-fish/atlantic-salmon	2017	SNH

Title	Source	Year	Author
Marine mammals			
Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys			
Scientific Advice on Matters Related to the Management of Seal Populations	Special Committee on Seals (SCOS)	2011, 2012, 2013, 2014, 2015, 2016, 2017	SCOS
Management Units for cetaceans in UK waters	JNCC Report No. 547	2015	IAMMWG.
Distributions of Cetaceans, Seals, Turtles, Sharks and Ocean Sunfish recorded from Aerial Surveys 2001-2008	Wildfowl and Wetland Trust aerial surveys	2009	WWT Consulting Ltd.
Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management	SCANS II	2006	Hammond *et al*.
UK Cetacean Status Review	Sea Watch Foundation	*2003*	Evans *et al.*
Atlas of cetacean distribution in north-west European waters	JNCC	2003	Reid *et al.*
Abundance of Harbour Porpoise and other Cetaceans in the North Sea and Adjacent Waters	SCANS I	2002	Hammond *et al*.

Site-specific surveys

11.20 In order to ascertain the sediment physical and chemical properties and characteristic benthic communities of Scrabster Harbour and the Thurso Bay area, RPS commissioned two surveys. The first survey was undertaken on 15 May 2018 to collect sediment samples to determine the physical and chemical properties of sediments within Scrabster Harbour dredging footprint to assess the suitability of sediments for repurposing within the proposed redevelopment of the pier and for disposal within the licensed marine disposal site (Scrabster Extension). The second survey was undertaken on 7 February 2019 to determine and describe the benthic communities found within Thurso Bay and Scrabster Harbour, in waters between 5 m and 30 m that could be potentially impacted by the redevelopment. A summary of the sampling methods are provided below and the results of both surveys are provided in sections 11.35 *et seq.* and 11.49 *et seq.* respectively. Full details are provided in EIAR Volume II, Appendix 11.2: Benthic Technical Report.

Physico-chemical survey

11.21 A total of nine samples were collected from the dredge footprint, three samples on the western side of St. Ola's Pier and six samples on the eastern side (Figure 11.3). All samples were collected by divers and transferred to acid washed sample jars, labelled and frozen before being sent to RPS laboratories for testing. Samples were analysed for organotins, metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and particle size analysis (PSA). Contaminant concentrations were then compared against the CEFAS Action Levels (AL) 1 & 2, Canadian threshold effect levels (TEL) and probable effect levels (PEL), with sediments described following the Folk and Ward method (Long, 2006).

Benthic survey

11.22 A total of 10 sediment samples were collected, three of which were collected from within the proposed dredge footprint and seven from Thurso Bay (Figure 11.4). Ten litres of sediment was collected for each sample using a 0.1 m^2 day grab. Once onboard the survey vessel, detailed physical descriptions of each sample was obtained using the Folk and Ward method. A sub-sample of sediment (circa 10% of the sample volume) was taken for PSA and the remaining sample was emptied onto a 0.5 mm sieve net laid over a 4 mm sieve table and washed through with seawater. The remaining sample was then backwashed into a suitably sized container containing 10% formalin to fix for analysis.

The benthic samples were analysed at Ocean Ecology's benthic laboratory by qualified marine ecologist / taxonomists. The samples were washed through a 0.5 mm sieve and elutriated in water to float off the small, lighter fauna which was transferred to a petri dish and all fauna picked out. Some sediment was captured and retained during elutriation to ensure all fauna and faunal fragments were extracted. Larger fractions (> 5 mm) were transferred to a tray and sorted by eye to remove all remaining fauna. Fauna and faunal fragments were identified to species level, where possible, under a binocular zoom microscope using appropriate taxonomic keys. Where experts were unable to identify specimens to species level they identified to the next taxon level (i.e. Genus or family). All faunal samples were preserved in 70 % Industrial Methylated Spirits.

Identification of designated sites

11.23 All designated sites within the local and regional marine biodiversity study areas with qualifying marine mammals, fish and shellfish or benthic habitats as qualifying interest features that could be potentially impacted by the construction or operational phases of the proposed redevelopment were identified using the following approach:

- Step 1: All designated sites of international, national and local importance were identified using a number of sources (Table 11.1), encompassing MCZs, SACs, SPAs, and SSSIs identified by examining the JNCC's website, the European Site European Nature Information System (EUNIS) database and the MAGIC interactive map applications (http://magic.defra.gov.uk/);
- Step 2: Information was compiled on the relevant qualifying feature for each of these sites by examining each data source. The known occurrence of each of qualifying feature within the study area was based on relevant desktop information (Table 11.1);

- Step 3: Using the above information and expert judgement, sites were included in the assessment if:
  - A designated site directly overlaps with proposed redevelopment;
  - Sites and associated features were located within the potential Zone of Impact (ZoI) for impacts associated with proposed redevelopment, based on expert judgement;
  - Qualifying features of a designated site were either recorded as present during historic surveys within proposed redevelopment area, or identified during the desktop study as having the potential to occur within proposed redevelopment area; and
  - Where a national site falls outside of an international site, but is located within identified study areas, the national site has been taken forward for further assessment for a particular feature.

Consultation

11.24 A summary of consultation responses relating to marine biodiversity aspects of the associated scoping report is set out in the table below (Table 11.2).

Table 11.2: Consultation responses relevant to marine biodiversity

Date	Consultee and Issues Raised	How/ Where Addressed
17 August 2018	**The Highland Council** Support the need for an assessment of the impacts of underwater noise on migratory fish and marine mammals.	Underwater noise impacts have been considered in sections 11.200 *et. seq.* and 11.271 *et. seq.*
17 August 2018	**The Highland Council** Recommend an assessment of the contaminant levels in the dredged material and consideration of any likely impact on benthic species.	Results from a physico-chemical survey are presented in section 11.35 *et. seq.*
21 September 2018	**Scottish Natural Heritage** Identify the need to consider mitigation measures to address potential impacts from noise and physical obstruction on migrating salmon.	Underwater noise impacts have been considered in sections 11.200 *et. seq.* and 11.271 *et. seq.*
21 September 2018	**Scottish Natural Heritage** Advise that thorough consideration in the EIA is given to the potential for noise generated by the construction works to impact European Protected Species (EPS)	Underwater noise impacts have been considered in sections 11.200 *et. seq.* and 11.271 *et. seq.*
21 September 2018	**Scottish Natural Heritage** Recommend that a consideration of impacts on seal haul-outs and basking sharks should be included in the EIA report	Consideration of impacts on seal haul-outs has been considered primarily in accidental pollution impact assessment and others (see section 11.369 *et. seq.*) Consideration of impacts on basking sharks has been considered in the fish and shellfish impact assessment (sections 11.200 *et. seq.* and 11.338 *et seq.*)

Date	Consultee and Issues Raised	How/ Where Addressed
21 September 2018	**Marine Scotland** Concur with the applicant and the views of the consultees that marine biodiversity including migratory fish, marine mammals and benthic ecology should be scoped in to the EIA report.	All addressed in the assessment of effects (section 11.160 *et seq.*)
21 September 2018	**Marine Scotland** Support the consultee view that an assessment of underwater noise is also required and that this should be included either in this chapter or in the relevant chapter(s) relating to ecological receptors	Underwater noise impacts have been considered in sections 11.200 *et. seq.* and 11.271 *et. seq.*
21 September 2018	**Marine Scotland** Agree that impacts on receptors should be addressed in the relevant chapters and that major disasters and accidents can be scoped out of the EIA report.	Impacts on receptors addressed in the chapter (section 11.160 *et. seq.*); major disasters and accidents scoped out
21 September 2018	**Scottish Natural Heritage** Identified the Meygen project which should be assessed for cumulative impacts and offered to provide further advice regarding projects which should be considered.	Meygen project screened in for consideration in cumulative impacts (see section 11.346 *et seq.*)
21 September 2018	**Marine Scotland** Advise that the applicant contacts SNH, in addition to the approaches listed in the scoping report, to identify projects with potential cumulative effects. In general however, the Scottish Ministers are supportive of the applicants approach to assess cumulative impacts for each receptor in each chapter of the EIA and thus conclude that a standalone chapter on cumulative assessment can be scoped out of the EIA report.	Chapter 1 sets out our approach and methodology to scoping other projects for consideration of cumulative effects
17 August 2018	**Highland Council** Suggest the applicants consult the Caithness District Salmon Fishery Board (CDSFB) on likely impacts on wild salmonids.	Applicant consulted CDSFB for likely impacts on wild salmonids
17 August 2018	**Highland council** Suggest the EIA report should consider the likely impacts on the area surrounding the dredge site if the material dredged out of the pier site during the benthic survey is found to be contaminated and likely to impact benthic species	Likely impacts on the area surrounding dredge site considered in benthic ecology assessment (see sections 11.160 *et. seq.* and 11.160 *et. seq.*)
13 August 2018	**Scottish Natural Heritage** Suggest that protected areas listed below should be scoped into the EIA: Moray Firth SAC Sanday SAC Faray and Holm of Faray SAC River Thurso SAC	Protected areas scoped into EIA (see Table 11.8)

Assessment Criteria and Assignment of Significance

11.25 The criteria for determining the significance of effects is a two-stage process that involves defining the magnitude of the impacts and sensitivity of the receptors. This section describes the criteria applied in this chapter to assign values to the receptor to assist in defining sensitivity of receptors and the magnitude of potential impacts.

11.26 An assessment of the ecological effects of a proposed development should focus on 'Important Ecological Features (IEFs). These are species and habitats that are valued in some way and could be affected by a proposed development; other IEFs may occur on or in the vicinity of the site of a proposed development but do not need to be considered because there is no potential for them to be affected significantly.

11.27 The value of ecological features is dependent upon their biodiversity, social, and economic value within a geographic framework of appropriate reference (CIEEM, 2018). The most straightforward context for assessing ecological value is to identify those species and habitats that have a specific biodiversity importance recognised through international or national legislation or through local, regional or national conservation plans (e.g. Annex I habitats under the Habitats Directive, OSPAR, Biodiversity Action Plan (BAP) habitats and species, habitats/species of principal importance listed under the NERC Act 2006 and habitats/species listed as features of Marine Conservation Zones (MCZs) / recommended MCZs (rMCZs)). However, only a very small proportion of marine habitats and species are afforded protection under the existing legislative or policy framework and therefore evaluation must also assess value according to the functional role of the habitat or species. For example, some features may not have a specific conservation value in themselves but may be functionally linked to a feature of high conservation value. Table 11.3 shows the criteria applied to determining the ecological value of IEFs.

Table 11.3: Criteria used to inform the valuation of receptors

Value	Definition
International	• Internationally designated sites. • Habitats and species protected under international law (i.e. Annex I habitats within an SAC boundary; Annex II protected species designated as a feature of a European designated site). • OSPAR List of Threatened and/or Declining Species and Habitats.
National	• Nationally designated sites. • Species protected under national law. • Internationally protected species (including EPS) that are not qualifying features of a candidate of designated European site but are regularly recorded within the regional or marine biodiversity study areas. • Annex I habitats not within an SAC boundary. • UK BAP priority habitats and species, NERC habitats and species of principal importance in England, and Nationally Important Marine Species that have nationally important populations within the study area, particularly in the context of species/habitat that may be rare or threatened in the UK.

Value	Definition
	• Habitats and species that are features of MCZs and rMCZs (i.e. broad-scale habitats and Features of Conservation Importance (FOCI)).
Regional	• Internationally protected species that are not qualifying features of a European designated site and are infrequently recorded within the regional study area in very low numbers compared to other regions of the British Isles. • UK BAP priority habitats, NERC habitats and species of principal importance in England, or Nationally Important Marine Species that have regionally important populations within the study area (i.e. are locally widespread and/or abundant). • Habitats or species that provide important prey items for other species of conservation or commercial value.
Local	• Habitats and species which are not protected under conservation legislation which form a key component of the marine ecology within the study area.
Negligible	• Habitats and species of very local importance only.

Magnitude of Impact

11.28 The criteria for defining magnitude in this chapter is outlined in Table 11.4 below.

Table 11.4: Example definitions of magnitude of impact

Magnitude of impact	Typical descriptors
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse).
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Receptor Sensitivity

11.29 Each IEF sensitivity has been defined by categorising according to the five-point scale presented in Table 11.3. This scale is based on:

- The vulnerability of the receptor to the impact;

- The potential for recovery of the receptor following the impact; and
- The status of the receptor based on the criteria summarised in Table 11.5 below.

Table 11.5: Example definitions of sensitivity

Sensitivity	Typical Descriptors
Very High	International or National IEFs with high vulnerability and no ability for recovery.
High	Regional IEF with high vulnerability and no ability for recovery. International or National IEF with high vulnerability and low recoverability.
Medium	Local IEF with high vulnerability and no ability for recovery. Regional IEF with medium to high vulnerability and low recoverability. International or National IEFs with medium vulnerability and medium recoverability.
Low	Local IEF with medium to high vulnerability and low recoverability. Regional IEF with low vulnerability and medium to high recoverability. International or National IEFs with low vulnerability and high recoverability.
Negligible	Receptor is not vulnerable to impacts regardless of value/importance. Local IEF with low vulnerability and medium to high recoverability.

Significance of Effect

11.30 The significance of the effect upon marine biodiversity receptors is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed for this assessment is presented in Table 11.6. Where a range of significance of effect is presented in Table 11.6, the final assessment for each effect is based upon expert judgement.

11.31 For the purposes of this assessment, any effects with a significance level of minor or less have been concluded to be not significant in terms of the EIA Regulations.

Table 11.6: Significance of Effect Assessment Matrix

Sensitivity	Magnitude of Impact				
	No Change	**Negligible**	**Low**	**Medium**	**High**
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
Very high	No change	Minor	Moderate or Major	Major or Substantial	Substantial

Limitations of the Assessment

Benthic Ecology

11.32 No site-specific surveys were carried out for the intertidal area of Thurso Bay. However, considering the proposed redevelopment will only occur within Scrabster Harbour and in association with existing man-made structures, a desk-based study of species associated with other harbour structures within the area has been suitable for characterising the intertidal baseline.

Fish and shellfish

11.33 Spawning and nursery areas spatially and temporally vary over time (Ellis *et al*., 2010) and as such data only provides an indicative location, representing a 'snapshot', of available species. For the purposes of this project, it has been assumed that if the study area overlaps with either the spawning or nursery areas then species have been included within the assessment, unless evidence suggests otherwise (i.e. incompatible ecological parameters e.g. freshwater species in marine environments or fish known to only occur at depths not found within the study area).

Marine mammals

11.34 Mobile species, such as cetaceans and pinniped exhibit varying spatial and temporal patterns. All historic surveys across the regional marine biodiversity study area represent snapshots of the species considered at the time of sampling. Abundance and distribution of species is likely to vary both seasonally and annually.

11.3 Baseline Environment

Physico-chemical survey results

Particle sediment analysis (PSA)

11.35 PSA revealed sediments to comprise of very fine sand, fine sand and coarse sand. Very fine sand dominated samples collected at sites 1 – 3 and at site 9, while fine sand dominated sites 4 – 7 and coarse sand at site 8 (Figure 11.3). Very fine – fine sand indicates a relatively low energy environment as fine material would be expected to be resuspended in a higher energy environment, the presence of coarse sand may indicate eddies forming within the centre of the harbour (Nordstrom, 1997).

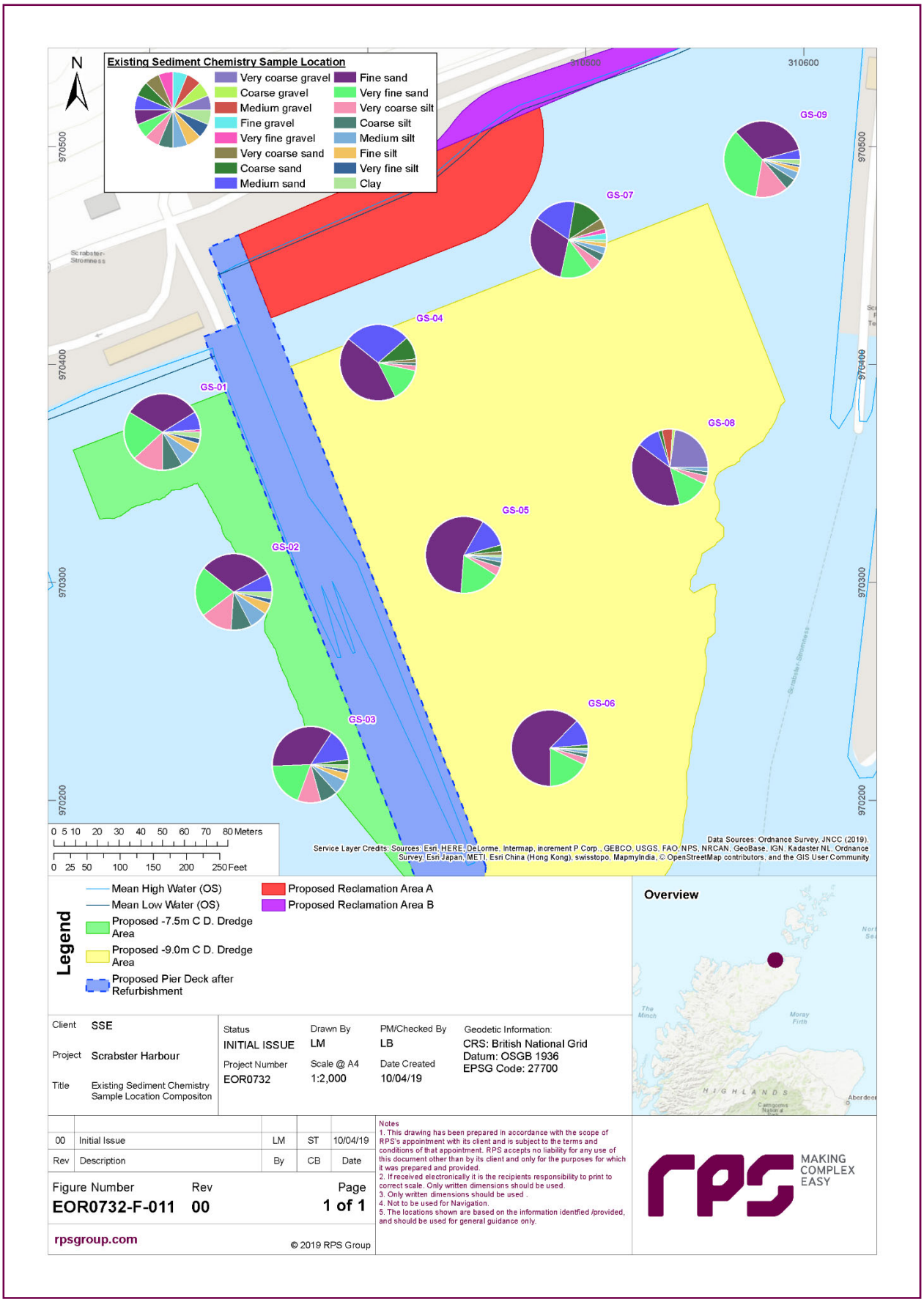


Figure 11.3: PSA results and physico-chemical sample locations relative to the dredge footprint

Sediment Chemistry Analysis

11.36 Chemical analysis was undertaken from samples collected from within the dredge area to assess the sediments' suitability for offshore disposal. Sediment chemistry results are presented in EIAR Volume II, Appendix 11.2: Benthic Technical Report.

11.37 The results have been compared to environmental quality standard thresholds, where relevant, including Cefas Action Level 1 (AL1)[1], Cefas Action Level 2 (AL2)[2], Canadian[3] Threshold Effect Levels (TEL)[4] and Probable Effect Levels (PEL)[5].

Metal Contamination

11.38 Heavy metals are readily adsorbed by sediments and can lead to metals accumulating to concentrations far higher than the surrounding environment. These sediments can become re-suspended through bioturbation or through physical processes/disturbances. Metals will tend to accumulate in these fine-grained sediments and can become bioavailable to marine organisms through ingestion. The uptake of heavy metals by marine organism can lead to bioaccumulation through tropic levels leading to apex organisms accumulating metals to adverse and toxic levels. This could result in significant adverse effects including mortality, impaired reproduction, reduced growth, alterations in metabolism as a result of oxidative stress and disruption to the food chain.

11.39 All metal concentrations were below adopted thresholds except for sites 1–3 Metal concentrations which were elevated above AL1 and Canadian TEL threshold for metals arsenic, copper and nickel, all located the dredge footprint to the west of St. Ola Pier (Figure 11.3).

11.40 Site 1 marginally exceeded the Canadian TEL for Arsenic and CEFAS Action Level 1 for Chromium. Site 2 marginally exceeded the Canadian TEL for Arsenic, Copper and Nickel. Site 3 exceeded the Canadian TEL for Copper. No metal concentrations were elevated above Cefas AL2 (defined as the level at which material would not be deemed suitable for disposal at sea).

Organotins

11.41 Organotin compounds are based on tin with hydrocarbon substitutes, these include the historically used biocides dibutyltin (DBT) and tributyltin (TBT). Primarily used as antifungal and anti-fouling agents to improve the efficiency, performance and longevity of marine structures and vessels. Concerns over toxicity of these compounds to biological organisms led to the

[1] Sediments below Cefas AL1 are generally considered acceptable for disposal at sea, pending other considerations such as physical suitability for the disposal site and potential beneficial uses.

[2] Sediments above Cefas AL2 are considered unacceptable for uncontrolled disposal at sea without special handing and containment.

[3] The Canadian Sediment quality guidelines were developed by the Canadian Council of Ministers of the Environment as broadly protective tools to support the functioning of healthy aquatic ecosystems (CCME, 2001). They are based on field research programmes that have demonstrated associations between chemicals and biological effects by establishing cause and effect relationships in particular organisms. Comparison of measured concentrations of various contaminants within the sediments with these guideline values will, therefore, provide a basic indication on the degree of contamination and likely impact on ecology.

[4] The minimal effect range below which adverse effects rarely occur.

[5] The probable effect range above which adverse effects frequently occur.

International Maritime Organisation introducing a worldwide ban. Adverse biological effects are comparable to hydrogen cyanide, whereby the compound halts cellular respiration within the mitochondria leading to cell and organism death. Legacy trace TBT and DBT can still be present within sediments in harbours and low energy environments.

11.42 Dibutyltin (DBT) and tributyltin (TBT) concentrations determined from all samples were found to be below adopted environmental quality standard thresholds levels for sediments (see EIAR Volume II, Appendix 11.2: Benthic Technical Report).

Polychlorinated Biphenyls (PCB)

11.43 PCBs are toxic to fish and other aquatic organisms. Reproductive and developmental problems have been observed in fish at low PCB concentrations, with the early life stages being most susceptible. There is growing evidence linking PCBs and similar compounds with reproductive and immuno-toxic effects in wildlife, including effects on seals and other marine mammals. The World Health Organisation (WHO, 1993) also reported that, for marine mammals, there was evidence that PCBs reduce their reproductive capacity. Due to their persistence and lipophilic nature, PCBs have the potential to bioaccumulate, particularly in lipid rich tissue such as fish liver. Bioaccumulation of PCBs is recorded in fish, birds and Annex II marine mammals with known sublethal toxicological effects. Accumulation of PCBs in sediments poses a potential hazard to sediment-dwelling organisms.

11.44 PCB concentrations determined from all sites were found to be below AL1 (Sum of ICES 7). AL1 is below the Canadian TEL and PEL thresholds (EIAR Volume II, Appendix 11.2: Benthic Technical Report).

Polycyclic Aromatic Hydrocarbons (PAH)

11.45 Polycyclic Aromatic Hydrocarbons (PAH) enter the environment through a number of sources, these include road run-off, sewage, atmospheric circulation and from historical industrial discharge. Once in the environment, PAHs exert a strong affinity for organic carbon and as such organic sediment in rivers can act as a substantial sink. Due to the high affinity for organic carbon, once ingested by fauna the PAHs cause oxidative stress and lead to adverse effects in the organism. Most species have a limited ability to metabolize PAHs and as a result can bioaccumulate to toxic levels.

11.46 PAH concentrations were found to exceed the Canadian TEL for sites 4, 5,7 and 8 and CEFAS AL1 for all other sites. See EIAR Volume II, Appendix 11.2: Benthic Technical Report for a comprehensive breakdown of all PAH by site.

Regional Ecology

11.47 St. Ola's Pier is located within the strategically placed Scrabster Harbour; acting as the closest mainland port for oil and gas, and renewables industries, and ideally located for northern fishing grounds. The Harbour is located within Thurso Bay and to the west of Dunnet Bay, on the north eastern peninsula of Scotland, just off to the west of the Pentland Firth along the Caithness Coast (see Figure 11.2).

11.48 Little is known of the specific ecology of Thurso Bay; however, the wider area is home to a multitude of benthic communities, fish and shellfish species of both commercial and conservation value and marine mammals. Designated sites (SACs) within the local and regional marine biodiversity study areas are defined with harbour seal (*Phoca vitulina*), grey seal (*Haligochoerus grypus*), harbour porpoise (*Phocoena phocoena*) and Atlantic salmon (*Salmo salar*) as primary reasons for designation, however no SAC overlaps with proposed redevelopment. Most species within the wider area are mercurial, transitory and can be found to migrate through the area, including basking sharks, salmonids and minke whale. Sessile species can be found throughout the Orkney Islands down through the Pentland Firth and along the Caithness Coast, including lobsters, oysters and crabs.

Benthic Ecology

Intertidal

11.49 Scrabster Harbour is nestled within the north western part of the bay, where a beach, with intermittent rocky outcrops, extends in a south-easterly direction towards the River Thurso mouth. Beyond the river mouth a rocky outcrop extends in a north-easterly direction. The north of the harbour is backed steep cliffs that wraps in an easterly direction around the headland.

11.50 Throughout the intertidal zone, common fauna species found along the north and north eastern coast of Scotland include rough periwinkle *Littorina saxatilis*, barnacle *Semibalanus balanoides*, mussels *Mytilus edulis*, dog whelk *Nucella lapillus* and common limpets *Patella vulgata* while common flora species include the bladder wrack *Fucus vesiculosus* and brown algae *Laminaria* spp. (Bartrop *et al*., 1980; Boon, 1995; Bennet & Mcleod, 1998; Eleftheriou *et al*., 2004).

11.51 Within the immediate confines of Scrabster Harbour (inner and outer), the intertidal substrate is predominantly composed of artificial hard substrate in the form of vertical concrete and stone harbour/breakwater walls as well as localised areas of boulders forming coastal protection, such as on the seaward edges of the outer harbour breakwaters. These surfaces are likely to host encrusting benthic flora and fauna including taxa such as bryozoans, barnacles, mussels, sea squirts and sea anemones (Hawkins *et al.,* 2002; Derweduwen *et al*., 2014) as well as seaweeds common to the area, such as fucoids and kelp.

11.52 In addition, studies of harbour and dock sediments have demonstrated very low densities of only a few macrobenthic species (Derweduwen *et al.,* 2014) and those that have been recorded have generally been short lived species (Hawkins *et al*., 2002).

Subtidal

11.53 The EMODnet indicated that the bathymetry of Thurso Bay has a depth range of between 0 m – -40 m CD (EMODnet, undated). A review of the EMODnet seabed habitats maps, full-detail habitat classification (EUNIS), indicates that the majority of Thurso Bay is 'infralittoral fine sand or infralittoral muddy sand' (EUNIS habitat: A5.23 or A5.24). The subtidal fringe along the west side of the bay, above the redevelopment site, has been recorded as 'Atlantic and Mediterranean low energy infralittoral rock' (EUNIS habitat: A3.3). Along the eastern fringe, habitat has been recorded as 'Atlantic and Mediterranean moderate energy infralittoral rock' (EUNIS habitat: A3.2). Extending out from the bay towards the dredge disposal site, habitat have been recorded as 'circalittoral fine sand or circalittoral muddy sand' (EUNIS habitat: A5.25 or A5.26) and 'infralittoral coarse sediment' (EUNIS habitat: A5.13).

11.54 Surveys undertaken by ASML (2011) for the MeyGen project, in the nearshore waters of the Pentland Firth, circa 23 km to the MeyGen project from Scrabster Harbour, found the sediment was composed of mainly very fine to very coarse sand, with areas of gravel. Species found to be associated with this area included: sponges *Esperiopsis fucorum* and *Hymedesmia paupertas*, patchy bryozoan crusts, dead man's fingers *Alcyonium digitatum*, hydroids with mobile species including brown crab (*Cancer pagurus)*, common sea urchin *Echinus esculentus* and starfish *Asteroidea* spp. and *henricia* sp (Moore & Roberts, 2011). Biotopes described included *Balanus crenatus* and *Tubularia indivisa* on extremely tide-swept circalittoral rock (CR.HCR.FaT.BalTub) although the characterising species *T. indivisa*, appeared to be only present at low density, *T. indivisa* and cushion sponges on tide-swept turbid circalittoral bedrock (CR.HCR.FaT.CTub) and circalittoral coarse sediment (SS.SCS.CCS) (ASML, 2011).

11.55 The subtidal benthic communities associated with the harbour has been found to differ from those found in the wider bay area due to the semi-enclosed and stable nature of the harbour compared to the dynamic more exposed environment of the bay. Fine sediments (mud) have been found to be more common within the harbour as they tend to fall out of suspension more readily in less exposed, sheltered environments such as the harbour resulting in potentially reduced (poorly oxygenated) sediment conditions. Subtidal benthic ecological communities generally associated with these sediments include annelids, bivalvia, oligochaeta, polychaeta, gastropoda, crustacea and algae (Seiderer and Newell, 1999).

11.56 Particle size analysis (PSA) carried out on the benthic grab samples collected in February 2019 found sediments to be predominantly sand and mud sediments with higher percentages of mud found within Scrabster Harbour (Figure 11.4). Multivariate analysis of the infaunal grab data revealed three distinct benthic communities that fall within two biotope classifications within the dredge footprint and wider Thurso Bay area:

- Faunal group a - The samples that made up this faunal group all have poorly sorted fine sand with some small shells and were found outside Scrabster Harbour in Thurso Bay. This group was given the biotope Infralittoral fine sand (SS.SSa.IFiSa) due to its characterising species of the amphipods *Bathyporeia elegans*, *Centraloecetes kroyeranus,* polychaetes *Scoloplos armiger* and Nephtys (juv).

- Faunal group b – Sample G03 made up this faunal group and had a sediment classification of poorly sorted very fine sand with small shells and organics and was found to the north west of the study area, on the landward side of the St. Ola Pier within Scrabster Harbour. This group has been given the biotope Infralittoral sandy mud (SS.SMu.ISaMu) due to its diverse range characterising species including the polychaetes *S.armiger*, high abundance of the round worm Nematoda, and the bivalve *Abra Alba*.
- Faunal group c – All samples within faunal group a had moderately well sorted fine sand with small stones and shell fragments and was found to the north west of the study area, within Scrabster Harbour. This group has been given the biotope of Infralittoral sandy mud (SS.SMu.ISaMu) due to its characterising species including the polychaetes *Scoloplos armiger, Prionospio fallax,* Nemertea and bivalves e.g. *A. Alba*.

11.57 None of the habitats identified are protected and none of the species present are of conservation interest. Offshore subtidal sands and gravels are considered Scottish Marine Priority Features however these component biotopes have not been identified within this study. No species found within this study are Scottish Marine Priority Features (JNCC, 2012). The sand and mud communities are typical of large parts of Thurso Bay and the North Coast of Scotland.

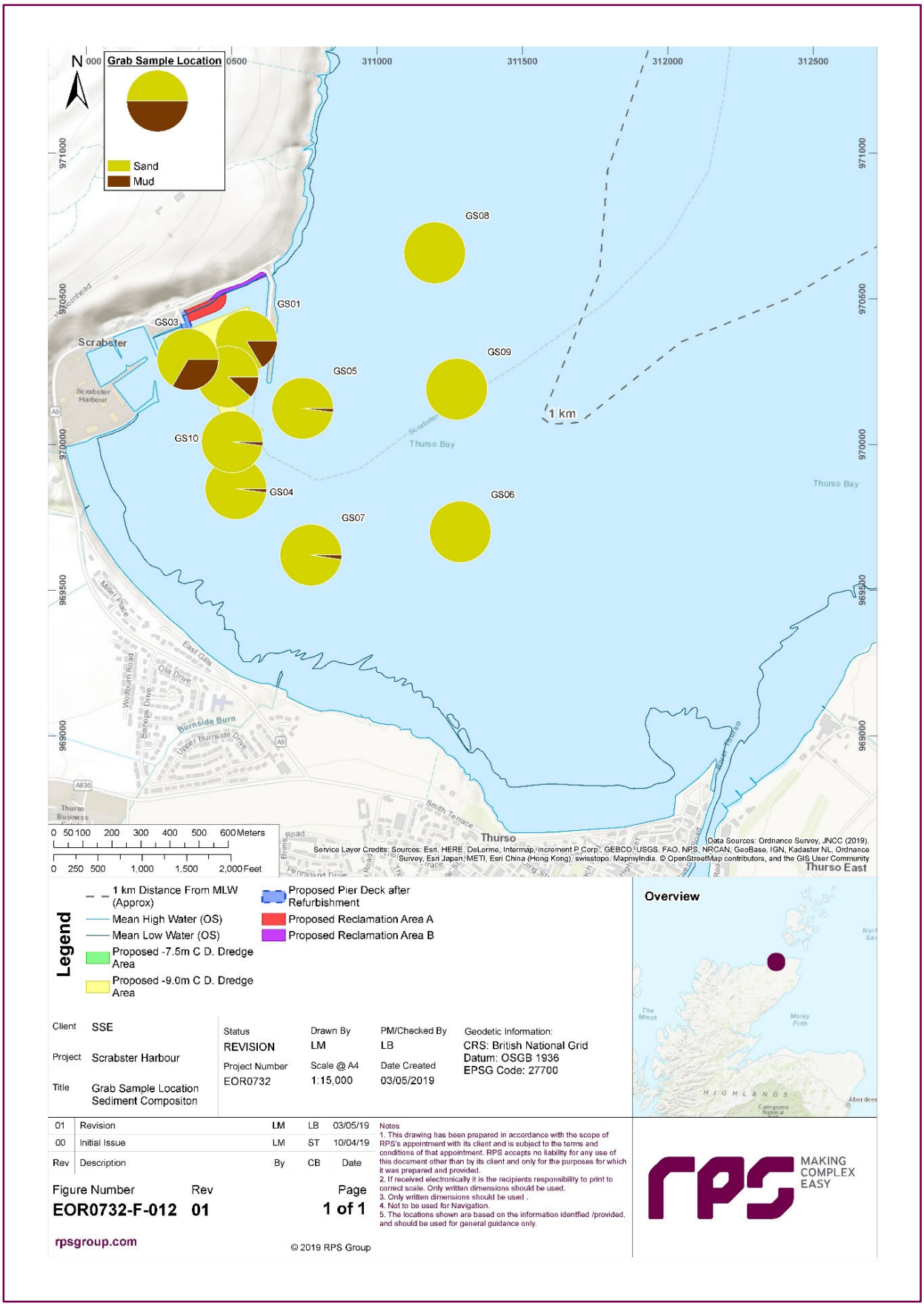


Figure 11.4: Site sediment fractions derived from the benthic survey PSA

Fish and Shellfish

Regional Fish and Shellfish Assemblage

11.58 The regional fish assemblage of the area is typical of species found within the northern Atlantic including species of both commercial and conservation value. Migratory species such as Atlantic salmon (*Salmo salar*) and sea trout (*Salmo trutta)* have been found to spawn and migrate to and from Scottish rivers. The River Thurso, adjacent to the proposed redevelopment has been designated a Special Area of Conservation (SAC) for its Atlantic salmon population. In addition, elasmobranchs (sharks and rays) have been found distributed throughout Scotland, with the largest, the basking shark (*Cetorhinus maximus)*, associated with seasonal feeding grounds.

11.59 Shellfish grounds[6] can be found within the Orkney Islands and Tongue Bay, circa 77.21 km north east and 50 km west, respectively. Species harvested for commercial purposes include razor clams, lobsters, oysters and crabs (ICES, 2017).

Local Fish Assemblages

11.60 The fish assemblages of Scrabster Harbour would be expected to be typical of a harbour community and reflect species known to occur within the North Coast Marine region i.e. Pentland Firth and along the Caithness coastline. No fish and shellfish surveys have been undertaken within Thurso Bay, however studies (MeyGen, 2012 and DTL, 2016) have been carried out in the region. Based on these studies the key fish species likely to be present within and in close proximity to Scrabster Harbour include elasmobranchs (e.g. sharks, rays and skates, including the basking shark) and a number of commercially important fish species, either as adults or juveniles, including herring *Clupea harengus*, lemon sole *Microstomus kitt*, sandeel *Ammodytes* spp., whiting *Merlangius merlangus,* cod *Gadus morhua*, mackerel *Scomber scombrus*, haddock *Melanogrammus aeglefinus*, plaice *Pleuronectes platessa* and saithe *Pollachius virens* (MeyGen, 2012; DTL, 2016 and ICES, 2017).

Migratory Species

11.61 Two species of anadromous[7] fish, the Atlantic salmon and sea trout, and sea lamprey *Petromyzon marinus*, and the catadromous[8] fish species European eel *Anguilla anguilla* that have the potential to be present in the area.

Atlantic Salmon

11.62 The juvenile life stage typically lasts between one to four years before migrating to the sea. Following migration to the sea, salmon are known as post-smolts until the spring of the following year and after one winter as grilse. Adult Atlantic salmon spend the majority of their lives at sea, growing rapidly and only returning to fresh water environments to spawn from November to December (extending from October to late February) (SNH, 2017b). Due to a highly acute sense of smell, the Atlantic salmon is able to locate the river in which it originated and on

[6] Defined as 'classified shellfish harvesting areas' identified from https://marinescotland.atkinsgeospatial.com/nmpi/

[7] Anadromous: Migrating from sea to fresh water to spawn.

[8] Catadromous: Migrating from fresh water to sea to spawn.

maturity migrates back to spawn (Dipper, 2001; Lockwood, 2005). The length of time an Atlantic salmon spends in the sea varies from one to five years (Marine Scotland, 2011).

11.63 Atlantic salmon are widely distributed throughout Scotland and are recognised as Annex II (EU Habitats Directive), British Action Plan (BAP) species, Scottish PMF (juvenile) and as an OSPAR species. They are currently both nationally and internationally important species. In recognition of the importance of Scottish salmon populations, 17 rivers have been designated as SACs for the Atlantic salmon, with the nearest being the River Thurso SAC. However, no management plan currently exists for this SAC.

11.64 The River Thurso SAC is located approximately 2000 m to the south east (Figure 11.2). The river supports a higher proportion of multi sea-winter[9] Atlantic salmon than are found in many rivers further south in the species' range. This is likely aided by the northerly location of the river and the cooler ambient water temperature, resulting in slower-growing juveniles which smolt at an older age, and tend to return as older multi sea-winter salmon. In addition to these multi sea-winter fish, grilse also return to the River Thurso, meaning that the river supports the full range of salmon life-history types.

11.65 Data and information on the movements of salmon during their sea migration is limited. Smolts are believed to school and move to deep-sea feeding areas. Prior to seaward migration, the fish undergo a preparatory smolting process involving morphological, biochemical, physiological and behavioural changes that preadapt them for life within the marine environment (Hoar, 1988; Høgasen, 1998; Thorpe *et al*., 1998; Finstad & Jonsson, 2001). The migration from fresh water through the estuary and into the marine environment is predominantly nocturnal during the early part of the smolt run. During the latter part of the season, a significant proportion of the smolts switch to migration during both day and night (Thorstad *et al.,* 2012). The average total body length of wild smolts is usually 10–20 cm, and they may weigh from 10 to 80 g (Thorstad *et al*., 2011a).

11.66 Salmon originating in Scottish rivers are thought to use near-shore areas, spending most of their migratory time in the surface 1 to 6 m of the water column, diving to depths of 280 m. This may account for lower recorded numbers migrating west (Davidsen *et al.*, 2008; Plantelech Manel-La *et al.*, 2009). Evidence suggest smolts originating from the east coast rivers travel through the Pentland Firth on their way to feeding grounds and as such it can be expected that salmon migrating from the River Thurso would follow the same route (Malcom *et al.*, 2010). Adult and sub-adult salmon form Scottish rivers have been found to migrate to areas around Greenland and the Faroe Islands (Malcolm *et al.*, 2010).

11.67 During a review of adult salmon tagging studies in Scottish waters, Malcolm *et al.* (2010) reported that as well as Atlantic salmon from the east coast moving through the Pentland Firth in an easterly direction towards their natal rivers, movement from the east to the north coast in a westerly direction may be relatively common for both grilse and multi-winter salmon. However, the numbers involved in the westerly movement are likely to be lower than the main movement east.

9 Adult salmon after surviving more than one winter at sea.

11.68 Communication with the Caithness District Salmon Fishery Board (CDSFB) as part of this impact assessment has indicated that Thurso Bay, including the vicinity around Scrabster Harbour, are heavily used by smolts during April and May, with returning adult salmon present between April and September. In addition, Pentland Firth, including Thurso Bay, supports a salmon fishery, indicating that this area is a hot-spot for returning adult salmon and therefore high abundance (Youngson, 2017a).

Sea Trout

11.69 The sea trout has a similar ecology to the Atlantic salmon but are smaller in size, have a much larger distribution and remain within nearshore waters rather that undergoing extensive migration offshore (DECC, 2009). Trout spawn in winter from October to January, with the eggs deposited in redds[10], small deviations in the river bed, cut by the female in the river gravel.

11.70 As mentioned above, sea trout have a large distribution throughout Scotland and are recognised as a BAP species. Records from the NBN gateway have indicated that sea trout are present in the River Thurso, Murkle, Link, Harland, Heilen and Dunnet.

11.71 A review carried out by Malcolm *et al.* (2010) concluded that no reliable conclusion can be drawn on the marine distribution of adult sea trout. However, given the proximity of the proposed redevelopment to the River Thurso, it can be expected that sea trout may be present in the area.

11.72 The CDSFB has identified in their electric fishing survey (Youngson, 2017b), that sea trout were present throughout the River Thurso. As such it can be expected that trout are found throughout Thurso Bay and in close vicinity to Scrabster Harbour.

European Eel

11.73 The European eel has a complex life history, entering two metamorphizations stages. Spawning occurs in the Sargasso Sea (mid Atlantic Ocean), after which larval eels cross the Atlantic Ocean. Once eels have reached the continental shelf, they will have metamorphized into ‘glass eels’, whereby some remain in the sea and others ascend rivers and move between marine, estuarine and freshwater environments. During this time, the European eel will develop pigmentation and are referred to as ‘yellow eels’. The yellow eel state can last from 30-60 years before they enter a final metamorphization into ‘silver eels’ and return to the Sargasso Sea for spawning.

11.74 European eels are widely distributed throughout Scotland and are recognised as a BAP species, priority marine feature, OSPAR Designations, IUCN Red List (critically endangered) and has a European Union Management Plan. They are currently both nationally and internationally Important species. Records from the NBN gateway have indicated that eel are present in the River Thurso and smaller rivers: Murkle, Link, Harland, Heilen and Dunnet.

11.75 Little is known about the migratory routes taken by eels. The timing of migration peaks in Scottish waters in September to December, with glass eels remaining in coastal waters until April to May, waiting for river temperatures to increase sufficiently for them to enter (Malcolm *et*

[10] ‘Nests’ of spawning fish.

al., 2010). The European eel has been found throughout the water column (up to 300m deep), can vary with the time of day and state of tide.

11.76 Records from the NBN gateway indicate no activity within Thurso Bay, however, European eels have been sited at the mouth the River Thurso and personal communication with the CDSFB identified that the annual electric-fishing surveys indicates that eels are ubiquitous in all the streams and rivers of Caithness, including the River Thurso (Youngson, 2017b). As such, the European eel can be expected to occur near or within the proposed redevelopment.

Elasmobranchs

11.77 Elasmobranchs are a cartilaginous fish group that comprises sharks, rays and skates. Shark species expected to be present in the North Coast Marine region include basking sharks *Cetorhinus maximus*, spurdog *Squalus acanthias*, top shark *Galeorhinus galeus*, lesser spotted dogfish *Scyliorhinus canicular*, porbeagle *Lamna nasus,* Kitefin shark *Dalatias licha*, shortfin *mako Isurus oxyrinchus*, blue shark *Prionance glauca and* nurse hound Scyliorhinus stellaris *(*Faber Maunsell, 2007 and MarLIN, 2011). The main species of skate and ray present are thornback ray *Raja clavate*, cuckoo ray *Raja naeus*, spotted ray *Raja montagui* and common skate *Dipturus intermedia* and *Dipterus flossata* (Faber Maunsell, 2007). The basking shark is a PMF and as such has been given a species account. Other species that are a PMF or have a nursery area that overlaps with the study area have been given species accounts in section 11.84 *et seq.*

Basking Sharks

11.78 The basking shark is the second largest fish in the world, growing up to a typical length of 6 – 8 m. Mating is thought to occur in early summer with males following females into shallow water and birthing occurring in late summer approximately a year later. Basking sharks are ovoviviparous, developing embryos with a yolk sac. The young are born fully developed, measuring 1.5 – 2 m.

11.79 The basking shark has been identified as being of both commercial and conservation value and have been categorised as a BAP species, PMF, OSPAR species, IUCN red list species (vulnerable), and is listed on the Bern Convention Appendix II and the CITES Appendix II.

11.80 The Marine Conservation Society (MCS) has been collating UK-wide sightings of basking sharks since 1987 in a project called the Basking Shark Watch Project, through which they have temporal and spatial data of over 21,000 sharks from over 5,200 records. Over 90% of basking shark sightings in the UK are reported between the months of May and August, when sightings peak earliest in the southwest UK and lastly in Scotland around August (MSC, 2008). Sightings in 2009 were highest in the months of July to September (MSC, 2009).

11.81 Sighting distribution maps show large concentrations of sightings on the west coast of Scotland; however, sightings have been recorded along the north coast of Scotland, including within the Thurso Bay (MSC, 2008). Two sightings were made in 2005 and again in 2007 in close proximity to Scrabster Harbour, with the closest basking shark being approximately 200 m and the furthest at 2000 m away from the eastern wall.

Local Shellfish Assemblages

11.82 Shellfish are aquatic demersal shelled molluscs. Using commercial landing data as a proxy for species present in the North Coast Marine region and within Thurso Bay, species most caught include[11] the brown crab *Cancer pagarus*, European lobster *Homarus Gammarus*, great Atlantic scallop *Pecten maximus*, velvet crab *Necora puber* and crawfish *Palinurus elephas.* Other species caught in the area include periwinkles *Littorina* spp., whelks *Buccinum undatum* and Nehrops *Nephrops norvegicus*, Mussels *Mytilus edulis*, razor clams *Solen spp*., cockles *Cerastoderma edule* and native oysters *Ostrea edulis*.

11.83 There are no classified shellfish harvesting waters or shellfish water protected areas in the Thurso Bay area. The nearest classified shellfish harvesting waters are located within Tongue Bay, circa 50 km west of Thurso Bay. The closest shellfish water protected area is circa 50 km north east within the Bay of Firth.

Spawning and Nursery Grounds

11.84 Thurso Bay and the wider area has been identified as a spawning ground for a range of demersal and pelagic species and a nursery ground for species, such as plaice *Pleuronectes platessa,* saithe *Pollachinus virens* and sandeel *Ammodytidae.* The species identified as having spawning or nursery grounds within the study area, based on existing data, are summarised in Table 11.7. Nursery and spawning habitats were categorised by Ellis *et al.* (2012) as either high or low intensity dependant on the level of spawning activity or abundance of juveniles recorded within these habitats. Species with nursery grounds within or near the proposed redevelopment have been given individual species accounts.

[11] Note: This list includes the top ten shellfish species caught within ICES rectangle 46E6 contributing to over 90% of the average landings value (2013-2017; ICES, 2017).

Table 11.7: Key species with spawning and nursery areas (Coull *et al.*, 1998 and Ellis *et al.*, 2010) in proximity to the proposed redevelopment and dredge disposal sites

Common Name	Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Nursery area
Atlantic Salmon	*Salmo salar*													
Cod	*Gadus morhua*													
Common skate	*Dipturus intermedia*	Unknown												
Herring	*Clupea harengus*													
Ling	*Molva molva*													
Plaice	*Pleuronectes platessa*													
Saithe	*Pollachinus virens*													
Sandeel	*Ammodytidae*													
Sea trout	*Salmo trutta*													
Spotted ray	*Raja montagui*													
Spurdog	*Squalus sp.*													High Intensity
Thornback ray	*Raja clavata*													

	Spawning period
	Peak spawning
	Overlap with local study area

Cod

11.85 Cod are widely distributed demersal species that occurs throughout the UK waters and found from the shoreline to depths of circa 600 m (Figure 11.5). Spawning occurs between January and April, with peak spawning occurring in February to March, whereby up to 6 million buoyant eggs are released into the pelagic environment. The eggs hatch after approximately 12 days and the larvae enter the plankton for up to 2 months before settling on the seabed (Dipper, 2001). Cod have been found to spawn to the south of the Pentland Firth, with low intensity nursery areas encompassing most of the northern Scottish coast.

11.86

Common Skate

11.87 Common skate are a demersal species that is distributed along the west and north of Scotland, and throughout the UK and can be found at depths of 10 – 600 m (Figure 11.5). Juveniles will often occupy shallower waters on sandy and muddy sediments.

11.88 Common skate have been identified as having conservation importance and have been categorised as a BAP species, PMF, OSPAR species and critically endangered on the IUCN red list.

Herring

11.89 Herring are widely distributed throughout Scottish waters and can be found in deep waters to depths of 200 m (Figure 11.5). Spawning times are dependent on sub-populations and herring found in Scotland have been found to spawn in March to April and again in August to September (Ellis *et al.* 2010). Sticky Eggs are deposited on a wide range of substrate types, but preferred substrate type is gravel (Drapeau, 1973; Rogers & Stock, 2001). The eggs adhere to the seabed and can form extensive beds. After hatching the larvae enter the plankton and drift with the current until reaching inshore nursery grounds. After a year they migrate further offshore to join adults at feeding grounds. Given that sediment found within Thurso Bay is muddy sand it is unlikely that herring will deposit eggs within the substrate there.

11.90 Herring currently have a BAP in place and are under an EU management plan to ensure fish stocks are exploited at a maximum sustainable yield.

Ling

Ling is the largest species of the cod family; the ecology of cod has been described in section (Figure 11.5). Ling have been classed as a BAP species and a PMF.

Plaice

11.91 Plaice are widely distributed demersal flat fish throughout Britain and found within the intertidal region to depths of 8 m, on sand, gravel and mud (Figure 11.6) (Faber Maunsell, 2007). In their first year, plaice live in very shallow waters, after which they migrate to deeper waters (Ruiz, 2007). The nursery area extends from within Thurso Bay to Dunnet Head (Coull *et al.* 1998), and along the nearshore coastal waters of the North Coast Marine region.

Saithe

11.92 Saithe are widely distributed benthopelagic species that occur throughout Britain at depths of 100 – 300 m (Figure 11.6). Juvenile saithe have a similar diet to adults, consuming herring, cod and sandeels as well as benthic invertebrates, often growing to 1.2 m in length. Saithe nursery areas have been found all along the inshore water of the Scottish coast (Coull *et al.*, 1998).

11.93

Sandeel

11.94 There are five species of sandeels in Scottish waters, commercial catch has found that approximately 90% of this catch is *Ammodytes marinus* (Faber Maunsell, 2007). During the winter sandeel remain in the sediment only emerging to spawn (Figure 11.6). Sexual maturity is reached at the age of two. The eggs are laid in clumps within sandy substrate until they hatch, after which they enter the water column. Sandeels will then metamorphose and settle in sandy sediments amongst adults (Van Deurs *et al.,* 2009). As a result, there is very little movement between spawning and feeding grounds. Sandeel nursery grounds occur throughout the northern coastal waters of Scotland and extend north east towards Norway.

11.95 Sandeel have been identified as a highly commercial and have been categorised as BAP species and a priority marine feature. However, no sandeels were landed from ICES Rectangle 46E6 over the last five years of data collection (2013 – 2017; ICES, 2017).

Spotted ray

11.96 Spotted rays have been found to inhabit inshore waters to depths of 8 – 283 m (Figure 11.6). Juveniles tend to occur on sandy sediments, closer inshore and adults occurring offshore in coarse gravel substrates. Low intensity nursery grounds have been found to occur of the north coast of Scotland, extending east.

11.97 Spotted Ray have been identified as being of commercial importance and have been categorised as an OSPAR species. Landed values from ICES Rectangle 46E6 over the last five years of data collection (2013 – 2017; ICES, 2017) indicates £2,620 (based on 14 spotted ray).

Spurdog

11.98 The spurdog is an umbrella term for species in the *Squalus* genus, widely distributed pelagic species, occurring at depths between 10 m and 100 m (Figure 11.7). They are viviparous and produce live young, often with females migrating inshore to give birth. A high intensity nursery ground is located outside of Thurso Bay, which extends westwards along the north coast, and southwards down the west coast of Scotland (Ellis *et al.* 2010).

11.99 Spurdogs have been identified of conservation importance and have been categorised as a BAP species, an OSPAR species and listed on the IUCN red list for juveniles.

Thornback Ray

11.100 Thornback Ray are a widely distributed demersal species throughout the UK and found at depths of 2 - 60 m (Figure 11.7). They are found on wide variety of seabed types from mud,

sand, shingle and gravel. It is likely that thornback rays will be found within Thurso Bay, given the predominant sediment type is sandy mud.

11.101 They are currently listed as an OSPAR Annex V species and are on the IUCN red list as a species of least concern.

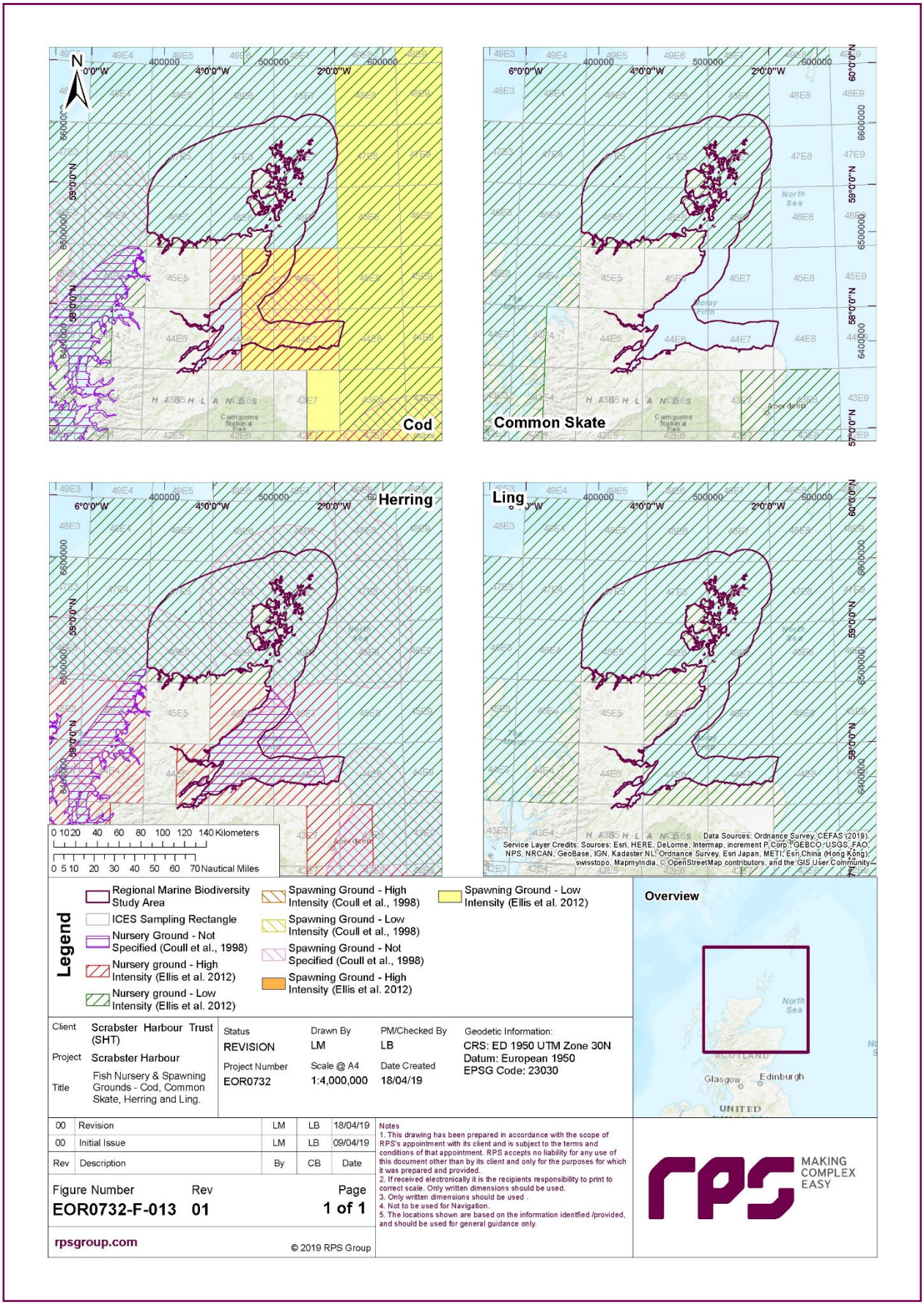


Figure 11.5: Spawning and nursery location for cod, common skate, herring and ling

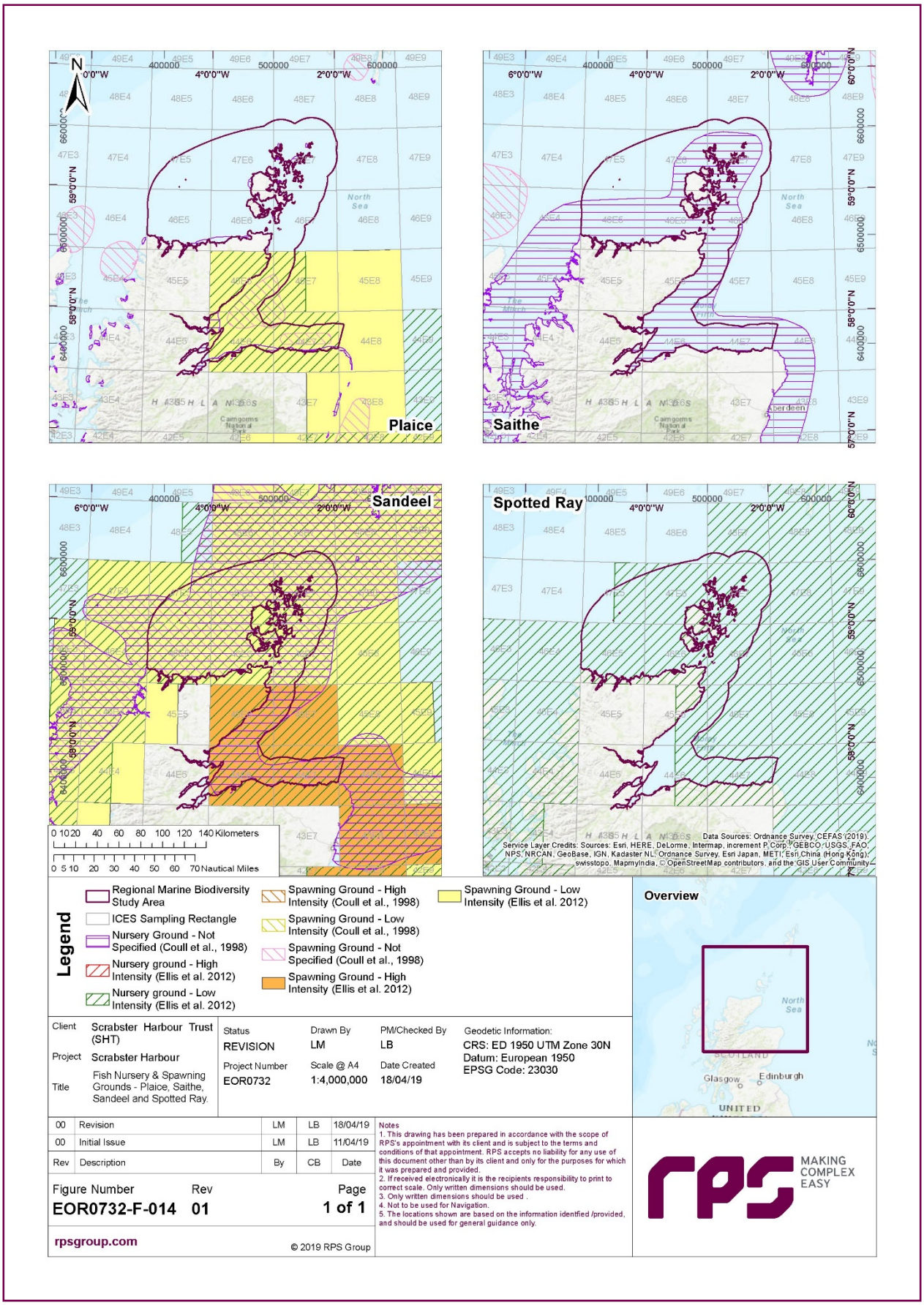
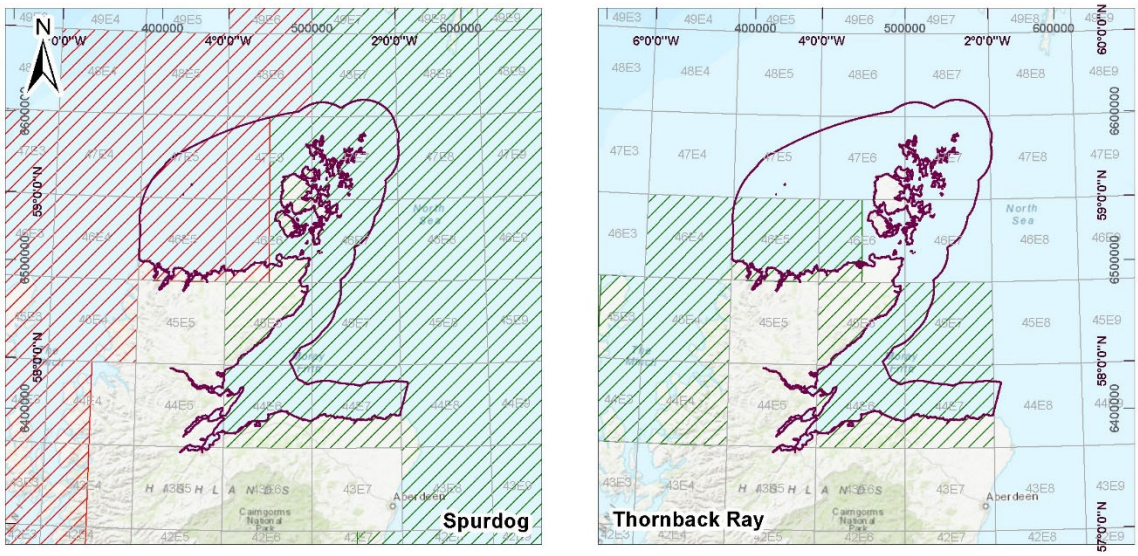


Figure 11.6: Spawning and nursery location for plaice, saithe, sandeel, spotted ray



0 10 20 40 60 80 100 120 140 Kilometers
0 5 10 20 30 40 50 60 70 Nautical Miles

Data Sources: Ordnance Survey, CEFAS (2019).
Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Legend

- Regional Marine Biodiversity Study Area
- ICES Sampling Rectangle
- Nursery Ground - Not Specified (Coull et al., 1998)
- Nursery ground - High Intensity (Ellis et al. 2012)
- Nursery ground - Low Intensity (Ellis et al. 2012)
- Spawning Ground - High Intensity (Coull et al., 1998)
- Spawning Ground - Low Intensity (Coull et al., 1998)
- Spawning Ground - Not Specified (Coull et al., 1998)
- Spawning Ground - High Intensity (Ellis et al. 2012)
- Spawning Ground - Low Intensity (Ellis et al. 2012)

Overview

Client	Scrabster Harbour Trust (SHT)
Project	Scrabster Harbour
Title	Fish Nursery & Spawning Grounds - Spurdog and Thornback Ray

Status	Drawn By	PM/Checked By	Geodetic Information:
REVISION	LM	LB	CRS: ED 1950 UTM Zone 30N
Project Number	Scale @ A4	Date Created	Datum: European 1950
EOR0732	1:4,000,000	18/04/19	EPSG Code: 23030

Rev	Description	By	CB	Date
00	Revision	LM	LB	18/04/19
00	Initial Issue	LM	LB	11/04/19

Figure Number EOR0732-F-015 Rev 01 Page 1 of 1

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MAKING COMPLEX EASY

Figure 11.7: Spawning and nursery location for spurdog and thornback ray.

Marine Mammals

11.102 Over the last 25 years a total of 23 cetacean species have been recorded in Scottish waters, of which 11 are regularly sighted. The remaining 12 are considered to be vagrants or rare visitors which do not occur regularly in Scottish waters. Cetaceans have the potential to range widely with some undertaking large scale seasonal migrations to other parts of Europe or rest of the world. Some species are more localised in their distribution and resident populations of some species are present in Scottish waters. Many of these species may use areas within proximity of Scrabster Harbour and within Thurso Bay.

11.103 Based on data available from Marine Scotland Information (Marine Scotland, 2018), and surveys conducted in the Pentland Firth (see Figure 11.1) within the vicinity of the proposed redevelopment by MeyGen (2012) and DTL (2016), the most likely species to be present in the regional marine biodiversity study area include bottlenose dolphin (*Tursiops truncatus*), harbour porpoise (*Phocoena phocoena*), killer whale (*Orcinus orca*), Risso's dolphin (*Grampus griseus*), white-beaked dolphin (*Lagenorhyncus albirostris*) and minke whale (*Balaenoptera acutorostrata*). Peak sightings typically occur for all species in summer months (Weir *et al*., 2001; Hammond *et al*., 2003; Evans *et al*., 2003).

11.104 Two species of seals, grey seal (*Halichoerus grypus*) and harbour (common) seal (*Phoca vitulina*) are found around Scotland's coast and inshore waters. Grey seal are the most frequently sighted pinniped in the waters surrounding Thurso bay, and are known to use the full extent of the Caithness coast (see Figure 11.1). Harbour seals are more conservative in their range of movements from their dominant colonies in Orkney, and to a lesser extent, Pentland Firth. Seal usage data presented by Russell *et al*., (2017) demonstrate that both grey seal and harbour seal are present within Thurso Bay and the vicinity of Scrabster Harbour.

11.105 Regional abundance and density data for cetaceans was taken from the SCANS III (Hammond, 2017), and Irish OBSERVE surveys (Rogan *et. al.,* 2018)) which were carried out in 2017, and presented to provide context to local abundance estimates. These large-scale cetacean surveys used both aerial and boat-based transects to cetacean identify species across the European shelf. The local and regional marine biodiversity study areas fall into 'Block S' of the Scans III survey. Figure 11.1 shows the location of Block S in the context of the wider SCANS III and OBSERVE surveys.

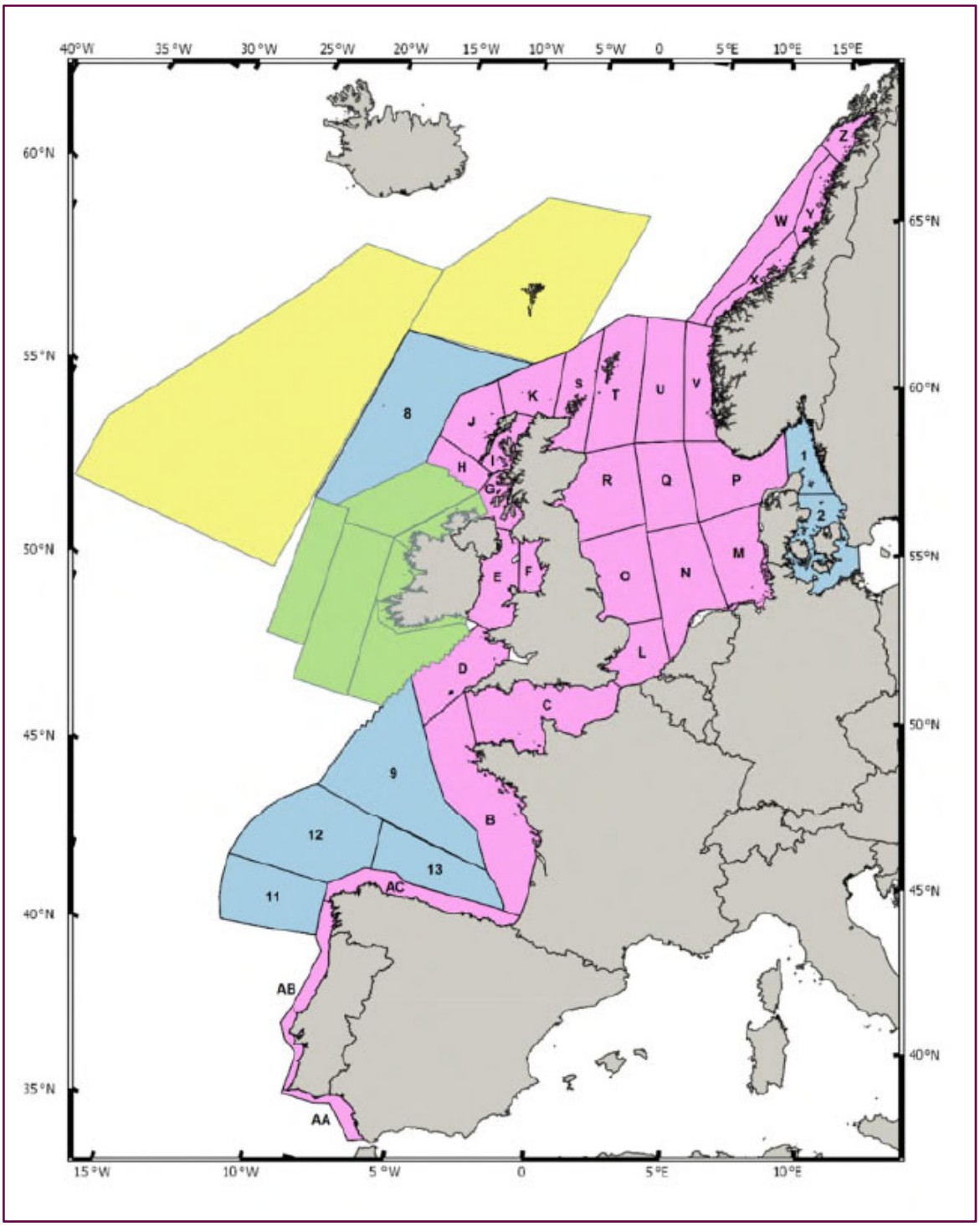

Figure 11.8: Area covered by SCANS III, the Irish OBSERVE and adjacent surveys.
Green blocks = OBSERVE surveys; blue blocks = SCANS III surveys (by boat) and pink blocks = SCANS III (by air), and yellow blocks show a North Atlantic Sightings survey (not relevant to this project).

Bottlenose dolphin (*Tursiops truncatus*)

11.106 Two large aggregations of bottlenose dolphins, and associated designated areas are found in the UK; one is located in Cardigan Bay, Wales (Cardigan Bay SAC) and the second is located in the Moray Firth (Moray Firth SAC), 51 km from the redevelopment (as the crow flies) (see Figure 11.9).

11.107 In northern Scotland, the Scottish East Coast population is concentrated in the Moray Firth, individuals of this populations largely transiting south from the Moray Firth SAC. Whilst some sightings in the Pentland Firth and Thurso Bay have been recorded, the species does not occur regularly along the Caithness Coast. Sightings within Thurso Bay are likely connected to the Moray Firth SAC (see Figure 11.9).

11.108 Bottlenose dolphins are seen in the Moray Firth at all times of year, however numbers are lower in winter and spring and peak in summer (Wilson *et al.,* 1997). As part of the Scottish East Coast population it is likely that seasonality on the Caithness coast is similar to that of the Moray Firth.

11.109 The bottlenose dolphin feeds on a wide range of benthic and pelagic fish species in addition to cephalopods; in Scottish waters the stomach contents of stranded animals indicate that the species preys primarily upon cod, saithe, whiting and sandeel (Santos *et al.,* 2001), all of which occur along the Caithness coast, with Thurso Bay providing nursery grounds for saithe (*Pollachinus virens*) and sandeel (*Ammodytidae*).

11.110 The total abundance of bottlenose dolphins in the entire European shelf survey area was calculated as 106,531, based on the SCANS III abundance estimate of 19,201 (95% Confidence Interval (CI) = 11,404 - 29,670) (Hammond, 2017) and season three of the Irish OBSERVE program abundance estimate of 87,330 (95% CI = 58,029 – 131,426) (based on corrected design-based estimates (Rogan *et. al.,* 2018). The north-east Scotland population is thought to number around 200 animals (Thompson *et al*., 2011), corroborated by Cheney *et al.* (2013) who, via integrated multiple data sources, placed the East Coast bottlenose dolphin population estimate in 2006 at 195 (95% CI = 162-253). Block S of the SCANS III survey covering the study area was calculated as 151 (95% CI = 0 - 527) (Hammond, 2017) (see Figure 11.8). Estimates of abundance of the bottlenose dolphin population in Moray Firth in 2010 = 114 (95% CI = 109 – 131) (Cheney *et al.,* 2012).

Harbour porpoise (*Phocoena phocoena*)

11.111 Harbour porpoise are distributed widely all around the Orkney Islands and are also found throughout the Pentland Firth, including Thurso Bay, Dunnet Bay and Gills Bay. The waters around Stroma, including the Inner Sound, are used regularly by porpoises. The harbour porpoise is found within UK and Irish waters throughout the year (Evans *et al*., 2003), including a year-round occurrence in the Orkney and Pentland Firth region (Northridge *et al*., 1995, Hughes, 1998).

11.112 Often associated with near-shore headlands and strong tidal currents, porpoise are commonly observed within shallow bays, estuaries and narrow tidal channels (Pierpoint, 2008; Baines and Earl, 1999). Harbour porpoise exhibit diet flexibility, feeding on a varied diet of fish, cephalopods and crustaceans.

11.113 The total abundance of harbour porpoise in the entire European shelf survey area was calculated as 464,505, based on the SCANS III abundance estimate of 424,245 (95% CI = 313,151 – 596,827) (Hammond *et al*., 2017) and season three of the Irish OBSERVE program abundance estimate of 38,260 (95% CI = 30,971.6 – 47,264.5) (based on corrected design-

based estimates (Rogan *et. al.,* 2018). The total harbour porpoise abundance for Block S of the SCANS III abundance estimates covering the study area was calculated as 6,147 (95% CI 3,401 – 10,065) (Hammond, 2017).

Killer whale (*Orcinus orca*)

11.114 In UK waters, Killer whale are most common in northern and western Scotland. They occur in all months of the year but are generally recorded near-shore between April and October (Evans, 1988, 1992 in Reid *et al.,* 2006) and further offshore between November to March. Recent surveys north and west of Scotland suggest that killer whales concentrate along the continental slope north of Shetland between May and June (Reid *et al.* 2006). Seasonal movements may be associated with the distribution of particular prey; (e.g. seals are preyed upon close to land particularly in June to October when they haul out to breed).

11.115 Whilst killer whales occur throughout Scottish waters (Evans *et al.,* 2003; Reid *et al.,* 2003), sightings reports are typically clustered in the extreme northeast, between the Caithness mainland and the Northern Isles, or along the opposing west coast, in the Minches and Sea of Hebrides (Robinson *et al.,* 2017). Killer whales are recorded year round in the Moray Firth SAC located 51 km from the redevelopment, with peak sightings between May and July. Movements of individual killer whales between Iceland and Scotland (Samarra & Foote, 2015) suggest seasonal, rather than permanent, passages by individuals, with animals travelling to Scotland in the late spring and summer. Those known animals migrating between Iceland and Scotland represent just 2% of the total individuals presently identified in Iceland and only 10% of those identified from northeast Scotland (Foote *et al.,* 2010; Samarra & Foote, 2015).

11.116 There is no overall population estimate for the North Atlantic killer whale population, however sightings surveys in eastern North Atlantic, mainly between Iceland and Faroe Islands indicate a population in the region of somewhere between 3,500 and 12,500 (Gunnlaugsson and Sigurjonsson 1990 in Reid *et. al.,* 2006). Whilst killer whales have not been afforded an IAMWWG management unit, nor assessed within SCANS III, dedicated mark-recapture studies have noted at least 50 identifiable whales using the Northern Isles (Orkney and Shetland, 25 km and 180 km from the proposed redevelopment, respectively) and the northeast Scottish coastline, with individuals being linked through association patterns to a larger number of animals (ca. 200) from the east coast of Iceland (Foote *et al.,* 2010; Beck *et al.,* 2012). Between 2001 and 2015 143 sightings from within or immediately adjacent to the outer Moray Firth (51 km from the proposed redevelopment) were recorded, with nine records within the Moray Firth SAC, 75% of which were clustered along the northern coastline between Helmsdale and Duncansby Head, 26 km east of Scrabster Harbour (as the crow flies).

Minke whale (Balaenoptera acutorostrata)

11.117 The minke whale is the most frequently recorded baleen whale (or mysticete) in British shelf waters (Evans, 2008), including the Pentland Firth region (see Figure 11.1).

11.118 Minke whale have a temporal distribution, and are mainly sighted in summer months (peak sightings occurring between June and August (Weir *et al*., 2001, Evans *et al*., 2003); as most minke whales are thought to move out of British waters during the winter in a seasonal migration

to offshore or more southerly waters (Hammond *et al.,* 2003; Anderwald and Evans, 2008). During the summer months they are expected to occur throughout the regional marine biodiversity study area (see Figure 11.1).

11.119 In Scottish waters, sandeels are the most important prey species for minke whales, comprising 62% of the diet by weight (Pierce *et al*., 2004). Clupeids (herring and sprat) account for around 30% of the diet (Pierce *et al*., 2004). They often forage in areas of upwelling or strong currents around headlands and small islands (Evans *et al*., 2010).

11.120 The total abundance of minke whale in the entire European shelf survey area was calculated as 19,676.7, based on the SCANS III abundance estimate of 13,101 (95% CI = 7,050 – 26,721) and season three of the Irish OBSERVE program abundance estimate of 6,578.7 (95% CI = 3575.6 – 12,104.4) (based on corrected design-based estimates (Rogan *et. al.,* 2018). Minke whale abundance estimate for Block S of SCANS III was estimated as 383 (95% CI = 0 – 1363) (Hammond, 2017).

Risso's Dolphin (*Grampus griseus*)

11.121 Within the UK Risso's dolphins are particularly concentrated in north-west Scotland, in parts of the Irish Sea and off south-west Ireland (Reid *et al*., 2003) but they are regularly observed around the Northern Isles (Evans *et al*., 2010).

11.122 Whilst no sightings occurred in Block S of the SCANS III survey, Risso's dolphins are observed regularly in the Orkney Islands and Pentland Firth region, though not in high numbers (Weir *et al*., 2001, Evans *et al*., 2010), with sightings occurring particularly along the west coasts of Hoy and the Orkney mainland. Evans *et al*. (2010) reported that the Caithness mainland coast and the Orkney Islands were used by Risso's dolphins for both feeding and for breeding purposes, year round, occurring mostly from April to September (Pereira, 2008), with peaks in sightings occurring particularly between June and August (Evans e*t al*., 2010).

11.123 Diet comprises octopus, cuttlefish and small bottom-dwelling squid (Reid *et al*., 2003). In Scotland, the stomach contents of 11 stranded Risso's dolphins consisted almost exclusively of octopus (Pierce *et al*., 2007).

11.124 The total abundance of Risso's dolphin in the entire European shelf survey area was calculated as 27,025.5, based on the SCANS III abundance estimate of 11,069 (95% CI = 2,794 – 24,412) and season four of the Irish OBSERVE program abundance estimate of 738.5 (95% CI = 349.3 – 1561.2) (based on corrected design-based estimates (Rogan *et. al.,* 2018).

White-beaked dolphin (Lagenorhyncus albirostris)

11.125 The white-beaked dolphin is the most abundant dolphin species in Scottish shelf waters, and consequently it is one of the most commonly sighted cetaceans in the Pentland Firth (Weir *et al*., 2001, Reid *et al*., 2003). Sightings are widely distributed around the Orkney Islands and Pentland Firth region, with no obvious areas of concentration.

11.126 White-beaked dolphins inhabit UK shelf waters throughout the year, although sightings are most numerous in coastal waters during the summer months between June and September (Weir *et al*., 2001, Evans *et al*., 2003, Reid *et al*., 2003, Weir *et al*., 2007, Canning *et al*., 2008).

11.127 Haddock and whiting have been identified as the most important prey items in the diet of white-beaked dolphins in British waters, with cod, herring and mackerel were also identified as prey (Canning *et al*., 2008).

11.128 The total abundance of white-beaked dolphin in the entire European shelf survey area was calculated as 37,025, based on the SCANS III abundance estimate of 36,287 (95% CI = 18,694 – 61,869) and season four of the Irish OBSERVE program abundance estimate of 739 (95% CI = 349.3 – 1561.2) (based on corrected design-based estimates (Rogan *et. al.,* 2018). The white-beaked dolphin abundance estimate for Block S was calculated as 868 (95% CI = 0 – 2,258) (SCANS III, 2017).

Harbour seal (*Phoca vitulina*)

11.129 Harbour seals are widespread around the west coast of Scotland and throughout the Hebrides and Northern Isles. On the east coast, their distribution is more restricted with concentrations in the major estuaries of the Thames, The Wash and the Moray Firth (51 km from the proposed redevelopment). Scotland holds approximately 79% of the UK harbour seal population, with 16% in England and 5% in Northern Ireland (SCOS, 2017; Marine Scotland, 2019).

11.130 Harbour seal foraging distance from haul-out sites is much smaller than that of grey seals, feeding normally within 40-50 km from haul out sites (Thompson *et al.,* 1996;). Harbour seal diet is known to be more varied than grey seal, taking a wide variety of prey including sandeels (predominant species), gadoids, herring and sprat, flatfish, octopus and squid from both pelagic and benthic environments (Ramasco *et al.,* 2015; Hammond *et. al.,* 2016). Diet, however, varies seasonally and from region to region.

11.131 Tagged harbour seals have been tracked within Thurso Bay (Jones *et al.,* 2017; Russell *et al.,* 2017. Based on observed transit distances, and tracking data, it is possible that individuals sighted within the vicinity of the redevelopment are connected to Sanday SAC (86 km from the redevelopment site) or to Dornoch Firth and Morrich More SAC (89 km from the redevelopment site), both of which are designated for harbour seal.

11.132 The total harbour seal August counts for the North Coast and Orkney MU between 2011 and 2016 were 1,349 (SCOS, 2017). The nearest haul-out site and breeding colony to the redevelopment is 24 km to the east of the proposed redevelopment and, and the nearest breeding colony is 29.5 km to the east of the proposed redevelopment.

Grey seal (Halichoerus grypus)

11.133 The coast of the UK supports 38% of the World's grey seals (SCOS, 2017); 88% of these animals breed at colonies in Scotland with the main concentrations in the Outer Hebrides and in Orkney (SCOS, 2017).

11.134 While grey seals are known to travel up to 2,100 km on foraging trips, most foraging trips remain within 145 km from haul-out sites (SCOS, 2015). Seals are highly mobile and feed mainly at the benthos in shelf seas (Thompson, 2012; Chen *et al.,* 2016). Compared with other times of the year, grey seals in the UK spend longer hauled out during their annual moult (between December and April) and during their breeding season (between August and December) (SCOS,2017).

11.135 Tagged grey seals have been tracked within Thurso Bay (Russell *et al.,* 2017); based on observed transit distances, individuals sighted within the vicinity of Thurso bay are likely connected to Faray and Holm of Faray SAC (77 km from the redevelopment) and North Rona SAC (143 km from the redevelopment), both designated for grey seal.

11.136 They are generalist feeders, foraging mainly on the sea bed at depths of up to 100 m although they are probably capable of feeding at all the depths found across the UK continental shelf. They take a wide variety of prey including sandeels, gadoids (cod, whiting, haddock, ling), and flatfish (plaice, sole, flounder, dab). Amongst these, sandeels are typically the predominant prey species. Diet varies seasonally and from region to region. Food requirements depend on the size of the seal and fat content (oiliness) of the prey, but an average consumption estimate of an adult is 4 to 7 kg per seal per day depending on the prey species.

11.137 Grey seal population size is normally derived from the numbers of pups born during their autumn breeding season. Grey seal distribution during their breeding season is, however, very different to their distribution at other times of the year. For this reason, the numbers of grey seal pups born in the autumn is provided as well as the summer counts of grey seals for each Management Unit (IAMMWG, 2015). Pup production on Orkney was estimated as 23,758 in 2014 (SCOS, 2017) (~ 45 % of Scottish pup production). The nearest haul-out site to the proposed redevelopment is 21 km to the east and the nearest breeding colony is 29.5 km to the east

Conservation and management

Designated sites

11.138 Marine Protected Areas (MPA) afford protection to habitats and species within the marine environment. There are three categories of MPA, namely Nature Conservation MPAs, Demonstration and Research MPAs and Historic MPAs. The Scottish MPA network includes sites for nature conservation, protection of biodiversity, demonstrating sustainable management, and protecting Scottish heritage. As of December 2018, the MPA network covers approximately 22% of Scottish seas and comprises:

- 217 sites for nature conservation protecting a broad range of habitats and species, ranging from rocky shores and sea caves at the coastline to deep sea habitats;
- 5 other area based measures which protect species such as sandeels and blue ling, as well as vulnerable marine ecosystems;
- 1 Demonstration and Research MPA around Fair Isle to investigate the factors affecting seabird populations demonstrate the socio-economic benefits of the marine environment; and
- 8 Historic MPAs to preserve sites of historical importance around the Scottish coast.

11.139 Designated sites identified for the marine biodiversity assessment are described in Table 11.8 and shown in Figure 11.9 below.

Table 11.8: Designated sites identified for marine biodiversity receptors considered in this assessment.

Designated site	Closest distance to redevelopment (km)	Relevant qualifying feature
Marine mammals		
Moray Firth SAC	56.4	Bottlenose dolphin *Tursiops truncatus*)
Sanday SAC	85.9	Harbour seal (*Phoca vitulina*)
Faray and Holm of Faray SAC	77.3	Grey seal (*Halichoerus grypus*)
Inner Hebrides and the Minches cSAC	119.13	Harbour porpoise (*Phocoena phocoena*)
North Rona SAC	143.2	Grey seal (*Halichoerus grypus*)
Dornoch Firth and Morrich More SAC	89	Harbour seal (*Phoca vitulina*)
Fish and shellfish		
River Thurso SAC	2	Atlantic salmon (*Salmo salar*)
Benthic ecology		
No relevant SACs identified		

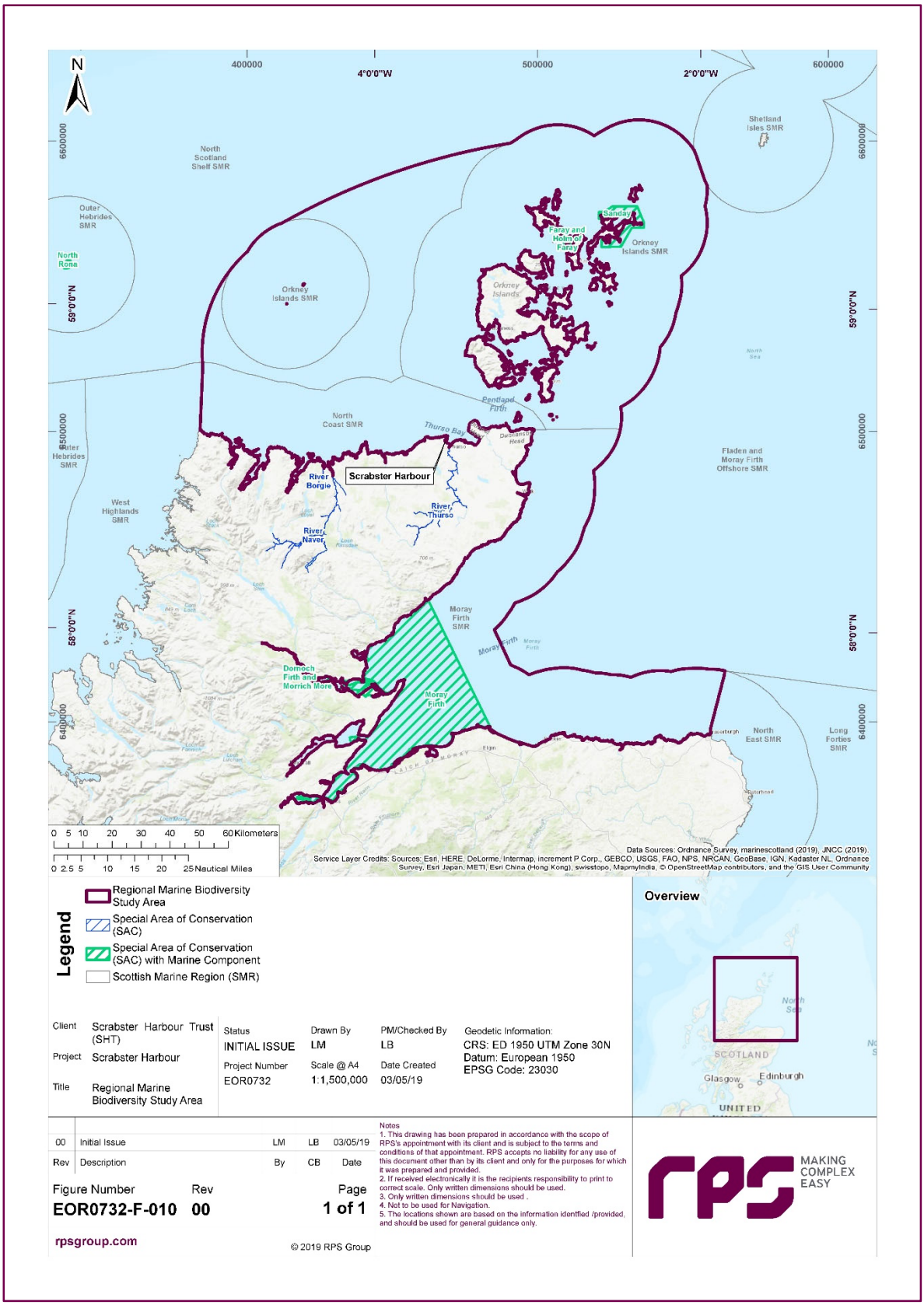

Figure 11.9: Designated sites identified for marinebiodiversity receptors considered in this assessment.

Species management plans

11.140 Conservation and environmental sensitivities along with management plans relevant to those marine biodiversity receptors considered in this chapter are shown in Table 11.9 below.

Table 11.9: Species potentially present in the marine biodiversity regional study area with specific conservation/environmental sensitivities and/or management plans.

juv. = juvenile, v = vulnerable, nt = near threatened, ce = critically endangered.

Species	Legislation / environment sensitivity or management plan													
	Annex II of the EU Habitats Directive	EPSp	BAP Species	Priority Marine Feature	OSPAR	CMS Appendix I	CMS Appendix II	ASCOBANS	IUCN Red List	Bern Convention Appendix II	Bern Convention Appendix III	CITES Appendix I	CITES Appendix II	EU Management Plans
Marine Mammals														
Bottlenose dolphin (*Tursiops truncatus*)	x	x		x			x	x		x			x	
Harbour porpoise (*Phocoena phocoena*)	x	x		x	x		x	x		x			x	
Killer whale (*Orcinus orca*)		x		x			x	x		x			x	
Minke whale (*Baleanoptera acutorostrata*)		x		x				x		x		x		
Risso's dolphin (*Grampus griseus*)		x		x			x	x		x			x	
White-beaked dolphin (*Lagenorhynchus albirostris*)		x		x			x	x		x			x	
Grey seal (*Halichoerus grypus*)	x			x			x				x			
Harbour seal (*Phoca vitulina*)	x			x			x				x			
Fish and shellfish														
Angler fish, (Lophius piscatorius)			x	x (juv.)										
Atlantic salmon, (*Salmo salar)*	x		x	x	x									
Basking shark, (*Cetorhinus maximus*)			x	x	x	x	x		x (v)	x			x	
Blue shark, (*Prionace glauca*)			x				x		x (nt		x			
Cod, (*Gadus morhua*)			x		x				x (v)					x

Species	Legislation / environment sensitivity or management plan													
	Annex II of the EU Habitats Directive	EPSp	BAP Species	Priority Marine Feature	OSPAR	CMS Appendix I	CMS Appendix II	ASCOBANS	IUCN Red List	Bern Convention Appendix II	Bern Convention Appendix III	CITES Appendix I	CITES Appendix II	EU Management Plans
Common skate, (*Dipturus sp.*)			x	x	x				x (ce)					
Crawfish (*Palinurus elephas*)			x	x					x (v)					
European eel, (*Anguilla anguilla*)			x	x	x		x		x (ce)					x
Haddock, (*Melanogrammus aeglefinus*)									x (v)					
Hake, (*Merluccius merluccius*)			x											x
Halibut, (*Hippoglossus hippoglossus*)			x						x (v)					
Herring, (*Clupea harengus*)			x											x
Kitefin shark, (*Dalatias licha*)			x						x (nt)					
Ling, (*Molva molva)*			x	x										
Mackerel, (*Scomber scombrus*)			x	x										
Monkfish, (*Squatina squatina*)			x			x	x							
Native Oyster (Ostrea edulis)			x		x									
Norway pout, (*Trisopterus esmarkii*)				x										
Plaice, (*Pleuronectes platessa*)			x											x
Porbeagle, (*Lamna nasus*)			x		x		x				x			
Saithe, (*Pollachinus virens*)				x (juv.)										
Sandeel, (*Ammodytes marinus*)			x	x										
Sand goby, (*Pomatoscistus minutus*)				x										

Species	Legislation / environment sensitivity or management plan													
	Annex II of the EU Habitats Directive	EPSp	BAP Species	Priority Marine Feature	OSPAR	CMS Appendix I	CMS Appendix II	ASCOBANS	IUCN Red List	Bern Convention Appendix II	Bern Convention Appendix III	CITES Appendix I	CITES Appendix II	EU Management Plans
Sea lamprey (*Petromyzon marinus*)	x		x	x	x						x			
Sea trout, (*Salmo trutta*)			x											
Shortfin mako, (*Isurus oxyrinchus*)							x		x (v)		x			
Spiny dogfish (*Squalus acanthias*)							x		x (v)					
Spotted ray, (*Raja montagui*)					x									
Spurdog, (*Squalus acanthias*)			x		x				x (v)					
Tope, (*Galeorhinus galeus*)			x						x (v)					
Whiting, (*Merlangius marlangus*)			x											

EU Management Plans – Fish Stocks

11.141 Certain commercially important fish stocks have been assigned specific management plans by the EU in order to ensure long term management, protection and (where appropriate) recovery of these stocks. There are a number of fish species that have the potential to be present in the regional marine biodiversity study area which have specific management plans. These management plans are summarised in Table 11.10 below. Species specific management plans aim to help EU countries meet targets to aid recovery of depleted populations and to maintain commercially exploited stocks.

Table 11.10: EU management plan summary for fish stocks likely to be present in the marine biodiversity regional study area.

Species	EU management plan summary
Cod	Multi-annual plans are in place for several stocks, including the North Sea and West of Scotland.
European eel	EU management plans specify that EU countries need to enable 40% of adult eels to escape to the sea for spawning purposes, Plans aim to protected eels by limiting fisheries, making it easier for eels to migrate through rivers and through restocking suitable inland waters with young eel.
Hake	The northern stock (present in the North Sea), is considered by the EU as stable (no further information was available at the time of writing).
Herring	The west of Scotland herring stock is covered by a long term EU management plan. Atlanto-Scandian stocks are jointly managed by Norway under a long-term management plan. The main aim of the EU management plan is for establishment of multi-annual plan with the objective to ensure stock exploitation at a maximum sustainable yield.
Plaice	The majority of plaice stocks are stable, with the objective of the EU management plan to return stocks to a level within safe biological limits to protect and conserve stocks. Multi-annual management plans have been developed in consultation with Norway, with the aim to preserve stocks by exploiting the maximum sustainable yield. Attainment of this objective through fishing effort limitation is set for 2018.

Important Ecological Features

11.142 In accordance with the baseline characterisation above, a number of Important Ecological Features (IEF) were identified for benthic ecology, fish and shellfish and marine mammal receptors. The valuations are based on protected status, abundance and distribution within study areas, as well as wider distribution and abundance within natural ranges. Table 11.11, Table 11.12 and Table 11.13 present the IEFs identified for the marine biodiversity impact assessment and the value of each IEF considered within the study area based on value definitions provided in Table 11.3.

Table 11.11: Benthic Ecology IEFs identified for this assessment.

Benthic ecology IEFs	Representative flora and fauna	Value within the study area	Justification
Harbour Intertidal	Bryozoans Barnacles Mussels Sea squirts Sea anemones Fucoids Kelp	Low	Identified flora and fauna is common throughout the UK but forms a component of the benthic assemblages in the study area.
Thurso Bay intertidal	Periwinkles Barnacles Mussels Dog whelks Common limpets Fucoids	Low	Identified flora and fauna is common throughout the UK but forms a component of the benthic assemblages in the study area.
Harbour subtidal	Polychaetes Oligochaeta Nematoda Nemertea Bivalves Algae Annelids	Low	Identified flora and fauna is common throughout the UK but forms a component of the benthic assemblages in the study area.
Thurso Bay subtidal	Sponges Bryozoans Soft corals Hydroids Crustacea Urchins Starfish	Low	Identified flora and fauna is common throughout the UK but forms a component of the benthic assemblages in the study area.
Harbour subtidal biotope	Infralittoral sandy mud (SS.SMu.ISaMu)	Low	Biotopes are typical of the north coast of Scotland, with no protected species associated with this biotope.
Thurso Bay subtidal biotope	Infralittoral fine sand (SS.SSa.IFiSa)	Low	Biotopes are typical of the north coast of Scotland, with no protected species associated with this biotope.

Table 11.12: Fish and shellfish IEFs identified for this assessment.

Fish and shellfish IEF	Representative species	Value within the study area	Justification
Demersal fish species	Plaice Sandeel Common skate Lemon Sole Angler fish Sand Goby	Regional	Regionally important population of OSPAR threatened or declining species and UK BAP Priority species.
	Common skate	National	UKBAP and OSPAR species, on the IUCN red List as critically endangered
Migratory fish species	Sea trout European eel	National	Annex II of the EU habitats directive, OSPAR threatened, priority marine feature or declining species and UK BAP Priority species.
	Atlantic salmon	International	Annex II species protected under international legislation and designated features of the River Thurso SAC.
Elasmobranchs	Lesser spotted dogfish Nurse hound Cuckoo ray	Local	Species that form a key component of the ecosystem: no specific protection.
	Common skate Spotted ray Thornback ray	Regional	Regionally important population of OSPAR threatened or declining species and UK BAP Priority species.
	Spurdog	Regional	Nationally important protected species under BAP and OSPAR
	Basking shark	International	Internationally important protected species under the Bern Convention and CITES.
Shellfish assemblage	Periwinkles Whelks Nehrop Mussel	Local	Commonly recorded within the study area but no conservation value. There may be some small-scale commercial exploitation of these species and North Coast Marine Region may be a valuable potting ground for decapod species.
	Brown crab European lobster Great Atlantic scallop Velvet crab Crawfish Native Oyster	Regional	Species that are of commercial value to the fisheries which operate within the study area.
Spawning or nursery grounds	Cod Common skate Herring Ling Sea trout Spotted ray	Regional	Low intensity spawning, or nursery habitat overlaps the study area.

Fish and shellfish IEF	Representative species	Value within the study area	Justification
	Thornback ray		
	Plaice Saithe Sandeel Spotted ray Spurdog	National	High intensity spawning, or nursery habitat overlaps the study area.

Table 11.13: Marine mammal IEFs identified for this assessment.

Marine mammal IEF	Value	Justification
Bottlenose dolphin	International	Annex II species protected under international legislation and designated feature of the Moray Firth SAC
Harbour porpoise	International	Annex II species protected under international legislation and designated feature of Inner Hebrides and the Minches cSAC
Killer whale	National	Internationally protected species regularly sighted in the regional marine biodiversity study area
Minke whale	National	Internationally protected species regularly sighted in the regional marine biodiversity study area
Risso's dolphin	National	Internationally protected species regularly sighted in the regional marine biodiversity study area
White-beaked dolphin	National	Internationally protected species regularly sighted in the regional marine biodiversity study area
Grey seal	International	Large haul out to the east of the regional marine biodiversity study area. Annex II species protected under international legislation and designated feature of Faray and Holm of Faray SAC, North Rona SAC
Harbour seal	International	Large haul out to the east of the regional marine biodiversity study area. Annex II species protected under international legislation and designated feature of Sanday SAC, Dornoch Firth and Morrich More SAC

Future Baseline Conditions

11.143 The (Marine Works (EIA) Regulations 2007 (as amended)) requires that "*a description of the relevant aspects of the current state of the environment (baseline scenario), and an outline of the likely evolution thereof without implementation of the project, as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge*" is included within the Environmental Statement.

11.144 In the event that the proposed redevelopment does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

Benthic communities

11.145 Variability and long-term changes on physical influences may bring direct and indirect changes to benthic habitats and communities in the mid to long-term future (DECC, 2016). A strong base of evidence indicates that long-term changes to benthic communities may be linked to climate change (DECC, 2016). Studies of the benthic ecology over the last three decades have shown that biomass has increased by at least 250 to 400%; driven by an increase in opportunistic and short-lived species. Long-living sessile animals have been found to decrease (Krönke, 1995; Krönke, 2011). Modelling sea surface temperature in relation to climate change in the UK has shown that the rate of temperature increase over the previous 50 years has been greater in waters off the east coast of the UK compared to the west and this is predicted to continue for the next 50 years (MCCIP, 2013). As such, the baseline of the benthic subtidal and intertidal study area described in section 11.49 *et seq.* can only be considered as a 'snapshot' of the present benthic ecosystem within a gradual yet continuously changing environment. Any changes that may occur during the lifetime of the redevelopment should be considered in the context of both greater variability and sustained trends occurring on national and international scales in the marine environment.

Fish and shellfish

11.146 Recent research has suggested that there have been substantial changes in the fish communities within the fish and shellfish study area over several decades, as a result of a number of factors including climate change and anthropogenic activities (i.e. industrialisation of the fish and shellfish study area, fishing, aquaculture etc.) (DECC, 2016). These communities consist of species that have complex interactions with one another and the natural environment.

11.147 Fish and shellfish populations are subject to natural variation in population size and distributions, largely as a result of year to year variation in recruitment success. These population trends will be influenced by broad-scale climatic and hydrological variations, as well as anthropogenic activities such as climate change and overfishing. Fish and shellfish play a pivotal role in the transfer of energy from some of the lowest to the highest trophic levels within the ecosystem and serve to recycle nutrients from higher levels through the consumption of detritus. Fish and shellfish are important prey items for top marine predators including elasmobranchs, seabirds, marine mammals and humans. Small planktivorous species such as sandeel and herring act as important links between zooplankton and top predators (Frederiksen *et al.* 2006).

11.148 Climate change may influence fish distribution and abundance, affecting growth rates, recruitment, behaviour, survival and response to changes of other trophic levels. Within the fish and shellfish study area, increased sea surface temperatures may lead to an increase in the relative abundance of species associated with more southerly areas. For example, data on herring and sardine (*Sardina* sp.) landings at ports in the UK showed that higher herring landings were correlated with colder winters, while warm winters were associated with large catches of sardine (Alheit and Hagen, 1997). Studies have shown that anchovy *Engraulis encrasicolus* have extended their distribution throughout the UK waters, from which they were largely absent until the mid-1990s (Alheit *et al.,* 2012).

11.149 One potential effect of increased sea surface temperatures is that some fish species will extend their distribution into deeper, colder waters. In these cases, however, habitat requirements are likely to become important with some shallow water species having specific habitat requirements in shallow water areas which are not available in these deeper areas. For example, the sandeel is less likely to be able to adapt to increasing temperatures as a result of their specific habitat requirements for coarse sandy sediment; declining recruitment in sandeel in parts of the UK has been correlated with increasing sea temperature (Heath e*t al.,* 2012). Climate change may also affect key life history stages of fish and shellfish species, including the timing of spawning migrations (DECC, 2016). However, climate change effects on marine fish populations are difficult to predict and the evidence is not easy to interpret, therefore it is difficult to make accurate estimations of the future baseline scenario for the entire lifetime of the proposed redevelopment.

11.150 In addition to climate change, overfishing subjects many fish species to considerable pressure, reducing the biomass of commercially valuable species, and non-target species. Overfishing can reduce the resilience of fish and shellfish populations to other pressures, including climate change and other anthropogenic impacts. For example, a study on cod in an area where trawl fishing has been banned since 1932 indicated that this population was significantly more resilient to environmental change (including climate change) than populations in neighbouring fished areas (Lindegren *et al.,* 2010). Converse modelling by Beggs *et al*. (2013) indicated that cod may be more sensitive to climate variability during periods of low spawning stock biomass. There are indications that overfishing in UK waters is reducing to some degree, with declines in fishing mortality estimates in recent years. ICES guidance suggests that some of the stocks are recovering, with increased quotas for several species in 2018 (see http://www.ices.dk/community/advisory-process/Pages/Latest-advice.aspx). OSPAR's Quality Status Report (OSPAR, 2010) concluded that many fish stocks are still outside safe biological limits, although there have been some improvements in some stocks. Should these improvements continue, this may not result in significant changes in the species assemblage in the fish and shellfish study area but may result in increased abundance of the characterising species present in the area. Therefore, it is predicted that the future baseline scenario of the fish and shellfish study area will most likely result in increases in abundance as per the OSPAR Quality Status Report.

11.151 The fish and shellfish baseline characterisation described in the preceding sections represents a 'snapshot' of the fish and shellfish assemblages of the fish and shellfish study area, within a gradual and continuously changing environment. Any changes that may occur during the lifetime of the proposed redevelopment (i.e. installation, operation and decommissioning) should be considered in the context of the natural variability and anthropogenic effects, including climate change, overfishing and other environmental impacts.

Marine mammals

11.152 Marine mammal populations naturally fluctuate over space and time, however given the temporary nature of the construction phase of the proposed redevelopment, identifiable fluctuations are unlikely to occur over the lifetime of the proposed redevelopment. Their distribution is, to a large extent, mediated by the distribution and abundance of prey species.

Many species range over large distances and, to a certain extent, can adapt to gradual changes in the environment, such as those that may occur as a result of climate change (Hoegh-Guldberg and Bruno, 2010). This is not the case for all species. Those that have more restricted habitat ranges are likely to be more vulnerable to changes in their environment. For the marine mammal IEFs identified in Table 11.13, species such as grey seal or harbour seal, whose natural foraging ranges is more restricted than cetacean species (most foraging trips remain within 145 km and 50 km, respectively, from haul-out sites (SCOS, 2015), may be more sensitive to long-term changes.

11.153 The impact of anthropogenic-induced climate change has so far been recorded as decreased productivity of the oceans, altered food-web dynamics, reduced abundance of habitat-forming species, shifting species distributions and a greater incidence of disease (Hoegh-Guldberg and Bruno, 2010). Temperature changes in northern Europe may affect cold-water shelf species such as harbour porpoise. Increased sea levels modifying shallow seas could affect the availability of protected cave sites for breeding seals, as well as low-lying areas and other haul out sites (e.g. grey seal) (Evans *et al*., *2010*).

11.154 Anthropogenic activities in the marine environment can influence the distribution and abundance of marine mammal populations, and therefore can affect future baseline of populations. In the regional marine biodiversity study area, potential impacts include: probable mortality due to bycatch from fisheries (particularly for harbour porpoise); direct or indirect effects of contamination (from pollution incidents, sewage discharge, or litter disposal at sea); injury or disturbance from introduced noise into the marine environment (e.g. from shipping, drilling, piling, seismic surveys, military activity, dredging and disposal, aggregate extraction, Unexploded Ordinance (UXO) detonations, and Acoustic Deterrent Devices (ADD)); death or injury due to collision with physical objects (vessels or renewable energy devices); and removal of prey species by overfishing.

11.155 For grey seals, population trend objectives have been based on pup production, since that metric has been long established as the most robust for determining changes in population dynamics (SCOS, 2017).

11.156 Harbour seal counts were stable or increasing in all regions until around 2000. Since then there have been rapid declines in Orkney (down 85% between 1997 and 2016), and along the East coast of Scotland (down 52% between 1997 and 2016). Shetland declined by 30% between 2000 and 2009, but then increased by 10% between 2009 and 2015. The most recent counts for the West Scotland region (2013 to 2015) and for the Western Isles (2011) were 43% and 50% respectively higher than the previous estimates (2007 to 2009). The most recent composite count for Scotland for 2011 to 2016 is 25% higher than the equivalent estimate for 2007-2009.

11.157 Ongoing work suggests that both grey and harbour are at risk of range contraction at the southern end of their range under predicted climate changes in both the lowest and highest warming scenarios presented by the IPCC. However, these predictions contain considerable uncertainty in part because the scenarios do not take account of potential prey re-distributions.

11.158 All populations are increasing, although numbers are still relatively low in the Baltic where the population was drastically reduced by human exploitation and reproductive failure, probably due to pollution. In the UK and Canadian populations, there are clear indications of a slowing down in population growth in recent years.

Mitigation Measures Adopted as Part of the Project

11.159 Mitigation measures have been proposed as an integral part of the proposed redevelopment, in order to reduce or negate the potential impacts of the proposed redevelopment on marine biodiversity receptors. Mitigation measures proposed in relation to marine biodiversity receptors are shown in Table 11.14 below.

Table 11.14: Proposed mitigation measures adopted for this project.

Mitigation measure	Description
Marine Mammal Observation (MMO) / Passive Acoustic Monitoring (PAM)	MMO/PAM to conduct pre-piling watches and associated mitigation measures prior to piling during the construction phase. Watches to be conducted according to the JNCC guidelines for minimising the risk of injury to marine mammals from piling nose (JNCC, 2010)
Construction of piling to be intermittent and restricted to daylight hours	Salmon smolts are known to use Thurso Bay in April and May and are sensitive to impacts, particularly noise emissions. It is proposed that piling activities are to be restricted to daylight operations during the months of April and May to ensure salmon are not impeded during their most active time. Night time piling activity restrictions will not apply outside of these months.
Site Waste Management Plan (SWMP) and pollution prevention measures	A SWMP will be implemented as part of the proposed redevelopment, and along with pollution prevention measures (in Chapter 10: Water Quality) will mitigate the likelihood of accidental pollution (spills) occurring as part of the construction phase of the proposed redevelopment

11.4 Assessment of Construction Effects

Benthic Ecology

Permanent habitat loss

11.160 The construction activities including reclamation of land within Area A and B will result in the complete loss or severe modification to, if not all, of the intertidal and subtidal marine habitats present within those footprint areas (chapter 2: Project Description). This section will assess the magnitude of impact, the sensitivity of the benthic receptor and the significance of effect.

Magnitude of impact

11.161 Reclamation of land at Scrabster Harbour will result in the permanent loss of up to 6,962 m^2 of existing harbour intertidal (1010 m^2) and subtidal (5952 m^2) habitat. Similarly, the proposed redevelopment of the pier will result in an additional loss of approximately 5399 m^2 from pier widening. Rock armour is to be used on each of the reclaimed areas for protection. These reclamation works represent a permanent loss in habitat, however, the installation of rock armour may help to offset some loss of biodiversity by introducing a novel heterogenous environment for colonisation and may act as nursery/ haven for predator avoidance for juvenile species.

11.162 The potential impact of permanent habitat loss from construction activities is therefore predicted to be of local spatial extent, permanent duration and not reversible. It is predicted that the potential impact will remove both intertidal[12] and subtidal benthic habitats and associated species within the revetment and pier widening footprint, however, introduction of rock armour may represent a novel habitat and may marginally offset the loss of the benthic habitat as a consequence of these activities. The magnitude is therefore considered to be negligible (adverse/positive).

Sensitivity of receptor

11.163 Species characterising both the harbour intertidal and harbour subtidal IEFs are predominantly short lived and fast reproducing species (Hawkins *et al*., 2002). Recolonization of the intertidal and subtidal areas of the proposed reclamation and pier widening can be expected, following the completion of works, within subsequent reproducing cycles and deemed of low importance and rarity. Species that are removed because of the redevelopment are unlikely to have any effect on the status of wider populations. Additionally, no species of conservation concern have been identified. Therefore the harbour intertidal and harbour subtidal IEFs are therefore deemed to be of low vulnerability, high recoverability, local value. The sensitivity of the receptors is therefore considered to be low.

11.164 The Infralittoral sandy mud (SS.SMu.ISaMu) biotope, that represents the harbour subtidal biotope IEF, has been found to be highly sensitive, with very low resilience to physical loss of habitat (Tillin, 2016). However, the harbour subtidal biotope IEF has been identified as low value and typical of the wider north coast of Scotland and permanent loss of habitat is unlikely

[12] It is important to note that only pre-existing man-made structures will be affected during the reclamation works within the intertidal habitats.

to have any long-term effect on this biotope. Therefore, the harbour subtidal biotope IEF are therefore deemed to be of low vulnerability, no recoverability, local value. The sensitivity of the receptors is therefore considered to be low.

Significance of effect

11.165 The magnitude of the impact is deemed to be negligible and the sensitivity of is considered to be negligible to low. The effect will, therefore, be of **negligible or minor (adverse**) significance, which is not significant in EIA terms.

Temporary disturbance and loss of habitat

11.166 Ancillary operations during construction works, such as using dredging, entrenching of fuel and water pipelines, jack-up barges and pin piling to support the proposed redevelopment of the pier could temporarily disturb or lead to a temporarily loss of intertidal and subtidal marine habitat.

Magnitude of impact

11.167 Dredging works will potentially result in temporary disturbance and loss of habitat of up to 52,500 m^2 (157,000 m^3), disturbance of seabed associated with two options for the installation of fuel and water pipelines, option 1 will disturb an area of 280 m^2 while option 2 will be disturb an area of area of 660 m^2. In addition, it is anticipated that a considerable amount of the piling works are to be completed from the existing pier, however, where this is not possible a jack-up barge will be used as a temporary platform for works.

11.168 Currently, specifications of the jack-up barge are unknown and subject to the design and build contractor, and as such assumptions can be made on a typical modular jack-up barge with a leg area of circa 6 m^2 (HMS, 2017). Sediments within Scrabster Harbour have been described as sand and mud (section 11.35 *et seq.*). Once the jack-up barge has been towed into position, the legs will be deployed to seabed where disturbance of sediments will occur. Once the legs have been deployed, sediments that have been resuspended can be expected to settle around the legs or within a proximate area. Following cessation of works and the removal of the barge from site, it can be expected that the legs will leave an impression in the sediments, however, back filling will occur due to local hydrodynamic processes.

11.169 The potential impact of temporary disturbance and loss of habitat changes from construction activities is therefore predicted to be of local spatial extent, short term duration, intermittent and reversible. It is predicted that the potential impact may affect benthic ecology receptors directly through loss of habitat, however works are being carried out within an area of high disturbance through anthropogenic activities i.e. vessel movements. The magnitude is therefore considered to be negligible (adverse).

Sensitivity of receptor

11.170 The benthic habitats and species directly affected by the dredging and jack-up barge operations will be restricted to those associated with the benthic subtidal sediments within the Thurso Bay. Only subtidal IEFs found within the harbour are expected to be affected. No temporary intertidal

habitat is lost and no disturbance to the intertidal habitat is likely, therefore the Thurso Bay intertidal, harbour intertidal and Thurso Bay subtidal IEFs has been excluded from assessment.

11.171 Species representing the harbour subtidal IEF are expected to recover quickly due to adult migration from undisturbed areas within the proposed redevelopment (Ferns *et al.*, 2000). Species characterising this IEF are expected to be short lived, reaching maturity rapidly and often with several spawning events per year (Ferns *et al.*, 2000). Furthermore, these species are not listed under any nature conservation legislation. The sensitivity of the harbour subtidal IEF is deemed to be of low vulnerability, high recoverability and local value. The sensitivity of the receptors is therefore, considered to be low.

11.172 The biotope SS.SMu.ISaMu associated with the harbour subtidal biotope IEF is expected to recover quickly following disturbance (Tillin, 2016). This biotope has been found to have a medium sensitivity to habitat structure changes (Tillin, 2016), however, this biotope has been found to be typical of the north coast of Scotland and has no associated protected species. Therefore, the sensitivity of the harbour subtidal biotope IEF is deemed to be of medium vulnerability, high recoverability and local value. The sensitivity of the receptors is therefore, considered to be low.

Significance of effect

11.173 The magnitude of the impact is deemed to be negligible and the sensitivity is considered to be low. The effect will, therefore, be of negligible or minor (adverse) significance, which is not significant in EIA terms.

Effects of increased suspended sediment concentration and potential contaminant release

11.174 Dredging of the seabed and subsequent disposal at sea and preparatory works for the proposed redevelopment is likely to disturb the seabed sediments, resulting in an increase in suspended sediment concentrations (SSC) and could result in the release of any sediment bound contaminates. Background SSC in Thurso Bay is likely to vary by runoff and outflow from Thurso River, mobilisation of sediment by propeller wash from vessel movements. Natural SSC variation is also expected to be influenced by tides and storm conditions (Smith *et. al.,* 2003).

Magnitude of impact

11.175 Whilst no suspended sediment samples were taken for this project, the baseline levels of SSC are expected to be lower than 30 mg/L. Suspended sediment samples were taken to support the MeyGen tidal stream development in 2011; four samples were taken south of Stroma Island in the Pentland Firth, circa 24.8 km giving SSC levels of 10 mg/L, 14 mg/L, 11 mg/L and 12 mg/L (MeyGen, 2012).

11.176 Against this background of natural variability, potential impacts have been considered in relation to an increase in suspended sediment arising from dredging within the harbour. Dredge disposal offshore will occur within a licensed disposal ground. During dredging and dumping operations, SSC has the potential to increase by tens to hundreds of thousands mg/L at the point of sediment release (near the water surface) (refer Figures 9.32 – 9.38 in Chapter 9 *Coastal Processes*). The sediment to be dredged around the pier comprises of muddy sand

and sand. Where possible dredged material will be reused within the reclamation laydown area or within the new pier structure if suitable. Material which is not suitable for reuse within the proposed redevelopment will be disposed of at the sea dredge disposal site or at a licensed waste facility on land.

11.177 Two models were carried out as part of Chapter 9: Coastal Processes. The first (maximum scenario) models a scenario where dredging is carried out using a trailer suction dredger, over (just under) 6 days, based on a total dredged volume estimated at 172,000 m^3; and the model assumed that dredging is undertaken over a period of spring times to afford the maximum excursions of the dredged/dumped plumes. The second (mean scenario) models a scenario whereby dredging is carried out using a trailer suction dredger, over (just under) 12 days, based on a total dredged volume estimated at 172,000 m^3. The dredging simulation was undertaken over a period of spring tides so that there will be the maximum excursion of the dredging and dumping plumes.

11.178 Using the second model considered to be the worst case scenario from the two scenarios modelled which includes 12 days of dredging, the mean SSC released that is contained within the harbour is estimated to be 200 mg/L - 1000 mg/L, with a maximum SSC of 800 – 5000 mg/L. Mean SSC that is expected to be released outside of the harbour (extent of the Thurso Bay area; Chapter 9: Coastal Processes – Figures 9.36 – 9.38. Note a conversion of units was made from kg/m^3 – mg/L) is expected to be in the range of 10 – 60 mg/L, maximum SSC of 10 – 200 mg/l, with an expected sediment deposition of 1 mm. Generally, the increase in SSC from background levels is relatively small, for example the increase in the SSC at the mouth of the Thurso River will peak at about 25 mg/L above background (Chapter 9: Coastal Processes). This level of deposition is not significant in terms of the variations that will naturally occur with time in this area i.e. during storm swells.

11.179 Sediment chemical analysis undertaken in 2018 within the dredge footprint and described in section 11.35 *et seq.*, revealed that Organotins (TBT and DBT), PCBs and metals were all under the CEFAS AL 1, with the exception of site 1 – 3 which were elevated above CEFAS AL1 and Canadian TEL threshold for arsenic, copper and nickel. PAHs at all sites located within the dredge footprint, were found to exceed the CEFAS AL 1 and Canadian TEL (EIAR Volume II, Appendix 11.2: Benthic Technical Report). While sediments exceed adopted guideline criteria thresholds for some heavy metals and PAHs, the proposed dredge material will likely be surface sediments that have been exposed to anthropogenic contaminant sources that amounts to a relatively small volume (approx. 9000m^3) that will be exposed to receiving environment. Removal of the material by backhoe excavator will limit exposure of sediments displayed elevated contaminant concentrations to the water column and therefore the potential for contaminant elutriation. During dredge disposal increased flushing from tidal currents will assist with dilution of any contaminants released into the water column. Based on 12-day modelling, the volume of sediments disturbed is small (paragraph 11.178), the plume extent is likely to be small.

11.180 The potential impact of increased suspended sediment concentrations and potential contaminant release from construction activities is therefore predicted to be of local spatial extent (inside the harbour), short term duration, intermittent and reversible. It is predicted that

the potential impact may affect benthic receptors directly through contaminant release and less so by increases in sediment concentration. The magnitude is therefore considered to be low (adverse).

Sensitivity of receptor

Increases in SSC

11.181 Increases in suspended sediments and turbidity levels from dredging can, under certain conditions, have adverse effects on the marine flora and fauna. Increased SSC can affect filter feeding organisms through clogging and damaging feeding and breathing apparatus. Disturbance of sediments will also cause sediment deposition outside the area of disturbance as sediments fall out of suspension following mobilisation potentially resulting in the smothering of benthic communities.

11.182 The important characterising species of the harbour intertidal IEF includes encrusting benthic flora and fauna (Hawkins *et al.,* 2002; Derweduwen *et al*., 2014) on artificial surfaces associated with harbour infrastructure. These species are likely to already experience some level of reduced water clarity and smothering from vessel movements and propeller wash such that resistance is likely to be of medium and high resilience. For instance, species associated with the harbour intertidal IEFs have been found within high sediment environments, such as beaches, throughout the UK coast (Bartrop *et al*., 1980; Boon, 1995; Bennet & Mcleod, 1998; Eleftheriou *et al*., 2004). Therefore, the sensitivity of the harbour intertidal IEF is deemed to be of low vulnerability, high recoverability and local value. The sensitivity of the receptors is therefore, considered to be low.

11.183 Thurso Bay Intertidal IEFs found outside of the harbour are unlikely to be affected as species are likely to be well adapted to increases in SSC from Thurso River and from storm swell events (Tillin and Budd, 2016). Additionally, sediment plume modelling indicates that suspended sediments are unlikely to migrate far from the dredging works (Chapter 9). The sensitivity of the Thurso Bay intertidal IEFs is deemed of low importance, of low rarity and of local scale. The sensitivity of this IEF is considered to be low.

11.184 The characterising species of the harbour subtidal and Thurso Bay subtidal IEFs live in the sediment, to depths of 15 cm and are considered likely to resist smothering by 5 cm of sediment and be able to adapt to temporary increases in SSC. Resistance and resilience are, therefore, assessed as high and the biotopes are considered not sensitive. The MarLIN benchmark used for the assessment of sensitivity defined as 'the mechanism by which an activity or natural event affects the ecosystem'; for smothering is 5 – 30 cm of fine material added to a habitat in a single, discrete event and for water clarity is a change in one rank on the Water Framework Directive scale over the course of a year which is not predicted from modelling undertaken. Furthermore, these habitats are not listed under any nature conservation legislation. The sensitivity of the harbour subtidal and Thurso Bay subtidal IEFs is deemed to be of low vulnerability, high recoverability and local value. The sensitivity of the receptors is therefore considered to be low.

11.185 Infralittoral sandy mud (SS.SMu.ISaMu) as a proxy for the dominant subtidal habitat type present within Scrabster Harbour which identified key benthic species as *C. capitate*,

polychaete spp. and *Tubificoides* spp. are not considered to be sensitive to decreases in water clarity or increases in smothering (Tillin, 2016). This biotope is typical of disturbed environments and, therefore, the resident species are likely adapted to high SSC. *C. capitate* has also demonstrated high recovery rates following disturbance (Fern *et al.,* 2000). Oligochaetes such as *Tubificoides* spp. also live buried in sediments to depths of 2 – 5 cm and can therefore tolerate periods of low oxygen that may occur following the deposition of a fine layer of sediment (Hines and Comtois, 1985; De-Bastos and Hiscock, 2016). Therefore, the sensitivity of the harbour subtidal biotope IEF is deemed to be of low vulnerability, high recoverability and local value. The sensitivity of the receptors is therefore, considered to be low.

11.186 Subtidal biotopes found outside of the harbour within Thurso Bay grade from the harbour biotope (SS.SMu.ISaMu) to Infralittoral fine sand (SS.SSa.IFiSa) outside of the harbour walls where mud factions are reduced. According to MarLIN's sensitivity report this biotope, using semi-permanent tube-building amphipods and polychaetes in sublittoral sand (SS.SSa.IFiSa.TbAmPo) as a proxy biotope, have been found to be of low sensitivity to smothering and changes in water clarity. Therefore, the sensitivity of the Thurso Bay subtidal biotope IEF is deemed to be of low vulnerability, high recoverability and local value. The sensitivity of the receptors is therefore, considered to be low.

Potential contaminant release

11.187 The re-suspension and subsequent dispersion of sediments during capital dredging may lead to the release of sediment-bound contaminants, However, as noted in the plume modelling, disposition of sediments outside the harbour are likely to be circa 1 mm of sediment. It is therefore highly unlikely that the Thurso Bay intertidal IEFs will be affected by potential contaminate release and have been excluded from assessment.

11.188 Species characterising the harbour intertidal and Thurso Bay intertidal IEF are likely to be tolerant to existing levels of contamination. For instance, macroalgal communities are likely to be relatively tolerant of contamination but the MarESA notes that metal-impacted intertidal communities can have low diversity assemblages dominated by opportunistic and fast-growing species (Stamp and Marshall, 2015). Barnacles and gastropods are also likely to be tolerant of fairly high levels of heavy metals (Tillin and Hill, 2016) but grazing gastropods such as limpets are well documented as being highly intolerant of hydrocarbon contamination, with lower littoral populations likely to be the most vulnerable to this sort of contamination (Stamp and Marshall, 2015). Any loss of limpets and barnacles is likely to result in rapid recolonization although this will depend on processes such as larval supply and recruitment between populations. The sensitivity of the subtidal IEF is deemed of low importance, of low rarity and of local scale. The sensitivity of this IEF is considered to be low.

11.189 Considering harbour subtidal and Thurso Bay subtidal IEFs species that characterise the baseline within Scrabster Harbour predominantly live within the sediments, it can be expected that these species are resistant/ have a high tolerance to contaminants (Nikitik and Robinson, 2003). For instance, polychaetes are largely expected to be tolerant of heavy metal contamination and although they may be adversely affected by hydrocarbon contamination they are generally the first organisms to recolonise sediments polluted by hydrocarbons (Tillin and

Rayment, 2016; Tillin and Budd, 2016). The characterising species are not considered to be sensitive to elevated concentrations of heavy metals, hydrocarbons and PAHs (De-Bastos and Hiscock, 2016). The sensitivity of the subtidal IEF is deemed of low importance, of low rarity and of local scale. The sensitivity of this IEF is considered to be low.

11.190 Both the Harbour subtidal and Thurso Bay subtidal biotope IEFs sensitivity has not been assessed by MarLIN. However, OSPAR (2009) notes that contamination, '*arising from seabed disturbance is only a risk in heavily contaminated locations*' of which the sediments to be dredged are not. In addition, none of the subtidal biotope IEFs potentially affected are valued as protected habitats. The sensitivity of this IEF is deemed of low importance, of low rarity and of local scale. The sensitivity of this IEF is considered to be low.

Significance of effect

11.191 The magnitude of the impact is deemed to be low (adverse) and the sensitivity is considered to be low. The effect will, therefore, be of negligible or minor (adverse) significance, which is not significant in EIA terms.

Accidental pollution release

11.192 During the construction phase, accidental spillages or release of chemicals, such as fuel, oil and lubricants, into the environment could potentially contaminate the marine environment and harm benthic ecology receptors. It is likely that over time, these pollutants would be dispersed by tidal currents and wave action. Static receptors and less mobile species unable to avoid accidental pollution events could be adversely impacted.

Magnitude of impact

11.193 At this stage, the quantities and types of material that might conceivably enter the marine environment are limited to substances used in operation of the jack-up barge, backhoe excavators, vessels and ancillary equipment that may be used in close proximity to the water during construction. Where possible works will be undertaken from the pier to decrease the likeliness of accidental pollution release spreading to the marine environment.

11.194 The magnitude of this impact is entirely dependent upon the quantities and nature of the spillage, the dilution and dispersal properties of the waters and the bio-availability of the contaminant to species. The more toxic components of fuel spills are volatile and relatively short-lived. Heavier hydrocarbons, while less toxic, may persist for longer in the marine environment. However, any spill or leak would be immediately diluted and rapidly dispersed.

11.195 The likelihood of a spill occurring is deemed to be extremely rare based on the implementation of management measures. As part of the proposed redevelopment, water quality mitigation measures for the prevention of pollution events shall be implemented at construction phase. Therefore, accidental release of contaminants will be strictly controlled, and an emergency plan will also be put in place in the unlikely event of an incident. Provided that the pollution prevention measures are followed there are unlikely to be any pollution events and those that do occur would be very small scale and short lived, due to rapid dispersal and dilution.

11.196 The potential impact of accidental pollution from construction activities is therefore predicted to be of local spatial extent, short term duration, intermittent and reversible. The magnitude is therefore considered to be negligible (adverse).

Sensitivity of receptor

11.197 The sensitivity of IEFs within Scrabster Harbour to pollutants is described in section 11.187 *et seq.* The communities are not considered to be sensitive to elevated concentrations of heavy metals, hydrocarbons and PAHs at the pressure benchmark that assumes compliance with relevant environmental protection standards (i.e. AL1, AL2, TEL and PELs). However, in the event of a spill, these standards may be exceeded, and therefore IEFs are considered vulnerable to this impact.

11.198 The sensitivity of the IEFs is deemed to be of high vulnerability, low recoverability and local value. The sensitivity of the receptors is therefore, considered to be medium.

Significance of effect

11.199 The magnitude of the impact is deemed to be negligible and the sensitivity is considered to be low. The effect will, therefore, be of negligible or minor (adverse) significance, which is not significant in EIA terms.

Fish Ecology

Effects of underwater noise arising from construction activities

Magnitude of impact

11.200 Construction activities including marine piling, dredging and vessel movements within the proposed redevelopment have the potential to generate underwater noise, which may result in effects on fish and shellfish within and outside the harbour.

11.201 Noise arising from vessels operating during construction may increase the risk of disturbance to fish species. Radiated vessel noise relates to factors including vessel size, speed, load, condition, age, and engine type and can range from <150 dB re. 1µPa to over 190 dB re. 1µPa (McKenna *et al.* 2012,). Noise from vessels is received as a low-level chronic exposure (as opposed to acute impulse and intense noises from piling operations) and can affect fish and shellfish receptors by masking sounds in the sea soundscape (Popper and Hastings, 2009; Richardson *et al*., 1995). Subsea noise from vessels will most likely fall within a low frequency spectrum and therefore impact magnitude will be lower than for high speed vessels in terms of masking communications of species which hear within a higher frequency spectrum (Pirotta *et al*., 2013). For instance, fish will show best hearing sensitivity under the quietest sea conditions, any increase in the level of ambient sea noise results in a raise of auditory threshold and a decline in the ability to detect, locate, discriminate and recognise biologically important sounds (Popper and Hawkins, 2019).

11.202 Dredging and vessel movements during construction would likely produce underwater noise at similar levels to those vessel movements associated with the operating harbour. In addition, impact piling is likely to produce noise at substantially higher levels than those levels produced by dredging and vessel movements. Noise produced from impact piling and has therefore been

considered as a worst-case scenario in the assessment of underwater noise on fish during construction.

11.203 Piling will be undertaken through construction of a closed wall pier structure likely to be made up of a combi piled wall using either steel or concreate piles. As the precise nature of the piles and the piling solution is not yet known and will be determined by the Design and Build Contractor during the tender phase a worst-case scenario in terms of the magnitude of noise emissions generated by piling activities has been assessed.

11.204 Piling noise is generated through the impacting of a hydraulically powered hammer onto the end surface of a foundation pile. The noise is dependent on the force applied and the dimensions of the impacting hammer. The assessment of magnitude is largely based on the relative increase of sound from baseline levels within the area of development. The baseline noise levels in Thurso bay are expected to be in line with average background levels of noise found throughout the UK, from 92 – 132 dB re 1 µPa (rms) (Brooker *et al*., 2012).

11.205 The underwater noise assessment was carried out using a worst-case scenario of installation of 1219 mm diameter steel tubular piles installed using an impact pile hammer with a maximum hammer energy of 240 kJ (EIAR Volume II, Appendix 11.1: Underwater Noise Assessment). Piling is scheduled to be undertaken over a period of 6 months with a total of 230 tubular piles being installed. It is expected that a single pile will take up to 6 hours to install. Therefore, piling will be undertaken during daytime hours only on an approximate total of 115 days over this 6-month period.

11.206 Piling noise source levels used in this assessment are given in Table 11.15 below.

Table 11.15: Piling noise source levels used in assessment (un-weighted).

Parameter	Source level at 1 m
SEL per blow @ 1 m, dB re 1 µPa²s	195
Peak sound pressure level @ 1 m, dB re 1 µPa	228
rms_{T90} sound pressure level @ 1 m, dB re 1 µPa	205

11.207 The source of construction related underwater noise will be of medium-term duration, intermittent over the 6-month construction period and will affect the receptor directly. There may be some measurable change and minor loss to IEFs identified. The magnitude is therefore, considered to be minor (adverse).

Sensitivity of receptor

11.208 Sound plays an important role in fish, allowing them to communicate with one another, detect predators and prey, navigate their environment, and avoid hazards.

11.209 Recent peer reviewed guidelines have been published by the Acoustical Society of America (ASA) and provide directions and recommendations for setting criteria (including injury and behavioural criteria) for fish. For the purposes of this assessment, these Sound Exposure Guidelines for Fishes and Sea Turtles (Popper *et. al.,* 2014) were considered to be most relevant for impacts of underwater noise on fish species. The Popper *et al.* (2014) guidelines broadly group fish into the following categories according to the presence or absence of a swim

bladder and on the potential for that swim bladder to improve the hearing sensitivity and range of hearing (Popper *et al*., 2014):

- Group 1: Fishes lacking swim bladders (e.g. elasmobranchs and flatfish). These species are only sensitive to particle motion, not sound pressure, such as flatfishes, sharks, skates and rays;
- Group 2: Fishes with a swim bladder but the swim bladder does not play a role in hearing (e.g. salmonids). These species are only sensitive to particle motion, such as salmonids (Salmonidae);
- Group 3: Fishes with swim bladders that are close, but not connected, to the ear (e.g. gadoids and eels). These fishes are sensitive to both particle motion and sound pressure and show a more extended frequency range than groups 1 and 2, extending to about 500 Hz. This group includes the likes of cod fishes (*Gadidae*) and eels (*Auguillidae*);
- Group 4: Fishes that have special structures mechanically linking the swim bladder to the ear (e.g. clupeids such as herring, sprat and shads). These fishes are sensitive primarily to sound pressure, although they also detect particle motion. These species have a wider frequency range, extending to several kHz and generally show higher sensitivity to sound pressure than fishes in Groups 1, 2 and 3, such as herring; and
- Group 5: Eggs and larvae

11.210 Shellfish IEFs have been scoped out of this impact due to their very low to negligible sensitivity to noise. Most shellfish hear in a different way to vertebrates, e.g. arrays of sensory hairs on lobsters, crabs etc. or statocyct organs. They are able to sense vibrations and movements associated with sound production, but the absence of gas-filled cavities indicates a lesser potential for injury and mortality.

Injury

11.211 Table 11.16 summarises the fish injury criteria recommended for pile driving based on the recent Popper *et al.,* 2014 guidelines. In the table, both peak and SEL criteria are unweighted.

Table 11.16: Criteria for onset of injury in fish due to piling (Popper *et al.*, 2014). All criteria are presented as sound pressure even for fish without swim bladders since no data for particle motion exist.

Group	Type of animal	Parameter	Mortality and potential mortal injury	Recoverable injury
1	Fish: no swim bladder (particle motion detection)	SEL, dB re 1 μPa^{2}s	>219	>216
		Peak, dB re 1 μPa	>213	>213
2	Fish: where swim bladder is not involved in hearing (particle motion detection)	SEL, dB re 1 μPa^{2}s	210	203
		Peak, dB re 1 μPa	>207	>207
3 & 4	Fish: where swim bladder is involved in hearing (primarily pressure detection)	SEL, dB re 1 μPa^{2}s	207	203
		Peak, dB re 1 μPa	>207	>207
5	Eggs and larvae	SEL, dB re 1 μPa^{2}s	>210	(*Near*[a]) Moderate (*Intermediate*[b]) Low (*Far*[c]) Low
		Peak, dB re 1 μPa	>207	

[a] **Tens of metres**
[b] **Hundreds of metres**
[c] **Hundreds of metres**

11.212 Mortality or direct physical injury from noise and vibration propagated from a sound source is associated with very high peak pressure or impulse levels. Typically, these effects can be associated with receptors in the immediate vicinity of an impact piling operation.

11.213 Acoustic impact criteria have been developed to assess sensitivities of fish receptors to noise. This assessment adopts a conservative approach to injury thresholds and uses Sound Exposure Guidelines for Fishes and Sea Turtles (Popper *et. al.*, 2014) for impulsive sound.

11.214 Calculation of the ranges of peak pressure values causing physiological effects are very small and suggest that underwater noise levels from piling will be insufficient to cause lethality in any species, and that no injury for all fish will occur beyond 28 m from the piling source for the maximum hammer energy (see Table 11.17). None of the SEL injury thresholds were exceeded for fish and so are not included in the table. The use of soft start piling (see Further Mitigation, paragraph 11.326) will further reduce the potential for injury, allowing fish to move away from areas of elevated noise levels before they reach a threshold where injury may occur.

Table 11.17: Summary of injury ranges for fish due to impact piling (assumes a maximum hammer energy of 240 kJ).

Group	Class	Threshold	Range
1	Mortality No swim bladder (particle motion detection)	213 dB re 1 µPa (pk)	11 m
	Impairment No swim bladder (particle motion detection)	213 dB re 1 µPa (pk)	11 m
2	Mortality Swim bladder not involved in hearing (particle motion detection)	207 dB re 1 µPa (pk)	28 m
	Impairment Swim bladder not involved in hearing (particle motion detection)	207 dB re 1 µPa (pk)	28 m
3 & 4	Mortality Swim bladder involved in hearing (primarily pressure detection)	207 dB re 1 µPa (pk)	28 m
	Impairment Swim bladder involved in hearing (primarily pressure detection)	207 dB re 1 µPa (pk)	28 m
5	Mortality Fish eggs and larvae	207 dB re 1 µPa (pk)	28 m

Behavioural response

11.215 Vessel noise can cause potential masking of important acoustic cues and behavioural disturbance to fish receptors. For example, research looking at biases of vessel noise on the spatial distribution of fish showed that pelagic schooling fish respond by vertical or lateral avoidance of approaching vessels (Mitson and Knudsen, 2003).

11.216 Behavioural effects in response to construction related underwater noise include a wide variety of responses including startle responses (also known as C-turn responses), strong avoidance behaviour, changes in swimming or schooling behaviour or changes of position in the water column. The Popper *et al*. (2014) guidelines provide qualitative behavioural criteria for fish from a range of noise sources (see Table 11.18). These categorise the risks of effects in relative terms as “high”, “moderate” or “low” at three distances from the source: “near” (i.e. tens of metres), “intermediate” (i.e. hundreds of metres) or “far” (i.e. thousands of metres). These behavioural criteria for impulsive noise such as piling are summarised in Table 11.18 for the four fish groupings.

Table 11.18: Criteria for onset of behavioural effects in fish for impulsive piling (Popper *et al*., 2014).

Group	Type of animal	Relative risk of behavioural effects
1	Fish: no swim bladder (particle motion detection)	(*Near*) High (*Intermediate*) Moderate (*Far*) Low
2	Fish: where swim bladder is not involved in hearing (particle motion detection)	(*Near*) High (*Intermediate*) Moderate (*Far*) Low
3 & 4	Fish: where swim bladder is involved in hearing (primarily pressure detection)	(*Near*) High (*Intermediate*) High (*Far*) Moderate
5	Eggs and larvae	(*Near*) Moderate (*Intermediate*) Low (*Far*) Low

11.217 Underwater noise modelling undertaken for the project have estimate that behavioural responses may occur up to 1.8 km from the noise source (EIAR Volume II, Appendix 11.1: Underwater Noise Assessment). As outlined above, behavioural responses include a wide variety of responses such as startle responses (also known as C-turn responses), strong avoidance behaviour, changes in swimming or schooling behaviour or changes of position in the water column. Depending on the strength of the response and the duration of the impact, there is potential for some of these responses to lead to significant effects at an individual level (e.g. reduced fitness, increased susceptibility to predation) or at a population level (e.g. avoidance or delayed migration to key spawning grounds), although these may also result in short term, intermittent changes in behaviour that have no wider effect, particularly once acclimatisation to the noise source is taken into account.

11.218 Effects of avoidance will also depend on the species in question and the life stage affected but may include reduced access to spawning and feeding grounds or barriers to migration, which may have negative consequences for breeding success and stock recruitment. While behavioural effects have been demonstrated in numerous fish species in response to underwater noise, it has also been demonstrated that such effects are temporary with normal behavioural patterns returning soon after the noise source ceases. For example, in studies on the effects of seismic survey noise on various caged fish species, McCauley et al. (2000) showed a return to normal fish behaviour patterns 14 to 30 minutes after the cessation of seismic airgun operations.

Fish and shellfish IEFs

11.219 Demersal fish and elasmobranch species are expected to have a low sensitivity to sound, only detecting a narrow band of frequencies (group 3) (Popper and Hawkins, 2019). Of all the fish species of interest to the proposed redevelopment only cod and European eel may be classed as having high auditory sensitivity (group 3). Sea trout and Atlantic salmon are moderately sensitive to underwater noise as they have a gas-filled swim bladder, which is vulnerable to sharp changes in pressure, but lack the connection between the swim bladder and the internal ear compared to more sensitive species (group 2; Gill & Barlett, 2010). Shellfish have been

scoped out on the basis that no shellfish species have been identified within the proposed redevelopment site through site-specific surveys.

Demersal, elasmobranch, spawning and nursery ground IEFs

11.220 As discussed in paragraph 11.212 *et seq.*, impacts to fish from underwater noise include lethal and physical injury, auditory injury and behavioural responses, the latter of which includes a range of responses such as changes in swimming and schooling behaviour. The behavioural responses of the IEF species will, however, depend on the life stage of the fish and the drivers for being in the area (e.g., feeding, spawning). The sensitivity of fish to underwater noise will also depend on the presence or absence of a swim bladder and on the potential for that swim bladder to improve the hearing sensitivity and range of hearing (Popper *et al.,* 2014).

11.221 Demersal and elasmobranch IEFs are likely to be sensitive to sound particle motion and show sensitivity to only a narrow band of frequencies (group 1). It is highly unlikely that the piling will result in auditory injury unless the IEFs are within 11 m of piling works, however, behavioural disturbance is likely in the near (10s of meters) and intermediate (100s of meters) vicinity. Spawning and nursery ground IEFs are part of group 5 and injury is to be expected to only occur within 28 m, there is a moderate risk of behavioural effects are expected to occur within the near vicinity (tens of meters; see Table 11.18).

11.222 There are is no evidence of spawning fish within the proposed redevelopment area, however, this does not prove absence of spawning areas. Section 11.84 identifies indicative areas of fish that may possibly have nursery or spawning grounds where the proposed redevelopment is located. In the event of a spawning area being present within Thurso Bay, based on the underwater noise assessment, injury would only occur at distances of up to 28 m, therefore it is unlikely that any loss of eggs or larvae would represent a significant change to a species' population.

11.223 The sensitivity of the demersal, elasmobranch, spawning and nursery IEFs are therefore deemed to be of low vulnerability, high recoverability and of local value. The sensitivity of the receptors is therefore, considered to be low.

Migratory fish IEFs

11.224 Salmon have been characterised as a group 2 species whereby the swim bladder is not involved in hearing (paragraph 11.209). Group 2 fish species are considered to have a low sensitivity to sound pressure under a narrow range of frequencies (32 to 380 Hz) and limited auditory response thresholds compared to other teleost fish (group 3 and 4) (Hawkins and Johnstone, 1978; Popper and Fay, 1999; Hawkins and Popper, 2014; Simpson and Bruintjes, 2016), indicating sensitivity for particle motion rather than sound pressure (Hawkins and Johnstone, 1978). Atlantic salmon are sensitive to particle motion at very low frequencies in the range of 5-150 Hz and demonstrate behavioural responses by avoiding localised high intensity sound fields of below 10 Hz (Knudsen *et al*., 1992; 1994; Harding, Radford and Simpson, 2016). The proposed pile driving is likely to be of broad-spectrum covering frequencies of up 500 Hz and peak sound pressure levels ranging from 198 to 220 dB, and therefore will be detected by salmon individuals that are within the zone of influence predicted by noise modelling undertaken.

11.225 Disturbance in the form of a behavioural response potentially causing effects on during migration from underwater noise emissions associated with piling activities could occur to adult salmon in an area of up to 1.8 km from the source, for the maximum hammer energy. This is broadly in line with the qualitative assessment presented in Popper *et al*. (2014), which predict that there is likely to be a high risk of a behavioural response from group 2 fish species, including startle responses (also known as C-turn responses), strong avoidance behaviour, changes in swimming or schooling behaviour or changes of position in the water column, in the near field (tens of meters), moderate risk within the intermediate field (hundreds of metres) and low risk in the far field (1000's meters from the of the noise source; Table 11.18).

11.226 Research trials carried out on caged farmed Salmonids (*S. trutta* as a proxy for *S. salar*: group 2) investigated the effect of both pile driving and vibropiling (non-percussive pile driving), where the source noise was between 193 and 201 dB re 1 µPa peak (Nedwell *et al*., 2006) with cages positioned at varying distances from the source. Results indicated no evidence that the fish reacted to impact piling at a distance of approximately 400 m, nor to vibration piling at close ranges (Nedwell and Howell, 2004; Nedwell *et al*., 2006) . Additionally, research investigating the impact of pile-driving playback (audio files) within laboratory aquaria-based conditions on the behaviour and physiology on captive Atlantic salmon found no observable difference between ambient noise and pile driving noise, additionally there was no clear stale response in relation to playback of individual hammer strikes. This experiment also demonstrated that there was no change in active metabolic rate when exposed to pile driving noise in marine phase salmon (Harding, Radford and Simpson, 2016). The results of these studies indicate that mature salmon may not be sensitive to piling noise[13].

11.227 Adopting a precautionary principle, adult salmon migrating through Thurso Bay may exhibit a behavioural response to underwater noise from the project and given the location of the harbour, some of the migration may be temporarily affected in some parts of the bay including entrance to the mouth of the River Thurso.

11.228 Less is known on the effects of underwater noise on migrating salmon smolts. As described in paragraph 11.65 salmon smolts are juvenile salmon that migrate from the freshwater river where they hatch, to estuarine and marine offshore waters. Salmon smolts are known to congregate each year during April and May in Thurso Bay prior to migrating in shoals offshore. Their migration from the river to offshore areas are predominantly undertaken during nocturnal periods in the early part of the smolt migration period. During the latter part of the season (May), a significant proportion of the smolts switch to migration during both day and night (Thorstad *et al.,* 2012).

11.229 Prior to seaward migration, smolts undergo a preparatory smolting process involving morphological, biochemical, physiological and behavioural changes that preadapt them for life within the marine environment (Hoar, 1988; Høgasen, 1998; Thorpe *et al*., 1998; Finstad & Jonsson, 2001). During this process, smolting salmon populations suffer high mortality due to

[13] It is important to note that these studies used captive or famed Salmonids which may exert different behaviours to wild Salmonids and caution must be employed in interpreting behaviours.

novel predators, food types and the change in salinity (Klemetsen *et al.,* 2003; Thorstad *et al.,* 2011a, b).

Smolts are known to be analogous[14] compared with other fish in group 2, and therefore may be less sensitive to noise that mature salmon (Iwashita *et al.*,1999; Kenyon, 1996; and Wysocki and Ladich, 2001). However, it is uncertain whether smolts that have recently undergone smolting, as those found in Thurso Bay during April and May, may be more vulnerable to underwater noise as they may not have sufficient energy to immediately continue their migration offshore. Therefore, additional stress caused by underwater noise emission from piling may ultimately result in mortality either from continued stress from a collection of stressors or from predation as they migrate offshore without sufficient time to rest in Thurso Bay. By adopting the precautionary principle, the sensitivity of salmon smolts to disturbance from underwater noise from the project is considered to be higher than the sensitivity assessed for adult salmon. Due to this increased sensitivity, it has been proposed that piling be restricted to daylight hours during April and May (see Further Mitigation paragraph 11.326) to avoid the most sensitive migration periods for salmon smolts.

11.230 European eel would be expected to have some sensitivity to both particle motion and sound pressure components of piling noise (Group 3 Fish). The Popper *et al*. (2014) guidelines predict that there is likely to be a high risk of a behavioural response including startle responses (also known as C-turn responses), strong avoidance behaviour, changes in swimming or schooling behaviour or changes of position in the water column within tens of meters, and hundreds of metres and moderate risk at 1000's meters from the of the noise source (Table 11.18).

11.231 It is highly unlikely that the piling will result in auditory injury, on the basis that migratory fish are unlikely to be within the proposed redevelopment footprint (28 m from the noise source). The risk of disturbance effects outside the harbour, however, are likely and may result in behavioural effects on migration from smolts and adult salmon and eels and elevation of stress levels on salmon smolts with the potential for increased mortality or exposure to increased predation.

11.232 The migratory fish IEFs are therefore deemed to be of medium vulnerability, medium recoverability and international to national value. The sensitivity of the receptor is therefore considered to be medium.

Significance of the effect

11.233 The magnitude of the impact is therefore deemed to be low (adverse), with further mitigation measures applied the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor (adverse)** significance, which is significant in EIA terms and therefore will need mitigation to prevent any adverse effects to population of Salmon.

Permanent habitat loss

11.234 The construction activities including reclamation of land at Area A and B, and the capital dredging along both sides of the pier will result in the complete loss or severe modification to, if not all, of the marine habitats present within those footprint areas.

[14] Other fish found within group 2 have displayed an increase in sensitivity with body size and age.

Magnitude of impact

11.235 Redevelopment of the pier and revetment areas will result in the permanent loss of habitat. The magnitude has been described in section 11.161 *et seq.* Therefore, the magnitude is therefore considered to be negligible.

Sensitivity of receptor

11.236 In a regional/national context the loss of habitat present within Scrabster Harbour is considered unlikely to result in impairment to an ecosystem at this scale. Demersal fish, migratory fish and elasmobranch IEFs are likely to move away from any works during the construction phase and are unlikely to be affected by permanent habitat loss. Spawning or nursery grounds IEFs are likely to use the extensive alternative spawning and nursery grounds available.

11.237 Demersal fish, migratory fish, elasmobranch, spawning ground and nursery ground IEFs are therefore deemed to be of low vulnerability, high recoverability and local to international value. The sensitivity of the receptor is therefore considered to be low. The shellfish assemblage IEF is more likely to be affected by permanent habitat loss, however site-specific surveys have determined that no sessile species, such as great Atlantic scallop or native oysters were identified in the local marine biodiversity study area. More mobile shellfish species, such as brown crab, European lobster, velvet crab and crawfish that have been identified within the local marine biodiversity study area are likely to move away during the construction phase and therefore are unlikely to be affected by permanent habitat loss.

11.238 The shellfish assemblage IEF is deemed to be of low vulnerability, high recoverability and of local to regional value. The sensitivity of the receptor is therefore, considered to be low.

Significance of effect

11.239 The magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of negligible - minor (adverse**)** significance, which is not significant in EIA terms.

Temporary disturbance and loss of habitat

11.240 Ancillary operations during construction works, such as using jack-up barges, entrenching of fuel and water pipelines, and pin piling to support the proposed redevelopment of the pier could temporarily disturb or lead to a temporarily loss of intertidal and subtidal marine habitat.

Magnitude of impact

11.241 Temporary works on the pier will potentially result in temporary disturbance and loss of habitat. The magnitude of the impact has been described in section 11.167 for dredging works and section 11.168 for the jack-up barge foot placement and is not reiterated here. The magnitude is therefore considered to be negligible.

Sensitivity of receptor

11.242 Temporary habitat disturbance is also likely to arise in the vicinity of the marine piling works including from jack-up barge leg placements for piling, pipeline installation and from the pier

redevelopment works. Many of the fish and shellfish species found within the study area are likely to make use of benthic and pelagic habitats for foraging and migratory movement.

11.243 Demersal fish, migratory fish and elasmobranch IEFs are likely to be vulnerable to changes to or loss of habitat in the short-term (days) but are considered likely to recover rapidly following short to medium term (months) disturbance. Fish species are generally considered likely to avoid temporary changes in habitat (EMU, 2004) as they are able to move away from temporary areas of disturbance. Newell *et al.* (1998) found that following cessation of disturbance events, marine communities conform with well-established principles of ecological succession, that communities associated with sandy/coarse gravel sediments are well adapted to rapid recolonization with 'optimistic/pioneering' species establishing initially and later longer-lived and slow-growing organisms.

11.244 The demersal fish, migratory fish and elasmobranch IEFs are deemed to be of low vulnerability, high recoverability and of local to international value. The sensitivity of the receptors is therefore, considered to be low.

11.245 The most vulnerable shellfish assemblage IEFs are likely to be demersal, non-mobile species such as native oyster, great Atlantic scallop and mussels. Any temporary changes in availability of suitable habitat are likely to be temporary with recovery of sediments and associated shellfish communities considered to be rapid (Newell *et al.*, 1998). Site-specific surveys haven't identified any sessile species within the proposed redevelopment area and mobile shellfish species are likely to avoid changes in habitat (EMU, 2004) as they are able to move away from the habitat change. For instance, the sensitivity of the native oyster to a physical change to another sediment type has been described as not sensitive and highly resistant to this change (Perry and Jackson, 2017).

11.246 The shellfish assemblage IEF is deemed to be of medium vulnerability, high recoverability and of local to international value. The sensitivity of the receptor is therefore, considered to be low. The proposed redevelopment lies within a number of indicative spawning or nursery grounds IEFs. Spawning and nursery grounds may be more vulnerable to disturbance in the long-term, however as outlined above potential impacts on these areas are likely to be short-duration and of minimal extent. It can be expected that there will be no fundamental change to the substrate type of the area and therefore will not affect where eggs are laid. However, sediment will be removed which may affect species that have spawned within the harbour, although it is likely that species will seek alternative grounds away from the proposed redevelopment area during construction (see section 11.84 for spawning and nursery areas). Additionally, proximity to spawning and nursery grounds can also increase re-colonisation of temporarily disturbed habitats through larval recolonization (Phua *et al*., 2002).

11.247 The spawning and nursery ground IEFs are deemed to be of medium vulnerability, medium recoverability and regional to national value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of effect

11.248 The magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be low – medium. The effect will, therefore, be of negligible - minor (adverse) significance, which is not significant in EIA terms.

Effects of increased suspended sediment concentration

Magnitude of impact

11.249 The magnitude of impact has been described in section 11.175 and not reiterated here again. The potential impact of increased suspended sediment concentration and potential contaminant release from construction activities is therefore considered to be minor (adverse).

Sensitivity of receptor

11.250 Fish are sensitive to increases in SSC, both directly, through physiological and behavioural disruption, and indirectly, through habitat modification (e.g. smothering of spawning/nursey habitats). Increased SSC can impair foraging, increase mortality, affect growth, reproduction and survival at all trophic levels. However, there is also evidence to indicate that high sediment loads, and associated turbidity found in natural ecosystems can create feeding opportunities for some species such as demersal fish (Henley *et al*., 2000).

11.251 Elasmobranchs are likely to exhibit avoidance reactions and move away from the vicinity of adverse sediment conditions, particularly if refuge conditions are present (Sigler *et al.,* 1984; Bash *et al.,* 2001). Fish species including skates and thornback ray live partially buried in sediment on the sea floor and therefore are unlikely to be sensitive to increases in sediment deposition. Therefore, most individuals could tolerate or avoid any unfavourable discharges of particulate matter (Robertson *et al.,* 2006).

11.252 The elasmobranch IEF is deemed to be of low vulnerability, high recoverability and of local to regional value. The sensitivity of the receptor is therefore, considered to be low.

11.253 Many shellfish species have a high tolerance to SSC and are likely to be insensitive to increases in turbidity; however, they are likely to avoid areas of increased suspended sediment concentration as they rely on visual acuity during predation. Therefore, the sensitivity of the shellfish assemblages, both within and near to Scrabster Harbour and the dredge disposal site are assessed as low.

11.254 The shellfish IEF is deemed to be of low vulnerability, high recoverability and of local to regional value. The sensitivity of the receptor is therefore considered, to be low.

11.255 Fish are also known to tolerate high levels of SSC and migrating fish species, such as salmonids, are commonly known to migrate through high SSC in estuaries (Salmon and Trout Association, 2015). In addition, migratory fish species, such as *Salmo salar*, often have an acute sense of smell which helps to direct them to their home grounds to spawn and therefore are not relying on visual cues to navigate (Heard, 2007).

11.256 The migratory fish IEF is deemed to be of low vulnerability, high recoverability and of national to international value. The sensitivity of the receptor is therefore, considered to be low.

11.257 Excessive fine sediment (in suspension or deposited) can have damaging effects on all life stages of fish and particularly on fish eggs and larvae and fry (Robertson *et al*., 2006). Juvenile fish are more likely to be affected by habitat disturbances (such as increased SSC) than adult fish, due to decreased mobility, making them less able to avoid impacts.

11.258 Spawning and nursery ground IEFs are deemed to be of high vulnerability, low recoverability and of regional to national value. The sensitivity of the receptor is therefore, considered to be high.

Significance of effect

11.259 The magnitude of the impact is deemed to be minor (adverse) and the sensitivity of the receptor is considered to be low – high. The effect will, therefore, be of negligible - minor (adverse) significance, which is not significant in EIA terms.

Accidental pollution release

11.260 During the construction phase, accidental spillages or release of chemicals, such as fuel, oil and lubricants, into the environment could potentially contaminate the marine environment and harm fish and shellfish receptors.

Magnitude of impact

11.261 Temporary works on the pier could lead to accidental pollution being released into the marin environment; parameters of the construction phase have been described in section 11.193 *et seq.* and is not re-iterated here. Therefore, the magnitude is therefore considered to be negligible (adverse).

Sensitivity of receptor

11.262 Demersal and elasmobranch IEFs are unlikely to be vulnerable to pollutants due to detection and avoidance behaviours and are expected to move away from high concentrations of pollutants.

11.263 Demersal and elasmobranch IEFs are therefore deemed to be of low vulnerability, high recoverability and of local to national value. The sensitivity of the receptors is therefore, considered to be medium.

11.264 Migratory fish species, such as Atlantic salmon, sea trout and the European eel, known to occur in the regional marine biodiversity study area are also expected to show some tolerance and avoidance behaviour to pollutants (Elliot *et al.,* 1988). Construction activities are expected to be short-lived and likely to result in only short-term changes in migratory fish behaviour (avoidance) and are therefore not considered likely to result in fish mortality.

11.265 The migratory fish IEF has therefore been deemed to be of low vulnerability, high recoverability and of national to international value therefore the sensitivity of the receptor is considered to be medium

11.266 Mobile species of shellfish will have access to alternative feeding areas and are likely to detect and avoid areas of pollution. Sessile species of shellfish are potentially more vulnerable to any

pollution event, however the proposed redevelopment site lies outside any areas known to support shellfish.

11.267 The shellfish IEF is deemed to be of low vulnerability, high recoverability and of local to regional value. The sensitivity of the receptor is therefore considered to be low.

11.268 Spawning and nursery grounds may be at higher risk of impact as juvenile fish are likely to have a higher mortality associated with accidental pollution. Juvenile fish and eggs are likely to be affected due to decreased avoidance response and less efficient cellular/compartmentalisation repair mechanisms (Heath, 2018).

11.269 Spawning and nursery ground IEFs are deemed to be of medium vulnerability, medium recoverability and national to international value. The sensitivity of the receptor is therefore, considered to be high.

Significance of effect

11.270 The magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor (adverse) significance, which is not significant in EIA terms.

Marine Mammals

Effects of underwater noise arising from construction activities

11.271 Marine mammals, particularly cetaceans, are capable of detecting and generating sound (Au *et al., 1974;* Bailey *et al.,* 2010) and are dependent on sound for many aspects of their lives, i.e. prey-identification; predator avoidance; communication and navigation. Increases in anthropogenic noise may consequently pose a risk within the marine environment (Parsons *et al.,* 2008; Bailey *et al.,* 2010).

11.272 The impact of exposure to anthropogenic sound on marine mammals, particularly cetaceans has been well documented, and effects may include physical damage, disorientation and impact on navigation; communication masking; and reduced ability to locate prey.

11.273 It is now recognised that some of the more ubiquitous noise sources, such as ships, can either individually or cumulatively mask communication signals of, and pose a threat to marine mammals (Clark *et al.,* 2009; Ellison *et al.,* 2011; Chen *et al.,* 2017; Simpson *et al.,* 2016, Rolland *et al.,* 2012). The overall increase in oceanic background noise can alter acoustic habitats over large regions in ways which may be detrimental to marine animals that rely on sound for basic life functions (Ellison *et al.,* 2011). It is also now emerging that non-injurious effects can accumulate at the population level (Williams *et al.,* 2015).

11.274 As stated in the fish and shellfish impact assessment (see 11.202 *seq.*) dredging and vessel movements during construction would likely produce underwater noise at similar levels to those vessel movements associated with the operating harbour. In addition, impact piling is likely to produce noise at substantially higher levels than those levels produced by dredging and vessel movements. Nosie produced from impact piling and has therefore been considered as worst-case scenario in the assessment of underwater noise on marine mammals during construction.

11.275 Information on piling, parameters for assessment, and baseline noise levels in Thurso Bay are given in 11.203 *et seq.* and are not reiterated here.

Magnitude of impact

All marine mammal VERs

Injury

11.276 The potential for auditory injury to occur in marine mammals, defined as a Permanent Threshold Shift (PTS), was modelled using a dual criteria approach based on the most recent published guidelines (NMFS, 2018). Unweighted peak Sound Pressure Level (SPLpk) and marine mammal hearing weighted Sound Exposure Level (SEL) were used to predict the maximum ranges over which PTS could occur.

11.277 The maximum predicted ranges of PTS (maximum design scenario of 240 kJ; see Table 11.20) for all IEFs are given in Table 11.19 and shows that the potential for injury to occur is very localised for all species, with a maximum range of 80 m within which injury could occur. In addition, the implementation of marine mammal mitigation measures for piling activities is proposed; trained and experienced Marine Mammal Observers (MMO) and/or Passive Acoustic Monitoring (PAM) would be engaged to follow JNCC protocol for minimising the risk of injury to marine mammals from piling noise, including the implementation of pre-piling watches and a soft-start protocol. Given these impact ranges, alongside the adoption of embedded mitigation, the risk of PTS to any marine mammal IEF as a result of exposure to piling noise is negligible. Therefore, the magnitude of the potential impact for all marine mammal IEFs is considered negligible.

Table 11.19: Summary of injury ranges for marine mammals due to impact piling (N/E = threshold not exceeded). Marine mammal hearing groups: LF=Low frequency; MF=Mid frequency, HF=High frequency; PW = Phocid pinnipeds in water.

Species / Group	Threshold (SEL)	Range	Threshold (Peak SPL)	Range
LF cetacean (minke whale)	183 dB re 1 μPa^{2}s	77 m	219 dB re 1 μPa (pk)	*N/E*
MF cetacean (bottlenose dolphin, white-beaked dolphin, Risso's dolphin, killer whale)	185 dB re 1 μPa^{2}s	*N/E*	230 dB re 1 μPa (pk)	*N/E*
HF cetacean (harbour porpoise)	155 dB re 1 μPa^{2}s	80 m	202 dB re 1 μPa (pk)	58 m
PW (harbour seal, grey seal)	185 dB re 1 μPa^{2}s	*N/E*	218 dB re 1 μPa (pk)	*N/E*

Disturbance

11.278 Unlike for thresholds of auditory injury, there are currently no established regulatory guidance documents and few published scientific articles providing clear advice on the appropriate thresholds for behavioural response to pile driving noise. Behavioural responses to noise are highly variable and are dependent on a variety of animal dependent and environmental factors. Animal dependent factors include past experience, individual hearing sensitivity, activity patterns, motivational and behavioural state at the time of exposure. Demographic factors such as age, sex and presence of dependent offspring can also have an influence. Environmental factors include the habitat characteristics, presence of food, predators, proximity to shoreline

or other features. Influenced by these factors, responses can be highly variable, from small changes in behaviour such as longer intervals between surfacing (Richardson, 1995a) or a cessation in vocalisation (Watkins, 1986) to more dramatic escape responses (Götz and Janik, 2016). This variability makes it extremely difficult to predict the likelihood of responses to underwater noise from piling. Even where empirical data exist on responses of animals in one particular environment, the context related variability makes it difficult to extrapolate from one study to a new situation. It is important to note that all any impact assessment can do, is predict the potential for behavioural responses, as definitive predictions of likelihood or magnitude are particularly difficult.

11.279 The approach taken in this assessment follows that is set out in Graham *et al.* (2017) and is described in detail in EIAR Volume II, Appendix 11.1: Underwater Noise Assessment (section 4.13 *et seq.*). In brief, this approach used empirical evidence on the responses of harbour porpoise to piling at the Beatrice Offshore Wind Farm in the Moray Firth to derive a dose-response relationship based on unweighted single pulse SELs. The resulting probability of disturbance contours are shown Figure 11.10. In the absence of a species-specific dose-response curves, the dose-response curve for harbour porpoise was implemented for all cetacean marine mammal species and was considered to be precautionary.

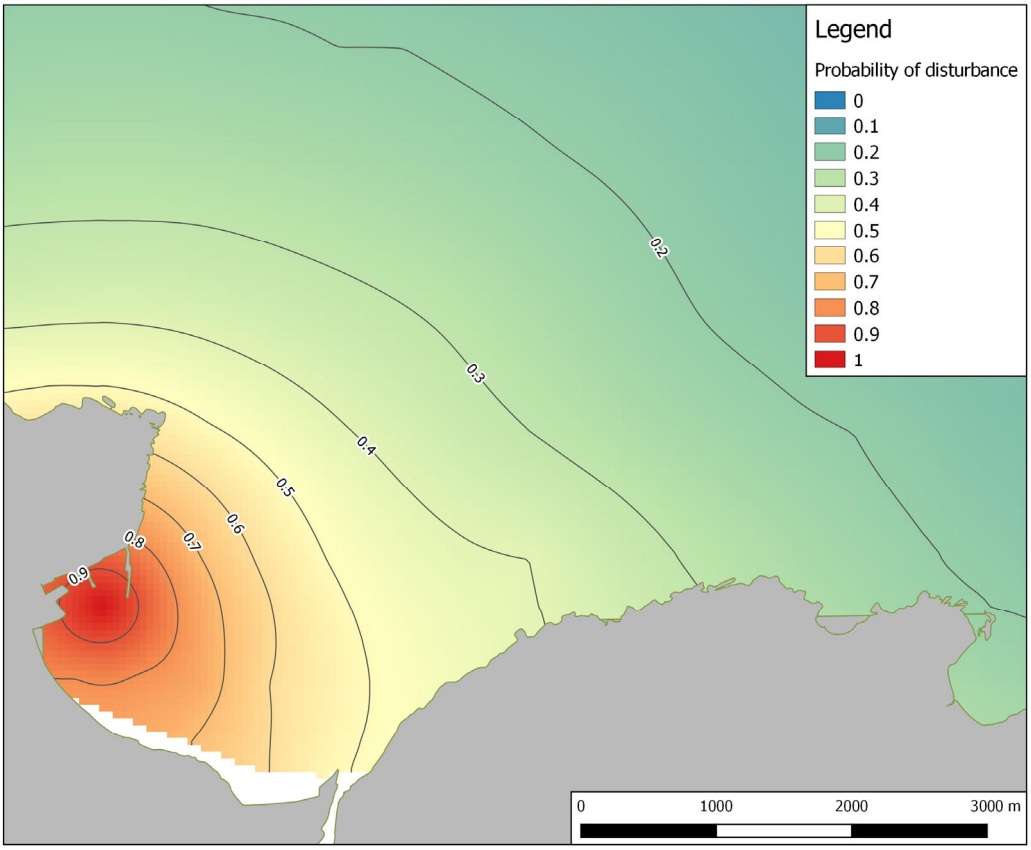

Figure 11.10: Probability of disturbance contours based on 5 dB increments of predicted received unweighted single pulse SELs due to impact piling using a 240 kJ hammer energy (maximum design scenario) at St. Ola Pier.

11.280 Figure 11.10 shows the probability of disturbance at each 5 db increment from the sound source. The greatest impact will occur within the vicinity of Scrabster Harbour, at the

disturbance probability contour of 0.9, extending out to as far as 4.6 km from the sound source, at the disturbance probability contour of 0.2. Based on the low number of expected sightings of all marine mammals up to the 0.2 contour, the number of animals likely to be disturbed by piling noise is expected to be minor and therefore the magnitude is assessed as low.

Sensitivity of receptor

High frequency IEFs

Injury

11.281 Studies of auditory injury in relation to the frequencies of the noise exposure have suggested that hearing impairment as a result of exposure to piling noise is likely to occur in and around the frequency of the fatiguing signal (Kastelein *et al.,* 2013), therefore auditory injury from piling is likely to be in lower frequency bands which would be unlikely to affect the ability of harbour porpoises to communicate or echolocate. However, given the fact that effects are irreversible and in light of the importance of sound for echolocation, foraging and communication in small toothed cetaceans, harbour porpoises are deemed be of high vulnerability, low recoverability and international value. The sensitivity of the receptor is therefore, considered to be high.

Disturbance

11.282 Previous studies have shown that harbour porpoise are displaced from the vicinity of piling events. For example, studies at wind farms in the German North Sea have recorded large declines in porpoise detections close to the pile (> 90% decline at noise levels above 170 dB) with decreasing effect with increasing distance from the pile (25% decline at noise levels between 145 and 150 dB) (Brandt *et al*., 2016). The detection rates revealed that porpoise were only displaced from the piling area in the short term (1 to 3 days) (Brandt *et al.,* 2011, Dähne *et al.*, 2013, Brandt *et al.,* 2016). These studies however, are based on the installation of monopiles at offshore windfarms, with distinctly higher hammer energy usage (~ 5,000 kJ as opposed to 240 kJ). Harbour porpoise are small cetaceans which makes them vulnerable to heat loss and requires them to maintain a relatively high metabolic rate. This makes them potentially vulnerable to disturbance if they are unable to obtain sufficient levels of prey intake.

11.283 The results from Wisniewska *et al.* (2016) could also suggest that porpoises have an ability to respond to short term reductions in food intake, implying a resilience to disturbance. As Hoekendjik *et al.* (2018) argue, this could help explain why porpoises are such an abundant and successful species. However, it is important to note that the studies providing evidence for the responsiveness of harbour porpoises to piling noise have not provided any evidence for subsequent individual consequences. In this way, responsiveness to disturbance is not the same as sensitivity to disturbance and porpoises may well be able to compensate by moving quickly to alternative areas to feed, while at the same time increasing their feeding rates.

11.284 The high frequency IEF is therefore deemed to be of medium vulnerability, high recoverability and international value. The sensitivity of the receptor is therefore, considered to be medium.

Mid frequency IEFs

Injury

11.285 The underwater noise assessment showed that the threshold for PTS for mid frequency IEFs was not exceeded therefore the sensitivity is deemed to be negligible and is not discussed any further.

Disturbance

11.286 There is limited information on the effects of disturbance on mid frequency IEFs such as white-beaked dolphin, Risso's dolphin or killer whale specifically. However, there is evidence for bottlenose dolphins which can be used as a proxy for all mid-frequency IEFs.

11.287 Bottlenose dolphins have been shown to be displaced from an area as a result of the noise produced by offshore construction activities. In a recent study in the Moray Firth, small effects of pile driving on dolphin presence have been observed however, dolphins were not excluded from the vicinity of the piling activities (Graham *et al*., 2017b). The pile driving resulted in a slight reduction of the presence and the encounter duration for dolphins within the immediate area. Encounter rates decreased within the immediate area of the piling works and increased outside on days of piling activity.

11.288 These data highlight a small spatial and temporal scale disturbance to bottlenose dolphins as a result of impact piling activities. There is the potential for behavioural disturbance and displacement to result in a disruption in foraging and resting activities and an increase in travel and energetic costs. It has been previously shown, however, that bottlenose dolphins have the ability to compensate for behavioural responses as a result of increased commercial vessel activity (New *et al*., 2013). Therefore, while there remains the potential for disturbance and displacement to affect individual behaviour, bottlenose dolphins do have some capability to adapt their behaviour and tolerate certain levels of disturbance.

11.289 Mid frequency IEFs are deemed to be of medium vulnerability, high recoverability and international or national value. The sensitivity of the receptor is therefore, considered to be medium.

Low Frequency IEFs

Injury

11.290 Although very little is known about minke whale hearing, it is likely that they rely on low frequency hearing; whilst they do not echolocate, minke whales likely use sound for communication. As such a conservative approach to sensitivity assessment has been taken.

11.291 The low frequency IEF is therefore deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore, considered to be high.

Disturbance

11.292 There is little information available on the behavioural responses of minke whales to underwater noise. Minke whales have been shown to change their diving patterns and behavioural state in response to disturbance from whale watching vessels; and it was suggested that a reduction in

foraging activity at feeding grounds could result in reduced reproductive success in this species given its capital breeding pattern (i.e. that it relies on stored energy to provide resources for future breeding attempts) (Christiansen *et al.,* 2013). McGarry *et al*. (2017) demonstrated that minke whales exhibited clear aversive responses to acoustic deterrent devices, resulting in an increased swim speed and increased directed movement away from the sound source. It is unknown if the regional marine biodiversity study area is a feeding ground for minke whales. Therefore, this assessment will assume that there is the potential for displacement from foraging areas which could, in turn, impact on the reproductive rates of affected individuals.

11.293 The low frequency IEF is deemed to be of medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be medium.

Pinniped IEFs

Injury

11.294 The underwater noise assessment showed that the threshold for PTS for pinniped IEFs was not exceeded therefore the sensitivity is deemed to be negligible and is not discussed any further.

Disturbance

11.295 Unlike cetaceans, seals store energy in a thick layer of blubber, which means that they are more tolerant of periods of fasting when hauled out and resting between foraging trips, and when hauled out during the breeding and moulting periods. Therefore, they are unlikely to be particularly sensitive to short-term displacement from foraging grounds during periods of active piling. Juvenile seals may be more sensitive to displacement from foraging grounds due to a smaller body size and higher energetic needs. Therefore, seals have been assessed as having medium sensitivity to disturbance and resulting displacement from foraging grounds during pile-driving events.

11.296 Pinniped IEFs are deemed to be of medium vulnerability, high recoverability and international value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of the effect

Cetacean IEFs

Injury

11.297 Overall, the magnitude of the effect for all cetacean IEFs to injury is deemed to be negligible, and the sensitivity is considered to be high. The effect will therefore be of minor (adverse) significance, which is not significant in EIA terms.

Disturbance

11.298 Overall, the sensitivity of all cetacean IEFs is considered to be medium and the magnitude is deemed to be low. The effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.

Pinniped IEFs

Injury

11.299 Overall, the sensitivity of all pinniped IEFs to injury is considered to be medium and the magnitude of the effect is deemed to be negligible. The effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.

Disturbance

11.300 Overall, the sensitivity of all pinniped IEFs is considered to be medium and the magnitude is deemed to be low. The effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.

Collision risk from increased vessel traffic

Magnitude of impact

11.301 Existing shipping activity from Scrabster Harbour, based on data provided by Marine Scotland's National Marine Plan Interactive (NMPI) portal can be seen in Table 11.20 below.

Table 11.20: Vessel activity associated with Scrabster Harbour based on AIS data from 2012 - 2015 provided by Marine Scotland's NMPI portal

Type of vessel	Average weekly density 2012-2015 (time aware)
Passenger	20 – 50 transits
Non-port service craft	2 – 10 transits
Military or law enforcement	2 transits or less
High speed craft	0
Fishing	20 – 50 transits
Vessels engaged in dredging or underwater operations	5 – 20 transits
Cargo	10 -20
All vessel types	**50 – 150 transits**

11.302 Marine mammal collision (ship strike) is well documented, particularly in busy ports and harbours, and collision is a known cause of injury and mortality in marine mammals (Laist *et al*., 2001). Increased vessel traffic during the construction phase presents an increased risk of marine mammals colliding with vessels. Wilson *et al*., (2007) identifies the main drivers in influencing the number and severity of strikes as a result of shipping as:

- Vessel type and speed;
- High levels of ambient noise resulting in difficulty in detection of approaching vessels;
- Weather conditions and time of navigation affecting the ability of crew to locate marine mammals; and
- Marine mammal behaviour, which is species-specific (but appears to affect juveniles and sick individuals more often than animals in good health as juveniles are inexperienced in how to respond to ship presence and sick animals may be unable to remove themselves from an impact situation and may be less able to recover).

11.303 Vessels travelling at 7 ms^{-1} (13.7 knots) or faster are those most likely to cause death or serious injury (Wilson *et al.,* 2007). Vessels involved in the construction phase are likely to be predominantly barges, operating in either the intertidal area for dredging, or to the outside of the existing pier for piling. These vessels will predominantly be stationary during construction or when travelling, moving at considerably slower speeds than this. There is expected to be a maximum of three vessels involved in the installation of piles and a maximum of six vessels (including split hopper barges) involved in dredging and disposal phase at any one time (see Table 11.21 for details), and the likely impact is expected to be intermittent and limited to periods of vessel movement.

Table 11.21: Vessels involved in construction phase of the proposed redevelopment (maximum likely).

Vessel type	Likely Vessel Speed	Number of vessels (maximum likely)
Piling operations		
Work barge	Towed by tug	1
Work / safety boat	Approx. speed 7-10 knots	1
Supply barge	Approx. speed 8-10 knots	1
Tug	Approx. speed 8-11 knots	4
TOTAL		**4**
Dredging operations		
Dredger	Approx. speed 8 knots	1
Split hopper barges	Approx. speed 8-10 knots	3
Tug	Approx. speed 8-11 knots	1
Work/survey vessel	Approx. speed 7-10 knots	1
TOTAL		**6**

11.304 Where possible, all vessels involved in construction will follow the Scottish Marine Wildlife Watching Code: A Guide to Best Practice to Watching Marine Wildlife (SMWWC), when manoeuvring around marine mammals, which will help to mitigate against any potential collision effects.

11.305 Therefore, although Scrabster would not be considered to be a busy harbour, collision risk is still expected to be lower than that posed by commercial shipping activity and the magnitude is considered to be minor.

Sensitivity of receptor

11.306 Vessel strikes are known to be a cause of mortality in marine mammals although the greatest risk is usually from fast moving vessels. Whilst vessel strikes can occur for any species of marine mammals, evidence from the literature suggests that large vessels (> 80 m in length) travelling at speeds in excess of 14 knots may represent the greatest threat (Laist *et al*., 2001). Context is also an important factor in assessing risk; marine mammals at rest or feeding may be more vulnerable and there may be seasonal differences in times of peak habitat use (Panigada *et al*., 2006).

11.307 Although all vessels involved in the construction phase of the proposed redevelopment will be slow-moving or stationary, and the abundance of all IEFs within the vicinity of the proposed redevelopment is low, any vessel collision would be permanent in nature, and irreversible.

11.308 All marine mammal IEFs therefore are deemed to be of medium vulnerability, low recoverability and of either international or national value. The sensitivity of all marine mammal receptors is therefore considered to be medium.

Significance of the effect

11.309 The magnitude of the impact for all marine mammal IEFs is deemed to be minor and the sensitivity is considered to be medium. The effect will therefore be of minor (adverse) significance, which is not significant in EIA terms.

Increases in suspended sediment concentration (SSC)

11.310 Marine mammals use vision to navigate in their environment, detect prey and avoid obstacles. Increases in SSC arising from construction activities may affect marine mammals through visual impairment.

Magnitude of impact

11.311 Relevant parameters of the proposed redevelopment are detailed in 11.175 and are therefore not reiterated here.

11.312 No significant adverse effects on fish and shellfish were predicted from increases to SSC and it is likely that the noise and vessel presence associated with the activities causing the increase in SSC will displace marine mammals away from the core affected zone (see Table 6.3 in EIAR Volume II, Appendix 11.1: Underwater Noise Assessment for potential radius of disturbance). The potential impact for all marine mammal IEFs therefore, is predicted to be of local spatial extent, short duration, intermittent (short-term individual operations) and reversible. The magnitude is therefore considered to be negligible.

Sensitivity of receptor

11.313 Marine mammals regularly occur in turbid environments and therefore are adapted to finding prey in such conditions. Marine mammals forage through the diel cycle and can therefore successfully forage in low light conditions, including at night. Most marine mammals rely on vision however to some extent: the large forward pointing eyes of seals gives them binocular vision and suggests that this is an important sense for detecting prey.

11.314 The use of echolocation by HF and MF cetaceans enables these species to locate prey that is out of sight. Prey capture may be more difficult for non-echolocating species, such as seals, in turbid environments. Most marine mammals, however, have an acute sense of touch. Seals and otters possess sensitive muzzles with vibrissae or sensory whiskers that these species use to detect prey items either through direct contact or due to receiving vibrations in the water column (Denhardt *et al*., 2001). Minke whale also use vibrissae to sense their prey and olfactory receptors may also be important in detecting prey. These senses are also used to navigate in the marine environment, allowing animals to avoid obstacles if undetected using their visual sense.

11.315 In general, since light is limited in the marine environment, most marine mammals use their hearing, and other sensory modalities, including touch, instead of sight, to gain information about their environment.

11.316 All marine mammal IEFs therefore are deemed to be of low vulnerability, high recoverability and of either international or national value. The sensitivity of the receptor is therefore, considered to be low.

Significance of the effect

11.317 The magnitude of the impact for all marine mammal IEFs is deemed to be negligible and the sensitivity is considered to be low. The significance of the effect will, therefore, be of minor (adverse) significance, which is not significant in EIA terms.

Accidental pollution release

11.318 Accidental release of pollutants from vessels during construction or from installation of a fuel line may have a negative effect on marine mammals. Pollutants include diesel oil, sewage discharge, vessel antifouling biocides and leachates from cement and/or grouts used in construction. Although marine mammals are highly mobile with the ability to detect and thus avoid pollutants in the marine environment, general concerns with regards to spills are:

- Ingestion of contaminated prey;
- Potential irritation of skin and eyes;
- Inhalation of toxic fumes; and
- Abandonment of polluted feeding or breeding habitat (Clapham *et al.,* 1999).

Magnitude of impact

11.319 Details on the magnitude of the impact are provided in 11.193 *et seq.* and are not re-iterated here. In addition, it is likely that the noise and vessel presence associated with construction activities will result in displacement of marine mammals from the area where a pollution release could occur. The magnitude of the impact is therefore considered to be negligible (adverse).

Sensitivity of receptor

11.320 Release of contaminants into the water column may lead to direct impacts on marine mammals through ingestion, inhalation or absorption through the skin, and potentially longer-term indirect impacts from bioaccumulation in the food chain. Seals are likely to be more vulnerable to the effects of pollution than cetaceans because of their reliance on terrestrial sites for resting, moulting and pupping. Of particular concern would be the contamination of the coastal waters of the north Caithness coast, where grey and harbour seal haul-out in large numbers. Seal pups entering the water would be particularly vulnerable as oil residues can reduce the thermal properties of neonate animals, increasing their susceptibility to hypothermia (Jenssen, 1996).

11.321 Waterborne hydrocarbon contaminates could adhere to and foul the baleen plates of minke whales as they surface. Fouling is likely to be short-term but ingestion of contaminated food may have longer term consequences for the health of individuals. The release of crude oil is also a serious concern for all marine mammals as the inhalation of toxic, volatile compounds would lead to mortality.

11.322 Whilst seals and cetaceans are highly mobile, and capable of detecting surface slicks in open water, the more extensive the slick, the more likely that an animal will surface within it (Geraci and St. Aubin, 1990).

11.323 Cetacean IEFs are deemed to be of low vulnerability, high recoverability and of either international to national importance and therefore their sensitivity is considered to be low.

11.324 Harbour and grey seal IEFs, whilst able to avoid any minor spill events at sea, may be more vulnerable to the accumulation of pollutants at haul-out sites. They are therefore deemed to be of medium vulnerability and medium recoverability and therefore their sensitivity is considered to be medium.

Significance of effect

11.325 The magnitude of the impact is deemed to be negligible and the sensitivity of the receptors is considered to be low to medium. The likelihood of a loss of a large fuel inventory from a vessel is deemed extremely rare and the effect will, therefore, be of negligible significance, which is not significant in EIA terms.

Mitigation & Monitoring

11.326 Due to the presence of migratory fish, specifically Atlantic salmon smolts, restrictions on construction times (specifically piling) are proposed. Smolts are known to be present within Thurso Bay in April and May and have been identified as risk from underwater noise, including potential behavioural effects on migrating smolts. Restrictions proposed are:

- During piling operations, soft starts will be used, with lower hammer energies used at the beginning of the piling sequence before increasing energies to the higher levels. This will reduce the potential for injury and will reduce behavioural effects on fish and marine mammals.
- Avoiding major night time operations (particularly impact piling) during peak salmon migration period in April and May to ensure salmon are not impeded during their most active time.

11.327 In the event that a European Protected Species licence (EPS Licence) is required for construction phase, an EPS Supporting Information Document has been included as EIAR Volume II, Appendix 11.3 to demonstrate that there would be no effect on the Favourable Conservation Status (FCS) of European Protected Species (EPS) likely to occur in the Redevelopment area.

11.328 No future monitoring is recommended.

11.5 Assessment of Operational Effects

11.329 As for construction section but relating to effects during the operational phase e.g. effects associated with operational traffic.

Benthic Ecology

Accidental pollution release

Magnitude of impact

11.330 During the operational phase, the quantities and types of material that might conceivably enter the marine environment are limited to spills relating to vessels utilising the St. Ola Pier, including the transfer of fuel to vessels.

11.331 A stated in the assessment of construction impacts (see 11.193) the magnitude of this impact is entirely dependent upon the quantities of the spillage, the dilution and dispersal properties of the waters and the bio-availability of the contaminant to species. The more toxic components of fuel spills are volatile and relatively short-lived. Heavier hydrocarbons, while less toxic, may persist for longer in the marine environment. However, any spill or leak within the would be immediately diluted and rapidly dispersed.

11.332 During the operational phase, a fuel pipe will be required to service vessels on the St. Ola Pier. The pipeline will be provided for the import of fuel to hold in storage for subsequent export (refuelling of vessels). Only import or export activity permitted at one time. The pipeline will be installed via one of two options:

- Routed from the existing fuel supply at Jubilee Pier, via either:
  - Along the seabed within the inner berth directly on to the St. Ola Pier; or
  - on to the seabed to the root of the opposite Ice Pier and behind the existing ferry terminal building on to St. Ola Pier.
- Routed from a new tank(s) proposed for the reclamation area, across land onto St. Ola Pier.

11.333 The fuel pipe to be installed will be a maximum of 580 m in length and 0.25 m in diameter.

11.334 The fuel pipeline will have a maximum import delivery capacity of 500m^3/hr and a maximum export delivery capacity of 150m^3/hr.

11.335 Whilst vessel movements during the operational phase will likely increase from existing levels, the Harbour Oil Spill Contingency Plan (OSCP) will be updated to incorporate relevant pollution measures for operation of the St. Ola Pier and for the fuel pipe from the Jubilee Pier to St. Ola Pier. Therefore, the magnitude of the impact is not expected to differ from the magnitude of the impact of the construction phase and the magnitude of the impact is therefore considered to be negligible.

11.336 The potential impact of accidental pollution from operational activities is therefore predicted to be of local spatial extent, short term duration, intermittent and reversible. The magnitude is therefore considered to be negligible.

Sensitivity of the receptor

11.337 The sensitivity of benthic ecology IEFs to accidental pollution has been described in section 11.197 *et seq.* and is not reiterated here. The sensitivity of all benthic ecology receptors is therefore considered to be high.

Significance of the effect

11.338 The magnitude of the impact for all benthic ecology receptors is deemed to be negligible and the sensitivity of the receptor is considered to be high. The significance of the effect will therefore, be of minor (adverse) significance, which is not significant in EIA terms.

Fish and Shellfish

Accidental pollution release

Magnitude of impact

11.339 The magnitude of the impact is described in section 11.193 *et seq.* and is not reiterated here. Therefore, the magnitude is therefore considered to be negligible (adverse).

Sensitivity of receptor

11.340 The sensitivity of fish and shellfish IEFs to accidental pollution has been described in section 11.250 *et seq.* and is not reiterated here. The sensitivity of all fish and shellfish IEFs is therefore considered to be high.

Significance of the effect

11.341 The magnitude of the impact for all fish and shellfish IEFs is deemed to be negligible and the sensitivity of the receptor is considered to be high. The significance of the effect will therefore, be of minor (adverse) significance, which is not significant in EIA terms.

Marine Mammals

Accidental pollution release

Magnitude of impact

11.342 The magnitude of the impact is described in section 11.193 *et seq.* and is not reiterated here. The magnitude for all marine mammals IEFs is therefore considered to be negligible.

Sensitivity of receptor

11.343 The sensitivity of the receptors in the operational phase is not expected to differ from the sensitivity of receptors of the construction phase. An assessment of sensitivity is given in section 11.320 *et seq.* and is not reiterated here. The sensitivity of all marine mammal IEFs is therefore considered to be medium.

Significance of the effect

11.344 The magnitude of the impact for all marine mammal IEFs is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The significance of the effect is therefore considered to be minor (adverse) significance, which is not significant in EIA terms.

Mitigation & Monitoring

11.345 No further mitigation is proposed for the operational phase of the proposed redevelopment.

11.346 No future monitoring is suggested.

Potential Changes to the Assessment as a Result of Climate Change

It is important to consider predicted effects of climate change to baseline conditions for the duration of the proposed redevelopment, and whether any future changes would result in a change to any of the assessments for the proposed redevelopment's operational phase. Due to the nature and scale of the proposed redevelopment, future baseline conditions are not expected to change any of the assessments for the operational phase set out above.

11.6 Assessment of Cumulative Effects

11.347 This chapter considers and assesses the potential for cumulative effects arising from the proposed redevelopment in association with other developments.

11.348 The cumulative effects of a development refer to the way in which an environmental resource may be subject to a particular type of impact from more than one proposed development. The impacts from multiple projects may overlap or act in combination at a particular location or upon a particular resource, thereby leading to more significant environmental impacts than if the impacts were considered in isolation.

11.349 The EIA Directive 2014/52/EU specifies in Annex III that "the likely significant effects of projects on the environment must be considered […] taking into account [*inter alia*] the cumulation of the impact with the impact of other existing and/or approved projects"; and at Annex IV that "a description of the likely significant effects of the proposed redevelopment on the environment resulting from, inter alia […] the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources" is required.

11.350 This obligation is mirrored in Schedule 4 to The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

Methodology

11.351 The following guidelines and publications were considered when determining the other projects to be considered for their potential to generate cumulative effects with the proposed redevelopment:

- Scottish Natural Heritage Environmental Impact Assessment Handbook (v5) (2018);
- Scottish Government Planning Circular 1/2017: Environmental Impact Assessment Regulations (2017);
- The Planning Inspectorate Advice Note 17: Cumulative Effects Assessment (2015); and
- European Commission (EC) Guidelines for the Assessment of Indirect and Cumulative Impacts (1999).

11.352 The first step in determining cumulative effects comprised the identification of a list of 'other projects which may have the potential to overlap with the proposed redevelopment based on available information.

11.353 Other projects and plans that have been considered as part of this cumulative assessment have been identified through a desk study involving general internet searches and in particular, scrutiny of consenting authority websites. The projects were either registered on the Highland Council planning website or MS LOT website, or are other developments that SHT have proposed. Other projects for which a development consent application has been submitted or consent granted were included. Potential future projects which have not submitted an application for consent were not included.

11.354 Those other projects whose impacts could foreseeably overlap with the construction or operation of the proposed redevelopment or where construction impacts may be consecutive but cumulative, were considered. The cut-off date for sourcing information on the other projects considered was 12 April 2019. Table 11.22 shows those projects which were considered as part of the desk study.

11.355 Five projects were identified to be included for further consideration at this stage, and information on works to be undertaken, and location of works was obtained. Those impacts which were considered to have the widest zone of impact and therefore potential for cumulative impacts were as follows:

- Underwater noise; and
- Increased suspended sediment concentration.

11.356 Based on the modelled zone of impacts for these impacts (see EIAR Volume II, Appendix 11.1: Underwater Noise Assessment and Chapter 9: Coastal Processes) for the proposed redevelopment, and the expected ZoI for these impacts under other considered project, it was deemed that there is no potential for spatial overlap, and therefore no potential for cumulative impact.

11.357 The significance of effect for all impacts at construction and operation phases is therefore not expected to differ from the predicted significance of effects, as reported in the Assessment of Construction Effects (section 11.160) or the Assessment of Operational Effects (section 11.329).

Table 11.22: List of other projects and plans considered for cumulative effects.

Project Title	Justification	Stage	Distance from project (km)	Temporal Overlap	Spatial Overlap	Included for further consideration?	Potential cumulative impact (construction phase) justification	Potential cumulative impact (operation phase) justification
Dounreay Trì Floating Wind Demonstration Project	Work yet to be undertaken	Post - determination	25	Yes	No	Yes	Screened out due to lack of spatial overlap of zone of impacts	Screened out due to lack of spatial overlap of zone of impacts
Katanes Floating Energy Park	Work yet to be undertaken	Pre-application	>25	Yes	No	Yes	Screened out due to lack of spatial overlap of zone of impacts	Screened out due to lack of spatial overlap of zone of impacts
Ness of Duncansby Tidal Array	Work yet to be undertaken	Pre-application	>25	Yes	No	Yes	Screened out due to lack of spatial overlap of zone of impacts	Screened out due to lack of spatial overlap of zone of impacts
MeyGen Tidal Energy	Work yet to be undertaken	Post-determination	25	Yes	No	Yes	Screened out due to lack of spatial overlap of zone of impacts	Screened out due to lack of spatial overlap of zone of impacts
Orkney-Caithness Link	Work yet to be undertaken	Early development	12	Yes	No	Yes	Screened out due to lack of spatial overlap of zone of impacts	Screened out due to lack of spatial overlap of zone of impacts

11.7 Residual Effects

- Benthic ecology receptors during the construction phase have the potential to be affected on a long-term timescale by permanent loss of habitat, and on a short-term timescale by temporary disturbance and loss of habitat, effects of increased SSC, and accidental pollution;
- No connectivity to sites designated for Annex I habitat have been identified;
- Fish and shellfish receptors during the construction phase have the potential to be affected on a long-term timescale by permanent habitat loss, and on a short-term timescale by effects of underwater noise, temporary disturbance and loss of habitat, effects of SSC and accidental pollution release;
- Potential connectivity to River Thurso SAC have been identified for Atlantic salmon;
- Marine mammal receptors during the construction phase have the potential to be affected on a short-term timeline by effects of underwater noise; collision risk; increases in SSC and accidental pollution release;
- Potential connectivity has been identified to Moray Firth SAC for bottlenose dolphin, Inner Hebrides and the Minches cSAC for harbour porpoise, Faray and Holm of Faray SAC and North Rona SAC for grey seal, and Sanday SAC and Dornoch Firth and Morrich More SAC for harbour seal.
- Overall, the assessment of construction effects has identified all impacts to be not significant in terms of EIA; the significance of effects for all impacts is considered to be of negligible or minor (adverse) significance;
- Overall, the assessment of operational effects has identified all impacts to be not significant in terms of EIA; the significance of effect for accidental pollution for all marine biodiversity receptors is considered to be negligible;
- Mitigation proposed to offset or reduce the likely impacts to marine biodiversity receptors during the construction phase includes the implementation of marine mammal mitigation under JNCC guidelines during piling operations; scheduling construction activities to avoid major night time operations (particularly impact piling) during peak salmon migration and employ soft start on piling (section 11.326); and implementation of pollution prevention measures to prevent impacts from accident pollution release;
- No monitoring is proposed for the proposed redevelopment in relation to marine biodiversity receptors;
- The potential for cumulative effects arising from the proposed redevelopment in association with other developments was considered. It was deemed that there is no potential for spatial overlap with projects in the vicinity of the proposed redevelopment and therefore the assessment of effects for the construction and operational phases of the proposed redevelopment is not expected to differ from the predicted significance of effects;
- The potential for inter-related effects on marine biodiversity receptors were considered; no potential marine biodiversity inter-related effects were identified;
- Predicted effects of climate change to baseline conditions for the duration of the proposed redevelopment were considered. Due to the nature and scale of the proposed redevelopment, future baseline conditions are not expected to change any of the assessments for the operational phase.

Table 11.23: Summary of Likely Environmental Effects on Marine Biodiversity.

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant
Permanent habitat loss	Negligible - low	Construction activities (including reclamation of land) will result in compete loss or severe modification to intertidal and subtidal marine habitats	Long term	Negligible	Minor (adverse)	Not significant
Temporary disturbance and loss of habitat	Low	Temporary works on the pier will potentially result in temporary disturbance and loss of habitat within the vicinity of Scrabster Harbour	Short term	Negligible	Minor (adverse)	Not significant
Effects of increased suspended sediment concentrations and potential contamination release	Low	Dredging of the seabed and preparatory works for pier redevelopment is likely to disturb seabed sediments, resulting in an increase of SSC, particularly affecting filter feeding organisms	Short term	Low	Minor (adverse)	Not significant
Accidental pollution release	Medium	Accidental spillages could potentially contaminate the marine environment, harming benthic receptors	Short term	Negligible	Negligible	Not significant
Effects of underwater noise arising from construction activities	Low – medium	Noise generated by piling activities has the potential to cause injury and/or disturbance to fish receptors	Short term	Low	Minor (adverse)	Not significant
Temporary disturbance and loss of habitat	Low - medium	Ancillary operation works such as entrenching of fuel and water pipelined, use of jack-up barge and pin piling could lead to temporary disturbance/loss of intertidal and subtidal marine habitat	Short term	Negligible	Negligible - minor	Not significant
Effects of increased suspended sediment concentrations	Low - high	Dredging of the seabed and preparatory works for pier redevelopment is likely to disturb	Short term	Minor (adverse)	Negligible – minor (adverse)	Not significant

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant
		seabed sediments, resulting in an increase of SSC, and potential physiological or behavioural disruption to fish and shellfish species				
Accidental pollution release	Low - high	Accidental spillages could potentially contaminate the marine environment, harming fish and shellfish receptors	Short term	Negligible	Negligible	Not significant
Effects of underwater noise arising from construction activities	Medium – high	Noise generated by piling activities has the potential to cause injury and/or disturbance to marine mammal receptors	Short term	Negligible	Minor (adverse)	Not significant
Collision risk from increased vessel traffic	Medium	Increased vessel traffic as a result of construction activities could lead to an increased risk of collision with marine mammals	Short term	Minor	Minor (adverse)	Not significant
Increases in suspended sediment concentration	Low	Dredging of the seabed and preparatory works for pier redevelopment is likely to disturb seabed sediments, resulting in an increase of SSC, and changes to prey species communities	Short term	Negligible	Negligible	Not significant
Accidental pollution release	Medium	Accidental spillages could potentially contaminate the marine environment, harming marine mammal receptors	Short term	Negligible	Negligible	Not significant
Accidental pollution release	Medium	Accidental spillages could potentially contaminate the marine environment, harming benthic receptors	Long term	Negligible	Negligible	Not significant
Accidental pollution release	Low - high	Accidental spillages could potentially contaminate the marine environment, harming fish and shellfish receptors	Long term	Negligible	Negligible	Not significant

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant
Accidental pollution release	Medium	Accidental spillages could potentially contaminate the marine environment, harming marine mammal receptors	Long term	Negligible	Negligible	Not significant

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12 TERRESTRIAL BIODIVERSITY AND ORNITHOLOGY

12.1 Introduction

12.1 This chapter assesses the potential impacts of the redevelopment of St. Ola Pier, Scrabster Harbour (the proposed redevelopment) on key ornithological and terrestrial ecological receptors. Key receptors refer to features of nature conservation importance including habitats, species and sites protected for their nature conservation value. These features have been characterised within and around the redevelopment site through the evaluation of a desk study and implementation of site-specific surveys. Subsequently, this chapter presents an assessment of the potential impacts of the redevelopment of the St. Ola Pier on key ecological receptors of conservation importance. Details of mitigation are also presented.

12.2 This chapter is accompanied by a Habitat Regulation Screening and Report to Inform Appropriate Assessment, at EIAR Volume II, Appendix 12.1.

12.2 Assessment Methodology

Planning Policy Context

12.3 The key policy and legislation relevant to Ornithology and Terrestrial Ecology are provided below:

- Scottish Planning Policy (SPP) (Scottish Government, 2014);
- The Council Directive on the Conservation of Wild Birds 2009/147/EC (European Union (EU) Birds Directive):
- The Council Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora 1992/43/EEC (EU Habitats Directive);
- Conservation (Natural Habitats, etc.) Regulations 1994 (as amended);
- The Wildlife and Countryside Act 1981 (as amended); and
- The Nature Conservation (Scotland) Act 2004 (as amended).

Relevant Guidance

12.4 This Chapter has been prepared taking account of the following guidance:

- Guidelines on Ecological Impact Assessment in the United Kingdom and Ireland, Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018); and
- A Handbook on Environmental Impact Assessment (Scottish Natural Heritage (SNH) 2013).

12.5 The Ecological Impact Assessment (EcIA) methods used within this chapter follow the principals and approaches detailed in CIEEM (2018). The significance of the effects that potential impacts

associated with the proposed redevelopment may have on ecological receptors is defined by correlating the magnitude of the impacts with the sensitivity of the particular ecological receptor under consideration.

Study Area

12.6 Due to the relatively small scale and limited extent of impact likely to be caused by the proposed work searches for marine marine/coastal and terrestrial International/European, National and Local designated sites was limited to a 2km buffer surrounding the proposed redevelopment site (the 'Study Area').

12.7 The predominant habitat of ecological interest is the marine area that lies within the harbour revetments, comprising of subtidal and intertidal zones which represent favourable foraging conditions for seabirds.

12.8 Ornithological field surveys were conducted within a 500m buffer of the proposed redevelopment site (the 'Study Site') to encompass all tidal and subtidal habitats suitable for seabird use. In addition, due to the proximity of sea cliffs to the north of the proposed redevelopment an investigation of the suitability of nesting habitat for peregrine was undertaken out to a buffer of 1000m.

12.9 The harbour wall revetments comprise of corrugated iron sheeting along their entire length, providing no ledges, and therefore no nesting habitat that is considered optimal for seabird breeding.

12.10 The terrestrial components of the site comprise of a combination of industrial areas associated with the harbour, mainly hardstanding for vehicle loading and parking, commercial buildings and offices. Inland of the harbour the land rises to the north and west and comprises steep-sided grassy embankments and low cliffs, with agricultural land above (comprising improved grassland).

12.11 Between St. Ola Pier and Queen Elizabeth Pier is an area of rock armour aggregate running along the shoreline that is unconsolidated, providing prospective resting places in the crevices for otter.

12.12 Due to the absence of a diverse habitat mosaic and limited presence of habitat suitable for supporting protected terrestrial species, surveys were targeted entirely on ascertaining the presence of features that could be of importance to otter. The survey area for the otter walkover was limited to within a 200m buffer of the redevelopment site incorporating all suitable habitat above the mean high water (MHW) level of the intertidal zone.

Baseline Methodology

Desk based study

12.13 An ecological desk study was undertaken of the area using the sources listed below:

- Multi-Agency Geographical Information for the Countryside (MAGIC) (https://magic.defra.gov.uk/magicmap.aspx)
- Scottish Natural Heritage SiteLink (https://sitelink.nature.scot/)
- Scotland's Environment Web (https://map.environment.gov.scot/sewebmap/)

Field Surveys

12.14 Ornithological surveys used a standard count method (hereafter referred to as 'birds on the water') agreed by SNH, to identify birds foraging in tidal habitats present within the Study Site. Surveys were undertaken throughout the breeding season (late-March - July) when foraging bird abundance is at its peak due to chick provisioning.

12.15 Birds on water surveys were undertaken monthly in all sea and tidal states, with a total of three visits per month. Each visit consisted of five scans of the survey area at 15-minute intervals, three scans from the tip of St. Ola pier and two from on the top of the steep banking situated to the north of the Study Site overlooking the harbour.

12.16 The area surveyed encompassed all water within a 500m buffer at a 360-degree radius from the tip of St. Ola pier.

12.17 At each 15-minute interval the viewshed (i.e. visible area within which bird observations were recorded) was scanned systematically for birds present on the water; birds in flight were not recorded unless plunge feeding (i.e. diving into the water from on the wing rather than the surface). Once a bird was located it was observed for a short period of time to identify the species, behaviour and location. This information was then transcribed on a survey map and the process repeated until all visible birds on the water were recorded. Each scan generally took 5-10 minutes at which point the surveyor waited for the time until the start of the next interval had elapsed before making any further records.

12.18 Field surveys conducted to ascertain otter presence followed Common Standards Monitoring Guidance (2004), comprising of a standard walkover survey carried out by two qualified ecologists intensively searching all suitable habitat for signs of otter presence including: spraint, footprints, and feeding.

Consultation

12.19 Following scoping and pre-application consultation responses relevant to ornithology and terrestrial ecology were received from Highland Council Coastal Planner, and SNH, a summary of which is provided in Table 12.1.

Table 12.1: Consultation Responses Relevant to this Chapter

Date	Consultee and Issues Raised	How/ Where Addressed
24th July 2018	Highland Council Coastal Planner An assessment of the impact of piling and construction noise on marine mammals (e.g. porpoise) and migratory fish species (Atlantic Salmon, and feature of the nearby The River Thurso SAC). Close proximity of the work to Caithness Cliffs SPA may require an Appropriate Assessment; SNH can advise.	An assessment of the impact on marine species will be covered in Chapter 11. See SNH consultation response below.
13th August 2018	Scottish Natural Heritage Protected Areas - advise the following protected areas scoped into the EIA: Moray First SAC, Sanday SAC, Faray & Holm SAC, The River Thurso SAC. Ornithology - proximity to North Caithness Cliffs SPA (200m) designated for nesting seabirds and peregrine falcon has the potential to be impacted by noise, sedimentation and pollution. The scope of ornithological surveys was deemed satisfactory, however, further information required to demonstrate no adverse effect on the SPA's integrity due to the previously mentioned potential impacts. It is also noted that the adverse effects could be prevented through mitigation measures. Furthermore analysis and assessment of the following will be required within the ER: dumping and disposal of material - its volume and composition; increased disturbance and discharge caused by changes in the nature and type of vessel activity; and cumulative impact of other developments (e.g. MeyGen tidal stream energy project). Marine Biodiversity - the key issues and the scope of the EIA identified within the scoping report was largely agreed with. Further additional advice given on various issues. European Protected Species, Otter - proposal to undertake otter survey welcomed. Mitigation should be implemented if impacts to otter are identified European Protected Species, Cetaceans - a full assessment of any potential impact on cetaceans undertaken as part of the EIA, and mitigation measures of any identified impacts outlined in a Marine Mammal Protected Plan (MPP). Nationally Protected Species, Basking Sharks - an assessment of the potential impacts on this species should be undertaken as part of the EIA, and mitigation measures outlined in a MPP.	Effects on the SACs listed have been assessed in Chapter 11: Marine Biodiversity. The potential for effects from the listed activities on birds has been considered in paragraphs: 12.72-12.85 Noise; 12.68-12.69 Sedimentation; and 12.110-12.114/12.120-12.130 Pollution. Noted. Mitigation is considered in section 12.48-12.50. Assessment of effects on cetaceans is considered in Chaper 13 Marine Ecology. As above. .

Assessment Criteria and Assignment of Significance

Receptor Sensitivity

12.20 Determining the sensitivity of ecological receptors within the Study Area is undertaken in a systematic way using criteria that determine their importance. The approach to determining the nature conservation level of each receptor is outlined in Table 12.2 with the scale of sensitivity being classed as 'Low', 'Moderate', or 'High'.

12.21 When assigning a level of sensitivity to each receptor, their distribution and status, including a consideration of trends based on available historical records, are considered. Rarity is considered because of its relationship with threat and vulnerability, although rarity in itself is not necessarily an indicator of sensitivity. A species that is rare and declining will be assigned a higher level of importance than one that is rare but known to be stable.

Table 12.2: Definitions of sensitivity

Sensitivity	Geographic Frame of Reference	Typical Descriptors
High	International	Species that form part of the cited interest within an internationally protected site, such as those designated under the Birds (e.g. SPAs) or Habitats Directives (e.g. SACs) or other international convention (e.g. Ramsar site). A feature (e.g. population) which is either unique or sufficiently unusual to be considered as being one of the highest quality examples in an international/ national context, such that the site is likely to be designated as a site of European importance (e.g. SPA or SAC).
	National	Species that form part of the cited interest within a nationally designated site, such as a SSSI or NNR. A feature (e.g. population) which is either unique or sufficiently unusual to be considered as being one of the highest quality examples in a national/ regional context for which the site could potentially be designated as a SSSI. Presence of SBL species, where the action plan states that all areas of representative habitat or individuals of the species should be protected.
Moderate	Regional	Species that form part of the cited interest of a LNR, or some local-level designated sites depending on specific site conditions. A feature (e.g. population), which is either unique or sufficiently unusual to be considered as being of nature conservation value in a regional context. Presence of LBAP species, where the action plan states that all areas of representative individuals of the species should be protected, or Red-listed UK Birds of Conservation Concern (BoCC).
Low	Local	Species that form part of the cited interest of a local-level designated site and may be designated as a non-statutory Site of Importance for Nature Conservation or the equivalent, e.g. Local Wildlife/Countryside Site, Ancient Woodland designation. A feature (e.g. population) that is of nature conservation value in a local context only, with insufficient value to merit a formal nature conservation designation.

Magnitude of Impact

12.22 The magnitude of impacts is determined through understanding how each ecological receptor responds to the activities associated with the proposed redevelopment. The elements used to define the magnitude of impacts include:

- Duration: whether particular impacts/activities will occur in the short-term (<5 years), medium-term (5-15 years) or long-term (15-25 years or longer);
- Timing: such as if impacts/activities occur during critical life-stages or seasons (e.g. bird nesting season);
- Frequency: the number of times an impact/activity occurs could influence the resulting effect which could affect foraging or breeding success and energy expenditure with knock-on effects on individuals' ability to survive;
- Extent: the spatial or geographical area over which the impact/effect may occur; and,
- Reversibility: whether the effects will be reversible in the short to medium term.

12.23 The magnitude of potential impacts associated with the proposed redevelopment was defined using the criteria presented in Table 12.3

Table 12.3: Definitions of magnitude

Magnitude	Typical Descriptors
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse). Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse). Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse). Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse). Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Significance of Effects

12.24 Effects are classified as either direct or indirect. Direct effects are those such as habitat loss and noise disturbance to ecological receptors. Indirect effects include displacement from potential foraging areas through disturbance impacts or physical loss or disruption of foraging resources.

12.25 As mentioned above, the significance of effects is defined by relating the sensitivity of the particular ecological receptor (as defined in Table 12.2) with the magnitude of the impacts arising from the proposed redevelopment (as defined in Table 12.3). Consideration of the receptor sensitivity and the magnitude of potential impacts will determine an outcome for the residual effects (both positive and negative) following application of mitigation as demonstrated in the matrix shown in Table 12.4.

12.26 Through the broad application of the matrix approach, some combinations of receptor sensitivity and impact magnitude result in dual outcomes (i.e. minor/moderate or moderate/major). In such cases, the final outcome of effect significance is determined by applying professional judgement based on the information used to inform the matrix-based assessment.

Table 12.4: Significance of effect assessment matrix

Sensitivity	Magnitude of Impact			
	Negligible	**Low**	**Medium**	**High**
Negligible	Negligible	Negligible or minor	Negligible or minor	Minor
Low	Negligible or minor	Negligible or minor	Minor	Minor or moderate
Medium	Negligible or minor	Minor	Moderate	Moderate or major
High	Minor	Minor or moderate	Moderate or major	Major

Consideration of Valued Ecological Receptors

12.27 A preliminary list of Valued Ecological Receptors (VERs) to be considered within the impact assessment was selected based upon the following:

- Statutory and non-statutory designated sites of nature conservation importance, as defined in in the Baseline Environmental Section below, located within the Study Areas and their associated qualifying interests;
- Legally protected species under the Wildlife and Countryside Act 1981 (as amended) (excluding common breeding birds) and/or the Conservation (Natural Habitats, etc.) Regulations 1994 (as amended);
- Bird species listed on Annex 1 of the EU Birds Directive;
- Qualifying and assemblage species of the North Caithness Cliffs SPA;
- Red-listed bird species of conservation concern (BoCC) (Eaton et al. 2015); and/or,

- Species identified on the Scottish Biodiversity List

12.28 Ecological receptors which met one or more of the above criteria, and which were identified as being associated with the proposed redevelopment (e.g. via the desk study and/or field surveys), formed the preliminary group of VERs for this assessment.

12.29 The aim of the EIA is to report on significant effects, rather than every conceivable effect. Therefore, selected VERs were scoped out of the assessment where baseline desk study and survey results showed significant effects were not likely to occur (for example if there was no connectivity to designated sites, no breeding was recorded, the number of individuals recorded was extremely low in relation to their relevant reference populations, and/or site usage was rare). Consequently, such impacts do not require assessment under the terms of the EIA Regulations and SNH (2006) guidelines. The resulting list of receptors is shown in Table 12.5.

Table 12.5: Sensitivity of Receptors

Receptor	Sensitivity	Scoped In/Out	Qualification
North Caithness Cliffs SPA	High	In	Internationally designated (Nature 2000) site the boundary of which is approximately 400m from the proposed redevelopment site. This site is desinated for supporting large populations of seabirds that utilise the tdal habitats within the Study Area for foraging.
Common Guillemot Kittiwake Razorbill Atlantic Puffin	High	In	Qualifying/assemblage interest of the North Caithness Cliffs SPA that were recorded within the Study Area during birds on the water surveys
Peregrine Falcon	High	Out	Qualifying interest of the North Caithness Cliffs SPA but not recorded during birds on water surveys, and nearest suitable nesting habitat identified to be 660m away.
Arctic Tern Black-headed Gull Common Gull Common Tern Common Scoter Greater-black Backed Gull Great Crested-grebe Herring Gull Great Skua Great Northern Diver Red-troated Diver Shag	Moderate	Out	Schedule 1 protected, Red-listed and/or SBL species recorded during birds of the water surveys, but recorded in low numbers compared to the species' breeding populations
Otter	Low	In	European proteced species for which suitable resting habitat exists within the Study Area, but no signs recorded of regularly used resting or couch sites.

Limitations of the Assessment

12.30 There are no significant limitations to the assessment, in light of the combination of desk study and survey data on which to base the assessment (and Habitat Assessment Appraisal (HRA) in EIAR Volume II, Appendix 12.1). RPS, who undertook the ornithology and ecology work for this Chapter have considerable expertise in assessing the effects of port development. In addition, the team also has particular experience in this part of the Scottish coast, for example having completed all the ornithological surveys for the MeyGen Tidal Array development in the Pentland Firth.

12.3 Baseline Environment

Desk Study

Statutory Designated Sites

12.31 There is one coastal/marine statutory International/European designated site within the Study Area, namely North Caithness Cliffs SPA.

12.32 There are no National or Local Nature Reserves within the Study Area.

North Caithness Cliffs SPA

12.33 The North Caithness Cliffs SPA covers an area of 557.73 ha comprising of five discrete areas situated between Duncansby Head to the east and Red Point to the west, and the area around the small Island of Stroma ca 3km from the coastline. The cliffs are made up of red sandstone and are generally 30-60m high, rising to 120m at Dunnet Head, providing important nesting habitat for seabird colonies, especially gulls and auks. The cliffs also provide nesting sites for peregrine falcon.

12.34 This area is designated under the EU Birds Directive (2009/147/EC) due to its importance for breeding birds. Specifically, the site qualifies under Article 4.1 of the directive by supporting breeding peregrine (6 pairs, 0.5% of the Great Britain (mid-1990s) population. It also qualifies under Article 4.2 of the Directive by regularly supporting breeding guillemot (26,994 pairs, representing at least 1.2% of the breeding east Atlantic population (1987 count), and a breeding seabird assemblage regularly supporting 110,000 individual seabirds, including puffin, razorbill, kittiwake, fulmar and guillemot.

12.35 In addition, the North Caithness Cliffs SPA incorporates Holborn Head SSSI, a site of national importance designated under the Wildlife and Countryside Act 1981 (as amended), notified for both geological and maritime habitat features.

Non-statutory Designated Sites

12.36 There are no non-statutory designated sites (e.g. Local Wildlife/Countryside Sites) located within the Study Area.

Seabird Counts at North Caithness Cliffs SPA Report

12.37 As part of applications for tidal wave energy projects on the east coast of Scotland and within the Pentland Firth, SNH was commissioned to provide up-to-date populations estimates for complete colony counts at the North Caithness Cliffs SPA. The densities recorded have been used in this

EIA as reference populations with which the densities of foraging birds present within the Study Area can be compared.

12.38 The five discrete areas of the SPA were split into 16 sections and counted over two breeding seasons in 2015 and 2016. All sections were surveyed from a boat, in suitable weather conditions by experienced seabird counters, with some sections also being surveyed from the land.

12.39 The surveys identified varying densities of SPA qualifying species throughout the five discrete areas. The section directly adjacent to the redevelopment site, Holborn Head SSSI, displayed in Table 12.6.

Table 12.6: Densities of seabirds across the North Caithness Cliffs SPA

	FU	SA	GB	HG	LB	KI	GU	RA	PU	AE
North Caithness Cliffs SPA	13405	170	68+	232+	2	5568	38863	3503	3053	3
Duncansby Head SSSI	4888	35	2	31	0	584	19177	1713	18	0
Stroma SSSI	1665	42	38	35	2	137	7008	549	17	0
Dunnet Head SSSI	4003	20	8	5	0	2015	9669	561	1604	0

Key:- FU: Fulmar. SA: Shag, GB: Great black-backed Gull, HG: Herring Gull, LB: Lesser black-backed Gull, KI: Kittiwake, GU: Common Guillemot, RA: Razorbill, PU; Puffin, and AE; Arctic Tern

Site Specific Ornithological Surveys

12.40 A total of 11 birds on the water surveys were undertaken during the 2018 breeding season to determine the density, behaviour and distribution of seabirds using the tidal habitats within Scrabster Harbour.

12.41 There were 1935 individual records made throughout the surveys, representing a total of 18 species. The results of the surveys are presented in Table 12.7.

Table 12.7: Birds on water results across all surveys. Reference populations were taken from the North Caithness Cliffs SPA citation and Seabird Counts at North Caithness Cliffs SPA in 2015 and 2016 for Marine renewables Casework report.

Species	North Caithness Cliffs SPA Qualifier	Highest Peak Count (Single Scan)	Mean Peak Count	Reference Population	Mean Peak Count % of Reference Population
Arctic tern	No	2	0.5	3	3.3
Black-headed gull	No	12	1.6	*	*
Common gull	No	11	1.5	*	*
Common tern	No	1	0.1	*	*
Common scoter	No	1	0.3	*	*
Eider	No	25	6.5	*	*
Great black-backed gull	No	3	1.3	*	*
Great crested grebe	No	2	0.2	*	*
Common guillemot	Yes/Assemblage	41	12.1	38300	0.03
Herring gull	No	82	13.7	232	5.9
Kittiwake	Assemblage	4	0.8	13100	0.006
Great skua	No	1	0.2	*	*
Great northern diver	No	1	0.1	*	*
Puffin	Assemblage	1	0.1	2080	0.005
Razorbill	Assemblage	33	6.8	4000	0.2
Red-throated diver	No	1	0.2	*	*
Shag	No	5	2.2	170	1.3
Black guillemot	No	15	7.5	*	*

Key:- * no reference population avaiable.

12.42 Of the 18 species recorded guillemot was the only SPA qualifying species of the North Caithness Cliffs SPA. Three species were assemblage qualifying species namely: kittiwake, puffin and razorbill.

12.43 Investigation of suitable peregrine nesting habitat within the North Caithness Cliffs SPA identified no suitable habitat within 660m of the proposed redevelopment site. No peregrine or nests were observed during any surveys.

Site Specific Otter Survey

12.44 An otter survey was undertaken on the 07/03/2019. Four otter signs were identified and recorded during the survey, all of which were spraint in a significantly degraded condition, showing signs of having been there a considerable amount of time.

12.45 The spraints were all located in the crevices of the rock armour between St. Ola Pier and Elizabeth Pier. The unconsolidated rock armour provided an abundance of large gaps along its length between the aggregate providing otter with resting sites while foraging.

12.46 There was no further sign of otter identified within a 200m buffer of the redevelopment site.

Future Baseline Conditions

12.47 The baseline conditions for terrestrial habitats or otter presented in this chapter are not considered to have the potential for significant change within the timeframe of the proposed redevelopment.

12.48 The baseline conditions for breeding seabirds in the area have experienced significant change over time and therefore can be expected to continue to vary. Changes to the benthic habitats, fish and shellfish (on which birds depend) have been considered in Chapter 11 - Marine Ecology (see 11.147 to 11.153). Breeding numbers of seabirds in the North Caithness Cliffs SPA and more widely have been in general long-term decline (at regional, national and UK scales), with some recent stabilisation or recovery. The numbers of seabirds recorded within the study area is very low however, and peripheral to the main SPA breeding colony locations, so future baseline conditions in this locality are not anticipated to change significantly within the timeframe of the proposed redevelopment. It is therefore likely that Scrabster Harbour and its immediate surroundings will continue to provide shelter, foraging and roosting habitat for a small number of breeding seabirds.

12.4 Impact Assessment

12.49 The Scoping responses highlighted the potential impacts which stakeholders wanted to be assessed. These impacts are listed in Table 1.1 and related to construction and operation of the proposed redevelopment. Chapter 2: Project Description provides a detailed description of the construction work and operational activities, but for ease of reference, a summary is provided below.

Construction

12.50 St. Ola Pier is to be partially demolished with the existing structure being encapsulated within the extent of the new pier. The demolition work will be achieved by means of an excavator mounted rock breaker, concrete sawing, explosive or a combination of these methods.

12.51 The new pier wall to be constructed around the existing pier will likely comprise of steel combi-wall pilling. It is anticipated that a considerable amount of pilling work will need to be completed, either from the existing pier or using a jack-up barge.

12.52 Two areas are to be dredged: the area between St. Ola Pier and Queen Elizabeth Pier at a depth of -9.0m across an area of 5.85 ha, and the area between St. Ola Pier and Ice Quay at a depth of -7.5m across an area of 0.845 ha. The spoil from dredging activity will be used within the reclamation area of the new pier structure, if suitable.

12.53 At the base of St. Ola Pier, a storage/let down area is to be constructed with a reclamation area of up to 0.84 ha. The fill material will consist of reused dredge material or imported fill, or a combination of both. The rock armour facing the current revetment will be reused for the new revetment with the addition of imported inert stone if required.

12.54 A new water/fuel supply to St. Ola Pier will be constructed. There are three potential options: a new pipeline routed along the seabed from the opposite Ice Quay and behind the existing ferry terminal building, a new pipeline directed along the seabed from Jubilee Pier, or a fuel tank(s) sited on the newly reclaimed area between St. Ola Pier and Queen Elizabeth Pier.

Operation

12.55 Operational stage activities include an increase of up to 30 cruise vessels per annum and associated tourist traffic, and an additional 100 oil and gas related vessels per annum with associated cargo handling. This additional traffic would represent a 6% increased on current vessel arrivals at the port.

Definition of Potential Impacts

12.56 The following potential impacts have been considered in this assessment, split into construction and operational phases. The issues highlighted in Scoping responses are shown with an *, whilst the remainder have been included (albeit briefly) for the sake of completeness:

- Impacts of Construction:
  - Permanent/temporary habitat loss arising from land take and foreshore reclamation;
  - Temporary disturbance and/or displacement from (airborne) noise*;
  - Temporary visual disturbance and/or displacement*;
  - Temporary disturbance/loss of habitat arising from dredging activity within the harbour; and
  - Effects on prey species due to underwater noise arising from construction activities (notably dredging, vessel noise and piling), increased suspended sediment concentrations and sediment deposition in the harbour and the selected dredge disposal location, and potential for resuspension of contaminated sediments; and
  - Pollution of intertidal habitat through accidental spillage of chemicals or fuels, or the release of sediment from within the Application Site

- Impacts of Operation:
  - Temporary disturbance from increased vessel traffic*;
  - Pollution of intertidal habitat through accidental spillage of chemicals or fuels by the increased vessel traffic from within the Application Site*; and
  - Cumulative impacts*

12.4.1 Effects of Construction

Permanent Land Take

12.57 As evident from Chapter 2: Project Description, the proposed redevelopment would involve extending the rock armour foreshore seaward and widening the existing pier. As noted in paragraph 11.163 in the assessment on marine biodiversity, reclamation of land will result in the permanent loss of approximately 0.7ha (1,010 m2 of intertidal habitat and 5,952 m2 of subtidal habitat) and widening of the redeveloped pier will result in loss of approximately 0.5ha (5399 m2). Rock armour is to be used on each of the reclaimed areas for protection. The redevelopment results in a permanent loss in habitat which is valued as being 'low' (refer Table 11.11 in Chapter 11 Marine Biodiversity). Rock armour would be used to face the newly reclaimed area so there would be no net loss of foreshore habitat once reclamation was complete.

12.58 There will be no significant environmental effect on terrestrial foreshore habitats as a result of construction of the proposed redevelopment. The low sensitivity and low magnitude of this temporary impact means land take effects would be negligible.

12.59 For seabirds, because they have large foraging ranges, the loss of benthic habitat, and the associated habitat for prey, is not considered significant.

12.60 In terms of European or UK terrestrial protected species using the foreshore, otter presence was identified during walkover surveys along the existing rock armour revetment between St. Ola Pier and Queen Elizabeth Pier. The signs recorded were all spraint in later stages of decay however, and the absence of any fresh signs indicates otters only use the area infrequently, and that the habitat is sub-optimal. Following the reclamation work the existing rock armour will be reused to create a new seaward revetment, so habitat loss would be temporarily and have no impact on this species after reconstruction. The magnitude of impact is therefore deemed to be low. The low sensitivity of the VER and the low magnitude of impact means effects are predicted to be negligible or minor.

12.61 No other European or UK protected species were recorded on the foreshore, and habitats are in fact unsuitable. No European or UK protected terrestrial species impacts would therefore be affected by the proposed redevelopment.

12.62 Moving on to ornithological interests, the proposed redevelopment would not involve any loss of habitat from the North Caithness Cliffs SPA (the nearest habitat change (the foreshore reclamation) being approximately over 200m from the SPA).

12.63 Based on survey results and longer-term desk study data (ERM 1997, Jacobs 2010), the existing foreshore was not used to any significant degree by roosting, foraging or nesting seabirds, waders or wildfowl, including qualifying or assemblage species of the nearby North Caithness Cliffs SPA. The reclamation and seaward extension of the harbour area would therefore affect very low numbers of low, moderate or high sensitivity species. Given the negligible impact from the temporary loss of foreshore, predicted potential effects from reclamation would be minor or less, so not significant in EIA terms.

12.64 Overall therefore, there would be no significant effects on any wildlife from land take, as a result of the proposed port redevelopment.

Permanent Loss of Open Water and Benthic Habitat

12.65 The proposed redevelopment would not involve any loss of open water habitat in immediate proximity or adjacent to the North Caithness Cliffs SPA.

12.66 The proposed port redevelopment will reduce the area of open water within the harbour itself by approximately 1.1ha (below the High Water Mark) (refer para 12.58). This represents a very small portion of the open water habitat within the harbour and a negligible fraction of shallow open water habitat along the north and east coast of Caithness that SPA (or other) nesting seabirds can access within their foraging ranges. This loss is not therefore considered significant.

Temporary Loss of Benthic Habitat

12.67 The proposed redevelopment would not involve any temporary loss of benthic habitat in immediate proximity or adjacent to the North Caithness Cliffs SPA.

12.68 As described in Chapter 9: Coastal Processes and in more detail in Chapter 11: Marine Biodiversity in relation to marine ecology, there will be temporary loss of benthic habitat from dredging, entrenching of fuel and water pipelines, and placement of jack-up barge legs. These will lead to a temporarily loss of intertidal and subtidal marine habitat.

Magnitude of impact

12.69 Dredging works will involve dredging of 172,000 m^3 of material from the outer basin as part of the proposed St. Ola Pier redevelopment and subsequent disposal at sea. This could potentially result in temporary disturbance and loss of habitat of up to 52,500m^2 (144,000m^3) of the seabed. In addition, installation of a fuel and water pipeline will temporarily disturb an area <0.1ha. Also, it is anticipated that a proportion of piling will be completed from a jack-up barge, the legs of which will cause further disturbance (although the extent of this impact cannot be precisely quantified at present, as it depends on the contractor appointed).

12.70 The magnitude, sensitivity and significance of these temporary impacts for marine ecological interests are fully considered in Chapter 11: Marine Biodiversity (sections 11.169 to 11.175). The magnitude of the impact is deemed to be negligible and the sensitivity is considered to be low. The effect will, therefore, be of negligible or minor (adverse) significance in terms of marine habitat, which is not significant in EIA terms. For seabirds, because they have large foraging ranges, the loss of benthic habitat and the associated habitat for prey, is not considered a significant impact.

Audible and Visual Temporary Disturbance and/or Displacement

12.71 The construction phase of the redevelopment project would involve temporary disturbance and displacement in the form of airborne construction noise from the construction activities highlighted in paragraphs 12.51 to 12.55 above.

Magnitude of impact

12.72 Disturbance to birds results from human activities which cause a bird to behave differently from the behaviour it would be reasonably expected to exhibit without the presence of that activity (Gill 2007). In the harbour and adjacent environment, disturbance can manifest in a number of forms of varying severity depending on the nature, duration and intensity of the disturbance source:

- Birds looking up or heads raised, temporarily stopping feeding or roosting;
- Birds moving away from the cause of the disturbance by swimming before resuming previous activity;
- Birds taking flight and landing somewhere in the same feeding area; and
- Birds taking flight and leaving the survey area completely (i.e. displacement).

12.73 The resulting impacts of disturbance episodes for seabirds birds are variable (Cutts et al. 2013). In general, each subsequent level of severity will result in a greater reduction in feeding time, and greater energy expenditure. Flushing (moving away in response to disturbance) is an energetic implication that, in severe and prolonged cases, can result in decreases in the overall fitness of a population, which in turn can lead to reduced breeding success and increased mortality. Birds that are more tolerant than other individuals and remain in an area affected by disturbance may not forage efficiently, and if there are additional pressures on the birds (for example cold weather), then this may impact upon the survival of individual birds or their ability to breed later in the year.

12.74 For birds on the sea, behavioural responses to the presence of vessels also involve flushing, either into flight or by diving in the case of species such as divers and auks. This reduces feeding time and increases energy expenditure, with knock on impacts to breeding success and mortality possible.

12.75 At seabird colonies, a range of disturbance responses are possible. This can be a moderate response whereby the birds displayed heads up behaviour. The most extreme response is flushing. Flushing during incubation or chick-rearing periods can lead to egg or chick loss because of displacement from the breeding site, egg breakage or predation. The effects of flushing on birds that are not attending eggs or chicks include disruption of courtship, nest-site defence and prospecting activities.

12.76 Disturbance and displacement can take place in response to noise generated from adjacent areas of land, or from sea-based activities (such as dredging).

12.77 Noise modelling undertaken (Chapter 7: Noise and Vibration) was used to predict noise levels emitted during the construction phase of the redevelopment project. Predicted construction noise was 50db at the nearest point of the SPA boundary during daytime operational activity.

12.78 Cutts *et al.*, (2013) states that as a guideline unhabituated waterfowl show no effect to noise levels below 50db, and from 50-70 there is only a moderate response involving head turning. Levels between 50-70 are expected to occur within the harbour area near construction activities. This is likely to result in reduced feeding time and abandonment of the area to nearby alternatives. Given that within the SPA boundary noise levels are not predicted to be above 50db birds displaced from foraging within the harbour area have suitable alternatives inside the SPA boundary and along the north coast of Caithness.

12.79 Furthermore, the predicted noise level model was based on a worst-case scenario whereby all construction activities occurred concurrently. Although this could potentially occur it is unlikely, and therefore construction noise is likely to be lower than the predicted 50db at the nearest point of the North Caithness Cliffs SPA.

12.80 The term 'habituated' is used to describe birds that have become accustomed to particular sources of disturbance. Birds foraging within the harbour are likely to have some degree of habituation to noise disturbance due to the presence of commercial fishing operations within the harbour, and the associated noise generated on a regular basis. Therefore, certain species that regularly forage within the harbour have the potential to be less effected than at high noise levels than those stated by Cutts *et al.,* (2013).

12.81 Due to the low noise level at the boundary of the North Caithness Cliffs SPA and the absence of birds roosting on the cliffs immediately adjacent to the redevelopment project, it is likely that construction noise will not impact roosting birds.

Sensitivity of receptor

12.82 The sensitivity of the North Caithness Cliffs SPA and the qualify species is high (see Table 12.5).

Significance of the effect

12.83 The magnitude of the impact for the SPA and the qualifying species is therefore considered negligible and the sensitivity of the receptor is considered high. The significance of the effect will therefore, be of minor (adverse) significance, which is not significant in EIA terms.

The North Caithness Cliffs SPA

12.84 As identified in Table 12.5, the North Caithness Cliffs SPA is a key receptor in the area potentially subject to increased airborne construction noise. The period for which the sensitivity applies is the breeding season only however, from April through to August (inclusive), when the birds are nesting.

Magnitude of impact

12.85 Published literature reports a wide range of disturbance and/or standoff distances for seabird colonies. These include a maximum flight initiation distance of 78m for yellow-legged gull colonies to pedestrian approach (Martinez-Abrain et al. 2008), and a 100m standoff distance between tern colonies and motor boats (Burger 1998; Rodgers and Smith 1995), while Carney and Sydeman (2009) suggested that double-crested cormorants in Florida could be approached to 100m without causing ill effects. A mixed colony of fulmars, shags, herring gulls, kittiwakes, guillemots, razorbills and puffins in Scotland demonstrated virtually no reaction behaviourally or reproductively to flights by fixed-wing aircraft within 100m of the colony (Dunnet 1977).

12.86 Rojek et al. (2007) studied in detail the disturbance responses of seabird (predominantly guillemot) colonies when approached by fishing vessels over a two-year period. Birds were typically not affected by vessels passing by at extended distances, but those approaching closely elicited a range of disturbance responses. Nearly all vessel disturbances to guillemots and cormorants occurred at vessel distances of less than 100m. At one colony, 23 vessel approaches were made within 500m, of which seven resulted in disturbance responses by guillemots. Four of these responses were a heads up and/or walking movement response (considered a moderate level response). The remaining three vessel approaches resulted in flushing (very severe response). Of recorded disturbances, 78% occurred when boats approached within 50m of the colony, and all flushing events occurred within 75m. On two occasions, heads up responses occurred when boats approached to within 200m, and a vessel with a loud engine elicited heads up responses when about 800m away.

12.87 The Canadian Government has published guidance relating to avoiding disturbance at seabird colonies (Canadian Government 2016). A general minimum 300m standoff distance between smaller vessels and seabird colonies is recommended, increasing to 500m for larger vessels such as cruise ships and 1km for 'high disturbance activities (e.g. drilling, blasting)'. When in proximity to colonies, it is recommended that sharp or loud noises should be avoided (e.g. horns) and that a constant engine noise level is maintained (Canadian Government 2016).

12.88 As well as consideration of linear separation distance, and the effect this has on reducing airborne noise at the SPA receptor, the Queen Elizabeth pier itself also providing significant noise attenuation, given its height and structure. Of note also, is that beyond the lighthouse (from where the Holburn Head SSSI begins), the SPA cliffs are sheltered from the works as they curve round to the north.

12.89 For the assessment of potential disturbance, the degree of any pre-existing habituation by nesting birds need to be judged. The breeding seabirds already experience twice-daily departures of Northlink ferries as well as other vessel traffic, berthing at approximately 120m from the SPA boundary at the Queen Elizabeth Pier. It is therefore reasonable to conclude nesting seabirds at the Scrabster end of the North Caithness Cliffs SPA are already habituated to this degree of activity.

12.90 Work to dredge the basin west of the Queen Elizabeth Pier is not expected to generate sudden spikes in noise levels or sufficiently high increases above background levels to impact the birds on the SPA cliffs. The reclamation to create additional storage will generate a moderate level of noise. The demolition of the existing concrete platform of the St. Ola Pier would, in contrast, result in the greatest noise levels, although this activity would be over approximately 375m from the nearest SPA cliff.

12.91 The application of the standoff distances considered in the Canadian Government (2016) guidance overall seems over-precautionary in this local context. Instead, the evidence noted in the other cited research appears more appropriate. The proposed harbour redevelopment works are over approximately 200m away from the SPA cliffs or SPA open water.

12.92 The foreshore reclamation and dredging westwards of Queen Elizabeth Pier are over approximately 200m from the SPA cliffs or SPA open water. St. Ola Pier, where the higher levels of noise will be generated, is approximately over 400m from the start of the SPA cliffs. In all cases, the noise

generated will be dissipated with distance and by the Pier itself. The increased noise generated during construction (above background levels) is not anticipated to cause disturbance to nesting birds on the cliffs.

12.93 Therefore, the magnitude of construction noise disturbance is therefore considered to be negligible (adverse).

12.94 The Habitat Regulation Screening and Report to Inform Appropriate Assessment discusses the potential effects on North Caithness Cliffs SPA in more detail, and is located at EIAR Volume II, Appendix 12.1 of the EIAR.

Sensitivity of receptor

12.95 The sensitivity of North Caithness Cliffs SPA is high (see Table 12.5).

Significance of the effect

12.96 The magnitude of the impact for the SPA is therefore considered negligible and the sensitivity of the receptor is considered high. The significance of the effect will therefore, be of minor (adverse) significance, which is not significant in EIA terms.

Qualifying/Assemblage Species of the North Caithness Cliffs SPA

12.97 As identified in Table 12.5, common guillemot, kittiwake, razorbill and puffin are the North Caithness Cliffs qualifying/assemblage species that are key receptors in the area potentially subject to increased airborne construction noise. The period for which the sensitivity applies is the breeding season, when birds are present in the area. This core breeding period extends from April to August (inclusive), with birds present on the water into September, generally dispersing to wintering grounds thereafter.

Magnitude of impact

12.98 As well as the North Caithness Cliffs SPA colonies themselves, surveys have demonstrated there are SPA qualifying birds present within waters close to the harbour. As shown in Table 12.7, the number of birds present on the water within the survey area is generally very low, with common guillemot the only named SPA species (mean count of 12.1 birds representing 0.03% of the reference population), and kittiwake, puffin and razorbill being qualifying species (respectively a mean count of 0.8 birds representing 0.006% of the reference population, a mean count of 0.1 birds representing 0.005% of the reference population, and a mean count of 6.8 birds representing 0.2% of the reference population).

12.99 For these SPA species, it is also important to consider behaviours recorded (feeding or loafing) were not dependent on the birds being present at a specific location. It is highly likely that if birds were displaced therefore, these activities could be undertaken at an alternative location on a temporary basis if required, without significant impacts on individuals or their SPA populations. Relocating (if required) to locations entirely away from construction activity is clearly within the capability of these species, based on published mean foraging distances of 37.8km for common guillemot, 23.7km for razorbill, 4.0km for puffin and 24.8km for kittiwake (Thaxter et al., 2012).

12.100 Considering each species further, kittiwake is a highly mobile species that spends a significant amount of time in flight. Garthe and Hüppop (2004) and Furness and Wade (2012) therefore classify vessel traffic and construction impacts on this species as negligible.

12.101 Common guillemot and razorbill are species of medium vulnerability to boat traffic, according to these same sources. These species may illicit a degree of disturbance by vessel activity either by flushing from the sea surface or diving when a vessel approaches. Auk species have been shown to exhibit flushing behaviour at up to 600m (Bellefleur et al., 2009); Ronconi and Clair, 2002), although these studies involved vessels travelling at relatively high speeds. It is expected that this distance will be significantly less during construction, as it will involve vessels that are either stationary or travelling at low speed, and birds within the harbour are evidently habituated to a degree of vessel activity. During July and August, auks leave nesting cliffs to moult. In this period, some birds may be flightless (Wright and Begg, 1987) and more susceptible to disturbance. Flightless birds were not recorded in large numbers during the surveys however, so this is not considered to represent any significantly different sensitivity for the harbour redevelopment. On this basis, the sensitivity of common guillemot and razorbill to the works is considered to be low, and the impact magnitude negligible.

12.102 Puffin are of below average sensitivity to vessel traffic (Garthe and Hüppop, 2004; Furness and Wade, 2012). On this basis, the sensitivity of puffins to the works is also considered to be low, and the impact magnitude negligible.

Sensitivity of receptor

12.103 The sensitivity of the SPA qualifying species is high (Table 12.5).

Significance of the effect

12.104 The magnitude of the impact for all SPA qualifying species is deemed to be negligible and the sensitivity of the receptor is considered to be high. The significance of the effect will therefore, be of minor (adverse) significance, which is not significant in EIA terms. The confidence in all the predictions in this section is of probable certainty.

Impacts on Prey of Birds by Suspended Sediments or Potential Contaminants Caused by Dredging

Magnitude of impact

12.105 Chapter 11: Marine Biodiversity considers the impact of sedimentation and potential release of contaminants from the dredging within the harbour on benthic habitats, fish and other marine organisms. The magnitude of the impact on these receptors is deemed to be low (adverse) and the sensitivity is considered to be low. The effect is therefore predicted to be of negligible or minor (adverse) significance, which is not significant in EIA terms.

12.106 In light of this conclusion, and birds' ability to search for prey over wide areas, the impact from any changes in prey availability due to suspended sediments or potential contaminants will be of negligible magnitude.

Sensitivity of receptor

12.107 The sensitivity of the SPA qualifying species is high (Table 12.5).

Significance of the effect

12.108 The magnitude of the impact for all SPA qualifying species is deemed to be negligible and the sensitivity of the receptor is considered to be high. The significance of the effect will therefore, be of minor (adverse) significance, which is not significant in EIA terms. The confidence in all the predictions in this section is of probable certainty.

Accidental pollution release

Magnitude of impact

12.109 Chapter 11: Marine Biodiversity assesses the impacts of an accidental spillage or release of chemicals (such as fuel, oil and lubricants) during construction on benthic ecology or fish receptors. Associated impacts on birds could also arise, indirectly by birds eating contaminated prey or prey abundance being reduced by the impact of pollution. Direct impacts on birds could also result from ingestion or oiling of feathers.

12.110 Birds are highly mobile creatures (except during the moulting period) so generally have the potential ability to move away from a pollution event. They also have the ability to search for prey over wide areas. This capacity to avoid certain spills or secure food over a wide area to some degree helps to reduce the potential magnitude of impact from pollution incidents (particularly in an emergency spill situation, when there would be increased disturbance/displacement from human activity visible around the harbour and on the open water). The low density of seabirds recorded within the harbour further limits the potential impact of any pollution release.

12.111 In light of all these considerations, the impact of any changes in prey availability due to accidental pollution release will be of negligible magnitude.

Sensitivity of receptor

12.112 The sensitivity of the SPA qualifying species is high (Table 12.5).

Significance of the effect

12.113 The magnitude of the impact for all SPA qualifying species is deemed to be negligible and the sensitivity of the receptor is considered to be high. The significance of the effect will therefore, be of minor (adverse) significance, which is not significant in EIA terms. The confidence in all the predictions in this section is of probable certainty.

12.4.2 Assessment of Operational Effects

SPA Qualifying Species

Accidental pollution release

Magnitude of impact

12.114 As highlighted in Chapter 11: Marine Biodiversity, during the operational phase, the quantities and types of material that might conceivably enter the marine environment are limited to spills relating to vessels utilising the St. Ola Pier, including the transfer of fuel to vessels.

12.115 A stated in the assessment of construction impacts the magnitude of this impact is dependent upon the quantities of the spillage, the dilution and dispersal properties of the waters and the bio-

availability of the contaminant to species. The more toxic components of fuel spills are volatile and relatively short-lived. Heavier hydrocarbons, while less toxic, may persist for longer in the marine environment. However, any spill or leak within the harbour would be immediately diluted and rapidly dispersed.

12.116 During the operational phase, a fuel pipe is required to service vessels and will be installed via one of two options:

- Routed from the existing fuel supply at Jubilee Pier, via either:
  - Along the seabed within the inner berth directly on to the St. Ola Pier; or
  - on to the seabed to the root of the opposite Ice Pier and behind the existing ferry terminal building on to St. Ola Pier.
- Routed from a new tank(s) proposed for the reclamation area, across land onto St. Ola Pier.

12.117 The fuel pipe to be installed will be a maximum of 580 m in length and 0.25 m in diameter.

12.118 The fuel pipeline will have a maximum import delivery capacity of 500m3/hr and a maximum export delivery capacity of 150m3/hr.

12.119 Whilst vessel movements during the operational phase will likely increase from existing levels, the Harbour Oil Spill Contingency Plan (OSCP) will be updated to incorporate relevant pollution measures for operation of the St. Ola Pier and for the fuel pipe from the Jubilee Pier to St. Ola Pier. Therefore, the magnitude of the impact is not expected to differ from the magnitude of the impact of the construction phase and the magnitude of the impact is therefore considered to be negligible.

12.120 The potential impact of accidental pollution from operational activities is therefore predicted to be of local spatial extent, short term duration, intermittent and reversible. The magnitude is therefore considered to be negligible.

Sensitivity of the receptor

12.121 The sensitivity of qualifying SPA birds is high.

Significance of the effect

12.122 The magnitude of the impact for all SPA qualifying species is deemed to be negligible and the sensitivity of the receptor is considered to be high. The significance of the effect will therefore, be of minor (adverse) significance, which is not significant in EIA terms.

12.5 Mitigation and Monitoring

Mitigation

12.123 At construction phase, standard operating procedures during construction and operation will be adopted as part of good environmental practice. Notably in relation to species and habitats, these are the measures put in place as normal part of construction works to avoid pollution from fuel, oil or other liquid spills.

12.124 In relation to otters, a pre-commencement survey will be completed to check there is no change from the current baseline, but no further mitigation is considered necessary given the evident low level of use of the foreshore by this species.

12.125 No further mitigation is proposed for the operational phase of the proposed redevelopment.

Future Monitoring

12.126 No future monitoring is required at either construction or operational stage.

Potential Changes to the Assessment as a Result of Climate Change

12.127 Climate change has been implicated in long-term declines of the North Caithness Cliffs SPA qualifying seabirds. It is therefore important to consider whether continuing changes in bird populations would change the impact assessments of the proposed redevelopment (either its construction or operational phases).

12.128 If the number of common guillemot, kittiwake, razorbill and Atlantic puffin decline, the birds become scarcer and their conservation importance increases, given the SPA would be in unfavourable status. The corollary is that with fewer birds, the numbers present and therefore risk of impacts also decreases. In balance, because operational impacts are not significant, and because the extent of the development is so limited, future baseline conditions are not expected to change any of the assessments for the operational phase set out above.

12.6 Assessment of Cumulative Effects

12.129 This chapter considers and assesses the potential for cumulative effects arising from the proposed redevelopment in association with other developments.

Methodology

12.130 The following guidelines and publications were considered when determining the other projects to be considered for their potential to generate cumulative effects with the proposed redevelopment:

- Scottish Natural Heritage Environmental Impact Assessment Handbook (v5) (2018);
- Scottish Government Planning Circular 1/2017: Environmental Impact Assessment Regulations (2017);
- The Planning Inspectorate Advice Note 17: Cumulative Effects Assessment (2015); and
- European Commission (EC) Guidelines for the Assessment of Indirect and Cumulative Impacts (1999).

12.131 The first step in determining cumulative effects comprised the identification of a list of ‘other projects which may have the potential to overlap with the proposed redevelopment based on available information.

12.132 The scope of the other projects that have been considered as part of this cumulative assessment have been identified through a desk study involving general internet searches and in particular,

scrutiny of consenting authority websites. The projects were either registered on the Highland Council planning website or MS LOT website, or are other developments that SHT have proposed. Other projects for which a development consent application has been submitted or consent granted were included. Potential future projects which have not submitted an application for consent were not included.

12.133 Those other projects whose impacts could foreseeably overlap with the construction or operation of the proposed redevelopment or where construction impacts may be consecutive but cumulative, were considered. The cut-off date for sourcing information on the other projects considered was 12 April 2019. Table 12.8 taken from EIAR Volume II, Appendix 1.2 shows those projects which were considered as part of the desk study.

12.134 Five projects were identified to be included for further consideration at this stage, and information on works to be undertaken, and location of works was obtained. Those impacts which were considered to have the widest zone of impact and therefore potential for cumulative impacts were as follows:

- Disturbance or displacement to birds; and
- Increased vessel traffic.

12.135 Based on either the fact that projects were already completed, that their effects were not significant or found to be negligible, and that they were sufficiently distant (i.e. no spatial overlap of potential effects), there would be no cumulative impact on the North Caithness Cliffs SPA or its qualifying species recorded at and around Scrabster Harbour.

12.136 The significance of effect for all impacts at construction and operation phases is therefore not expected to differ from the predicted significance of effects, as reported in the Assessment of Construction Effects or the Assessment of Operational Effects.

Table 12.8: List of other projects and plans considered cumulatively

Project Title	Included for further consideration?	Justification	Stage	Temporal Overlap	Spatial Overlap	Distance from project (km)	Potential cumulative impact (construction phase)	Potential cumulative impact (operation phase)
Dounreay Trì Floating Wind Demonstration Project	Yes	Work yet to be undertaken	Post - determination	Yes	No		Screened out due to lack of spatial overlap of zone of impacts and no associated significant impacts on disturbance or displacement or adverse SPA effects (Dounreay Tri Ltd. 2016a)	Screened out due to lack of spatial overlap of zone of impacts and no associated significant impacts on disturbance or displacement or adverse SPA effects (Dounreay Tri Ltd. 2016a)
Katanes Floating Energy Park	Yes	Work yet to be undertaken	Pre-application	Yes	No	21km	Screened out due to lack of spatial overlap of zone of impacts (Katanes Floating Energy Ltd' (2017) Marine Scotland (2017)	Screened out due to lack of spatial overlap of zone of impacts (Katanes Floating Energy Ltd' (2017) Marine Scotland (2017)
Ness of Duncansby Tidal Array	Yes	Work yet to be undertaken	Pre-application	Yes	No	c. 25km	Screened out due to lack of spatial overlap of zone of impacts (SPR (2012) Marine Scotland 2013) SIMEC Atlantis (2019)	Screened out due to lack of spatial overlap of zone of impacts (SPR (2012) Marine Scotland 2013) SIMEC Atlantis (2019)
MeyGen Tidal Energy	Yes	Work yet to be undertaken	Post-determination	Yes	No		Screened out due to lack of spatial overlap of zone of impacts (and lack of significant impacts on the North Caithness Cliffs SPA or its qualifying species recorded at Scrabster Harbour) (MeyGen 2012)	Screened out due to lack of spatial overlap of zone of impacts (and lack of significant impacts on the North Caithness Cliffs SPA or its qualifying species recorded at Scrabster Harbour) (MeyGen 2012)
Orkney-Caithness 220kV Link	Yes	Work yet to be undertaken	Early development	Yes	No		Screened out due to lack of spatial overlap of zone	Screened out due to lack of spatial overlap of

Project Title	Included for further consideration?	Justification	Stage	Temporal Overlap	Spatial Overlap	Distance from project (km)	Potential cumulative impact (construction phase)	Potential cumulative impact (operation phase)
							of impacts (and lack of significant impacts on the North Caithness Cliffs SPA or its qualifying species recorded at Scrabster Harbour) (SSE 2013)	zone of impacts (and lack of significant impacts on the North Caithness Cliffs SPA or its qualifying species recorded at Scrabster Harbour) (SSE 2013)
Scrabster Harbour Proposed Habour Laydown Area	No	Work incomplete and unlikely to go ahead	N/A	No	Yes		N/A	N/A
Scrabster Harbour Old fish Pier Redevelopment	No	Work complete	N/A	No	Yes		N/A	N/A
Thurso Waste Water Treatment Works wind energy development	No	Onshore works	N/A	No	No		N/A	N/A
Caithness and Sutherland Landscape Character Assessment	No	Onshore works	N/A	No	No		N/A	N/A

12.7 Residual Effects

12.137 Following feedback from SNH on the proposed scope of ecological and ornithological impact assessment, surveys were carried out of habitats, otter and breeding seabirds in the development area.

12.138 The limited loss of terrestrial and intertidal habitat from the proposed redevelopment is not significant, given the affected ecologically low value area currently comprises hard standing (car park and access road) and rock revetment. The revetment will be replaced in any case by the new foreshore.

12.139 The existing foreshore was nonetheless, checked for otters. Otters evidently make limited use of this location so the port redevelopment will have no significant effects on this species. The low value and highly developed nature of the habitats present mean there will also be no significant effect on any other terrestrial UK or European protected species.

12.140 Expansion of St. Ola Pier will result in permanent loss of a small area of benthic habitat but this is so small compared to potential feeding habitat available to seabirds that this loss has no significant effect.

12.141 Apart from habitat losses during construction, the other potential causes of impacts have also been assessed. Through the seabird surveys, it is clear the study area (comprising the project area and a 500m buffer) is only used by small numbers of seabirds. Given the distance of construction works from the North Caithness Cliffs SPA and the screening influence of Queen Elizabeth Pier, the limited sensitivity of the species recorded to construction activity, an existing degree of habituation and the localised extent of construction, no significant impacts are predicted from the proposed harbour redevelopment on either the SPA or on its qualifying species from disturbance or displacement caused by noise. The increased levels of construction activity and personnel present over the construction period are equally not predicted to cause any significant impact on either the SPA or its qualifying species.

12.142 Chapter 11: Marine Biodiversity discusses the impact of dredging and associated sediment plumes within the Harbour on fish and shellfish. It is concluded that the impacts associated with dredging will be short-term and of negligible to no magnitude on fish and shellfish. Therefore, given the fact that prey will not be significantly affected, the impact significance on all ornithological species is not significant.

12.143 Measures are in place to prevent or respond to pollution incidents, and therefore, taking account of the ability of birds and otters to find alternative foraging areas in the event of a spill, no significant impacts are predicted if these occur during construction.

12.144 Once operational, the increase in vessel activity is not considered sufficient to have a significant impact predicted on either otters, the North Caithness Cliffs SPA or qualifying bird species within the area. The Harbour's Oil Spill Contingency Plan will be up-dated accordingly to ensure that increased vessel activity will not result in an elevated risk of pollution incidents.

Table 12.9: Summary of Likely Environmental Effects of the proposed redevelopment.

Receptor	Sensitivity of receptor	Description of impact	Short/medium/ longterm	Magnitude of impact	Significance of effect	Significant/Not Significant	Notes
Construction phase							
Benthic Ecology (inter-related findings from Chapter 11: Marine Biodiversity)							
Permanent habitat loss	Negligible - low	Construction activities (including reclamation of land) will result in complete loss or severe modification to intertidal and subtidal marine habitats	Long term	Negligible	Minor (adverse)	Not significant	
Temporary disturbance and loss of habitat	Low	Temporary works on the pier will potentially result in temporary disturbance and loss of habitat within the vicinity of Scrabster Harbour	Short term	Negligible	Minor (adverse)	Not significant	
Effects of increased suspended sediment concentrations and potential contamination release	Low	Dredging of the seabed and preparatory works for pier redevelopment is likely to disturb seabed sediments, resulting in an increase of SSC, particularly affecting filter feeding organisms	Short term	Low	Minor (adverse)	Not significant	
Accidental pollution release	Medium	Accidental spillages could potentially contaminate the marine environment, harming benthic receptors	Short term	Negligible	Negligible	Not significant	
Fish and Shellfish (inter-related findings from Chapter 11: Marine Biodiversity)							
Effects of underwater noise arising from construction activities	Low – high	Noise generated by piling activities has the potential to cause injury and/or disturbance to fish receptors	Short term	Low	Minor (adverse)	Not significant	
Temporary disturbance and loss of habitat	Low - medium	Ancillary operation works such as entrenching of fuel and water pipelined, use of jack-up barge and pin piling could lead to temporary disturbance/loss of intertidal and subtidal marine habitat	Short term	Negligible	Negligible - minor	Not significant	
Effects of increased suspended sediment concentrations	Low - high	Dredging of the seabed and preparatory works for pier redevelopment is likely to disturb seabed sediments, resulting in an increase of SSC, and potential	Short term	Minor (adverse)	Negligible – minor (adverse)	Not significant	

Receptor	Sensitivity of receptor	Description of impact	Short/medium/ longterm	Magnitude of impact	Significance of effect	Significant/Not Significant	Notes
		physiological or behavioural disruption to fish and shellfish species					
Accidental pollution release	Low - high	Accidental spillages could potentially contaminate the marine environment, harming fish and shellfish receptors	Short term	Negligible	Negligible	Not significant	
Otters							
Habitat loss	Low	Reclamation of land will result in loss of intertidal rock revetment along shoreline	Short term	Negligible	Minor (adverse)	Not significant	
Effects of underwater noise arising from construction activities	Low	Noise generated by piling activities has the potential to cause injury and/or disturbance to fish receptors	Short term	Low	Minor (adverse)	Not significant	
Effects of increased suspended sediment concentrations	Low	Dredging of the seabed and preparatory works for pier redevelopment is likely to disturb seabed sediments, resulting in an increase of SSC, and potential physiological or behavioural disruption to fish and shellfish species, diminishing prey availability	Short term	Minor (adverse)	Negligible – minor (adverse)	Not significant	
Accidental pollution release	Low	Accidental spillages could potentially contaminate the marine environment, harming benthic receptors	Short term	Negligible	Negligible	Not significant	
North Caithness Cliffs SPA							
Temporary disturbance from construction activities	Low	Temporary works will potentially result in temporary disturbance at the section of the SPA closest to the Harbour, by the (lighthouse)	Short term	Negligible	Minor (adverse)	Not significant	
Qualifying Species Present Within 500m of the Proposed Redevelopment (guillemot, kittiwake, razorbill, puffin)							
Habitat loss	Negligible - low	Construction activities (reclamation of land and extension of St. Ola Pier) will result in loss of subtidal marine habitats	Long term	Negligible	Minor (adverse)	Not significant	
Temporary disturbance and displacement	Low	Temporary works on the pier, foreshore, and dredging will result in temporary disturbance and displacement of seabirds within Scrabster Harbour	Short term	Negligible	Negligible	Not significant	

Receptor	Sensitivity of receptor	Description of impact	Short/medium/ longterm	Magnitude of impact	Significance of effect	Significant/Not Significant	Notes
Effects of increased suspended sediment concentrations and potential contamination release	Low	Dredging of the seabed and preparatory works for pier redevelopment is likely to disturb seabed sediments, resulting in an increase of SSC, causing potential physiological or behavioural disruption to fish and shellfish species, diminishing prey availability	Short term	Low	Minor (adverse)	Not significant	
Accidental pollution release	Medium	Accidental spillages could potentially contaminate the marine environment, harming benthic receptors	Short term	Negligible	Negligible	Not significant	
Operational phase							
Accidental pollution release	Low	Accidental spillages could potentially contaminate the marine environment, harming seabires, and/or fish and shellfish prey	Long term	Negligible	Negligible	Not significant	

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13 INTERACTIONS

13.1 The EIA Directive and its transposing Regulations requires that in addition to assessing impacts on those environmental aspects scoped in for assessment, the interrelationship between those aspects must be taken into account as part of the environmental assessment.

13.2 Table 13.1 below is a matrix table indicating the significant interactions that are likely to occur between the various environmental disciplines with regard to the proposed development. Where a cross exists in a box in the table, this indicates that a relationship exists between the two environmental areas. The purpose of the table is to allow interaction between various disciplines to be recognised, although the level of interaction will vary in each case.

13.3 It is assumed in presenting this table that an environmental discipline has a potential inter-relationship both during the construction and operational phases of the development.

13.4 A summary of expected interactions is given in Table 13.2.

Table 13.1: Inter-relationship Matrix – Potential Interaction between Environmental Aspects

	Waste	Soils, Geology and Hydrogeology	Water Quality	Biodiversity	Air Quality and Climate	Noise and Vibration	Traffic and Transport
Waste		X	X	X	X	X	X
Soils, Geology and Hydrogeology	X		X	X			
Water Quality		X		X	X		X
Biodiversity	X	X	X		X	X	X
Air Quality and Climate		X	x	X			X
Noise and Vibration	X			X			X
Traffic and Transport	X		X	X	X	X	

Table 13.2: Summary of Interactions

Environmental Aspect	Interacts with	Description
Waste	*Soils, Geology and Hydrogeology*	Dredged seabed sediments are waste arisings and require management
	Water Quality	Ineffective waste management can result in pollution and deterioration of water quality
	Biodiversity	Ineffective waste management can result in pollution and affect biodiversity features of value
	Air Quality and Climate	More waste arisings may require more off-site management. This can result in greater levels of traffic on the road network giving rise to greater aerial emissions.
	Noise and Vibration	More waste arisings may require more off-site management. This can result in greater levels of traffic on the road network giving rise to greater levels of road traffic noise.
	Traffic and Transport	More waste arisings may require more off-site management. This can result in greater levels of traffic on the road network.
Soils, Geology and Hydrogeology	*Water Quality*	Geological sediments require removal by dredging and disposal at sea. Associated suspended sediment plumes can result in deterioration of water quality.
	Biodiversity	Geological sediments shall be dredged and disposed at sea. Associated suspended sediment plumes can result in displacement of marine biodiversity features.
Water Quality	*Biodiversity*	Pollution of marine waters, elevated suspended sediments and deterioration of water quality can cause disturbance to key species and displacement of prey items of marine and avian biodiversity features.
	Air Quality and Climate	Significant levels of aerial emissions can result in subsequent deposition in the marine environment and cause deterioration of water quality.
	Traffic and Transport	Greater levels of traffic on the road network increases the risk of accidental spillages and increases the levels of contaminants in routine road runoff which discharges to surface waters and coastal waterbodies.
Biodiversity	*Air Quality and Climate*	Significant levels of aerial emissions can result in subsequent deposition in nearby or downwind habitats, resulting in habitat deterioration effects.

	Noise and Vibration	Increased levels of noise can disturb or displace species, or mask key calls and communication, resulting in habitat deterioration effects.
	Traffic and Transport	Greater levels of traffic on the road network increases the risk of accidental collision with wildlife.
Air Quality and Climate	*Traffic and Transport*	Greater levels of traffic on the road network increases the level of aerial emissions. This can cause deterioration of ambient air quality.
Noise and Vibration	*Traffic and Transport*	Greater levels of traffic on the road network increases background noise due to the increased contribution of road traffic noise.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT
VOLUME I: MAIN REPORT - CONTENTS

1 INTRODUCTION

2 PROJECT DESCRIPTION

3 ALTERNATIVES

4 WASTE

5 TRAFFIC AND TRANSPORTATION

6 AIR QUALITY AND CLIMATE

7 NOISE AND VIBRATION

8 GEOLOGY, HYDROGEOLOGY AND CONTAMINATION

9 COASTAL PROCESSES

10 WATER QUALITY

11 MARINE BIODIVERSITY

12 TERRESTRIAL BIODIVERSITY AND ORNITHOLOGY

13 INTERACTIONS

TABLES

1 INTRODUCTION

Table 1.1 Environmental Topics and the Scoping Opinion (scoped in or out)
Table 1.2 Structure of Volume I of the EIAR
Table 1.3 Where Topics specified in the EIA Regulations and considered in the EIA Scoping Opinion are addressed in the EIAR
Table 1.4 Definition of Sensitivity or Value
Table 1.5 Definition of Magnitude
Table 1.6 Assessment Matrix

2 PROJECT DESCRIPTION

Table 2.1 Waste generated by Construction Works

3 ALTERNATIVES

(No Tables)

4 WASTE

Table 4.1 Glossary of terms used to explain the quality and significance of impacts
Table 4.2 Details on weight of waste managed at Scrabster Harbour
Table 4.3 Types of waste produced and current management route
Table 4.4 Capacity of Currently Authorised Landfills
Table 4.5 Waste Sites Capacity
Table 4.6 Predicted Waste Streams to be Generated and Associated Management Options and Strategy
Table 4.7 Summary of Impacts

5 TRAFFIC AND TRANSPORTATION

Table 5.1 Summary of Stagecoach Services serving Scrabster Harbour
Table 5.2 ScotRail Train Schedule between Thurso, Wick and Inverness
Table 5.3 MV Hamnavoe Timetable
Table 5.4 Provisional 2019 Scrabster Harbour Cruise Schedule
Table 5.5 Scrabster Harbour 2018 Cruise Schedule
Table 5.6 Summary of the Main Events and Festivals on Orkney and Shetland, 2018
Table 5.7 Monthly Breakdown of Total Vehicles on A9, 2018
Table 5.8 AADT Vehicle Classification Data on the A9, 2017, from Department for Transport Counted Survey
Table 5.9 AADT and Two Busiest Traffic Days in 2018
Table 5.10 NRFT Traffic Growth Rates
Table 5.11 Oil & Gas Activity, Number of Berthages and HGV
Table 5.12 Summary of Annual Operational Generated Traffic
Table 5.13 Impact on AADT

6 AIR QUALITY AND CLIMATE

Table 6.1 Chapter Summary of Air Quality Objectives (AQO) of the National Air Quality Strategy
Table 6.2 UK Air Quality Objectives for protection of vegetation and ecosystems - July 2007
Table 6.3 Summary of Methodology for Assessment
Table 6.4 Consultation Responses Relevant to this Chapter
Table 6.5 Impact descriptors for individual receptors
Table 6.6 IAQM Potential Dust Emission Classes - Demolition
Table 6.7 IAQM Potential Dust Emission Classes - Demolition
Table 6.8 IAQM Potential Dust Emission Classes from Earthworks Activities
Table 6.9 Risk Category from Earthworks Activities
Table 6.10 IAQM Potential Dust Emission Classes from Construction Activities
Table 6.11 Risk Category from Construction Activities

Table 6.12 IAQM Potential Dust Emission Classes from Trackout
Table 6.13 Risk Category from Trackout
Table 6.14 Assessment Matrix
Table 6.15 Summary of Likely Environmental Effects on air quality and climate

7 NOISE AND VIBRATION

Table 7.1 Internal Ambient Noise Levels
Table 7.2 Noise Threshold Limits at Nearest Sensitive Receptors for Construction Activities
Table 7.3 Transient Vibration Guide Values for Cosmetic Damage (Ref BS52282:2009+A1:2014)
Table 7.4 Summary of Cadna Model Inputs
Table 7.5 Receptor Sensitivity
Table 7.6 Demolition and Construction Noise: Magnitude of Effect
Table 7.7 Operational Traffic: Magnitude of Effect
Table 7.8 Significance of Effects
Table 7.9 Summary of Noise Monitoring Survey Dates
Table 7.10 Lowest and Typical LA90 Sound Levels
Table 7.11 Summary of Construction Plant and Equipment during Demolition
Table 7.12 Summary of Construction Plant and Equipment during Construction
Table 7.13 Summary of Construction Plant, Noise Levels and Utilisations
Table 7.14 Daytime Predicted Construction Noise levels at Noise Sensitive Receptor Locations
Table 7.15 Night time Predicted Construction Noise levels at Noise Sensitive Receptor Locations
Table 7.16 Measured Peak Particle Velocity (PPV) at Various Plan Distances (ref: Table D.11 BS 8233)
Table 7.17 Summary of Likely Environmental Effects on Noise and Vibration

CHAPTER 8 GEOLOGY, HYDROGEOLOGY AND CONTAMINATION

Table 8.1 Example Definitions of Sensitivity or Value
Table 8.2 Definitions of Magnitude
Table 8.3 Assessment Matrix
Table 8.4 Significance Criteria
Table 8.5 Summary of Likely Environmental Effects on Geology, Hydrogeology and Contamination

CHAPTER 9 COASTAL PROCESSES

Table 9.1 Tidal levels at Scrabster Harbour
Table 9.2 SEPA Extreme water levels at Scrabster
Table 9.3 Grading of dredged sediment

CHAPTER 10 WATER QUALITY

Table 10.1 Consultation Responses Relevant to this Chapter
Table 10.2 Sensitivity Indication
Table 10.3 Magnitude of Impact Indicating Type and Scale of Effect (DMRB, 2011)
Table 10.4 Assessment Matrix
Table 10.5 Water quality information for the River Thurso SAC from 2007- 2017
Table 10.6 Water quality information for the Thurso Bay
Table 10.7 Lab analysis results for relevant cAL exceedances
Table 10.8 Summary of Likely Environmental Effects on water quality

CHAPTER 11 MARINE BIODIVERSITY

Table 11.1 Summary of key desktop reports
Table 11.2 Consultation responses relevant to marine biodiversity
Table 11.3 Criteria used to inform the valuation of receptors
Table 11.4 Example definitions of magnitude of impact
Table 11.5 Example definitions of sensitivity
Table 11.6 Significance of Effect Assessment Matrix
Table 11.7 Key species with spawning and nursery areas (Coull et al., 1998 and Ellis et al., 2010) in proximity to the proposed redevelopment and dredge disposal sites
Table 11.8 Designated sites identified for marine biodiversity receptors considered in this assessment

Table 11.9 Species potentially present in the marine biodiversity regional study area with specific conservation/environmental sensitivities and/or management plans
Table 11.10 EU management plan summary for fish stocks likely to be present in the marine biodiversity regional study area
Table 11.11 Benthic Ecology IEFs identified for this assessment
Table 11.12 Fish and shellfish IEFs identified for this assessment
Table 11.13 Marine mammal IEFs identified for this assessment
Table 11.14 Proposed mitigation measures adopted for this project
Table 11.15 Piling noise source levels used in assessment (un-weighted)
Table 11.16 Criteria for onset of injury in fish due to piling (Popper et al., 2014)
Table 11.17 Summary of injury ranges for fish due to impact piling (assumes a maximum hammer energy of 240 kJ)
Table 11.18 Criteria for onset of behavioural effects in fish for impulsive piling (Popper et al., 2014)
Table 11.19 Summary of injury ranges for marine mammals due to impact piling (N/E = threshold not exceeded). Marine mammal hearing groups: LF=Low frequency; MF=Mid frequency, HF=High frequency; PW = Phocid pinnipeds in water
Table 11.20 Vessel activity associated with Scrabster Harbour based on AIS data from 2012 - 2015 provided by Marine Scotland's NMPI portal
Table 11.21 Vessels involved in construction phase of the proposed redevelopment (maximum likely).
Table 11.22 List of other projects and plans considered for cumulative effects
Table 11.23 Summary of Likely Environmental Effects on Marine Biodiversity

CHAPTER 12 TERRESTRIAL BIODIVERSITY AND ORNITHOLOGY

Table 12.1 Consultation Responses Relevant to this Chapter
Table 12.2 Definitions of sensitivity
Table 12.3 Definitions of magnitude
Table 12.4 Significance of effect assessment matrix
Table 12.5 Sensitivity of Receptors
Table 12.6 Densities of seabirds across the North Caithness Cliffs SPA
Table 12.7 Birds on water results across all surveys. Reference populations were taken from the North Caithness Cliffs SPA citation and Seabird Counts at North Caithness Cliffs SPA in 2015 and 2016 for Marine renewables Casework report
Table 12.8 List of other projects and plans considered cumulatively
Table 12.9 Summary of Likely Environmental Effects of the proposed redevelopment.

13 INTERACTIONS

Table 13.1 Inter-relationship Matrix – Potential Interaction between Environmental Aspects
Table 13.2 Summary of Interactions

FIGURES (within text)

1 INTRODUCTION

Figure 1.1 Scrabster Harbour

2 PROJECT DESCRIPTION

Figure 2.1 Location of Scrabster Harbour
Figure 2.2 Scrabster Harbour Layout
Figure 2.3 Pier Outline Encompassing Existing Structure
Figure 2.4 Typical Section Through Outer Structure Showing Existing Structure Encased by New Structure
Figure 2.5 Typical Combi-Wall Arrangement
Figure 2.6 Typical Jack-Up Barge Completing Marine Piling
Figure 2.7 Typical Backhoe Dredger
Figure 2.8 Typical Trailing Suction Hopper Dredger
Figure 2.9 Proposed Contractor Site Compound

3 ALTERNATIVES

Figure 3.1 Option 0 Baseline
Figure 3.2 Option 1 Layout
Figure 3.3 Option 2 Layout
Figure 3.4 Option 3 Layout
Figure 3.5 Option 4 Layout
Figure 3.6 Land Reclamation Areas Considered at Outline Design Stage

4 WASTE

(No Figures)

5 TRAFFIC AND TRANSPORTATION

Figure 5.1 Existing Layout of Scrabster Harbour including existing accesses and approach road
Figure 5.2 Indicative Extent of Proposed Surface Works
Figure 5.3 Pedestrian Facilities on A9 Trunk Road in the vicinity of Scrabster Harbour
Figure 5.4 A9 Pedestrian Footway between Scrabster and Thurso
Figure 5.5 Ferry Passenger Walkway at Scrabster Harbour
Figure 5.6 Sustrans NCN Route 1 – Northern Scotland, Highlands Region
Figure 5.7 Designated Cycling Facilities in the vicinity of the Scrabster Harbour
Figure 5.8 The Bike Shop, High Street, Thurso
Figure 5.9 Location of Public Transport Hubs within the vicinity of Scrabster Harbour and its surrounds
Figure 5.10 Example of Real-time Bus Service Information at www.stagecoachbus.com
Figure 5.11 Bus Stop Locations in the vicinity of Scrabster Harbour
Figure 5.12 Bus Stop Facilities on A9 in the vicinity of Scrabster Harbour
Figure 5.13 Bus Stop Facilities on A9 in the vicinity of Scrabster Harbour
Figure 5.14 Thurso Rail Station
Figure 5.15 ScotRail North Highlands Rail Line and Stations
Figure 5.16 ScotRail North Highlands Rail Line and Stations
Figure 5.17 ScotRail Connecting Services between Inverness, Scrabster and Stromness
Figure 5.18 A9 Trunk Road in the vicinity of Scrabster Harbour
Figure 5.19 A9 Trunk Road from trafficscotland.org
Figure 5.20 Car Parking Facilities, Scrabster Harbour
Figure 5.21 Location of ATC Counter on A9 in the vicinity of Scrabster Harbour
Figure 5.22 Total Two-way Traffic on A9 in the vicinity of Scrabster, 2018
Figure 5.23 Total Two-way Traffic Profile on A9 and Cruises that docked in Scrabster Harbour during August 2018
Figure 5.24 Location of Most Recent Traffic Collision Recorded on A9 in the Vicinity of Scrabster Harbour (https://www.crashmap.co.uk/)
Figure 5.25 Construction Traffic Flows
Figure 5.26 Construction Traffic Flows, Sensitivity Test, All Dredge Material Removed by Road

6 AIR QUALITY AND CLIMATE

(No figures)

7 NOISE AND VIBRATION

(No figures)

8 GEOLOGY, HYDROGEOLOGY AND CONTAMINATION

Figure 8.1 Study Area
Figure 8.2 Whiteford Geoservices Borehole Location Plan
Figure 8.3 Schematic cross section of the ground conditions beneath St. Ola Pier

9 COASTAL PROCESSES

Figure 9.1 Extent of the Pentland Firth tidal model
Figure 9.2 Tidal flow model mesh around Scrabster Harbour, Thurso Bay and its approaches
Figure 9.3 Spring flood tidal patterns in Thurso Bay with existing Scrabster harbour layout
Figure 9.4 Spring ebb tidal patterns in Thurso Bay with existing Scrabster harbour layout
Figure 9.5 Spring flood tidal patterns in Thurso Bay with proposed redevelopment layout
Figure 9.6 Spring ebb tidal patterns in Thurso Bay with proposed redevelopment layout
Figure 9.7 Difference in Spring flood flow – Proposed redevelopment minus existing
Figure 9.8 Difference in Spring ebb flow – Proposed redevelopment minus existing
Figure 9.9 Extent and bathymetry of Mike21 Spectral Wave transformation model
Figure 9.10 Significant combined wave height and mean wave direction - 1 in 50 year return period storm from 355°
Figure 9.11 Significant combined wave height and mean wave direction - 1 in 50 year return period storm from 355° at Scrabster
Figure 9.12 Significant combined wave height and mean wave direction - 1 in 50 year return period storm from NE at Scrabster
Figure 9.13 Orientation of Boussinesq wave disturbance model for NNW wave studies
Figure 9.14 Wave disturbance patterns –Combined NNW wave 7m Hm0, 16.5s Tp
Figure 9.15 Wave disturbance patterns – NE wind sea 2.40m Hm0, 6.0s Tp
Figure 9.16 Wave disturbance patterns – redeveloped St Ola Pier with dredged outer harbour Combined NNW wave 7m Hm0, 16.5s Tp
Figure 9.17 Wave disturbance patterns – redeveloped St Ola Pier with dredged outer harbour NE wind sea 2.40m Hm0, 6.0s Tp
Figure 9.18 Significant wave heights around the existing harbour 7m Hm0, 16.5s Tp from NNW at HAT
Figure 9.19 Significant wave heights around the existing harbour 4.25m Hs, 17.48s Ts from NNW at HAT
Figure 9.20 Significant swell wave heights around the existing harbour 2.80m Hs, 14.87s Ts from NNW at MHWS
Figure 9.21 Significant wave heights around the existing harbour 2.40m Hm0, 6.0s Tp from NE at MHWS
Figure 9.22 Significant wave heights – redeveloped St Ola Pier with dredged outer harbour 7m Hm0, 16.5s Tp from NNW at HAT
Figure 9.23 Significant wave heights – redeveloped St Ola Pier with dredged outer harbour 4.25m Hs, 17.48s Ts from NNW at HAT
Figure 9.24 Significant wave heights – redeveloped St Ola Pier with dredged outer harbour 2.80m Hs, 14.87s Ts from NNW at MHWS
Figure 9.25 Significant wave heights – redeveloped St Ola Pier with dredged outer harbour 2.40m Hm0, 6.0s Tp from NE at MHWS
Figure 9.26 Significant wave height differences – redeveloped St Ola pier and dredging minus existing 7m Hm0, 16.5s Tp from NNW at HAT
Figure 9.27 Significant wave height differences – redeveloped St Ola pier and dredging minus existing 4.25m Hs, 17.48s Ts from NNW at HAT
Figure 9.28 Significant wave height differences – redeveloped St Ola pier and dredging minus existing 2.80m Hs, 14.87s Ts from NNW at MHWS
Figure 9.29 Significant wave height differences – redeveloped St Ola pier and dredging minus existing 2.40m Hm0, 6.0s Tp from NE at MHWS

Figure 9.30 Assumed track of TSHD in the simulation of the dredging of the outer basin
Figure 9.31 Tidal curve and 6 day dredging/dumping period (shown in red)
Figure 9.32 Maximum envelope of SSC in the water column during 6 days of dredging/dumping
Figure 9.33 Mean envelope of SSC in the water column during 6 days of dredging/dumping
Figure 9.34 Deposition depth of dredged spoil on the sea bed on completion of 6 day dredge
Figure 9.35 Tidal curve and 12 day dredging/dumping period (shown in purple)
Figure 9.36 Deposition depth of dredged spoil on the sea bed on completion of 12 day dredge
Figure 9.37 Maximum envelope of SSC in the water column during 12 days of dredging/dumping
Figure 9.38 Mean envelope of SSC in the water column during 12 days of dredging/dumping

10 WATER QUALITY

Figure 10.1 Location of Scrabster Harbour and surrounding designated sites
Figure 10.2 Marine sample borehole locations and dredge areas
Figure 10.3 Proposed sea disposal location boundary

11 MARINE BIODIVERSITY

Figure 11.1 Regional marine biodiversity study area
Figure 11.2 Local marine biodiversity study area
Figure 11.3 PSA results and physico-chemical sample locations relative to the dredge footprint
Figure 11.4 Site sediment fractions derived from the benthic survey PSA
Figure 11.5 Spawning and nursery location for cod, common skate, herring and ling
Figure 11.6 Spawning and nursery location for plaice, saithe, sandeel, spotted ray
Figure 11.7 Spawning and nursery location for spurdog and thornback ray
Figure 11.8 Area covered by SCANS III, the Irish OBSERVE and adjacent surveys
Figure 11.9 Designated sites identified for marinebiodiversity receptors considered in this assessment
Figure 11.10 Probability of disturbance contours based on 5 dB increments of predicted received unweighted single pulse SELs due to impact piling using a 240 kJ hammer energy (maximum design scenario) at St Ola Pier

12 TERRESTRIAL BIODIVERSITY AND ORNITHOLOGY

(No Figures)

13 INTERACTIONS

(No Figures)

ABBREVIATIONS

AADT	Average Annual Daily Traffic
ACMs	Asbestos Containing Materials
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Areas
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas
ASSI	Area of Special Scientific Interest
ATC	Automatic Traffic Count
BAP	Biodiversity Action Plan
bgl	Below Ground Level
BoCC	Birds of Conservation Concern
BPEO	Best Practicable Environmental Option
CAFÉ	Clean Air for Europe
CAFS	Cleaner Air for Scotland
Cals	Chemical Action Levels
CD	Chart Datum
CD&E	Construction, Demolition and Excavation
CEDaR	Centre for Environmental Data and Recording
CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute of Ecology and Environmental Management
CIEH	Chartered Institute of Environmental Health
CJEU	Court of Justice of the European Union
CL:AIRE's	Contaminated Land: Applications in Real Environments
CLVIA	Cumulative Landscape and Visual Impacts
CO	Carbon monoxide
CO2e	Carbon dioxide equivalent
COMEAP	Committee on the Medical Effects of Air pollution
CSM	Conceptual Site Mode
DEFRA	Department for Environment Food & Rural Affairs
DHI	Danish Hydraulics Institute
DMRB	Design Manual for Roads and Bridges
EAL	Environmental Assessment Level
EC	European Commission
EcIA	Ecological Impact Assessment
ECOP	Ecological Constraints and Opportunities Plan
ECoW	Ecological Clerk of Works
EEZ	Ecological Exclusion Zone
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIC	Environmental Industries Commission
EPS	European Protected Species
EPUK	Environmental Protection UK
EQI	Environmental Quality Index
EUNIS	European Site European Nature Information System
EWCs	European Waste Codes
FCS	Favourable Conservation Status
FRA	Flood Risk Assessment
GAC	Generic Assessment Criteria
GES	Good Ecological Status
GHGs	Greenhouse Gases
GIS	Geographic Information System
GLVIA3	Guidelines for Landscape and Visual Impact Assessment, Third Edition
GQRA	Generic Quantitative Risk Assessment

HA	Highways Agency
HDV	Heavy Duty Vehicles
HGV	Heavy Goods Vehicle
HIA	Health Impact Assessment
HRA	Habitats Regulations Assessment
HV	High Voltage
IAN	Interim Advice Note
IAQM	Institute of Air Quality Management
IEFS	Important Ecological Features
IHR	Industrial Heritage Record
ITS	Intelligent Transport System
LAQM	Local Air Quality Management
LAQM.TG16	Local Air Quality Management Technical Guidance 2016
LoW	List of Waste
LQM	Land Quality Management
MCS	Marine Conservation Society
MCZ	Marine Conservation Zone
MHW	Mean High Water
MMO	Marine Mammal Observation
MNRs	Marine Nature Reserves
MPS	Marine Policy Statement
MSLOT	Marine Scotland Licensing Operations Team
MV	Medium Voltage
N	Nitrogen
NCN	National Cycle Network
NML	Noise Monitoring Location
NMPI	National Marine Plan Interactive
NO	Nitric Oxide
NO2	Nitrogen Dioxide
NOx	Oxides of Nitrogen
NR	Nature Reserve
NRMM	Non-road mobile machinery
NTS	Non-Technical Summary
OSCP	Harbour Oil Spill Contingency Plan
PACC	Pre-Application Community Consultation Report
PAH	Polycyclic Aromatic Hydrocarbons
PAM	Passive Acoustic Monitoring
PAN	Planning Advice Note
PCBs	Polychlorinated Biphenyls
PEL	Probable Effect Levels
PMF	Priority Marine Features
PPC	Pollution Prevention Control
PRA	Preliminary Risk Assessment
PRFs	Potential Roost Features
PSA	Particle Size Analysis
PTS	Permanent Threshold Shift
QE	Queen Elizabeth
RBD	River Basin District
RBMP	River Basin Management Plan
RHAT	River Hydromorphological Assessment Technique
RICT	River Invertebrate Classification Tool
RIGS	Regionally Important Geological Sites
RIVPACS	River Invertebrate Prediction and Classification Software
SAC	Special Area of Conservation
SEL	weighted Sound Exposure Level

SEPA	Scottish Environment Protection Agency
SHT	Scrabster Harbour Trust
SLM	Specific Landscape Mitigation
SLNCI	Site of Local Nature Conservation Interest
SMART	Specific, Measurable, Attainable, Relevant and Timed
SMR	Sites and Monuments Record
SMWWC	Scottish Marine Wildlife Watching Code: A Guide to Best Practice to Watching Marine Wildlife
SO2	Sulphur Dioxide
SPA	Special Protection Area
SPL	Significant Pollutant Linkages
SPLpk	Unweighted peak Sound Pressure Level
SPP	Scottish Planning Policy
SSC	Suspended Sediment Concentration
SUDs	Sustainable Urban Drainage System
SWL	Sound Power Levels
SWMP	Site Waste Management Plan
TEL	Threshold Effect Levels
UKNAQS	The UK National Air Quality Strategy
WAC	Waste Acceptance Criteria
WFD	Water Framework Directive
WFD	Waste Framework Directive
WHO	World Health Organisation
WML	Waste Management Licence
ZoI	Zone of Impact

GLOSSARY OF TERMS

Term	Definition
Aggregate	Granular material (e.g. sand and gravel or crushed rock) that can be used for building and/or civil engineering purposes (e.g. for concrete production)
Air Quality Action Plan AQAP	A plan that must be compiled by a local authority if they declare an air quality management area.
Air Quality Dispersion Modelling System	An advanced dispersion model used to model the air quality impact of projects.
Air quality exceedance	Where pollutant concentrations exceed an air quality standard.
Air Quality Management Area (AQMA)	If a local authority identifies any locations within its boundaries where the air quality objectives are not likely to be achieved, it must declare the area as an air quality management area. The local authority is subsequently required to put together a local air quality action plan.
Air quality objective	Objectives are policy targets generally expressed as a maximum ambient pollutant concentration to be achieved. The objectives are set out in the UK Government's Air Quality Strategy for the key air pollutants.
Ambient noise	A sound that is totally encompassing in a given situation at a given time usually composed of sound from many sources near and far.
Amenity	The benefits of enjoyment and well-being which are gained from a resource in line with its intended function. Amenity may be affected by a combination of factors such as: sound, noise and vibration; dust/air quality; traffic/congestion; and visual impacts.
Annual Average Daily Traffic (AADT)	The total volume of vehicle traffic on a road flowing past a certain point over a year, divided by 365 days.
Annual Average Weekday Traffic	The average 24-hour traffic volume occurring on weekdays throughout a full year.
Anthropogenic	Relating to, or resulting from the influence of human beings on nature.
Appropriate Assessment	An assessment of the effects of a plan or project on the Natura 2000 network of European sites of nature conservation significance. The assessment focuses on the plan or project's implications for the site and any potential adverse impacts on its integrity.
Baseline conditions	The environment as it appears (or would appear) immediately prior to the implementation of the project together with any known or foreseeable future changes that will take place before completion of the project.
Basic Noise Level (BNL)	A measure of source noise at a reference distance of 10m from the nearside carriageway edge.
Bedrock	Rock that underlies loose deposits such as soil or alluvium.
Berthage	Accommodation for mooring or anchoring specifically : space (as at a wharf) reserved to take care of shipping
Biodiversity	The variety of life in the world or in a particular habitat or ecosystem.
Borehole	A hole bored into the ground, usually as part of investigations, typically to test the depth and quality of soil, rock and groundwater. A borehole can also be used to dewater the ground.

British Geological Survey (BSG)	A body which aims to advance geoscientific knowledge of the United Kingdom landmass and its continental shelf by means of systematic surveying, monitoring and research
British Standard (BS)	Standard produced by the British Standards Institution.
British Standards Institution (BSI)	A group which produces British Standards across industry sectors and which is formally designated as the National Standards Body for the UK.
Buffer	Specified area or distance surrounding a site or feature of interest.
Built heritage	A structure or building of historic value. These structures are visible above ground level.
Bypass	The diversion of a major road to carry traffic around a built up area, constructed to improve the journey of through traffic and/or improve the environmental conditions along the original route.
Calculation of Road Traffic Noise	A technical memorandum that describes the procedures for calculating noise from road traffic.
Carbon footprint	The total greenhouse gas emissions associated with a particular policy or development.
Carbon monoxide	A pollutant gas generated by combustion sources. At very high concentrations it can be a dangerous asphyxiant.
Catchment	A drainage/basin area within which precipitation drains into a river system and eventually into the sea.
Chartered Environmentalist	A professional qualification obtained by knowledgeable, experienced, competent and committed environmental professionals.
Chartered Institute of Ecology and Environmental Management (CIEEM)	The leading professional membership body representing and supporting ecologists and environmental managers in the UK, Ireland and abroad.
Climate change	This refers to a change in the state of the climate, which can be identified by changes in average climate characteristics which persist for an extended period, typically decades or longer.
Committed development	A development that has full or outline planning permission, or is allocated in an adopted development plan.
Competent Expert(s)	The terms used in the EIA Regulations to describe a suitably qualified and experienced person (or persons) responsible for the preparation of the Environmental Impact Assessment Report, either whole or in part.
Conservation Area	An area designated as being of special architectural or historic interest and with a character or appearance which is desirable to preserve or enhance.
Conservation status	The state of a species or habitat including for example, extent, abundance, distribution and their trends.
Construction Compound	Construction compounds will generally act as the points of entry to the worksites from the public highway. They may also be used for major stockpiling of materials such as top soil, and to facilitate transfer of materials to and from the site.
Contractor	A general term used to describe an individual or company appointed by a developer to construct or manage a project at a certain price or rate.
Construction plant	Portable construction machinery and equipment.
Culvert	A tunnel (pipe or box shaped) that carries a stream or open drain under a road or railway.
Cumulative	The environmental effects of the proposed development in cumulation with effects from other nearby developments of an appropriate scale.

Cutting (road)	Excavation of earth material to lower the ground level on which a road would be positioned, in order to help to reduce noise and/or visual impact.
Cycle lane	A lane reserved exclusively for the use of bicycles.
Decibel	The scale used to measure noise is the decibel scale which extends from 0 to 140 decibels, corresponding to the intensity of the sound pressure level.
Deposition (dust)	The vertical passage of a substance (e.g. dust) to a surface or the ground.
Deposition (sediment)	The laying down of part, or all, of the sediment load of a stream on the bed, banks or floodplain which forms various sediment features such as bars, berms and floodplain deposits.
Design Manual for Roads and Bridges (DMRB)	A set of documents that provide a comprehensive manual system which accommodates all current standards, advice notes and other published documents relating to the design, assessment and operation of trunk roads (including motorways).
Detailed Assessment	Method applied to gain an in-depth appreciation of the beneficial and adverse consequences of the project and to inform project decisions. Detailed Assessments are likely to require detailed field surveys and/or quantified modelling techniques.
Earthworks	The removal or placement of soils and rocks such as in cuttings, embankments and environmental mitigation, including the in-situ improvement of soils/rocks to achieve the desired properties.
Effect	Term used to express the consequence of an impact (expressed as the 'significance of effect'), which is determined by correlating the magnitude of the impact to the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria. For example, land clearing during construction results in habitat loss (impact), the effect of which is the significance of the habitat loss on the ecological resource.
Enhancement	A measure that is over and above what is required to mitigate the adverse effects of a project.
Environmental Assessment	A method and a process by which information about environmental effects is collected, assessed and used to inform decision-making. Assessment processes include Strategic Environmental Assessment, Assessment of Implications on European Sites and environmental impact assessment
Environmental Impact Assessment	"The systematic, reproducible and interdisciplinary identification, prediction and evaluation, mitigation and management of impacts from proposed development and its reasonable alternatives."Used for the purposes of this guidance when referring to both statutory Environmental Impact Assessment (EIA) and non-statutory environmental impact assessment.
EIA	An Environmental Impact Assessment is an assessment of the environmental consequences (positive and negative) of a project
EIAR	An Environmental Impact Assessment Report is a publicly available document setting out the developer's assessment of the likely environmental effects of a project
EIA Screening	The Screening process determines whether a project falls within the remit of the Regulations and whether it will have significant effects and thus require assessment
EIA Scoping	EIA Scoping The Scoping process determines the extent of the issues to be assessed and reported in the Environmental Statement EC Directive 2001/92/EU This is a Directive of the European Parliament on the assessment of the effects of public and private projects on the environment

Essential mitigation	Mitigation which the Overseeing Organisation has the statutory power to achieve.
European Protected Species	Species of plants and animals (not birds) which are protected by European law.
European site	The generic term used to describe the following designated sites: • Special Areas of Conservation (SACs) and Special Protection Areas (SPAs); • Sites that are in the process of designation as SACs and SPAs -these are known as proposed SACs (pSACs), candidate SACs (cSACs), potential SPAs (pSPAs) and Sites of Community Importance (SCIs), depending on the type of designation and point of progression through the designation process; and • Ramsar Sites.
Evaluation	The determination of the significance of effects. Evaluation involves making judgements as to the value of the receptor/resource that is being affected and the consequences of the effect on the receptor/resource based on the magnitude of the impact.
Greenhouse gases	Atmospheric gases such as carbon dioxide, methane, chlorofluorocarbons, nitrous oxide, ozone, and water vapour that absorb and emit infrared radiation emitted by the Earth's surface, the atmosphere and clouds.
Groundwater	All water which is below the surface of the ground and within the permanently saturated zone.
Habitat	The natural home or environment of an animal, plant, or other organism.
Hydrogeology	The nature, distribution and movement of groundwater in soils and rocks, including in aquifers.
Impact	Change that is caused by an action; for example, land clearing (action) during construction which results in habitat loss (impact).
Institute of Public Health (IPH)	The Institute of Public Health in Ireland (IPH) promotes cooperation for public health between Northern Ireland and the Republic of Ireland by: strengthening public health intelligence; building public health capacity; policy and programme development and evaluation.
Key characteristics (landscape)	The combination of elements that are particularly important to the current character of the landscape and help to give an area its particularly distinctive sense of place.
Link	A section of road between two junctions.
Magnitude	The size of something.
Mitigation	Measures intended to avoid, reduce and, where possible, remedy significant adverse environmental effects.
Monitoring	A continuing assessment of the performance of the project, including mitigation measures. This determines if effects occur as predicted or if operations remain within acceptable limits, and if mitigation measures are as effective as predicted.
National Nature Reserve	Areas of land or water designated under the Wildlife and Countryside Act 1981 as containing habitats and species of national importance.
Noise Insulation Regulations	Noise Insulation Regulations 1975 made under Part II of the Land Compensation Act 1973.
Noise Sensitive Receptor	These comprise mainly residential buildings, but also include educational buildings, hospitals and places of worship.

Nitrogen dioxide NO2	A gas produced when fuels are burned and is often present in motor vehicle and boiler exhaust fumes. It is an irritant to the respiratory system.
Nitrogen oxide NOx	A group of chemical compounds consisting only of nitrogen and oxygen which may be interconverted in the atmosphere. The principal oxides of nitrogen are nitric oxide and nitrogen dioxide.
Non-Technical Summary (NTS)	Information for the non-specialist reader to enable them to understand the main predicted environmental effects of the proposal without reference to the main Environmental Statement.
Operational	The functioning of a project on completion of construction
Optioneering	The systematic examination of the performance of alternative products and designs to better meet major construction challenges. It takes into account the impact of each product or design method on a project's cost, environmental footprint, and safety issues
Ornithological	Of or relating to ornithology which is the study of birds.
Particulate matter	Discrete particles in ambient air, with diameters ranging between nanometres (billionths of a metre) to micrometres (millionths of a metre).
Personal Protective Equipment	Protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection.
Phase 1 habitat survey	A habitat classification and field survey technique to record semi-natural vegetation and other wildlife habitats.
Photomontage	Inserting an image of a proposed development onto a photograph for the purposes of creating an illustrative representation of potential changes to existing views.
Pollution Prevention Guidelines (PPG)	Pollution Prevention Guidelines (PPGs) are a series of documents developed by the Environment Agency for England and Wales, the Northern Ireland Environment Agency (NIEA) for Northern Ireland, and the Scottish Environment Protection Agency (SEPA) for Scotland. Each PPG is targeted at a particular type of business or activity and covers environmental good environmental practice to minimise pollution. The PPGs also make reference to environmental legal obligations, but that information is currently out-of-date and requires updating. A review plan for the PPGs is currently underway, resulting in a replacement guidance series, with new branding and title "Guidance for Pollution Prevention" (GPPs). The new series provide environmental good practice guidance for the whole UK, and environmental regulatory guidance directly to Northern Ireland, Scotland and Wales only.
Pre-Application Consultation	The process of communicating and consulting with members of the public so that local communities are better informed about development proposals and to have an opportunity to contribute their views before a formal planning application is submitted
Programme	A series of steps that have been identified by the Overseeing Organisation, or series of projects that are linked by dependency.
Project objectives	The objectives of the project, set by the Overseeing Organisation and including those set out in the Project Brief.
Protected Species	Species of wild plants, birds and animals which are afforded protection through legislative provisions.
Public right of way	A highway where the public has the right to walk. It can be a footpath (used for walking), a bridleway (used for walking, riding a horse and cycling), or a byway that is open to all traffic (including motor vehicles).

Ramsar (site)	Wetland sites that are of international importance, as designated under Article 2(1) of the Convention on Wetlands of International Importance especially as Waterfowl Habitat. Ramsar (Iran), 2 February 1971. UN Treaty Series No. 14583.
Receptor	A defined individual environmental feature usually associated with population, fauna and flora that has potential to be affected by a project.
Reclamation Area	The area of land which has undergone the process of creating new land from oceans, riverbeds, or lake beds. The land reclaimed is known as reclamation ground or land fill.
Remediation	The process of removing a pollution linkage (i.e. by removing one or more of the elements in a sourcepathway- receptor linkage) in contaminated land in order to render an acceptable risk. Usually this involves a degree of removal of contaminants and/ or blockage of pathways.
Residual Effect	The predicted consequential change on the environment from the impacts of a development after mitigation.
Resource	A defined but generally collective environmental feature usually associated with soil, water, air, climatic factors, landscape, and material assets, including the architectural and archaeological heritage that has potential to be affected by a project.
Restoration (ecological)	The re-establishment of a damaged or degraded system or habitat to a level similar to its original condition.
Riparian	Relating to or situated on the banks of a river.
Risk Assessment	An assessment of the probability of a hazard occurring that could result in an impact.
Runoff	The flow of water over the ground surface.
Scheduled Monument	Nationally significant heritage assets protected by legislation.
Scottish Environmental Protection Agency (SEPA)	The Scottish Environment Protection Agency is Scotland's environmental regulator and national flood forecasting, flood warning and strategic flood risk management authority. Its main role is to protect and improve Scotland's environment.
Scoping	The process of identifying the issues to be addressed by the Environmental Impact Assessment process. It is a method of ensuring that an assessment focuses on the important issues and avoids those that are considered to be not significant.
Scoping Report	A report which records the outcomes of the scoping process and is typically submitted as part of a formal request for a Scoping Opinion.
Screening	The formal process undertaken to determine whether it is necessary to carry out a statutory Environmental Impact Assessment and publish an Environmental Impact Assessment Report in accordance with the EIA Regulations.
Silt	Soil particles from 0.002mm to less than 0.06mm in equivalent diameter.
Significance of effect	A measure of the importance or gravity of the environmental effect, defined by significance criteria specific to the environmental topic.
Areas of Special Scientific Interest	Area of land notified as being of special interest due to its flora, fauna or geological or physiological features.
Soil compaction	The removal of pore spaces within soil structures and drainage channels between soil structures. This inhibits root penetration and the movement of air and water in soil.

Soil erosion	The detachment and movement of soil by the action of water and/or wind.
Soil resource	The textures, structures and volume of different qualities of topsoil and subsoil that have a potential for beneficial reuse.
Sound power level	The sound power level of a source is a measurement of the total acoustic power it radiates. The sound power level is an intrinsic characteristic of a source (analogous to its volume or mass), which is not affected by the environment within which the source is located.
Sound pressure level	The parameter by which sound levels are measured in air. It is measured in decibels. The threshold of hearing has been set at 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dB at a distance of 1 metre and a change of 3dB in a time varying sound signal is commonly regarded as being just detectable. A change of 10dB is subjectively twice, or half, as loud.
Special Area of Conservation (SAC)	Sites designated under EU legislation for the protection of habitats and species considered to be of European interest.
Stakeholder	An organisation or individual with a particular interest in the project
Statutory consultee	"Organisations that the relevant determining authority is required to consult by virtue of the EIA Regulations."
Standard mitigation	Measures comprising standard techniques and activities which are implemented during the construction of a development project to protect the environment and/or mitigate adverse effects, for example the covering of exposed materials to reduce dust emissions.
Study area	The spatial area within which environmental effects are assessed (i.e. extending a distance from the project footprint in which significant environmental effects are anticipated to occur). This may vary between the topic areas
Sulphur dioxide	A gas primarily arising from anthropogenic activities and more specifically combustion of fuels containing sulphur and sulphur compounds. Sulphur dioxide is emitted in negligible quantities during the combustion of natural gas but generally at higher concentrations for liquid fuels which have a higher sulphur content.
Surface water	Waters including rivers, lakes, loughs, reservoirs, canals, streams, ditches, coastal waters and estuaries.
Sustainable development	The overarching aim to "enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generations".
Terrestrial	On or relating to the earth.
Till	Unsorted glacial sediment deposited directly by a glacier during the Ice Age.
Topic report	Document produced to report the findings of the environmental impact assessment of an individual topic area that may or may not contain raw data
Topsoil	Upper layer of a soil profile, usually darker in colour (because of its higher organic matter content) and more fertile than subsoil, and which is a product of natural biological and environmental processes.
Trackout	The transportation of dust and dirt from construction sites onto the road network.
Transect Survey	A path along which one counts and records occurrences of the species of study (e.g. plants).

Translocation	The transporting and release of species or habitats from one location to another. For example, if an area of land is required permanently for a new development, species can be moved from that site to a suitable alternative location.
Two-way vehicle flows	A person trip is a one-way journey by one person by any mode of transport, including walking, cycling, privately operated motor vehicles, or any public transport modes. A vehicle trip is a one-way journey by a single privately operated motor vehicle regardless of the number of persons in the vehicle. Two-way trips refer to the total number of vehicle movements in both directions (i.e. with 200 westbound vehicles and 100 eastbound, there would be 300 two-way trips)
Utilities	The term utilities can also refer to the set of services provided by these organisations consumed by the public: Coal, electricity, natural gas, water, sewage, telephone, and transportation. Broadband internet services (both fixed-line and mobile) are increasingly being included within the definition.
Water Framework Directive (WFD)	EU directive which commits European Union member states to achieve good qualitative status of all waterbodies by 2015