



**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)**

**10th Monthly Progress Report for Contaminated
 Mud Pits to the South of The Brothers and at
 East Sha Chau – June 2013**

Revision 0

14 August 2013

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Client:		Project No:			
Civil Engineering and Development Department (CEDD)		0175086			
Summary:		Date:			
This document presents the tenth monthly progress report for Contaminated Mud Pits at the South of The Brothers and at East Sha Chau.		14 August 2013			
		Approved by:			
					
		Craig A. Reid Partner			
v0	10 th Monthly Progress Report for CMP V and SB CMPs	RC	JT	CAR	14/8/13
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>		<p>Distribution</p> <p><input checked="" type="checkbox"/> Internal</p> <p><input checked="" type="checkbox"/> Public</p> <p><input type="checkbox"/> Confidential</p>			
		 			

**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/ Plan to be Certified / Verified:	10 th Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau – June 2013
Date of Report:	14 August 2013
Date prepared by ET:	14 August 2013
Date received by IA:	14 August 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/~~plan~~ complies with the above referenced condition of EP-427/2011/A

Craig A. Reid,
Environmental Team Leader:



Date: 14/8/2013

IA Verification

I hereby verify that the above referenced document/~~plan~~ complies with the above referenced condition of EP-427/2011/A

Dr Wang Wen Xiong,
Independent Auditor:



Date: 14/8/2013

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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

10TH MONTHLY PROGRESS REPORT FOR JUNE 2013

1.1 BACKGROUND

- 1.1.1 Since early 1990s, contaminated sediment ⁽¹⁾ 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) ⁽²⁾ 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)* ⁽³⁾. 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 ⁽⁴⁾. 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)*

1.1.4 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 ⁽¹⁾ 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 June 2013.

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 4, 6, 8, 11, 13, 15, 17, 20, 24, 26 and 28 June 2013) in this reporting month in accordance with the EM&A Manual. It should be noted that the *Impact Water Quality Monitoring during Dredging Operations of CMP 1* was not conducted on 22 June 2013 due to the adverse weather and Typhoon signal No. 3 was hoisted.

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

1.4.1 No outstanding sampling remained from June 2013. A summary of field activities conducted are presented in *Annex A*.

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

1.5.1 Monitoring data collected for SB CMPs from 27 May to 28 June 2013 are presented in this monthly report. Detailed discussion will be presented in the corresponding *Quarterly Report*.

(1) ERM (2012) Environmental Monitoring and Audit (EM&A) Manual. Final First Review. 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 November 2012.

1.5.2 **Impact Water Quality Monitoring during Dredging Operations of CMP 1 – May and June 2013**

1.5.3 *Impact Water Quality Monitoring during Dredging Operations of CMP 1* was conducted three times per week for a total of fourteen (14) sampling days from 27 May to 28 June 2013. On each 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*.

1.5.4 Monitoring results from 27 May to 28 June 2013 are presented in *Table B1* of *Annex B*. It should be noted that sampling at station THB2 during mid-ebb tide on 11 June 2013 and during mid-flood tides on 15 and 24 June 2013 were not carried out due to adverse weather. Levels of Dissolved Oxygen (DO), Turbidity and Suspended Solids (SS) at most of the stations generally complied with the Action and Limit Levels (see *Table B2* for details) set in the Baseline Monitoring Report ⁽¹⁾, except for the following occasions of exceedances shown in *Table 1.1* below.

Table 1.1 *Details of exceedances recorded at CMP 1 between 27 May and 28 June 2013*

Date	Tide	Parameter	Station	Type
27 May 2013	Mid-Ebb	Turbidity	WSR46	Action
6 June 2013	Mid-Flood	Turbidity	WSR45C	Action
11 June 2013	Mid-Flood	SS	THB2	Action
13 June 2013	Mid-Ebb	Turbidity	DS1	Action
13 June 2013	Mid-Ebb	SS	DS1	Limit
15 June 2013	Mid-Ebb	SS	DS1	Limit
15 June 2013	Mid-Ebb	SS	THB1	Limit
20 June 2013	Mid-Flood	SS	WSR46	Action
24 June 2013	Mid-Ebb	Turbidity	THB2	Action
24 June 2013	Mid-Ebb	SS	THB2	Limit
24 June 2013	Mid-Flood	SS	WSR46	Action
26 June 2013	Mid-Flood	SS	DS4	Action

(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.

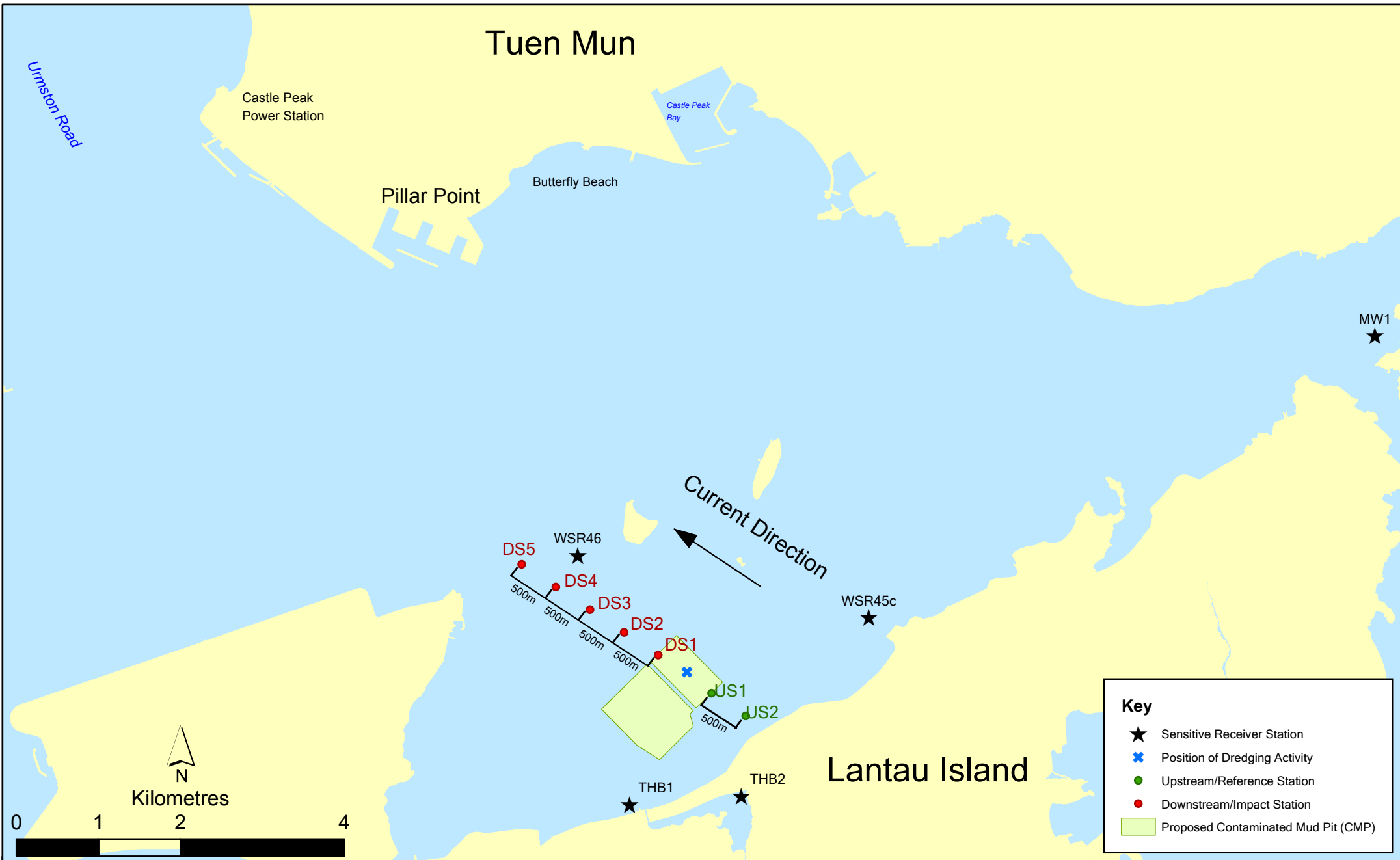


Figure 1.1

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

- 1.5.5 Action/Limit Level exceedances of Turbidity and SS were recorded at Impact station DS1 during mid-ebb tide on 13 and 15 June 2013. Since station DS1 is located in close proximity to the works area of CMP 1 (ie at the boundary of the works area) and the exceedances were recorded during one tidal period only, it is considered that the sediment plume, if any, was transient in nature and limited to the close vicinity of the works area as predicted in the EIA review of the Project ⁽¹⁾. Hence, the dredging works did not appear to cause any unacceptable deterioration in water quality.
- 1.5.6 Exceedances were recorded at stations DS4, THB1, THB2, WSR45C and WSR46 on other occasions. These stations 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 during the same tidal period. As such, the exceedances at these stations (ie DS4, THB1, THB2, WSR45C and WSR46) are not likely to be caused by the dredging works at CMP 1. In addition, THB2 is located downstream of Tai Ho Stream which will be influenced by the erosion of uphill sediments during heavy rain. It should be noted that high levels of Turbidity and SS were occasionally recorded during baseline monitoring which are considered to be sporadic events and characteristic of water quality in this area of Hong Kong. Therefore, the Action and Limit Level exceedances may be caused by natural background variation in water quality of the area.
- 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 July 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) Under the CEDD study *Contaminated Sediment Disposal Facility to the South of The Brothers (Agreement No. FM 2/2009)*

Annex A

Sampling Schedule

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

	2012												2013												2014												2015												2016												2017																												
	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	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
Cumulative Impact Sediment Chemistry																																																																																									
Near-field Stations																																																																																									
SB-RNA	4 times per year																																																																																								
SB-RNB	4 times per year																																																																																								
Mid-field Stations																																																																																									
SB-RMA	4 times per year																																																																																								
SB-RMB	4 times per year																																																																																								
Far-Field Stations																																																																																									
SB-RFA	4 times per year																																																																																								
SB-RFB	4 times per year																																																																																								
Capped Pit Stations																																																																																									
SB-RCA	4 times per year																																																																																								
SB-RCB	4 times per year																																																																																								
Sensitive Receiver Stations																																																																																									
MW1	4 times per year																																																																																								
THB1	4 times per year																																																																																								
THB2	4 times per year																																																																																								
Sediment Toxicity Tests																																																																																									
SB CMP 1 Active																																																																																									
Reference																																																																																									
SB-TRA	2 times per year																																																																																								
SB-TRB	2 times per year																																																																																								
Near-Field																																																																																									
SB-TAA	2 times per year																																																																																								
SB-TAB	2 times per year																																																																																								
Sensitive Receiver Stations																																																																																									
MW1	2 times per year																																																																																								
THB1	2 times per year																																																																																								
THB2	2 times per year																																																																																								
SB CMP 2 Active																																																																																									
Reference																																																																																									
SB-TRA	2 times per year																																																																																								
SB-TRB	2 times per year																																																																																								
Near-Field																																																																																									
SB-TBA	2 times per year																																																																																								
SB-TBB	2 times per year																																																																																								
Sensitive Receiver Stations																																																																																									
MW1	2 times per year																																																																																								
THB1	2 times per year																																																																																								
THB2	2 times per year																																																																																								
Tissue/ Whole Body Sampling																																																																																									
Near-Pit Stations																																																																																									
SB-INA	2 times per year																																																																																								
SB-INB	2 times per year																																																																																								
Reference North																																																																																									
TNA	2 times per year																																																																																								
TNB	2 times per year																																																																																								
Reference South																																																																																									
TSA	2 times per year																																																																																								
TSB	2 times per year																																																																																								
Demersal Trawling																																																																																									
Impact																																																																																									
SB-INA 1-5	4 times per year																																																																																								
SB-INB 1-5	4 times per year																																																																																								
Reference North																																																																																									
TNA 1-5	4 times per year																																																																																								
TNB 1-5	4 times per year																																																																																								
Reference South																																																																																									
TSA 1-5	4 times per year																																																																																								
TSB 1-5	4 times per year																																																																																								

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

	2012					2013					2014					2015					2016					2017																											
	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
Capping Water Quality Monitoring																																																					
<i>Ebb Tide</i>																																																					
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																																																				
<i>Flood Tide</i>																																																					
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																																																				
SB-INF2	8 times per year																																																				
SB-INF3	8 times per year																																																				
Reference Stations Upcurrent																																																					
SB-RFF1	8 times per year																																																				
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																																																				
Benthic Recolonisation Studies																																																					
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:
 "" = 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 May and June
2013

Table B1 *Summary Table of DO, Turbidity and SS Levels Recorded in May and June 2013*

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2013/5/27	Mid-Ebb	DS1	5.70	5.94	6.17	5.33
		DS2	5.57	5.94	6.53	13.56
		DS3	5.27	5.86	4.89	7.11
		DS4	5.65	5.89	4.85	6.78
		DS5	5.90	5.98	3.58	6.17
		US1	5.52	5.88	5.65	7.33
		US2	5.37	5.51	7.30	9.67
		MW1	6.02	6.14	6.94	7.11
		THB1	6.07	6.06	4.11	4.50
		THB2	-	5.72	3.79	2.33
		WSR45C	6.14	6.28	6.24	7.89
		WSR46	5.63	6.16	26.00	12.78
	Mid-Flood	DS1	5.40	5.41	8.13	10.50
		DS2	5.51	5.53	9.92	9.50
		DS3	5.45	5.50	8.58	9.56
		DS4	5.09	5.62	6.51	9.22
		DS5	6.11	5.90	4.68	6.83
		US1	5.27	5.54	4.16	5.33
		US2	5.14	5.36	12.04	11.00
		MW1	4.42	5.21	4.45	3.33
		THB1	5.58	5.91	5.92	5.00
		THB2	-	5.33	4.96	3.33
		WSR45C	4.62	5.19	10.79	3.56
		WSR46	4.52	4.94	16.73	16.56
2013/5/29	Mid-Ebb	DS1	5.62	5.81	12.76	18.22
		DS2	5.87	6.03	5.81	8.67
		DS3	6.02	6.16	4.97	6.67
		DS4	5.97	6.10	4.09	5.78
		DS5	5.82	5.82	3.47	5.17
		US1	5.95	6.00	5.61	6.83
		US2	5.93	6.09	4.98	6.33
		MW1	5.67	5.93	4.16	5.22
		THB1	4.90	5.20	10.53	8.67
		THB2	-	6.18	10.43	7.56
		WSR45C	5.03	5.67	6.07	7.44
		WSR46	4.97	5.24	6.17	10.17
	Mid-Flood	DS1	5.32	5.32	4.90	6.33
		DS2	5.32	5.41	4.43	5.83
		DS3	5.42	5.42	7.97	9.33
		DS4	5.37	5.38	5.96	8.00
		DS5	5.34	5.54	4.38	6.33
		US1	5.50	5.46	8.04	12.22
		US2	5.02	5.32	3.96	5.11
		MW1	4.96	5.16	9.96	12.67
		THB1	5.11	6.00	5.84	4.83
		THB2	-	5.16	19.09	8.89
		WSR45C	4.75	5.13	15.57	7.56
		WSR46	4.91	5.81	12.76	18.22

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2013/5/31	Mid-Ebb	DS1	4.96	6.88	6.92	9.44
		DS2	5.50	7.19	5.31	5.22
		DS3	6.02	8.14	4.06	5.56
		DS4	6.68	8.39	3.41	3.67
		DS5	8.30	8.36	3.00	2.67
		US1	7.20	7.63	3.17	6.00
		US2	7.12	8.51	4.17	5.00
		MW1	5.23	7.25	2.97	4.00
		THB1	6.35	8.38	3.89	2.83
		THB2	-	7.61	5.09	3.33
	WSR45C	4.67	6.90	7.75	8.33	
	WSR46	5.18	6.46	3.82	4.44	
	Mid-Flood	DS1	5.31	5.81	3.65	4.50
		DS2	5.51	5.85	3.20	3.67
		DS3	6.23	6.05	2.45	4.50
		DS4	4.83	5.68	4.12	4.89
		DS5	6.58	6.87	2.57	5.00
		US1	5.04	5.59	2.70	4.22
		US2	4.94	5.76	2.85	4.89
		MW1	4.55	5.17	3.06	4.56
THB1		5.13	5.39	3.63	3.17	
THB2		-	6.51	3.93	4.33	
WSR45C	4.60	5.17	10.68	12.56		
WSR46	4.75	5.48	5.64	6.00		
2013/6/4	Mid-Ebb	DS1	4.93	9.44	7.91	9.33
		DS2	5.22	9.87	4.18	8.67
		DS3	4.34	9.82	3.81	7.44
		DS4	4.52	9.29	5.72	9.89
		DS5	10.61	12.06	3.53	7.78
		US1	7.73	9.04	3.73	5.33
		US2	5.87	8.85	6.49	8.67
		MW1	4.07	6.30	3.17	6.11
		THB1	7.21	11.32	5.28	8.83
		THB2	-	11.79	2.05	4.00
	WSR45C	4.57	7.78	4.27	7.67	
	WSR46	4.89	7.60	3.78	6.22	
	Mid-Flood	DS1	7.81	10.12	2.41	6.50
		DS2	8.12	10.11	2.46	4.83
		DS3	7.57	9.36	4.87	7.67
		DS4	5.08	8.28	6.10	9.67
		DS5	9.72	9.77	1.60	3.33
		US1	5.12	8.04	2.38	4.44
		US2	4.51	6.92	3.30	8.00
		MW1	4.18	6.43	3.67	6.44
THB1		8.14	9.36	3.74	6.00	
THB2		-	13.14	3.25	8.67	
WSR45C	4.48	6.32	6.83	9.44		
WSR46	4.89	8.81	6.17	7.56		
2013/6/6	Mid-Ebb	DS1	5.15	6.13	7.61	7.56
		DS2	4.85	6.04	5.12	7.22
		DS3	4.17	6.03	6.29	5.44

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2013/6/8	Mid-Flood	DS4	5.97	6.31	2.10	3.11
		DS5	6.50	6.62	0.93	4.83
		US1	6.06	6.06	1.87	1.33
		US2	3.09	5.77	2.84	3.11
		MW1	4.19	5.45	1.92	1.33
		THB1	4.86	5.83	4.19	1.17
		THB2	-	5.57	3.25	1.00
		WSR45C	3.69	5.93	10.52	5.33
		WSR46	4.40	5.44	5.36	3.89
		DS1	4.65	5.27	7.18	6.00
		DS2	5.40	5.66	5.66	5.50
		DS3	5.40	6.20	5.43	4.67
		DS4	3.40	4.99	8.20	5.67
		DS5	5.61	6.22	2.99	2.67
		US1	4.32	5.30	4.37	3.78
	US2	3.89	4.97	5.58	5.11	
	MW1	3.97	4.49	5.33	7.00	
	THB1	5.64	6.34	5.48	2.33	
	THB2	-	5.14	6.14	8.33	
	WSR45C	3.96	4.96	25.84	14.56	
	WSR46	4.50	5.12	24.09	19.78	
	Mid-Ebb	DS1	5.39	5.77	3.85	3.89
	DS2	5.54	5.85	3.55	2.44	
	DS3	5.67	5.96	3.50	4.11	
	DS4	6.38	6.46	3.61	4.44	
	DS5	6.74	6.76	3.53	6.17	
	US1	6.28	6.51	2.69	3.00	
	US2	5.44	6.31	3.55	3.78	
	MW1	4.25	5.69	2.97	3.78	
	THB1	5.99	6.90	3.31	4.33	
THB2	-	7.32	3.08	6.67		
WSR45C	4.05	6.06	12.10	11.78		
WSR46	4.19	5.32	7.86	6.56		
Mid-Flood	DS1	5.00	6.32	7.82	6.67	
DS2	6.20	6.26	4.75	4.67		
DS3	6.36	6.44	4.39	5.00		
DS4	5.44	6.16	9.33	9.44		
DS5	3.96	6.49	6.52	5.56		
US1	4.29	5.68	5.72	5.56		
US2	4.08	5.20	5.41	6.00		
MW1	4.12	4.44	7.07	5.22		
THB1	5.71	6.78	9.28	6.33		
THB2	-	8.10	5.77	4.33		
WSR45C	4.11	5.23	7.40	6.44		
WSR46	4.22	6.04	10.09	8.22		
2013/6/11	Mid-Ebb	DS1	3.79	5.39	5.57	6.11
DS2	3.92	5.25	5.81	7.89		
DS3	3.77	5.33	5.63	7.78		
DS4	4.34	5.60	7.98	11.11		
DS5	6.82	6.88	2.12	2.33		
US1	5.27	5.45	6.05	6.56		

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2013/6/13	Mid-Flood	US2	4.42	5.36	6.64	8.22
		MW1	4.39	5.65	3.92	4.00
		THB1	4.12	6.16	8.86	13.50
		THB2	-	-	-	-
		WSR45C	3.52	5.24	7.44	6.89
		WSR46	4.00	5.20	4.17	3.67
		DS1	4.60	5.00	5.11	6.11
		DS2	4.71	5.64	6.38	6.67
		DS3	5.42	5.76	3.62	5.83
		DS4	4.50	5.42	5.00	5.56
		DS5	5.43	5.98	4.10	6.89
		US1	4.00	5.56	6.45	8.11
		US2	3.70	4.92	12.79	16.67
		MW1	3.75	4.97	2.84	4.78
		THB1	5.62	5.91	4.73	6.33
		THB2	-	5.46	5.57	29.00
	WSR45C	3.82	4.92	10.50	14.56	
	WSR46	4.21	5.30	6.18	8.00	
	Mid-Ebb	DS1	3.37	3.99	44.88	79.11
	DS2	3.38	4.06	5.16	15.33	
	DS3	3.33	4.20	4.81	9.22	
	DS4	3.16	4.34	5.40	8.89	
	DS5	3.76	4.54	4.03	6.78	
	US1	3.37	4.12	6.98	9.33	
	US2	4.04	4.77	10.73	14.67	
	MW1	3.68	4.50	2.45	9.56	
	THB1	3.55	5.03	3.06	11.33	
	THB2	-	4.66	3.32	8.33	
	WSR45C	3.24	4.49	5.47	11.67	
	WSR46	3.43	4.18	4.63	11.67	
	Mid-Flood	DS1	3.59	4.23	3.25	10.56
	DS2	3.74	4.21	5.02	11.00	
DS3	3.36	4.39	4.18	6.78		
DS4	4.33	4.96	2.79	8.50		
DS5	4.59	4.90	2.85	6.00		
US1	3.40	4.09	5.68	16.00		
US2	3.29	4.32	7.58	21.11		
MW1	3.45	3.84	2.48	7.56		
THB1	4.07	4.99	7.29	6.67		
THB2	-	4.45	3.45	7.33		
WSR45C	3.48	3.71	5.52	11.00		
WSR46	3.51	4.10	9.22	8.22		
2013/6/15	Mid-Ebb	DS1	3.69	4.55	24.60	49.11
DS2	3.76	4.62	9.24	13.89		
DS3	3.78	4.71	6.58	8.56		
DS4	3.75	4.72	5.49	9.00		
DS5	3.97	4.72	4.81	7.33		
US1	4.30	5.04	6.82	7.67		
US2	5.02	5.34	9.70	10.33		
MW1	4.15	4.43	2.03	3.22		
THB1	5.51	5.59	1.98	50.50		

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)	
			Bottom	Surface and Mid Depth			
2013/6/17	Mid-Flood	THB2	-	4.60	4.21	3.67	
		WSR45C	3.82	4.63	4.97	5.78	
		WSR46	3.86	4.44	5.53	7.00	
		DS1	4.16	4.91	3.44	3.89	
		DS2	4.63	5.23	3.93	3.89	
		DS3	4.97	5.37	2.89	1.89	
		DS4	4.90	5.47	3.18	1.50	
		DS5	5.55	5.60	2.36	7.17	
		US1	3.69	4.83	5.68	8.33	
		US2	3.66	4.66	5.55	5.44	
		MW1	3.68	4.21	2.53	3.78	
		THB1	4.99	5.55	3.11	4.17	
		THB2	-	-	-	-	
		WSR45C	3.80	4.46	4.37	7.67	
	WSR46	3.91	4.61	11.35	13.33		
	Mid-Ebb	DS1	4.54	5.77	8.02	6.33	
		DS2	4.61	5.93	5.19	6.00	
		DS3	4.74	5.94	3.79	4.33	
		DS4	4.77	5.85	4.35	5.89	
		DS5	5.17	5.61	3.81	4.67	
		US1	5.54	6.06	6.19	5.33	
		US2	4.73	5.86	8.65	10.11	
		MW1	4.67	5.33	2.30	3.67	
		THB1	5.82	6.57	4.66	3.33	
		THB2	-	6.52	5.11	2.33	
		WSR45C	4.25	5.60	5.10	7.11	
		WSR46	4.36	5.41	6.19	7.33	
		Mid-Flood	DS1	4.65	5.04	8.46	11.11
DS2			5.28	5.77	5.44	6.11	
DS3	5.07		6.20	5.21	6.22		
DS4	5.40		5.85	7.69	8.22		
DS5	6.33		6.32	3.04	5.33		
US1	4.17		5.25	5.19	6.89		
US2	4.16		5.02	6.54	8.11		
MW1	4.21		4.94	2.40	2.56		
THB1	5.79		5.96	4.19	3.33		
THB2	-		5.66	4.08	5.67		
WSR45C	4.19		5.08	5.10	5.67		
WSR46	4.32		5.21	5.43	7.44		
2013/6/20	Mid-Ebb		DS1	5.28	6.86	7.18	7.44
			DS2	5.59	7.22	5.13	6.89
		DS3	5.16	7.25	6.18	8.22	
		DS4	6.14	7.77	7.25	8.22	
		DS5	9.68	9.31	3.68	7.44	
		US1	6.32	8.21	4.83	3.78	
		US2	4.68	8.67	5.63	5.78	
		MW1	4.91	6.44	2.10	3.67	
		THB1	6.06	11.31	4.89	5.33	
		THB2	-	8.63	4.32	5.67	
		WSR45C	4.46	8.39	7.59	10.56	
		WSR46	4.51	6.93	6.97	6.11	

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)	
			Bottom	Surface and Mid Depth			
2013/6/24	Mid-Flood	DS1	4.67	7.60	7.82	10.00	
		DS2	6.49	10.59	6.96	10.83	
		DS3	4.90	8.36	8.44	8.56	
		DS4	4.16	10.24	8.06	10.22	
		DS5	11.31	13.84	4.85	7.33	
		US1	4.90	8.77	5.77	6.44	
		US2	4.84	7.66	5.23	8.78	
		MW1	4.95	6.00	5.47	6.56	
		THB1	11.34	14.61	6.64	8.67	
		THB2	-	18.36	5.74	9.00	
	WSR45C	4.82	8.44	6.59	8.44		
	WSR46	4.67	8.42	19.48	26.89		
	Mid-Ebb	DS1	5.16	5.67	12.84	16.78	
		DS2	5.26	5.67	13.52	18.56	
		DS3	5.23	5.63	12.97	16.67	
		DS4	5.26	5.59	11.31	12.67	
		DS5	5.28	5.42	10.92	15.56	
		US1	5.88	6.09	6.82	8.44	
		US2	5.79	5.94	8.21	11.22	
		MW1	5.32	5.63	7.66	9.00	
THB1		5.83	5.97	5.36	5.83		
THB2		-	7.15	49.27	41.67		
2013/6/26	Mid-Ebb	WSR45C	5.24	5.78	13.53	20.22	
		WSR46	5.06	5.74	15.06	17.44	
		Mid-Flood	DS1	5.79	5.83	12.58	13.33
			DS2	5.83	5.95	6.94	9.67
			DS3	5.81	5.92	7.15	10.56
			DS4	5.87	5.93	8.41	9.33
			DS5	6.10	6.10	6.28	6.67
			US1	5.25	5.59	9.96	10.56
			US2	5.10	5.49	15.65	20.11
			MW1	5.02	5.55	6.53	7.22
	THB1		5.55	5.80	10.74	10.00	
	THB2		-	-	-	-	
	WSR45C	5.02	5.46	13.60	15.44		
	WSR46	5.02	5.45	29.53	17.22		
	Mid-Ebb	DS1	5.55	5.91	8.77	14.89	
		DS2	5.60	5.98	9.10	12.00	
		DS3	5.46	6.03	9.05	12.44	
		DS4	5.60	6.08	7.48	11.00	
		DS5	5.80	5.90	7.58	10.67	
		US1	5.93	5.98	12.34	15.22	
US2		5.75	5.80	16.04	16.44		
MW1		6.08	6.28	9.08	9.89		
THB1		5.89	6.11	15.08	8.33		
THB2		-	5.75	4.65	6.33		
WSR45C	5.76	6.18	11.39	11.78			
WSR46	5.30	6.12	15.19	12.11			
Mid-Flood	DS1	5.78	5.87	10.45	10.17		
	DS2	5.87	5.90	9.05	11.50		
	DS3	5.55	5.82	14.05	19.22		

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2013/6/28	Mid-Ebb	DS4	5.41	5.54	23.67	24.44
		DS5	5.65	5.87	9.65	12.67
		US1	5.37	5.76	8.05	8.56
		US2	4.98	5.40	12.48	15.89
		MW1	4.88	5.43	8.58	6.33
		THB1	5.66	5.94	11.86	9.33
		THB2	-	5.26	6.41	6.67
		WSR45C	5.28	5.76	9.88	7.56
		WSR46	5.39	5.74	12.48	10.11
		DS1	5.81	6.44	8.37	6.56
		DS2	6.08	6.49	10.02	10.11
		DS3	5.34	6.52	10.17	10.00
		DS4	6.34	6.53	6.26	7.78
		DS5	6.10	6.21	6.20	7.67
	Mid-Flood	US1	6.84	6.93	5.69	6.67
		US2	6.14	6.77	7.55	9.00
		MW1	6.33	6.57	4.82	7.56
		THB1	5.79	6.26	8.19	6.83
		THB2	-	8.07	5.31	4.00
		WSR45C	5.34	6.67	10.21	9.67
		WSR46	5.19	6.19	8.62	7.78
		DS1	5.91	6.22	5.68	5.33
		DS2	6.10	6.24	6.39	6.17
		DS3	6.18	6.23	6.27	4.56
		DS4	5.54	6.29	9.76	9.67
		DS5	6.33	6.44	5.02	3.50
		US1	5.29	5.92	6.16	4.00
		US2	4.89	5.79	7.36	8.33
MW1	4.30	5.51	4.15	3.89		
THB1	5.96	6.18	5.87	4.67		
THB2	-	5.33	8.84	4.33		
WSR45C	4.75	5.76	8.29	8.11		
WSR46	4.91	5.83	16.02	13.78		

Notes:

1. Please refer to Table B2 below for the Action and Limit Levels for dredging activities.
2. Cell shaded yellow indicated value exceeding the Action Level criteria.
3. Cell shaded red indicated value exceeding the Limit Level criteria.
4. Only mid-depth water was sampled at Station THB2 because water depth was less than 3m.
5. Sampling at Station THB2 during mid-ebb tide of 11 June 2013 and mid-flood tides of 15 and 24 June 2013 were not carried out due to adverse weather.

Table B2 *Action and Limit Levels of Water Quality for Dredging, Backfilling and Capping Activities*

Parameter	Action Level	Limit Level
Dissolved Oxygen (DO) ⁽¹⁾	<u>Surface and Mid-depth</u> ⁽²⁾ The average of the impact, WSR 45C and WSR 46 station readings are < 5%-ile of baseline data for surface and middle layer = 4.32 mg L⁻¹	<u>Surface and Mid-depth</u> ⁽²⁾ The average of the impact, WSR 45C and WSR 46 station readings are < 4 mg L⁻¹
	and	and
	Significantly less than the reference stations mean DO (at the same tide of the same day)	Significantly less than the reference stations mean DO (at the same tide of the same day)
	<u>Bottom</u> The average of the impact, WSR 45C and WSR 46 station readings are < 5%-ile of baseline data for bottom layers = 3.12 mg L⁻¹	<u>Bottom</u> The average of the impact station, WSR 45C and WSR 46 readings are < 2 mg L⁻¹
	and	and
	Significantly less than the reference stations mean DO (at the same tide of the same day)	Significantly less than the reference stations mean DO (at the same tide of the same day)
Depth-averaged Suspended Solids (SS) ⁽³⁾⁽⁴⁾	The average of the impact, WSR 45C and WSR 46 station readings are > 95%-ile of baseline data for depth average = 21.60 mg L⁻¹	The average of the impact, WSR 45C and WSR 46 station readings are > 99%-ile of baseline data for depth average = 40.10 mg L⁻¹
	and	and
	120% of control station's SS at the same tide of the same day	130% of control station's SS at the same tide of the same day
Depth-averaged Turbidity (Tby) ⁽³⁾⁽⁴⁾	The average of the impact, WSR 45C and WSR 46 station readings are > 95%-ile of baseline data = 25.04 NTU	The average of the impact, WSR 45C and WSR 46 station readings are > 99%-ile of baseline data = 56.30 NTU
	and	and
	120% of control station's Tby at the same tide of the same day	130% of control station's Tby at the same tide of the same day
Notes:		
(1) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.		
(2) The Action and Limit Levels for DO for Surface & Middle layers were calculated from the combined pool of baseline surface layer data and baseline middle layer data.		
(3) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.		
(4) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.		

Annex C

Study Programme

