



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)* 

32<sup>nd</sup> Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau – April 2015

Final (Revision 1)

29 May 2015

**Environmental Resources Management** 

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Client:		Project N	0:		
	gineering and Development Department (CEDD)	017508			
Summary:		Date: 29 May	2015		
		Approved	by:		
	ument presents the 32 <sup>nd</sup> monthly progress report for nated Mud Pits at the South of The Brothers and at East	6	-		
Sna Cha	u.	Craig A.	. Reid		
v1	32 <sup>nd</sup> Monthly Progress Report for ESC CMPs and SB CMPs	CY	JT	CAR	29/5/15
v0	32 <sup>nd</sup> Monthly Progress Report for ESC CMPs and SB CMPs	CY	JT	CAR	14/5/15
Revision	Description	Ву	Checked	Approved	Date
name of 'ER terms of the Business an	has been prepared by Environmental Resources Management the trading M Hong-Kong, Limited', with all reasonable skill, care and diligence within the Contract with the client, incorporating our General Terms and Conditions of the daking account of the resources devoted to it by agreement with the client.	Distributio	on ernal		6 18001:2007 No. OHS 515956
We disclaim scope of the	any responsibility to the client and others in respect of any matters outside the above.	⊠ Puk	olic		BSI
nature to thi	s confidential to the client and we accept no responsibility of whatsoever rd parties to whom this report, or any part thereof, is made known. Any such on the report at their own risk.	□ Соі	nfidential	ISO 9 Certificat	0001 : 2008 e No. FS 32515







# 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: 32nd Monthly Progress Report for Contaminated Mud Pits

to the South of The Brothers and at East Sha Chau - April

2015

Date of Report: 14 May 2015

Date prepared by ET: 14 May 2015

Date received by IA: 14 May 2015

#### 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/ $\frac{1}{plan}$  complies with the above referenced condition of EP-427/2011/A

Craig A. Reid,

Environmental Team Leader:

Date:

14/5/2015

#### **IA Verification**

I hereby verify that the above referenced document/<del>plan</del> complies with the above referenced condition of

Menso Mang

EP-427/2011/A

Dr Wang Wen Xiong, Independent Auditor: Date

14/5/2015

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WATER QUALITY MONITORING RESULTS

STUDY PROGRAMME

## Agreement No. CE 23/2012 (EP)

### **Environmental Monitoring and Audit**

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

#### 32ND MONTHLY PROGRESS REPORT FOR APRIL 2015

#### 1.1 BACKGROUND

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

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).

<sup>(2)</sup> 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.7

<sup>(3)</sup> 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))

<sup>(4)</sup> 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 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 (1) (2) is required to be implemented for the CMPs.
- 1.1.5 The present EM&A programme under *Agreement No. CE 23/2012 (EP)* covers the dredging, disposal and capping operations of the SB CMPs as well as ESC CMPs. Detailed works schedule for both CMPs is shown in *Figure 1.1*. In April 2015, the following works were being undertaken at the CMPs:
  - Capping operations at ESC CMPs;
  - Capping operations at SB CMP 1; and
  - Disposal of contaminated mud at SB CMP 2.

Figure 1.1 Works Schedule for ESC CMPs and SB CMPs

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#### 1.2 REPORTING PERIOD

1.2.1 This 32<sup>nd</sup> Monthly Progress Report covers the EM&A activities for the reporting month of April 2015.

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

- 1.3.1 No monitoring activities have been undertaken for ESC CMPs in April 2015.
- 1.3.2 The following monitoring activities have been undertaken for SB CMPs in April 2015:
  - Routine Water Quality Monitoring of CMP 2 was undertaken on 14 April 2015;

<sup>(1)</sup> 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.

<sup>(2)</sup> 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.

- *Pit Specific Sediment Chemistry* of CMP 2 was undertaken on 15 April 2015; and
- Water Column Profiling of CMP 2 was undertaken on 17 April 2015.

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

- 1.4.1 No outstanding sampling remained for April 2015. The following laboratory analyses were still in progress during the preparation of this monthly report and hence are not presented in this monthly report:
  - Laboratory analyses of Routine Water Quality Monitoring of CMP 2 in April 2015; and
  - Laboratory analyses of sediment samples collected for *Pit Specific Sediment Chemistry* of CMP 2 in April 2015.
- 1.4.2 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 Brief discussion of the monitoring results of the following activities for SB CMPs is presented in this 32<sup>nd</sup> Monthly Progress Report:
  - *In-situ* measurements of *Routine Water Quality Monitoring* of CMP 2 undertaken on 14 April 2015; and
  - Water Column Profiling of CMP 2 undertaken on 17 April 2015.

#### 1.5.2 Routine Water Quality Monitoring of SB CMP 2 - April 2015

1.5.3 The monitoring results for the *Routine Water Quality Monitoring* conducted in April 2015 in the wet season have been assessed for compliance with the Water Quality Objectives (WQOs) set by EPD. This consists of a review of the EPD routine water quality monitoring data for the wet season period (April to October) of 2004 - 2013 from stations in the Northwestern Water Control Zone, where the CMPs are located. For Salinity, the averaged value obtained from the Reference stations was used for the basis as the WQO. Levels of Dissolved Oxygen (DO) and Turbidity were also assessed for compliance with the Action and Limit Levels (see *Table C1* of *Annex C* for details). The monitoring results are shown in *Figures 1-5* of *Annex B* and *Table C2* of *Annex C*. A total of fourteen (14) monitoring stations were sampled in April 2015 as shown in *Figure 1.2*.

In-situ Measurements

- 1.5.4 Analyses of results for April 2015 indicated that the levels of pH, DO and Salinity complied with the WQOs at all stations (Impact, Intermediate, Reference and Water Sensitive Receiver stations) in April 2015 (*Figures 1-5 of Annex B*).
- 1.5.5 The levels of DO and Turbidity complied with the Action and Limit Levels at all stations (*Figures 3* and 5 of *Annex B*; *Table C1* of *Annex C*).
- 1.5.6 Overall, *in-situ* measurement results of the *Routine Water Quality Monitoring* indicated that the disposal operation at CMP 2 did not appear to cause any unacceptable impacts in water quality in April 2015.
- 1.5.7 Water Column Profiling of CMP 2 April 2015
- 1.5.8 Water Column Profiling was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 17 April 2015. The water quality monitoring results have been assessed for compliance with the WQOs as discussed in Section 1.5.3. The monitoring results were also compared with the Action and Limit Levels set in Baseline Monitoring Report (see Table C1 of Annex C for details).

In-situ Measurements

1.5.9 Analyses of results for April 2015 indicated that levels of Salinity, DO and pH complied with the WQOs at both Downstream and Upstream stations (*Table C3* of *Annex C*). DO and Turbidity at all stations complied with the Action and Limit Levels (*Table C1* and *C3* of *Annex C*).

Laboratory Measurements for SS

1.5.10 Analyses of results for April 2015 indicated that the Suspended Solid (SS) levels at Upstream station exceeded the WQO while Downstream station complied with the WQO. It is considered that the exceedance of SS at

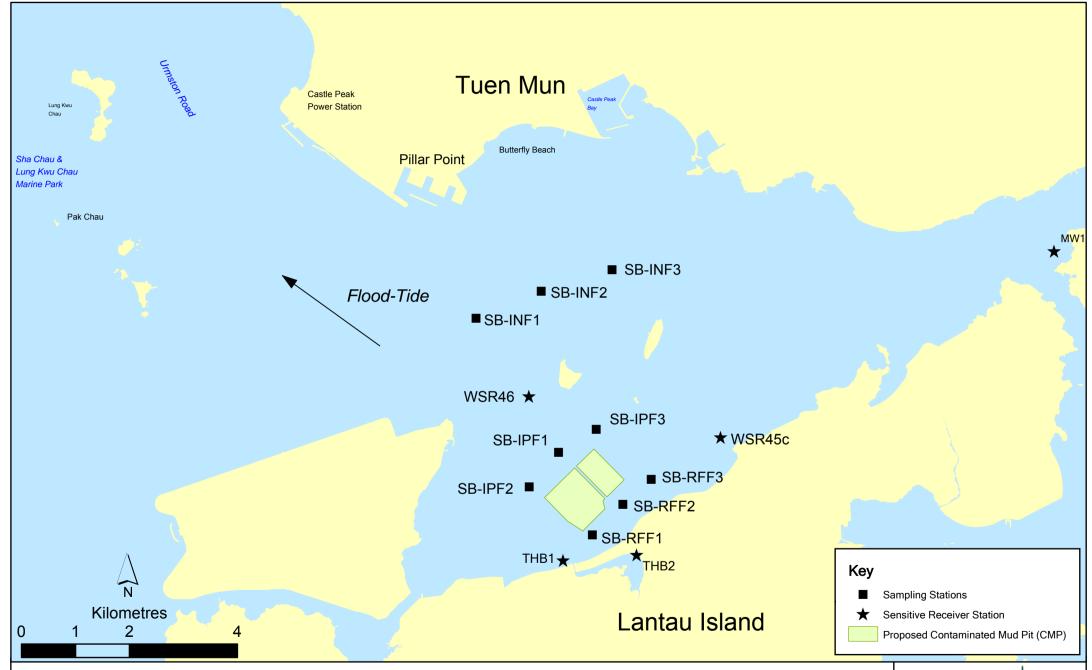


Figure 1.2

Routine & Capping Water Quality Sampling Stations (Flood-Tide) for South Brothers Facility



Upstream station was possibly caused by natural background variation of water quality in the area. However, both Upstream and Downstream stations complied with the Action and Limit Levels (*Tables C1 and C3* of *Annex C*).

1.5.11 Overall, the monitoring results indicated that the mud disposal operation at CMP 2 did not appear to cause any deterioration in water quality during this reporting period.

#### 1.6 ACTIVITIES SCHEDULED FOR THE NEXT MONTH

- 1.6.1 The following monitoring activities will be conducted in the next monthly period of May 2015 for SB CMPs:
  - Pit Specific Sediment Chemistry of CMP 2;
  - Water Column Profiling of CMP 2; and
  - Routine Water Quality Monitoring of CMP 2.
- 1.6.2 No monitoring activity is scheduled to be conducted in the next monthly period of May 2015 for ESC CMPs.
- 1.6.3 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 D*.

### Annex A

## Sampling Schedule

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Annex A1 - Environmental Monito	oring ana Auait S	sampli			or Eas	st oj Sn	ia Cnau			2 - Febri	ary 2017)						2014								2015									2016				2017
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Capped Contaminated Mud Pits I	Va-c				+			,	,	-			, -			,	,	1 0			<del>'</del>				, ,	0 0		_	,	_				<del>, ,</del>	+		-	
T T	ESC-CPA			*						*		*						*		,	*				*			*					$\neg$	$\neg$	+		+	1
	ESC-CPB			*	1					*		*						*			*				*			*							1 1			
	ESC-CPC			*						*		*						*			*				*			*										
Reference Stations																																						
	ESC-RBA			*						*		*						*			*				*			*										
	ESC-RBB			*						*		*						*			*				*			*										
	ESC-RBC			*						*		*						*			*				*			*										
Impact Monitoring for Dredging		S	0	N D	J	F	M A	M J	J	A S	O N	D	J F	M	A	M J	J	A S	0	N I	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
Upstream/Reference Stations	1.101	-	*	* *	*	*	* *	*			1						-				_													_	+	-	+-+	
	US1 US2	*				*							_																				+	-	+	-	+-+	
Downstream/Impact Stations	032	-	-	<b>+</b>	+	+ -				-		-	-				-				+												+	-	+		+-+	
Downstream/ impact stations	DS1	*	*	* *	*	*	* *	*			1										-												$\dashv$	+	+-+		+-+	<del>-   -   -  </del>
	DS2	*	*		_		* *	*									+-				-												+	+	+	-	+-+	+++-
	DS3	*	*	* *	*	*	* *	*									-				-												+	+	+	-+	+-+	
	DS4	*			_		* *	*		-	+ +	╁┼					+	+++	+		+	+								$\vdash$	-+	-+	+	+	+++	+	++	+
	DS5	*				*		*		-	+	+	-				+		+		+									<del>   </del>	-+	-+	+	+	+	+	+++	+
Ma Wan Station	D33	$\vdash$	1	+ +	+	++	-			+	+	╁	-+				-	+	+		+	+	+		<del>                                     </del>					$\vdash$	-+	+	+	+	+	+	++	+
	MW1	*	*	* *	*	*	* *	*											1		+										$-\dagger$		+	+	+	+	++	+
			-1	<u> </u>		1	<u> </u>							1		<u> </u>			<u> </u>	<u> </u>			1 1			<u> </u>	<u> </u>		<u> </u>	<u> </u>	1							
Capping		S	0	N D	J	F	M A	M J	J	A S	O N	D	J F	M	Α	M J	J	A S	0	N I	D J	F	M A	M	J J A	S O	N	D	J	F	M	<b>A</b>	M	J J	A	S O	ΝΓ	) J F
Ebb Tide																																						
Impact Station																																						
	ESC-IPE1											*	*			*		*			*	*			* *			*										
	ESC-IPE2											*	*			*		*			*	*			* *			*										
	ESC-IPE3											*	*			*		*			*	*			* *			*										
	ESC-IPE4											*	*			*		*			*	*			* *			*										
	ESC-IPE5											*	*			*		*			*	*			* *			*										
Intermediate Station																																						
	ESC-INE1											*	*			*		*			*	*			* *			*										
	ESC-INE2											*	*			*		*			*	*			* *			*										
	ESC-INE3											*	*			*		*		:	*	*			* *			*										
	ESC-INE4											*	*			*		*			*	*			* *			*						$\bot$	$\perp \perp \perp$			
	ESC-INE5											*	*			*		*		,	*	*			* *			*						$\bot$	$\perp \perp \perp$			
Reference Station																																			$\perp$		$\bot$	
	ESC-RFE1											*	*			*		*				*			* *			*							$\perp$		$\bot$	
	ESC-RFE2											*	*			*		*			*	*			* *			*							$\perp$		$\bot$	
	ESC-RFE3											*	*			*		*			*	*			* *			*					_		$\bot$		$\perp$	
	ESC-RFE4	<u> </u>		$\bot \bot$							$\bot \bot$	*	*			*		*			*	*			* *	$oxed{oxed}$		*					$\perp$		+	$\bot$	+	
	ESC-RFE5	<u> </u>	-		1	+						*	*	1		*	_	*	4		*	*			* *		-	*				_	$\dashv$	$\bot$	+		+	<del></del>
Ma Wan Station	) This	$\vdash$		+	1	1						<i>J.</i>		1		*	_	*	1		*	at.			* *			4-				_	$\dashv$	-	+	-	+	
Flood Tide	MW1	+			+	<u> </u>						_ ^	*	1		*		î			_	*			^ *			_ ^						—				+
Impact Station		1																																				
Impact outlon	ESC-IPF1	$\vdash$	1		+						П	*	*			*		*			*	*		1	* *			*			1		$\overline{}$	$\neg$	$\top$	$\overline{}$	$\overline{}$	+
	ESC-IPF2	$\vdash$	-	++-	+	++		+	+	+	++	*	*			*	+	*	+	<b>,</b>		*	+++	-	* *		+	*		$\vdash$	-+	-+	+	+	++	+	++	++-
	ESC-IPF3	$\vdash$	1	+ +	+	++	_	++		-	+ +	*	*			*	+	*	+		*	*	+		* *			*		<b> </b>		-+	+	+	+	+	++	+
Intermediate Station	Local Fo	$\vdash$		1 1	+	+				+	+ + -	+	+	+			+	+ +	+		+					<del>                                     </del>				<del>   </del>	-	+	+	+	++	+	++	+
	ESC-INF1	$\vdash$	+	+ +	+	+ +				+	+ + -	*	*			*	+	*	+		*	*	+		* *			*			-	+	+	+	++	+	++	+
	ESC-INF2	$\vdash$	+	1 1	1	+ +				-	+ + -	*	*			*	+	*	+		*	*			* *			*				-	+	+	++	+	++	+ + - '
	ESC-INF3	$\vdash$		1	1						+ + -	*	*			*	+	*	+		*	*			* *			*					+	+	+	+	++	
Reference Station	100 HVI	$\vdash$	+	+ +	+	+ +				+	+ + -	╁	+				+	+ +	+		+	+	+		<del>                                     </del>			$\vdash$			-	+	+	+	++	+	++	+
The control of the co	ESC-RFF1	$\vdash$			+						+ + -	*	*			*	1	*			*	*			* *			*			-	-	+	+	+	+	++	
	ESC-RFF2	$\vdash$	+	+ +	+	+ +				+	+ + -	*	*			*	+	*	+		*	*	+		* *			*			-	+	+	+	++	+	++	+
	ESC-RFF3	$\vdash$	+	1 1	1	+ +				-	+ + -	*	*			*	+	*	+			*			* *			*				-	+	+	++	+	++	+ + - '
Ma Wan Station	200 1010	$\vdash$	+	+ +	+	+ +			+	+	+ + -	1	+	+			+	+ +	+		+	+						$\vdash$		$\vdash$	-	-+	+	+	++	+	+++	+
	MW1	$\vdash$	+	1	1					-	+ + -	*	*			*	+	*	+		*	*			* *			*					+	+	+	+	+ +	+ + - '
	******	_1						<u> </u>	1			1							1																			

Annex A1 - Environmental Monitoring and Audit Sampling Schedule for East of Sha Chau (September 2012 - February 2017)

Trayer Station    SCL-195   SCL-195	Timex III Environmental Monte			2012						2013			J							201	4									20	015									2016					2017
The part of Section    Section   Sec	Routine Water Quality Monitoring	ç	S	O N	D	J :	F M	A	M	J	J.	A S	О	N I	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	ı j	J	A	s O	N	D	J F
SC-1P2   SC-1P3   S	Ebb Tide																																												$\neg \neg$
SCL-175   SCL 175   SCL	Impact Station																																						$\top$				1		
BSCHIPS BSCHIP		ESC-IPE1		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
55.174   57.		ESC-IPE2		* *		*	*	*	*		*	*																								*	*	* *	$\top$	*	*	*	*		* *
SCHES    SCHES		ESC-IPE3		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
Mathematical Mathe		ESC-IPE4		* *		*	*	*	*		*	*																								*	*	* *	$\top$	*	*	*	*		* *
FROM THE MATERIAN STATE		ESC-IPE5		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
School Sc	Intermediate Station																																												
Schelle Schell		ESC-INE1		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
SS-INF    SS-I		ESC-INE2		* *		*	*	*	*		*	*																								*	*	* *	$\top$	*	*	*	*		* *
SCAPS   SCAPS		ESC-INE3		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
Reference Station    Column		ESC-INE4		* *		*	*	*	*		*	*			ı																					*	*	* *		*	*	*	*		* *
SCARFE   S		ESC-INE5		* *		*	*	*	*		*	*																								*	*	* *	$\top$	*	*	*	*		* *
ESCRETA  SCRETA  SCRET	Reference Station																																												
SCARFIA   SCAR		ESC-RFE1		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
SCAREA   S		ESC-RFE2		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
ESCRIPS   SCRIPS   SC		ESC-RFE3		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
May		ESC-RFE4		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
FLOOM TIME IMPACT STATION  SECRETIC SECRETION		ESC-RFE5		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
Field Tide Impact Station  SC-IPF1 ESC-IPF2 ESC-IPF3 ESC-	Ma Wan Station																																												
May and Station		MW1		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
ESC-IPF1   SC-IPF1   SC-IPF2   SC-IPF3   SC-IP	Flood Tide																																												
ESC-IPF3   SC   FS   SC   SC	Impact Station																																												
ESC-IPF3  ESC-IPF3  ESC-INF1  ESC-INF2  ESC-INF3  ESC-INF5  ESC-IN		ESC-IPF1		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
Intermediate Station		ESC-IPF2		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
ESC-INF1   ESC-INF2   ESC-INF3		ESC-IPF3		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
ESC-INF2 ESC-INF3  ESC-RF1 ESC-RF2 ESC-RF3  A W W W W W W W W W W W W W W W W W W	Intermediate Station																																												
ESC-INF3  Reference Station  Fig. 1. F		ESC-INF1		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
Reference Station  ESC-RFF1 ESC-RFF2 ESC-RFF3  Ma Wan Station  ESC-RFF3  Ma Wan Station		ESC-INF2		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
ESC-RF1 ESC-RF2 ESC-RF3  Ma Wan Station		ESC-INF3		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
ESC-RFF2	Reference Station																																												
ESC-RFF3		ESC-RFF1		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
Ma Wan Station		ESC-RFF2		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*	$\Box$	* *
		ESC-RFF3		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *
MW1   *   *   *   *   *   *   *   *   *	Ma Wan Station																																												
		MW1		* *		*	*	*	*		*	*																								*	*	* *		*	*	*	*		* *

Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

				2012	2						2013									2014	1								20	15									2016	5					201
Baseline Monitoring Prior to Dredging	Code	Frequency	JA	A S		D	J	F M	I A	M		A	S	) N	D	J	F M	<b>Л</b> А	M			S	O N	N D	J	F	M	A M			A	s (	O N	D	J	F	M A	A M			S	0	N		
Far Field Stations				$\overline{}$																																$\Box$	-	$\Box$		$\top$	$\top$			$\top$	
	SB-WFA	3 days per week for 4 weeks	* *	k																																									
	SB-WFB	3 days per week for 4 weeks	* *	ř																																									
Mid Field Stations																																													
	SB-WMA	3 days per week for 4 weeks	* *	*																																Ш			Ш		'				
	SB-WMB	3 days per week for 4 weeks	* *	e																																Ш			$\perp \perp$		'				
Near Field Stations																																				Ш			$\perp \perp$		'				
	SB-WNAA	* *	* *	e																																Ш			$\perp \perp$		'				
	SB-WNAB	3 days per week for 4 weeks	* *	e																																Ш			$\perp \perp$		'				
	SB-WNBA	3 days per week for 4 weeks	* *	e																																Ш			$\perp \perp$		'				
	SB-WNBB	3 days per week for 4 weeks	* *	e																																Ш			$\perp \perp$		'				
Reference Stations																																				Ш			$\perp \perp$		'				
	NM1	3 days per week for 4 weeks	* *	*																																Ш			$\perp \perp$		'				
	NM2	3 days per week for 4 weeks	* *																																	$\perp \perp \downarrow$			ш	$\bot$	'			$oldsymbol{\perp}$	
	NM3	3 days per week for 4 weeks	* *																																	$\perp \perp \downarrow$			ш	$\bot$	'			$oldsymbol{\perp}$	
	NM5	3 days per week for 4 weeks	* *	*																																$\perp \perp \downarrow$			ш	$\bot$	'			$oldsymbol{\perp}$	
	NM6	3 days per week for 4 weeks	* *	*				_		igspace							_								$\perp$			_					┸		1	$\downarrow \downarrow \downarrow$		$\perp \!\!\! \perp \!\!\! \perp$	$\sqcup$	Щ.	Щ'				
Sensitive Receiver Stations				$\bot$		$\perp$									-							$\perp$				igsquare									1	$\downarrow \downarrow \downarrow$	$\perp$	$\perp \!\!\! \perp \!\!\! \perp$	$\sqcup$		Щ'	$\bigsqcup$		$\perp$	
	MW1	3 days per week for 4 weeks	* *			$\perp$			-						1		_					$\perp \perp$			1				$\bot$				$\perp$		1	+	$\perp$	$\perp \perp \downarrow$	$\vdash$		Щ'		$\Box$		
	THB1	3 days per week for 4 weeks	* *			$\perp$			-						1		_					$\perp \perp$			1				$\bot$				$\perp$		1	+	$\perp$	$\perp \perp \downarrow$	$\vdash$		Щ'		$\Box$		
	THB2	3 days per week for 4 weeks		*		$\perp$			-						1		_					$\perp \perp$			1				$\bot$				$\perp$		1	+	$\perp$	$\perp \perp \downarrow$	$\vdash$		Щ'		$\Box$		
	WSR45C	3 days per week for 4 weeks	* *	*																																$\perp \perp \downarrow$		$\bot$	$\sqcup$		'				
	WSR46	3 days per week for 4 weeks	* *																																	Ш			ـــــــــــــــــــــــــــــــــــــــ					丄	
																																													_
Impact Monitoring for Dredging			J A	ı S	O N	D	J	F M	I A	M	J J	Α	S	) N	D	J	F N	A A	M	J	J A	S	O N	N D	) J	F	M	A N	J	J	A :	S	) N	D	J	F	M A	M	7	JA	S	O	N	D	J
Upstream Stations	LICA	2.1	<u> </u>	++	*	*	*	* *	*	*	* *	*	*	k *	*		* *	k *	*	*	* *				-									-	1	++	+	$\dashv$	$\vdash$	+	┿			-	_
	US1	3 days per week		+	*	*	*	* *	*		* *			· ·				· · ·		*	* *	*	* '	*	-										+	++	+	+	++	+				$\dashv$	$\dashv$
Downstream Stations	US2	3 days per week	<b>-</b>	+	- "		-		-			-			-			-	-	-		,		-	-								-	-	1	++	+	+	$\vdash$	+	+'			+	$\dashv$
Downstream Stations	DS1	3 days per week		+++	*	*	*	* *	*	*	* *	*	*	k *	*	*	* *	k *	*	*	* *	*	* *	*	-					-			-	+	1	++	+	+	$\vdash$	+	+'			+	$\dashv$
	DS2	3 days per week		+	*	*	*	* *	*		* *			k *		*		k *			* *	*	* *	*	+										1 -	++	+	+	$\vdash$	+	+'			+	$\dashv$
	DS3	3 days per week		++	*		*	* *	*		* *		*	* *	*	*		* *			* *	*	* *	*								-			1	++	+	+	$\vdash$	+	+-			+	$\dashv$
	DS4	3 days per week		++	*	*	*	* *	*	*	* *	*	*	* *	*	*	* *	* *	*	*	* *	*	* *	*								-			1	++	+	+	$\vdash$	+	+-			+	$\dashv$
	DS5	3 days per week		+	*	*	*	* *	*	*	* *	*	*	* *	*	*	* *	* *	*	*	* *	*	* *	*	+										1	++	+	+	$\vdash$	+	+-			+	-
Sensitive Receiver Stations	200	s days per week		+																												-			1	+	+	1	$\Box$	+	+			$\dashv$	$\dashv$
	MW1	3 days per week			*	*	*	* *	*	*	* *	*	*	k *	*	*	* *	* *	*	*	* *	*	* *	*											1						$\top$				$\neg$
	THB1	3 days per week			*	*	*	* *	*	*	* *	*	*	* *	*	*	* *	* *	*	*	* *	*	* *	*											l			111			$\top$				$\exists$
	THB2	3 days per week			*	*	*	* *	*	*	* *	*	*	* *	*	*	* *	* *	*	*	* *	*	* *	*																					$\exists$
	WSR45C	3 days per week			*	*	*	* *	*	*	* *	*	*	* *	*	*	* *	* *	*	*	* *	*	* *	*																					$\Box$
	WSR46	3 days per week			*	*	*	* *	*	*	* *	*	*	*	*	*	* *	* *	*	*	* *	*	* *	*												Ш			Ш						
																																													_
Pit Specific Sediment Chemistry			J A	A S	O N	D	J	F M	I A	M	J J	Α	S	) N	D	J	F N	A A	M	J	J A	S	O N	N D	) J	F	M	A N	J	J	A :	S	) N	D	J	F	M A	A M	J	JA	S	O	N	D j	J
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 $Annex\ A2-Environmental\ Monitoring\ and\ Audit\ Sampling\ Schedule\ for\ South\ of\ The\ Brothers\ (July\ 2012-February\ 2017)$ 

Cumulative Impact Sediment Chemistry  Near-field Stations  SB-RNA SB-RNB  Mid-field Stations  SB-RMA SB-RMB  Far-Field Stations  SB-RFA SB-RFB  Capped Pit Stations  SB-RCA SB-RCB Sensitive Receiver Stations	4 times per year	J A	2012 A S (		D J	F	M A	2013 M J		0	12	12		A M J 12		O N	12	J F 12	M A M J		S O	N D	J F M A M	2016 1 J J		S O	NI	2017 D J F
SB-RNA SB-RNB Mid-field Stations SB-RMA SB-RMB Far-Field Stations SB-RFA SB-RFB Capped Pit Stations SB-RCA SB-RCB Sensitive Receiver Stations	4 times per year 4 times per year 4 times per year												2	12	12	H	12	12	12	12		12			oxdot			$\Box$
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SB-RMA SB-RMB Far-Field Stations SB-RFA SB-RFB Capped Pit Stations SB-RCA SB-RCB Sensitive Receiver Stations	4 times per year			++						+ +	12	12	2	12	12	-	12	12	12	12		12		-				
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THB2	4 times per year					ـــــــــــــــــــــــــــــــــــــــ			12		12	12	2	12	12		12	12	12	12		12						
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Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

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Routine Water Quality Monitoring			J A	s o	N D	J F M A M		Α	s O N D	I	F			s	O N D	J F	M .	A M	Ţ	I A	s o	N	D	J F M A M	Ţ	I A	A S	О	N	
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	SB-IPE3	8 times per year						8	8 8		8	8 8	8 8		8 8	8 8		8 8		8 8		8	-	<del>-                                     </del>		_	-+	+	-+	-
	SB-IPE4	8 times per year						8	8 8		8	8 8	8 8		8 8	8 8		8 8		8 8		8	-	<del>-                                     </del>		_	-+	+	-+	-
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	SB-INE3	8 times per year						8	8 8		8	8 8	8 8		8 8	0 0		8 8		0 0		8					+	+	$\leftarrow$	+
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	SB-RFE5	8 times per year						8	8 8	8	8	8 8	8 8		8 8	8 8		8 8		8 8	8	8						$\bot$	$\longrightarrow$	
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	THB1	8 times per year						8	8 8	Ü	8	8 8	8 8		8 8	8 8		8 8		8 8		8							$\leftarrow$	
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	WSR46	8 times per year						8	8 8	8	8	8 8	8 8		8 8	8 8		8 8		8 8	8	8							ш	
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	SB-RFF3	8 times per year						8	8 8	8	8	8 8	8 8		8 8	8 8		8 8		8 8	8	8						+		
Sensitive Receiver Stations		1 ,																									$\neg$	+	1	
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Plume Stations	WCP1	Monthly						4	4   4   4   4	4	4	4 4 4 4	4 4	4	4 4 4 4	4 4	4	4 4	4	4 4	4 4	4	4		J.			1	, ,	

Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

				20	12					2	013							2014						2015						2016					2017
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Naming of stations are tentative only and will be subjected to changes

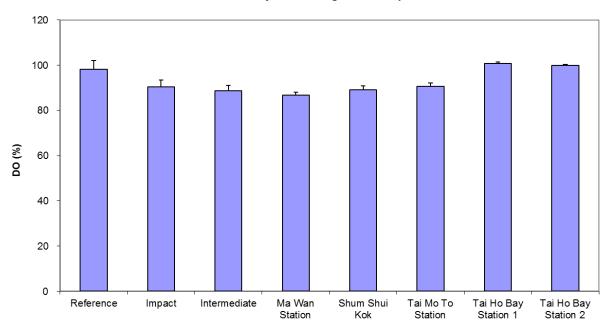
### Annex B

## **Graphical Presentations**

#### Routine Water Quality Monitoring for CMP 2 - April 2015 10.00 9.00 WOO Max 8.00 7.00 WQO Min 6.00 5.00 펍 4.00 3.00 2.00 1.00 0.00 Tai Ho Bay Tai Ho Bay Intermediate Ma Wan Shum Shui Tai Mo To Reference Impact Station 2 Station Kok Station Station 1

Figure 1: Level of pH recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in April 2015.

#### Routine Water Quality Monitoring CMP 2 - April 2015



Level of Dissolved Oxygen (% saturation; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in April 2015.

Source: H:\Team\EM\GMS Projects\0175086 CEDD EM&A for South Brothers\02

Deliverable\07 CMP Monthly Report\32nd (April 2015)

Date: 14/5/2015



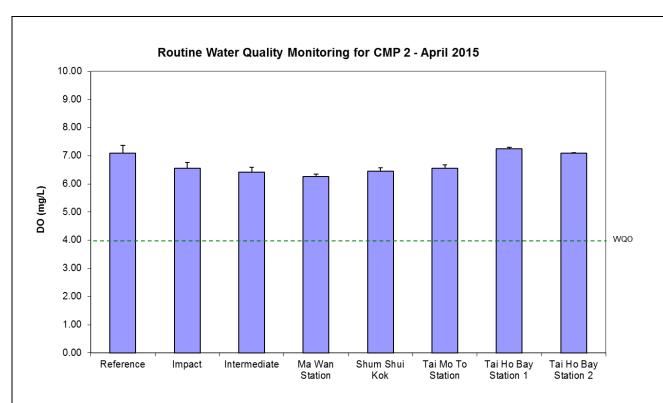


Figure 3: Concentration of Dissolved Oxygen (mg/L; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in April 2015.

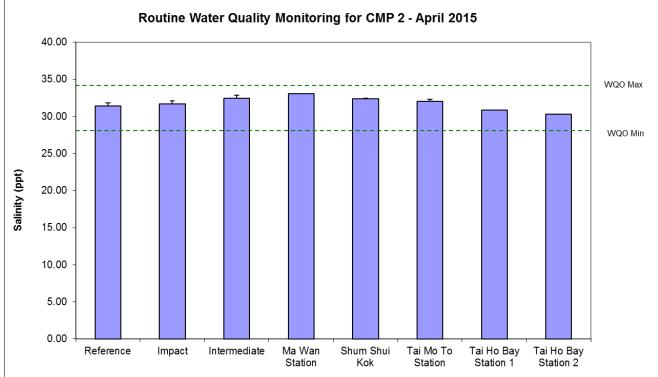


Figure 4: Level of Salinity (ppt; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in April 2015.

Source: H:\Team\EM\GMS Projects\0175086 CEDD EM&A for South Brothers\02 Deliverable\07 CMP Monthly Report\32nd (April 2015)

Date: 14/5/2015



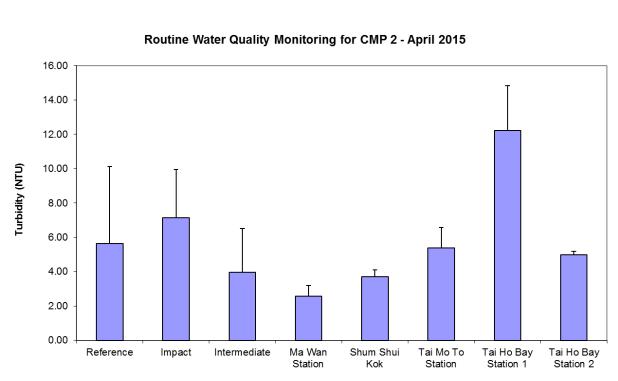


Figure 5: Levels of Turbidity (NTU; ,mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in April 2015.

Source: H:\Team\EM\GMS Projects\0175086 CEDD EM&A for South Brothers\02

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## Annex C

## Water Quality Monitoring Results

Table C1 Action and Limit Levels of Water Quality for Dredging, Backfilling and Capping Activities for SB CMPs

Parameter	Action Level	Limit Level
Dissolved Oxygen (DO) (1)	Surface and Mid-depth (2) The average of the impact, WSR 45C and WSR 46 station readings are < 5%-ile of baseline data for surface and	Surface and Mid-depth (2) The average of the impact, WSR 45C and WSR 46 station readings are < 4 mg L-1
	middle layer = <b>4.32 mg L</b> -1 and	and Significantly less than the reference
	Significantly less than the reference stations mean DO (at the same tide of the same day)	stations mean DO (at the same tide of the same day)
	$\frac{Bottom}{The average of the impact, WSR 45C} \\ and WSR 46 station readings are < 5%-ile of baseline data for bottom layers = 3.12 mg L^{-1}$	$\frac{\text{Bottom}}{\text{The average of the impact station,}}$ WSR 45C and WSR 46 readings are < 2 mg $L^{-1}$
	and Significantly less than the reference	and Significantly less than the reference stations mean DO (at the same tide of
	stations mean DO (at the same tide of the same day)	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 = <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
	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.

Table C2 In-situ Monitoring Results for Routine Water Quality Monitoring of CMP 2 on 14 April 2015

Sampling	Stations	Temp	Salinity	Turbidity	Dissolved Oxygen		pН
Period		(°C)	(ppt)	(NTU)	(%)	(mg L-1)	(mg L-1)
April	RFF (Reference)	22.41	31.43	5.64	98.17	7.10	8.03
2015	IPF (Impact)	22.17	31.71	7.15	90.51	6.56	8.01
	INF (Intermediate)	21.94	32.46	3.96	88.60	6.42	7.97
	Ma Wan	21.99	33.07	2.58	86.73	6.26	8.01
	Shum Shui Kok	22.09	32.35	3.72	89.18	6.45	7.99
	Tai Mo To	22.08	32.00	5.37	90.55	6.56	8.01
	Tai Ho Bay 1	22.87	30.82	12.21	100.71	7.25	8.03
	Tai Ho Bay 2	23.84	30.29	4.98	99.95	7.09	7.97
	WQO	N/A	28.28-34.57#	N/A	N/A	>4	6.5-8.5

Notes:

Table C3 Water Column Profiling Results for SB CMP 2 on 17 April 2015

Stations	Temp	Salinity	Turbidity	Dissolved Oxygen		pН	Suspended Solids
	(°C)	(ppt)	(NTU)	(%)	(mg L-1)	(mg L-1)	(mg L-1)
WCP 1 (Downstream)	23.25	29.70	3.86	109.87	7.91	8.03	6.08
WCP 2 (Upstream)	23.82	29.80	23.13	116.14	8.26	8.11	15.68
WQO (dry season)	N/A	26.82- 32.89#	N/A	N/A	>4	6.5-8.5	11.6

**Note:** \*Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.

 $<sup>^{\#}</sup>$ Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station. Cell shaded yellow / red indicate value exceeding the Action/Limit levels.

## Annex D

## Study Programme

