



**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)**

**13<sup>th</sup> Monthly Progress Report for Contaminated  
 Mud Pits to the South of The Brothers and at  
 East Sha Chau – September 2013**

Revision 0

5 November 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

## 13<sup>th</sup> Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau – September 2013

### Revision 0

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Client:		Project No:			
Civil Engineering and Development Department (CEDD)		0175086			
Summary:		Date:			
This document presents the 13 <sup>th</sup> monthly progress report for Contaminated Mud Pits at the South of The Brothers and at East Sha Chau.		5 November 2013			
		Approved by:			
					
		<b>Craig A. Reid</b> Partner			
v0	13 <sup>th</sup> Monthly Progress Report for CMP V and SB CMPs	YL	JT	CAR	5/11/13
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 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 to be Certified</del> / Verified:	13 <sup>th</sup> Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau – September 2013
Date of Report:	5 November 2013
Date prepared by ET:	5 November 2013
Date received by IA:	5 November 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: 5/11/2013

**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: 5/11/2013

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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

13<sup>TH</sup> MONTHLY PROGRESS REPORT FOR SEPTEMBER 2013

**1.1 BACKGROUND**

1.1.1 Since early 1990s, contaminated sediment <sup>(1)</sup> arising from various construction works (e.g. dredging and reclamation projects) 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) 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)*

1.1.4 *Environmental Permits (EPs) (EP-312/2008/A and EP-427/2011A)* were issued by the Environmental Protection Department (EPD) to the CEDD, the Permit Holder, on 28 November 2008 for East of Sha Chau (ESC) CMP V and on 23 December 2011 for SB CMPs, respectively. Under the requirements of the *EPs*, an Environmental Monitoring and Audit (EM&A) programme as set out in the EM&A Manuals <sup>(1) (2)</sup> is required to be implemented for the CMPs.

1.1.5 The present EM&A programme undertaken under *Agreement No. CE 23/2012 (EP)* covers the dredging, disposal and capping operations of the SB CMPs as well as CMPs at East of Sha Chau (ESC). In September 2013, the following works were being undertaken at the CMPs:

- Capping was being undertaken at CMP IVc;
- Disposal of contaminated mud was taking place at SB CMP 1; and
- Dredging operations were taking place at SB CMP 2.

## 1.2 **REPORTING PERIOD**

1.2.1 This Monthly Progress Report covers the EM&A activities for the reporting month of September 2013.

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

1.3.1 No monitoring activities were undertaken for CMP IV and V in the monitoring month of September 2013.

1.3.2 The following monitoring activities have been undertaken for SB CMPs in September 2013:

- *Pit Specific Sediment Chemistry* was conducted for SB CMP 1 on 26 September 2013;
- *Water Column Profiling* was scheduled to be undertaken on 17 September 2013. However, there was no dumping activity at CMP 1 while the monitoring team was on-site. As such, *in-situ* measurements and water sampling were not undertaken for Water Column Profiling in September 2013; and
- *Impact Water Quality Monitoring during Dredging Operations* was undertaken for SB CMP 2 three times per week (i.e. 2, 4, 6, 9, 11, 13, 16,

(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.

(2) ERM (2010) Environmental Monitoring and Audit (EM&A) Manual. Final Second Review. Environmental Monitoring and Audit for Contaminated Mud Pit at Sha Chau (2009-2013) – Investigation. Agreement No. CE 4/2009(EP). Submitted to EPD in November 2010.

18, 21, 25, 27, and 30 September 2013) in this reporting month in accordance with the EM&A Manual.

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

1.4.1        No outstanding sampling remained for September 2013. Laboratory analyses of *Pit Specific Sediment Chemistry* of SB CMP 1 conducted in September 2013 are yet to be completed. A summary of field activities conducted are presented in *Annex A*.

**1.5            *BRIEF DISCUSSION OF THE MONITORING RESULTS FOR CMP V***

1.5.1        *Pit Specific Sediment Chemistry Monitoring and Cumulative Impact Sediment Chemistry Monitoring* for CMP Va are not conducted in September 2013 and the laboratory analysis of the monitoring activities undertaken in August 2013 is yet to be completed during the preparation of this monthly report. Hence, brief discussion of the monitoring results is not presented in this *13<sup>th</sup> Monthly Report*. Detailed discussion will be presented in the corresponding *Quarterly Report*.

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

1.6.1        Monitoring data collected for CMP 2 from 2 September to 30 September 2013 are presented in this monthly report. Detailed discussion will be presented in the corresponding *Quarterly Report*.

**1.6.2        *Impact Water Quality Monitoring during Dredging Operations of CMP 2 – 2 September to 30 September 2013***

1.6.3        *Impact Water Quality Monitoring during Dredging Operations of CMP 2* (i.e. from 2 September to 30 September 2013) was conducted three times per week for a total of nine (9) sampling days. 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 2. 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*.

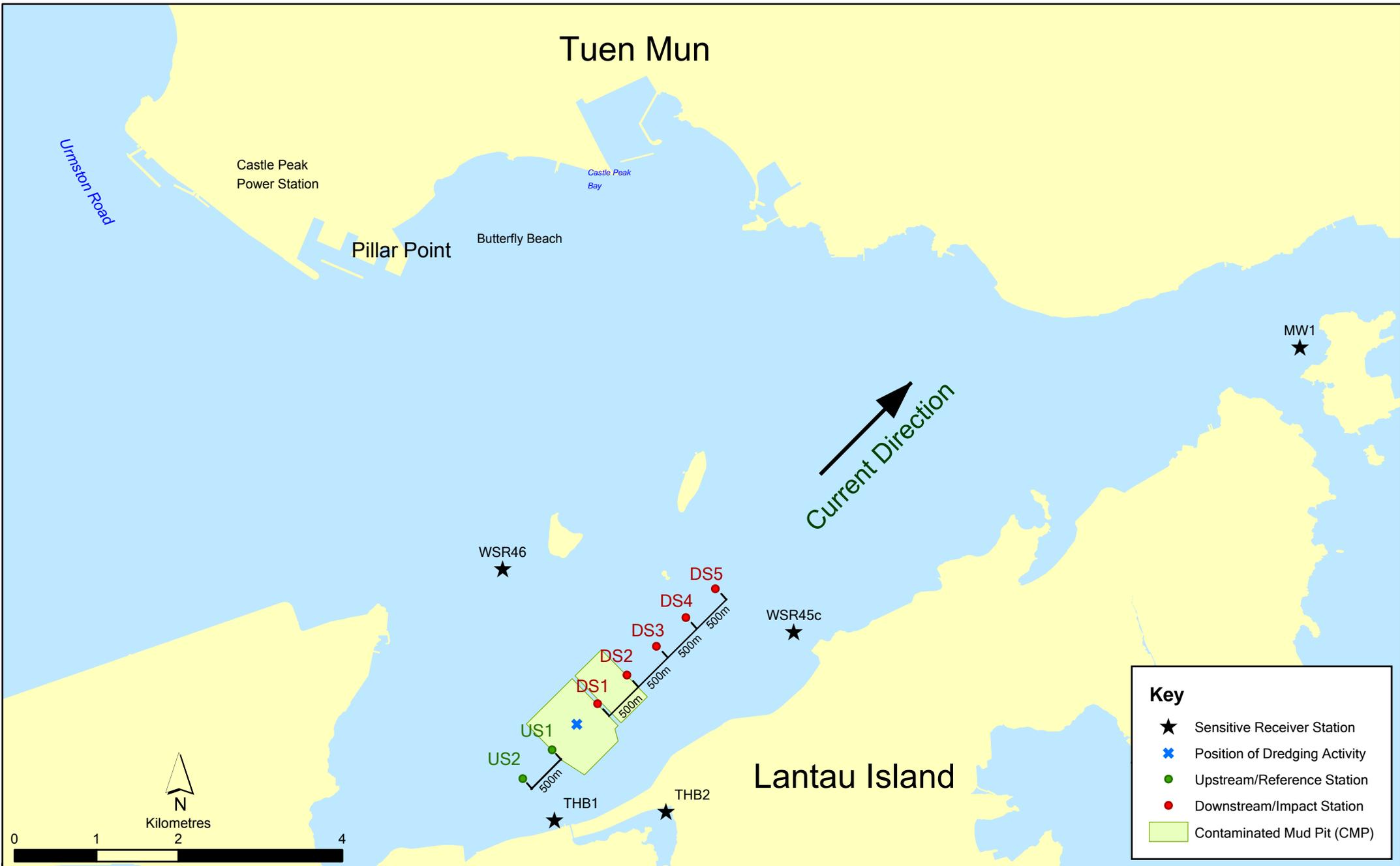


Figure 1.1

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.

1.6.4 Monitoring results from 2 September to 30 September are presented in *Table B1 of Annex B*. Sampling at THB2 was cancelled during mid-ebb tide on 4 September 2013 due to adverse weather. Sampling at THB2 was also cancelled during both mid-ebb and mid-flood tides on 21 September 2013 since severe Typhoon Usagi was approaching. Levels of DO, Turbidity and SS generally complied with the Action and Limit Levels (see *Table B2 of Annex B* for details) set in the Baseline Monitoring Report <sup>(1)</sup>, except for the following occasions of exceedances shown in *Table 1.1* below.

**Table 1.1** *Details of exceedances recorded at SB CMP 2 in September 2013*

Date	Tide	Parameter	Station	Type
2 September 2013	Mid-Ebb	Bottom DO	WSR45C	Action
4 September 2013	Mid-Flood	Turbidity	WSR46	Limit
6 September 2013	Mid-Ebb	Turbidity	WSR46	Limit
	Mid-Ebb	SS	WSR46	Action
	Mid-Flood	Turbidity	DS1	Limit
	Mid-Flood	SS	DS1	Limit
	Mid-Flood	SS	WSR46	Action
18 September 2013	Mid-Ebb	Turbidity	WSR46	Action
	Mid-Flood	SS	WSR45C	Action
21 September 2013	Mid-Flood	Turbidity	WSR46	Limit
	Mid-Flood	SS	WSR46	Action
25 September 2013	Mid-Ebb	Turbidity	DS2	Limit
	Mid-Ebb	SS	DS2	Limit
27 September 2013	Mid-Flood	SS	DS2	Action

1.6.5 It should be noted that all exceedances except those on 6 September 2013 were recorded at stations which are located further away from the works area when compared to station DS1 at which the levels of SS, Turbidity and DO (Surface and Mid-depth) did not exceed the Action and Limit Levels during the same tidal period on the same day. As such, these recorded exceedances are not likely to be caused by the dredging works at CMP 2.

1.6.6 On 6 September 2013, though exceedances of Action and Limit Levels were recorded at stations WSR46 and DS1, there did not appear to be any trend of increasing SS or Turbidity levels toward the dredging operations. Instead, high levels of Turbidity and SS and low levels of DO 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) 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.

1.6.7 Overall, the results indicated that the dredging operations at CMP 2 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.

**1.7** *ACTIVITIES SCHEDULED FOR THE NEXT MONTH*

1.7.1 *Pit Specific Sediment Chemistry, Routine Water Quality Monitoring and Water Column Profiling* for CMP 1 as well as *Impact Water Quality Monitoring during Dredging Operations* for CMP 2 will be conducted in the next monthly period of October 2013.

1.7.2 No monitoring activities will be conducted for CMP IV and CMP V in the next monthly period of October 2013.

1.7.3 The sampling schedule is presented in *Annex A*.

**1.8** *STUDY PROGRAMME*

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

Annex A

## Sampling Schedule

Annex A1 - East of Sha Chau Environmental Monitoring and Audit Sampling Schedule for CMP IV (January 2012 - December 2013)

		2012												2013											
<b>Tissue/ Whole Body Sampling</b>		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Near-Pit Stations	INA		*																						
	INB		*																						
	Reference North		*																						
	TNA		*																						
	TNB		*																						
Reference South	TSA		*																						
	TSB		*																						
<b>Demersal Trawling</b>		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Near Pit Stations	INA 1-5		*	*																					
	INB 1-5		*	*																					
Reference North	TNA 1-5		*	*																					
	TNB 1-5		*	*																					
Reference South	TSA 1-5		*	*																					
	TSB 1-5		*	*																					
<b>Capping</b>		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
<i>Ebb Tide</i>																									
Impact Station Downcurrent	IPE1		*				*	*				*	*		*				*	*				*	*
	IPE2		*				*	*				*	*		*				*	*				*	*
	IPE3		*				*	*				*	*		*				*	*				*	*
	IPE4		*				*	*				*	*		*				*	*				*	*
	PFC1		*				*	*				*	*		*				*	*				*	*
Intermediate Station Downcurrent	INE1		*				*	*				*	*		*				*	*				*	*
	INE2		*				*	*				*	*		*				*	*				*	*
	INE3		*				*	*				*	*		*				*	*				*	*
	INE4		*				*	*				*	*		*				*	*				*	*
	INE5		*				*	*				*	*		*				*	*				*	*
Reference Station Upcurrent	RFE1		*				*	*				*	*		*				*	*				*	*
	RFE2		*				*	*				*	*		*				*	*				*	*
	RFE3		*				*	*				*	*		*				*	*				*	*
	RFE4		*				*	*				*	*		*				*	*				*	*
	RFE5		*				*	*				*	*		*				*	*				*	*
<i>Flood Tide</i>																									
Impact Station Downcurrent	INF1		*				*	*				*	*		*				*	*				*	*
	PFC2		*				*	*				*	*		*				*	*				*	*
	INF3		*				*	*				*	*		*				*	*				*	*
Intermediate Station Downcurrent	IPF1		*				*	*				*	*		*				*	*				*	*
	IPF2		*				*	*				*	*		*				*	*				*	*
	IPF3		*				*	*				*	*		*				*	*				*	*
Reference Station Upcurrent	RFF1		*				*	*				*	*		*				*	*				*	*
	RFF2		*				*	*				*	*		*				*	*				*	*
	RFF3		*				*	*				*	*		*				*	*				*	*
<b>Water Column Profiling</b>		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Plume Stations	WCP1		*																						
	WCP2		*																						
<b>Benthic Recolonisation Studies</b>		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Capped Contaminated Mud Pits III																									
CPA	1 grab per station								*																
CPB	1 grab per station								*																
CPC	1 grab per station								*																
Reference Stations																									
RBA	1 grab per station								*																
RBB	1 grab per station								*																
RBC	1 grab per station								*																

\*n = Number of replicates depends on field catch or parameters

Light Blue = Sampling completed  
Yellow = Sampling to be completed



		2012												2013												2014	
<b>Routine Water Quality Monitoring</b>		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
<i>Ebb Tide</i>																											
Impact Station	ESC-IPE1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	ESC-IPE2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	ESC-IPE3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	ESC-IPE4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	ESC-IPE5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Intermediate Station	ESC-INE1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	ESC-INE2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	ESC-INE3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	ESC-INE4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	ESC-INE5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Reference Station	ESC-RFE1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	ESC-RFE2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	ESC-RFE3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	ESC-RFE4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	ESC-RFE5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Ma Wan Station	MW1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
<i>Flood Tide</i>																											
Impact Station	ESC-IPF1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	ESC-IPF2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	ESC-IPF3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Intermediate Station	ESC-INF1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	ESC-INF2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	ESC-INF3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Reference Station	ESC-RFF1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	ESC-RFF2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	ESC-RFF3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Ma Wan Station	MW1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
<b>Water Column Profiling</b>		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
Plume Stations	WCP1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	WCP2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<b>Benthic Recolonisation Studies</b>		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
Capped Contaminated Mud Pits IVa-c																											
Reference Stations	ESC-CPA							*				*								*				*			
	ESC-CPB							*				*								*				*			
	ESC-CPC							*				*								*				*			
	ESC-RBA							*				*								*				*			
	ESC-RBB							*				*								*				*			
	ESC-RBC							*				*								*				*			
<b>Impact Monitoring for Dredging</b>		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
Upstream/Reference Stations	US1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	US2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Downstream/Impact Stations	DS1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	DS2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	DS3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	DS4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	DS5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Ma Wan Station	MW1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
		<div style="display: flex; justify-content: space-between; width: 100%;"> <span><span style="background-color: cyan; border: 1px solid black; padding: 2px;"> </span> Sampling completed</span> <span><span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Sampling to be completed</span> </div>																									









Annex B

Results of Impact  
Monitoring during  
Dredging Operations of  
CMP 2 in September 2013

**Table B1** *Summary Table of DO, Turbidity and SS Levels Recorded in September 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		
2013/9/2	Mid-Ebb	DS1	6.21	6.32	6.88	9.67
		DS2	6.41	6.21	4.13	4.17
		DS3	3.85	6.23	4.90	5.00
		DS4	6.67	6.46	3.30	2.67
		DS5	6.57	6.49	3.63	3.00
		US1	5.44	6.90	8.85	9.83
		US2	5.73	6.41	5.08	7.33
		MW1	2.78	4.76	3.44	5.00
		THB1	5.53	7.48	5.48	6.33
		THB2	-	5.09	4.63	5.00
	WSR45C	2.69	4.67	7.36	8.44	
	WSR46	3.53	4.64	8.20	4.89	
	Mid-Flood	DS1	6.69	7.56	9.75	10.83
		DS2	7.75	7.79	10.68	7.33
		DS3	8.22	8.02	7.97	4.67
		DS4	9.05	8.14	4.83	5.83
		DS5	4.40	8.51	5.83	6.67
		US1	4.01	5.34	7.77	9.50
		US2	4.06	6.10	4.35	5.00
		MW1	3.21	3.84	6.34	7.56
THB1		6.70	7.38	7.03	5.50	
THB2		-	7.14	6.97	5.33	
WSR45C	3.13	4.85	15.64	13.33		
WSR46	3.15	5.64	13.51	10.78		
2013/9/4	Mid-Ebb	DS1	4.62	5.56	16.80	19.00
		DS2	4.51	5.24	9.92	13.89
		DS3	3.48	4.75	7.88	12.11
		DS4	5.05	5.18	5.81	8.67
		DS5	4.92	5.23	5.10	9.17
		US1	4.28	5.56	9.28	8.17
		US2	4.31	5.07	8.45	10.33
		MW1	3.35	4.55	2.81	6.67
		THB1	4.06	5.40	11.67	11.83
		THB2	-	-	-	-
	WSR45C	4.12	5.28	8.10	8.78	
	WSR46	3.51	4.66	20.57	15.22	
	Mid-Flood	DS1	4.59	5.02	7.23	12.83
		DS2	4.75	4.94	6.27	8.83
		DS3	4.81	5.03	6.35	7.00
		DS4	4.21	5.01	7.38	8.56
		DS5	4.40	5.06	7.63	9.44
		US1	4.65	4.77	7.62	10.17
		US2	4.06	4.59	6.42	11.33
		MW1	3.22	3.57	19.51	10.56
THB1		5.07	5.37	10.40	3.83	
THB2		-	4.50	6.27	13.33	
WSR45C	3.52	4.29	17.88	12.56		
WSR46	3.75	4.67	36.13	21.44		

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2013/9/6	Mid-Ebb	DS1	4.64	5.03	8.80	9.00
		DS2	4.52	4.96	7.76	9.67
		DS3	4.09	5.01	9.38	11.78
		DS4	4.51	4.94	6.79	7.89
		DS5	4.95	5.09	5.98	7.67
		US1	4.42	5.02	9.90	14.33
		US2	5.07	5.37	11.98	18.67
		MW1	3.74	3.81	9.86	7.00
		THB1	5.05	5.37	13.38	7.50
		THB2	-	4.27	5.83	6.33
	WSR45C	4.29	4.61	16.76	9.67	
	WSR46	4.49	4.85	63.89	35.56	
	Mid-Flood	DS1	5.30	5.30	38.88	61.67
		DS2	5.51	5.50	9.82	12.00
		DS3	5.04	5.43	9.34	13.56
		DS4	5.23	5.58	7.82	19.17
		DS5	4.73	5.42	10.13	14.00
		US1	3.62	5.00	16.67	23.33
		US2	3.46	4.56	20.48	21.44
		MW1	5.08	3.91	11.30	12.89
		THB1	4.29	5.04	7.05	6.83
		THB2	-	5.33	11.07	10.00
WSR45C		4.33	5.02	8.17	9.33	
WSR46		4.29	4.58	24.62	30.67	
2013/9/9	Mid-Ebb	DS1	4.99	5.40	6.58	4.67
		DS2	4.77	5.19	4.54	3.33
		DS3	4.44	5.15	4.40	4.00
		DS4	4.83	5.23	3.90	3.67
		DS5	4.82	4.99	5.88	5.33
		US1	4.76	5.22	21.41	23.00
		US2	4.54	5.34	15.37	12.22
		MW1	4.47	4.87	4.97	5.00
		THB1	5.41	5.99	6.13	5.67
		THB2	-	5.33	8.07	3.00
	WSR45C	4.37	5.00	5.88	4.22	
	WSR46	4.26	4.83	5.96	5.78	
	Mid-Flood	DS1	4.94	4.90	4.32	3.50
		DS2	5.09	5.06	5.20	3.67
		DS3	5.14	5.13	7.43	8.83
		DS4	5.16	5.20	7.25	7.33
		DS5	5.21	5.30	5.13	5.17
		US1	4.53	4.91	5.53	4.50
		US2	4.19	4.60	8.91	7.89
		MW1	4.04	4.29	7.56	8.78
		THB1	5.34	5.21	4.95	6.17
		THB2	-	4.19	5.23	7.00
WSR45C		4.08	4.46	6.74	8.44	
WSR46		4.10	4.72	8.83	11.00	
2013/9/11	Mid-Ebb	DS1	5.03	5.91	8.95	14.00
		DS2	4.72	5.56	5.51	4.78
		DS3	4.60	5.34	4.56	4.56

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
		DS4	4.78	5.44	4.27	4.00
		DS5	4.63	5.27	4.40	4.78
		US1	5.86	5.70	10.20	6.00
		US2	4.62	5.30	10.90	10.78
		MW1	4.72	5.03	2.56	3.11
		THB1	5.73	6.28	7.42	7.83
		THB2	-	6.74	6.53	2.33
		WSR45C	4.59	5.35	3.88	4.44
		WSR46	4.40	5.17	6.26	7.33
	Mid-Flood	DS1	5.19	5.23	3.40	5.17
		DS2	5.29	5.34	2.98	3.00
		DS3	4.97	5.30	8.38	8.33
		DS4	5.44	5.49	5.66	7.22
		DS5	5.72	5.63	4.15	3.17
		US1	4.91	5.23	4.70	5.50
		US2	4.42	5.02	7.13	7.22
		MW1	4.42	4.47	7.72	9.56
		THB1	5.39	5.36	3.75	3.50
		THB2	-	4.94	6.63	4.00
		WSR45C	4.38	4.76	5.87	5.11
		WSR46	4.38	4.84	9.62	10.56
2013/9/13	Mid-Ebb	DS1	5.37	5.68	7.70	9.17
		DS2	5.14	5.44	6.16	8.56
		DS3	5.47	5.59	4.13	6.00
		DS4	5.29	5.47	4.59	6.44
		DS5	5.42	5.54	4.50	5.67
		US1	5.29	5.78	8.77	15.33
		US2	5.45	5.64	4.90	5.00
		MW1	4.95	5.50	1.62	3.56
		THB1	5.26	5.92	4.13	4.50
		THB2	-	5.61	3.33	3.33
		WSR45C	4.86	5.38	4.61	6.00
		WSR46	4.67	5.12	5.64	5.22
	Mid-Flood	DS1	6.11	6.15	2.92	4.67
		DS2	6.26	6.26	2.52	4.33
		DS3	6.31	6.35	3.13	4.67
		DS4	5.66	6.21	5.63	5.33
		DS5	6.20	6.23	3.63	3.83
		US1	5.26	6.30	2.53	3.50
		US2	4.68	5.54	4.76	5.22
		MW1	4.89	5.05	4.76	5.78
		THB1	5.98	6.21	6.52	6.17
		THB2	-	5.64	8.80	6.00
		WSR45C	4.63	5.32	7.72	9.22
		WSR46	4.51	5.29	10.93	14.22
2013/9/16	Mid-Ebb	DS1	5.35	5.84	6.25	11.33
		DS2	4.98	5.70	6.52	9.22
		DS3	5.30	5.85	5.72	8.11
		DS4	4.86	5.55	5.94	9.22
		DS5	4.76	5.27	6.78	8.78
		US1	6.76	6.78	8.56	13.17

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)		
			Bottom	Surface and Mid Depth				
	Mid-Flood	US2	4.91	5.65	16.68	20.89		
		MW1	4.84	5.15	3.10	11.89		
		THB1	6.65	6.97	3.80	20.17		
		THB2	-	5.39	6.68	7.67		
		WSR45C	4.60	5.43	9.34	10.78		
		WSR46	5.01	5.73	13.51	13.89		
		DS1	6.81	7.43	4.93	7.00		
		DS2	6.89	7.23	5.28	6.00		
		DS3	6.91	6.94	7.81	11.50		
		DS4	6.68	6.78	9.88	10.83		
		DS5	6.90	7.38	11.18	11.83		
		US1	5.90	6.79	4.28	6.67		
		US2	5.04	5.21	7.04	10.78		
		MW1	4.70	4.98	6.65	3.67		
		THB1	6.50	6.97	7.51	4.67		
		THB2	-	9.07	7.81	4.00		
		WSR45C	4.87	5.66	9.91	10.67		
		WSR46	5.38	6.35	13.36	12.44		
		2013/9/18	Mid-Ebb	DS1	6.15	6.20	9.92	13.44
				DS2	6.19	6.27	8.61	11.89
DS3	6.30			6.40	5.85	9.00		
DS4	5.85			6.31	8.31	14.11		
DS5	5.95			6.30	7.59	12.78		
US1	6.27			6.27	15.32	21.67		
US2	6.27			6.39	16.34	19.00		
MW1	4.95			5.04	5.44	8.22		
THB1	6.20			6.54	11.91	15.17		
THB2	-			5.84	4.29	4.00		
WSR45C	5.50			6.18	10.23	9.11		
WSR46	5.98			6.21	30.50	22.44		
Mid-Flood	DS1			6.42	6.49	10.12	12.67	
	DS2			6.56	6.62	12.89	13.00	
	DS3			6.65	6.65	11.56	13.50	
	DS4			6.55	6.53	14.34	19.67	
	DS5			6.64	6.85	19.76	12.78	
	US1			6.15	6.30	11.42	12.83	
	US2			5.39	5.91	30.66	23.22	
	MW1			5.14	5.43	14.84	9.44	
	THB1	6.07	6.06	28.87	13.17			
	THB2	-	6.61	8.18	6.00			
WSR45C	5.43	6.06	13.55	22.33				
WSR46	5.94	6.10	9.40	14.33				
2013/9/21	Mid-Ebb	DS1	5.72	5.80	7.65	9.56		
		DS2	5.07	5.45	16.39	23.11		
		DS3	5.74	5.75	7.71	7.22		
		DS4	5.19	5.75	10.20	13.22		
		DS5	5.63	5.80	8.80	9.89		
		US1	5.39	5.61	15.13	19.22		
		US2	5.51	5.74	19.52	22.33		
		MW1	5.55	5.62	5.96	4.89		
		THB1	6.02	6.11	6.31	6.33		

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
		THB2	-	-	-	-
		WSR45C	5.65	5.84	9.73	15.22
		WSR46	5.41	5.71	9.04	11.44
	Mid-Flood	DS1	5.54	5.53	10.74	12.17
		DS2	5.66	5.58	11.17	10.00
		DS3	5.70	5.63	10.25	12.83
		DS4	5.78	5.76	8.79	12.22
		DS5	5.78	5.78	8.43	10.11
		US1	5.26	5.44	35.31	39.11
		US2	5.25	5.42	10.52	13.67
		MW1	5.25	5.36	10.01	13.67
		THB1	5.69	5.69	7.33	7.33
		THB2	-	-	-	-
		WSR45C	5.32	5.43	14.25	18.78
		WSR46	5.27	5.53	36.34	33.33
2013/9/25	Mid-Ebb	DS1	6.58	6.58	5.96	7.67
		DS2	5.36	5.89	58.65	73.56
		DS3	5.55	6.17	7.78	8.67
		DS4	5.53	6.10	7.06	7.22
		DS5	5.49	6.10	6.97	6.67
		US1	6.13	6.37	12.02	14.50
		US2	5.93	6.20	35.32	44.22
		MW1	5.57	5.83	6.16	4.78
		THB1	6.03	6.28	13.79	10.17
		THB2	-	6.19	9.14	5.33
		WSR45C	5.51	5.80	6.31	5.67
		WSR46	5.60	6.22	10.17	13.33
	Mid-Flood	DS1	6.14	6.23	11.65	13.83
		DS2	6.16	6.27	11.71	8.00
		DS3	6.09	6.17	11.51	10.44
		DS4	6.18	6.22	9.99	10.33
		DS5	6.27	6.28	8.31	8.50
		US1	5.75	6.12	7.24	6.17
		US2	6.06	6.36	5.08	3.00
		MW1	5.46	5.89	8.86	6.67
		THB1	6.24	6.28	6.96	4.33
		THB2	-	5.28	6.91	5.33
		WSR45C	5.73	6.03	8.75	8.00
		WSR46	5.62	6.10	14.08	7.11
2013/9/27	Mid-Ebb	DS1	5.46	5.97	15.41	17.22
		DS2	5.16	5.63	7.06	9.89
		DS3	5.15	6.02	5.27	9.22
		DS4	5.08	6.03	5.47	7.11
		DS5	5.05	5.86	5.79	6.56
		US1	5.23	6.00	7.36	11.22
		US2	5.54	6.18	10.35	8.78
		MW1	5.37	5.84	3.29	4.78
		THB1	6.15	6.26	4.16	3.33
		THB2	-	5.76	3.89	5.00
		WSR45C	5.01	5.61	6.76	9.33
		WSR46	5.39	5.85	5.41	6.78

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
	Mid-Flood	DS1	6.23	6.43	7.30	10.00
		DS2	5.25	6.47	21.87	30.22
		DS3	5.62	6.69	8.23	13.67
		DS4	5.46	6.44	9.72	15.00
		DS5	5.34	6.28	9.11	13.89
		US1	6.07	6.55	4.65	6.44
		US2	5.32	5.86	4.95	6.33
		MW1	5.05	5.21	4.47	8.67
		THB1	5.50	6.36	5.13	7.33
		THB2	-	5.67	12.35	7.00
		WSR45C	4.83	5.43	5.53	8.33
		WSR46	4.83	5.37	9.36	14.11

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 THB2 was cancelled due to adverse weather condition at mid-ebb tide on 4 September 2013.
6. Sampling at THB2 was cancelled during both mid-ebb and mid-flood tides on 21 September 2013 since severe Typhoon Usagi was approaching.

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

<b>Parameter</b>	<b>Action Level</b>	<b>Limit Level</b>
Dissolved Oxygen (DO) <sup>(1)</sup>	<u>Surface and Mid-depth</u> <sup>(2)</sup> The average of the impact, WSR 45C and WSR 46 station readings are < 5%-ile of baseline data for surface and middle layer = <b>4.32 mg L<sup>-1</sup></b>	<u>Surface and Mid-depth</u> <sup>(2)</sup> The average of the impact, WSR 45C and WSR 46 station readings are < <b>4 mg L<sup>-1</sup></b>
	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 = <b>3.12 mg L<sup>-1</sup></b>	<u>Bottom</u> The average of the impact station, WSR 45C and WSR 46 readings are < <b>2 mg L<sup>-1</sup></b>
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) <sup>(3)(4)</sup>	The average of the impact, WSR 45C and WSR 46 station readings are > 95%-ile of baseline data for depth average = <b>21.60 mg L<sup>-1</sup></b>	The average of the impact, WSR 45C and WSR 46 station readings are > 99%-ile of baseline data for depth average = <b>40.10 mg L<sup>-1</sup></b>
and	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	130% of control station's SS at the same tide of the same day
Depth-averaged Turbidity (Tby) <sup>(3)(4)</sup>	The average of the impact, WSR 45C and WSR 46 station readings are > 95%-ile of baseline data = <b>25.04 NTU</b>	The average of the impact, WSR 45C and WSR 46 station readings are > 99%-ile of baseline data = <b>32.68 NTU</b>
and	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	130% of control station's Tby at the same tide of the same day
<b>Notes:</b>		
(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

