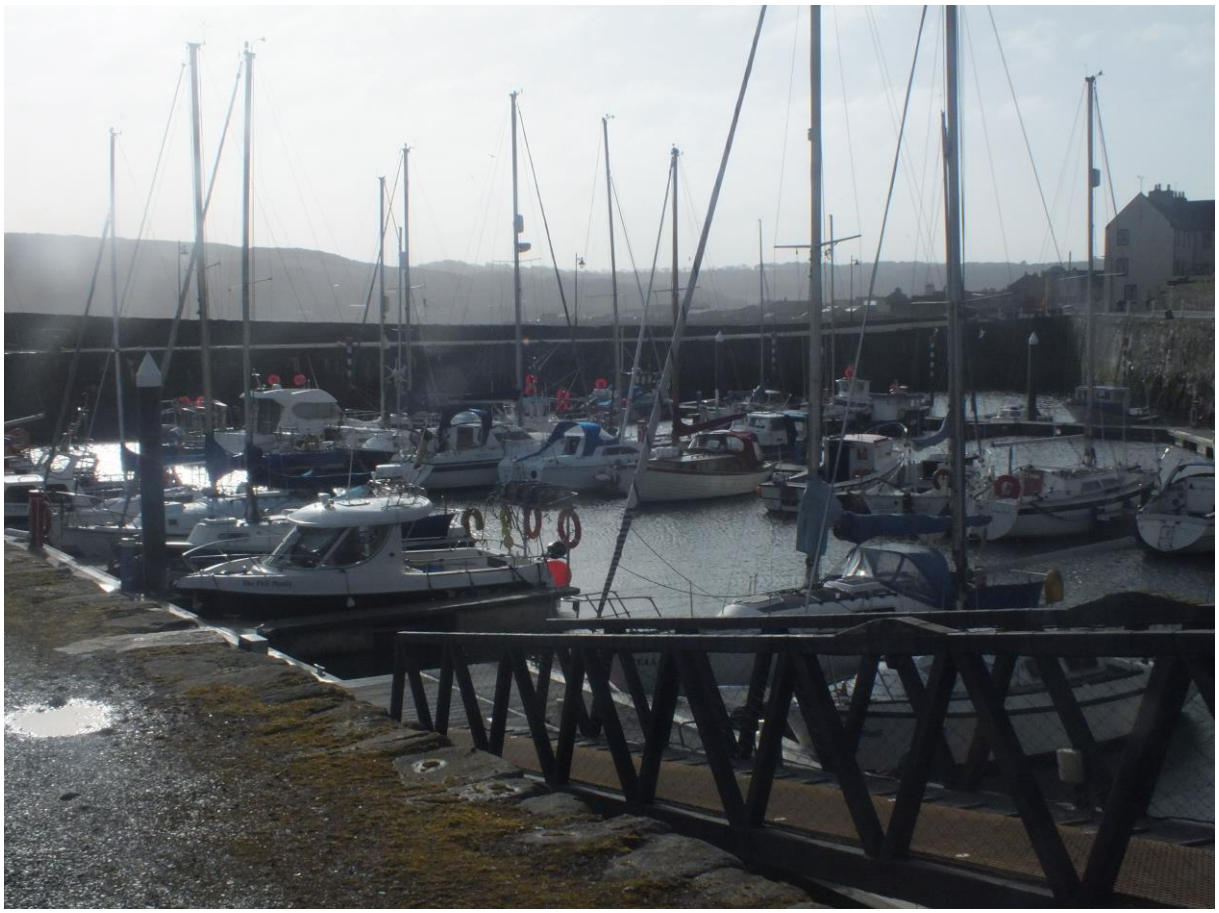
Banff Harbour
Best Practicable Environmental Option (BPEO) Assessment



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Best Practicable Environmental Option (BPEO) Assessment

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1 INTRODUCTION

1.1 Scope of Report

EnviroCentre have been commissioned by Aberdeenshire Council to produce a Best Practicable Environmental Option Assessment (BPEO) in support of proposed maintenance dredging at Banff Harbour.

The dredge area is shown in Drawing No. 374655-QGIS001 in Appendix A.

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.

Those options which are practicable are examined in detail and assessed against the following considerations:

- Environmental;
- Strategic; and
- Cost.

The report then compares the practicable disposal options and draws a conclusion on the BPEO.

1.2 Programme of Work

The programme of work involves the removal of up to 5,000m^3 (10,000 tonnes) of material from within the harbour, to a maximum depth of 1 metre below bed level. The maintenance dredging activity is required to ensure that sufficient depth remains to ensure that Banff Harbour continues to be able to accommodate vessels. Sediment primarily consists of sand and silt and it is anticipated that material will be removed by a grab dredger.

Chemical testing of the material has been undertaken to support this assessment. The findings of the sediment sampling exercise are summarised in *Banff Harbour – Sediment Sampling Report*, EnviroCentre report ref. 9551, dated April 2021.

1.3 Dredging Activities

The method of dredging at the dredge site has not been completely finalised and the specific plant will not be confirmed until a contractor has been appointed. However, the method is most likely to utilise a grab dredger with a split-hull hopper or similar as per previous dredging campaigns.

The harbour is currently closed to all vessels while construction work is undertaken to repair the East pier. Dredging will be undertaken once the work is completed and the temporary gravel bund removed.

1.4 Nature of the Marine Sediments

A pre-dredge sampling exercise incorporating three grab samples collected in 2019 plus an additional three vibrocore samples and two grab samples were undertaken in March 2021. A total of 14 sediment samples were analysed for the standard Marine Scotland suite.

The locations of the samples are given in Drawing No. 374655-QGIS001 in Appendix A.

A summary of the laboratory testing is detailed in Table 1-1 below:

Table 1-1: Exceedances of Revised Action Levels and Maximum Concentrations

Contaminant	No. Exceedances (of 11 samples)		Maximum Concentration (mg/kg) and Location
	RAL1	RAL2	
Arsenic	1	0	21.9 @ A7402 C (2019)
Cadmium	8	0	0.83 @ A7402 C (2019
Copper	6	0	419 @ A7402 C (2019)
Chromium	1	0	71.3 @ A7402 C (2019)
Lead	0	0	49.2 @ A7402 C (2019)
Mercury	0	0	0.24 @ A7402 C (2019)
Nickel	3	0	40.8 @ A7402 C (2019)
Zinc	1	0	899 @ A7402 C (2019)
PAH (All Species)	11	-	0.891 – Fluoranthene @ GS1
PCBs	0	0	0.0023 @ VC3, 0.20-0.70m
TBT	0	0	0.026 @ VC01 0.00-0.15m
THC	11	-	456 @ VC3, 0.20-0.70m

A maximum of 8 samples exceeded RAL1 for at least one metal, with most exceedances occurring for cadmium. All but three samples recorded exceedances above RAL1 for at least one PAH species and 12 of the 14 samples recorded RAL1 exceedances for Total hydrocarbons (THC).

There were no exceedances above RAL1 for PCBs and TBT.

RAL2 exceedances for copper and zinc were recorded in sample A7402 C collected in 2019.

1.5 Additional Sampling 2022

Following submission of the Dredge licence application and supporting information in May 2021 Marine Scotland requested additional sample date to delineate the area of the harbour represented by sample A7402 C collected in 2019.

A grab sample was collected at the coordinate of the original sample location with 4 additional samples surrounding it. The sample plan, summary of works and results are provided in Appendix C.

In summary no further RAL2 exceedances were recorded in the sediment within the area with all samples considered representative of the wider sediment quality as per the other samples previously collected.

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.

Further details on methodology are provided within each section.

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 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?
Coastline	Leave in situ	Not an option due to the requirements to maintain depth to allow vessels to access and berth in the harbour.	No
	Infilling of an existing dry dock/harbour facility (re-use)	No current or proposed dock/harbour infilling projects are known within a reasonable distance of the dredge site. In addition, given the relatively small volume of sediment to be dredged (~5,000 m^3), it is most likely that this would not be a sufficient amount of material to complete any infilling project and would provide only part of the total amount of sediment that would be required. Once material is brought on to land it falls under the jurisdiction of SEPA. Further geotechnical and chemical testing would likely be required before it is permitted for use on any such development.	No
	Beach Nourishment	Much of the Aberdeenshire and Moray coast are designated sites (SSSI, SPA) and hold both national and international importance to nature conservation. Specific beach nourishment projects may require to be supported by Environmental Assessments 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. The harbour authority (Aberdeenshire Council) have previously used dredged material from the outer basin for beach nourishment (with the remainder of material from the middle and inner basins being disposed at sea). The dredge material in the outer basin area predominantly comprises sand, which is likely to be considered suitable for beach nourishment. Finer grained material from the middle and inner basins is unlikely to be considered to be suitable for beach nourishment in the traditional sense.	Yes
			No

Land	Landfill Disposal	This is technically possible but it is unlikely that this option will offer a long term solution due to lack of space at landfills, with other waste types likely to be prioritised. Landfill space is currently at a premium and does not offer a sustainable solution either financially or environmentally for the disposal of dredged arisings. Dredged material is likely to require treatment first in a dewatering facility. There will be significant cost associated with set up of dewatering facility at the quayside or elsewhere plus transportation and additional costs associated with gaining the necessary planning and regulatory consents.	Yes
	Land Incineration	The dredged material consists of non-combustible material (silts, sands, gravels, shells) with a low combustible component.	No
	Application to Agricultural Land	The dredged material would need to be treated to reduce salt concentrations to acceptable levels. It would require detailed chemical analysis and assessment as well as a Waste Management License Exemption. It would require special precautions during spreading in relation to the risk of odour and watercourses / aquifers. Disposal of sediments in this manner would potentially have a detrimental effect on existing terrestrial habitats.	No
	Recycling	Recycling of dredged material is theoretically possible, however, due to the varied lithology there would need to be either segregation during dredging works, or energy and water rich processing on land. EnviroCentre have not been made aware by the harbour authority of an established disposal and reuse route in Aberdeenshire and Moray at present. In addition, given the relatively small volume of sediment, and the logistics involved, this unlikely to be a cost effective option.	No
Sea	Aquatic disposal direct to seabed.	The closest dredge spoil disposal ground is Macduff (CR050), 3.6km north east of Banff Harbour. The proposed dredge method is to utilise a grab dredger with a split hull hopper or similar, as per previous dredging campaigns. Overall disposal costs associated with sea disposal are generally lower than land-based disposal, with low environmental risk due to appropriate sediment quality screening measures applied during the licensing process.	Yes

2.2 Summary of Identified BPEO Options

Following review of the available options, three options were identified for further detailed BPEO assessment which are as follows:

- Beach Nourishment;
- Landfill Disposal; and
- Sea Disposal.

A brief summary of the necessary works or methodology for each option being taken forward for detailed BPEO assessment is provided below.

2.2.1 Beach Nourishment

This method would involve the following material handling stages:

- Dredging;
- Temporary stockpiling of material on land;
- Transfer of sediment on to wagon;
- Placement of sediment on beach; and
- Distribution/profiling of sediment by excavator.

It is anticipated that dredging will be undertaken using a grab dredger. The material would then have to be transferred on to land and temporarily stockpiled before being transferred into a suitable wagon for transport to the beach site before it is then suitably distributed and profiled. Aberdeenshire Council have identified a beach 150m west of Banff Harbour as a possible site for a small-scale beach nourishment project. There is potential for some temporary disruption to local residents and harbour users as a result of plant movements.

The previous maintenance dredge licence has permitted the use of material from the outer basin of the harbour to be used as part of a beach nourishment exercise.

2.2.2 Landfill Disposal

Dredged material is considered to be controlled waste for the purpose of transport, storage and disposal as per Section 34 (7) of the Environmental Protection Act 1990. The Landfill (Scotland) Regulations 2003 require the classification and characterisation (i.e. inert, non-hazardous or hazardous) of the dredged material to be determined prior to landfill acceptance.

Disposal to landfill would require several stages in material handling operations:

- Dredging;
- Transfer to a dewatering facility or temporary storage until it had dried to a suitable moisture content for landfilling;
- Dewatering;
- Transfer of dewatered material to storage area for stockpiling;
- Loading of lorries and transport to landfill site; and
- Disposal at Landfill site.

Dredging is proposed to be undertaken using a grab dredger. Therefore, material will require to be moved from the on-board hopper on to land. The material would then require to be transferred to the dewatering facility.

The dewatering facility would most likely require to be purpose built and capable of receiving up to 5,000 m^3 of material. We understand that no facility currently exists in Aberdeenshire or Moray. Settlement tanks, with the aid of sluices and rotational management, would allow solids to settle out and the water element drain off and return to the sea. Temporary mobilisation of bespoke mechanical dewatering equipment could also be utilised but at greater cost. Alternatively, the material could be temporarily stored until the material dried out, resulting in a reduced cost assuming that suitable temporary storage is available. The dewatered dredged sediment would then be removed from the facility and stockpiled for transfer via lorry to a suitably licensed landfill. This is dependent on space being available close to the harbour and given the close proximity of residential housing to the harbour, it may be disruptive to the local community.

We understand that the type of vehicle most suitable for transporting the dewatered dredged material is either a rigid bodied tipper or an articulated tanker both with a 16 tonne load capacity. The dredge volume will be a maximum of 10,000 tonnes[1] of material and approximately 625 return trips would typically be required to transport the dewatered dredged material to landfill.

Information from the SEPA website[2] suggests that the closest operational landfill to the site is Nether Dallachy Landfill near Portgordon, approximately 25 miles from Banff by road. Approximately 625 return trips of 70 miles each would result in an approximate total of 15,625 miles of road transport to dispose of the sediment at this location. In addition, the available capacity of each site is limited by the amount of material it can receive per annum. Nether Dallachy Landfill is a non-hazardous landfill with a permitted annual capacity of 120,000 tonnes per annum. Given that space in non-hazardous landfill is limited, it is likely that municipal waste will be prioritised over sediment where other disposal methods are available.

The closest operational inert landfill according to information on the SEPA website is at Loch Hills Quarry, Dyce, near Aberdeen – some 40 miles by road from Banff. This would require up to 50,000 miles of road transport to take the dredged material to this location. The site has an annual permitted capacity of 100,000 tonnes per annum. Therefore if the site received up to 10,000 tonnes of sediment from Banff, this would be a considerable proportion of the site's annual capacity limit. This disposal route would also assume that the sediment would meet the more stringent acceptance criteria for an inert landfill.

2.2.3 Sea disposal

A licenced sea disposal site is located within close proximity of Banff Harbour – Macduff (CR050) is located 3.6km north east of the harbour to be dredged.

It is anticipated that dredging will be undertaken using a grab dredger with a split hull hopper, or a similar configuration. This would mean that dredging and disposal can take place without the need for double handling of material or bringing the dredged material ashore.

This practice has previously been accepted as a disposal route for dredged material from Banff Harbour.

[1] Maximum volume of dredged material is 5,000m^3. Assumed 1m^3 = 2 tonnes.
[2] https://www.sepa.org.uk/data-visualisation/waste-sites-and-capacity-tool/

3 FURTHER CONSIDERATION OF REMAINING DISPOSAL OPTIONS

3.1 Detailed BPEO Assessment

Each of the identified options was assessed against the criteria detailed in Table 3-1 below.

Table 3-1: BPEO Detailed Assessment Criteria

Primary Criteria	Description and Attributes
Strategic	• Operational aspects, including handling, transport etc. • Availability of suitable sites/facilities • General Public/local acceptability • Legislative Implications • Summary of the outcome of consultation with third parties
Environmental	• Safety Implications • Public Health Implications • Pollution/ Contamination Implications • General Ecological Implications • Interference with other legitimate activities e.g. fishing • Amenity/Aesthetic Implications
Costs	• Operating costs e.g. labour, site operations, environmental monitoring • Capital e.g. Transport, equipment hire

3.1.1 BPEO Strategic Assessment

Table 3-2 below provides details of the strategic assessment for each option taken forward for the detailed BPEO assessment:

Table 3-2: BPEO Strategic Assessment

Criteria	Beach Nourishment	Landfill	Sea Disposal
Operational Aspects (inc. handling and transport)	This method would involve double handling of material, with road transport by HGV between the harbour and the beach site required. A small beach 150m west of the harbour has been identified as a potentially suitable site, therefore HGV movements would be over short distances. The potential need for additional environmental assessment and potential licensing requirements may put pressure on the required project timescales.	Would involve multiple handling of material through dewatering and transportation to landfill. A facility would need to be built for dewatering purposes. Would also increase the number of HGV's on the road network.	There would be no double handling of the dredged material. Transportation to the disposal site would be by dredging vessel without the need to bring the material on to land. The proposed disposal site is only 3.4km away by sea.
Availability of suitable sites/facilities	Aberdeenshire Council have identified a potential receiving beach, approximately 150m west of the harbour.	The geotechnical composition of the dewatered dredged material is considered to be suitable for disposal via this route. However, there are a limited number of operational landfills in the area. Moreover, there is typically a limit to the amount of waste that can be accepted both on a daily and annual basis at a landfill. Based on the annual capacity of the two closest operational landfills, the dredged material would account for up to 10% of the respective site's annual input limit. Due to limited space at non-hazardous landfills, it is possible that municipal waste will be prioritised over dredge material where other disposal routes are available.	Marine disposal sites nearby have been designed to accommodate the quantities of material typically generated by dredging operations. The total dredge volume for this project is considered to be relatively low. The chemical analysis of the sediments from the proposed dredge sites would indicate that the material is likely to be acceptable for testing pending further risk assessment for contaminants present at levels between Action Level 1 and Action Level 2.

Criteria	Beach Nourishment	Landfill	Sea Disposal
General Public /Local acceptability	The beach nourishment project is likely to be generally welcomed by the public, as it will be seen as a way of bolstering and protecting the beach from erosion. However, the HGV movements required may not be looked upon favourably. That said, any HGV movements will be concentrated within the harbour area and considered to have little impact on the wider town.	Increased traffic/HGV movements on streets around Banff Harbour and through the town have potential to result in public complaints.	Traditionally accepted disposal route for dredged material with limited public impact.
Legislative Implications	This option may have licencing requirements over and above the routine dredge and disposal licencing. This may add additional programme/timescale pressures which make this option less favourable or practical. However, the beneficial re-use of material reduces the amount of material being disposed of.	Contravenes the principles of minimising waste and long term commitments by the government to reduce landfilling.	This is an accepted disposal route as long as a Marine Licence is obtained.

3.1.2 BPEO Environmental Assessment

Table 3-3 details the environmental assessment for each option taken forward for detailed BPEO assessment.

Table 3-3: BPEO Environmental Assessment

Criteria	Beach Nourishment	Landfill	Sea Disposal
Safety Implications	HGV movements between the harbour and disposal site increase potential for accidents to occur. Work would be undertaken in accordance with H&S legislation.	Double handling of material increases the potential for accidents to occur. Traffic and pedestrian control would likely be required around the harbour. Work would be undertaken in accordance with H&S legislation.	Low amount of material handling required as it is directly placed at the disposal site. Work would be undertaken in accordance with H&S legislation.
Public Health	Limited potential for human contact assuming that the public are excluded from the active work area. Some potential for dust release during beach profiling works (only if the sediment dries out). Further geochemical testing/risk assessment of the sediment may be required to ensure it is suitable for use.	Measures i.e. fencing/sire security will be required to limit human contact during transfer of material from dredger to dewatering facility/stockpile and transportation to landfill. Security measures typically employed at licensed landfills which will minimise human contact once accepted and emplaced at site.	Low potential for human contact during dredging and disposal operations. Once deposited at disposal site, pathways for human contact are greatly reduced.

Criteria	Beach Nourishment	Landfill	Sea Disposal
Pollution/ contamination	HGVs transporting material to the beach site would have implication on carbon footprint and potential for localised impact on air quality. Potential also for temporary noise impacts and dust release during profiling works (if sediment dries out).	Transfer to dewatering facility and transportation to landfill will all require significant energy. Road transport increases the carbon footprint of this disposal option and would result in localised reduction in air quality in Banff town centre. Potential for spillages to occur.	Pollutant concentrations in dredged material to be disposed are limited to acceptable levels through regulatory licensing processes. Information with regards to the type of disposal site and its effects on sediments has not been provided. Correspondence with Marine Scotland has previously concluded that disposal sites in Scotland are dispersive. Transport by sea to disposal site would increase the project carbon footprint, however this is limited due to the relatively short distance (3.6 km) to the nearest sea disposal site.
General Ecological Implications	Significant ecological implications are unlikely as a result of deposition of additional sand on the beach. The receiving beach is part of the Whitehills to Melrose Coast SSSI. The feature of note in the SSSI is the Dalradian metamorphic rocks, which are unlikely to be adversely impacted by sediment deposition where sand material is already present.	Licensed landfill would be away from protected species and habitats with measures in place to prevent or minimise pollution of the surrounding environment.	Macduff (CR050) is a licensed disposal site for dredged material.
Interference with other legitimate activities	Significant interference or disruption with other operations would not be anticipated. Recreational beach users would require to be excluded from the beach while works are undertaken.	Potential of limited short term local impact to residents and commercial operations in the area of the dredged material handling and road hauling principally related to noise and dust potential.	The Macduff disposal site is licensed by Marine Scotland for the disposal of dredging spoil. It is likely that interference with other activities (such as commercial vessels or fishing) will have been considered as part of the licencing process. Therefore the likelihood of significant disruption is considered to be low.

Criteria	Beach Nourishment	Landfill	Sea Disposal
Amenity / Aesthetic Implications	Temporary visual impacts during sediment placement and beach profiling works but no long term impacts. Some potential for odour emissions and noise impact although these impacts will be short term. Residential properties are noted to be within 50 metres of the beach.	Potential for odour release from dewatering facility. Increase in traffic noise during transportation from dewatering facility to landfill facility. Potential for spillages on haul route. No significant additional visual / odour / noise effects as using existing landfill site.	Some potential for temporary visual / odour / noise effects while marine plant is in the harbour. However, no significant additional visual / odour / noise effects following disposal as this occurs at sea.

3.1.3 BPEO Cost Assessment

Costs were assessed for each of the options taken forward for detailed BPEO assessment. The BPEO assessment considered the typical costs associated with dredging, transportation to the disposal site, construction of treatment facilities (where applicable) and methods employed to protect the environment for each of the identified options. As costs are generally "commercially sensitive" the rates are based on best estimates and experience within industry, as opposed to formal quotations.

For the purposes of comparing costs associated with each option a benchmark of 10,000 tonnes (approximately 5,000m^3) of dredged material has been set.

The assumptions to calculate the costs are as follows:

- Dredging costs are estimated to be £3.21 per m^3;
- Ship transportation costs from the dredged area to disposal site have been calculated based on £4 per tonne;
- Due to the relatively small volume, and anticipated free draining nature of the material, i.e. fine sand, no cost has been included for the establishment and operation of a dewatering facility. It has been assumed that dewatering would be undertaken by temporary storage of sediment until it dried out;
- Costs associated with transfer of dewatered material to lorry are based on a wheeled shovel (costing £450 per day) operating for 5 days;
- Transportation costs of dewatered material to landfill are estimated to be £2.00 per mile, with a 625 return trips of 70 miles required between the Harbour and the nearest landfill. This equates to a total of 43,750 miles and a cost of £87,500;
- To transport sediment from the harbour to the beach (for beach nourishment), it is anticipated that this would use a 16 tonne wagon and it is estimated that 125 return trips (0.2 mile round trip) would be required to transport a maximum of 2,000 tonnes of material. Minimum hire charges mean that the cost of this work element is estimated to be in the region of £5,000;
- Landfill gate fees are estimated to be £30 per tonne for a non-hazardous landfill (Note: dredged material is currently exempt from landfill tax as defined in Section 7 of the Landfill Tax (Scotland) Act 2014[3]); and
- The cost for an excavator to distribute sediment and profile the beach as part of a beach nourishment project has been assumed as £450 per day for 5 days.

Table 3-4 provides details on the Cost assessment for each option taken forward for detailed BPEO assessment:

[3] https://www.revenue.scot/scottish-landfill-tax/guidance/slft-legislation-guidance/whether-tax-payable/slft3005/slft3006

Table 3-4: BPEO Cost Analysis (based on 10,000 tonnes)

Activity	Beach Nourishment (£)	Landfill Disposal (£)	Sea Disposal (£)
Dredging	16,050	16,050	16,050
Transport by vessel to disposal site	-	-	40,000
Transfer of material to lorry	2,250	2,250	-
Transportation Cost to Landfill	-	87,500	-
Transportation Cost to Beach	5,000	-	-
Landfill Gate Fee	-	300,000	-
Excavator for beach profiling works	2,250	-	-
Total Costs	**28,550**	**405,800**	**56,050**

Note that the above costs do not take into account the cost of additional environmental assessments, or cost associated with gaining planning or licensing consents or potentially to purchase land (where applicable). They also do not take account of the influence volumes will have on costs (economies of scale).

The costs noted above are indicative and given as a general comparison between the different disposal methods (i.e. assuming a single volume for disposal of 10,000 tonnes). The totals given above do not account for the splitting of the total dredged material between different disposal routes (e.g. sea disposal with a smaller proportion of material destined for beach nourishment).

3.1.4 BPEO Assessment Discussion

For each of the above assessment criteria, the options were qualitatively and semi-quantitatively (for costs) assessed against feasibility/preference and awarded a ranking ranging from 1 to 4; 1 being the most acceptable and 4 being the least acceptable option. The assignment of rank was on the basis of professional judgement.

The individual assessment criteria rankings for each option were added up to give an overall hierarchy of preference. Table 3-5 provides a summary of the BPEO assessment.

Table 3-5: BPEO Summary

Criteria	Beach Nourishment	Landfill Disposal	Sea Disposal
Environment	2	4	2
Strategic	3	4	2
Costs	1	4	2
TOTAL SCORE	**6**	**12**	**6**

Disposal to landfill is considered to be the least suitable option for the dredged material. It contravenes the principles of minimising waste and reducing landfilling. Multiple stages in material handling operations would be required to dispose of the material by this route. The cost associated with

transport and disposal of the dredged material is significant. Transportation of material by road is also undesirable as a result of increased traffic and the potential for accidental spillages. Landfill capacity is also typically limited and is noted that dredged sediment would account for up to 10% of the permitted annual waste input tonnage limit at the landfill sites closest to Banff.

Deposition of the dredged material at a licensed marine disposal site has traditionally been deemed acceptable. The nearby licensed marine disposal site has been designed to allow easy access as well as being capable of accommodating the quantities of material typically generated by dredging activities. Pollutant concentrations within sediments are also limited to acceptable levels through regulatory requirements.

Aberdeenshire Council have identified a receiving beach 150m west of the harbour as a potential disposal location for sand material from the outer basin only as part of a small-scale beach nourishment project. It is understood that this practice has been accepted previously, with the remaining material unsuitable for beach nourishment (i.e. from the middle and inner basins) destined for sea disposal. Beach nourishment has been assessed as the most cost-effective option. Further environmental assessments are likely to be required for beach nourishment, At a minimum, it is understood that particle size analysis of the sand on the receiving will require to be undertaken to confirm the suitability of the dredged material for use on the beach. Also, it would require plant movements between the harbour and the beach meaning that strategically it scores lower than sea disposal. If beach nourishment at the proposed location is deemed a necessity at present or in the near future, then the use of the dredged material would be preferable than importing sand from further afield. This disposal route has been assessed as the joint preferred disposal option along with sea disposal.

3.2 Conclusions

The Best Practicable Environmental Option for disposal of the Banff Harbour dredged material has therefore been assessed as a combination of sea disposal and beach nourishment as per Table 3-5.

Depending upon the confirmed dredging methodology and plant available, it is proposed that material from the middle and inner basins (silt-laden material unsuitable for beach nourishment) is disposed of at sea, with sand material with a considerably lower silt content from the outer basin used as part of a beach nourishment project. It is understood that this has been accepted on the most recent dredging licences, with a split of up to 80%/20% of the material destined for sea disposal and beach nourishment permitted respectively.

Similarly, if the final dredging method and available plant mean that it would be logistically more straightforward to dispose of all the material at sea (i.e. from the outer, middle and inner basins), then it is proposed that this disposal route is followed as circumstances dictate. If time pressures arise which mean dredging and disposal has to be undertaken quickly, then those circumstances would also mean that it would be proposed that all material is disposed of at sea. The final methodology is to be confirmed.

None of the black, silt-laden material from the middle or inner basins will be used for beach nourishment in any case.

As identified in the sediment chemical quality section, further assessment is deemed necessary to confirm the suitability of the sediment for disposal within the disposal site and consider potential impacts to the receiving environment. The following section details this assessment.

4 FURTHER ASSESSMENT

As detailed in Section 3.2, on the basis of the exceedances of Action Level 1, further assessment to determine the suitability of the material for sea disposal is deemed a requirement.

The approach for this further assessment is outlined as follows:

- Provide an overview of the proposed dredge works and the identified disposal site including existing chemical monitoring data for the site where available; and
- Compare existing chemical data with other recognised sediment assessment criteria including those listed below. Summary tables are provided in Appendix B.

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 ERL 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), which are related to the PELs have been not been included in the summary table in Appendix B or used as part of the further assessment as they typically fall below the RAL1.

Review of 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) to draw conclusions from available information and provide recommendation for proposed disposal routes.

4.1 Dredge and Disposal Site

The dredge is to be undertaken within Banff Harbour, as shown on Drawing No. 374655-QGIS003 in Appendix A.

It is anticipated that a minimum 80% of the total dredged material (including all of the material from the middle and inner basins) will be destined for sea disposal, with a maximum of 20% of the total dredged material (only to include sand material from the outer basin) will be used as part of a small-scale beach nourishment project.

Material to be disposed of at sea is deposited at the Macduff disposal site (CR050). The proposed receiving beach for the sand material from the outer basin is 150 metres west of the harbour. Proposed disposal locations are shown on Drawing No. 374655-QGIS003 in Appendix A. It should be noted that depending on available marine plant and the finalised dredging method, then it may be proposed that all material is destined for sea disposal.

4.2 Analytical Data Review

Existing analytical data from both the 2019 (3 samples) and 2021(11 samples) sampling campaigns for the proposed dredge site is provided in Summary Table A in Appendix B. This data has been summarised against RAL 1 & 2, the BAC, ERL and PEL. As detailed previously, the data has not been reviewed against the Canadian TEL as these numbers are typically lower than RAL1. A summary of the exceedances is detailed below:

4.2.1 Action Level 1

Exceedances of RAL1 can be summarised as follows:

- Arsenic – 1 of 14 samples recorded arsenic above RAL1
- Cadmium – 8 of 14 samples recorded cadmium above RAL1;
- Chromium – 1 of 14 samples recorded chromium above RAL1;
- Copper – 6 of 14 samples recorded copper above RAL1;
- Nickel – 3 of 14 samples recorded nickel above RAL1;
- Zinc – 1 of 14 samples recorded zinc above RAL1
- PAHs – 11 of 14 samples recorded at least one PAH species above RAL1; and
- THC – 12 of 14 samples recorded total hydrocarbons above RAL1.

4.2.2 BAC Review

Exceedances of the BAC can be summarised as follows:

- Cadmium – 11 of 14 samples recorded cadmium above the BAC;
- Copper – 7 of 14 samples recorded copper above the BAC;
- Mercury – 1 of 14 samples recorded mercury above the BAC
- Nickel – 1 of 14 samples recorded nickel above the BAC;
- Lead - 1 of 14 samples recorded lead above the BAC;
- Zinc – 1 of 14 samples recorded zinc above the BAC; and
- PAHs – 12 of 14 samples recorded at least one PAH species above the BAC.

4.2.3 ERL & PEL Review

Exceedances of the ERL and PEL can be summarised as follows:

- Copper – 4 of 14 samples recorded copper above the ERL. One sample recorded copper above the PEL;
- Mercury – 1 of 14 samples recorded mercury above the ERL
- Lead - 1 of 14 samples recorded lead above the ERL;
- Zinc – 1 of 14 samples recorded zinc above the ERL. One sample recorded zinc above the PEL;
- PAHs – 11 of 14 samples recorded at least one PAH species above the ERL; and
- PAHs – 2 of 14 samples recorded PAH species (Phenanthrene and dibenzo(ah)anthracene) above the PEL where one is available for review.

4.2.4 Action Level 2

Copper and zinc both exceeded RAL2 in sample A7204 C from the 2019 sampling.

4.3 Averages

A review of the averaged data for all the samples has been undertaken i.e. considering the material as a single volume for disposal. The averaged data is presented in Summary Table B in Appendix B. The review of average data against the available adopted assessment criteria can be summarised as follows:

- Averaged concentrations marginally exceeded RAL1 for cadmium, chromium, copper and various PAH species. Averaged concentrations for THC also exceeded RAL1;
- Averaged concentrations exceeded the BAC for cadmium, copper, zinc and various PAH species;
- Averaged concentrations exceeded the ERL for copper and benzo(g,h,i)perylene only;
- All samples recorded averaged concentrations below the PEL where one is available for comparison; and
- All samples recorded averaged concentrations below RAL2.

4.4 Historic Sample Data (2017 and 2019)

4.4.1 Sediment Data 2017

Three sediment samples tested by James Hutton Institute. Review of the data indicates that all samples were recorded below their limit of detection (LOD) or RAL 1 where one exists.

No exceedances of RAL2 were recorded were once is available.

No information was provided with regards to grain size/physical characteristics.

4.4.2 Trends

Marine Scotland requested that the data from 2019 and 2021 sampling campaigns be collated and assessed as a single data set. In addition to this, it was requested that the data set from 2019/2021 be compared to the data set from 2017 where no exceedances of RAL1 were recorded with a view to providing some comments with regards to the change in contaminant concentrations in this period. In addition to this, it was requested that commentary on the apparent change in PAH levels within the sediments between 2019 and 2021 be provided.

Differences between the 2017 and 2021/2019 samples could be for the following reasons;

Samples in 2017 were tested by the James Hutton Institute (JHI) 2019 and 2021 by Socotec – slight variances in preparation technique, analytical equipment may have an influence on results. Previous discussion and research into the methods have concluded that Socotec and JHI use different methodologies. JHI analyse whole sample and analyse while Socotec follow best practice and only analyse the silt/clay <63µm fraction.

Sample type, number and location – contaminant distribution through sediments is not typically homogeneous and may be very localised depending on the source of the contamination. Contaminants may be associated with flaked paint for example and may be found in discrete locations following maintenance/damage of painted surface. PAHs are more likely to be dispersed as they are often bound to organic material or soot/black carbon particles. This becomes part of finer grained fraction of sediments and as a result, they can be suspended and settle out in the lower energy areas of the harbour. Higher proportions of finer grain material i.e. silts and clays also typically have the finer

organic material which contaminants become associated with, and as such contaminant levels are often higher where the finer grained proportion of the sediment is higher.

The three samples collected in 2019 which had a silt fraction of 6.5-23%. The range for the samples from 2021 was 2.5-59%. The total organic carbon content average for the samples in 2019 was 7.5% and 6.2% in 2021, so broadly similar. No data was provided for the 2017 sample physical characteristics.

Additionally, the inner harbour has been cut off from the outer harbour January 2021 by a crushed rock bund, which essentially means that any inputs may accumulate rather than be redistributed during the daily tidal cycles with exchanges of water. This may also account for some of the apparent changes in fine grained sediment as well with fines being washed into the harbour and settling out.

In summary, the samples collected in 2021 do not necessarily represent an increase in PAH concentration but may just highlight the variable composition in the sediment quality across the dredge site. This is further highlighted by the absence of RAL2 exceedances for metals in the 2021 data set and reflect inherent spatial variability within the harbour sediments. Further sampling undertaken in 2022 has concluded that there are no widespread RAL2 exceedances and the RAL2 exceedances appear to be an isolated to a single location.

Finally, the sample sets from 2019 and 2021 were analysed for the extended PAH suite. These additional PAHs do not have associated action levels at this stage. Review of the data indicates that the samples collected in 2021 contain higher levels of these PAH species compared to the samples collected in 2019 which reflects the same trend as per the 16 PAH species listed with action levels. While a single reason for this increase is unlikely to be identified, the potential reasons outlined above which includes small data sets, spatial variability, increased fine grain content, closure of harbour etc. apply equally to these species as they are all commonly found together.

4.5 Chemical Assessment Conclusions

A number of samples recorded exceedances of RAL1 for various metals, several PAH species and THC. One sample recorded contaminant levels in exceedance of RAL2 for copper and zinc. Averaged concentrations which consider the dredge as a single volume for disposal marginally exceeded RAL1 for cadmium, chromium, copper and several PAH species, with the averaged concentrations also exceeding RAL1 for THC.

The confirmatory sampling undertaken in 2022 concluded that there is no widespread contamination within the area where the original RAL2 exceedance was recorded in 2019. The additional sampling has further supported the existing data set that the RAL2 exceedances recorded in Grab C in 2019 appear to be the result of an anomaly which is not representative of the wider harbour area sediment quality. Re sampling of the original location where the failure was recorded has not identified any further exceedances of RAL2 which suggests that the original sample may have been contaminated with a discrete source of contamination i.e. paint chips, treated wood, metal plating or another similar source which has been removed from the sediment at the time of sampling and is no longer present.

A number of individual samples recorded exceedances above the ERL for copper and at least one PAH species, with one sample recording one PAH species above the PEL. Averaged concentrations exceeded the ERL for Benzo(g,h,i)perylene only. No averaged concentrations exceeded the PEL or RAL2.

At the time of writing, no background chemical data for the proposed sea disposal site is available for review, therefore a comparison between sediment sample results and disposal site data cannot be made.

Further consideration of the potential risks associated with the proposed disposal is considered in the following sections.

4.6 Water Framework Directive Assessment

As outlined in the Water Framework Directive Assessment: estuarine and coastal waters guidance (Environment Agency, 2017), there are several key receptors which can be impacted upon including the following:

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

Each of these points are considered in Table 4-1 below, in the context of disposing of sediment by disposal at sea and for beach nourishment.

Table 4-1: Receptor Risk Assessment

Key Receptor[4]	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Hydromorphology (Source Area and Disposal Site)	Morphological conditions, for example depth variation, the seabed and intertidal zone structure tidal patterns, for example dominant currents, freshwater flow and wave exposure	No	Despite continued maintenance dredging in the harbour, SEPA do not consider Banff (as part of the Banff and Macduff coastal body) as a Heavily Modified Water Body (HMWB)[5]. The coastal body has a classification of "High" for morphology. This classification will take into account the presence of the harbour and the impacts of previous dredging and disposal. The sea disposal site is also located in the Banff and Macduff coastal body (i.e. classified as "High" for morphology and not considered to be heavily modified). The classification will take into account the presence of the disposal site, so no further assessment is considered to be required. It is noted that the Whitehills to Melrose Coast Site of Special Scientific Interest (SSSI) lies immediately beyond the harbour walls. The SSSI accounts for the rocky foreshore and is designated for its structural and metamorphic geology. The proposed beach nourishment site is located within the SSSI. However, the placement of sand on an area where sand is already present is considered unlikely to cause significant impact on the notified natural features of the SSSI. Dredging works are not anticipated to cause negative impacts on the condition of the SSSI. Similarly, it is noted that sea disposal will take place in a Marine Protection Area (MPA). This is considered separately below.

[4] https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters
[5] https://marinescotland.atkinsgeospatial.com/nmpi/

Biology - habitats	Included to assess potential impacts to sensitive/high value habitats.	No	The WFD classification for the Banff and Macduff body for macro-invertebrates is “good”. The classification will take into account the presence of the disposal site, so no further assessment with regard to sea disposal is considered to be required. Any effects are considered to be both localised and temporary. Similarly, the deposition of sediment as part of a beach nourishment programme is unlikely to cause significant adverse impacts on habitats. It is noted that sea disposal will take place in a Marine Protection Area (MPA). This is considered separately below.
Biology – fish	Consideration of fish both within the estuary and also potential effects on migratory fish in transit through the estuary	No	Banff and the surrounding area does not have a WFD classification for fish. In addition, there is no estuary in close proximity to the site in which migratory fish would be travelling towards. Immediately out with the harbour lies open sea with no obvious constraints. Dredged material will be deposited in the same way as per previous dredging campaigns. Therefore no further assessment is considered necessary.
Water Quality	Consideration must be given to water quality when contaminants are present in exceedance of CEFAS RAL1.	Yes	The Banff and Macduff coastal body is classified as “pass” for specific pollutants. No classification is provided for “priority substances”. The overall classification for overall status is “good”. Contaminants are noted to exceed CEFAS RAL1 within sediment samples. Potential effects are considered to be both localised and temporary. Further consideration of potential effects is discussed in section 4.7.1 for completeness.

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	The dredging site is located 1.1km south of the Southern Trench Marine Protected Area (MPA). The sea disposal site is located within the MPA. The MPA was designated in December 2020 with its features are noted to include: burrowed mud, Minke whale, thermal fronts, shelf deeps, submarine mass movements and Quaternary geology. The closest designated bathing water to the dredge site is Inverboyndie (1.4 km west). The proposed disposal site is not located within 2km of any other protected areas (including SAC, SPA or Ramsar sites). There are no designated shellfish waters along the northern Aberdeenshire and Moray coasts. Further assessment with regard to protected areas is given in section 4.7.2 below.

4.7 Potential Risk to Water Quality and Protected Areas

The potential risks to water quality and habitats/protected areas at the dredge and disposal sites are further considered as all other receptors have been screened out of the assessment.

4.7.1 Water Quality

SEPA classified the Banff and Macduff coastal water body as “pass” for specific pollutants. No classification is provided for priority substances.

Although there are contaminants of concern above the RAL1 within the sediment for disposal, it is considered that these levels will not contribute to an overall degradation of water quality at the disposal site. While any effects are considered to be both localised and temporary, the potential for both dilution and natural attenuation in the open waters beyond the harbour wall is considerable.

When the sediment results are reviewed as an average to assess all of the dredged sediment as a single unit for disposal, RAL1 is exceeded for several contaminants of concern as follows. The dredge average cadmium marginally exceeded RAL1 (average concentration of 0.5 mg/kg vs. RAL1 of 0.4 mg/kg). The maximum average PAH concentration recorded was 0.35 mg/kg (Fluoranthene) vs. RAL1 of 0.1 mg/kg. For THC, the averaged concentration was 265 vs. RAL1 of 100 mg/kg.

Several averaged concentrations exceeded the BAC, however it should be noted that the BAC is intended to be used to determine if concentrations are near to background concentrations, rather than qualify any potential environmental impact. In addition the BACs for PAHs and metals are generally lower than the Marine Scotland RAL1, therefore it is considered to be a very conservative assessment criteria. The averaged concentration for benzo(g,h,i)perylene exceeded the ERL, but in this instance the ERL is lower than RAL1 and is again considered to be a very conservative assessment criteria. Averaged concentrations do not exceed RAL2 or the PEL.

The key contaminants for impacting water quality are considered to be metals as these have the potential to dissolve or desorb from sorption sites within the sediment. However the overall concentrations of metals are generally low and natural geochemical processes will limit their solubility along with the large dilution potential it is not expected that thee would have a long term impact on water quality.

PAHs and hydrocarbons are hydrophobic with low aqueous solubility and will naturally remain associated with organic sediment fractions, rather than become dissolved within the water column. On this basis, the risks associated with impact to water quality from chemical contaminants in sediment are considered to be low, with the associated dilution potential providing further mitigation.

The key risk to water quality is considered to be an increase in turbidity/suspended solids during the sea disposal activity. Although this is likely to cause a localised increase in suspended solids, it is considered that this will be both local and temporary in nature and has been factored into the selection and location of the agreed sea disposal ground.

It is proposed that the dredged material is split into two disposal sites. It is anticipated that between 80% and 100% of the dredged sediment will be disposed of at the Macduff disposal ground (CR050). This will include all silt-containing material from the middle and inner harbour basins. The remaining material (0% to 20% of the total dredge) will be used as part of a beach nourishment project. Any material destined for beach nourishment will include sand material from the outer basin only (represented by sediment sample GS1). Results from the GS1 sample show that exceedances above RAL1 are noted only for PAHs. For the same reasons given above, it is considered that elevations in

PAHs above RAL1 in material deposited on the receiving beach are unlikely to have significant adverse effects on water quality.

According to averaged particle size analysis (PSA) data, the sediment material from the inner and middle basins primarily comprises sand and silt with negligible quantities of gravel. Sediment from the outer basin chiefly comprises sand with a greater quantity of gravel and a relatively small quantity of silt sized particles.

Table 4-2 and Table 4-3 summarises the average physical sediment type for all samples from the inner and middle basins; and outer basin respectively. Estimated volumes are given for physical sediment type based upon the average PSA data and assuming an 80%/20% split of the total dredge volume of 5,000m3 between sea disposal and beach nourishment respectively.

Table 4-4 provides the average PSA data for the dredge as a single unit for disposal.

Table 4-2: Summary of Average PSA Data – Middle & Inner Basins

Gravel (>2mm)	Sand (0.063mm<Sand<2mm)	Silt & Clay (<0.063mm)	80% of total dredge volume m^3
0.7 %	56.7 %	42.6 %	4,000
28 m^3	2,268 m^3	1,704 m^3	

Table 4-3: Summary of PSA Data (Sample GS1 only) – Outer Basin

Gravel (>2mm)	Sand (0.063mm<Sand<2mm)	Silt & Clay (<0.063mm)	20% of total dredge volume m^3
11.3 %	86.2 %	2.5 %	1,000
113 m^3	862 m^3	25 m^3	

Table 4-4: Summary of Average PSA Data – Entire Dredge

Gravel (>2mm)	Sand (0.063mm<Sand<2mm)	Silt & Clay (<0.063mm)	Maximum quantity to be dredged m^3
1.7 %	59.4 %	38.9 %	5,000
85 m^3	2,970 m^3	1,945 m^3	

The dominant sediment types for material destined for sea disposal are sand and silt. Sand particles will generally fall out of suspension quickly with minimal lateral spread. The silt particles, making up approximately 40% of the material to be disposed at sea, can be suspended in the water column for a longer period of time. However, if the finer grained material is cohesive and in clumps, then it will sink much faster than if in a slurry. The Macduff sea disposal site has accepted dredged material from Banff previously. The Banff and Macduff coastal water body as a classification of “good”, which will take into account the presence of the disposal site. On this basis, it is considered that any impact on water quality as a result of suspended solids/turbidity will be localised and temporary and unlikely to cause a change in the classification status at both the dredge and disposal sites.

With regard to material destined for beach nourishment, the material to be dredged from the outer basin comprises a much higher proportion of sand sized particles, which are unlikely to be held in suspension in the water column. It is anticipated that the relatively small proportion of silt sized particles in the outer basin (2.5%) will be transported to sea relatively quickly by the tidal cycles with little impact on water quality anticipated.

4.7.2 Protected Areas

4.7.2.1 Southern Trench MPA

Banff Harbour is located 1.1km south of the boundary of the recently designated Southern Trench MPA. The Macduff sea disposal site is located within the MPA.

The Conservation and Management Advice document for the MPA[6] has been reviewed as part of this assessment. The document notes the protected features within the MPA, along with the latest assessment condition. This information is summarised in Table 4-5.

Table 4-5: Southern Trench MPA - Protected Features and Conditions (NatureScot, 2020)

Protected Feature	Feature Type	Feature Condition (2019)
Burrowed mud	Inshore sublittoral sediment (Marine)	Favourable
Fronts	Large-scale feature (Marine)	Favourable
Minke whale *(Balaenoptera acutorostrata)*	Mammals (Marine)	Favourable
Shelf deeps	Large-scale feature (Marine)	Favourable
Quaternary of Scotland (subglacial tunnel valleys and moraines)	Quaternary geology and geomorphology	Favourable
Submarine Mass Movement (slide scars)	Geomorphology	Favourable

Each of the protected features noted in Table 4-5 will be considered in turn, with the risk of negative impacts on the feature assessed in the context of sea disposal works. Features of the MPA are not considered to be at risk as a result of dredging or beach nourishment works due to the relative small-scale of the works and distances involved. Therefore, these are not considered any further.

Burrowed Mud

The Conservation and Management Advice for the MPA states that burrowed mud habitats are "highly sensitive to physical disturbance."

Table 2 of the Advice document provides specific management advice for marine deposit sites and burrowed mud:

"Minimise the likely effects of new disposal sites where there would be likely to be an impact upon burrowed mud habitats. Early pre-application discussions are recommended and these should focus on the appropriate siting of new disposal sites and any pre-submission surveys to avoid impacts within areas of burrowed mud habitat."

The specific management advice refers only to the establishment of new disposal sites and therefore it is considered likely that the presence of the Macduff disposal site was taken into account upon the designation of the MPA, and that the existing disposal site would not be situated in an area of burrowed mud habitat. No further assessment is considered necessary.

Minke Whale

The Conservation and Management Advice for the MPA notes that minke whales are "sensitive to entanglement and incidental bycatch." The sea disposal activity is not considered to cause a risk to minke whales in those regards.

[6] https://sitelink.nature.scot/site/10477

Minke whales are also noted to be sensitive to underwater noise, collision and water pollution. There may be some short-lived, temporary effects on underwater noise as a result of the disposal activity may be experienced. Secondly, it is considered that the risk of underwater collision between a minke whale and the dredging vessel is no greater than any other vessel passing through the MPA area. Finally, the effects on water quality as a result of the disposal to sea have been considered above. Effects on water quality are likely to be localised and temporary.

It is considered likely that the presence of the dredge spoil disposal site will have been taken into account when the MPA was designated, and on that basis the potential risks to minke whale are considered to be acceptable.

Table 2 of the MPA document provides specific management advice for marine deposit sites and minke whales:

"Minimise the potential impact of new deposit sites (including disused/closed sites if to be reopened) on the habitat of sandeels. Early pre-application discussions are recommended and these should consider the appropriate siting of new deposit sites and any pre-submission surveys to ensure that the habitat of sandeels is maintained in extent and suitability."

The specific management advice refers only to the establishment of new disposal sites (or re-opening of old ones) and therefore it is considered likely that the presence of the Macduff disposal site was taken into account upon the designation of the MPA, and that the existing disposal site would not be situated in an area of sandeel habitat (which are feeding grounds for minke whale).

If considered necessary through statutory consultation with NatureScot, then a Marine Mammal Observer (MMO) could be deployed to the dredging vessel to monitor minke whale activity at the disposal ground.

Fronts
The Conservation and Management Advice for the MPA states that thermal fronts states that "the MPA could be sensitive to pressures such as changes in tidal flow or physical changes to the seabed." The deposition of sediment at the Macduff disposal ground will cause a change in the seabed topography as deposited material settles.

However, it is known that sediment disposal sites in Scotland are generally dispersive, therefore any changes to seabed topography are likely to be temporary. Moreover, the Advice document also states: *"Currently most pressures associated with human activities in the marine environment are considered unlikely to cause significant risk of impact on the fronts feature within the MPA."* It is also assumed that the dredge spoil disposal site would have been taken into account when the MPA was designated. No further assessment is considered necessary,

Shelf Deeps
The Conservation and Management Advice for the MPA states that: *"Shelf deeps are considered to be robust, entirely natural in origin and are not considered to be at risk of significant damage from human activity."* Therefore the dredging and disposal activity is considered unlikely to have a negative impact on shelf deeps.

Quaternary of Scotland
According to the Conservation and Management Advice for the MPA, subglacial tunnel valleys are "highly resistant" and are "not sensitive or have a low sensitivity" to human activities. Further assessment with regard to subglacial tunnel valleys is not considered necessary.

Moraines are stated to have a *"medium sensitivity to sub-surface abrasion and changes in tidal flow, and a high sensitivity to physical removal."* The deposition of sediment at the Macduff disposal site is

not considered likely to have a negative impact on the moraines. It is considered unlikely that a licensed disposal site would have been permitted in an area known to have protected moraine features susceptible to sub-surface abrasion. Further assessment is not considered necessary.

Submarine Mass Movement
The Conservation and Management Advice for the MPA states that slide scars have a "medium sensitivity… to any activities that could cause obscuring". The deposition of dredged sediment at the Macduff disposal site may cause temporary obscuring of slide scars, if present at the disposal site.

However, it is known that sediment disposal sites in Scotland are dispersive, therefore any obscuring by deposited sediment is likely to be temporary. In addition, the licenced disposal site has been present at Macduff since at least 1995[7] (although the exact opening date of the site is not currently known). It is considered unlikely that the disposal site would continue to remain open for sediment deposits if there was likely to be a significant risk of damage to the protected slide scar features. Further assessment is not considered necessary.

4.7.2.2 Inverboyndie Bathing Water
The Inverboyndie Bathing Water is located 1.4km west of Banff Harbour (as the crow flies), and 4.9km south west of the Macduff sea disposal site. The bathing water was most recently classified as "sufficient"[8].

It is concluded above that the key risk to water quality as a result of the dredging and disposal activities is a temporary increase in suspended solids at the dredge and disposal sites.

Even if dredging and disposal works are undertaken during the bathing water season (June to September), the temporary and localised impacts on water quality experienced at the dredge and disposal sites (i.e. increase in suspended solids/turbidity) are unlikely to impact the status of the bathing water at Inverboyndie.

Furthermore, the monitoring and classification of bathing water quality by SEPA pertains primarily to microbiological parameters (E. Coli and intestinal enterococci). The nature of marine sediments is such that the dredging and disposal activity is not considered likely to have an impact on microbiological results and bathing water quality classification.

[7] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/197331/TR_SEA2_ExistingActivities.pdf (See Table 6)
[8] https://map.environment.gov.scot/sewebmap/

5 BPEO CONCLUSIONS AND RECOMMENDATIONS

Aberdeenshire Council appointed EnviroCentre Ltd to undertake a BPEO assessment in support of proposed maintenance dredging at Banff Harbour.

A review of the available information has highlighted that although several contaminants of concern exceed RAL1 and one sample exceeding RAL2 for copper and zinc, assessment of key receptors identified from the Water Framework Directive assessment for estuarine and coastal waters concluded that there is a low risk of the sediments impacting upon the overall ecological or chemical status.

Sediment chemical data used in the previous licence application recorded several exceedances of RAL1 for metals, PAHs and THC, with exceedances above RAL2 for copper and zinc. Averaged concentrations exceeded RAL1 only for copper. The previous sediment assessment included three grab samples, therefore the most recent sediment assessment (which includes cores and additional grabs) provides a more comprehensive dataset. Although the most recent dataset recorded a greater number of exceedances above RAL1, none were recorded above RAL2.

Additional sampling undertaken in 2022 has confirmed the absence of additional exceedances of RAL2 which would indicate that the original sample may have been contaminated with a discrete source of contamination i.e. paint chips, treated wood, metal plating or another similar source which has been removed from the sediment at the time of sampling and is no longer present.

Overall, based on the multiple lines of evidence approach adopted to further assess the exceedances identified in the sediment assessment, the recommendation for a combination of sea disposal and beneficial re-use as part of a small-scale beach nourishment is considered to be the preferred option.

The sea disposal option is considered to have no significant long-term impact on the marine environment; the disposal site is readily accessible from the harbour and previously acceptable disposal route. The identified receiving beach for the beach nourishment project is a short distance from the harbour and means that a portion of the dredged material will be subject to a beneficial re-use. The use of beach nourishment as an additional disposal route to sea disposal is dependent on the final confirmed dredging method and plant available.

REFERENCES

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APPENDICES

A FIGURES

368800 368900 369000

864700 864600 864500

GS1

OUTER BASIN

GS2

MIDDLE BASIN

INNER BASIN

VC2

VC3

VC1

Quayside

North Castle Street

A953

A97

Braeheads

Clunie Street

Harbour Place

Banff Marina

Imagery Source: Bing Maps. Image courtesy of Ordance Survey, © 2021 TomTom
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368800 368900 369000

Do not scale this map

Legend

- Dredge Area
- Sediment Sample Location

Client
Aberdeenshire Council

Project
Banff Harbour Maintenance Dredging

Title
Sediment Sampling Locations

Scale
1:1,000 @ A3

Status
FInal

Drawing No.	Revision	Date
374655-QGIS001	-	23 Apr 2021
Drawn	**Checked**	**Approved**
FR	NC	CCAS

Rev	Date	Amendment	Initials
-	-	-	-

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368800 368900 369000

864700 864600 864500

Construction Site -
No access for crane.

Temporary Gravel Bund

Storage of spare floating pontoons -
No access for crane.

Hard bed in vicinity -
Possible bedrock or
gravel from bund.

Construction Work on East Pier -
No access for crane.

CRANE LOCATION

Public Road -
Unable to accommodate crane

Boats remained present in Marina - some with high masts. This further restricted where crane boom could extend and available rope tie-off locations.

Shallow Area -
Not subject to dredging

368800 368900 369000

Do not scale this map

Legend

Specific Constraints to Sampling Locations

Client
Aberdeenshire Council

Project
Banff Harbour Maintenance Dredging

Title
Constraints to Sampling Locations

Scale
1:1,000 @ A3

Status
FInal

Drawing No.	Revision	Date
374655-QGIS002	-	19 Mar 2021
Drawn	**Checked**	**Approved**
FR	NC	CCAS

Rev	Date	Amendment	Initials
-	-	-	-

envirocentre
Banchory Business Centre, Burn o' Bennie Road,
Banchory, AB31 5ZU. T: 01330 826596
E: info@envirocentre.co.uk W:www.envirocentre.co.uk

368000 369000 370000 371000 372000

867000 866000 865000 864000

Macduff Spoil Deposit Site (CR050)

Receiving Beach

MACDUFF

Banff Bay

Hill of Doune

Douneside

Dey Hill

Craigneil

Gallow Hill

Legend

- Dredged Material Deposit Sites
- Dredge Area

Do not scale this map

Client
Aberdeenshire Council

Project
Banff Harbour Maintenance Dredging

Title
Proposed Dredged Material Deposit Sites

Status
Final

Drawing No.	Revision	Date
374655-QGIS003	-	28 Apr 2021
Drawn	**Checked**	**Approved**
FR	NC	CCAS

Scale
1:15,000 @ A3

Rev	Date	Amendment	Initials
-	-	-	-

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B DATA SUMMARY TABLES

Summary Table A

Sampling Results Incorporated with BPEO Assessment (mg/kg) **152.1** **33.4125**

						2019 Grabs																					
	AL1	AL2	BAC	ERL	PEL				GS01 0.00-0.15m	GS02 0.00-0.15m	VC01 0.00-0.15m	VC01 0.15-0.65m	VC01 0.65-1.15m	VC02 0.00-0.15m	VC02 0.15-0.50m	VC02 0.50-1.00m	VC03 0.00-0.15m	VC03 0.20-0.70m	VC03 0.70-1.20m	Grab A	Grab B	Grab C	Grab D	Grab E	AVERAGE	No. Exceed RAL 1	No. Exceed RAL 2	No.Exceed BAC?	No. Exceed ERL	No. Exceed PEL?
Source			CSEMP	CSEMP	Canada	A7204_A	A7204_B	A7204_C																					
Arsenic	20	70	25		41.6	2.5	3.4	21.9	4.0	9.9	6.6	4.0	5.0	6.1	6.9	2.8	6.3	3.4	3.2	5.4	5.3	6.1	7.7	5.5	6.11	1	0	0	-	0
Cadmium	0.4	4	0.31	1.2	4.2	0.1	0.19	0.83	0.27	0.56	0.47	0.47	0.57	0.33	0.74	0.4	0.36	0.38	0.45	0.34	0.42	0.56	0.48	0.5	0.44	12	0	16	0	0
Chromium	50	370	81	81	160	21.3	47.2	71.3	24.2	37.7	31.9	21.9	29.0	17.7	35.8	13.3	21	18.7	18.5	26.6	35.8	36.6	41.8	36.6	30.89	1	0	0	0	0
Copper	30	300	27	34	108	17.2	20.1	419	15.7	34.3	39.7	29.1	30.7	22.5	38.6	17.9	25.3	25.6	30.8	36.4	44.1	42.7	55.2	46	52.15	11	1	12	9	1
Mercury	0.25	1.5	0.07	0.15	0.7	0.03	0.03	0.24	0.03	0.06	0.07	0.05	0.06	0.03	0.06	0.04	0.04	0.04	0.05	0.05	0.06	0.08	0.08	0.08	0.06	0	0	4	1	0
Nickel	30	150	36	-	-	13.9	28.4	40.8	15.6	34.8	27.2	18.2	23.9	19.9	30.4	11.9	20.0	16.4	16.6	30.7	38.3	30.4	38.3	31.7	25.65	8	0	3	N/A	N/A
Lead	50	400	38	47	112	6.9	6.4	49.2	11.2	22.4	22.6	17.0	20.9	13.3	25.7	11.4	14.3	14.8	15.3	18.1	23.5	23.9	28.9	25	19.52	0	0	1	1	0
Zinc	130	600	122	150	271	48.5	75.6	899.0	49.2	97.1	98.3	70.6	85.2	63.1	101.0	46.9	63.5	64.6	70.9	82	101.0	124.0	133.0	116.0	125.75	2	1	3	1	1
Napthalene	0.1		0.08	0.16	0.391	0.003	0.001	0.010	0.100	0.018	0.020	0.046	0.035	0.009	0.034	0.116	0.074	0.052	0.038						0.04	2	-	2	0	0
Acenaphthylene	0.1				0.128	0.013	0.001	0.020	0.059	0.011	0.011	0.016	0.017	0.002	0.021	0.025	0.018	0.036	0.011						0.02	0	-	N/A	N/A	0
Acenaphthene	0.1				0.0889	0.034	0.003	0.058	0.039	0.004	0.006	0.005	0.011	0.002	0.008	0.014	0.008	0.019	0.008						0.02	0	-	N/A	N/A	0
Fluorene	0.1				0.144	0.083	0.002	0.103	0.098	0.010	0.017	0.014	0.020	0.003	0.018	0.038	0.021	0.040	0.014						0.03	1	-	N/A	N/A	0
Phenanthrene	0.1		0.032	0.24	0.544	0.111	0.003	0.134	0.678	0.094	0.103	0.065	0.117	0.009	0.125	0.249	0.159	0.338	0.075						0.16	9	-	12	3	1
Anthracene	0.1		0.05	0.085	0.245	0.067	0.003	0.086	0.205	0.064	0.038	0.033	0.044	0.002	0.048	0.102	0.055	0.145	0.041						0.07	3	-	7	4	0
Fluoranthene	0.1		0.039	0.6	1.494	0.069	0.004	0.091	0.891	0.283	0.221	0.239	0.250	0.008	0.260	0.550	0.288	0.701	0.185						0.29	10	-	12	2	0
Pyrene	0.1		0.024	0.665	1.398	0.060	0.004	0.083	0.831	0.254	0.214	0.256	0.238	0.008	0.295	0.497	0.279	0.640	0.185						0.27	10	-	12	1	0
Benzo(a)anthracene	0.1		0.016	0.261	0.693	0.091	0.004	0.136	0.417	0.136	0.103	0.138	0.114	0.003	0.156	0.240	0.143	0.343	0.086						0.15	10	-	12	2	0
Chrysene	0.1		0.02	0.384	0.846	0.013	0.001	0.012	0.424	0.151	0.117	0.154	0.133	0.004	0.170	0.235	0.165	0.342	0.099						0.14	9	-	10	1	0
Benzo(b)fluoranthene	0.1		-	-	-	0.188	0.009	0.252	0.344	0.126	0.101	0.144	0.134	0.004	0.138	0.177	0.139	0.302	0.086						0.15	11	-	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1		-	-	-	0.011	0.001	0.022	0.167	0.070	0.078	0.092	0.076	0.005	0.095	0.101	0.107	0.195	0.053						0.08	4	-	N/A	N/A	N/A
Benzo(a)pyrene	0.1		0.03	0.384	0.763	0.063	0.003	0.073	0.424	0.145	0.118	0.149	0.139	0.003	0.172	0.219	0.157	0.326	0.089						0.15	9	-	12	1	0
Indeno(1,2,3cd)pyrene	0.1		0.103	0.24	-	0.027	0.004	0.066	0.300	0.118	0.102	0.130	0.114	0.003	0.131	0.155	0.128	0.238	0.075						0.11	9	-	8	1	N/A
Benzo(ghi)perylene	0.1		0.08	0.085	-	0.088	0.012	0.141	0.277	0.107	0.105	0.133	0.108	0.003	0.138	0.138	0.125	0.234	0.078						0.12	10	-	11	11	N/A
Dibenzo(a,h)anthracene	0.01		-	-	0.135	0.184	0.012	0.226	0.058	0.021	0.019	0.024	0.024	0.001	0.027	0.031	0.022	0.050	0.016						0.05	2	-	N/A	N/A	2
THC	100		-	-	-	137	50	345	52	180	296	350	306	140	384	192	317	456	245						246.46	12	-	N/A	N/A	N/A
PCBs	0.02	0.18	-	-	0.189	0.00008	0.00008	0.00171	0.00062	0.00187	0.00215	0.00205	0.00185	0.00192						0.00195	0.00212	0.00196	0.00238	0.00204	0.0016	0	0	N/A	N/A	0
TBT	0.1	0.5	-	-	-	0.005	0.005	0.005	0.005	0.005	0.026	0.005	0.005	0.005						0.005	0.005	0.005	0.024	0.005	0.0078	0	0	N/A	N/A	N/A

Note: Underlined Values are < LOD

PEL Data Source: http://ceqg-rcqe.ccme.ca/en/index.html#void

C ADDITIONAL SAMPLING 2022

Thomas Inglis
Marine Scotland
Marine Licensing Operations Team
By Email Only

Our ref 374655/CCAS/003
Telephone 0141-341-5040
E-mail [redacted]

26 April 2022

Dear Thomas

Banff Harbour
Additional Sampling March 2022

Further to recent correspondence please find detailed overleaf the findings of the additional sampling undertaken at Banff Harbour in March 2022 and associated conclusions with regards to the current application.,

Yours sincerely
for EnviroCentre Ltd

(issued electronically)

Campbell Stewart
Associate Director

Graeme Duff
Director

Enc: Additional Sampling Findings
Appendicies
Photographs

CC:

ADDITIONAL SAMPLING FINDINGS

Background

1. EnviroCentre were appointed by Aberdeenshire Council to undertake additional sampling following discussions with Marine Scotland (MSLOT). It was agreed that additional samples should be collected at Banff Harbour to provide further information/evidence on the quality of sediment following the previous monitoring undertaken in 2019 and 2021. The works were undertaken in March 2022. The accompanying drawings, laboratory analysis, data provided in the appendices at the end of the report.

2. Previous sampling works undertaken in 2019 returned a single sample with exceedances of RAL2 arsenic, copper and zinc. Additional sampling undertaken in 2021 did not record any exceedances of RAL2. A total of 14 samples were collected in 2019 (3 samples) and 2021 (11 samples).

3. It was agreed that 5 additional samples should be collected to confirm the presence of a potential hotspot within the inner harbour area and establish its extent if possible, with a confirmatory sample to also be collected from the original sampling point where the exceedance was noted.

Findings

4. Sampling was undertaken on the 8th of March 2022 as per the accompanying figure appended at the end of the letter report. Samples were submitted for the standard metals suite. Sampling was undertaken from a small boat within the inner harbour using a 0.045m^3 Van Veen Grab Sampler.

5. Photographs of the grab samples are appended at the end of the report and summarised in the table below. Note that there is no photograph for Grab E.

Table 1: Summary of Grab Samples

Sample ID	Description
Grab A	Soft black silt mixed with organic matter (leaves/twigs/kelp) with strong hydrogen sulphide odour
Grab B	Soft black silt mixed with organic matter with strong hydrogen sulphide odour
Grab C	Soft black silt mixed with organic matter (leaves/twigs/kelp) with strong hydrogen sulphide odour
Grab D	Soft black silt with hydrogen sulphide odour with minor organic matter
Grab E	Soft black silt mixed with organic matter with strong hydrogen sulphide odour

6. All samples recorded two or more metals in exceedance of RAL1 which is consistent with the previous sampling results.

7. No exceedances of RAL 2 were recorded in the additional samples including the location of the original sample (Grab C) which had exceedances of RAL2 for arsenic, copper and zinc in 2019.

8. The sample concentrations/RAL1 exceedances recorded in 2019, 2021 and 2022 are all similar in magnitude.

9. Average concentrations are presented in Table 2 for each year and show that distribution of metals is fairly uniform and at similar levels throughout all the samples and varying depths. Average concentrations for arsenic, copper and are broadly similar to the other samples when the "hotspot sample "Grab C from 2019 is excluded from the data set.

Table 2: Summary of Exceedances March 2022

Sample ID	RAL1 Exceedances	RAL2 Exceedances
Grab A	Cu, Ni	N/A
Grab B	Cd, Cu, Ni	N/A
Grab C	Cd, Cu, Ni	N/A
Grab D	Cd, Cu, Ni & Zn	N/A
Grab E	Cd, Cu, Ni	N/A

Table 3: Average Concentrations of Metals

Metal	2019	2021	2022
Arsenic	9.3/3.0*	5.3	6
Cadmium	0.37	0.45	0.46
Chromium	46.6	24.5	35.5
Copper	152/18.7*	28.2	44.9
Mercury	0.1	0.05	0.07
Nickle	27.7	21.4	33.9
Lead	20.8	17.1	23.9
Zinc	341/62*	73.7	111

*Note – Value excludes Grab C sample Hotspot Sample

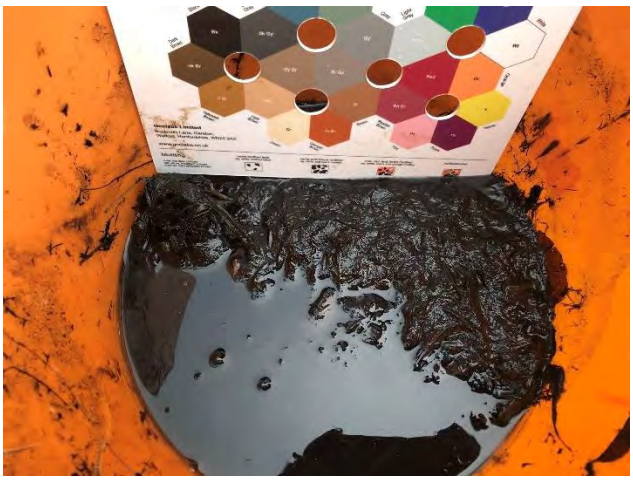
Conclusions

10. The confirmatory sampling has concluded that there is no widespread contamination within the area where the original RAL2 exceedance was recorded in 2019. The additional sampling has further supported the existing data set that the RAL2 exceedances recorded in Grab C in 2019 appear to be the result of an anomaly which is not representative of the wider harbour area sediment quality. Re sampling of the original location where the failure was recorded has not identified any further exceedances of RAL2 which suggests that the original sample may have been contaminated with a discrete source of contamination i.e. paint chips, treated wood, metal plating or another similar source which has been removed from the sediment at the time of sampling and is no longer present.

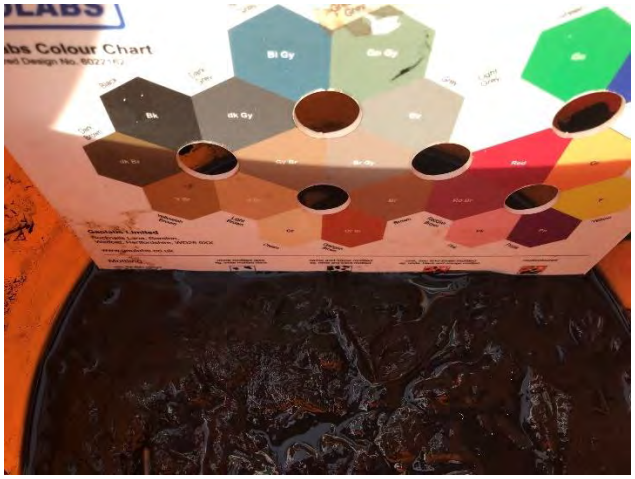
11. On this basis, the original assessment outlined within the supporting BPEO for the licence application still stands and that all of the material identified as part of the sampling works is suitable for sea based disposal.

APPENDICIES

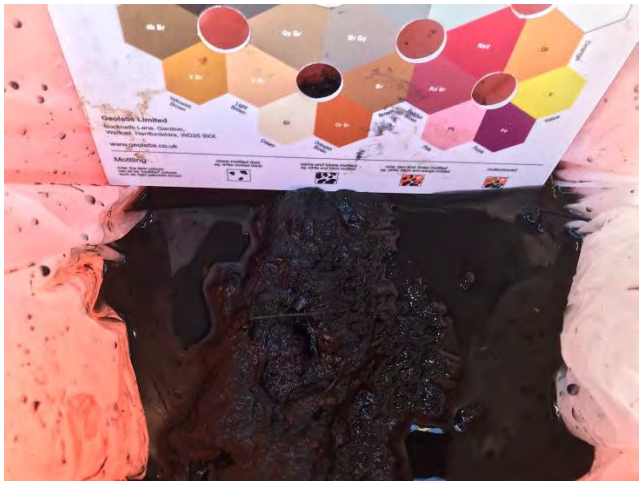
PHOTOGRAPHS



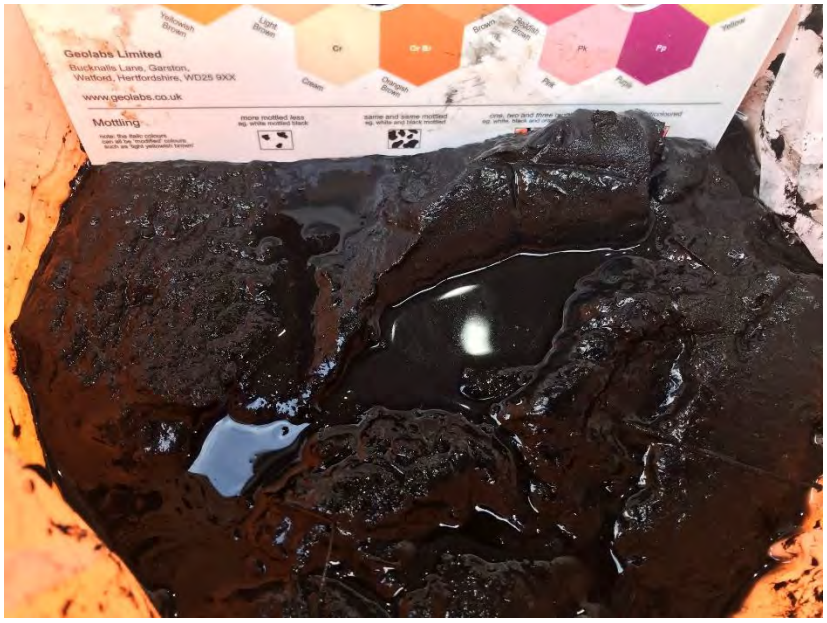
Grab A



Grab B



Grab C


Geolabs Limited
Bucknalls Lane, Garston,
Watford, Hertfordshire, WD25 9XX
www.geolabs.co.uk
Mottling

Grab D

DRAWINGS

368900 369000

864700 864600 864500

OUTER BASIN

MIDDLE BASIN

INNER BASIN

Grab A
Grab B
Grab C
Grab D
Grab E

Quayside
North Castle Street
A953
A97
Braeheads
Railway Line
Banff Marina
Aberdeenshire

Imagery Source: Bing Maps. Image courtesy of Ordance Survey, © 2021 TomTom
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368900 369000 Do not scale this map

Legend

- Dredge Area
- Proposed Additional Samples - March 2022
- Previous Grab A7204_C (2019)
- Area Earmarked for Further Assessment

Client
Aberdeenshire Council

Project
Banff Harbour Maintenance Dredging

Title
Proposed Additional Grab Sample Locations - March 2022

Scale
1:750 @ A3

Status
Draft

Drawing No.	Revision	Date
374655-QGIS004	-	14 Mar 2022
Drawn	**Checked**	**Approved**
FR	##	##

Rev	Date	Amendment	Initials
-	-	-	-

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LAB RESULTS

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID	**MAR01387**	
Issue Version	1	
Customer	Envirocentre, Craighall Business Park, 8 Eagle Street, Glasgow, G4 9XA	
Customer Reference	Banff Harbour - March 2022	
Date Sampled	31-Mar-22	
Date Received	05-Apr-22	
Date Reported	25-Apr-22	
Condition of samples	Ambient	Satisfactory

Authorised by: Marya Hubbard

Position: Laboratory Manager

Any additional opinions or interpretations found in this report, are outside the scope of UKAS accreditation.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01387
Issue Version 1
Customer Reference Banff Harbour - March 2022

		Units	mg/Kg (Dry Weight)							
		Method No	ICPMSS*							
		Limit of Detection	0.5	0.04	0.5	0.5	0.01	0.5	0.5	2
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Mercury**	**Nickel**	**Lead**	**Zinc**
Grab A	MAR01387.001	Sediment	5.4	0.34	26.6	36.4	0.05	30.7	18.1	81.8
Grab B	MAR01387.002	Sediment	5.3	0.42	35.8	44.1	0.06	38.3	23.5	101
Grab C	MAR01387.003	Sediment	6.1	0.56	36.6	42.7	0.08	30.4	23.9	124
Grab D	MAR01387.004	Sediment	7.7	0.48	41.8	55.2	0.08	38.3	28.9	133
Grab E	MAR01387.005	Sediment	5.5	0.50	36.6	46.0	0.08	31.7	25.0	116
Certified Reference Material SETOC 774 (% Recovery)			89	88	90	90	94	89	89	89
QC Blank			<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5	<2

* See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01387
Issue Version 1
Customer Reference Banff Harbour - March 2022

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
ICPMSS*	MAR01387.001-005	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.

DEVIATING SAMPLE STATEMENT

Deviation Code	Deviation Definition	Sample ID	Deviation Details. The following information should be taken into consideration when using the data contained within this report
D1	Holding Time Exceeded	N/A	N/A
D2	Handling Time Exceeded	N/A	N/A
D3	Sample Contaminated through Damaged Packaging	N/A	N/A
D4	Sample Contaminated through Sampling	N/A	N/A
D5	Inappropriate Container/Packaging	N/A	N/A
D6	Damaged in Transit	N/A	N/A
D7	Insufficient Quantity of Sample	N/A	N/A
D8	Inappropriate Headspace	N/A	N/A
D9	Retained at Incorrect Temperature	N/A	N/A
D10	Lack of Date & Time of Sampling	N/A	N/A
D11	Insufficient Sample Details	N/A	N/A
D12	Sample integrity compromised or not suitable for analysis	N/A	N/A

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR01387
Issue Version	1
Customer Reference	Banff Harbour - March 2022

Method	Sample and Fraction Size	Method Summary
Metals	Air dried and seived to <63µm	Aqua-regia extraction followed by ICP analysis.

Analyte Definitions

Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name
ACENAPTH	Acenaphthene	C2N	C2-naphthalenes	THC	Total Hydrocarbon Content
ACENAPHY	Acenaphthylene	C3N	C3-naphthalenes	AHCH	alpha-Hexachlorcyclohexane
ANTHRACN	Anthracene	CHRYSENE	Chrysene	BHCH	beta-Hexachlorcyclohexane
BAA	Benzo[a]anthracene	DBENZAH	Dibenzo[ah]anthracene	GHCH	gamma-Hexachlorcyclohexane
BAP	Benzo[a]pyrene	FLUORANT	Fluoranthene	DIELDRIN	Dieldrin
BBF	Benzo[b]fluoranthene	FLUORENE	Fluorene	HCB	Hexachlorobenzene
BEP	Benzo[e]pyrene	INDPYR	Indeno[1,2,3-cd]pyrene	DDD	p,p'-Dichlorodiphenyldichloroethane
BENZGHIP	Benzo[ghi]perylene	NAPTH	Naphthalene	DDE	p,p'-Dichlorodiphenyldichloroethylene
BKF	Benzo[k]fluoranthene	PERYLENE	Perylene	DDT	p,p'-Dichlorodiphenyltrichloroethane
C1N	C1-naphthalenes	PHENANT	Phenanthrene		
C1PHEN	C1-phenanthrene	PYRENE	Pyrene		