



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)*

47th Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau – July 2016

Draft (Revision 0)

11 August 2016

Environmental Resources Management

16/F Berkshire House 25 Westlands Road Quarry Bay, Hong Kong Telephone (852) 2271 3000 Facsimile (852) 2723 5660 www.erm.com



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16/F Berkshire House 25 Westlands Road Quarry Bay Hong Kong

Telephone: (852) 2271 3000 Facsimile: (852) 2723 5660 E-mail: post.hk@erm.com http://www.erm.com

Client:		Project N	0:		
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v0	47 th Monthly Progress Report for ESC CMPs and SB CMPs	RC	JT	CAR	11/8/16
Revision	Description	Ву	Checked	Approved	Date
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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:

47th Monthly Progress Report for Contaminated Mud Pits to

the South of The Brothers and at East Sha Chau - July 2016

Date of Report:

11 August 2016

Date prepared by ET:

11 August 2016

Date received by IA:

11 August 2016

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:

11/8/2016

IA Verification

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

Mean Warg

Dr Wang Wen Xiong, Independent Auditor: Date:

11/8/2016

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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

47TH MONTHLY PROGRESS REPORT FOR JULY 2016

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) ⁽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.

- 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.7
- (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 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 ESC CMPs and SB CMPs is shown in *Figure 1.1.* In July 2016, the following works were being undertaken:
 - Disposal of contaminated mud at ESC CMP Vd; and
 - Capping operation at SB CMP 2.

Figure 1.1 Works Schedule for ESC CMPs and SB CMPs

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	Dredging																																																							
SB CMP 2	Backfilling																																																							
	Capping																																																							

1.2 REPORTING PERIOD

1.2.1 This 47th Monthly Progress Report covers the EM&A activities for the reporting month of July 2016.

1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES

- 1.3.1 The following monitoring activities have been undertaken for ESC CMPs in July 2016:
 - Routine Water Quality Monitoring of ESC CMP Vd was undertaken on 4 July 2016;
 - Water Column Profiling of ESC CMP Vd was undertaken on 5 July 2016;

⁽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.

- *Pit Specific Sediment Chemistry of ESC CMP Vd* was undertaken on 6 July 2016; and
- *Demersal Trawling* of *ESC CMP Vd* was undertaken on 27 and 28 July 2016.
- 1.3.2 No monitoring activities were scheduled to be undertaken for SB CMPs in July 2016.
- 1.4 DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS
- 1.4.1 No outstanding sampling remained for July 2016.
- 1.4.2 A summary of field activities conducted are presented in *Annex A*. The following analyses are in progress and will be presented in the corresponding quarterly report:
 - Species identification of the biota samples collected from *Demersal Trawling for ESC CMP Vd* in July 2016.
- 1.5 Brief Discussion of the Monitoring Results for ESC CMPs
- 1.5.1 Brief discussion of the monitoring results of the following activities for ESC CMPs is presented in this 47th Monthly Progress Report:
 - Routine Water Quality Monitoring of ESC CMP Vd in July 2016;
 - Water Column Profiling of ESC CMP Vd in July 2016; and
 - Pit Specific Sediment Chemistry of ESC CMP Vd in July 2016.

1.5.2 Routine Water Quality Monitoring of ESC CMP Vd - July 2016

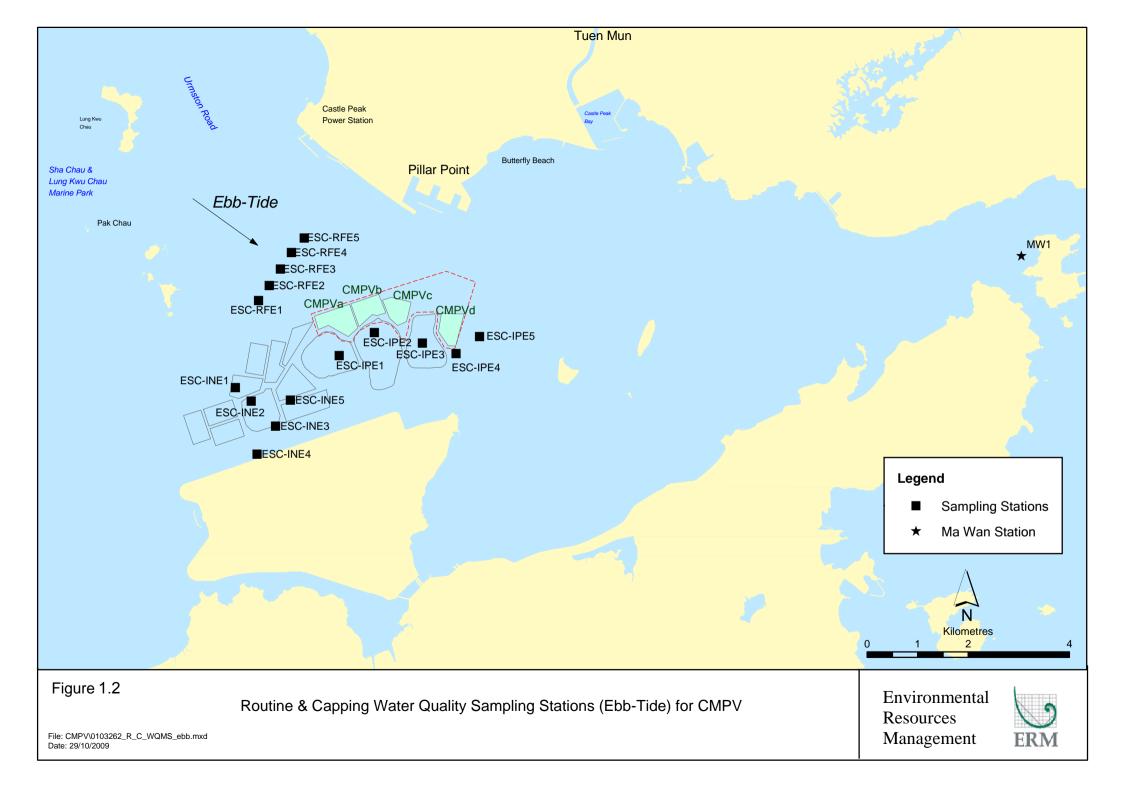
1.5.3 Routine Water Quality Monitoring was undertaken on 4 July 2016. The monitoring results have been assessed for compliance with the Water Quality Objectives (WQOs) set by Environmental Protection Department (EPD). This consists of a review of the EPD routine water quality monitoring data for the wet season period (April to October) of 2005 - 2014 from stations in the Northwestern Water Control Zone (WCZ), where the ESC CMPs are located (1). 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 B1* of *Annex B* for details). The monitoring results are shown in *Tables B2 and B3* of *Annex B* and *Figures 1 - 10* of *Annex C*. A total of sixteen (16) monitoring stations were sampled in July 2016 as shown in *Figure 1.2*.

In-situ Measurements

- 1.5.4 Graphical presentation of the monitoring results (Temperature, DO, pH, Salinity and Turbidity) is shown in *Figures 1 6* of *Annex C*. Analyses of results for July 2016 indicated that the levels of pH and DO complied with the WQOs at all stations (Impact, Intermediate, Reference and Ma Wan stations) in *July* 2016 (*Table B2* of *Annex B*; *Figures 1*, 2, 3 and 4 of *Annex C*). Levels of Salinity at Impact and Intermediate stations exceeded the WQOs (*Table B2* of *Annex B*; *Figure 5* of *Annex C*). The lower Salinities recorded at these stations is likely to be caused by the freshwater discharged from the Pearl River Delta during the summer months which tend to form a surface layer of lower salinity water at these stations with shallower depth when compared with the Reference stations.
- 1.5.5 The levels of DO and Turbidity complied with the Action and Limit Levels at all stations (*Table B2* of *Annex B*; *Figures 2*, 3 and 6 of *Annex C*).
- 1.5.6 Overall, *in-situ* measurement results of the *Routine Water Quality Monitoring* indicated that the disposal operation at ESC CMP Vd did not appear to cause any unacceptable impacts in water quality in July 2016.

Laboratory Measurements

1.5.7 Laboratory analysis of July 2016 results indicated that concentrations of Cadmium, Chromium, Silver and Mercury were below their limit of reporting at all stations. Arsenic, Lead, Nickel, Copper and Zinc were detected in July 2016 samples and the concentrations of these metals and metalloid were similar amongst stations, except higher concentration of Zinc was recorded at Impact stations (*Table B3* of *Annex B*; *Figure 7* of *Annex C*).



- 1.5.8 For nutrients, concentrations of Total Inorganic Nitrogen (TIN) at all stations in July 2016 exceeded the WQO (0.5 mg/L) (*Table B3* of *Annex B*; *Figure 8* of *Annex C*). It should be noted that due to effect of Pearl River, the North Western WCZ has historically experienced higher levels of TIN (1). Since TIN concentrations were recorded to be similar amongst all stations, the exceedances of TIN WQO at all stations are unlikely to be caused by the disposal operation at ESC CMP Vd. Concentrations of Ammonia Nitrogen (NH3-N) were relatively similar amongst all stations (*Table B3* of *Annex B*; *Figure 8* of *Annex C*). Levels of 5-day Biochemical Oxygen Demand (BOD₅) appear to be higher at Reference station in July 2016 (*Table B3* of *Annex B*; *Figure 9* of *Annex C*).
- 1.5.9 Concentrations of SS were higher than the WQO (11.1 mg/L for wet season) at Impact and Reference stations. However, concentrations of SS complied with the Action and Limit Levels at all stations in July 2016 (*Table B3* of *Annex B*; *Figure 10* of *Annex C*).
- 1.5.10 Overall, results of the *Routine Water Quality Monitoring* indicated that the disposal operation at ESC CMP Vd did not appear to cause any unacceptable deterioration in water quality in July 2016. Detailed statistical analysis will be presented in the Quarterly Report to investigate any spatial and temporal trends of potential concern.
- 1.5.11 Water Column Profiling of ESC CMP Vd July 2016
- 1.5.12 Water Column Profiling was undertaken on 5 July 2016. The monitoring results have been assessed for compliance with the WQOs (see Section 1.5.3 for details). Levels of DO and Turbidity were also assessed for compliance with the Action and Limit Levels (see Table B1 of Annex B for details).

In-situ Measurements

1.5.13 Analyses of results for July 2016 indicated that levels of Salinity, DO and pH complied with the WQOs at both Downstream and Upstream stations (*Table B4* of *Annex B*). In addition, DO and Turbidity at all stations complied with the Action and Limit Levels (*Table B4* of *Annex B*).

Laboratory Measurements for Suspended Solids (SS)

1.5.14 Analyses of results for July 2016 indicated that the SS levels were higher than the WQO at both Upstream and Downstream stations. Both Upstream and Downstream stations complied with the Action and Limit Levels (*Table B4* of *Annex B*).

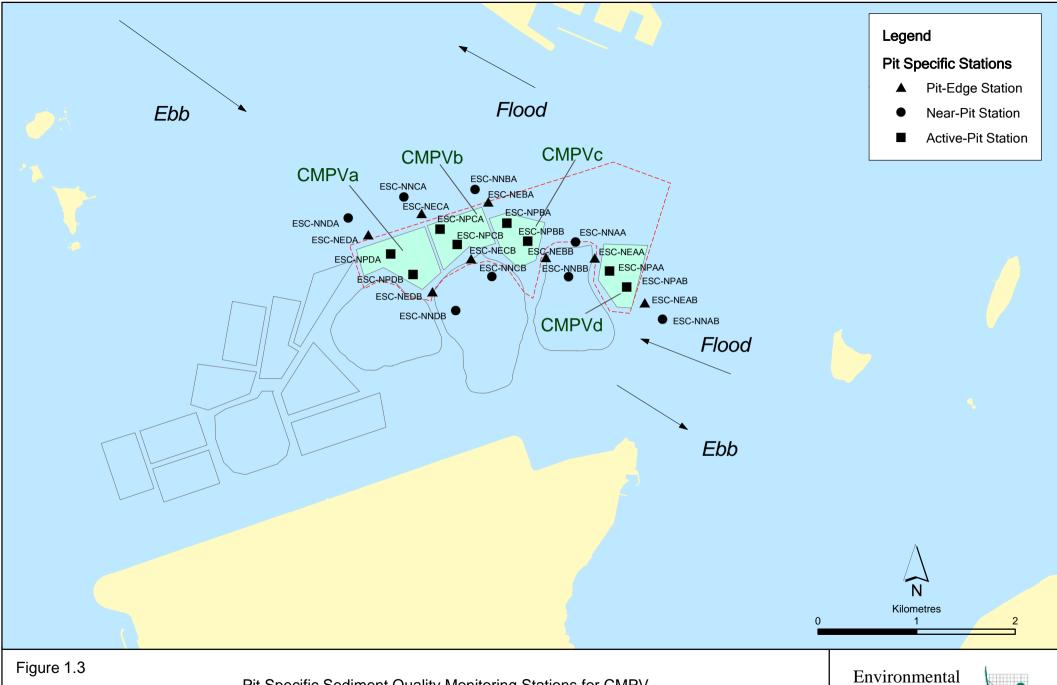
Overall, the monitoring results indicated that the mud disposal operation at ESC CMP Vd did not appear to cause any deterioration in water quality during this reporting period.

 $\label{eq:local_problem} \begin{tabular}{ll} (1) & http://www.epd.gov.hk/epd/misc/marine_quality/1986-2005/textonly/eng/index.htm \end{tabular}$

- 1.5.15 Pit Specific Sediment Chemistry of ESC CMP Vd July 2016
- 1.5.16 Monitoring locations for *Pit Specific Sediment Chemistry for ESC CMP Vd* are shown in *Figure 1.3*. A total of six (6) monitoring stations were sampled in July 2016.
- 1.5.17 The concentrations of most inorganic contaminants were lower than the Lower Chemical Exceedance Level (LCEL) at all stations, except Arsenic (*Figures 11* and 12 of *Annex C*). In July 2016, concentration of Arsenic at Active Pit station ESC-NPAB exceeded the LCEL (*Figure 11* of *Annex C*).
- 1.5.18 Whilst the average concentration of Arsenic in the Earth's crust is generally ~2mg/kg, significantly higher Arsenic concentrations (median = 14 mg/kg) have been recorded in Hong Kong's onshore sediments (1). It is presumed that the natural concentrations of Arsenic are similar in onshore and offshore sediments (2), and relatively high Arsenic levels may thus occur throughout Hong Kong. Therefore, the LECL exceedances of Arsenic are unlikely to be caused by the disposal operations at ESC CMP Vd but rather as a result of naturally occurring deposits.
- 1.5.19 For organic contaminants, the concentrations of Total Organic Carbon (TOC) were similar amongst the stations in July 2016 (*Figure 13* of *Annex C*). In July 2016, Tributyltin (TBT) concentrations were higher at Active Pit station ESC-NPAB (*Figure 14* of *Annex C*). Low and High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs), Total Polychlorinated Biphenyls (PCBs), Total dichlorodiphenyltrichloroethane (DDT) and 4,4′-dichlorodiphenyldichloroethylene (DDE) concentrations were below the limit of reporting at all stations in July 2016.
- 1.5.20 Overall, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at ESC CMP Vd in July 2016. Statistical analysis will be undertaken and presented in the quarterly report to investigate whether there are any unacceptable impacts in the area caused by the contaminated mud disposal.

⁽¹⁾ Sewell RJ (1999) Geochemical Atlas of Hong Kong. Geotechnical Engineering Office, Government of the Hong Kong Special Administrative Region

⁽²⁾ Whiteside PGD (2000) Natural geochemistry and contamination of marine sediments in Hong Kong. In: The Urban Geology of Hong Kong (ed Page A & Reels SJ). Geological Society of Hong Kong Bulletin No. 6, p109-121



File: CMPV\0103262_SQMS_pit specific.mxd

Date: 29/10/2009

Pit Specific Sediment Quality Monitoring Stations for CMPV

Resources Management



- 1.6 ACTIVITIES SCHEDULED FOR THE NEXT MONTH
- 1.6.1 The following monitoring activities will be conducted in the next monthly period of August 2016 for ESC CMPs:
 - Water Column Profiling of ESC CMP Vd;
 - Routine Water Quality Monitoring of ESC CMPs;
 - Pit Specific Sediment Chemistry of ESC CMP Vd;
 - Cumulative Impact Sediment Chemistry of ESC CMPs;
 - Sediment Toxicity Test of ESC CMPs;
 - Benthic Recolonisation Studies of ESC CMP IV; and
 - Demersal Trawling of ESC CMPs.
- 1.6.2 The following monitoring activities will be conducted in the next monthly period of August 2016 for SB CMPs:
 - Water Quality Monitoring During Capping of SB CMPs; and
 - Benthic Recolonisation Studies of SB 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

Annex A1 - Environmental Monitoring and Audit Sampling Schedule for East of Sha Chau (September 2012 - February 2017) 2012 2013 2014 2015 2016 2017 Pit Specific Sediment Chemistry Code 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 Active-Pit ESC-NPDA ESC-NPDB Pit-Edge ESC-NEDA **ESC-NEDB** Near-Pit ESC-NNDA ESC-NNDB **Cumulative Impact Sediment Chemistry** SONDJFMAMJJASONDJFMAAMJJJASONDJFMAAMJJJASONDJFFMAAMJJJASONDJFMAAMJJJASONDJFFMAAAMJJJASONDJF Near-field Stations ESC-RNA ESC-RNB Mid-field Stations ESC-RMA ESC-RMB Capped Pit Stations ESC-RCA ESC-RCB Far-Field Stations ESC-RFA ESC-RFB Ma Wan Station MW1 **Sediment Toxicity Tests** Near-Field Stations ESC-TDA ESC-TDB Reference Stations ESC-TRA ESC-TRB Ma Wan Station MW1 Tissue/Whole Body Sampling Impact Stations ESC-INA ESC-INB Reference ESC-TNA ESC-TNB ESC-TSA ESC-TSB

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

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Routine Water Quality Monit	toring	S O	N D	J	F M	I A M	J	J	A S	0	NI) J	F M	[A	. M	J	JA	S	ON	D	J	F	M A	M	J J	A	$S \mid O$	N D	J	F N	I A M	J	J	A 5	5 O	N	D]	F
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	ESC-INE4	*	*	*	*	* *		*	*																						* *		* *	f	*	*		* *
	ESC-INE5	*	*	*	*	* *		*	*																						* *		* *	f	*	*	*	* *
Reference Station																																						
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	ESC-RFE2	*	*	*	*	* *		*	*																						* *		* *	f	*	*		* *
	ESC-RFE3	*	*	*	*	* *		*	*																						* *		* *	f	*	*		*
	ESC-RFE4	*	*	*	*	* *		*	*																						* *		* *	f	*	*		* *
	ESC-RFE5	*	*	*	*	* *		*	*																						* *		* *	f	*	*	*	* *
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Flood Tide																																						
Impact Station																																						
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Intermediate Station																																	$\perp \perp$		\bot			
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Reference Station																																	$\perp \perp$		\bot			
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Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

				2012							2013									203	14									2015										20	016					
Baseline Monitoring Prior to Dredging	Code	Frequency	I A	S 0		D	J F	M	Α				S	0 1	N D	J	F	M A	M			A	$\mathbf{S} \mid \mathbf{O}$	O N	D	J	FIN	и А	M		A	S	0	N	D	Ţ	FIN	Л А	M		010 J	A	$\mathbf{s} \mid \mathbf{o}$	N	D	
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	SB-WFB	3 days per week for 4 weeks	* *																																				\top	+	\vdash	-	\top	+		十
Mid Field Stations		T T T T T T T T T T T T T T T T T T T											t																1 1			1							+	+	+	-	+	+	+	十
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	SB-WMB	3 days per week for 4 weeks	* *	+ +				+			+		t														_					+					_		+	+	+	-	$\overline{}$	+	+	十
Near Field Stations	OD WIND	5 days per week for 1 weeks		+ +	+			1	\vdash		+		+		+		-+	-	+			-	+	+	+		-					╁	1	\vdash			-	-	+	+-	+	-	+	+	+	十
vear rela stations	SR_W/NI A A	3 days per week for 4 weeks	* *	+ +				+			+		\vdash		\dashv		-+	-	+			-	+				+		1 1	-		╁	<u> </u>	\vdash			+	-	+	+	+	-+	+	+	+	+
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	SB-WNBA	3 days per week for 4 weeks	* *						\vdash		-		+		+		-		+				-	+	+							+	<u> </u>	\vdash				-	+	+	+	-+	+	+	+	+
		3 days per week for 4 weeks	* *		+	\vdash					-		\vdash			-	-					-	_	+	+		-					-		\vdash			-	-	+	+	+	-	+	+	+	+
Reference Stations	3D-WINDD	3 days per week for 4 weeks	\vdash	+	+						-		\vdash			-	-					-	_	+	+		-					+		\vdash			-	-	+	+	+	-+	+	+	+	+
Reference Stations	NM1	2 dans non man le fan 4 marilia	* *		-						-					-	-						-		1		-					1							+	+-	+	-+	+	$+\!\!-$	+	+
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	NM6	3 days per week for 4 weeks	* *	\bot	1	$oxed{oldsymbol{eta}}$		1	\sqcup				\sqcup			$\downarrow \downarrow \downarrow$			1						$oxed{igspace}$		\perp		+			<u> </u>	1				\perp		4		+		\bot		4	
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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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Far-Field Stations																																	
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Capped Pit Stations																																	
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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			Ţ			N D	I F	F M	A	M J		A S	0	N D) I	F	M	A M		A	$s \mid 0$	N	D	F	M	A M			S	0	N	ρп	F	М	AN			A	S	O N		
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	SB-IPE5	8 times per year										8	8	8	8		8	8 8		8	8	8	8	3 8		8 8		8 8	;	8		8			\top	+	+		\top	+	\neg	+
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	SB-INE2	8 times per year										8	8	8	8	8	8	8 8	8	8	8	8		3 8	1 1	8 8		8 8	3	8	8	8	8		\top	+	+	\vdash	\neg	+	-	\top
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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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	SB-IPE2	4 times per year																			3	3			3	3			3	3	+	3	3			3	
	SB-IPE3	4 times per year																			3	3			3	3			3	3	+	3	3			3	
	SB-IPE4	4 times per year																			3	3			3	3			3	3	+	3	3			3	
	SB-IPE5	4 times per year		1 1	_		+ + +														3	3			3	3		1 1	3	3	1 	3	3			3	
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	SB-RFE5	4 times per year																			3	3			3	3			3	3		3	3			3	
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	SB-INF3	4 times per year																			3	3			3	3			3	3		3	3			3	
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	SB-RFF3	4 times per year			\neg						1 1						1 1		1 1	\neg	3	3		1 1	3	3			3	3		3	3			3	\neg
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				-		-	•	•	•			-		•			_				-	-	•	-	•		_										

Notes:

[&]quot;*" = Number of replicates depends on parameters

Naming of stations are tentative only and will be subjected to changes

Annex B

Water Quality Monitoring Results

Table B1 Action and Limit Levels of Water Quality for Dredging, Backfilling and Capping Activities at ESC CMPs

Parameter	Action Level	Limit Level
Dissolved Oxygen (DO) (1)	Surface and Mid-depth (2)	Surface and Mid-depth (2)
	5%-ile of baseline data for surface and	1%-ile of baseline data for surface and
	middle layer = 3.76 mg L-1	middle layer = 3.11 mg L^{-1} (3)
	and	and
	Significantly less than the reference	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)
	Bottom	Bottom
	5%-ile of baseline data for bottom	The average of the impact station
	layers = 2.96 mg L-1	readings are <2 mg/L-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)
Depth-averaged Suspended	95%-ile of baseline data for depth	99%-ile of baseline data for depth
Solids (SS) (4) (5)	average = 37.88 mg L-1	average = 61.92 mg L-1
	and	
		and
	120% of control station's SS at the same	130% of control station's SS at the same
	tide of the same day	tide of the same day
Depth-averaged Turbidity (Tby) (4) (5)	95%-ile of baseline data = 28.14 NTU	99%-ile of baseline data = 38.32 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) Given the Action Level for DO for Surface & Middle layers has already been lower than 4 mg L-1, it is proposed to set the Limit Level at 3.11 mg L-1 which is the first percentile of the baseline data.
- (4) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.
- (5) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

Table B2 In-situ Monitoring Results for Routine Water Quality Monitoring of ESC Vd in July 2016

Sampling	Stations	Temp	Salinity	Turbidity	Dissolve	pН	
Period	Stations	(°C)	(ppt)	(NTU)	(%)	(mg L-1)	(mg L-1)
July 2016	RFE (Reference)	27.81	18.55	16.16	68.54	4.86	7.73
	IPE (Impact)	28.22	16.42	13.22	74.33	5.33	7.73
	INE (Intermediate)	28.39	15.90	5.44	81.91	5.83	7.78
	Ma Wan	28.15	17.27	4.86	76.91	5.46	7.81
	WOO	NT / A	16.70 -	N/A	NI / A	>.1	6.5-8.5
	WQO	N/A	20.41#	IN/A	N/A	>4	6.5-8.5

Notes:

Cell shaded grey indicate value exceeding the WQO.

Table B3 Laboratory Results for Routine Water Quality Monitoring of ESC Vd in July 2016

Sampling	npling Stations	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	NH ₃	TIN	BOD_5	SS
Period	Stations	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
July 2016	RFE	2.51	<lor< td=""><td><lor< td=""><td>2.74</td><td>0.92</td><td>0.25</td><td>0.92</td><td>0.50</td><td>5.16</td><td>0.15</td><td>1.04</td><td>1.50</td><td>18.52</td></lor<></td></lor<>	<lor< td=""><td>2.74</td><td>0.92</td><td>0.25</td><td>0.92</td><td>0.50</td><td>5.16</td><td>0.15</td><td>1.04</td><td>1.50</td><td>18.52</td></lor<>	2.74	0.92	0.25	0.92	0.50	5.16	0.15	1.04	1.50	18.52
	IPE	2.29	<lor< td=""><td><lor< td=""><td>4.66</td><td>1.45</td><td>0.25</td><td>1.62</td><td>0.50</td><td>18.12</td><td>0.12</td><td>1.13</td><td>0.47</td><td>20.86</td></lor<></td></lor<>	<lor< td=""><td>4.66</td><td>1.45</td><td>0.25</td><td>1.62</td><td>0.50</td><td>18.12</td><td>0.12</td><td>1.13</td><td>0.47</td><td>20.86</td></lor<>	4.66	1.45	0.25	1.62	0.50	18.12	0.12	1.13	0.47	20.86
	INE	2.36	<lor< td=""><td><lor< td=""><td>3.00</td><td>1.04</td><td>0.25</td><td>0.91</td><td>0.50</td><td>5.61</td><td>0.11</td><td>1.12</td><td>0.56</td><td>9.78</td></lor<></td></lor<>	<lor< td=""><td>3.00</td><td>1.04</td><td>0.25</td><td>0.91</td><td>0.50</td><td>5.61</td><td>0.11</td><td>1.12</td><td>0.56</td><td>9.78</td></lor<>	3.00	1.04	0.25	0.91	0.50	5.61	0.11	1.12	0.56	9.78
	Ma Wan	2.43	<lor< td=""><td><lor< td=""><td>4.10</td><td>0.57</td><td>0.25</td><td>0.99</td><td>0.50</td><td>5.63</td><td>0.13</td><td>1.03</td><td>0.68</td><td>5.94</td></lor<></td></lor<>	<lor< td=""><td>4.10</td><td>0.57</td><td>0.25</td><td>0.99</td><td>0.50</td><td>5.63</td><td>0.13</td><td>1.03</td><td>0.68</td><td>5.94</td></lor<>	4.10	0.57	0.25	0.99	0.50	5.63	0.13	1.03	0.68	5.94

WQO of TIN: 0.5 mg/L

Wet Season WQO of SS : 11.1 mg/L $\,$

Notes:

Cell shaded yellow / red indicate value exceeding the Action/Limit levels.

Cell shaded grey indicate value exceeding the WQO.

Table B4 Water Column Profiling Results for ESC CMP Vd in July 2016

Stations	Temp	Salinity	Turbidity	Dissolved Oxygen		pН	Suspended Solids
	(°C)	(ppt)	(NTU)	(%)	(mg L-1)	(mg L-1)	(mg L-1)
WCP 1							
(Downstream) WCP 2	26.96	20.88	14.05	60.42	4.29	7.71	18.12
(Upstream)	27.45	19.20	14.52	64.00	4.55	7.72	12.70
WQO (Wet season)	N/A	18.03 - 22.04#	N/A	N/A	>4	6.5-8.5	11.1

Note:

#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.

Cell shaded grey indicate value exceeding the WQO.

^{*}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 C

Graphical Presentations

Routine Water Quality Monitoring for ESC CMP Vd - July 2016 10.00 9.00 WQO Max 8.00 7.00 WQO Min 6.00 5.00 핂 4.00 3.00 2.00 1.00 0.00 Ma Wan Station Reference Impact Intermediate

Figure 1: Level of pH recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in July 2016.

Routine Water Quality Monitoring ESC CMP Vd - July 2016 120 100 80 40 20 Reference Impact Intermediate Ma Wan Station

Figure 2: Level of Dissolved Oxygen (DO) (% saturation; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in July 2016.

Source: H:\Team\EM\GMS Projects\0175086 CEDD EM&A for South Brothers\02 Deliverable\07 CMP Monthly Report\47th (July 2016)

Date: 8/8/2016



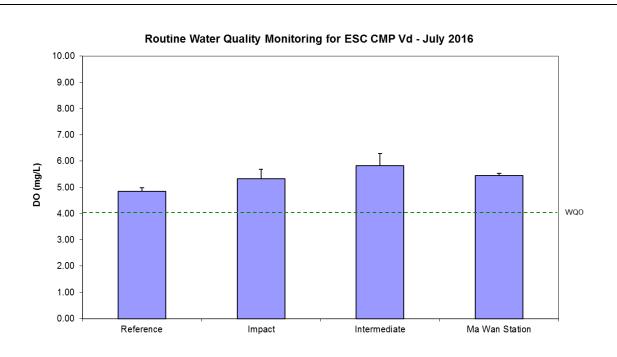


Figure 3: Concentration of Dissolved Oxygen (DO) (mg/L; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in July 2016.

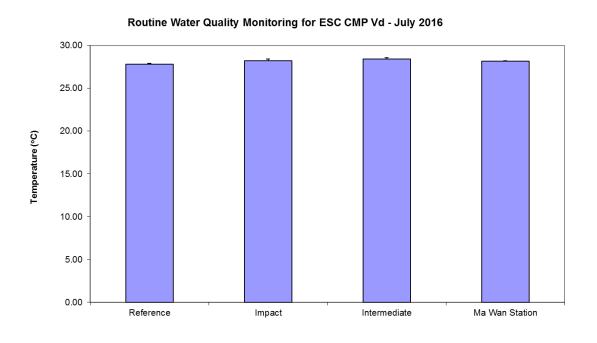


Figure 4: Level of Temperature (°C; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in July 2016.

Source: H:\Team\EM\GMS Projects\0175086 CEDD EM&A for South Brothers\02 Deliverable\07 CMP Monthly Report\47th (July 2016)

Date: 8/8/2016



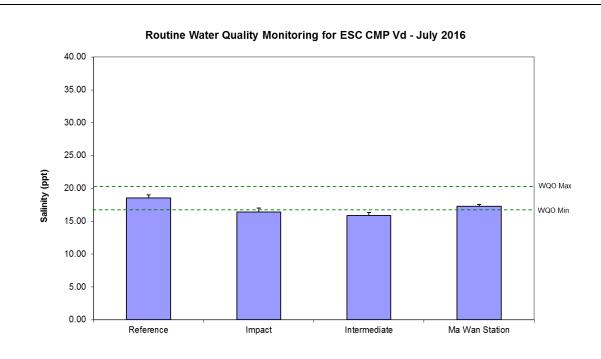


Figure 5: Level of Salinity (ppt; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in July 2016.

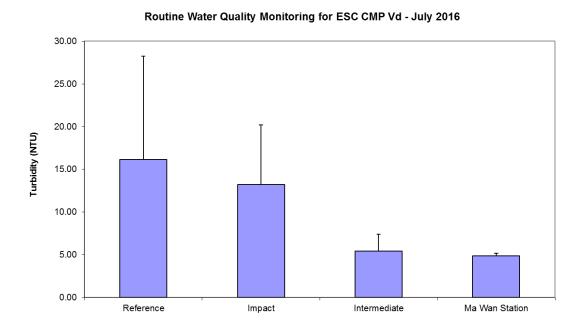


Figure 6: Levels of Turbidity (NTU; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in July 2016.

Source: H:\Team\EM\GMS Projects\0175086 CEDD EM&A for South Brothers\02 Deliverable\07 CMP Monthly Report\47th (July 2016)

Date: 8/8/2016



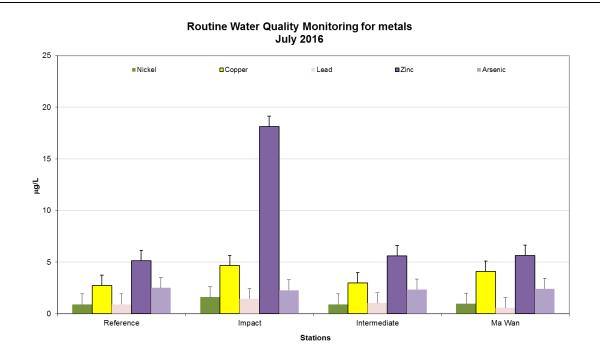


Figure 7: Concentration of Copper, Zinc, Arsenic and Lead (μ g/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in July 2016.

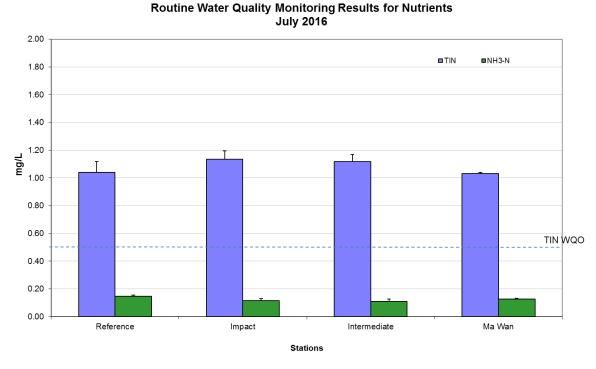


Figure 8: Concentration of Total Inorganic Nitrogen (TIN) and Ammonia Nitrogen (NH3-N) (μ g/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in July 2016.

 $Source: H:\ Team\ EM\ GMS\ Projects\ 0175086\ CEDD\ EM\&A\ for\ South\ Brothers\ 02\\ Deliverable\ 07\ CMP\ Monthly\ Report\ 47th\ (July\ 2016)$

Date: 8/8/2016



Routine Water Quality Monitoring Results for Biochemical Oxygen Demand (BOD₅) July 2016 3.5 2.0 2.5 1.5 1.0 Reference Impact Intermediate Ma Wan

Figure 9: Level of Biochemical Oxygen Demand (BOD5) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in July 2016.

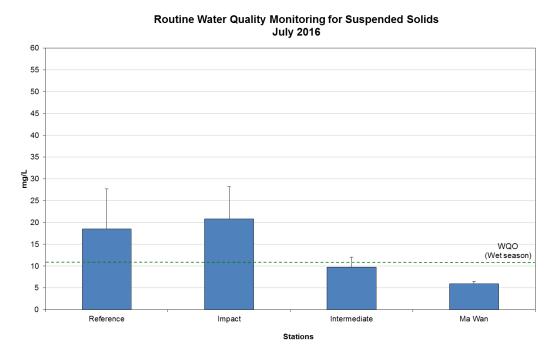


Figure 10: Concentration of Suspended Solids (SS) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in July 2016.

Source: H:\Team\EM\GMS Projects\0175086 CEDD EM&A for South Brothers\02 Deliverable\07 CMP Monthly Report\47th (July 2016)

Date: 8/8/2016



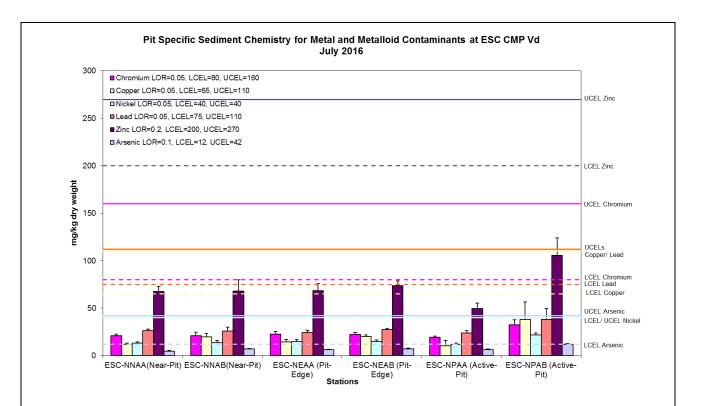


Figure 11: Concentration of Metals (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in July 2016.

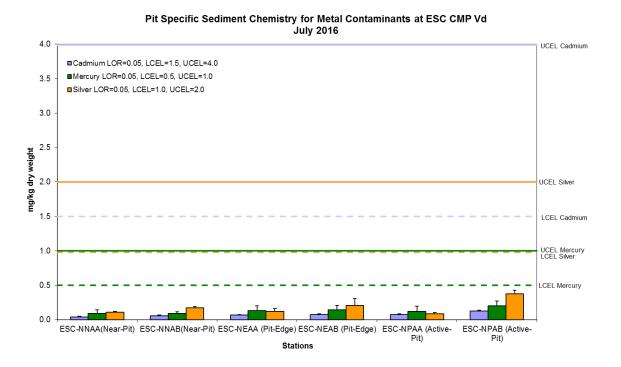


Figure 12: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in July 2016.

Source: H:\Team\EM\GMS Projects\0175086 CEDD EM&A for South Brothers\02 Deliverable\07 CMP Monthly Report\47th (July 2016)

Date: 8/8/2016



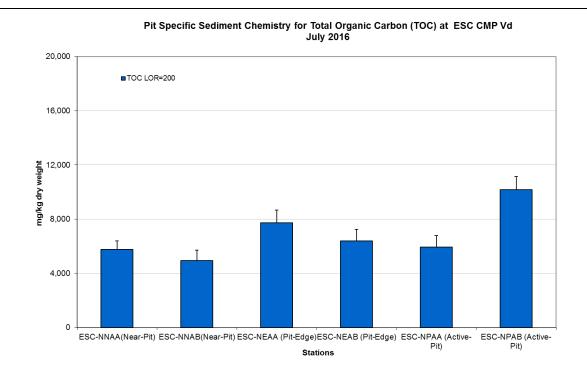


Figure 13: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in July 2016.

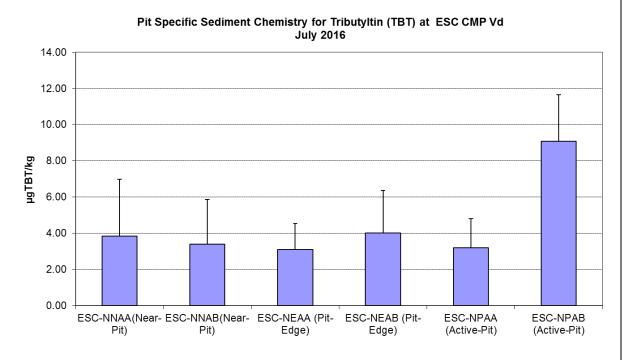


Figure 14: Concentration of Tributyltin (TBT) (µg TBT/kg; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in July 2016.

Source: H:\Team\EM\GMS Projects\0175086 CEDD EM&A for South Brothers\02 Deliverable\07 CMP Monthly Report\47th (July 2016)

Date: 8/8/2016



Annex D

Study Programme

