



**Environmental Monitoring and Audit  
 for Contaminated Mud Pits to the  
 South of The Brothers and at East  
 Sha Chau (2012-2017) – Investigation  
 Agreement No. CE 23/2012(EP)**

**4<sup>th</sup> Monthly Progress Report for Contaminated  
 Mud Pits to the South of The Brothers and at  
 East Sha Chau – December 2012**

Revision 0

14 January 2013

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# Environmental Monitoring and Audit for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau (2012-2017) – Investigation




## 4<sup>th</sup> Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau – December 2012

### Revision 0

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Client:		Project No:			
Civil Engineering and Development Department (CEDD)		0175086			
Summary:		Date:			
<p>This document presents the fourth monthly progress report for Contaminated Mud Pits at the South of The Brothers and at East Sha Chau.</p>		14 January 2013			
		Approved by:			
		 Craig A. Reid <i>Partner</i>			
v0	4 <sup>th</sup> Monthly Progress Report for CMP V and SB CMPs	RC	JT	CAR	14/1/13
Revision	Description	By	Checked	Approved	Date
<p>This report has been prepared by Environmental Resources Management the trading name of 'ERM Hong-Kong, Limited', with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.</p> <p>We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.</p> <p>This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.</p>		Distribution <input checked="" type="checkbox"/> Internal <input checked="" type="checkbox"/> Public <input type="checkbox"/> Confidential			
				 	

## Dredging, Management and Capping of Contaminated Sediment Disposal Facility to the South of The Brothers

### Environmental Certification Sheet EP-427/2011/A


#### Reference Document/Plan

Document/ <del>Plan</del> -to be-Certified/ Verified:	4 <sup>th</sup> Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau – December 2012
Date of Report:	14 January 2013
Date prepared by ET:	14 January 2013
Date received by IA:	14 January 2013

#### Reference EP Condition

Environmental Permit Condition:	Condition No.: 4.4
4 hard copies and 1 electronic copy of monthly EM&A Report shall be submitted to the Director within 2 weeks after the end of the reporting month. The EM&A Reports shall include a summary of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit Levels). The submissions shall be certified by the ET Leader and verified by the Independent Auditor. Additional copies of the submission shall be provided to the Director upon request by the Director.	

#### ET Certification

I hereby certify that the above referenced document/ <del>plan</del> complies with the above referenced condition of EP-427/2011/A	
Craig A. Reid, Environmental Team Leader:	 Date: 14/1/2013

#### IA Verification

I hereby verify that the above referenced document/ <del>plan</del> complies with the above referenced condition of EP-427/2011/A	
Dr Wang Wen Xiong, Independent Auditor:	 Date: 14/1/2013

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Agreement No. CE 23/2012 (EP)  
Environmental Monitoring and Audit  
for Contaminated Mud Pits at the South of The Brothers and at East Sha  
Chau (2012-2017) - Investigation

4<sup>th</sup> MONTHLY PROGRESS REPORT FOR DECEMBER 2012

**1.1 BACKGROUND**

1.1.1 Since early 1990s, contaminated sediment <sup>(1)</sup> arising from various construction works in Hong Kong has been disposed of at a series of seabed pits at East of Sha Chau (ESC). In late 2008, a review indicated that the existing and planned facilities at ESC would not be able to meet the disposal demand after 2012. In order to meet this demand, the Hong Kong Special Administrative Region Government (HKSARG) decided to implement a new contained aquatic disposal (CAD) <sup>(2)</sup> facility at the South of The Brothers (SB CMPs) (hereafter referred to as “the Project”) which had been under consideration for a number of years.

1.1.2 The environmental acceptability of the construction and operation of the Project had been confirmed by findings of the associated Environmental Impact Assessment (EIA) study completed in 2005 under *Agreement No. CE 12/2002(EP)* <sup>(3)</sup>. The Director of Environmental Protection (DEP) approved this EIA report under the *Environmental Impact Assessment Ordinance (Cap. 499) (EIAO)* in September 2005 (*EIA Register No.: AEIAR-089/2005*).

1.1.3 In accordance with the EIA recommendation, prior to commencement of construction works for the SB CMPs, the Civil Engineering and Development Department (CEDD) undertook a detailed review and update of the EIA findings for the SB site <sup>(4)</sup>. Findings of the EIA review undertaken in 2009/2010 confirmed that the construction and operation of the SB site had been predicted to be environmentally acceptable.

- (1) According to the Management Framework of Dredged/ Excavated Sediment of ETWB TC(W) No. 34/2002, contaminated sediment in general shall mean those sediment requiring Type 2 – Confined Marine Disposal as determined according to this TC(W).
- (2) CAD options may involve use of excavated borrow pits, or may involve purpose-built excavated pits. CAD sites are those which involve filling a seabed pit with contaminated mud and capping it with uncontaminated material such that the original seabed level is restored and the contaminated material is isolated from the surrounding marine environment.
- (3) Detailed Site Selection Study for a Proposed Contaminated Mud Disposal Facility within the Airport East/ East of Sha Chau Area (*Agreement No. CE 12/2002(EP)*)
- (4) Under the CEDD study *Contaminated Sediment Disposal Facility to the South of The Brothers (Agreement No. FM 2/2009)*

An *Environmental Permit (EP-427/2011)* was issued by the Environmental Protection Department (EPD) to the CEDD, the Permit Holder, on 3 November 2011 and varied on 23 December 2011 (*EP-427/2011/A*). Under the requirements of *Condition 4* of the *EP (EP-427/2011/A)*, an Environmental Monitoring and Audit (EM&A) programme as set out in the EM&A Manual is required to be implemented for the SB CMPs. The present EM&A programme undertaken under *Agreement No. CE 23/2012 (EP)* covers the dredging, disposal and capping operations of the SB CMPs.

## **1.2 REPORTING PERIOD**

1.2.1 This Monthly Progress Report covers the EM&A activities for the reporting month of December 2012.

## **1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES**

1.3.1 *Impact Water Quality Monitoring during Dredging Operations of CMP 1* was conducted three times per week (ie 1, 4, 6, 8, 11, 13, 15, 18, 20, 22, 24, 27, 29 and 31 December 2012) in this reporting month.

## **1.4 DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS**

1.4.1 No outstanding sampling and laboratory analysis remained from December 2012. A summary of field activities are presented in *Annex A*.

## **1.5 BRIEF DISCUSSION OF THE MONITORING RESULTS FOR SB CMPs**

1.5.1 All monitoring data collected for SB CMPs in December 2012 will be presented in this monthly report. Detailed discussion will be presented in the corresponding *Quarterly Report*.

### **1.5.2 *Impact Water Quality Monitoring during Dredging Operations of CMP 1 – November 2012***

1.5.3 *Impact Water Quality Monitoring during Dredging Operations of CMP 1* was conducted three times per week in a total of fourteen sampling days in December 2012. On the survey day, sampling was conducted during both mid-ebb and mid-flood tides at two Reference (Upstream) stations upstream and five Impact (Downstream) stations downstream of the dredging operations at CMP 1. Monitoring was also conducted at five Sensitive Receiver Stations (Ma Wan, Shum Shui Kok, Tai Mo To and Tai Ho Bay). A total of twelve stations were monitored and locations of the sampling stations are shown in *Figure 1.1*.



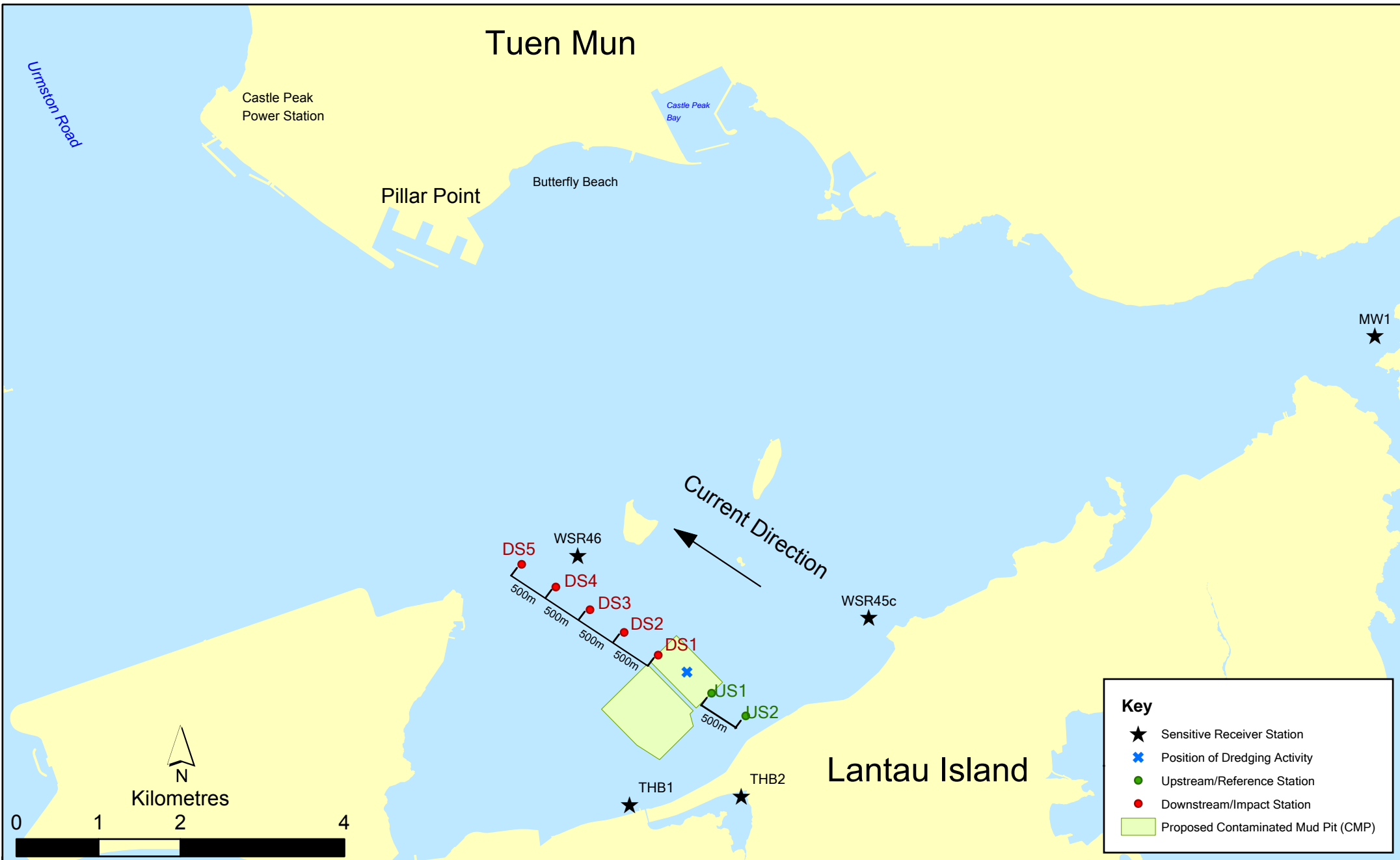


Figure 1.1

Indicative Dredging Impact Sampling Stations for South Brothers Facility

Note: The locations of sampling stations will be determined on site based on current direction and position of dredging activities

- 1.5.4 Monitoring results are presented in *Table B1* of *Annex B*. Levels of Dissolved Oxygen (DO), Turbidity and Suspended Solids (SS) generally complied with the Action and Limit Levels set in the Baseline Monitoring Report <sup>(1)</sup>, except on 15, 29 and 31 December 2012 during the mid-flood tide.
- 1.5.5 On 15 December 2012, level of turbidity exceeded the Action Level at Sensitive Receiver Station WSR46 while level of SS exceeded the Action Level at Downstream Stations DS2, DS4 and DS5 and Sensitive Receiver Stations WSR45C and WSR46. On 29 December 2012, level of turbidity exceeded the Action Level at Downstream Station DS5 and levels of SS exceeded the Action Level at Downstream Stations DS4 and DS5 and Sensitive Receiver Station WSR46. Exceedance of Action Level of SS was recorded at Station WSR46 on 31 December 2012.
- 1.5.6 Stations DS2, DS4, DS5, WSR45C and WSR46 are located further away from the works area of CMP 1 when compared to Station DS1 at which the levels of SS and Turbidity did not exceed the Action and Limit Levels. Hence, it is unlikely that the exceedances are caused by the dredging operations of CMP 1. In addition, high levels of SS and turbidity were occasionally recorded and such fluctuations were also observed during baseline monitoring. The high SS and turbidity levels recorded are thus considered to be sporadic events and characteristic of water quality in this area of Hong Kong.
- 1.5.7 Overall, the results indicated that the dredging operations at CMP 1 of SB did not appear to cause any unacceptable deterioration in water quality during this reporting period. Therefore, no further mitigation measures, except for those recommended in the Environmental Permit (*EP-427/2011/A*), are considered necessary for the dredging operations.

## 1.6 *ACTIVITIES SCHEDULED FOR THE NEXT MONTH*

- 1.6.1 *Impact Water Quality Monitoring during Dredging Operations for CMP 1* will be conducted three times per week in the next monthly period of January 2013. The sampling schedule is presented in *Annex A*.

## 1.7 *STUDY PROGRAMME*

- 1.7.1 A summary of the Study programme is presented in *Annex C*.

(1) ERM (2012) Baseline Monitoring Report. Environmental Monitoring and Audit for Contaminated Mud Pits to the South of the Brothers and at East Sha Chau (2012-2017) – Investigation. Agreement No. CE 23/2012(EP). Submitted to EPD in October 2012.



Annex A

## Sampling Schedule







Annex A - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (September 2012 - December 2017)

			2012					2013					2014					2015					2016					2017																																		
			J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
<b>Capping Water Quality Monitoring</b>																																																														
<b>Ebb Tide</b>																																																														
Impact Stations Downcurrent																																																														
	SB-IPE1	8 times per year																																																												
	SB-IPE2	8 times per year																																																												
	SB-IPE3	8 times per year																																																												
	SB-IPE4	8 times per year																																																												
	SB-IPE5	8 times per year																																																												
Intermediate Stations Downcurrent																																																														
	SB-INE1	8 times per year																																																												
	SB-INE2	8 times per year																																																												
	SB-INE3	8 times per year																																																												
	SB-INE4	8 times per year																																																												
	SB-INE5	8 times per year																																																												
Reference Stations Upcurrent																																																														
	SB-RFE1	8 times per year																																																												
	SB-RFE2	8 times per year																																																												
	SB-RFE3	8 times per year																																																												
	SB-RFE4	8 times per year																																																												
	SB-RFE5	8 times per year																																																												
Sensitive Receiver Stations																																																														
	MW1	8 times per year																																																												
	THB1	8 times per year																																																												
	THB2	8 times per year																																																												
	WSR45C	8 times per year																																																												
	WSR46	8 times per year																																																												
<b>Flood Tide</b>																																																														
Impact Stations Downcurrent																																																														
	SB-IPF1	8 times per year																																																												
	SB-IPF2	8 times per year																																																												
	SB-IPF3	8 times per year																																																												
Intermediate Stations Downcurrent																																																														
	SB-INF1	8 times per year																																																												
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Reference Stations Upcurrent																																																														
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	SB-RFF2	8 times per year																																																												
	SB-RFF3	8 times per year																																																												
Sensitive Receiver Stations																																																														
	MW1	8 times per year																																																												
	THB1	8 times per year																																																												
	THB2	8 times per year																																																												
	WSR45C	8 times per year																																																												
	WSR46	8 times per year																																																												
<b>Benthic Recolonisation Studies</b>																																																														
Capped Contaminated Mud Pits																																																														
	SB-CPA	2 times per year																																																												
	SB-CPB	2 times per year																																																												
Reference Stations																																																														
	RBA	2 times per year																																																												
	RBB	2 times per year																																																												
	RBC	2 times per year																																																												

Notes:  
 "x" = Number of replicates depends on parameters  
 Naming of stations are tentative only and will be subjected to changes

Annex B

Results of Impact  
Monitoring during  
Dredging Operations of  
CMP 1 in December 2012

**Table B1** *Summary Table of DO, Turbidity and SS Levels Recorded in December 2012*

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2012/12/01	Mid-Ebb	DS1	6.22	6.37	7.88	11.01
		DS2	6.22	6.34	10.56	12.79
		DS3	6.22	6.34	6.63	9.91
		DS4	6.19	6.32	6.85	9.60
		DS5	6.16	6.27	6.40	9.63
		US1	6.35	6.42	8.63	11.12
		US2	6.48	6.52	14.35	14.80
		MW1	6.23	6.27	6.24	7.18
		THB1	6.64	6.69	10.95	12.95
		THB2	-	8.39	9.76	11.47
		WSR45C	6.21	6.35	6.65	10.19
		WSR46	6.32	6.36	10.61	13.78
	Mid-Flood	DS1	6.58	6.61	11.59	13.29
		DS2	6.57	6.61	10.97	12.68
		DS3	6.55	6.59	11.64	12.51
		DS4	6.60	6.60	12.81	14.45
		DS5	6.60	6.59	13.40	15.80
		US1	6.41	6.42	35.62	37.38
		US2	6.16	6.29	11.58	13.86
		MW1	6.11	6.19	8.71	11.27
		THB1	6.54	6.57	16.27	19.42
		THB2	-	8.07	7.88	8.40
		WSR45C	6.27	6.39	11.99	11.56
		WSR46	6.43	6.48	22.10	23.84
2012/12/04	Mid-Ebb	DS1	6.41	6.52	4.79	7.09
		DS2	6.35	6.50	6.04	8.11
		DS3	6.42	6.53	5.84	8.32
		DS4	6.36	6.50	6.08	7.96
		DS5	6.35	6.48	6.58	8.81
		US1	6.45	6.70	5.50	7.21
		US2	6.65	6.66	8.19	9.80
		MW1	6.25	6.29	3.92	6.38
		THB1	6.52	6.53	8.29	12.40
		THB2	-	8.59	14.99	9.23
		WSR45C	6.19	6.34	6.06	7.51
		WSR46	6.20	6.41	5.99	7.91
	Mid-Flood	DS1	6.50	6.72	11.73	14.61
		DS2	6.60	6.71	12.37	12.45
		DS3	6.71	6.70	14.80	17.12
		DS4	6.77	6.76	13.64	17.50
		DS5	6.67	6.68	13.87	15.85
		US1	6.27	6.49	10.53	21.68
		US2	6.28	6.48	6.10	8.40
		MW1	6.16	6.25	4.98	6.67
		THB1	6.42	6.43	13.11	14.78
		THB2	-	7.56	9.53	8.90
		WSR45C	6.10	6.33	10.21	11.93
		WSR46	6.21	6.29	18.10	18.70



Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2012/12/06	Mid-Ebb	DS1	6.35	6.39	15.23	14.19
		DS2	6.37	6.43	4.50	6.78
		DS3	6.35	6.44	4.57	6.16
		DS4	6.34	6.41	4.09	6.33
		DS5	6.33	6.43	4.63	6.53
		US1	6.43	6.56	7.37	10.41
		US2	6.55	6.56	8.95	10.23
		MW1	6.36	6.38	3.47	4.88
		THB1	6.42	6.54	9.15	10.68
		THB2	-	8.52	10.19	7.93
		WSR45C	6.29	6.36	3.37	5.64
		WSR46	6.33	6.34	5.44	7.92
	Mid-Flood	DS1	6.49	6.60	10.77	12.48
		DS2	6.52	6.57	10.45	10.70
		DS3	6.55	6.58	9.73	9.89
		DS4	6.63	6.62	6.66	7.03
		DS5	6.65	6.63	7.61	7.40
		US1	6.33	6.45	7.98	19.79
		US2	6.28	6.40	9.80	11.86
		MW1	6.20	6.21	3.39	5.22
		THB1	6.37	6.34	16.64	19.07
		THB2	-	8.69	9.99	7.60
		WSR45C	6.26	6.44	7.84	10.38
		WSR46	6.36	6.39	10.26	12.71
2012/12/08	Mid-Ebb	DS1	6.61	6.61	13.15	16.54
		DS2	6.55	6.52	13.89	16.08
		DS3	6.40	6.48	5.39	8.30
		DS4	6.19	6.38	5.34	7.28
		DS5	6.31	6.33	4.95	6.59
		US1	6.69	6.69	6.31	14.95
		US2	6.67	6.67	7.81	10.56
		MW1	6.25	6.27	2.81	5.08
		THB1	6.69	6.64	6.32	7.57
		THB2	-	9.57	6.26	7.60
		WSR45C	6.27	6.40	4.45	5.74
		WSR46	6.80	6.79	5.45	6.90
	Mid-Flood	DS1	6.85	6.89	5.86	7.63
		DS2	6.92	6.92	5.41	7.15
		DS3	6.93	6.92	7.35	9.51
		DS4	6.93	6.94	9.25	10.99
		DS5	7.11	7.12	6.15	8.70
		US1	6.62	6.66	15.66	15.61
		US2	6.45	6.50	9.92	13.12
		MW1	6.37	6.41	3.95	7.34
		THB1	6.57	6.59	10.14	16.02
		THB2	-	9.83	8.09	9.40
		WSR45C	6.35	6.40	9.84	11.78
		WSR46	6.65	6.59	10.78	9.06
2012/12/11	Mid-Ebb	DS1	6.63	6.62	6.87	10.32
		DS2	6.59	6.62	6.58	9.28
		DS3	6.52	6.60	7.15	10.07

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2012/12/13	Mid-Flood	DS4	6.58	6.66	7.92	10.21
		DS5	6.76	6.77	6.92	7.83
		US1	6.88	6.91	6.92	16.83
		US2	6.89	6.90	8.20	9.33
		MW1	6.30	6.33	5.74	7.58
		THB1	7.07	7.09	7.36	9.90
		THB2	-	6.52	8.65	7.20
		WSR45C	6.41	6.62	6.43	8.61
		WSR46	6.87	6.99	5.94	7.36
		DS1	7.11	7.14	8.06	9.58
		DS2	7.14	7.17	7.96	9.17
		DS3	7.13	7.17	19.28	17.93
		DS4	7.15	7.17	8.28	11.91
		DS5	7.18	7.19	4.94	6.90
		US1	6.78	6.77	12.40	14.01
	US2	6.50	6.50	10.95	14.49	
	MW1	6.55	6.56	6.52	8.20	
	THB1	7.34	7.37	4.68	7.50	
	THB2	-	6.69	12.11	10.90	
	WSR45C	6.72	6.73	10.13	11.74	
	WSR46	6.95	7.06	9.28	9.38	
	Mid-Ebb	DS1	6.71	6.72	9.76	12.24
	DS2	6.60	6.75	6.22	8.48	
	DS3	6.64	6.80	5.76	7.16	
	DS4	6.60	6.83	5.93	7.53	
	DS5	6.80	6.82	7.60	10.62	
	US1	7.14	7.16	7.07	14.96	
	US2	7.17	7.20	12.72	14.14	
	MW1	5.27	5.35	8.89	9.91	
	THB1	6.91	6.96	10.23	13.05	
THB2	-	6.69	7.13	9.33		
WSR45C	5.97	6.30	5.99	8.58		
WSR46	6.91	7.01	10.34	10.98		
Mid-Flood	DS1	6.95	6.95	18.07	20.10	
DS2	7.00	6.99	12.11	13.81		
DS3	7.04	7.04	7.37	9.56		
DS4	7.10	7.11	7.20	8.93		
DS5	7.17	7.19	7.39	8.99		
US1	6.53	6.54	16.28	18.32		
US2	6.40	6.43	15.50	17.32		
MW1	6.47	6.49	7.92	9.64		
THB1	7.16	7.27	8.21	8.83		
THB2	-	6.89	8.54	10.17		
WSR45C	6.59	6.70	12.88	11.81		
WSR46	6.98	7.12	10.83	10.41		
2012/12/15	Mid-Ebb	DS1	6.82	6.93	8.08	10.10
DS2	6.81	6.90	8.23	9.42		
DS3	6.69	6.95	8.01	9.69		
DS4	6.70	6.86	8.17	10.00		
DS5	6.82	6.86	8.73	11.21		
US1	6.81	6.82	11.28	12.82		

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2012/12/18	Mid-Flood	US2	6.78	6.79	11.75	13.78
		MW1	6.82	6.87	5.97	9.32
		THB1	6.99	7.07	9.02	9.62
		THB2	-	6.72	6.96	8.93
		WSR45C	6.77	7.03	8.20	10.76
		WSR46	6.93	6.98	8.94	10.86
		DS1	6.69	6.63	17.12	19.10
		DS2	6.69	6.61	19.20	23.43
		DS3	6.65	6.60	15.25	18.06
		DS4	6.70	6.68	22.73	25.13
		DS5	-	6.74	21.70	27.38
		US1	6.69	6.72	12.86	14.69
		US2	6.63	6.66	16.97	17.96
		MW1	6.61	6.64	24.71	24.88
		THB1	6.86	6.87	8.82	11.15
		THB2	-	5.99	12.45	10.17
	WSR45C	6.82	6.85	21.10	23.94	
	WSR46	6.96	6.99	36.38	35.81	
	Mid-Ebb	DS1	6.35	6.50	8.58	10.20
	DS2	6.41	6.53	8.49	10.47	
	DS3	6.39	6.52	8.30	10.80	
	DS4	6.43	6.55	6.52	9.07	
	DS5	6.63	6.63	9.22	11.53	
	US1	6.68	6.70	5.70	7.24	
	US2	6.51	6.60	6.53	8.07	
	MW1	6.79	6.83	4.87	6.76	
	THB1	6.98	6.97	12.57	15.03	
	THB2	-	6.39	13.54	15.57	
	WSR45C	6.71	6.82	6.15	8.80	
	WSR46	6.67	6.68	8.58	10.67	
	Mid-Flood	DS1	6.58	6.58	8.95	10.30
	DS2	6.57	6.58	8.87	11.13	
DS3	6.55	6.57	10.49	12.62		
DS4	6.52	6.53	14.49	15.20		
DS5	-	6.58	13.21	14.20		
US1	6.49	6.56	10.43	11.96		
US2	6.34	6.48	9.77	11.61		
MW1	6.43	6.50	7.95	11.21		
THB1	6.83	6.83	16.68	20.92		
THB2	-	6.39	14.64	8.40		
WSR45C	6.61	6.72	8.85	13.33		
WSR46	6.73	6.82	9.74	12.51		
2012/12/20	Mid-Ebb	DS1	6.75	6.73	2.87	5.56
DS2	6.71	6.72	3.22	4.87		
DS3	6.65	6.71	4.64	6.60		
DS4	6.69	6.72	4.77	6.76		
DS5	6.59	6.69	6.99	9.37		
US1	6.89	6.94	6.19	7.51		
US2	6.82	6.85	12.04	14.40		
MW1	6.41	6.54	1.72	4.00		
THB1	6.74	6.74	10.36	14.33		

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)	
			Bottom	Surface and Mid Depth			
2012/12/22	Mid-Flood	THB2	-	6.60	11.73	12.63	
		WSR45C	6.46	6.62	4.15	6.98	
		WSR46	6.55	6.74	5.21	8.26	
		DS1	6.74	6.74	12.63	14.33	
		DS2	6.76	6.77	17.38	20.07	
		DS3	6.79	6.79	19.98	18.85	
		DS4	6.87	6.89	11.64	12.89	
		DS5	6.99	7.00	8.93	10.48	
		US1	6.80	6.84	7.59	11.03	
		US2	6.78	6.82	8.33	7.88	
		MW1	6.08	6.18	2.50	5.24	
		THB1	6.55	6.53	15.00	22.40	
		THB2	-	7.37	13.57	24.77	
		WSR45C	6.38	6.54	3.20	5.66	
	WSR46	6.57	6.74	7.14	14.57		
	Mid-Ebb	DS1	6.95	6.96	4.25	5.79	
		DS2	6.96	6.96	3.80	5.00	
		DS3	6.93	6.95	3.69	4.73	
		DS4	6.96	6.96	3.64	5.92	
		DS5	6.97	6.96	5.35	6.03	
		US1	6.95	6.95	3.89	4.85	
		US2	6.93	6.93	5.11	6.08	
		MW1	6.57	6.73	1.61	5.79	
		THB1	7.20	7.19	3.91	11.23	
		THB2	-	6.99	6.67	9.37	
		WSR45C	6.66	7.07	2.83	5.23	
		WSR46	6.69	7.10	3.73	6.22	
		Mid-Flood	DS1	7.01	7.11	5.54	6.54
DS2			7.13	7.16	6.01	6.40	
DS3	7.19		7.20	4.04	5.70		
DS4	7.12		7.22	8.55	9.56		
DS5	7.30		7.33	5.82	6.46		
US1	6.73		7.06	8.10	6.80		
US2	6.71		6.92	5.42	7.22		
MW1	6.70		6.83	2.42	4.50		
THB1	7.30		7.31	2.89	5.93		
THB2	-		7.28	10.66	13.87		
WSR45C	6.66		7.09	7.23	9.66		
WSR46	6.61		7.00	4.75	6.56		
2012/12/24	Mid-Ebb		DS1	7.06	7.22	3.17	5.51
			DS2	7.02	7.11	3.38	6.61
		DS3	7.15	7.20	2.45	4.59	
		DS4	7.09	7.17	3.24	5.79	
		DS5	7.08	7.14	4.71	10.02	
		US1	7.30	7.35	2.74	3.90	
		US2	7.26	7.33	2.96	4.20	
		MW1	7.49	7.54	2.35	5.76	
		THB1	7.43	7.43	3.32	7.13	
		THB2	-	7.30	5.41	8.40	
		WSR45C	7.42	7.50	2.37	5.11	
		WSR46	7.13	7.31	3.35	3.51	

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2012/12/27	Mid-Flood	DS1	7.08	7.27	3.99	7.97
		DS2	7.32	7.49	3.35	7.40
		DS3	7.51	7.55	3.07	5.22
		DS4	7.13	7.51	4.08	7.59
		DS5	7.52	7.69	3.76	4.94
		US1	7.10	7.26	2.88	4.73
		US2	7.13	7.27	2.10	4.07
		MW1	6.79	6.84	1.76	3.74
		THB1	7.16	7.32	2.78	4.48
		THB2	-	7.02	5.42	9.30
	WSR45C	6.88	7.01	1.59	4.48	
	WSR46	6.76	7.03	2.80	6.72	
	Mid-Ebb	DS1	7.18	7.18	4.76	5.86
		DS2	7.06	7.11	4.52	7.11
		DS3	7.01	7.10	4.63	7.31
		DS4	7.04	7.13	4.48	6.50
		DS5	7.16	7.18	3.89	5.92
		US1	7.42	7.45	5.20	7.17
		US2	7.47	7.46	5.57	6.83
		MW1	6.90	6.92	3.77	6.32
THB1		7.36	7.37	4.31	6.35	
THB2		-	6.82	11.37	9.13	
WSR45C	7.07	7.15	2.45	4.44		
WSR46	7.40	7.45	4.34	6.21		
Mid-Flood	DS1	7.29	7.32	11.12	13.09	
	DS2	7.29	7.30	11.20	14.28	
	DS3	7.27	7.28	11.78	14.23	
	DS4	7.30	7.30	5.68	7.38	
	DS5	7.27	7.28	5.98	8.07	
	US1	6.94	6.91	8.93	11.17	
	US2	6.78	6.82	9.02	11.14	
	MW1	7.01	7.03	4.38	4.99	
	THB1	7.44	7.47	4.20	6.87	
	THB2	-	6.78	8.65	7.23	
WSR45C	7.21	7.20	4.19	5.98		
WSR46	7.46	7.46	4.13	5.33		
2012/12/29	Mid-Ebb	DS1	7.24	7.24	5.17	6.59
		DS2	7.17	7.23	5.37	6.99
		DS3	7.11	7.23	5.09	6.97
		DS4	7.16	7.27	7.22	9.61
		DS5	7.22	7.30	4.89	6.41
		US1	7.35	7.42	5.77	6.01
		US2	7.38	7.40	5.89	7.58
		MW1	6.74	6.77	3.94	7.17
		THB1	7.19	7.19	8.12	10.78
		THB2	-	6.99	7.60	9.57
WSR45C	6.80	7.04	3.14	6.00		
WSR46	7.05	7.08	7.57	10.80		
Mid-Flood	DS1	7.53	7.54	10.03	11.21	
	DS2	7.53	7.52	11.01	13.42	
	DS3	7.51	7.50	10.63	12.56	

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2012/12/31	Mid-Ebb	DS4	7.46	7.47	23.10	25.32
		DS5	7.47	7.47	25.37	28.55
		US1	7.32	7.33	18.79	24.16
		US2	7.27	7.30	9.57	10.54
		MW1	6.87	6.90	6.38	8.97
		THB1	7.30	7.30	18.12	21.08
		THB2	-	7.02	10.85	9.13
		WSR45C	7.18	7.21	11.46	15.08
		WSR46	7.26	7.26	19.63	22.54
		DS1	7.11	7.07	4.99	7.58
		DS2	7.01	7.11	4.51	6.88
		DS3	7.01	7.08	4.07	6.29
		DS4	7.02	7.09	3.15	6.13
		DS5	7.11	7.10	3.16	5.66
	US1	7.49	7.45	7.45	10.29	
	US2	7.49	7.48	8.32	10.07	
	MW1	7.39	7.39	4.64	7.63	
	THB1	7.96	8.00	6.52	8.85	
	THB2	-	7.37	10.02	8.27	
	WSR45C	7.46	7.55	2.40	5.07	
	WSR46	7.60	7.63	3.77	6.76	
	Mid-Flood	DS1	7.40	7.39	10.60	12.30
	DS2	7.42	7.39	8.84	11.55	
	DS3	7.41	7.38	9.21	12.10	
	DS4	7.42	7.40	12.53	14.32	
	DS5	-	7.59	11.32	13.10	
	US1	7.16	7.13	8.58	10.94	
	US2	6.96	6.96	9.59	12.04	
MW1	7.82	7.84	5.44	8.19		
THB1	8.04	8.02	10.48	13.70		
THB2	-	7.32	6.15	7.30		
WSR45C	7.86	7.80	9.15	13.10		
WSR46	7.70	7.67	10.68	21.91		

Notes:

1. Cell shaded yellow indicated value exceeding the Action Level criteria.
2. Cell shaded red indicated value exceeding the Limit Level criteria.
3. DO for Surface and Mid-depth: less than 4.32 mg L<sup>-1</sup> (Action Level); less than 4 mg L<sup>-1</sup> (Limit Level).  
DO for Bottom: less than 3.12 mg L<sup>-1</sup> (Action Level); less than 2 mg L<sup>-1</sup> (Limit Level).  
Depth-average Turbidity: greater than 25.04 NTU and 120% or more of the reference stations turbidity at the same tide of the day (Action Level); greater than 56.30 NTU and 130% or more of the reference stations turbidity at the same tide of the day (Limit Level).  
Depth-average SS: greater than 21.60 mg L<sup>-1</sup> and 120% or more of the reference stations SS at the same tide of the day (Action Level); greater than 40.10 mg L<sup>-1</sup> and 130% or more of the reference stations SS at the same tide of the day (Limit Level).
4. Only mid-depth water was sampled at Station THB2 because water depth was less than 3m.

Annex C

## Study Programme



