FORTH PORTS

Newhaven Harbour Maintenance Dredging Marine License Application

Best Practicable Environmental Option Report

10 August 2022

Project No: 0496046.02

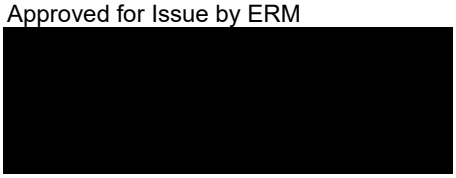
The business of sustainability

ERM

Document title	Newhaven Harbour Maintenance Dredging Marine License Application
Document subtitle	Best Practicable Environmental Option Report
Project No.	0496046.02
Date	10 August 2022
Version	1.2
Author	ERM
Client Name	Forth Ports Ltd

			ERM approval to issue		
Version	Revision	Author	Name	Date	Comments
Draft	00	ERM	Mark Irvine	01.02.2022	Client Review
Draft	01	ERM	Mark Irvine	04.02.2022	For submission
Draft	02	ERM	Mark Irvine	10.08.2022	Address Marine Scotland comment

Approved for Issue by ERM



Mark Irvine
Technical Director

Environmental Resources Management Limited
6th Floor
102 West Port
Edinburgh
EH3 9DN

© Copyright 2022 by ERM Worldwide Group Ltd and / or its affiliates ("ERM").
All rights reserved. No part of this work may be reproduced or transmitted in any form,
or by any means, without the prior written permission of ERM

CONTENTS

List of Tables

List of Figures

1. INTRODUCTION

1.1 Background

This report has been prepared by Environmental Resources Management Ltd (ERM) on behalf of Forth Ports Ltd (Forth Ports) in support of a Marine Licence application for disposal of dredged sediments at sea from maintenance dredging activities at Newhaven Harbour.

Under the *Marine (Scotland) Act 2010,* a Marine Licence issued by Marine Scotland is required for the deposit of substances or articles within waters adjacent to Scotland. Under Part 4, Section 27(2), Marine Scotland has an obligation to consider the availability of practical alternatives when considering applications involving disposal of material at sea. Applications for a Marine Licence to dispose of dredged spoil at sea require a Best Practicable Environmental Option (BPEO) (1) assessment, demonstrating that alternatives to sea disposal have been investigated and that sea disposal does not pose an unacceptable risk to the marine environment and other legitimate users. This report compares various options for the disposal of maintenance dredge material from Newhaven Harbour and identifies the (BPEO).

Marine Licences for maintenance dredging activities are currently valid in Scotland for up to three years (2). Forth Ports currently has a maintenance disposal licence (07021/19/0) to maintain a safe navigable depth which covers the period 5 November 2019 to 4 November 2022. This current application is to cover the period from November 2022 to November 2025.

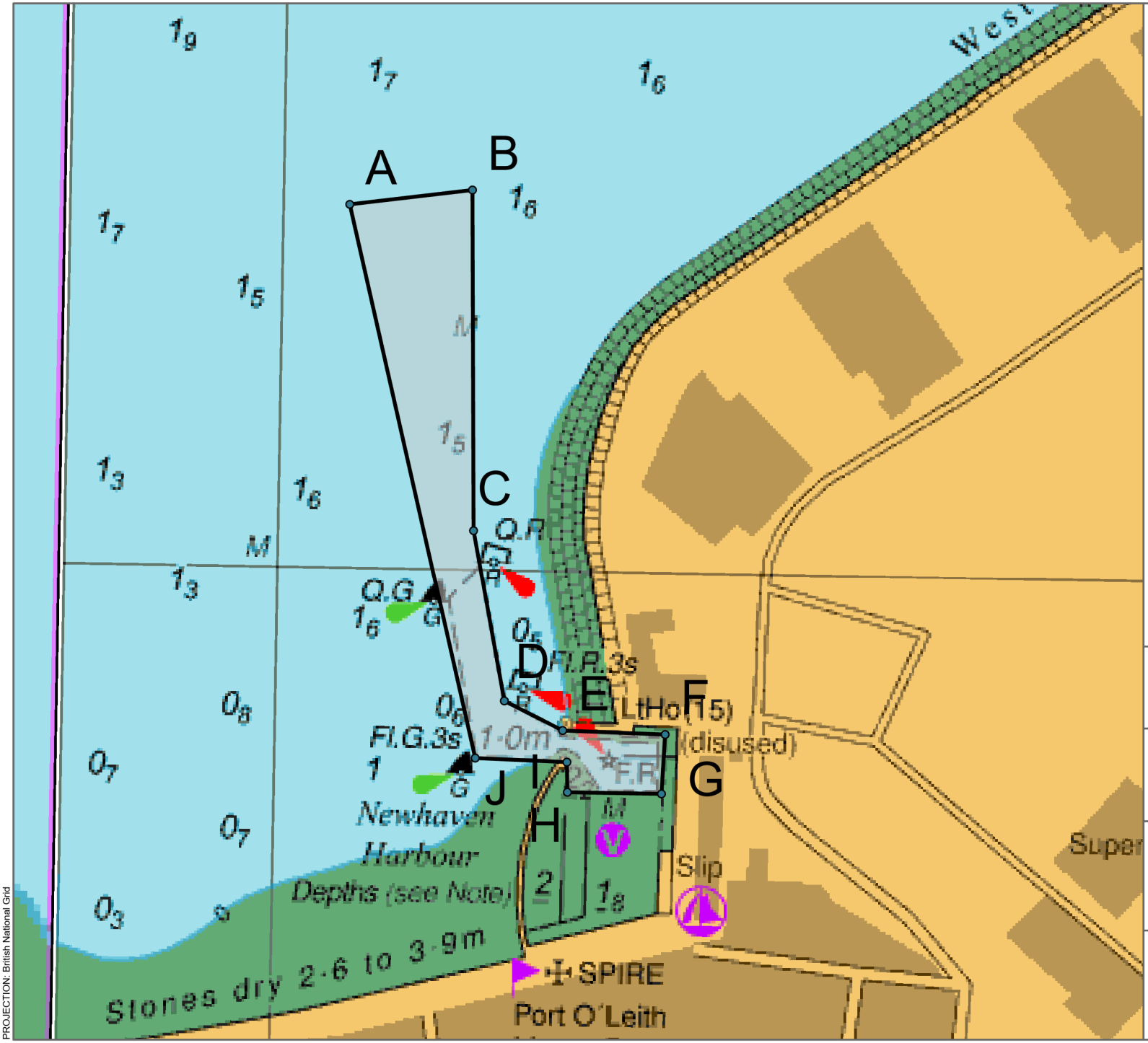
1.2 The Need for Dredging Spoil Disposal

Newhaven Harbour is located on the south bank of the Firth of Forth, in the north of Edinburgh, and has been owned by Forth Ports since 1967, and prior to that by its predecessor bodies. It is located between Leith and Granton harbours and is the smallest of the three. Figure 1.1 shows the proposed dredging area.

In 2015 Forth Ports Ltd undertook a capital dredge of the eastern side of Newhaven Harbour and the approach channel to allow the safe navigation of Newhaven Harbour by tenders from cruise liners. A berthing pontoon was also installed. The western half of Newhaven Harbour is currently leased to the Leith Motor Boat Club, who installed pontoons in 2013 to accommodate the boats resident there throughout the year. A single crab/lobster fishing vessel operates out of Newhaven Harbour five days a week throughout the year, with several others fishing for mackerel on a recreational basis (3). The entrance to the harbour is accessed by a 0.2 nautical mile approach with a maximum depth of 1.7 m below Chart Datum (CD).

Without the ability to accommodate these vessels, the economy of the local area would decrease and Newhaven Harbour would not be able to continue normal operations. Given Forth Port's statutory duty as the Harbour Authority to ensure safe navigation, there is an ongoing maintenance dredging requirement and the need for disposal of the dredged material, therefore the 'do nothing' option is not considered further in this BPEO. In line with Section 13 of Scotland's National Marine Plan (Marine Planning Policy Transport 4), the planned dredging operations will continue to maintain and support the sustainable development of activities at Newhaven Harbour.

(1) The term BPEO was derived by the Royal Commission on Environmental Pollution who described it as a procedure which "establishes, for a given set of objectives, the option that provides the most benefit or least damage to the environment as a whole, at an acceptable cost, in the long term as well as in the short-term.
(2) Marine (Scotland) Act 2010, Part 4 Marine Licencing. General Guidance for Applicants. Available online http://www.scotland.gov.uk/Resource/0043/00435338.pdf
(3) Leith Harbour Master, Ashley Nicholson, pers comm, February 2019



Newhaven Harbour Planned Dredging Area

POINT	LAT	LONG
A	55°59.145'N	3°11.952'W
B	55°59.152'N	3°11.865'W
C	55°59.016'N	3°11.860'W
D	55°58.948'N	3°11.836'W
E	55°58.937'N	3°11.794'W
F	55°58.936'N	3°11.721'W
G	55°58.912'N	3°11.723'W
H	55°58.912'N	3°11.790'W
I	55°58.924'N	3°11.791'W
J	55°58.925'N	3°11.856'W

0 0.1 0.2
Kilometres

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: HD
PROJECT: 0496046	CHECKED: MI
DATE: 14/01/2022	APPROVED: MI

Figure 1.1 - Newhaven Harbour Planned Dredging Area

ERM

PROJECTION: British National Grid

Path: Q:\Edinburgh\Projects\0496046 Forth Ports Ltd Newhaven BPEO 2019.MI\2022\GIS\MAPS\0496046 - Forth Ports Ltd.aprx\0496046 Figure 1

The harbour entrance lies west of Leith Sands and the action of the waves on the sediments, combined with turbulence created by the movement of tide against the breakwaters at Leith Docks, results in the transport of suspended sediments into Newhaven Harbour. There is no known sediment accretion as a result of the harbour breakwater to the west of the mouth of the harbour or elsewhere (1). Forth Ports proposes to remove up to approximately 15,000 m^3 of material per annum, with the volume of accreted sediments that require to be dredged each year depending on sedimentation rates which in turn are influence by weather conditions.

1.2.1 *Previous Dredge Spoil Disposal Activities*

Newhaven Harbour was used as a naval dockyard at the beginning of the 16th century, and comprised a harbour and a shipbuilding yard. By 1560 there were two piers built out from the shore, with the western pier inclining towards the eastern pier to create a narrow entrance to the harbour. It is understood that there was no dredging works undertaken at this time and the harbour was left to silt up and allow vessels to be beached and thus secured at low water (2).

Between 1572 and 1890, Newhaven Harbour was a major port for landing oysters and played a role in the whaling industry. In 1792, an Act was passed to improve the ferry service between Leith and Burntisland, which included improving access and berthing at Newhaven Harbour. It is considered that this is the earliest period during which maintenance dredging was undertaken at Newhaven Harbour. Under the Act, the sloping jetty was built and the height of the pier was raised (3), with the pier and breakwater competed by 1878 (4).

In 2015, ERM undertook a BPEO on behalf of Forth Ports to support the application for a capital dredge licence to Marine Scotland to dredge the eastern Harbour and approach channel to allow shuttle vessels from cruise liners moored in deeper waters in the Firth of Forth to safely land at Newhaven. Marine Scotland granted Forth Ports a Marine Licence for the capital dredge of up to 11,200 m^3 sediment in March 2015. The capital dredge took place between March and May 2015 and 10,705 m^3 spoil was disposed of at Oxcars disposal site, which was determined by the BPEO to be the best option for disposal.

In 2016 and 2019 Marine Licence applications were made to Marine Scotland for maintenance dredge licences to dredge the eastern harbour and approach, within the footprint of the previous capital dredge. Marine Scotland granted Forth Ports a licence to dredge up to 15,000 m^3 per year from 2017 to 2019 and then from 2020 to 2022) so that Forth Ports could continue to ensure the safe navigation of vessels into and out of the harbour throughout the tidal cycle.

As with the dredge spoil from the 2015 capital dredge and the ongoing maintenance dredging since 2017, it is proposed that the dredged material over the next licence period will be disposed of at sea at the licenced marine disposal site at Oxcars. Forth Ports has been using the Oxcars disposal site for the disposal of dredged material from a number of harbours in the Firth of Forth since 1905. It has also used by Forth Ports for the disposal of dredged material from Rosyth since 1996 (5). Port Edgar has also used Oxcars for capital and maintenance dredge spoil disposal since 2014, and some material arising from the construction of the Queensferry Crossing was also disposed of at Oxcars between 2011 and 2016.

(1) Bruce Pybus, Forth Ports pers comm, February 2019

(2) Graham, A (1971) 'Archaeological notes on some harbours in eastern Scotland', Proc Soc Antiq Scot, vol.101 Page(s): 256-7 fig. 7b Held at RCAHMS J.6.4.GRA

(3) Graham, A (1971) 'Archaeological notes on some harbours in eastern Scotland', Proc Soc Antiq Scot, vol.101 Page(s): 256-7 fig. 7b Held at RCAHMS J.6.4.GRA

(4) Hume, J R (1976) The industrial archaeology of Scotland, 1, Lowlands and Borders London Page(s): 189 Held at RCAHMS J.4.11.HUM

(5) When Forth Ports took over the management of the Port of Rosyth from the Ministry of Defence

1.3 Proposed Dredge Spoil Disposal Operations

To continue to allow vessels to berth alongside the pontoon jetty at Newhaven Harbour, Forth Ports requires to dredge the berthing area and approach channel to a depth of 1.0 m below CD. As with the previous maintenance dredging campaigns, the proposed dredging operations are normally undertaken over a four week period between February and the end of April, removing up to approximately 15,000 m^3 (up to 19,500 wet tonnes based on density of 1.3 (1)) each year for three years. Forth Ports, however, require to be able to dredge at any time of the year to deal with accreted sediments, for example due to storm induced sediment transport into the harbour or approach channel. The maintenance dredge is anticipated to be undertaken using a grab, backhoe and/or plough dredger. The boundary co-ordinates of the proposed dredge area shown in Figure 1.1 are presented in Table 1.1.

Table 1.1 Co-ordinates of Proposed Dredge Sites at Newhaven Harbour

Node	Latitude	Longitude
A	55.98336	-3.19759
B	55.98314	-3.19797
C	55.98204	-3.19764
D	55.98176	-3.19690
E	55.98210	-3.19656
F	55.98207	-3.19647
G	55.98200	-3.19656
H	55.98170	-3.19686
I	55.98167	-3.19539
J	55.98224	-3.19539
K	55.98223	-3.19589
L	55.98225	-3.19589
M	55.98226	-3.19658
N	55.98250	-3.19721

Coordinates in WGS84, UTM Zone 30N, decimal degrees

The boundary co-ordinates of the Oxcars disposal site shown in Figure 1.2 are presented in Table 1.2. The water depth within the Oxcars disposal site ranges from 2.1 m below CD at the centre of the site and increases to 13.7 m below CD towards the west of the site.

Table 1.2 Coordinates of Oxcars Disposal Site

Node	Latitude	Longitude
A	56° 01.34970696' N	003° 14.06050590' W
B	56° 00.82976472' N	003° 14.19020760' W
C	56° 00.89951853' N	003° 16.28962223' W
D	56° 00.89954454' N	003° 17.79008983' W
E	56° 01.19968387' N	003° 17.28997979' W
F	56° 01.19981056' N	003° 16.28986543' W

All coordinates in WGS84, UTM 30N, degrees and decimal minutes

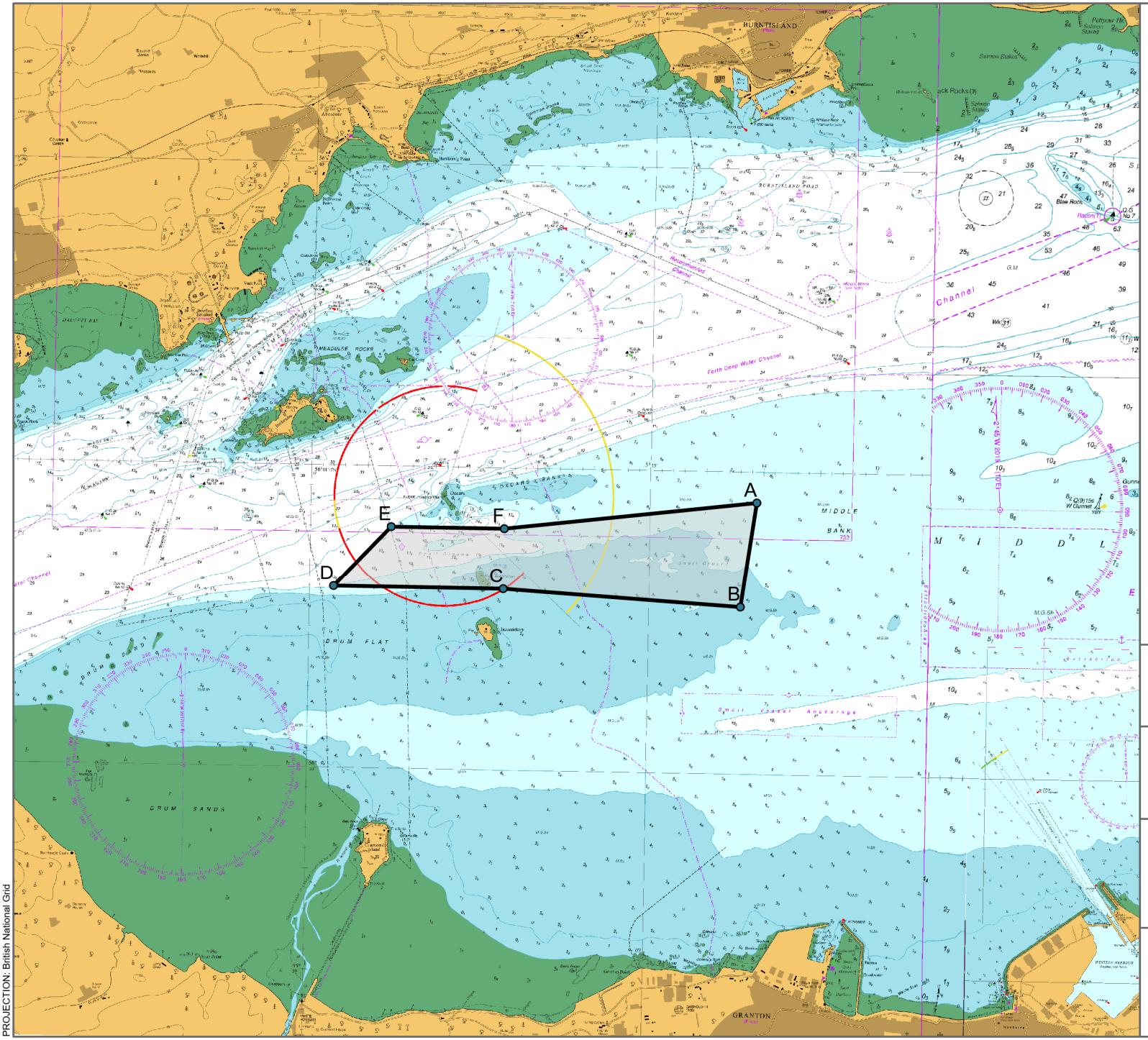
The volume of dredged material deposited at the Oxcars spoil disposal ground from Newhaven Harbour and approach channel from the 2015 capital works and ongoing maintenance works are shown in *Table 1.3*. Due to low levels of siltation during some years no or only small volumes of material were dredged, with higher volumes required in some years. The application volume is to cover years when larger volumes require to be dredged and disposed of due to high levels of sediment accretion.

(1) Conversion factor used by Forth Ports for maintenance dredge sediments from the Newhaven Harbour. Forth Ports pers comm January 2022.

Table 1.3 Volume of Dredge Spoil Disposal at Oxcars Disposal Ground (2015 to 2021)

Year	Quantity (m^3)
2015	10,705
2016	0
2017	3,560
2018	850
2019	400
2020	750
2021	1,280

Data source: Forth Ports November 2021



Oxcars Licenced Spoil Ground

POINT	Lat	Long
A	56° 01.350' N	3° 14.061' W
B	56° 00.830' N	3° 14.190' W
C	56° 00.900' N	3° 16.290' W
D	56° 00.900' N	3° 17.790' W
E	56° 01.200' N	3° 17.290' W
F	56° 01.200' N	3° 16.290' W

0 0.5 1 1.5 2
Kilometres

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: HD
PROJECT: 0496046	CHECKED: MI
DATE: 19/01/2022	APPROVED: MI

Figure 1.2 - Oxcars Licenced Spoil Ground

ERM

PROJECTION: British National Grid

Path: Q:\Edinburgh\Projects\0496046 Forth Ports Ltd Newhaven BPEO 2019.MI\2022\GIS\MAPS\0496046 - Forth Ports Ltd.aprx\0496046 Figure 1.2

1.4 Description of Sediment to be Dredged

In line with Marine Scotland guidelines on pre-dredge sampling protocol (1), a survey programme was undertaken on 1 December 2021 to sample the sediments within Newhaven Harbour and its approach.

A hand held van-Veen grab was used to take a surface sample from two stations within the harbour and one in the approach channel. Sediments were analysed for:

- sediment particle size distribution;
- the sediment water/solids content and density;
- presence of asbestos;
- a suite of metals (arsenic, cadmium, chromium, copper, mercury, nickel, lead, zinc);
- Tributyl Tin (TBT);
- Poly Chlorinated Biphenyls (PCB); and
- Polycyclic Aromatic Hydrocarbons (PAH).

The physico-chemical analysis is presented in *Appendix A.*

The sediment to be dredged from the channel and harbour is material deposited since the capital dredge was undertaken in 2015 and subsequent annual maintenance dredging has been undertaken. It mainly comprises mud, with smaller fractions of sand and some gravel (in the sample from the approach channel).

There are elevated concentrations above Marine Scotland Action Level 1(2) of some metals, TBT and PAHs in some of the samples within the dredge area. This is consistent with historic industrial discharges to the Firth of Forth and Forth Estuary. No samples recorded concentrations of contaminants above Marine Scotland Action Level 2.

Historic sediment analysis data from Oxcars disposal site is presented in *Appendix A.*

1.5 Scope of the Study

This report provides an appraisal of available disposal options and short-lists those that are considered to be practicable. Options are reviewed according to the Waste Hierarchy, as outlined in the European Waste Framework Directive (2008/98/EC) (3). The options on the short-list are then reviewed against strategic, environmental and cost considerations. The options are then compared and the BPEO identified.

The remainder of this report is structured as follows.

- *Section 2* describes the BPEO assessment method.
- *Section 3* describes each of the available disposal options and summarises their respective advantages and disadvantages and shortlists feasible options.
- *Section 4* compares the short-listed disposal options.
- *Section 5* identifies the BPEO.

Further supporting information is provided in the three Appendixes.

(1) Guidance for the sampling and analysis of sediment and dredged material to be submitted in support of applications for sea disposal of dredged material. Available online http://www.scotland.gov.uk/Resource/0044/00443832.pdf

(2) Action Levels for metals, PCBs, TBT and PAHs are used by Marine Scotland to assess the suitability for disposal of sediments at sea.

(3) Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098

- *Appendix A:* Sediment Sample Physical and Chemical Analysis Results.
- *Appendix B:* Environmental Impacts of Disposal Operations.
- *Appendix C:* Consultee Responses.

2. BPEO ASSESSMENT METHOD

2.1 Introduction

The BPEO study was undertaken using the following method.

- Identification of potential disposal options.
- Preliminary appraisal and short-listing of options based on practicability.
- Assessment of the short-listed options based on:
  - strategic considerations;
  - environmental considerations *ie* what the environmental impacts would be; and
  - cost, in terms of capital and maintenance/operating costs.
- Comparison of the relative merits and performance of the options and identification of the BPEO.

Information was obtained through literature review and consultation with the following consultees.

- City of Edinburgh Council;
- Forth District Salmon Fisheries Board (FDSFD);
- Marine Scotland;
- Maritime and Coastguard Agency (MCA).
- NatureScot (NS);
- Northern Lighthouse Board (NLB);
- Scottish Environment Protection Agency (SEPA); and
- Crown Estate Scotland.

2.2 Identification of Options

The following seven potential treatment/disposal options for the dredged material were identified:

- beach nourishment;
- coastal reclamation and construction fill;
- spreading on agricultural land;
- sacrificial landfill;
- incineration;
- other disposal options and reuse; and
- sea disposal.

2.3 Preliminary Appraisal

A preliminary appraisal of each of the options identified above was undertaken, including an assessment of the practicability of each option with regard to availability of disposal sites. Following the preliminary appraisal those options that are considered to be practicable were short-listed for further consideration.

2.4 Assessment of Options

The relative performance of the short-listed options were then assessed against the following criteria.

2.4.1 *Strategic Considerations*

Strategic considerations included the following.

- Operational feasibility - whether the option is technically practicable.
- Availability of sites/facilities - whether there are any sites or facilities that can take the dredge spoil.
- Security of option - whether Forth Ports will have control over all stages of the disposal.
- Established practice - whether technologies and techniques proposed are established and therefore whether the performance and potential difficulties of the technologies and techniques can be anticipated.
- Likely public acceptability - whether the public are likely to object to or support the proposals.
- Likely agency acceptability - whether public agencies are likely to have any major concerns when consulted on the Marine Licence application.
- Legislative implications - assessing compliance with relevant legislation and the potential management control required.

2.4.2 *Health, Safety and Environmental Considerations*

The factors used to assess the health, safety and environmental performance of the options are summarised below.

- Public health. Assessing whether there would be any risk of a detrimental effect on public health, based on predicted pathways and receptors.
- Safety. Considering potential sources of hazard and probability that there would be any risk to the general public or workers.
- Contamination/Pollution. Evaluating whether there is potential for contamination or pollution that could result in failure to meet Water Framework Directive (WFD) objectives and associated Environmental Quality Standards (EQSs: the amount or concentration of a substance that should not be exceeded in an environmental system). Contamination is defined as the presence of an unwanted constituent in the natural environment whilst pollution is the introduction of contaminants into the natural environment that causes adverse change.
- Ecological impact. Assessing the significance of any potential impact on important habitats or species, including designed sites.
- Interference with other legitimate users. Considering whether there are likely to be impacts on other activities, such as other users of the Firth of Forth, local ports or roads.
- Amenity/aesthetic. Assessing whether there is likely to be a visual, olfactory or noise impact resulting from the disposal or any impact on local amenity.

2.4.3 *Cost Considerations*

Cost of disposing of dredged material was considered in terms of the following.

- Capital costs (site costs, construction and equipment hire /purchase costs).
- Operational/maintenance costs (transport costs, disposal costs including site operation).

2.5 Comparison of Options

The performance of each option was evaluated on a scale from Low to High according to definitions presented in Table 2.1. Intermediate grades (Low to Medium and Medium to High) were also used

where the assessment was marginal between Low, Medium or High. The results of the assessment process are presented in *Section 3* and *Section 4.*

Table 2.1 Definitions of Performance

Consideration	High	Medium	Low
Strategic Considerations			
Operational Feasibility	Practical, easy to operate and achievable as process is robust and established. Low number of stages and each stage easy to control.	Some practical difficulties. Moderate number of stages with some difficulties.	Major practical difficulties. Large number of steps with some major difficulties.
Availability of Sites/Facilities	Suitable site/facility available within 1 km of the port by road and 10 km by sea.	Suitable site/facility available within 10 km of the port by road and 20 km by sea.	No suitable sites/facilities within the vicinity (over 10 km by road and 20 km by sea).
Security of option	In complete operational control of Forth Ports.	Is mainly in control of Forth Ports with some outside involvement for which there are alternative sources of supply.	Has elements that are out of Forth Ports control for which there are no practical alternative sources of supply.
Established Practice	Technology and techniques are clearly established with no foreseeable significant problems.	Technology and techniques have been tested but not applied to dredge material.	Technologies and techniques are untested and unforeseen problems are likely.
General Public Acceptability	Likely to be generally acceptable to the public based on reaction to similar developments.	Unlikely to provoke a strong negative or positive reaction based on reaction to similar developments.	Likely to provoke a strong negative reaction based on reaction to similar operations.
Likely Agency Acceptability	Likely to be generally acceptable to statutory bodies after consultation.	Statutory bodies may have some concerns that may be overcome through further consultation.	Statutory bodies may have major concerns that may not be overcome through consultation.
Legislative Implications	Would easily comply with legislation with a low level of management and physical control.	Requires some control/intervention to achieve compliance.	Requires a high level of management control and intervention to achieve compliance.
Health, Safety and Environmental Considerations			
Safety	No significant risk to workers and the general public.	Low risk to workers and the general public which is easily controlled.	Moderate to high risk to workers and general public.
Public Health	Will not cause workers or public to be exposed to substances potentially hazardous to health.	May cause some low level intermittent exposure to substances potentially hazardous to health.	Risk of exposing workers and general public to substances potentially hazardous to health.
Pollution/Contamination	Compliant with emission standards and water quality objectives. Low risk of harm from substances released to environment.	Environmental quality standards may be approached or breached occasionally. Some risk of harm to environment.	Environmental quality standards may be breached regularly and there is a moderate or high risk of harm to environment.

Consideration	High	Medium	Low
Ecological Impact	Priority species and habitats under the UK Biodiversity Framework (1) and qualifying features and species under the *Habitats Regulations, 2019* (2) will not be affected.	Priority species and habitats under the UK Biodiversity Framework and qualifying features and species under the *Habitats Regulations, 2019* may be slightly affected.	Priority species and habitats under the UK Biodiversity Framework and qualifying features and species under the *Habitats Regulations 2019*, are likely to be significantly affected.
Interference with other Legitimate Activities	Little potential for interference with other activities.	Some potential for interference with other activities.	High potential for interference with other activities.
Amenity/Aesthetic	No significant impact on local amenity or aesthetic qualities.	Potential for impacts of moderate significance on local amenity or aesthetic qualities.	Potential for impacts of high significance on local amenity or aesthetic qualities.
Cost			
Capital and operational	£1m or less.	Between £1m and £2.5m.	More than £2.5m.

(1). JNCC and Defra (on behalf of the Four Countries' Biodiversity Group). 2012. UK Post-2010 Biodiversity Framework. July 2012. Available from: http://jncc.defra.gov.uk/page-6189.

(2) The *Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations, 2019* apply to European sites (formerly Special Protection Areas and Special Areas of Conservation).

3. PRELIMINARY ASSESSMENT OF AVAILABLE DISPOSAL OPTIONS

3.1 Introduction

This section describes the identified disposal options and makes a preliminary assessment of each based on overall practicality. There are a number of steps that are common to some of the land-based options and these are described in *Section 3.2* to avoid repetition. The section concludes by identifying those options that are short-listed for further consideration in the BPEO process.

The seven identified disposal options are:

- beach nourishment;
- coastal reclamation;
- spreading on agricultural land;
- sacrificial landfill;
- incineration;
- other disposal options and reuse; and
- disposal at sea.

3.2 Common Steps to Land-Based Disposal Options

The disposal options that have land-based components include:

- beach nourishment (if material transported by road);
- coastal reclamation and construction fill (if material transported by road);
- spreading on agricultural land;
- sacrificial landfill;
- incineration; and
- other disposal options and reuse (such as brick making/concrete aggregate/topsoil production).

The steps that are common to the land-based disposal options are:

- landing the dredge material;
- storage of dredge material;
- dewatering the dredge material; and
- loading and transport for disposal.

These steps are described below along with some discussion of the practicalities of undertaking these steps at Newhaven Harbour.

3.2.1 *Landing the Dredged Material*

All of the land based options require transport to on-shore facilities. This could be via a pumped discharge, conveyor or grab. As Forth Ports does not have suitable landing facilities at Newhaven, or elsewhere within the Firth of Forth area, a new coastal landing facility would be required to enable the materials to be off-loaded.

3.2.2 *Storage of Dredged Material*

Once the dredged material has been landed, it will require storage prior to onward transport for final disposal. A storage facility may therefore require construction at the site, capable of retaining the dredged material and associated run-off and dust.

3.2.3 *Dewatering the Dredged Material*

The land disposal options require dewatering of the dredged material either to make transport more feasible or to create a material which is suitable for disposal to land or incineration *ie*, disposal of a more solid sludge rather than a liquid.

There are three approaches that are typically used for drying marine sediments: construction of settling lagoons, use of a mobile centrifuge unit and filter press as described below.

Settling Lagoons

Settling lagoons are likely to be large, ring-dammed structures into which the dredged material would be offloaded. These could be built within the intertidal area or on land. The material would be piled up in the lagoon and the water drained out under gravity. The lagoons would have a drainage system to collect the water and watery sludge from the dredged material for further treatment (usually by hydrocyclone, see below) or to be transported offsite for disposal. The lagoons must be of sufficient size to contain the dredged material prior to transport. They must also be accessible by road and must have facilities to load the dredged material into tankers or sealed heavy goods vehicles (HGVs) for movement to the disposal/treatment centre. To minimise the distance the wet dredge material has to be transported from the dredger they must be located near the quayside.

Setting up settling lagoons would require assessment to ensure that any leachate from them would not contaminate groundwater and a licence would be required from SEPA under the *Water Environment (Controlled Activities) Regulations* (2011). Forth Ports advise that the potential to be able to find appropriate space to create settling lagoons close to the port is considered to be very low.

As some samples of the material analysed contains metals, TBT and PAHs above Marine Scotland Action Level 1 (see *Appendix A*) it might be additionally necessary to construct the lagoons with special liners to retain the contaminants and consider treatment of the supernatant water draining out of the lagoons.

Centrifuge or Hydrocyclone System

The use of a centrifuge or hydrocyclone system to dewater the material to a level suitable for disposal to landfill (approximately 10% water content) may be required, depending on the final water content of the recovered material. One mobile unit system was reported as being capable of treating up to 150 $m^3\,hr^{-1}$ depending on unit size and material solids content. Other systems may be available that can process material at different rates, however, for the purposes of this assessment a rate of 150 $m^3\,hr^{-1}$ has been used. If material can be dried at a rate of 150 $m^3\,hr^{-1}$, to dewater a total volume of approximately 15,000 m^3 would require approximately 100 hours (5 days assuming working 24 hours a day, seven days a week, or approximately 13 standard working days). Other units with lower throughputs could take longer (1).

Filter Press

A filter press is a tool used to separate solids and liquids using the principle of pressure. The press is filled with the spoil, building up pressure before the spoil is strained through filter cloths by force. The remaining dried spoil can then be removed from the filter press and taken away for disposal. Processing rates would be similar to that of a centrifuge

(1) Maximum throughput of 120 m^3hr^{-1} http://www.euroby.com/services/mobilecontract-dewatering-units/

3.2.4 *Loading and Transport for Disposal*

A loading facility would be required adjacent to the storage or dewatering area to load the material into covered HGVs for transport to treatment/disposal sites. The required infrastructure would include hard standing to allow a fleet of HGVs to be loaded by mechanical excavators. Although limited hard standing is available at the quayside at Newhaven Harbour, there are currently no storage or dewatering sites adjacent to the possible loading area and no space to build any.

Assuming the materials can be dried to a water content of 10% (by volume) at Newhaven Harbour quayside, the estimated 13,500 m^3 of dried materials per annum would require transport for disposal, either to an incinerator, to agricultural land, to landfill or to a reclamation project. The length of journey required would depend on the location of the deposit/incineration sites.

A volume of 13,500 m^3 of dried (to 10% water content) material equates to approximately 17,550 tonnes (1). Assuming 20 tonne capacity sealed HGVs are used, this would equate to 878 return trips or 1,756 vehicle movements per annum.

The significance of the number of movements will be dependent upon the distance to the disposal/treatment site and the existing volume of HGVs on the haulage routes. The access road to Newhaven Harbour exits onto the trunk road network where the HGV count is recorded as 87,235 per year (2019 data (2)). The additional HGV movements as a result of the dredging operations would increase this current level by approximately 2% per year. There may also be an issue with regard to increase in HGV traffic flows if minor roads are used to reach disposal/treatment sites.

3.2.5 *Disposal/Treatment Issues*

Neither method of the drying process (*eg* lagoons or centrifuge) is likely to reduce the concentration of metals, TBT, PAHs and salt present within the dredged material. This will restrict disposal and reuse options and as the material has elevated levels of some contaminants, pre-treatment may be required prior to disposal on land.

Where an option involves disposal on land there is an issue of classification of the dredged material. Once the material has been removed from the harbour for disposal on land it will be classed as waste. The waste then requires disposal at a licensed waste management facility and to be transported by a registered waste carrier. In the waste hierarchy set out in the *Waste Management Licensing (Scotland) Regulations, 2011*, dredged spoil is coded as 17 05 05 (Mirror Hazardous) or 17 05 06 (Mirror Non-hazardous), depending on the concentrations of particular contaminants. If landfill is identified as the disposal route for this waste then further analysis may be required to ensure that the material meets the Waste Acceptance Criteria for hazardous landfill.

The saline nature of the sediment also restricts its application on land, as without going through a washing process it will not be able to support any form of terrestrial flora growth.

3.3 Beach Nourishment

3.3.1 *Process Description*

Beach nourishment involves the disposal of the dredged material on a beach directly from the dredging vessel or, if dewatering was required, the spoil would be brought ashore and dewatered prior to transport or placement on the beach using earth moving plant.

3.3.2 *Suitable Sites for Beach Nourishment*

Beach nourishment requires materials of a similar composition to the existing beach materials and usually involves clean sand or gravel. The sediment from within the proposed dredge area comprises fine material (mainly mud with smaller fractions of sand and some gravel). An oil contamination

(1) Based on a density of 1.3 tonnes per m^3 of dredge spoil (Forth Ports pers comm January 2022).

(2) 2020 data has reduced counts due to influence of Covid-19 restrictions

incident at Limekilns near Rosyth in February 2019 resulted in the removal of circa 500 tonnes of sand and gravel from the beach area. However, the sediment from Newhaven Harbour is not suitable for beach recharge due to the particle size distribution and the presence of contaminants such as metals, TBT and PAHs.

Given the incompatibility of the fine sediment material with sandy beach sediments at the potential receiving site, the contaminant concentrations in the material to be dredged and the conservation status of the Firth of Forth and Forth Estuary, beach nourishment is not likely to be a feasible option.

3.4 Coastal Reclamation and Construction Fill

3.4.1 *Process Description*

This section considers the use of the dredged material in coastal reclamation projects or as fill material inland. Depending on the potential site, reclamation or fill could involve landing, storage, dewatering, transport and possibly desalination. Coastal use directly from the dredging vessel would be preferable as this would involve pumping or spraying the material directly from the dredger or barge to the site where it was needed and would avoid handling and transporting the material on land.

3.4.2 *Suitable Sites for Reclamation*

Forth Ports, Marine Scotland and Edinburgh City Council are the most likely bodies to be responsible for or aware of reclamation projects in the Forth. No sites for coastal reclamation have been identified through the consultation process as requiring any of the dredged material at a time that fits with the dredging programme. In addition, the dredged material would not be suitable for many reclamation sites due to the low compressive strength properties of fine sediments. The spoil could be pumped into bunded lagoons at the edge of the Firth of Forth to create land that could be used for development, agricultural or similar purposes. The majority of the intertidal area falls within the Firth of Forth Site of Special Scientific Interest (SSSI) and Outer Firth of Forth and St Andrews Bay Complex Special Protection Area (SPA). The SPA is a large estuarine/marine site consisting of the two adjacent Firths of Forth and Tay. NS has previously expressed the view on similar BPEO assessments that further loss of intertidal habitats is not considered a realistic option.

3.4.3 *Construction Material*

Use as fill in inland construction projects would not be appropriate because of low compressive strength properties of fine sediments and the need for landing, drying and transport of the dredged material. If landing, drying and transport were feasible then it may be that the material could be used for quarry/landfill capping. However, the presence of metals, TBT and PAHs in the dredged material and its high salt content make this option unattractive.

3.5 Spreading on Agricultural Land

3.5.1 *Process Description*

SEPA has previously confirmed that the disposal or recycling of marine dredged material on agricultural land does not fall within the exemptions under Paragraph 7 of Schedule 1 of the *Waste Management Licensing (Scotland) Regulations, 2011*, and the activity would therefore require to be licensed. Planning permission may also be required from the local authority. In support of the application to dispose of the dredged material to agricultural land, evidence that the material would not cause pollution of the environment or harm to human health would need to be provided.

The disposal of marine spoil to agricultural land would involve landing, dewatering, storage, desalination and transport for disposal. Dewatering the dredged material in lagoons, centrifugal drier or filter press would remove some of the salt; however it is likely that the desalination would still be required. Desalination could be achieved by placing the spoil in lagoons, layering it with sharp sand, spraying water over the material and allowing leaching of the salt back into the Firth of Forth.

Approximately 200,000 tonnes of sludge are recycled to agricultural land per annum across Scotland [1]. Forth Ports are seeking to dispose of approximately 13,500 m^3 of dewatered material (approximately 17,550 tonnes at 1.3 tonnes m^{-3}) of dried material equating to approximately 8.8% of the current volume of annually recycled sludge in Scotland. As the material from Newhaven has a low organic carbon content (an average of approximately 5% from the sediment sample analysis) spreading dredged material from Newhaven on agricultural land is not considered a practicable option. In addition, the material sampled at Newhaven has contamination from some metals, TBT and PAHs above Action Level 1.

3.6 Sacrificial Landfill

3.6.1 *Process Description*

The type of landfill site which can take the spoil is dependent upon the classification of the waste. As discussed in Section 3.2.5 above it is understood that the waste would likely be classified as hazardous or non-hazardous rather than inert and therefore a suitably licensed landfill site with sufficient capacity is required.

3.6.2 *Available Landfill Sites*

Subsequent to implementation of the *Landfill Allowance Scheme (Scotland) Regulations* 2005 and re-evaluation of landfill licences, there is currently one site within an hour's drive from Newhaven Harbour with the facilities to accept the material. This is Avondale Landfill at Polmont, approximately 35 km west of Newhaven Harbour. Previous consultation with the operators confirmed that the site cannot accommodate the dredged material due to the composition, and volume not fitting with their site operations. The Avondale site could consider taking some dredged material if the availability coincided with the closure of one or all of the phases within the plant.

3.6.3 Taxes and Royalties

The material will be exempt from landfill tax under the terms of the *Landfill Tax (Scotland) Act 2014* issued by the Scottish Government that specifies that dredged material from any inland waters, including harbours and their approaches, are not subject to landfill tax.

As Crown Estate Scotland owns part of the seabed in the Firth of Forth, royalties may be due to be paid by Forth Ports or the receiving party. The requirement and value of Royalties would require to be subject of discussions between Forth Ports and Crown Estate Scotland and are not known at this point. Costs are based on disposing of the maximum volume of dredged material being applied for in this Marine Licence; in this case, 15,000 m^3.

3.7 Incineration

3.7.1 *Process Description*

Incineration would involve landing the dredged material, dewatering, possibly storing it and transporting it to either an existing incinerator or a newly constructed incinerator. The ash would then require disposal. Options for disposal of ash include landfill, reclamation and spreading on agricultural land.

The organic content of the dredged material is assumed to be around 5% (based on the 2021 samples which had an average percentage of organic carbon of 5.1% and range of 4.87 to 5.41%) and therefore there is only a small combustible component within the material. It is anticipated that incineration would result in a reduction in volume of the dried spoil by only 15% *ie,* 5% organics plus 10% water content. Incinerator operators generally require material to have an organic content above

[1] https://www.gov.scot/publications/review-storage-spreading-sewage-sludge-land-scotland-sludge-review-final/

20% to ensure efficient combustion and would most likely reject material with an organic content below this threshold (1).

A further consideration is that the material to be dredged contains some metals, TBT and PAHs above Action Level 1. Following incineration the leaching potential of metals would be reduced, however, the ash would still be contaminated. Pre-treatment is likely to be required for the removal of metals. Emissions to atmosphere from the incineration processes would also require to be controlled by SEPA under the *Environmental Protection Act 1990.*

3.7.2 *Available Incinerator Sites*

There are no appropriate waste incinerators in Scotland that could accept the dredged material. The nearest incinerator is at Ellesmere Port, Merseyside (approximately 388 km south) and transport would be costly and is unlikely to be practicable.

3.8 Other Disposal Options and Reuse

The other disposal options are re-injection into the tidal flats via a pipeline and reuse in brick making, concrete aggregate or top soil production processes.

3.8.1 *Re-injection*

Re-injection would require the construction of a pipeline to take the dredged material to a high tide point on the Cramond tidal flats (the closest to Newhaven) and injecting it at velocity back into the mudflats. The advantage of re-injection of dredged material into nearby sedimentary areas this is that it effectively returns the sediment to its source. In addition to the high costs associated with the construction and operation of the pipeline, a disadvantage is that the re-injection at velocity would be likely to have an adverse impact on the protected mudflat habitat through disturbance and erosion and may affect the ornithological interest of the mudflats.

3.8.2 *Brick Making/Concrete Aggregate/Topsoil Production*

There are processes by which marine sediments can be made into bricks or can be used to form concrete aggregate. The advantage is that the materials can be beneficially used and metals are sealed into the bricks or aggregate, although there are issues with the salt content for brick making and concrete construction material.

Almost no agricultural species can grow in salty soils and very few in brackish soils. The salinity of the dredged sediment would require to be reduced naturally by rainwater or by a dewatering process before consideration for use as topsoil. The best topsoil is a mixture of sand, silt, clay and organic matter and must be clean for use in the production of food crops (2).

3.9 Disposal to Sea

3.9.1 *Process Description*

Disposal at sea involves the dredge material being transported to a licensed marine spoil ground in a dredging vessel. Disposal to sea is the normal practice for disposal of dredged spoil from Newhaven and from other ports and harbours in the Forth Estuary and Firth of Forth. This approach takes place at sea and does not require the landing of any materials. It involves the dredger sailing to a licenced spoil ground and releasing the materials through bottom doors or by lowering the excavator head into the water. For the current dredger, bottom door disposal is used.

There are seven licenced marine spoil grounds in the Forth Estuary and Firth of Forth; Bo'ness, Oxcars, Blae Rock, Kirkcaldy, Methil and two sites designated at Narrow Deep. For the dredging

(1) Baldovie Waste to Energy Plant, pers comm, January 2014

(2) Permanent International Association of Navigation Congresses. Permanent Technical Committee II. Working Group 19. 1992. Beneficial Uses of Dredged Material, Issue 19.

operations at Newhaven, Forth Ports would propose to use the Oxcars spoil ground located 2.1 nautical miles northwest of Newhaven Harbour. This site has historically been used for the disposal of dredged material from Newhaven and is the closest site to the harbour, thus minimising the distance for vessel transport.

Forth Ports proposes to use a backhoe, grab and plough to dredge the harbour and approach channel, depositing the material at the Oxcars disposal site. The time required for one cycle (dredging - travelling - discharging - travelling) is approximately two hours. Newhaven Harbour is tidal, and as such dredging operations will be restricted to the hours around high tide. A differential global positioning system (dGPS) would be used to position the vessel in the disposal area and records of the spoil discharge locations would be retained.

The baseline environmental conditions and potential environmental impacts at the spoil ground are described in *Appendix B*.

3.10 Conclusion

The description of the available options allows options that are evidently impracticable to be ruled out, for example due to the nature of the dredged material. This is summarised in Table 3.1. The assessment of the short-listed options taken forward for further consideration is presented in *Section 4.*

Table 3.1 Short-listing of Options

Option	Assessment	Result
Beach Nourishment	This option does not appear to be practicable. The material is not suited to beach nourishment in the Firth of Forth and there are no beaches within the Firth of Forth or Forth estuary that require nourishment with this grade of material.	Discard
Coastal Reclamation and Construction Fill	This option may be practical. The salt content, poor load bearing properties and the potential concentration of contaminants limits the available options for reuse of the dredged material.	Short-list
Spreading on Agricultural Land	This option does not appear to be practicable. The material is not desirable for disposal on agricultural land due to potentially containing concentrations of contaminants and having a low organic content. Furthermore, desalination, storage, dewatering and transport of this material are impractical. Disposal on agricultural land would require a Waste Management Licence and evidence that there would be no harm to human health.	Discard
Sacrificial Landfill	This option is practicable and there is one local site. There are a large number of steps involved in storage, dewatering and transport. Landfill site operators may be unwilling to accept the material due to the sediment composition.	Short-list
Incineration	This option does not appear to be practicable. The material is not suited to incineration due to low organic content and large volume of spoil involved. If incinerated, volume would only slightly reduce and there are no available incinerators in Scotland that could take this amount of material.	Discard
Other Uses	This option may be practicable in the form of brick making, concrete aggregate and top soil production.	Short-list
Disposal at Sea	This option is practicable and has been the BPEO for the previous dredging campaigns at Newhaven Harbour.	Short-list

4. ASSESSMENT OF SHORT-LISTED DISPOSAL OPTIONS

4.1 INTRODUCTION

This section presents an assessment of each option against the assessment definitions of performance listed in Table 2.1. The environmental effects of disposal at sea are addressed in *Appendix B.*

4.2 COASTAL RECLAMATION AND CONSTRUCTION FILL

4.2.1 *Strategic Considerations*

Operational Feasibility

The reuse of the dredged material for reclamation will involve either direct pumping from the dredger into the disposal site or drying the material and desalination for disposal on land. This option would be achievable if disposal sites were available adjacent to the Firth of Forth.

Classification: Low to Medium

Availability of Sites

No coastal sites within the Firth of Forth requiring this grade of material for reclamation or construction fill have been identified by Forth Ports, consultees or in the latest Dynamic Coast – National Coastal Change Assessment (2017) [(1)].

Classification: Low

Security of Option

No sites have been identified as belonging to Forth Ports, so disposal to reclamation sites is out with their control and could present practical problems, such as scheduling in sediment delivery with proposed dredging programme.

Classification: Low

Established Practice

The use of suitable dredged materials, such as marine aggregates, in coastal reclamation and construction fill is common practice and the technologies and techniques to move such material are well established. However, the use of maintenance dredge spoil for such activities is not common.

Classification: Low to Medium

General Public Acceptability

Use of the dredged material for reclamation or construction fill is likely to be acceptable to the general. There may be some concerns regarding the contamination levels in the dredge spoil and the volume of material to be transported by HGVs for reasons relating to air quality and proximity to residential areas. Transport by sea is likely to be viewed as more favourable than transport by land.

Classification: Medium

Likely Agency Acceptability

Use of the dredged material for reclamation or construction fill is likely to be acceptable to public agencies. There may be some concerns regarding the contamination levels in the dredge spoil with respect to the future use of any reclaimed areas, and the volume of material to be transported by HGVs for reasons relating to air quality and proximity to residential areas.

Classification: Medium to High

(1) Fitton, J.M., Rennie, A.F., and Hansom, J.D. (2017) Dynamic Coast - National Coastal Change Assessment: Cell 2 - Fife Ness to Cairnbulg Point, CRW2014/2

Legislative Implications

The disposal of dredged material from Newhaven directly from the dredger to a reclamation site requires a Marine Licence from Marine Scotland under Section 20(1) of the Marine (Scotland) Act 2010.

Once the material has been removed from Newhaven Harbour for disposal on land it will be classed as waste under the *Waste Management Licensing (Scotland) Regulations, 2011* and the disposal will therefore require a waste management licence and an exemption for reclamation works. As well as a Marine Licence for the construction works, consent will be required from the planning authority and a levy paid to the Crown Estate Scotland.

Classification: Medium to High

4.2.2 *Health, Safety and Environmental Considerations*

Public Health

Slight risks to public health are anticipated due to intermittent increase in HGV traffic.

Classification: Medium to High

Safety

Pumping the dredged material ashore has risks associated with operational activities, all of which have mitigation measures in place. Should the dredged material be transported by HGV, there may be an increase in safety risks associated with the movement of materials for disposal, particularly if tankers/sealed HGVs travel through populated areas and along minor roads.

Classification: Medium to High

Pollution / Contamination

The material may be classified as hazardous or non-hazardous (*i.e*. not inert) due to the concentration of contaminants with respect to land based disposal, however, further analysis would be required to confirm this and run-off and leaching would need to be controlled. There may be localised and temporary deterioration in air quality as a result of HGV movements.

Classification: Medium

Ecological Impacts

There are unlikely to be any ecological risks resulting from the use of dredged materials for reclamation, assuming any contaminants are contained within the site and there would be no significant impact on national or local priority species or habitats. If the site was to be used for terrestrial habitat creation then the salt levels would limit plant growth.

Classification: Medium to High

Interference with Other Legitimate Activities

The disposal of dredged material is unlikely to interfere with other activities unless the reclamation site is in a port area, in which case the dredger may interfere with other port users, or if the area to be reclaimed was used for recreation. If HGVs are used to transport the dredged material, they may affect other road users.

Classification: Medium to High

Amenity/Aesthetic

If the dredged material is disposed of directly from the dredger there are low risks to amenities/aesthetics. If disposed of by HGV, landing, storage and transport may result in an impact to both amenities and aesthetics of the area.

Classification: Medium to High

4.2.3 *Cost Considerations*

If the dredged material was pumped directly ashore there would be no further capital costs. The estimated operational costs below would apply:

- Dredging costs and pumping material to site – approximately £300,000 dredging cost plus £131,250 pumping costs (£8.75 per m^3 (1) for 15,000 m^3).

Total: £0.43 m.

Classification: High

If the dredged material was landed, treated and then transported by road, the estimated capital and operational costs below would apply:

- a discharge berth for the dredger with a storage facility - £3.5 m;
- lagoons to settle dredged material and possibly desalinate - £2.5 m; or
- dockside centrifuge facility capable of dewatering and desalinating 15,000 m^3 of silt per annum - £20 m;
- operational costs for the operation of the dredger - £300,000 per annum; and
- loading and transport (sealed HGVs) – assuming the disposal site is less than one hour drive away and based on one HGV transporting 20 tonnes material at a cost of cost of £200/load(2): £175,500.

Total: £6.48 m to £23.98 m

Classification: Low

4.3 Sacrificial Landfill

4.3.1 *Strategic Considerations*

Operational Feasibility

Disposal to landfill would require the landing, storage and drying of the dredged materials prior to transporting to a landfill facility. Approximately 17,550 tonnes of dried material would require transport. This option has practical difficulties relating to drying the dredged material and transport of material to a landfill site.

Classification: Low to Medium

Availability of Sites / Facilities

The nearest suitable site is located at Avondale Landfill, Polmont, approximately 35 km from Newhaven Harbour, however as discussed above, due to the dredged sediment composition and volume, Avondale would be unable to receive any of the material. In addition, the timing of receipt of material would need to fit in with its operational requirements when closing exiting landfill cells (3).

Under the *Landfill (Scotland) Regulations, 2003* the presence of contaminants will classify the material as *non-hazardous* rather than *inert* and consequently reduces the number of available landfill sites capable of accepting this material.

Classification: Low

(1) Based on previous consultation with contractors.
(2) Estimated cost based on consultation with HGV operator at £50/hour and estimated time for travel and loading/unloading time giving 4 hours per two-way trip.
(3) Avondale pers comm, February 2016.

Security of Option

Whilst Forth Ports have control over the dredging operations, it would have no control over the continued availability of landfill space for the material or the disposal route.

Classification: Low

Established Practice

Dredged material is sometimes disposed of to landfill for small one-off dredging operations, however it is not established practice to routinely dispose of dredged material in this way. Landfill sites require the dredged material to be dried to 10% water content before acceptance. It is unlikely that this is a practice that would be acceptable if there are other viable alternatives.

Classification: Low to Medium

General Public Acceptability

Disposal of the material to landfill is likely to be acceptable to the general public. However, the transport of the dredged material from Newhaven Harbour to potential landfill sites may be unacceptable to residents and other road users.

Classification: Medium

Likely Agency Acceptability

Scotland's Zero Waste Plan (2010) establishes the direction of the Scottish Executive's policies for sustainable waste management. One such policy is to reduce landfilling of waste to 5% of all wastes by 2025 and as such there may be objection to dredged material routinely requiring space in landfill. Disposal to nearby landfill sites is likely to be acceptable to SEPA provided the materials are regarded as suitable for landfill, however, the acceptability would depend on the quantities to be disposed of and further assessment and classification of hazardous substances.

Classification: Medium

Legislative Implications

The material would be controlled waste material for the purposes of transport, storage and disposal. As such, Section 34(7) of *The Environmental Protection Act* 1990 and Regulation 6 of the *Pollution Prevention and Control (Scotland) Regulations* 2012 will apply and compliance is likely to be possible. The disposal of the material will also require a waste management licence under *Waste Management Licensing (Scotland) Regulations* 2011.

Classification: Medium to High

4.3.2 *Health, Safety and Environmental Consideration*

Public Health

No risks to public health are anticipated due to the short-term increase in HGV traffic.

Classification: Medium to High

Safety

There may be an increase in safety risks associated with the movement of materials for disposal, particularly if there are 2,430 tankers/sealed HGVs movements through populated areas and along minor roads each year.

Classification: Medium to High

Pollution/Contamination

There may be a small risk of leaching of contaminants being disposed of in landfill, however, these should be contained on site.

Classification: Medium to High

Ecological Impacts

Although there is a small risk of contaminants leaching out from the dredged material, this would be at very low concentrations and is unlikely to cause significant harm to the local ecology. The salt content in the material may prevent plant growth unless covered in a topsoil.

Classification: Medium to High.

Interference with Other Legitimate Activities

The increase in HGV movements may interfere with other road users. Baseline traffic data for the A901 in the vicinity of Newhaven Harbour indicates that in 2019 HGVs made up an average of 1.57% of all traffic(1) . As a result of the proposed disposal to landfill, the total HGV movements would increase to an average of 2.8% of all traffic in the vicinity of Newhaven. However over an 8 week period on dredging and disposal activities the increase in HGV movement would be approximately 18% compared to the average annual HGV movements in this area. Depending on the landing and storage arrangements there may be potential for interference with other harbour and road users.

Classification: Medium

Amenity/Aesthetic

The movement of HGVs through the area will have an impact on local amenity through noise, vibration, visual impacts and road congestion. This risk also applies to the disposal site.

Classification: Medium

4.3.3 *Cost Considerations*

Capital would be required to purchase new equipment. Estimates of the capital and operational costs are:

- a discharge berth for the dredger with a storage facility - £3.5 m;
- lagoons to settle dredged material and possibly desalinate - £2.5 m; or
- dockside centrifuge facility capable of dewatering and desalinating 15,000 m^3 of silt per annum - £20 m;
- operational costs for the operation of the dredger - £300,000 per annum; and
- loading and transport (sealed HGVs) – assuming the disposal site is less than one hour drive away and based on one HGV transporting 20 tonnes material at a cost of cost of £200/load(2): £175,500.

Total: £6.48 m to £23.98 m

Classification: Low

4.4 OTHER DISPOSAL OPTIONS AND REUSE

4.4.1 *Strategic Considerations*

Operational Feasibility

Reuse for brick making, concrete aggregate or topsoil production would require the landing, storage and drying of the dredged materials prior to transporting to a landfill facility. Approximately 17,550 tonnes of dried material would require transport. There are practical difficulties relating to handling

(1) Average annual daily counts obtained from https://roadtraffic.dft.gov.uk/local-authorities/29. Accessed 14 January 2022.
(2) Estimated cost based on consultation with HGV operator at £50/hour and estimated time for travel and loading/unloading time giving 4 hours per two-way trip.

the dredged material at the Newhaven site. The availability of suitable factories/facilities to process the dredged material and markets for the final products are also considerations.

Classification: Low to Medium

Availability of Sites/Facilities

There are no known sites or facilities to receive the dredged material for other uses such as topsoil production, brick making or other construction materials.

Classification: Low

Security of Option

Although Forth Ports would have control over the dredging and landing, they would not have control over the continued acceptance of the materials for making bricks or aggregate.

Classification: Low to Medium

Established Practice

Use of excavated materials for brick making or concrete aggregate is common practice but use of marine dredged spoil is not and it is generally not feasible due to the level of salinity and the composition of the material. Whilst topsoil has been made from dredged material in the past it is not common practice.

Classification: Low to Medium

General Public Acceptability

Making bricks, concrete or topsoil is likely to be publicly acceptable depending on the end use. However, the transport of the material over a large distance may not be acceptable to residents and other road users.

Classification: Medium to High

Likely Agency Acceptability

It is likely that brick making, concrete production and topsoil production would be acceptable to agencies and considered a positive activity. However, the contaminant levels in the samples would make using the material for topsoil unattractive.

Classification: Medium to High

Legislative Implications

SEPA would control emissions from brick making factories under the provisions of the *Environmental Protection Act* 1990. A waste management licence would also be required for their transport and storage under the *Waste Management Licensing (Scotland) Regulations* 2011.

Classification: Medium

4.4.2 *Health, Safety and Environmental Considerations*

Public Health

Slight risks to public health are anticipated due to the short-term increase in HGV traffic.

Classification: Medium to High

Safety

There are unlikely to be any significant safety risks associated with making bricks, concrete or topsoil with the exception that there may be an increase in safety risks associated use of plant and manual handling of materials as well as the movement of materials, particularly if HGVs travel through settlements and along minor roads.

Classification: Medium

Pollution / Contamination

The contaminant levels in the dredged material would make using the material for topsoil unattractive. Pollution from plant emissions is not likely to be an issue provided emissions are controlled in accordance with licences.

Classification: Medium to High

Ecological Impacts

Making bricks or concrete should have no adverse ecological effects, provided the materials were decontaminated and desalinated before use.

Classification: High

Interference with Other Legitimate Activities

There is a slight risk that movement of the material would impact other road users.

Classification: Medium to High

Amenity/Aesthetic

The only impacts on amenity are likely to stem from the impact of HGVs from transporting the material (up to 2430 HGV movements per annum).

Classification: Medium to High

4.4.3 *Cost Considerations*

Capital would be required to purchase new equipment. Estimates of the capital and operational costs are:

- a discharge berth for the dredger with a storage facility - £3.5 m;
- lagoons to settle dredged material and possibly desalinate - £2.5 m; or
- dockside centrifuge facility capable of dewatering and desalinating 15,000 m^3 of silt per annum - £20 m;
- operational costs for the operation of the dredger - £300,000 per annum; and
- loading and transport (sealed HGVs) – assuming the disposal site is less than one hour drive away and based on one HGV transporting 20 tonnes material at a cost of cost of £200/load(1): £175,500.

Total - £6.48 m to £23.98 m

Classification: Low

4.5 SEA DISPOSAL

4.5.1 *Strategic Considerations*

Operational Feasibility

Operationally disposal at the Oxcars site is comparatively simple as it does not require the landing, storage and drying of the spoil and all the necessary procedures are understood. This option has proven practicable during spoil disposal from the Newhaven Harbour since 2015 and for other dredging activities within the Firth of Forth.

Classification: High

(1) Estimated cost based on consultation with HGV operator at £50/hour and estimated time for travel and loading/unloading time giving 4 hours per two-way trip.

Availability of Sites / Facilities

The sites/facilities which are required for the sea disposal option are those which are already used at the Oxcars disposal site. No other disposal sites have been indicated by Forth Ports as available at this time for the Newhaven dredged material.

Classification: High

Security of Option

Forth Ports will have full control over all stages in the dredging and disposal process assuming they receive a disposal licence.

Classification: Medium to High

Established Practice

Disposal at sea at Oxcars disposal site is the current established practice for the disposal of dredged spoil from Newhaven Harbour.

Classification: High

General Public Acceptability

Forth Ports has confirmed that similar disposal operations from other docks and harbours in the Firth of Forth and Forth Estuary have not attracted any appreciable comment. Dredging operations are unlikely to affect members of the general public, with the possible exception of some recreational users when the vessel is transiting to and from the disposal site.

Classification: High

Likely Agency Acceptability

Consultations with the regulatory bodies to date indicate that there is no objection to Sea Disposal at Oxcars (comments made by consultees are provided in Appendix C).

Forth District Salmon Fishery Board (FDSFB) did not respond to the consultation, however, it previously highlighted concerns surrounding time of year of disposal clashing with migrating smolts and requested that disposal was avoided during June and July. Due to the operational requirements at Newhaven to maintain the navigation channel at all times of the year and the small magnitude of potential effects of disposal operations to migrating salmonids, Forth Ports does not consider that this request is justified. This issue is addressed in *Appendix B*.

Classification: Medium to High

Legislative Implications

A Marine Licence will be required from Marine Scotland and provided that the BPEO is satisfactory, and the statutory consultees do not object, it is established practice that a Marine Licence will be issued. Compliance should not therefore demand significant management control. Permission will be required from Crown Estate Scotland for disposal of spoil to Crown Estate Scotland owned sea bed.

Classification: Medium to High

4.5.2 *Health, Safety and Environmental Considerations*

Public Health

The risk of members of the general public being exposed to contamination from the dredged material deposited at Oxcars is considered to be low. Commercial species of demersal fish are not taken from the disposal area so no direct food chain links between the disposal site, fish and human consumers leading to impacts on public health are considered likely.

Classification: Medium to High

Safety

The operations are undertaken at sea, therefore members of the public are not likely to be exposed to risk from the disposal activities. Forth Ports will have oversight of the dredging contractor's operations.

Classification: High

Pollution/Contamination

The effects on water quality of the disposal operations and the potential for impacts on sediment contamination may cause the occasional exceedance of Environmental Quality Standards, although based on current evidence this would be localised and short-term. The identification and assessment of environmental impacts of dredged material are presented in *Appendix B* and follow the guidance provided in Best (2106) [(1)].

Classification: Medium

Ecological Impacts

The disposal operations may affect the benthic fauna in proximity to the disposal site due to sediment drifting from the disposal area itself. It is anticipated that there will not be any significant impact on the Forth marine ecosystem as a whole given the scale and duration of effects of continued disposal at this site which has been operational for over 30 years. There may be some localised and short-term effects such as displacement on migrating fish due to increased suspended sediments caused by the discharge of dredged material into the water column but these impacts are not predicted to prevent migration, cause mortalities or affect the viability of fish populations. Under the proposed disposal proposals, cumulative impacts with other operations are not predicted to create a significant impact to the Firth of Forth SSSI, SPAs or SACs farther afield or marine ecosystems.

The ecological impacts of disposal of dredged material to sea is addressed in *Appendix B.*

Classification: Medium to High.

Interference with Other Legitimate Activities

There are currently approximately 38 boats moored in Newhaven Harbour during the summer months, taking it almost to capacity. During the winter this number drops to approximately 20 as some boats are taken out of the water to dry dock. There is a commercial fishing vessel operating out of the harbour most days of the week, with a number of smaller vessels taking out weekend anglers. The disposal activities may cause some disruption to other users of the Firth of Forth, however as the operations will only be occurring for a limited period of time it is not anticipated that there will be any significant interference. In addition, historic operations at Oxcars have not resulted in any reported disruption to other Firth of Forth users.

Classification: High

Amenity/Aesthetic

The disposal activities may cause some short-term disruption to other users of the Firth of Forth but the proposals will contribute to the normal functioning of Newhaven Harbour and maintain its capacity to accommodate cruise ship tenders and other vessels.

Classification: Medium to High

4.5.3 *Cost Considerations*

There would be no capital required to purchase new equipment. Operational costs for the operation of the dredger are approximately £300,000 per annum, depending on dredging volume requirements.

Classification: High

(1) Best, M (2016). Clearing the Waters for All: WFD guidance for developers and regulators in estuarine and coastal waters. Environment Agency.

5. SUMMARY OF THE BPEO

5.1 INTRODUCTION

This section summarises the assessment of options against the criteria described in Chapter 2: Table 2.1 and identifies the BPEO.

5.2 COMPARISON OF OPTIONS

Seven options were initially considered for the disposal of the dredged spoil from Newhaven Harbour. These were reduced to a short-list of four options, based on operational and technical feasibility. A summary of the key considerations with regard to each of the four short-listed options is provided below and illustrated in Table 5.1.

5.2.1 *Coastal Reclamation and Construction Fill*

Operationally, coastal reclamation and construction fill would be possible. The process would be expensive and would involve a number of contractors to undertake the transition from vessel to bunded lagoons and drying and fixing of the material in the lagoons. The sediment is primarily sandy mud, with some gravel fractions close to the harbour wall (as per sample N1), with low compressive strength properties, making it unsuitable for most types of construction. In addition, the presence of some metals TBT and PAHs restricts its suitability for application on land.

Currently there are no significant areas of coastal reclamation planned in the Firth of Forth. Furthermore, if the dredged material (where owned by Crown Estate Scotland) is beneficially used for fill or construction purposes this will attract a royalty rate per cubic metre. The specific royalty rates for material beneficially used are dependent on the quality and specific end use, and this is set during commercial negotiations between the developer and Crown Estate Scotland.

5.2.2 *Sacrificial Landfill*

Operationally, disposal to landfill will be possible. The dredged materials would require landing and drying in specially constructed facilities and would then require transport in sealed HGVs to an appropriate landfill site. There are limited sites available to take the material, and a full analysis of the contaminants in the material would be required by the operators before final acceptance.

Whilst small amounts of dredged material are sometimes disposed of to landfill, it is not common practice and Forth Ports would not have the security of controlling the disposal route. The public and agencies are likely to find this disposal acceptable, but there may be concerns relating to transport and Scotland's Zero Waste Plan (2010) which favours a reduction in the volume of material disposed by landfill (to 5% of all wastes by 2025).

The requirement for transport will result in some safety and public health risks and interference with legitimate activities and there is low risk of ecological disturbance. There would be an increase in traffic volume due to HGV movements. The costs of this option would be high due to the requirement for construction of a landing and storage facility, a drying facility and transport costs.

5.2.3 *Other Disposal Options and Reuse*

Operationally the option to supply the dredged material for other purposes such as brick making would be possible but there would be difficulties associated with the requirement to land, store, dry and transport the material leading to high capital and operational costs. Forth Ports would have limited control over the option and it is not common practice to use marine dredged material for these purposes. It is likely to be viewed as an attractive option by the public and agencies and no legislative issues are anticipated. Environmental and public health and safety concerns associated with this option are linked to transport of the materials and are anticipated to be minimal. There will be no significant impact on amenity and little interference with other legitimate users other than road users.

The mineralogical composition and salinity of the material limit its suitability for use for brick making, as concrete aggregate or in top soil production as it would require treatment to desalinate and decontaminate the material.

5.2.4 *Sea Disposal*

Operationally few problems are anticipated with disposal at Oxcars and this site is has been historically used for disposal of dredged materials from Newhaven and other harbours and docks within the Firth of Forth and Forth Estuary.

It is anticipated that this option will be acceptable to both public and agencies, based on previous applications. The FDSFD has previously sought a seasonal restriction to disposal operations in the Firth of Forth during June and July. The assessment presented in Appendix B concludes that there will be no significant impacts on fish and fish passage based on the levels of suspended sediment generated during disposal operations and the intermittent, localised and temporary nature of the effects of dredge spoil disposal, and therefore no seasonal restrictions are justified. Forth Ports would have full control over the dredging process through the appointment of contractors and risks to safety and public health are anticipated to be low.

There will be some intermittent, short-term and localised effects on water quality during disposal, such as raised turbidity and suspended sediment levels, which may have short-term and localised ecological effects but these are considered to be not significant. There is unlikely to be interference with other legitimate activities and there is not anticipated to be any impact on local amenity.

5.3 IDENTIFICATION OF THE BPEO

The assessment of options highlights the major operational difficulties associated with the landfill and other use options that primarily relate to lack of available sites and facilities and the nature of the material. There are also major costs associated with the need to construct landing, storage and drying facilities at Newhaven Harbour or elsewhere in the vicinity of Newhaven.

The proposed disposal of dredged material at sea supports the objectives set out in Scotland's National Marine Plan and will support the planned dredging operations to safeguard the access to Newhaven Harbour and its navigational safety.

Disposal at sea will keep the dredged material within the ecosystem, maintaining the sediment budget for the area. In line with guidance from Marine Scotland, the Best Practicable Environmental Option is identified as the disposal at a licensed sea disposal site. The preferred site for this is the Oxcars disposal site.

Table 5.1 Summary of Assessment of Options

	Coastal Reclamation and Construction Fill*	Sacrificial Landfill	Other Uses	Sea Disposal
Operational feasibility				
Availability of sites/facilities				
Security of option				
Established practice				
General public acceptability				
Likely Agency acceptability				
Legislative implications				
Public health				
Safety				
Pollution/contamination				
Ecological impact				
Interference with other users				
Amenity/aesthetic				
Cost considerations	* *			

*costs of this option range from high to low, depending on method used, with direct pumping to a site having a high performance and landing and treating having a low performance.

Key: Performance of Options	
Low	
Low to Medium	
Medium	
Medium to High	
High	

APPENDIX A SEDIMENT SAMPLE PHYSICAL AND CHEMICAL ANALYSIS

APPENDIX A

Sediment Sample Chemical Analysis Results

CONTENTS

List of Tables

List of Figures

A1 NEWHAVEN SEDIMENT SAMPLE DATA

A1.1 Introduction

Samples of the seabed sediments to be dredged were collected from the harbour and approach channel seabed by Forth Ports on 1 December 2021 and were analysed by Socotec Ltd.

The survey plan followed the Marine Scotland guidance and was agreed with Marine Scotland on 12th October 2021. Based on the dredging depths of up to 1 m and estimated dredge volumes, surface samples from three sample stations were required. Sample station locations are shown in Figure A1.1 and the coordinates in degrees decimal minutes were:

- 55°58.923'N 3°11.745'W
- 55°58.919'N 3°11.778'W
- 55°59.027'N 3°11.882'W

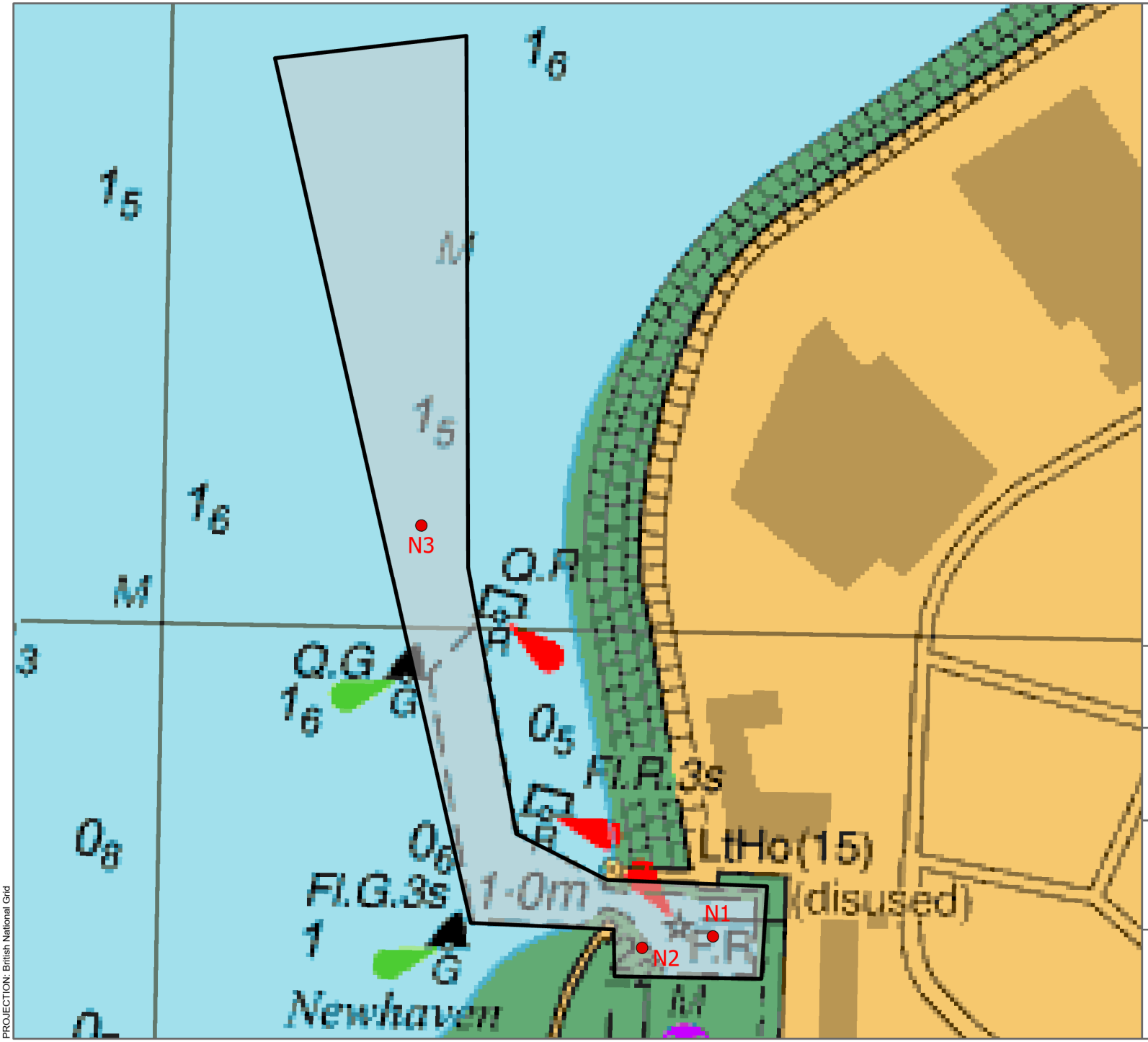
Samples were taken using a van Veen grab and the sample retrieved from each survey station was subsampled on deck and stored in pre-cleaned sample containers provided by Socotec Ltd.

Each sample was labelled with a unique sample ID and a field log was kept to record the sample location, date and time sample was taken and a photograph and description of the sediment taken. Sediment photographs are presented in Figure A1.2.

Samples were kept chilled and sent by overnight courier in coolboxes to the analytical laboratory. For each of the samples the following chemical analysis was undertaken:

- metals (As, Cd, Cr, Cu, Hg, Ni, PB, Zn);
- TBT;
- PAHs (USEPA 16);
- Total hydrocarbons
- PCBs (ICES 7);
- presence of asbestos;
- sediment solids/water content;
- total organic content (TOC); and
- sediment particle size distribution.

Marine Scotland Action Levels are discussed in Section A1.2 and the sediment sample data are presented in Section A1.3 to Section A1.8.



Newhaven Harbour Planned Dredging Area

Newhaven Sediment Sample Positions

Name	Lat	Long
N1	55.982044	-3.195757
N2	55.98199	-3.196294
N3	55.983776	-3.198028

0 50 100
Meters

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: HD
PROJECT: 0496046	CHECKED: MI
DATE: 14/01/2022	APPROVED: MI

Figure A1.1: Newhaven Harbour Sediment Sample Stations

ERM

PROJECTION: British National Grid

Path: Q:\Edinburgh\Projects\0496046 Forth Ports Ltd Newhaven BPEO 2019.MI\2022\GIS\MAPS\0496046 - Forth Ports Ltd.aprx\0496046 Figure 11

Figure A1.2 Photographs of Sediment Samples

A1.2 Marine Scotland Action Levels

Table A1.1 and *Table A1.2* set out the Action Levels for metals, TBT, PCBs and PAHs used by Marine Scotland to assess the suitability for disposal of sediments at sea.

In general, contaminant levels in dredged material below Action Level 1 are of no concern and are unlikely to influence the licensing decision. A breach of Action Level 1 does not automatically preclude disposal at sea but usually requires further consideration before a decision can be made. Dredged material with contaminant levels above Action Level 2 is generally considered unsuitable for normal sea disposal but may be suitable for other management options such as treatment or seabed burial/capping, unless a compelling case can be made for normal sea disposal.

Table A1.1 Marine Scotland Action Levels: Metals

Metal	AL1 (mg kg^{-1} Dry Weight)	AL2 (mg kg^{-1} Dry Weight)
Arsenic	20	70
Cadmium	0.4	4
Chromium	50	370
Copper	30	300
Mercury	0.25	1.5
Nickel	30	150
Lead	50	400
Zinc	130	600

Table A1.2 Marine Scotland Action Levels: PCBs, TBT and PAHs

Determinand	AL1 (mg kg^{-1} Dry Weight)	AL2 (mg kg^{-1} Dry Weight)
ICES 7 PCBs	0.02	0.18
TBT	0.10	0.50
PAHs		
Naphthalene	0.10	
Phenanthrene	0.10	
Anthracene	0.10	
Fluoranthene	0.10	
Pyrene	0.10	
Benz[a]anthracene	0.10	
Chrysene/Triphenylene	0.10	
Benzofluoranthenes	0.10	
Benzo[a]pyrene	0.10	
Indenopyrene	0.10	
Benzoperylene	0.10	
Acenaphthylene	0.10	
Acenaphthene	0.10	
Fluorene	0.10	
Dibenz[a,h]anthracene	0.01	
Total PAHs	100	

A1.3 Metal Results

Concentrations of metals are presented in *Table A1.3*. Levels above Marine Scotland Action Level 1 are highlighted in blue. No concentrations above Action Level 2 were recorded (see Table A1.1 for Action Levels for metals).

Table A1.3 Analysis of Metal Contaminants from Newhaven (mg kg^{-1} Dry Weight) 2021

Station	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
N1	18.5	0.4	57.6	47.7	0.79	34.5	84.7	163
N2	18.1	0.51	57.4	57.8	0.87	33.3	93.4	174
N3	14.7	0.47	47	33.4	0.71	29.5	66.1	133
Mean	17.1	0.46	54.0	46.3	0.79	32.4	81.4	156.7

As = Arsenic, Cd = Cadmium, Cr = Chromium, Cu = Copper, Hg = Mercury, Ni = Nickel, Pb = Lead and Zn = Zinc.

Table A1.4 provides a comparison of metal data from samples analysed from 2014, 2019 and 2021. In most cases in all years, the mean concentrations of metals in the sediments are above Action Level 1 but below Action Level 2. In 2014 the mean mercury concentration from the samples was above Action Level 2 (shaded in red). In the current survey, concentrations of all metals were within the range observed in the previous surveys with the mean concentrations being generally lower than in the previous surveys.

Table A1.4 Comparison of Metal Contaminants from Newhaven (mg kg^{-1} Dry Weight) 2014, 2019 and 2021

Year		As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
2014	Mean	16.6	1.5	75.2	89.6	1.7	35.4	149.0	238.0
	Range	13.1-18.4	1.3-2.2	55.1-97.5	70.8-108.0	1.1-2.7	28.0-50.8	143.0-157.0	202.0-289.0
2019	Mean	17.6	0.5	75.2	79.5	0.67	36.2	112.1	180.7
	Range	15.5-20.8	0.3-0.8	58.7-94.8	33.5-156.0	0.6-0.67	30.7-42.7	74.9-170.0	145.0-221.0
2021	Mean	17.1	0.46	54	46.3	0.79	32.4	81.4	156.7
	Range	14.7-18.5	0.4-0.51	47-57.6	33.4-57.8	0.71-0.87	29.5-34.5	66.1-93.4	133-174
2014-2021	Mean	17.1	0.82	68.7	71.8	1.05	34.7	114.2	191.8
	Range	13.1-20.8	0.3-2.2	55.1-97.5	33.5-156.0	0.6-2.7	28.0-50.8	74.9-170.0	145.0-289.0

The data from the 2021 samples shows that the mean metal concentrations were generally within the range the range of available data from Newhaven and other ports within the Forth Estuary and the Firth of Forth (*Table A1.5*) (1).

Table A1.5 Concentrations of Metals in Newhaven Sediment (2014, 2019 and 2021) and those from other Firth of Forth and Forth Estuary Ports

	Metal Concentration (expressed as mg kg^{-1} Dry Weight)							
	As	**Cd**	**Cr**	**Cu**	**Hg**	**Ni**	**Pb**	**Zn**
Newhaven 2021								
Mean	17.1	0.46	54	46.3	0.79	32.4	81.4	156.7
Range	14.7-18.5	0.4-0.51	47-57.6	33.4-57.8	0.71-0.87	29.5-34.5	66.1-93.4	133-174
Newhaven 2014-2021								
Mean	17.1	0.82	68.7	71.8	1.05	34.7	114.2	191.8
Range	13.1-20.8	0.3-2.2	55.1-97.5	33.5-156.0	0.6-2.7	28.0-50.8	74.9-170.0	145.0-289.0
Leith 1990-2020								
Mean	13.1	1.1	61.4	71.1	1.2	39.8	134.5	261.3
Range	4.6-21.6	0.0-3.9	14.1-84.3	12.8-144	0.2-4.4	13.0-59.3	29.0-787	62.6-687
Methil 2003-2020								
Mean	11.27	0.38	32.70	40.94	0.20	23.32	33.62	142.38
Range	2.8-17.3	BDL-0.7	10.1-72.8	11.2-90.1	0.1-0.3	7.1-39.5	7.5-76.3	26.2-347
Rosyth 2000-2020								
Mean	17.04	0.23	74.3	38.8	0.95	34.0	70.0	150.1
Range	12.4-21.9	BDL-4.5	46.3-106	22.5-189.9	0.4-2.6	24.6-43.4	43.1-137.5	88.4-1,730
Grangemouth 1988-2019								
Mean	14.5	0.1	73.3	49.6	1.1	32.2	69.9	147.3
Range	0.0-43.6	0.0-1.2	10.7-211	3.0-353	0.0-3.8	7.6-80.6	9.3-209	28.9-743

Key: As = Arsenic, Cd = Cadmium, Cr = Chromium, Cu = Copper, Hg = Mercury, Ni = Nickel, Pb = Lead, Zn = Zinc.
Blue shading indicates concentrations above Marine Scotland Action Level 1.

(1) Data for Grangemouth, Rosyth and Leith provided by Marine Scotland, Aberdeen and NLS, Leeds.

A1.4 Polychlorinated Biphenyls Results

Polychlorinated biphenyls (PCBs) are organic compounds comprising a biphenyl group (composed of two benzene rings) with between one and ten bonded chlorine atoms. PCBs are highly toxic, persistent pollutants and are readily bioaccumulated in animals.

Although production in the UK ceased in the 1970s, PCBs still enter the marine ecosystem through the disposal of industrial plant, emissions from old electrical equipment and from landfill sites (1).

Dry weight concentrations of ICES 7 PCBs from samples collected in 2019 are presented in Table A1.6. No ICES 7 PCB levels exceed Action Level 1 (0.02 mg kg^{-1}) in any of the samples.

Table A1.6 Analysis of PCBs (mg kg^{-1} Dry Weight) from Newhaven in 2021

Station	Sum of ICES 7 PCB Concentrations
N1	0.0158
N2	0.0182
N3	0.01425
Mean	0.01608
Range	0.01425 to 0.0182

ICES 7 PCB congeners (with IUPAC numbers): 28 - 2,4,4' - Trichlorobiphenyl, 52 - 2,2',5,5' - Tetrachlorobiphenyl, 101 - 2, 2', 4, 5, 5' - Pentachlorobiphenyl, 118 - 2, 3', 4, 4', 5 - Pentachlorobiphenyl, 138 - 2, 2', 3, 4, 4', 5' - Hexachlorobiphenyl, 153 - 2, 2', 4, 4', 5, 5' - Hexachlorobiphenyl, 180 - 2, 2', 3, 4, 4', 5, 5' - Heptachlorobiphenyl.

Table A1.7 presents a comparison of mean dry weight concentrations of ICES 7 PCBs from samples collected in 2014, 2019 and 2021. Results show that there were lower mean concentrations of PCBs from samples taken in 2021 compared to 2019 and 2014.

Table A1.7 Analysis of PCBs from Newhaven (mg kg^{-1} Dry Weight) 2014, 2019 and 2021

Year		Sum of ICES 7 PCB Concentrations
2014	Mean	0.053
	Range	0.039-0.071
2019	Mean	0.028
	Range	0.011-0.059
2021	Mean	0.0161
	Range	0.0143-0.018
2014-2021	Mean	0.0324
	Range	0.011-0.071

ICES 7 PCB congeners (with IUPAC numbers): 28 - 2,4,4' - Trichlorobiphenyl, 52 - 2,2',5,5' - Tetrachlorobiphenyl, 101 - 2, 2', 4, 5, 5' - Pentachlorobiphenyl, 118 - 2, 3', 4, 4', 5 - Pentachlorobiphenyl, 138 - 2, 2', 3, 4, 4', 5' - Hexachlorobiphenyl, 153 - 2, 2', 4, 4', 5, 5' - Hexachlorobiphenyl, 180 - 2, 2', 3, 4, 4', 5, 5' - Heptachlorobiphenyl.

(1) Forth Replacement Crossing: Environmental Statement 2009. Available online from http://www.transportscotland.gov.uk/strategy-and-research/publications-and-consultations/j11223-081.htm

A1.5 Polycyclic Aromatic Hydrocarbons

Levels of PAHs are presented in Table A1.8. Levels above Marine Scotland Action Level 1 for individual PAHs are highlighted in blue. Action Level 1 for Total PAHs is 100 mg kg^{-1}, and all the samples are below that level. There are no Action Levels for Total Hydrocarbons. A comparison of mean dry weight concentrations of PAHs from samples collected in 2014, 2019 and 2021 are presented in Table A1.9, which shows that PAH concentrations of the majority of individual PAHs are above Action Level 1 in all three years, with concentrations similar between the years.

Table A1.8 Analysis of PAHs from Newhaven Harbour 2021 (mg kg^{-1} Dry Weight)

	Sample Station		
PAH	**N1**	**N2**	**N3**
Acenaphthene	32	208	74.6
Acenaphthylene	31.1	119	71.5
Anthracene	139	648	308
Benzo(a)anthracene	268	1,690	659
Benzo(a)pyrene	288	1,840	738
Benzo(b)fluoranthene	337	1,650	751
Benzo(k)fluoranthene	166	962	394
Benzo(ghi)perylene	301	1,420	686
Chrysene	300	1,760	687
Dibenzo(ah)anthracene	49.1	266	95.3
Fluoranthene	473	2,930	1,090
Fluorene	64.1	268	146
Indeno(1,2,3-c,d)pyrene	239	1,230	603
Naphthalene	160	366	256
Phenanthrene	302	1610	647
Pyrene	598	3460	1,440
Total Hydrocarbons	348,000	655,000	630,000

Table A1.9 Comparison of PAHs from Newhaven Harbour 2014, 2019 and 2021 (mg kg^{-1} Dry Weight)

Year	**2014**		**2019**		**2021**	
PAH	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**
Acenaphthene	0.16	0.15-0.17	0.17	0.06-0.38	0.11	0.03-0.21
Acenaphthylene	0.01	0.01-0.02	0.04	0.04-0.08	0.07	0.03-0.12
Anthracene	0.41	0.37-0.44	0.36	0.17-0.76	0.37	0.14-0.65
Benzo(*a*)anthracene	1.16	1.08-1.24	0.80	0.41-1.57	0.87	0.27-1.69
Benzo(*a*)pyrene	1.13	1.04-1.28	0.79	0.45-1.57	0.96	0.29-1.84
Benzo fluoranthenes	0.79	0.55-1.28	0.83	0.44-1.42	-	
Benzo(b)fluoranthene	-	-	-	-	0.91	0.34-1.65
Benzo(k)fluoranthene	-	-	-	-	0.51	0.17-00.96
Benzoperylene	-	-	0.67	0.36-1.06	0.80	0.30-1.42
Chrysene/Triphenylene	0.84	0.80-0.88	0.61	0.46-1.63	-	-
Chrysene	-	-	-	-	0.92	0.30-1.76
Dibenz[*a,h*]anthracene	0.20	0.19-0.23	0.43	0.07-0.21	0.14	0.05-0.27
Fluoranthene	2.05	1.82-2.23	1.42	0.64-2.93	1.50	0.47-2.930
Fluorene	0.21	0.20-0.23	0.84	0.09-0.38	0.16	0.06-0.27
Indenopyrene	0.66	0.58-0.72	0.65	0.32-0.98	0.69	0.24-1.23
Naphthalene	0.30	0.22-0.41	0.12	0.19-0.64	0.26	0.16-0.37
Phenanthrene	1.04	0.98-1.14	0.06	0.40-2.22	0.85	0.30-1.61
Pyrene	2.22	2.07-2.46	1.42	0.78-2.82	1.83	0.60-3.46

A1.6 Tributyltin

Tributyltin (TBT) is a highly toxic compound historically used as an anti-biofouling agent in paint used to coat the hulls of vessels. It is also toxic to non-target organisms and is linked to immune-suppression and imposex (1) in snails and bivalves. TBT was also used in various industrial processes as a biocide and can enter the marine environmental through effluent discharges. In some cases, TBT can also be persistent in the marine environment.

Mean dry weight concentrations of TBT from the samples collected are presented in *Table A1.10.* Station N1 has TBT concentrations above Marine Scotland Action Level 1 (0.1 mg kg^{-1}). It is noted that this is the innermost station within the harbour with the highest concentration of fine sediment fractions.

Table A1.10 Analysis of TBT from Newhaven Harbour 2021 (mg kg^{-1} Dry Weight)

Station	TBT Concentration
N1	0.141
N2	0.0464
N3	<0.001
Mean	0.0628
Range	<0.001 to 0.141

A comparison of TBT concentrations from samples collected in 2014, 2019 and 2021 are presented in *Table A1.11,* which shows that mean TBT concentrations were above Action Level 1 in in 2014 and 2019 but below Action Level 1 in 2021. The highest average concentrations was in the 2014 samples.

Table A1.11 Comparison of mean TBT from Newhaven Harbour in 2014, 2019 and 2021 (mg kg^{-1} Dry Weight)

Year		TBT Concentration
2014	Mean	0.140
	Range	<0.007-0.196
2019	Mean	0.110
	Range	0.014-0.276
2021	Mean	0.0628
	Range	<0.001-0.141
2014-2021	Mean	0.104
	Range	<0.001-0.276

A1.7 Asbestos

No asbestos fibres were identified in the samples.

(1) The development of male characteristics in females

A1.8 Sediment Particle Size Analysis

Sediment Particle Size Analysis (PSA) was undertaken on the three sediment samples taken from Newhaven Harbour and approach channel in 2021. Sediments were predominantly muddy, with fractions of sand and gravel. The sandy-mud material is typical of a relatively low energy harbour environment. Table A1.12 and Figure A1.3 presents the 2021 data.

- Gravel is defined as >2 mm,
- Sand is defined as >63 µm<2 mm, and
- Mud (silts and clays) is defined as <63 µm.

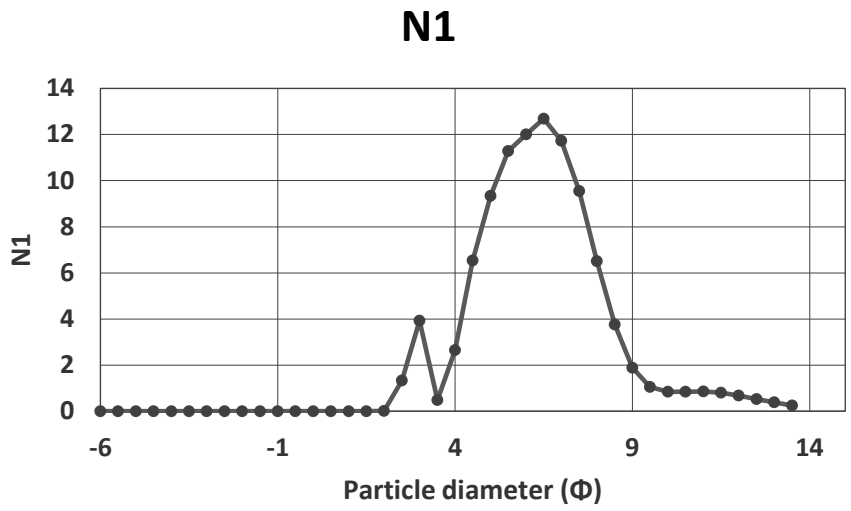
The sediment particle sizes in sample station N1 comprised mud, N2 sandy mud and N3 slightly gravelly sandy mud.

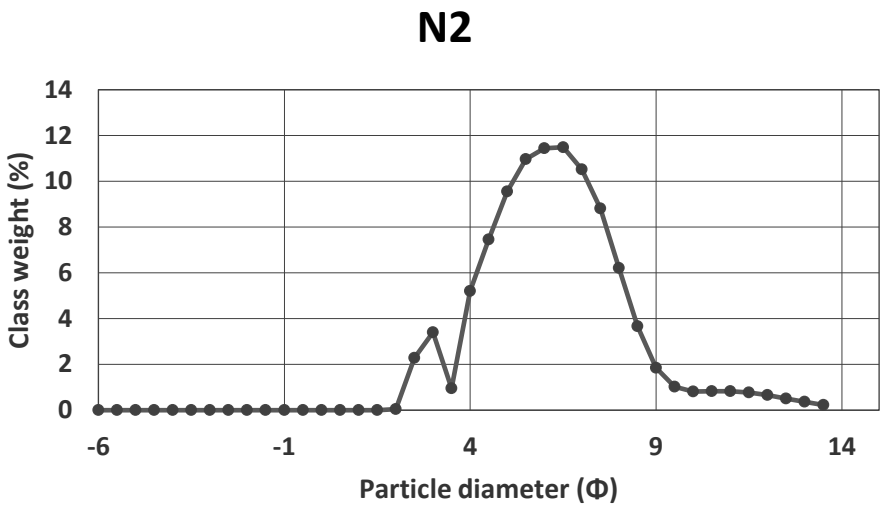
Table A1.12 Newhaven Harbour 2021 Sediment Data Summary

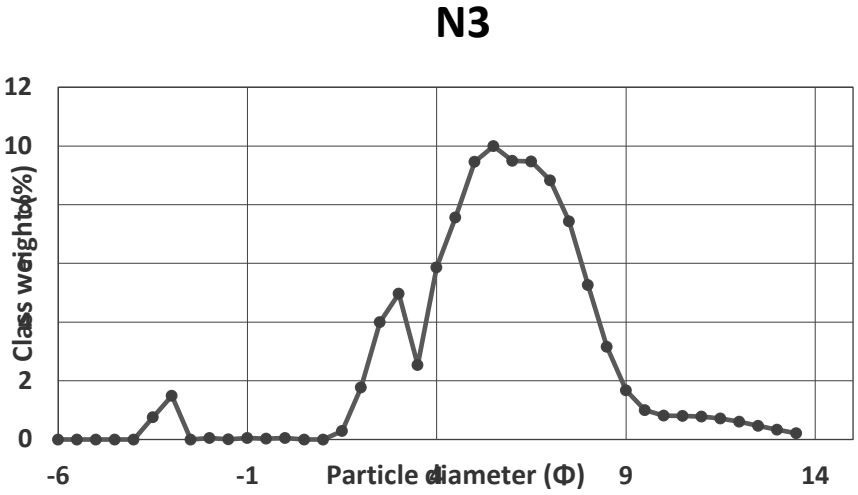
Parameter	Sample Station		
	N1	N2	N 3
Textural Group Classification	Mud [M]	Sandy Mud [sM]	Slightly Gravelly Sandy Mud [(g)sM]
Folk and Ward Description	Medium Silt	Coarse Silt	Coarse Silt
Folk and Ward Sorting	Poorly Sorted	Poorly Sorted	Very Poorly Sorted
Mean µm	14.43	16.1	21.82
Mean phi	6.115	5.956	5.518
Sorting Coefficient	1.798	1.855	2.111
Skewness	0.041	0.049	0.008
Kurtosis	1.291	1.190	1.116
Gravel (%)	0	0	2.30
Sand (%)	8.4	11.9	19.5
Mud (silts and clays) (%)	91.6	88.1	78.2
Total Organic Carbon (%)	4.87	5.02	5.41
Solids (%) @120°C	46.0	32.3	39.6
Density (mg m^{-3})	2.64	2.63	2.59

Note: the Phi scale is $-\log_2$ of the particle diameter in mm

Figure A1.3 Newhaven Harbour and Approach Channel Sediment PSA







2. SPOIL GROUND SEDIMENT SAMPLE DATA

Table A1.13 presents metal and PCB concentration data from sediment sampled from spoil ground sites within the Firth of Forth and Forth Estuary. Levels above Marine Scotland Action Level 1 for metals and PCBs are highlighted in blue. Monitoring of spoil grounds is not mandatory therefore, the data presented are the most recent data available. The data indicate that concentrations of metals and PCBs within sediment samples from the Oxcars spoil ground are generally slightly higher than from the other spoil grounds sampled.

Table A1.13 Concentration of Metals and PCBs (mg kg^{-1} Dry Weight) from Forth Spoil Grounds

Site Name/Date	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn	Sum ICES 7 PCBs
Oxcars 2011	11.2	0.1	42.5	22.2	0.6	22.3	153.5	92.2	0.007 (2007, n=6)
(n=6)									
Oxcars 2015	15.7	0.3	79.6	41.6	1.0	35.8	78.1	141.7	0.008
(n=3)									
Methil 1993	8.2	0.2	9.8	10.7	0.1	19.2	10.5	51.0	
(n=1)									
Methil 2011	6.9	0.07	13.7	7.14	0.07	8.97	20.2	39.8	0.0004 (n=3)
(n=3)									
Methil 2015	8.7	0.1	18.0	9.6	BDL	11.2	14.5	72.8	0.003 (n=1)
(n=1)									
Narrow Deep 2011	9.5	0.2	42.9	21.6	0.49	22.9	53.4	109.4	0.008 (n=3)
(n=6)									
Narrow Deep 2015	11.7	0.2	63.8	24.6	0.6	30.0	58.4	105.9	0.03 (n=3)
(n=4)									
Kirkcaldy 2011	6.24	0.1	21.9	16.2	0.14	16.4	21.7	45.9	-
N=3									
Kirkcaldy 2015	8.9	0.1	43.1	17.0	0.2	22.0	30.6	62.9	0.0025 (n=3)
(n=3)									
Blae Rock 2007	13.4	BDL	59.7	32.4	0.8	28.2	63.9	108.6	0.008 (n=5)
n=3)									
Blae Rock 2011	17.2	0.1	39.6	21.9	0.5	21.4	52.1	80.3	0.01 (n=2)
(n=6)									
Bo'ness 2011	14.5	0.1	50.8	23.3	0.8	23.6	56.9	95.7	0.005 (n=3)
(n=7)									
Bo'ness 2015	18.6	0.1	59.6	26.5	0.7	27.5	54.2	114.0	0.004 (n=3)
(n=5)									

* Data provided by Marine Scotland (2019)

Key: n = the number of samples analysed (where known)

APPENDIX B ENVIRONMENTAL IMPACTS OF DISPOSAL OPERATIONS

CONTENTS

LIST OF TABLES

B1 INTRODUCTION

This appendix addresses the environmental impacts of the disposal of dredged material from the planned maintenance dredging at Newhaven Harbour at the licenced Oxcars disposal site in the Firth of Forth. Impacts on water quality, sediment quality, and habitats and species are considered. Table B1.1 presents the impact summary.

As the Marine Licence application is for disposal of the dredged material, impacts of the dredging activities are not addressed, other than in the context of Bathing Waters and cumulative impacts from existing and proposed dredging and disposal activities, and other activities and developments.

Dredger vessel traffic between Newhaven and Oxcars during disposal operations are limited by suitable high tides therefore typically one loads can be disposed of each tide. Potential impacts on general vessel movements within the Firth of Forth due to the disposal operations are not considered to be significant as commercial traffic in the main channel is controlled by Forth Ports' standard operating procedures.

B2 DISPOSAL IMPACTS

The identification and assessment of environmental impacts of the disposal of dredged material in this Appendix follows the Clearing the Waters for All guidance (1).

As described in *Section 1.3* it is proposed that approximately 15,000 m^3 (approximately 19,500 wet tonnes) of material would be disposed at Oxcars spoil ground over a period of approximately four weeks annually, subject to siltation rates and commercial requirements.

The material to be dredged and disposed consists primarily of mud, sandy mud, and gravelly sandy mud. Concentrations of contaminants in the material are presented in *Appendix A*. Samples were taken at three stations (N1-N3) and the results are summarised here.

- The mean concentrations of metals were above Action Level 1 but below Action Level 2 with the exception of arsenic that was below Action Level 1.
- TBT concentrations were below Action Level 1 at stations N2 and N3 with the sample from station N1 being above Action Level 1.
- The concentration of total PCBs were below Action Level 1 in all three stations sampled.
- The total PAH concentrations at all survey stations were below Action Level 1. For individual PAHs most were above Action Level 1 but all were below Action Level 2. This pattern was observed in the previous data from samples analysed in 2014 and 2019.

Available metal and PCB concentration data from sediment sampled in the Oxcars spoil ground are presented in *Appendix A* and indicate that levels are slightly higher those from other spoil grounds within the Firth of Forth.

B2.1 Impacts on Water and Sediment Quality

Coastal water quality in the Firth of Forth is currently Good in the outer Firth, with the exception of the area around Portobello and Musselburgh, which is classified as Poor. It is classified as Good in the lower estuary to Muirhouses and Moderate upstream in the estuary to Kincardine bridge (2).

(1)Best, M (2016). Clearing the Waters for All: WFD guidance for developers and regulators in estuarine and coastal waters. Environment Agency.
(2)Water Framework Directive (WFD) Waterbody Classification 2007-2017 (SEPA)
https://marinescotland.atkinsgeospatial.com/nmpi/default.aspx?layers=1110

The salinity in the Firth of Forth averages 33‰, decreasing into the Forth Estuary under the influence of freshwater inputs. Suspended solids levels are also usually low, and average 3 mg l^{-1} (1). In the Firth of Forth, dissolved oxygen concentrations show little variation with depth and are approximately 90-95%, but may be lower during periods of high summer water temperatures (2).

There are no designated bathing waters within 2 km of the dredging or disposal sites. The nearest is Portobello West which is approximately 7 km from the dredging site and approximately 10 km from the disposal site.

The material disposed at Oxcars will fall to the sea bed by gravity and consist of cohesive lumps of dredged material. Fine sediment will be liberated as it sloughs off the descending material and when the clumps reach the seabed. There are no data available that indicate the concentration or dispersion of suspended solids from the disposal operations at Oxcars. Field measurements of suspended solids in surface waters following similar disposal operations indicate that less than 5% of the discharged material escapes the descending density jet (3).

There are no data available that indicate the concentration or dispersion of suspended solids from the disposal operations at Oxcars. Data available from Middle Bank in the Firth of Forth during dredging operations in 2008 (4) recorded the baseline mean suspended solids concentrations between 8.87 mg l^{-1} and 10.3 mg l^{-1} (mean 9.1 mg l^{-1}). Comparison of these mean baseline suspended solids concentrations with those recorded during dredging activities at Middle Bank indicated peak increases were approximately two and half times above background levels (1). These increases were short-lived and dissipated with the outgoing tide. Significant increases in suspended sediments associated with the disposal operations are therefore likely to be confined to the immediate area of the spoil ground and for a short period.

Similar studies were undertaken for the Forth Replacement Crossing which showed that increases in suspended sediment concentrations from dredging works were short-lived and localised (5).

The levels of suspended sediments in the Firth of Forth vary with seasonal weather conditions. The natural sedimentation in the Firth of Forth aids the removal of contaminants from the water column and incorporates them in the seabed sediments.

Any increased nutrient levels from suspended sediments from disposal operations may stimulate local algal production, although the effects are predicted to be short-term and confined to the immediate area of the disposal operations. Nitrogen is generally regarded to be the limiting nutrient in estuarine and marine systems and in its reduced form (ammoniacal nitrogen) is also toxic to fish. As a consequence of the reduced (oxygen demanding) nature of the seabed sediments, nitrogenous nutrients are likely to be in this form.

The oxidation of anoxic sediments released into the water column has been shown to reduce oxygen concentrations by up to 58%(6). Based on the background levels, this may reduce the oxygen saturation to between 40 and 50% (equating to approximately 4 to 5 mg l^{-1}). Therefore, if the disposal operations occurred during a period of 'naturally' low dissolved oxygen it is possible that the water quality standards of oxygen concentration greater than 6 mg l^{-1} would not be met(7). It is predicted that this would be short-lived, due to the limited period over which disposal is intended to occur, and localised based on previous dredge plume studies. The impacts are not considered to be significant given the generally high dissolved oxygen levels anticipated at the spoil ground, the relatively low

(1) SEPA monitoring buoy data from Gunnet Ledge, Firth of Forth, available online from http://www.sepa.org.uk/environment/environmental-data/monitoring-buoys-network/gunnet-ledge/
(2) SEPA (1998). Winter Nutrient Distribution in the Firth of Forth, 1987 - 1997. Report TW 01/98, January 1998.
(3) Kennish M.J. 1992. Ecology of Estuaries Anthropogenic Effects Dredging and Dredged Spoil Disposal p357-397
(4) ERM, 2008. Middle Bank Aggregate Production Licence: Monitoring Report. A report for Westminster Gravels Ltd.
(5) Transport Scotland, 2009. Forth Replacement Crossing: Environmental Statement.
(6) Brown C. 1968. Observations on Dredging and Dissolved Oxygen in a Tidal Waterway. Water Resources Research Vol 4, No 6, p1381.
(7) UKTAG 2010. Water Framework Directive: An approach to the Revoked Directives:- the Freshwater Fish Directive, the Shellfish Directive and the Dangerous Substances Directive. Available online from: http://www.wfduk.org/resources%20/approach-revoked-directives-%E2%80%93-freshwater-fish-directive-shellfish-directive-and-dangeroussubstances Directive

levels of organic carbon in the dredged sediments (c 5%) and the extent of the area potentially affected.

Although there may be some release of contaminants such as metals and PAHs into the water column during disposal operations the majority of the dredged material will descend to the seabed rapidly. Sediment bound contaminants liberated during the disposal operations will quickly become complexed with particulate matter in the water column and be re-deposited on the sea bed. Previous studies have shown that metal concentrations in the water column remained consistent following sediment disposal ((1).

The PAHs in the sediment samples comprised both low molecular weight (LMW) (two and three benzene rings) and high molecular weight (HMW) (more than 3 benzene rings) compounds. The individual PAHs that were in concentrations above Action Level 1 had both LMW and HMW PAHs. PAHs tend not to be volatile and are poorly soluble and therefore readily absorb onto particulate matter in the water column and are incorporated into marine sediments. The HMW PAHs are generally less water soluble, less acutely toxic and slower to biodegrade (*i.e.* more persistent) than the LMW PAHs.

The ratios of individual PAHs have been used to determine the likely anthropogenic source of PAHs in the environment: *e.g.* from petroleum hydrocarbons (petrogenic) or combustion sources (pyrolytic). Petrogenic PAHs are often characterised by phenanthrene to anthracene (Ph/An) ratios more than 10, whereas pyrolytic PAH from combustion processes are characterised by Ph/An ratios less than 10. Ratios of fluoranthene to pyrene (Fl/Py) of less than 1 generally indicates petrogenic sources while ratios more than 1 generally come from pyrolytic sources (2).

For the sediment samples analysed from Newhaven the Ph/An ratios were between 2.1 and 2.48 and the Fl/Py ratios were between 0.73 and 0.85. This suggests that these contaminants are from both combustion and petroleum hydrocarbon sources. This pattern has been identified in other ports in the Firth of Forth and Forth Estuary indicating that these sources of PAHs are in the sediments from the wider Forth Estuary and Firth of Forth sediment circulation system.

There was a large reduction in point source discharges of metals and hydrocarbons within the Forth Estuary and the Firth of Forth between the mid-1980s and 1990s (3). Reduction and improved regulation of point source discharges has improved many aspects of the Forth system: inputs of organic material have declined and there has been an associated rise in dissolved oxygen during summer in the upper Forth Estuary. The rise in dissolved oxygen has led to increasing numbers of smelt caught in the upper estuary and to increasing inputs of nitrate generated by nitrification in the suspended sediment maxima of the estuary during summer. In winter, conservative mixing of nutrients is seen and there has been little change in winter nutrient concentrations in the Forth Estuary and Firth of Forth. Metal and trace organic inputs have been reduced so that aqueous concentrations have fallen rapidly (4). With efforts focussed on improving the water quality of the Firth of Forth in more recent years, point source discharges have continued to decrease and the water quality of the Firth of Forth has continued to improve as a result (5).

It is therefore not anticipated that the disposal operation at Oxcars will introduce significant amounts of contamination into the water column. Disposal of the dredged material may result in a localised and short-term increase in the levels of some contaminants within the seabed sediments at the disposal site; however, the deposited sediment will disperse over time. Considering the short-term,

(1) Brown C. 1968. Observations on Dredging and Dissolved Oxygen in a Tidal Waterway. Water Resources Research Vol 4, No 6, p1381.
(2) Y.W. Qiu, G. Zhang, G.Q. Liu, L.L. Guo, X.D. Li, O. Wai. Polycyclic aromatic hydrocarbons (PAHs) in the water column and sediment core of Deep Bay, South China. Estuar. Coast. Shelf Sci., 83 (1) (2009), pp. 60-66.
(3) SEPA, 1998. Trace Metals in the Forth 1986 - 1996. Available online from http://www.sepa.org.uk/science_and_research/data_and_reports/water/forth_estuary_trace_metals.aspx
(4) Dobson, J., Edwards, A., Hill, A. and Park R (2001). Decadal changes in the Forth Estuary and Firth of Forth in relation to the North Sea 1980–2000. *Senckenbergiana maritima* 31: 187-195. https://doi.org/10.1007/BF03043028.
(5) SEPA, 2014. Scottish bathing waters 2013-2014. Available online http://www.sepa.org.uk/media/39125/scottish-bathing-waters-report-2013-2014.pdf

localised and intermittent increase in the levels of some contaminants in the water column will not affect the overall water body quality statuses of the Firth of Forth.

B2.2 Impacts on Benthic Ecology

The benthic macrofaunal communities recorded in proximity to Oxcars disposal site are expected to be typical for estuarine conditions and not considered to be of high conservation significance due to the wide distribution, low diversity and lack of any rare or notable species (1).

It is anticipated that the deposition of dredged material at the Oxcars disposal site may result in the loss (burial) of the benthos within and in the immediate vicinity of the 'deposition zone' within the disposal site. Localised impoverishment of the fauna (in terms of abundance and diversity) is likely along the axis of tidal flow as a result of secondary impacts comprising sediment deposition subsequent to the disposal activities. Oxcars is an existing licenced spoil ground therefore the benthic communities in this area will have been impacted by the ongoing spoil deposition activities that have occurred there over more than 30 years.

Given the relatively homogenous nature of benthic communities (2) and their exposure to the naturally high levels of suspended levels during periods of low river flow and availability of similar habitat within the Firth of Forth, the spatial extent of predicted sediment related impacts to benthos (and resultant impact on prey availability for foraging seabirds) are unlikely to be significant.

B2.3 Impacts on Seabirds

The Firth of Forth Special Protection Area (SPA), Forth Islands SPA and the Outer Firth of Forth and St Andrews Bay Complex SPA are designated (3) for rare, vulnerable and regularly occurring migratory bird species.

There are three potential effects of the disposal of dredge material at sea on seabirds; increased suspended solids, release of contaminated particulates and physical disturbance of birds by the dredging vessel. These effects could potentially have a significant effect on the qualifying interests of the SPAs by reducing prey availability and disturbing bird behaviour and breeding patterns. The vessel used for disposal of the material will be travelling to and from Newhaven Harbour and the disposal site during the four week period of dredging (typically between February and April each year), a round trip of approximately 2.1 nautical miles.

The main passage population of sandwich tern occurs during the autumn and the proposals are not likely to have significant effects on open water habitats that might support foraging terns during this period.

The SPAs support breeding seabirds which forage over a wide area. The disposal of the dredged material will result in localised increases in suspended sediment which may reduce the ability of fish eating birds to forage around the spoil ground due to impaired visibility. However the area affected is a small percentage of the total available foraging habitat, with alternative sources of prey available close by.

The results of sediment dispersion studies undertaken by HR Wallingford (4) for aggregate extraction activities on Middle Bank (approximately 2.3 nm east of Oxcars) involving the disposal of 68,000 m^3 sediment overburden (estimated 40% silt, 60% sand content) at the Narrow Deep spoil ground (approximately 3.5 nm southeast of Oxcars) indicated that the maximum levels of dispersion were achieved with disposal during spring tides. The study showed that at peak tidal velocity the plume would extend 7 km west and 5 km northeast of the disposal site, *ie* along the axis of tidal flow with

(1) Elliot M & Kingston P F (1987). The Sublittoral Benthic Fauna of the Estuary and Firth of Forth, Scotland. Proceedings of the Royal Society of Edinburgh, 93B, pp 449-465
(2) Elliot M & Kingston P F (1987). The Sublittoral Benthic Fauna of the Estuary and Firth of Forth, Scotland. Proceedings of the Royal Society of Edinburgh, 93B, pp 449-465
(3) The *Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations, 2019*.
(4) HR Wallingford Ltd, 1998. Middle Bank Aggregate Dredging - Dispersion Studies. Report EX 3874.

very little movement to the north or south and therefore not impacting coastal or intertidal areas within the SPA(1).

Oxcars is an established and long term spoil ground with disposal activities from Newhaven being ongoing prior to the time that the SPAs were designated. Given that disposal was an existing activity and ongoing disposal is at a similar scale to previous disposal activities, it is considered that the proposals will not have significant effects on the qualifying interest of the SPAs.

B2.4 Impacts on Fish and Marine Mammals

The River Teith Special Conservation Area (SAC), the Isle of May SAC and the Moray Firth SAC are designated (2) for their habitats and fish and mammals species of European importance.

Atlantic salmon, river lamprey and sea lamprey inhabit and migrate up and down the Firth of Forth and Forth Estuary to reach spawning grounds in the River Teith SAC and may therefore pass the Oxcars disposal site. The Forth District Salmon Fishery Board has previously advised that smolts are likely to be passing through the lower Forth Estuary and Firth of Forth during June and July. The river lamprey grows to maturity in estuarine environments and between October and December moves into fresh water to spawn in clean rivers and streams. The sea lamprey spends most of its life at sea, only returning to freshwater to spawn around April and May.

A potential effect of disposal at sea is for increased levels of suspended solids to disturb fish migration routes and areas they occupy. The proposals are not likely to have a significant effect on fish for the following reasons.

- The concentration of suspended sediment at which the passage of salmonid fish is affected has been observed to be approximately 500 mg l^{-1} (3). Studies in the US, looking at a variety of salmonid species, illustrates that fatalities to smolts (50%) can occur at high suspended sediment concentrations over extended periods (*e.g.* exposure of between 488 to 19,364 mg l^{-1} for 96 hrs) (4). The natural suspended sediment maxima in the Forth Estuary is in the upper estuary with mean concentrations over ten times higher than in the Firth of Forth (130 mg l^{-1} at Kincardine (5) and approximately 10 mg l^{-1} ambient levels recorded during the Middle Bank dredging and disposal operations in the Firth of Forth) (6).
- The disposal activities will take place within the Firth of Forth which represents a small area where sea lamprey and salmon smolts may be present or may pass through. The width of the Firth of Forth at the Oxcars site is approximately 8.735 km (10 nm) wide and the spoil ground is approximately 530 m wide, representing approximately 6% the width of the Firth of Forth at that point. The fish species will be able to avoid the area during the short periods of raised suspended sediment during disposal and migrate using an alternative route through the Firth of Forth and therefore short-term and intermittent disposal operations are not considered to present a significant barrier to migration.

A localised, short-term and non-continuous increase in suspended sediment concentration affecting a small proportion of the width of the Firth of Forth is not anticipated to affect the migration of adult salmon, smolts or other fish species, based on the evidence of studies on the effects of suspended sediments on salmonids and the predicted suspended sediments concentrations resulting from the disposal operations. It has been reported that Atlantic salmon numbers have been decreasing in

(1) ERM, 1998. Aggregate Production Licence Application, Middle Bank, Firth of Forth: Environmental Statement. Report to Westminster Gravels Ltd.
(2) The *Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations, 2019.*
(3) Redding M.J. and Schreck C.B. 1987, Physiological effects on coho salmon and steelhead of exposure to suspended solids, Transactions of the American Fisheries Society, Vol 116 pp737-747
(4) Bash J, Berman, C and Bolton S. 2001. Effects of Turbidity and Suspended Solids On Salmonids. Prepared for Washington State Transportation Commission, Department of Transportation and U.S. Department of Transportation, Federal Highway Administration
(5) Transport Scotland, 2009. Forth Replacement Crossing: Environmental Statement.
(6) ERM, 1998. Aggregate Production Licence Application, Middle Bank, Firth of Forth: Environmental Statement. Report to Westminster Gravels Ltd.

Scotland and farther afield over the last ten years (1). Forth Ports' dredge spoil disposal operations have been ongoing at Oxcars for over 30 years, covering the periods of much higher salmon numbers indicating that there is no causal link between the ongoing spoil disposal activities and a broad scale decline in salmon numbers. Seasonal restrictions to operational requirements to dispose of dredged material at the Methil spoil ground are therefore not considered to be justified.

The Isle of May SAC, in the outer Firth of Forth, is designated for its populations of grey seal. Grey seals forage widely and may forage at the Oxcars site. Potential effects on grey seals resulting from the disposal activities are disturbance and noise due to vessel movements and disposal activities and displacement of prey species as a result of increased levels of suspended sediment at the disposal site.

The proposals are not likely to have a significant effect on grey seals for the following reasons.

- The small potential foraging area affected by disposal activities at the Oxcars spoil ground in relation to the available foraging area in the Firth of Forth.
- The intermittent and short duration of disposal activities (four to eight weeks a year).
- The small number of vessel movements (one per tide) associated with the disposal activities in relation to total vessel movements within the Firth of Forth.
- The long term existing disposal operations in the area which pre-date the site designation.

Bottlenose dolphins are a Habitats Directive Annex II species and are resident in the Moray Firth SAC. They are infrequent summer visitors to the Firth of Forth, mainly between June and September (2).

Vessel movements and noise have the potential to disturb or displace marine mammals and disposal activities have the potential to displace prey species within and in the vicinity of the spoil ground. The proposals are not likely to have a significant effect on bottlenose dolphins for the following reasons.

- The distance between the spoil ground and the SAC is large and the proportion of the bottlenose dolphin population anticipated to pass through the small area affected by disposal activities is anticipated to be low.
- The intermittent and short duration of disposal activities (four to eight weeks a year).
- The small number of vessel movements (one per tide) associated with the disposal activities relative to total vessel movements within the Firth of Forth.
- The relatively low speed and direct line of travel of dredge vessel movements to and from the spoil ground (*i.e.* no fast moving and erratic vessel movements).
- The long term existing disposal operations in the area which pre-date the site designation.

B2.5 Summary of Impacts

Table B1.14 presents a summary of the impacts and an assessment of significance of the impacts in relation to the sensitivity/importance of the receiving site.

(1) https://www.britishecologicalsociety.org/understanding-decline-atlantic-salmon-catches-scotland/#:~:text=The%20Scottish%20Government%20has%20collected,the%20previous%205%2Dyear%20average.
(2) Evans P. G. H. Chapter 5.15 Whales, Dolphins and Porpoises. In Coasts and Areas of the United Kingdom. Region 4 South- east Scotland: Montrose to Eyemouth, ed by J H Barne, C F Robson, S S Kaznowska, J P Doody, N C Davidson and A L Buck, pp 129-132. JNCC (Coastal Directories Series).

Table B1.14 Summary of Significance of Impacts

Receptor	Impact Significance Justification	Impact Significance
Water quality at disposal site	Disposal will be periodic and sediment will descend to the seabed rapidly. Any impacts will be localised and short-lived.	Not Significant
Sediment quality at disposal site	Increase in the levels of some contaminants will be localised and short-term and the deposited sediment will disperse within the open water system over time.	Not Significant
Benthic ecology at disposal site	Oxcars is designated as a disposal site. Disposal will occur over a relatively short period and similar habitat is available in close proximity to the site.	Not Significant
Seabirds	Proposed disposal operations are over a relatively short period each year and the area affected is a small percentage of the total available foraging habitat, with alternative sources of prey available close by. The SPAs were designated after the Oxcars spoil site was designated, and have not been impacted by historic and ongoing disposal operations.	Not Significant
Marine mammals and fish	Proposed disposal operations are over a short period of time and the area affected is a small percentage of the total available foraging habitat, with alternative sources of prey available close by. Due to the scale of the proposed operations and the likely impacts on water quality and seabed habitat it is predicted that the proposals are not likely to have a significant effect on migratory fish species. The volume of dredger vessel traffic will not be significant in relation to the existing traffic in the Firth of Forth.	Not Significant

B3 Cumulative Effects within the Firth of Forth

B3.1 Introduction

The potential impacts of the sea disposal option have been assessed within *Section B2* in isolation from other activities within the Firth of Forth and Forth Estuary. The impacts associated with the sea disposal option are not predicted to result in adverse effects on the integrity of the SPAs and SACs, however, it is possible that cumulative impacts with other projects could result in significant impacts.

For the purposes of this report a working definition of cumulative impacts as 'impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions, together with the project' (1) has been adopted. The assessment of potential cumulative impacts has been restricted to activities and proposed activities with the potential to directly impact the water and / or sediment quality within the SPAs and SACs. The other activities considered therefore include those that are at some distance from the activities at the Oxcars spoil ground but are within the foraging range of species that may utilise both areas.

B3.2 Past and Current Activities within the Firth of Forth and Forth Estuary

B3.2.1 Introduction

The Firth of Forth and Forth Estuary has previously experienced pollution from a number of industrial sources and sewage discharges, such as the petro-chemical operations at Grangemouth and the

(1) European Union. Guidelines for the Assessment of Indirect and Cumulative Impacts, as well as Impact Interactions, DG XI Brussels Downloaded from http://ec.europa.eu/environment/eia/eia-support.htm

sewage works at Seafield. The Imperial Chemical Industries (ICI) chemical plant previously based in Grangemouth is also known to have been a source of mercury into the Forth Estuary. Over the past 40 years, however, most of these pollution sources have been controlled or eliminated altogether.

Additional improvements to sewage works and other effluent treatment plants upstream have improved the condition of the water coming down the estuary into the Firth of Forth.

In addition, there are unknown and diffuse sources of discharges into the Forth Estuary, Firth of Forth and riverine inputs to these areas, for example from agricultural run-off and unrecorded drainage outfalls.

B3.2.2 Petro-Chemicals and Power Generation

The INEOS refinery and wider petro-chemical complex at Grangemouth are historically a dominant source of oil related PAHs in the Forth Estuary and the Firth of Forth.

Methil power station was a small base load coal slurry-fired power station, located on the south side of the mouth of the River Leven, where the river enters the Firth of Forth at Methil. The power station started operations in 1965 and was decommissioned in 2000, finally being demolished in 2011. Water from the Firth of Forth was abstracted and used as cooling water by the power station before being discharged back into the Firth of Forth.

The Longannet coal-fired power station on the north bank of the estuary closed in March 2016. The historic release of combustion related PAHs from this source will have contributed to the PAH loading within the Forth Estuary and Firth of Forth (1). Water from the Firth of Forth was abstracted and used as cooling water by the power station before being discharged back into the Firth of Forth.

Cockenzie power station was a coal-fired power station located on the southern shore of the Firth of Forth near to Cockenzie and Port Seaton. It generated electricity between 1967 and 2013, with demolition of the station completed in 2015. Water was abstracted from and discharged back into the Firth of Forth in the same way it was for Methil and Longannet.

B3.2.3 Commercial Fishing Activity

The sandeel fishery on the Wee Bankie, at the mouth of the Firth of Forth, has been closed since 2000 on seabird conservation grounds. The initial five year period was reviewed and extended following the reduction in numbers of some seabird species observed during a 2004 count (reduced sandeel numbers may be linked) within the Firth of Forth (2).

Improved water quality in the Firth of Forth has led to a resumption of cockle fishing, particularly on the Fife coast. Uncontrolled cockling could impact upon wintering bird populations by causing loss of prey species, directly (removal of cockles) and indirectly (damage to non-target species). A Special Nature Conservation Order (SNCO) was implemented under the *Conservation (Natural Habitats) Regulations 1994* to the outer Firth of Forth, including Forth Bridge to Granton Harbour and from Leith Docks to Joppa. This Order, implemented in March 2003, was revoked and reissued in 2006, and still stands (3).

B3.3 Other Dredging Disposal Activities

In addition to the intended maintenance dredging activities at Newhaven Harbour with proposed disposal at Oxcars, Forth Ports manages five other dredging operations within the Forth Estuary and Firth of Forth. The operations comprise the following.

(1) Richardson D.M., Davies I.M., Moffat C.F., Pollard P. and Stagg R.M. 2001. Biliary PAH metabolites and EROD activity in flounder (*Platichthys flesus)* from a contaminated estuarine environment. J. Environ. Monit., **3**, 610-615.
(2) Marine Scotland (2012). The Distribution of Zooplankton Prey of Forage Fish in the Firth of Forth Area, East Coast of Scotland. Available online http://www.scotland.gov.uk/Publications/2012/08/2345/1 .
(3)http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8499

- Trailer suction dredging in Grangemouth with disposal at Bo'ness spoil ground: maximum volume for maintenance dredging is 1,700,000 m^3 per annum. Dredging is undertaken over four days every month.
- Trailer suction dredging in Leith with disposal at Narrow Deep spoil ground: maximum volume for maintenance dredging is 100,000 m^3 per annum. Dredging is undertaken over one to two days per month, six months of the year.
- Trailer suction dredging in Rosyth with disposal at Oxcars spoil ground: maximum volume for maintenance dredging is 400,000 m^3 per annum. Dredging is typically undertaken over three days per month, every other month.
- Trailer suction or grab dredger Methil approach channel with disposal at Methil spoil ground: maximum volume for maintenance dredging is 12,500 m^3. Dredging is undertaken annually.
- Grab dredger and plough at Kirkcaldy with disposal at Kirkcaldy spoil ground: maximum volume for maintenance volume for dredging is 5,000 m^3. Dredging is undertaken annually.

The actual timing of dredging and volumes required to be dredged during each campaign depend on operational requirements and sedimentation rates (for example due to storm events, which can happen at any time of year).

Other recent, ongoing or planned licenced dredging activities in the Firth of Forth include the following (note these are based on planned or licenced activities so actual volumes dredged may be lower and dates may have been delayed due to Covid-19).

- Babcock Marine at Rosyth had a Marine Licence for maintenance dredging of up to 100,000 tonnes between March 2019 and March 2020 with disposal at Oxcars B.
- Capital dredge of up to 33,800 tonnes using a plough dredger at Port Edgar within the confines of the marina between April 2021 and April 2022 with disposal to the entrance to the marina.
- Trailer suction and backhoe dredging with self-propelled barge at Defence Munitions Crombie, maximum quantity of disposed material is 22,000 m^3 per annum for maintenance (1) (although this has not been undertaken annually), with disposal at Bo'ness spoil ground.
- Maintenance dredging at Granton Harbour by agitation of 5,904 tonnes per annum between August 2021 and August 2023. Previous licence to dredge 86,980 m^3 at Granton Harbour with disposal at Bo'ness or Narrow Deep spoil ground between August 2019 and July 2022.
- Maintenance dredging at Pittenweem Harbour, with disposal of 27,334 tonnes at Anstruther spoil ground between August 2019 and August 2020.
- Maintenance dredging using land based plant of 1,200 tonnes over two years at Dysart Harbour, Fife, with disposal on the adjacent foreshore where it is dispersed on the incoming tide (July 2019 to July 2021).
- Capital dredging and sea disposal of 225,000 wet tonnes from deepening the berth pockets at one of the quays at the Fife Energy Park at Methil. The licence covered the period 10 April and 3 September 2021. Disposal of the dredged sediment material was to be disposed at the Methil spoil ground with material with larger rock fractions to be disposed of at Narrow Deep.

Ongoing maintenance dredging spoil disposal operations require licence renewals every three years by Marine Scotland. Potential impacts are therefore assessed and reviewed every three years prior to granting a Marine Licence. The historical disposal route for spoil from all listed dredging operations has been deposition at sea, and to date, no environmental impacts, other than direct impacts within the spoil ground, have been reported.

(1) Rosyth International Container Terminal. Operational In-combination Assessment of Maintenance Dredging and Implications for the River Teith SAC. Jacobs, 2011.

Work began on the Forth Replacement Crossing at the end of 2011, and capital dredging works for the bridge support foundations started at the beginning of 2012. The purpose of the dredging was to create access for the construction of the foundations for the structures which will support the new bridge. In total 180,000 m^3 silt and sand was dredged from the seabed to form access channels for bridge foundation works between 2011 and 2016 (1) and the spoil was disposed of at the Oxcars spoil disposal site. For the larger dredged rock material, the Blae Rock spoil disposal site was used.

B3.4 Current and Foreseeable Future Activities

There is one existing and one proposed single turbine wind farm developments in the Firth of Forth, offshore from Methil

- Levenmouth Demonstration Turbine

  The Offshore Renewable Energy (ORE) Catapult's seven megawatt wind turbine was completed in 2013 and is located 50 m from the coast connected to the land by a ramp. The tower stands at 110 m and is 195 m to the top of the blade. Samsung had previously owned the wind turbine demonstrator, before selling to ORE Catapult in December 2015. In 2018 the licence to permit the turbine was extended to 2029.

- Forthwind Demonstration Project

  Forthwind has proposed to install a single turbine with a generating capacity of up to 20 megawatts and a meteorological mast 1.5 km offshore from the coast at Methil. The current application replaces the previous two turbine scheme, approved in 2016. The project is at the EIA scoping stage.

There are three large scale offshore windfarm development sites in the outer Firth of Forth area. These sites are at some distance from Oxcars (circa 60 to 100 km) but are within the foraging areas of the qualifying features of the SPAs and SACs. In addition, there will be power export cables laid on the seabed from the windfarm sites to coastal substations within the Firth of Forth. Other potential windfarm sites in the outer Firth of Forth area are at a concept/early planning stage.

- Neart na Gaoithe Offshore Wind Farm

  NnG Offshore Wind was granted consent by the Scottish Government in 2018 to build a 448 megawatt offshore wind farm in the outer Firth of Forth comprising up to 54 wind turbines up to 208 m high occupying an area of approximately 105 km^2. Construction commenced in 2020 with seabed preparations being undertaken prior to piling works. An onshore operations and maintenance base at Eyemouth received planning permission in September 2020. The wind farm is expected to be operational in 2023.

- Inch Cape Offshore Wind Farm

  Consent was granted for the proposed Inch Cape Offshore Wind Farm in October 2014. Consent was delayed following an objection lodged by the Royal Society for the Protection of Birds and final approval was given in 2017. A revised scope of design was granted by Scottish Ministers in June 2019. This scope reduced the number of wind turbine generators from 110 to 72. The turbines will occupy an area of 150 km^2. The windfarm will connect to the National grid at Cockenzie (with the closest part of the cable route being approximately 12 km from Oxcars). Construction is expected to begin in 2022. Once fully operational the wind farm will have an export capacity of approximately 1,000 megawatts.

- Seagreen Offshore Wind Farm

  Scottish and Southern Electric (SSE) and Fluor joint venture partnership Seagreen Wind Energy was awarded the exclusive development rights for the Firth of Forth Zone by the Crown Estate

(1) Hochtief (UK) Construction (2016). Forth Road Bridge Replacement - Queensferry Crossing. Available online http://www.hochtief-construction.co.uk/bridges_Forth_Road.shtml

Scotland. The zone covers an area of 2,852 km^2 in the outer Firth of Forth. Seagreen was awarded consent by the Scottish Government in October 2014 to develop the northern part of the Firth of Forth Zone to generate up to 1,050 megawatts of power from up to 150 turbines. The design was updated and approved in 2018 to comprise fewer, larger wind turbines. Currently the plan is for 1075 MW from 114 turbines which are currently under construction and are expected to be operational by early 2023. Montrose port is the preferred location for the operations and maintenance base and the export cable will go to Dundee. A further phase of 36 turbines in proposed with the export cable going to Cockenzie.

B3.5 Conclusions

Potential cumulative impacts associated with the above activities can be broadly categorised as comprising suspension of sediments during dredge spoil disposal operations and construction activities resulting in loss or smothering of benthos, the discharge of contaminants with the potential to impact both water and sediment quality, and the disturbance to seabirds and mammals from piling operations and vessel movements.

The Oxcars spoil disposal site also receives material from maintenance dredging at Rosyth. If disposal of material from Newhaven and Rosyth occurred at the same time then cumulative impacts from suspended sediments could occur. Similarly, disposal operations from dredging at the Port of Leith at the Narrow Deep spoil ground could results in cumulative impacts on suspended sediment concentrations. As Forth Ports has control over all these disposal operations, simultaneous operations can be avoided. These other dredging and disposal activities and the windfarm construction activities are at some distance from the Oxcars spoil site and no significant cumulative impacts from suspended sediments, noise and other vessel movements from these activities on the Oxcars site are considered likely.

The dredge spoil disposal operations at the Oxcars spoil ground pre-date the SPA and SAC designations and there is no evidence to suggest that the past and current disposal operations at Oxcars managed by Forth Ports have impacted the integrity of designated sites, supported species or resulted in other significant environmental impacts either alone or cumulatively with other activities in the area. Any significant future developments within the Firth of Forth are likely to be subject to assessment of significant environmental effects through the appropriate consenting processes.

APPENDIX C CONSULTEE RESPONSES (EXTRACTS FROM LETTERS/EMAILS RECEIVED)

C1 CITY OF EDINBURGH COUNCIL

Having considered the information, we can advise that we do not hold any relevant information or have any suggestions as to alternative disposal options, or comments in relation to the use of the Oxcars spoil disposal ground. We assume that, as part of this BPEO consultation, an enquiry relating to feasible disposal options has also been made to SEPA (the Waste Regulation Authority) in relation to feasible disposal options, such as landfill, reclamation or possibilities for waste licence exemption being authorised by SEPA.

C2 CROWN ESTATE SCOTLAND

I can confirm that the area to be dredged is not an area managed by Crown Estate Scotland and therefore we have no comment in relation to the proposed dredging. I understand that the disposal of dredge material from this area has historically been to the Oxcars dumping ground. Crown Estate Scotland will generally follow the recommendations of Marine Scotland where disposal sites are concerned and would most likely adopt the same approach in this case. There would be no objection to the use of the Oxcars disposal site. I am not aware of any alternative uses for dredge material within the Forth at this time.

C3 MARINE AND COASTGUARD AGENCY

Thank you very much for your letter notifying the MCA of your intended dredging and deposit activities within Newhaven Harbour. You have specifically asked for '*any relevant information or suggestions you may have regarding disposal options, including potential beneficial reuse and the use of the Oxcars spoil disposal ground'.* As a policy team in MCA HQ, our role is to assess the impact of your proposals on the safety of navigation, what risk mitigation measures are put in place for the works, and whether the risk is ALARP. We therefore have no further information to provide at this time on the disposal options.

C4 MARINE SCOTLAND

Thanks for your email regarding the BPEO for the planned application for maintenance dredge and sea disposal of dredged material from Newhaven Harbour. We would not comment or make judgements on a BPEO until it is submitted in support of an application. You may well have already have a copy, but the following is a link for the Marine Scotland general guidelines for marine licence applicants which contains some information regarding the required contents of the BPEO. Guidance+for+Marine+Licence+Applicants.pdf.

C5 NATURESCOT

Our advice remains unchanged from previous BPEO consultations for this site. We are not currently aware of any potentially beneficial re-use options. The Oxcars site is long established and as such benthic habitats and mobile species will be adapted to disposal operations. We suggest that this method of disposal remains suitable.

C6 NORTHERN LIGHTHOUSE BOARD

Northern Lighthouse Board has no objections to the proposed dredging and/ or disposal of dredged spoil to the charted and approved spoil ground at Oxcars, and will respond formally to the Marine Licence application, however we would advise the following:

- Forth Ports Ltd issue marine safety information as considered appropriate prior to the commencement of each dredging campaign.

- Forth Ports Ltd advise the UK Hydrographic Office (sdr@ukho.gov.uk) of the revised water depths in order that chart updates are completed.

ERM has over 160 offices across the following countries and territories worldwide

Argentina
Australia
Belgium
Brazil
Canada
Chile
China
Colombia
France
Germany
Hong Kong
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
The Netherlands
New Zealand
Norway
Panama
Peru
Poland
Portugal
Puerto Rico
Romania
Russia
Singapore
South Africa
South Korea
Spain
Sweden
Switzerland
Taiwan
Thailand
UAE
UK
US
Vietnam

ERM's Edinburgh Office

6th Floor
102 West Port
Edinburgh
EH3 9DN

T: 0131 221 6750

www.erm.com

The business of sustainability

ERM