REPORT

# Port of Leith Outer Berth: Approach Channel Deepening

## Supplementary Report to Inform Appropriate Assessment

Client: Forth Ports Limited

Reference: PC4514-RHD-YY-XX-RP-EV-0018

Status: Final/01

Date: 4 December 2023

FORTH PORTS SCOTLAND

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| Classification |
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| Project related |

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# Acronyms

| Acronym | Acronym Description |
|---|---|
| AA | Appropriate Assessment |
| AEoI | Adverse Effects on Integrity |
| AL | Action Level |
| BHD | Back-hoe Dredger |
| BPEO | Best Practicable Environmental Option |
| BTO | British Trust for Ornithology |
| CD | Chart Datum |
| CEDA | Central Dredging Association |
| cSAC | Candidate Special Areas of Conservation |
| ECoW | Environmental Clerk of Works |
| EIA | Environmental Impact Assessment |
| GPP | Guidance for Pollution Prevention |
| HRA | Habitats Regulations Appraisal |
| HVDC | High Voltage Direct Current |
| IAMMWG | Inter-Agency Marine Mammal Working Group |
| IoM | Isle of May |
| IROPI | Imperative Reasons of Overriding Public Interest |
| JNCC | Joint Nature Conservation Committee |
| LSE | Likely Significant Effect |
| MD-LOT | Marine Directorate Licensing Operations Team |
| MMO | Marine Mammal Observer |
| MS | Marine Scotland |
| MS-LOT | Marine Scotland's Licensing Operations Team |
| MU | Management Unit |
| NMFS | National Marine Fisheries Service |
| NSN | National Site Network |
| OWF | Offshore Wind Farms |
| PCB | Polychlorinated Biphenyls |
| PPG | Pollution Prevention Guidance |
| pSPA | Possible Special Areas of Conservation |
| PTS | Permanent Threshold Shift |
| rms | root mean square |
| RSPB | Royal Society for the Protection of Birds |

| Acronym | Acronym Description |
|---|---|
| SAC | Special Areas of Conservation |
| SCANS | Small Cetaceans in the European Atlantic and North Sea |
| SCOS | Special Committee on Seals |
| SEL | Sound Exposure Level |
| $SEL_{cum}$ | Cumulative Sound Exposure Level |
| $SEL_{ss}$ | Single Strike Sound Exposure Level |
| SNH | Scottish Natural Heritage |
| SPA | Special Protection Areas |
| SPL | Sound Pressure Level |
| sRIAA | Supplementary Report to Inform Appropriate Assessment |
| SSC | Suspended Sediment Concentration |
| TSHD | Trailer Suction Hopper Dredger |
| TTS | Temporary Threshold Shift |
| WeBS | Wetland Bird Survey |
| WODA | World Organization of Dredging Associations |

# 1 Introduction

## 1.1 Proposed Amendments to the Outer Berth Development

Forth Ports Limited ("Forth Ports") is improving the Outer Berth at the Port of Leith ("the Port") to support the offshore renewable energy industry. In December 2022, Marine Licences were granted by Marine Scotland's Licensing Operations Team (MS-LOT) (now known as the Marine Directorate Licensing Operations Team (MD-LOT)) for improvement works to the Outer Berth (MS-00009818) as well as the disposal of associated dredged material (MS-00009819). A Habitats Regulations Appraisal (HRA) was undertaken on the Outer Berth development (herein referred to as "the Outer Berth HRA") and an HRA Stage One and Stage Two Report was produced to support the licence applications (Royal HaskoningDHV, 2022).

The current water depth of the Leith approach channel (between -6.5m Chart Datum (CD) and -7.0m CD) significantly limits the tidal window during which deep-drafted vessels can transit in or out of the Port and, on some neap tides, access is not possible at all. Given this, the increased water depth required by the evolving offshore renewables industry, limited vessel availability, the increasing draft of construction vessels associated with this industry and the under-keel requirements for navigational safety, Forth Ports is proposing to deepen the Leith approach channel. The deepening of the approach channel would not change the number of vessel movements to the Outer Berth as described in the Outer Berth HRA Report. Instead, its purpose is to increase the frequency and length of the tidal window when deeper drafted vessels can access the Outer Berth.

The proposed deepening would increase the depth of the approach channel to -9.0m CD and extend the offshore extent, from the current maintenance dredge limit, to the -9.0m CD contour within the Firth of Forth. The Outer Berth berth pocket, most of which will have been deepened to -9.0m CD as part of the consented Outer Berth development, would be repositioned northwards, increased in size, and deepened to -13.0m CD. The footprint of the proposed deepening can be seen in **Figure 1-1**.

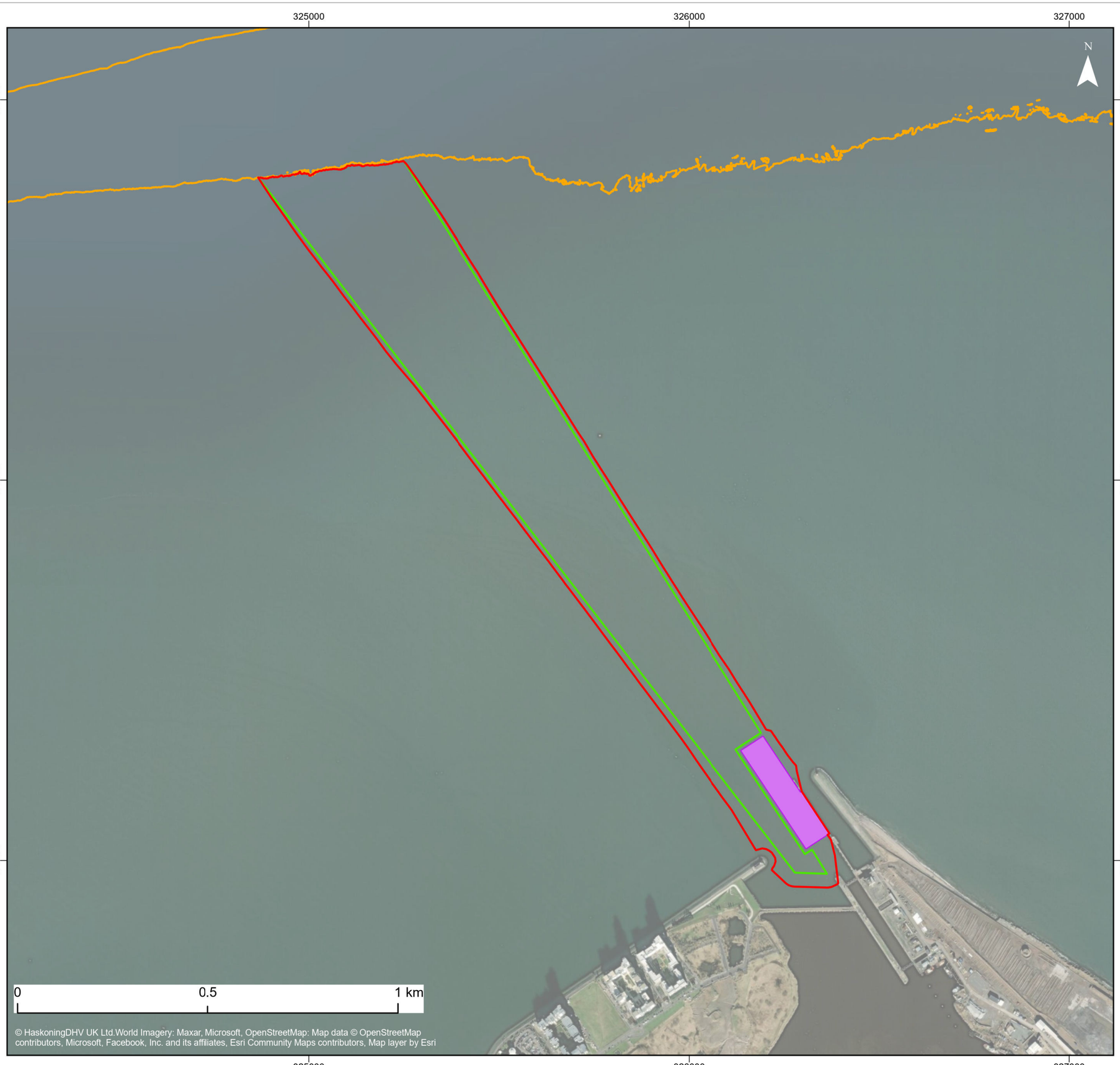
It is anticipated that the dredge and disposal activities would be completed within approximately four months, with approximately 1,300,000m$^3$ of material removed, approximately 1,410,000m$^3$ including a 0.25m over-dredge allowance. Disposal would be at Narrow Deep B Spoil Disposal Ground (FO038), as confirmed by the Best Practicable Environmental Option (BPEO) assessment submitted as part of the licence application.

In order to ensure the stability of the Eastern Breakwater of the port following the repositioning and deepening of the berth pocket, a short retaining wall approximately 45m in length will be installed between the dredge pocket and the toe of the breakwater (**Figure 1-2**).

To summarise, the 'Proposed Scheme' comprises the following elements:

- Deepening of the approach channel to -9.0m CD;
- Deepening of the Outer Berth berth pocket to -13.0m CD;
- Disposal of dredge material at Narrow Deep B Spoil Disposal Ground (FO038); and
- Installation of a 45m retaining wall at the toe of the Eastern Breakwater.

Further detail of the Proposed Scheme is provided in **Chapter 2**.





**Legend**

- Dredge Area including slopes
- -9mCD Approach Channel
- -13mCD Berth Pocket
- -9mCD contour

| | |
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| Client: Forth Ports Limited | Project: Port of Leith Outer Berth: Approach Channel Deepening |

Title: Footprint of the Proposed Deepening at the Port of Leith

Figure: 1.1

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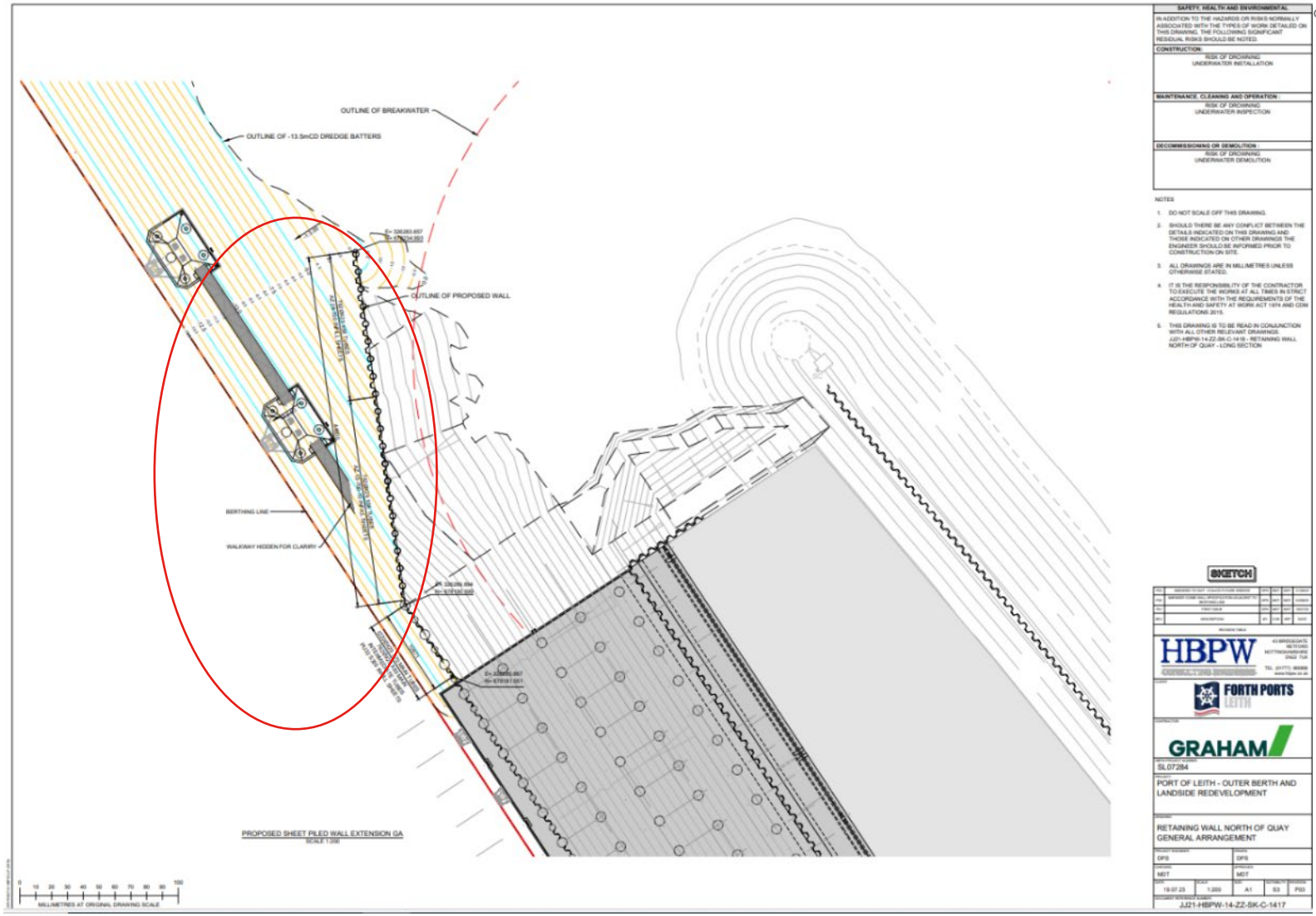



*Figure 1-2 Proposed retaining wall extending north west of the Outer Berth (circled in red)*

## 1.2 Approach to the HRA

Forth Ports is seeking marine licences for the construction works and associated disposal activities associated with the Proposed Scheme (dredging activity would be undertaken under the Port's powers conferred by the Forth Ports Authority Order Confirmation Act 1969). The Proposed Scheme would not change the operational use of the Outer Berth to that considered during the consenting of the Outer Berth development. In order to support the marine licence applications, the Outer Berth HRA has been updated to include the Proposed Scheme.

The marine elements (i.e. the dredging and marine construction works) of the Outer Berth development (i.e. those with the potential for in-combination effects with the Proposed Scheme) will be completed before works related to the Proposed Scheme begins. As such, the presence of the marine elements of the Outer Berth development formed part of the baseline upon which the Proposed Scheme will be assessed.

## 1.3 Purpose of this Report

This report provides information to inform Stage Two of the HRA process: Appropriate Assessment. Stage One (determination of whether or not a plan or project is likely to have a significant effect (Likely Significant Effect (LSE)) on the qualifying features and Conservation Objectives of a National Site Network (NSN) site or Ramsar site, either alone or in-combination with other plans and projects) can be found in **Appendix 1-1**.

Where the potential for LSE could not be discounted, it has been 'screened in' for Appropriate Assessment. Stage Two comprises the provision of sufficient evidence to allow an Appropriate Assessment of the Proposed Scheme to be carried out by the competent authority (in this instance Marine Scotland). The Appropriate Assessment is a determination of whether the Proposed Scheme may, even with mitigation measures in place, result in an adverse effect on site integrity.

# 2 The Proposed Scheme

## 2.1 Construction Phase

### 2.1.1 Dredging and Disposal

To deepen the approach channel to -9.0m CD and the Outer Berth berth pocket to -13.0m CD would require the removal of approximately 1,300,000m$^3$ of sediment (approximately 1,410,000m$^3$ of sediment including a 0.25m over-dredge allowance).

It is anticipated that the majority of dredging would be undertaken by a Trailer Suction Hopper Dredger (TSHD). In areas where the water depth is greater than -4.0m CD, it is likely that a medium TSHD with a hopper capacity of approximately 4,500m$^3$ would be employed (production rate of approximately 83,960m$^3$ per week). At shallower depths a smaller TSHD with a hopper capacity of approximately 1,500m$^3$ would be employed (production rate of approximately 25,680m$^3$ per week). It is anticipated that the TSHDs may work concurrently. In the berth pocket and proximity to the Port of Leith, the TSHD would be supported by a plough vessel to remove sediment from corners and level out ridges.

A breakdown of sediment types and estimated percentage breakdown of the material arising are presented in **Table 2-1**.

*Table 2-1 Estimated sediment fractions of material to be dredged as part of the approach channel deepening*

| Sediment Type | Sediment Fractions (%) | |
|---|---|---|
| | Medium TSHD | Small TSHD |
| Silt/Clay | 64 | 82 |
| Fine Sand | 20 | 17 |
| Medium Sand | 3 | 1 |
| Coarse Sand | 3 | 0 |
| Gravel/Cobble | 10 | 0 |

It is possible that some areas may also require the use of a Back-hoe Dredger (BHD), particularly within areas difficult for a TSHD to access or where rock or consolidated sediment is present. If a BHD would be used, it is expected that the BHD would work in place of one of the TSHDs. Given that the production rate of a BHD is below that of a TSHD, and would be working with rock or consolidated sediment, the resultant sediment plume would be smaller than that of the TSHD. To provide a worst-case assessment, the sediment dispersion modelling (see **Chapter 7: Coastal Processes**) has been based on all of the material being dredged by TSHD.

The BHD would excavate rock with the bucket, including ripping. Should the sediment be too hard to remove using this method, a hydraulic breaker would be attached. The typical underwater noise source level generated by a hydraulic breaker is 175.1 dB 1 µPa SPLRMS @ 1m[1] (Royal HaskoningDHV, 2019). The underwater noise source level for the TSHD is 186 dB 1 µPa SPLRMS @ 1m (see Appendix 10-1 of the Outer Berth EIA Report), the use of a TSHD. Consequently, in terms of underwater noise, the use of TSHD provides the worst-case scenario.

The dredged arisings would be transported to Narrow Deep B Spoil Disposal Ground (FO038) within the TSHD (or support barge in the case of material from BHD). Over the course of the dredge/disposal campaign, it is anticipated that there would be in the region of 800 round trips to the disposal site and dredge/disposal activities would take approximately four months.

### 2.1.2 Installation of the Retaining Wall

The retaining wall would comprise a short sheet piled structure, effectively forming an extension to the sheet piled wall that forms the face of the Outer Berth development. It would be installed below mean low water initially by vibratory piling and completed by percussive piling, as required. Installation would most likely take place from land-based plant working from the Outer Berth. To get access for a crane, there may be a requirement for some minor infilling, depending on the size of the crane to be used. The infill would either be removed following completion of piling or suitably protected with rock armour and left in-situ. The retaining wall would be approximately 45m in length.

### 2.1.3 Anticipated Construction Programme

Overall, dredging programme would be dependent on the dredging equipment scenario(s) employed (e.g. method, capacity); however, it is anticipated that the dredge would be completed within approximately four months. Installation of the retaining wall would take around 12 weeks and may be carried out concurrently with the dredging.

## 2.2 Operational Phase

### 2.2.1 Change in Vessel Access to the Outer Berth

The Proposed Scheme would not change the number of vessel movements to the Outer Berth. Instead, its purpose is to increase the frequency and length of the tidal windows when deeper drafted vessels can access the Outer Berth.

### 2.2.2 Predicted Increase in Maintenance Dredging Requirements

Historic annual dredging volumes over the last two decades (2001 to 2020) have ranged up to 48,000m$^3$, with an average of 20,000m$^3$. Upon completion of the consented Outer Berth development (the baseline for the Proposed Scheme), the baseline maintenance dredge requirement for the entire channel is predicted to increase by 22% (Royal HaskoningDHV, 2022). This will equate to an annual predicted average dredge volume of about 24,000m$^3$. These volumes can be used as a proxy for the rate of sediment transport and deposition in the existing approach channel, and in combination with the change in its dimensions following the Proposed Scheme can be used to estimate the future maintenance dredging requirement.

The removal of about 1,410,000m$^3$ of sediment means that the accommodation space in the future channel compared to the existing channel would increase by this volume. Using the bathymetries of the approach channel and the areas to either side of the channel, the existing accommodation space in the approach channel (excluding the berth pocket) is estimated to be 365,000m$^3$. The existing accommodation space in the berth pocket (to -9.0m CD) is 54,000m$^3$, therefore the total existing accommodation space across the approach channel and berth pocket is 419,000m$^3$.

The removal of 1,410,000m$^3$ of sediment means that the accommodation space would increase from about 419,000m$^3$ to about 1,829,000m$^3$. This equates to an increase in accommodation space compared to the existing of about 337%. Using the baseline average maintenance dredging volume of 24,000m$^3$ and an increase in accommodation space of 337% means the estimated future average maintenance dredging requirement would be about 105,000m$^3$ with a maximum of up to approximately 197,000m$^3$.

The marine licence being made for the Proposed Scheme will not include for this maintenance dredging; consequently, maintenance dredging is not assessed within this sRIAA Report.

# 3 Habitats Regulations Appraisal

## 3.1 Legislation

The HRA process affords protection to those sites designated under the European Council Directive 2009/147/EC on the conservation of wild birds (the 'Birds Directive') and Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive'). The UK also has to meet its obligations under relevant international agreements such as the Ramsar Convention. The UK exited the EU on 31 January 2020; however, the application of the HRA process remains largely unchanged due to the introduction of the EU Exit Regulations 2019.

### 3.1.1 International Legislation

#### 3.1.1.1 EU Habitats Directive

The Habitats Directive provides a framework for the conservation and management of natural habitats, wild fauna (except birds) and flora in Europe. Its aim is to maintain or restore natural habitats and wild species at a favourable conservation status. The relevant provisions of the Directive are the identification and classification of Special Areas of Conservation (SAC) in Article 4, and procedures for the protection of SACs and Special Protection Areas (SPA) in Article 6. SACs are identified based on the presence of natural habitat types listed in Annex I and populations of the species listed in Annex II. The Directive requires national Governments to establish SACs and to have in place mechanisms to protect and manage them.

#### 3.1.1.2 EU Birds Directive

The Birds Directive provides a framework for the conservation and management of wild birds in Europe. The relevant provisions of the Birds Directive are the identification and classification of SPAs for rare or vulnerable species listed in Annex I of the Directive and for all regularly occurring migratory species (required by Article 4). The Directive requires national Governments to establish SPAs and to have in place mechanisms to protect and manage them. The SPA protection procedures originally set out in Article 4 of the Birds Directive have been replaced by the Article 6 provisions of the Habitats Directive.

#### 3.1.1.3 Ramsar Convention

The Convention on Wetlands of International Importance especially as Waterfowl Habitat, as amended in 1982 and 1987 (the 'Ramsar Convention') is an international treaty for the conservation and sustainable use of wetlands of international importance. Ramsar site selection has had an emphasis on wetlands of importance to waterbirds, however non-bird features are increasingly taken into account, both in the selection of new sites and when reviewing existing sites. The UK government and the devolved administrations have issued policy statements relating to Ramsar sites which extend to them the same protection at a policy level as SACs and SPAs. Ramsar sites are therefore included in the HRA process.

### 3.1.2 Scottish HRA Legislation

#### 3.1.2.1 Conservation (Natural Habitats, &c.) Regulations 1994

In Scotland, the Habitats Directive and Birds Directive is transposed into Scottish national legislation by the Conservation (Natural Habitats, &c.) Regulations 1994, as amended (hereafter the 'Habitats Regulations'). The Habitats Regulations place an obligation on a competent authority (for marine licensing matters, this refers to Marine Scotland) to carry out an appropriate assessment of any proposal likely to affect a designated site. When undertaking appropriate assessment, the competent authority must seek advice from NatureScot (as the appropriate nature conservation body) and cannot approve any application that would have an adverse effect on the integrity of a designated site unless certain conditions are met (i.e. that

alternative solutions have been exhausted, that compensatory measures can be secured and that the proposal is necessary for imperative reasons of overriding public interest).

## 3.2 HRA Process

The HRA process helps meet the requirements of Article 6(3) of the Habitats Directive and Regulation 48(1) of the Habitats Regulations, which state that any plan or project, which is not directly connected with or necessary to the management of a designated site and is likely to have a significant effect on such a site (either alone or in combination with other plans or projects), will be subject to an appropriate assessment of its implications for the site in view of its conservation objectives.

In accordance with the Habitats Regulations, Appropriate Assessment is required for any plan or project, not connected with the management of a site within the NSN, which is likely to have a significant effect on the site, either alone, or in-combination with other plans and projects.

According to the Waddenzee judgement (Judgement of 7.9.2004 – Case C-127/02), an appropriate assessment is required if LSE cannot be excluded on the basis of objective information. The Sweetman Opinion (Opinion of Advocate General 22.10.2012 – Case C-258/11) states that the question is simply whether the plan or project concerned is capable of having an effect.

### 3.2.1 Stages of HRA

The HRA process (in its entirety) follows a four-staged approach, as detailed in NatureScot (then Scottish Natural Heritage; 'SNH') Natura Casework Guidance (SNH, 2014).

1. **What is the plan or project**: to establish whether there is sufficient information on the plan or project (location, extent, timings).

2. **Is the plan or project directly connected with or necessary to site management for nature conservation**: works which are clearly necessary to the management of the site, or that provide value to the site are not required to undertake further assessment.

3. **Is the plan or project likely to have a significant effect**: The process of identifying potentially relevant designated sites, and whether the Proposed Scheme is likely to have a significant effect on the qualifying features of the site, either alone or in-combination with other plans and projects. If it is concluded at this stage that there is no potential for LSE, there is no requirement to carry out subsequent stages of the HRA.

4. **Undertake an Appropriate Assessment**: Where an LSE for a designated site(s) cannot be ruled out, either alone or in-combination with other plans and projects, assessment of the potential effects on the integrity of the site(s), again either alone or in-combination with other plans and projects, in view of its qualifying features and conservation objectives is required. Where an adverse effect on integrity cannot be excluded, an assessment of mitigation options is carried out and mitigation measures (where available) are proposed to address the effects. If, after taking account of mitigation, an adverse effect on integrity cannot be excluded, the HRA must progress to Stages Three and Four.

5. **Can it be ascertained that the plan or project will not adversely affect site integrity**: the appropriate authority must decide if the plan or project in question will or will not adversely affect the integrity of the site/s.

6. **Are there Alternative Solutions**: Identifying and examining alternative ways of achieving the objectives of the project to establish whether there are solutions that would avoid or have a lesser effect on the site(s).

7. **Would a priority habitat or species be adversely affected**: priority habitats and species are afforded a greater level of protection under the Regulations, this stage determines whether Stage Eight or Stage Nine should be undertaken.

8. **Are there Imperative Reasons of Overriding Public Interest (IROPI) (non-priority habitats and/or species)**: Where no alternative solution exists, the next stage of the process is to assess whether the development is necessary for IROPI and, if so, the identification of compensatory measures needed to maintain the overall coherence of the designated site network.

9. **Are there IROPI (priority habitats and/or species):** as above, for priority habitats and/or species, where there are exceptional health, safety, or environmental benefits, or other reasons for IROPI.

### 3.2.2 Types of Designated Sites included in HRA

The classes of designations considered by HRA are:

- Ramsar sites;
- SPAs and Potential SPAs (pSPAs); and
- SACs, Possible SACs (pSACs) and Candidate SACs (cSACs).

# 4 Stage One: Screening for LSE

## 4.1 Introduction

A Stage One: Screening for LSE was undertaken on the Proposed Scheme and submitted to MD-LOT, NatureScot and the Royal Society for the Protection of Birds (RSPB) in August 2023 (See **Appendix 1-1**). No response was received from NatureScot nor MD-LOT. RCPB confirmed that they were content with the approach and that it had captured the issues to be included.

The following changes to the design of the Proposed Scheme have arisen since the Screening for LSE report was issued:

- Target depth in the approach channel has been increased from -8.0m CD (plus 0.25m over-dredge) to -9.0m CD (plus 0.25m over-dredge);
- Target depth in the Outer Berth berth pocket has increased from -12.0m CD (plus 0.25m over-dredge) to -13.0m CD (plus 0.25m over-dredge); and
- The volume of dredged material requiring disposal has increased from approximately 575,000m$^3$ (approximately 695,000m$^3$ including over-dredge) to approximately 1,300,000m$^3$ of sediment (1,410,000m$^3$ of sediment when including a 0.25m over-dredge allowance).

It is anticipated that the capital dredge would now take approximately four months to complete, compared to the previously anticipated approximately three months.

As the proposed changes in dredge depth do not introduce any new activities to that considered by the screening exercise, there are no changes to the potential effects considered by the screening exercise and the LSE conclusions and the approach to providing information for Appropriate Assessment remain valid.

## 4.2 Conclusions of the Screening Assessment

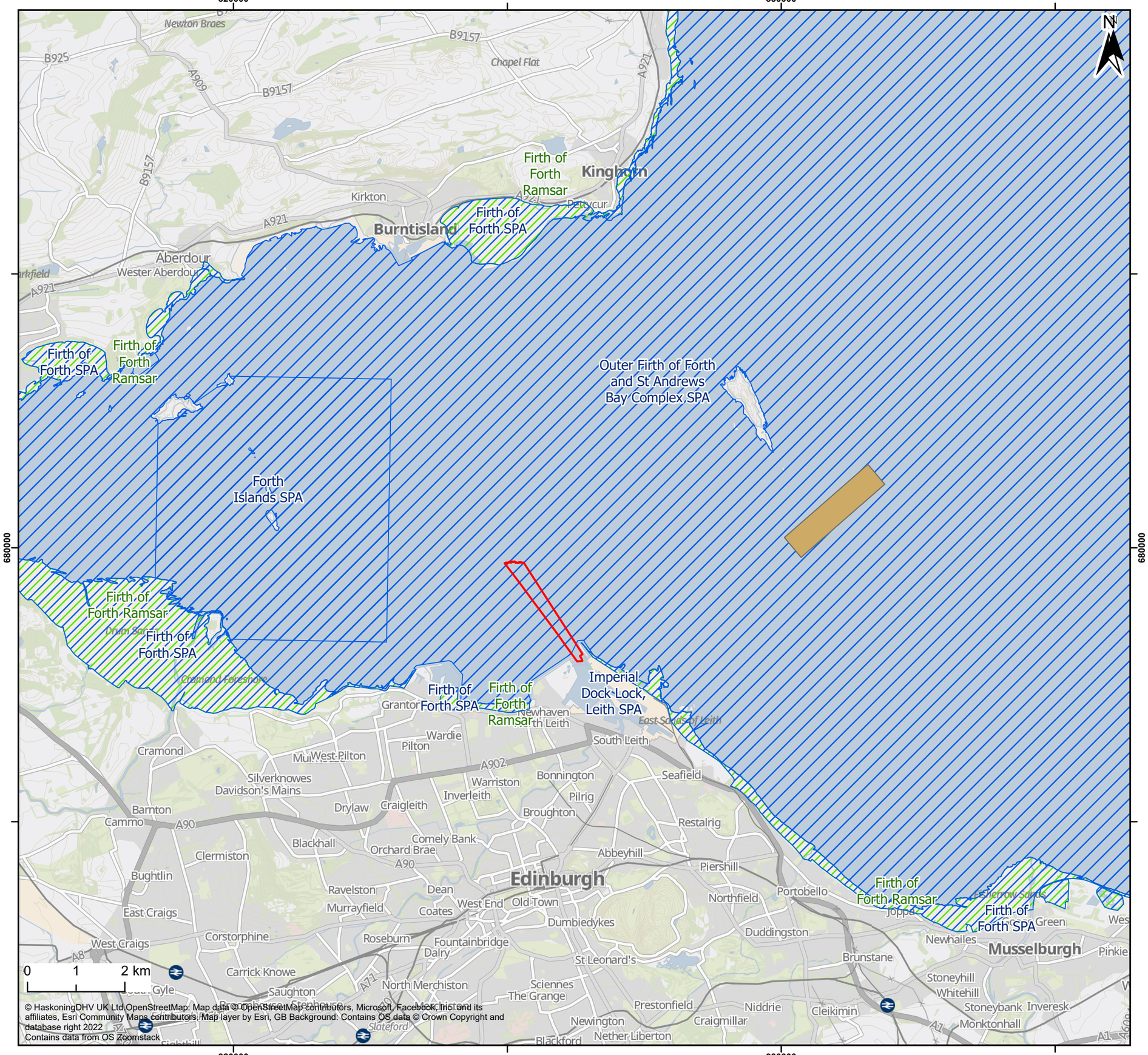
**Table 4-1** and **Table 4-2** summarise the sites and features where LSE has been concluded (or cannot be excluded), alone and in-combination, respectively, and therefore are the subject of Appropriate Assessment. The locations of the designated sites are shown on **Figure 4-1** and **Figure 4-2**.

*Table 4-1 Summary of Screening for LSE (alone)*

| Designated site | Feature |
|---|---|
| River Teith SAC | Sea lamprey, river lamprey, Atlantic salmon |
| Outer Firth of Forth and St Andrews Bay Complex SPA | Common tern, eider, shag, non-breeding waterbird assemblage, non-breeding seabird assemblage, breeding seabird assemblage |
| Firth of Forth SPA | Bar-tailed godwit, knot, pink-footed goose, redshank, turnstone, red-throated diver, Sandwich tern, nonbreeding waterfowl assemblage |
| Firth of Forth Ramsar site | Bar-tailed godwit, knot, pink-footed goose, redshank, non-breeding waterfowl assemblage |
| Imperial Dock Lock, Leith SPA | Common tern |
| Forth Islands SPA | Common tern, lesser black-backed gull, roseate tern, sandwich tern, shag, breeding seabird assemblage |
| Isle of May SAC | Grey seal |
| Firth of Tay and Eden Estuary SAC | Harbour seal |
| Berwickshire and North Northumberland Coast SAC | Grey seal |
| Moray Firth SAC | Bottlenose dolphin |

*Table 4-2 Summary of Screening for LSE (in-combination)*

| Designated site | Feature |
|---|---|
| River Teith SAC | • Seagreen Alpha and Bravo Offshore Wind Farms (OWFs);<br>• Neart na Gaoithe OWF (revised);<br>• Inch Cape OWF (revised); and<br>• Grangemouth Flood Protection. |
| Isle of May SAC | • Seagreen Alpha and Bravo OWFs;<br>• Neart na Gaoithe OWF (revised);<br>• Inch Cape OWF (revised); and<br>• Grangemouth Flood Protection. |
| Firth of Tay and Eden Estuary SAC | • Seagreen Alpha and Bravo OWFs;<br>• Neart na Gaoithe OWF (revised);<br>• Inch Cape OWF (revised); and<br>• Grangemouth Flood Protection. |
| Berwickshire and North Northumberland Coast SAC | • Seagreen Alpha and Bravo OWFs;<br>• Neart na Gaoithe OWF (revised);<br>• Inch Cape OWF (revised); and<br>• Grangemouth Flood Protection. |
| Moray Firth SAC | • Nigg Energy Park East Quay;<br>• North Connect High Voltage Direct Current (HVDC) Cable;<br>• Seagreen Alpha and Bravo OWFs;<br>• Neart na Gaoithe OWF (revised);<br>• Inch Cape OWF (revised);<br>• Moray West OWF;<br>• Alexandra Parade Sea Wall;<br>• Grangemouth Flood Protection; and<br>• Ardersier Port Development. |






Legend:

- Dredge Area
- Ramsar Sites
- Special Protection Area
- Disposal Site Narrow Deep B

Data Sources: ©NatureScot 2023, ©CEFAS 2023

| Client: | Project: |
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| Forth Ports Limited | Port of Leith Approach Channel Deepening |

Title:

Special Protection Areas and Ramsar sites screened in for Appropriate Assessment

Figure: 4-1

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Co-ordinate system: British National Grid

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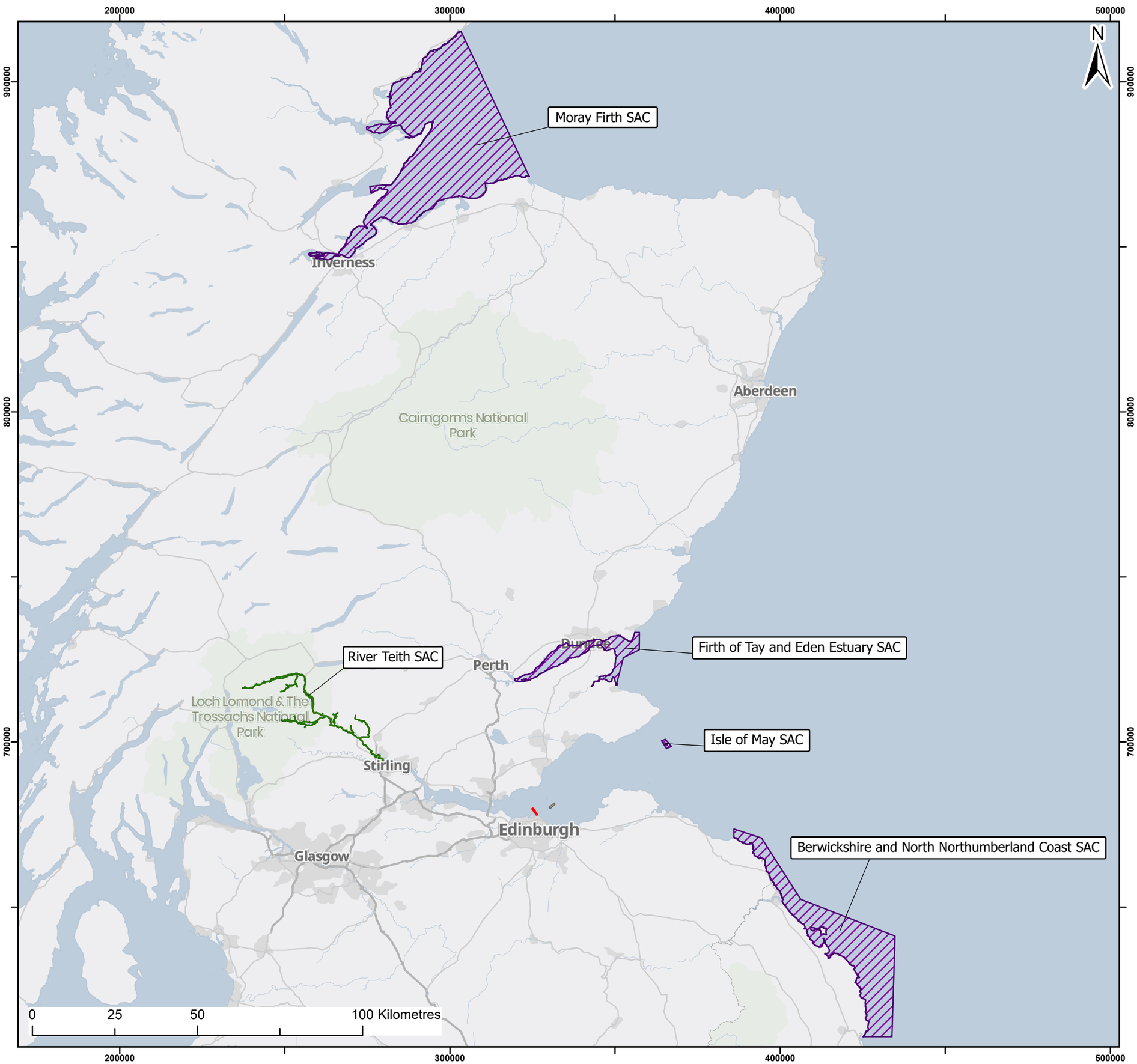



Legend:

- Dredge Area
- Disposal Site Narrow Deep B

Special Areas of Conservation (SAC)

SACs for transitional fish

- River Teith

SACs for marine mammals

- Berwickshire and North Northumberland Coast
- Firth of Tay and Eden Estuary
- Isle of May
- Moray Firth



| Client: | Project: |
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| Forth Ports Limited | Port of Leith Approach Channel Deepening |

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Special Areas of Conservation Screened In for Appropriate Assessment

Figure: 4-2

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# 5 Information for Appropriate Assessment: Transitional Fish

## 5.1 Approach to Assessment

This chapter provides information to determine whether the potential effects of the Proposed Scheme would have an adverse effect on the Conservation Objectives and site integrity of the River Teith SAC.

### 5.1.1 Data Sources

A number of publicly available datasets and information on transitional fish in the area were used and included in the baseline review and assessment of effects. These are listed below:

- SNH's (now NatureScot) Habitats Regulations Appraisal (HRA) on the Firth of Forth: A Guide for developers and regulators (SNH, 2016);
- Underwater noise modelling undertaken as part of the Outer Berth development, undertaken by Subacoustech (see Appendix 2 of the Outer Berth HRA Report);
- Marine Mammal and Fish Technical Report for Underwater Noise Impacts (Appendix 3 of the Outer Berth HRA Report);
- Numerical dispersion modelling carried out on the proposed dredging and disposal activities; and
- Sediment sample analysis of material to be dredged and disposed of.

## 5.2 River Teith SAC

### 5.2.1 Description of Designation

The River Teith in eastern Scotland represents part of the east coast range of sea lamprey in the UK, and also supports a strong population of river lamprey. It is the most significant tributary of the River Forth. It lacks any significant artificial boundaries to migration, has good water quality and has the necessary habitat types to support the full lamprey life-cycle (extensive gravel beds with marginal silt beds). Atlantic salmon also spawn in the river and are present as a qualifying Annex II species, though is not a primary reason for site selection.

### 5.2.2 Conservation Objectives

The Conservation Objectives for sea and river lamprey, and Atlantic salmon, are:

- To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and,
- To ensure for the qualifying species that the following are maintained in the long term:
    - Population of the species, including range of genetic types for salmon, as a viable component of the site;
    - Distribution of the species within site;
    - Distribution and extent of habitats supporting the species;
    - Structure, function and supporting processes of habitats supporting the species; and
    - No significant disturbance of the species.

- River lamprey and Atlantic salmon within the River Teith SAC are in favourable condition, and sea lamprey are in an unfavourable condition.

### 5.2.3 Features Screened In

The following features are considered in the Appropriate Assessment for this SAC:

- Sea lamprey;
- River lamprey; and
- Atlantic salmon

### 5.2.4 Overview of Effect Pathways Screened In

As described in the HRA Screening Report submitted to MD-LOT in August 2023 (**Appendix 1-1**), the potential effects on fish considered during the construction phase are:

- Generation of underwater noise from dredge/disposal activities and impact piling, which could have physiological and/or behavioural response impacts, or may form a 'barrier' to migration routes;
- Impacts due to changes to water quality, such as increased suspended sediment, which may have physiological effects or may form a barrier to migration; and
- Impacts due to a change in habitat quality, such as increased sedimentation or loss of habitat.

#### 5.2.4.1 Underwater Noise

Underwater noise modelling was undertaken for the Port of Leith Outer Berth Project in 2022, for the same location and for similar activities; therefore, this underwater noise modelling has not been updated and the previous modelling results have been used to inform the below assessments. The underwater noise modelling report is provided in Appendix 2 of the Outer Berth HRA Report.

Details of elements of the Proposed Scheme that may act as a source of underwater noise are presented in Appendix 2 of the HRA for the Outer Berth scheme and Appendix 3 of the HRA for the Outer Berth scheme. Notably, such sources would constitute piling using impact and vibro-piling techniques.

Use of construction vessels during the construction phase would not form a significant increase in vessel activity in and around a busy working port and would not form a significant source of underwater noise disturbance.

Fish have a wide range of auditory capabilities, mostly in the range of 30Hz to 1kHz, and detect sound through mechanosensory organs including the otolithic organs and (for detecting nearby sounds) a lateral line system. As such, underwater sound arising from the piling and dredging is expected to fall within the hearing ranges of transitional fish species from the River Teith SAC (Popper *et al*., 2003).

The extent to which underwater sound might cause an adverse impact on fish is dependent on the sound energy level, sound frequency, duration and/or repetition of the sound wave (Popper and Hastings, 2009). The impacts can be summarised into three broad categories (Popper *et al.,* 2014):

- Physical trauma/mortality: Either immediate mortality or tissue and/or physiological damage that is sufficiently severe (e.g., a barotrauma) that death occurs sometime later, due to decreased fitness. Mortality has a direct effect upon animal populations, especially if it affects individuals close to maturity;

- Auditory damage (Temporary Threshold Shift (TTS) or Permanent Threshold Shift (PTS)[1]): Short term changes in hearing sensitivity may, or may not, reduce fitness and survival. Impairment of hearing may affect the ability of animals to capture prey and avoid predators, and also cause deterioration in communication between individuals, affecting growth, survival, and reproductive success. After termination of a sound that causes TTS, normal hearing ability returns over a period that is variable, depending on many factors, including the intensity and duration of sound exposure; and
- Disturbance (i.e. behaviour modification, masking of background noise): Tissue and other physical damage, or physiological effects, that are recoverable, but which may place animals at lower levels of fitness, may render them more open to predation, infection, impaired feeding and growth, or lack of breeding success, until recovery takes place.

The presence of a gas-filled swim bladder (or other gas chamber) increases the risk of sound pressure-related injury (i.e. barotrauma), since the involuntary movement of the swim bladder caused by sudden pressure changes (notably from impulsive noises) can cause damage to it and surrounding organs. As such, fish with swim bladders are more sensitive to exposure to sound pressure (i.e. more likely to be physically harmed) than those without a swim bladder (Popper *et al.*, 2014).

The swim bladder of Atlantic salmon *Salmo salar* does not aid in hearing and the species can be regarded as a hearing generalist (Popper *et al.,* 2014). Studies by Hawkins and Johnstone (1978) found salmon show low sensitivity to noise. Their ability to respond to noise is regarded as poor with a narrow frequency span and a limited ability to discriminate between different noises. Nedwell *et al* (2006), concluded for salmon and brown trout, no obvious signs of trauma could be attributed to sound exposure from vibro and impact piling associated with these fish species which were caged between 30m – 400m from the source of noise.

Sea lamprey *Petromyzon marinus* and river lamprey *Lampetra fluviatilis* are fish without a swim bladder and are considered to have a low sensitivity to noise (Popper *et al.,* 2014).

Overall, sea and river lamprey; and Atlantic salmon are considered to be members of Hearing Group One and Two respectively (Popper *et al.,* 2014), and therefore have medium to low sensitivity to noise (Potter *et al*., 2014).

Behavioural responses to underwater noise disturbance have the potential to occur anywhere within the zone of audibility and may include evasive actions or other altered behaviour due to masking of ambient background sounds. Masking effects can be significant if an anthropogenic sound prevents fish from responding to biologically relevant sounds. Of particular relevance for transitional fish species is the risk of underwater noise forming a 'barrier' to movement along migratory routes, potentially preventing upstream or downstream movement thus affecting productivity/spawning success.

It should be noted that all piling would be subjected to the Joint Nature Conservation Committee (JNCC) soft-start protocol to reduce risk to sensitive marine receptors (JNCC, 2010), meaning that piling energy would be gradually ramped up from commencement over a period of at least 20 minutes, to allow for receptors within injurious range to move away from the source. This has been taken into account in the assessment that follows.

As set out in Appendix 2 of the HRA for the Outer Berth scheme, for fish, the largest recoverable injury ranges (203dB $SEL_{cum}$ threshold) are predicted out to a maximum of 190m when considering a stationary animal, which reduces to less than 100m for fleeing animal calculations. Maximum TTS impact ranges

[1] *Permanent Threshold Shift (PTS) thresholds do not form part of Popper et al., (2014) guidelines.*

(186dB $SEL_{cum}$ threshold) are predicted out to 1.2km for stationary animals, and these ranges also reduce to less than 100m when considering fleeing animals.

#### 5.2.4.2 Changes in Water Quality

Dredging of fine material during the construction phase of the Proposed Scheme would result in a temporary increase in Suspended Sediment Concentrations (SSC). An increase in SSC in the water column may lead to physiological effects in finfish, including, *inter alia*, impaired swimming ability, immunosuppression (i.e. increased susceptibility to disease) and reduced rates of growth and larval development (Robertson *et al.*, 2007). Particles in the water column may increase the risk of asphyxiation due to inhibition of gaseous exchanges at the gill lamellae or blockage of the opercular cavity. Increased SSC can also result in decreased foraging efficiency and a reduction in the ability to detect and evade predators. Disturbance of sediment may also risk the release of sediment-bound contaminants into the water column, which again may have physiological effects (depending on concentration).

As with underwater noise, adverse water quality effects (i.e. increases in SSC or contaminant release) may potentially act as a barrier to migratory movements in transitional fish.

#### 5.2.4.3 Changes in Habitat Quality

In terms of physical loss of habitat used by fish, this would constitute subtidal habitat where the existing berth pocket at the approach channel to the Port of Leith would be enlarged and deepened during the dredging component of the Proposed Scheme.

In addition to physical loss of habitat, suspension and transportation of fine sediment during dredge/disposal activities would result in subsequent deposition as the sediment settles back out of the water column. Significant levels of sediment deposition on benthic habitat may lead to 'loss' or change in the composition of supporting habitat for estuarine fish species.

### 5.2.5 Potential Effects of the Proposed Scheme Alone

#### 5.2.5.1 Underwater Noise

**All Features**

An underwater noise assessment has been undertaken for fish within the Firth of Forth based on noise modelling of both impulsive (i.e. tubular and sheet piling) and continuous (i.e. dredging) noise sources, using recognised noise threshold criteria set by Popper *et al*. (2014). The noise modelling methodology and output is provided in Appendix 2 of the HRA for the Outer Berth scheme, and the assessment of impacts is presented in Appendix 3 of the HRA for the Outer Berth scheme. Both appendices should be read in conjunction with this section of the HRA.

While lamprey or salmon within 50m of the piling source would be exposed to injurious noise levels from a single strike of a tubular pile, a soft start procedure would allow any individuals within this range to move to a less affected area. For cumulative exposure to repeated strikes over a working day (i.e. up to six hours), lamprey species (which lack a swim bladder) would be at risk of injury (mortal or recoverable) if stationary within 100m of the piling source throughout that period. Atlantic salmon (which have a swim bladder not involved in hearing) would be at risk of injury if stationary within 190m of the piling source. There is a potential for TTS in all species (for up to six hours a day) at a distance of up to 1.2km from the piling source, again assuming a stationary animal. Since only mobile adults/pre-adults are likely to be present within the marine environment, there is little to no risk of mortality, recoverable injury or significant TTS onset.

In terms of the effects on migration activity, the key migratory route is considered to be in and out of the mouth of the Forth estuary. In the outer estuary, at the location where the piling would take place, the estuary is approximately 8km wide, which is considerably greater than the maximum impact range predicted in the

modelling. Popper *et al*. (2014) provides a qualitative description of relative sensitivity of fish and indicates that far-field behavioural responses (i.e. more than 1km from the source) would be of low magnitude in fish without swim bladders and those with swim bladders that aren't involved in hearing mechanics. As such, based on the modelled maximum impact range, it can be concluded that the respective ranges for potential injury, TTS and significant behavioural modification would not extend significantly into the main migratory routes. Migrating individuals would not be exposed to a 'barrier' effect from considerable noise levels extending across an entire cross section of the river channel, hence migration is expected to continue unimpeded. Any individuals that may move along the southern edge of the Firth of Forth (and hence may encounter noise levels capable of preventing onwards movement (bearing in mind that there remains a lack of evidence for the potential of piling noise to cause a barrier to movement for these species) would be able to simply move further out into the river channel to circumnavigate through unaffected waters.

Given the duration of the piling works twelve weeks, no more than one migration season (either upstream by mature adults or downstream by juveniles/pre-adults) is likely to overlap with piling activity.

Underwater noise modelling was also undertaken for dredging, which indicated that fish would have to remain stationary for 12 hours within a range of 50m from the dredger in order to experience either recoverable injury or TTS. The impacted zone is hence considerably smaller than that predicted from piling activity and again would have no significant effect on the capability of lamprey and salmon to navigate along the estuary during migration.

**As such, it is concluded that the effects of underwater noise on migrating sea lamprey, river lamprey and Atlantic salmon would not have an adverse effect on the integrity of the River Teith SAC**.

#### 5.2.5.2 Change in Water Quality

**All Features**

Total dredging for the Proposed Scheme would be approximately 1,410,000m$^3$ of material. The extent of the sediment plume predicted near to the sea bed, where the predicted increases are greatest, from the proposed dredging and subsequent disposal is shown on **Figure 5-1** and **Figure 5-2**, respectively.

The extent of the sediment plumes, outlined in **Figure 5-1**, show that significant increase in SSCs during dredging activity would be confined to the immediate vicinity of the dredge footprint. At a distance of more than *c.*100m from the dredging source, maximum SSCs increases are likely to be less than 20mg/l, which is within the natural variations in SSCs expected in the context of a dynamic estuarine system such as that present in the Forth. As noted, the Firth of Forth at the location of the Proposed Scheme is approximately 8km wide, hence there would be no significant obstruction or 'barrier effect' to migrating lamprey and salmon.

Any trace contaminants disturbed during dredging would be bound to fine sediment particles hence would only be present within the sediment plume. Chemical analysis of the source dredge material has been undertaken and is reported in detail in Chapter 8 of the accompanying supplementary Environmental Impact Assessment (sEIA) Report. The analyses show that contaminant levels within the sediment are sufficiently low that offshore disposal of the material is considered appropriate and therefore would not pose a significant risk to migrating fish.

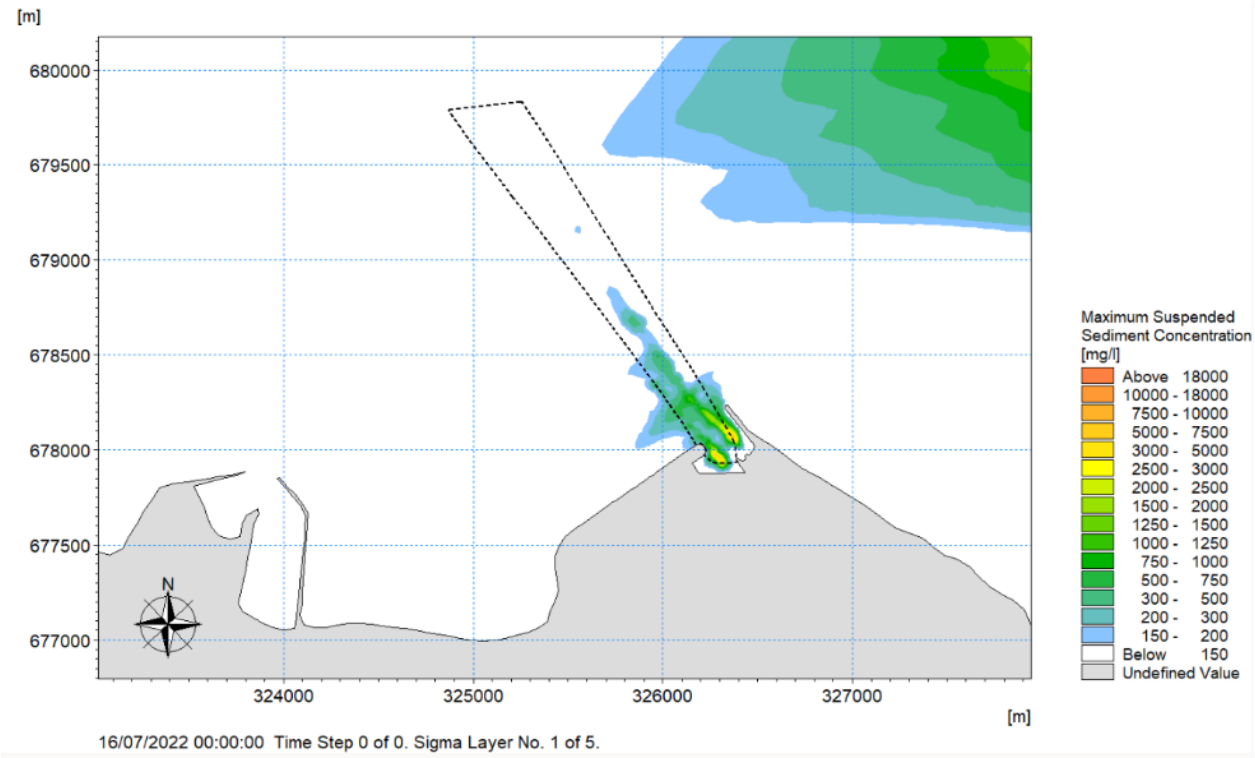



*Figure 5-1 Modelled maximum suspended sediment concentrations at the bottom layer during dredging*

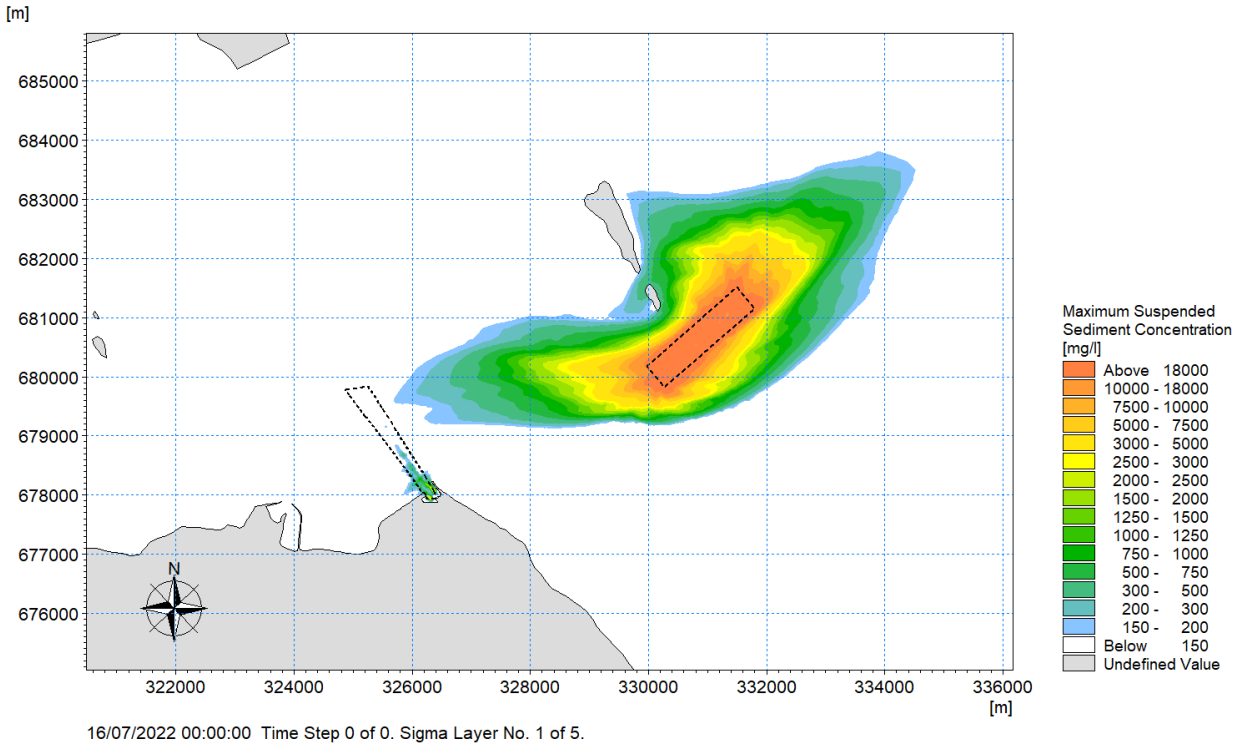



*Figure 5-2 Modelled maximum suspended sediment concentrations at the bottom layer during disposal*

The offshore disposal site (Narrow Deep B Spoil Disposal Ground) is a licensed site which has been used in the past for disposal of fine sediments and is located where the estuary widens (the estuary is over 12km wide at this location). Significant increase in SSC (ranging from 200 mg/l to *c.*1,500mg/l at the point of release) would be confined within the footprint and immediate vicinity of the disposal site, with lower magnitude increases (i.e. 20 to 200mg/l) possible at distances of up to *c.*2km north and *c.*500m south of the site. The sediment plumes shown in **Figure 5-2** represent the modelled maximum area affected over the course of the disposal campaign; it is important to note that it is highly unlikely that the entire plume would be present at any single time.

The numerical modelling (see Chapter 7 of the accompanying sEIA Report) indicates a return to baseline SSCs would be expected within one hour of a disposal. On average there would be 7.1 disposal activities at the disposal site per day, resulting in elevated SSCs for approximately seven hours per day, with water quality not being affected during the remaining 17 hours.

Given the availability of unaffected waters within the main migratory path through to the River Teith, and the fact that increases in SSC outside of the disposal site are likely to be minor and in line with natural variation in a dynamic estuarine environment (and would return to baseline quickly), there would be no risk of 'barrier effect' to migrating fish.

**Given the above, it is concluded that the effects of predicted changes in water quality on migrating sea lamprey, river lamprey and Atlantic salmon would not have an adverse effect on the integrity of the River Teith SAC**.

#### 5.2.5.3 Changes in Habitat Quality

An EIA Scoping Opinion issued by MD-LOT (see Appendix 1-1 of the accompanying sEIA Report) confirmed that the potential impact of changes in habitat availability on fish and shellfish species would have a negligible effect for the following reasons:

- Dredging would represent a temporary loss of benthic habitat;
- Much of the dredge area is within the existing approach channel, where maintenance dredging is undertaken on a routine basis; and
- Habitat types present within the affected area are ubiquitous in this section of the Firth of Forth.

As such, no further assessment was required on changes in habitat availability on fish and shellfish species.

**Given the above, it is concluded that the effects of predicted changes in habitat quality on migrating sea lamprey, river lamprey and Atlantic salmon would not have an adverse effect on the integrity of the River Teith SAC.**

### 5.2.6 In-Combination Effects

Projects with the potential to contribute to in-combination effects are those located within 5km of the Proposed Scheme, as beyond this distance it would not be expected that there is the potential for combined disturbance to individuals affected by the Proposed Scheme and other projects. As discussed above, the maximum noise-induced TTS ranges for fish are predicted out to 1.2km (assuming stationary animals as a precaution). Given this maximum impact range, a 5km screening distance for in-combination effects with the projects is considered sufficiently conservative. As the projects listed in **Table 4-2** are more than 5km away from the Proposed Scheme, there would be no spatial overlap of underwater noise-related effects (considered to be the most-far reaching effect of the Proposed Scheme).

**It has therefore been concluded that there would be no potential for an adverse effect on the River Teith SAC, due to in-combination effects.**

# 6 Information for Appropriate Assessment: Ornithology

## 6.1 Approach to Assessment

The ornithological assessment presented in the Outer Berth HRA was based on baseline bird activity within the Port and surrounding marine areas surveyed on a bi-monthly basis between April 2021 and April 2022, inclusive. As confirmed within MD-LOT's Scoping Opinion (Appendix 1-1 of the accompanying sEIA Report), the recent and comprehensive nature of the 2021/22 survey is considered suitable to inform the ornithological assessment within this Supplementary RIAA (sRIAA).

## 6.2 Data Sources and Environmental Baseline

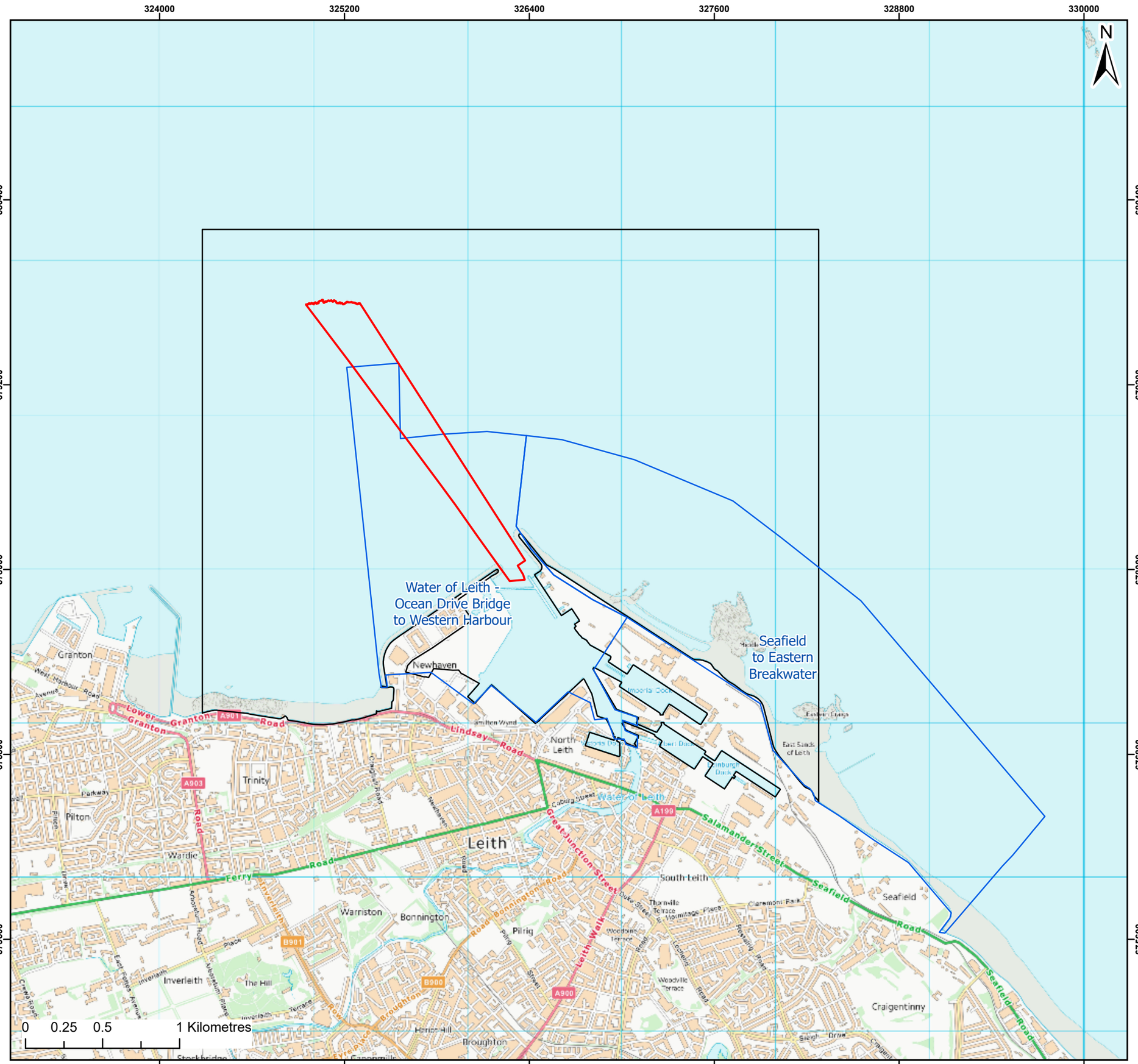
The Outer Berth HRA report provided full details regarding baseline bird usage in and around the Port of Leith, a summary of which is provided below. Baseline survey data presented in the Outer Berth HRA came from the following sources:

- Site-specific estuarine bird counts (twice monthly), covering the period March 2021 to March 2022 (inclusive);
- Common tern colony counts (twice monthly) at Imperial Dock Lock, Leith SPA, covering the period May to July 2021 (inclusive);
- Common tern flight behaviour surveys at Imperial Dock Lock, Leith SPA, covering the period May to July 2021; and
- British Trust for Ornithology (BTO) Wetland Bird Survey (WeBS) data from 2018/19 to 2019/20, from count sectors 'Water of Leith – Ocean Drive Bridge to Western Harbour' (sector no. 83440) and 'Seafield to Eastern Breakwater' (sector no. 83441).

The area covered by the above surveys is presented in **Figure 6-1** while the Port of Leith Bird Survey Report 2021-22 can be found in Appendix 1-1 Outer Berth HRA.

The peak annual counts from the above sources were compared with SPA totals (SPA reference populations are outlined in Section 5.3 of the Outer Berth HRA). Where peak counts exceeded 1% of the SPA population, this was classified as a 'significant' proportion of the population. The 1% significance parameter is routinely used as a benchmark for HRA screening in Scotland.

**Table 4-1** summarises, for each designation, those ornithological features where LSE was concluded (or could not be excluded) and therefore would be the subject of Stage Two: Appropriate Assessment, as established within the Approach Channel Deepening: Habitats Regulations Appraisal Screening Report **Appendix 1-1**.





Legend:

- Dredge Area
- Survey Area
- WeBS Sectors



| Client: | Project: |
|---|---|
| Forth Ports Limited | Port of Leith Approach Channel Deepening |

Title:

2021/22 baseline survey area and WeBS sectors

| Figure: | Drawing No: |
|---|---|
| 6.1 | PC4514-RHD-YY-XX-FN-EV-0017 |

| Revision: | Date: | Drawn: | Checked: | Size: | Scale: |
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| P01 | 10/01/2022 | ND | BH | A3 | 1:25,000 |
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Co-ordinate system: British National Grid

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## 6.3 Overview of Effect Pathways Screened In

Following the Approach Channel Deepening: Habitats Regulations Appraisal Screening Report (**Appendix 1-1**), the following effect pathways have been screened in for Appropriate Assessment:

- Visual disturbance at the disposal site as a result of increased vessel activity;
- Changes in water quality and prey availability as a result of the sediment plume arising from dredging and disposal; and
- Noise generated by piling works for the construction of the retaining wall.

These effect pathways are discussed further below.

### 6.3.1 Potential Effects of Visual Disturbance at the Disposal Site

Estuarine and marine birds can respond to visual disturbance in a number of ways. Disturbance may cause birds to move away from an area to another site, in which case the consequence is essentially the same as habitat loss (either temporary or permanent). Disturbance may also cause birds to temporarily interrupt their normal activity leading to, for example, reduced feeding rates or productivity, or increased energy expenditure through movement away from sources of disturbance. In these ways and others, disturbance effects have the potential to reduce individuals' fitness and could ultimately lead to an increase in mortality. However, the actual effects of disturbance are complex and there is increasing evidence that the behavioural response is not a reliable means of predicting the ultimate effect on the population. For example, a major disturbance event, causing birds to leave the site altogether, may not be significant if alternative sites are available in the general area, while a number of apparently small, insignificant disturbance events may become cumulatively significant if this leads to an overall critical reduction in available feeding time (Stillman *et al.*, 2007).

It is therefore expected that bird species that utilise the disposal site and adjacent area are habituated to disturbance from regular vessel movements along the busy shipping routes in the Firth of Forth (Schwemmer *et al.,* 2011). This is taken into account in the assessments that follow.

### 6.3.2 Potential Effects of Sediment Plumes Arising from Dredging and Disposal of Dredged Arising

Dredging and disposal of fine material during the construction phase of the Proposed Scheme would result in a temporary increase in Suspended Sediment Concentrations (SSC). To underpin an assessment of changes in water quality and consequent effects on prey resources and hunting ability, sediment dispersion modelling has been undertaken to predict the effects of the sediment plume both from the dredging and disposal. A sediment sampling campaign has been undertaken to confirm the concentrations of sediment-bound contaminants. The details of which are outlined in **Section 5.2.5.2.**

An increase in SSC within the water column may lead to adverse effects on fish prey resources within the water column (as discussed in **Section 5.2.5.2**), which could lead to behavioural responses, such as temporary displacement of those species from the affected range. This in turn has the potential to affect piscivorous bird species that feed on such resources. Furthermore, high turbidity as a result of increased SSC limits visibility through the water, which may adversely affect the ability of aerial predators to detect prey items in the affected range (Cook and Burton, 2010).

The potential effect of changes in prey availability would depend on the timing of the dredging works relative to the period when birds numbers are at their highest. For common terns, the baseline data indicates this is likely to be during the breeding/post-breeding season (May to August). For the other species screened in

for assessment, the baseline data indicates it is likely to be during the wintering and passage season (generally late August to March). For the purposes of assessment, and on a precautionary basis, it has been assumed that the dredging/disposal activity may take place during either of these periods. While all species screened in for assessment have been taken into consideration, effects would likely be most of an issue for breeding birds that are constrained in their foraging areas by requirements to attend a nest. Of the species screened in, this would only apply to common tern.

### 6.3.3 Potential Effects of Noise Generated by Piling Works for the Construction of the Retaining Wall

The construction of a sheet piled retaining wall could have noise implications for surrounding bird species. For example, birds are sensitive to noise as auditory disturbance can affect their communication, breeding, and feeding behaviours. During the nesting period, excessive noise can lead to nest abandonment, reduced reproductive success and interfere with acoustic signals which are crucial for mate attraction, territory defence and warning of potential threats. The timing of construction activities to avoid critical periods for birds, such as breeding and migration seasons, should also be considered when assessing the potential effects of noise disturbance on ornithological features.

## 6.4 Potential Effects of the Proposed Scheme Alone

### 6.4.1 Visual Disturbance at the Disposal Site

It is anticipated that the Proposed Scheme would result in a short term (less than one year) and temporary increase of approximately 800 vessel visits to the disposal site during the dredging works. The associated potential impacts from visual disturbance as a result of increased vessel movements around the disposal site would only have the capacity to affect those ornithological features (see **Table 4-1**) that forage offshore in this area. These species have been identified as common tern, eider, shag, red-throated diver, sandwich tern and roseate tern, as well as breeding and non-breeding seabird assemblages. The associated designated sites for these species are the Outer Firth of Forth and St Andrews Bay Complex SPA, Firth of Forth SPA, Imperial Dock Lock, Leith SPA and the Forth Islands SPA.

The approach channel deepening would result in an increase in approximately 800 visits to the disposal site over an approximately four-month period, equating to 7.1 vessels per day. In the accompanying Outer Berth EIAR Addendum (Royal HaskoningDHV, 2022) submitted as part of the Outer Berth licence application, it was reported that in 2019 that there were 3,087 vessel movements over the disposal site, equating to an average of 8.5 vessel trips per day. Consequently, birds that utilise the disposal site area will have habituated to this form of disturbance.

**Given the existing level of vessel activity, short-term and temporary nature of works and habituation of ornithological features to visual disturbance, it is concluded that the increased vessel presence and visual disturbance at the disposal site associated with the Proposed Scheme would not adversely affect the Conservation Objectives of the SPAs and Ramsar site or their qualifying features.**

### 6.4.2 Sediment Plume Arising from Dredging and Disposal Activities

Screened in ornithological features that may forage in sub-tidal areas within the vicinity of the modelled dredge and disposal sediment plumes were common tern, eider, shag, red-throated diver, roseate tern and Sandwich tern, as well as breeding and non-breeding seabird assemblages.

The model outputs of the sediment plumes resulting from dredging and disposal activities are visualised below, with the maximum suspended sediment concentrations above ambient conditions in the bottom layer

found in **Figure 5-2**, the mid layer in **Figure 6-2** and surface layer in **Figure 6-3**. Elevated levels of suspended sediment are predicted to return to background levels in less than one hour after dredging and disposal activities cease. Increases in SSCs were found to be the highest in the bottom layer of the water column, followed by mid layer and the lowest at the surface layer.

Any trace contaminants disturbed during dredging would be bound to fine sediment particles hence would only be present within the sediment plume. Chemical analyses of the dredge material have been undertaken and is reported in the accompanying sEIA Report. The analyses show that contaminant levels within the sediment are suitable for offshore disposal and therefore would not pose a significant risk to prey resources; therefore, there is no risk to bird species reliant on benthic prey or non-piscivorous birds, such as waders and wildfowl, that feed on invertebrates or algae.

Ornithological features that forage in the sub-tidal areas affected by the sediment plumes would be able to use alternative unaffected marine areas elsewhere within their foraging range as the sediment plumes cover only a small proportion of the available foraging range in the Firth of Forth. Furthermore, as fish resource is not significantly impacted by the sediment plumes (See **Section 5.2.5.2**) and increases in SSCs are concentrated towards the bottom of the water column. The ability of ornithological features to hunt and feed within the areas affected by sediment plumes is expected to be unaffected.

For piscivorous (or partly piscivorous) waterbird and seabird species, namely tern species, lesser black backed gull, shag and red-throated diver, the distribution maps presented in the Bird Survey Report 2021-22 can be found in Appendix 11-1 Outer Berth HRA do not indicate a foraging reliance on the approach channel. Instead, foraging activity was either spread across the marine area or focused to the west and east of the study area and outside the affected range; therefore, it is considered that it would be possible for those species to forage in alternative areas unaffected by increases in suspended sediment around the entrance to the port.

Common tern are present across the study area in numbers of high regional importance and have a mean maximum foraging range of 17.6km (standard deviation of 9.1km), with a maximum flight range from the Imperial Dock Lock colony of *c*.21km (Wilson *et al.*, 2014; Woodward *et al.*, 2019); hence, the overall proportion of available foraging habitat for terns from the SPA that would potentially be affected by the dredging works would be very small. Additionally, the 2021/22 baseline survey indicated that common terns generally did not actively forage within the nearshore waters around the Port. A peak foraging count of just 17 individuals represented less than 1% of the overall peak count of birds present at the SPA. This was also noted during foraging ecology surveys undertaken by Jennings (2012). This provides further evidence that the majority of breeding terns would, therefore, forage beyond the extent of any sediment plume. As such, the proportion of common terns foraging within the affected area would be relatively low and hence the spatial magnitude of the effect (with regard to the regional receptor populations) would be minimal.

The Proposed Scheme is considered to have no significant effect on designated piscivorous seabirds and waterbirds that may feed on fish resources within the modelled sediment plume areas or for non-piscivorous waterbirds and waders present in the intertidal/shallow-subtidal regions potentially affected by the approach channel sediment plume. Invertebrate and algal feeding birds, as well as other waterbirds including waterfowl present along the shoreline would be unaffected by the indirect effects on prey resources, also constituting no significant effect on designated features.

**Based on the above, it is concluded that sediment plumes arising from the proposed dredging and disposal activities and the subsequent changes in water quality/fish resource would have no effect on any designated ornithological feature nor adversely affect the Conservation Objectives of the SPAs and Ramsar site or their qualifying features.**

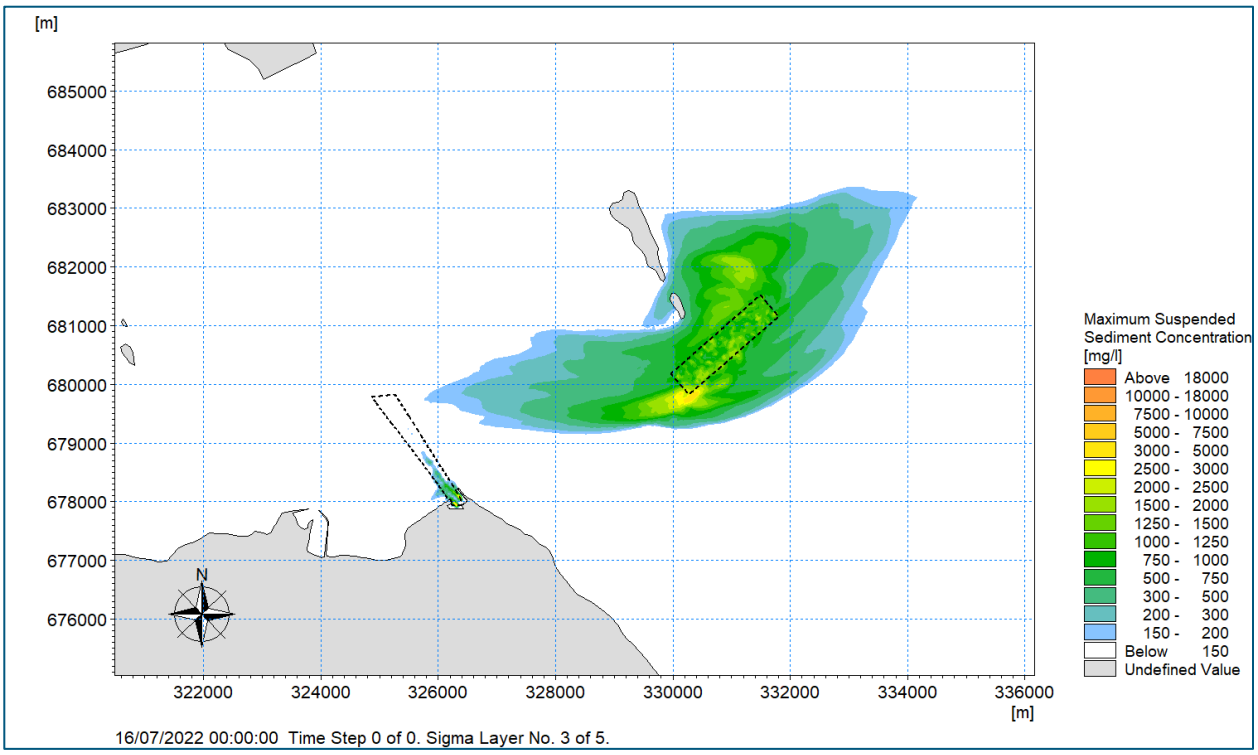


*Figure 6-2 Maximum suspended sediment concentrations above ambient conditions in the mid layer*

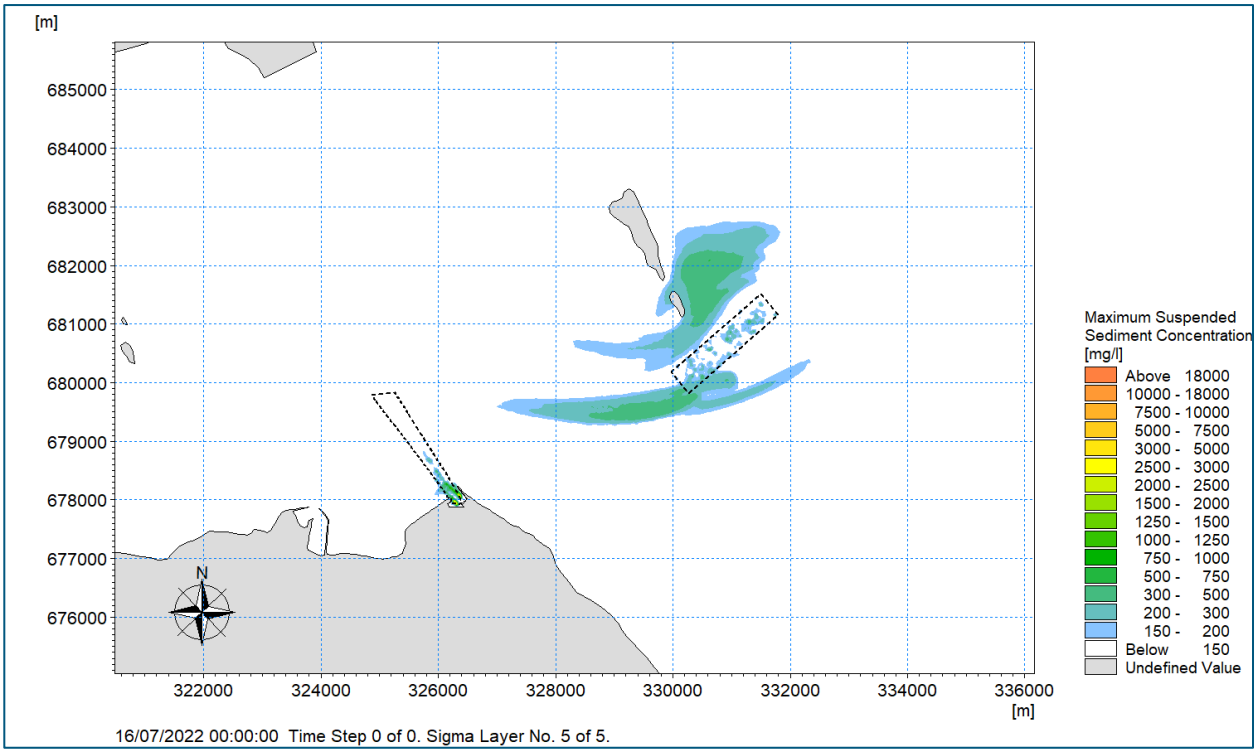


*Figure 6-3 Maximum suspended sediment concentrations above ambient conditions in the surface layer*

### 6.4.3 Noise Generated by Piling Works for the Construction of the Retaining Wall

With the exception of breeding and post-breeding common tern, a qualifying feature of the Imperial Dock Lock, Leith SPA, the Outer Berth HRA concluded that impact piling would not have an adverse effect on the Conservation Objectives of the SPAs and Ramsar site or their qualifying features.

To avoid an adverse effect on breeding and post breeding common tern, and therefore the Imperial Dock Lock, Leith SPA, a piling shroud was installed on the percussive piling hammer during piling activities and an environmental clerk of Works (ECoW) was in place to monitor disturbance (from 1 May to 30 September).

Monitoring by the ECoW (see **Appendix 6-1**) observed that disturbance by nearby activities and predators were a regular occurrence. Throughout the piling works undertaken six days a week, over five months, only two disturbance instances appeared to have been a result of impact piling, on 15 May and 19 July. These instances were not considered particularly significant in comparison to the more frequent disturbances that were attributed to other causes.

Taking the ECoW's observations into account and that the piling associated with the retaining wall would be on a much smaller scale, it is proposed that the use of an EcOW is not required should piling take place during the common term breeding and post breeding period. A piling shroud would be fitted to the percussive piling hammer.

**Given the above, it is concluded that disturbance of breeding and post-breeding common tern due to piling activity would not adversely affect the Conservation Objectives of the Imperial Dock Lock, Leith SPA or its qualifying features.**

# 7 Information for Appropriate Assessment: Marine Mammals

## 7.1 Approach to Assessment

This chapter provides information to determine whether the potential effects of the Proposed Scheme would have an adverse effect on the Conservation Objectives and site integrity for SACs screened into Appropriate Assessment for marine mammals.

### 7.1.1 Data Sources

A number of publicly available datasets and information on marine mammals in the area were used and included in the baseline review and assessment of effects. These are listed below:

- SNH's (now NatureScot) Habitats Regulations Appraisal (HRA) on the Firth of Forth: A Guide for developers and regulators (SNH, 2016);
- Underwater noise modelling undertaken as part of the Outer Berth development, undertaken by Subacoustech (see Appendix 2 of the Outer Berth HRA Report);
- Marine Mammal and Fish Technical Report for Underwater Noise Impacts (Appendix 3 of the Outer Berth HRA Report);
- Numerical dispersion modelling carried out on the proposed dredging and disposal activities; and
- Sediment sample analysis of material to be dredged and disposed of.

A number of datasets have been used to suppose the baseline for marine mammals. These are listed in **Table 7-1**.

*Table 7-1 Data Sources*

| Data | Year | Coverage | Notes |
|---|---|---|---|
| Small Cetaceans in the European Atlantic and North Sea (SCANS-IV) data (Gilles *et al.*, 2023) | Summer 2022 | North Sea and European Atlantic waters | Provides information including abundance and density estimates of cetaceans in European Atlantic waters in summer 2022, including the proposed offshore development area. |
| Distribution and abundance maps for cetacean species around Europe (Waggitt *et al.*, 2019) | 1980-2018 | North-east Atlantic | Provides information on harbour porpoise in the North Sea area. |
| Management Units (MUs) for cetaceans in UK waters (Inter-Agency Marine Mammal Working Group (IAMMWG), 2023) | 2023 | UK waters | Provides information on cetacean MUs for the proposed offshore development area. |
| Scientific Advice on Matters Related to the Management of Seal Populations: 2022 (Special Committee on Seals (SCOS), 2022) | 2022 | UK Waters | Provides information on seal populations for the proposed offshore development area and the area around. |
| Abundance estimation and movements of bottlenose dolphin along the east coast of Scotland (Arso Civil *et al.,* 2021) | 2009-2019 | East coast, Scotland | Provides abundance estimates for bottlenose dolphin on the east coast. |
| Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles (Carter *et al.,* 2022) | 1991-2019 | British Isles | Provides information on abundance and absolute density estimates (i.e. number of seals) for seal species. |
| Seal telemetry data (e.g. Sharples *et al.,* 2008; Russell and McConnell, 2014; Russell, 2016a) | 1988-2010; 2015 | North Sea | Provides information on relative density (i.e. percentage of at-sea population) for seal species. |

### 7.1.2 Overview of Effect Pathways Screened In

As described in the HRA Screening Report submitted (**Appendix 1-1**), the potential effects on marine mammals considered during the construction phase are:

- Potential for auditory injury and/or behavioural effects from underwater noise during piling;
- Potential for auditory injury and/or behavioural effects from underwater noise during dredging works;
- Any changes to water quality;
- Any changes in prey availability; and
- In-combination effects.

#### 7.1.2.1 Underwater Noise Effects from Piling Activities

**Underwater Noise Modelling**

Underwater noise modelling was undertaken for the Port of Leith Outer Berth Project in 2022, for the same location and for similar activities. Therefore, this underwater noise modelling has not been updated and the previous modelling results have been used to inform the below assessments. The underwater noise modelling report is provided in Appendix 2 of the Outer Berth HRA Report.

**Potential for Effects from Underwater Noise during Piling**

For the Project, there is the potential for both impact piling, and vibro-piling to be utilised. The potential for impact piling has greater potential for impact to marine mammals, and therefore has been assessed as the worst-case. As shown by the Underwater Noise Modelling Report (Appendix 2 of the Outer Berth HRA Report), the resultant impact ranges for vibro-piling (for cumulative exposure ($SEL_{cum}$)) are the same as those modelled for impact piling, and therefore the assessments provided below for impact piling would also be valid for vibro-piling (for cumulative exposure). Vibro-piling is a continuous noise source, and therefore single strike ($SPL_{peak}$) modelling results are not relevant for that activity.

Impact piling has long been established as a source of high-level underwater noise (Würsig *et al.,* 2000; Caltrans, 2001; Nedwell *et al.,* 2003; 2007; Parvin *et al.,* 2006; Thomsen *et al.,* 2006). If a marine mammal is in very close proximity to the piling sound source, the high peak pressure sound levels have the potential to cause physical injury, with a severe injury having the potential to lead to death, without mitigation. High exposure levels from underwater noise sources (such as impact piling) can cause auditory injury or hearing impairment, through permanent loss of hearing sensitivity, or PTS or from a temporary loss in hearing sensitivity, or TTS. The potential for auditory injury is not just related to the level of the underwater sound and its frequency relative to the hearing bandwidth of the animal but is also influenced by the duration of exposure. The level of impact on an individual is related to the Sound Exposure Level (SEL) that an individual receives.

PTS can occur instantaneously from acute exposure to high noise levels, such as single strike ($SEL_{ss}$) of the maximum hammer energy during piling. PTS can also occur as a result of prolonged exposure to increased noise levels, such as during the duration of pile installation ($SEL_{cum}$).

All species of cetaceans rely on sonar for navigation, finding prey and communication; they are therefore highly sensitive to permanent hearing damage (Southall *et al.,* 2007). Pinnipeds use sound both in air and water for social and reproductive interactions (Southall *et al.,* 2007), but not for finding prey. Therefore, Thompson *et al.* (2012) suggest damage to hearing in pinnipeds may not be as sensitive as it could be in cetaceans. The effect would be permanent and marine mammals within the potential impact area are considered to have very limited capacity to avoid such effects, and unable to recover from the effects.

*Potential for PTS Onset during Impact Piling*

The underwater noise modelling results for the potential for PTS in bottlenose dolphin, grey seal and harbour seal are presented in **Table 7-2**. The range for cumulative SEL ($SEL_{cum}$) for PTS is the distance an animal would need to be from the pile location to not be at risk of PTS from cumulative exposure (in this case, due to three piles being installed in one 24 hour period). $SEL_{cum}$ determines the potential risk of PTS from the repeated percussive strikes required to install a single pile. The ranges at which an individual could experience PTS are assessed as a result of cumulative exposure during the entire piling duration of six hours (two hours per pile, up to three piles per day), based on the animals fleeing at a precautionary average swimming speed.

*Table 7-2 Impact ranges and areas that could be at risk of PTS from impact piling*

| Potential impact | Receptor | Impact range | Impact area |
|---|---|---|---|
| PTS without mitigation – single strike | Bottlenose dolphin | <50m | <0.01km$^2$ |
| | Grey seal | <50m | <0.01km$^2$ |
| | Harbour seal | <50m | <0.01km$^2$ |
| PTS without mitigation – cumulative exposure | Bottlenose dolphin | <100m | <0.1km$^2$ |
| | Grey seal | <100m | <0.1km$^2$ |
| | Harbour seal | <100m | <0.1km$^2$ |

The impact range for bottlenose dolphin, grey seal, and harbour seal, due to a single strike of impact piling is less than 50m (**Table 7-2**). The impact range (without mitigation) within which PTS onset could occur from cumulative exposure, due to up to three piles being installed in a 12 hour period (a total of six hours of piling) for all marine mammal species is less than 100m (**Table 7-2**). This takes into account the anticipated soft-start and ramp-up procedure as per JNCC (2010).

It should be noted that the assessment for PTS from cumulative exposure is highly precautionary for the following reasons:

- The maximum impact ranges, based on the worst-case exposure levels an animal may receive at different depths in the water column, have been used in the assessment; this is highly conservative as it is unlikely a marine mammal would remain at this depth level.
- The assessment does not take account of periods where exposure will be reduced when they are at the surface or heads are out of the water.
- The cumulative noise dose received by the marine mammal will be largely dependent on the swimming speed, and whether the animal moves away from the noise source rapidly as a flee response.

*Potential for TTS Onset during Impact Piling*

The underwater noise modelling results for the potential for TTS in bottlenose dolphin, grey seal and harbour seal are presented in **Table 7-3**.

As for PTS, the range for cumulative SEL for TTS is the distance an animal would need to be from the pile location to not be at risk of TTS from cumulative exposure due to three piles being installed in one 24 hour period. The ranges at which an individual could experience TTS are assessed as a result of cumulative exposure during the entire piling duration of six hours, based on the animals fleeing at a precautionary average swimming speed.

*Table 7-3 Impact ranges and areas for the risk of TTS from impact piling*

| Potential impact | Receptor | Impact range | Impact area |
|---|---|---|---|
| TTS without mitigation – single strike | Bottlenose dolphin | <50m | <0.01km$^2$ |
| | Grey seal | <50m | <0.01km$^2$ |
| | Harbour seal | <50m | <0.01km$^2$ |
| TTS without mitigation – cumulative exposure | Bottlenose dolphin | <100m | <0.01km$^2$ |
| | Grey seal | <100m | <0.01km$^2$ |
| | Harbour seal | <100m | <0.01km$^2$ |

The maximum impact range (without mitigation) within which TTS onset could occur due to a single strike, is less than 50m for all other species (**Table 7-3**). The impact range (without mitigation) within which TTS onset could occur from cumulative exposure over 12 hours (up to six hours of piling) is less than 100m for all species (**Table 7-3**).

*Potential for Disturbance during Impact Piling*

For marine mammal species, there is currently no agreed threshold for disturbance from underwater noise. The US National Marine Fisheries Service guidance (NMFS, 2018a) sets the Level B harassment threshold[2] for marine mammals at 160dB re 1µPa (root mean square (rms)) for impulsive noise and 120dB re 1µPa (rms) for continuous noise. However, Southall *et al.* (2021) found that simple all-or-nothing thresholds such as these, that attempt to relate single noise exposure parameters (e.g. received noise level) and behavioural response across broad taxonomic grouping and sound types, can lead to severe errors in predicting effects.

During a harbour development project in Scotland, the behavioural response of bottlenose dolphin was recorded, both for impact piling and vibro-piling, using an array of acoustic recording devices (Graham *et al*., 2017). Monitoring was undertaken for a year prior to construction, and during construction. The impact piling sound level was recorded as being 240dB re 1µPa. Bottlenose dolphins were not excluded from the area as a result of the piling, but fine-scale changes in the local abundance were detected, and bottlenose dolphins were present in the area less often when impact piling was occurring, compared to where no activity was occurring (Graham *et al*., 2017). This indicates that bottlenose dolphin can be disturbed from a very localised area, and for a short-period of time.

**Mitigation for Piling Works**

Mitigation will be undertaken for all piling works at the Proposed Scheme, in accordance with the best practice guidance for minimising the risk of injury to marine mammals from piling noise provided by the JNCC (2010).

Mitigation will include:

- The establishment of a mitigation zone of 500m from the piling location:
- Only commence piling operations during the hours of daylight and good visibility (and within the 12 hour construction window);
- Pre–piling search for marine mammals of mitigation zone by Marine Mammal Observer(s) (MMOs);

[2] *Level B Harassment is defined as having the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioural patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild.*

- Delay if marine mammals detected within the mitigation zone;
- Soft-start and ramp-up of piling for a period of not less than 20 minutes, as per JNCC (2010);
- Pre–construction activity search and soft-start procedure should be repeated before piling recommences, if piling operations pause for a period of greater than 10 minutes; and
- All mitigation procedures, soft-start and ramp-up, and reporting requirements, are as per the JNCC guidelines, with the exception of the reduced mitigation zone.

#### 7.1.2.2 Underwater Noise Effects during Dredging Activities

The dredging process emits continuous, broadband sound into the marine environment. Sound Pressure Levels (SPLs) can vary widely, dependent on the dredger type, operational stage, or environmental conditions (e.g. sediment type, water depth, salinity and seasonal phenomena such as thermoclines; Jones and Marten, 2016). These factors will also affect the propagation of sound from dredging activities and along with ambient sound already present, will influence the distance at which sounds can be detected.

Sound sources for TSHD include the draghead on the seabed, material going through the underwater pipe, as well as sound sources from the vessel, such as inboard pump, thrusters, propeller and engine noise (Central Dredging Association (CEDA), 2011; World Organization of Dredging Associations (WODA), 2013). Noise measurements indicate that the most intense sound emissions from TSHD dredgers are typically low frequencies, up to and including 1kHz (Robinson *et al.,* 2011). Underwater noise from a TSHD is comparable to those for a cargo ship travelling at modest speed (between 8 and 16 knots) (Theobald *et al.,* 2011).

Based on reviews of published sources of underwater noise during dredging activities (e.g. Thomsen *et al.,* 2006; CEDA, 2011; Theobald *et al.,* 2011; WODA, 2013; Todd *et al.,* 2014), sound levels that marine mammals may be exposed to during dredging activities are usually below auditory injury thresholds or PTS exposure criteria; however, TTS cannot be ruled out if marine mammals are exposed to noise for prolonged periods (Todd *et al.,* 2014), although marine mammals remaining in close proximity to such activities for long periods of time is unlikely.

Underwater noise as a result of dredging activity also has the potential to disturb marine mammals (Pirotta *et al.,* 2013). Therefore, there is the potential for short, perhaps medium-term behavioural reactions and disturbance to marine mammals in the area during dredging activities. Marine mammals may exhibit varying behavioural reactions intensities as a result of exposure to noise (Southall *et al.,* 2007).

Marine mammals within the potential disturbance area are considered to have limited capacity to avoid such effects, although any disturbance to marine mammals would be temporary and they would be expected to return to the area once the disturbance had ceased or they had become habituated to the sound.

*Potential for PTS and TTS Onset during Dredging Activities*

The potential impact range and areas, due to dredging, for bottlenose dolphin, grey seal and harbour seal are shown in **Table 7-4**. The results of the underwater noise modelling show that at the source levels predicted for the dredging activities, any marine mammal would have to remain in close proximity (i.e. less than 100m) of the sound source for 12 hours to be exposed to levels of sound that are sufficient to induce PTS or TTS onset as per the Southall *et al*. (2019) threshold criteria.

*Table 7-4 Impact ranges and areas, for potential PTS and TTS onset as a result of underwater noise associated with dredging activities*

| Potential Impact | Receptor | Impact range | Impact area |
|---|---|---|---|
| PTS without mitigation – cumulative exposure (over 12 hours) | Bottlenose dolphin | <100m | 0.03km$^2$ |
| | Grey seal | <100m | 0.03km$^2$ |
| | Harbour seal | <100m | 0.03km$^2$ |
| TTS without mitigation – cumulative exposure (over 12 hours) | Bottlenose dolphin | <100m | 0.03km$^2$ |
| | Grey seal | <100m | 0.03km$^2$ |
| | Harbour seal | <100m | 0.03km$^2$ |

*Potential for Disturbance during Dredging Activities*

McQueen *et al.* (2020) found that habitat avoidance was not at a sufficient spatial scale to pose a risk to seals, in the context of activity in dredging areas (adjacent to navigation channels and port infrastructure areas)[3]. For behavioural assessments, there are a myriad of significant data gaps that contribute to the uncertainty of the assessment. The major sources of uncertainty are clear exposure–response relationships among observed marine mammal behavioural studies (McQueen *et al.,* 2020). In some cases, there are orders of magnitude differences in reported sound thresholds for similar behavioural reactions, likely influenced by the difficulties with behavioural response scoring (Gomez *et al*., 2016) and study-specific context (e.g., multivariate exposure conditions; Ellison *et al.,* 2012).

Although there is the potential for behavioural response to the construction activities and excavation works, it is anticipated to be localised in effect and short in duration with animals returning to the area shortly after the sound source is stopped or completion of the works.

### 7.1.2.3 Indirect Effects

The potential for indirect effects to marine mammals include effects due to potential changes in water quality, and changes in prey availability.

#### Potential for Changes to Water Quality

Potential changes in water quality during construction could occur through:

- Increase in SSC in water body due to dredging and disposal;
- Potential release of historic contamination in sediments during dredging and disposal; and
- Accidental spills or leaks from construction plant or vessels.

Any direct effects to marine mammals as a result of any contaminated sediment during construction activities are unlikely, as any exposure is more likely to be through potential indirect effects via prey species.

*Potential Increase in Suspended Sediment Concentrations*

An increase in SSC during the dredging and disposal for the Proposed Scheme could lead to a potential reduction in water clarity and therefore quality. Modelling results predict the increase in SSC to be highly localised and temporary during dredging, and that they would be highest at the bottom, while minimum at the surface layers within the water column. Dredging will be non-continuous and SSC levels will dissipate to within background levels between dredging activities.

[3] *using the maximum source level of 192 dB re 1 µPa·m, SELs for the marine mammals were calculated using the sheet for "non-impulsive, continuous, mobile sources" from the publicly available NMFS (2018b) spreadsheet tool*

Marine mammals often inhabit turbid environments and cetaceans utilise sonar to sense the environment around them and there is little evidence that turbidity affects cetaceans directly (Todd *et al*., 2014). Pinnipeds are not known to produce sonar for prey detection purposes; however, it is likely that other senses are used instead of, or in combination with, vision. Studies have shown that vision is not essential to seal survival, or ability to forage (Todd *et al*., 2014).

Increased turbidity is unlikely to have a substantial direct impact on marine mammals that often inhabit naturally turbid or dark environments. This is because other senses are utilised, and vision is not relied upon solely.

*Potential Release of Historic Contamination in Sediments during Dredging and Disposal*

Samples of sediments at the dredging site found contaminants slightly exceeding MS Action Level (AL) 1 of some polycyclic aromatic hydrocarbons (PAHs) and to be suitable for offshore disposal (full details of sediment chemical analyses is provided in Chapter 8 of the accompanying sEIA Report for the Proposed Scheme). The disposal activities would be intermittent over the dredging campaign and modelling has predicted that background SSCs would be restored within one hour of disposal ceasing. Given this, a decline in water quality at the disposal site is not anticipated.

*Accidental Spills or Leaks from Construction Plant or Vessels*

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

- Oils and fuels stored on site;
- Construction and refuelling machinery or site vehicles; and
- Concrete and cement in construction works.

The effect of the potential spill and leaks incidences during construction on water quality would be dependent on the scale and nature of the incident. The following pollution prevention guidelines are relevant to the Proposed Scheme and will be adhered to:

- Guidance for Pollution Prevention (GPP) 1: Understanding your environmental responsibilities - good environmental practices;
- GPP 5: Works and maintenance in or near water;
- PPG 6: Working at construction and demolition sites;
- PPG 7: Safe storage - The safe operation of refuelling facilities;
- GPP 8: Safe storage and disposal of used oils;
- GPP 13: Vehicle washing and cleaning (April 2017);
- GPP 21: Pollution incident response planning; and
- GPP 22: Dealing with spills.

With adherence to the above, the potential for accidental spill or leaks is considered to be low, and therefore there to be no risk to marine mammals.

**Potential for Changes to Prey Availability**

The potential impacts on fish species during construction can result from:

- Generation of underwater noise from piling operations, which could have physiological and/or behavioural response impacts; and
- Indirect effects due to changes to water quality (e.g., increased suspended sediment).

Bottlenose dolphin are opportunistic feeders, feeding on wide range of prey species and have large foraging ranges (see **Section 7.5.3.2**) and are therefore not considered to be sensitive to changes in prey resources.

Grey and harbour seal feed on a variety of prey species, both are considered to be opportunistic feeders, feeding on wide range of prey species and they are able to forage in other areas and have relatively large foraging ranges (see **Sections 7.7.2.3.3** and **7.7.3.3.2**). As for bottlenose dolphin, grey seal and harbour seal are not considered to be sensitive to changes in prey resources.

*Potential for Underwater Noise Effects on Fish (Prey) Species*

Underwater noise from piling and dredging activities during construction may injure, disturb and displace prey species. If the abundance and/or availability of prey is reduced through displacement or mortality arising from underwater noise, this could adversely affect marine mammal receptors.

Impact piling activities creating impulsive underwater noise are considered to pose the greatest risk to prey fish species, with very limited risk posed by other underwater noise sources such as dredging or vibro-piling.

Evidence of the effects of underwater noise from the proposed piling on fish is described in **Appendix 3**. For all fish species, potential mortal injury could only occur in a very limited range (less than 100m) of the source, and the mitigations for marine mammals as outlined in **Section 7.1.2.1**, would allow for fish species to vacate the area before full hammer energy was achieved. As such, mortality rates in fish of all levels of sensitivity are anticipated to be very low. Temporary disturbance to fish is possible across the range to which TTS may arise. For particularly sensitive species, this is predicted to be a maximum of 1.2km and mean of 710m from source (based on stationary, non-fleeing fish), while for less sensitive species, it would be considerably less (within a few hundred metres). Within this range, there may be small decreases in the abundance of fish species due to displacement, although fish species utilising the area will be somewhat adapted to noise associated with constant vessel access to a busy port area. For this reason, displacement levels are likely to be limited outside of TTS range.

Given the above, and based on the short-term nature of the effect, it is concluded that there would not be a significant reduction in prey availability, and, as noted above for water quality changes, marine mammal species are able to prey upon a wide range of species, and therefore a small and localised displacement effect would not have a significant effect on any marine mammal within the vicinity of the Proposed Scheme.

*Potential for Indirect Effects on Prey Availability due to Changes in Water Quality*

Dredging of fine material during the construction phase of the Proposed Scheme would result in a temporary increase in SSC, which has the potential to impact upon prey species, including behavioural responses, such as temporary displacement of those species from the affected range. This in turn has the potential to affect marine mammal species that feed on such resources.

The extent of the sediment plume predicted from the proposed dredging (and subsequent disposal) is shown in **Figure 5-1** and **Figure 5-2**. Significant increases in SSC are only likely within the footprint of the dredge site (i.e. confined solely to the entrance to the Port) and the boundaries of the licensed disposal site.

Dredging activities will operate on a 24/7 basis during the campaign; however, given the campaign will last around four months, the temporal magnitude of the effect would be short-term and temporary.

The potential for significant effects to prey species due to increased SSC is unlikely, given the very localised and temporary nature of the potential effect, and this, alongside the foraging ability of marine mammals, indicates a very low risk of any effect to the availability of prey species.

Any trace contaminants would be bound to fine particles and would only be present within the sediment plume itself. As noted above, analysis of the sediment present in the dredge area indicates that contaminant levels within the sediment are low enough that disposal of such sediment would not pose a significant risk to fish (prey species).

### 7.1.2.4 In-Combination Effects

The initial screening for in-combination effects and projects is included in **Table 4-2.** Other projects and effect pathways taken forward for in-combination assessment are summarised in **Table 7-5**.

Due to the limited potential for any effect from either a change in water quality, or a change in prey availability, and that the nearest in-combination project screened in, with relevant potential effects for marine mammals, is the Grangemouth Flood Protection Scheme, at 30km from the Proposed Scheme, the following in-combination assessment will focus on the potential for in-combination underwater noise effects only. In addition, as each project is required to provide mitigation for any potential for PTS onset, there is no potential for PTS onset at the Proposed Scheme in-combination with other projects (as all potential PTS will be mitigated for). Therefore, the following underwater noise assessment will include the potential for TTS onset and disturbance only.

*Table 7-5 Summary of in-combination projects, effects, and designated sites (for marine mammals) taken forward for assessment*

| Project | Screened in for further consideration (and reasoning) | Marine mammal designated site/s screened in for | Potential effects to be considered |
|---|---|---|---|
| Nigg Energy Park East Quay | No – construction works now completed | Bottlenose dolphin; Moray Firth SAC | TTS onset and/or disturbance due to underwater noise |
| NorthConnect HVDC Cable | No – project was not granted consent in Norway, and now on hold | | |
| Moray West OWF | **Yes** – potential for overlap in construction timeframes | | |
| Sea Wall Repair and Extension – Alexandra Parade | **Yes** – potential for overlap in construction | | |
| Ardersier Port Development | **Yes** – potential for overlap in construction | | |
| Seagreen Alpha and Bravo OWFs (Optimised Project) | No – OWF is now fully operational | Bottlenose dolphin; Moray Firth SAC<br>Grey seal; Isle of May SAC & Berwickshire and North Northumberland Coast SAC<br>Harbour seal; Firth of Tay and Eden Estuary SAC | |
| Neart na Gaoithe OWF (Revised Design) | **Yes** – potential for overlap in construction timeframes | | |
| Inch Cape OWF (Revised Design) | No – offshore construction will not overlap with the Proposed Scheme | | |
| Grangemouth Flood Protection Scheme | **Yes** – potential for overlap in construction | | |

## 7.2 Isle of May SAC

### 7.2.1 Description of Designation

The Isle of May SAC is located at the entrance to the Firth of Forth, approximately 44km from the Proposed Scheme. This site supports a breeding colony of grey seal, with the largest east coast breeding colony of grey seals in Scotland, and the fourth-largest breeding colony in the UK (JNCC, 2021).

Grey seals haul-out on land to rest, moult, and breed. Foraging trips can last between one and 30 days, and usually occurs within 100km of their haul-out site, although individuals have been reported to travel up to several hundred kilometres offshore to forage (SCOS, 2022). In Scotland, grey seal pupping occurs between September and December, with the moult occurring between December and April the following year (Hague *et al.,* 2020). Tagging studies of grey seal within UK waters have been undertaken since 1988, with a total of 285 individuals tracked within Scottish waters. These studies show that there is connectivity with the Proposed Scheme and the Isle of May Coast SAC, with individuals travelling from the SAC through the Firth of Forth, and near to the Proposed Scheme (Carter *et al.,* 2020; 2022 (**Plate 7-1**)).

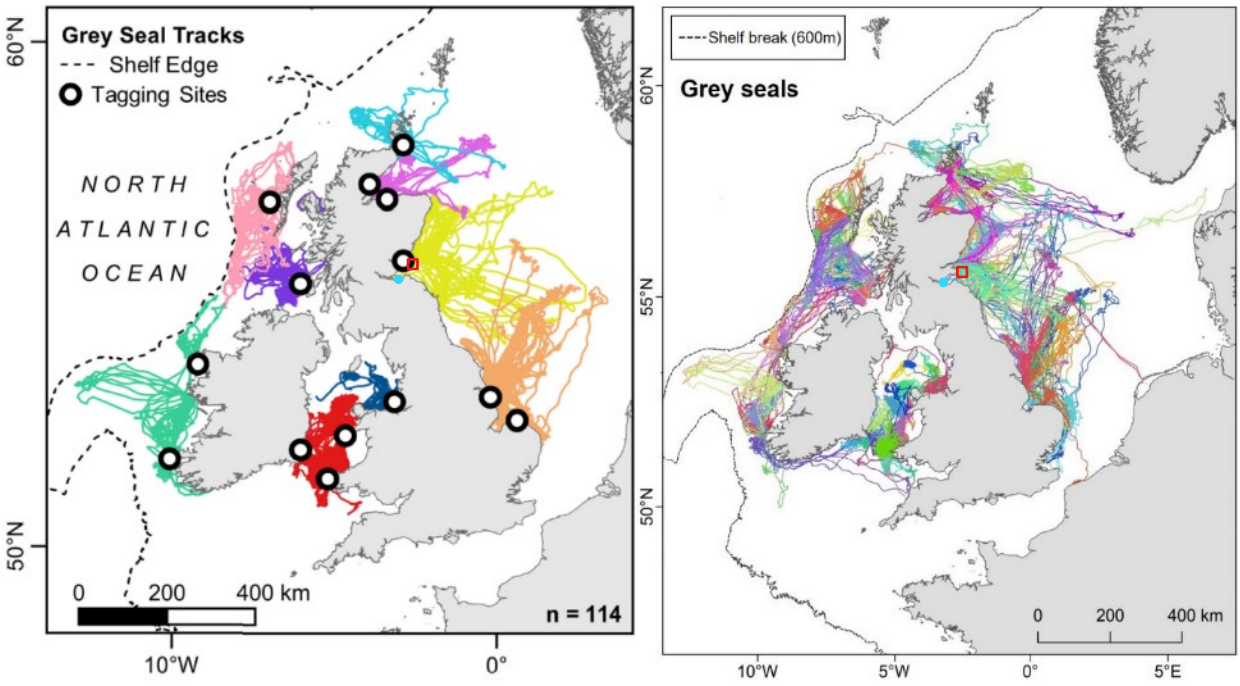


*Plate 7-1 Grey seal tagging studies; Left = grey seal (n=114) tracking data combined from SMRU, University of Aberdeen and University College Cork, coloured by individual (Carter et al., 2020); Right = tracking data for grey seal (n=114), cleaned to remove erroneous locations, trips between locations, and locations in breeding season (Carter et al., 2022). [Approximate location of the Isle of May SAC shown by the red square, and approximate location of the Proposed Scheme shown by the blue circle].*

### 7.2.2 Conservation Objectives

The Isle of May SAC Conservation Objectives for grey seal are:

- To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and
- To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site;
- Distribution of the species within site;
- Distribution and extent of habitats supporting the species;
- Structure, function and supporting processes of habitats supporting the species; and
- No significant disturbance of the species.

Grey seal within the Isle of May SAC are in favourable condition.

### 7.2.3 Features Screened In

Grey seal is the only feature screened in for further assessment.

#### 7.2.3.1 Distribution and Abundance

Grey seals only occur in the North Atlantic, Barents and Baltic Sea with their main concentrations on the east coast of Canada and United States of America and in north-west Europe (SCOS, 2022). Approximately 36% of the worlds grey seals breed in the UK, and 80% of these breed at colonies in Scotland with the main concentrations in the Outer Hebrides and in Orkney. Grey seal haul out on land to rest, moult and breed and forage at sea where they range widely, frequently travelling for up to 30 days with over 100km between haul-out sites (SCOS, 2022). Tagging studies have shown grey seal to make foraging distances of up to 448km (Carter *et al.*, 2022).

Compared with other times of the year, grey seal in the UK spend longer hauled out during their annual moult (between December and April) and during their breeding season, in eastern Scotland, pupping occurs mainly between early November and mid-December (SCOS, 2022).

The latest count of grey seal on the Isle of May was in 2021 and the total number was 97 (SCOS, 2022). However, the latest population numbers of grey seal on Isle of May SAC was documented in 2016, with a population reference of 8,000 (Scottish Natural Heritage, 2016). This reference population will be used to assess for any potential impacts to grey seal in the Isle of May SAC.

Grey seal are likely to be present in and around the Proposed Scheme (SCOS, 2022; Carter *et al.,* 2022). Carter *et al.,* (2022) provides habitat-based predictions of at-sea distribution for grey seal in the British Isles, including SACs. The habitat preference approach predicted distribution maps provide estimates per species, on a 5km x 5km grid, of relative at-sea density for seals hauling-out in the British Isles. It is important to note that Carter *et al.,* (2022) provides *relative density* (i.e. percentage of at-sea population within each 5km x 5km grid square).

For grey seal associated with the Isle of May SAC, the mean predicted density for all grid squares that overlap with the Proposed Scheme is 0.238/km$^2$ (Carter *et al.*, 2022). As noted above, the total population for the Isle of May SAC is estimated to be 8,000; this has been corrected to generate an at-sea population of 6,589 of which the absolute densities are based on (using the correction factor of 0.8616 (Russell *et al.,* 2015)). This density will be used for the assessing the potential impacts to grey seal associated with the Isle of May SAC.

#### 7.2.3.2 Haul-Out Sites

The Isle of May SAC is an important breeding site for grey seal, with grey seal pup production within the Isle of May SAC has been relatively stable since the late 1990s, with approximately 2,000 pups born each year (SCOS, 2020). Approximately 2,050 recorded in 2010 (Russell *et al.*, 2019), and approximately 2,300 in 2014 (SCOS, 2016).

#### 7.2.3.3 Diet and Prey Species

Grey seals will typically forage in the open sea and return regularly to land to haul-out, although they may frequently travel up to 100km between haul-out sites. (SCOS, 2022). Grey seal generally travel between known foraging areas and back to the same haul-out site, but will occasionally move to a new site. For example, movements have been recorded between haul-out sites on the east coast of England and the Outer Hebrides (SCOS, 2022).

Grey seal are generalist feeders, feeding on a wide variety of prey species (SCOS, 2022; Hammond and Grellier, 2006). Diet varies seasonally and from region to region (SCOS, 2022).

In the North Sea, principal prey items are sandeel *Ammodytes sp*., whitefish (such as cod *Gadus morhua*, haddock *Melanogrammus aeglefinus*, whiting *Merlangius merlangus* and ling *Molva molva*) and flatfish (plaice *Pleuronectes platessa*, sole *Solea solea*, flounder *Platichthys flesus*, and dab *Limanda limanda*) (Hammond and Grellier, 2006). Amongst these, sandeels are typically the predominant prey species.

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 7kg per seal per day depending on the prey species (SCOS, 2022).

### 7.2.4 Potential Effects of the Proposed Scheme Alone

#### 7.2.4.1 Underwater Noise Effects from Piling Activities

**Potential for PTS or TTS onset from Piling Activities**

The potential for tubular piling effects on grey seal have been put into context of this SAC population, using the underwater noise modelling results presented in Appendix 2 of the Outer Berth HRA Report. The results of this assessment are provided in **Table** .

*Table 7-6 Impact ranges and areas, and maximum number of individuals (and % of reference population) that could be at risk of PTS or TTS onset from piling*

| Activity | Potential Impact | Receptor | Impact range (and area) | Maximum number of individuals (% of reference population) |
|---|---|---|---|---|
| Piling | PTS without mitigation – single strike | Grey seal of the Isle of May (IoM) SAC | <50m <0.01km$^2$ | 0.002 (0.0000003% of the IoM SAC population) |
| | PTS without mitigation – cumulative exposure | | <100m <0.1km$^2$ | 0.02 (0.000003% of the IoM SAC population) |
| | TTS without mitigation – single strike | | <50m <0.01km$^2$ | 0.002 (0.0000003% of the IoM SAC population) |
| | TTS without mitigation – cumulative exposure | | <100m <0.1km$^2$ | 0.02 (0.000003% of the IoM SAC population) |

The number of grey seal at potential risk of either PTS or TTS onset, as a result of piling activity, is less than one individual, with a maximum population level effect of up to less than 0.0001% of the Isle of May SAC being affected (**Table** ). In addition, mitigation measures will be in place for all piling works, as described in **Section 7.1.2.1**.

Therefore, given the very low number of individuals at risk of effect from either PTS or TTS onset, and that the Isle of May SAC is not located within close proximity of the Proposed Scheme, and the mitigation measures that will be put in place for all piling activities, it is concluded that **there would be no potential for adverse effect on the integrity of grey seal, as a designated feature of the Isle of May SAC, due to underwater noise effects from piling works**.

**Potential for Disturbance from Piling Activities**

While there is the potential for a displacement response from the area for grey seal, it is expected that they would return once the activity has been completed, and therefore any effects from underwater noise as a result of piling will be both localised and temporary. The area surrounding the Port of Leith is already a busy marine area, and any seals in the vicinity of the Proposed Scheme would be used to increased levels of marine traffic and noisy environments. Given the busy nature of the area, that the piling works will be small in scale and temporary, any potential for disturbance would be localised, and would be unlikely to cause any significant disturbance to grey seal in the area, there is unlikely to be the potential for any significant effect on grey seal, as a result of piling activity.

Taking into account the above, including the limited potential for a disturbance effect on any grey seal, and that the Isle of May SAC is not located within close proximity of the Proposed Scheme, it is concluded that **there would be no potential for adverse effect on the integrity of grey seal, as a designated feature of the Isle of May SAC, due to underwater noise effects from piling works**.

### 7.2.4.2 Underwater Noise from Dredging Activities

**Potential for PTS or TTS Onset from Dredging Activities**

The potential for underwater noise effects on grey seal due to dredging activities have been put into context of Isle of May SAC population, as well as the wider reference populations as described above, using the underwater noise modelling results presented in Appendix 2 of the Outer Berth HRA Report**.** The results of this assessment are provided in **Table** .

*Table 7-7 Impact ranges and areas, and maximum number of individuals (and % of reference population) that could be at risk of PTS or TTS onset due to dredging activities*

| Activity | Potential Impact | Receptor | Impact range (and area) | Maximum number of individuals (% of reference population) |
|---|---|---|---|---|
| Dredging | PTS without mitigation – cumulative exposure (over 12 hours) | Grey seal of the IoM SAC | <100m 0.03km$^2$ | 0.007 (0.0000009% of the IoM SAC population). |
| | TTS without mitigation – cumulative exposure (over 12 hours) | | <100m 0.03km$^2$ | 0.007 (0.0000009% of the IoM SAC population). |

The number of grey seal at potential risk of either PTS or TTS onset, as a result of dredging, is less than one individual, with a maximum population level effect of less than 0.0001% of the Isle of May SAC being affected (**Table -7**).

Therefore, given the very low number of individuals at risk of effect from either PTS or TTS onset, and that the Isle of May SAC is not located within close proximity of the Proposed Scheme, it is concluded that **there would be no potential for adverse effect on the integrity of grey seal, as a designated feature of the Isle of May SAC, due to underwater noise effects from piling works**.

**Potential for Disturbance from Dredging Activities**

Although there is the potential for behavioural response to the dredging activities, it is anticipated to be localised in effect and short in duration, with individuals returning to the area shortly after the sound source is stopped, or on completion of the works. As noted for piling, the area surrounding the Port of Leith is a busy marine area, and any seals present in the area would be used to increased levels of underwater noise. Given the busy nature of the area, that the dredging works will be small in scale and temporary, any potential for disturbance would be localised, and that it is unlikely to cause any significant disturbance to grey seal in the area, it is unlikely that there would be any potential for any significant effect on grey seal, as a result of dredging activity.

Taking into account the above, including the limited potential for a disturbance effect on any grey seal, and that the Isle of May SAC is not located within close proximity of the Proposed Scheme, it is concluded that **there would be no potential for adverse effect on the integrity of grey seal, as a designated feature of the Isle of May SAC, due to underwater noise effects from dredging activities**.

#### 7.2.4.3 Indirect Effects

**Potential for Indirect Effects as a Result of Changes to Water Quality**

The potential for indirect effect to grey seal from changes to water quality would be from any increase in SSC, the release of contaminated sediments through dredging, and accidental spills and leaks. As described in **Section 7.1.2.3**, none of the potential effects noted above would have the potential for any significant effect on grey seal, and therefore, **there would be no potential for adverse effect on the integrity of grey seal, as a designated feature of the Isle of May SAC, due to a change in water quality**.

**Potential for Indirect Effects as a Result of Changes to Prey Availability**

The potential for effects to fish (marine mammal prey species) are described in **Section 7.1.2.3**. Grey seal are generalist feeders, and therefore any small scale and temporary changes in prey availability would have no effect on the grey seal ability to forage in the area. As described above, all effects to fish (prey species) would be over a localised area and would be temporary only. There are no significant effects identified for fish (prey species). Therefore, **there would be no potential for adverse effect on the integrity of grey seal, as a designated feature of the Isle of May SAC, due to a change in prey availability.**

### 7.2.5 Potential Effects of the Proposed Scheme in Combination with Other Projects

The potential for in-combination effects have been assessed in **Table -8**. In summary, there is no potential for significant effect to grey seal, as a result of any other project screened in, in-combination with the Proposed Scheme. Therefore, **there would be no potential for adverse effect on the integrity of grey seal, as a designated feature of the Isle of May SAC, due to in-combination effects.**

*Table 7-8 In-combination assessment for grey seal at the Isle of May SAC*

| In-combination project | In-combination Project Information | Proposed Scheme Assessment | | In-combination Project Assessment | | Overall In-Combination Assessment |
|---|---|---|---|---|---|---|
| | | Potential Effect | Assessment | Potential Effect | Assessment | |
| Neart na Gaoithe OWF (Revised Design) | The Neart na Gaoithe wind farm is currently under construction. There is therefore the potential for piling to overlap with the piling at the Proposed Scheme. | TTS (highest potential impact range of 100m for TTS cumulative exposure due to sheet piling used as the worst-case) | 0.02 grey seal (0.00005% of the IoM SAC population).<br><br>No potential for adverse effect. | TTS from piling (as the worst-case).<br><br>Piling at the Neart na Gaoithe wind farm would either be using a combination of pile driving and drilling (the 'drive-drill-drive' scenario) or under pile driving only (the 'drive only' scenario). | The assessments predicted that between 1,263 and 1,833 grey seal may receive noise levels capable of causing TTS. However, it was also predicted that the individuals would avoid the area, and the duration of potential exposure would be low, and therefore was concluded that there would not be a significant impact. | Due to the temporary nature of the piling at the Proposed Scheme, and that any effect to grey seal at Neart na Gaoithe would be temporary, and that it is unlikely that all grey seal in the vicinity of the projects would be from the Isle of May SAC, it is concluded that there is unlikely to be any significant effect to grey seal within the IoM SAC, and therefore there is **no potential for adverse effect on the integrity of the site**. |
| | | Disturbance effects | Localised and temporary effect only, no potential for significant level of disturbance to any individuals.<br><br>No potential for adverse effect. | Disturbance from piling (as the worst-case) | The assessment concludes that total displacement of grey seal may occur up to 15km from the piling location. Therefore, for the 'drill-drive-drill' scenario up to 95 seals may be disturbed, and under the 'drive only' scenario, up to 113 grey seal may be displaced. | Due to the localised and temporary nature of the piling at the Proposed Scheme, in-combination with the low number of grey seal that may be disturbed as a result of the piling activities at Neart na Gaoithe, and that it is unlikely that all grey seal in the vicinity of the project would be from the IoM SAC, it is concluded that there is unlikely to be any significant effect to grey seal, and therefore there is **no potential for adverse effect on the integrity of the site**. |
| Grangemouth Flood Protection Scheme | To date, only the EIA Scoping report is available, and no formal application for the | TTS (highest potential impact range of 100m for TTS | 0.02 grey seal (0.00005% of the IoM SAC population; | N/A | | While an in-combination assessment for this project is not possible, it is expected that, due to the planned activities, any potential effects would be less than those of the Proposed Scheme, and |

| In-combination project | In-combination Project Information | Proposed Scheme Assessment | | In-combination Project Assessment | | Overall In-Combination Assessment |
|---|---|---|---|---|---|---|
| | | Potential Effect | Assessment | Potential Effect | Assessment | |
| | scheme has been submitted. Within the EIA Scoping Report[4], it is stated that construction would be undertaken from 2022, for a period of between five and 10 years. However, given that no formal application has been submitted, it is considered unlikely that the construction of this flood protection scheme would overlap with the Proposed Scheme. | cumulative exposure due to sheet piling used as the worst-case) | 0.0002% of the ES MU; or 0.0001% of the wider MU). No potential for adverse effect. | | | given the expected localised and temporary nature of any effects, there is no potential for significant in-combination effect to grey seal, and therefore **no potential for adverse effect on the integrity of the site**. |
| | | Disturbance effects | Localised and temporary effect only, no potential for significant level of disturbance to any individuals.<br><br>No potential for adverse effect. | | | |

[4] https://marine.gov.scot/sites/default/files/grangemouth_fps_eia_scoping_report_final_for_submission.pdf

## 7.3 Firth of Tay and Eden Estuary SAC

### 7.3.1 Description of Designation

The Firth of Tay and Eden Estuary SAC is approximately 65km from Port Leith and supports a nationally important breeding colony of harbour seal, which form part of the east coast population of seals that typically utilise sandbanks. Harbour seal haul-out on land to rest, breed, and moult, with the core pupping period being between June and July. Harbour seal generally take foraging trips of between 30km and 50km, however, movements of harbour seal vary among individuals, and have reported foraging trips of up to 273km (Carter *et al.,* 2022).

Tagging studies of harbour seal within UK waters have been undertaken since 2001, with a total of 420 individuals tracked within Scottish waters. These studies show that there is connectivity with the Proposed Scheme and the Firth of Tay and Eden Estuary SAC, with individuals travelling from the SAC through the Firth of Forth (**Plate 7-2**; Carter *et al*., 2020; 2022).

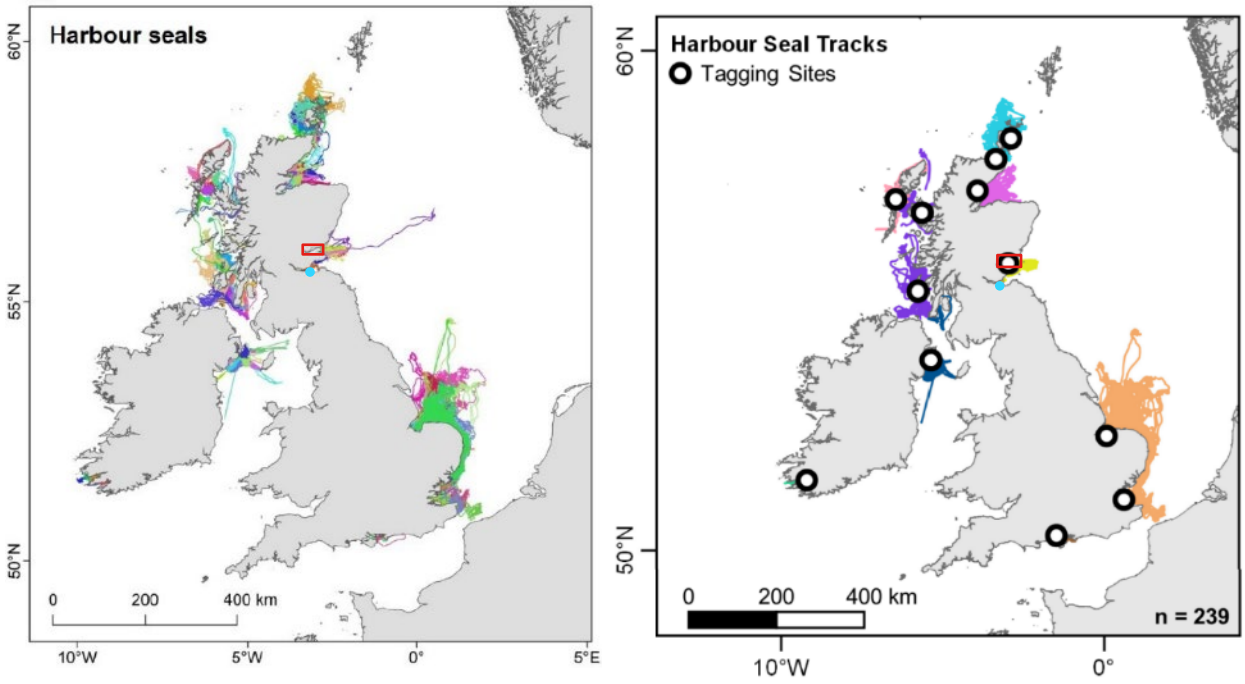


*Plate 7-2 Harbour seal tagging studies; Left = harbour seal (n=114) tracking data combined from SMRU, University of Aberdeen and University College Cork, coloured by individual (Carter et al., 2020); Right = tracking data for harbour seal (n=239), cleaned to remove erroneous locations, trips between locations, and locations in breeding season (Carter et al., 2022). [Approximate location of the Firth of Tay and Eden Estuary SAC shown by the red square, and approximate location of the Proposed Scheme shown by the blue circle].*

### 7.3.2 Conservation Objectives

The Firth of Tay and Eden Estuary SAC Conservation Objectives for harbour seal are:

- To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and
- To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site;
- Distribution of the species within site;
- Distribution and extent of habitats supporting the species;
- Structure, function and supporting processes of habitats supporting the species; and
- No significant disturbance of the species.

Harbour seal within the Firth of Tay and Eden Estuary SAC are in unfavourable condition.

### 7.3.3 Features Screened In

Harbour seal are the only feature screened in for further assessment.

#### 7.3.3.1 Distribution and Abundance

Harbour seal have a circumpolar distribution in the Northern Hemisphere and are divided into five sub-species. The population in European waters represents one subspecies *Phoca vitulina vitulina* (SCOS, 2020). Harbour seals are widespread around the west coast of Scotland and throughout the Hebrides and Northern Isles. On the east coast of the UK, their distribution is more restricted with concentrations in the major estuaries of the Thames, The Wash, Firth of Tay and the Moray Firth.

Harbour seal come ashore in sheltered waters, typically on sandbanks and in estuaries, but also in rocky areas. They give birth to their pups in June and July and moult in August. At these, as well as other times of the year, harbour seals haul-out on land regularly in a pattern that is often related to the tidal cycle. They forage at sea and haul-out on land to rest, moult and breed.

The latest harbour seal count (from 2021) in the Firth of Tay and Eden Estuary SAC was 41 (SCOS, 2022), and the population in this site has been in decline since the 2000s; the 1990 to 2002 count within the SAC was 641 (Hague *et al.,* 2020). The count of harbour seal within the SAC has been stable, at between 29 and 60, since 2013 (**Plate 7-33**; SCOS, 2020; SCOS, 2022). To generate a SAC population estimate of this SAC, the count has been corrected to take account of those not available to count during the surveys (a correction of 0.72; Lonergan *et al.,* 2013). This results in a total SAC population estimate of 57, for which the potential for effect has been assessed.

While there is some connectivity of individuals from the Firth of Tay and Eden Estuary SAC within the wider area, this SAC population is the most isolated harbour seal SAC population in Scotland, with the majority of individuals staying within close proximity of the SAC. Only a small proportion of the wider East Scotland population are associated with haul-out sites within the Firth of Tay and Eden Estuary SAC (**Plate 7-3**; SCOS, 2020).

Harbour seal are likely present in lower number around the Proposed Scheme (SCOS, 2022; Carter *et al.,* 2022). For harbour seal associated with the Firth of Tay and Eden Estuary SAC, the mean predicted density for each grid square that overlaps with the Proposed Scheme is 0.000005km$^2$, a relative density of very low when compared to the overall distributions of harbour seal (Carter *et al*., 2022). As noted above, the total population for the Firth of Tay and Eden Estuary SAC is estimated to be 57; this has been corrected to generate an at-sea population of 47 of which the absolute densities are based on (using the correction factor of 0.8236 (Russell *et al.,* 2015)). This density will be used for the assessing the potential impacts to harbour seal associated with the Firth of Tay and Eden Estuary SAC.

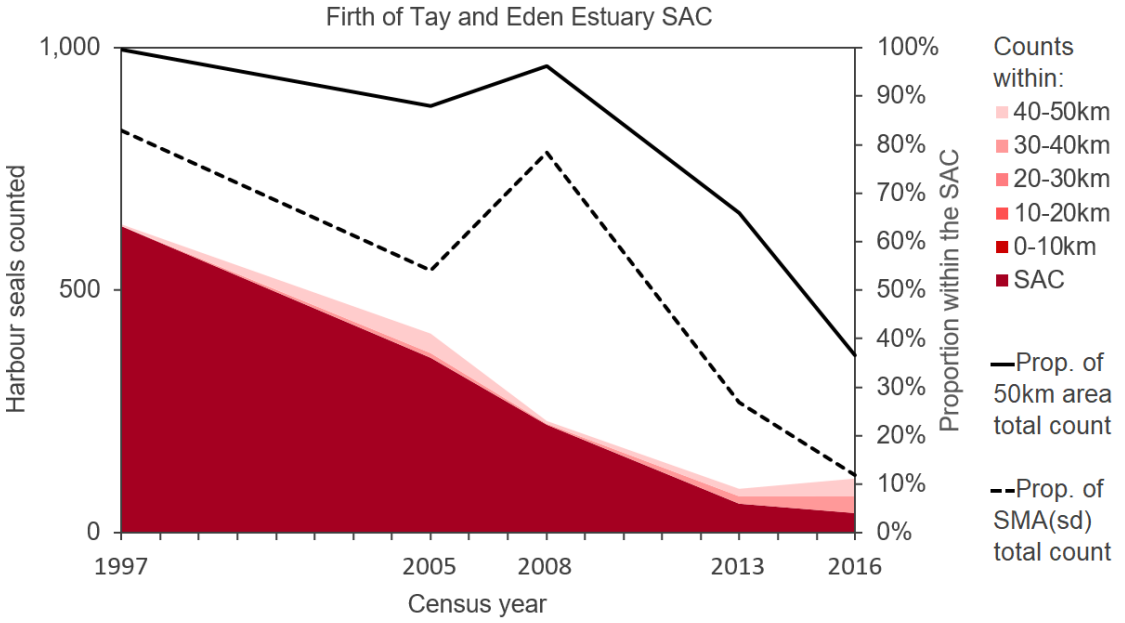


*Plate 7-3 Harbour seal counts in the Firth of Tay and Eden Estuary SAC, and up to 50km from the SAC. The dotted black line shows the SAC count as a proportion of the total count for East Scotland MU (SCOS, 2020).*

### 7.3.3.2 Diet and Prey Species

Harbour seal take a wide variety of prey including sandeels, gadoids., herring *Clupea harengus* and sprat *Sprattus sprattus*, flatfish and cephalopods. Diet varies seasonally and regionally, prey diversity and diet quality also showed some regional and seasonal variation (SCOS, 2022). It is estimated harbour seals eat 3-5kg per adult seal per day depending on the prey species (SCOS, 2022).

The range of foraging trips varies depending on the surrounding marine habitat (e.g. 25km on the west of Scotland (Cunningham *et al.,* 2009), and 30km-45km in the Moray Firth (Tollit *et al.,* 1998; Thompson and Miller 1990). Telemetry studies indicate that the tracks of tagged harbour seals have a more coastal distribution than grey seals and do not travel as far from haul-outs.

## 7.3.4 Potential Effects of the Proposed Scheme Alone

### 7.3.4.1 Underwater Noise Effects from Piling Activities

**Potential for PTS or TTS Onset from Piling Activities**

The potential for piling effects on harbour seal have been put into context of this SAC population, using the underwater noise modelling results presented in Appendix 3 of the Outer Berth HRA Report. The results of this assessment are provided in **Table** .

*Table 7-9 Impact ranges and areas, and maximum number of individuals (and % of reference population) that could be at risk of PTS or TTS onset from piling*

| Activity | Potential Impact | Receptor | Impact range (and area) | Maximum number of individuals (% of reference population) |
|---|---|---|---|---|
| Piling | PTS without mitigation – single strike | Harbour seal of the Firth of Tay and Eden Estuary (FT&EE) SAC | <50m <0.01km$^2$ | 0.0000001 (<0.0000001% of the FT&EE) SAC) |
| | PTS without mitigation – cumulative exposure | | <100m <0.1km$^2$ | 0.000001 (<0.0000001% of FT&EE SAC) |
| | TTS without mitigation – single strike | | <50m <0.01km$^2$ | 0.0000001 (<0.0000001% of the FT&EE SAC) |

| Activity | Potential Impact | Receptor | Impact range (and area) | Maximum number of individuals (% of reference population) |
|---|---|---|---|---|
| | TTS without mitigation – cumulative exposure | | <100m <0.1km$^2$ | 0.000001 (<0.0000001% of FT&EE SAC) |

The number of harbour seal at potential risk of either PTS or TTS onset, as a result of piling activity, is less than one individual, with a maximum population level effect less than 0.00001% of the Firth of Tay and Eden Estuary SAC being affected **(Table** ). In addition, mitigation measures will be in place for all piling works, as described in **Section 7.1.2.1**.

Therefore, given the very low number of individuals at risk of effect from either PTS or TTS onset, and that the SAC is not located within close proximity of the Proposed Scheme, in addition to the mitigation measures that will be put in place for all piling activities, it is concluded that **there would be no potential for adverse effect on the integrity of harbour seal, as a designated feature of the Firth of Tay and Eden Estuary SAC, due to underwater noise effects from piling works**.

**Potential for Disturbance from Piling Activities**

As for grey seal, while there is the potential for a displacement response from the area for harbour seal, it is expected that they would return once the activity has been completed, and therefore any effects from underwater noise as a result of piling will be both localised and temporary. The area surrounding the Port of Leith is already a busy marine area, and any seals in the vicinity of the Proposed Scheme would be used to increased levels of marine traffic and noisy environments. Given the busy nature of the area, that the piling works will be small in scale and temporary, any potential for disturbance would be localised, and would be unlikely to cause any significant disturbance to harbour seal in the area, there is unlikely to be the potential for any significant effect on harbour seal, as a result of piling activity.

Taking into account the above, including the limited potential for a disturbance effect on any harbour seal, and that the Firth of Tay and Eden Estuary SAC is not located within close proximity of the Proposed Scheme, it is concluded that **there would be no potential for adverse effect on the integrity of harbour seal, as a designated feature of the Firth of Tay and Eden Estuary SAC, due to underwater noise effects from piling works**.

### 7.3.4.2 Underwater Noise Effects from Dredging Activities

**Potential for PTS or TTS Onset from Dredging Activities**

As for the potential effect of piling, the potential for underwater noise effects on harbour seal due to dredging activities have been put into context of the Firth of Tay and Eden Estuary SAC population, using the underwater noise modelling results presented in Appendix 2 of the Outer Berth HRA Report. The results of this assessment are provided in **Table** Table .

*Table 7-10 Impact ranges and areas, and maximum number of individuals (and % of reference population) that could be at risk of PTS or TTS onset due to dredging activities*

| Activity | Potential Impact | Receptor | Impact range (and area) | Maximum number of individuals (% of reference population) |
|---|---|---|---|---|
| Dredging | PTS without mitigation – cumulative exposure (over 12 hours) | Harbour seal of the FT&EE SAC | <100m <0.1km$^2$ | 0.000001 (<0.0000001% of FT&EE SAC) |
| | TTS without mitigation – cumulative exposure (over 12 hours) | | <100m <0.1km$^2$ | 0.000001 (<0.0000001% of FT&EE SAC) |

The number of harbour seal at potential risk of either PTS or TTS onset, as a result of dredging, is less than one individual, with a maximum population level effect of up to less than 0.00001% of the Firth of Tay and Eden Estuary SAC being affected (**Table** ).

Therefore, given the very low number of individuals at risk of effect from either PTS or TTS onset, and that the SAC is not located within close proximity of the Proposed Scheme, it is concluded that **there would be no potential for adverse effect on the integrity of harbour seal, as a designated feature of the Firth of Tay and Eden Estuary SAC, due to underwater noise effects from piling works**.

**Potential for Disturbance from Dredging Activities**

Although there is the potential for behavioural response to the dredging activities, it is anticipated to be localised in effect and short in duration, with individuals returning to the area shortly after the sound source is stopped, or on completion of the works. As noted for piling, the area surrounding the Port of Leith is a busy marine area, and any seals present in the area would be used to increased levels of underwater noise. Given the busy nature of the area, that the dredging works will be small in scale and temporary, any potential for disturbance would be localised, and that it is unlikely to cause any significant disturbance to harbour seal in the area, it is unlikely that there would be any potential for any significant effect on harbour seal, as a result of dredging activity.

Taking into account the above, including the limited potential for a disturbance effect on any harbour seal, and that the SAC is not located within close proximity of the Proposed Scheme, it is concluded that **there would be no potential for adverse effect on the integrity of harbour seal, as a designated feature of the Firth of Tay and Eden Estuary SAC, due to underwater noise effects from dredging activities**.

### 7.3.4.3 Indirect Effects

**Potential for Indirect Effects as a Result of Changes to Water Quality**

The potential for indirect effect to harbour seal from changes to water quality would be from any increase in SSC, the release of contaminated sediments through dredging, and accidental spills and leaks. As described in **Section 7.1.2.3**, none of the potential effects noted above would have the potential for any significant effect on harbour seal, and therefore, **there would be no potential for adverse effect on the integrity of harbour seal, as a designated feature of the Firth of Tay and Eden Estuary SAC, due to a change in water quality**.

**Potential for Indirect Effects as a Result of Changes to Prey Availability**

The potential for effects to fish (marine mammal prey species) are described in **Section 7.1.2.3**.

Harbour seal are generalist feeders, and therefore any small scale and temporary changes in prey availability would have no effect on the harbour seal ability to forage in the area. As described above, all effects to fish (prey species) would be over a localised area and would be temporary only. There are no significant effects identified for fish (prey species). Therefore, **there would be no potential for adverse effect on the integrity of harbour seal, as a designated feature of the Firth of Tay and Eden Estuary SAC, due to a change in prey availability.**

### 7.3.4.4 In-Combination Effects

The potential for in-combination effects have been assessed in **Table** . In summary, there is no potential for significant effect to harbour seal, as a result of any other project screened in, in-combination with the Proposed Scheme. Therefore, **there would be no potential for adverse effect on the integrity of harbour seal, as a designated feature of the Firth of Tay and Eden Estuary SAC, due to in-combination effects.**

*Table 7-11 In-combination assessment for harbour seal at the Firth of Tay and Eden Estuary SAC*

| In-combination project | In-combination Project Information | Proposed Scheme Assessment | | In-combination Project Assessment | | Overall In-Combination Assessment |
|---|---|---|---|---|---|---|
| | | Potential Effect | Assessment | Potential Effect | Assessment | |
| Neart na Gaoithe Offshore Wind Farm (Revised Design) | The Neart na Gaoithe wind farm is currently under construction. There is therefore the potential for piling to overlap with the piling at the Proposed Scheme. | TTS (highest potential impact range of 100m for TTS cumulative exposure due to sheet piling used as the worse-case) | 0.000004 harbour seal (0.000009% of FT & EE SAC; 0.002% of the ES MU; or 0.0006% of the wider MU).<br><br>No potential for adverse effect. | TTS from piling (as the worst-case). Piling at the Neart na Gaoithe wind farm would either be using a combination of pile driving and drilling (the 'drive-drill-drive' scenario) or under pile driving only (the 'drive only' scenario). | The assessments predicted that between 95 and 152 harbour seal may receive noise levels capable of causing TTS. However, it was also predicted that the individuals would avoid the area, and the duration of potential exposure would be low, and therefore was concluded that there would not be a significant impact. | Due to the temporary nature of the piling at the Proposed Scheme, and that any effect to harbour seal at Neart na Gaoithe would be temporary, and that it is unlikely that all harbour seal in the vicinity of the projects would be from the Firth of Tay and Eden Estuary SAC, it is concluded that there is unlikely to be any significant effect to harbour seal, and therefore there is **no potential for adverse effect on the integrity of the site**. |
| | | Disturbance effects | Localised and temporary effect only, no potential for significant level of disturbance to any individuals.<br><br>No potential for adverse effect. | Disturbance from piling (as the worst-case) | The assessment concludes that total displacement of harbour seal may occur up to 15km from the piling location, and that between 283 and 314 individuals may be exposure to sound levels high enough to cause behavioural changes. However, population modelling has shown that this | Due to the localised and temporary nature of the piling at the Proposed Scheme, in-combination with the conclusion that piling at Neart na Gaoithe would not alter the harbour seal population of the Firth of Tay and Eden Estuary SAC, and that it is unlikely that all harbour seal in the vicinity of the project would be from this SAC, it is concluded that there is unlikely to be any significant effect to harbour seal of the Firth of Tay and Eden Estuary SAC, and therefore there is **no potential for adverse effect on the integrity of the site**. |

| In-combination project | In-combination Project Information | Proposed Scheme Assessment | | In-combination Project Assessment | | Overall In-Combination Assessment |
|---|---|---|---|---|---|---|
| | | Potential Effect | Assessment | Potential Effect | Assessment | |
| | | | | | would alter the existing harbour seal population trend, and that therefore there would be no significant effect on the population as whole[5]. | |
| Grangemouth Flood Protection Scheme | To date, only the EIA Scoping report is available, and no formal application for the scheme has been submitted. Within the EIA Scoping Report[6], it is stated that construction would be undertaken from 2022, for a period of between five and 10 years. However, given that no formal application has been submitted, it is considered unlikely that the construction of this flood protection scheme would overlap with the Proposed Scheme. | TTS (highest potential impact range of 100m for TTS cumulative exposure due to sheet piling used as the worse-case) | 0.000004 harbour seal (0.000009% of FT & EE SAC; 0.002% of the ES MU; or 0.0006% of the wider MU).<br><br>No potential for adverse effect. | N/A | | While an in-combination assessment for this project is not possible, it is expected that, due to the planned activities, any potential effects would be less than those of the Proposed Scheme, and given the expected localised and temporary nature of any effects, there is no potential for significant in-combination effect to harbour seal, and therefore **no potential for adverse effect on the integrity of the site**. |
| | | Disturbance effects | Localised and temporary effect only, no potential for significant level of disturbance to any individuals.<br><br>No potential for adverse effect. | | | |

[5] https://marine.gov.scot/sites/default/files/appropriate_assessment_1.pdf
[6] https://marine.gov.scot/sites/default/files/grangemouth_fps_eia_scoping_report_final_for_submission.pdf

## 7.4 Berwickshire and North Northumberland Coast SAC

### 7.4.1 Description of Designation

The closest point of Berwickshire and North Northumberland Coast SAC to port Leith is 64km. In the SAC, there are two main pup production locations, one at the Farne Islands and one at Fast Castle. In 2010, pup production was estimated to be 1,700 at Fast Castle and 1,500 at the Farne Islands, a total of 3,200 within the SAC as a whole (Russell *et al.,* 2019). Overall, pup production in the SAC is increasing since 2005 (SCOS, 2020). The latest grey seal count for the Northumberland sites was 6,427 in 2018 (SCOS, 2022). Based on the grey seal count of 2008-2017, the overall abundance in the east coast of Scotland is estimated to be 2,712 (SCOS, 2022).

Tagging studies of grey seal within UK waters show that there is connectivity with the Proposed Scheme and the Berwickshire and North Northumberland Coast SAC, with individuals travelling from the SAC through the Firth of Forth, and near to the Proposed Scheme (Carter *et al.,* 2022).

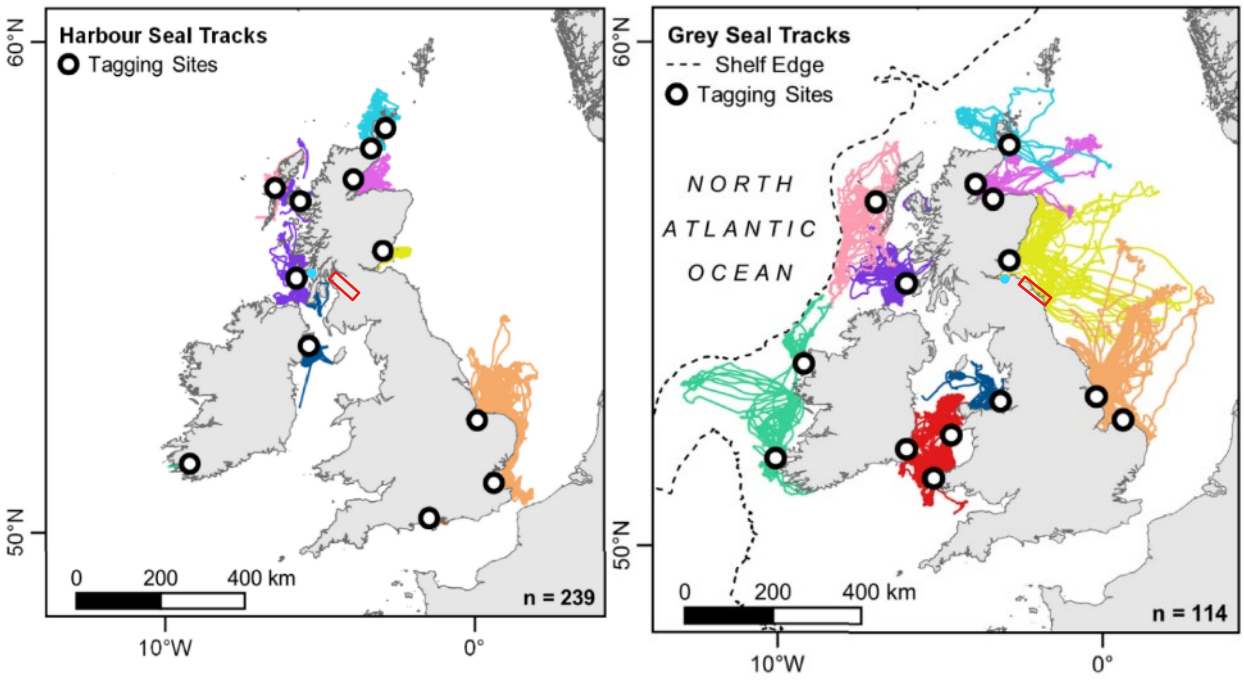


*Plate 7-4 Grey seal tagging studies; Left = grey seal (n=114) tracking data combined from SMRU, University of Aberdeen and University College Cork, coloured by individual (Carter et al., 2020); Right = tracking data for grey seal (n=114), cleaned to remove erroneous locations, trips between locations, and locations in breeding season (Carter et al., 2022). [Approximate location of the Berwickshire and North Northumberland SAC shown by the red square, and approximate location of the Proposed Scheme shown by the blue circle].*

The SAC includes a protected grey seal haul-out site at Fast Castle, which is approximately 58km from the Proposed Scheme.

### 7.4.2 Conservation Objectives

The Berwickshire and North Northumberland Coast SAC Conservation Objectives for grey seal are:

- To ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its qualifying features, by maintaining or restoring:
    - The extent and distribution of qualifying natural habitats and habitats of the qualifying species;

- The structure and function (including typical species) of qualifying natural habitats;
- The structure and function of the habitats of the qualifying species;
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- The populations of each of the qualifying species; and
- The distribution of qualifying species within the site.

Grey seal within the Berwickshire and North Northumberland Coast SAC are in favourable condition.

### 7.4.3 Features Screened In

Grey seal are the only feature screened in for assessment.

#### 7.4.3.1 Distribution and Abundance

See **Section 7.2.3** above for a full description of the grey seal baseline.

As noted above, the latest grey seal count for the Northumberland sites was 6,427 in 2018 (SCOS, 2022), of which 4,251 were within the Berwickshire and North Northumberland SAC. To generate a SAC population estimate, this count has been corrected to take account of those not available to count during the surveys (a correction of 0.2515; SCOS, 2021). This results in a total SAC population estimate of 16,903, for which the potential for effect has been assessed.

For grey seal associated with the Berwickshire and North Northumberland Coast SAC, the mean predicted density for all grid squares that overlap with the Proposed Scheme is 0.165/km$^2$. (Carter *et al*., 2022). This density will be used for assessing the potential impacts to grey seal of the SAC.

As noted above, the total population for the Berwickshire and North Northumberland Coast SAC is estimated to be 16,903; this has been corrected to generate an at-sea population of 14,563 of which the absolute densities are based on (using the correction factor of 0.8616 (Russell *et al.,* 2015)). This density will be used for the assessing the potential impacts to grey seal associated with this SAC.

### 7.4.4 Potential Effects of the Proposed Scheme Alone

#### 7.4.4.1 Underwater Noise Effects from Piling Activities

**Potential for PTS or TTS Onset from Piling Activities**

The potential for piling effects on grey seal have been put into context of the SAC population, using the underwater noise modelling results presented in Appendix 2 of the Outer Berth HRA Report and **Section 7.2.4.1** above. The results of this assessment are provided in **Table** .

*Table 7-12 Impact ranges and areas, and maximum number of individuals (and % of reference population) that could be at risk of PTS or TTS onset from piling*

| Activity | Potential Impact | Receptor | Impact range (and area) | Maximum number of individuals (% of reference population) |
|---|---|---|---|---|
| Piling | PTS without mitigation – single strike | Grey seal of the Berwickshire and North Northumberland | <50m <0.01km$^2$ | 0.002 (<0.0000001% of the B&NNC SAC) |
| | PTS without mitigation – cumulative exposure | | <100m <0.1km$^2$ | 0.02 (0.000001% of the B&NNC SAC) |

| Activity | Potential Impact | Receptor | Impact range (and area) | Maximum number of individuals (% of reference population) |
|---|---|---|---|---|
| | TTS without mitigation – single strike | Coast (B&NNC) SAC | <50m <0.01km$^2$ | 0.002 (<0.0000001% of the B&NNC SAC) |
| | TTS without mitigation – cumulative exposure | | <100m <0.1km$^2$ | 0.02 (0.000001% of the B&NNC SAC) |

The number of grey seal at potential risk of either PTS or TTS onset, as a result of piling activity, is less than one with a maximum population level effect of less than 0.00001% of the Berwickshire and North Northumberland Coast SAC being affected (**Table 7-12**). In addition, mitigation measures will be in place for all piling works, as described in **Section 7.1.2.1**.

Therefore, given the very low number of individuals at risk of effect from either PTS or TTS onset, and that the Berwickshire and North Northumberland Coast SAC is not located within close proximity of the Proposed Scheme, and the mitigation measures that will be put in place for all piling activities, it is concluded that **there would be no potential for adverse effect on the integrity of grey seal, as a designated feature of the Berwickshire and North Northumberland Coast SAC, due to underwater noise effects from piling works**.

**Potential for Disturbance from Piling Activities**

The potential for disturbance to grey seal of the Berwickshire and North Northumberland Coast SAC would be as for the assessment of disturbance to grey seal within the Isle of May SAC; therefore, see **Section 7.2.4.1** for more information on the potential for effect.

In conclusion, as for the Berwickshire and North Northumberland Coast SAC assessed above, taking into account the limited potential for a disturbance effect on any grey seal, and that the Berwickshire and North Northumberland Coast SAC is not located within close proximity to the Proposed Scheme, it is concluded that **there would be no potential for adverse effect on the integrity of grey seal, as a designated feature of the Berwickshire and North Northumberland Coast SAC, due to underwater noise effects from piling works**.

### 7.4.4.2 Underwater Noise from Dredging Activities

**Potential for PTS or TTS Onset from Dredging Activities**

The potential for underwater noise effects on grey seal due to dredging activities has been put into context of Berwickshire and North Northumberland Coast SAC population, using the underwater noise modelling results presented in Appendix 2 of the Outer Berth HRA Report. The results of this assessment are provided in **Table 7-13**.

*Table 7-13 Impact ranges and areas, and maximum number of individuals (and % of reference population) that could be at risk of PTS or TTS onset due to dredging activities*

| Activity | Potential Impact | Receptor | Impact range (and area) | Maximum number of individuals (% of reference population) |
|---|---|---|---|---|
| Dredging | PTS without mitigation – cumulative exposure (over 12 hours) | Grey sea of the B&NNC SAC | <100m 0.03km$^2$ | 0.02 (0.000001% of the B&NNC SAC) |
| | TTS without mitigation – cumulative exposure (over 12 hours) | | <100m 0.03km$^2$ | 0.02 (0.000001% of the B&NNC SAC) |

The number of grey seal at potential risk of either PTS or TTS onset, as a result of dredging, is less than one), with a maximum population level effect of less than 0.0001% of the Berwickshire and North Northumberland Coast SAC being affected (**Table 7-13**).

Therefore, given the very low number of individuals at risk of effect from either PTS or TTS onset, and that the Berwickshire and North Northumberland Coast SAC is not located within close proximity of the Proposed Scheme, it is concluded that **there would be no potential for adverse effect on the integrity of grey seal, as a designated feature of the Berwickshire and North Northumberland Coast SAC, due to underwater noise effects from piling works**.

**Potential for Disturbance from Dredging Activities**

The potential for disturbance to grey seal of the Berwickshire and North Northumberland Coast SAC would as for the assessment of disturbance to grey seal within the Isle of May SAC. Therefore, see **Section 7.2.4.1** for more information on the potential for effect.

In conclusion, as for the assessment for the Isle of May SAC in **Section 7.2.4.1**, taking into account the limited potential for a disturbance effect on any grey seal, and that the Berwickshire and North Northumberland Coast SAC is not located within close proximity to the Proposed Scheme, it is concluded that **there would be no potential for adverse effect on the integrity of grey seal, as a designated feature of the Berwickshire and North Northumberland Coast SAC, due to underwater noise effects from dredging activities**.

### 7.4.4.3 Indirect Effects

**Potential for Indirect Effects as a Result of Changes to Water Quality**

The potential for indirect effect to grey seal from changes to water quality would be from any increase in SSC, the release of contaminated sediments through dredging, and accidental spills and leaks. As described in **Section 7.1.2.3**, none of the potential effects noted above would have the potential for any significant effect on grey seal, and therefore, **there would be no potential for adverse effect on the integrity of grey seal, as a designated feature of the Berwickshire and North Northumberland Coast SAC, due to a change in water quality**.

**Potential for Indirect Effects as a Result of Changes to Prey Availability**

The potential for effects to fish (marine mammal prey species) are described in **Section 7.1.2.3**.

Grey seal are generalist feeders, and therefore any small scale and temporary changes in prey availability would have no effect on the grey seal ability to forage in the area. As described above, all effects to fish (prey species) would be over a localised area, and would be temporary only. There are no significant effects identified for fish (prey species). Therefore, **there would be no potential for adverse effect on the integrity of grey seal, as a designated feature of the Berwickshire and North Northumberland Coast SAC, due to a change in prey availability.**

### 7.4.4.4 In-Combination Effects

The potential for in-combination effects have been assessed in **Table** . In summary, there is no potential for significant effect to grey seal, as a result of any other project screened in, in-combination with the Proposed Scheme. Therefore, **there would be no potential for adverse effect on the integrity of grey seal, as a designated feature of the Berwickshire and North Northumberland Coast SAC, due to in-combination effects.**

*Table 7-14 In-combination assessment for grey seal at the Berwickshire and North Northumberland Coast SAC*

| In-combination project | In-combination Project Information | Proposed Scheme Assessment | | In-combination Project Assessment | | Overall In-Combination Assessment |
|---|---|---|---|---|---|---|
| | | Potential Effect | Assessment | Potential Effect | Assessment | |
| Neart na Gaoithe Offshore Wind Farm (Revised Design) | The Neart na Gaoithe wind farm is currently under construction. There is therefore the potential for piling to overlap with the piling at the Proposed Scheme. | TTS (highest potential impact range of 100m for TTS cumulative exposure due to sheet piling used as the worst-case) | 0.006 grey seal (0.0001 % of the B & NNC SAC population; 0.0002% of the ES MU; or 0.0001% of the wider MU).<br><br>No potential for adverse effect. | TTS from piling (as the worst-case). Piling at the Neart na Gaoithe wind farm would either be using a combination of pile driving and drilling (the 'drive-drill-drive' scenario) or under pile driving only (the 'drive only' scenario). | The assessments predicted that between 1,263 and 1,833 grey seal may receive noise levels capable of causing TTS. However, it was also predicted that the individuals would avoid the area, and the duration of potential exposure would be low, and therefore was concluded that there would not be a significant impact. | Due to the temporary nature of the piling at the Proposed Scheme, and that any effect to grey seal at Neart na Gaoithe would be temporary, and that it is unlikely that all grey seal in the vicinity of the projects would be from the Berwickshire and North Northumberland Coast SAC, it is concluded that there is unlikely to be any significant effect to grey seal within the SAC, and therefore there is **no potential for adverse effect on the integrity of the site**. |
| | | Disturbance effects | Localised and temporary effect only, no potential for significant level of disturbance to any individuals.<br><br>No potential for adverse effect. | Disturbance from piling (as the worst-case) | The assessment concludes that total displacement of grey seal may occur up to 15km from the piling location. Therefore, for the 'drill-drive-drill' scenario up to 95 seals may be disturbed, and under the 'drive only' scenario, up to 113 grey seal may be displaced. | Due to the localised and temporary nature of the piling at the Proposed Scheme, in-combination with the low number of grey seal that may be disturbed as a result of the piling activities at Neart na Gaoithe, and that it is unlikely that all grey seal in the vicinity of the project would be from the Berwickshire and North Northumberland Coast SAC, it is concluded that there is unlikely to be any significant effect to grey seal, and therefore there is **no potential for adverse effect on the integrity of the site**. |
| Grangemouth Flood Protection Scheme | To date, only the EIA Scoping report is available, and no formal application for the scheme has been submitted. Within the | TTS (highest potential impact range of 100m for TTS cumulative exposure due to sheet piling | 0.006 grey seal (0.0001 % of the B & NNC SAC population; 0.0002% of the ES MU; or | N/A | | While an in-combination assessment for this project is not possible, it is expected that, due to the planned activities, any potential effects would be less than those of the Proposed Scheme, and given the expected localised and temporary nature of any effects, there is no potential for significant in-combination effect to grey seal, and |

| In-combination project | In-combination Project Information | Proposed Scheme Assessment | | In-combination Project Assessment | | Overall In-Combination Assessment |
|---|---|---|---|---|---|---|
| | | Potential Effect | Assessment | Potential Effect | Assessment | |
| | EIA Scoping Report[7], it is stated that construction would be undertaken from 2022, for a period of between five and 10 years. However, given that no formal application has been submitted, it is considered unlikely that the constriction of this flood protection scheme would overlap with the Proposed Scheme. | used as the worst-case) | 0.0001% of the wider MU).<br><br>No potential for adverse effect. | | | therefore **no potential for adverse effect on the integrity of the site**. |
| | | Disturbance effects | Localised and temporary effect only, no potential for significant level of disturbance to any individuals.<br><br>No potential for adverse effect. | | | |

[7] *https://marine.gov.scot/sites/default/files/grangemouth_fps_eia_scoping_report_final_for_submission.pdf*

## 7.5 Moray Firth SAC

### 7.5.1 Description of Designation

The Moray Firth SAC in north-east Scotland supports the only known resident population of bottlenose dolphin in the North Sea. The Moray firth is approximately 315km from Port Leith. Individuals are present all year round, and, while they range widely in the Moray Firth, they appear to favour particular areas. The bottlenose dolphin is a wide-ranging species and occurs across the continental shelf. Historically, very few sightings of bottlenose dolphin were recorded further south on the east coast of the UK, however, in recent years an increase in bottlenose dolphins in the north-east of England have been reported (Aynsley, 2017), with one individual from the Moray Firth population being recorded as far south as The Netherlands (NatureScot, 2021).

### 7.5.2 Conservation Objectives

The Moray Firth SAC Conservation Objectives for bottlenose dolphin are:

- To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status.
- To ensure that the integrity of Moray Firth SAC is maintained or restored in the context of environmental changes by meeting the following objectives for each qualifying feature:
    - The population of bottlenose dolphin is a viable component of the site;
    - The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance; and
    - The supporting habitats and processes relevant to bottlenose dolphin and the availability of prey for bottlenose dolphin are maintained.

Bottlenose dolphin within the Moray Firth SAC are in favourable condition.

### 7.5.3 Features Screened In

Bottlenose dolphin are the only feature of the Moray Firth SAC screened in for further assessment.

#### 7.5.3.1 Distribution and Abundance

The Moray Firth SAC is in the SCANS block CS-K, however, none were recorded in this survey block. For the entire SCANS-IV survey area, bottlenose dolphin abundance in the summer of 2022 was estimated to be 80,809, with an overall estimated density of 0.0551/km$^2$ (CV = 0.194; 95% CL = 52,711 – 117,736; Gilles *et al.,* 2023). This recent SCANS-IV survey didn't identify any bottlenose dolphins within the Proposed Scheme (survey block NS-D). However, the SCANS-III survey identified bottlenose dolphin block R ,where the Proposed Scheme is located (same as block NS-D), abundance and density estimates for bottlenose dolphin (Hammond *et al.,* 2021) of 1,924 bottlenose dolphin (95% CI = 0 - 5,048) and a density estimate of 0.0298 bottlenose dolphin/km$^2$ (CV = 0.861).

For bottlenose dolphin, the distribution maps (Waggitt *et al.,* 2019) show a clear pattern of higher density to the western coastal areas of the UK, extending south to the Bay of Biscay. Densities of bottlenose dolphin in the North Sea are very low in comparison (Waggitt *et al.,* 2019). Examination of this data, including all 10km grids that overlap with Proposed Scheme, indicates an average annual density estimate of 0.00008 individuals per km$^2$. However, the Waggitt *et al.,* (2019) distribution maps only include data for the offshore eco-type of bottlenose dolphin, and therefore would not provide accurate mapping for areas with resident bottlenose dolphin populations (such as the east coast of Scotland).

The IAMMWG (2023) define seven MUs for bottlenose dolphin. The Proposed Scheme site is located in the CES MU; the CES has an abundance estimate of 224 (CV = 0.023; 95% CI = 214 – 234; Arso Civil *et al*., 2021, IAMMWG, 2023).

In recent years an increase in bottlenose dolphins along the coastline of north-east England have been reported (Aynsley, 2017; Hacket, 2022). They have been recorded approximately 300 miles outside of what would be considered their 'normal' home range (Cheney *et al*. 2018), with one individual from the Moray Firth population being recorded as far south and east as The Netherlands (Hoekendijk *et al.,* 2021).

Hackett (2022) conducted a photo ID study of bottlenose dolphins that were sighted along the northeast coast of England, where 38 individuals were identified by photo ID techniques from 584 recorded sightings between 2014 and 2022 along the Northumbrian coast. Of the 38 individuals, all except for one individual has been recorded in the Moray Firth SAC. Out of the 38, 14 of these dolphins have been exclusively recorded along the northeast coast. Whereas 24 dolphins have been recorded to travel between the Moray Firth and the northeast coast of England, with eight being recorded making annual migrations between the two areas.

Hackett (2022) study is the first multi-year study focusing on the bottlenose dolphins found off the northeast coast of England. The study shows that bottlenose dolphin sightings are increasing every year, and that previously were considered residents all year round in the Moray Firth SAC but are now recorded travelling south more frequently. Short-range movements of bottlenose dolphins are not uncommon, and studies have shown that seasonal transience occurs in populations all around the world (Toth, *et al*. 2010; Durden, 2011), but the data presented in Hackett (2022) study show that the presence of bottlenose is increasing every year, particularly in the summer months. This could be evidence of a new population becoming resident in the area or perhaps an expansion of the range of the Moray Firth bottlenose dolphin.

#### 7.5.3.2 Diet and Prey Species

Bottlenose dolphin are opportunistic feeders and take a wide variety of fish and invertebrate species. Benthic and pelagic fish (both solitary and schooling species), as well as octopus and other cephalopods, have all been recorded in the diet of bottlenose dolphin (Santos *et al.,* 2001; Santos *et al.,* 2004; Reid *et al.,* 2003).

Analysis of the stomach contents of ten bottlenose dolphin in Scottish waters, from 1990 to 1999, reveals that the main prey are cod (29.6% by weight), saithe *Pollachius virens* (23.6% by weight), and whiting (23.4% by weight), although other species including salmon (5.8% by weight), haddock (5.4% by weight) and cephalopods (2.5% by weight) were also identified in lower number (Santos *et al.,* 2001).

### 7.5.4 Potential Effects of the Proposed Scheme Alone

#### 7.5.4.1 Underwater Noise Effects from Piling Activities

**Potential for PTS or TTS Onset from Piling Activities**

As noted above, the most recent population estimate for bottlenose dolphin at the Moray Firth SAC is 224 (Arso Civil *et al*,. 2021). The potential for piling effects on bottlenose dolphin have been put into context of this SAC population, which, as noted above, is the same as the wider reference population, using the underwater noise modelling results presented in Appendix 2 of the Outer Berth HRA Report. The results of this assessment are provided in **Table 7-15**.

*Table 7-15 Impact ranges and areas, and maximum number of individuals (and % of reference population) that could be at risk of PTS or TTS onset from piling*

| Activity | Potential Impact | Receptor | Impact range (and area) | Maximum number of individuals (% of reference population) |
|---|---|---|---|---|
| Piling | PTS without mitigation – single strike | Bottlenose dolphin of the Moray Firth (MF) SAC (and wider population) | <50m <0.01km$^2$ | 0.0003 (0.000001% of the MF SAC) |
| | PTS without mitigation – cumulative exposure | | <100m <0.1km$^2$ | 0.003 (0.00001% of the MF SAC) |
| | TTS without mitigation – single strike | | <50m <0.01km$^2$ | 0.0003 (0.000001% of the MF SAC) |
| | TTS without mitigation – cumulative exposure | | <100m <0.1km$^2$ | 0.003 (0.00001% of the MF SAC) |

The number of bottlenose dolphin at potential risk of either PTS or TTS onset, as a result of piling activity, is less than one individual in all cases, with a maximum population level effect of less than 0.0001% of the Moray Firth SAC being affected (**Table 7-15**). While the number of bottlenose dolphin at risk of either PTS or TTS onset is very low, mitigation measures will be in place for all piling works, as described in **Section 7.1.2.1.**

**Therefore, it is concluded that there would be no potential for adverse effect on the integrity of bottlenose dolphin, as a designated feature of the Moray Firth SAC, due to underwater noise effects from piling works.**

**Potential for Disturbance from Piling Activities**

As described in **Section 7.1.2.1**, there is the potential for a displacement response from the area for as a result of piling activities. However, the reduction in bottlenose dolphin presence would not be significant, and any individuals disturbed would return to the area following the cessation of piling. Therefore, any effects from underwater noise as a result of piling will be both localised and temporary. The area surrounding the Port of Leith is already a busy marine area, and any bottlenose dolphins in the vicinity of the Proposed Scheme would be used to increased levels of marine traffic and noisy environments. Given the busy nature of the area, that the piling works will be small in scale and temporary, any potential for disturbance would be localised, and would be unlikely to cause any significant disturbance to individuals in the area, there is unlikely to be the potential for any significant effect on bottlenose dolphin, as a result of piling activity.

Taking into account the above, including the limited potential for a disturbance effect on any bottlenose dolphin, it is concluded that **there would be no potential for adverse effect on the integrity bottlenose dolphin, as a designated feature of the Moray Firth SAC, due to underwater noise effects from piling works**.

### 7.5.4.2 Underwater Noise from Dredging Activities

**Potential for PTS or TTS Onset from Dredging Activities**

As for the potential effect of piling, the potential for underwater noise effects on bottlenose dolphin due to dredging activities have been put into context of Moray Firth SAC population, as well as the wider reference populations, using the underwater noise modelling results presented in Appendix 2 of the Outer Berth HRA Report and **Section 7.2.4.1** above. The results of this assessment are provided in **Table 7-16**.

*Table 7-16 Impact ranges and areas, and maximum number of individuals (and % of reference population) that could be at risk of PTS or TTS onset due to dredging activities*

| Activity | Potential Impact | Receptor | Impact range (and area) | Maximum number of individuals (% of reference population) |
|---|---|---|---|---|
| Dredging | PTS without mitigation – cumulative exposure (over 12 hours) | Bottlenose dolphin of the MF SAC | <100m 0.03km$^2$ | 0.002 (0.00001% MF SAC) |
| | TTS without mitigation – cumulative exposure (over 12 hours) | | <100m 0.03km$^2$ | 0.002 (0.00001% MF SAC) |

The number of bottlenose dolphin at potential risk of either PTS or TTS onset, as a result of dredging, is up to one individual, with a maximum population level effect of up to less than 0.001% of the Moray Firth SAC population being affected (**Table 7-16).**

Therefore, given the very low number of individuals at risk of effect from either PTS or TTS onset, **it is concluded that there would be no potential for adverse effect on the integrity of bottlenose dolphin, as a designated feature of Moray Firth SAC, due to underwater noise effects from dredging activities**.

**Potential for Disturbance from Dredging Activities**

Although there is the potential for behavioural response to the dredging activities, it is anticipated to be localised in effect and short in duration, with individuals returning to the area shortly after the sound source is stopped, or on completion of the works. As noted for piling, the area surrounding the Port of Leith is a busy marine area, and any bottlenose dolphin present in the area would be used to increased levels of underwater noise. Given the busy nature of the area, that the dredging works will be small in scale and temporary, any potential for disturbance would be localised, and that it is unlikely to cause any significant disturbance to individuals in the area, it is unlikely that there would be any potential for any significant effect on the SAC population, as a result of dredging activity.

Taking into account the above, including the limited potential for a disturbance effect on any bottlenose dolphin, **it is concluded that there would be no potential for adverse effect on the integrity of bottlenose dolphin, as a designated feature of the Moray Firth SAC, due to underwater noise effects from dredging activities**.

### 7.5.4.3 Indirect Effects

**Potential for Indirect Effects as a Result of Changes to Water Quality**

The potential for indirect effect to bottlenose dolphin from changes to water quality would be from any increase in SSC, the release of contaminated sediments through dredging, and accidental spills and leaks. As described in **Section 7.1.2.3**, none of the potential effects noted above would have the potential for any significant effect on bottlenose dolphin, and therefore, **there would be no potential for adverse effect on the integrity of bottlenose dolphin, as a designated feature of the Moray Firth SAC, due to a change in water quality**.

**Potential for Indirect Effects as a Result of Changes to Prey Availability**

The potential for effects to fish (marine mammal prey species) are described in **Section 7.1.2.3**.

Bottlenose dolphin are generalist feeders, and therefore any small scale and temporary changes in prey availability would have no effect on the bottlenose dolphin ability to forage in the area. As described above, all effects to fish (prey species) would be over a localised area and would be temporary only. There are no significant effects identified for fish (prey species). Therefore, **there would be no potential for adverse effect on the integrity of bottlenose dolphin, as a designated feature of the Moray Firth SAC, due to a change in prey availability.**

#### 7.5.4.4 In-Combination Effects

The potential for in-combination effects have been assessed in **Table 7-17**. In summary, there is no potential for significant effect to bottlenose dolphin, as a result of any other project screened in, in-combination with the Proposed Scheme. Therefore, **there would be no potential for adverse effect on the integrity of bottlenose dolphin, as a designated feature of the Moray Firth SAC, due to in-combination effects.**

*Table 7-17 In-combination assessment for bottlenose dolphin at the Moray Firth SAC*

| In-combination project | In-combination Project Information | Proposed Scheme Assessment | | In-combination Project Assessment | | Overall In-Combination Assessment |
|---|---|---|---|---|---|---|
| | | Potential Effect | Assessment | Potential Effect | Assessment | |
| Moray West OWF | The Moray West OWF is currently under construction. There is therefore the potential for piling to overlap with the piling at the Proposed Scheme. | TTS (highest potential impact range of 100m for TTS cumulative exposure due to sheet piling used as the worst-case) | 0.003 bottlenose dolphin (0.001% MF SAC).<br><br>No potential for adverse effect | TTS from piling as the worst-case activity[8]. | Not assessed. | **There is no risk of in-combination TTS onset at the Proposed Scheme and piling at the Moray West OWF.** |
| | | Disturbance effects | Localised and temporary effect only, no potential for significant level of disturbance to any individuals.<br><br>No potential for adverse effect. | Disturbance from piling as the worst-case activity. | The assessment found that up to 53 bottlenose dolphin may be disturbed (or up to 23.75% of the CES MU) for a single piling event, or up to 54 individuals (24.07 of the CES MU) for concurrent piling. The number of individuals at risk of disturbance was used to inform population modelling for bottlenose dolphin, resulting in a reported magnitude of low, and overall impact significance of minor adverse. | Due to the localised and temporary nature of the piling at the Proposed Scheme, and the very small number at risk of disturbance, it is concluded that there is unlikely to be any significant effect to bottlenose dolphin of the Moray Firth SAC, and therefore there is **no potential for adverse effect on the integrity of the site**. |
| Sea Wall Repair and Extension – Alexandra Parade | Activities to be undertaken include excavation, and placement of rock armour. Works to be completed by the end of 2022, and therefore there is the potential for overlap with the construction of the Proposed Scheme. | TTS (highest potential impact range of 100m for TTS cumulative exposure due to sheet piling used as the worse-case) | 0.003 bottlenose dolphin (0.001% MF SAC).<br><br>No potential for adverse effect. | TTS from construction activities[9] | There is no risk of TTS onset to bottlenose dolphin due to the low noise levels associated with the activities. There is therefore no potential for significant impact to bottlenose dolphin. | **There is no risk of in-combination TTS onset at the Proposed Scheme and the sea wall repair project.** |
| | | Disturbance effects | Localised and temporary effect only, no potential for significant level | Disturbance from construction activities | Disturbance response for bottlenose dolphin was predicted to occur up to 30m from the source of noise. There is therefore no potential for significant impact to bottlenose dolphin. | Due to the localised and temporary nature of the piling at the Proposed Scheme, and that any effect to bottlenose dolphin due to the sea wall repair at |

[8]

[9] https://marine.gov.scot/sites/default/files/environmental_appraisal_document_redacted.pdf

| In-combination project | In-combination Project Information | Proposed Scheme Assessment | | In-combination Project Assessment | | Overall In-Combination Assessment |
|---|---|---|---|---|---|---|
| | | Potential Effect | Assessment | Potential Effect | Assessment | |
| | | | of disturbance to any individuals.<br><br>No potential for adverse effect. | | | Alexandra Parade is a low risk, and would be temporary, it is concluded that there is unlikely to be any significant effect to bottlenose dolphin of the Moray Firth SAC, and therefore there is **no potential for adverse effect on the integrity of the site**. |
| Ardersier Port Development | This project is to develop a port and port related series for energy uses at a former fabrication yard.<br><br>Construction activities will include dredging, and quay wall construction (using vibro-piling)[10].<br><br>Construction may take place until 2024, and therefore there is the potential for construction phase overlap with the Proposed Scheme. | TTS (highest potential impact range of 100m for TTS cumulative exposure due to sheet piling used as the worse-case) | 0.003 bottlenose dolphin (0.001% MF SAC).<br><br>No potential for adverse effect. | TTS from piling works (vibro-piling only) | TTS from vibro-piling may occur in bottlenose dolphins up to 1m from the source. This is within the standard mitigation zone of 500m (JNCC, 2010), and therefore, there would no potential for TTS onset in bottlenose dolphins. | **There is no risk of in-combination TTS onset at the Proposed Scheme and the Ardersier Port Development.** |
| | | Disturbance effects | Localised and temporary effect only, no potential for significant level of disturbance to any individuals.<br><br>No potential for adverse effect. | Disturbance effects from piling works (vibro-piling only) | The potential for disturbance was not assessed. However, given the activities being undertaken at this project, it can be assumed that any disturbance effect would be the similar as the at the Proposed Scheme. | Due to the localised and temporary nature of the piling at the Proposed Scheme, and that any effect to bottlenose dolphin due to the Ardersier Port Development is a low risk, and would be temporary, it is concluded that there is unlikely to be any significant effect to bottlenose dolphin of the Moray Firth SAC, and therefore there is **no potential for adverse effect on the integrity of the site**. |
| Neart na Gaoithe Offshore Wind | The Neart na Gaoithe wind farm is currently under construction. There is | TTS (highest potential impact range of 100m for | 0.003 bottlenose dolphin (0.001% MF SAC). | TTS from piling (as the worst-case). | The assessments predicted that between up to six bottlenose dolphins may receive noise levels capable of causing TTS. | Due to the temporary nature of the piling at the Proposed Scheme, and that any effect to |

[10] https://marine.gov.scot/sites/default/files/volume_2_envionmental_impact_assessment_report_redacted.pdf

| In-combination project | In-combination Project Information | Proposed Scheme Assessment | | In-combination Project Assessment | | Overall In-Combination Assessment |
|---|---|---|---|---|---|---|
| | | Potential Effect | Assessment | Potential Effect | Assessment | |
| Farm (Revised Design) | therefore the potential for piling to overlap with the piling at the Proposed Scheme. | TTS cumulative exposure due to sheet piling used as the worse-case) | No potential for adverse effect | Piling at the Neart na Gaoithe wind farm would either be using a combination of pile driving and drilling (the 'drive-drill-drive' scenario) or under pile driving only (the 'drive only' scenario). | However, no bottlenose dolphins were recorded within 8km of the wind farm, and therefore the risk of any individuals being at risk of TTS onset is very low, and not significant. | bottlenose dolphin at Neart na Gaoithe is a low risk, and would be temporary, it is concluded that there is unlikely to be any significant effect to bottlenose dolphin, and therefore there is **no potential for adverse effect on the integrity of the site**. |
| | | Disturbance effects | Localised and temporary effect only, no potential for significant level of disturbance to any individuals.<br><br>No potential for adverse effect. | Disturbance from piling (as the worst-case) | The assessment concludes that total displacement of bottlenose dolphin may occur up to 13.3km from the piling location. However, no bottlenose dolphins were recorded within 8km of the wind farm, and therefore the risk of any individuals being affected by displacement is very low, and not significant. | Due to the localised and temporary nature of the piling at the Proposed Scheme, and that it is unlikely that bottlenose dolphin would be present in the vicinity of Neart na Gaoithe, it is concluded that there is unlikely to be any significant effect to bottlenose dolphin of the Moray Firth SAC, and therefore there is **no potential for adverse effect on the integrity of the site**. |
| Grangemouth Flood Protection Scheme | To date, only the EIA Scoping report is available, and no formal application for the scheme has been submitted. Within the EIA | TTS (highest potential impact range of 100m for TTS cumulative exposure due to | 0.003 bottlenose dolphin (0.001% MF SAC). | N/A | | While an in-combination assessment for this project is not possible, it is expected that, due to the planned activities, any potential effects would be |

| In-combination project | In-combination Project Information | Proposed Scheme Assessment | | In-combination Project Assessment | | Overall In-Combination Assessment |
|---|---|---|---|---|---|---|
| | | Potential Effect | Assessment | Potential Effect | Assessment | |
| | Scoping Report[11], it is stated that construction would be undertaken from 2022, for a period of between five and 10 years. However, given that no formal application has been submitted, it is considered unlikely that the constriction of this flood protection scheme would overlap with the Proposed Scheme. | sheet piling used as the worse-case) | No potential for adverse effect. | | | less than those of the Proposed Scheme, and given the expected localised and temporary nature of any effects, there is no potential for significant in-combination effect to bottlenose dolphin, and therefore **no potential for adverse effect on the integrity of the site**. |
| | | Disturbance effects | Localised and temporary effect only, no potential for significant level of disturbance to any individuals.<br><br>No potential for adverse effect. | | | |

[11] https://marine.gov.scot/sites/default/files/grangemouth_fps_eia_scoping_report_final_for_submission.pdf

# 8 Conclusions

The Stage One (screening) assessment concluded that, during the construction phase of the Proposed Scheme, LSE could not be excluded for designated features of the following sites:

- Transitional fish features of the River Teith SAC;
- Some (not all) estuarine breeding and non-breeding ornithological features of the Firth of Forth SPA and Ramsar site, Imperial Dock Lock, Leith SPA, Forth Islands SPA and OFFSABC SPA; and
- Marine mammal features of the Isle of May SAC, Firth of Tay and Eden Estuary SAC, Berwickshire and North Northumberland Coast SAC and Moray Firth SAC.

There would not be any significant change during the operational phase compared to the existing activity levels, given that there would be no significant increase in vessel traffic as a result of the Proposed Scheme. The operational phase does not have the potential to cause LSE to any of the qualifying features of the above sites with respect to their Conservation Objectives. As such, no operational mitigation measures are necessary.

The information provided to inform the Appropriate Assessment has concluded that there would be no adverse effect on the integrity of the sites listed above during the operational phase of the Proposed Scheme, and that any construction stage potential impacts can be mitigated for.

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# Appendix 1-1

## Approach Channel Deepening: Habitats Regulations Appraisal Screening Report

REPORT

# Port of Leith Outer Berth Development

## Approach Channel Deepening: Habitats Regulations Appraisal Screening Report

Client: Forth Ports Limited

Reference: PC4514-RHD-YY-XX-RP-EV-0014

Status: Final/1.0

Date: 22 August 2023

Royal HaskoningDHV

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Document title: Port of Leith Outer Berth Development

Subtitle: Approach Channel Deepening: Habitats Regulations Appraisal Screening Report
Reference: PC4514-RHD-YY-XX-RP-EV-0014
Your reference
Status: Final/1.0
Date: 22 August 2023
Project name: Leith Approach Channel Deepening
Project number: PC4514
Author(s): Ben Hughes

Drafted by: Ben Hughes and Luke Evans-Jones

Checked by: Ben Hughes

Date: 20/07/2023

Approved by: Jamie Gardiner

Date: 14/08/2023

Classification
Project related

Royal HaskoningDHV

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# Acronyms

| Acronym | Acronym description |
|---|---|
| **BHD** | Back Hoe Dredging |
| **BPEO** | Best Practicable Environmental Option |
| **CD** | Chart Datum |
| **HPAI** | Highly Pathogenic Avian Influenza |
| **HRA** | Habitats Regulations Appraisal |
| **IROPI** | Imperative Reasons of Overriding Public Interest |
| **LSE** | Likely Significant Effect |
| **MS-LOT** | Marine Scotland Licensing Operations Team |
| **NSN** | National Site Network |
| **OFFSABC** | Outer Firth of Forth and St Andrews Bay Complex |
| **RIAA** | Report to Inform Appropriate Assessment |
| **SAC** | Special Area of Conservation |
| **SPA** | Special Protection Area |
| **TSHD** | Trailer Suction Hopper Dredger |

# 1 Introduction

## 1.1 Proposed amendments to the Outer Berth Development

Forth Ports Limited ("Forth Ports") is improving the Outer Berth at the Port of Leith ("the Port") to support the offshore renewable energy industry. In December 2022, marine licences were granted by Marine Scotland's Licensing Operations Team (MS-LOT) for improvement works to the Outer Berth (MS-00009818) as well as the disposal of associated dredged material (MS-00009819). A Habitats Regulations Appraisal (HRA) was undertaken on the Outer Berth development and which supported the marine licence applications (herein referred to as "the Outer Berth HRA") (Royal HaskoningDHV, 2022).

The current water depth of the Leith approach channel (between -6.5m Chart Datum (CD) and -7.0m CD) significantly limits the tidal window during which deep-drafted vessels can transit in or out of the Port and, on some neap tides, access is not possible at all. Given this, the increased water depth required by the evolving offshore renewables industry, limited vessel availability and the increasing draft of construction vessels associated with this industry, Forth Ports is now proposing to deepen the Leith approach channel.

The proposed deepening would increase the depth of the approach channel to -8.0m CD and extend the offshore extent to the current -8m CD contour within the Firth of Forth. The Outer Berth berth pocket, most of which will have been deepened to -9.0m CD as part of the consented Outer Berth development, would also be repositioned northwards and deepened to -12.0m CD. The footprint of the proposed deepening can be seen in **Figure 1.1**.

Given much of the proposed deepening is within the existing approach channel, the area is subject to periodic maintenance dredging and the dredge depth is mostly relatively shallow (i.e. less than 1.0m). It is anticipated that the dredge and disposal activities would be completed within approximately three months, with approximately 575,000m$^3$ of material removed (inclusive of 1:4 side slopes), which increases to approximately 695,000m$^3$ including a 0.25m over-dredge allowance. Disposal is likely to be at Narrow Deep B Spoil Disposal Ground (FO038), though a Best Practicable Environmental Option (BPEO) assessment will be undertaken to determine the most appropriate disposal option.

In order to ensure the stability of the Eastern Breakwater following the repositioning and deepening of the berth pocket, a short retaining wall would be installed between the berth pocket and the toe of the breakwater, as indicated in **Figure 1.2**.

To summarise, the 'Proposed Scheme' comprises the following elements:

- Deepening of the approach channel to -8.0m CD;
- Deepening of the Outer Berth berth pocket to -12.0m CD;
- Disposal of dredge material at a suitable location; and
- Installation of a retaining wall at the toe of the Eastern Breakwater.

Further detail of the Proposed Scheme is provided in **Chapter 2**.

325200

326400

679200

678000

N

0 0.25 0.5 1 Kilometres




Legend:

- Dredge Area
- Maintenance Dredge Area
- -8mCD contour

**Depth of excavation (m)**

Value

- -8.9 - -8.5
- -8.4 - -8
- -7.9 - -7.5
- -7.4 - -7
- -6.9 - -6.5
- -6.4 - -6
- -5.9 - -5.5
- -5.4 - -5
- -4.9 - -4.5
- -4.4 - -4
- -3.9 - -3.5
- -3.4 - -3
- -2.9 - -2.5
- -2.4 - -2
- -1.9 - -1.5
- -1.4 - -1
- -0.9 - -0.5
- -0.4 - 0

Client: Forth Ports Limited

Project: Approach Channel Deepening: Habitats Regulations Appraisal Screening Report

Title: Footprint of the Proposed Deepening at the Port of Leith

Figure: 1.1

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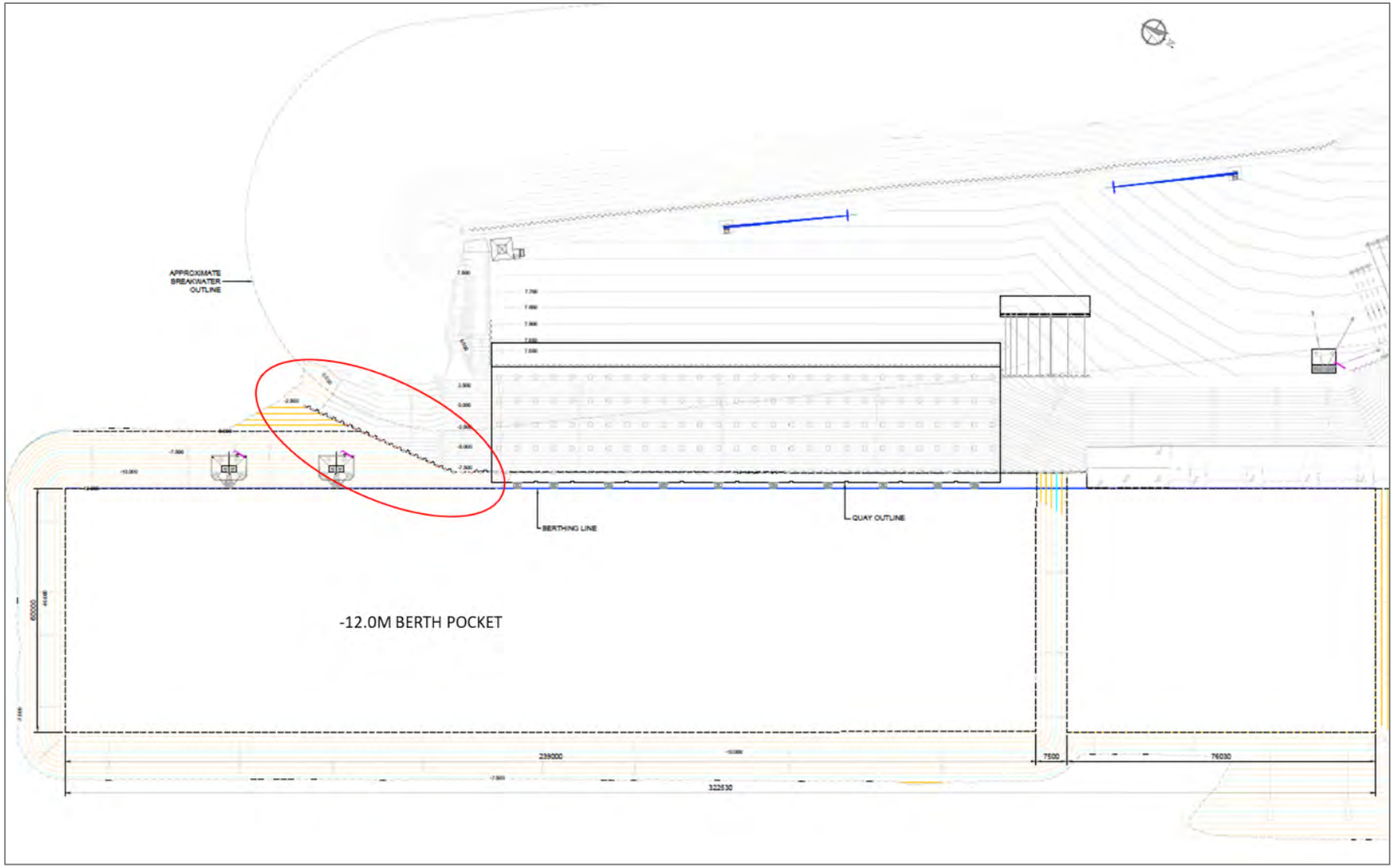



*Figure 1.2 Location of the proposed piled retaining wall (circled)*

## 1.2 Approach to the HRA

Forth Ports is seeking to vary the Outer Berth development's marine licences to include the construction works and associated disposal activities associated with the Proposed Scheme (dredging activity would be undertaken under the Port's powers conferred by the Forth Ports Authority Order Confirmation Act 1969). The Proposed Scheme would not change the operational use of the Outer Berth to that considered during the consenting of the Outer Berth development. In order to support the marine licence variation request, the Outer Berth HRA needs to be updated to include the Proposed Scheme.

The marine elements (i.e. the dredging and marine construction works) of the Outer Berth development (i.e. those with the potential for in-combination effects with the Proposed Scheme) will be completed before works related to the Proposed Scheme begins. As such, the presence of the marine elements of the Outer Berth development forms part of the baseline upon which the Proposed Scheme will be assessed.

## 1.3 Purpose of this Report

This report documents Stage One of the HRA process for the Proposed Scheme. The aim of Stage One is to determine whether or not the Proposed Scheme would have a likely significant effect (LSE) on the qualifying features and conservation objectives of one (or more) National Site Network (NSN) and / or Ramsar site(s), either alone or in-combination with other plans, projects and developments.

Specifically, this report sets out the following:

- The designated sites considered relevant to the HRA;
- The qualifying features and conservation objectives of the relevant designated sites;
- Identification of pathways and impacts considered; and
- Screening of potential effects.

This report also provides an overview of the proposed approach to the second stage of the HRA process (Appropriate Assessment) (**Chapter 5**).

## 1.4 Structure of the HRA screening report

This HRA screening report is structured as follows:

**Chapter 1** provides an introduction to the Proposed Scheme and the requirement for HRA.

**Chapter 2** provides a project description for the Proposed Scheme, including information on the construction methodology and an overview of the operational phase.

**Chapter 3** provides an overview of the HRA process in Scotland, including the associated legislation and detail on the staged approach to assessment.

**Chapter 4** provides Stage One LSE screening for the Proposed Scheme, both alone and in-combination with other projects and developments.

**Chapter 5** details the proposed approach to the second stage of the HRA (Appropriate Assessment), which will form a subsequent 'Supplementary' Report to Inform Appropriate Assessment (RIAA).

**Chapter 6** lists the references used in the compilation of this screening report.

# 2 Description of the Proposed Scheme

## 2.1 Construction phase

### 2.1.1 Dredging and disposal

To deepen the approach channel to -8.0m CD and the Outer Berth berth pocket to -12.0m CD would require the removal of approximately 575,000m$^3$ of sediment (approximately 695,000m$^3$ including a 0.25m over-dredge allowance).

It is anticipated that the majority of dredging would be undertaken by trailer suction hopper dredger (TSHD). In areas where the water depth is greater than 4.0m CD, it is likely that a large TSHD with a hopper capacity of *c.*4,500m$^3$ would be employed (production rate of *c.*55,000m$^3$ per week in the berth pocket and *c.*80,000m$^3$ per week in the approach channel). At shallower depths a smaller TSHD with a hopper capacity of *c.*1,500m$^3$ would be employed (production rate of *c.*20,000m$^3$ per week). It is anticipated that the TSHDs may work concurrently. In the berth pocket and Port area, the TSHD would be supported by a plough vessel to remove sediment from corners and level out ridges.

It is possible that some areas may also be dredged using back hoe dredging (BHD), particularly within areas difficult for a TSHD to access or where hard rock or consolidated sediment is present. Production rate using BHD would range from *c.*5,000 to *c.*10,000m$^3$ per week for hard rock, and *c.*30,000m$^3$ to c.50,000m$^3$ per week for consolidated material.

Should offshore disposal be considered the most appropriate disposal option, the dredged arisings would be transported to Narrow Deep B within the hopper of the TSHD (or support barge in the case of material from BHD). Over the course of the dredge / disposal campaign, it is envisaged that there would be in the region of 400 round trips to the disposal site (assuming average loads of *c.*1,700m$^3$), though this is an early estimate and may differ dependent on logistical practicalities and substrate investigations. The number of vessel trips would be reviewed in the Supplementary RIAA.

### 2.1.2 Installation of retaining wall

The retaining wall would be formed of a short length of sheet piling (similar in nature to the sheet piling installed as part of the improved Outer Berth's suspended deck), which would be installed by either vibratory or percussive means (or a combination thereof). Installation would most likely take place from land-based plant working from the Outer Berth. To get access for a crane, there may be a requirement for some minor infilling, depending on the size of the crane to be used. The infill would either be removed following completion of piling or suitably protected with rock armour and left *in-situ*. The retaining wall would be approximately 50m in length.

### 2.1.3 Anticipated programme

Overall, it is anticipated that the Proposed Scheme would commence in Q1/Q2 of 2024, for completion by Q3 of 2024. The dredging programme would be dependent on the dredging equipment scenario(s) employed (e.g. method, capacity); however, it is anticipated that the dredge would be completed within approximately three months. Installation of the retaining wall would around four weeks and may be carried out concurrently with the dredging.

## 2.2 Operational phase

The Proposed Scheme would not increase the number of vessel movements to the Outer Berth. Instead, its purpose is to increase the frequency and length of the tidal window when deeper drafted vessels can access the Outer Berth.

Historic annual dredging volumes over the last two decades (2001 to 2020) have ranged up to 48,000m$^3$, with an average of 20,000m$^3$. Upon completion of the consented Outer Berth development (the baseline for the Proposed Scheme), the baseline maintenance dredge requirement for the entire channel is predicted to increase by 22% (Royal HaskoningDHV, 2022). This will equate to an annual predicted average dredge volume of about 24,000m$^3$, with a maximum of about 58,500m$^3$. These volumes can be used as a proxy for the rate of sediment transport and deposition in the existing approach channel and, in-combination with the change in its dimensions following the Proposed Scheme, can be used to estimate the future maintenance dredging requirement.

The deepening of the approach channel to -8m CD would increase the capacity volume (i.e. the volume of 'space' below surrounding bed levels which could accommodate sedimentation) of the approach channel from *c.* 419,000m$^3$ to *c.* 994,000m$^3$, an increase of 137%. Using the predicted baseline average maintenance dredging volume of 24,000m$^3$, this increase means the estimated future average annual maintenance dredging requirement would be *c.* 57,000m$^3$, with a maximum of *c.* 138,500m$^3$. This calculation has been refined since the EIA Scoping Report was submitted to MS-LOT (which indicated an increase of 147%), with detail on the calculation presented in **Appendix A**.

# 3 Habitats Regulations Appraisal

## 3.1 Legislation

The HRA process affords protection to those sites designated under the European Council Directive 2009/147/EC on the conservation of wild birds (the 'Birds Directive') and Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive'). The UK also has to meet its obligations under relevant international agreements such as the Ramsar Convention. The UK exited the EU on 31 January 2020; however, the application of the HRA process remains largely unchanged due to the introduction of the EU Exit Regulations 2019.

### 3.1.1 International legislation

#### EU Habitats Directive

The Habitats Directive provides a framework for the conservation and management of natural habitats, wild fauna (except birds) and flora in Europe. Its aim is to maintain or restore natural habitats and wild species at a favourable conservation status. The relevant provisions of the Directive are the identification and classification of Special Areas of Conservation (SAC) in Article 4, and procedures for the protection of SACs and Special Protection Areas (SPA) in Article 6. SACs are identified based on the presence of natural habitat types listed in Annex I and populations of the species listed in Annex II. The Directive requires national Governments to establish SACs and to have in place mechanisms to protect and manage them.

#### EU Birds Directive

The Birds Directive provides a framework for the conservation and management of wild birds in Europe. The relevant provisions of the Birds Directive are the identification and classification of SPAs for rare or vulnerable species listed in Annex I of the Directive and for all regularly occurring migratory species (required by Article 4). The Directive requires national Governments to establish SPAs and to have in place mechanisms to protect and manage them. The SPA protection procedures originally set out in Article 4 of the Birds Directive have been replaced by the Article 6 provisions of the Habitats Directive.

#### Ramsar Convention

The Convention on Wetlands of International Importance especially as Waterfowl Habitat, as amended in 1982 and 1987 (the 'Ramsar Convention') is an international treaty for the conservation and sustainable use of wetlands of international importance. Ramsar site selection has had an emphasis on wetlands of importance to waterbirds, however non-bird features are increasingly taken into account, both in the selection of new sites and when reviewing existing sites. The UK government and the devolved administrations have issued policy statements relating to Ramsar sites which extend to them the same protection at a policy level as SACs and SPAs. Ramsar sites are therefore included in the HRA process.

### 3.1.2 Scottish HRA legislation

#### Conservation (Natural Habitats, &c.) Regulations 1994

In Scotland, the Habitats Directive and Birds Directive is transposed into Scottish national legislation by the Conservation (Natural Habitats, &c.) Regulations 1994, as amended (hereafter the 'Habitats Regulations'). The Habitats Regulations place an obligation on a competent authority (for marine licensing matters, this refers to Marine Scotland) to carry out an appropriate assessment of any proposal likely to affect a designated site. When undertaking appropriate assessment, the competent authority must seek advice from NatureScot (as the appropriate nature conservation body) and cannot approve any application that would have an adverse effect on the integrity of a designated site unless certain conditions are met (i.e. that

alternative solutions have been exhausted, that compensatory measures can be secured and that the proposal is necessary for imperative reasons of overriding public interest).

## 3.2 HRA process

The HRA process helps meet the requirements of Article 6(3) of the Habitats Directive and Regulation 48(1) of the Habitats Regulations, which state that any plan or project, which is not directly connected with or necessary to the management of a designated site and is likely to have a significant effect on such a site (either alone or in combination with other plans or projects), will be subject to an appropriate assessment of its implications for the site in view of its conservation objectives.

According to the Waddenzee judgement (Judgement of 7.9.2004 – Case C-127/02), an appropriate assessment is required if LSE cannot be excluded on the basis of objective information. The Sweetman Opinion (Opinion of Advocate General 22.10.2012 – Case C-258/11) states that the question is simply whether the plan or project concerned is capable of having an effect.

### 3.2.1 Stages of HRA

The HRA process (in its entirety) follows a systematic approach, as detailed in NatureScot (then Scottish National Heritage) Natura Casework Guidance (SNH, 2014), which is described below and in **Plate 3.1**.

1. **What is the plan or project?** Establishes whether there is sufficient information on the plan or project (location, extent, timings) to undertake an assessment.
2. **Is the plan or project directly connected with or necessary to site management for nature conservation?** Works which are clearly necessary to the management of the site, or that provide value to the site, are not subject to appropriate assessment.
3. **Is the plan or project likely to have a significant effect?** The Stage One assessment is undertaken, through which potentially relevant designated sites are identified and LSE of a proposed plan or project (either alone or in-combination with other plans and projects) are assessed. If it is concluded that there is no LSE, there is no requirement to carry out subsequent stages of the HRA.
4. **Undertake appropriate assessment (Stage Two assessment).** Where LSE has been concluded (or failed to be excluded) in the Stage One assessment, an appropriate assessment of the potential effects on the integrity of the site(s), either alone or in-combination with other plans and projects, in view of its qualifying features and conservation objectives is required. Where an adverse effect cannot be excluded, an assessment of mitigation options is carried out and mitigation measures (where available) are proposed to address the effects.
5. **Can it be ascertained that the plan or project will not adversely affect site integrity?** The competent authority must decide if the plan or project in question will or will not adversely affect the integrity of the site(s). If, after taking account of mitigation, an adverse effect on integrity cannot be excluded, the HRA must progress to the next steps.
6. **Are there alternative solutions?** Identifying and examining alternative ways of achieving the objectives of the project to establish whether there are solutions that would avoid or have a lesser effect on the site(s).
7. **Would a priority habitat or species be adversely affected?** Priority habitats and species are afforded a greater level of protection under the Regulations. This step determines whether the following steps should be undertaken.
8. **Are there Imperative reasons of overriding public interest (IROPI) (non-priority habitats and / or species)?** Where no alternative solution exists, the next step of the process is to assess whether the development is necessary for IROPI and, if so, the identification of compensatory measures needed to maintain the overall coherence of the designated site network.

9. **Are there IROPI (priority habitats and/or species)?** As above, for priority habitats and / or species, only where there are exceptional health and safety considerations or environmental benefits.

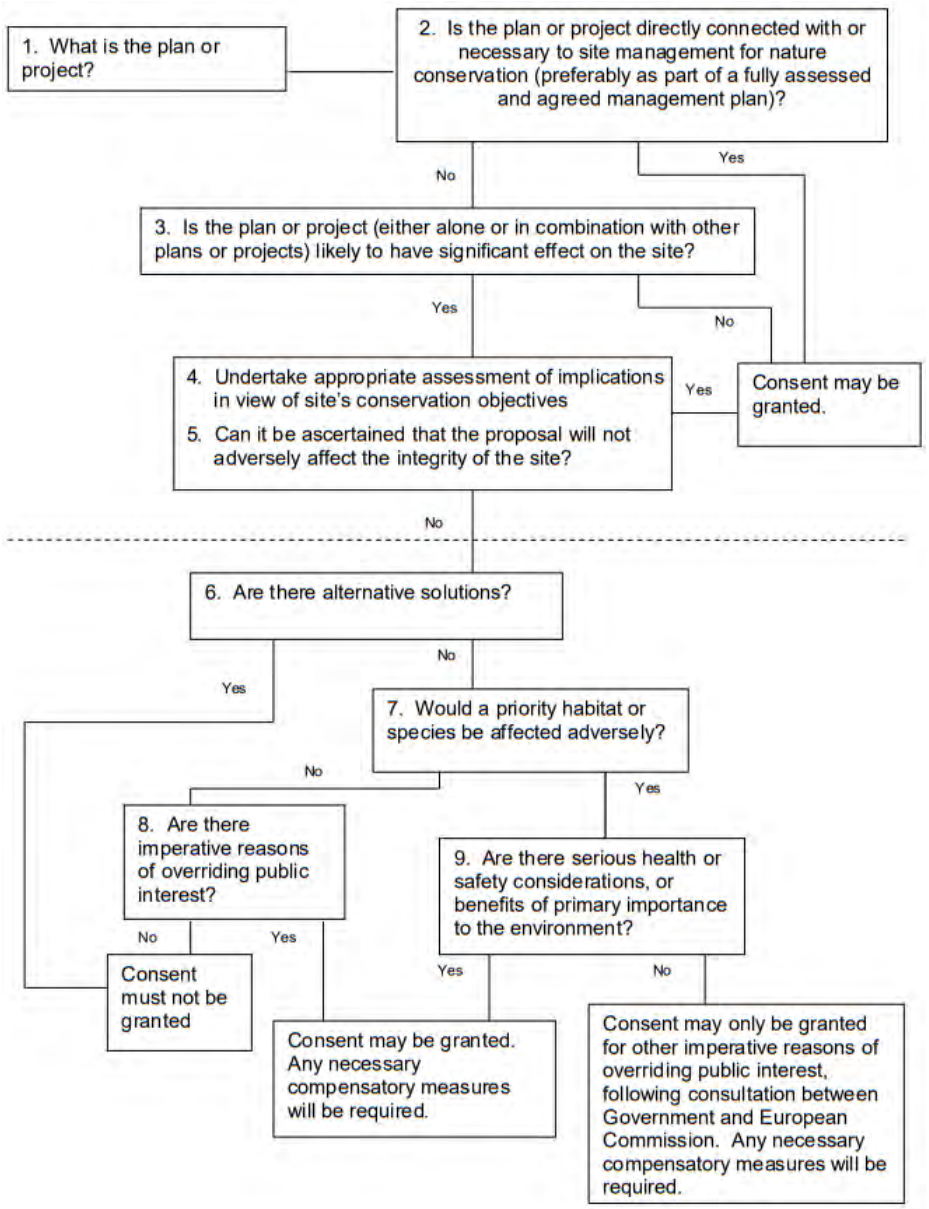



*Plate 3.1 The HRA process (SNH, 2014)*

### 3.2.2 Designated sites included in HRA

The classes of designation considered in HRA are:

- SACs, possible SACs and candidate SACs;
- SPAs and potential SPAs; and
- Ramsar sites.

# 4 Stage One: Screening for LSE

## 4.1 Approach to screening

Screening is based on a conceptual 'source-pathway-receptor' approach. This approach identifies likely environmental effects resulting from the proposed construction and operation of the Proposed Scheme. The parameters are defined as follows:

- Source – the origin of a potential impact (noting that one source may have several pathways and receptors);
- Pathway – the means by which the impact of the activity could affect a receptor; and
- Receptor – the element of the receiving environment that is affected.

Where there is no pathway, or the pathway has sufficient distance such that the effect from the source has dissipated to a negligible (or *de minimis*) level before reaching the receptor, there may be justification for the screening out of that particular receptor (i.e. feature) for the designated site in question.

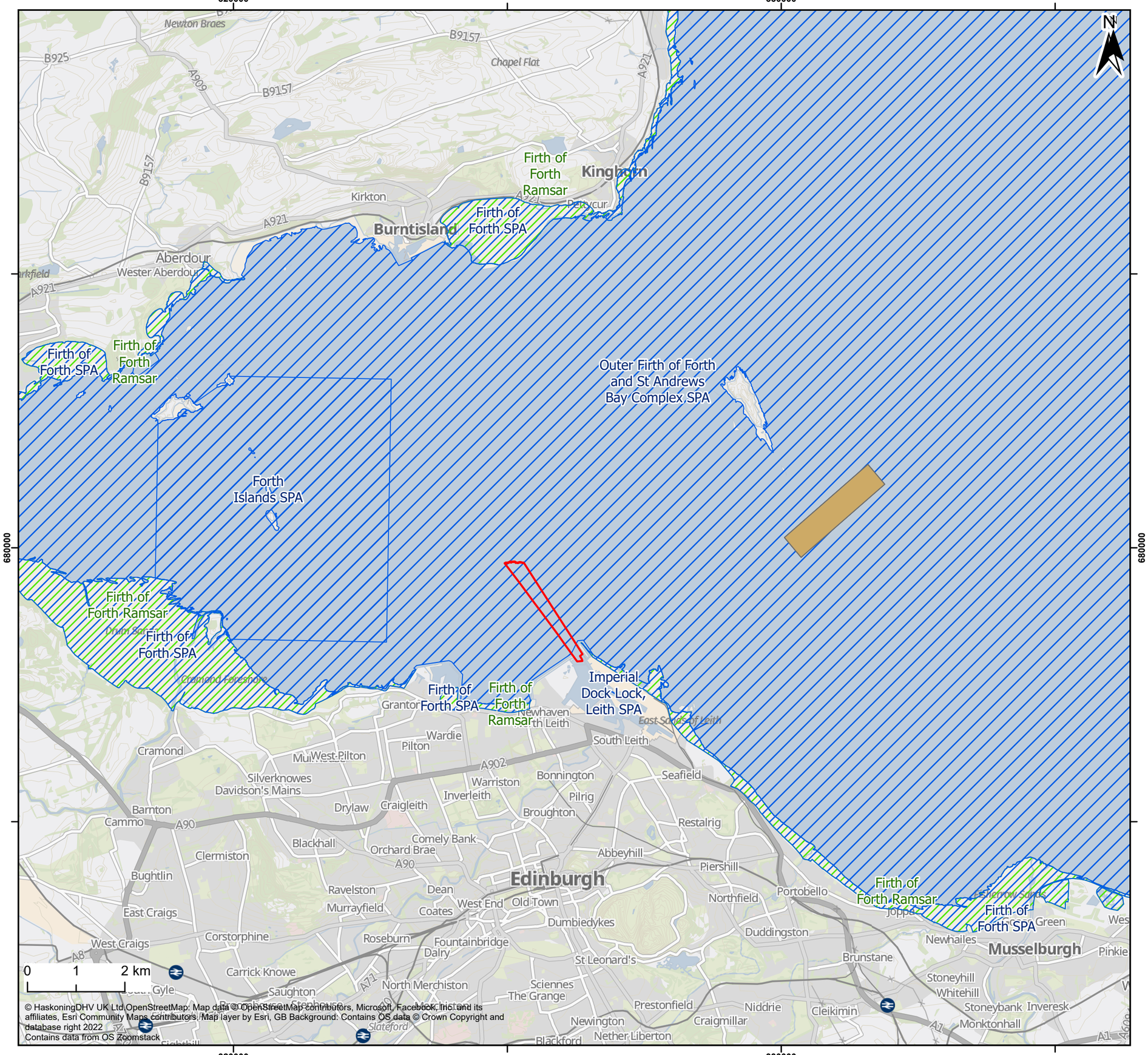
Note that designated sites are screened in if, for any one of their qualifying features (i.e. a species or habitat), a source-pathway-receptor relationship and potential for LSE cannot be ruled out (including in-combination effects). However, each qualifying feature of that designated site will be considered separately and it may be that the screening process rules out LSE for some features at this stage. As described above, mitigation is not taken into account at Stage One, but can be considered where relevant in Stage Two (Appropriate Assessment).

The approach to screening for each receptor is based on the known distribution, ecology and sensitivities of each receptor group and therefore the potential for being affected. Where there is insufficient information available at this stage to screen out a designated site, the site is screened in for further consideration.

Based on the HRA guidance "*HRA on the Firth of Forth – A Guide for Developers and Regulators"* (SNH, 2019) specifically developed for the Firth of Forth, and consultation that was undertaken on the consented Outer Berth development (Royal HaskoningDHV, 2022), it has been determined that the designated sites that should be considered within the Stage One screening assessment are those listed in **Table 4.1** (shown in **Figure 4.1** and **Figure 4.2**).

*Table 4.1 Designated sites considered in the Stage One LSE screening*

| Site | Distance from Proposed Scheme | Distance from Narrow Deep B |
|---|---|---|
| Outer Firth of Forth and St Andrews Bay Complex (OFFSABC) SPA | 0km | 0km |
| Firth of Forth SPA / Ramsar site | 0.1km | 3.3km |
| Imperial Dock Lock, Leith SPA | 0.8km | 4.2km |
| Forth Islands SPA | 2.1km | 7.2km |
| River Teith SAC | 47km | 52km |
| Isle of May SAC | 44km | 38km |
| Firth of Tay and Eden Estuary SAC | 41km | 37km |
| Berwickshire and North Northumberland Coast SAC | 58km | 53km |
| Moray Firth SAC | 176km | 177km |







Legend:

- Dredge Area
- Ramsar Sites
- Special Protection Area
- Disposal Site Narrow Deep B

Data Sources: ©NatureScot 2023, ©CEFAS 2023

| Client: | Project: |
|---|---|
| Forth Ports Limited | Approach Channel Deepening: Habitats Regulations Appraisal Screening Report |

Title: Special Protection Areas and Ramsar sites

Figure: 4.1

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Co-ordinate system: British National Grid

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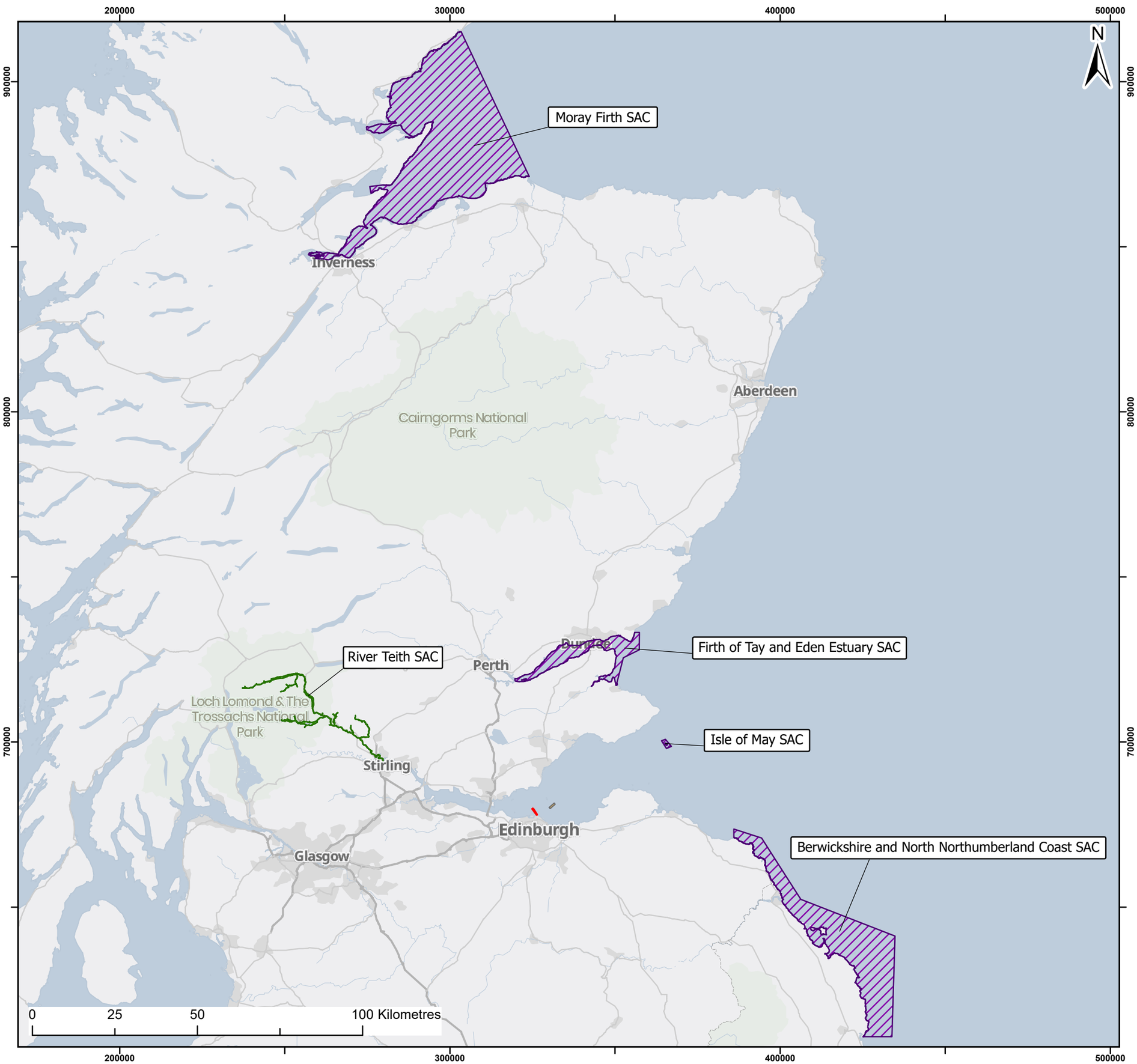



Legend:

- Dredge Area
- Disposal Site Narrow Deep B

Special Areas of Conservation (SAC)

SACs for transitional fish

- River Teith

SACs for marine mammals

- Berwickshire and North Northumberland Coast
- Firth of Tay and Eden Estuary
- Isle of May
- Moray Firth



| Client: | Project: |
|---|---|
| Forth Ports Limited | Approach Channel Deepening: Habitats Regulations Appraisal Screening Report |

Title: Special Areas of Conservation

Figure: 4.2

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The closest sites with benthic and intertidal habitat features are the Isle of May SAC and the Firth of Tay and Eden Estuary SAC. Consequently, benthic and intertidal habitat features have been screened out of the HRA, given that there would be no impact at this distance. Instead, the following features are the focus of this screening assessment:

- Transitional (migratory) fish;
- Ornithology; and
- Marine mammals.

## 4.2 Screening of the Proposed Scheme (alone)

### 4.2.1 Transitional fish

#### River Teith SAC (UK0030263)

The River Teith is the most significant tributary of the River Forth, and the River Teith SAC is designated for the following features:

- Atlantic salmon *salmo salar*;
- Sea lamprey *Petromyzon marinus*;
- River lamprey *Lampetra fluviatilis*; and
- Brook lamprey *Lampetra planeri.*

The NatureScot guidance document (SNH, 2016) states there is the potential for connectivity with the River Teith SAC due to the migration routes of Atlantic salmon, sea lamprey and river lamprey. These species are known to occur within the wider Forth Estuary during parts of their life cycle. Note, brook lamprey is a non-migratory freshwater feature and is therefore not a consideration of this assessment.

Mature sea lamprey migrate to the River Teith SAC and freshwater reaches of the Forth every year to spawn. Spawning in the Teith and Forth usually occurs in late May or June, when the water temperature reaches at least 15°C (SNH, 2016), and mature sea lamprey start to migrate through the Firth of Forth as early as April. Adults die after spawning. Juvenile lamprey settle in silt beds in the SAC for up to five years, before pre-adult lamprey migrate downstream to the open sea, typically between October and December. Sea lamprey will spend up to two years feeding at sea and reach sexual maturation before migrating back to the SAC (SNH, 2016).

River lamprey live in freshwater as juveniles, before migrating out to estuarine or coastal areas for maturation. Mature river lamprey adults return to the SAC every year from October to December, ready for spawning when water reaches temperatures of 10-11°C, typically late March to May. Juveniles disperse into silt beds and remain in the SAC for three to five years, before migrating to the Firth of Forth and other coastal or estuarine areas, where they will spend up to two years feeding. Individuals will remain at sea for up to two years before returning to freshwater from October to December.

Atlantic salmon have a complex life cycle, which begins and ends in freshwater spawning grounds in the Teith catchment (SNH, 2016). Atlantic salmon typically spend four years as juveniles in freshwater, before migrating downstream and out to sea. They then spend up to four years at sea, before migrating back to their spawning grounds as mature adults. Juvenile smolt migrate from freshwater to sea from March to May, and adults can migrate back to freshwater at any time of the year. Peak spawning occurs between November and December, but can extend from October to late February in larger rivers (SNH, 2016).

### Potential effects of the Proposed Scheme on SAC features

There is the potential for the following effects of the Proposed Scheme on SAC transitional fish features during construction:

- Generation of underwater noise from dredge / disposal activities and impact piling, which could have physiological and / or behavioural response impacts, or may form a 'barrier' to migration routes;
- Impacts due to changes to water quality, such as increased suspended sediment, which may have physiological effects or may form a barrier to migration; and,
- Impacts due to a change in habitat quality, such as increased sedimentation or loss of habitat.

During operation, construction-phase impacts would cease to exist and there would be no significant change to baseline vessel traffic, hence there would be no pathway for effect.

### Results of screening for LSE

The results of the screening is presented in **Table 4.2**. The potential impacts listed above have the potential to affect all three features in question as they migrate through, or dwell in, the Firth of Forth.

*Table 4.2 Results of HRA screening for the Proposed Scheme (alone) – transitional fish*

| Designation | Qualifying features | LSE (yes / no) | | |
|---|---|---|---|---|
| | | Underwater noise | Changes in water quality | Changes in habitat availability |
| River Teith SAC | Sea lamprey, river lamprey, Atlantic salmon | **Yes[1]** | **Yes[1]** | **Yes[1]** |
| [1] Only in the outer Firth of Forth, effects within freshwater spawning grounds would not occur. | | | | |

## 4.2.2 Ornithology

### Outer Firth of Forth and St Andrews Bay Complex SPA (UK9020316)

The OFFSABC SPA is a marine designation that covers an extensive area off the east coast of Scotland, totalling 2,720.68km$^2$, including the Firth of Forth. The SPA protects foraging and resting areas of wintering and breeding waterbirds and seabirds and has one of the largest and most diverse marine bird concentrations in Scotland. A summary of the qualifying features of the SPA is presented in **Table 4.3**.

*Table 4.3 Summary of OFFSABC SPA qualifying features*

| Description | Features |
|---|---|
| Qualification under Article 4.1 (of the EU Birds Directive) by regularly supporting Annex I populations of national / international importance. | Non-breeding:<br>• Red-throated diver *Gavia stellata*;<br>• Slavonian grebe *Podiceps auritus*; and<br>• Little gull *Larus minutus*.<br>Breeding:<br>• Common tern *Sterna hirundo*; and<br>• Arctic tern *Sterna paradisaea*, |
| Qualification under Article 4.2 by regularly supporting migratory populations of European importance. | Non-breeding:<br>• Eider *Somateria mollissima.*<br>Breeding:<br>• Shag *Phalacrocorax aristotelis*; and<br>• Gannet *Morus bassanus*. |

| Description | Features |
|---|---|
| Qualification under Article 4.2 by regular supporting in excess of 20,000 individual birds in a single season. | Non-breeding:<br>• Waterfowl assemblage[1]; and<br>• Seabird assemblage[2].<br>Breeding:<br>• Seabird assemblage[3]. |

[1]Component species: long-tailed duck *Clangula hyemalis*, [Redacted] [Redacted] red-breasted merganser *Mergus serrator*.
[2]Component species: black-headed gull *Chroicocephalus ridibundus*, common gull *Larus canus*, herring gull *Larus argentatus*, guillemot *Uria aalge*, shag, kittiwake *Rissa tridactyla*, razorbill *Alca torda*.
[3]Component species: puffin *Fratercula arctica*, kittiwake, Manx shearwater *Puffinus puffinus*, guillemot, herring gull.

## Firth of Forth SPA (UK9004411) and Ramsar site (UK13017)

The Firth of Forth SPA and Ramsar Site is formed of an estuarine and coastal complex, covering an area of 63.2km$^2$ of coastline around the Firth of Forth, with extensive intertidal flats and rocky shores, saltmarsh, lagoons and sand dunes (SNH, 2018a). Summaries of the qualifying features of the SPA and Ramsar site are presented in **Table 4.4** and **Table 4.5**, respectively.

*Table 4.4 Summary of Firth of Forth SPA qualifying features*

| Description | Features |
|---|---|
| Qualification under Article 4.1 (of the EU Birds Directive) by regularly supporting Annex I populations of national / international importance. | Non-breeding:<br>• Red-throated diver;<br>• Slavonian grebe;<br>• Golden plover *Pluvialis apricaria*; and<br>• Bar-tailed godwit *Limosa lapponica*.<br>Post-breeding (passage):<br>• Sandwich tern *Thalasseus sandvicensis.* |
| Qualification under Article 4.2 by regularly supporting migratory populations of European importance. | Non-breeding:<br>• Pink-footed goose *Anser brachyrhynchus;*<br>• Shelduck *Tadorna tadorna*;<br>• Knot *Calidris canutus*;<br>• Redshank *Tringa totanus*; and<br>• Turnstone *Arenaria interpres.* |
| Qualification under Article 4.2 by regular supporting in excess of 20,000 individual birds in a single season. | Non-breeding:<br>• Waterfowl assemblage[1]. |

[1]Component species: great crested grebe *Podiceps cristatus*, cormorant *Phalacrocorax carbo*, scaup *Aythya marila*, eider, long-tailed duck, common scoter, velvet scoter, goldeneye, red-breasted merganser, oystercatcher *Haematopus ostralegus*, ringed plover *Charadrius hiaticula*, grey plover *Pluvialis squatarola*, dunlin *Calidris alpina*, curlew *Numenius arquata*, mallard *Anas platyrhynchos*, lapwing *Vanellus vanellus*, wigeon *Anas penelope*.

*Table 4.5 Summary of Firth of Forth Ramsar site qualifying features*

| Description | Features |
|---|---|
| Ramsar criterion 5: Assemblages of international importance. | Species with peak counts in winter:<br>• Waterfowl assemblage. |
| Ramsar criterion 6: Species / populations occurring at levels of international importance. | Species with peak counts in spring / autumn:<br>• Pink-footed goose; and<br>• Redshank.<br>Species with peak counts in winter:<br>[Redacted]<br>• Knot; and<br>[Redacted] |

## Imperial Dock Lock, Leith SPA (UK9004451)

The Imperial Dock Lock, Leith SPA is located on a man-made structure at the mouth of the Imperial Dock in the heart of the Port of Leith, covering a total area of 0.001km$^2$. This site is designated as it regularly supports a breeding population of common terns (SNH, 2004).

## Forth Islands SPA (UK9004171)

The Forth Islands SPA affords protection to number of islands that support the main seabird colonies and core foraging areas within the Firth of Forth and totals an area of 97.97km$^2$. The islands encompassed by the designation include the Isle of May, Inchmickery, Fidra, The Lamb, Craigleith, Bass Rock and Long Craig (SNH, 2018b). A summary of the qualifying features of the SPA is presented in **Table 4.6**.

*Table 4.6 Summary of Forth Islands SPA qualifying features*

| Description | Features |
|---|---|
| Qualification under Article 4.1 (of the EU Birds Directive) by regularly supporting Annex I populations of national / international importance. | Breeding:<br>• Arctic tern;<br>• Common tern;<br>• [Redacted]<br>• Sandwich tern. |
| Qualification under Article 4.2 by regularly supporting migratory populations of European importance. | Breeding:<br>• Gannet;<br>• Lesser black-backed gull *Larus fuscus*;<br>• Puffin; and<br>• Shag. |
| Qualification under Article 4.2 by regular supporting in excess of 20,000 individual birds in a single season. | Breeding:<br>• Seabird assemblage[1]. |
| [1]Component species: razorbill, guillemot, kittiwake, herring gull, cormorant. | |

## Baseline information

The Outer Berth HRA provided full detail regarding baseline bird usage in and around the Port of Leith, a summary of which is provided below.

Baseline survey data presented in the Outer Berth HRA came from the following sources:

- Site-specific estuarine bird counts (twice monthly), covering the period March 2021 to March 2022 (inclusive);

- Common tern colony counts (twice monthly) at Imperial Dock Lock, Leith SPA, covering the period May to July 2021 (inclusive) (noting, however, that the colony was subsequently affected by highly-pathogenic avian influenza (HPAI) during the 2023 breeding season)[1];
- Common tern flight behaviour surveys at Imperial Dock Lock, Leith SPA, covering the period May to July 2021; and
- Wetland Bird Survey (WeBS) data from 2018/19 to 2019/20, from count sectors 'Water of Leith – Ocean Drive Bridge to Western Harbour' (sector no. 83440) and 'Seafield to Eastern Breakwater' (sector no. 83441).

The area covered by the above surveys is presented in **Figure 4.3**.

For the purposes of HRA screening, the peak annual counts from the above sources were compared with SPA totals (SPA reference populations are defined in the Outer Berth HRA). Where peak counts exceeded 1% of the SPA population, this was classified as a 'significant' proportion of the population. The 1% significance parameter is routinely used as a benchmark for HRA screening in Scotland. **Table 4.7** summarises, for each designation, those features for which peak counts were significant.

### Potential effects of the Proposed Scheme on SPA / Ramsar features

There is the potential for the following effects of the Proposed Scheme on SPA / Ramsar ornithological features during the construction phase:

- Noise and visual disturbance at the disposal site, as a result of increased number of disposal visits;
- Noise disturbance from impact piling at the retaining wall; and
- Changes in water quality and prey availability as a result of the sediment plume.

While the proposed dredge footprint extends further into the Firth of Forth than that of the consented Outer Berth development, noise and visual disturbance associated with dredging activity would not have a significant effect on SPA features as dredging vessels would be confined to the busy Port approach channel and established shipping routes, where regular vessel passage forms part of the baseline environment.

While the enlarged channel would result in changes to bathymetry (and potential consequent changes in tidal currents and sediment transport mechanisms at the coastline) during the operational phase, hydrodynamic modelling of the Proposed Scheme indicates that any such changes would be low in magnitude and highly localised and therefore would not affect coastal habitat or prey availability, even in close proximity to the dredging location. Details of this modelling are presented in **Appendix A**.

[1] *Ecological Clerk of Work observations indicated at least 210 adult tern deaths attributed to HPAI in June / July 2023, representing roughly a third of the colony population at that time*



Legend:

- Dredge Area
- Survey Area
- WeBS Sectors



| Client: | Project: |
|---|---|
| Forth Ports Limited | Approach Channel Deepening: Habitats Regulations Appraisal Screening Report |

Title:

2021/22 baseline survey area and WeBS sectors

| Figure: | Drawing No: |
|---|---|
| 4.3 | PC4514-RHD-YY-XX-FN-EV-0017 |

| Revision: | Date: | Drawn: | Checked: | Size: | Scale: |
|---|---|---|---|---|---|
| P01 | 10/01/2022 | ND | BH | A3 | 1:25,000 |
| | | | | | |

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

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*Table 4.7 Qualifying features of SPAs / Ramsar sites present in potentially significant numbers*

| Designation | Qualifying features potentially present in significant numbers |
|---|---|
| OFFSABC SPA | Common tern |
| | Eider |
| | Shag |
| | Non-breeding waterfowl assemblage |
| | Non-breeding seabird assemblage |
| | Breeding seabird assemblage |
| Firth of Forth SPA | [Redacted] |
| | Knot |
| | Pink-footed goose |
| | [Redacted] |
| | Redshank |
| | Sandwich tern |
| | Turnstone |
| | Non-breeding waterfowl assemblage |
| Firth of Forth Ramsar site | [Redacted] |
| | Knot |
| | Pink-footed goose |
| | Redshank |
| | Non-breeding waterfowl assemblage |
| Imperial Dock Lock, Leith SPA | Common tern |
| Forth Islands SPA | Common tern |
| | Lesser black-backed gull |
| | [Redacted] |
| | Sandwich tern |
| | Shag |
| | Breeding seabird assemblage |

## Results of screening for LSE

The results of the HRA screening is presented in **Table 4.8**. Of the potential impacts listed above, noise disturbance from piling has the potential to affect all features listed in **Table 4.7**. Disturbance at the disposal site would only effect those features that forage offshore in this area. Changes in water quality and prey availability would only affect features that forage in the subtidal area; features that forage in the intertidal / supratidal area would be unaffected.

*Table 4.8 Results of HRA screening for the Proposed Scheme (alone) – ornithology*

| Designation | Qualifying features | LSE (yes / no) | | |
|---|---|---|---|---|
| | | Noise disturbance (impact piling) | Noise / visual disturbance (disposal) | Changes in water quality |
| OFFSABC SPA | Common tern, eider, shag, non-breeding waterbird assemblage, non-breeding seabird assemblage, breeding seabird assemblage | **Yes**[1] | **Yes**[1] | **Yes**[1] |
| Firth of Forth SPA | [Redacted] knot, pink-footed goose, redshank, turnstone | **Yes** | No[2] | No[3] |
| | [Redacted] Sandwich tern, non-breeding waterfowl assemblage | **Yes** | No[2] | **Yes** |
| Firth of Forth Ramsar site | [Redacted] knot, pink-footed goose, redshank | **Yes** | No[2] | No[3] |
| | Non-breeding waterfowl assemblage | **Yes** | No[2] | **Yes** |
| Imperial Dock Lock, Leith SPA | Common tern | **Yes** | **Yes** | **Yes** |
| Forth Islands SPA | Common tern, lesser black-backed gull, [Redacted] shag, breeding seabird assemblage | **Yes**[1] | **Yes**[1] | **Yes**[1] |

[1]Foraging / loafing / resting birds only – no pathway for effect on breeding colonies.
[2]Distance between SPA / Ramsar site and disposal ground is sufficient that the effect pathway would be negligible.
[3]Features that forage in the intertidal / supratidal zone, hence no pathway for effect.

### 4.2.3 Marine mammals

#### Isle of May SAC (UK0030172)

The Isle of May SAC, located at the entrance to the Firth of Forth, supports the following Annex II feature as a primary reason for designation of the site:

- Grey seal *Halichoerus grypus*.

The site is the largest east coast breeding colony of grey seals in Scotland and the fourth largest breeding colony in the UK.

#### Firth of Tay and Eden Estuary SAC (UK0030311)

The Firth of Tay and Eden Estuary SAC supports the following Annex II feature as a primary reason for designation of the site:

- Harbour seal *Phoca vitulina*.

The site supports a nationally important breeding colony, part of the east coast population of harbour seals that typically utilise sandbanks. Around 600 adults haul-out at the site to rest, pup and moult.

### Berwickshire and North Northumberland Coast SAC (UK0017072)

Berwickshire and North Northumberland Coast SAC is an extensive and diverse stretch of coastline in north-east England and south-east Scotland, which supports the following Annex II feature as a primary reason for designation of the site:

- Grey seal.

### Moray Firth SAC (UK0019808)

The Moray Firth Sac, in north-east Scotland, supports the following Annex II feature as a primary reason for designation of the site:

- Bottlenose dolphin *Tursiops truncatus.*

The site supports the only known resident population of bottlenose dolphins in the North Sea, with dolphins present all year round.

### Potential effects of the Proposed Scheme on SAC features

There is the potential for the following impacts to affect marine mammal SAC features:

- Underwater noise from impact piling and dredging activity, which could result in physiological and / or behavioural effects; and,
- Changes in water quality and prey availability as a result of the sediment plume.

Disturbance associated with vessel movements and engine noise would not have a significant effect on SAC features as vessels would be confined to the busy Port approach channel and established shipping routes, where regular vessel passage forms part of the baseline environment. Collision risk is not considered to be an issue, given that dredging vessels would not travel at speed.

During the operational phase, construction-phase impacts would cease to exist and there would be no significant change to baseline vessel traffic, hence there would be no pathway for effect.

### Results of screening for LSE

The results of the screening is presented in **Table 4.9**. Given the mobile nature of marine mammals from the SACs listed above, there is potential for effect on foraging individuals that have commuted into the Firth of Forth. Clearly, given the distances involved, there is no risk of adverse effect on hauled-out seals and those at breeding sites.

*Table 4.9 Results of HRA screening for the Proposed Scheme (alone) – marine mammals*

| Designation | Qualifying features | LSE (yes / no) | | |
|---|---|---|---|---|
| | | Underwater noise (impact piling) | Underwater noise (dredging) | Changes in water quality |
| Isle of May SAC | Grey seal | **Yes**[1] | **Yes**[1] | **Yes**[1] |
| Firth of Tay and Eden Estuary SAC | Harbour seal | **Yes**[1] | **Yes**[1] | **Yes**[1] |
| Berwickshire and North Northumberland Coast SAC | Grey seal | **Yes**[1] | **Yes**[1] | **Yes**[1] |
| Moray Firth SAC | Bottlenose dolphin | **Yes** | **Yes** | **Yes** |

[1] Foraging individuals only – no pathway for effect on haul-outs / breeding grounds due to distance.

## 4.3 Screening of the Proposed Scheme (in-combination)

### 4.3.1 In-combination effects with the Outer Berth development

As stated in **Section 1.2**, the marine elements of the Outer Berth development (i.e. those with the potential for in-combination effects with the Proposed Scheme) would be completed before the works related to the Proposed Scheme begins. As such, the presence of the Outer Berth development forms part of the baseline upon which the Proposed Scheme will be assessed, and not as an in-combination project.

### 4.3.2 In-combination effects with other plans and projects

Given that the types of activities forming the Proposed Scheme are the same as those that comprise the marine elements of the Outer Berth development (i.e. dredging and disposal, and impact piling), the plans and projects considered by the in-combination assessment in the Outer Berth HRA have been reviewed. Any plans and projects that would be completed prior to the commencement of the Proposed Scheme (i.e. by Q1 2024) have been excluded, as there would be no temporal overlap in effects. Following a review of new applications / pre-applications on MS-LOT's marine licensing portal, it is considered that there are no new plans or projects with the potential for in-combination effects with the Proposed Scheme.

For ornithological features, other plans / projects with the potential for in-combination effects are those located within 5km of the Proposed Scheme; this is considered a suitable distance beyond which zones of influence would not spatially overlap. For wider-ranging species (namely transitional fish and marine mammals), it is important to consider projects over a wider area. For seals and transitional fish, projects are considered if they are located anywhere within the Firth of Forth. For the Moray Firth SAC bottlenose dolphin population, projects are considered if they are located within the Firth of Forth or anywhere along the east Scotland coastline between the Proposed Scheme and the Inner Moray Firth.

Based on the above, no plans / projects have been identified with the potential for in-combination effects on ornithological features of the SPAs / Ramsar site, as all plans / projects considered are located more than 5km from the Proposed Scheme. **Table 4.10** presents those plans / projects where there is the potential for in-combination effects on foraging marine mammals and / or transitional fish.

*Table 4.10 Results of HRA screening for the Proposed Scheme (in-combination)*

| Designated site | Feature(s) screened in | Potential for in-combination effect (Y / N) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Nigg Energy Park East Quay | North Connect HVDC Cable | Seagreen Alpha and Bravo OWFs | Neart na Gaoithe OWF (revised) | Inch Cape OWF (revised) | Moray West OWF | Alexandra Parade Sea Wall | Grangemouth Flood Protection | Ardersier Port Development |
| River Teith SAC | Sea lamprey, river lamprey, Atlantic salmon | N[1] | N[1] | **Y** | **Y** | **Y** | N[1] | N[1] | **Y** | N[1] |
| Isle of May SAC | Grey seal | N[1] | N[1] | **Y** | **Y** | **Y** | N[1] | N[1] | **Y** | N[1] |
| Firth of Tay and Eden Estuary SAC | Harbour seal | N[1] | N[1] | **Y** | **Y** | **Y** | N[1] | N[1] | **Y** | N[1] |
| Berwickshire and North Northumberland SAC | Grey seal | N[1] | N[1] | **Y** | **Y** | **Y** | N[1] | N[1] | **Y** | N[2] |
| Moray Firth SAC | Bottlenose dolphin | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** |

[1] Project / development is located outside the Firth of Forth.

## 4.4 Conclusion of Stage One

**Table 4.11** and **Table 4.12** summarise the sites and features where LSE has been concluded (or cannot be excluded) and therefore would be the subject of Stage Two assessment (Appropriate Assessment).

*Table 4.11 Summary of LSE screening (alone)*

| Designated site | Feature |
|---|---|
| River Teith SAC | Sea lamprey, river lamprey, Atlantic salmon |
| OFFSABC SPA | Common tern, eider, shag, non-breeding waterbird assemblage, non-breeding seabird assemblage, breeding seabird assemblage |
| Firth of Forth SPA | [Redacted], knot, pink-footed goose, redshank, turnstone, [Redacted], Sandwich tern, non-breeding waterfowl assemblage |
| Firth of Forth Ramsar site | [Redacted], knot, pink-footed goose, redshank, non-breeding waterfowl assemblage |
| Imperial Dock Lock, Leith SPA | Common tern |
| Forth Islands SPA | Common tern, lesser black-backed gull, [Redacted] shag, breeding seabird assemblage |
| Isle of May SAC | Grey seal |
| Firth of Tay and Eden Estuary SAC | Harbour seal |
| Berwickshire and North Northumberland Coast SAC | Grey seal |
| Moray Firth SAC | Bottlenose dolphin |

*Table 4.12 Summary of LSE screening (in-combination)*

| Designated site | Other plan / project for consideration |
|---|---|
| River Teith SAC | • Seagreen Alpha and Bravo OWFs;<br>• Neart na Gaoithe OWF (revised);<br>• Inch Cape OWF (revised); and<br>• Grangemouth Flood Protection. |
| Isle of May SAC | • Seagreen Alpha and Bravo OWFs;<br>• Neart na Gaoithe OWF (revised);<br>• Inch Cape OWF (revised); and<br>• Grangemouth Flood Protection. |
| Firth of Tay and Eden Estuary SAC | • Seagreen Alpha and Bravo OWFs;<br>• Neart na Gaoithe OWF (revised);<br>• Inch Cape OWF (revised); and<br>• Grangemouth Flood Protection. |
| Berwickshire and North Northumberland Coast SAC | • Seagreen Alpha and Bravo OWFs;<br>• Neart na Gaoithe OWF (revised);<br>• Inch Cape OWF (revised); and<br>• Grangemouth Flood Protection. |
| Moray Firth SAC | • Nigg Energy Park East Quay;<br>• North Connect HVDC Cable;<br>• Seagreen Alpha and Bravo OWFs; |

| Designated site | Other plan / project for consideration |
|---|---|
| | • Neart na Gaoithe OWF (revised);<br>• Inch Cape OWF (revised<br>• Moray West OWF;<br>• Alexandra Parade Sea Wall;<br>• Grangemouth Flood Protection; and<br>• Ardersier Port Development. |

# 5 Approach to providing information for Appropriate Assessment

The information to inform Appropriate Assessment for the Proposed Scheme will be provided in the form of a 'Supplementary RIAA' to the Outer Berth HRA. The Supplementary RIAA will provide further assessment of the potential effects on designated features as described below.

## 5.1 Approach to assessment for ornithological features

The ornithological assessment presented in the Outer Berth HRA was based on baseline bird activity within the Port and surrounding marine areas surveyed on a bi-monthly basis between April 2021 and April 2022, inclusive. Given the recent and comprehensive nature of the 2021/22 survey, this is considered to remain suitable to inform the ornithological assessment in the Supplementary RIAA. Note, however, that the assessment would be undertaken in the context that seabird numbers may have been subsequently affected by the effects of HPAI.

### 5.1.1 Potential impacts from dredging and disposal activity

Given the increase in dredging and disposal activity, further assessment on SPA and Ramsar site features would be considered in the Supplementary RIAA. The Supplementary RIAA would assess the potential for adverse effect on site integrity and investigate whether additional mitigation measures (to those employed for the consented Outer Berth development) are required.

To underpin an assessment of changes in water quality and consequent effects on prey resources, sediment dispersion modelling will be undertaken to predict the effects of the sediment plume both from the dredging and disposal. A sediment sampling campaign will be undertaken to confirm the concentrations of sediment-bound contaminants.

### 5.1.2 Potential impacts from piling activity

Piling noise from the Proposed Scheme would be of notably lower magnitude (in terms of both extent and duration) than that assessed as part of the Outer Berth HRA. It is therefore proposed that the Supplementary RIAA would confirm whether the implementation of the mitigation measures employed for the Outer Berth development – notably soft-start protocols and the use of piling shrouds – are still required to avoid an adverse effect on the integrity of the designated sites.

## 5.2 Approach to assessment for marine mammals and transitional fish

### 5.2.1 Potential impacts from dredging and disposal activity

Given the increase in dredging and disposal activity, further assessment on SAC features would be considered in the Supplementary RIAA.

Assessments undertaken for the Outer Berth HRA included underwater noise modelling of the dredging activity. A repeat of the underwater noise modelling is not considered necessary to inform the Supplementary RIAA, as the modelling undertaken for the Outer Berth HRA indicated that dolphins and seals would need to remain within 100m of the source of dredging activity for 12 hours prior to the effects of temporary threshold shift or permanent threshold shift setting in. Dredging activities for the Proposed Scheme would be similar in nature to those for the Outer Berth scheme, albeit of longer duration due to the additional volume involved.

While marine mammals and transitional fish may exhibit varying behavioural reaction intensities as a result of exposure to dredging noise, the potential impacts are unlikely to be significant and a desk-based approach is proposed, similar to that undertaken for the Outer Berth HRA (which concluded that the behaviour responses to dredging would be localised and temporary). The assessment will take into account the fact that, as with the Outer Berth scheme, all construction vessels would adhere to the Scottish Marine Wildlife Watching Code (i.e. maintaining distance and a slow speed when encountering marine mammals, including hauled-out seals) to reduce the risk of disturbance.

To determine the extent of the sediment plume during dredging and disposal (which may affect transitional fish and prey items of marine mammals) and the potential scale of subsequent deposition (which may affect habitat availability for transitional fish), sediment dispersion modelling will be undertaken to support the assessment. A sediment sampling campaign will be undertaken to confirm the concentrations of sediment-bound contaminants.

### 5.2.2 Potential impact from piling activity

As noted in **Section 5.1.2**, piling noise from the Proposed Scheme would be of notably lower magnitude than that assessed as part of the Outer Berth HRA. It is proposed that the Supplementary RIAA would confirm that the continued implementation of mitigation measures employed for the Outer Berth – notably soft-start protocols and the deployment of observers on board vessels – would be sufficient to avoid an adverse effect on the designated sites, and further assessment, including underwater noise modelling, is not required.

## 6 References

Royal HaskoningDHV, 2022. Port of Leith – Outer Berth: Habitats Regulations Appraisal – Screening for LSE and Provision of Information to Inform Appropriate Assessment. Report PC2045-RHD-ZZ-XX-RP-EV-0009 to Forth Ports Limited. April, 2022.

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# Appendix A Interpretation of Hydrodynamic Modelling Results

**Note / Memo**

**HaskoningDHV UK Ltd.**
**Water & Maritime**

| | |
|---|---|
| To: | Ben Hughes |
| From: | David Brew |
| Date: | 18 August 2023 |
| Copy: | Luke Evans-Jones |
| Our reference: | PC4514-RHD-YY-XX-FN-EV-0016 |
| Classification: | Project related |
| Checked by | Click or tap here to enter text. |

**Subject:** **Interpretation of Hydrodynamic Modelling Results at Leith**

# 1 Introduction

Hydrodynamic modelling of the existing layout and a future layout for the Port of Leith approach channel has been completed by Royal HaskoningDHV. This Technical Note provides an interpretation of the results from both physical (spring tide tidal currents) and sedimentary (spring tide bed shear stress) process perspectives, including an estimation of future maintenance dredging requirement changes because of the new configuration. The Note also provides a summary of the wave climate across the approach channel and berth pocket, using existing information.

# 2 Bathymetry

The existing layout bathymetry is a gradually deepening seabed from the coast to -8m CD offshore, intersected by the existing approach channel (deeper than -7m CD but shallower than -8m CD) and berth pocket oriented north-northwest to south-southeast in the lee of the eastern breakwater (Figure 2.1).

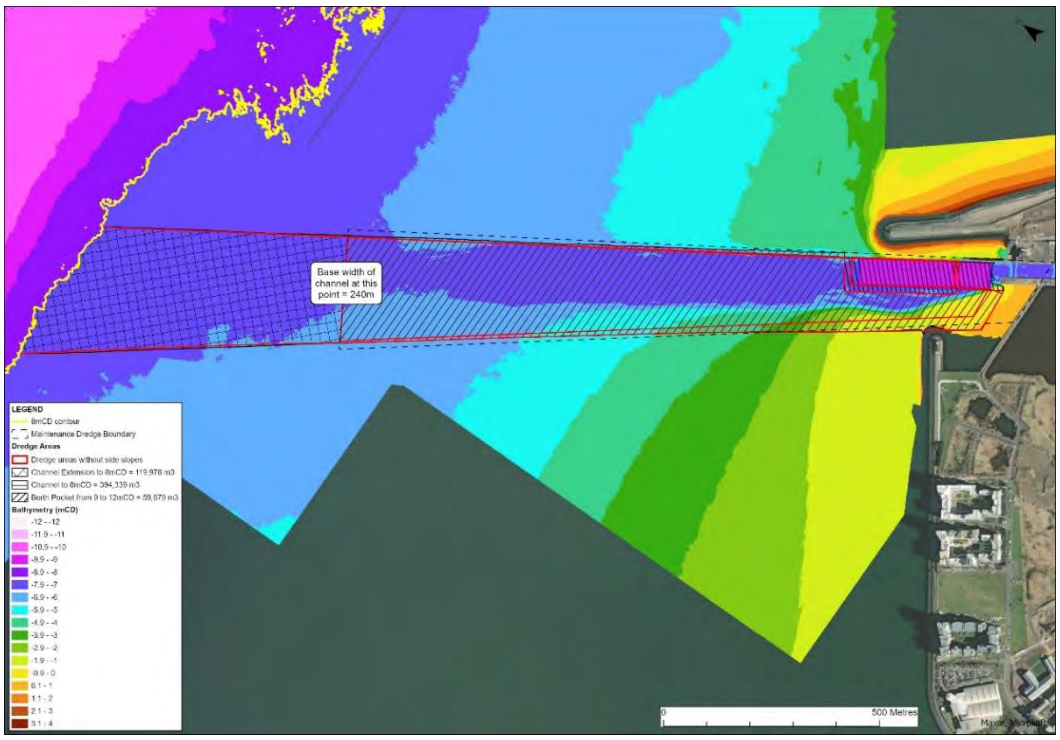



*Figure 2.1. Existing bathymetry of the Port of Leith approach channel and berth pocket*

The proposed future layout bathymetry would be an extension of the approach channel (Figure 2.2). The depth would increase to -8m CD across a wider section of the seabed, extending out to -8m CD offshore. The berth pocket would be deepened to -12m CD for the most part with a smaller inner area to -9m CD. The area of the future approach channel at -8m CD including the side slopes would be 456,309m$^2$ with a berth pocket of 25,518m$^2$. To create the future approach channel and berth pocket would require excavation of 573,995m$^3$ of sediment (Table 2.1). If this volume is averaged across the entire channel and berth pocket, it would equate to about 1.19m of sediment.

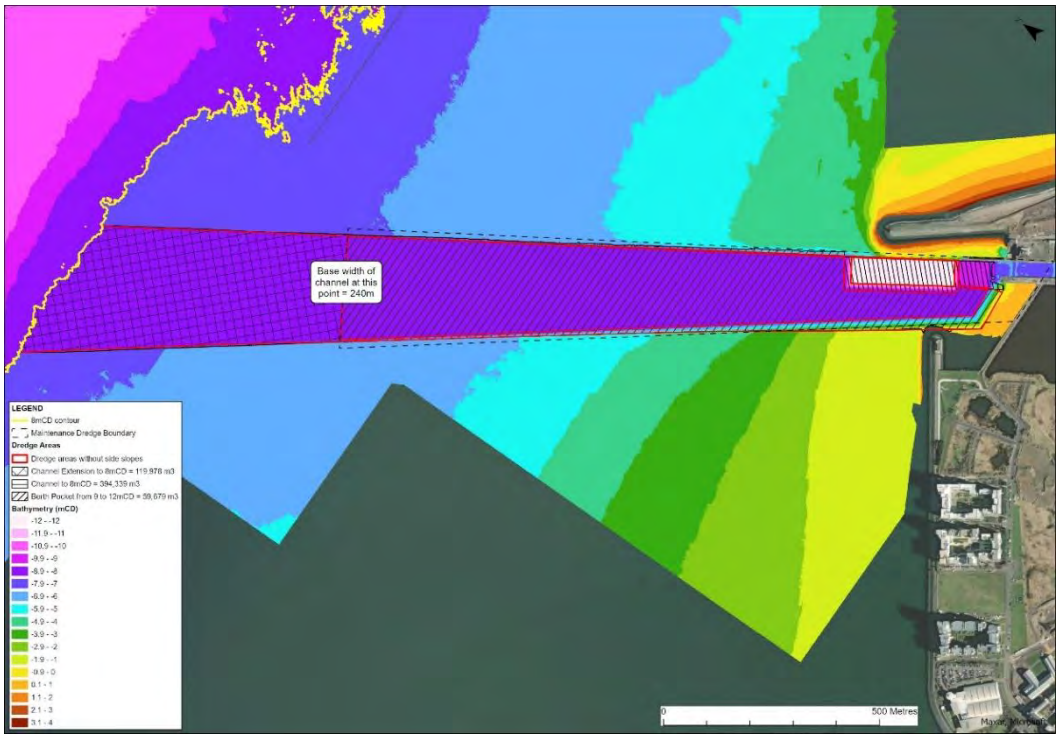


*Figure 2.2. Future bathymetry of the Port of Leith approach channel and berth pocket*

*Table 2.1. Dredge volumes estimated by comparing the bathymetries of the existing layout and the future layout*

| Location | Volume (m$^3$) |
|---|---|
| Berth Pocket -12m CD and -9m CD (including side slopes) | 59,679 |
| Approach Channel -8m CD (including side slopes) | 514,317 |
| Total | 573,995 |

The existing and future layouts as shown in Figure 2.1 and Figure 2.2 were input to the hydrodynamic model to predict existing tidal currents and bed shear stresses, and changes to them due to the changes in approach channel geometry. However, since the modelling has been completed a small length of piled wall has been added as a design feature on the inside of the eastern breakwater (Figure 2.3). The location, orientation and size of the wall is only a minor modification to the geometry of the future layout that was modelled and will have no material effect on the results of the modelling presented in this Technical Note.

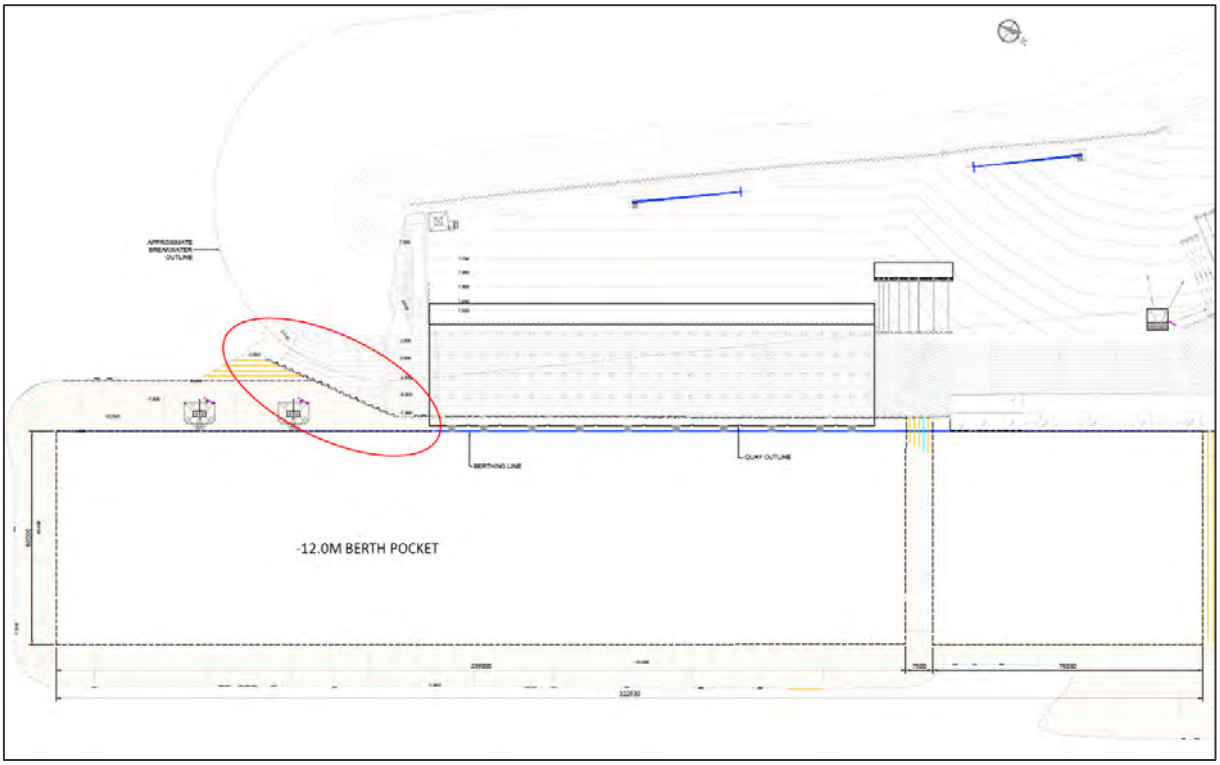



*Figure 2.3. Short length of piled wall (circled in red) added as a design feature post modelling*

# 3 Spring Tide Tidal Currents

## 3.1 Flow Distribution for the Existing Layout

For the existing layout, the predicted spring tide peak flood currents typically flow from east to west at speeds of 0.5-0.6m/s across the approach channel (Figure 3.1). Either side of the channel the velocities are slightly higher between 0.6m/s and 0.7m/s. The predicted velocities across the channel are slower because the water is deeper (Figure 2.1). There are local complexities in the port basin where tidal currents are slower between the eastern and western breakwaters. Here, there is a predicted reversal in flow direction (west to east, up to 0.5m/s) along the coast west of the berth pocket, and a predicted south to north flow (up to 0.3m/s) adjacent to the berth pocket. Elsewhere, in the port basin, flows are predicted to be less than 0.1m/s.

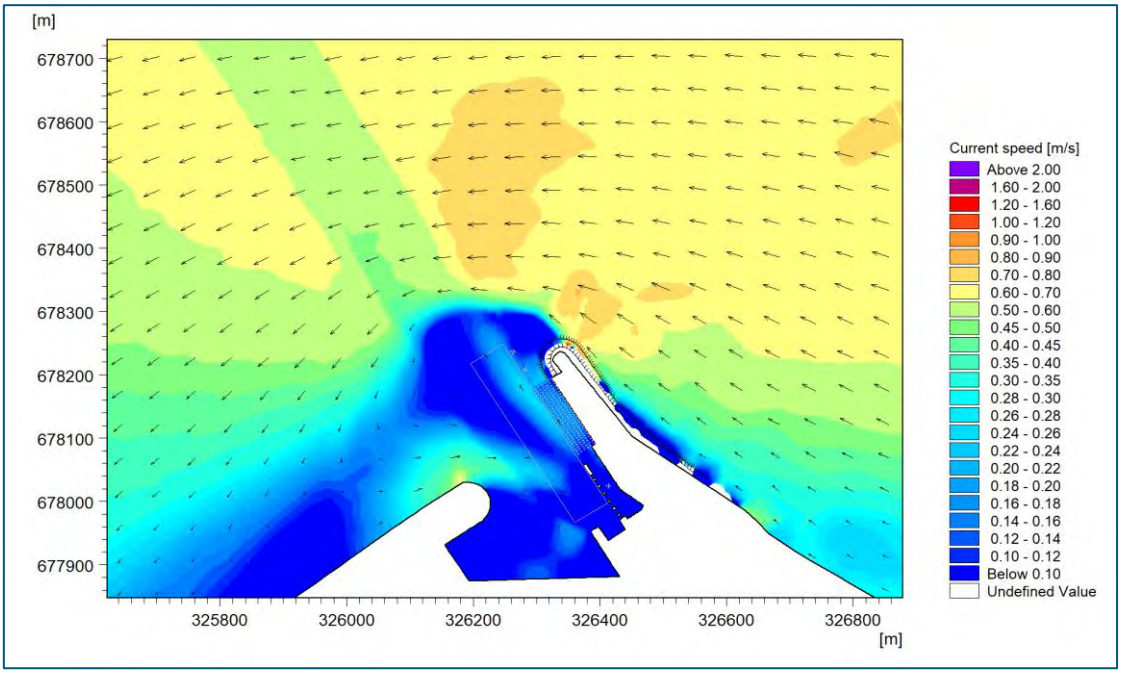



*Figure 3.1. Predicted spring tide peak flood currents for the existing layout (inner approach channel and berth pocket)*

The predicted spring tide peak ebb currents typically flow from west-southwest to east-northeast. Speeds reduce from 0.5-0.6m/s across the outer part of the existing approach channel to about 0.3m/s closer to the berth pocket (Figure 3.2). To the west of the channel, predicted velocities are like those across the outer channel and slightly higher (0.6-0.7m/s) to the east of the channel. Within the port basin and berth pocket, flows are predicted to be less than 0.1m/s. There is an increase in predicted current velocities to greater than 1.0m/s around the tip of the eastern breakwater.

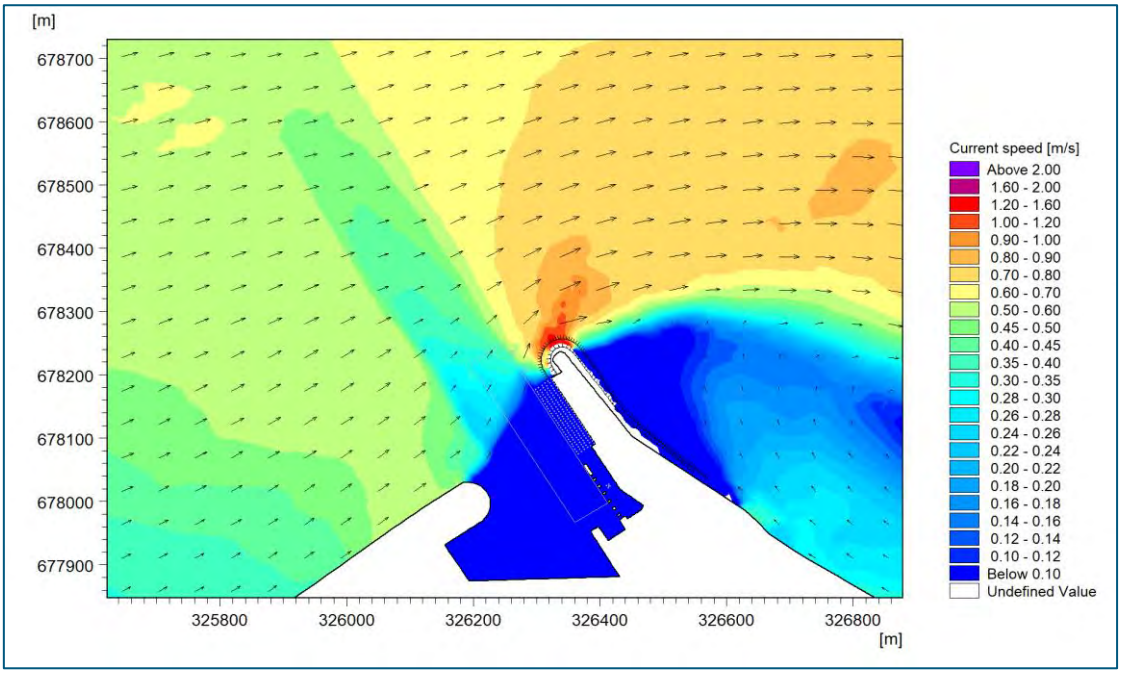



*Figure 3.2. Predicted spring tide peak ebb currents for the existing layout (inner approach channel and berth pocket)*

## 3.2 Flow Distribution for the Future Layout

For the future layout, the general distribution of predicted spring tide peak flood currents is like the flow distribution for the existing layout (Figure 3.3). The main change is the spatial extent of flows with velocities between 0.5m/s and 0.6m/s within the larger approach channel dimensions, and changes in the port basin and berth pocket due to its deepening. The general distribution of predicted spring tide peak ebb currents is also like the flow distribution for the existing layout (Figure 3.4), apart from the spatial extent of similar flow velocities within the larger approach channel dimensions.

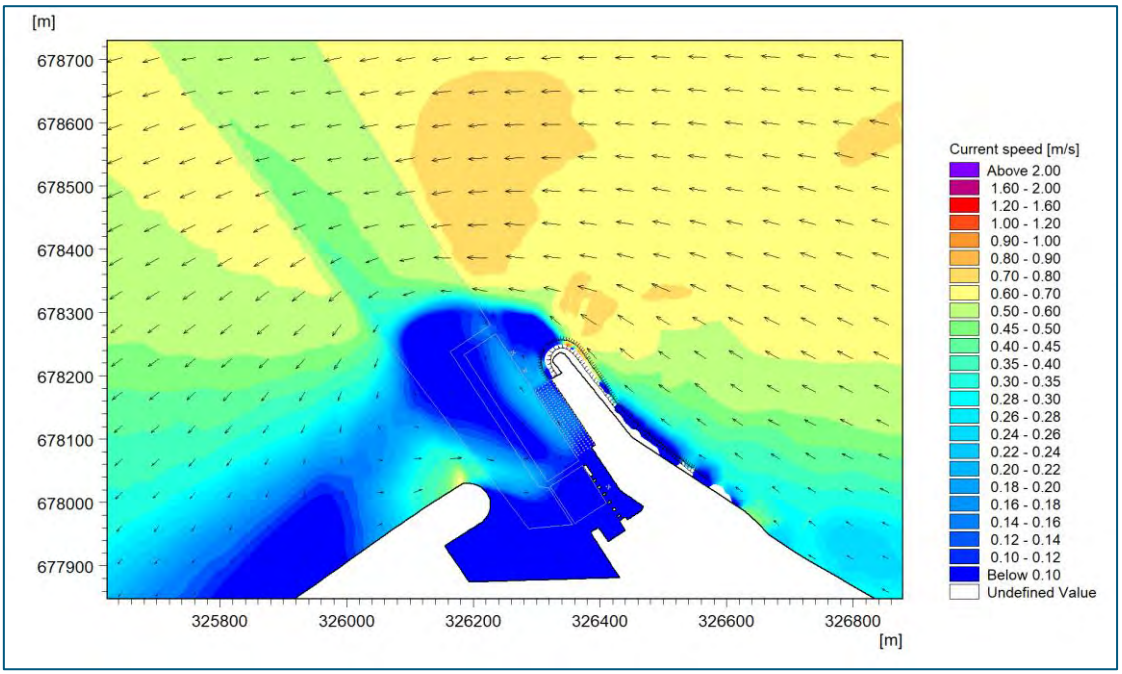



*Figure 3.3. Predicted spring tide peak flood currents for the future layout (inner approach channel and berth pocket)*

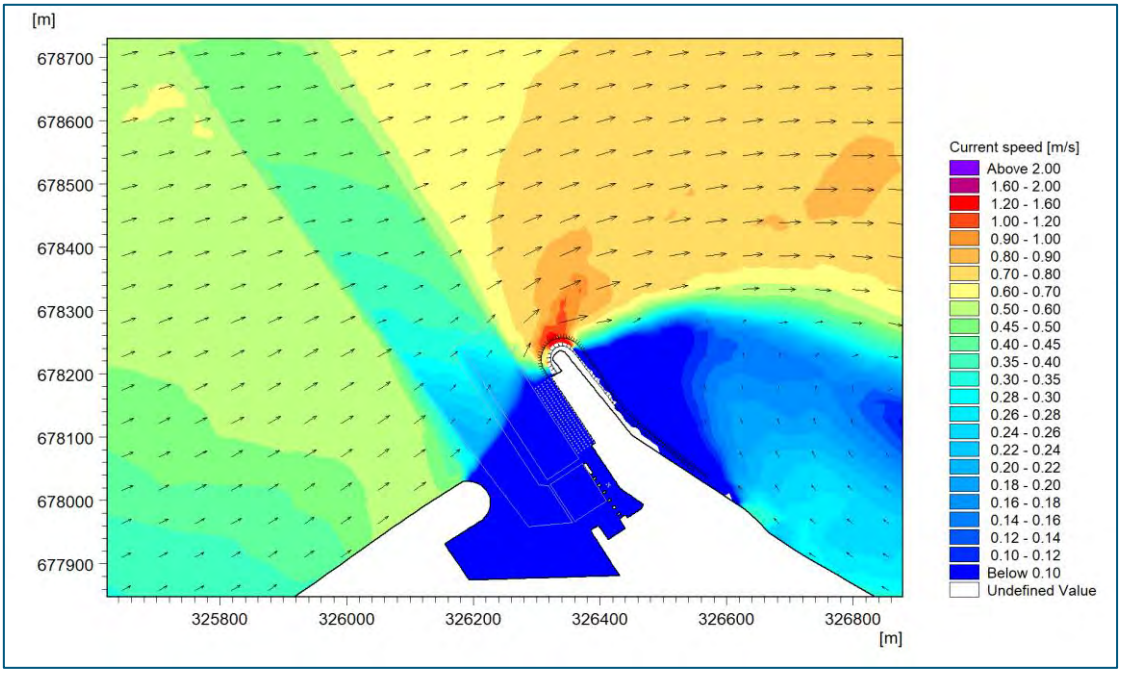



*Figure 3.4. Predicted spring tide peak ebb currents for the future layout (inner approach channel and berth pocket)*

## 3.3 Changes in Flow Distribution

The predicted differences in overall flow distribution between the existing layout and the future layout are reflected in predictions of how tidal current flows would change with implementation of the larger approach channel. Most of the changes are restricted to within the bounds of the future approach channel and are due to its increase in overall dimensions. Other changes occur within the port basin and parts of the deeper berth pocket.

Spring tide peak flood currents are predicted to reduce apart from small areas in the port basin (Figure 3.5). Speeds reduce mainly along the west side of the future approach channel, by 0.025-0.05m/s in the outer channel, 0.05-0.1m/s in the central part of the channel, and greater than 0.2m/s in the inner channel. Predicted changes to flows along most of the eastern side of the channel are less than 0.025m/s as are those within the berth pocket. Within the port basin, the flows are predicted to both decrease (up to 0.1-0.15m/s) and increase (up to 0.05-0.1m/s).

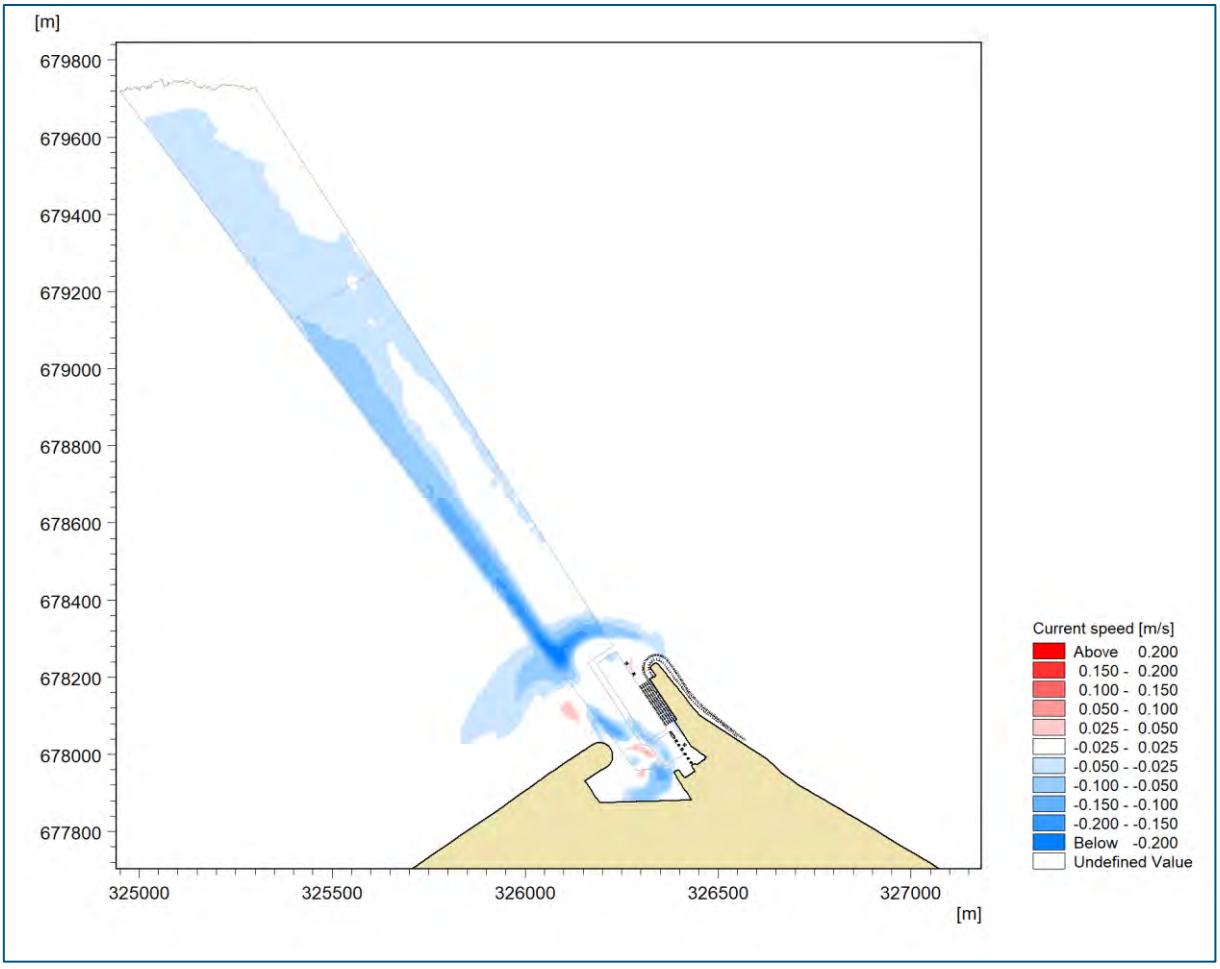



*Figure 3.5. Predicted change in spring tide peak flood currents between the existing and future layouts*

A similar distribution of change is predicted for the spring tide peak ebb currents, with the greatest changes along the west side of the future approach channel, although there are reductions (0.025-0.05m/s) along the east side of the central and inner channel which extend into the northern half of the berth pocket (Figure 3.6). There are no significant changes to predicted flow speeds within the port basin.

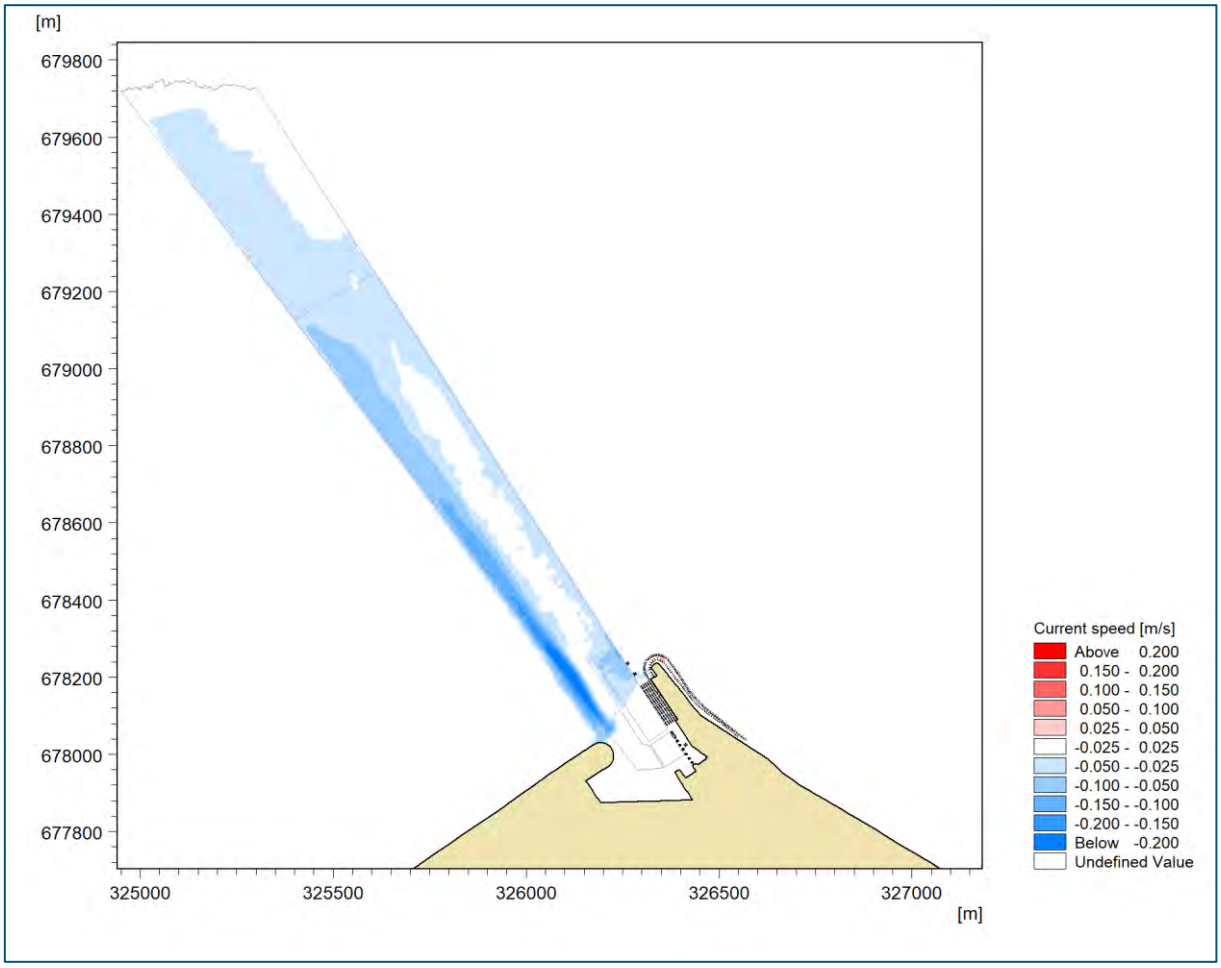



*Figure 3.6. Predicted change in spring tide peak ebb currents between the existing and future layouts*

These distributions of change are predicted to occur because the greatest change in water depth after dredging of the future approach channel is along its west side (Figure 2.1). The increase in water depth here would tend to reduce tidal current velocities. The bathymetry of the east side of the approach channel is only modified marginally (slightly deeper), and so the predicted reduction in tidal current velocities is less. For both spring tide flood currents and spring tide ebb currents, the speeds will universally decrease across the future layout approach channel compared to the existing currents.

# 4 Spring Tide Bed Shear Stress

The tidal current speeds have been transformed into bed shear stresses in the approach channel, port basin and berth pocket.

## 4.1 Bed Shear Stress Distribution for the Existing Layout

For the existing layout, the predicted spring bed shear stress on a peak flood tide is between 0.27N/m$^2$ and 0.50N/m$^2$ in the existing approach channel (Figure 4.1). These values reduce to less than 0.18N/m$^2$ in the port basin and berth pocket. Either side of the approach channel, the bed shear stress is higher at 0.50-1.23N/m$^2$. For the peak spring ebb tide, bed shear stresses are generally lower than the flood tide predictions (Figure 4.2). Bed shear stress is 0.27-0.50N/m$^2$ in the outer channel, reducing to 0.18-0.27N/m$^2$ in the central channel, and less than 0.18N/m$^2$ in the inner channel, port basin and berth pocket. In both

cases, the bed shear stress magnitudes mimic the flow speed magnitudes, whereby lower current speeds are associated with lower bed shear stresses.

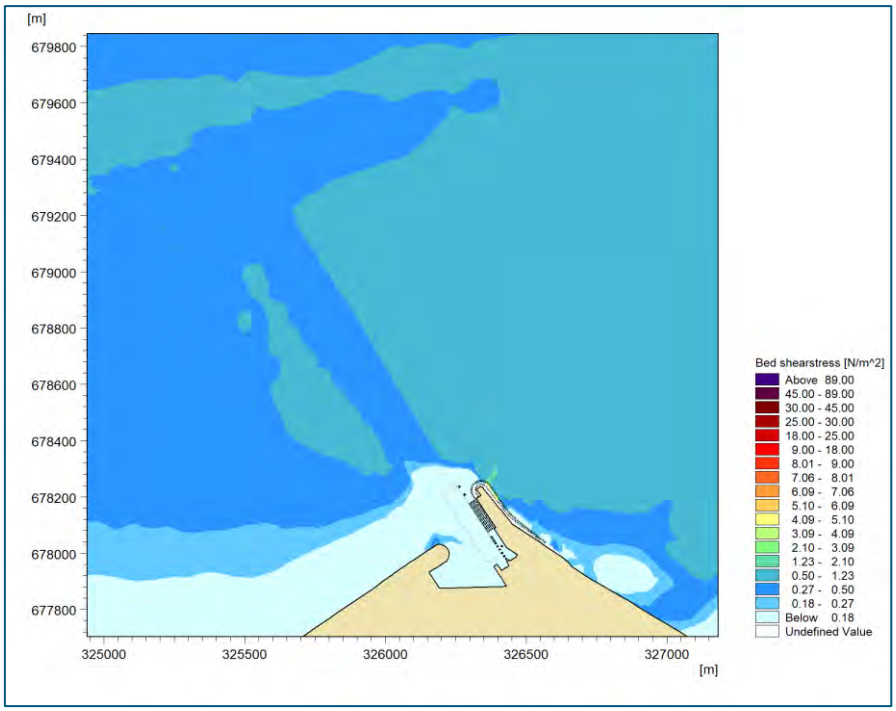



*Figure 4.1. Predicted spring tide peak flood bed shear stress for the existing layout*

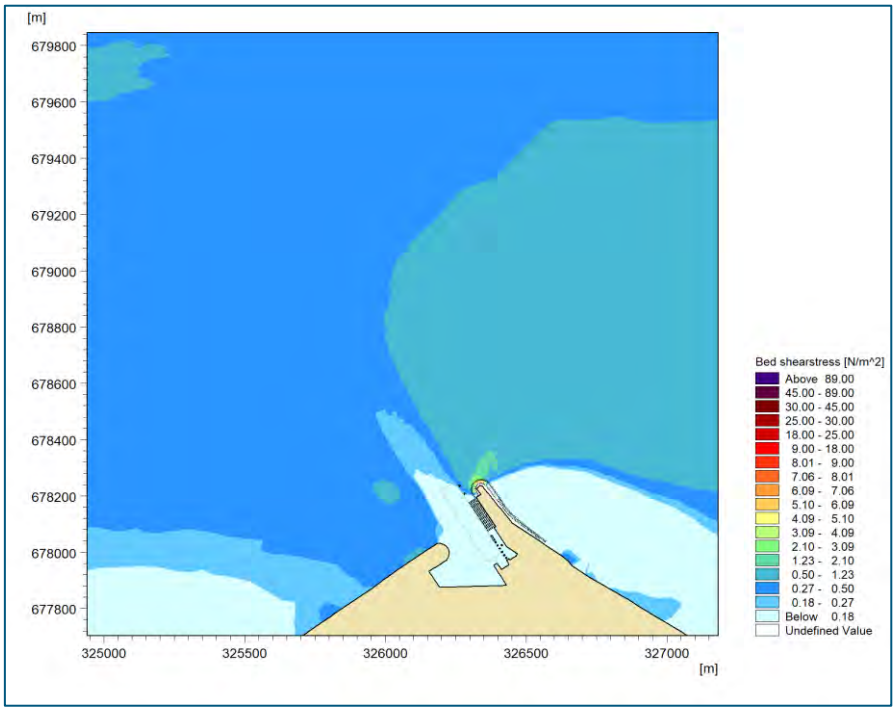



*Figure 4.2. Predicted spring tide peak ebb bed shear stress for the existing layout*

## 4.2 Bed Shear Stress Distribution for the Future Layout

For the future layout, the general distribution of predicted bed shear stress (for peak currents on both spring flood and spring ebb tides) is like the bed shear stress distribution for the existing layout (Figure 4.3 and Figure 4.4). The main change is the spatial extent of the bed shear stress magnitudes within the larger approach channel dimensions.

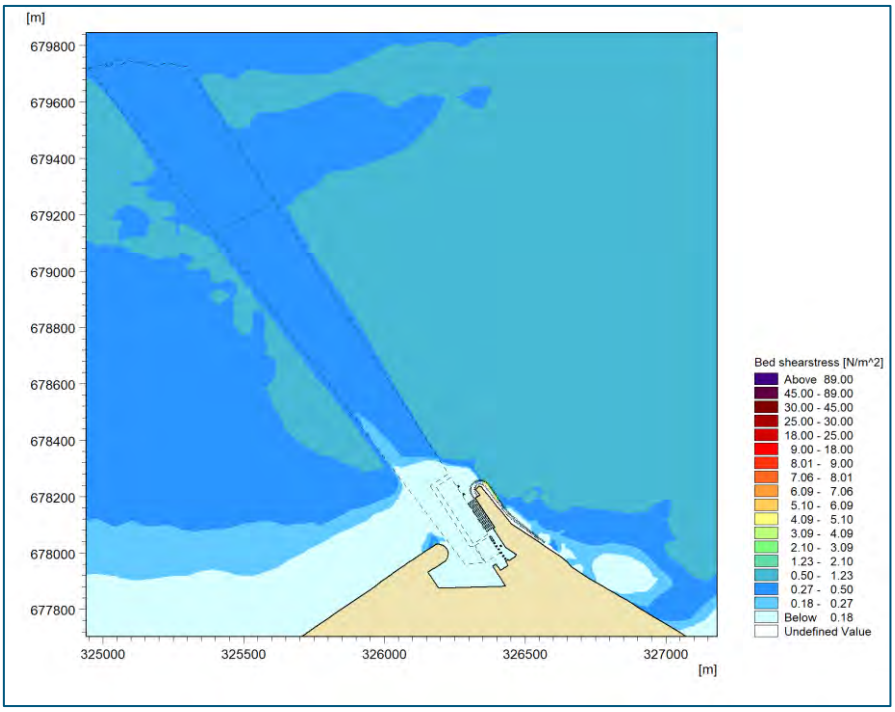



*Figure 4.3. Predicted spring tide peak flood bed shear stress for the future layout*

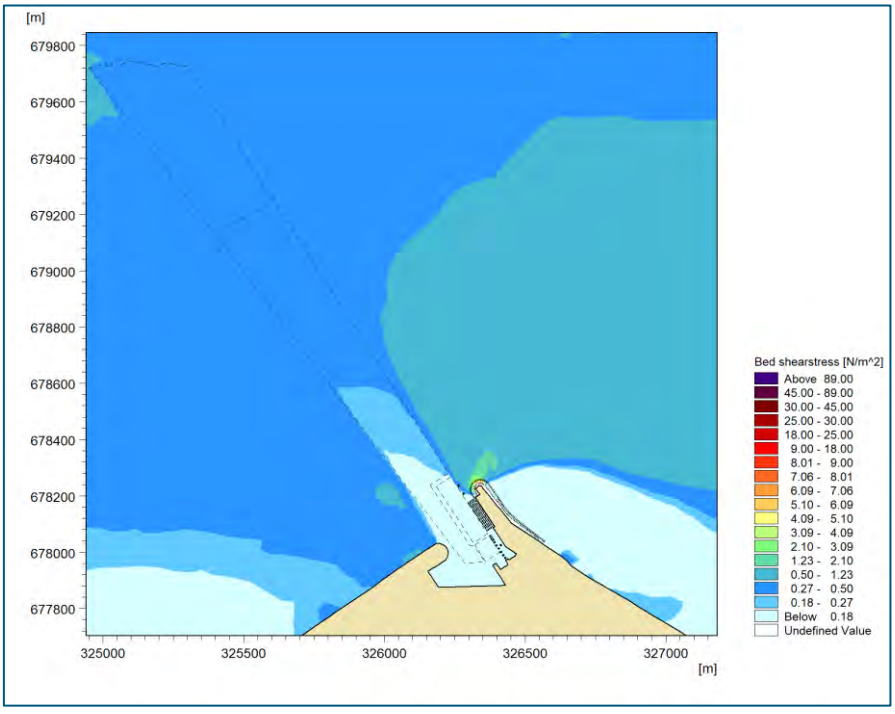



*Figure 4.4. Predicted spring tide peak ebb bed shear stress for the future layout*

## 4.3 Changes in Bed Shear Stress Distribution

The predicted differences in overall bed shear stress distribution between the existing layout and the future layout are reflected in predictions of how bed shear stress would change with dredging of the larger approach channel. Most of the changes are restricted to within the bounds of the future approach channel and are due to reductions in tidal current flows driven by the increase in overall dimensions of the channel. Smaller changes occur within the port basin and parts of the deeper berth pocket.

The dominant predicted change in bed shear stress is for a reduction across the entire future approach channel with minor areas of increase outside the channel (Figure 4.5 and Figure 4.6). For peak flows on both spring flood and ebb tides, the greatest reduction occurs along the west side of the inner channel (0.1N/m$^2$ to greater than 0.2N/m$^2$), mimicking the reduction in tidal current speeds in this area. Smaller reductions (0.025-0.1N/m$^2$) occur across the rest of the channel.

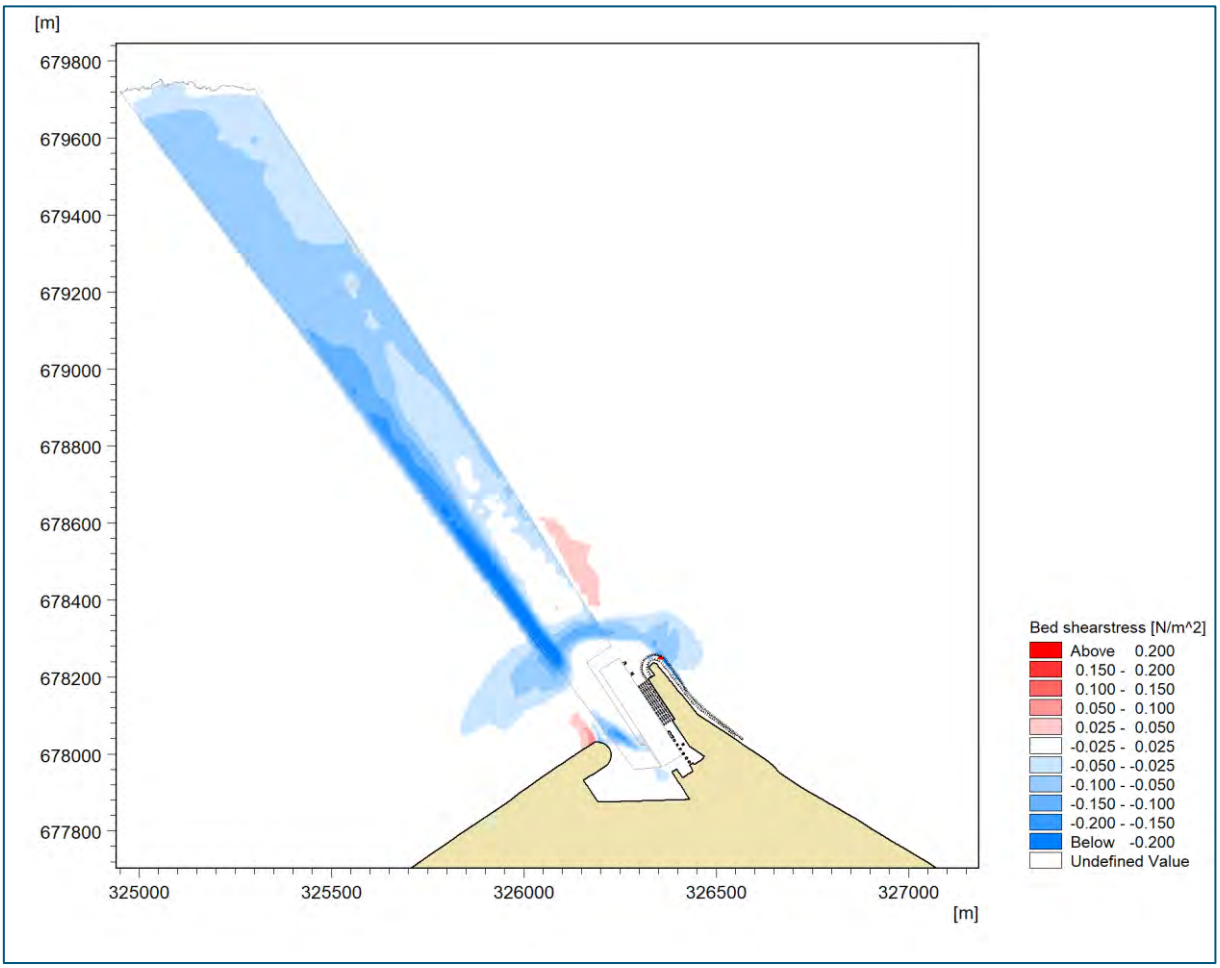



*Figure 4.5. Predicted change in bed shear stress for spring tide peak flood currents between the existing and future layout*

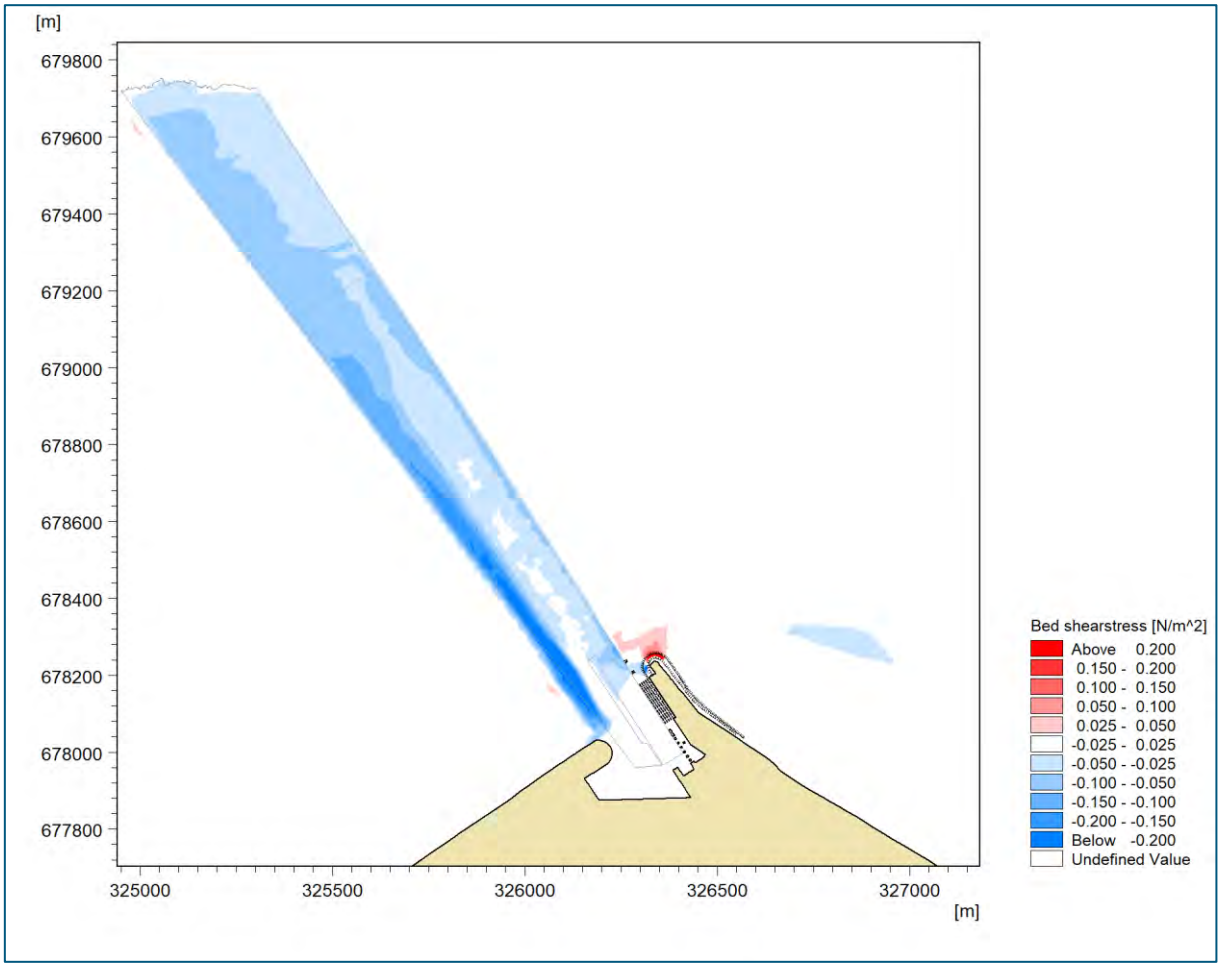



*Figure 4.6. Predicted change in bed shear stress for spring tide peak ebb currents between the existing and future layout*

# 5 Waves

The predominant waves approach the Port of Leith coast from the east to east-northeast sector (from the North Sea). These waves drive longshore sediment transport to the west. The waves are composed of two distinct components (HR Wallingford, 2007). These are short period waves generated by winds blowing across the Firth of Forth and longer period swell waves generated further offshore modified (reduced) by the sheltering effects of the adjacent coast and refraction as they propagate through the Firth of Forth.

HR Wallingford (2004) used hindcast wave data between 1987 and 2002 and showed that the largest incident wave conditions caused by wind are from the 45-75° offshore sector, which has long fetch lengths and one of the strongest wind speed sectors. For a one-summer (April to September) return period, the maximum significant wave height from this sector is 1.7m. The sectors either side (15-45° and 75-105°) have maximum significant wave heights of 1.3m and 1.4m, respectively. Swell waves approaching the site from the 30-120° degree sectors have significant wave heights of 0.6-0.9m for the one-summer return period. The combination of wind-wave and swell waves from the northeast results in maximum significant wave heights of 1.5-1.8m for the one-summer return period. Waves from the west have shorter fetches but higher wind speeds resulting in maximum significant wave heights of 1.3m for the one-summer return period. Waves from the north have a maximum significant wave height of 1.0m for the one-summer return period.

Using an extended hindcast dataset (1987-2006), HR Wallingford (2007) showed that the nearshore wave conditions are relatively benign with fewer than 0.1% of significant wave heights predicted to be greater than 2m. The larger waves (significant wave heights greater than 1.2m) had peak periods less than seven seconds. Longer period waves do penetrate the site, with peak periods as high as 17 seconds, but the longest waves (periods greater than 12 seconds) tend to be associated with relatively small waves (significant wave heights less than 0.6m).

FugroEMU (2013) collected wave data at Site 3 shown in Figure 5.1. General statements on wave conditions were provided. Maximum significant wave heights during calm conditions were less than 0.5m. Three periods of elevated wave heights were recorded, during which significant wave heights increased to up to 1m with maximums between 1.25m and 2.9m.

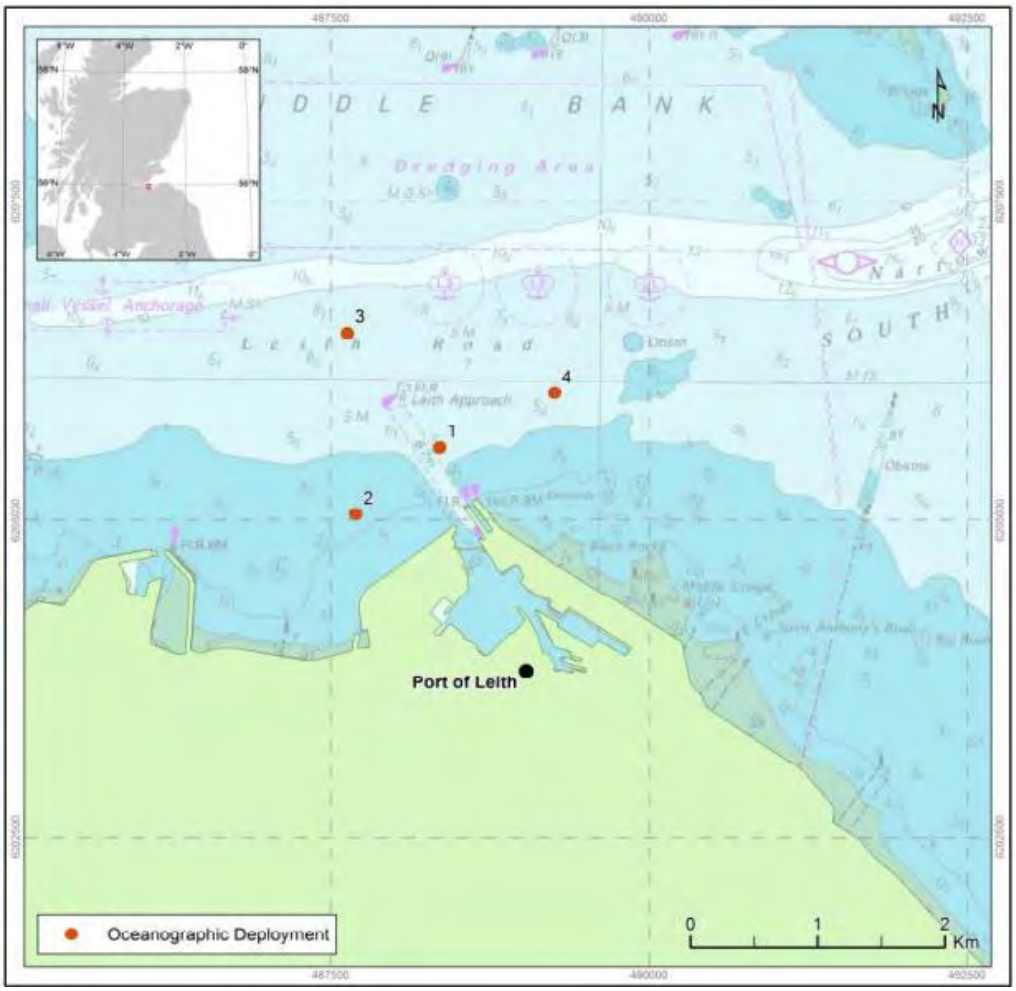



*Figure 5.1. Locations of acoustic current profiler deployments in 2012 (FugroEMU, 2013a)*

# 6 Implications for the Maintenance Dredging Requirement

## 6.1 Historic Dredge Volumes in the Approach Channel

The Port of Leith is licensed to dispose 250,000m$^3$ of dredged sediment annually in the Narrow Deep Channel, although actual volumes are much smaller. Forth Ports provided maintenance dredge volumes from the approach channel and from within the dock area between 2001 and 2021. Between 2001 and

2017, the recorded volumes were the combined dredging of the approach channel and inside the dock (Table 6.1), whereas between 2018 and 2021 the volumes are for the approach channel only (Table 6.2). Most of the deposition inside the dock was derived from supply from Water of Leith, whereas the sediment removed from the approach channel was supplied by marine/coastal sediment transport. The predominance of silty sand in the approach channel suggests that the deposition mechanism could be a combination of deposition from suspension in the water column and deposition by sediment transport processes along the bed. However, the proportion deposited by each mechanism is not known.

The annual combined (approach channel and inside the dock) volumes (2001 to 2017) range from 0 to 65,719m$^3$ with an average of 19,608m$^3$. The annual volumes dredged from the approach channel (2018 to 2020) range from 6,780m$^3$ to 28,342m$^3$ with an average of 19,197m$^3$. These volumes suggest that most of the sediment is removed from the approach channel with very small volumes from inside the dock. Hence, the longer-term average volume of maintenance dredging from the approach channel has been about 20,000m$^3$/year (but has been up to an annual maximum of 48,000m$^3$).

*Table 6.1. Annual maintenance dredge volumes from the approach channel and dock combined (data from Forth Ports)*

| Year | Volume (m$^3$) |
|---|---|
| 2001 | 65,719 |
| 2002 | 23,820 |
| 2003 | 21,689 |
| 2004 | 10,162 |
| 2005 | 0 |
| 2006 | 14,096 |
| 2007 | 3,173 |
| 2008 | 28,412 |
| 2009 | 28,241 |
| 2010 | 23,574 |
| 2011 | 21,597 |
| 2012 | 0 |
| 2013 | 0 |
| 2014 | 25,930 |
| 2015 | 18,966 |
| 2016 | 47,957 |
| 2017 | 0 |
| Average 2001-2017 | 19,608 |

*Table 6.2. Annual maintenance dredge volumes from the approach channel (data from Forth Ports)*

| Year | Volume ($m^3$) |
|---|---|
| 2018 | 22,468 |
| 2019 | 6,780 |
| 2020 | 28,342 |
| 2021 | 8,523 (to September) |
| Average 2018-2020 | 19,197 |

Upon completion of the consented Outer Berth works (the baseline for the proposed future layout), the maintenance dredge requirement for the entire channel is predicted in the Outer Berth EIA (Royal HaskoningDHV, 2022). to increase by 22%. This equates to an annual predicted baseline average volume of about 24,000$m^3$, up to a maximum of about 58,500$m^3$.

## 6.2 Potential Future Dredge Volumes in the Approach Channel

In the design for the port, the geometry of the existing coastal structures (eastern and western breakwaters) is not going to change. This means that the bedload transport rates will not be affected. However, the change in bathymetry induced by dredging 575,000$m^3$ of sediment to create a larger and deeper channel and berth pocket would increase the potential for deposition of sediment from suspension. It is likely that a larger approach channel would induce larger volumes of suspended sediment to accumulate in it, because it is providing more accommodation space for sediment to deposit (the channel acts as a larger sink for sediment).

The predicted tidal current velocities and bed shear stresses across the future channel layout are similar in magnitude to the tidal current velocities and bed shear stresses across the existing channel layout. The predicted reductions in both these processes across parts of the future channel described by Figure 3.5, Figure 3.6, Figure 4.5 and Figure 4.6 relate to the significant lowering of the existing channel seabed post dredging (particularly in the west channel). Hence, the magnitude of the drivers of sediment transport are similar but operate over a larger area of channel, increasing the potential for deposition.

The predicted baseline average maintenance dredging rate of 25,000$m^3$ (but potentially up to 59,000$m^3$) can be used as a proxy for the rate of sediment transport and deposition in the existing approach channel. This is used here in combination with the change in dimensions of the approach channel in the future layout to estimate what the future maintenance dredging requirement may be.

The removal of about 575,000$m^3$ of sediment means that the accommodation space in the future channel compared to the existing channel would increase by this volume. Using the bathymetries of the approach channel and the areas to either side of the channel (Figure 2.1), the existing accommodation space in the approach channel (excluding the berth pocket) is estimated to be 365,000$m^3$. According to Royal HaskoningDHV (2022), the existing accommodation space in the berth pocket (to -9.0m CD) is 54,000$m^3$. So, the total existing accommodation space across the approach channel and berth pocket is 419,000$m^3$.

The removal of 575,000$m^3$ of sediment means that the accommodation space would increase from about 419,000$m^3$ to about 994,000$m^3$ (419,000$m^3$ + 575,000$m^3$). This equates to an increase in accommodation space compared to the existing of about 137%. Using the baseline average maintenance dredging volume of 24,000$m^3$ and an increase in accommodation space of 137% means the estimated future average maintenance dredging requirement would be about 57,000$m^3$.

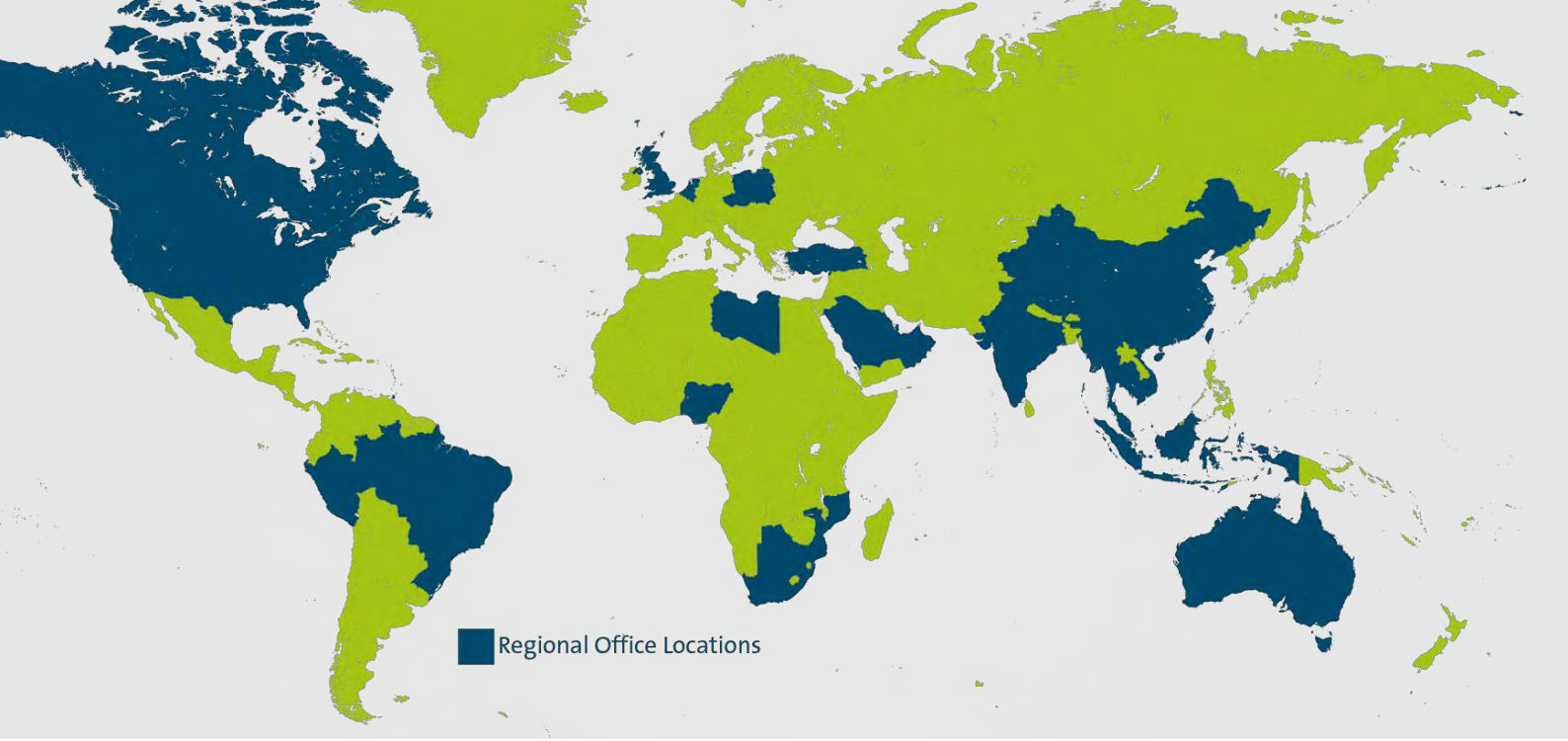
# 7 References

FugroEMU. 2013. Port of Leith Outer Berth Marine Ground Investigation – Oceanographic Survey. Report to Scottish Enterprise, March 2013.

HR Wallingford. 2004. Leith Docks Development Framework. Leith Harbour cruise linear terminal and coastal protection. HR Wallingford Report EX5023 to Forth Ports, September 2004.

HR Wallingford. 2007. Leith Docks Cruise Berth wave disturbance and operability assessment. HR Wallingford Report EX 5458 to Forth Ports, January 2007.

Royal HaskoningDHV. 2022. Outer Berth Environmental Impact Assessment.

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Backed by expertise and experience of 6,000 colleagues across the world, we work for public and private clients in over 140 countries. We understand the local context and deliver appropriate local solutions.

We focus on delivering added value for our clients while at the same time addressing the challenges that societies are facing. These include the growing world population and the consequences for towns and cities; the demand for clean drinking water, water security and water safety; pressures on traffic and transport; resource availability and demand for energy and waste issues facing industry.

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# Appendix 6-1

## Port of Leith Common Tern SPA Monitoring 2023

# Port of Leith Common Tern SPA Monitoring 2023

**Background**

Construction works on the over berth development commenced at the Port of Leith in spring 2023 under Marine Licence MS-00009818. A condition of this licence required the appointment of an environmental clerk of works (ECoW) to carry out monitoring of the common tern colony of the Imperial Dock Lock, Leith Special Protected Area (SPA). Monitoring was required between the 1st of May 2023 and the 30th of September 2023 inclusive whenever piling works were taking place.

Full licence text set out below:

*"The Licensee must avoid undertaking any piling works during the common tern breeding and post breeding seasons, 01 May to 31 September, inclusive. If piling is carried out between 01 May and 30 September, inclusive, the Licensee must appoint a suitably qualified and experienced Environmental Clerk of Works ("ECoW") prior to commencement of the piling activities. The ECoW must be onsite during piling and is responsible for monitoring any disturbance to the common tern colony of the Imperial Dock Lock, Leith* [*Special Protection Area* (SPA)]. *The ECoW must have authority to halt the piling activities if any disturbance of breeding common terns is observed and the Licensing Authority must be notified. The piling works can only re-commence with further written approval of the Licensing Authority. The ECoW must report to the Licensing Authority detailing monitoring and compliance with the Marine Licences on at least an annual basis".*

**Survey effort**

Monitoring by the ECoW team took place from Tuesday the 2nd of May (no works took place on the 1st of May) until Saturday the 30th of September 2023 inclusive for up to six days a week. Monitoring was carried out on every day that piling took place for the full duration of piling. Monitoring took place on 119 days over 22 weeks, and the average time on site each day was 9 hours 54 minutes.

Initially monitoring of the SPA took place from a single vantage point on Imperial Dock. After occupation of the SPA by common terns ceased on the 22nd of July, monitoring of this species continued in the wider port area from an additional seven vantage points (**Figure 1**).


*Figure 1 Vantage points used during common tern monitoring*

**SPA tern colony overview**

During the first week of monitoring, estimated adult tern numbers increased from 18 to 160 by the end of the week (maximum daily counts). Adult tern numbers peaked at 650 individuals on the 16th of May and remained above 500 until the week commencing 19th of July. The occupation of the SPA ended on about the 22nd of July and at this time the adult count in the wider port was 63. These figures are likely to be an underestimate of actual numbers because a proportion of terns would have been foraging at sea at the time of any count.

The first eggs on the SPA were observed on the 16th of May and the first chick on the 6th of June. The apparently occupied nest (AON) counts peaked at 276 during the week commencing 29th of May and declined to zero by the 22nd of July. Chick counts peaked at 123 during the week commencing 26th of June and declined to zero by the 22nd of July. The counts of AONs and chicks are likely to be an underestimate of actual numbers because of the presence of rubble and vegetation on the SPA obscuring sight-lines.

After occupation of the SPA ended, monitoring of common terns continued in the wider port from eight vantage points. Counts of terns (both adults and juveniles) included individuals seen foraging at sea viewed from the outer sea wall vantage point. Maximum daily counts peaked at 69 during the week commencing 24th of August and declined to 4 during the last week of monitoring. The count total is a combined figure of birds seen from the eight vantage points and there is likely to be some double counting.

On the 7th of August two new chicks were observed on the old wooden pier to the north-east of the distillery building. Both chicks had disappeared by the 15th of August.

**Disturbance monitoring**

A change in behaviour that coincided with an apparent visual or aural trigger was described as 'disturbance'. Levels of disturbance were categorised as low, medium and high. For reference, a fly-up /mass flush or panic that affected a significant proportion of the colony, but continued for only a short period of time, was considered medium disturbance.

In practice it was often difficult to determine cause and effect (between possible trigger and response) because of the high number of daily spontaneous fly-ups / mass panics, that had no apparent trigger. This spontaneous behaviour has been observed at other tern colonies and is considered normal.

**Disturbance from piling works**

Only two instances of disturbance were recorded that appeared to be triggered by piling activity. The first was observed two weeks into the piling programme on the 15th of May when frequent short-lived fly-ups of many terns, from the west end of the SPA, were observed during the first hour of drop hammer piling. The second was on the 19th of July when 50+ terns were observed carouseling over the west end of the SPA during use of the drop hammer. This was at the tail end of the occupation of the SPA by terns (occupation of the SPA ended by the 22nd of July).

These instances were not considered particularly significant in comparison to the more frequent fly-ups and mass flushes that were attributed to other causes.

After the occupation of the SPA ended, roosting and loafing birds were monitored in the wider port area for signs of disturbance from the piling works. No signs of disturbance were identified.

**Other disturbance**

Fly-ups and mass flushes, caused by nearby activities, were a regular occurrence. The apparent cause of this disturbance was from a variety of visual and aural sources including people and plant movements on nearby docks, vessel movements close to the SPA, noise from metalworking at Dales Marine and dust blowing across the SPA.

The other major cause of disturbance was caused by potential predator species, such as gulls and corvids. The intensity of predator activity, and the mobbing response, varied over the course of the survey period. In general, activity was highest when there were a high number of eggs and young chicks on the SPA.

**Avian flu**

Avian flu had a major impact on the colony during 2023. The first mortalities were identified on the 21st of June, and by the end of the week (the 24th of June) eight dead birds had been observed. The mortality rate peaked over the following two weeks and the running total of dead birds reached 211 adults and 62 juveniles by the 22nd of July when the SPA occupation ended. No further mortalities were identified during monitoring of birds in the wider port area. The mortality counts are likely to be an underestimate of actual mortalities because of birds dying away from the SPA and because of vegetation on the SPA obscuring sight-lines.

It was noted that scavenger species, such as starlings and carrion crows, were effective at carcass cleaning and removal. In particular, there were large flocks of starlings present on the SPA during the second and third weeks of July carrying out their cleaning work.