

# Ardrishaig Harbour BPEO Report –December 2020

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## **1 INTRODUCTION**

### 1.1 Scope of Report

Scottish Canals Ltd (are required to undertake a Best Practicable Environmental Option (BPEO) assessment to undertake plough dredging of material within Adrishaig Harbour within Loch Goil sea loch to maintain navigation to the Canal via the harbour. At present the access is restricted during low tides, and the windows of access and egress from the canal into the harbour are limited. Two areas are to be deepened including one area to 3m below CD and the other 5m below CD as 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

This report covers dredge areas which are detailed in the Figure in Appendix A and Table 1-1 below.

#### Table 1-1: Proposed Dredge Site and Approximate Dredge Volume

Site Name	Dredge Volume (m <sup>3</sup> )
Ardrishaig Harbour	14,000m <sup>3</sup>

### 1.3 Report Usage

The information and recommendations contained within this report have been prepared in the specific context stated above and should not be utilised in any other context without prior written permission from EnviroCentre.

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## 2 NATURE OF MARINE SEDIMENTS

Samples from the proposed dredge area were collected in November 2020 and submitted for analysis in line with Marine Scotland's Guidance. The results from this exercise are provided in Appendix C and also accompanying the licence application in the appropriate template.

Sediments sampled within the proposed dredge areas are reported as a mixture of gravel, silt and sand with these constituents varying by sample location.

### 2.1 Chemical Analysis Assessment Criteria

All chemical analytical results were assessed against Revised Action Levels (RAL) criteria as adopted by Marine Scotland. The results are summarised in Table 2-1 below. Full summary reports detailing exceedances in the Marine Scotland format have been submitted along with the supporting information for the application. The full sediment sampling report is provided in Appendix B.

Where contaminants have RALs as adopted by Marine Scotland, exceedances above these criteria are summarised in Table 2-1, along with the maximum concentration recorded for each parameter.

Contaminant	ontaminant No. of Exceedances (of 9 samples)*		Maximum Concentration (mg/kg) and Location	
	RAL 1	RAL 2	-	
Copper	4	0	41.3 - BHA ES104 2.30-2.80m	
Lead	2	0	78.1 - BHA ES101 0.00-0.15m	
Mercury	2	0	0.45 - BHA ES101 0.00-0.15m	
Nickel	4	0	42.7 - BHA ES104 2.30-2.80m	
PAH (All	1	-	Grab D ES101 0.00-0.15m	
Species)				
TPH	1	-	Grab D ES101 0.00-0.15m	

Table 2-1: Exceedances of Revised Action Levels and Maximum Concentrations

Multiple exceedances above RAL 1 were noted for metals, TPH, and PAHs. There were no exceedances of RAL 1 for TBT.

All results were recorded below RAL 2 where they exist.

### 2.2 Physical Characteristics

Samples recovered were predominately gravel, sand and silt varying in content by both location and depth. Average percentages across the dredge area are 8.5% gravel, 54.6% sand and 36.8% silt. Sample logs are provided in Appendix B.

## **3 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.

#### 3.1 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 3-1 along with justification for screening out those options which have not been taken forward for further consideration.

#### Table 3-1: Initial Best Practicable Available Options

Location	Options	Screening Assessment	Carry
Ectuory/		Not an aption due to the project apositio requirements to maintain the depth within the Harbour	No
Estuary/ Riverbank		The site is fairly isolated and no historic deals or other sites are systellable in previmity for reuse	
Niverballk	ovicting dry	of the project	NO
	dock/barbour	of the project.	
	facility/dovelop	The use of the dradged material on a development site is dependent upon programme timing	
	mont site (ro	and the suitability of the leastion of the receiving site. Once material is brought on to lead it falls	
		under the jurisdiction of SEPA. Further chemical and gestechnical testing is likely to be	
	usej	required before it is permitted for use on a development site	
	Peeeb	Specific basch neurishment prejects would require to be supported by Environmental	No
	Neurichmont	Assessments as a minimum to inform how the project could affect the appired by Environmental	INO
	Nounsninent	Assessments as a minimum to inform now the project could affect the environment as a result	
		and quality of the meterial and measures deviced from the second surface to the variable composition	
		and quality of the material and measures devised from the assessment outcomes to minimise	
		The dredge meterial comprises a mixture of group and and ailt. Fine addiments (i.e. ailt) is not	
		i ne dredge material comprises a mixture of gravel, sand and slit. Fine sediments (i.e. slit) is not	
Land	L an alfill	Suitable for beach nourisment in the traditional sense.	Vee
Land	Landfill	I his is possible but it is unlikely that this option will offer long term solution due to lack of space	res
	Disposal	at landfills. Landfill space is currently at a premium and does not offer a sustainable solution	
		either financially of 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.	N
		I he dredged material consists of non-combustible material (slits, sands, gravels, shells) with a	NO
		low combustible component and very nign-water content.	N
	Application to	I he dredged material would need to be treated to reduce salt concentrations to acceptable	NO
	Agricultural	levels. Would require detailed chemical analysis and assessment as well as a waste	
	Land	Management License Exemption. Would require special precautions during spreading in	
		relation to the risk of odour and watercourses / aquiters. 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.	

	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 site 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. The current proposal, based on historic activities, is to plough the dredge the material from the harbour to the deeper waters of Loch Gilp.	Yes

## 3.2 Summary of Identified BPEO Options

Four options were taken forward for further detailed BPEO assessment as follows:-

- 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.

#### 3.2.1 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 and transport to shore;
- Transfer to shore to a dewatering facility;
- Dewatering;
- Transfer of dewatered material to storage area for stockpiling;
- Loading of lorries and transport to landfill site; and
- Disposal at Landfill site.

Transport to the shore would require the identification of an available jetty facility suitable for receiving material directly to the dewatering facility. Two options are available for off-loading; namely grabbing the spoil from the barge or hopper or pumping directly ashore.

The dewatering facility would require being purpose built and capable of receiving large quantities of dredged material. 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. The dewatered dredged sediment would then be removed from the facility and stockpiled for transfer via lorry to a suitably licensed landfill. The closest landfill is c.4.5 miles to the east, Lochgilphead landfill Operated by Shanks and Argyll and Bute Council and is for domestic refuse.

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. It is estimated that approximately 1,600 return trips would be required to transport the dewatered dredged material to landfill.

The number of landfills within a viable distance of the site is considered to be very limited. In addition, the available capacity of each site is limited by the amount of material it can receive per annum. Due to the proposed quantity of material to be dredged it is therefore unlikely that any landfill within viable distance of the dredge site will have the capacity to receive the dredged material.

#### 3.2.2 Sea Disposal through Plough Dredging

This option only handles material at one stage namely transport to the disposal site via plough dredging. The proposed methodology will remove the material via plough dredging.to the deeper waters of Loch Gilp away from the Harbour. It is understood that this method has historically been used with success. This method minimises the requirement for additional processing/treatment, handling and transportation.

## 4 FURTHER CONSIDERATION OF REMAINING DISPOSAL OPTIONS

#### 4.1 Detailed BPEO Assessment

Each of the identified options was assessed against the criteria detailed in Table 4-1 below.

Primary Criteria	Description and Attributes	
Strategic	• Operational aspects, including handling, transport etc.	
	<ul> <li>Availability of suitable sites/facilities</li> </ul>	
	General Public/local acceptability	
	Legislative Implications	
	Summary of the outcome of consultation with third	
	parties	
Environmental	Safety Implications	
	Public Health Implications	
	<ul> <li>Pollution/ Contamination Implications</li> </ul>	
	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	

Table 4-1: BPEO Detailed Assessment Criteria

#### 4.1.1 BPEO Strategic Assessment

Table 4-2 below provides details of the strategic assessment for each option taken forward and details the environmental assessment for each option taken forward for detailed BPEO assessment.

Criteria	Landfill	Sea Disposal
Operational	Would involve double handling of material through dewatering and	There would be no double handling of the dredged
Aspects (inc.	transportation to landfill. A facility would need to be built for	material. The material would be ploughed away from
handling and	dewatering purposes. Would also increase the number of HGV's on	the harbour into the deeper waters of Loch Gilp.
transport)	the road network.	
Availability of	The geotechnical composition of the dewatered dredged material is	The chemical analysis of the sediments from the
suitable	considered to be suitable for disposal via this route. However, there	proposed dredge sites would indicate that the
sites/facilities	is typically a limit to the amount of waste that can be accepted both	material would typically be acceptable for sea
	on a daily and annual basis at a landfill. The landfill capacity will	disposal pending further risk assessment for
	therefore not be able to accommodate the quantity of material	contaminants present at levels between Action Level
	generated by the dredging activities and another disposal option	1 and Action Level 2.
	will be required for the surplus material.	
General Public	Increase traffic on haul routes therefore potential for increase in	Traditionally accepted disposal route for dredged
/Local acceptability	public complaints.	material and limited public impact. This method has
		historically been adopted.
Legislative	Contravenes the principles of minimising waste and long term	Would need approval from Marine Scotland other
Implications	commitments by the government to reduce land filling	relevant authorities
Legislative Implications	Contravenes the principles of minimising waste and long term commitments by the government to reduce land filling.	Would need approval from Marine Scotland other relevant authorities.

Criteria	Landfill	Sea Disposal
Safety Implications	Double handling of material increases the potential for accidents	Minimal handling of material required as it would be dredged
	to occur.	directly to Loch Gilp for dispersal
	Work would be undertaken in accordance with H&S legislation.	Work would be undertaken in accordance with H&S legislation.
Public Health	Measures will be required to limit human contact during transfer	Low potential for human contact during dredging and disposal
	of material from dredger to dewatering facility and transportation	operations. Plough dredging would not result in the material being
	to landfill.	raised above the surface of the water, therefore no public health
	Security measures typically employed at licensed landfills which	potential.
	will minimise human contact once accepted and emplaced at site.	
<b>Pollution/contamination</b>	Pumping ashore to dewatering facility and transportation to	Pollutant concentrations in dredged material to be disposed are
	landfill will all require energy. Road transport increases the	limited to acceptable levels through regulatory licensing processes.
	carbon footprint of this disposal option. Potential for spillages to	Further discussion with marine Scotland is likely to be required.
	occur.	
General Ecological	Licensed landfill would be away from protected species and	Removal to Loch Gilp has previously been utilised with no previous
Implications	habitats with measures in place to prevent or minimise pollution of	ecological impact being identified. There are no designated sites
	the surrounding environment.	adjacent to the harbour.
Interference with other	Potential for limited short term local impact to commercial	Works would be coordinated so as not to interfere with other
legitimate activities	operations in the area of the dredged material handling and road	activities.
	hauling principally related to noise and dust potential.	
Amenity / Aesthetic	Odour release from dewatering facility. Increase traffic noise	Limited short term visual / odour / noise effects as dredged material
Implications	during transportation from dewatering facility to landfill facility.	is transported by dredger to final resting place.
	Potential for spillages on haul route.	
	No significant additional visual/ odour/noise effects as using	
	existing landfill site.	

#### Table 4-3:: BPEO Environmental Assessment

## 4.2 BPEO Cost Assessment

#### 4.2.1 BPEO Cost Assessment

An operating budget estimate is provided in the table below. It should be noted that the rates in Table 4-4 are based on the dredged spoil being able to be transferred ashore in its as dug state and do not allow for placing within a bunded area, draining the material or transporting in watertight vehicles. If any of these are required, the costs would increase significantly.

14,000 m3 of material are to be dredged assuming it equates to 28,000 tonnes of material which has been used for the costings below.

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

Disposal Option	-			
	Activity	Weight (Tons)	Unit Cost	Cost (£)
	Description		(Tonne)	
Landfill Disposal	Excavation	28,000	1.50	42,000
	Transport by	28,000	3.00	84,000
	barge			
	Transfer to lorry	28,000	2.00	56,000
	Transport by lorry	28,000	8.00	224,000
	Disposal to land	28,000	2.50	70,000
	Total	28,000	17	476,000
Sea Disposal via	Plough Dredging	28,000	1.42-2.14	40-60,000
Plough Dredging	Contractor			
	Budgets based			
	on 2020 tenders			

#### Table 4-4: BPEO Cost Analysis

#### 4.3 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 - 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 4-5 below provides a summary of the BPEO assessment.

Criteria	Landfill Disposal	Sea Disposal			
Environment	4	2			
Strategic	4	1			
Costs	4	1			
TOTAL SCORE	12	4			

Table 4-5: BPEO Summary

#### 4.4 Conclusions

The Best Practicable Environmental Option for disposal of the dredging from Adrishaig Harbour has therefore been assessed as sea disposal through plough dredging of material to Loch Gilp due to both strategic, logistic and cost benefits when compared against other available viable options, namely land based disposal.

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

## **5 FURTHER ASSESSMENT**

As detailed in Section 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 fingerprints 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 <u>http://www.ccme.ca/en/resources/canadian environmental quality guidelines/</u>) 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 (<u>https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters</u>) to draw conclusions from available information and provide recommendation for proposed disposal routes.

### 5.1 Analytical Data Review

Analytical data for the proposed dredge site is 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. A summary of the exceedances is detailed below:

Contaminant	No. of Exceedances (of 9 samples)*							
	RAL 1	RAL 2						
Copper	4	0						
Lead	2	0						
Mercury	2	0						

Contaminant	No. of Exceedances (of 9 samples)*					
	RAL 1	RAL 2				
Nickel	4	0				
PAH (All Species)	1	-				
ТРН	1	-				

#### 5.1.1 ERL & PEL Review

Exceedances of the ERL and PEL (where one is available) is summarised in Table 5-2. Full summary tables are provided in Table A in Appendix C : Note any contaminant of concern with N/A indicates no corresponding ERL or PEL value currently available.

Contaminant	No. of Exceedances (of 44 samples)*						
	ERL	PEL					
Copper	4	0					
Lead	2	0					
Mercury	2	0					
Nickel	0	0					
PAH (All Species)	1	1					
ТРН	N/A	N/A					

#### Table 5-2: Exceedances of ERL and PEL

#### 5.2 Averages

Review of the averaged data for all the data has been undertaken i.e. considering the material as a single volume for disposal. The concentrations of the various contaminants of concern are quite variable, the review of average data against the available adopted assessment criteria are as follows:

- Averaged concentrations are below RAL1 for all contaminants of concern with the exception of several PAH species;
- There are no average concentrations in exceedance of the ERL where they exist;.
- There are no average concentrations in exceedance of the PEL where they exist; and .
- All samples recorded averaged concentrations below RAL2 where they exist.

#### 5.3 Chemical Assessment Conclusions

RAL1 exceedances were recorded in up to 4 samples for metals and 1 sample for PAHs and TPH.

Up to 4 individual samples recorded exceedances of the ERL for metals copper and 1 sample for PAHs. One sample (Grab D) exceeds the PEL for individual PAH species.

When the averaged data is considered there are no exceedances recorded for either the RAL1, ERL, PEL of RAL2 where one is available for review.

In summary, the material that is earmarked for dredging is considered to represent a low potential chemical risk to marine life based on the levels of contaminants of concern present when reviewed in parallel with available screening criteria.

### 5.4 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 5-3 below:

#### Table 5-3: Receptor Risk Assessment

Key Receptor <sup>1</sup>	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	No	The areas proposed to be dredged have previously been subjected to routine maintenance dredging.
	dominant currents, freshwater flow and wave exposure		The dredge sites are within the Outer Loch Fyne Basin which is classified as a High Class site.
Biology - habitats	Included to assess potential impacts to sensitive/high value habitats.	No	The Outer Loch Fyne Basin is classified as good for macroinvertebrates and there is no information available on the status of fish.
Biology – fish	Consideration of fish both within the estuary and also potential effects on migratory fish in transit through the estuary	No	There is no information available for the status of fish in the Outer Loch Fyne Basin. The proposed works are considered to be both short lived and any effects would be localised and temporary. There is plenty of room across Loch Gilp for migrating fish to migrate away from any works should the work coincide with any migration
Water Quality	Consideration must be given to water quality when contaminants are present in exceedance of CEFAS RAL1.	Yes	The Outer Loch Fyne Basin water quality status is classified as Pass with regards to specific pollutants. No information was available for priority substances.
			Contaminants are noted to exceed CEFAS RAL1 within sediment samples obtained at the harbour and further consideration of the potential effects is provided following this section.

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

Key Receptor <sup>1</sup>	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Protected Areas	If your activity is within 2km of any WFD protected area, include each identified area in your impact assessment.	No	The proposed dredge site is not located within 2km of an SAC or SPA, marine protected area or Ramsar sites.
	<ul> <li>special areas of conservation (SAC)</li> <li>special protection areas (SPA)</li> <li>shellfish waters</li> </ul>		The dredge site is within a designated as shellfish water. The site is not within 2km of a shellfish site with the closest noted as "Site 1" in excess of 6km due east and Ardcastle Bay over 14KM north east.
	<ul><li> bathing waters</li><li> nutrient sensitive areas</li></ul>		The dredge site is not within 2Km of a designated bathing Water with the closest noted as c 36km south east at Ettrick Bay on the Isle of Bute.

## 5.5 Potential Risk to Water Quality and Marine Life

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

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 in proximity to the disposal site. While any effects are considered to be both localised and temporary, the potential for dilution in the Loch Gilp (Outer Loch Fyne Basin) is considerable when comparing the volume of material to be relocated through plough dredging in relation to the wider waterbody within the Outer Loch Fyne Basin.

The key contaminants for impacting water quality are considered to be metals as these have the potential to dissolve/desorb from sorption sites, whereas the organic contaminants (e.g. PAHs)have a greater affinity for the organic materials which they are bound to, and are more likely to remain strongly bound to the sediment, or if become dissolved, quickly adsorbed onto organic matter within the water column or sediments.

The key risk is considered to be an increase in turbidity/suspended solids during the plough dredging activity although this is likely to cause localised degradation in water quality, it is considered that this will be a local and temporary event.

The sediment material primarily has a variable grain size with the dominant fraction recorded as sand. Table 5-4 summarises the physical sediment type on average by each dredge area versus the proposed dredge volume.

Dredge Area	Gravel (>2mm)	Sand (0.063mm <sand<2m m)</sand<2m 	Silt & Clay (<0.063mm)	Quantity to be dredged m <sup>3</sup>
Ardishaig Harbour	8.5	54.6	36.8	14,000

#### Table 5-4: Summary of PSA Data

Sands and gravel will settle quickly following ploughing, along with any clumps of cohesive material. Silts and clays, being finer grained will suspend and have the potential for dispersal due to longer times in suspension, however it is expected that the majority will quickly fall quickly to the seabed.

In addition, 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.

### 5.6 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 when plough dredged from their current location in the harbour out to the deeper waters in Loch Gilp.

Overall, based on the multiple lines of evidence approach adopted to further assess the exceedances identified in the sediment assessment, the recommendation for sea disposal through plough dredging is considered to be the preferred option for dredge arisings.

## 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









## **B** SAMPLE LOGS



## PRELIMINARY

# **BOREHOLE LOG**

Contract:								Client:					Boreho	ole:	
		Ar	drisha	aig		Scottish Canals							BHA		
Contract Re	f:			Start:	02.01.20 Gro			nd Level: National Grid Co		d Co-ordir	nate:	Sheet:			
541765			End: 0		.20				E:185368.0 N:		:685343.0		1	of <b>2</b>	
		Sample	s & Test	ing	=	L								Dopth	Matoria
Depth (m)	No	Туре	Res	sults	Backfi	Wate			[	Description o	of Strata			(Thick ness)	Graphi
0.00-0.15	101	ES	2xGV	′, 3 <b>x</b> ₽			Brown	nish grey sl	ightly grav	velly silty fine	to coarse	e SAND with low	cobble	0.25	0.00
0.25-0.80	102	ES	2xG∨	′, 3 <b>x</b> ₽			litholo fragm	gies. Cobb ents. Organ	les are s lic odour.	ubrounded o	ounded n of schist.	Contains frequer	nt shell	(0.55)	* ~ ×
0.80-2.00	103	ES	2xG∨	′, 3 <b>x</b> ₽			Grey	gravelly silf ar to suban	comes gre by fine to gular fine	ey. coarse SAN to coarse of r	D with sh mixed litho	ell fragments. G	ravel is	-	<i>₫ ×</i> , × ×
							Grey	silty fine to	medium S	and.				- -(1.50)	× × · · ·
															× . × .
-	104	50	0.0				0-8				d := 6 4			2.30	××
2.30-2.80	104	ES	ZXGV	, ZXP			Song	rey siity siiq	ntiy sand	IY CLAY. San	id is tine to	o meaium.		(0.50)	÷÷
							Boreh	ole termina	ted at 2.8	Om depth as	scheduled	I.		- <u>2.80</u> -	<u>~~</u>
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														-	
Bo	oring (	Progress	s and Wa	ater Ob	servati	ons	1							1	
Date	Time	Bore	hole C	asing	Boreh Diame	ole ter	Water			Ge	neral	Remarks			
	Depth Depth		(mm	)	Depth	1. 2 atte 2. 2 inc	empts tak h diamete	en to recover er barrel used	material t	o target depth.					
Mothod				Dior	+			<i> </i>		ions in metre	S	Scale:	1:50	od	
Used:	v	ibrocor	e	Use	d:	Be	spoke R	lig	By:	MField	By:	ZCockburn	By:	<del>cu</del>	AG



Plant

MField

ZCockburn





# **BOREHOLE LOG**

PRELIMINARY

Contract:								Client: Bo				Boreho	Borehole:		
Ardrishaig								Scottish Canals						BHB	
Contract F	Contract Ref: Start: 02.11.20 Groun					d Level:		National Gri	d Co-ordir	nate:	Sheet:				
	541	765		End:	02.11	.20				E:1854	43.0 N	:685364.0		1	of <b>2</b>
		Sample	s & Tes	ing	Į	ъ								Depth	Material
Depth (m)	No	Type	Res	sults	Back	Wat			0	Description o	f Strata			(Thick ness)	Graphic Legend
- 0.00-0.15	5 101	ES	2xG\	/, 3 <b>x</b> P			Dark	grey slightly	clayey ve	ery sandy an	gular to su	ibrounded fine to	coarse	-	000
0 30-0 80	102	ES	2xG\	3xP			GRA	/EL of mixed	l lithologi	es and shell	fragments	. Sand is fine to c	oarse.	0.30	0 %3
				,			fragm	ents. Grave	l is ang	ular to subr	ounded fi	ne to coarse of	mixed	-(0.50)	ð s
0.80-1.80	0 103	ES	2xG\	∕, 3 <b>x</b> P				gies. sandv slight	ly grave	llv SILT with	sholl fra	amonte Sand is	fine to	- 0.80	*o_*×
Ę							coarse	e. Gravel is	s angula	ar to suban	gular fin	e to coarse of	mixed		× • × • ×
E							litnolo	gies.						(1.00)	^°× ^ ×°
-														180	× × × ×
1.80-2.50	) 104	ES	2xG\	∕, 3 <b>x</b> P			Grey	slightly sand	y slightly	gravelly SIL	T. Sand is	s fine to medium.	Gravel	-	*• * * * *
E							is rare	subangular	to sudro	unded line lo	coarse o	r mixed iithologies	-	-(0.70) C	× × × ×
-							Derek			One douth as				2.50	ו × ×
Ę							Boren	ole terminate	ed al 2.50	um depin as	scheduled	1.			
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Boring Progress and Water Observations							101-1	_		Ge	neral	Remarks			
Date	Time	Bore	nole C pth 1	asing Depth	Diame	ter	vvater Depth								
				opui	(unit	,	Jopur	1. 2 atter	mpts to re diamete	ecover target r barrel used	depth of	material.			
											-				
									I dimonci	ions in motro	c	Seele	1.50		
Method				Plan	nt				Drilled		Logged	Scale.	Checke	ed	
Used:	۱	/ibrocor	e	Use	d:	Bes	poke R	tig i	By:	MField	By:	ZCockburn	By:		AGS



Plant

Used

MField

ZCockburn





# PRELIMINARY

Γ	Contract:							(	Client: Borel				
	Ardrishaig								Scottish Canals				BHC
ŀ	Contract Ref	-			Start:	02.11	.20	Ground	Level:	National Grid Co-ordinate:	Sheet:		
	5	5417	65		End:	02.11	.20			E:185474.0 N:685330.0		1	of <b>2</b>
ſ		Ś	Samples	s & Test	ing	Ē	۲				·	Depth	Material
	Depth (m)	No	Type	Res	sults	Backf	Wate		[	Description of Strata		(Thick	Graphic
	0.00-0.15	101	FS	2xGV	/ 3xP	_		Grevis	h brown flecked bla	ck silty fine to medium SAND with occ	asional	-	x ·····x
ŀ	0.15-0.60	102	ËS	2xGV	, 3xP			shell fr	agments. Organic o	dour.	asional	-	×
												(1.18)	. ×
Ē	0.60-1.18	103	ES	2xGV	, 3xP							È	× × ×
+	-											- 1.18	× ×
								Boreho	ble terminated at 1.1	8m depth due to obstruction.		-	
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	Bo	ring P	Progress	and Wa	ater Ob	servatio Boreho	ons ole	Wator	-	General Remarks			
	Date	Time	Dep	oth [	Depth	Diame (mm	ter )	Depth	1 3 attampta to -	account target denth of material			
ſ									2. 3 inch diamete	ecover target depth of material. er barrel used.			

						1	All dimensi	ons in metre	s	Scale:	1:50	
Method Used:	Vib	rocore	Plan Usec	t 1: Bo	espoke Rig	1	Drilled By:	MField	Logged By:	ZCockburn	Checked By:	AGS



## PRELIMINARY

Alle .							BC	DREF	IOLI	ΞL	_ <b>C</b>	)G
Contract:				Client:					Boreho	e:		
Ardrish	aid					Scottish C	anals				B	HC
Contract Ref:	Start:	02.11.20	Groun	d Level:		National Grid	d Co-ordina	te:	Sheet:			
5/1765	End	02 11 20				E-1854	74 0 N.	685330 0		2	of	2
341703	ENQ.	02.11.20				L. 1004		000000.0			OI	2
	-	The second	NAME OF	541765 E	<u>3HC 0.00</u>	<u>1.18m</u>				-		
			Pro Pro Poi De Da	oject oject: int ID pth: ( te: 02	no: 5 Ardri ): BH 0.00 - 2/11/2	41765 shaig C 1.18m 20		6				
			1	Ċ	Ŕ	11						
- ja-				100			24.5			-		

ZCockburn

MField





# **BOREHOLE LOG**

PRELIMINARY

1	Contract:								Client:		Boreho	le:	
			Α	rdris	haig				S	cottish Canals		G	rab D
1	Contract R	lef:			Start:	02.11	.20	Ground	d Level:	National Grid Co-ordinate:	Sheet:		
		541	765		End:	02.11	.20			E:185330.0 N:685291.0		1	of <b>1</b>
Γ			Sampl	es & T	esting	fill	er					Depth	Material
	Depth (m)	No	Туре	F	Results	Back	Wat		I	Description of Strata		(Thick ness)	Graphic Legend
╞	0.00-0.15	101	ES	2x	GV, 3xP			Greyis	h black slightly san	dy SILT with frequent shell fragments. S	Sand is _	- 0 15	* . • × •
Ē								fine to	coarse (organic odo	ur).	/	- -	
È								Giabs	sample taken nom se	eabed to 0. 1311 depth.		-	
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Γ	E	Boring	Progres	ss and	Water Ob	servatio	ons			Conoral Domarka			
	Date	Time	Bor	ehole	Casing	Boreho Diame	ble ter	Water	]	General Remarks			
$\left  \right $			D	epth	Depth	(mm	)	Depth	1. A grab sample	of sediment taken from seabed level to	0.15m de	epth.	

G NT\_L BRARY\_V10\_01.GLB LibVersion: v8\_07\_001 PriVersion: v8\_07 | Log COMPOSITE LOG - A4P | 541765\_ARDRISHAIG. GPJ - v10\_01. Structural Solis Ld, Branch Office - Glasgow. 65 Sussex Street, Glasgow, Scottand, G41 1DX. Tet: 0141 332 8440, Fax: 0141 332 8008, Web: www.solis.co.uk, Email: ask@solis.co.uk | 12/11/20 - 14 39 | ZC1 |

Method Used:

						,	All dimensi	ons in metre	s	Scale:	1:50	
Samplin	ng Location	ı	Plant Used	Ekmar	n Grab San	npler	Drilled By:	???	Logged By:	ZCockburn	Checked By:	AGS

## C DATA SUMMARY TABLES

#### Summary Table A - Adrishaig Harbour

#### Sampling Results Assessment Summary November 2020

Г

	AL1 (mg/kg)	AL2 (mg/kg)	BAC (mg/kg	ERL (mg/kg)	PEL (mg/kg)	BHA ES101	BHA ES103	BHA ES104	BHB ES101	BHB ES103 0.80-	BHB ES104 1.80-	BHC ES101	BHC ES103	Grab D ES101						
						0.00-0.15m	0.80-2.00m	2.30-2.80m	0.00-0.15m	1.80m	2.50m	0.00-0.15m	0.60-1.18m	0.00-0.15m	AVERAGE	Data No. Exceed	Data No. Exceed	2020 Data No.Exceed	2020 Data No.	2020 Data No. Exceed
Source			CSEMP	CSEMP	Canada											RAL 1	RAL 2	BAC?	Exceed ERL	PEL?
Arsenic	20	70	25	-	41.6	3.6	4.9	4.4	4	6.7	10.4	4.4	3.8	6.8	5.44	0	0	0		0
Cadmium	0.4	4	0.31	1.2	4.2	0.36	0.24	0.27	0.26	0.2	0.24	0.19	0.22	0.36	0.26	0	0	2	0	0
Chromium	50	370	81	81	160	25.6	40.6	47.6	36.7	35.9	43.2	21.8	21.4	26.1	33.21	. 0	0	0	0	0
Copper	30	300	27	34	108	23.3	37.8	41.3	21.5	17.2	37.1	16	19	36.3	27.72	4	0	4	4	0
Mercury	0.25	1.5	0.07	0.15	0.7	0.45	0.05	0.04	0.04	0.06	0.05	0.06	0.14	0.39	0.14	2	0	3	2	0
Nickel	30	150	36	-	-	21.9	37.4	42.7	31.9	28.1	39.4	19.2	19.1	21.2	28.99	4	0	3	N/A	N/A
Lead	50	400	38	47	112	78.1	13.8	12.4	62.1	13.4	22.8	12.8	28.7	37.6	31.30	2	0	2	2	0
Zinc	130	600	122	150	271	83.4	80	90.5	94	70.4	94.7	79.8	63.3	108	84.90	0	0	0	0	0
Napthalene	0.1		0.08	0.16	0.391	0.00462	0.001	0.001	0.001	0.001	0.001	0.00216	0.033	0.189	0.03	1	-	1	1	0
Acenaphthylene	0.1		-	-	0.128	0.00546	0.001	0.001	0.001	0.001	0.001	0.001	0.00461	0.0443	0.01	. 0	-	N/A	N/A	0
Acenaphthene	0.1		-	-	0.0889	0.00269	0.001	0.001	0.001	0.001	0.001	0.001	0.00581	0.12	0.01	1	-	N/A	N/A	0
Fluorene	0.1		-	-	0.144	0.00678	0.001	0.001	0.001	0.001	0.001	0.001	0.00925	0.118	0.02	1	-	N/A	N/A	0
Phenanthrene	0.1		0.032	0.24	0.544	0.0348	0.001	0.001	0.00175	0.00158	0.00116	0.00293	0.0613	0.831	0.10	1	-	3	1	1
Anthracene	0.1		0.05	0.085	0.245	0.0109	0.001	0.001	0.001	0.001	0.001	0.001	0.0162	0.276	0.03	1	-	1	1	0
Fluoranthene	0.1		0.039	0.6	1.494	0.0466	0.001	0.001	0.00224	0.001	0.001	0.00452	0.0567	2.17	0.25	1	-	3	1	1
Pyrene	0.1		0.024	0.665	1.398	0.0651	0.001	0.001	0.0024	0.001	0.001	0.00448	0.0668	2.07	0.25	1	-	3	1	1
Benzo(a)anthracene	0.1		0.016	0.261	0.693	0.0253	0.001	0.001	0.0011	0.001	0.001	0.00423	0.0354	1.05	0.12	1	-	3	1	1
Chrysene	0.1		0.02	0.384	0.846	0.0248	0.001	0.001	0.00119	0.001	0.001	0.0041	0.0381	1.03	0.12	1	-	3	1	1
Benzo(b)fluoranthene	0.1		-	-	-	0.0279	0.001	0.001	0.00161	0.001	0.001	0.00493	0.0458	0.872	0.11	1	-	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1		-	-	-	0.0112	0.001	0.001	0.00114	0.001	0.001	0.0023	0.0223	0.483	0.06	1	-	N/A	N/A	N/A
Benzo(a)pyrene	0.1		0.03	0.384	0.763	0.0313	0.001	0.001	0.00154	0.001	0.001	0.00585	0.0525	1.11	0.13	1	-	3	1	1
Indeno(1,2,3cd)pyrene	0.1		0.103	0.24	-	0.0234	0.001	0.001	0.00161	0.001	0.001	0.00422	0.0393	0.748	0.09	1	-	1	1	N/A
Benzo(ghi)perylene	0.1		0.08	0.085	-	0.0378	0.001	0.001	0.00182	0.00111	0.001	0.004	0.042	0.715	0.09	1	-	1	1	N/A
Dibenzo(a,h)anthracene	0.01		-	-	0.135	0.00553	0.001	0.001	0.001	0.001	0.001	0.001	0.00853	0.145	0.02	1	-	N/A	N/A	1
ТРН	100		-	-	-	9.51	2.13	5.18	16.5	6.89	4.91	12.8	27.7	231	35.18	1	-	N/A	N/A	N/A
PCBs (Sum ICES 7)	0.02	0.18	-	-	0.189	0.00058	0.00072	0.00062	0.00057	0.00067	0.00064	0.00056	0.00057	0.0021	0.0008	0	0	N/A	N/A	0
TBT	0.1	0.5	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.0500	0	0	N/A	N/A	N/A
Note 1 All concentrations an	e recorded in	n mg/kg																		

Note 2 Underlined Values are < LOD PEL Data Source http://ceqg-rcqe.ccme.ca/en/index.html#void

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





Authorised by: Marya Hubbard

Position: Laboratory Manager

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



Test Report IDMAR00805Issue Version1

Customer Reference Ardishaig

		Units	%	%	%	%	%
		Method No	ASC/SOP/303	ASC/SOP/303	SUB_01*	SUB_01*	SUB_01*
		Limit of Detection	0.2	0.2	N/A	N/A	N/A
		Accreditation	UKAS	UKAS	Ν	Ν	Ν
Client Reference:	SOCOTEC Ref:	Matrix	Total Moisture @ 120°C	Total Solids	Gravel (>2mm)	Sand (63-2000 µm)	Silt (<63 µm)
BHA ES101 0.00-0.15m	MAR00805.001	Sediment	25.9	74.1	6.3	87.7	5.9
BHA ES103 0.80-2.00m	MAR00805.002	Sediment	16.8	83.2	0.8	50.1	49.1
BHA ES104 2.30-2.80m	MAR00805.003	Sediment	19.0	81.0	0.0	4 9	95.1
BHB ES101 0.00-0.15m	MAR00805.004	Sediment	28.0	72.0	43.1	50.2	6.7
BHB ES103 0.80-1.80m	MAR00805.005	Sediment	21.6	78.4	7.0	44.8	48.2
BHB ES104 1.80-2.50m	MAR00805.006	Sediment	23.6	76.4	7.4	2 2	90.4
BHC ES101 0.00-0.15m	MAR00805.007	Sediment	30.1	69.9	1.1	95.9	3.0
BHC ES103 0.60-1.18m	MAR00805.008	Sediment	20.3	79.7	0.2	97.2	2.6
Grab D ES101 0.00-0.15m	MAR00805.009	Sediment	44.0	56.0	10.9	58.5	30.6
	Reference	Material (% Recovery)	N/A	N/A	N/A	N/A	N/A
		QC Blank	N/A	N/A	N/A	N/A	N/A

\* See Report Notes NAIIS - No Asbestos Identified In Sample

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



Test Report IDMAR00805Issue Version1

Customer Reference Ardishaig

		Units	N/A	% M/M
		Method No	SUB_02*	SOCOTEC Env Chem*
		Limit of Detection	N/A	0.02
		Accreditation	UKAS	UKAS
Client Reference:	SOCOTEC Ref:	Matrix	Asbestos	TOC
BHA ES101 0.00-0.15m	MAR00805.001	Sediment	NAIIS	0.37
BHA ES103 0.80-2.00m	MAR00805.002	Sediment	NAIIS	0.09
BHA ES104 2.30-2.80m	MAR00805.003	Sediment	NAIIS	0.07
BHB ES101 0.00-0.15m	MAR00805.004	Sediment	NAIIS	0.31
BHB ES103 0.80-1.80m	MAR00805.005	Sediment	NAIIS	0.26
BHB ES104 1.80-2.50m	MAR00805.006	Sediment	NAIIS	0.19
BHC ES101 0.00-0.15m	MAR00805.007	Sediment	NAIIS	0.15
BHC ES103 0.60-1.18m	MAR00805.008	Sediment	NAIIS	0.89
Grab D ES101 0.00-0.15m	MAR00805.009	Sediment	NAIIS	2.04
	Reference	Material (% Recovery)	N/A	101
		QC Blank	N/A	<0.02

\* See Report Notes NAIIS - No Asbestos Identified In Sample

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



Test Report IDMAR00805Issue Version1

Customer Reference Ardishaig

		Units				mg/Kg (D	ry Weight)			
		Method No				SOCOTEC	Env Chem*			
		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
BHA ES101 0.00-0.15m	MAR00805.001	Sediment	3.6	0.36	25.6	23.3	0.45	21.9	78.1	83.4
BHA ES103 0.80-2.00m	MAR00805.002	Sediment	4.9	0.24	40.6	37.8	0.05	37.4	13.8	80.0
BHA ES104 2.30-2.80m	MAR00805.003	Sediment	4.4	0.27	47.6	41.3	0.04	42.7	12.4	90.5
BHB ES101 0.00-0.15m	MAR00805.004	Sediment	4.0	0.26	36.7	21.5	0.04	31.9	62.1	94.0
BHB ES103 0.80-1.80m	MAR00805.005	Sediment	6.7	0.20	35.9	17.2	0.06	28.1	13.4	70.4
BHB ES104 1.80-2.50m	MAR00805.006	Sediment	10.4	0.24	43.2	37.1	0.05	39.4	22.8	94.7
BHC ES101 0.00-0.15m	MAR00805.007	Sediment	4.4	0.19	21.8	16.0	0.06	19.2	12.8	79.8
BHC ES103 0.60-1.18m	MAR00805.008	Sediment	3.8	0.22	21.4	19.0	0.14	19.1	28.7	63.3
Grab D ES101 0.00-0.15m	MAR00805.009	Sediment	6.8	0.36	26.1	36.3	0.39	21.2	37.6	108
Certified	TOC 774 (% Recovery)	100	107	103	106	101	99	96	100	
		QC Blank	<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5	<2

\* See Report Notes

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



Test Report IDMAR00805Issue Version1Customer ReferenceArdishaig

		Units	μg/Kg (D	ry Weight)
		Method No	ASC/S	OP/301
		Limit of Detection	1	1
		Accreditation	UKAS	UKAS
Client Reference:	SOCOTEC Ref:	Matrix	Dibutyltin (DBT)	Tributyltin (TBT)
BHA ES101 0.00-0.15m	MAR00805.001	Sediment	<5	<5
BHA ES103 0.80-2.00m	MAR00805.002	Sediment	<5	<5
BHA ES104 2.30-2.80m	MAR00805.003	Sediment	<5	<5
BHB ES101 0.00-0.15m	MAR00805.004	Sediment	<5	<5
BHB ES103 0.80-1.80m	MAR00805.005	Sediment	<5	<5
BHB ES104 1.80-2.50m	MAR00805.006	Sediment	<5	<5
BHC ES101 0.00-0.15m	MAR00805.007	Sediment	<5	<5
BHC ES103 0.60-1.18m	MAR00805.008	Sediment	<5	<5
Grab D ES101 0.00-0.15m	MAR00805.009	Sediment	<5	<5
Certi	ified Reference Material E	3CR-646 (% Recovery)	89	78
		QC Blank	<1	<1

\* See Report Notes

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Test Report IDMAR00805Issue Version1

Customer Reference Ardishaig

		Units	µg/Kg (Dry Weight)					
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	SOCOTEC Ref:	Matrix	ACENAPTH	ACENAPHY	ANTHRACN	BAA	BAP	BBF
BHA ES101 0.00-0.15m	MAR00805.001	Sediment	2.69	5.46	10.9	25.3	31.3	27 9
BHA ES103 0.80-2.00m	MAR00805.002	Sediment	<1	<1	<1	<1	<1	<1
BHA ES104 2.30-2.80m	MAR00805.003	Sediment	<1	<1	<1	<1	<1	<1
BHB ES101 0.00-0.15m	MAR00805.004	Sediment	<1	<1	<1	1.10	1.54	1.61
BHB ES103 0.80-1.80m	MAR00805.005	Sediment	<1	<1	<1	<1	<1	<1
BHB ES104 1.80-2.50m	MAR00805.006	Sediment	<1	<1	<1	<1	<1	<1
BHC ES101 0.00-0.15m	MAR00805.007	Sediment	<1	<1	<1	4.23	5.85	4 93
BHC ES103 0.60-1.18m	MAR00805.008	Sediment	5.81	4.61	16.2	35.4	52.5	45.8
Grab D ES101 0.00-0.15m	MAR00805.009	Sediment	120	44.3	276	1050	1110	872
Certified F	Reference Material QPH	1098MS (% Recovery)	110	130	110	87	85	84
		QC Blank	<1	<1	<1	<1	<1	<1

For full analyte name see method summaries

~ Indicates result is for an In-house Reference Material as no Certified Reference

Materials are avaliable.

As the method uses surrogate standards to correct for losses, the RM results are

reported as percentage trueness, not recovery.

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



Test Report IDMAR00805Issue Version1

Customer Reference Ardishaig

		Units	µg/Kg (Dry Weight)					
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	SOCOTEC Ref:	Matrix	BENZGHIP	BKF	CHRYSENE	DBENZAH	FLUORANT	FLUORENE
BHA ES101 0.00-0.15m	MAR00805.001	Sediment	37.8	11.2	24.8	5.53	46.6	6.78
BHA ES103 0.80-2.00m	MAR00805.002	Sediment	<1	<1	<1	<1	<1	<1
BHA ES104 2.30-2.80m	MAR00805.003	Sediment	<1	<1	<1	<1	<1	<1
BHB ES101 0.00-0.15m	MAR00805.004	Sediment	1.82	1.1	1.19	<1	2.24	<1
BHB ES103 0.80-1.80m	MAR00805.005	Sediment	1.11	<1	<1	<1	<1	<1
BHB ES104 1.80-2.50m	MAR00805.006	Sediment	<1	<1	<1	<1	<1	<1
BHC ES101 0.00-0.15m	MAR00805.007	Sediment	4.15	2.30	4.10	<1	4.52	<1
BHC ES103 0.60-1.18m	MAR00805.008	Sediment	42.0	22.3	38.1	8.53	56.7	9 25
Grab D ES101 0.00-0.15m	MAR00805.009	Sediment	715	483	1030	145	2170	118
Certified F	Reference Material QPI	1098MS (% Recovery)	92	88	94	95	97	110
		QC Blank	<1	<1	<1	<1	<1	<1

For full analyte name see method summaries

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Test Report IDMAR00805Issue Version1

Customer Reference Ardishaig

		Units	µg/Kg (Dry Weight)				
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/306
		Limit of Detection	1	1	1	1	100
		Accreditation	UKAS	UKAS	UKAS	UKAS	Ν
Client Reference:	SOCOTEC Ref:	Matrix	INDPYR	NAPTH	PHENANT	PYRENE	THC
BHA ES101 0.00-0.15m	MAR00805.001	Sediment	23.4	4.62	34.8	65.1	9510
BHA ES103 0.80-2.00m	MAR00805.002	Sediment	<1	<1	<1	<1	2130
BHA ES104 2.30-2.80m	MAR00805.003	Sediment	<1	<1	<1	<1	5180
BHB ES101 0.00-0.15m	MAR00805.004	Sediment	1.61	<1	1.75	2.40	16500
BHB ES103 0.80-1.80m	MAR00805.005	Sediment	<1	<1	1.58	<1	6890
BHB ES104 1.80-2.50m	MAR00805.006	Sediment	<1	<1	1.16	<1	4910
BHC ES101 0.00-0.15m	MAR00805.007	Sediment	4.22	2.16	2.93	4.48	12800
BHC ES103 0.60-1.18m	MAR00805.008	Sediment	39.3	33.0	61.3	66.8	27700
Grab D ES101 0.00-0.15m	MAR00805.009	Sediment	748	189	831	2070	231000
Ce	rtified Reference Material QPI	H098MS (% Recovery)	80	87	100	98	108~
		QC Blank	<1	<1	<1	<1	<100

For full analyte name see method summaries

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Materials are avaliable.

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Test Report ID	MAR00805
Issue Version	1

Customer Reference Ardishaig

		Units	µg/Kg (Dry Weight)						
		Method No	ASC/SOP/302						
		Limit of Detection	0.08	0.08	0.08	0.08	0.08	0.08	0.08
		Accreditation	UKAS						
Client Reference:	SOCOTEC Ref:	Matrix	PCB28	PCB52	PCB101	PCB118	PCB138	PCB153	PCB180
BHA ES101 0.00-0.15m	MAR00805.001	Sediment	<0.08	0.10	<0.08	<0.08	<0.08	<0.08	<0.08
BHA ES103 0.80-2.00m	MAR00805.002	Sediment	0.14	0.18	<0.08	<0.08	<0.08	<0.08	<0.08
BHA ES104 2.30-2.80m	MAR00805.003	Sediment	0.11	0.11	<0.08	<0.08	<0.08	<0.08	<0.08
BHB ES101 0.00-0.15m	MAR00805.004	Sediment	<0.08	0.09	<0.08	<0.08	<0.08	<0.08	<0.08
BHB ES103 0.80-1.80m	MAR00805.005	Sediment	0.12	0.15	<0.08	<0.08	<0.08	<0.08	<0.08
BHB ES104 1.80-2.50m	MAR00805.006	Sediment	0.12	0.12	<0.08	<0.08	<0.08	<0.08	<0.08
BHC ES101 0.00-0.15m	MAR00805.007	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
BHC ES103 0.60-1.18m	MAR00805.008	Sediment	<0.08	0.09	<0.08	<0.08	<0.08	<0.08	<0.08
Grab D ES101 0.00-0.15m	MAR00805.009	Sediment	0.18	0.29	0.30	0.27	0.41	0.41	0.24
Certified Reference Material QOR136MS (% Recovery)			81	117	96	99	140	98	72
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries

~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are available.

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



Test Report ID MAR00805 1

Issue Version

Customer Reference Ardishaig

#### REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report				
SOCOTEC Env Chem*	MAR00805.001-009	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.				
SUB_01*	MAR00805.001-009	Analysis was conducted by an approved subcontracted laboratory.				
SUB_02*	MAR00805.001-009	Analysis was conducted by an approved subcontracted laboratory.				
ASC/SOP/301	MAR00805.001-009	The matrix of this sample has been found to interfere with the result for this test. The sample has therefore been diluted, but in doing so, the detection limit for this test has been elevated.				
ASC/SOP/303/304	MAR00805.001, .004, .007-009	Chrysene is known to coelute with Triphenylene and these peaks can not be resolved. t is believed Triphenylene is present in these samples therefore it is suggested that the Chrysene results should be taken as a Chrysene (inc. Triphenylene). This should be taken into consideration when utilising the data.				

#### 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

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



Test Report IDMAR00805Issue Version1Customer ReferenceArdishaig

Method	Sample and Fraction Size	Method Summary			
Total Solids	Wet Sediment	Calculation (100%-Moisture Content). Moisture content determined by drying a portion of the sample at 120°C to constant weight.			
Particle Size Analysis	Wet Sediment	Wet and dry sieving followed by laser diffraction analysis.			
Total Organic Carbon (TOC)	Air dried and ground	Carbonate removal and sulphurous acid/combustion at 1600°C/NDIR.			
Metals	Air dried and seived to <63µm	Aqua-regia extraction followed by ICP analysis.			
Organotins	Wet Sediment	Solvent extraction and derivatisation followed by GC-MS analysis.			
Polyaromatic Hydrocarbons (PAH)	Wet Sediment	Solvent extraction and clean up followed by GC-MS analysis.			
Total Hydrocarbon Content (THC)	Wet Sediment	Solvent extraction and clean up followed by GC-FID analysis.			
Polychlorinated Biphenyls (PCBs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS 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'-Dichorodiphenyldichloroethane			
BENZGHIP	Benzo[ghi]perylene	NAPTH	Naphthalene	DDE	p,p'-Dichorodiphenyldicloroethylene			
BKF	Benzo[k]fluoranthene	PERYLENE	Perylene	DDT	p,p'-Dichorodiphenyltrichloroethane			
C1N	C1-naphthalenes	PHENANT	Phenanthrene					
C1PHEN	C1-phenanthrene	PYRENE	Pyrene	]				