



Burghead & Hopeman Harbours Best Practicable Environmental Option (BPEO) Report



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EnviroCentre Limited Office Locations:

Glasgow

Edinburgh

Inverness

Banchory

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

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1 INTRODUCTION

Moray Council are seeking to renew their dredge licenses for Burghead and Hopeman Harbours. Each of the applications are for maintenance dredges. As part of the licensing process applicants are required to undertake a Best Practicable Environmental Option (BPEO) assessment for the disposal routes for the prospective dredge material in conjunction with the assessment of the chemical and physical properties of the same material to ensure that quality of the material is suitable for the identified disposal route(s).

1.1 Scope of Report

Sediment sampling was recently undertaken at both harbours with sample locations detailed in the drawings 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 Background to Application

The sediment sampling was undertaken in February 2023.

The proposed dredge areas and volumes are detailed in Table 1-1 below with the dredge areas presented in Appendix A.

Table 1-1: Proposed Dredge Areas and Approximate Dredge Volumes

Dredge Area	Approximate Dredge Volume (m ³)	Dredge Thickness range (m)
Burghead	10,000	<1.0m
Hopeman	3,500	<1.0m

At present, the exact dredging details are unconfirmed, but it is envisaged that dredging would be carried out potentially by a combination of methods including the Council owned Back-hoe Dredger MV Selkie. Further details on the dredging methodologies will be provided once tendering of works has been completed.

Burghead and Hopeman are in proximity to the Moray Firth Special Protected Area (SPA) with the relevant SPA interests noted as wintering seabird species.

1.3 Sediment Sampling and Nature of Marine Sediments on Site

Samples from the proposed dredge area were collected in February 2023 and submitted for analysis in line with Marine Scotland’s guidance and the agreed sampling plan(s). The sample logs are provided in Appendix B with Laboratory certificates and data summary tables in Appendix C.

The dominant sediment type at each site is as follows:

- Burghead – predominately sand with areas up to 35% silt.
- Hopeman – predominately sand with one area up to 34% silt.

The following sections details the exceedances of the Revised Action Levels (RALs) with further consideration of these exceedances undertaken in in Section 4 as needed.

Table 1-2: Burghead Harbour Screening Results

Contaminant	No. of RAL 1 Exceedances	No. of RAL 2 Exceedances
Arsenic	0 of 4	0 of 4
Cadmium	1 of 4	0 of 4
Copper	1 of 4	0 of 4
Chromium	0 of 4	0 of 4
Mercury	0 of 4	0 of 4
Nickel	0 of 4	0 of 4
Lead	1 of 4	0 of 4
Zinc	2 of 4	0 of 4
PAHs	2 of 4	N/A
PCBs	0 of 4	0 of 4
TBT	1 of 4	0 of 4
THC	2 of 4	N/A
PBDEs	N/A	N/A

Table 1-3: Hopeman Harbour Screening Results

Contaminant	No. of RAL 1 Exceedances	No. of RAL 2 Exceedances
Arsenic	0 of 3	0 of 3
Cadmium	1 of 3	0 of 3
Copper	1 of 3	0 of 3
Chromium	0 of 3	0 of 3
Mercury	0 of 3	0 of 3
Nickel	0 of 3	0 of 3
Lead	0 of 3	0 of 3
Zinc	0 of 3	0 of 3
PAHs	1 of 3	N/A
PCBs	0 of 3	0 of 3
TBT	0 of 3	0 of 3
THC	1 of 3	N/A
PBDEs	N/A	N/A

1.3.1 PBDEs

Marine Scotland requested that PBDEs were included within the analytical suite. There are no action levels at present for screening of data. One or more of the 12 PBDEs were recorded in samples at or above the detection level at both of the sites.

1.4 Chemical Results Summary

Results at both harbours recorded at least one sample with an exceedance above Revised Action Level 1 (RAL 1) of one of the key contaminants of concern. Further assessment of these results is required should this material be deemed suitable for sea disposal.

No results were recorded which exceeded RAL 2, where an action level is available.

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 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?
Harbour/ Quayside	Leave in situ	Not an option due to the project specific requirements to maintain the depth of the operational harbours.	No
	Infilling of an existing dry dock/harbour facility/development site (re-use)	There are currently no proposed developments in the local area which could accommodate this material.	No
	Beach Nourishment	<p>While sediments with high sand content are suitable for beach replenishment, material with a high silt content are not generally considered suitable. Material sampled and analysed from both Burghead and Hopeman are noted to consist predominantly sand. Typically, the material used in replenishment projects needs to be of a similar nature i.e. grain size proportions to that of the receiving beach. There is potential for this option to be adopted assuming that the timings of dredging and opportunities for disposal align.</p> <p>Much of the Moray coast are within/in proximity to designated sites (SSSI, SPA, MPA) and hold both national and international importance to nature conservation. 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. The harbour authority (Moray Council) have expressed an interest in the possibility of using the dredged material for a beach nourishment project. The dredge material from sites/areas within sites which predominantly comprises sand would be the preferred material.</p>	Yes

Land	Landfill Disposal	This is possible but it is unlikely that this option will offer long term solution due to lack of space at landfills. 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 likely to require treatment first in a dewatering facility. Significant cost associated with set up of dewatering facility at the quayside plus transportation and additional costs associated with gaining the necessary planning and regulatory consents.	No
	Land Incineration	The dredged material consists of non-combustible material (silts, sands, gravels, shells) with a low combustible component and very high-water content.	No
	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 and 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 to minimise the entrainment of fine-grained material into the sands, or energy and water rich processing on land. This is not currently understood to be an established disposal and reuse route in proximity to the Moray Council Harbours at present and is not likely to be something which could be established in the project timeframes due to the requirement for various permitting requirements including waste management licencing, discharge consents for process water as well as increased road transportation for delivery of waste material and collection of processed material.	No
Sea	Aquatic disposal direct to seabed.	Relatively low cost, minimal transportation requirements compared to all other options and potential for low environmental risk due to the requirement for regulatory approval and sediment characterisation. The closest spoil ground to all of these sites, and have had dredged material disposed of historically is Burghead CR030 centred at the point: 57° 43.500' N 003° 31.000' W	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; 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 (at low tide);
- 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 long-arm excavator on land. The material will then be temporarily stockpiled before being transferred into a suitable wagon for transport to the identified beach site(s) before it is then suitably distributed and profiled. Moray Council will give consideration to suitable candidate sites ahead of the dredging works. There is potential for some temporary disruption to local residents as a result of the HGV movements.

2.2.2 Sea disposal

This option handles material in a single stage namely transport to the disposal site. The existing licensed disposal site is CR030 Burghead. It is located in naturally deep water with ease of access, has a large capacity and is anticipated to be active for the foreseeable future.

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	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Safety Implications• Public Health Implications• Pollution/ Contamination Implications• General Ecological Implications• Interference with other legitimate activities e.g. fishing• Amenity/Aesthetic Implications
Costs	<ul style="list-style-type: none">• 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	Sea Disposal
Operational Aspects (inc. handling and transport)	<p>This method would likely involve road transport from the dredge site to the reuse site.</p> <p>The need for additional environmental assessment and potential licencing requirements would need to be established up front and taken into consideration to ensure that it minimised pressure on the required project timescales.</p>	<p>There would be no double handling of the dredged material. Transportation to the disposal site would be by dredger or barge(s) depending on methodology.</p>
Availability of suitable sites/facilities	<p>Early discussions with Moray Council have identified that this may be an option in relation to at least one of the sites subject to further discussions and consideration of the proposals.</p>	<p>The marine disposal site has been designed to accommodate the quantities typically generated by dredging operations. 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.</p>
General Public /Local acceptability	<p>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. There would likely be a short period of disruption, but would likely be acceptable in the event that the longer term amenity value objectives of the project are achieved.</p>	<p>Traditionally accepted disposal route for dredged material and limited public impact.</p>
Legislative Implications	<p>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. This should be established prior to progressing to ensure that project timescales are realistic and achievable.</p>	<p>This is an accepted disposal route as long as a Marine Licence is obtained.</p>

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	Sea Disposal
Safety Implications	HGV movements between the harbours and disposal site increase potential for accidents to occur. Work would be undertaken in accordance with H&S legislation.	Minimal handling of material 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).	Low potential for human contact during dredging and disposal operations. Once deposited at disposal site pathways for human contact greatly reduced.
Pollution/contamination	HGVs transporting material to the beach site would have implication on carbon footprint and potential for local impact on air quality. Potential also for temporary noise impacts and dust release during profiling works (if sediment dries out).	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 with regards to its effects on sediments has not been provided. Correspondence with Marine Scotland has previously concluded that disposal sites in Scotland are dispersive.
General Ecological Implications	Significant ecological implications are unlikely as a result of deposition of additional sand on the beach. The receiving beach would need to be assessed on its location within or in proximity to sensitive ecological features/designations.	The Burghead disposal site has historically been used for disposal of dredged material from these harbours and is the closest licensed disposal site.
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. Ideally these works would be undertaken out with the bathing season.	Designated disposal site, as such there is considered no significant impact to commercial vessels or commercial fishing.
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.	Limited short term visual / odour / noise effects as dredged material is transported by dredger and disposed of below sea level.

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 experience within industry (as opposed to formal quotations).

Since the beach nourishment and sea disposal options are to be proposed both as options assuming that timescales for beach nourishment and dredging programme overlap, costs for each based on a nominal dredge of 8,000 tonnes (approximately 4,000m³) of dredged material has been set for comparative purposes.

The assumptions to calculate the costs are as follows:

- Dredging costs are estimated to be £3.21 per m³;
- Ship transportation costs from the dredged area to disposal / transfer site have been calculated based on £1.85 per tonne.
- Due to the relatively small volume likely to be used for Beach Nourishment, and anticipated free draining nature of the material, i.e. 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 £500/day) operating for 2 hours per day for 4 days (although a minimum hire charge may make this cost higher);
- To transport sediment from the harbour to the beach (for beach nourishment), it is anticipated that this would use a 26 tonne wagon and it is estimated that 308 return trips would be required to transport 8,000 tonnes of material. The location and distance of a receiving beach is not yet known, but for the purposes of costing is assumed to be within 3 miles of the harbour. The haulage cost per mile is estimated to be £2.25 per mile. 308 return trips of 3 miles each way = 1,848 miles. The cost therefore is assumed to be approximately £4,158.
- The cost for an excavator to distribute sediment and profile the beach following placement of sediment 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:

Table 3-4: BPEO Cost Analysis

Activity	Beach Nourishment (£)	Sea Disposal (£)
Dredging	12,840	12,810
Mobilisation of Marine Plant for Sea Disposal	-	5,000
Transport by vessel to disposal site	-	14,800
Transfer of material to lorry	2,000	-
Transportation Cost to Beach	4,158	-
Excavator for beach profiling works	2,250	-
Total Costs	21,248	32,610

Note: The above costs do not take into account the cost required to gain 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).

3.2 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 below provides a summary of the BPEO assessment.

Table 3-5: BPEO Summary

Criteria	Beach Nourishment	Sea Disposal
Environment	2	2
Strategic	2	3
Costs	1	3
TOTAL SCORE	5	8

Moray Council has indicated that beach nourishment may be an option for some of the dredged spoil but further consideration of this needs to be undertaken. This is being kept as an option as it meets the requirement for beneficial reuse where possible.

Deposition of the dredged material at a licensed marine disposal site has traditionally been deemed acceptable. Despite being assessed as more expensive, it is being kept under consideration as a potential disposal route for material that is considered unsuitable for beach nourishment or where the timescales between beach nourishment and dredging do not align. The 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. Material handling is limited to transportation thereby reducing the risk for pollution incidences occurring. Pollutant concentrations within sediments are also limited to acceptable levels through regulatory requirements.

3.3 Conclusions

The Best Practicable Environmental Option for disposal of the dredged material from the sites has therefore been assessed as sea disposal or where possible, beach nourishment.

As identified in the sediment chemical quality section, further assessment is deemed necessary to confirm the suitability of the sediment for disposal to the wider environment. The following section details this assessment.

4 FURTHER ASSESSMENT

As detailed in Section 1, 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) have been included in the summary table in Appendix B, but have not been 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 Analytical Data Review

Analytical data for the proposed dredge sites are provided in Summary Table A in Appendix C. 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.

While individual site results were compared against RAL1 and RAL2 in preceding sections, the further screening will be undertaken for all data and any specific issues identified for individual harbours.

A summary of the exceedances is detailed below:

4.1.1 Action Level 1

Exceedances of RAL1 can be summarised as follows:

- Arsenic – 0 of 7 samples recorded arsenic levels above RAL1;
- Cadmium – 2 of 7 samples recorded cadmium levels above RAL1;
- Copper – 2 of 7 samples recorded copper levels above RAL1;
- Chromium – 0 of 7 samples recorded chromium levels above RAL1;
- Lead – 1 of 7 samples recorded lead levels above RAL1;
- Mercury – 0 of 7 samples recorded mercury levels above RAL1;
- Nickel – 0 of 7 samples recorded nickel levels above RAL1;
- Zinc – 2 of 7 samples recorded zinc levels above RAL1;
- PAHs – 3 of 7 samples recorded at least one PAH species above RAL1;
- THC – 3 of 7 samples recorded total hydrocarbons above RAL1;
- TBT 1 of 7 samples recorded total TBT above RAL1; and
- PCBs 0 of 7 samples recorded PCBs above RAL1.

4.1.2 ERL & PEL Review

Exceedances of the ERL (where one is available) can be summarised as follows:

- Cadmium – 1 of 7 samples recorded cadmium levels above the ERL;
- Copper – 2 of 7 samples recorded copper levels above the ERL;
- Mercury – 1 of 7 samples recorded mercury levels above the ERL;
- Lead – 6 of 24 samples recorded mercury levels above the ERL;
- Zinc – 2 of 7 samples recorded zinc levels above the ERL; and
- PAHs – 2 of 7 samples recorded at least one PAH species above the ERL.

Exceedances of the PEL (where one is available) can be summarised as follows:

- Copper – 1 of 7 samples recorded copper levels above the PEL, specifically sample BH3 0.0-0.15m from Burghead Harbour;
- Zinc – 1 of 7 samples recorded zinc levels above the PEL, specifically sample BH3 0.0-0.15m from Burghead Harbour; and
- PAHs - 1 of 7 samples recorded at least one PAH species above the PEL, specifically sample BH3 0.0-0.15m from Burghead Harbour.

4.1.3 Action Level 2

All sample results were recorded below RAL 2, where values are available.

4.2 Averages

Review of the averaged data for each site has been undertaken *i.e.* considering the material as a single volume for disposal from each site. These data are provided in Tables B and C in Appendix C. The concentrations of the various contaminants of concern are quite variable, the review of average data against the available adopted assessment criteria are summarised below.

4.2.1 Burghead Harbour

- The averaged concentration exceeded RAL 1 for the following contaminants of concern: cadmium, copper, zinc and various PAHs;
- The averaged concentration exceeded the ERL for copper, zinc and various PAHs;
- The averaged concentration exceeded the PEL for Acenaphthene only; and

- There were no average concentrations recorded in exceedance of RAL 2 where one is available.

4.2.2 Hopeman Harbour

- The averaged concentration exceeded RAL 1 various PAHs;
- The averaged concentration exceeded the ERL for Benzo(ghi)perylene only; and
- There were no average concentrations recorded in exceedance of their respective PEL or RAL2 where one is available.

4.3 Chemical Assessment Conclusions

Samples collected from across both Burghead and Hopeman Harbours recorded exceedances of RAL 1 for metals, PAHs and THC. One sample (BH3 at Burghead) exceeded RAL 1 for TBT. There were no exceedances of RAL 2.

Two individual samples (one from each harbour) recorded exceedances of the ERL for various metals and PAH species, while 1 individual sample (from Burghead) recorded exceedances of the PEL for several metals and PAHs. However, when the averaged data is considered, the PEL is exceeded for only for Acenaphthene in the Burghead dredge. No individual samples (and therefore the averaged concentrations) did not exceed the PEL for samples collected from Hopeman.

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

4.4 Water Framework Directive Assessment

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
- Protected areas.

Each of these points are considered in Table 4-1 below:

Table 4-1: Receptor Risk Assessment

Key Receptor ¹	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	<p>Dredging and Sea Disposal The areas proposed to be dredged are routinely subject to dredging to maintain depth in the harbours and approach. The dredge and disposal sites are located in the Burghead to Lossiemouth coastal water body (ID: 200148) and has an overall classification status of “good” and a classification of “high” specifically for hydromorphology². The water body is not considered to be Heavily Modified. The classification of this water body takes into account the presence of the disposal site, so no further assessment is considered to be required.</p> <p>Beach Nourishment While there may be temporary, localised effects on the given receiving beach, grading of sediment by the excavator and incoming tides are likely to quickly move sediment into a natural morphology. The impacts on local hydromorphology from disposal are considered to be no more significant than sand naturally being transported to and from the coastline by tides/currents. The suitability of dredged material for the receiving beach, in terms of particle size, will be investigated and confirmed prior to the dredging and disposal exercise. No further assessment with respect to the water framework directive is likely to be required.</p>

¹ <https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters>

² <https://www.sepa.org.uk/data-visualisation/water-classification-hub/>

Key Receptor ¹	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Biology - habitats	Included to assess potential impacts to sensitive/high value habitats.	No	<p>The dredge sites are in proximity to designated features including the following designated sites:</p> <ul style="list-style-type: none"> • Moray Firth Special Area of Conservation (SAC) • Moray Firth Special Protection Area (SPA) <p>Neither the Moray Firth SAC or SPA have designations for habitats.</p> <p>No further assessment considered necessary.</p>
Biology – fish	Consideration of fish both within the estuary and also potential effects on migratory fish in transit through the estuary	No	<p>Dredging and Sea Disposal</p> <p>The Burghead to Lossiemouth coastal water body does not have a classification for fish. The material proposed to be dredged/deposited as part of dredging campaign(s) is similar in nature with material previously deposited. In addition, there is no estuary in close proximity to the site in which migratory fish would be migrating towards. Immediately out with the harbour lies open sea with no obvious constraints. No further assessment considered necessary.</p> <p>It is noted that under periods of exceptionally hot and dry weather the potential for oxygen related issues to arise: <i>i.e.</i> oxygen depletion and it is proposed that dredging works will be avoided as far as practicable during such times.</p>

Key Receptor ¹	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Water Quality	Consideration must be given to water quality when contaminants are present in exceedance of CEFAS RAL1.	Yes	<p>Dredging, Sea Disposal and Beach Nourishment</p> <p>The Burghead to Lossiemouth coastal water body are classified as “good” for water quality and “pass” for specific pollutants. Contaminants are noted to exceed CEFAS RAL1 within sediment samples. Potential effects are considered to be both local and temporary. Further consideration of potential effects is discussed in section 4.5 for completeness.</p>
Protected Areas	<p>If your activity is within 2km of any WFD protected area, include each identified area in your impact assessment.</p> <ul style="list-style-type: none"> • special areas of conservation (SAC) • special protection areas (SPA) • shellfish waters • bathing waters • nutrient sensitive areas 	Yes	<p>Dredging and Sea Disposal</p> <p>The Moray Firth SAC and SPA are present beyond the harbour walls and encompasses the Burghead disposal site. Further consideration to this is given in Section 4.5 below.</p> <p>No shellfish waters are present on the Moray coast. The closest designated bathing water is at Findhorn, some 7km south-west of Burghead Harbour.</p> <p>Beach Nourishment</p> <p>The location of any potential receiving beach is not yet known, therefore consideration with regard to protected areas will be required when the location is known.</p>

4.5 Potential Risk to Water Quality and Protected Areas

4.5.1 Water Quality

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

SEPA classified the Burghead to Lossiemouth coastal water body as overall “good” and “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.

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 there 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.

Table 4-2 summarises the physical sediment type versus the proposed dredge volume.

Table 4-2: Summary of PSA Data

Dredge Area	Gravel (>2mm)	Sand (0.063mm<Sand<2mm)	Silt & Clay (<0.063mm)	Quantity to be dredged m ³
Burghead	4.3%	81.7%	14.0%	10,000
	430 m ³	8,170 m ³	1,400 m ³	
Hopeman	0.1%	87.8%	12.1%	3,500
	4 m ³	3,073 m ³	424 m ³	

The dominant sediment type across both dredge sites is sand. Silt comprises between 12% and 14% of the material sampled from both sites.

Given that an average of between 85% and 90% of the sediment across both dredge sites comprises sand and gravel, it is considered that the majority of the deposited sediment will fall out of suspension quickly at the disposal site with limited lateral spread.

The silt and clay material is considered to have a longer suspension time than sand and gravel sized particles when in suspension. Depending on how the material is dredged, the cohesive nature of the material will mean that it would fall as consolidated units with minimal dispersion.

It is noted that the Burghead disposal ground has been utilised for the maintenance dredge disposal from surrounding dredge sites for a number of previous exercises (including the period of the most recent SEPA water quality classification for chemical status of the waterbody which accommodates the disposal grounds as “good”).

In summary, 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 change in status of the waterbodies in question at both the dredge and disposal sites.

4.5.2 Protected Areas

The Moray Firth Special Area of Conservation (SAC) and Special Protection Area (SPA) are present beyond the harbour walls and encompasses the Burghead disposal site. The specific features designated within the SAC and SPA are noted in Table 4-3 and Table 4-4 respectively. The SAC and SPA extend across a large area of coastline and coastal water; and will encompass a variety of features. Not all of the features listed below will be present at every location.

Table 4-3: Moray Firth SAC Features³

Feature Type	Feature	Latest Assessed Condition
Marine (incl. marine mammals)	Bottlenose dolphin (<i>Tursiops truncatus</i>)	Favourable Maintained
	Subtidal sandbanks	Favourable Maintained

The SAC is a protected area for bottlenose dolphins and subtidal sandbanks. Neither of these features are likely to be affected by dredging activity, as dolphins are unlikely to be present within or in the immediate vicinity of the harbours to be dredged. Protected subtidal sandbank features are unlikely to be present in the harbours as they are subject to ongoing maintenance dredging. With respect to the disposal site, the SAC listing does not specify dredging activities as a negative pressure impacting protected features, despite the disposal ground being within the SAC. Moreover, it is assumed that the presence of the SAC was taken into account when the Burghead disposal site was approved for use.

Table 4-4: Moray Firth SPA Features⁴

Feature Type	Feature	Latest Assessed Condition
Birds	Common scoter (<i>Melanitta nigra</i>)	Favourable Maintained
	Eider (<i>Somateria mollissima</i>)	Favourable Declining
	Goldeneye (<i>Bucephala clangula</i>)	Unfavourable Declining
	Great northern diver (<i>Gavia immer</i>)	Favourable Maintained
	Long-tailed duck (<i>Clangula hyemalis</i>), non-breeding	Favourable Maintained
	Red-breasted merganser (<i>Mergus serrator</i>), non-breeding	Favourable Maintained
	Red-throated diver (<i>Gavia stellata</i>), non-breeding	Favourable Maintained
	Scaup (<i>Aythya marila</i>), non-breeding	Unfavourable Declining

³ <https://sitelink.nature.scot/site/8327>

⁴ <https://sitelink.nature.scot/site/10490>

Feature Type	Feature	Latest Assessed Condition
	Shag (<i>Phalacrocorax aristotelis</i>), breeding and non-breeding	Favourable Maintained
	Slavonian grebe (<i>Podiceps auritus</i>), non-breeding	Favourable Maintained
	Velvet scoter (<i>Melanitta fusca</i>), non-breeding	Unfavourable Declining

The SPA is a protected area for seabirds. Neither the dredging or disposal activities are considered likely to result in a significant negative impact to breeding and non-breeding bird populations, primarily due to the localised and temporary nature of the works. In addition, the SPA listing does not specify dredging activities as a negative pressure impacting protected features, despite the disposal ground being within the SPA. Moreover, it is assumed that the presence of the SPA was taken into account when the Burghead disposal site was approved for use.

In summary, there are unlikely to be significant negative impacts on protected features of the SAC and SPA as a result of dredging and sea disposal activities. It is acknowledged that this assessment may require to be updated to take account of disposal/re-use by beach nourishment, depending on the location of the receiving beach.

5 CONCLUSIONS AND RECOMMENDATIONS

Review of available information has highlighted that although several contaminants of concern exceed RAL1 in sediment samples, 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. Additionally, the contaminants of concern levels recorded in the sediment are not considered likely to have a significant adverse impact on the sediment quality already located within the disposal ground. The materials nature is similar to that previously licensed for disposal in the existing maintenance dredge licence.

Overall, based on the multiple lines of evidence approach adopted to further assess the exceedances identified in the sediment assessment, the material as a whole is considered suitable for sea disposal.

As outlined earlier in the report, there is potential for some of the dredged material to be used for beach nourishment. Further consideration is to be given this option ahead of future dredging works. Marine Scotland will be notified in advance should this be a viable option with regards to dredge timescales and the bathing season.

The sea disposal option is considered to have no significant long-term impact on the marine environment and the disposal site is readily accessible from both dredging areas.

The BPEO has been identified as sea-based disposal for dredged material supplemented by beach nourishment where feasible.

REFERENCES

Marine Scotland (2017). Pre-Dredge Sampling Guidance Version 2: Scottish Government.

Marine Scotland (2015). Guidance for Marine Licence Applicants Version 2: Scottish Government.

APPENDICES

A FIGURES

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Legend

- Dredge Areas
- Sediment Samples
 - ◆ Grab

Do not scale this map

Client
Arch Henderson LLP

Project
Moray Council Dredging
Burghead Harbour

Title
Burghead Harbour Sediment Sample Locations

Status
Final

Drawing No. 377468-QGIS001	Revision -	Date 05 Apr 2023
Drawn FR	Checked GD	Approved CCAS

Scale
1:2,000 @ A3

Rev	Date	Amendment	Initials
-	-	-	-

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



Legend

- Dredge Areas
- Sediment Samples
 - ◆ Grab

Do not scale this map

Client
Arch Henderson LLP

Project
Moray Council Dredging
Hopeman Harbour

Title
Hopeman Harbour Sediment Sample Locations

Status
Final

Drawing No. 377468-QGIS002	Revision -	Date 05 Apr 2023
Drawn FR	Checked GD	Approved CCAS

Scale
1:1,000 @ A3

Rev	Date	Amendment	Initials
-	-	-	-



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

B SAMPLE LOGS

GRAB SAMPLE LOG

Date/Time	16/02/2023	Latitude	57.701241
Dredge Area	Burghead	Longitude	-3.5002001
Method	0.045m ² Van Veen Grab Sampler	Sampled/logged by	FR/AK

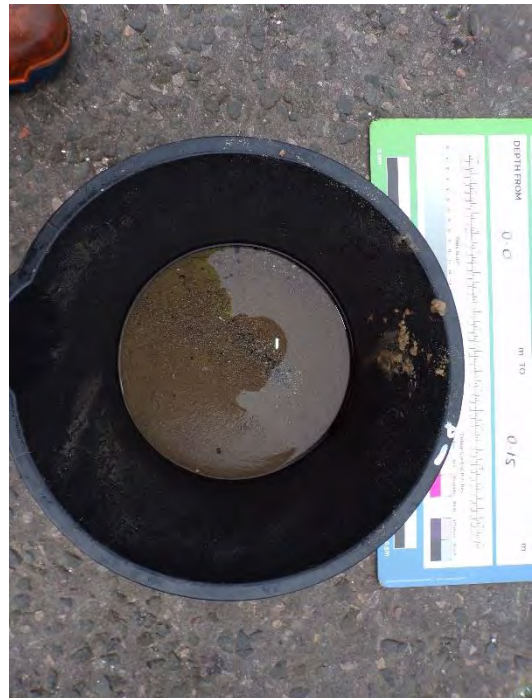
Remarks: Light brown/yellow brown silty fine to medium sandy with rare black seaweed and shell fragments.

Biota: One or two sandworms.

Odours: None noted.

Anthropogenic Inputs: None noted.

Notes: -



GRAB SAMPLE LOG

Date/Time	16/02/2023	Latitude	57.702437
Dredge Area	Burghead	Longitude	-3.4986655
Method	0.045m ² Van Veen Grab Sampler	Sampled/logged by	FR/AK

Remarks: Dark grey/black fine sandy silt. Frequent rounded cobbles. Rare vegetation and leaf litter.

Biota: None noted.


Odours: Moderate anoxic H₂S odour.

Anthropogenic Inputs: None noted.

Notes:

-



 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	Project Name	Moray Harbours - Pre-Dredge Licensing Support	Location ID
	Project No.	377468 (Burghead)	BH3
	Client	Arch Henderson	

GRAB SAMPLE LOG

Date/Time	16/02/2023	Latitude	57.701947
Dredge Area	Burghead	Longitude	-3.4967288
Method	0.045m ² Van Veen Grab Sampler	Sampled/logged by	FR/AK

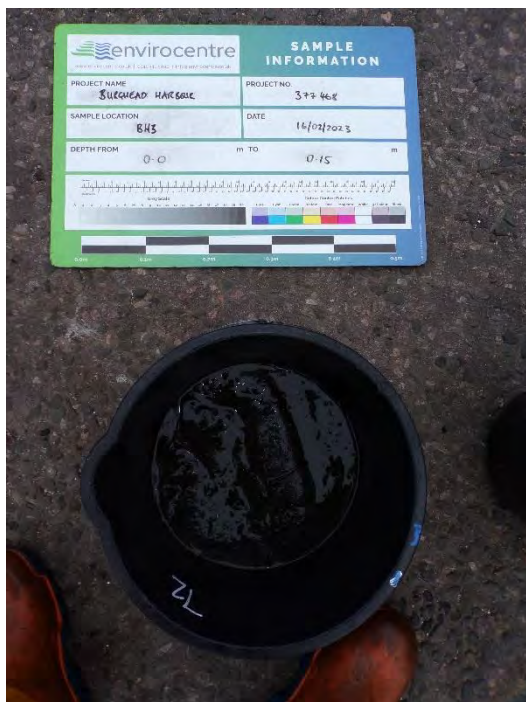
Remarks: Soft dark grey silt with occasional vegetation, seaweed and leaf litter.

Biota: None noted.

Odours: Strong H₂S odour.

Anthropogenic Inputs: Piece of a plastic bag.

Notes: -



GRAB SAMPLE LOG

Date/Time	16/02/2023	Latitude	57.701657
Dredge Area	Burghead	Longitude	-3.4988273
Method	0.045m ² Van Veen Grab Sampler	Sampled/logged by	FR/AK

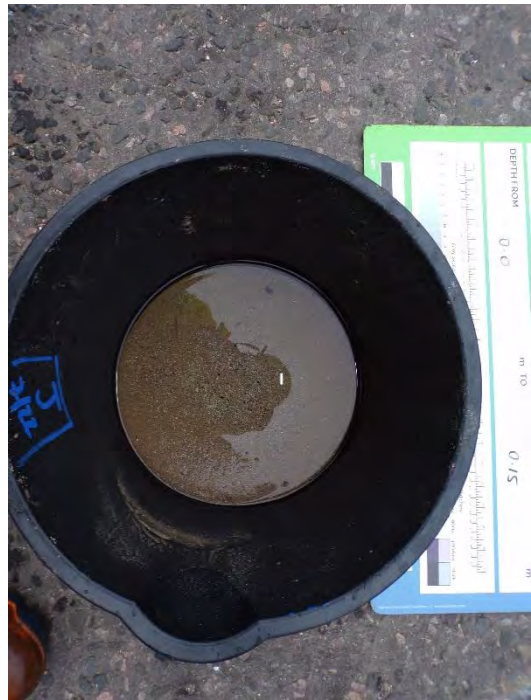
Remarks: Light brown/yellow brown silty fine to medium sandy with rare black seaweed and shell fragments.

Biota: Singular sand eel.

Odours: None noted

Anthropogenic Inputs: None noted.

Notes: -



GRAB SAMPLE LOG

Date/Time	16/02/2023	Latitude	57.711773
Dredge Area	Hopeman A	Longitude	-3.4372069
Method	0.045m ² Van Veen Grab Sampler	Sampled/logged by	FR/AK

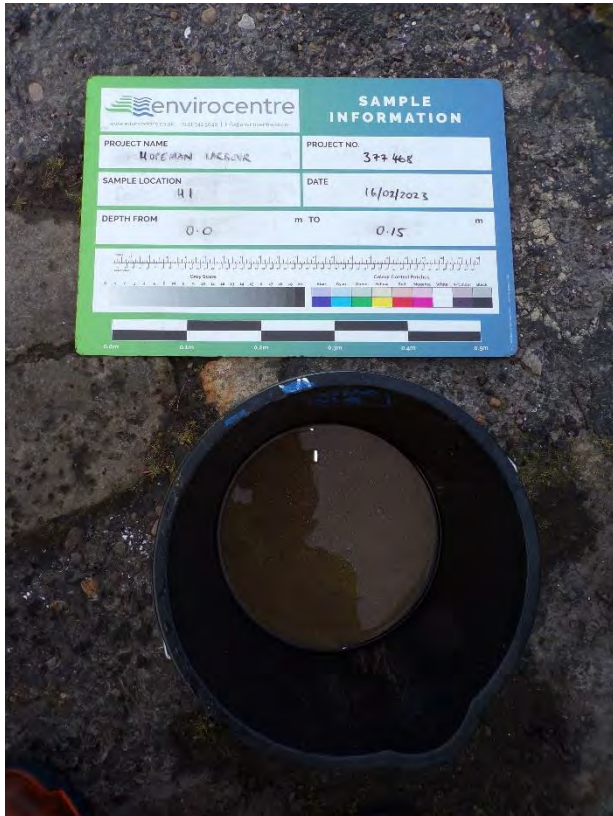
Remarks: Light brown/ yellow silty fine sand with fine shell fragments.

Biota: None noted.

Odours: None noted.

Anthropogenic Inputs: None noted.

Notes: -



GRAB SAMPLE LOG

Date/Time	16/02/2023	Latitude	57.711496
Dredge Area	Hopeman B	Longitude	-3.4370757
Method	0.045m ² Van Veen Grab Sampler	Sampled/logged by	FR/AK

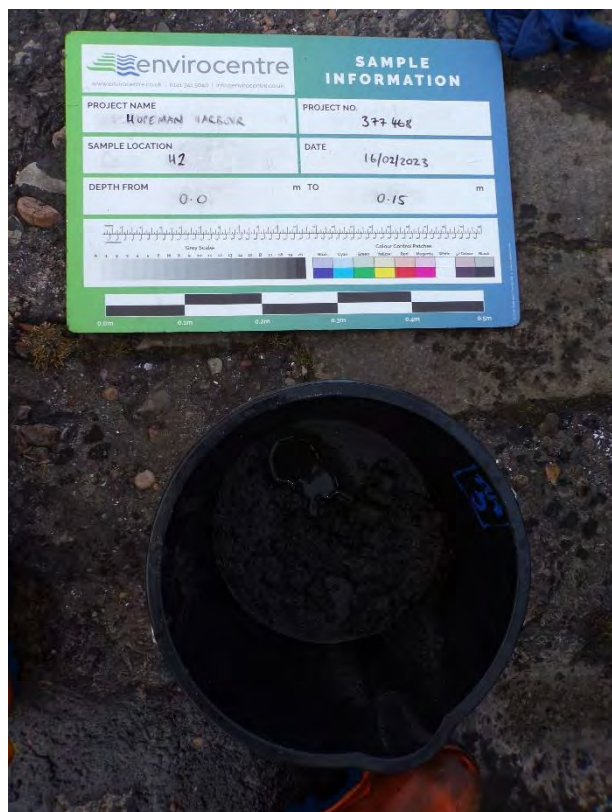
Remarks: Dark grey silty fine to medium with rare seaweed and vegetation.

Biota: None noted.

Odours: Moderate H₂S odour.

Anthropogenic Inputs: None noted.

Notes: -



GRAB SAMPLE LOG

Date/Time	16/02/2023	Latitude	57.710920
Dredge Area	Hopeman B	Longitude	-3.4372454
Method	0.045m ² Van Veen Grab Sampler	Sampled/logged by	FR/AK

Remarks: Soft dark grey silt with frequent seaweed.

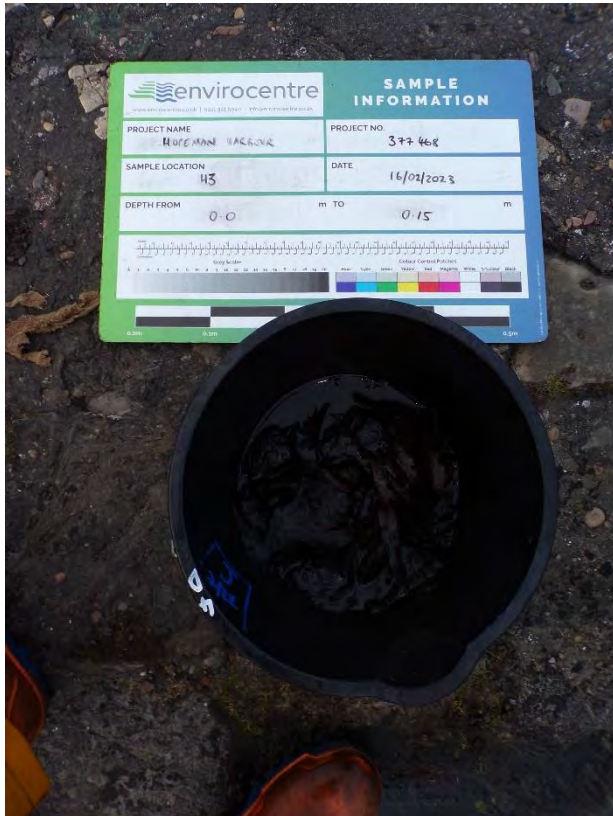
Biota: None noted.

Odours: Strong H₂S anoxic odour.

Anthropogenic Inputs: None noted.

Notes:

-



C DATA SUMMARY TABLES

Summary Table A

Sampling Results Incorporated with BPEO Assessment (mg/kg)

Source	Background					Burghead Harbour				Hopeman Harbour			AVERAGE	No. Exceed RAL 1	No. Exceed RAL 2	No. Exceed BAC?	No. Exceed ERL	No. Exceed PEL?
	AL1	AL2	BAC CSEMP	ERL CSEMP	PEL Canada	BH1	BH2	BH3	BH4	H1	H2	H3						
Arsenic	20	70	25		41.6	2.8	7.5	18.2	3.6	1.5	1.9	10.1	6.51	0	0	0	-	0
Cadmium	0.4	4	0.31	1.2	4.2	0.04	0.37	1.26	0.04	0.18	0.11	0.62	0.37	2	0	3	1	0
Chromium	50	370	81	81	160	9.2	20.1	29	11	9.5	13	34.2	18.00	0	0	0	0	0
Copper	30	300	27	34	108	12.5	3.4	196	3.8	8.8	11.1	67.5	43.30	2	0	2	2	1
Mercury	0.25	1.5	0.07	0.15	0.7	0.01	0.06	0.23	0.01	0.01	0.01	0.14	0.07	0	0	2	1	0
Nickel	30	150	36	-	-	6.6	12.8	16.9	7.7	6.7	8.7	17.7	11.01	0	0	0	N/A	N/A
Lead	50	400	38	47	112	5.8	1.4	61.2	1.5	2.8	5.3	35.7	16.24	1	0	1	1	0
Zinc	130	600	122	150	271	18	153	557	38	18	29	128	134.33	2	0	3	2	1
Napthalene	0.1		0.08	0.16	0.391	0.001	0.005	0.046	0.001	0.001	0.012	0.040	0.02	0	-	0	0	0
Acenaphthylene	0.1				0.128	0.001	0.005	0.040	0.001	0.001	0.001	0.049	0.01	0	-	N/A	N/A	0
Acenaphthene	0.1				0.0889	0.001	0.005	0.704	0.001	0.001	0.005	0.026	0.11	1	-	N/A	N/A	0
Fluorene	0.1				0.144	0.001	0.005	0.400	0.001	0.001	0.005	0.054	0.07	1	-	N/A	N/A	1
Phenanthrene	0.1		0.032	0.24	0.544	0.001	0.019	1.120	0.001	0.001	0.042	0.390	0.22	2	-	3	2	1
Anthracene	0.1		0.05	0.085	0.245	0.001	0.009	0.383	0.001	0.001	0.012	0.109	0.07	2	-	2	2	0
Fluoranthene	0.1		0.039	0.6	1.494	0.005	0.063	3.310	0.002	0.001	0.083	0.798	0.61	2	-	4	2	1
Pyrene	0.1		0.024	0.665	1.398	0.004	0.115	2.930	0.003	0.001	0.082	0.802	0.56	3	-	4	2	1
Benzo(a)anthracene	0.1		0.016	0.261	0.693	0.002	0.033	2.530	0.001	0.001	0.034	0.312	0.42	2	-	4	2	1
Chrysene	0.1		0.02	0.384	0.846	0.002	0.041	2.730	0.001	0.001	0.034	0.324	0.45	2	-	4	1	1
Benzo(b)fluoranthene	0.1		-	-	-	0.002	0.037	2.710	0.001	0.001	0.024	0.293	0.44	2	-	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1		-	-	-	0.002	0.039	2.290	0.001	0.001	0.027	0.300	0.38	2	-	N/A	N/A	N/A
Benzo(a)pyrene	0.1		0.03	0.384	0.763	0.002	0.038	2.880	0.001	0.001	0.032	0.385	0.48	2	-	4	2	1
Indeno(1,2,3cd)pyrene	0.1		0.103	0.24	-	0.001	0.032	1.980	0.001	0.001	0.021	0.264	0.33	2	-	2	2	N/A
Benzo(ghi)perylene	0.1		0.08	0.085	-	0.001	0.031	1.610	0.001	0.001	0.021	0.262	0.28	2	-	2	2	N/A
Dibenzo(a,h)anthracene	0.01		-	-	0.135	0.001	0.005	0.411	0.001	0.001	0.005	0.044	0.07	2	-	N/A	N/A	1
TPH	100		-	-	-	0.99	152.00	1090.00	2.43	0.91	20.60	202.00	209.85	3	-	N/A	N/A	N/A
PCBs	0.02	0.18	-	-	0.189	0.00294	0.00058	0.00135	0.00008	0.00056	0.00056	0.0058	0.0017	0	0	N/A	N/A	0
TBT	0.1	0.5	-	-	-	0.001	0.010	0.154	0.001	0.001	0.005	0.017	0.0271	1	0	N/A	N/A	N/A

Note: Underlined Values are < LOD

PEL Data Source: <http://ceqg-rcqe.cmc.ca/en/Index.html#void>