BEST PRACTICABLE ENVIRONMENTAL OPTION (BPEO):

MAINTENANCE DREDGING OF BERTHS AND APPROACHES AT ABERDEEN HARBOUR

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1. INTRODUCTION

1.1. Background

Aberdeen Harbour is the major port serving the North East of Scotland. There are approximately 8,000 vessel arrivals and 5 million tonnes of cargo handled each year, with the harbour supporting 10,000 full time equivalent jobs. It is also the mainland port for the lifeline service to the Northern Isles and as well as general cargo and passengers. Aberdeen is the largest support harbour for the North Sea Energy Industry.

As a statutory harbour authority, Aberdeen Harbour Board (AHB) is required to carry out maintenance dredging of the main navigation channels and berths (shown on Figure 1) to maintain safe navigable depths and support customers' business needs. Clause 72 of the Aberdeen Harbour Order (Confirmation) Act 1960 gives AHB powers to dredge within its statutory harbour limits.

This report presents the Best Practicable Environmental Option (BPEO) assessment for the fate of maintenance dredged material from Aberdeen Harbour. BPEO assessment is a method for identifying the option that provides the *most environmental benefit* or *least environmental damage*. It assesses the performance of different options using a range of criteria such as environmental impact, technical feasibility and cost.

1.2. Source of Materials

Aberdeen Harbour has been built on the former delta at the mouth of the River Dee. Both the harbour and the entrance channel are susceptible to continued progressive natural infilling from two sources:

a) River-borne silts and muds; and
b) Sea-borne sands

In 1986, AHB commissioned HR Wallingford Ltd to study the siltation at the harbour entrance (see Appendix 1). The results concluded that the sediment transport is due to a complex action of tides, currents and wave action and consequently cannot be controlled.

In addition, the siltation of harbour berths is caused by the river silt being carried down the River Dee to the harbour. There the natural current takes some of this material anticlockwise around the Point Law headland where it is deposited at the harbour berths.

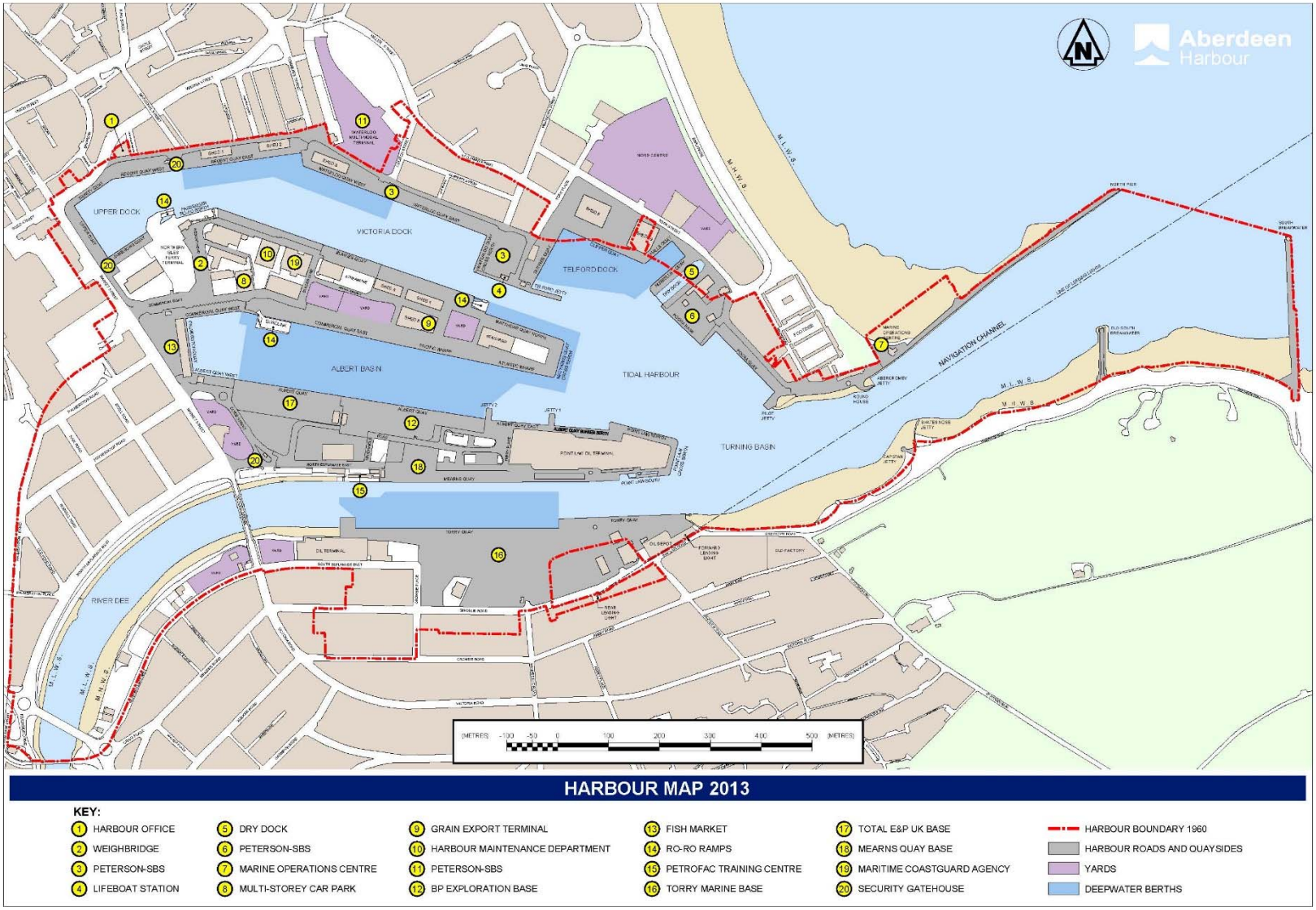

Figure 1 Aberdeen Harbour

2. DESCRIPTION OF PROPOSED DREDGING

2.1. Dredging Methodology

AHB has a recorded history of almost 900 years and a record of dredging going back almost 200 years. In recent years, maintenance dredging has been carried out mainly with a trailer suction hopper dredger, working in conjunction with a bed levelling tug. The latter is used to smooth out any high spots left by the suction dredger. The dredged material is taken by the trailer suction hopper dredger to the designated offshore disposal site Aberdeen CR110, approximately 2.5 nautical miles to the southeast of the harbour entrance, as shown in Figure 2.

The annual maintenance dredging campaign is typically carried out once a year within the areas shown in Figure 3; however, there have been occasions in the past where an additional winter dredging campaign has been required due to inundated accretion of material in the navigation channel and River Dee caused by severe winter storms.

The annual maintenance dredging campaign is typically carried out in spring/summer each year, after any winter storms, depending on the availability of dredging plant. The duration of the campaign will vary from one to four weeks depending on the dredge volumes.

The combined volume of material removed annually from the harbour and channel varies between 100,000 to 200,000 m^3 in-situ volume of sand and silt.

Occasionally, deepening of sections of the harbour beyond the maintained depth is carried out to improve the facilities available to shipping; however, any such capital dredging is subject to a separate marine licence application and is outside the scope of this BPEO Assessment.

2.2. Material to be dredged

In October 2017, 10 surface grab samples were collected from the areas to be dredged, as agreed with Marine Scotland. Sediment samples were analysed for the Marine Scotland suite of parameters. A summary of the results is presented in this section and the full report is provided in Appendix 2.

2.2.1 Comparison with Marine Scotland Revised Action Levels

The results have been compared to the Marine Scotland Revised Action Levels, which are used to determine the contaminant loading of the material and its suitability for disposal at sea. Levels of some heavy metals (cadmium, copper, lead and zinc) were elevated above Marine Scotland Revised Action Level 1 in four of the samples analysed. In all cases the levels were well below Action Level 2.

Levels of polychlorinated biphenyls and tributyl tin were below Action Level 1 in all samples.

Levels of polycyclic aromatic hydrocarbons (PAHs) were elevated above Action Level 1 in nine of the samples analysed; however, levels did not exceed (and in many cases were lower than) the PAH levels observed in the samples collected in 2014 for the previous marine licence application for disposal of dredged material 2015 – 2017 (see Appendix 3).

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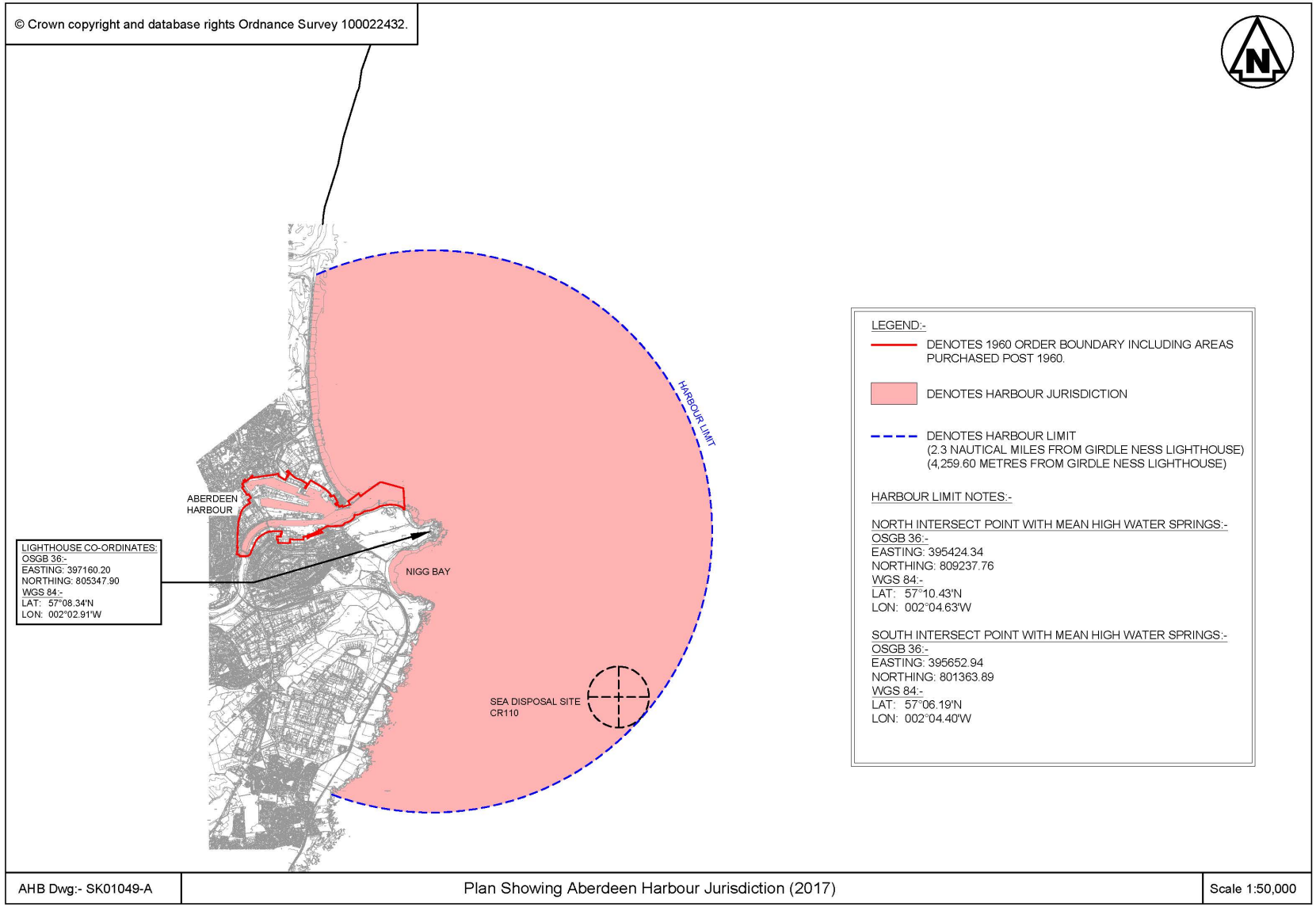
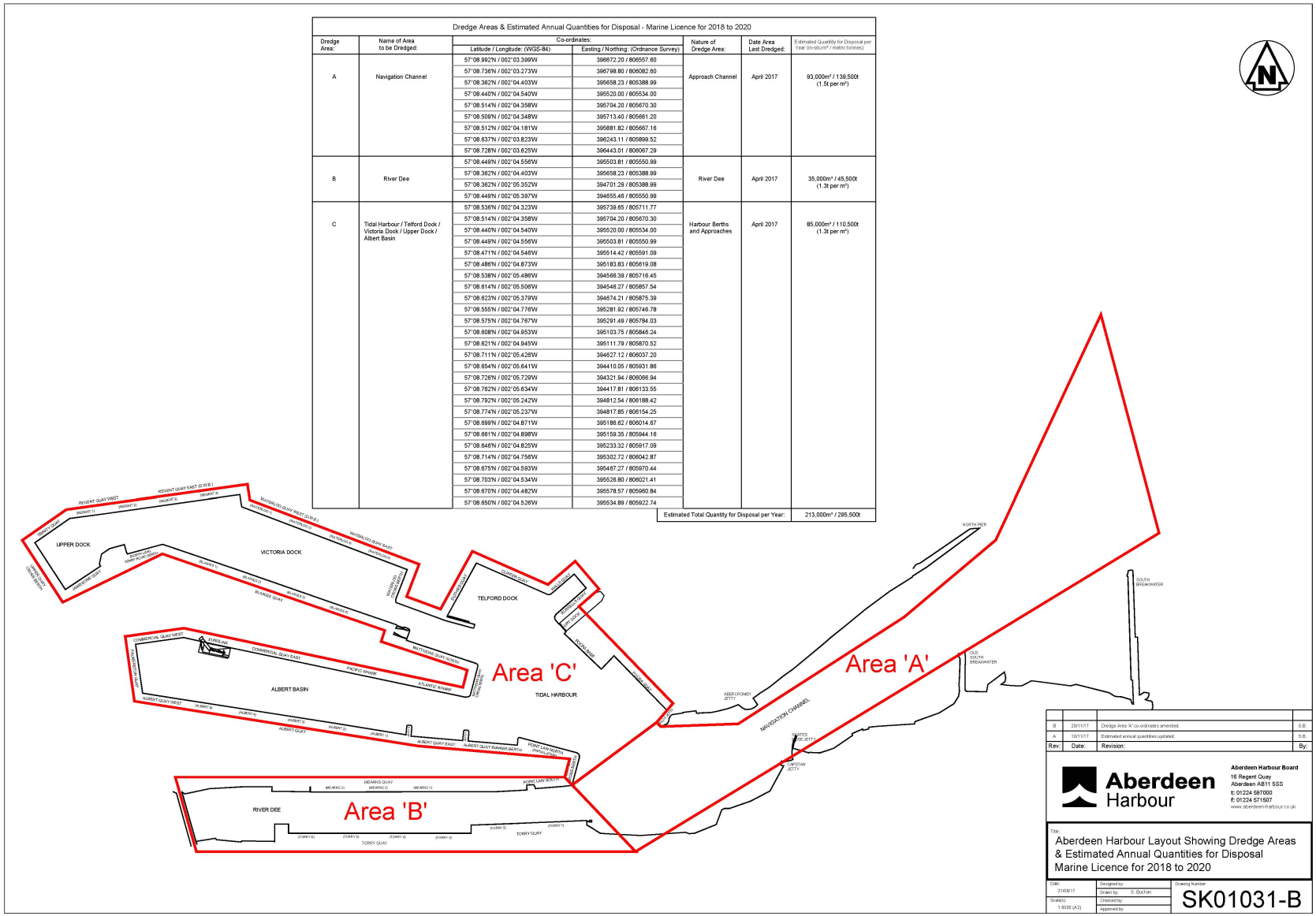


Figure 2 Offshore disposal site Aberdeen CR110



Dredge Areas & Estimated Annual Quantities for Disposal - Marine Licence for 2018 to 2020

Dredge Area:	Name of Area to be Dredged:	Co-ordinates: Latitude / Longitude: (WGS-84)	Co-ordinates: Easting / Northing: (Ordnance Survey)	Nature of Dredge Area:	Date Area Last Dredged:	Estimated Quantity for Disposal per Year (in-situm³ / metric tonnes)
A	Navigation Channel	57°08.992'N / 002°03.399'W	396672.20 / 806557.60	Approach Channel	April 2017	93,000m³ / 139,500t (1.5t per m³)
		57°08.736'N / 002°03.273'W	396798.80 / 806082.60			
		57°08.362'N / 002°04.403'W	395658.23 / 805388.99			
		57°08.440'N / 002°04.540'W	395520.00 / 805534.00			
		57°08.514'N / 002°04.358'W	395704.20 / 805670.30			
		57°08.509'N / 002°04.348'W	395713.40 / 805661.20			
		57°08.512'N / 002°04.181'W	395881.82 / 805667.16			
		57°08.637'N / 002°03.823'W	396243.11 / 805899.52			
		57°08.728'N / 002°03.625'W	396443.01 / 806067.29			
B	River Dee	57°08.449'N / 002°04.556'W	395503.81 / 805550.99	River Dee	April 2017	35,000m³ / 45,500t (1.3t per m³)
		57°08.362'N / 002°04.403'W	395658.23 / 805388.99			
		57°08.362'N / 002°05.352'W	394701.29 / 805388.99			
		57°08.449'N / 002°05.397'W	394655.48 / 805550.99			
C	Tidal Harbour / Telford Dock / Victoria Dock / Upper Dock / Albert Basin	57°08.536'N / 002°04.323'W	395739.65 / 805711.77	Harbour Berths and Approaches	April 2017	85,000m³ / 110,500t (1.3t per m³)
		57°08.514'N / 002°04.358'W	395704.20 / 805670.30			
		57°08.440'N / 002°04.540'W	395520.00 / 805534.00			
		57°08.449'N / 002°04.556'W	395503.81 / 805550.99			
		57°08.471'N / 002°04.546'W	395514.42 / 805591.09			
		57°08.486'N / 002°04.873'W	395183.83 / 805619.08			
		57°08.538'N / 002°05.486'W	394566.39 / 805716.45			
		57°08.614'N / 002°05.506'W	394546.27 / 805857.54			
		57°08.623'N / 002°05.379'W	394674.21 / 805875.39			
		57°08.555'N / 002°04.776'W	395281.92 / 805746.78			
		57°08.575'N / 002°04.767'W	395291.49 / 805784.03			
		57°08.608'N / 002°04.953'W	395103.75 / 805846.24			
		57°08.621'N / 002°04.945'W	395111.79 / 805870.52			
		57°08.711'N / 002°05.428'W	394627.12 / 806037.20			
		57°08.654'N / 002°05.641'W	394410.05 / 805931.86			
		57°08.728'N / 002°05.729'W	394321.94 / 806066.94			
		57°08.762'N / 002°05.634'W	394417.81 / 806133.55			
		57°08.792'N / 002°05.242'W	394812.54 / 806188.42			
		57°08.774'N / 002°05.237'W	394817.85 / 806154.25			
		57°08.699'N / 002°04.871'W	395186.62 / 806014.67			
		57°08.661'N / 002°04.898'W	395159.35 / 805944.16			
		57°08.646'N / 002°04.825'W	395233.32 / 805917.09			
		57°08.714'N / 002°04.756'W	395302.72 / 806042.87			
		57°08.675'N / 002°04.593'W	395467.27 / 805970.44			
		57°08.703'N / 002°04.534'W	395526.80 / 806021.41			
		57°08.670'N / 002°04.482'W	395578.57 / 805960.84			
		57°08.650'N / 002°04.526'W	395534.89 / 805922.74			
				Estimated Total Quantity for Disposal per Year:		213,000m³ / 295,500t

Rev.	Date:	Revision:	By:
B	28/11/17	Dredge Area 'A' co-ordinates amended.	S.B.
A	10/11/17	Estimated annual quantities updated.	S.B.

Date:	Designed by:	Drawing Number:
21/03/17	Drawn by: S. Buchan	SK01031-B
Scale(s): 1:5000 (A2)	Checked by:	
	Approved by:	

Figure 3 Areas to be dredged

To set the results into context, Marine Scotland has undertaken regular analysis of the material from the dredge hopper during AHB's maintenance dredging campaigns as far back as 1988, and the results of the analysis are provided in Appendix 4. The levels of heavy metals range between below the detection limit to above Revised Action Level 2. For example, a set of samples collected in 1998 and 1999 show elevated levels of copper, zinc, nickel and cadmium above Action Levels 1 and 2, and there are notable samples that are far in excess of Action Level 2. It should be noted that the licensing regime for dredging and disposal activities has changed substantially since 1988 and that disposal activities were carried out in accordance with the regulations of the time.

A report by the Marine Laboratory (Hayes *et al*., 2005) examined the concentration of heavy metals at the Aberdeen offshore disposal site CR110, along with a number of other disposal sites off the east coast of Scotland. The majority of samples were collected from surveys undertaken in 2002 and 2003; however, historical data collected and analysed in a similar manner was also included. Table 1 presents the average and maximum concentrations of heavy metals.

In addition to the Hayes *et al*. study (2005), additional sampling was undertaken by Marine Scotland at disposal site CR110 between 1995 and 2011: the results are presented in Appendix 5, and the average concentrations of heavy metals are presented in Table 2. The results from this dataset and the study by Hayes *et al*. (2005) show that levels of heavy metals at the disposal site are consistently below Action Level 1, even during times when material above Action Level 1 (and in some cases above Action Level 2) was disposed at the site. As the average levels are considerably lower in the sediments at the disposal site than at the source of dredging, there is no evidence of an accumulation of heavy metals at the disposal site at levels that could cause biological harm. As such, the disposal of material at the offshore site that is either below Action Level 1, or between Action Level 1 and 2, is considered to have a negligible effect on water quality or biological receptors.

Table 1 Concentrations of heavy metals at Aberdeen offshore disposal site (~2003)

Metal	**Average (mg/kg dry weight)**	**Maximum (mg/kg dry weight)**
Arsenic	6.1	14.0
Cadmium	0	0.2
Chromium	13.1	32.5
Copper	7.9	34.9
Mercury	0.1	0.3
Nickel	7.8	21.2
Lead	13.6	28.5
Zinc	35.9	75.8

(Reproduced from Hayes et al. (2005))

Table 2 Average concentration of heavy metals at Aberdeen offshore disposal site (1995 – 2011)

Metal	**Average concentration (mg/kg dry weight)**
Arsenic	5.65
Cadmium	0.07
Chromium	12.78
Copper	6.17
Mercury	0.07
Nickel	7.19
Lead	10.93
Zinc	35.95

2.2.2 Comparison with Sediment Quality Guidelines

Sediment quality guidelines (SQGs) developed by Long et al. (1998) utilise the 'Effects Range Low'/'Effects Range Median' (ERL/ERM) methodology which is founded on a large database of sediment toxicity and benthic community information. They were derived based upon empirical analyses of data compiled from numerous field and laboratory studies, including chemistry data and a variety of different types of biological data for numerous taxa derived from either bioassays of field- collected samples, laboratory toxicity tests of clean sediments spiked with specific toxicants, benthic community analyses, or equilibrium-partitioning models. The ERL/ERM methodology derives SQGs representing, respectively, the 10th and 50th percentiles of the effects dataset and can be derived for heavy metals and individual PAH compounds. This method is adopted by the Centre for Environment, Fisheries and Aquaculture Science (Cefas) in their monitoring of dredged material disposal sites in England (e.g. Bolam *et al.*, 2014).

Adverse biological effects are rarely observed when concentrations are below the ERL; the ERM represents concentrations toward the middle of the effects ranges and above which effects are more frequently observed (Gorham-Test, 1998; Long *et al.*, 1998).

Table 3 presents the results of the sediment analysis, and exceedances of the ERL and ERM are identified using colour-coding. The results are summarised below.

Heavy metals

- No exceedences of the ERM in any samples.
- Arsenic: ERL is marginally exceeded in 6 samples. The highest concentration is 12.5 mg/kg, which is well below the ERM of 70 mg/kg.
- Copper: ERL is exceeded in 5 samples. The highest concentration is 80.7 mg/kg, which is well below the ERM of 270 mg/kg.
- Lead: ERL is exceeded in 2 samples. The highest concentration is 62.9 mg/kg, which is well below the ERM of 218 mg/kg.
- Nickel: ERL is marginally exceeded in 1 sample, at a concentration of 22.6 mg/kg, which is well below the ERM of 52 mg/kg.
- No exceedences of the ERL for cadmium, chromium, mercury or zinc.

PAHs

- No exceedences of the ERM in any samples.
- Acenaphthene: ERL is exceeded in 3 samples. The highest concentration is 40 µg/kg, which is well below the ERM of 500 µg/kg.
- Fluorene: ERL is exceeded in 2 samples. The highest concentration is 43 µg/kg, which is well below the ERM of 540 µg/kg.
- Phenanthrene: ERL is exceeded in 1 sample, at a concentration of 259 µg/kg, which is well below the ERM of 1,500 µg/kg.
- No exceedences of the ERL for the remaining PAHs.

As there are no exceedences of the ERM, and only limited exceedences of the ERL for some heavy metals and PAHs (which are in many cases only marginally exceeded, and in all cases are far closer to the ERL than the ERM), the material to be dredged is not considered to pose a significant risk to the marine environment. As such, the material to be dredged is considered suitable for disposal at sea and use on land. If material is disposed at sea, sampling and testing of material within the hopper will be carried out during the dredging campaign, in accordance with Marine Scotland's requirements.

Parameter	Units (dry weight)	*ERL*	*ERM*	Sample number and location									
				CL/1778 079	CL/1778 080	CL/1778 081	CL/1778 082	CL/1778 083	CL/1778 084	CL/1778 085	CL/1778 086	CL/1778 087	CL/1778 088
Heavy metals				1- Channel Outer	2- Channel Outer	3- Channel Mid	4- Channel Inner	5-Pocra	6-Telford Pit	7-Regent / Waterloo	8- Palmerston	9-Atlantic	10-River
Arsenic	mg/kg	*8.2*	*70*	7.4	6	7.3	9	9.3	10	12.5	10.8	9.8	6.6
Cadmium	mg/kg	*1.2*	*9.6*	0.23	0.05	0.1	0.2	0.46	0.43	0.7	0.48	0.4	0.16
Chromium	mg/kg	*81*	*370*	12.4	21.6	26.6	28.5	30.5	32.4	36.3	28.2	30.6	22
Copper	mg/kg	*34*	*270*	14.3	14.6	17.4	27.8	39.7	51.6	80.7	53.4	39.1	26
Lead	mg/kg	*47*	*218*	13	13.1	14.2	23.3	42.4	37.6	62.9	42.1	60.2	28.6
Mercury	mg/kg	*0.15*	*0.71*	<0.01	<0.01	0.013	0.04	0.05	0.06	0.08	0.05	0.05	0.02
Nickel	mg/kg	*21*	*52*	5.9	12.8	15.6	18.2	19.2	20.3	22.6	17.9	20	14.9
Zinc	mg/kg	*150*	*410*	31.5	44.5	51	65.8	92.9	91.3	133.7	101.2	91.8	67.9
PAHs													
Acenaphthene	µg/kg	*16*	*500*	<1	11	14	40	9	15	13	12	20	16
Acenaphthylene	µg/kg	*44*	*640*	<1	4	8	14	9	10	13	11	13	9
Anthracene	µg/kg	*85*	*1100*	<1	21	29	75	31	40	38	37	45	36
Benzo(a) Anthracene	µg/kg	*261*	*1600*	2	44	79	140	98	111	104	100	112	88
Benzo(a)Pyrene	µg/kg	*430*	*1600*	2	55	97	145	112	135	131	125	131	102
Benzo(b/k)Fluoranthene	µg/kg	*None exist*	*None exist*	<1	21	47	62	54	62	75	57	58	46
Benzo(ghi)Perylene	µg/kg	*None exist*	*None exist*	2	48	87	113	106	127	144	137	122	95
Chrysene	µg/kg	*384*	*2800*	2	51	90	150	112	126	130	117	126	99
Dibenzo(ah)Anthracene	µg/kg	*63*	*260*	<1	8	15	19	18	20	22	22	25	16
Fluoranthene	µg/kg	*600*	*5100*	3	93	151	316	186	227	210	198	219	185
Fluorene	µg/kg	*19*	*540*	<1	10	15	43	14	18	17	18	22	17
Indeno(123-cd)Pyrene	µg/kg	*None exist*	*None exist*	2	49	91	116	111	129	138	135	119	98
Naphthalene	µg/kg	*160*	*2100*	<1	10	24	50	21	24	25	27	36	20
Phenanthrene	µg/kg	*240*	*1500*	2	77	105	259	98	132	124	119	140	119
Pyrene	µg/kg	665	2600	3	97	151	289	181	209	208	202	213	181

Table 3 2017 sediment sample analysis: comparison with ERL and ERM

3. SCOPING OF POTENTIAL DISPOSAL OPTIONS

3.1. Introduction

This section describes all potential disposal options for the dredged material. When an option is not considered feasible, the reason is given and it is not taken forward to the assessment stage. Those options which are considered to be practicable are considered in Section 4 of this report.

3.2. Option 1: Landfill

The most common use of dredged material within landfill sites is as capping or restoration material. Material would need to be brought ashore within the existing harbour and dewatered before being transported to trucks and taken to the landfill site by road.

There are no suitable sites in the immediate vicinity of the harbour that could cope with a large quantity of material on an annual basis. The closest operational landfill sites to Aberdeen Harbour are approximately 9 km to the south and 12 km to the north by road from Aberdeen Harbour (SEPA, 2016a). Existing sites must cope with large volumes of domestic and industrial requirements, and marine dredgings on the present scale would place an intolerable burden on these sites. Dredged material is relatively inert, so disposal to landfill is not usually necessary or recommended unless dredged material is significantly contaminated, which it is not in this case (see Section 2.2).

Prior to landfill, dredged material would have to be dried in lagoons before being transported by road to a distant site. Suitable land for drying lagoons is not available within the harbour estate.

Transportation of material from the harbour to the landfill would generate significant vehicle movements on local roads, contributing to congestion and generating air and noise pollution, as well as road safety concerns.

On these grounds this option for disposal has been discounted.

3.3. Option 2: Agriculture Use

The North East of Scotland is a rural farming area with an abundance of good arable land and there is therefore no requirement for a supplement of imported material. The dredged material would have to be de-watered and desalinated to make it suitable for soil conditioning or spreading, and no land is available to locate a drying lagoon. This option for disposal has been discounted.

3.4. Option 3: Reclamation

Dredged material can be suitable for land reclamation and other construction works. The material grade and quality are critical: material suitable for reclamation is generally medium to coarse sands and gravel fractions. As the material to be dredged is variable and cannot easily be dredged according to material type, use in reclamation projects is not considered appropriate. This option for disposal has been discounted.

3.5. Option 4: Beach Recharge

The use of dredged material for beach recharge is a sustainable beneficial use: it generates a purpose for the material that benefits a local amenity. Material is typically deposited direct

from the dredging vessel via a pipeline or by 'rainbowing' onto the beach, where it is reprofiled using land-based plant. This option is considered in detail in Section 4.

3.6. Option 5: Other uses for Dredged Material

The saline content of the material makes it unsuitable as a construction material. The grading and washing required coupled with the drying and storage previously identified makes this option uneconomical. This disposal option has been discounted.

3.7. Option 6: Sea Disposal

The present sea disposal site for dredged material from Aberdeen Harbour (CR110 - shown on Figure 2) is approximately 20 minutes' sailing time from the harbour. The site is located far enough from the shore and harbour so as not to have any visual or operational effects or impact at the shore line of the harbour. It is a long-established disposal site.

The nature of the dredged material and the proximity of the suitable licensed disposal site makes disposal at sea a viable option which will be considered in detail in Section 4.

3.8. Summary of options scoping

The identification of available disposal options concludes that Options 1 (landfill), 2 (agricultural use), 3 (reclamation) and 5 (other uses) are not viable for the reasons described above. The following options will be taken forward to assessment:

- Option 4: Beach recharge
- Option 6: Sea disposal

4. ASSESSMENT OF OPTIONS

In this section, Options 4 and 6 are considered in greater detail. The BPEO assessment comprises three aspects: strategic, environmental and cost considerations.

4.1. Option 4: Beach Recharge

4.1.1. Strategic Considerations

Operational Aspects

Beach recharge (sometimes called beach nourishment) requires clean, sandy material. Such material is typically found in the outer part of the entrance channel; the remaining mixed silty material from the berths would be unacceptable (see Appendix 6 showing areas of sand and mixed clays/silts/sands). A volume computation based on the 2017 post-dredge survey versus the pre-dredge survey revealed that just over 20,000 m^3 of the 93,610 m^3 dredged was likely to be sandy material. For this BPEO the proportion of material that is potentially suitable for beach recharge is estimated at 20%, but this will vary annually.

The material is typically dredged using a trailer suction hopper dredger. However, since the material has to be deposited on an exposed open beach, the dredger could not sail close to the beach and strong pipelines through the breaker zone would be required to deposit sand on the beach. Once ashore, the material would be stockpiled in a bund and recovered and spread during low water.

The sediment transport study completed by HR Wallingford in 1989 (see Appendix 1) concluded that the beach material from Aberdeen Bay moves in a cyclical motion; thus, with this type of motion and the groynes located on the beach there has never been a regular need for beach recharge in the area.

The following points have emerged from recent studies of beach recharge projects:

1) Replenishment sand should have a medium grain size 1½ to 2 times that occurring naturally on the beach. A high content of fine particles should be avoided since this will lead to initial instability and rapid loss of the fine fraction.

   As described above, the particle size of maintenance dredged material is unlikely to be suitable in this case.

2) About 20 to 30% of the bulk replacement volume is normally lost during the process.

   As stated in Section 2.1, the overall dredge volume may vary from 100,000 m^3 to 200,000 m^3 per annum, so the volume of material suitable for beach recharge may vary from 20,000 m^3 out of 100,000 m^3, to 40,000 m^3 out of 200,000 m^3. Therefore, with a 20% loss this drops to 16,000 m^3 – 32,000 m^3.

Availability of Suitable Sites/Facility

In response to the previous marine licence application for disposal of dredged material in 2015, Scottish Natural Heritage suggested that AHB liaise with Aberdeen City Council (ACC) to determine whether they are considering further beach recharge in Aberdeen and whether the quantities of sand would be of use.

In November 2017, AHB contacted Aberdeen City Council (ACC) to enquire whether there were any opportunities for using dredged material for beach recharge. ACC confirmed that they have no plans to do any beach recharge works in Aberdeen in the next 3 years so there would be no potential to use dredged material (see correspondence in Appendix 7). There are no beach recharge sites available within a reasonable sailing distance of Aberdeen.

Analysis of the Coastal Erosion Susceptibility Model, an output of the Dynamic Coast (Coastal Change Assessment) project, reveals that areas of erosion are predicted in the 'Future Look (2050)' condition along the sandy coastline between the Bridge of Don and Newburgh. AHB contacted Aberdeenshire Council in 2015 and again in 2018 to establish any plans for beach recharge; as demonstrated in the correspondence in Appendix 8, there are no projects planned that would make use of dredged material.

General Public Acceptability

The pipework and bunds required to pump the dredged material ashore would create a temporary barrier along the beach. This would prevent the public from accessing parts of the beach in the spring/summer months when the dredging would take place.

Legislative Implications

Standing advice from the Scottish Environment Protection Agency (SEPA) states that waste material, which includes dredged material, deposited above the low water mark is subject to Waste Management Licensing controls regulated by SEPA unless it is subject to a licence issued under Part 4 of the Marine (Scotland) Act 2010, in which case it is excluded from such controls (SEPA, 2016b), provided that it does not constitute a landfill, which is not applicable

to this project. As beach recharge would require a marine licence, it is assumed that a separate Waste Management Licence would not be required.

Section 34 of the Environmental Protection Act 1990 (as amended) makes it a duty to take all measures available as are reasonable in the circumstances to apply the waste hierarchy set out in Article 4(1) of the Waste Directive. The waste hierarchy ranks waste management options according to the best environmental outcome taking into consideration the lifecycle of the material. In its simplest form, the waste hierarchy gives top priority to preventing waste. When waste is created, it gives priority to reuse, then recycling, then other recovery, and last of all disposal (i.e. landfill). The option to reuse the material for beach recharge ranks highly on the waste hierarchy; it negates the need to otherwise dispose of the material.

4.1.2. Environmental Considerations

Safety Implications

A pipeline over a beach could pose a tripping hazard or falling from height hazard and would have to be cordoned off. The construction plant required to spread the material would present a small risk to users of the beach.

Public Health Implications

There is no public health risk given that the dredged material is naturally occurring sands that is suitable for disposal at sea (see Section 2.2).

Pollution/Contamination

There would be little or no risk of pollution or contamination resulting from the inert material.

Amenity/Aesthetic Implications

The temporary stockpiling of the dredged material would not be aesthetically pleasing, but otherwise of little implication. There would be temporary access restrictions on the beach whilst the recharge activity was on-going.

4.1.3. Cost considerations

Estimated annual cost of dredging 100,000 m^3 of sand, of which 20,000 m3 is used for beach recharge.

Lag Pipeline	£400,000
Dismantle Pipeline	£100,000
Hire of Plant	£ 50,000
Pumping Costs @ £1/m^3	£ 20,000
Dredger Mobilisation	£ 50,000
Dredge Costs @ £2.50/m^3	£250,000
TOTAL	£870,000

4.2. Option 6: Sea disposal

Dredging and disposal to sea has been carried out at Aberdeen Harbour throughout its history. For the past 80 years at least, the material has been deposited at the same offshore site used solely by the harbour: Aberdeen CR110, as shown on Figure 2.

4.2.1.Strategic considerations

Operational Aspects

The practicalities of disposing of dredged material at the Aberdeen CR110 designated disposal site are straightforward: it is likely that a split hopper barge would be used, which would discharge directly at the disposal site. No preparation of the material is required prior to disposal.

The option to dispose of the material at an offshore site ranks poorly on the waste hierarchy (see Section 4.1.1 for details); however, for various reasons, including waste reduction but also the high cost and the logistical challenges of accommodating a dredger in the harbour, AHB dredges only the volume of material required to maintain the navigation channel and berths at the published depths. Applying for a marine licence to dispose of the maximum volume reduces the risk of breaching the marine licence by exceeding our licensed disposal volume, and/or having to re-apply for a licence to amend the volume.

Availability of Suitable Sites/Facility

The licensed disposal site is available for the acceptance of dredged material and has been used for many years by the harbour.

General Public Acceptability

The disposal site has a long history of use for disposal of dredged material. As there is no requirement for the dredged material to come ashore for onward transportation, there is no associated impact on the local road network.

Local Acceptability

There are no anticipated local acceptability issues associated with the continuation of a long-standing method of disposing of dredged material. AHB has never received a complaint or enquiry from a member of the public regarding the disposal of maintenance dredged material at sea. No known objections have been received from members of the public relating to previous marine licence applications.

Legislative Implications

The existing disposal site Aberdeen CR110 has received dredged material from Aberdeen Harbour for many years. Clause 72 of the Aberdeen Harbour Order (Confirmation) Act 1960 gives Aberdeen Harbour Board powers to dredge provided that the activity is approved by the Scottish Ministers before it is carried on. A marine licence would be required from Marine Scotland to dispose of material at the site.

4.2.2. Environmental considerations

Safety Implications

Disposal to sea would have negligible implications for safety providing that normal navigational and maritime procedures are observed.

Public Health Implications

There are no known threats to public health associated with sea disposal.

Pollution/Contamination Implications

As presented in Section 2.2, the material to be dredged contains isolated elevations above Marine Scotland Revised Action Level 1, but not to an extent that would prevent disposal of the material in the marine environment. The risk of pollution/contamination is very low.

Interference with other Legitimate Activities

There is the potential for interference between the dredging vessel and other users of the sea (e.g. fishing vessels); however, this can be managed through compliance with harbour byelaws and good communication between the dredging crew, AHB and other users.

Amenity/Aesthetic Implications

There are no amenity or aesthetic implications of disposing of material at a designated offshore site.

4.2.3. Cost Considerations

Estimated cost of sea disposal of 100,000m^3

Dredger Mobilisation	£50,000
Dredger Costs @ £2.50/m^3	£250,000
TOTAL	£300,000

5. BEST PRACTICABLE ENVIRONMENTAL OPTION

Table 2 summarises the BPEO assessment presented in Section 4 by allocating a relative score of 0 or 1 for each option in each of the three areas considered, where a score of 0 is the least favourable option.

	Option 4: Beach recharge	Option 6: Sea disposal
Strategic considerations	0	1
Environmental considerations	1	0
Cost considerations	0	1
Total	**1**	**2**

Table 2: Relative scoring of BPEO assessment

It is concluded that the best practicable environmental option is sea disposal. Whilst beach recharge is a more environmentally sustainable option as it uses a material that would otherwise be disposed of, there are no known suitable beach recharge schemes, and it is a significantly more expensive option.

6. REFERENCES

Bolam, S.G., Mason, C., Bolam, T., Rance, J., Rumney, H.S., Barber, J.L., Birchenough, S.N.R, Rees, J. & Law, R.J. (2014) Dredged material disposal site monitoring around the coast of England: Results of sampling (2012). Cefas contract report: SLAB5.

Gorham-Test, C. (1998) Regional Environmental Monitoring and Assessment Program: Galveston Bay 1993. US EPA report no EPA/906/R-98/002. 51 pp.

Hayes, P., Russell, M. & Packer, G. (2005) Surveys of dredged material and wastewater sludge sea disposal sites for the east coast of Scotland. Fisheries Research Services Internal Report No. 08/05.

Long, E.R., Field, L.J. & MacDonald, D.D. (1998) Predicting toxicity in marine sediments with numerical sediment quality guidelines. *Environmental Toxicology and Chemistry*, 17(4): 714

SEPA (2016) https://www.sepa.org.uk/data-visualisation/waste-sites-and-capacity-tool/ [accessed 13 November 2017].

Appendix 1

Extract from HR Wallingford Siltation Study (1986)

Appendix II

Hydraulics Research
Wallingford

ABERDEEN HARBOUR
An Investigation of Wave Effects in the Harbour Entrance

Report No EX 1475
August 1986

Registered Office: Hydraulics Research Limited.
Wallingford, Oxfordshire OX10 8BA.
Telephone: 0491 35381. Telex: 848552

Extract from Report (Ex 1475)

Summary and Recommendations

This preliminary study has investigated the siltation of the navigation channel at Aberdeen, in particular reviewing the link between infill and wave action. Analysis was based on the recorded changes of a single cross-section, because of the time and cost restraints of the study, but it is felt that the observed behaviour of that section gives a good indication of the channel infill as a whole.

Apart from some infill soon after maintenance dredging, which is tentatively attributed to slumping of the channel side-slopes, the majority of siltation seems to travel into the channel from the north. In addition, periods of rapid infill appear to be strongly linked with heavy wave activity.

However, the siltation of the channel cannot be explained by wave effects alone. Calculations of along shore drift for the beaches north of the harbour indicate a strong sediment transport from south to north, and this is confirmed both by the spit and the mouth of the Rive Don, and the reported build-up of material on the southern side of groynes along this frontage. This direction of sediment transport therefore opposes the observed direction causing infill in the channel.

Although this may be partially explained by a long-term onshore movement of sand from deep water, a more satisfactory explanation involves the tidal currents.

Because of the generally southward set of the tidal currents from about 4¾ hours before to 1¼ hours after high-water, it seems likely that sand on the sea bed is stirred during heavy wave action by the oscillating currents, and then advected into the harbour entrance by the admittedly rather weak tidal currents. Once reaching the channel, the material is deposited in the area sheltered by the breakwaters. On the ebb tide, when at lower water levels this shelter is increased, the wave action cannot stir the sediment quite so vigorously. In addition, the ebb current has to flow up the channel side-slope (near the sea bed) and is therefore less able to flush material out of the channel entrance. This wave-stirring/tidal advection process will occur whatever the wave direction, and will also produce the observed infill pattern in the channel.

In addition to this combined tidal current/wave action mechanism, there is also the infill due to wave action alone when the wind direction is from north of east. Although these conditions occur much more infrequently than waves from the south-east sector, they will be much more efficient, hour for hour, in causing channel infill.

Appendix 2

Sediment sampling results 2017

Applicant Information

Applicant:	Aberdeen Harbour Board
Description of dredging:	Maintenance Dredging: berths and channels
Total amount to be dredged (wet tonnes)	295,500

Sample Details & Physical Properties

Explanatory Notes:
An example of a 'Dredge area' is: 'Dock A, Harbour X'
Provide description of the dredge area and the latitude and longitude co-oridnates (WGS84) for each sample location. Co-ordinates taken from GPS equipment should be set to WGS84.
Note for sample depth that the seabed is 0 metres.
Gravel is defined as >2mm, **Sand** is defined as >63um<2mm, **Silt** is deinfed as <63um).

Sample information:

Sample ID	Dredge area	Latitude	Longitude	Type of sample	Sample depth (m)	Total solids (%)	Gravel (%)	Sand (%)	Silt (%)	TOC (%)	Specific gravity	Asbestos
CL/1778079	1-Channel Outer 8.00	57° 08.768'N	002° 03.558'W		0	75.6	0	98.37	1.63	0.16		No
CL/1778080	2-Channel Outer 8.00	57° 08.714'N	002° 03.645'W		0	54.4	0	46	54	0.82		No
CL/1778081	3-Channel Mid 7.00	57° 08.576'N	002° 03.872'W		0	50.7	0	41.5	58.5	1.37		No
CL/1778082	4-Channel Inner 6.00	57° 08.427'N	002° 04.319'W		0	44.8	0	42.9	57.1	2.06		No
CL/1778083	5-Pocra 6.00	57° 08.523'N	002° 04.362'W		0	42.1	0	38.7	61.3	2.44		No
CL/1778084	6-Telford Pit 11.00	57° 08.639'N	002° 04.650'W		0	47.7	0	35.7	64.3	2.46		No
CL/1778085	7-Regent / Waterloo 9.30	57° 08.749'N	002° 05.256'W		0	31.2	0	30.9	69.1	2.49		No
CL/1778086	8-Palmerston 6.00	57° 08.577'N	002° 05.422'W		0	30.4	0	32.2	67.8	2.65		No
CL/1778087	9-Atlantic	57° 08.533'N	002° 04.802'W		0	44.8	0	36.6	63.4	2.28		No
CL/1778088	10-River	57° 08.407'N	002° 04.871'W		0	51.3	0	42.9	57.1	1.45		No
		° .'N	° .'W									
		° .'N	° .'W									
		° .'N	° .'W									
		° .'N	° .'W									
		° .'N	° .'W									
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		° .'N	° .'W									
		° .'N	° .'W									

Trace Metals & Organotins

Explanatory Notes:
Results above Action Level 1 will be highlighted in blue and above Action Level 2 in red.

Sample information:

Sample ID	Dredge area	Type of sample	Sample depth (m)	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Mercury (Hg)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)	Dibutyltin (DBT)	Tributyltin (TBT)
				mg/kg dry weight									
CL/1778079	1-Channel Outer 8.00	0	0	7.4	0.23	12.4	14.3	<0.01	5.9	13	31.5		<0.001
CL/1778080	2-Channel Outer 8.00	0	0	6	0.05	21.6	14.6	<0.01	12.8	13.1	44.5		<0.001
CL/1778081	3-Channel Mid 7.00	0	0	7.3	0.1	26.6	17.4	0.013	15.6	14.2	51		<0.001
CL/1778082	4-Channel Inner 6.00	0	0	9	0.2	28.5	27.8	0.04	18.2	23.3	65.8		<0.001
CL/1778083	5-Pocra 6.00	0	0	9.3	0.46	30.5	39.7	0.05	19.2	42.4	92.9		<0.001
CL/1778084	6-Telford Pit 11.00	0	0	10	0.43	32.4	51.6	0.06	20.3	37.6	91.3		0.0015
CL/1778085	7-Regent / Waterloo 9.30	0	0	12.5	0.7	36.3	80.7	0.08	22.6	62.9	133.7		0.00299
CL/1778086	8-Palmerston 6.00	0	0	10.8	0.48	28.2	53.4	0.05	17.9	42.1	101.2		0.00144
CL/1778087	9-Atlantic	0	0	9.8	0.4	30.6	39.1	0.05	20	60.2	91.8		<0.001
CL/1778088	10-River	0	0	6.6	0.16	22	26	0.02	14.9	28.6	67.9		<0.001
0	0	0	0										
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Polyaromatic Hydrocarbons (PAH)

Explanatory Notes:
Results above Action Level 1 will be highlighted in blue and above Action Level 2 in red.

Definitions:

ACENAPTH	Acenaphthene
ACENAPHY	Acenaphthylene
ANTHRACN	Anthracene
BAA	Benz(a)anthracene
BAP	Benzo(a)pyrene
BBF	Benzo(b)fluoranthene
BEP	Benzo(e)pyrene
BENZGHIP	Benzo(ghi)perylene
BKF	Benzo(K)fluoranthene
C1N	C1-naphthalenes
C1PHEN	C1-phenanthrene
C2N	C2-naphthalenes
C3N	C3-naphthalenes
CHRYSENE	Chrysene
DBENZAH	Diben(ah)anthracene
FLUORANT	Fluoranthene
FLUORENE	Fluorene
INDPYR	Indeno(1,2,3-cd)pyrene
NAPTH	Naphthalene
PERYLENE	Perylene
PHENANT	Phenanthrene
PYRENE	Pyrene
THC	Total Hydrocarbon Content

Sample information:

Sample ID	Dredge area	Type of sample	Sample depth (m)	µg/kg																				
				ACENAPTH	ACENAPHY	ANTHRACN	BAA	BAP	BBF	BEP	BENZGHIP	BKF	C1N	C1PHEN	C2N	C3N	CHRYSENE	DBENZAH	FLUORANT	FLUORENE	INDPYR	NAPTH	PERYLENE	PHENANT	PYRENE	THC
CU/1778079	1-Channel Outer 8.00	0	0	<1	<1	<1	1.5670194	2.044973545	1.87654321	1.799823633	1.958553792	<1	<1	1.330687831	<1	<1	1.834215168	<1	2.74691358	<1	1.700176367	<1	<1	1.579365079	3.141093474	29673.20261
CU/1778080	2-Channel Outer 8.00	0	0	10.50612745	3.676470588	21.30637255	44.16421569	54.52205882	55.52205882	46.49142157	48.33823529	21.39705882	18.2745098	42.41421569	22.02818627	19.44607843	51.3247549	7.965686275	93.10416667	9.567401961	49.21813725	9.600490196	21.00245098	77.06004902	97.11029412	97773.65492
CU/1778081	3-Channel Mid 7.00	0	0	13.82248521	8.089414859	28.63905325	79.21630506	96.71926364	105.4398422	83.05062459	87.00197239	47.40039448	49.00591716	83.29257068	57.54635108	50.13543721	89.76594346	14.52728468	151.2675871	14.5877712	91.43852728	23.75673899	37.41485865	105.200526	150.5943458	149518.3044
CU/1778082	4-Channel Inner 6.00	0	0	40.06845238	13.55803571	75.2202381	139.6220238	145.4955357	132.671131	110.75	112.8318452	62.11309524	54.54910714	132.1860119	57.47172619	51.8125	150.2931548	19.30505952	316.1949405	42.77529762	116.3184524	50.4360119	47.22767857	258.9300595	289.4657738	203298.9691
CU/1778083	5-Pocra 6.00	0	0	8.764845606	9.236737926	30.86935867	98.25494854	111.8004751	133.2335709	100.989707	106.3388757	54.39271576	44.51464766	101.8780681	78.59699129	56.09026128	112.3388757	18.34204276	186.0095012	14.10926366	110.5716548	20.69992082	59.8685669	98.36421219	180.584323	272058.8235
CU/1778084	6-Telford Pit 11.00	0	0	15.31516422	10.45842068	40.32704403	110.5856045	134.8357792	128.5842068	113.6925227	126.5534591	61.83647799	42.4416492	108.8176101	62.51991614	57.42557652	125.7512229	20.47239693	227.4772886	17.60866527	129.4129979	23.8546471	62.58280922	132.2096436	209.3053809	240566.0377
CU/1778085	7-Regent / Waterloo 9.30	0	0	13.33547009	12.81410256	37.91666667	104.1837607	130.8418803	151.0555556	126.0790598	143.8141026	75.35897436	50.27136752	117.792735	73.42094017	69.17735043	129.991453	22.3525641	210.0683761	17.34401709	138.4871795	24.65384615	89.5534188	123.5641026	208.1303419	482191.7808
CU/1778086	8-Palmerston 6.00	0	0	11.50219298	11.26315789	37.21929825	100.3684211	125.4320175	149.3267544	119.627193	137.0701754	57.32236842	52.10307018	125.6535088	76.89035088	74.01096491	117.497807	22.43640351	197.5065789	17.81359649	135.2083333	26.56578947	93.04605263	119.0942982	201.6074561	418539.3258
CU/1778087	9-Atlantic	0	0	19.80208333	13.14285714	44.53125	111.5119048	130.5997024	140.703869	112.8883929	122.4821429	58.21875	61.75446429	108.1339286	79.02083333	70.28571429	126.0446429	25.16666667	218.9866071	21.76636905	118.7008929	35.5639881	65.87797619	139.5758929	212.7946429	211688.3117
CU/1778088	10-River	0	0	16.45094217	8.525016244	36.21442495	87.5711501	101.6569201	125.1176088	89.26445744	94.99675114	45.96101365	41.00064977	86.45224172	55.24236517	52.65756985	98.71345029	15.74528915	184.9538661	16.73684211	97.58934373	19.66731644	47.24496426	119.2501624	180.5289149	162474.645
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Organohalogens

Explanatory Notes:
Results above Action Level 1 will be highlighted in blue and above Action Level 2 in red.
ICES7 is the sum of PCB 28,52,101,138,153,180 and 118.

Definitions:

AHCH	alpha-Hexachlorcyclohexane
BHCH	beta-Hexachlorcyclohexane
GHCH	gamma-Hexachlorcyclohexane
DIELDRIN	Dieldrin
HCB	Hexachlorobenzene
PPDDE	p,p'-Dichorodiphenyldicloroethylene
PPDDT	p,p'-Dichorodiphenyltrichloroethane
PPTDE	p,p -Dichorodiphenyldicloroethane

Sample information:

Sample ID	Dredge area	Type of sample	Sample depth (m)	PCB28	PCB52	PCB101	PCB118	PCB138	PCB153	PCB18	PCB105	PCB110	PCB128	PCB141	PCB149	PCB151	PCB156	PCB158	PCB170	PCB180	PCB183	PCB187	PCB194	PCB31	PCB44	PCB47	PCB49	PCB66	ICES7	AHCH	BHCH	GHCH	DIELDRIN	HCB	DDE	DDT	TDE	BDE100	BDE138	BDE153	BDE154	BDE17	BDE183	BDE209	BDE28	BDE47	BDE66	BDE85	BDE99
				µg/kg																																															
CL/1778079	1-Channel Outer 8.00	0	0	3.3663	1.8847	1.05	0.5488	1.0129	0.7184											0.5206									9.1017	<0.10		<0.10	1.2097	0.1063	2.2363	0.6347	0.6033																
CL/1778080	2-Channel Outer 8.00	0	0	0.5482	0.43	0.2669	0.1257	0.2522	0.2652											0.1057									1.9939	<0.10		<0.10	<0.10	<0.10	0.3558	0.1009	0.1669																
CL/1778081	3-Channel Mid 7.00	0	0	0.3446	0.2745	0.2135	0.1894	0.2036	0.1978											0.1037									1.5271	<0.10		<0.10	0.2804	<0.10	0.2097	0.7908	0.1684																
CL/1778082	4-Channel Inner 6.00	0	0	0.3316	0.4301	0.6594	0.4155	0.7644	0.6286											0.3171									3.5467	<0.10		<0.10	0.472	<0.10	0.3869	0.3143	0.4008																
CL/1778083	5-Pocra 6.00	0	0	0.6087	0.9507	1.1252	0.6171	1.2948	0.9126											0.4565									5.9656	<0.10		<0.10	2.3573	1.0939	1.5425	1.3408	1.4905																
CL/1778084	6-Telford Pit 11.00	0	0	0.3067	0.4514	0.5366	0.3673	0.6758	0.4365											0.2581									3.0324	<0.10		<0.10	0.4885	0.1653	0.8732	0.5556	0.8909																
CL/1778085	7-Regent / Waterloo 9.30	0	0	0.5821	0.7615	0.8252	0.4879	0.7755	0.6473											0.3118									4.3913	<0.10		<0.10	0.9779	0.1665	1.4549	0.9215	1.1607																
CL/1778086	8-Palmerston 6.00	0	0	4.0357	4.6375	2.6877	1.74	2.1593	1.2507											0.6135									17.1244	<0.10		<0.10	1.6407	0.2998	1.8009	4.333	2.2887																
CL/1778087	9-Atlantic	0	0	0.525	0.6848	0.8688	0.5202	0.9706	0.7125											0.3553									4.6372	<0.10		<0.10	1.9055	0.1492	2.1697	0.8498	1.7926																
CL/1778088	10-River	0	0	0.4045	0.422	0.4815	0.2634	0.544	0.3918											0.1278									2.635	<0.10		<0.10	0.891	0.1078	0.7039	0.5504	0.985																
0	0	0	0																																														
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PR Details

Total amount to be dredged (wet tonnes)	295,500

Explanatory Notes:
The values entered for each determinand should be an average wet weight concentration from all the samples representing the material to be disposed to sea. They should be entered in the units stated in the Unit of measurement column in the table below.
Results above Action Level 1 will be highlighted in blue and above Action Level 2 in red.

Average for the total dredge area:

Sample ID	Unit of measurement	
Total Solids	%	47.3
Gravel	%	0
Sand	%	44.6
Silt	%	55.4
Arsenic (As)	mg/kg	4.271792
Cadmium (Cd)		0.154594
Chromium (Cr)		12.95986
Copper (Cu)		17.55914
Mercury (Hg)		0.016856
Nickel (Ni)		8.061984
Lead (Pb)		16.24918
Zinc (Zn)		37.16026
Dibutyltin (DBT)		
Tributyltin (TBT)		0.00067
Acenapth	µg/kg	7.074555
Acenapthylene		4.293147
Anthracn		16.66113
BAA		41.48425
BAP		48.90577
BBF		53.14302
BEP		42.78915
Benzghip		46.41956
BKF		22.89324
C1N		19.5782
C1PHEN		42.94611
C2N		26.61749
C3N		23.69926
Chrysene		47.46818
Debenzah		7.866624
Flurant		84.58734
Fluorene		8.150226
Indypr		46.76294
napth		11.10598
perylene		24.77663
phenant		55.56938
pyrene		81.98332
THC		96750
PCB28		0.573008
PCB52		0.566466
PCB101		0.451775
PCB118		0.273472
PCB138		0.448577
PCB153		0.319407
PCB18		
PCB105		
PCB110		
PCB128		
PCB141		
PCB149		
PCB151		
PCB156		
PCB158		
PCB170		
PCB180		0.164338
PCB183		
PCB187		
PCB194		
PCB31		
PCB44		
PCB47		
PCB49		
PCB66		
ICES7		0.164338
AHCH		<0.1
BHCH		
GHCH		<0.1
DIELDRIN		0.529
HCB		0.108
DDE		0.608
DDT		0.538
TDE		0.515
BDE100		
BDE138		
BDE153		
BDE154		
BDE17		
BDE183		
BDE209		
BDE28		
BDE47		
BDE66		
BDE85		
BDE99		

Comments:

Laboratory Details

Explanatory Notes
Please complete a separate worksheet for each laboratory (e g. complete 'Laboartory_1' worksheet for 1 laboratory and complete 'Laboartory_2' worksheet for a second laboratory). If there are more than 3 laboratories then please contact MS-LOT.

Laboratory 1 Details

Laboratory name:	Environmental Scientific Group Limited
Year:	2017

LabRefMat	**Q1**	Does the laboratory carrying out the analyses undertake the analysis of blank samples and laboratory reference materials with each batch of samples of waste and other material dumped in the maritime area that is analysed by that laboratory?	Yes
CompAnal	**Q2**	Does the laboratory carrying out the analyses undertake periodic comparative analysis of laboratory reference materials and certified reference materials?	Yes
QAQC	**Q3**	Does the laboratory carrying out the analyses undertake the compilation of quality control charts based upon the data resulting from the analyses of the laboratory reference materials and certified reference materials, and the use of those quality control charts to monitor analytical performance in relation to all samples of dumped wastes or other materials?	Yes
InterlabCaleb	**Q4**	Does the laboratory carrying out the analyses undertake periodic participation in interlaboratory comparison exercises, including, where possible, international comparison exercises?	Yes
InternatCaleb	**Q5**	Does the laboratory carrying out the analyses undertake periodic participation in national and, where possible, international laboratory proficiency schemes?	Yes
SpikedSamples	**Q6**	If the answer to questions 4 or 5 is 'Yes' then does the laboratory analyse samples of substances which are provided by the organisers of the scheme?	Yes
BlindSamples	**Q7**	If the answer to questions 4 or 5 is 'Yes' then does the laboratory confirm that the composition of those samples is not disclosed in advance?	Yes
Ranking	**Q8**	If the answer to questions 4 or 5 is 'Yes' then does the laboratory confirm that the results of the scheme for each participating laboratory are made available to all participating laboratories?	Yes
FracAnal	**Q9**	Enter the size fraction that is analysed i e. Whole or less than 63µm etc.	<63um(metals)
GranMeth	**Q10**	PSA method	NMBAQC
OCMeth	**Q11**	Organic Carbon method	carbonate removal and sulfurous acid/combustion at 800°C/ND R,
MetExtrType	**Q12**	Method of extraction used for metal analysis	Aquaregia
MethOfDetMetals	**Q13**	Method of detection used for metal analysis	ICP-MS
PAHExtrType	**Q14**	Method of extraction used for poly aromatic hydrocarbon analysis	Methanol/DCM solvent extraction with silica clean up and copper clean up stages
MethOfDetPAH	**Q15**	Method of detection used for poly aromatic hydrocarbons analysis	GCMS
OHExtrType	**Q16**	Method of extraction used for organohalogens inc PCBs, pesticides, flame retardants etc analysis	Ultrasonic acetone/hexane solvent extraction
MethOfDetOH	**Q17**	Method of detection used for organohalogens inc PCBs, pesticides, flame retardants etc analysis	GCMSMS
OTExtrType	**Q18**	Method of extraction used for organotin analysis	derivatisation and solvent extraction
MethOfDetOT	**Q19**	Method of detection used for organotin analysis	GCMS

		LOD/LOQ	Precision (%)	Recovery (%)
mg/kg	Hg	0.015	4 2	97.3
	As	0.5	2.7	98 04
	Cd	0 04	3 6	95.18
	Cu	0.5	2 9	92 61
	Pb	0.5	3	101.34
	Zn	2	2 6	94 86
	Cr	0.5	3.1	87 97
	Ni	0.5	3 6	96 26
	TBT	0.001	12 62	100.65
	DBT			
µg/kg	PCB28	0.1	12 56	95 55
	PCB31			
	PCB44			
	PCB47			
	PCB49			
	PCB52	0.1	6.999	104.3
	PCB66			
	PCB101	0.1	8.43	100.2
	PCB105			
	PCB110			
	PCB118	0.1	14 61	105.4
	PCB128			
	PCB138+163	0.1	12 93	96 65
	PCB141			
	PCB149			
	PCB151			
	PCB153	0.1	7.41	106.6
	PCB156			
	PCB158			
	PCB170			
	PCB180	0.1	9.85	105.05
	PCB183			
	PCB187			
	PCB194			
	DDE	0.1	14 01	104.9
	DDT	0.1	17 61	113.85
	DDD	0.1	12.79	95
	Dieldrin	0.1	6.21	93.4
	Lindane	0.1	7.63	107.45
	HCB	0.1	8.67	99.75
	BDE17			
	BDE28			
	BDE47			
	BDE66			
	BDE85			
	BDE99			
	BDE100			
	BDE138			
	BDE153			
	BDE154			
	BDE183			
	BDE209			
	ACENAPTH	1	6.68	105.98
	ACENAPHY	1	7.74	103.16
	ANTHRACN	1	4.95	103.44
	BAA	1	9 8	94.12
	BAP	1	9.07	92.16
	BBF	1	8.44	88 66
	BENZGH P	1	13.46	92.72
	BEP	1	7 9	98 54
	BKF	1	8 9	100.46
	C1N	1	8.27	108.8
	C1PHEN	1	N/A	N/A
	C2N	1	N/A	N/A
	C3N	1	N/A	N/A
	CHRYSENE	1	7.87	99 32
	DBENZAH	1	19 23	87 66
	FLUORENE	1	5.25	106.26
	FLUORANT	1	4.36	102.24
	INDPYR	1	17.1	80 94
	NAPTH	1	3.02	100.7
	PERYLENE	1	N/A	N/A
	PHENANT	1	5.41	109.44
	PYRENE	1	4.29	101.22
	THC	10000	7 5	96

Appendix 3

Sediment sampling results 2014

Marine Scotland – 2014 Seabed Samples at Aberdeen Harbour – 18 March 2014

Aberdeen Harbour

Sample Number:	Location Number:	Location:	Maintained Dredge Depth:	Easting:	Northing:	Latitude:	Longitude:	Colour:	Texture:	Odour:	Biota Y/N:	Description:	Strata Info:
1/ABZ/14	1	Outer Channel	8.0m	396587.3	806370.2	57 08.8913N	02 03.4827W	Light Brown	Sand	None	Y	Sand. A single 5mm long crustacean which resembled a shrimp was noticed in the sample.	Uniform sand.
2/ABZ/14	2	Inner Channel	8.0m	396390.8	805941.1	57 08.6599N	02 03.6771W	Grey Brown	Stiff Sandy Silt	None	N	Clayey Sandy Silt with Leaves and Twigs	90mm layer of Grey Brown Sandy Silt with Black Silt Beneath
3/ABZ/14	3	Turning Basin	6.0m	395687.7	805512.9	57 08.4287N	02 04.3738W	Grey Brown	Sandy Silt	Hydrogen Sulphide	N	Clayey Sandy Silt with Leaves and Twigs	70mm layer of Grey Brown Sandy Silt with Black Silt Beneath
4/ABZ/14	4	Pocra Quay	6.0m	395678.6	805699.9	57 08.5295N	02 04.3830W	Grey Brown	Clayey Silt	Hydrogen Sulphide (light)	N	Clayey Silt with Leaves and Twigs	50mm layer of Grey Brown Sandy Silt with Black Silt Beneath
5/ABZ/14	5	Telford Pit	11.0m	395374.6	805907.8	57 08.6414N	02 04.6846W	Grey Brown	Soft Silt	None	N	Soft Silt with Leaves and Twigs	10mm layer of Grey Brown Sandy Silt with Leaves and Twigs beneath
6/ABZ/14	6	Regent Quay DWB	9.3m	394749.0	806121.5	57 08.7562N	02 05.3052W	Grey Brown	Soft Silt	None	N	Soft Silt	Soft Silt
7/ABZ/14	7	Palmerston Quay	6.0m	394638.4	805779.7	57 08.5718N	02 05.4144W	Light Brown with Black Underneath	Soft Silt	Hydrogen Sulphide	N	Soft Silt with Leaves and Twigs	10mm layer of Light Grey Brown Silt with Black Silt Beneath
8/ABZ/14	8	Atlantic Wharf	8.7m	395264.8	805712.4	57 08.5360N	02 04.7933W	Grey Brown	Soft to Stiff Silt	None	N	Soft Silt with Fine Sand	Soft to Stiff Silt
9/ABZ/14	9	Torry Quay	7.5m	395140.7	805449.9	57 08.3944N	02 04.9160W	Grey Brown	Soft to Stiff Silt	None	N	Soft Clayey Silt	50mm layer of Grey Brown Silt with Clayey Black Silt Beneath

Image 01 – Sample 1 – Outer Channel

Image 02 – Sample 2 – Inner Channel

Image 03 – Sample 2 – Inner Channel

Image 04 – Sample 3 – Turning Basin

Image 05 – Sample 3 – Turning Basin

Image 06 – Sample 4 - Pocra

Image 07 – Sample 5 – Telford Pit

Image 08 – Sample 6 – Regent Quay

Image 09 – Sample 6 – Regent Quay

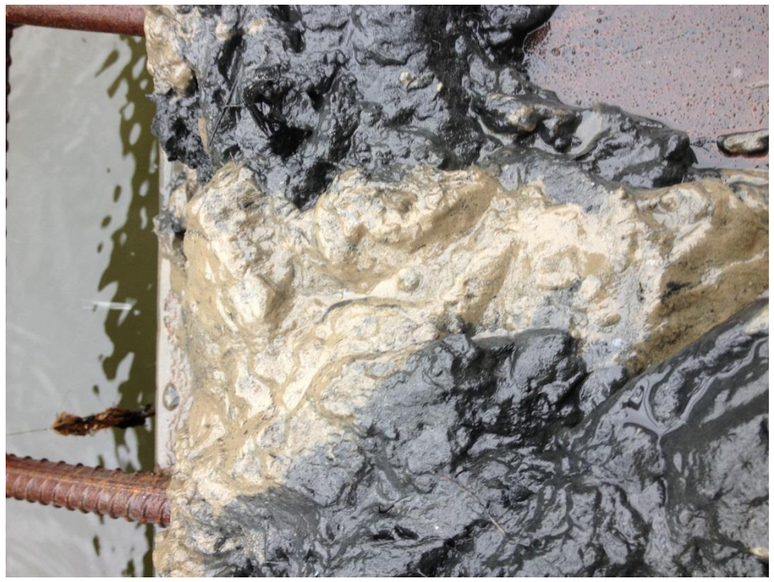


Image 10 – Sample 7 – Palmerston Quay

Image 11 – Sample 7 – Palmerston Quay

Image 12 – Sample 8 – Atlantic Wharf

Image 13 – Sample 8 – Atlantic Wharf

Image 14 – Sample 9 – Torry Quay

Image 15 – Sample 9 – Torry Quay

Image 16 – Sample 9 – Torry Quay

MACAULAY SCIENTIFIC CONSULTING LTD

Report Number: 2014-18812

ANALYTICAL LABORATORY SERVICES
Assured Analytical Excellence

Analytical Report

on the Analysis of Harbour Sediments

FOR:

[Redacted]
Aberdeen Harbour Board
16 Regent Quay
Aberdeen
AB11 5SS

REPORT AUTHOR:

[Redacted] , (Senior Analyst)

(email: [Redacted]

INVESTORS IN PEOPLE

Job and Sample Information:	
Job No(s):	*2014-18812*
Client Order No/Reference:	1264
Date Sample(s) Received:	18th March 2014
Lab Code	**Client Code**
1165415-1165423	See results tables

Methods

Methods
Heavy metals by ICP-MS
ICES 7 Polychlorinated Biphenyls (PCBs) by GC-MS
Brominated Flame Retardants (PBDEs) by GC-MS
Total Petroleum Hydrocarbons by GC-FID
US EPA 16 Polycyclic Aromatic Hydrocarbons (PAHs) by GC-MS
Tributyltins (TBT) by GC-MS
Total Organic Carbon by Dumas Combustion Elemental Analyser
Particle Size by Laser Diffractometry

Analytical Procedures

Heavy metals by ICP-MS
The samples were air dried at 30°C and sieved to <63µm. This fraction was subjected to a strong acid digestion and the digests analysed for selected heavy metals by ICP-MS.

Tributyltins by GC-MS
The samples were air dried at 30°C and sieved to <63µm. This fraction was extracted, the extract derivatised and the TBT derivatives analysed by GC-MS in the single ion mode. TBTs were quantified with reference to an added internal standard.

US EPA 16 PAHs
The samples were freeze dried and sieved to <2mm. This fraction was extracted and the extract analysed for the US EPA 16 PAHs by GC-MS in the single ion mode. PAHs were quantified with reference to a series of 7 deuterated PAH internal standards.

ICES 7 PCBs
The samples were freeze dried and sieved to <2mm. This fraction was extracted and the extract analysed for the ICES 7 PCBs by GC-MS in the single ion mode. PCB congeners were quantified with reference to an added internal standard.

Brominated Flame Retardants (PBDEs)
The samples were freeze dried and sieved to <2mm. This fraction was extracted and the extract analysed for the PBDEs by GC-MS in the single ion mode. PBDE congeners were quantified with reference to an added internal standard.

Total Petroleum Hydrocarbons
The as received samples were extracted and the extracts treated with Florisil. The extracts were then analysed for total petroleum hydrocarbons using GC-FID. The hydrocarbons were quantified by comparison with an added internal standard.

Particle Size
Material <2mm was suspended in a dispersant and the particle size distribution measured using a Malvern laser diffractometer.

Total Organic Carbon
The dried material was pre-treated with acid to remove inorganic carbon and the remaining carbon measured using a Dumas combustion elemental analyser.

Results

Table 1 - Heavy Metals

		Concentration (mg/kg Dry matter)							
Sample identity	Lab code	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
1/ABZ/14	1165415	5.88	0.027	7.54	1.30	<0.01	3.41	4.62	16.0
2/ABZ/14	1165416	7.60	0.140	18.26	8.74	0.05	12.15	12.15	44.7
3/ABZ/14	1165417	8.65	0.121	20.65	10.10	0.09	13.71	12.06	48.6
4/ABZ/14	1165418	9.44	0.163	21.10	17.27	0.09	13.81	14.95	54.7
5/ABZ/14	1165419	10.75	0.137	22.82	16.80	0.09	14.92	17.38	55.4
6/ABZ/14	1165420	12.14	0.240	26.27	26.19	0.12	16.57	23.34	77.8
7/ABZ/14	1165421	8.80	0.242	22.75	59.78	0.09	14.06	15.91	77.2
8/ABZ/14	1165422	9.41	0.120	22.49	13.55	0.07	14.30	13.57	50.9
9/ABZ/14	1165423	8.43	0.141	21.79	11.64	0.07	13.71	14.64	50.4

Table 2 – Tributyltins

Sample identity	Lab code	TBT (µg/kg Dry matter)
1/ABZ/14	1165415	1
2/ABZ/14	1165416	15
3/ABZ/14	1165417	13
4/ABZ/14	1165418	24
5/ABZ/14	1165419	55
6/ABZ/14	1165420	38
7/ABZ/14	1165421	94
8/ABZ/14	1165422	28
9/ABZ/14	1165423	19

Table 3 – ICES 7 Polychlorinated Biphenyls

		PCB Congener Concentration (µg/kg Dry matter)							
Sample identity	Lab code	#28	#52	#101	#118	#138	#153	#180	Total ICES 7 PCBs
1/ABZ/14	1165415	<1	<1	<1	<1	<1	<1	<1	<7
2/ABZ/14	1165416	<1	2	<1	<1	<1	<1	<1	2
3/ABZ/14	1165417	<1	1	<1	<1	<1	<1	<1	1
4/ABZ/14	1165418	<1	3	<1	<1	<1	<1	<1	3
5/ABZ/14	1165419	14	7	<1	<1	<1	<1	<1	21
6/ABZ/14	1165420	<1	16	<1	<1	<1	<1	<1	16
7/ABZ/14	1165421	2	6	<1	<1	4	3	7	22
8/ABZ/14	1165422	<1	3	<1	<1	<1	<1	<1	3
9/ABZ/14	1165423	<1	3	<1	<1	<1	<1	<1	3

Table 4 – PBDEs

		PBDE Congener Concentration (µg/kgDry matter)							
Sample identity	Lab code	PBDE 28	PBDE 47	PBDE 100	PBDE 99	PBDE 154	PBDE 153	PBDE 183	Total 7 PBDEs
1/ABZ/14	1165415	<1	<1	<1	<1	<1	<1	<1	<7
2/ABZ/14	1165416	<1	17	10	30	9	8	<1	74
3/ABZ/14	1165417	<1	15	10	34	11	6	<1	76
4/ABZ/14	1165418	<1	38	34	281	55	95	5	508
5/ABZ/14	1165419	5	197	53	279	46	52	2	634
6/ABZ/14	1165420	12	403	109	3090	338	625	38	4615
7/ABZ/14	1165421	4	120	37	882	43	210	5	1301
8/ABZ/14	1165422	6	188	36	100	9	<1	<1	339
9/ABZ/14	1165423	<1	47	<1	56	14	21	<1	138

Table 5 – Total Organic Carbon

Sample identity	Lab Code	Total Organic Carbon (%w/w Dry matter)
1/ABZ/14	1165415	0.09
2/ABZ/14	1165416	2.20
3/ABZ/14	1165417	2.26
4/ABZ/14	1165418	1.56
5/ABZ/14	1165419	1.77
6/ABZ/14	1165420	3.82
7/ABZ/14	1165421	2.90
8/ABZ/14	1165422	2.39
9/ABZ/14	1165423	2.85

Table 6 – US EPA 16 Polycyclic Aromatic Hydrocarbons

	Concentration (µg/kg Dry matter)								
Sample identity	1/ABZ/14	2/ABZ/14	3/ABZ/14	4/ABZ/14	5/ABZ/14	6/ABZ/14	7/ABZ/14	8/ABZ/14	9/ABZ/14
Lab code	1165415	1165416	1165417	1165418	1165419	1165420	1165421	1165422	1165423
Naphthalene	8	36	71	46	25	38	30	19	32
Acenaphthylene	<1	6	3	5	10	7	3	2	2
Acenaphthene	<1	19	23	26	34	10	9	9	12
Fluorene	1	27	27	38	55	46	16	23	17
Phenanthrene	10	163	182	237	281	257	103	102	102
Anthracene	1	50	49	63	60	63	32	31	27
Fluoranthene	26	2	3	8	20	31	178	8	2
Pyrene	19	187	206	276	230	262	174	135	134
Benz[a]anthracene	11	98	98	134	112	103	96	69	75
Chrysene	22	235	242	328	294	352	224	175	181
Benzo(b)fluoranthrene	23	351	253	413	371	408	313	<1	271
Benzo(k)fluoranthrene	10	127	94	149	124	139	112	193	94
Benzo(a)pyrene	23	286	257	345	267	259	271	105	201
Indeno(1,2,3-cd)pyrene	7	201	82	228	219	248	135	106	122
Dibenzo(a,h)anthracene	<1	23	1	27	31	33	5	11	5
Benzo(g,h,i)perylene	12	228	174	276	250	289	231	121	169
Total US EPA 16 PAHs	172	2038	1765	2600	2383	2545	1932	1107	1447

Table 7 – Total Petroleum Hydrocarbons

Sample identity	Lab code	Total Petroleum Hydrocarbons (mg/kg as rec'd)
1/ABZ/14	1165415	<1
2/ABZ/14	1165416	2
3/ABZ/14	1165417	3
4/ABZ/14	1165418	25
5/ABZ/14	1165419	40
6/ABZ/14	1165420	81
7/ABZ/14	1165421	10
8/ABZ/14	1165422	16
9/ABZ/14	1165423	6

Note:
Samples will be stored for a period of eight weeks following completion of analysis and acceptance of analytical report(s) at no extra cost after which samples will be disposed of unless a specific instruction is given (with the sample analysis request/order) to store the sample beyond this period. Extended storage charges will apply.

Result Analysis Report

Laboratory Code
1/ABZ/14 1165415

Measured:
24 March 2014 14:05:15

Sample Source & type:
Supplier = Aberdeen Harbour Board

Measured by:
analy

Analysed:
24 March 2014 14:05:16

Sample bulk lot ref:
1165415 = Run 1

Result Source:
Measurement

Particle Name:
Default

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.520

Absorption:
0.1

Size range:
0.020 to 2000.000 um

Obscuration:
15.15 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
0.844 %

Result Emulation:
Off

Concentration:
0.4910 %Vol

Span :
0.967

Uniformity:
0.304

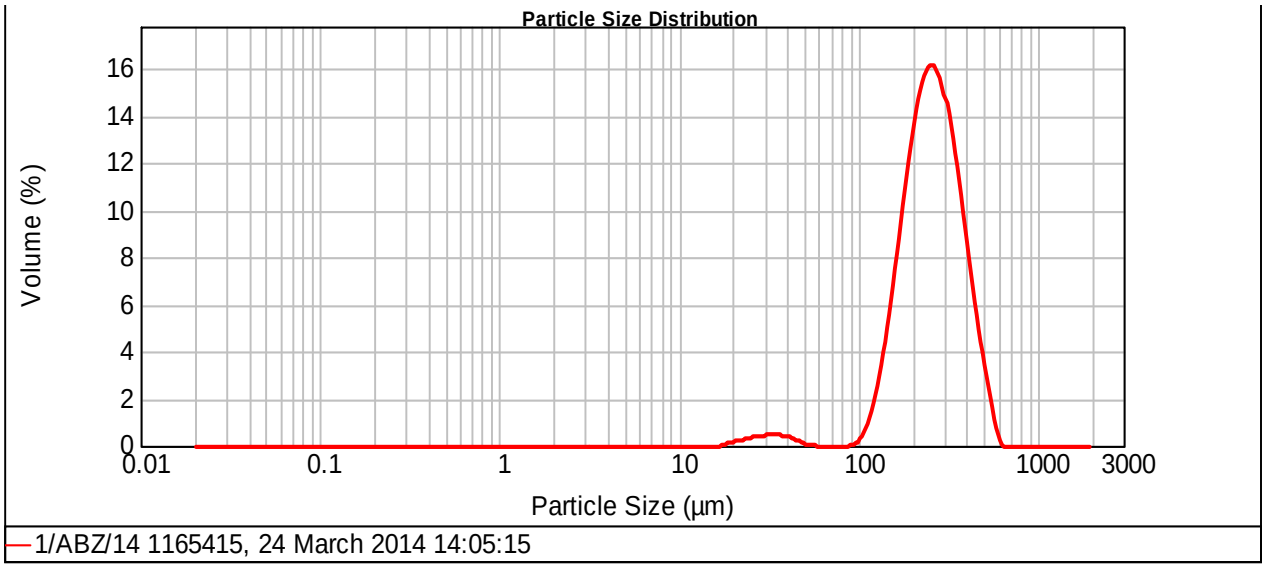
Result units:
Volume

Specific Surface Area:
0.0284 m²/g

Surface Weighted Mean D[3,2]:
211.283 um

Vol. Weighted Mean D[4,3]:
267.838 um

d(0.1): 157.217 um **d(0.5): 255.150 um** **d(0.9): 404.014 um**



Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.020	0.00	0.142	0.00	1.002	0.00	7.096	0.00	50.238	0.02	355.656	7.57
0.022	0.00	0.159	0.00	1.125	0.00	7.962	0.00	56.368	0.00	399.052	5.33
0.025	0.00	0.178	0.00	1.262	0.00	8.934	0.00	63.246	0.00	447.744	3.34
0.028	0.00	0.200	0.00	1.416	0.00	10.024	0.00	70.963	0.00	502.377	1.74
0.032	0.00	0.224	0.00	1.589	0.00	11.247	0.00	79.621	0.00	563.677	0.26
0.036	0.00	0.252	0.00	1.783	0.00	12.619	0.00	89.337	0.00	632.456	0.00
0.040	0.00	0.283	0.00	2.000	0.00	14.159	0.00	100.237	0.03	709.627	0.00
0.045	0.00	0.317	0.00	2.244	0.00	15.887	0.00	112.468	0.36	796.214	0.00
0.050	0.00	0.356	0.00	2.518	0.00	17.825	0.00	126.191	1.15	893.367	0.00
0.056	0.00	0.399	0.00	2.825	0.00	20.000	0.07	141.589	2.47	1002.374	0.00
0.063	0.00	0.448	0.00	3.170	0.00	22.440	0.14	158.866	4.35	1124.683	0.00
0.071	0.00	0.502	0.00	3.557	0.00	25.179	0.22	178.250	6.56	1261.915	0.00
0.080	0.00	0.564	0.00	3.991	0.00	28.251	0.28	200.000	8.84	1415.892	0.00
0.089	0.00	0.632	0.00	4.477	0.00	31.698	0.34	224.404	10.76	1588.656	0.00
0.100	0.00	0.710	0.00	5.024	0.00	35.566	0.35	251.785	11.94	1782.502	0.00
0.112	0.00	0.796	0.00	5.637	0.00	39.905	0.33	282.508	12.15	2000.000	0.00
0.126	0.00	0.893	0.00	6.325	0.00	44.774	0.25	316.979	11.34		
0.142		1.002		7.096		50.238	0.12	355.656	9.68		

Operator notes: *2014-18812*

Malvern Instruments Ltd.
Malvern, UK
Tel := +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 5.22
Serial Number : 34403-96

File name: 2014-18812-DM011(Data Used)
Record Number: 1
31/03/2014 11:26:46

Result Analysis Report

Laboratory Code
2/ABZ/14 1165416

Measured:
24 March 2014 14:11:16

Sample Source & type:
Supplier = Aberdeen Harbour Board

Measured by:
analy

Analysed:
24 March 2014 14:11:17

Sample bulk lot ref:
1165416 = Run 1

Result Source:
Measurement

Particle Name:
Default

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.520

Absorption:
0.1

Size range:
0.020 to 2000.000 um

Obscuration:
16.69 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
0.557 %

Result Emulation:
Off

Concentration:
0.0285 %Vol

Span :
5.623

Uniformity:
1.73

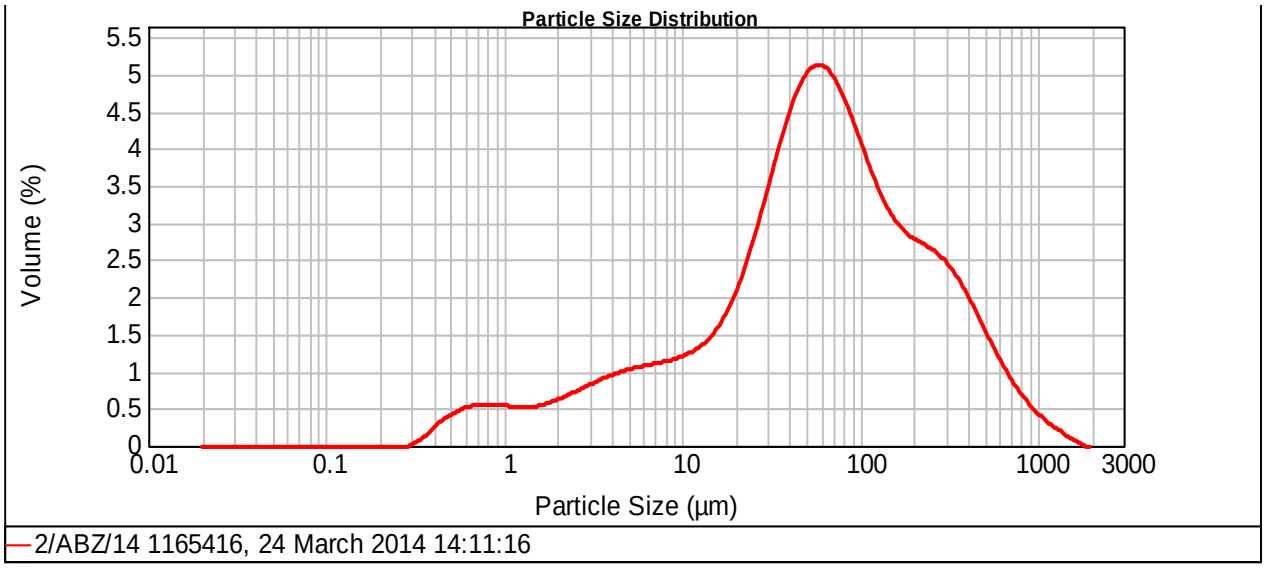
Result units:
Volume

Specific Surface Area:
0.654 m²/g

Surface Weighted Mean D[3,2]:
9.179 um

Vol. Weighted Mean D[4,3]:
127.372 um

d(0.1): 4.531 um **d(0.5): 59.396 um** **d(0.9): 338.536 um**



Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.020	0.00	0.142	0.00	1.002	0.40	7.096	0.84	50.238	3.83	355.656	1.62
0.022	0.00	0.159	0.00	1.125	0.39	7.962	0.87	56.368	3.86	399.052	1.45
0.025	0.00	0.178	0.00	1.262	0.39	8.934	0.89	63.246	3.79	447.744	1.27
0.028	0.00	0.200	0.00	1.416	0.40	10.024	0.93	70.963	3.65	502.377	1.08
0.032	0.00	0.224	0.00	1.589	0.42	11.247	0.98	79.621	3.45	563.677	0.90
0.036	0.00	0.252	0.00	1.783	0.45	12.619	1.05	89.337	3.21	632.456	0.74
0.040	0.00	0.283	0.01	2.000	0.49	14.159	1.15	100.237	2.96	709.627	0.60
0.045	0.00	0.317	0.07	2.244	0.53	15.887	1.28	112.468	2.72	796.214	0.48
0.050	0.00	0.356	0.15	2.518	0.58	17.825	1.46	126.191	2.51	893.367	0.37
0.056	0.00	0.399	0.23	2.825	0.62	20.000	1.68	141.589	2.33	1002.374	0.28
0.063	0.00	0.448	0.29	3.170	0.66	22.440	1.95	158.866	2.21	1124.683	0.21
0.071	0.00	0.502	0.35	3.557	0.70	25.179	2.26	178.250	2.13	1261.915	0.15
0.080	0.00	0.564	0.39	3.991	0.73	28.251	2.59	200.000	2.07	1415.892	0.08
0.089	0.00	0.632	0.41	4.477	0.76	31.698	2.92	224.404	2.02	1588.656	0.03
0.100	0.00	0.710	0.42	5.024	0.79	35.566	3.24	251.785	1.96	1782.502	0.00
0.112	0.00	0.796	0.42	5.637	0.81	39.905	3.51	282.508	1.88	2000.000	
0.126	0.00	0.893	0.41	6.325	0.83	44.774	3.71	316.979	1.76		
0.142		1.002		7.096		50.238		355.656			

Operator notes: *2014-18812*

Malvern Instruments Ltd.
Malvern, UK
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Mastersizer 2000 Ver. 5.22
Serial Number : 34403-96

File name: 2014-18812-DM011(Data Used)
Record Number: 2
31/03/2014 11:26:47

Result Analysis Report

Laboratory Code
3/ABZ/14 1165417

Measured:
24 March 2014 14:19:59

Sample Source & type:
Supplier = Aberdeen Harbour Board

Measured by:
analy

Analysed:
24 March 2014 14:20:00

Sample bulk lot ref:
1165417 = Run 1

Result Source:
Measurement

Particle Name:
Default

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.520

Absorption:
0.1

Size range:
0.020 to 2000.000 um

Obscuration:
15.37 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
0.474 %

Result Emulation:
Off

Concentration:
0.0359 %Vol

Span :
4.879

Uniformity:
1.43

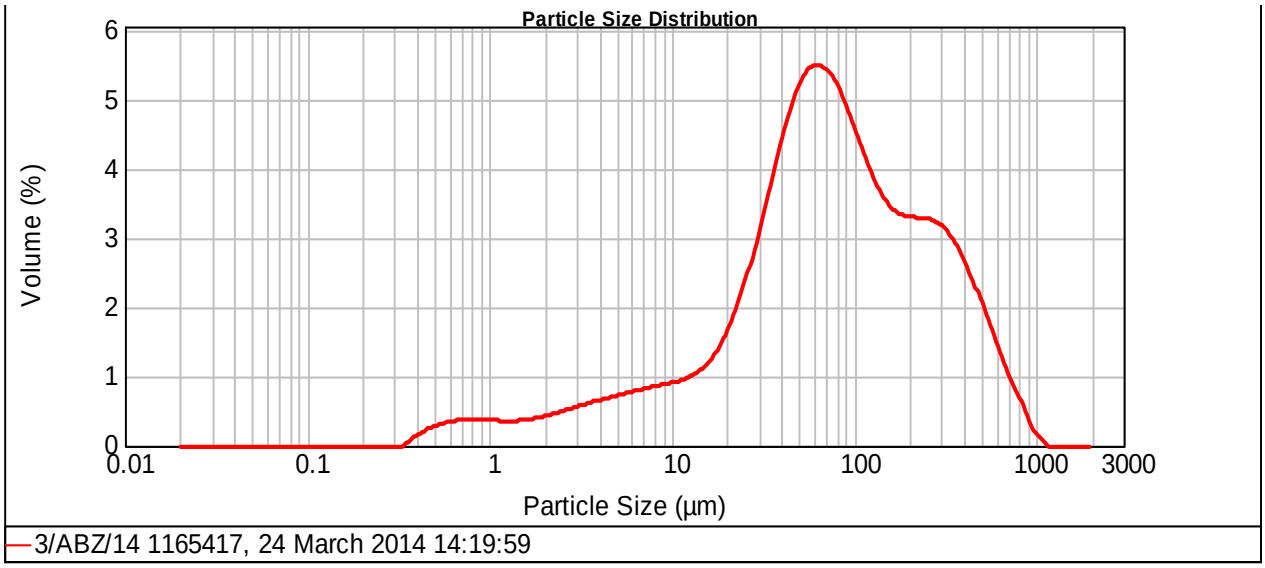
Result units:
Volume

Specific Surface Area:
0.459 m²/g

Surface Weighted Mean D[3,2]:
13.076 um

Vol. Weighted Mean D[4,3]:
137.587 um

d(0.1): 8.465 um **d(0.5): 73.071 um** **d(0.9): 364.970 um**



Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.020	0.00	0.142	0.00	1.002	0.28	7.096	0.63	50.238	4.04	355.656	2.14
0.022	0.00	0.159	0.00	1.125	0.27	7.962	0.66	56.368	4.14	399.052	1.93
0.025	0.00	0.178	0.00	1.262	0.27	8.934	0.68	63.246	4.14	447.744	1.68
0.028	0.00	0.200	0.00	1.416	0.28	10.024	0.70	70.963	4.03	502.377	1.41
0.032	0.00	0.224	0.00	1.589	0.29	11.247	0.74	79.621	3.84	563.677	1.13
0.036	0.00	0.252	0.00	1.783	0.31	12.619	0.78	89.337	3.59	632.456	0.87
0.040	0.00	0.283	0.00	2.000	0.34	14.159	0.86	100.237	3.32	709.627	0.63
0.045	0.00	0.317	0.00	2.244	0.36	15.887	0.97	112.468	3.06	796.214	0.45
0.050	0.00	0.356	0.00	2.518	0.39	17.825	1.13	126.191	2.84	893.367	0.19
0.056	0.00	0.399	0.09	2.825	0.42	20.000	1.34	141.589	2.67	1002.374	0.07
0.063	0.00	0.448	0.14	3.170	0.45	22.440	1.62	158.866	2.56	1124.683	0.00
0.071	0.00	0.502	0.20	3.557	0.48	25.179	1.95	178.250	2.50	1261.915	0.00
0.080	0.00	0.564	0.23	3.991	0.51	28.251	2.34	200.000	2.49	1415.892	0.00
0.089	0.00	0.632	0.26	4.477	0.54	31.698	2.74	224.404	2.48	1588.656	0.00
0.100	0.00	0.710	0.28	5.024	0.56	35.566	3.14	251.785	2.46	1782.502	0.00
0.112	0.00	0.796	0.29	5.637	0.59	39.905	3.52	282.508	2.40	2000.000	0.00
0.126	0.00	0.893	0.29	6.325	0.61	44.774	3.82	316.979	2.30		
0.142	0.00	1.002	0.28	7.096	0.61	50.238	3.82	355.656	2.30		

Operator notes: *2014-18812*

Malvern Instruments Ltd.
Malvern, UK
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Mastersizer 2000 Ver. 5.22
Serial Number : 34403-96

File name: 2014-18812-DM011(Data Used)
Record Number: 3
31/03/2014 11:26:47

Result Analysis Report

Laboratory Code
4/ABZ/14 1165418

Measured:
24 March 2014 14:28:37

Sample Source & type:
Supplier = Aberdeen Harbour Board

Measured by:
analy

Analysed:
24 March 2014 14:28:38

Sample bulk lot ref:
1165418 = Run 1

Result Source:
Measurement

Particle Name:
Default

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.520

Absorption:
0.1

Size range:
0.020 to 2000.000 um

Obscuration:
19.07 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
0.515 %

Result Emulation:
Off

Concentration:
0.0365 %Vol

Span :
5.385

Uniformity:
1.64

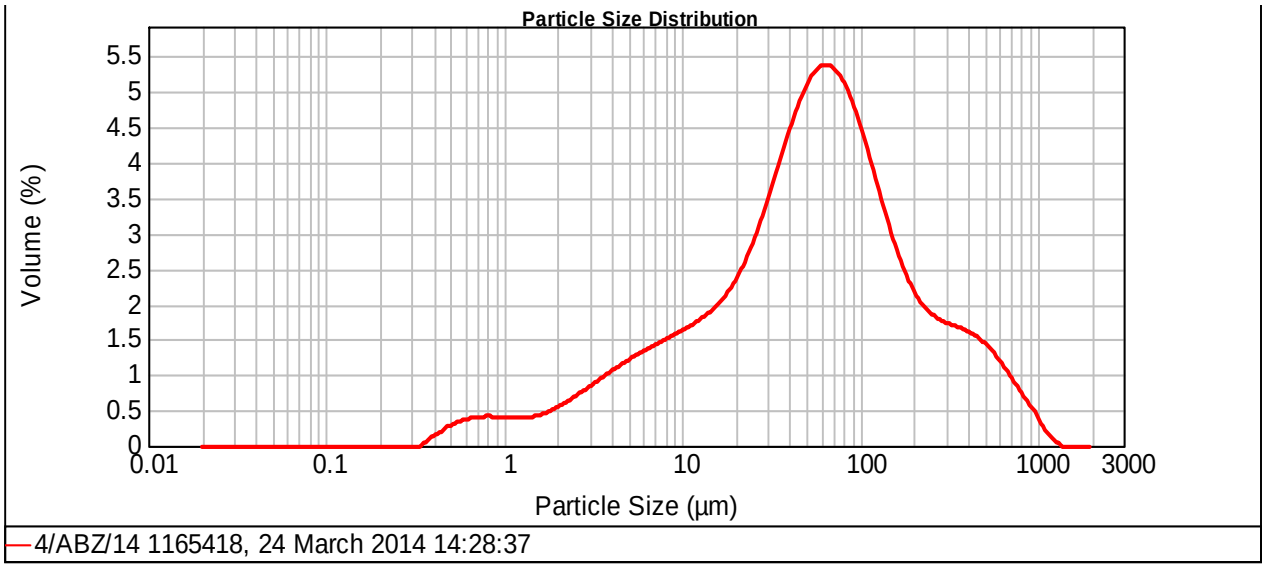
Result units:
Volume

Specific Surface Area:
0.55 m²/g

Surface Weighted Mean D[3,2]:
10.905 um

Vol. Weighted Mean D[4,3]:
113.069 um

d(0.1): 5.362 um **d(0.5): 55.115 um** **d(0.9): 302.134 um**



Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.020	0.00	0.142	0.00	1.002	0.30	7.096	1.11	50.238	3.93	355.656	1.24
0.022	0.00	0.159	0.00	1.125	0.30	7.962	1.16	56.368	4.04	399.052	1.20
0.025	0.00	0.178	0.00	1.262	0.30	8.934	1.21	63.246	4.05	447.744	1.13
0.028	0.00	0.200	0.00	1.416	0.32	10.024	1.26	70.963	3.97	502.377	1.04
0.032	0.00	0.224	0.00	1.589	0.35	11.247	1.32	79.621	3.79	563.677	0.93
0.036	0.00	0.252	0.00	1.783	0.39	12.619	1.38	89.337	3.55	632.456	0.80
0.040	0.00	0.283	0.00	2.000	0.44	14.159	1.46	100.237	3.25	709.627	0.65
0.045	0.00	0.317	0.00	2.244	0.50	15.887	1.56	112.468	2.91	796.214	0.51
0.050	0.00	0.356	0.00	2.518	0.57	17.825	1.70	126.191	2.57	893.367	0.38
0.056	0.00	0.399	0.08	2.825	0.63	20.000	1.86	141.589	2.25	1002.374	0.21
0.063	0.00	0.448	0.13	3.170	0.70	22.440	2.07	158.866	1.97	1124.683	0.10
0.071	0.00	0.502	0.20	3.557	0.77	25.179	2.32	178.250	1.74	1261.915	0.00
0.080	0.00	0.564	0.24	3.991	0.83	28.251	2.60	200.000	1.57	1415.892	0.00
0.089	0.00	0.632	0.28	4.477	0.89	31.698	2.90	224.404	1.44	1588.656	0.00
0.100	0.00	0.710	0.30	5.024	0.95	35.566	3.21	251.785	1.36	1782.502	0.00
0.112	0.00	0.796	0.31	5.637	1.00	39.905	3.50	282.508	1.31	2000.000	
0.126	0.00	0.893	0.31	6.325	1.06	44.774	3.75	316.979	1.28		
0.142		1.002	0.31	7.096		50.238		355.656			

Operator notes: *2014-18812*

Malvern Instruments Ltd.
Malvern, UK
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Mastersizer 2000 Ver. 5.22
Serial Number : 34403-96

File name: 2014-18812-DM011(Data Used)
Record Number: 4
31/03/2014 11:26:47

Result Analysis Report

Laboratory Code
5/ABZ/14 1165419

Measured:
24 March 2014 14:35:17

Sample Source & type:
Supplier = Aberdeen Harbour Board

Measured by:
analy

Analysed:
24 March 2014 14:35:19

Sample bulk lot ref:
1165419 = Run 1

Result Source:
Measurement

Particle Name:
Default

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.520

Absorption:
0.1

Size range:
0.020 to 2000.000 um

Obscuration:
16.59 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
0.714 %

Result Emulation:
Off

Concentration:
0.0202 %Vol

Span :
4.578

Uniformity:
1.85

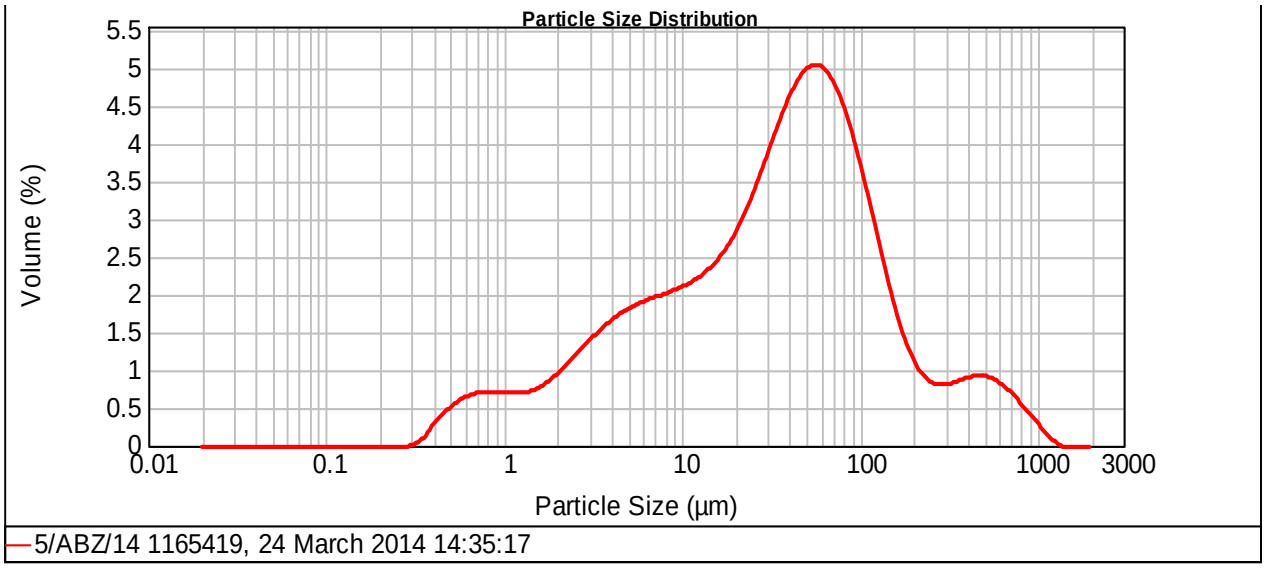
Result units:
Volume

Specific Surface Area:
0.885 m²/g

Surface Weighted Mean D[3,2]:
6.781 um

Vol. Weighted Mean D[4,3]:
80.681 um

d(0.1): 2.825 um **d(0.5): 36.555 um** **d(0.9): 170.161 um**



Size (µm)	Volume In %
0.020	0.00
0.022	0.00
0.025	0.00
0.028	0.00
0.032	0.00
0.036	0.00
0.040	0.00
0.045	0.00
0.050	0.00
0.056	0.00
0.063	0.00
0.071	0.00
0.080	0.00
0.089	0.00
0.100	0.00
0.112	0.00
0.126	0.00
0.142	

Size (µm)	Volume In %
0.142	0.00
0.159	0.00
0.178	0.00
0.200	0.00
0.224	0.00
0.252	0.00
0.283	0.01
0.317	0.06
0.356	0.17
0.399	0.28
0.448	0.36
0.502	0.43
0.564	0.49
0.632	0.52
0.710	0.54
0.796	0.54
0.893	0.53
1.002	

Size (µm)	Volume In %
1.002	0.53
1.125	0.52
1.262	0.54
1.416	0.57
1.589	0.62
1.783	0.69
2.000	0.77
2.244	0.87
2.518	0.96
2.825	1.05
3.170	1.14
3.557	1.22
3.991	1.29
4.477	1.35
5.024	1.40
5.637	1.44
6.325	1.47
7.096	

Size (µm)	Volume In %
7.096	1.50
7.962	1.54
8.934	1.57
10.024	1.61
11.247	1.67
12.619	1.73
14.159	1.82
15.887	1.93
17.825	2.06
20.000	2.23
22.440	2.44
25.179	2.66
28.251	2.91
31.698	3.16
35.566	3.39
39.905	3.59
44.774	3.73
50.238	

Size (µm)	Volume In %
50.238	3.80
56.368	3.79
63.246	3.70
70.963	3.53
79.621	3.29
89.337	2.98
100.237	2.63
112.468	2.24
126.191	1.87
141.589	1.50
158.866	1.19
178.250	0.95
200.000	0.77
224.404	0.66
251.785	0.61
282.508	0.61
316.979	0.63
355.656	

Size (µm)	Volume In %
355.656	0.67
399.052	0.69
447.744	0.70
502.377	0.68
563.677	0.64
632.456	0.57
709.627	0.48
796.214	0.37
893.367	0.28
1002.374	0.15
1124.683	0.07
1261.915	0.00
1415.892	0.00
1588.656	0.00
1782.502	0.00
2000.000	

Operator notes: *2014-18812*

Malvern Instruments Ltd.
Malvern, UK
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Mastersizer 2000 Ver. 5.22
Serial Number : 34403-96

File name: 2014-18812-DM011(Data Used)
Record Number: 5
31/03/2014 11:26:48

Result Analysis Report

Laboratory Code
6/ABZ/14 1165420

Measured:
24 March 2014 14:45:15

Sample Source & type:
Supplier = Aberdeen Harbour Board

Measured by:
analy

Analysed:
24 March 2014 14:45:16

Sample bulk lot ref:
1165420 = Run 1

Result Source:
Measurement

Particle Name:
Default

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.520

Absorption:
0.1

Size range:
0.020 to 2000.000 um

Obscuration:
15.68 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
0.789 %

Result Emulation:
Off

Concentration:
0.0186 %Vol

Span :
3.546

Uniformity:
1.26

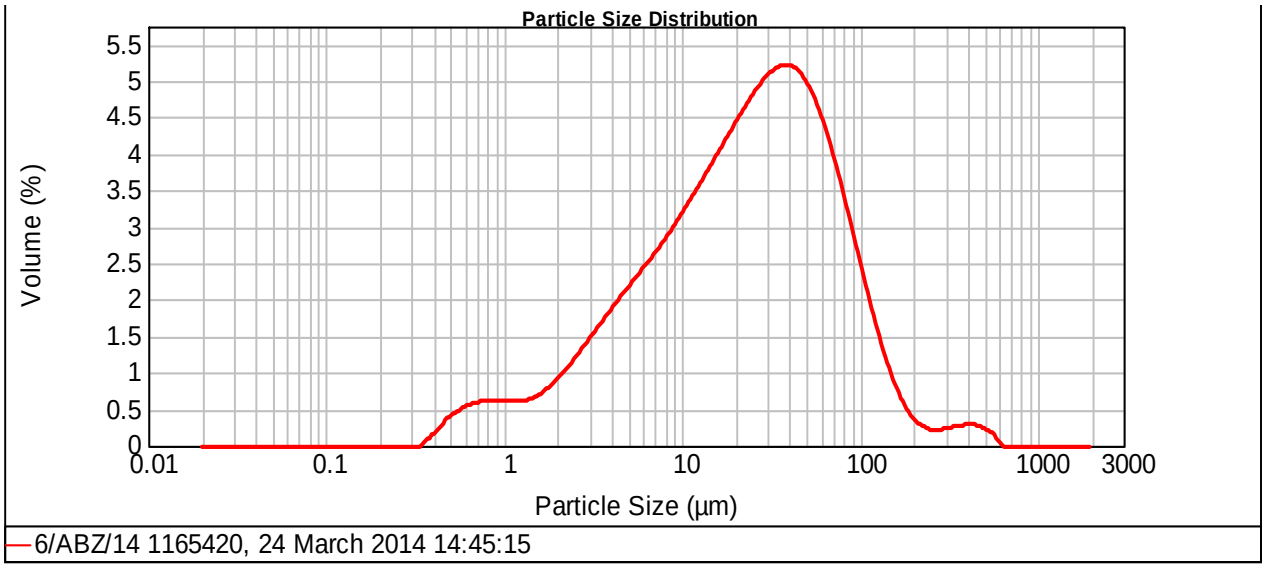
Result units:
Volume

Specific Surface Area:
0.851 m²/g

Surface Weighted Mean D[3,2]:
7.047 um

Vol. Weighted Mean D[4,3]:
39.678 um

d(0.1): 3.177 um **d(0.5): 23.618 um** **d(0.9): 86.919 um**



Size (µm)	Volume In %
0.020	0.00
0.022	0.00
0.025	0.00
0.028	0.00
0.032	0.00
0.036	0.00
0.040	0.00
0.045	0.00
0.050	0.00
0.056	0.00
0.063	0.00
0.071	0.00
0.080	0.00
0.089	0.00
0.100	0.00
0.112	0.00
0.126	0.00
0.142	

Size (µm)	Volume In %
0.142	0.00
0.159	0.00
0.178	0.00
0.200	0.00
0.224	0.00
0.252	0.00
0.283	0.00
0.317	0.00
0.356	0.00
0.399	0.09
0.448	0.17
0.502	0.29
0.564	0.35
0.632	0.41
0.710	0.44
0.796	0.46
0.893	0.46
1.002	0.46

Size (µm)	Volume In %
1.002	0.45
1.125	0.46
1.262	0.48
1.416	0.51
1.589	0.57
1.783	0.66
2.000	0.75
2.244	0.86
2.518	0.98
2.825	1.11
3.170	1.23
3.557	1.36
3.991	1.48
4.477	1.60
5.024	1.71
5.637	1.83
6.325	1.95
7.096	

Size (µm)	Volume In %
7.096	2.07
7.962	2.20
8.934	2.34
10.024	2.49
11.247	2.64
12.619	2.79
14.159	2.95
15.887	3.11
17.825	3.27
20.000	3.42
22.440	3.57
25.179	3.71
28.251	3.82
31.698	3.90
35.566	3.93
39.905	3.91
44.774	3.81
50.238	

Size (µm)	Volume In %
50.238	3.65
56.368	3.43
63.246	3.14
70.963	2.81
79.621	2.44
89.337	2.07
100.237	1.69
112.468	1.33
126.191	1.01
141.589	0.72
158.866	0.50
178.250	0.34
200.000	0.23
224.404	0.18
251.785	0.17
282.508	0.18
316.979	0.20
355.656	

Size (µm)	Volume In %
355.656	0.21
399.052	0.22
447.744	0.20
502.377	0.16
563.677	0.05
632.456	0.00
709.627	0.00
796.214	0.00
893.367	0.00
1002.374	0.00
1124.683	0.00
1261.915	0.00
1415.892	0.00
1588.656	0.00
1782.502	0.00
2000.000	

Operator notes: *2014-18812*

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Mastersizer 2000 Ver. 5.22
Serial Number : 34403-96

File name: 2014-18812-DM011(Data Used)
Record Number: 6
31/03/2014 11:26:48

Result Analysis Report

Laboratory Code
7/ABZ/14 1165421

Measured:
24 March 2014 14:51:16

Sample Source & type:
Supplier = Aberdeen Harbour Board

Measured by:
analy

Analysed:
24 March 2014 14:51:17

Sample bulk lot ref:
1165421 = Run 1

Result Source:
Measurement

Particle Name:
Default

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.520

Absorption:
0.1

Size range:
0.020 to 2000.000 um

Obscuration:
16.14 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
0.591 %

Result Emulation:
Off

Concentration:
0.0272 %Vol

Span :
9.202

Uniformity:
2.48

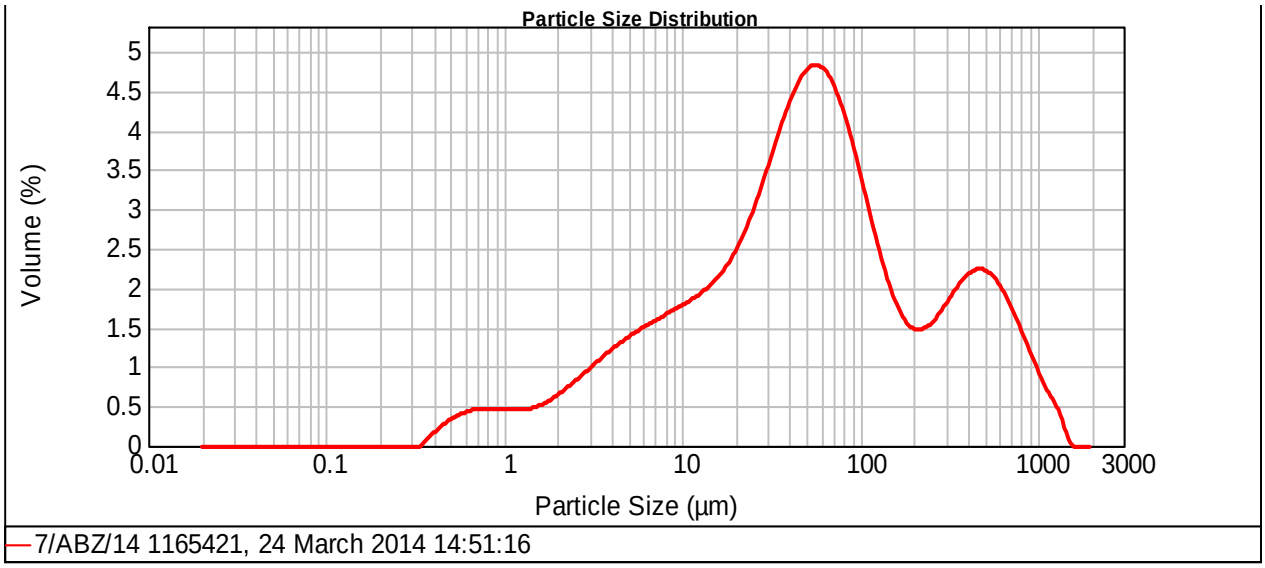
Result units:
Volume

Specific Surface Area:
0.617 m²/g

Surface Weighted Mean D[3,2]:
9.721 um

Vol. Weighted Mean D[4,3]:
145.659 um

d(0.1): 4.496 um **d(0.5): 50.777 um** **d(0.9): 471.733 um**



Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.020	0.00	0.142	0.00	1.002	0.34	7.096	1.23	50.238	3.63	355.656	1.58
0.022	0.00	0.159	0.00	1.125	0.34	7.962	1.27	56.368	3.63	399.052	1.66
0.025	0.00	0.178	0.00	1.262	0.35	8.934	1.32	63.246	3.53	447.744	1.69
0.028	0.00	0.200	0.00	1.416	0.37	10.024	1.37	70.963	3.34	502.377	1.65
0.032	0.00	0.224	0.00	1.589	0.41	11.247	1.42	79.621	3.07	563.677	1.55
0.036	0.00	0.252	0.00	1.783	0.46	12.619	1.49	89.337	2.76	632.456	1.41
0.040	0.00	0.283	0.00	2.000	0.52	14.159	1.57	100.237	2.41	709.627	1.22
0.045	0.00	0.317	0.00	2.244	0.59	15.887	1.67	112.468	2.06	796.214	1.02
0.050	0.00	0.356	0.00	2.518	0.66	17.825	1.80	126.191	1.74	893.367	0.81
0.056	0.00	0.399	0.10	2.825	0.74	20.000	1.96	141.589	1.47	1002.374	0.62
0.063	0.00	0.448	0.16	3.170	0.81	22.440	2.16	158.866	1.27	1124.683	0.45
0.071	0.00	0.502	0.24	3.557	0.89	25.179	2.39	178.250	1.15	1261.915	0.30
0.080	0.00	0.564	0.28	3.991	0.95	28.251	2.65	200.000	1.11	1415.892	0.04
0.089	0.00	0.632	0.32	4.477	1.02	31.698	2.91	224.404	1.14	1588.656	0.00
0.100	0.00	0.710	0.34	5.024	1.08	35.566	3.17	251.785	1.22	1782.502	0.00
0.112	0.00	0.796	0.36	5.637	1.13	39.905	3.39	282.508	1.34	2000.000	
0.126	0.00	0.893	0.36	6.325	1.18	44.774	3.55	316.979	1.47		
0.142		1.002	0.35	7.096		50.238		355.656			

Operator notes: *2014-18812*

Result Analysis Report

Laboratory Code
8/ABZ/14 1165422

Measured:
24 March 2014 14:57:11

Sample Source & type:
Supplier = Aberdeen Harbour Board

Measured by:
analy

Analysed:
24 March 2014 14:57:12

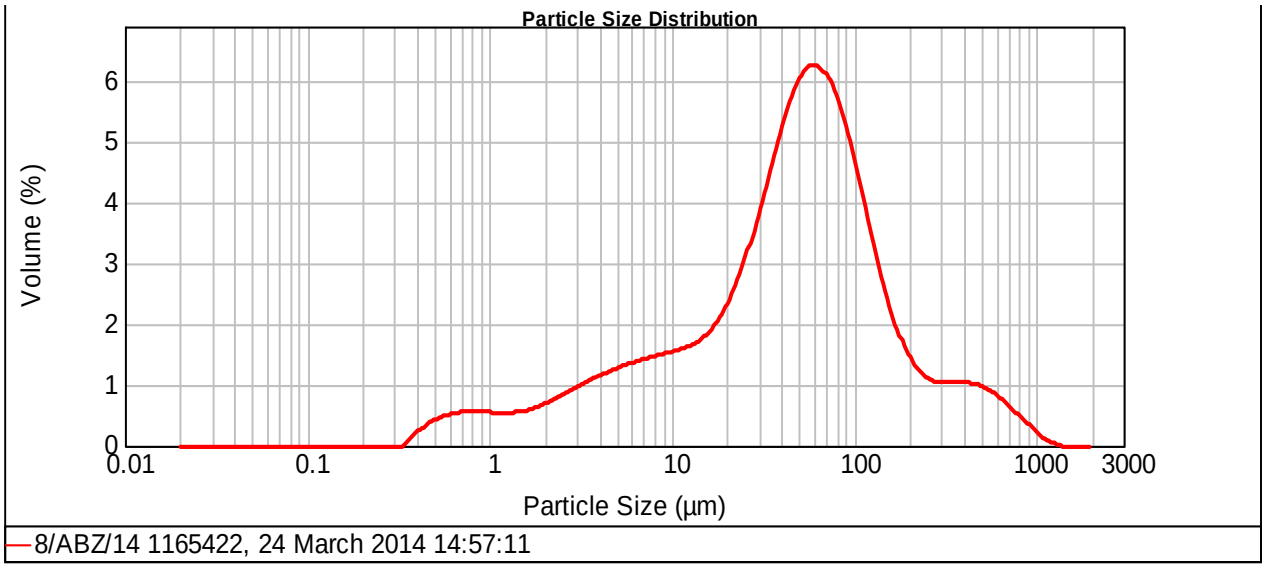
Sample bulk lot ref:
1165422 = Run 1

Result Source:
Measurement

Particle Name: Default	**Accessory Name:** Hydro 2000G (A)	**Analysis model:** General purpose	**Sensitivity:** Normal
Particle RI: 1.520	**Absorption:** 0.1	**Size range:** 0.020 to 2000.000 um	**Obscuration:** 15.69 %
Dispersant Name: Water	**Dispersant RI:** 1.330	**Weighted Residual:** 0.584 %	**Result Emulation:** Off

Concentration: 0.0246 %Vol	**Span :** 3.845	**Uniformity:** 1.41	**Result units:** Volume
Specific Surface Area: 0.679 m²/g	**Surface Weighted Mean D[3,2]:** 8.832 um	**Vol. Weighted Mean D[4,3]:** 89.469 um	

d(0.1): 4.101 um **d(0.5): 48.913 um** **d(0.9): 192.159 um**



Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.020	0.00	0.142	0.00	1.002	0.41	7.096	1.09	50.238	4.63	355.656	0.79
0.022	0.00	0.159	0.00	1.125	0.41	7.962	1.12	56.368	4.71	399.052	0.78
0.025	0.00	0.178	0.00	1.262	0.41	8.934	1.15	63.246	4.65	447.744	0.75
0.028	0.00	0.200	0.00	1.416	0.43	10.024	1.18	70.963	4.46	502.377	0.70
0.032	0.00	0.224	0.00	1.589	0.46	11.247	1.22	79.621	4.15	563.677	0.63
0.036	0.00	0.252	0.00	1.783	0.50	12.619	1.27	89.337	3.75	632.456	0.54
0.040	0.00	0.283	0.00	2.000	0.55	14.159	1.35	100.237	3.29	709.627	0.43
0.045	0.00	0.317	0.00	2.244	0.60	15.887	1.46	112.468	2.80	796.214	0.32
0.050	0.00	0.356	0.00	2.518	0.66	17.825	1.63	126.191	2.32	893.367	0.24
0.056	0.00	0.399	0.13	2.825	0.72	20.000	1.85	141.589	1.87	1002.374	0.12
0.063	0.00	0.448	0.20	3.170	0.78	22.440	2.14	158.866	1.50	1124.683	0.05
0.071	0.00	0.502	0.29	3.557	0.84	25.179	2.48	178.250	1.21	1261.915	0.00
0.080	0.00	0.564	0.34	3.991	0.89	28.251	2.88	200.000	1.01	1415.892	0.00
0.089	0.00	0.632	0.38	4.477	0.94	31.698	3.30	224.404	0.88	1588.656	0.00
0.100	0.00	0.710	0.41	5.024	0.98	35.566	3.72	251.785	0.81	1782.502	0.00
0.112	0.00	0.796	0.42	5.637	1.02	39.905	4.11	282.508	0.78	2000.000	
0.126	0.00	0.893	0.43	6.325	1.06	44.774	4.42	316.979	0.78		
0.142		1.002	0.42	7.096		50.238		355.656			

Operator notes: *2014-18812*

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Mastersizer 2000 Ver. 5.22
Serial Number : 34403-96

File name: 2014-18812-DM011(Data Used)
Record Number: 8
31/03/2014 11:26:49

Result Analysis Report

Laboratory Code
9/ABZ/14 1165423

Measured:
24 March 2014 15:03:00

Sample Source & type:
Supplier = Aberdeen Harbour Board

Measured by:
analy

Analysed:
24 March 2014 15:03:01

Sample bulk lot ref:
1165423 = Run 1

Result Source:
Measurement

Particle Name:	Accessory Name:	Analysis model:	Sensitivity:
Default	Hydro 2000G (A)	General purpose	Normal
Particle RI:	**Absorption:**	**Size range:**	**Obscuration:**
1.520	0.1	0.020 to 2000.000 um	15.94 %
Dispersant Name:	**Dispersant RI:**	**Weighted Residual:**	**Result Emulation:**
Water	1.330	0.598 %	Off

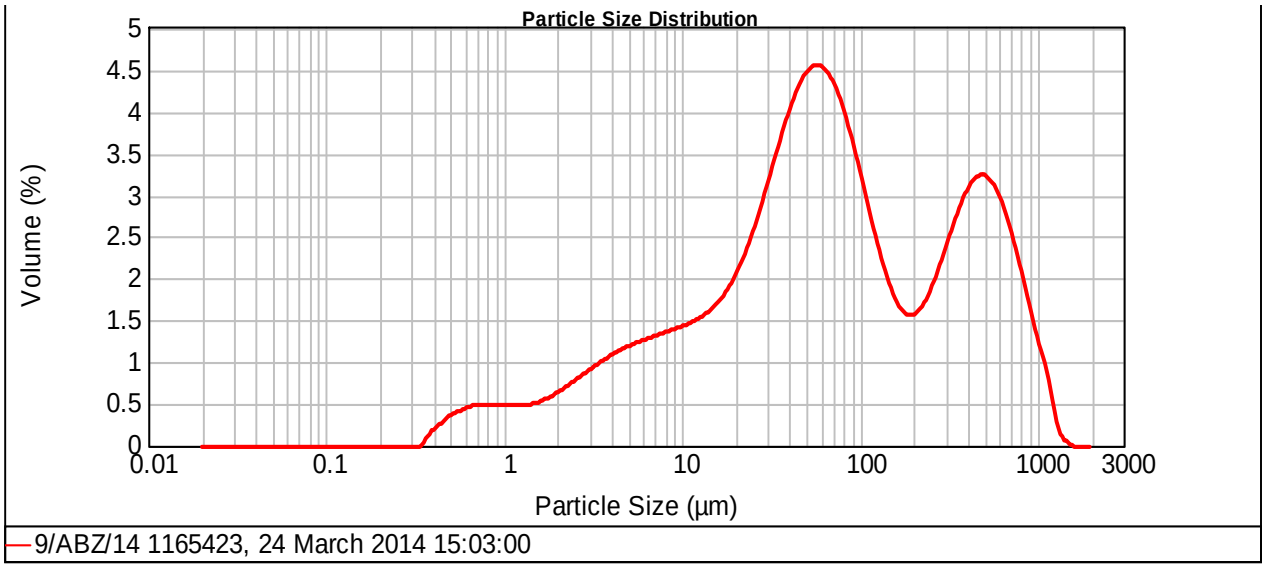
Concentration:	Span :	Uniformity:	Result units:
0.0279 %Vol	9.129	2.53	Volume

Specific Surface Area: 0.609 m²/g

Surface Weighted Mean D[3,2]: 9.857 um

Vol. Weighted Mean D[4,3]: 179.018 um

d(0.1): 4.582 um **d(0.5): 61.294 um** **d(0.9): 564.124 um**



Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.020	0.00	0.142	0.00	1.002	0.37	7.096	1.01	50.238	3.42	355.656	2.22
0.022	0.00	0.159	0.00	1.125	0.36	7.962	1.04	56.368	3.43	399.052	2.38
0.025	0.00	0.178	0.00	1.262	0.37	8.934	1.06	63.246	3.34	447.744	2.44
0.028	0.00	0.200	0.00	1.416	0.39	10.024	1.10	70.963	3.17	502.377	2.41
0.032	0.00	0.224	0.00	1.589	0.42	11.247	1.13	79.621	2.92	563.677	2.28
0.036	0.00	0.252	0.00	1.783	0.46	12.619	1.18	89.337	2.62	632.456	2.06
0.040	0.00	0.283	0.00	2.000	0.51	14.159	1.25	100.237	2.28	709.627	1.76
0.045	0.00	0.317	0.00	2.244	0.57	15.887	1.35	112.468	1.95	796.214	1.44
0.050	0.00	0.356	0.00	2.518	0.63	17.825	1.47	126.191	1.64	893.367	1.10
0.056	0.00	0.399	0.12	2.825	0.69	20.000	1.64	141.589	1.40	1002.374	0.81
0.063	0.00	0.448	0.18	3.170	0.74	22.440	1.84	158.866	1.24	1124.683	0.46
0.071	0.00	0.502	0.26	3.557	0.80	25.179	2.08	178.250	1.18	1261.915	0.10
0.080	0.00	0.564	0.30	3.991	0.84	28.251	2.36	200.000	1.21	1415.892	0.02
0.089	0.00	0.632	0.34	4.477	0.89	31.698	2.64	224.404	1.34	1588.656	0.00
0.100	0.00	0.710	0.36	5.024	0.92	35.566	2.91	251.785	1.53	1782.502	0.00
0.112	0.00	0.796	0.38	5.637	0.95	39.905	3.14	282.508	1.77	2000.000	
0.126	0.00	0.893	0.38	6.325	0.98	44.774	3.32	316.979	2.01		
0.142		1.002	0.37	7.096		50.238		355.656			

Operator notes: *2014-18812*

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Mastersizer 2000 Ver. 5.22
Serial Number : 34403-96

File name: 2014-18812-DM011(Data Used)
Record Number: 9
31/03/2014 11:26:49

Appendix 4

Marine Scotland sediment sampling analysis of maintenance dredged material from Aberdeen Harbour (1988 – 2012)

Marine Scotland sampling: Aberdeen Harbour maintenance dredging heavy metal results 1988 - 2012

NA = Not Analysed; ND = Not Detected; BDL = Below Detection Limit **Location I**	**Location II**	**LIMS/UKAS No.**	**Lab Sample No.**	**Latitude**	**Longitude**	**Oslo Dump**	**Year**	**As mg/g**	**Cd mg/g**	**Cr mg/g**	**Cu mg/g**	**Hg mg/g**	**Ni mg/g**	**Pb mg/g**	**Zn mg/g**
Aberdeen						CR110	1988	4.30	1.540	10.80	4.12	0.010	6.19	26.00	27.30
Aberdeen						CR110	1988	5.73	1.550	6.89	0.50	0.010	2.22	16.90	14.00
Aberdeen						CR110	1988	3.69	1.860	8.24	0.50	0.010	2.66	20.20	16.80
Aberdeen						CR110	1989	4.90	0.200	18.30	6.55	0.060	7.63	17.90	40.20
Aberdeen						CR110	1989	4.58	0.200	17.90	9.03	0.070	8.91	24.30	97.80
Aberdeen						CR110	1989	4.25	0.620	23.10	10.40	0.100	11.60	27.70	57.30
Aberdeen						CR110	1989	4.81	0.200	27.80	10.40	0.090	12.50	32.80	64.50
Aberdeen						CR110	1989	7.09	1.460	15.10	18.20	0.500	16.50	44.00	128.00
Aberdeen						CR110	1989	4.59	0.200	32.40	19.20	0.100	13.50	31.30	99.20
Aberdeen						CR110	1989	5.24	0.200	24.50	21.20	0.100	10.30	28.50	83.90
Aberdeen						CR110	1989	5.94	0.200	13.80	2.45	0.050	4.50	17.30	24.60
Aberdeen						CR110	1989	6.47	0.200	32.30	13.30	0.100	15.40	41.70	89.70
Aberdeen	A bert Quay					CR110	1990	6.24	0.518	36.20	69.70	0.654	28.20	133.00	274.00
Aberdeen	A bert Quay					CR110	1990	4.70	0.713	38.50	67.00	0.377	25.40	139.00	315.00
Aberdeen						CR110	1990	1.39	0.200	47.20	36.00	0.020	37.70	27.70	101.00
Aberdeen						CR110	1990	1.13	0.200	38.90	35.80	0.009	38.00	26.30	104.00
Aberdeen						CR110	1990	5.93	0.200	20.80	39.20	1.010	23.60	978.00	137.00
Aberdeen						CR110	1990	3.13	0.200	15.50	7.29	0.072	11.40	16.60	47.70
Aberdeen						CR110	1990	4.54	0.200	24.20	19.40	0.132	18.20	36.60	89.40
Aberdeen						CR110	1990	2.07	0.200	16.70	8.67	0.078	11.60	16.00	49.40
Aberdeen						CR110	1990	6.89	0.262	22.00	22.60	0.129	18.50	38.90	111.00
Aberdeen						CR110	1990	7.53	0.481	25.00	30.40	0.151	20.20	43.60	127.00
Aberdeen						CR110	1990	7.27	0.737	24.00	48.80	0.220	19.10	51.00	157.00
Aberdeen						CR110	1990	4.72	0.304	19.00	16.30	0.097	14.40	32.60	82.50
Aberdeen	Mearns Quay					CR110	1990	0.34	0.200	10.90	12.60	0.013	12.00	10.00	34.60
Aberdeen	Mearns Quay					CR110	1990	0.48	0.200	7.07	7.90	0.014	6.36	10.70	25.30
Aberdeen	Mearns Quay					CR110	1990	2.28	0.200	12.30	12.70	0.033	8.60	18.30	52.60
Aberdeen	Mearns Quay					CR110	1990	4.96	0.200	20.20	16.30	0.029	5.10	13.00	52.70
Aberdeen	Mearns Quay					CR110	1990	3.11	0.200	19.60	18.60	0.122	16.00	18.90	67.60
Aberdeen	Mearns Quay					CR110	1990	0.92	0.200	9.31	7.30	0.005	7.72	10.70	23.30
Aberdeen	Navigation Channel					CR110	1991	7.51	0.200	19.60	14.40	1.330	20.40	36.90	73.60
Aberdeen	Navigation Channel					CR110	1991	8.81	0.200	20.80	20.50	0.170	20.70	45.70	94.50
Aberdeen	Navigation Channel					CR110	1991	6.07	0.430	16.80	13.50	0.010	17.10	23.80	71.00
Aberdeen						CR110	1991	5.99	0.425	20.00	17.10	0.010	18.70	23.00	87.20
Aberdeen						CR110	1991	7.16	0.200	21.70	9.38	0.010	10.70	21.90	89.80
Aberdeen						CR110	1991	8.93	0.400	21.40	21.60	1.390	18.90	38.50	99.10
Aberdeen						CR110	1991	7.19	0.200	20.50	23.80	1.530	25.70	49.40	104.00
Aberdeen						CR110	1991	5.43	0.330	18.70	19.60	0.010	19.00	36.20	93.80
Aberdeen						CR110	1991	8.81	1.030	23.20	52.10	0.153	24.70	76.90	180.00
Aberdeen						CR110	1991	4.75	0.200	11.70	5.78	0.010	31.00	23.40	36.70
Aberdeen	A bert Quay West					CR110	1992	30.30	1.700	34.00	97.30	0.490	21.80	89.10	505.00
Aberdeen	A bert Quay					CR110	1992	11.30	0.500	21.40	30.30	0.170	13.00	38.50	104.00
Aberdeen	A bert Quay East					CR110	1992	6.19	0.500	19.50	20.00	0.130	15.60	33.50	94.30
Aberdeen	A bert Quay West					CR110	1992	11.50	0.590	27.50	71.70	0.450	20.10	81.40	354.00
Aberdeen	Tug Jetty					CR110	1992	15.20	0.500	21.10	27.00	0.230	15.00	36.50	112.00
Aberdeen	Pontoon No 4					CR110	1992	18.50	0.500	25.90	170.00	0.330	12.90	58.00	327.00
Aberdeen	Pontoon No 4					CR110	1992	21.10	0.860	27.80	187.00	1.010	20.20	97.20	371.00
Aberdeen	Tug Jetty					CR110	1992	8.33	0.500	20.30	29.30	0.360	15.60	36.60	123.00
Aberdeen	Upper Quay					CR110	1992	9.75	0.500	24.80	58.50	0.400	15.50	95.60	248.00
Aberdeen	Trinity Quay					CR110	1992	8.90	0.570	22.20	57.60	0.650	16.10	124.00	275.00
Aberdeen	Entrance Channel					CR110	1992	5.69	0.500	16.70	11.80	0.130	12.20	23.80	67.90
Aberdeen	Entrance Channel					CR110	1992	5.86	0.500	17.80	12.60	0.050	14.40	30.00	78.60
Aberdeen	Approach Channel					CR110	1992	5.66	0.500	20.00	14.20	0.200	15.10	27.60	78.50
Aberdeen	Pacific Wharf					CR110	1992	7.08	0.500	20.00	25.70	0.200	16.00	42.70	110.00
Aberdeen	Atlantic Wharf					CR110	1992	4.36	0.500	21.60	41.50	0.200	18.60	41.50	56.00
Aberdeen	Approach Channel					CR110	1992	5.68	0.500	13.80	6.06	0.130	10.00	14.80	40.20
Aberdeen	A bert Basin					CR110	1992	22.00	0.500	23.10	35.60	0.220	17.80	45.60	137.00

NA = Not Analysed; ND = Not Detected; BDL = Below Detection Limit **Location I**	**Location II**	**LIMS/UKAS No.**	**Lab Sample No.**	**Latitude**	**Longitude**	**Oslo Dump**	**Year**	**As mg/g**	**Cd mg/g**	**Cr mg/g**	**Cu mg/g**	**Hg mg/g**	**Ni mg/g**	**Pb mg/g**	**Zn mg/g**
Aberdeen	Mearns Quay					CR110	1992	15.90	0.500	17.50	19.00	0.100	13.20	43.50	104.00
Aberdeen	Victoria Dock					CR110	1992	25.90	0.500	23.90	40.40	0.350	18.40	66.80	165.00
Aberdeen	Bar					CR110	1992	5.04	0.500	10.80	4.13	0.050	11.40	11.40	32.30
Aberdeen	Atlantic Wharf					CR110	1992	9.00	0.500	15.20	16.60	0.080	13.60	26.60	83.40
Aberdeen	Tidal Basin					CR110	1992	14.80	0.500	19.90	20.60	0.130	15.50	36.20	101.00
Aberdeen	Tidal Basin					CR110	1992	13.30	0.500	19.90	20.30	0.220	15.90	34.80	95.80
Aberdeen	South Bar					CR110	1992	5.08	0.500	13.00	8.13	0.050	10.40	20.50	51.00
Aberdeen	Approach Channel					CR110	1992	5.86	0.500	13.70	14.90	0.100	11.50	26.40	76.10
Aberdeen	Texaco Berth					CR110	1993	8.61	0.200	12.30	16.80	0.060	18.30	38.20	88.90
Aberdeen	Maitland Quay					CR110	1993	6.91	0.200	12.40	22.50	0.100	14.40	55.40	154.00
Aberdeen	Mearns Quay					CR110	1993	8.87	0.200	17.20	15.70	0.100	17.90	51.70	86.30
Aberdeen	Total Quay					CR110	1993	7.98	0.200	12.00	19.50	0.080	18.50	37.00	103.00
Aberdeen	Hall Russell Quay					CR110	1993	10.10	0.200	19.50	45.00	0.530	19.60	110.00	151.00
Aberdeen	Hall Russell Quay					CR110	1993	8.14	0.200	19.80	29.70	0.290	17.20	59.30	121.00
Aberdeen	Hall Russell Quay					CR110	1993	4.04	0.200	6.09	16.70	0.120	5.65	34.60	37.40
Aberdeen	15m North of Jetty					CR110	1993	8.19	0.200	18.10	41.90	0.550	19.40	101.00	129.00
Aberdeen	Off Duthies Quay					CR110	1993	9.73	0.900	21.80	31.30	0.870	20.70	74.60	131.00
Aberdeen						CR110	1993	4.19	0.200	15.90	10.00	0.350	18.80	21.20	53.30
Aberdeen						CR110	1993	6.02	0.200	7.52	34.00	0.300	10.70	80.60	75.20
Aberdeen						CR110	1993	4.62	0.200	1.44	23.10	0.050	4.81	48.30	57.70
Aberdeen	Turning Basin					CR110	1994	56.10	0.300	17.50	32.70	0.194	19.70	58.20	113.00
Aberdeen	Turning Basin					CR110	1994	47.10	0.050	16.20	21.40	0.124	18.60	39.00	89.30
Aberdeen	Turning Basin					CR110	1994	4.92	0.350	20.20	29.50	0.295	21.50	51.80	112.00
Aberdeen	Navigation Channel					CR110	1994	3.71	0.050	11.10	23.90	0.046	10.90	18.10	49.70
Aberdeen	Navigation Channel					CR110	1994	3.45	0.050	11.30	11.00	0.082	14.50	20.80	58.70
Aberdeen	LN 45					CR110	1994	5.22	0.300	18.90	43.00	0.356	22.00	83.80	129.00
Aberdeen	LN 57					CR110	1994	2.64	0.050	12.90	15.80	0.110	15.80	29.80	78.70
Aberdeen	Navigation Channel					CR110	1994	3.41	0.050	10.10	9.02	0.043	2.64	18.90	53.40
Aberdeen	LN 46					CR110	1994	4.36	0.050	18.60	37.10	0.258	18.90	65.40	119.00
Aberdeen	A bert 1 and 2 Jetties					CR110	1994	3.52	0.350	19.10	29.60	0.220	24.10	45.20	108.00
Aberdeen	Mathews Quay North					CR110	1994	3.97	0.050	15.10	26.90	0.216	20.00	44.60	84.60
Aberdeen	Mearns Quay East					CR110	1994	4.06	0.270	16.20	27.10	0.180	22.10	45.40	98.10
Aberdeen	Total Quay					CR110	1994	3.84	0.230	13.90	19.00	0.125	18.60	37.50	91.80
Aberdeen	Turning Basin					CR110	1994	4.34	0.330	18.20	25.70	0.384	23.40	48.30	103.00
Aberdeen	Regent Quay					CR110	1994	4.89	0.720	20.20	48.30	0.328	23.40	67.00	161.00
Aberdeen	Upper Regent Dock					CR110	1994	3.67	1.510	40.10	72.20	0.938	18.10	103.00	252.00
Aberdeen	A bert Basin					CR110	1994	6.55	0.480	19.70	51.40	0.220	22.80	74.20	180.00
Aberdeen	Pacific/Atlantic Wharf					CR110	1994	4.86	0.230	17.90	33.10	0.266	23.00	57.20	113.00
Aberdeen	vigation Channel					CR110	1994	3.46	0.050	8.63	8.62	0.097	13.70	21.00	50.80
Aberdeen	Telford Dock					CR110	1994	6.85	0.270	18.40	75.00	0.124	24.10	157.00	201.00
Aberdeen	Navigation Channel					CR110	1995	3.50	0.020	9.07	4.93	0.010	10.80	32.30	39.70
Aberdeen	Navigation Channel					CR110	1995	2.40	0.020	16.10	14.00	0.010	16.50	20.20	52.30
Aberdeen	Torry Berth					CR110	1995	3.30	0.020	10.50	6.86	0.080	9.68	19.40	61.50
Aberdeen	Mearns West Approach					CR110	1995	12.50	0.370	15.70	22.90	0.186	21.50	36.70	128.00
Aberdeen	Telford Dock					CR110	1995	3.70	0.020	9.67	15.80	0.082	14.80	23.10	60.80
Aberdeen	A bert Dock					CR110	1995	10.90	0.600	16.10	30.70	0.179	21.10	41.80	126.00
Aberdeen	Regent Quay					CR110	1995	12.50	0.550	16.50	35.10	0.323	21.70	51.70	134.00
Aberdeen	River Dee Approaches					CR110	1995	8.00	0.540	26.30	25.30	0.100	23.20	51.70	112.00
Aberdeen	Torry Quay					CR110	1996	7.11	0.040	19.60	34.90	0.177	22.20	55.40	147.00
Aberdeen	Texaco Quay					CR110	1996	5.81	0.270	15.40	23.70	0.124	18.50	40.00	103.00
Aberdeen	Regent Quay West End					CR110	1996	7.16	0.590	17.60	44.60	0.132	20.90	60.20	165.00
Aberdeen	A bert Quay, No 2 Jetty					CR110	1996	6.12	0.310	16.40	28.90	0.160	20.10	42.60	117.00
Aberdeen	Abercrombie Jetty					CR110	1996	6.99	0.330	17.90	27.00	0.177	21.30	44.70	112.00
Aberdeen	Upper Dock					CR110	1996	7.42	0.620	19.20	46.80	0.275	20.40	75.90	186.00
Aberdeen	Navigation Channel					CR110	1996	6.56	0.310	15.60	20.70	0.410	18.90	42.00	96.50
Aberdeen	A bert Basin					CR110	1996	3.52	0.070	1.31	1.80	0.039	5.11	3.96	11.20
Aberdeen	Pontoon Berth					CR110	1996	19.30	0.680	39.50	1521.00	0.400	29.30	174.00	927.00

NA = Not Analysed; ND = Not Detected; BDL = Below Detection Limit **Location I**	**Location II**	**LIMS/UKAS No.**	**Lab Sample No.**	**Latitude**	**Longitude**	**Oslo Dump**	**Year**	**As mg/g**	**Cd mg/g**	**Cr mg/g**	**Cu mg/g**	**Hg mg/g**	**Ni mg/g**	**Pb mg/g**	**Zn mg/g**
Aberdeen	A bert Quay					CR110	1996	10.30	0.410	30.00	26.20	0.190	21.60	40.70	113.00
Aberdeen	Pontoon Berth					CR110	1996	15.00	0.550	33.10	17.70	0.270	23.70	75.10	370.00
Aberdeen	A bert Quay					CR110	1996	12.80	0.390	29.80	59.10	0.490	22.40	114.00	170.00
Aberdeen	Total Quay, River Dee					CR110	1998	7.22	0.285	28.90	15.80	0.189	132.00	26.80	76.20
Aberdeen	Telford Dock					CR110	1998	11.00	0.396	37.00	26.90	0.153	174.00	45.20	98.50
Aberdeen	Atlantic Quay, Albert Basin					CR110	1998	12.60	0.508	43.40	29.50	0.115	191.00	47.90	113.00
Aberdeen	Telford Dock					CR110	1998	10.90	0.412	37.50	26.30	0.127	173.00	46.50	100.00
Aberdeen	Navigation Channel					CR110	1998	7.14	0.215	24.80	10.30	0.038	115.00	20.80	57.20
Aberdeen	Total Quay, River Dee					CR110	1998	10.20	0.396	35.50	18.60	0.067	162.00	38.10	86.60
Aberdeen	Regent Quay					CR110	1998	12.70	0.699	40.30	39.40	0.041	178.00	63.60	145.00
Aberdeen	A bert Basin					CR110	1998	9.84	0.471	37.90	29.80	0.225	168.00	43.90	103.00
Aberdeen	A bert Basin					CR110	1998	10.30	0.413	36.60	22.50	0.192	160.00	38.30	91.40
Aberdeen	East end of Pontoon Jetty, Albert capital works					CR110	1999	15.40	0.584	41.20	146.00	0.177	36.20	94.20	422.00
Aberdeen	West end Pontoon jetty, A bert capital works					CR110	1999	14.90	1.450	57.80	135.00	0.473	41.10	94.90	502.00
Aberdeen	North West Corner, Albert capital works					CR110	1999	4.34	0.593	21.40	39.80	0.478	22.30	46.70	162.00
Aberdeen	Outside pontoon jetty, east leg, pontoon jetty works (6)					CR110	1999	10.40	0.615	38.40	52.60	0.241	189.00	50.40	170.00
Aberdeen	Pontoon Jetty (1)					CR110	1999	10.20	0.581	38.60	61.80	0.326	166.00	60.10	234.00
Aberdeen	Pontoon Jetty, No 1 Berth (4)					CR110	1999	31.00	2.660	149.00	11900.00	1.560	84.60	902.00	12300.00
Aberdeen	Pontoon Jetty, Mid West Leg (2)					CR110	1999	26.50	1.590	64.00	778.00	3.690	45.90	388.00	2440.00
Aberdeen	Pontoon Dock 4, below east limb					CR110	1999	2.93	0.147	55.10	38.20	0.170	58.90	29.90	116.00
Aberdeen	Telford Dock					CR110	1999	10.30	0.312	30.10	16.60	0.164	19.80	27.50	76.00
Aberdeen	Channel					CR110	1999	10.60	0.269	32.20	14.40	0.092	34.30	25.60	69.50
Aberdeen	Tidal Harbour					CR110	1999	10.40	0.342	31.00	18.40	0.165	41.60	31.30	81.70
Aberdeen	Turning Basin					CR110	1999	10.80	0.387	33.30	18.70	0.248	42.70	33.30	86.20
Aberdeen	A bert Basin					CR110	1999	12.20	0.456	38.10	26.50	0.167	25.10	37.20	108.00
Aberdeen	Navigation Channel					CR110	1999	8.96	0.242	27.90	12.70	0.106	15.80	23.10	61.70
Aberdeen	Mearns East					CR110	1999	12.40	0.467	39.30	26.90	0.217	29.30	40.80	111.00
Aberdeen	Deep Water Berth, Regent Quay					CR110	1999	9.51	0.583	29.50	35.40	0.176	21.50	46.60	132.00
Aberdeen	Tidal Basin/Pocra					CR110	2000	8.93	0.423	33.00	21.40	0.101	22.60	30.30	104.00
Aberdeen	River Berth					CR110	2000	1.12	0.071	7.42	3.76	0.028	3.39	7.50	28.90
Aberdeen	Atlantic Wharf					CR110	2000	10.70	0.316	39.20	25.50	0.266	25.20	35.40	111.00
Aberdeen	Hall Russells					CR110	2000	9.58	0.372	35.80	33.50	0.087	25.20	37.00	123.00
Aberdeen	A bert Quay, Bunker Berth					CR110	2000	9.78	0.386	33.30	25.40	0.065	23.80	32.50	110.00
Aberdeen	Upper Dock					CR110	2000	10.70	1.030	40.50	82.80	0.429	26.10	122.00	297.00
Aberdeen	Navigation Channel					CR110	2000	7.39	0.082	18.10	4.67	0.047	11.30	9.65	46.40
Aberdeen	Turning Basin/Pilot Jetty					CR110	2000	7.07	0.179	25.00	12.40	0.040	19.10	18.00	71.30
Aberdeen	Off Total Quay					CR110	2001	7.10	0.330	28.90	20.00	0.070	18.00	26.10	71.40
Aberdeen	Russells Quay					CR110	2001	9.80	0.340	35.20	26.60	0.100	23.00	34.50	86.40
Aberdeen	Tidal Harbour					CR110	2001	10.50	0.290	33.50	23.40	0.210	22.70	38.70	84.70
Aberdeen	A bert Basin South					CR110	2001	8.20	0.290	31.90	37.20	0.110	21.30	28.20	87.50
Aberdeen	Regent Quay East					CR110	2001	8.10	0.470	28.70	38.90	0.180	18.80	45.20	118.00
Aberdeen	Atlantic Wharf					CR110	2001	9.10	0.310	33.90	26.10	0.170	23.10	39.60	81.70
Aberdeen	Telford Dock					CR110	2001	11.00	0.270	33.20	22.50	0.100	22.60	33.70	71.90
Aberdeen	Navigation Channel					CR110	2001	7.10	0.186	23.80	9.20	0.048	16.40	17.90	42.90
Aberdeen						CR110	2002	5.11	BDL	23.50	17.90	0.086	13.20	11.60	53.00
Aberdeen						CR110	2002	9.05	1.050	41.30	74.20	0.611	20.40	109.00	234.00
Aberdeen						CR110	2002	7.43	0.298	35.90	23.70	0.158	20.00	27.70	86.00
Aberdeen						CR110	2002	12.00	2.600	51.10	80.70	0.959	28.00	227.00	317.00
Aberdeen						CR110	2002	1.85	BDL	12.70	8.86	0.173	8.82	6.89	29.10
Aberdeen						CR110	2002	7.18	0.445	34.40	21.20	0.115	21.10	32.80	104.00
Aberdeen						CR110	2002	11.00	1.150	55.90	75.80	0.522	24.30	229.00	262.00
Aberdeen						CR110	2002	9.87	0.292	31.70	21.50	0.202	20.50	28.40	81.40
Aberdeen						CR110	2002	7.25	0.276	26.80	15.90	0.155	17.20	24.00	72.60
Aberdeen						CR110	2002	5.98	0.239	23.80	14.00	0.156	15.30	20.70	69.80
Aberdeen						CR110	2002	8.46	0.312	32.20	22.90	0.179	20.90	29.30	86.40
Aberdeen						CR110	2002	10.70	0.261	31.20	38.40	0.160	20.00	31.70	81.00
Aberdeen						CR110	2002	10.20	0.453	45.60	41.80	0.263	26.00	40.90	162.00

NA = Not Analysed; ND = Not Detected; BDL = Below Detection Limit Location I	Location II	LIMS/UKAS No.	Lab Sample No.	Latitude	Longitude	Oslo Dump	Year	As mg/g	Cd mg/g	Cr mg/g	Cu mg/g	Hg mg/g	Ni mg/g	Pb mg/g	Zn mg/g
Aberdeen						CR110	2002								
Aberdeen						CR110	2002								
Aberdeen						CR110	2002								
Aberdeen						CR110	2003	8.72	0.300	35.21	31.54	0.120	21.67	27.06	100.83
Aberdeen						CR110	2003	6.89	0.284	29.77	28.05	0.255	21.34	26.56	86.68
Aberdeen						CR110	2003	10.12	0.327	31.53	36.32	0.209	20.76	30.15	103.69
Aberdeen						CR110	2004								
Aberdeen						CR110	2004								
Aberdeen						CR110	2004								
Aberdeen						CR110	2004								
Aberdeen						CR110	2004								
Aberdeen						CR110	2004								
Aberdeen						CR110	2004								
Aberdeen						CR110	2004								
Aberdeen						CR110	2004								
Aberdeen			01/2005/DS/O	57° 08.5927'N	002° 05.2257'W	CR110	2005	1.47	BDL	10.10	9.57	BDL	8.38	7.69	37.51
Aberdeen			02/2005/DS/O	57° 08.5707'N	002° 05.0818'W	CR110	2005	7.70	0.289	32.03	29.77	0.178	21.01	30.34	91.50
Aberdeen			03/2005/DS/O	57° 08.5732'N	002° 05.2345'W	CR110	2005	2.22	BDL	14.37	13.02	BDL	10.17	9.46	33.44
Aberdeen			04/2005/DS/O	57° 08.5534'N	002° 05.1016'W	CR110	2005	10.24	0.470	33.02	55.32	0.228	21.64	43.75	130.58
Aberdeen			05/2005/DS/O			CR110	2005	5.66	BDL	19.74	9.56	0.129	14.56	14.24	49.42
Aberdeen Beach Recharge	Aberdeen Beach Recharge	1320/06	56/2006/DS/O	56° 42.16'N	002° 27.95'W	N/A	2006								
Aberdeen Beach Recharge	Aberdeen Beach Recharge	1322/06	58/2006/DS/O	56° 42.23'N	002° 27.24'W	N/A	2006								
Aberdeen Beach Recharge	Aberdeen Beach Recharge	1324/06	60/2006/DS/O	56° 42.17'N	002° 25.95'W	N/A	2006								
Aberdeen Beach Recharge	Aberdeen Beach Recharge	1326/06	62/2006/DS/O	56° 42.20'N	002° 27.95'W	N/A	2006								
Aberdeen Beach Recharge	Aberdeen Beach Recharge	1328/06	64/2006/DS/O	56° 42.16'N	002° 27.24'W	N/A	2006								
Aberdeen Beach Recharge	Aberdeen Beach Recharge	1330/06	66/2006/DS/O	56° 42.16'N	002° 27.24'W	N/A	2006								
Aberdeen Beach Recharge	Aberdeen Beach Recharge	1332/06	68/2006/DS/O	56° 42.23'N	002° 27.95'W	N/A	2006								
Aberdeen	Aberdeen Harbour	1348/07	30/2007/DS/O	57 08.68 N	02 04.67 W	CR110	2007	8.95	0.287	36.10	28.30	0.099	22.60	28.70	78.50
Aberdeen	Aberdeen Harbour	1349/07	31/2007/DS/O	E395374	N805981	CR110	2007	8.91	0.298	37.70	31.00	0.092	22.90	29.00	83.10
Aberdeen	Aberdeen Harbour	1350/07	32/2007/DS/O	E395474	N805915	CR110	2007	8.97	0.317	37.70	30.10	BDL	22.80	29.80	82.70
Aberdeen	Aberdeen Harbour	1351/07	33/2007/DS/O	57 08.65 N	02 04.75 W	CR110	2007	10.10	0.337	39.20	26.00	BDL	23.50	29.80	82.60
Aberdeen	Aberdeen Harbour	1352/07	34/2007/DS/O	57 08 56 N	02 04.40 W	CR110	2007	9.37	0.315	38.60	25.00	0.103	23.40	30.30	82.60
Aberdeen	Aberdeen Harbour	1353/07	35/2007/DS/O	57 08.43 N	02 05.04 W	CR110	2007	7.39	0.313	33.40	20.90	0.063	20.30	26.50	76.60
Aberdeen	Aberdeen Harbour	1354/07	36/2007/DS/O	E395178	N805316	CR110	2007	8.94	0.407	38.40	28.00	0.091	23.50	32.80	90.20
Aberdeen	Aberdeen Harbour	1355/07	37/2007/DS/O	57 08.42 N	02 04.68 W	CR110	2007	8.31	0.339	36.10	22.10	BDL	21.60	28.20	79.60
Aberdeen	Aberdeen Harbour	1356/07	38/2007/DS/O	E395534	N805561	CR110	2007	7.35	BDL	31.70	17.10	BDL	20.10	23.80	66.40
Aberdeen	Aberdeen Harbour	1357/07	39/2007/DS/O	E385474	E805633	CR110	2007	8.84	0.304	36.20	23.50	BDL	22.50	27.90	79.10
Aberdeen	Navigation Channel	1315/07	19/2007/DS/O	396391E	805979N	CR110	2007	5.51	BDL	15.00	3.92	BDL	10.10	9.42	27.50
Aberdeen	Navigation Channel	1316/07	20/2007/DS/O	396164E	805832N	CR110	2007	4.21	BDL	12.70	3.72	BDL	6.86	7.53	21.00
Aberdeen	Navigation Channel	1317/07	21/2007/DS/O	396369E	805926N	CR110	2007	5.14	BDL	16.80	5.15	BDL	9.60	8.47	31.30
Aberdeen			45/2008/DS	N 805520	E 395686	CR110	2008								
Aberdeen			46/2008/DS	N 805944	E 395491	CR110	2008								
Aberdeen			47/2008/DS	N 805280	E 395819	CR110	2008								
Aberdeen			48/2008/DS	N 805745	E 395126	CR110	2008								
Aberdeen			50/2008/DS	N 805565	E 395539	CR110	2008								
Aberdeen			51/2008/DS	N 805506	E 395338	CR110	2008								
Aberdeen			52/2008/DS	N 805647	E 395363	CR110	2008								
Aberdeen			53/2008/DS	N 805840	E 396212	CR110	2008								
Aberdeen			54/2008/DS	N 806167	E 396479	CR110	2008								
Aberdeen			55/2008/DS			CR110	2008								
Aberdeen Navigation Channel	0-0.5m	N/A	V1	57 08.250	02 04.230	CR110	2012	6.14	0.150	27.80	12.22	0.080	15.44	15.49	48.76
Aberdeen Navigation Channel	0.5-1.0m	N/A	V1	57 08.250	02 04.230	CR110	2012	6.91	0.210	28.96	15.07	0.050	15.80	17.38	54.97
Aberdeen Navigation Channel	1.0-1.5m	N/A	V1	57 08.250	02 04.230	CR110	2012	8.56	0.190	30.19	12.76	0.040	17.06	19.60	56.44
Aberdeen Navigation Channel	0-0.5m	N/A	V2	57 08.433	02 04.257	CR110	2012	5.06	0.190	24.67	10.48	0.040	13.28	17.01	51.65
Aberdeen Navigation Channel	0.5-1.24m	N/A	V2	57 08.433	02 04.257	CR110	2012	6.78	0.350	24.85	12.85	0.110	14.47	34.51	67.81
Aberdeen Navigation Channel	1.24-1.74m	N/A	V2	57 08.433	02 04.257	CR110	2012	6.95	0.700	29.78	16.15	0.160	16.80	41.52	77.38
Aberdeen Navigation Channel	0-0.5m	N/A	V3	57 08.481	02 04.132	CR110	2012	4.63	0.140	22.27	9.57	0.060	11.84	16.58	41.00

NA = Not Analysed; ND = Not Detected; BDL = Below Detection Limit Location I	Location II	LIMS/UKAS No.	Lab Sample No.	Latitude	Longitude	Oslo Dump	Year	As mg/g	Cd mg/g	Cr mg/g	Cu mg/g	Hg mg/g	Ni mg/g	Pb mg/g	Zn mg/g
Aberdeen Navigation Channel	1.0-1.57m	N/A	V3	57 08.481	02 04.132	CR110	2012	4.92	0.230	22.19	11.95	0.570	14.10	33.33	54.71
Aberdeen Navigation Channel	0-0.36m	N/A	V4	57 08.558	02 03.938	CR110	2012	4.52	0.120	21.49	7.56	0.260	11.33	11.22	36.05
Aberdeen Navigation Channel	0.36-0.86m	N/A	V4	57 08.558	02 03.938	CR110	2012	5.62	0.140	21.94	10.03	0.180	12.21	12.81	39.79
Aberdeen Navigation Channel	0.86-1.36m	N/A	V4	57 08.558	02 03.938	CR110	2012	5.49	0.260	24.16	10.31	0.190	13.66	23.14	53.79
Aberdeen Navigation Channel	0-0.5m	N/A	V5	57 08.620	02 03.768	CR110	2012	5.30	0.030	9.16	2.38	0.060	4.01	5.53	16.58
Aberdeen Navigation Channel	0.5-1.07m	N/A	V5	57 08.620	02 03.768	CR110	2012	4.79	0.040	9.97	3.58	0.100	5.10	7.57	19.77
Aberdeen Navigation Channel	0.5-1.17m	N/A	V6	57 08.400	02 03.350	CR110	2012	5.46	0.060	11.68	2.87	0.070	5.87	7.12	24.23
Aberdeen Navigation Channel	0-0.5m	N/A	VC6	57 08.400	02 03.350	CR110	2012	6.58	0.040	11.82	2.90	0.040	5.83	6.88	22.92
Aberdeen Navigation Channel	Grab	N/A	G1	57 08.604	02 03.932	CR110	2012	6.81	0.070	14.14	4.15	0.040	7.53	9.61	28.02
Aberdeen Navigation Channel	Grab	N/A	G2	57 08.689	02 03.688	CR110	2012	6.48	0.090	20.87	5.32	0.120	11.52	11.23	31.09
Aberdeen Navigation Channel	Grab	N/A	G3	57 08.771	02 03.541	CR110	2012	5.79	<0.03	8.44	1.53	0.050	3.50	5.38	14.29
Aberdeen Navigation Channel	Grab	N/A	G4	57 08.743	02 03.411	CR110	2012	5.94	<0.03	7.22	1.53	0.040	3.22	4.50	12.50
Aberdeen Navigation Channel	Grab	N/A	G5	57 08.814	02 03.371	CR110	2012	6.35	<0.03	12.51	1.75	<0.03	4.26	5.77	14.88
Aberdeen Navigation Channel	Grab	N/A	G6	57 08.845	02 03.408	CR110	2012	6.17	<0.03	12.53	1.80	0.030	4.39	6.88	15.40
Aberdeen		54/2012/DS	MAR-2012-6256	57.1454 N	2.0600 W	CR110	2012	4.60	0.029	9.323	2.45	0.059	5.07	6.19	21.31
Aberdeen		55/2012/DS	MAR-2012-5874	57 8.6274 N	02 3.8266 W	CR110	2012	6.63	0.116	50.825	31.58	0.059	47.25	18.92	82.64
Aberdeen		56/2012/DS	MAR-2012-6257	57.1432 N	2.0646 W	CR110	2012	6.01	0.089	46.617	29.24	0.059	38.17	19.19	84.37
Aberdeen		57/2012/DS	MAR-2012-5875	57 8.8562 N	02 3.3729 W	CR110	2012	7.03	0.287	26.974	17.42	0.115	16.12	29.97	75.76
Aberdeen		58/2012/DS	MAR-2012-5876	57 8.7003 N	02 3.5818 W	CR110	2012	0.00	0.000	0.000	0.00	0.000	0.00	0.00	0.00
Aberdeen		59/2012/DS	MAR-2012-5877	57 8.7694 N	02 3.3390 W	CR110	2012	9.14	0.287	29.577	16.08	0.113	17.93	29.59	78.66
Aberdeen		60/2012/DS	MAR-2012-5878	57 8.4299 N	02 4.2982 W	CR110	2012	0.00	0.000	0.000	0.00	0.000	0.00	0.00	0.00
Aberdeen		61/2012/DS	MAR-2012-6258	57.1420 N	2.0670 W	CR110	2012	0.00	0.000	0.000	0.00	0.000	0.00	0.00	0.00
Aberdeen		62/2012/DS	MAR-2012-5879	57 8.48823 N	02 4.1159 W	CR110	2012	0.00	0.000	0.000	0.00	0.000	0.00	0.00	0.00
Aberdeen		63/2012/DS	MAR-2012-6259	57.1428 N	2.0655 W	CR110	2012	6.05	0.054	42.172	27.32	0.059	38.53	15.57	72.78
Aberdeen		64/2012/DS	MAR-2012-6260	57.1403 N	2.0732 W	CR110	2012	3.16	0.029	26.058	18.79	0.059	19.57	8.11	45.95
Aberdeen		65/2012/DS	MAR-2012-6261	57.1448 N	2.0617 W	CR110	2012	4.42	0.026	8.894	4.12	0.059	4.54	4.76	18.74
Aberdeen		66/2012/DS	MAR-2012-5880	57 8.6437 N	02 3.6393 W	CR110	2012	5.13	0.082	20.319	16.02	0.059	15.67	13.04	44.53
Aberdeen		67/2012/DS	MAR-2012-5881	57 8.7381 N	02 3.4054 W	CR110	2012	3.90	0.045	13.944	20.22	0.059	10.53	17.51	28.92
Aberdeen		68/2012/DS	MAR-2012-5882	57 8.9203 N	02 3.4553 W	CR110	2012	8.53	0.130	32.179	12.89	0.116	19.59	22.50	59.83
Aberdeen	Aberdeen	MAR-2012-6256	54/2012/DS	57.1454 N	2.0600 W	CR110	2012								
Aberdeen	Aberdeen	MAR-2012-5874	55/2012/DS	57 8.6274 N	02 3.8266 W	CR110	2012	4.16	0.035	9.97	2.67	0.059	5.39	6.38	20.27
Aberdeen	Aberdeen	MAR-2012-6257	56/2012/DS	57.1432 N	2.0646 W	CR110	2012								
Aberdeen	Aberdeen	MAR-2012-5875	57/2012/DS	57 8.8562 N	02 3.3729 W	CR110	2012	4.60	0.029	9.32	2.45	0.059	5.07	6.19	21.31
Aberdeen	Aberdeen	MAR-2012-5876	58/2012/DS	57 8.7003 N	02 3.5818 W	CR110	2012	6.63	0.116	50.83	31.58	0.059	47.25	18.92	82.64
Aberdeen	Aberdeen	MAR-2012-5877	59/2012/DS	57 8.7694 N	02 3.3390 W	CR110	2012	6.01	0.089	46.62	29.24	0.059	38.17	19.19	84.37
Aberdeen	Aberdeen	MAR-2012-5878	60/2012/DS	57 8.4299 N	02 4.2982 W	CR110	2012	7.03	0.287	26.97	17.42	0.115	16.12	29.97	75.76
Aberdeen	Aberdeen	MAR-2012-6258	61/2012/DS	57.1420 N	2.0670 W	CR110	2012								
Aberdeen	Aberdeen	MAR-2012-5879	62/2012/DS	57 8.48823 N	02 4.1159 W	CR110	2012	9.14	0.287	29.58	16.08	0.113	17.93	29.59	78.66
Aberdeen	Aberdeen	MAR-2012-6259	63/2012/DS	57.1428 N	2.0655 W	CR110	2012								
Aberdeen	Aberdeen	MAR-2012-6260	64/2012/DS	57.1403 N	2.0732 W	CR110	2012								
Aberdeen	Aberdeen	MAR-2012-6261	65/2012/DS	57.1448 N	2.0617 W	CR110	2012								
Aberdeen	Aberdeen	MAR-2012-5880	66/2012/DS	57 8.6437 N	02 3.6393 W	CR110	2012	6.05	0.054	42.17	27.32	0.059	38.53	15.57	72.78
Aberdeen	Aberdeen	MAR-2012-5881	67/2012/DS	57 8.7381 N	02 3.4054 W	CR110	2012	3.16	0.029	26.06	18.79	0.059	19.57	8.11	45.95
Aberdeen	Aberdeen	MAR-2012-5882	68/2012/DS	57 8.9203 N	02 3.4553 W	CR110	2012	4.42	0.026	8.89	4.12	0.059	4.54	4.76	18.74

Appendix 5

Marine Scotland sediment sampling analysis of Aberdeen offshore disposal site (1995 – 2011)

Marine Scotland CR110 disposal site heavy metal sampling results 1995 - 2011

No	Site Name	Year	Field ID	UKAS/LIMS No	Depth	Date	Latitude	Longitude	As mg/kg	Cd mg/kg	Cr mg/kg	Cu mg/kg	Hg mg/kg	Ni mg/kg	Pb mg/kg	Zn mg/kg	Mean Dia. mm	Median Dia mm	Sorting Coef.	Skewness	Kurtosis	PSA <20µm (%)	PSA <63µm (%)	Visual Description
9	Aberdeen	1995	9ABZ95	465/97		26-Sep-95	57°06.754'N	001°59.834'W	6.04	0.050	4.88	8.54	0.030	4.24	20.18	39.77	0.529	0.525	1.91	-0.04	1.25		6.40	
8	Aberdeen	1995	8ABZ95	464/97		26-Sep-95	57°06.871'N	001°59.858'W	5.36	0.040	4.30	9.22	0.030	4.29	19.55	36.45	0.297	0.330	1.74	0.10	1.66		11.00	
7	Aberdeen	1995	7ABZ95	463/97		26-Sep-95	57°07.116'N	001°59.994'W	6.09	0.040	3.03	4.98	0.100	2.74	12.20	22.21	0.299	0.312	0.76	-0.02	1.26		3.40	
6	Aberdeen	1995	6ABZ95	462/97		26-Sep-95	57°07.255'N	001°59.999'W	6.73	0.030	5.39	9.02	0.070	4.76	22.42	43.88	0.275	0.301	1.82	0.02	2.12		12.10	
5	Aberdeen	1995	5ABZ95	461/97		26-Sep-95	57°07.045'N	001°59.540'W	7.61	0.020	3.12	3.34	0.050	3.91	11.45	20.27	0.312	0.306	1.03	-0.17	1.41		3.90	
4	Aberdeen	1995	4ABZ95	460/97		26-Sep-95	57°07.019'N	001°59.740'W	5.65	0.070	4.14	5.88	0.020	3.45	14.03	27.14	0.363	0.339	1.02	-0.25	1.27		2.50	
3	Aberdeen	1995	3ABZ95	459/97		26-Sep-95	57°07.015'N	001°59.934'W	7.32	0.040	4.37	3.32	0.010	3.63	8.73	23.52	0.183	0.252	1.29	0.51	1.58		13.10	
2	Aberdeen	1995	2ABZ95	458/97		26-Sep-95	57°07.022'N	002°00.243'W	7.00	0.060	4.88	6.03	0.050	4.19	14.60	28.37	0.192	0.253	1.68	0.39	1.89		15.80	
1	Aberdeen	1995	1ABZ95	457/97		26-Sep-95	57°07.058'N	002°00.342'W	6.98	0.030	3.60	4.41	0.030	4.25	13.83	25.10	0.316	0.312	0.84	-0.15	1.31		2.80	
2	Aberdeen	2006	15ABZ2006	1839/06		7-Apr-06	57 11.610N	2 0.807W	4.95	BDL	13.47	2.74	BDL	6.69	6.32	19.10								Medium sand anaerobic at depth
3	Aberdeen	2006	14ABZ2006	1838/06		7-Apr-06	57 11.601N	2 1.611W	5.02	BDL	12.62	2.75	BDL	6.82	6.42	19.60								Fine-Medium Sand anaerobic at depth
4	Aberdeen	2006	13ABZ2006	1837/06		7-Apr-06	57 11.448N	2 2.754W	4.32	BDL	14.18	2.64	0.079	5.97	5.92	17.19								Medium Sand
5	Aberdeen	2006	12ABZ2006	1836/06		7-Apr-06	57 12.368N	2 0.486W	4.84	BDL	16.28	3.78	BDL	8.68	8.63	25.47								Fine-Medium sand anaerobic with depth
6	Aberdeen	2006	11ABZ2006	1835/06		7-Apr-06	57 12.280N	2 1.330W	4.83	BDL	19.98	3.81	BDL	8.89	8.39	24.87								Medium sand anaerobic at depth
7	Aberdeen	2006	10ABZ2006	1834/06		7-Apr-06	57 12.143N	2 2.357W	4.22	BDL	16.97	2.54	BDL	5.83	5.80	16.58								Medium Sand
8	Aberdeen	2006	9ABZ2006	1833/06		7-Apr-06	57 12.024N	2 0.627W	4.81	BDL	18.29	4.17	BDL	9.38	8.84	26.96								Fine_medium sand anaerobic at depth
9	Aberdeen	2006	8ABZ2006	1832/06		7-Apr-06	57 11.919N	2 1.521W	4.38	BDL	14.85	3.11	BDL	7.53	7.12	20.95								Medium Sand anaerobic at depth
10	Aberdeen	2006	7ABZ2006	1831/06		7-Apr-06	57 11.817N	2 2.529W	4.44	BDL	14.42	2.04	BDL	5.83	5.56	16.04								Medium Sand
11	Aberdeen	2006	6ABZ2006	1830/06		7-Apr-06	57 11.212N	2 0.952W	6.06	BDL	13.86	3.25	BDL	7.17	7.52	20.69								Medium sand anaerobic at depth
12	Aberdeen	2006	5ABZ2006	1829/06		7-Apr-06	57 11.137N	2 1.941W	5.02	BDL	16.85	3.68	BDL	8.04	8.10	22.69								Fine -Medium Sand Aanerobic below the surface
13	Aberdeen	2006	4ABZ2006	1828/06		7-Apr-06	57 11.043N	2 2.932W	4.16	BDL	13.80	2.22	BDL	6.68	6.14	23.28								Medium Sand
14	Aberdeen	2006	3ABZ2006	1827/06		7-Apr-06	57 12.650N	2 0.383W	5.04	BDL	20.72	4.58	BDL	10.08	10.22	29.39								Medium sand anaerobic at depth
15	Aberdeen	2006	2ABZ2006	1826/06		7-Apr-06	57 12.580N	2 1.225W	4.41	BDL	15.01	2.88	BDL	7.32	6.72	22.27								Medium sand anaerobic at depth
1	Aberdeen	2006	1ABZ2006	1825/06		7-Apr-06	57 12.510N	2 2.050W	4.27	BDL	14.09	2.01	BDL	5.85	5.46	20.65								Medium Sand
6	Aberdeen	2011	6/ABN/11	1737/2011		13-May-11	57.1146	-2.0010	5.51	0.029	6.65	9.42	0.059	3.41	4.18	19.58	0.278	0.258	0.65	0.06	1.06	1.793	4.143	
5	Aberdeen	2011	2/ABN/11	1734/2011		13-May-11	57.1197	-2.0014	3.94	0.023	5.32	2.22	0.059	3.25	3.46	13.59	0.414	0.351	0.78	-0.05	1.01	1.055	2.55	
4	Aberdeen	2011	4/ABN/11	1732/2011		13-May-11	57.1172	-2.0050	8.42	0.059	14.78	5.20	0.059	8.13	10.31	27.58	0.111	0.054	1.97	0.0	0.98	20.1	54.9	Sandy Mud
3	Aberdeen	2011	1/ABN/11	1731/2011		13-May-11	57.1170	-2.0010	3.78	0.043	8.55	4.13	0.059	5.25	4.91	24.26	0.200	0.177	2.1	0.53	1.23	15.666	25.944	
2	Aberdeen	2011	10/ABN/11	1728/2011		13-May-11											0.249	0.236	1.29	0.43	1.49	4.175	14.653	Muddy Sand
1	Aberdeen	2011	12/ABN/11	1727/2011		13-May-11																		
2	Aberdeen	2007	5ABZ2007	1504/07	56	5-Apr-07											0.320	0.276	1.27	0.27	1.54	4.26	10.10	8cm Grey brown Silty Sand
3	Aberdeen	2007	4ABZ2007	1503/07	48	5-Apr-07			4.25	BDL	7.27	2.74	BDL	5.49	5.40	16.70	0.432	0.373	0.78	-0.02	0.95	0.00	1.02	6cm Grey brown Sand and small stones
4	Aberdeen	2007	8ABZ2007	1502/07	44	5-Apr-07			4.84	BDL	10.60	4.01	BDL	6.54	6.45	22.50	0.343	0.298	0.69	-0.06	1.01	0.04	1.47	5cm Grey brown Sand
5	Aberdeen	2007	9ABZ2007	1501/07	43	5-Apr-07											0.387	0.347	0.72	0.00	1.00	1.26	3.12	9cm Choc brown Sand and shell fragments
6	Aberdeen	2007	7ABZ2007	1500/07	49	5-Apr-07											0.466	0.438	0.54	0.01	0.94	0.00	0.00	5cm Choc brown Sand
7	Aberdeen	2007	6ABZ2007	1499/07	46	5-Apr-07			4.46	BDL	8.74	5.98	BDL	5.76	6.48	20.90	0.383	0.320	0.79	-0.07	0.98	0.03	1.33	7cm Choc brown Sand (anoxic at depth)
8	Aberdeen	2007	1ABZ2007	1498/07	43	5-Apr-07			3.24	BDL	7.58	4.41	BDL	5.50	5.57	27.00	0.368	0.319	0.78	-0.01	0.99	1.14	2.85	5cm Grey brown Sand
9	Aberdeen	2007	2ABZ2007	1497/07	41	5-Apr-07			4.06	BDL	8.92	5.90	BDL	5.90	5.42	26.30	0.414	0.341	0.82	-0.08	0.97	0.03	1.23	4cm Grey brown Sand
1	Aberdeen	2007	3ABZ2007	1496/07	43	5-Apr-07											0.344	0.312	0.64	-0.02	0.97	0.00	1.44	6cm Grey brown Sand
32	Aberdeen	2002	32/ABZ/02	14148-02-SED					6.18	NA	9.43	4.62	0.052	5.38	13.60	34.20	0.297	0.323	0.04	0.94	0.71		3.90	
31	Aberdeen	2002	31/ABZ/02	14147-02-SED					5.99	NA	9.94	4.18	0.069	5.69	9.19	41.60	0.277	0.310	0.20	1.38	0.83		5.00	
30	Aberdeen	2002	30/ABZ/02	14146-02-SED					5.61	NA	15.60	11.30	0.057	9.19	12.70	42.70	0.178	0.214	0.27	0.99	1.27		13.30	
29	Aberdeen	2002	29/ABZ/02	14145-02-SED					5.81	NA	7.70	2.00	NA	4.34	5.57	16.00	0.311	0.328	0.01	0.93	0.67		2.70	
28	Aberdeen	2002	28/ABZ/02	14144-02-SED					8.92	NA	9.02	2.90	NA	4.09	9.42	19.80	0.285	0.308	0.04	1.06	0.63		3.50	
27	Aberdeen	2002	27/ABZ/02	14143-02-SED					5.86	NA	14.90	18.70	0.067	9.15	12.10	38.20	0.232	0.292	0.34	1.35	1.27		11.40	
26	Aberdeen	2002	26/ABZ/02	14142-02-SED					5.78	NA	18.60	10.10	0.088	10.90	17.20	47.20	0.118	0.173	0.41	0.93	1.72		28.10	
25	Aberdeen	2002	25/ABZ/02	14141-02-SED					3.61	NA	16.50	9.82	0.054	10.00	8.83	35.60	0.123	0.285	0.64	0.72	2.61		32.40	
24	Aberdeen	2002	24/ABZ/02	14140-02-SED					8.40	NA	26.00	11.10	0.153	16.20	21.10	49.90	0.079	0.071	-0.04	0.83	2.14		47.60	
23	Aberdeen	2002	23/ABZ/02	14139-02-SED					5.19	NA	16.40	9.24	0.077	9.51	11.80	41.80	0.181	0.504	0.88	1.11	2.41		23.40	
22	Aberdeen	2002	22/ABZ/02	14138-02-SED					7.17	0.205	16.60	2.70	0.078	10.30	25.90	410.00	0.141	0.206	0.42	0.97	1.68		24.10	
21	Aberdeen	2002	21/ABZ/02	14137-02-SED					3.91	NA	13.90	6.76	0.057	8.19	8.64	33.90	0.209	0.306	0.52	1.26	1.63		16.80	
20	Aberdeen	2002	20/ABZ/02	14136-02-SED					2.67	NA	9.37	4.32	NS	5.71	5.82	20.20	0.278	0.385	0.49	1.54	1.21		10.00	
19	Aberdeen	2002	19/ABZ/02	14135-02-SED					5.36	NA	11.00	3.41	0.060	6.06	6.38	22.40	0.251	0.290	0.23	1.53	0.92		6.30	
18	Aberdeen	2002	18/ABZ/02	14134-02-SED					3.45	NA	7.62	3.49	0.061	4.89	17.30	19.70	0.301	0.342	0.25	1.35	0.91		5.20	
17	Aberdeen	2002	17/ABZ/02	14133-02-SED					5.64	NA	12.30	34.90	0.064	6.98	8.20	26.60	0.192	0.264	0.48	1.84	1.33		13.10	
16	Aberdeen	2002	16/ABZ/02	14132-02-SED					6.14	0.192	19.80	10.20	0.325	11.70	16.50	52.00	0.105	0.142	0.30	0.88	1.86		33.60	
15	Aberdeen	2002	15/ABZ/02	14131-02-SED					3.15	NA	12.10	6.13	0.051	6.89	6.85	29.40	0.175	0.261	0.46	0.91	1.82		21.10	
14	Aberdeen	2002	14/ABZ/02	14130-02-SED					6.03	NA	11.10	4.72	NA	6.57	8.47	26.20	0.198	0.269	0.46	1.79	1.36		14.00	
13	Aberdeen	2002	13/ABZ/02	14129-02-SED					5.16	NA	15.70	10.80	0.064	9.64	13.70	48.00	0.124	0.190	0.38	0.84	1.96		30.90	
12	Aberdeen	2002	12/ABZ/02	14128-02-SED					6.09	0.190	18.10	10.20	0.081	10.40	14.70	47.10	0.153	0.189	0.26	0.97	1.43		18.20	
11	Aberdeen	2002	11/ABZ/02	14127-02-SED					4.94	NA	18.10	9.01	0.065	10.10	16.80	48.60	0.109	0.165	0.39	0.89	1.97		32.10	
10	Aberdeen	2002	10/ABZ/02	14126-02-SED					6.35	NA	13.60	9.35	0.068	11.00	28.50	75.80	0.142	0.212	0.41	0.94	1.94		24.70	
9	Aberdeen	2002	9/ABZ/02	14125-02-SED					4.56	NA	18.50	6.27	0.062	9.36	20.10	36.40	0.109	0.154	0.34	0.94	1.99		30.80	
8	Aberdeen	2002	8/ABZ/02	14124-02-SED					8.19	NA	17.60	5.96	0.088	9.11	12.30	34.30	0.108	0.156	0.34	0.90	2.01		32.00	
7	Aberdeen	2002	7/ABZ/02	14123-02-SED					5.26	NA	20.00	5.95	0.052	10.60	11.60	37.60	0.089	0.109	0.21	0.99	1.94		35.10	
6	Aberdeen	2002	6/ABZ/02	14122-02-SED					6.56	NA	20.20	4.66	0.053	9.23	12.10	34.80	0.146	0.174	0.22	1.05	1.42		17.90	
5	Aberdeen	2002	5/ABZ/02	14121-02-SED					14.00	NA	17.50	2.51	NS	6.19	9.47	26.50	0.249	0.340	0.45	1.57	1.33		10.40	
4	Aberdeen	2002	4/ABZ/02	14120-02-SED					8.44	NA	15.80	9.31	0.058	8.51	12.60	36.40	0.140	0.207	0.40	0.84	2.02		26.30	
3	Aberdeen	2002	3/ABZ/02	14119-02-SED					8.53	NA	11.70	4.58	0.051	6.33	10.40	26.40	0.241	0.315	0.38	1.58	1.29		10.80	
2	Aberdeen	2002	2/ABZ/02	14118-02-SED					6.39	NA	22.00	10.80	0.115	12.30	15.30	50.80	0.105	0.151	0.35	0.89	1.90		33.10	

Appendix 6

Map showing riverbed material type dredged 2015 – 2017

AHB Dwg:- SK01054-01	Aberdeen Harbour - Showing 2015 Areas of Maintenance Dredgings	Scale 1:10,000

AHB Dwg:- SK01054-02	Aberdeen Harbour - Showing 2016 Areas of Maintenance Dredgings	Scale 1:10,000

AHB Dwg:- SK01054-03	Aberdeen Harbour - Showing 2017 Areas of Maintenance Dredgings	Scale 1:10,000

Appendix 7

Correspondence with Aberdeen City Council regarding beach recharge

[Redacted]

From: [Redacted] @aberdeencity.gov.uk>
Sent: 13 November 2017 11:13
To: [Redacted]
Subject: RE: Beach recharge in Aberdeen

[Redacte

Thanks for your message. Unfortunately we have no plans to do any beach recharge works in Aberdeen in the next 3 years so there would be no potential to use dredged material. If there are any changes to these plans I will let you know.

Regards,

[Redacted]

From: [Redacted] aberdeen-harbour.co.uk]
Sent: 13 November 2017 09:37
To: [Redacted]
Subject: FW: Beach recharge in Aberdeen

Dear [Reda
t d]

[Redact has passed me your contact details - a few months ago I spoke to [R ed about the potential for using dredged material within the Aberdeen area – see email exchange below for details.

Are you able to confirm whether any beach recharge is planned/likely over the next 3 years?

Many thanks,
[Redacted
]

Aberdeen Harbour Board
16 Regent Quay
Aberdeen, AB11 5SS
[Redacted]

Aberdeen Harbour
www.aberdeen-harbour.co.uk

From: [Redacted] egcp.org.uk]
Sent: 16 August 2017 15:18
To: [Redacted] @aberdeen-harbour.co.uk>
Subject: RE: Beach recharge in Aberdeen

[Redacte

Sorry for taking so long to get back to you on this, my understanding is the Aberdeen City Council is looking at a beach recharge scheme but that this would be out with the timeframe you set out. The best person to talk to for more detail is [Redacted] berdeencity.gov.uk).

I am hoping to meet him to discuss these proposals and will let you know the outcome of these discussions.

All the best

[Redac
ted]

From: [Redacted] aberdeen-harbour.co.uk]
Sent: 04 July 2017 16:34
To: [Redac @egcp.org.uk
t d]
Subject: Beach recharge in Aberdeen

Dear [Re
d t

Good to talk to you just now. As discussed, we're preparing the marine licence renewal for our annual maintenance dredging campaign. We've been asked to explore whether there are any opportunities for using the dredged material for beach recharge/nourishment within the Aberdeen area. Could you please let me know whether any projects are planned over the next 3 years (the duration of the licence)?

The material is typically silts and fine sands so may not be suitable for recharge in any event; however, if there are projects in the pipeline (excuse the pun…) then we can discuss further whether the material is suitable.

I'll be out of the office for the next few days so if you have any questions please feel free to email or call my mobile.

Many thanks,
[Redacte
d]

Aberdeen Harbour Board
16 Regent Quay
Aberdeen, AB11 5SS
[Redacted]

Aberdeen Harbour
www.aberdeen-harbour.co.uk

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Appendix 8

Correspondence with Aberdeenshire Council regarding beach recharge

[Redacted]

From: [Redacted] aberdeenshire.gov.uk>
Sent: 01 February 2018 13:58
To: [Redacted]
Subject: FW: Aberdeen Harbour Board - dredged material
Attachments: Keith Young re Aberdeen harbour dredge material use.doc

Dear [Redacted

Further to our telephone conversation earlier today, I would confirm that we have no change in opinion from that stated in our previous letter dated 15th July 2015. We currently have no use for any dredged material.

Thank you for contacting us again regarding this matter.

Regards,
[Redacted]

Principal Engineer
Flood Risk & Coast Protection
Infrastructure Services
Aberdeenshire Council
[Redacted]

---
www.aberdeenshire.gov.uk
Follow us at:

From: [Redacted] @aberdeen-harbour.co.uk]
Sent: 01 February 2018 09:44
To: [Redacted] aberdeenshire.gov.uk>
Subject: Aberdeen Harbour Board - dredged material

Dear [Re
dac

Good to talk to you just now. As discussed, I'd be grateful if you could confirm by return of email that Aberdeenshire Council's position has not changed since [Redacte attached letter dated 15 July 2015 – i.e. you do not have any current plans that would make use of dredged material.

Many thanks,
[Redacted
]

Aberdeen Harbour Board
16 Regent Quay
Aberdeen, AB11 5SS
[Redacted]

[redacted]

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www.aberdeenshire.gov.uk

Aberdeenshire COUNCIL

JC/GG/S/1/175/3
D.11/1

[Redacted]
Engineering Director
Aberdeen Harbour Board
16 Regent Quay
Aberdeen
AB11 5SS

[Redacted]

Infrastructure Services
Roads
Carlton House
Arduthie Road
Stonehaven AB39 2QP
Tel 01569 768455
Fax 01569 768460
www.aberdeenshire.gov.uk
LP-5 STONEHAVEN

RECEIVED
17 JUL 2015

15 July 2015

[Redacted]

Dear [Redacted]

Coast Protection and Beach Recharge

Thank you for your letter dated 11 June 2015 regarding the potential use of dredged sand and silt from various activities taking place in Aberdeen Harbour.

I can confirm that we do not have any current plans which would make use of dredge material. However, there may be opportunities for mutually convenient options as we investigate and develop future flooding and coast protection and schemes along the Aberdeenshire coast.

Please do not hesitate to contact me should you wish to discuss this any further.

Yours sincerely

[Redacted]

Principal Engineer
Flooding and Coast Protection

Serving Aberdeenshire from mountain to sea – the very best of Scotland