Newton Basin Marina, Stornoway
Best Practicable Environmental Option Report

July 2018

Newton Basin Marina, Stornoway
Best Practicable Environmental Option Report

Client:	Stornoway Port Authority
Document number:	8222
Project number:	670526
Status:	Final
Author:	[Redacted]
Reviewer:	[Redacted]
Date of issue:	20 July 2018
Filename:	Newton Marina BPEO Draft Final

Glasgow

Craighall Business Park
8 Eagle Street
Glasgow
G4 9XA
0141 341 5040
info@envirocentre.co.uk
www.envirocentre.co.uk

Aberdeen

Banchory Business Centre
Burn O'Bennie Road
Banchory
AB31 5ZU
01330 826 596

Inverness

Alder House
Cradlehall Business Park
Inverness
IV2 5GH
01463 794 212

Edinburgh

Suite 114
Gyleview House
3 Redheughs Rigg
Edinburgh
EH12 9DQ
0131 516 9530

Contents

1 Introduction 1
1.1 Scope of Report 1
2 Discussion of available disposal options 2
2.1 Identification and screening of Available Disposal Options 2
2.2 Summary of Identified BPEO Options 5
3 Sediment Further Assessment 6
3.1 Dredge Material Characteristics 6
4 Water Framework Directive Assessment 9
5 Conclusions 12
References 13

Appendices

A Figures
B Laboratory data and Summary Tables

Tables

Table 2.1: Initial Best Practicable Available Options 3
Table 3.1: Summary of Exceedances at Disposal Sites 8
Table 4.1: Receptor Risk Assessment 9

1 INTRODUCTION

1.1 Scope of Report

Stornoway Port Authority are required to undertake a Best Practicable Environmental Option (BPEO) assessment for the dredging and reuse of material from the proposed Newton Marina project ('the proposed development').

The Newton Marina is proposed in response to the success of the Stornoway Inner Harbour Marina, which has been full, with the 83 berths occupied all year, virtually since it opened 3 years ago. The proposed development will provide berthing for an additional 75 vessels and relieve the pressure over the summer months for visiting yachts. Newton Basin lies within the shelter of Goat Island, but is exposed to winds and wave action from the west. It is proposed to build a sheltering breakwater and carry out land reclamation using material excavated to form the entrance channel and the marina basin.

Ground investigation has confirmed that, with the exception of a band of soft silt at the lower 0.5m of the dredge, all the dredged material will be physically suitable for reclamation. It is proposed that the soft silt (estimated at up to 20,000m^3) will need to be considered further for alternate disposal route.

Site investigation works were undertaken by Causeway Geotechnical and the results are summarised in Causeway Geotechnical Interpretive Report No.17-0769b, April 2018. Borehole locations are detailed within the figure in Appendix A. The relevant laboratory analytical data from the marine boreholes is included in Appendix B, and this data has been reviewed in line with the current Action Levels for disposing of sediment at sea.

In normal circumstances, the purpose of this report is to review each of the available potential disposal options for the dredged materials. The options which are not considered to be practicable are rejected and the reasons for doing so are explained. However, due to the fact it is envisaged that up to 80% of material will be incorporated into the proposed development for the purposes of land reclamation, the selection process will be undertaken for identification of the BPEO in a shortened format in Section 2.

2 DISCUSSION OF AVAILABLE DISPOSAL OPTIONS

The BPEO process is geared towards identifying a preferred overall strategy from the perspective of the environment as a whole, as opposed to detailed optimisation of any one selected scheme. It is a structured and systematic process to identify and compare strategic options in a transparent manner. Alternatives are evaluated in terms of their projected implications for the environment together with consideration of practicability, social and economic issues as well as within a wider strategic context.

The key stages of a BPEO are:

- Identification of options;
- Screening of options;
- Selection of assessment criteria;
- Analysis and evaluation of criteria; and
- Evaluation of BPEO.

2.1 Identification and screening of Available Disposal Options

A number of options are available for disposal of dredged sediments. The options considered are provided in Table 2.1 along with justification for screening out those options which have not been taken forward for further consideration.

Table 2.1: Initial Best Practicable Available Options

Location	Options	Screening Assessment	Carry forward?
Coast / Harbour	Do nothing Scenario/ Leave in situ	Not an option due to the requirement to develop a marina and associated facilities.	No
	Infilling of an existing dry dock/harbour facility	There are no suitable dry dock or harbour facilities requiring infill in the vicinity of the project and on this basis this option is not available.	No
	Beach Nourishment	Specific beach nourishment projects would require to be supported by Environmental Assessments as a minimum to inform how the project could affect the environment as a result of disturbance to the intertidal area, changes to the sediment levels, the variable composition and quality of the material and measures devised from the assessment outcomes to minimise impacts on the environment. 80% of dredge material will be utilised as infill for land reclamation and up to 20% of material is proposed to be disposed of due to poor geotechnical characteristics. The material which has been identified for exclusion within the land reclamation comprises silty material. Silty material is not typically used for beach nourishment projects. On this basis, this option can be discounted.	No
Land	Landfill Disposal	Material which is not suitable for sea disposal must be brought to land. Landfill is an option for the material which is not suitable for a sea based disposal, however it is not considered to be the most sustainable option available. The closest landfill is Bennadrove Landfill Site, Bennadrove Road, Marybank in Stornoway.	Yes
	Recycling/Re-use	80% of the dredged material will be utilised for reclaiming land behind a retaining wall and bunds.	Yes
	Land Incineration	The dredged material consists of non-combustible material (silts) with a low combustible component and very high water content.	No

Location	Options	Screening Assessment	Carry forward?
	Application to Agricultural Land	The dredged material would need to be treated to reduce salt concentrations to acceptable levels. Would require detailed chemical analysis and assessment as well as a Waste Management License Exemption. Would require special precautions during spreading in relation to the risk of odour and watercourses / aquifers. The availability of land for this option will be limited within a reasonable haulage distance of the dredge arisings. Large volumes each year are unlikely to be viable to dispose of in this manner.	No
Sea	Aquatic disposal direct to seabed.	Up to 20,000m^3 of the total 100,000m^3 dredge works is ear marked for sea disposal at HEO035 – Stornoway. Further consideration of this route is provided in Section 3.	Yes

2.2 Summary of Identified BPEO Options

Three options were identified for further assessment as follows:

- Landfill Disposal;
- Recycling/Re-use and
- Sea Disposal.

As outlined previously, the proposed disposal routes are to be split with 80,000m^3 to be reused for land reclamation, as such the majority of material is being re-used. Up to 20,000m^3 of the material comprises silt which is not suitable for re-use on the basis of geotechnical quality, and therefore this is considered for disposal.

Landfill disposal is an available option for the silt, however it is not considered to be the most efficient use of the landfill resource, especially on an island, where landfill opportunities are limited. A landfill based solution, assuming that the landfill would accept the material has the following considerations:

- 20,000m^3 of sediment with a bulk density of 1.8 equates to approximately 36,000 tonnes – this would result in approximately 900 HGV movements each way from site to the landfill; and
- The landfill site is approximately 3.8 miles (avoiding town centre) from Goat Island which equates to 13,680 miles of additional road movements, partly through residential areas; and
- Additional cost to the project – This option has significantly increased handling i.e. dredger to land, move to stockpile, move to lorry prior to landfill plus handling at the receiving end. All additional cost and fuel use. The sea based disposal option minimises these activities and keeps additional vehicles off the road while also protecting landfill capacity on the island with disposal in a pre-existing licensed facility for this purpose.

Further supporting information and detailed assessment of the sea based disposal for the silt fraction is considered in Section 3 as well as considerations on the potential risks associated with the reuse of the dredge material to the water environment.

3 SEDIMENT FURTHER ASSESSMENT

3.1 Dredge Material Characteristics

The dredge area and borehole locations are detailed in Drawing 670526-021 in Appendix A.

Review of the report has indicated that 7 boreholes were drilled within the dredge area,

- BH33;
- BH34;
- BH35;
- BH36;
- BH37;
- BH38; and
- BH39

45 samples were tested in total with samples tested from between 0.4m and 4.0m below surface

The sediments range from very fine gravelly medium silt to coarse gravel.

The data was compared against Action Level 1 and Action Level 2 for sea disposal. These data are summarised in Table A in Appendix B. Please note that all PAH concentrations are in ug/kg not mg/kg and that the associated screening values have also been converted. Additionally, to enable the screening of the ICES 7 PCB congeners, the LOD for each of the 7 congeners were added together to provide a concentration for screening for a worst-case scenario.

The results can be summarised as follows:

- 1 samples exceeded Al1 for cadmium;
- 11 samples exceeded AL1 for chromium;
- 4 samples exceeded Al1 for copper;
- 11 samples exceeded Al1 for nickel;
- 2 samples exceed AL 1 for one PAH species or more;
- PCBs and TBT did not record any concentrations above their respective LODs; and
- No contaminants of concern recorded concentrations above AL2.

It should be noted that average concentrations for all analytes fall below the corresponding AL 1 value.

It is intended that 90% of the total dredge volume will be reused in land reclamation and the unfavourable material (silt) will be disposed of at sea within the licensed disposal site at HEO35 – Stornoway.

3.2 Assessment Outline

The purpose of this assessment is to provide an overview of the proposed dredge material and the identified disposal site(s) including existing chemical monitoring data for the site where available.

This assessment will compare existing chemical data with other recognised sediment assessment criteria including those listed below:

- **Background Assessment Concentration (BAC**) - BACs were developed by the OSPAR Commission (OSPAR) for testing whether concentrations are near background levels. Mean concentrations significantly below the BAC are said to be near background. However, it should be noted that river catchments have their own unique geochemical finger prints and are also governed by the geology within the catchment, so in theory one set of background level values is not applicable to all situations;

- **Effects Range Low (ERL) -** ERLs were developed by the United States Environmental Protection Agency (USEPA) for assessing the ecological significance of sediment concentrations. Concentrations below the ERL rarely cause adverse effects in marine organisms. Concentrations above the ERM will often cause adverse effects in some marine organisms;

- **Probable Effects Level (PEL) –** PELs (Marine) have been adopted from the Canadian Environmental Quality Guidelines http://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/) If a concentration is recorded above the PEL this is the probable effect range within which adverse effects frequently occur. The Threshold Effect levels (TELs) have been included in the summary table in Appendix A, but have not been used as part of the further assessment as they typically fall below the RAL1

The assessment will review potential risks to the list of receptors identified in "Water Framework Directive Assessment: estuarine and coastal waters (https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters).

3.2.1 Chemical Quality Screening of Dredge Material

All exceedances are summarised in Section 3.1 in Table A in Appendix B with exceedances summarised below.

Revised Action Level 1

- Up to 11 of 45 samples exceed REV AL1 for metals and PAHs

BAC

- 8 of 45 samples exceed for metals (chromium and nickel
- 3 of 45 samples exceed for PAHs

ERL

- Up to 6 of 45 samples exceed ERL levels where available for chromium.

PEL

- 0 of 45 samples were noted to exceed the PEL where one was available for comparison.

Revised Action Level 2

- No exceedances of REV AL 2 are recorded where they are available for the 45 samples.

3.2.2 Chemical Data at Disposal Site

The sampling data for the local disposal site HEO035- Stornoway was provided by Marine Scotland as a means of baseline assessment. A summary of key contaminants concentrations is provided in Appendix B in TABLE B for the disposal site where data was provided by Marine Scotland.

There are a total of 77 samples, however, not all samples have all analytes included.

Data for all contaminants was not provided for each sample, so the summaries are of the data provided only and the number of data points vary accordingly.

Total PCB concentrations have been compiled by adding the ICES 7 congener concentrations as per the dredge material to enable a like for like comparison. Congeners included are PCB 28, 52, 101, 118, 138 153 and 180.

Table 3.1: Summary of Exceedances at Disposal Sites

Site ID	Total No. of Samples	Max No. of BAC Exceedances	Max No. of ERL Exceedances	Max No. of PEL Exceedances	Comments
HEO035 – Stornoway	77	24	13	10	PELs exceeded for various metals mercury and lead and PAH species

PEL levels are exceeded for mercury and lead as well as multiple PAH species.

In summary, the disposal site has a history of concentrations of contaminants of concern in exceedance of the PEL, where one is available.

3.2.3 Average Concentrations

Average concentrations for all the contaminants of concern in the samples from the dredge area are below PELs where available.

3.3 Chemical Assessment Conclusions

While exceedances of AL1, BAC and ERL (where available) values have been recorded for various contaminants of concern in the dredge area sediments, none record exceedances of either the PEL levels (where available) or corresponding AL2 values.

Additionally, review of the background contaminant levels all three of the potential disposal site has identified that there are contaminants of concern in exceedance ERL and PELs.

On this basis, it is considered that while some of the contaminants are recorded above their respective REV AL1 levels within the dredge sediment, the levels at the disposal site (HEO035) are similar in nature and unlikely to pose a significant risk for those materials should they require to be disposed of within the licensed spoil grounds.

4 WATER FRAMEWORK DIRECTIVE ASSESSMENT

This section details the assessment the dredge and disposal sites within the context of the Water Framework Directive as required by Marine Scotland.

As outlined in the Water Framework Directive Assessment: estuarine and coastal waters, there are several key receptors which can be impacted upon including the following:

- Hydromorphology;
- Biology – habitats;
- Biology – fish;
- Water quality; and
- Protected areas

In addition to this, to provide further assessment for the re-use of the material in the reclamation of land, leachability testing has been done on several samples to establish what the potential risks are to the water environment. This is detailed further in section 4.1

Each of these points are considered in Table 4.1 below:

Table 4.1: Receptor Risk Assessment

Key Receptor	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Hydromorphology	Morphological conditions, for example depth variation, the seabed and intertidal zone structure tidal patterns, for example dominant currents, freshwater flow and wave exposure	Yes	Hydromorphology is discussed within Chapter 8: Water Environment, Soils and Coastal Processes, and hydraulic modelling is covered within Technical Appendix 8.2: Hydraulic Modelling within the EIAR for the project.
Biology - habitats	Included to assess potential impacts to sensitive/high value habitats.	Yes	Habitats and fish are covered in Chapter 5: Marine Ecology and fish specifically within Technical Appendix 5.6: Fisheries Baseline Report within the EIA for the project.
Biology - fish	Consideration of fish both within the estuary and also potential effects on migratory fish in transit through the estuary	Yes	
Water Quality	Consideration must be given to water quality when contaminants are present in exceedance of CEFAS RAL1.	Yes	Contaminants noted to exceed CEFAS RAL1 within sediment samples. Further information is provided below.

Key Receptor	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Protected Areas	If your activity is within 2km of any WFD protected area, include each identified area in your impact assessment. • special areas of conservation (SAC) • special protection areas (SPA) • shellfish waters • bathing waters • nutrient sensitive areas	Yes	Protected areas can be viewed within Figure 1.2 of Volume 2 of the EIA – there are no protected areas within the site boundary but outside the site boundary there is a proposed Marine Protection Area and a candidate SAC.

Source: Taken from https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters

4.1 Potential Risk to Water Quality

The potential risks to water quality at both the dredge sites and disposal site are further considered below.

The coastal classification of this area of water in and around the site disposal ground is **good** (2016 Stornoway Harbour and Gob na Greige to Rubha Raerinis Polygons) as detailed on Scotland's Environment (http://www.environment.scotland.gov.uk/).

Although there are contaminants of concern above the Rev AL1 for sediment disposal, it is considered that these levels will not contribute to an overall degradation of water quality as the potential for dilution in and around the disposal site is very considerable. The key contaminants for impacting water quality are considered to be metals as these have the potential to dissolve/desorb from sorption sites, whereas the organic contaminants (PAHs) have a greater affinity for the organic materials which they are bound to, and are more likely to remain strongly bound to the sediment, or if become dissolved, quickly adsorbed onto organic matter.

Additionally, the sediment quality within the disposal ground which is also noted to contain levels of contaminants above the adopted PELs (metals and PAHs), does not appear to have impacted on the Water Quality classification of good in this area.

The key risk is considered to be an increase in turbidity/suspended solids during the disposal activity. , Although this is likely to cause localised degradation in water quality, it is considered that this will be a short term event and has been factored in to the selection and location of the agreed disposal ground. On this basis, the associated risk with degradation of water quality directly associated with the proposed disposal is considered to be Low i.e. unlikely to cause a significant adverse effect on the overall water quality.

4.2 Leachability Assessment of Dredge Material

Leachate preparation and analysis was undertaken as part of the testing regime. These data are summarised in Table C in Appendix B. The findings are summarised below.

- Arsenic, cadmium, copper, lead and zinc all recorded concentrations below the adopted Environmental Quality Standards (EQS) with most samples recording concentrations below the LOD;

- It is noted that the LOD for mercury is higher than the corresponding EQS. 45 of 48 samples recorded concentrations below detectable levels.
- The following metals recorded exceedances of the adopted EQS criteria:
    - Chromium-3 of 48 samples
    - Mercury - 3 of 48 samples
    - Nickel – 2 of 48 samples

- TBT, PCBs and Petroleum Hydrocarbons were recorded be low detectable limits. It is noted that the LOD for TBT is higher than the adopted EQS values.
- One sample BH34 -2.0m recorded concentrations of Petroleum Hydrocarbons fluoranthene and benzo (a) anthracene above the LOD. The single flouranthene concentration also exceeded the adopted EQS concentration.

Considering the material as a single unit in place behind the retaining wall, the average concentrations are below their adopted EQS values with the following exceptions:

- Mercury – LOD for mercury exceeds the marine EQS, so results are inconclusive; and
- Chromium – the average concentration calculates at 15.7 ug/l which is marginally higher than the adopted EQS of 15.

While several contaminants of concern have been recorded in exceedance of their adopted EQS criteria within leachate, this does not consider the huge dilution potential offered by the receiving water and also the presence of physical barriers (e.g. retaining structures around the area of reclaimed land).

Considering the dilution potential within the harbour and wider area it is considered that the risk to surface water from leachable contaminants and total concentrations recorded within the dredge material is very low, and is unlikely to have a measurable impact on the water environment.

4.3 Protected Areas

There are no protected areas in the dredge or disposal ground, or the area which is proposed for reclamation works. There is a proposed Marine Protection Area and a candidate SAC, the Inner Hebrides and Minches approximately 800m to the east of the disposal site and approximately 2.2Km south east of Goat Island.

The key potential risk to the sensitive features are considered to be attributed to the transport of suspended material from the dredge site during dredging whereby contaminants associated with particulate material could be transported from the dredge site towards the protected areas.

Considering the presence of low level contaminants i.e. a number of exceedances of AL1 within the sediments, mitigation measures will be required during the dredging works to minimise this potential risk during dredging and placement behind the retaining structures of the new development.

5 CONCLUSIONS

In summary, 100,000m^3 of material is proposed to be dredged to facilitate the development of the Newton Basin Marina. 80% (80,000m^3) of the dredge material is intended to be utilised within the land reclamation works.

The remaining 20% has been identified as potentially geotechnically unfavourable material (silts) and the identified BPEO for this material is sea based disposal at the licensed disposal site HEO035.

Chemical analysis of the dredge material recorded 11 samples with exceedances of Action Level 1. None of the samples recorded exceedances of adopted Probable Effect Levels (PELs) or Action Level 2. On this basis there is not considered to be a significant risk associated with dredging or sea based disposal of the material.

With respect to risks from re-use of the material, review of leachate data has highlighted a few minor exceedances of adopted EQS criteria. However, considering the magnitude of these exceedances, the physical barriers in place between the dredged material and the sea, this risk to the water environment is considered to be low as the dilution potential within the receiving water is significant, and would reduce any potential associated risks rapidly at the point of discharge.

Following the review of potential risks associated with dredging, sea based disposal and re-use options the risks associated with the dredged materials are considered to be Low.

REFERENCES

Canadian Council for Minsters of the Environment (CCME), Canadian Environmental Quality Guidelines, https://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/

Marine Scotland (2017). *Pre-DredgeSampling Guidance Version 1*: Scottish Government.

Marine Scotland (2018), National Marine Plan Interactive (NMPI), https://marinescotland.atkinsgeospatial.com/nmpi/

APPENDICES

A FIGURES

B LABORATORY DATA AND SUMMARY TABLES