

Dragados

**AHEP**

## AHEP - Dredge Monitoring Plan for 2018 and 2019 Operations

Report Ref: AHEP 2018 Dredge Surveys Mitigation

Rev B | 27 April 2018

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 253300-19

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**ARUP**

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# 1 Introduction

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This plan has been developed in accordance with the approved Aberdeen Harbour Expansion Project (AHEP) Construction Environmental Management Document (CEMD) and should be read in conjunction with AHEP CEMD Chapter 7 – Dredging and Dredge Spoil Disposal Management and Monitoring Plan.

This plan provides detail on the methodology for suspended sediment monitoring and sediment quality monitoring, adaptive management options and associated reporting requirements for the dredging operations proposed at AHEP for 2018 and 2019.

As part of the 2018 and 2019 dredging operations, Dragados commit to the use of a continuous monitoring system as described in Section 7.6.1 of the AHEP CEMD Dredging and Dredge Spoil Disposal Management Plan.

## 1.1 Proposed Dredging Operations

Planned dredging operations for 2018 and 2019 at AHEP are:

- Dredging operations commencing as soon as possible after 25<sup>th</sup> April 2018, subject to all necessary consents being in place;
- A Back Hoe Dredger (BHD) will commence dredging at the end of April 2018 and be serviced by 2 Split Hopper Barges (SHB) to transport material to the disposal site (CR110). Operations for 2018 are due to be completed in November 2018 and restart in Spring 2019, depending on progress in 2018;
- It is planned that a Trailing Suction Hopper Dredger (TSHD) will be dredging mid June to mid July 2018 and then again from the start of September 2018 to end of November 2018. The TSHD will return in 2019 as required, depending on progress in 2018;
- All dredging operations will be carried out within the areas marked in Figure 1: Proposed 2018 and 2019 Dredge Area. Dredging operations will be ongoing 24 hours a day, 7 days a week; and
- Dredged material (except rock), if not used on site, will be disposed of at the offshore disposal site ‘Aberdeen CR110’ as detailed within the AHEP ES and subsequent documents. All rock will be reused.

The vessels undertaking the dredging are similar to those described in the Dredging and Dredge Spoil Disposal Management and Monitoring Plan within the approved AHEP CEMD.



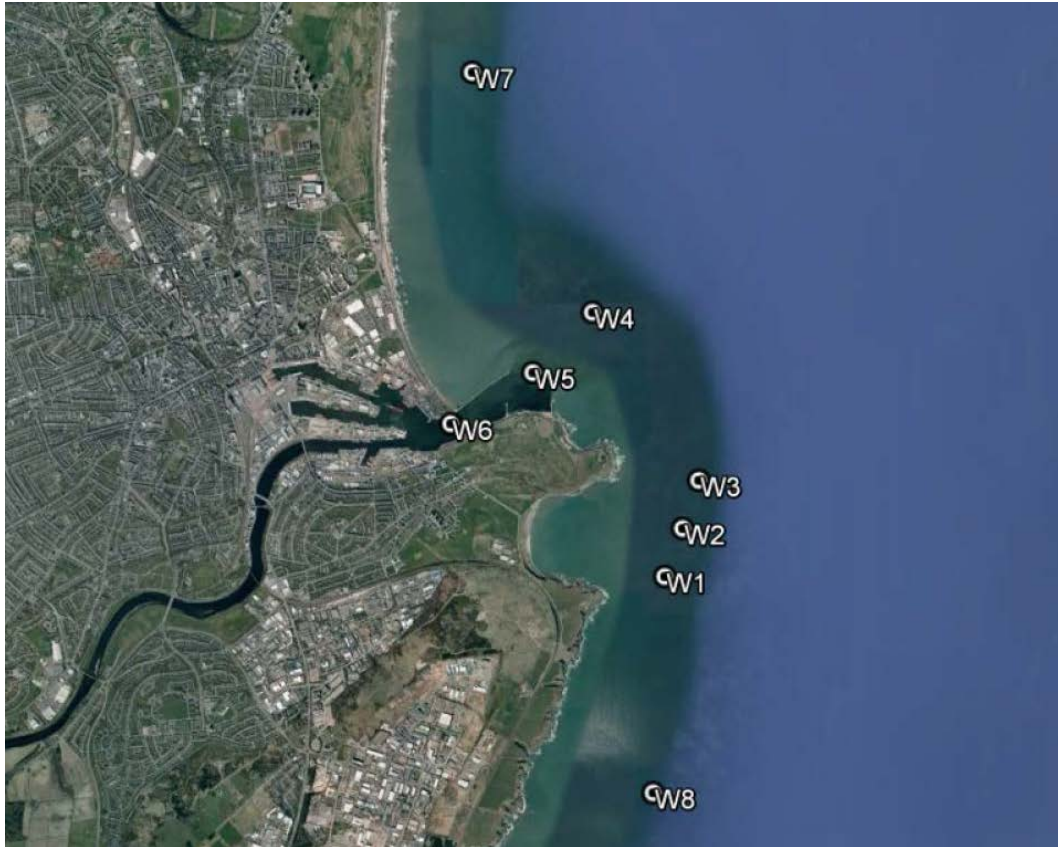


Figure 2: Water quality measurement locations

The baseline water samples were taken at three depths, 2m below surface, 2m above seabed and at a midpoint in the water column. During dredge operations, the suspended sediment concentration were calculated using an average turbidity value from 10 minutes of profiling data at each location.

Dredging operations ceased on September 16<sup>th</sup> 2017 with no further dredging in 2017. During the dredging campaign, no increase of above 50mg/l was recorded in suspended sediment concentrations, when comparing the baseline measurements at W8 to W1,2,3. Measurements at W5 & 6 were difficult to achieve given the boat traffic coming in and out of the river and found to add little value to the wider recordings given the impact of changing sediment levels in the River Dee It is not proposed that sampling at these locations are continued into 2018 and beyond.

### 3 Suspended Sediment Monitoring - 2018 & 2019 Dredging Season

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For the 2018 and 2019 dredging activities, Dragados will install a continuous suspended sediment monitoring system for monitoring suspended sediment levels at Nigg Bay. Handheld monitoring will be used to measure suspended sediments at the disposal site and as a contingency if the continuous system is unavailable.

### 3.1 Dredging Monitoring - Buoy Deployment Location

Appendix 7-D of the AHEP Environmental Statement describes the sediment plume modelling for the proposed dredging operations (Intertek Report Ref. - P1974\_R3873\_Rev2.docx, Issued 27 October 2015). The intention of the suspended sediment monitoring proposed by Dragados is to ensure that suspended sediment levels generated by the AHEP dredging operations do not exceed those predicted in the AHEP ES. The outer buoy will provide a background level and the inner buoy will measure the amount of suspended sediment generated by AHEP activities.

Buoy locations have been selected using the plume model (AHEP ES Appendix 7-D), namely outputs from the TSHD overspill maximum suspended sediment concentration (Figure 3) and the Backhoe overspill area maximum suspended sediment concentrations (Figure 4).

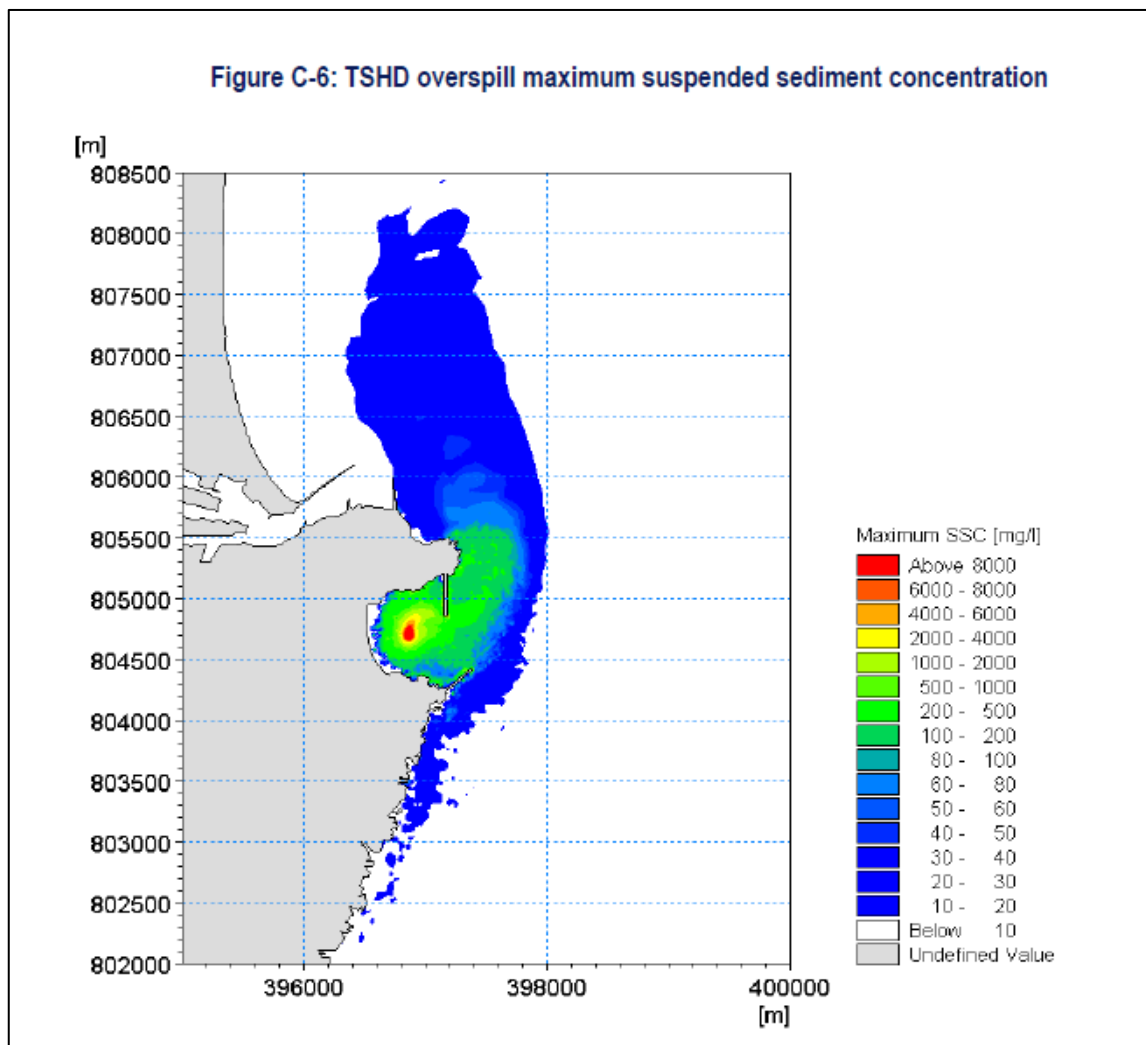


Figure 3: TSHD overspill maximum suspended sediment concentration (From AHEP ES Plume Modelling)

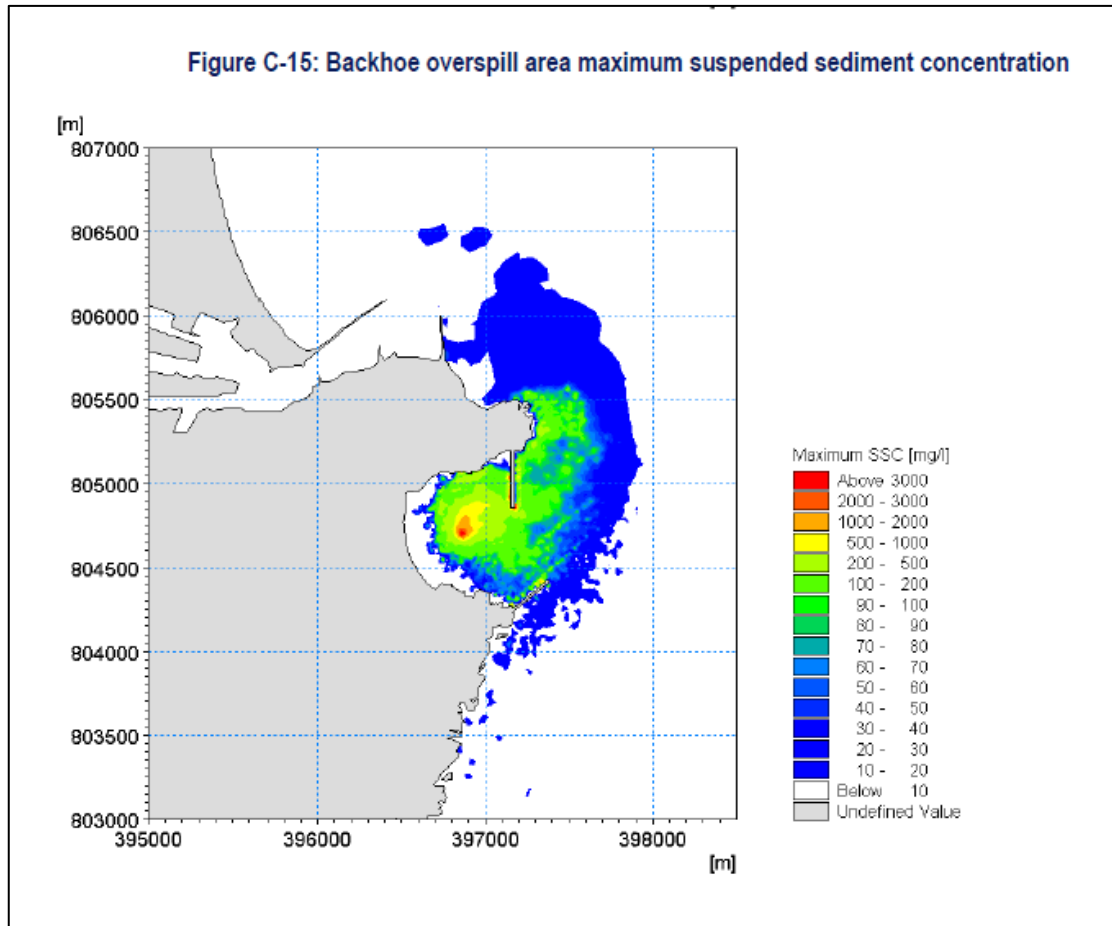


Figure 4: Backhoe overspill area maximum suspended sediment concentrations (From AHEP ES Appendix 7-D)

The locations for buoys have taken into account the location of construction activities ongoing at AHEP and other scientific equipment being placed on the seabed (C-Pods, Waverider etc.). A location, to the north of the site, outside the sediment plume has been selected for the baseline suspended sediment buoy and a location to the north, within the predicted sediment plume, has been selected to record suspended sediment levels within the dredge plume (See Figure 5). These locations are 750m apart. According to the plume model, the maximum suspended sediment concentration at the monitoring buoy location should be less than 200mg/l above the levels of suspended sediment at the baseline buoy.

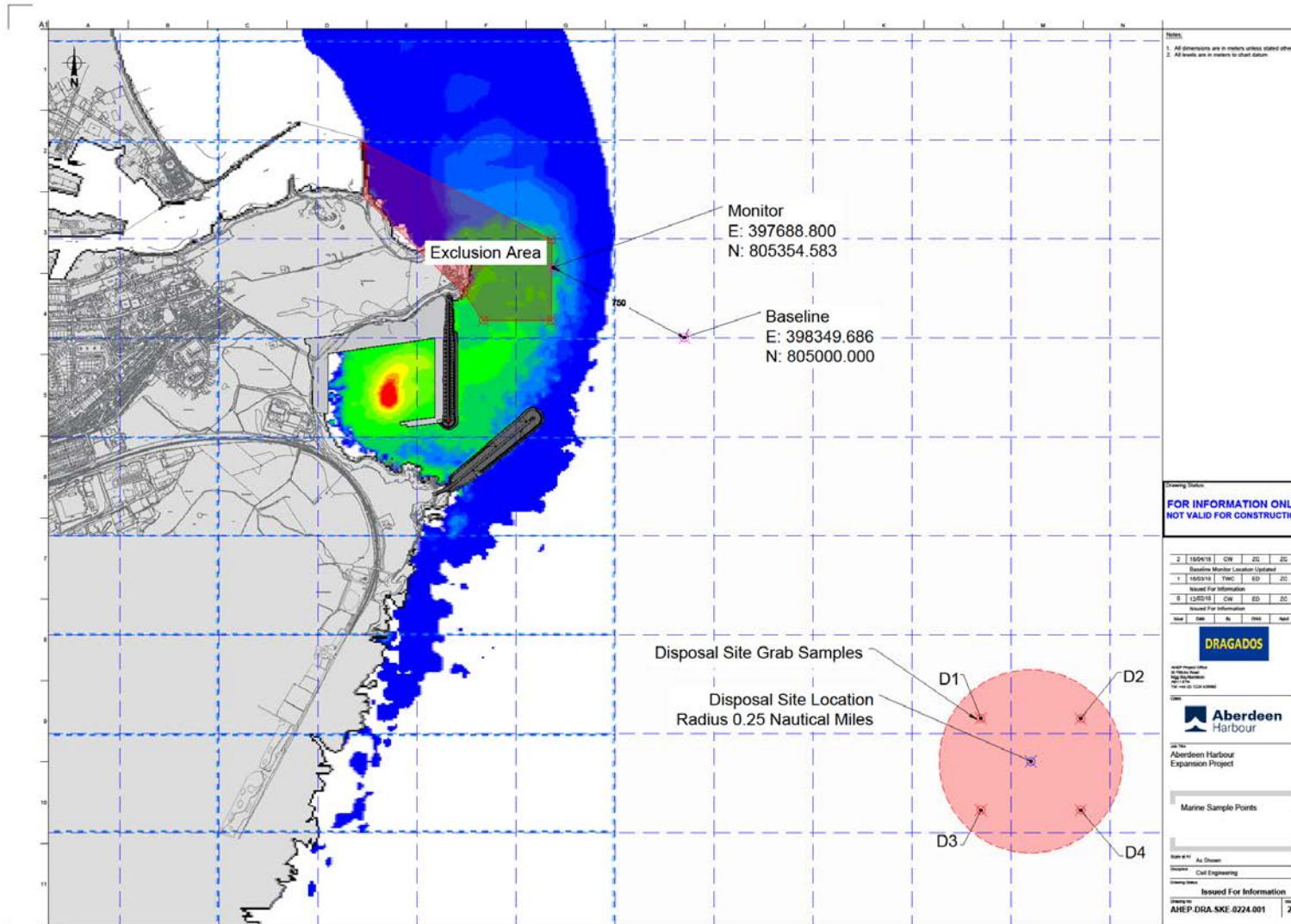


Figure 5: Baseline and Monitoring Buoy Locations



## 3.2 Dredging Monitoring - Suspended Sediment Monitoring Methodology

The suspended sediment monitoring kit deployed at AHEP will consist of a buoy/marker, weight and turbidity sensor deployed at two locations.

The monitoring equipment will measure the optical quantity, turbidity measured in Formazin turbidity units (FTU), whereas the model provides the physical quantity, the suspended sediment concentration measured in mg/l. As there is no universal relationship between FTU and SSC, turbidity measurements and water samples are collected concurrently to establish a site-specific relationship known as a correlation graph. Water samples within the dredge plume will be taken and analysed in an accredited laboratory for turbidity and suspended sediment concentrations in order to develop this correlation. In-situ turbidity measurements will also be conducted. This correlation graph will then be used to enable real-time monitoring during the dredging activities.

Before the equipment is deployed at AHEP, all instruments will have been tested and calibrated for each specific parameter and purpose. Calibration of the instruments and depth indicators will be performed according to the manufacturer's specification and recorded. Equipment will be cleaned / serviced as per manufacturer's instructions.

The buoys will measure turbidity and transmit the results via GPRS / GSM networks to an internet server every 30 minutes. The levels will be converted from Turbidity to Suspended Sediments. In order to manage peaks and changes due to natural variability, a running average over 12 hours will be taken to work out the elevation above background level. Using the information provided in the AHEP ES (Appendix 7-D), during dredging operations, the Suspended Sediment levels at the inner or monitoring buoy should not exceed 200mg/l above the background level recorded at the baseline or outer buoy.

The results will be displayed near real-time using an online monitoring system. This system allows automatic alerts to project personnel (via SMS or email) if a threshold is breached or if a buoy stops transmitting. If levels are breached, adaptive management measures will be put in place (See Section 4: Adaptive Management).

## 3.3 Hand Held Suspended Sediment Monitoring

Alongside the continuous monitoring, Dragados will also have in place a service provider to undertake handheld monitoring. This will be as a contingency for when continuous monitoring is not available at the dredging site due to a fault with the equipment and also for measuring turbidity at the disposal site on a monthly basis. Hand held monitoring may also be used at the start of dredging operations whilst the continuous monitor is being set up and calibrated.

Handheld monitoring will be undertaken using the same procedure as that deployed during the 2017 dredging season. A baseline survey will be conducted to establish reference conditions on site by taking samples at the six sites. These baseline condition surveys will establish the correlation curve to be used. Once dredging commences, the suspended sediment monitoring will be undertaken twice daily during dredging operations. A baseline will be established at W7 or W8 and measurements at W1,2,3 and 4 compared against the baseline suspended

sediment levels. As these monitoring points are within different parts of the plume model to where the continuous monitors will be, an exceedance of 50mg/l will trigger further action.

If exceedances are found the adaptive management described in Section 4 will be implemented and Marine Scotland informed.



Figure 6: Handheld monitoring sampling points

## 4 Suspended Sediments - Adaptive Management

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Should suspended sediment levels exceed those predicted by the sediment plume modelling an alert will be issued to the Dragados responsible person (EM, ECOW, Marine Manager etc. depending who is on duty) and adaptive management and reporting procedures implemented.

Initially, the Dragados responsible person will review the level of exceedance reported and using the flowcharts provided in Appendix A2, and in conjunction with the dredging contractor, decide upon the mitigation measures to be implemented from the bullet point list provided below.

At the dredging site, the levels of suspended sediment can be controlled by:

- Adjusting the overflow position of the TSHD and/or SHB's;
- Minimise the de-watering process
- Stop dewatering completely
- Reduce dredging production
- Dredge at a different location

If suspended sediment levels cannot be reduced using the above, or other mitigation, dredging will be temporarily stopped and other solutions explored such as the use of bubble screens, silt screens or only dredging during certain phases of the tide to reduce the release and/or dispersion of suspended sediment.

If suspended sediment concentrations are exceeded, these will be reported to MS-LOT Major Projects initially by a phone call to a member of the MS-LOT Major Projects Team on:0300 2445046 (within standard working hours) and by a follow up email (within 1 hour of the exceedance being detected) to [ms.majorprojects@gov.scot](mailto:ms.majorprojects@gov.scot) detailing the exceedance and the measures that are being implemented to control suspended sediment levels.

SEPA will also be notified regardless of the time if there is a potential impact on the bathing water by telephone on SEPA pollution hotline number 0800807060, local SEPA office reception number 01224 266600, if there are potentially any implications for bathing water quality (for instance, a substantial sediment plume which may impact upon the bathing water quality at Aberdeen Pleasure Beach).

Dragados are committed to providing details of what criteria will be used to determine whether a plume will impact on the bathing beach in a flowchart format. This will need to be submitted in a timely manner to allow review and approval by SEPA and MS-LOT's prior to 14 May 2018.

## 5 Sediment Sampling

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In terms of sediment quality and potential contamination, the following monitoring will be undertaken:

## 5.1 Split Hopper Barge and Trailer Suction Hopper Barge – Hopper Samples

During dredging operations, sampling will be undertaken within the dredge hoppers to verify that mixing material is taking place. In particular, there is a requirement to take samples from where material above AL1 have been found in past sampling campaigns.

To ensure samples are taken from the correct area, Dragados have pinpointed the location and depth at which samples will be taken at approximately 110 points across Nigg Bay. These are provided in Appendix A1. This information will be provided to the dredging contractor with clear instructions to take sufficient material from the hopper for sediment sampling, the first time dredging occurs at this location & dredge depth.

Based on the results of the pre-dredging sampling campaign, the samples will be analysed for Heavy metals (Arsenic, Cadmium, Chromium, Copper, Mercury, Nickel, Lead, Zinc), Tributyltin (TBT), Polychlorinated Biphenyls (PCB's) and Polycyclic Aromatic Hydrocarbons (PAHs) and the results compared to the Marine Scotland Action Levels.

Samples will be stored in a dark, cool environment for transport to the laboratory. At Nigg Bay a freezer will be available to freeze samples as required. The samples will be delivered to the laboratory within 48 hours after sampling. Details of the location where the material was dredged and where the material is disposed will be logged. Reports on the analysis of the given parameters will be provided to the Dragados within 28 days. Reports will be forwarded to MS-LOT on a monthly basis alongside the monthly report.

Duplicate samples will be collected and will be delivered to Marine Scotland, following on from testing for the presence of asbestos.

Table 1: Marine Scotland Action Levels

Contaminant	Revised AL1 mg/kg dry weight (ppm)	Revised AL2 mg/kg dry weight (ppm)
Arsenic (As)	20	70
Cadmium (Cd)	0.4	4
Chromium (Cr)	50	370
Copper (Cu)	30	300
Mercury (Hg)	0.25	1.5
Nickel (Ni)	30	150
Lead (Pb)	50	400
Zinc (Zn)	130	600
Tributyltin	0.1	0.5
Polychlorinated Biphenyls	0.02	0.18
<b>Polyaromatic Hydrocarbons</b>		
Acenaphthene	0.1	
Acenaphthylene	0.1	
Anthracene	0.1	
Fluorene	0.1	
Naphthalene	0.1	
Phenanthrene	0.1	
Benzo[a]anthracene	0.1	
Benzo[b]fluoranthene	0.1	
Benzo[k]fluoranthene	0.1	
Benzo[g]perylene	0.1	
Benzo[a]pyrene	0.1	
Benzo[g,h,i]perylene	0.1	
Dibenzo[a,h]anthracene	0.01	
Chrysene	0.1	
Fluoranthene	0.1	
Pyrene	0.1	
Indeno(1,2,3cd)pyrene	0.1	
Total hydrocarbons	100	
Booster Biocide and Brominated Flame Retardents *		

In accordance with the requirements of Marine Scotland’s *Pre-disposal Sampling Guidance Version 1 2017*, the laboratory performing the analyses will be ISO17025 accredited for marine sediment analysis and take part in intercomparison exercises such as QUASIMEME. The laboratory will meet the limit of detection (LOD) sensitivity requirements set out in the CSEMP Green Book.

## 5.2 Disposal Site

Monthly sediment sampling of the disposal site will be undertaken. Four samples will be collected at the disposal site and analysed at an accredited laboratory. The samples will be collected, with a Van Veen or similar day grab, at 4 fixed points within the disposal site. This will allow a comparison of results through time. The disposed material will be spread over a large part of the site, which will be covered by four sampling points:

- Point D1: 57°07’07” N – 02°00’15” W
- Point D2: 57°07’07” N – 01°59’45” W
- Point D3: 57°06’52” N – 02°00’15” W
- Point D4: 57°06’52” N – 01°59’45” W

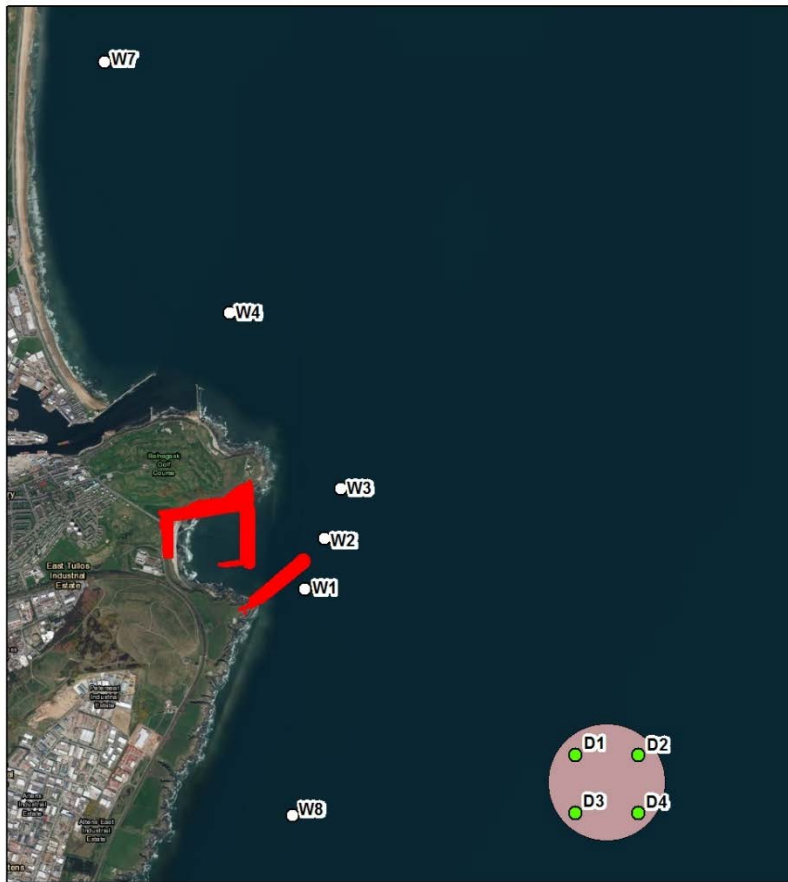


Figure 7: Sediment Sample locations at disposal site (green dots)

Based on the results of the pre-dredging sampling the samples will be analysed for Heavy metals (Arsenic, Cadmium, Chromium, Copper, Mercury, Nickel, Lead and Zinc), Tributyltin (TBT), Polychlorinated Biphenyls (PCB’s) and Polycyclic Aromatic Hydrocarbons (PAHs).

### 5.3 Sediment Sampling Adaptive Management – Material above AL1

The following adaptive management measures will be undertaken in the event that contamination above AL1 is encountered during the hopper monitoring testing.

1. Inform MS-LOT of exceedance of monitored sample by email within 48hrs of receipt of elevated result. Notification will include specific details on the dredge sample location, depth, date and time. Notification will also be made to MS-LOT regarding the disposal location of material where the exceedance occurred.
2. The exceedance will be assessed in line with the contamination assessment<sup>6</sup> performed by AHB and will assess whether the exceedance would lead to any increased level of risk to the marine environment compared to the baseline contamination assessment, this would be in line with the ERM/ERL assessment. **Error! Bookmark not defined. Error! Bookmark not defined.**
3. In the unlikely event of identifying material greater than AL2 within the hopper samples, adaptive measures 1-2 will be undertaken. Dragados would then take grab samples from

the relevant area of the disposal ground for subsequent analysis to enable the potential impact on the disposal site to be appropriately assessed.

4. Following conclusion of an assessment, proposals for mitigating environmental risk will be presented, Dredging activities will cease within any area/depth identified to have elevated levels of contaminants, until the issue is resolved. Changes to processes would be forwarded to and discussed with MS-LOT for agreement.

## 6 Monthly Reporting

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A monthly report will be provided to MS-LOT in which all data from the past month are summarised. The report will include all necessary data to give a complete overview of the results and actions of the past month. This includes:

- Suspended Sediment

A report on the suspended sediment concentrations will be produced and will include:

- Sampling methodology
- Any difficulties encountered during sampling and changes proposed as a result
- Suspended Sediment Concentrations at both Baseline and Monitoring Buoys and at the four locations at the disposal site
- Any instances of exceedances (baseline versus monitoring buoy)
- Adaptive Management / Actions taken when exceedances have occurred
- Results of adaptive measures taken
- Sediment Sampling

A report on the sediments sampled will be produced and include:

- Location and depth of samples taken
- Material sampled
- Log of when samples sent to laboratory, asbestos testing complete, duplicate samples sent to MS-LOT and results received
- Details of analyses undertaken and results
- Any further actions undertaken/required (as per Section 5.3)

## Appendix A

# Sediment Sample Locations & Suspended Sediment Exceedance Procedures



## A1 Sediment Sample Locations

Sediment Profile Area BH Number	BH Northing (Approximate locations)	BH Easting (Approximate locations)	VO Dredge Areas	Contaminant action level 2016 Sample Areas	Sample Depth -CD	No of Samples
RC2016-1	804900	396700	9,11, 10a,30	Between AL1 & 2	2,4,6	3
RC2016-5	804800	396700	16	Between AL1 & 2	5,7,8	3
RC2016-14	804600	396700	16	Between AL1 & 2	3,5,7	3
RC2016-17	804500	396700	19	Between AL1 & 2	3,5,7	3
RC2016-2	804900	396800	9, 10a,30	Between AL1 & 2	6	1
VC2016-6	804800	396800	16	Between AL1 & 2	4	1
VC2016-11	804700	396800	16	Between AL1 & 2	5	1
VC2016-3	804900	396900	3,31,32	Between AL1 & 2	4, 6,8	3
VC2016-7	804800	396900	2,16	Between AL1 & 2	4,6,8	3
VC2016-12	804700	396900	16	Between AL1 & 2	6,8	2
VC2016-19	804500	396900	16,18	Between AL1 & 2	5,8	2
VC2016-13	804700	397000	1c 35	Between AL1 & 2	8	1
RC2016-31	804600	397000	1b,35,	Between AL1 & 2	8	1
VC2016-20	804500	397000	1a,17	Between AL1 & 2	6	1
VC2016-19	804500	396900	18	Between AL1 & 2	6	1
VC2016-20	804500	397000	17,1a	Between AL1 & 2	6	1
VC2016-22	804500	397200	13,15	Between AL1 & 2	8	1
VC2016-33	804500	397362	15	Between AL1 & 2	12,14	2
RC2016-14	804600	396700	16	Between AL1 & 2	3	1
RC2016-16	804600	396900	16	Between AL1 & 2	4,6,8	3
RC2016-31	804600	397000	1b	Between AL1 & 2	6,8	2
North Quay	Various Points	Various Points	5a	New Areas	6,8	2

Sediment Profile Area BH Number	BH Northing (Approximate locations)	BH Easting (Approximate locations)	VO Dredge Areas	Contaminant action level 2016 Sample Areas	Sample Depth -CD	No of Samples
North Quay	Various Points	Various Points	6a	New Areas	6,8	2
North Quay	Various Points	Various Points	7a	New Areas	6,10	2
North Quay	Various Points	Various Points	10a	New Areas	4,8	2
North Quay	Various Points	Various Points	12a	New Areas	2,8	2
West Quay	Various Points	Various Points	20	New Areas	2,6,8	3
West Quay	Various Points	Various Points	21	New Areas	2,6,8	3
West Quay	Various Points	Various Points	22	New Areas	2,6,8	3
West Quay	Various Points	Various Points	23	New Areas	2,6,8	3
West Quay	Various Points	Various Points	24	New Areas	2,6,8	3
West Quay	Various Points	Various Points	29	New Areas	2,6,8	3
East Quay	Various Points	Various Points	8	New Areas	6,8, 10	3
East Quay	Various Points	Various Points	25	New Areas	8,10,12	3
East Quay	Various Points	Various Points	26	New Areas	8,10,12	3
East Quay	Various Points	Various Points	27	New Areas	8,10,12	3
<b>Disposal Site CR110</b>	802 859.69	400099.54	4 Grab Samples Per Month			28
					<b>Total</b>	<b>107</b>

## A2 Suspended Sediment Exceedance Procedures

