Aberdeen Harbour Expansion Project
Dredging & disposal marine licence application
Sediment Chemistry Overview
November 2019

1. Introduction

This document describes the sediment sampling and analysis undertaken prior to the Aberdeen Harbour Expansion Project capital dredging commencing, and during dredging operations. It explains why no further sediment sampling is considered to be required to support the marine licence application made on 31st October 2019 to extend the duration of the capital dredging to 31st December 2021.

2. Summary of dredging operations and marine licence

On 4th November 2016, a marine licence was granted for the capital dredging of 2,850,000 m^3 (6,120,000 wet tonnes) of material within Nigg Bay, with material to be disposed at the licenced offshore site Aberdeen CR110 or reused on-site within the harbour construction works.

Dredging commenced in September 2017. The current licence expires on 27th February 2020. Aberdeen Harbour Board (AHB) have applied for a licence to extend the end date to 31st December 2021. All other aspects of the dredging and disposal remain unchanged from the existing licence.

3. Material remaining to be dredged

The total permitted dredge volume under the existing licence is 6,120,000 wet tonnes. The volume remaining to be dredged as of 19th November 2019 is approximately 1,191,980 wet tonnes, so approximately 81% of the total volume has already been dredged. Figure 1 shows a recent bathymetric survey of the overall dredge area, showing that the target dredge depth has been achieved across much of the site.

Table 1 provides a breakdown of the approximate volume remaining to be dredged in each of the seven dredge areas. The three areas with the greatest volumes, which make up approximately 92% of the remaining material to be dredged, are:

- West Quay: 435,416 wet tonnes
- Harbour Basin: 375,558 wet tonnes
- North Quay: 285,806 wet tonnes

The physical characteristics of the material remaining to be dredged within the West Quay and North Quay are similar: on average, 35% rock or coarse sediments (≥ 2.0 mm), 4% sand and 61% clay and silt (≤ 0.063 mm). Within the Harbour Basin, 90% of the material remaining is rock or coarse sediments (≥ 2.0 mm).

All of the rock and the majority of the remaining coarse sediment will be reused on-site within the harbour construction works. As described in the Best Practicable Environmental Option Assessment (BPEO) Report submitted with the marine licence application, the finer fractions of dredged material (clay, silt and fine sand) are not suitable for use on-site, or as land reclamation, construction materials or beach restoration. In accordance with the BPEO, the remaining finer fractions will continue to be deposited at the offshore disposal site Aberdeen CR110, along with a limited proportion of coarser sediments that are mixed with fine sediments and cannot easily be separated.

The dredged material in all fractions (except rock) has been chemically tested prior to dredging taking place, and during dredging operations – see Sections 4 and 5 for details.

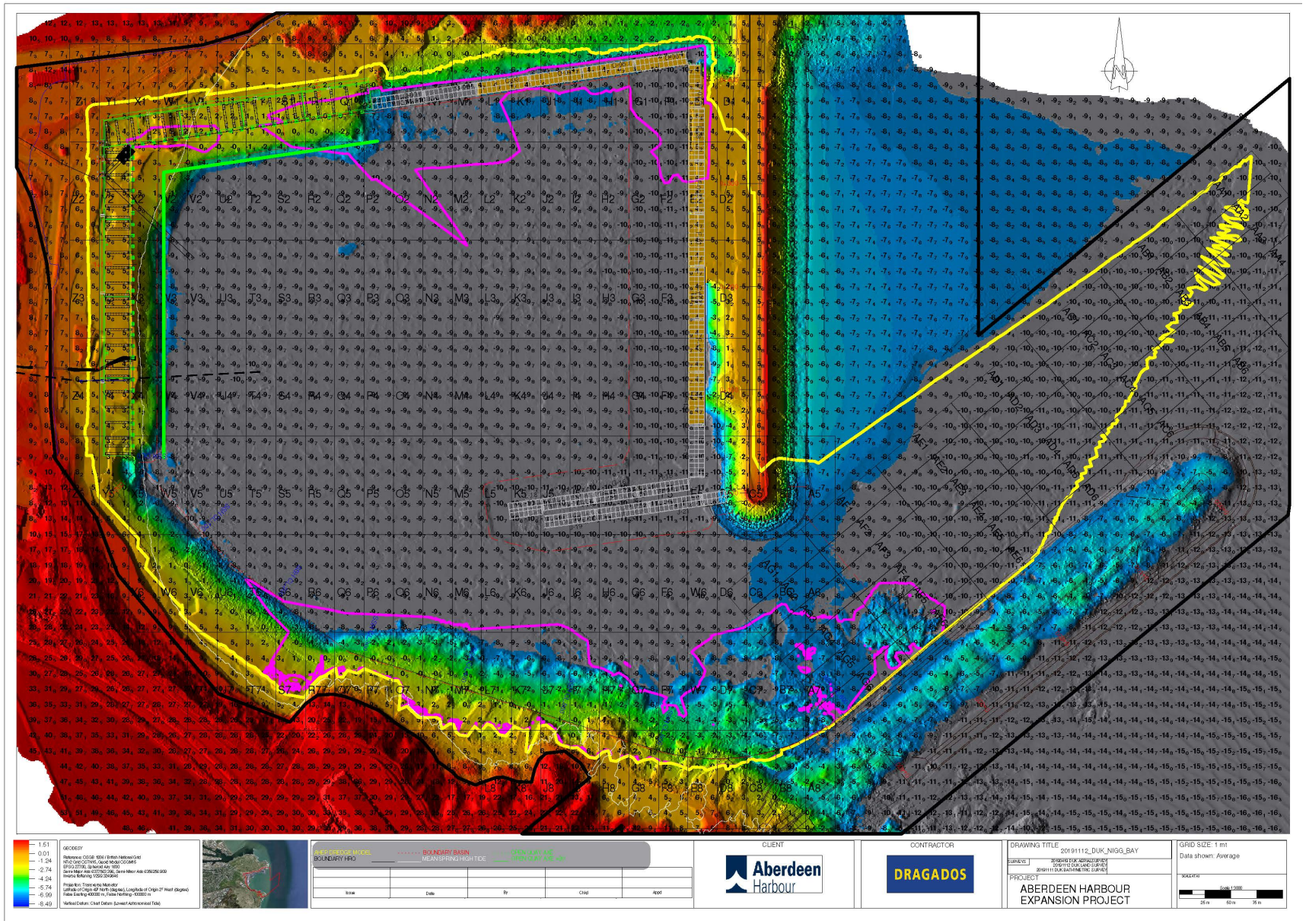

Figure 1 Bathymetric survey of Nigg Bay

Table 1 Breakdown of material remaining to be dredged

	Dredge Area	**Dredge Depth** (metres below CD)	**Clay and Silt** (≤ 0.063 mm)	**Sand** (≤ 2.0 mm)	**Pebbles, Cobbles & Boulders** (≥ 2.0 mm)	**Quantity to be dredged** (m^3)	**Quantity to be dredged** (wet tonnes)
A	Harbour Basin plus B1+B2+B3	9.00	5%	5%	90%	174,892	375,558
B	North Quay	9.85	60%	3%	37%	133,096	285,806
C	East Quay (Scour protection)	12.95	14%	0%	86%	8,450	18,145
D	Entrance Channel	10.50	0%	77%	23%	24,183	51,930
E	South East Pier (Connection NBW)	11.45	0%	0%	0%	0	0
F	SBW Roundhead & trenches	15.24	0%	100%	0%	11,700	25,124
G	West Quay	9.85	62%	5%	34%	202,767	435,416
					Total	555,088	1,191,980

4. Summary of pre-dredge sediment sampling and analysis

A comprehensive borehole survey was undertaken in 2016 to support the original marine licence application for dredging and disposal. From 34 boreholes, approximately 300 subsamples were collected at regular intervals from the seabed surface to the depth to be dredged, and analysed for physical and chemical characteristics.

The dredged material was deemed by Marine Scotland – Licensing Operations Team (MS-LOT) to be suitable for disposal at sea.

5. Summary of sediment sampling and analysis during dredging operations

In accordance with Chapter 7 of the Construction Environmental Management Document (CEMD), regular surface grab samples from the dredge areas and the sea disposal site, as well as in-hopper samples, have been collected and analysed for heavy metals, organotins and polycyclic aromatic hydrocarbons (PAHs) during the capital dredging and disposal operations. The results are presented in Appendix A and summarised below.

For heavy metals, there have been exceedances of the Revised Marine Scotland Action Level 1 and the Effect Range Low (ERL) across the samples, but the vast majority of these have been minor exceedances, i.e. well below Action Level 2 and the Effects Range Median (ERM). These results are consistent with the pre-dredge sampling results.

Similarly for PAHs, there have been exceedances of Action Level 1 and the ERL across the samples, but the vast majority of these have been minor exceedances, i.e. below the ERM. Three of the samples contained PAHs that exceeded (or were close to exceeding) the ERM, and these were considered in more detail. As shown in Appendix A, in all three cases, it was found that the elevations were not replicated in samples taken at the same or similar locations and depths on the same day, and/or in the samples taken at similar locations and depths in the pre-dredge borehole samples (2015-2016 – see above), so these are considered to be isolated elevations.

For tributyl tin, all results were below Action Level 1.

All results have been provided to MS-LOT, and no concerns have been raised about the chemical quality of the dredged material.

It is concluded from the sediment sampling undertaken during the dredging operations that the pre-dredge sampling survey results are representative of the material that is being dredged, and there is no evidence of widespread contaminated sediments over and above the levels found in the pre-dredge samples. The pre-dredge sampling survey results are, therefore, considered to accurately represent the material that remains to be dredged, irrespective of the date of the sampling.

6. Factors that could affect the quality of dredged material since the pre-dredge sampling

Since dredging and harbour construction commenced in 2017, there have been 11 marine pollution events within Nigg Bay, around half of which were small-scale spillages of biodegradable hydraulic fuel oil, as detailed in Appendix B. Each incident was dealt with swiftly in accordance with the CEMD. Routine sediment sampling of the dredged material after the incidents took place (see Section 5) has not revealed elevated levels of contaminants, so there is no evidence that the chemical quality of the dredged material has been adversely affected by the incidents.

As described in Section 4, during the pre-dredge borehole survey, samples were collected at regular intervals across the site down to the target dredge depth. Although much of the dredge area has been dredged to its target depth (as shown on Figure 1), in some areas (e.g. the West and North Quay) there are still several metres to be dredged below the current seabed level. As this material remains in situ and has not been exposed by dredging activities, there is no mechanism for the chemical quality of this material to have changed from the 2016 pre-dredge sampling results, so the existing data remains valid and additional sampling is considered unlikely to reveal significantly different results.

7. Conclusion

MS-LOT typically require sediment sampling to support a marine licence application for dredging and disposal to be no more than three years old. The sediment sampling survey undertaken for the original marine licence application is now 3 years and 7 months old. Approximately 81% of the material has already been dredged under the existing licence. Regular sediment sampling undertaken during the dredging operations has demonstrated that the contaminant levels observed in the pre-dredge sampling survey are representative of the material that is being dredged. The 2016 sediment quality data remains valid and additional sampling is considered unlikely to reveal significantly different results.

Appendix A
Sediment chemistry data during dredging operations 2018-2019

Aberdeen Harbour Expansion Project: Dredging Licence Application 2019 V5

Results of 2018-19 dredge samples: Heavy Metals and Tributyl Tin

Socotec Sample Ref	DUK Sample Ref	Date sampled	Marine Scotland Revised Action Levels (AL)										Effects Range Low (ERL) and Effects Range Medium (ERM)							
			Arsenic	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc	Tributyl tin		Arsenic	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc
		AL1	20	0.4	50	30	0.25	30	50	130	0.1	ERL	8.2	1.2	81	34	0.15	21	47	150
		AL2	70	4	370	300	1.5	150	400	600	0.5	ERM	70	9.6	370	270	0.71	52	218	410
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
MAR/00043.001	East Quay 8, 6m	22/05/2018	4.8	0.2	53.8	45.8	0.07	37.8	21.4	96.4	<0.001		4.8	0.2	53.8	45.8	0.07	37.8	21.4	96.4
MAR/00043.002	East Quay 8, 8m	22/05/2018	5.3	0.18	52.1	40.2	0.05	40.6	12.1	84.6	<0.001		5.3	0.18	52.1	40.2	0.05	40.6	12.1	84.6
MAR/00043.003	East Quay 26, 8m	22/05/2018	7.4	0.17	55.9	44.6	0.04	46.1	13.9	86.8	<0.001		7.4	0.17	55.9	44.6	0.04	46.1	13.9	86.8
MAR/00043.004	East Quay 26, 10m	22/05/2018	5.9	0.1	53	42.7	0.04	43.6	13.4	84.9	<0.001		5.9	0.1	53	42.7	0.04	43.6	13.4	84.9
MAR/00043.005	East Quay 26, 12m	22/05/2018	6.3	<0.04	20.3	11.4	0.04	13.3	9.4	36.7	<0.001		6.3	<0.04	20.3	11.4	0.04	13.3	9.4	36.7
MAR/00048.001	North Quay 6a @ 6m	29/05/2018	4.8	0.12	42.6	28	0.01	27.3	18.1	70.4	<0.001		4.8	0.12	42.6	28	0.01	27.3	18.1	70.4
MAR/00048.002	North Quay 6a @ 8m	29/05/2018	3.1	0.1	58.1	35.3	<0.015	38.3	14.3	74.6	<0.001		3.1	0.1	58.1	35.3	<0.015	38.3	14.3	74.6
MAR/00049.001	VC2016-3 @ 4m	31/05/2018	7.3	0.05	19.5	12.2	0.02	10.9	13.4	34.4	<0.001		7.3	0.05	19.5	12.2	0.02	10.9	13.4	34.4
MAR/00049.002	VC2016-3 @ 6m	31/05/2018	7.2	0.09	17.2	15.4	0.17	10.9	17.2	38.6	<0.001		7.2	0.09	17.2	15.4	0.17	10.9	17.2	38.6
MAR00051.001	01/Disposal/D1	31/05/2018	5.1	0.16	49.5	38.8	0.01	34.5	18.3	79.6	<0.001		5.1	0.16	49.5	38.8	0.01	34.5	18.3	79.6
MAR00051.002	01/Disposal/D2	31/05/2018	5.7	0.06	28.2	21	<0.015	20.2	12	47.6	<0.001		5.7	0.06	28.2	21	<0.015	20.2	12	47.6
MAR00051.003	01/Disposal/D3	31/05/2018	6.3	<0.04	18.4	13.9	0.02	11.2	10.6	32.4	<0.001		6.3	<0.04	18.4	13.9	0.02	11.2	10.6	32.4
MAR00051.004	01/Disposal/D4	31/05/2018	6.2	0.13	48.3	38.2	<0.015	34.2	14.8	79.3	<0.001		6.2	0.13	48.3	38.2	<0.015	34.2	14.8	79.3
MAR00057.001	VC2016-3 8m	04/06/2018	4.7	0.18	60.9	45.2	<0.015	41.9	24.9	104	<0.001		4.7	0.18	60.9	45.2	<0.015	41.9	24.9	104
MAR00060.001	RC2016-2 @ 6m	07/06/2018	5	0.11	30.8	20	0.05	21.5	6.7	47.6	<0.001		5	0.11	30.8	20	0.05	21.5	6.7	47.6
MAR00064.001	VC2016-13 8m	13/06/2018	5.5	0.2	52.2	39	0.02	35.9	16.8	82.5	<0.001		5.5	0.2	52.2	39	0.02	35.9	16.8	82.5
MAR00064.002	East Quay 27 8m	13/06/2018	4.3	0.2	47.6	35.6	0.02	30.8	15.3	77.9	<0.005		4.3	0.2	47.6	35.6	0.02	30.8	15.3	77.9
MAR00064.003	East Quay 27 10m	13/06/2018	4.6	0.22	43.7	32.6	0.02	28.6	15.2	70.1	<0.005		4.6	0.22	43.7	32.6	0.02	28.6	15.2	70.1
MAR00065.001	North Quay 7a	18/06/2018	2.9	0.08	16.9	11.9	0.03	11.2	5.6	33.7	<0.001		2.9	0.08	16.9	11.9	0.03	11.2	5.6	33.7
MAR00070.001	Disposal D5	03/07/2018	6.4	0.06	30.6	18.3	0.03	18.4	17	53.2	<0.001		6.4	0.06	30.6	18.3	0.03	18.4	17	53.2
MAR00070.002	Disposal D6	03/07/2018	9.3	0.06	21.4	42.7	0.03	12.1	14.1	45.8	0.001		9.3	0.06	21.4	42.7	0.03	12.1	14.1	45.8
MAR00070.003	Disposal D7	03/07/2018	9.7	0.06	25.3	17.2	0.04	14.3	15.8	52.2	0.005		9.7	0.06	25.3	17.2	0.04	14.3	15.8	52.2
MAR00070.004	Disposal D8	03/07/2018	13.6	0.06	31.7	13.5	0.04	15.3	31.9	53.1	0.004		13.6	0.06	31.7	13.5	0.04	15.3	31.9	53.1
MAR00072.001	RC2016-31 @ 6m	09/07/2018	6.6	0.09	24.9	17.8	0.09	13.7	11.7	46.2	<0.001		6.6	0.09	24.9	17.8	0.09	13.7	11.7	46.2
MAR00072.002	RC2016-31 @ 8m	09/07/2018	5.8	0.07	26.4	18.8	0.1	15.8	10.8	64.6	<0.001		5.8	0.07	26.4	18.8	0.1	15.8	10.8	64.6
MAR00074.001	VC2016-20 6m	13/07/2018	2.8	0.29	41.4	31.7	0.03	32	16.8	81	<0.001		2.8	0.29	41.4	31.7	0.03	32	16.8	81
MAR00078.001	VC2016-19 5m	18/07/2018	2.7	0.24	40.8	30.6	0.03	29.4	14.7	73.5	<0.001		2.7	0.24	40.8	30.6	0.03	29.4	14.7	73.5
MAR00078.002	VC2016-19 6m	18/07/2018	2.8	0.23	42	31.7	0.02	31	16.2	79	<0.001		2.8	0.23	42	31.7	0.02	31	16.2	79
MAR00078.003	VC2016-19 8m	18/07/2018	3	0.29	42.5	32.2	0.02	33.1	16	78.8	<0.001		3	0.29	42.5	32.2	0.02	33.1	16	78.8
MAR00079.001	VC2016-16 4m	18/07/2018	7.7	0.17	27.6	18.3	0.05	20.5	14	63.2	<0.001		7.7	0.17	27.6	18.3	0.05	20.5	14	63.2
MAR00084.001	VC2016-11 5m	19/07/2018	8	0.13	18.1	12.5	0.014	11	11.1	61.2	<0.001		8	0.13	18.1	12.5	0.014	11	11.1	61.2
MAR00087.001	VC2016-6 4m	23/07/2018	4.5	0.21	40.6	35.4	0.013	31.6	11.1	76.9	<0.001		4.5	0.21	40.6	35.4	0.013	31.6	11.1	76.9
MAR00092.001	Disposal D9	02/08/2018	9.7	1.39	30.3	73	0.1	19	35.8	151.1	<0.001		9.7	1.39	30.3	73	0.1	19	35.8	151.1
MAR00092.002	Disposal D10	02/08/2018	8.5	0.17	18.7	14.1	0.04	10.7	14.2	47	<0.001		8.5	0.17	18.7	14.1	0.04	10.7	14.2	47
MAR00092.003	Disposal D11	02/08/2018	14.9	0.09	14.2	10.6	0.02	10	8.8	30.2	<0.001		14.9	0.09	14.2	10.6	0.02	10	8.8	30.2
MAR00092.004	Disposal D12	02/08/2018	17.2	0.09	16.3	9	0.02	11	9.2	29	<0.001		17.2	0.09	16.3	9	0.02	11	9.2	29
MAR00093.001	VC2016/7 6m	07/08/2018	4.5	0.32	49.2	36.9	0.03	31.2	14.6	90.9	<0.001		4.5	0.32	49.2	36.9	0.03	31.2	14.6	90.9
MAR00093.002	VC2016/7 8m	07/08/2018	4.9	0.34	52.8	41.7	0.03	36.6	15.4	95.8	<0.001		4.9	0.34	52.8	41.7	0.03	36.6	15.4	95.8
MAR00104.001	VC2016-12 6CD	29/08/2018	6	0.11	28.2	22.8	0.04	20.2	11.2	50.6	<0.001		6	0.11	28.2	22.8	0.04	20.2	11.2	50.6
MAR00104.002	VC2016-12 8CD	29/08/2018	5	0.19	47.3	33.3	0.03	34	10.9	75.6	<0.001		5	0.19	47.3	33.3	0.03	34	10.9	75.6
MAR00105.001	D13	30/08/2018	8.5	0.11	20.1	15.8	0.02	11.3	11.4	39.7	<0.001		8.5	0.11	20.1	15.8	0.02	11.3	11.4	39.7
MAR00105.002	D14	30/08/2018	5.2	0.12	20.5	40.9	0.03	13.4	9.8	42.4	<0.001		5.2	0.12	20.5	40.9	0.03	13.4	9.8	42.4
MAR00105.003	D15	30/08/2018	8.7	0.12	22.7	17.1	0.04	12.4	16.4	45.4	<0.001		8.7	0.12	22.7	17.1	0.04	12.4	16.4	45.4
MAR00105.004	D16	30/08/2018	10.9	0.2	32.3	16.3	0.1	18.5	20.6	59.9	<0.001		10.9	0.2	32.3	16.3	0.1	18.5	20.6	59.9
MAR00116.001	RC2016-1 2CD	10/09/2018	13.1	0.41	60.6	47.4	0.07	49.9	17.7	96.6	<0.001		13.1	0.41	60.6	47.4	0.07	49.9	17.7	96.6
MAR00116.002	RC2016-1 4CD	10/09/2018	7.1	0.25	55.1	43.5	0.06	39.4	11.1	77.8	<0.001		7.1	0.25	55.1	43.5	0.06	39.4	11.1	77.8
MAR00116.003	RC2016-1 6CD	10/09/2018	7.6	0.23	45.6	30.5	0.03	32.8	8.9	61.8	<0.001		7.6	0.23	45.6	30.5	0.03	32.8	8.9	61.8
MAR00128.001	D17	28/09/2018	8.4	0.17	26	102.4	0.08	15.5	24.9	82.6	<0.001		8.4	0.17	26	102.4	0.08	15.5	24.9	82.6
MAR00128.002	D18	28/09/2018	8.1	0.09	18.3	45.4	0.03	11	14	48.1	<0.001		8.1	0.09	18.3	45.4	0.03	11	14	48.1
MAR00128.003	D19	28/09/2018	7.5	0.11	19.7	166.3	<0.01	11.9	23.4	95	<0.001		7.5	0.11	19.7	166.3	<0.01	11.9	23.4	95
MAR00128.004	D20	28/09/2018	7.3	0.08	20.6	99.4	0.02	12.4	17.7	70.8	<0.001		7.3	0.08	20.6	99.4	0.02	12.4	17.7	70.8
MAR00171.001	D21 - DISPOSAL	08/12/2018	13.2	0.25	44.3	31	0.08	21.1	20.4	95.9	0.001		13.2	0.25	44.3	31	0.08	21.1	20.4	95.9
MAR00171.002	D22 - DISPOSAL	08/12/2018	8.9	0.18	20.3	25.8	0.03	12.2	11.2	46.1	0.02		8.9	0.18	20.3	25.8	0.03	12.2	11.2	46.1
MAR00171.003	D23 - DISPOSAL	08/12/2018	6	0.27	52.3	37.7	0.03	34.3	22	98.7	0.1		6	0.27	52.3	37.7	0.03	34.3	22	98.7
MAR00171.004	D24 - DISPOSAL	08/12/2018	19.3	0.2	39.3	64.2	0.03	18	20.7	85.9	<0.001		19.3	0.2	39.3	64.2	0.03	18	20.7	85.9

Socotec Sample Ref	DUK Sample Ref	Date sampled	Marine Scotland Revised Action Levels (AL)									Effects Range Low (ERL) and Effects Range Medium (ERM)							
			Arsenic	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc	Tributyl tin	Arsenic	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc
		AL1	20	0.4	50	30	0.25	30	50	130	0.1	ERL 8.2	1.2	81	34	0.15	21	47	150
		AL2	70	4	370	300	1.5	150	400	600	0.5	ERM 70	9.6	370	270	0.71	52	218	410
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
MAR00282.001	DISPOSAL 19 D1	21/05/2019	6.5	0.13	28.7	17.5	<0.01	19.7	30.6	52.4	<0.001	6.5	0.13	28.7	17.5	<0.01	19.7	30.6	52.4
MAR00282.002	DISPOSAL 19 D2	21/05/2019	8.6	0.11	22.2	18.1	<0.01	14.2	13.6	41.2	<0.001	8.6	0.11	22.2	18.1	<0.01	14.2	13.6	41.2
MAR00282.003	DISPOSAL 19 D3	21/05/2019	10.3	0.09	25.3	16.7	<0.01	14.1	16.1	48.2	<0.001	10.3	0.09	25.3	16.7	<0.01	14.1	16.1	48.2
MAR00282.004	DISPOSAL 19 D4	21/05/2019	18	0.18	39.8	15.7	0.03	19.9	23.7	68	<0.001	18	0.18	39.8	15.7	0.03	19.9	23.7	68
MAR00289.001	RC2016-14	23-25/05/19	2.8	0.25	54	33	0.03	34.2	16.1	78.9	<0.001	2.8	0.25	54	33	0.03	34.2	16.1	78.9
MAR00289.002	RC2016-17	23-25/05/19	4.4	0.23	48.8	34.6	0.02	32	15	73.6	<0.001	4.4	0.23	48.8	34.6	0.02	32	15	73.6
MAR00289.003	RC2016-14	23-25/05/19	5.3	0.16	28.6	48.8	0.05	22.2	8.5	70.2	<0.001	5.3	0.16	28.6	48.8	0.05	22.2	8.5	70.2
MAR00289.004	RC2016-17	23-25/05/19	11.1	0.25	32.3	70	0.09	26.7	8.7	83.9	<0.001	11.1	0.25	32.3	70	0.09	26.7	8.7	83.9
MAR00294.001	RC2016-14	30/05/2019	4.4	0.25	50.8	38.7	0.04	33.2	16.8	90.7	<0.001	4.4	0.25	50.8	38.7	0.04	33.2	16.8	90.7
MAR00294.002	RC2016-17	30/05/2019	4.9	0.25	49.4	39.7	0.03	31.8	16.8	87.5	<0.001	4.9	0.25	49.4	39.7	0.03	31.8	16.8	87.5
MAR00306.001	RC2016-01 4m	11/06/2019	6.7	0.16	48	39.5	0.05	34.6	12.5	73.4	<0.001	6.7	0.16	48	39.5	0.05	34.6	12.5	73.4
MAR00306.002	RC2016-01 6m	11/06/2019	8.2	0.17	45.1	30.6	0.03	31.1	11.7	76.7	<0.001	8.2	0.17	45.1	30.6	0.03	31.1	11.7	76.7
MAR00317.001	West Quay 29 - 2m	22-25/06/19	9.9	0.16	50.4	33.9	0.06	40.4	11.3	71.3	<0.001	9.9	0.16	50.4	33.9	0.06	40.4	11.3	71.3
MAR00317.002	West Quay 29 - 6m	22-25/06/19	4.3	0.16	46.4	33.9	0.11	33.4	13.5	74.3	<0.001	4.3	0.16	46.4	33.9	0.11	33.4	13.5	74.3
MAR00317.003	West Quay 29 - 8m	22-25/06/19	3	0.18	46.8	33.4	0.06	32.9	14.8	74.1	<0.001	3	0.18	46.8	33.4	0.06	32.9	14.8	74.1
MAR00317.004	RC2016-05 5m	22-25/06/19	4.1	0.07	43.1	33.1	0.04	29.2	10.7	68	<0.001	4.1	0.07	43.1	33.1	0.04	29.2	10.7	68
MAR00317.005	RC2016-05 7m	22-25/06/19	5.5	0.11	46	35.3	0.04	32.7	11.2	71.6	<0.001	5.5	0.11	46	35.3	0.04	32.7	11.2	71.6
MAR00317.006	RC2016-05 8m	22-25/06/19	5.6	0.12	49.7	37.3	0.03	35.2	12.2	76.3	<0.001	5.6	0.12	49.7	37.3	0.03	35.2	12.2	76.3
MAR00321.001	West Quay 21 Box W4 - 2m	20/06-02/07/19	8.4	0.18	55.9	42.6	0.05	39.6	11.4	80.7	<0.001	8.4	0.18	55.9	42.6	0.05	39.6	11.4	80.7
MAR00321.002	West Quay 21 Box W4 - 6m	20/06-02/07/19	5.2	0.2	43.8	33.8	0.03	30.7	10.2	69	<0.001	5.2	0.2	43.8	33.8	0.03	30.7	10.2	69
MAR00321.003	West Quay 21 Box W4 - 8m	20/06-02/07/19	4	0.23	56.8	49.3	0.03	39.1	14.2	87.9	<0.001	4	0.23	56.8	49.3	0.03	39.1	14.2	87.9
MAR00321.004	RC2016 Box S2 - 2m	20/06-02/07/19	4.9	0.16	40.5	28.3	0.02	28	9.4	60.8	<0.001	4.9	0.16	40.5	28.3	0.02	28	9.4	60.8
MAR00321.005	West Quay Box W3 - 6m	20/06-02/07/19	6.7	0.18	43.3	31.1	0.03	32.8	10.6	64.6	<0.001	6.7	0.18	43.3	31.1	0.03	32.8	10.6	64.6
MAR00321.006	West Quay Box W3 - 2m	20/06-02/07/19	3.9	0.2	34.5	38.9	0.03	22.4	14	58.7	<0.001	3.9	0.2	34.5	38.9	0.03	22.4	14	58.7
MAR00326.001	West Quay 23 - 2m	05/07/2019	3.9	0.25	45.5	37.3	0.03	30.1	14.1	86.5	<0.001	3.9	0.25	45.5	37.3	0.03	30.1	14.1	86.5
MAR00326.002	West Quay 23 - 6m	05/07/2019	2.1	0.21	32.9	24.6	<0.01	21.2	11.4	60.9	<0.001	2.1	0.21	32.9	24.6	<0.01	21.2	11.4	60.9
MAR00326.003	West Quay 22 - 8m	05/07/2019	4.3	0.18	34.2	28	<0.01	25	10.2	58.9	<0.001	4.3	0.18	34.2	28	<0.01	25	10.2	58.9
MAR00326.004	West Quay 23 - 8m	05/07/2019	4.3	0.14	31.7	23.4	<0.01	21.7	9.5	49.7	<0.001	4.3	0.14	31.7	23.4	<0.01	21.7	9.5	49.7
MAR00337.001	West Quay 20 2m	14/07/2019	4	0.16	42.1	38.6	0.012	27.6	14.5	83.6	<0.001	4	0.16	42.1	38.6	0.012	27.6	14.5	83.6
MAR00337.002	West Quay 20 6m	14/07/2019	5.8	0.17	46.3	49.1	<0.01	30.9	15.4	96.4	<0.005	5.8	0.17	46.3	49.1	<0.01	30.9	15.4	96.4
MAR00337.003	West Quay 20 8m	14/07/2019	4.1	0.16	35.9	35.6	<0.01	23	12.1	79.1	<0.001	4.1	0.16	35.9	35.6	<0.01	23	12.1	79.1
MAR00343.001	Disposal D1	20/07/2019	4.6	0.16	28.3	24.5	0.04	21.8	15.4	55.7	<0.001	4.6	0.16	28.3	24.5	0.04	21.8	15.4	55.7
MAR00343.002	Disposal D2	20/07/2019	4.5	0.18	28.3	27.1	0.03	22	11.3	55.7	<0.001	4.5	0.18	28.3	27.1	0.03	22	11.3	55.7
MAR00343.003	Disposal D3	20/07/2019	6	0.18	29.6	27.3	0.04	23.5	12.8	69.6	<0.001	6	0.18	29.6	27.3	0.04	23.5	12.8	69.6
MAR00343.004	Disposal D4	20/07/2019	4.9	0.13	25.8	23.2	0.03	19.9	43.6	60.8	<0.001	4.9	0.13	25.8	23.2	0.03	19.9	43.6	60.8
MAR00374.001	Disposal D1	14/08/2019	9.4	0.13	23.8	26.6	0.09	14.8	16.4	74.9	<0.001	9.4	0.13	23.8	26.6	0.09	14.8	16.4	74.9
MAR00374.002	Disposal D2	14/08/2019	7.1	0.1	22.1	18.3	0.07	15.1	12.7	47.7	<0.001	7.1	0.1	22.1	18.3	0.07	15.1	12.7	47.7
MAR00374.003	Disposal D3	14/08/2019	2.5	0.16	32.9	25.6	0.02	23	13	61.4	<0.001	2.5	0.16	32.9	25.6	0.02	23	13	61.4
MAR00374.004	Disposal D4	14/08/2019	2.3	0.25	39.8	27.9	<0.015	27	16.1	71.8	<0.001	2.3	0.25	39.8	27.9	<0.015	27	16.1	71.8
MAR00381.001	Disposal D1	22/08/2019	8.4	0.14	20.2	12.4	0.03	12.2	9.2	49.2	<0.001	8.4	0.14	20.2	12.4	0.03	12.2	9.2	49.2
MAR00381.002	Disposal D2	22/08/2019	8.2	0.06	19.7	10.9	0.02	12.1	7.6	39.4	<0.001	8.2	0.06	19.7	10.9	0.02	12.1	7.6	39.4
MAR00381.003	Disposal D3	22/08/2019	8.7	0.1	19.1	10	0.02	11.7	8.4	39.5	<0.001	8.7	0.1	19.1	10	0.02	11.7	8.4	39.5
MAR00381.004	Disposal D4	22/08/2019	8.6	0.1	18.9	9.7	0.02	11.6	7.7	35	<0.001	8.6	0.1	18.9	9.7	0.02	11.6	7.7	35
MAR00444.001	Disposal D1	18/10/2019	6.3	0.08	17.7	10.6	0.02	11.1	11.2	54.7	<0.001	6.3	0.08	17.7	10.6	0.02	11.1	11.2	54.7
MAR00444.002	Disposal D2	18/10/2019	5.9	0.05	15.5	8.3	<0.015	9.1	6.8	37.4	<0.001	5.9	0.05	15.5	8.3	<0.015	9.1	6.8	37.4
MAR00444.003	Disposal D3	18/10/2019	5.8	0.08	18.6	10.1	<0.015	11.6	6.1	64.7	<0.001	5.8	0.08	18.6	10.1	<0.015	11.6	6.1	64.7
MAR00444.004	Disposal D4	18/10/2019	6	0.09	19.1	8.7	<0.015	11.6	5.9	59.2	<0.001	6	0.09	19.1	8.7	<0.015	11.6	5.9	59.2

Although there are a number of exceedances of Action Level 1 and the ERL for heavy metals across the samples, the vast majority of these are minor exceedances, i.e. they are well below Action Level 2 and the ERM. All results are below Action Level 1 for tributyl tin. These results are consistent with the 2016 pre-dredge sampling results.

Aberdeen Harbour Expansion Project: Dredging Licence Application 2019 V5

Results of 2018-19 dredge samples: Polycyclic Aromatic Hydrocarbons (PAHs)

Socotec Ref	DUK Ref	Date sampled		Marine Scotland Revised Action Levels (ALs)														
				Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)Anthracene	Benzo(a)Pyrene	Benzo(ghi)Perylene	Benzo(b/k)Fluoranthene	Chrysene	Dibenzo(ah)Anthracene	Fluoranthene	Fluorene	Indeno(123-cd)Pyrene	Naphthalene	Phenanthrene	Pyrene
				µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
			AL 1	100	100	100	100	100	100	100	100	10	100	100	100	100	100	100
MAR/00043.001	East Quay 8, 6m	22/05/2018		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR/00043.002	East Quay 8, 8m	22/05/2018		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR/00043.003	East Quay 26, 8m	22/05/2018		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR/00043.004	East Quay 26, 10m	22/05/2018		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR/00043.005	East Quay 26, 12m	22/05/2018		4.23	2.94	9.14	18.2	31	22.6	9.63	19.8	4.2	36	4.19	23.1	3.54	28.3	44.9
MAR/00048.001	North Quay 6a @ 6m	29/05/2018		48.8	12.3	112	179	240	113	82.6	181	20.3	421	45	107	22.3	370	453
MAR/00048.002	North Quay 6a @ 8m	29/05/2018		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR/00049.001	VC2016-3 @ 4m	31/05/2018		1.7	1.16	5.09	12.5	22.8	12	9.32	14.3	2.23	22.6	1.79	12.3	1.22	14.4	31.5
MAR/00049.002	*VC2016-3 @ 6m*	*31/05/2018*		*562*	*54.1*	*1206*	*1420*	*1422*	*738*	*527*	*1510*	*168*	*4162*	*458*	*505*	*416*	*4216*	*4470*
MAR00051.001	01/Disposal/D1	31/05/2018		3.05	5.58	8.06	18.1	39.1	24.1	14	22.6	4.49	31	2.63	22.7	1.31	19.1	42.6
MAR00051.002	01/Disposal/D2	31/05/2018		1.44	6.67	5.42	11.5	32.3	20.3	12.4	15.2	4.16	17.4	1.36	19	1.26	9.17	35.2
MAR00051.003	01/Disposal/D3	31/05/2018		<1	2.86	3.45	5.8	17.3	12.7	5.81	7.6	2.43	10.2	1.03	11.3	<1	6.68	17.6
MAR00051.004	01/Disposal/D4	31/05/2018		<1	4.2	4.1	9.2	29.7	19	10.8	12.2	3.79	14.6	<1	18.1	<1	6.64	32.4
MAR00057.001	VC2016-3 8m	04/06/2018		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00060.001	RC2016-2 @ 6m	07/06/2018		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00064.001	VC2016-13 8m	13/06/2018		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.12
MAR00064.002	East Quay 27 8m	13/06/2018		12.6	3.92	17.3	29.1	40.1	26.1	14.3	31.1	5.15	63.2	11.8	24	7.97	56.7	77.1
MAR00064.003	East Quay 27 10m	13/06/2018		55.1	17.2	112	188	222	131	89.8	187	27.7	422	62.7	130	34.5	352	431
MAR00065.001	North Quay 7a	18/06/2018		2.5	1.96	4.48	7.6	12.6	8.14	4.6	8.11	1.61	15.7	2.79	7.74	8.21	14.3	18.4
MAR00070.001	Disposal D5	03/07/2018		38.8	7.07	58.1	84.7	102	67.6	36.7	83.6	12	197	38	64.8	25.7	199	206
MAR00070.002	Disposal D6	03/07/2018		18.9	9.71	37.3	104	152	114	61.7	112	25.3	187	24.5	121	43.3	136	176
MAR00070.003	*Disposal D7*	*03/07/2018*		*108*	*44*	*192*	*307*	*298*	*163*	*120*	*291*	*33.5*	*733*	*115*	*182*	*96.3*	*571*	*589*
MAR00070.004	Disposal D8	03/07/2018		15.3	5.1	24.6	34.1	39.1	31.6	16.7	35.2	6.15	75	16.8	31.4	9.2	80	76.8
MAR00072.001	RC2016-31 @ 6m	09/07/2018		10.4	30.9	32.1	131	302	194	222	143	37.6	191	10.0	210	6.48	52.7	260
MAR00072.002	*RC2016-31 @ 8m*	*09/07/2018*		*2040*	*126*	*2440*	*2600*	*2950*	*1860*	*1870*	*2620*	*344*	*6700*	*1440*	*1700*	*3050*	*8860*	*7000*
MAR00074.001	VC2016-20 6m	13/07/2018		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00078.001	VC2016-19 5m	18/07/2018		<1	<1	<1	1.39	4.07	3.22	1.55	1.73	<1	1.67	<1	3.41	<1	<1	2.08
MAR00078.002	VC2016-19 6m	18/07/2018		<1	<1	<1	<1	1.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.51
MAR00078.003	VC2016-19 8m	18/07/2018		<1	<1	<1	<1	1.15	1.02	<1	<1	<1	<1	<1	<1	<1	<1	1.54
MAR00079.001	*VC2016-16 4m*	*18/07/2018*		*94.9*	*229*	*430*	*498*	*503*	*294*	*233*	*474*	*56.3*	*1011*	*322*	*320*	*96.1*	*894*	*945*
MAR00084.001	VC2016-11 5m	19/07/2018		7.64	7.87	17.4	50.3	93.7	56.9	32.4	55.4	8.83	91.6	9.61	60.5	4.21	45.9	136
MAR00087.001	VC2016-6 4m	23/07/2018		<1	2.01	2.37	5.07	15.3	11.1	5.57	6.07	1.9	8.51	<1	11.7	1.4	3.79	15
MAR00092.001	Disposal D9	02/08/2018		6.16	3.15	16.8	45.6	50.2	37	22	44.2	3.23	91.9	7.03	37.7	9.38	54.9	86.4
MAR00092.002	Disposal D10	02/08/2018		3.95	1.96	5.93	13	21	16.2	7.4	14.8	1.13	29.4	3.17	17.2	5.58	16.3	35.3
MAR00092.003	Disposal D11	02/08/2018		<1	<1	<1	9.85	10.9	6.51	4.33	9.65	<1	16.9	<1	7.7	<1	2.3	14.9
MAR00092.004	Disposal D12	02/08/2018		<1	<1	<1	1.83	4.47	3.98	1.7	1.92	<1	1.86	<1	4.26	<1	<1	1.84
MAR00093.001	VC2016/7 6m	07/08/2018		16.3	5.8	42.4	60	77	47	33.4	60	8.29	136	16.6	49.6	3.48	106	152
MAR00093.002	VC2016/7 8m	07/08/2018		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00104.001	VC2016-12 6CD	29/08/2018		12.5	3.75	26.5	59.7	82.3	50.1	27.3	62.5	7.2	131	9.1	49.8	4.56	82.9	134
MAR00104.002	VC2016-12 8CD	29/08/2018		1.38	<1	1.59	2.46	6.93	5.39	3.23	2.97	1.17	4.81	<1	5.88	<1	3.79	5.66
MAR00105.001	D13	30/08/2018		1.64	1.19	5.64	13.2	19	14.2	7.21	14.2	2.76	20.9	1.74	13.9	3.93	13.1	21.6
MAR00105.002	D14	30/08/2018		1.15	2.45	3.46	12.7	25.4	16.5	9.35	14.4	2.79	18.7	<1	16.8	1.08	6.3	32.7
MAR00105.003	D15	30/08/2018		8.82	8.12	18.4	64.6	82.3	48.2	26.6	64.5	8.85	91.5	8.97	47	9.57	55.1	107
MAR00105.004	D16	30/08/2018		5.13	1.79	8.25	21.5	28.6	27.7	12.3	24.2	4.46	43.8	3.57	28.4	6.38	21.8	43.6
MAR00116.001	RC2016-1 2CD	10/09/2018		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00116.002	RC2016-1 4CD	10/09/2018		<1	<1	<1	1.79	4.6	3.55	2.14	2.21	<1	1	<1	3.59	<1	<1	1
MAR00116.003	RC2016-1 6CD	10/09/2018		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

	Effects Range Low (ERL) and Effects Range Medium (ERM)															
	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)Anthracene	Benzo(a)Pyrene	Benzo(ghi)Perylene	Benzo(b/k)Fluoranthene	Chrysene	Dibenzo(ah)Anthracene	Fluoranthene	Fluorene	Indeno(123-cd)Pyrene	Naphthalene	Phenanthrene	Pyrene	
	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	
ERL	16	44	85	261	430	n/a	n/a	384	63	600	19	200	160	240	665	
ERM	500	640	1100	1600	1600	n/a	n/a	2800	260	5100	540	n/a	2100	1500	2600	
MAR/00043.001	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
MAR/00043.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
MAR/00043.003	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
MAR/00043.004	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
MAR/00043.005	4.23	2.94	9.14	18.2	31	22.6	9.63	19.8	4.2	36	4.19	23.1	3.54	28.3	44.9	
MAR/00048.001	48.8	12.3	112	179	240	113	82.6	181	20.3	421	45	107	22.3	370	453	
MAR/00048.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
MAR/00049.001	1.7	1.16	5.09	12.5	22.8	12	9.32	14.3	2.23	22.6	1.79	12.3	1.22	14.4	31.5	
MAR/00049.002	*562*	*54.1*	*1206*	*1420*	*1422*	*738*	*527*	*1510*	*168*	*4162*	*458*	*505*	*416*	*4216*	*4470*	*Selected for further analysis*
MAR00051.001	3.05	5.58	8.06	18.1	39.1	24.1	14	22.6	4.49	31	2.63	22.7	1.31	19.1	42.6	
MAR00051.002	1.44	6.67	5.42	11.5	32.3	20.3	12.4	15.2	4.16	17.4	1.36	19	1.26	9.17	35.2	
MAR00051.003	<1	2.86	3.45	5.8	17.3	12.7	5.81	7.6	2.43	10.2	1.03	11.3	<1	6.68	17.6	
MAR00051.004	<1	4.2	4.1	9.2	29.7	19	10.8	12.2	3.79	14.6	<1	18.1	<1	6.64	32.4	
MAR00057.001	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
MAR00060.001	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
MAR00064.001	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.12	
MAR00064.002	12.6	3.92	17.3	29.1	40.1	26.1	14.3	31.1	5.15	63.2	11.8	24	7.97	56.7	77.1	
MAR00064.003	55.1	17.2	112	188	222	131	89.8	187	27.7	422	62.7	130	34.5	352	431	
MAR00065.001	2.5	1.96	4.48	7.6	12.6	8.14	4.6	8.11	1.61	15.7	2.79	7.74	8.21	14.3	18.4	
MAR00070.001	38.8	7.07	58.1	84.7	102	67.6	36.7	83.6	12	197	38	64.8	25.7	199	206	
MAR00070.002	18.9	9.71	37.3	104	152	114	61.7	112	25.3	187	24.5	121	43.3	136	176	
MAR00070.003	*108*	*44*	*192*	*307*	*298*	*163*	*120*	*291*	*33.5*	*733*	*115*	*182*	*96.3*	*571*	*589*	*Selected for further analysis*
MAR00070.004	15.3	5.1	24.6	34.1	39.1	31.6	16.7	35.2	6.15	75	16.8	31.4	9.2	80	76.8	
MAR00072.001	10.4	30.9	32.1	131	302	194	222	143	37.6	191	10	210	6.48	52.7	260	
MAR00072.002	*2040*	*126*	*2440*	*2600*	*2950*	*1860*	*1870*	*2620*	*344*	*6700*	*1440*	*1700*	*3050*	*8860*	*7000*	*Selected for further analysis*
MAR00074.001	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
MAR00078.001	<1	<1	<1	1.39	4.07	3.22	1.55	1.73	<1	1.67	<1	3.41	<1	<1	2.08	
MAR00078.002	<1	<1	<1	<1	1.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.51	
MAR00078.003	<1	<1	<1	<1	1.15	1.02	<1	<1	<1	<1	<1	<1	<1	<1	1.54	
MAR00079.001	*94.9*	*229*	*430*	*498*	*503*	*294*	*233*	*474*	*56.3*	*1011*	*322*	*320*	*96.1*	*894*	*945*	*Selected for further analysis*
MAR00084.001	7.64	7.87	17.4	50.3	93.7	56.9	32.4	55.4	8.83	91.6	9.61	60.5	4.21	45.9	136	
MAR00087.001	<1	2.01	2.37	5.07	15.3	11.1	5.57	6.07	1.9	8.51	<1	11.7	1.4	3.79	15	
MAR00092.001	6.16	3.15	16.8	45.6	50.2	37	22	44.2	3.23	91.9	7.03	37.7	9.38	54.9	86.4	
MAR00092.002	3.95	1.96	5.93	13	21	16.2	7.4	14.8	1.13	29.4	3.17	17.2	5.58	16.3	35.3	
MAR00092.003	<1	<1	<1	9.85	10.9	6.51	4.33	9.65	<1	16.9	<1	7.7	<1	2.3	14.9	
MAR00092.004	<1	<1	<1	1.83	4.47	3.98	1.7	1.92	<1	1.86	<1	4.26	<1	<1	1.84	
MAR00093.001	16.3	5.8	42.4	60	77	47	33.4	60	8.29	136	16.6	49.6	3.48	106	152	
MAR00093.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
MAR00104.001	12.5	3.75	26.5	59.7	82.3	50.1	27.3	62.5	7.2	131	9.1	49.8	4.56	82.9	134	
MAR00104.002	1.38	<1	1.59	2.46	6.93	5.39	3.23	2.97	1.17	4.81	<1	5.88	<1	3.79	5.66	
MAR00105.001	1.64	1.19	5.64	13.2	19	14.2	7.21	14.2	2.76	20.9	1.74	13.9	3.93	13.1	21.6	
MAR00105.002	1.15	2.45	3.46	12.7	25.4	16.5	9.35	14.4	2.79	18.7	<1	16.8	1.08	6.3	32.7	
MAR00105.003	8.82	8.12	18.4	64.6	82.3	48.2	26.6	64.5	8.85	91.5	8.97	47	9.57	55.1	107	
MAR00105.004	5.13	1.79	8.25	21.5	28.6	27.7	12.3	24.2	4.46	43.8	3.57	28.4	6.38	21.8	43.6	
MAR00116.001	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
MAR00116.002	<1	<1	<1	1.79	4.6	3.55	2.14	2.21	<1	1	<1	3.59	<1	<1	1	
MAR00116.003	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	

Socotec Ref	DUK Ref	Date sampled		Marine Scotland Revised Action Levels (ALs)														
				Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)Anthracene	Benzo(a)Pyrene	Benzo(ghi)Perylene	Benzo(b/k)Fluoranthene	Chrysene	Dibenzo(ah)Anthracene	Fluoranthene	Fluorene	Indeno(123-cd)Pyrene	Naphthalene	Phenanthrene	Pyrene
				µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
			AL 1	100	100	100	100	100	100	100	100	10	100	100	100	100	100	100
MAR00128.001	D17	28/09/2018		1.41	2.11	5.23	12.3	17	16.9	6.7	14.5	3.68	18.6	2.03	15.9	18.1	30.6	19.4
MAR00128.002	D18	28/09/2018		1.34	6.11	8.02	15.8	59.8	44.1	19.4	20.2	6.94	29.2	2.17	44.8	1.4	16.6	42.3
MAR00128.003	D19	28/09/2018		1.94	2.3	7.1	24.8	35.8	30.5	12.7	26.4	5.56	48.1	2.29	28.8	4.07	20.6	49.3
MAR00128.004	D20	28/09/2018		1.88	1.99	4.92	11.6	38.8	29.9	13.8	15.4	5.42	16.9	1.51	30.3	4.78	11.1	22.1
MAR00171.001	D21 - DISPOSAL	08/12/2018		4.75	3.77	11.4	35.7	44.3	45.9	25.8	38.2	8.84	66.3	5.59	47.2	12.7	36.2	69
MAR00171.002	D22 - DISPOSAL	08/12/2018		<1	<1	1.58	4	7.18	6.46	4.09	4.98	1.19	7.7	<1	6.23	2.27	3.65	8.56
MAR00171.003	D23 - DISPOSAL	08/12/2018		21.1	10.1	46.5	94.7	100	71.1	44.1	97.8	12.7	198	23	69.4	22.2	161	209
MAR00171.004	D24 - DISPOSAL	08/12/2018		<1	<1	2.7	7.63	9.43	11.2	5.19	8.59	1.87	14.7	1.26	11.2	6.59	9	14.9
MAR00282.001	DISPOSAL 19 D1	21/05/2019		4.38	3.71	13.9	21.8	42.1	26.3	18.3	25.2	4.92	45.7	5.49	26.8	4.86	34.9	52.2
MAR00282.002	DISPOSAL 19 D2	21/05/2019		3.38	3.21	14.5	37.3	48.1	32	16.4	46.9	7.37	69	4.59	30.6	5.95	43.6	71.4
MAR00282.003	DISPOSAL 19 D3	21/05/2019		3.33	1.25	3.77	9.02	13.1	12.7	6.31	9.63	2.38	16.9	3.84	13.1	5.72	10.4	17.8
MAR00282.004	DISPOSAL 19 D4	21/05/2019		5.25	2.77	9.32	24.7	32.7	23.8	12.8	26.5	4.3	36.9	5.96	23.4	5.69	32.5	45.2
MAR00289.001	RC2016-14	23-25/05/19		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00289.002	RC2016-17	23-25/05/19		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00289.003	RC2016-14	23-25/05/19		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00289.004	RC2016-17	23-25/05/19		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00294.001	RC2016-14	30/05/2019		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00294.002	RC2016-17	30/05/2019		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00306.001	RC2016-01 4m	11/06/2019		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00306.002	RC2016-01 6m	11/06/2019		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00317.001	West Quay 29 - 2m	22-25/06/19		<1	<1	<1	1.75	2.82	2.36	1.78	2	<1	2.1	<1	1.73	<1	1.96	2.63
MAR00317.002	West Quay 29 - 6m	22-25/06/19		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	4.72	1.97
MAR00317.003	West Quay 29 - 8m	22-25/06/19		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00317.004	RC2016-05 5m	22-25/06/19		<1	<1	<1	<1	1.17	<1	<1	<1	<1	<1	<1	<1	<1	4.07	2.96
MAR00317.005	RC2016-05 7m	22-25/06/19		<1	<1	<1	<1	<1	<1	<1	<1	<1	1.38	<1	<1	<1	<1	1.46
MAR00317.006	RC2016-05 8m	22-25/06/19		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00321.001	t Quay 21 Box W4 - 2m	20/06-02/07/19		<1	<1	<1	1.38	3.46	2.35	1.7	1.99	<1	2.31	<1	2.23	<1	2.04	4.57
MAR00321.002	t Quay 21 Box W4 - 6m	20/06-02/07/19		<1	<1	<1	<1	4.65	3.03	1.95	1.29	<1	1.36	<1	3.27	<1	1.32	2.73
MAR00321.003	t Quay 21 Box W4 - 8m	20/06-02/07/19		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00321.004	RC2016 Box S2 - 2m	20/06-02/07/19		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00321.005	/est Quay Box W3 - 6m	20/06-02/07/19		20.2	1.88	51.7	52.5	55.7	31	20.8	51.8	5.19	139	18.1	32.7	3.58	103	141
MAR00321.006	/est Quay Box W3 - 2m	20/06-02/07/19		98.1	20.2	200	274	283	150	84.2	265	24.1	741	83.1	172	40.4	567	670
MAR00326.001	West Quay 23 - 2m	05/07/2019		44.8	12.2	93.3	150	188	130	65.1	145	27.5	259	40.4	132	36.3	305	277
MAR00326.002	West Quay 23 - 6m	05/07/2019		4.27	3.32	17	24.9	25.5	17.6	8.77	25.6	3.66	60.3	16.3	17.8	2.08	71.1	53.4
MAR00326.003	West Quay 22 - 8m	05/07/2019		5.27	2.59	17.2	17.3	13.3	8.43	5.96	17.1	1.7	52.7	25.1	8.31	1.42	66.4	43
MAR00326.004	West Quay 23 - 8m	05/07/2019		<1	1.02	1.88	4.74	9.91	6.55	3.8	5.76	1.47	8.25	<1	7.07	<1	4.33	18.1
MAR00337.001	West Quay 20 2m	14/07/2019		<1	<1	2.17	3.41	4.46	3.79	2.32	4.1	<1	7.52	1.16	3.56	<1	6.63	8.38
MAR00337.002	West Quay 20 6m	14/07/2019		13.2	14.5	85.8	69	67	48.2	38.1	78.5	15.8	222	61.1	50.7	8.38	324	181
MAR00337.003	West Quay 20 8m	14/07/2019		<1	<1	1.74	2.31	2.35	2.1	<1	3.05	<1	6.22	<1	2.06	<1	6	5.34
MAR00343.001	Disposal D1	20/07/2019		6.81	2.58	15.8	22.5	29.3	20.4	11.5	22.7	4.05	50.2	6.95	21.1	7.06	44	57.6
MAR00343.002	Disposal D2	20/07/2019		2.06	2.77	7.35	22.3	31.4	21.9	12.5	22.9	3.8	43.6	2.32	23.5	3.34	19.3	44.1
MAR00343.003	Disposal D3	20/07/2019		18.5	4.15	43.2	54.1	68.2	45.3	27.6	53.5	7.83	106	19.6	46.4	17.6	103	106
MAR00343.004	Disposal D4	20/07/2019		6.86	5.52	25.2	62.7	76.8	50	25.9	62.8	9.17	131	6.07	50.9	5.4	73.2	140
MAR00374.001	Disposal D1	14/08/2019		<1	<1	2.45	6.6	9.16	6.93	4.57	7.36	1.17	16.3	<1	6.69	1.56	7.06	15.2
MAR00374.002	Disposal D2	14/08/2019		<1	2.32	3	8.17	20.5	12.2	9.28	9.61	2.12	8.33	1.09	12.7	5.45	5.96	14.1
MAR00374.003	Disposal D3	14/08/2019		1.23	1.26	2.27	5.37	12.9	16.7	4.2	15.9	2.73	8.16	1.07	8.9	2.07	3.8	14.2
MAR00374.004	Disposal D4	14/08/2019		<1	<1	<1	1.49	2.81	2.32	<1	2.15	<1	2.47	<1	1.87	<1	1.44	3.62
MAR00381.001	Disposal D1	22/08/2019		2.57	<1	6.08	11.6	16.8	12.1	6.52	12.4	1.89	22.8	2.39	11.3	2	20.2	25.4
MAR00381.002	Disposal D2	22/08/2019		27.1	3.32	52	56.7	74	48.9	23.5	57.4	8.37	141	25.7	48.3	21.4	174	143
MAR00381.003	Disposal D3	22/08/2019		26	4.11	29.3	52.5	70.4	46.2	31.6	65.8	7.94	164	19.8	47	22.8	167	148
MAR00381.004	Disposal D4	22/08/2019		4.41	3.03	15.3	18.6	26.5	18.4	10.6	19	3.22	46.9	7.42	19.6	2.75	49.1	45.5
MAR00444.001	Disposal D1	18/10/2019		3.19	2.12	6.35	9.94	17.6	13.5	8.4	10.9	2.41	19.9	2.74	18	22.8		
MAR00444.002	Disposal D2	18/10/2019		49.8	13.1	76.1	83.6	90.4	53.1	32.5	81.7	9.57	210	58.3	49	70.3	269	214
MAR00444.003	Disposal D3	18/10/2019		4.2	3.26	10.2	25.5	29.8	18.9	11.8	25.4	3.31	53.8	3.85	17.7	7.05	24.2	52.6
MAR00444.004	Disposal D4	18/10/2019		42.5	14.6	89.9	140	165	102	83	143	21.9	362	30	96.1	18.1	234	311

	Effects Range Low (ERL) and Effects Range Medium (ERM)														
	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)Anthracene	Benzo(a)Pyrene	Benzo(ghi)Perylene	Benzo(b/k)Fluoranthene	Chrysene	Dibenzo(ah)Anthracene	Fluoranthene	Fluorene	Indeno(123-cd)Pyrene	Naphthalene	Phenanthrene	Pyrene
	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
ERL	16	44	85	261	430	n/a	n/a	384	63	600	19	200	160	240	665
ERM	500	640	1100	1600	1600	n/a	n/a	2800	260	5100	540	n/a	2100	1500	2600
MAR00128.001	1.41	2.11	5.23	12.3	17	16.9	6.7	14.5	3.68	18.6	2.03	15.9	18.1	30.6	19.4
MAR00128.002	1.34	6.11	8.02	15.8	59.8	44.1	19.4	20.2	6.94	29.2	2.17	44.8	1.4	16.6	42.3
MAR00128.003	1.94	2.3	7.1	24.8	35.8	30.5	12.7	26.4	5.56	48.1	2.29	28.8	4.07	20.6	49.3
MAR00128.004	1.88	1.99	4.92	11.6	38.8	29.9	13.8	15.4	5.42	16.9	1.51	30.3	4.78	11.1	22.1
MAR00171.001	4.75	3.77	11.4	35.7	44.3	45.9	25.8	38.2	8.84	66.3	5.59	47.2	12.7	36.2	69
MAR00171.002	<1	<1	1.58	4	7.18	6.46	4.09	4.98	1.19	7.7	<1	6.23	2.27	3.65	8.56
MAR00171.003	21.1	10.1	46.5	94.7	100	71.1	44.1	97.8	12.7	198	23	69.4	22.2	161	209
MAR00171.004	<1	<1	2.7	7.63	9.43	11.2	5.19	8.59	1.87	14.7	1.26	11.2	6.59	9	14.9
MAR00282.001	4.38	3.71	13.9	21.8	42.1	26.3	18.3	25.2	4.92	45.7	5.49	26.8	4.86	34.9	52.2
MAR00282.002	3.38	3.21	14.5	37.3	48.1	32	16.4	46.9	7.37	69	4.59	30.6	5.95	43.6	71.4
MAR00282.003	3.33	1.25	3.77	9.02	13.1	12.7	6.31	9.63	2.38	16.9	3.84	13.1	5.72	10.4	17.8
MAR00282.004	5.25	2.77	9.32	24.7	32.7	23.8	12.8	26.5	4.3	36.9	5.96	23.4	5.69	32.5	45.2
MAR00289.001	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00289.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00289.003	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00289.004	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00294.001	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00294.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00306.001	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00306.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00317.001	<1	<1	<1	1.75	2.82	2.36	1.78	2	<1	2.1	<1	1.73	<1	1.96	2.63
MAR00317.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	4.72	1.97
MAR00317.003	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00317.004	<1	<1	<1	<1	1.17	<1	<1	<1	<1	<1	<1	<1	<1	4.07	2.96
MAR00317.005	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.38	<1	<1	<1	<1	1.46
MAR00317.006	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00321.001	<1	<1	<1	1.38	3.46	2.35	1.7	1.99	<1	2.31	<1	2.23	<1	2.04	4.57
MAR00321.002	<1	<1	<1	<1	4.65	3.03	1.95	1.29	<1	1.36	<1	3.27	<1	1.32	2.73
MAR00321.003	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00321.004	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MAR00321.005	20.2	1.88	51.7	52.5	55.7	31	20.8	51.8	5.19	139	18.1	32.7	3.58	103	141
MAR00321.006	98.1	20.2	200	274	283	150	84.2	265	24.1	741	83.1	172	40.4	567	670
MAR00326.001	44.8	12.2	93.3	150	188	130	65.1	145	27.5	259	40.4	132	36.3	305	277
MAR00326.002	4.27	3.32	17	24.9	25.5	17.6	8.77	25.6	3.66	60.3	16.3	17.8	2.08	71.1	53.4
MAR00326.003	5.27	2.59	17.2	17.3	13.3	8.43	5.96	17.1	1.7	52.7	25.1	8.31	1.42	66.4	43
MAR00326.004	<1	1.02	1.88	4.74	9.91	6.55	3.8	5.76	1.47	8.25	<1	7.07	<1	4.33	18.1
MAR00337.001	<1	<1	2.17	3.41	4.46	3.79	2.32	4.1	<1	7.52	1.16	3.56	<1	6.63	8.38
MAR00337.002	13.2	14.5	85.8	69	67	48.2	38.1	78.5	15.8	222	61.1	50.7	8.38	324	181
MAR00337.003	<1	<1	1.74	2.31	2.35	2.1	<1	3.05	<1	6.22	<1	2.06	<1	6	5.34
MAR00343.001	6.81	2.58	15.8	22.5	29.3	20.4	11.5	22.7	4.05	50.2	6.95	21.1	7.06	44	57.6
MAR00343.002	2.06	2.77	7.35	22.3	31.4	21.9	12.5	22.9	3.8	43.6	2.32	23.5	3.34	19.3	44.1
MAR00343.003	18.5	4.15	43.2	54.1	68.2	45.3	27.6	53.5	7.83	106	19.6	46.4	17.6	103	106
MAR00343.004	6.86	5.52	25.2	62.7	76.8	50	25.9	62.8	9.17	131	6.07	50.9	5.4	73.2	140
MAR00374.001	<1	<1	2.45	6.6	9.16	6.93	4.57	7.36	1.17	16.3	<1	6.69	1.56	7.06	15.2
MAR00374.002	<1	2.32	3	8.17	20.5	12.2	9.28	9.61	2.12	8.33	1.09	12.7	5.45	5.96	14.1
MAR00374.003	1.23	1.26	2.27	5.37	12.9	16.7	4.2	15.9	2.73	8.16	1.07	8.9	2.07	3.8	14.2
MAR00374.004	<1	<1	<1	1.49	2.81	2.32	<1	2.15	<1	2.47	<1	1.87	<1	1.44	3.62
MAR00381.001	2.57	<1	6.08	11.6	16.8	12.1	6.52	12.4	1.89	22.8	2.39	11.3	2	20.2	25.4
MAR00381.002	27.1	3.32	52	56.7	74	48.9	23.5	57.4	8.37	141	25.7	48.3	21.4	174	143
MAR00381.003	26	4.11	29.3	52.5	70.4	46.2	31.6	65.8	7.94	164	19.8	47	22.8	167	148
MAR00381.004	4.41	3.03	15.3	18.6	26.5	18.4	10.6	19	3.22	46.9	7.42	19.6	2.75	49.1	45.5
MAR00444.001	3.19	2.12	6.35	9.94	17.6	13.5	8.4	10.9	2.41	19.9	2.75	12.9	2.74	18	22.8
MAR00444.002	49.8	13.1	76.1	83.6	90.4	53.1	32.5	81.7	9.57	210	58.3	49	70.3	269	214
MAR00444.003	4.2	3.26	10.2	25.5	29.8	18.9	11.8	25.4	3.31	53.8	3.85	17.7	7.05	24.2	52.6
MAR00444.004	42.5	14.6	89.9	140	165	102	83	143	21.9	362	30	96.1	18.1	234	311

Aberdeen Harbour Expansion Project: Dredging Licence Application 2019 V5

Analysis of 2018-19 dredge samples displaying elevated levels of PAHs

VC2016-3

			Effects Range Low (ERL) and Effects Range Medium (ERM)														
			Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)Anthracene	Benzo(a)Pyrene	Benzo(ghi)Perylene	Benzo(b/k)Fluoranthene	Chrysene	Dibenzo(ah)Anthracene	Fluoranthene	Fluorene	Indeno(123-cd)Pyrene	Naphthalene	Phenanthrene	Pyrene
			µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
		ERL	16	44	85	261	430	n/a	n/a	384	63	600	19	200	160	240	665
		ERM	500	640	1100	1600	1600	n/a	n/a	2800	260	5100	540	n/a	2100	1500	2600
Socotec Ref	**DUK Ref**	**Date sampled**															
MAR/00049.001	VC2016-3 @ 4m	31/05/2018	1.7	1.16	5.09	12.5	22.8	12	9.32	14.3	2.23	22.6	1.79	12.3	1.22	14.4	31.5
MAR/00049.002	VC2016-3 @ 6m	31/05/2018	562	54.1	1206	1420	1422	738	527	1510	168	4162	458	505	416	4216	4470

Sample VC2016-03 @ 6m is located in the North Quay area. The sample displays levels above the ERM and ERL for several PAHs. These are isolated elevations that are not replicated in the sample taken at 4m below Chart Datum (CD) on the same day (as presented above), or the samples taken at similar depths in the pre-dredge borehole at the same location in 2016 (as presented below).

AHB Ref	**Depth sampled**	**Date sampled**															
VC2016-03	3.30m	26/02/2016	<2.0	3.6	4.2	21	29	26	55	14	3.5	18	<2.0	30	2	9.5	28
VC2016-03	3.80m	26/02/2016	2.3	4.1	14	48	49	35	77	36	6	79	3.2	44	2.5	37	84
VC2016-03	4.30m	26/02/2016	3.6	<2.0	6.4	5.7	43	48	16	60	27	18	44	23	17	3.7	23
VC2016-03	4.80m	26/02/2016	15	2.5	21	46	41	31	76	36	4.9	85	12	34	8.6	66	94
VC2016-03	5.30m	26/02/2016	2.3	<2.0	9.6	7.4	80	140	29	120	78	52	87	41	25	8.8	34
VC2016-03	5.50m	26/02/2016	<2.0	<2.0	<2.0	13	15	14	27	6.3	3	8.4	<2.0	19	<2.0	4.2	13
VC2016-03	6.30m	26/02/2016	4	2.6	5.4	25	24	19	46	17	3.7	26	2.4	24	2.1	14	30
VC2016-03	6.80m	26/02/2016	<2.0	<2.0	<2.0	9.2	4.8	5.5	9.7	4.1	3.5	3.4	<2.0	8.7	<2.0	3.3	3.4
VC2016-03	7.30m	26/02/2016	<2.0	<2.0	<2.0	7.8	3.3	3.4	6.3	2.4	1.8	<2.0	<2.0	5.7	<2.0	<2.0	<2.0
VC2016-03	7.80m	26/02/2016	<2.0	<2.0	<2.0	7	4	5.1	8.2	2.6	1.9	<2.0	<2.0	7	<2.0	2.6	<2.0
VC2016-03	8.30m	26/02/2016	<2.0	<2.0	<2.0	7.6	5.9	7.2	12	3.4	2.2	2	<2.0	9.4	<2.0	2.5	<2.0
VC2016-03	8.80m	26/02/2016	<2.0	<2.0	<2.0	6.8	4.6	5.6	9.6	2.9	2.2	<2.0	<2.0	7.7	<2.0	2.1	<2.0

Disposal D7

			Effects Range Low (ERL) and Effects Range Medium (ERM)														
			Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)Anthracene	Benzo(a)Pyrene	Benzo(ghi)Perylene	Benzo(b/k)Fluoranthene	Chrysene	Dibenzo(ah)Anthracene	Fluoranthene	Fluorene	Indeno(123-cd)Pyrene	Naphthalene	Phenanthrene	Pyrene
			µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
		ERL	16	44	85	261	430	n/a	n/a	384	63	600	19	200	160	240	665
		ERM	500	640	1100	1600	1600	n/a	n/a	2800	260	5100	540	n/a	2100	1500	2600
Socotec Ref	**DUK Ref**	**Date sampled**															
MAR00070.003	Disposal D7	03/07/2018	108	44	192	307	298	163	120	291	33.5	733	115	182	96.3	571	589

Sample D7 is at sample location D3 at the offshore disposal site. The sample displays levels above the ERL for several PAHs but no exceedances of the ERM. These levels are not reflected in the samples collected at the same location approximately 1 month before and 1 month after this sample, so this is considered to be an isolated event.

VC-2016-16

			Effects Range Low (ERL) and Effects Range Medium (ERM)														
			Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)Anthracene	Benzo(a)Pyrene	Benzo(ghi)Perylene	Benzo(b/k)Fluoranthene	Chrysene	Dibenzo(ah)Anthracene	Fluoranthene	Fluorene	Indeno(123-cd)Pyrene	Naphthalene	Phenanthrene	Pyrene
			µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
		ERL	16	44	85	261	430	n/a	n/a	384	63	600	19	200	160	240	665
		ERM	500	640	1100	1600	1600	n/a	n/a	2800	260	5100	540	n/a	2100	1500	2600
Socotec Ref	**DUK Ref**	**Date sampled**															
MAR00079.001	VC2016-16 4m	18/07/2018	94.9	229	430	498	503	294	233	474	56.3	1011	322	320	96.1	894	945
Sample VC2016-16 is located in the centre of Nigg Bay. The sample at 4m below CD displays levels above the ERL for several PAHs but no exceedances of the ERM. These are isolated elevations that are not replicated in the samples taken at similar depths (3.7m and 4.2m below CD) in the pre-dredge borehole at the same location in 2016 as presented below, although elevations were observed at 5.2m below CD.																	
AHB Ref	**Depth sampled**	**Date sampled**															
RC2016-16	3.70m	27/02/2016	<2.0	<2.0	<2.0	2.1	23	65	8.1	63	31	20	49	23	18	2.6	22
RC2016-16	4.20m	27/02/2016	<2.0	<2.0	2.2	3.1	21	42	10	38	25	15	34	17	13	4.3	17
RC2016-16	4.70m	27/02/2016	2.6	<2.0	5.4	7.4	65	57	23	80	39	31	50	29	18	6.6	26
RC2016-16	5.20m	27/02/2016	57	17	140	140	1000	840	180	860	420	280	500	320	180	32	230
RC2016-16	5.70m	27/02/2016	2.3	<2.0	<2.0	<2.0	16	22	2.2	20	15	8.2	17	9.2	7.1	2.6	8.7
RC2016-16	6.20m	27/02/2016	<2.0	<2.0	<2.0	<2.0	2.9	<2.0	<2.0	<2.0	5.7	<2.0	<2.0	<2.0	2	0.8	<2.0
RC2016-16	6.70m	27/02/2016	<2.0	<2.0	<2.0	<2.0	2.8	<2.0	<2.0	<2.0	5.2	<2.0	<2.0	<2.0	2	0.8	<2.0
RC2016-16	7.20m	27/02/2016	<2.0	<2.0	<2.0	<2.0	3.4	2.5	<2.0	<2.0	5.3	<2.0	<2.0	<2.0	2.2	1.1	<2.0
RC2016-16	7.70m	27/02/2016	<2.0	<2.0	<2.0	<2.0	3.9	3.7	<2.0	3.2	6.5	3.9	4.2	<2.0	3.2	2.3	2.8
RC2016-16	8.20m	27/02/2016	<2.0	<2.0	<2.0	<2.0	6.2	5.5	<2.0	4.7	7.8	2.8	3.4	<2.0	2.6	1.7	2.8
RC2016-16	8.70m	27/02/2016	<2.0	<2.0	<2.0	<2.0	5.3	5.9	<2.0	4.8	7.4	4.2	5.1	2.3	3.4	1.8	3.1

RC-2016-31

			Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)Anthracene	Benzo(a)Pyrene	Benzo(ghi)Perylene	Benzo(b/k)Fluoranthene	Chrysene	Dibenzo(ah)Anthracene	Fluoranthene	Fluorene	Indeno(123-cd)Pyrene	Naphthalene	Phenanthrene	Pyrene
			µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
		ERL	16	44	85	261	430	n/a	n/a	384	63	600	19	200	160	240	665
		ERM	500	640	1100	1600	1600	n/a	n/a	2800	260	5100	540	n/a	2100	1500	2600
Socotec Ref	**DUK Ref**	**Date sampled**															
MAR00072.001	RC2016-31 @ 6m	09/07/2018	10.4	30.9	32.1	131	302	194	222	143	37.6	191	10	210	6.48	52.7	260
MAR00072.002	RC2016-31 @ 8m	09/07/2018	2040	126	2440	2600	2950	1860	1870	2620	344	6700	1440	1700	3050	8860	7000
Sample RC2016-31 is located in the centre of Nigg Bay. The sample displays levels above the ERM and ERL for all PAHs tested. These are isolated elevations that are not replicated in the sample taken at 6m below CD on the same day (as presented above), or the samples taken at similar depths (7.5 - 8m below CD) in the pre-dredge borehole at the same location in 2016 (as presented below).																	
RC2016-31	-5.0m - -5.5m	05/04/2016	17	34	45	300	560	330	1200	200	51	490	12	280	16	84	1100
RC2016-31	-5.5m- -6.0m	05/04/2016	4	5	9	27	43	31	110	20	5	45	4	24	2	20	54
RC2016-31	-6.5m - -7m	05/04/2016	<2	<2	<2	5	5	4	16	4	<2	7	<2	<2	<2	3	14
RC2016-31	-6m - -6.5m	05/04/2016	3	<2	7	11	9	7	24	11	3	25	3	3	5	20	27
RC2016-31	-7.0m - -7.5m	05/04/2016	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
RC2016-31	-7.5m - -8.0m	05/04/2016	<2	<2	<2	<2	<2	<2	<2	3	<2	<2	<2	<2	<2	<2	<2

Appendix B
Marine spills 2018-2019

DATE RAISED	Incident
06/05/2018	Around 11:10 am dredging sub-contractor (Van Oord) informed Dragados UK AHEP about an oil spill from one of the hydraulic hoses of BHD Goliath in the Nigg Bay. VTS was informed over the radio around 11:20 am, the spill was contained and cleaned. The source of the leak was an O-ring of one of the connections between the boom and the stick, the amount of spill into the water was approximately 10 litres of Thellus T68 (biodegradable Hydraulic oil spray). In order to prevent further spillage, the boom retrieved immediately onto the deck to minimize the spill into the water and control on the deck, absorbent booms were deployed into the water to contain the spill.
31/05/2018	After the daily check run by Joanna Thow (ECoW), hydrocarbons were noted in the marine environment around Pontoon 2, North Break Water.
17/07/2018	During site visit by DUK ECoW, Joanna Thow, marine hydrocarbons were observed around Ashleigh's pontoon which is moored adjacent to the North Breakwater. The Environmental Manager boarded the safety boat for further investigation and could not find the root cause of spill. Spill appeared to be carried in from tide and not from any activity related to AHEP.
23/07/2018	Around evening/night time, dredging subcontractor (Van Oord) had an oil spill approximately 1-2 litres from pilot line in the Nigg Bay. It was cleaned it up immediately after detection. It was reported to VTS.
03/08/2018	Hydraulic Oil spill in Nigg Bay from the Van Oord Dredger Goliath on the 3rd of August 2018 approximately 1.15am. There was approximately 1 ton of oil (Shell Tellus T68) lost into the marine environment due to a hydraulic block failing. The dredger was working in the NE Quay close to shore and the incident occurred during the incoming tide. Briggs Marine were called out to deal with the spill immediately and mobilised oil booms and a skimmer to recover the oil. DUK Environmental Manager notified the incident via email to SEPA, MS-LOT and MCA.
03/09/2018	Hydrocarbons were noted in the marine environment. ECoW led the investigation in collaboration with the environmental technicians and it was not possible to determinate the source of the potential spill. In addition, the pontoon located in the north breakwater was inspected to verify if was possible to determinate the source, however it was not successful.
12/09/2018	On the 9th of September around 19:10pm, Goliath had an hydraulic oil spill. It was estimated that 40 litres of oil were spilled. Immediately it was detected, oil spill boom deployed, VTS informed by radio and Briggs Marine contacted to assist with oil spill clean-up. Corresponding incident report sent to DUK by Van Oord the 12th of September.
07/06/2019	Unauthorised discharge: Approximately 60m3 of piling polymer (treated waste water) was discharged into East Tullos burn. This incident was reported to SEPA detailing measures taken to prevent reoccurrence and minimise effect. This was closed out by SEPA with no further actions required.
03/07/2019	Colcrete-Von Essen reported a spill of approximately 8L of hydraulic fluid to the marine environment as a result of equipment failure. Spill response was activated and booms were deployed to clean up the spill.
20/07/2019	At 13:30 a spill of approximately 35 litres of hydraulic fluid (Shell Tellus T68) occurred at the Van Oord vessel Goliath. This was caused by a fault with the hydraulic coupling of the rear spud winch. Engines were stopped and spill booms were immediately deployed to contain the majority of the spill. VTS was contacted.
04/08/2019	At approximately 10:55 the Van Oord vessel Razende Bol spilled approximately 15L of hydraulic fluid to the marine environment as result of a burst plant hose. The spill was immediately cleaned up and VTS was informed.