



Agreement No. CE 63/2016 (EP) Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau (2017-2020) – Investigation

Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau and the South of The Brothers – October 2018

Revision 0

November 2018

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Environmental Resources Management

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Client:		Project N	D:		
Civil Eng	gineering and Development Department (CEDD)	040072	0		
Summary:		Date:			
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		Approved	by:		
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name of 'EF terms of the	has been prepared by Environmental Resources Management the trading RM Hong-Kong, Limited', with all reasonable skill, care and diligence within the Contract with the client, incorporating our General Terms and Conditions of id taking account of the resources devoted to it by agreement with the client.	Distributio	ernal	OHSAS	5 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.	🛛 Put	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.	🗌 Сог	nfidential	ISO 9 Certificat	001 : 2008 e No. FS 32515







Dredging, Management and Capping of Contaminated Sediment Disposal Facility at Sha Chau and to the South of The Brothers

Environmental Certification Sheet EP-312/2008/A & EP-427/2011/A

Reference Document/Plan

Document/ Plan to be Certified / Verified:	Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau and the South of The Brothers – October 2018
Date of Report:	14 November 2018
Date prepared by ET:	14 November 2018
Date received by IA:	14 November 2018

Reference EP Condition

Environmental Permit Condition:

Condition 3.4 of EP-312/2008/A and Condition 4.4 of EP-427/2011/A:

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 noncompliance (exceedances) of the environmental quality performance limits (Action and Limit Levels). The submissions shall be certified by the ET Leader and verified by the Independent Auditor. Additional copies of the submission shall be provided to the Director upon request by the Director.

ET Certification

I hereby certify that the above referenced document/plan complies with the above referenced condition of EP-312/2008/A and EP-427/2011/A

Craig Reid, Environmental Team Leader:

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X	$\sum_{i=1}^{n}$
	2

Date:

Date:

14/11/2018

IA Verification

I hereby verify that the above referenced document/plan complies with the above referenced condition of EP-312/2008/A and EP-427/2011/A Mens Nang

Dr Wang Wen Xiong, Independent Auditor:

14/11/2018

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Agreement No. CE 63/2016 (EP) Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau (2017-2020) - Investigation

MONTHLY EM&A REPORT FOR OCTOBER 2018

1.1 BACKGROUND

- 1.1.1 The Civil Engineering and Development Department (CEDD) is managing a number of marine disposal facilities in Hong Kong waters, including the Contaminated Mud Pits (CMPs) to the South of The Brothers (SB) and to the East of Sha Chau (ESC) for the disposal of contaminated sediment, and opensea disposal grounds located to the South of Cheung Chau (SCC), East of Tung Lung Chau (ETLC) and East of Ninepins (ENP) for the disposal of uncontaminated sediment. Two Environmental Permits (EPs), EP-312/2008/A and EP-427/2011/A, were issued by the Environmental Protection Department (EPD) to the CEDD, the Permit Holder, on 28 November 2008 and 23 December 2011 for the Dredging, Management and Capping of Contaminated Sediment Disposal Facilities at ESC CMP V and SB CMPs, respectively.
- 1.1.2 Under the requirements of the two EPs for ESC CMP V and SB CMPs, EM&A programmes which encompass water and sediment chemistry, fisheries assessment, tissue and whole body analysis, sediment toxicity and benthic recolonisation studies as set out in the EM&A Manuals are required to be implemented. EM&A programmes have been continuously carried out during the operation of the CMPs at ESC and SB. A review of the collection and analysis of such environmental data from the monitoring programme demonstrated that there had not been any adverse environmental impacts resulting from disposal activities ⁽¹⁾ ⁽²⁾. The current programme will assess the impacts resulting from dredging, disposal and capping operations of CMP V as well as capping operations of SB CMPs.
- 1.1.3 The present EM&A programme under *Agreement No. CE 63/2016 (EP)* covers the dredging, disposal and capping operations of the ESC CMP V as well as the capping operations of the SB CMPs (see *Annex A* for the EM&A programme). Detailed works schedule for ESC CMP V and SB CMPs is shown in *Figure 1.1*. In October 2018, the following work was being undertaken:
 - Disposal of contaminated mud at ESC CMP Vd.

(2) ERM (2017) Final Report. Submitted under 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). For CEDD.

ERM (2013) Final Report. Submitted under Agreement No. CE 4/2009 (EP) Environmental Monitoring and Audit for Contaminated Mud Pit at East Sha Chau. For CEDD.

Figure 1.1 Works Schedule for ESC CMP V and SB CMPs

Pit	Operation					20	17	7										20	018	8												20)19)												20)20)						2	20	21	
ΡI	Operation	Α	М	J	J	1	4	s	0	Ν	D	J	F	: 1	M	A	М	J	J	J	A	s	0	Ν	D),	I	=	VI	A	М	J	J	A	۱S	5	О	Ν	D	J	F	: N	Λ.	A	М	J	J	Α	<u>،</u>	5	0	Ν	D	J	F	F	М
	Dredging																																																								
ESC CMP V	Disposal																																																								
	Capping																																																								
	Dredging																																																								
SB CMP 2	Disposal																																																								
	Capping																																																								

1.2 **REPORTING PERIOD**

- 1.2.1 This *Monthly EM&A Report for October 2018* covers the EM&A activities for the reporting month of October 2018.
- 1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES
- 1.3.1 The following monitoring activities were undertaken for ESC CMP V in October 2018:
 - Water Column Profiling of ESC CMP Vd;
 - Routine Water Quality Monitoring of ESC CMPs; and
 - Pit Specific Sediment Chemistry of ESC CMP Vd.
- 1.3.2 No monitoring activities were scheduled to be undertaken for SB CMP in October 2018.
- 1.4 DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS
- 1.4.1 No outstanding sampling remained for October 2018.
- 1.4.2 The following laboratory analyses were still in progress during the preparation of this monthly report and hence is not presented in this monthly report:
 - Laboratory analyses of sediment samples collected for *Pit Specific Sediment Chemistry of ESC CMP Vd* in October 2018.
- 1.5 BRIEF DISCUSSION OF THE MONITORING RESULTS FOR ESC CMP V
- 1.5.1Brief discussion of the monitoring results of the following activities for ESC
CMP V is presented in this *Monthly EM&A Report for October 2018*:
 - Water Column Profiling of ESC CMP Vd in October 2018;
 - *Routine Water Quality Monitoring of ESC CMPs* in October 2018;

- *Pit Specific Sediment Chemistry of ESC CMP Vd* in September 2018; and
- Sediment Chemistry after a Major Storm of ESC CMP V in September 2018.

1.5.2 Water Column Profiling of ESC CMP Vd - October 2018

1.5.3 *Water Column Profiling* was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 3 October 2018. 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 2007 - 2016 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 (Upstream) station 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).

In-situ Measurements

1.5.4 Analyses of results for October 2018 indicated that levels of Salinity and pH complied with the WQOs at both Downstream and Upstream stations and levels of DO were higher than the WQO (*Table B2* of *Annex B*). Levels of DO and Turbidity at all stations complied with the Action and Limit Levels (*Tables B1* and *B2* of *Annex B*).

Laboratory Measurements for Suspended Solids (SS)

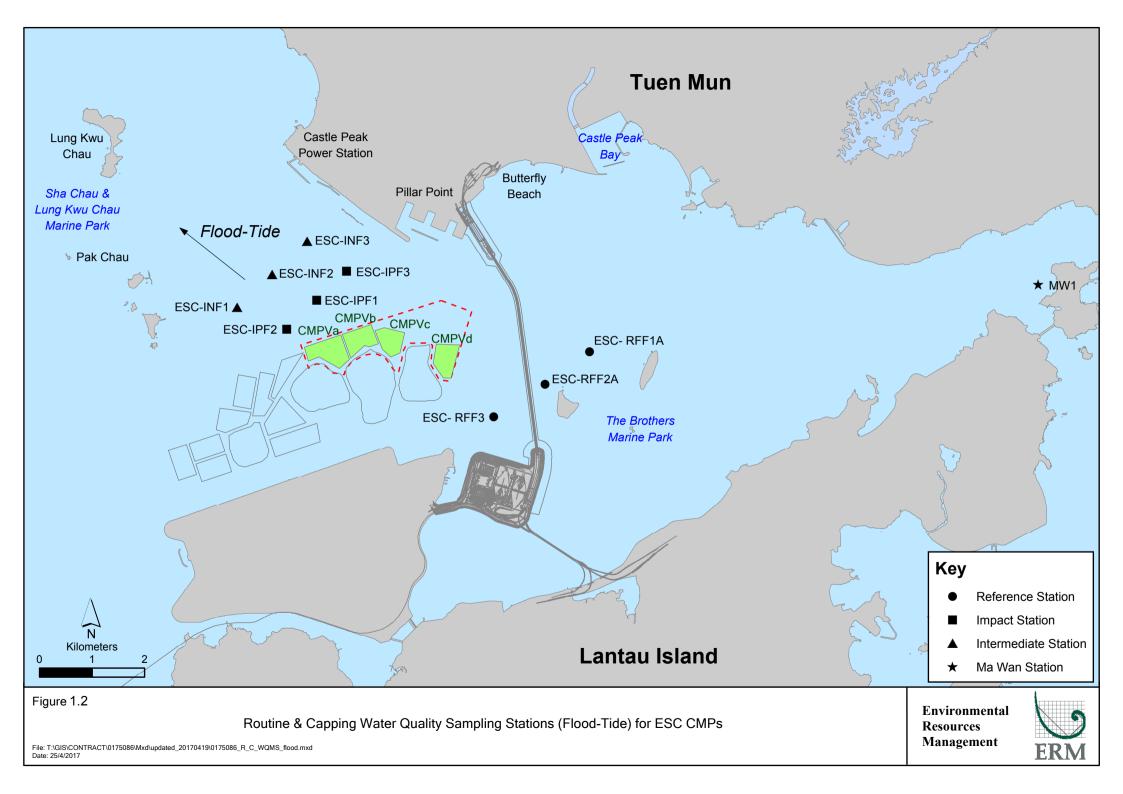
1.5.5 Analyses of results for October 2018 indicated that the SS levels complied with the WQO and the Action and Limit Level at both Downstream and Upstream stations (*Tables B1* and *B2* of *Annex B*).

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.

1.5.6 Routine Water Quality Monitoring of ESC CMP V - October 2018

1.5.7 Routine Water Quality Monitoring of ESC CMP V was undertaken on 2 October
2018. The monitoring results have been assessed for compliance with the
WQOs (see Section 1.5.3 for details). The monitoring results are shown in
Tables B3 and B4 of Annex B and Figures 1 - 10 of Annex C. A total of ten (10)
monitoring stations were sampled in October 2018 as shown in Figure 1.2.

(1) http://epic.epd.gov.hk/EPICRIVER/marine/?lang=en

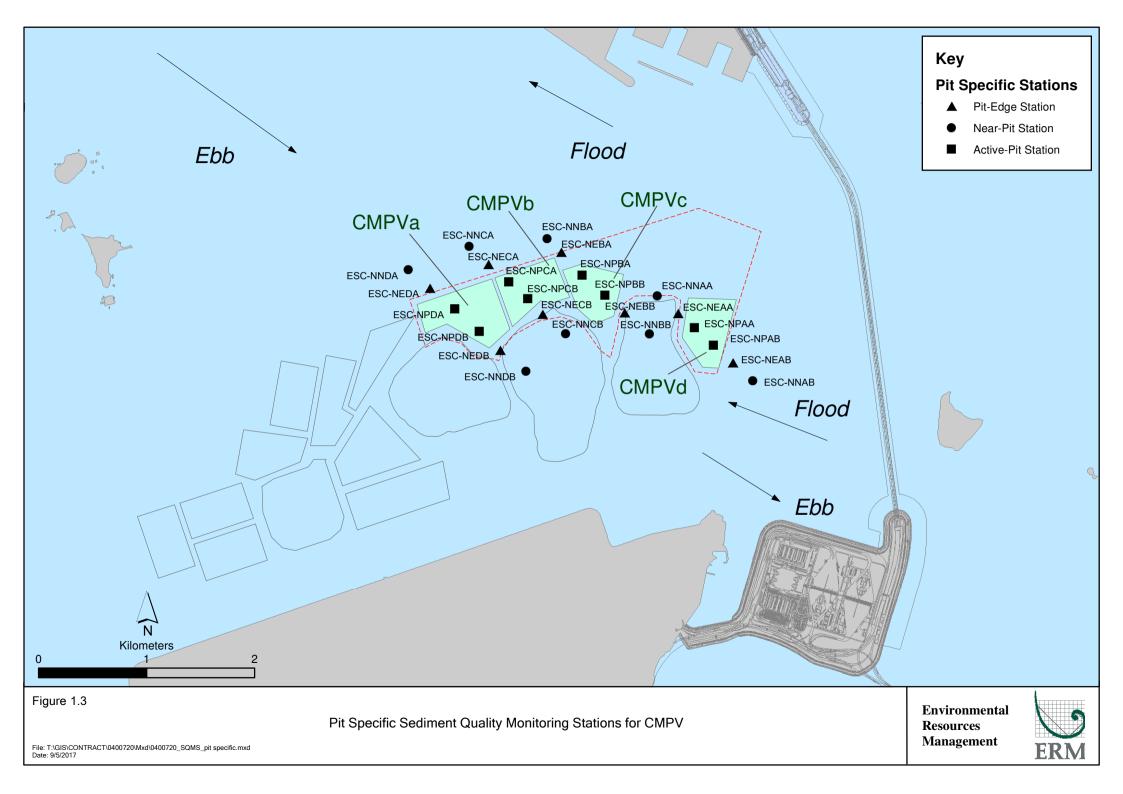


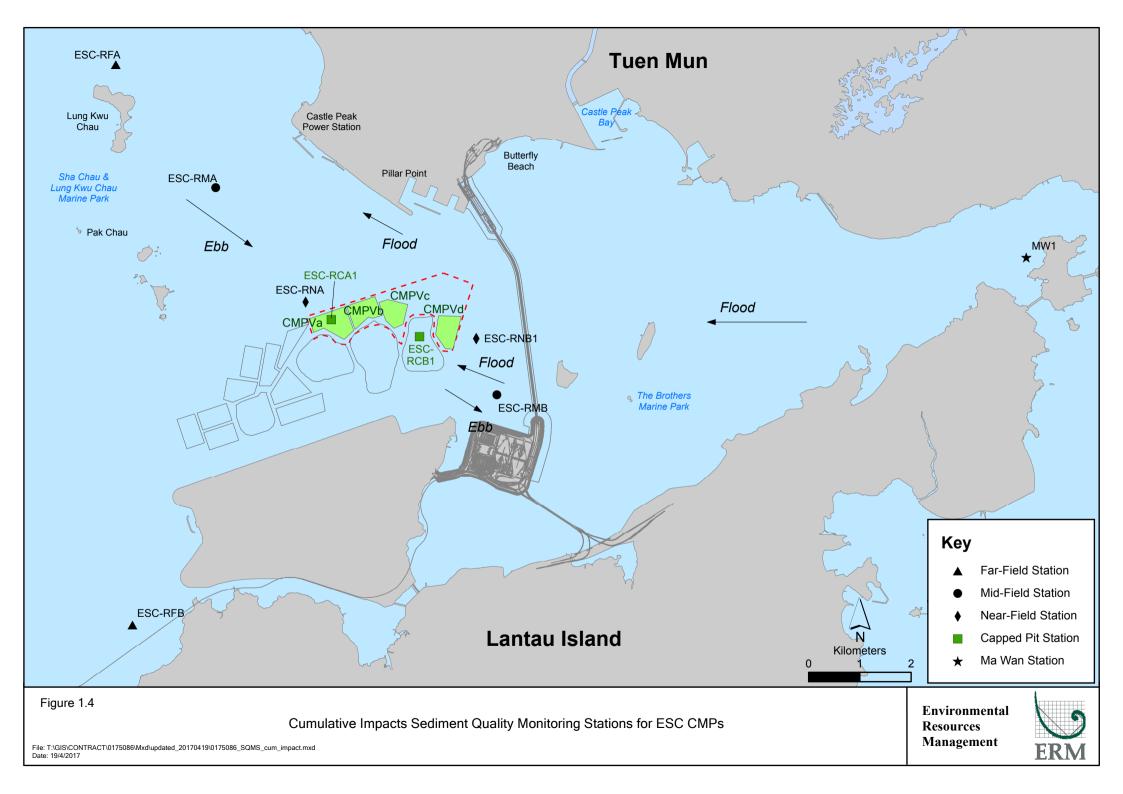
In-situ Measurements

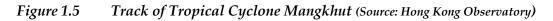
1.5.8	Graphical presentation of the monitoring results (Temperature, DO, pH, Salinity and Turbidity) is shown in <i>Figures 1 - 6</i> of <i>Annex C</i> . Analyses of results for October 2018 indicated that the levels of pH, Salinity and DO complied with the WQOs at all stations (Impact, Intermediate, Reference and Ma Wan stations) in October 2018.
1.5.9	The levels of DO and Turbidity also complied with the Action and Limit Levels at all stations (<i>Table B3</i> of <i>Annex B</i> ; <i>Figures 3</i> and 6 of <i>Annex C</i>).
1.5.10	Overall, <i>in-situ</i> measurement results of the <i>Routine Water Quality Monitoring</i> indicated that the disposal operation at ESC CMP Vd did not appear to cause any unacceptable impacts in water quality in October 2018.
	Laboratory Measurements
1.5.11	Laboratory analysis of October 2018 results indicated that concentrations of Cadmium, Chromium, Silver and Mercury were below their limit of reporting at all stations. Arsenic, Nickel, Lead, Copper and Zinc were detected in October 2018 samples at most stations and the concentrations of these metals and metalloids were similar amongst the stations (<i>Table B4</i> of <i>Annex B; Figure 7</i> of <i>Annex C</i>).
1.5.12	For nutrients, concentrations of Total Inorganic Nitrogen (TIN) at most stations in October 2018 were higher than the WQO, except at Ma Wan station (0.5 mg/L) (<i>Table B4</i> of <i>Annex B; Figure 8</i> of <i>Annex C</i>). It should be noted that due to the effect of the Pearl River, the North Western WCZ has historically experienced higher levels of TIN ⁽¹⁾ . Therefore, the exceedances of TIN WQO at these stations are unlikely to be caused by the disposal operation at ESC CMP Vd. Concentrations of Ammonia Nitrogen (NH ₃ -N) and 5-day Biochemical Oxygen Demand (BOD ₅) were generally similar amongst the stations in October 2018 (<i>Table B4</i> of <i>Annex B; Figure 8 and 9</i> of <i>Annex C</i>).
1.5.13	Analyses of results for October 2018 indicated that the SS levels at most stations were lower than the WQO (10.8 mg/L for wet season), except the exceedance of SS recorded at the Impact stations. However, the SS levels complied with the Action and Limit Levels at all stations (<i>Tables B1 and B4</i> of <i>Annex B; Figure 10</i> of <i>Annex C</i>).
1.5.14	Overall, results of the <i>Routine Water Quality Monitoring</i> indicated that the disposal operation at ESC CMP Vd did not appear to cause any unacceptable deterioration in water quality in October 2018. Detailed statistical analysis will be presented in the Quarterly Report to investigate any spatial and temporal trends of potential concern.

 $(^1) \qquad http://www.epd.gov.hk/epd/misc/marine_quality/1986-2005/textonly/eng/index.htm$

- 1.5.15 *Pit Specific Sediment Chemistry of ESC CMP Vd September* 2018
- 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 on 6 September 2018.
- 1.5.17The concentrations of all inorganic contaminants were lower than the Lower
Chemical Exceedance Level (LCEL) at all stations in September 2018 (*Figures*
11 and 12 of Annex C).
- 1.5.18 For organic contaminants, the concentrations of Total Organic Carbon (TOC) were generally similar in September 2018, except higher concentrations of TOC were recorded at the Active-Pit station ESC-NPAA (*Figure 13* of *Annex C*). The concentration of Tributyltin (TBT) was generally similar amongst stations in September 2018 (*Figure 14* of *Annex C*). Low and High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs), Total Polychlorinated Biphenyls (PCBs), Total dichloro-diphenyl-trichloroethane (DDT) and 4,4'-dichlorodiphenyldichloroethylene (DDE) concentrations were below the limit of reporting at most stations in September 2018, except High Molecular Weight PAHs were detected at Pit-Edge station ESC-NEAA (*Figure 15* of *Annex C*).
- 1.5.19 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 September 2018. Statistical analysis will be undertaken and presented in the corresponding quarterly report to investigate whether there are any unacceptable impacts in the area caused by the contaminated mud disposal.
- 1.5.20 Sediment Chemistry after a Major Storm of ESC CMP V September 2018
- 1.5.21 Sampling for Sediment Chemistry after a Major Storm Event was conducted at nine (9) monitoring stations (*Figure 1.4*) on 20 September 2018 after the visit of tropical cyclone Mangkhut, which led to the issue of No. 10 Hurricane Signal on 16 September 2018. The track of Mangkhut are shown in *Figures 1.5*.









1.5.22	Analyses of results for the <i>Sediment Chemistry after a Major Storm</i> indicated that the concentrations of most inorganic contaminants were below the LCEL, except Arsenic at Capped Pit station ESC-RCB and Mid-field stations ESC-RMA and ESC-RMB in September 2018 (<i>Figures 16</i> and <i>17</i> of <i>Annex C</i>).
1.5.23	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 slight exceedances of LCEL for Arsenic are unlikely to be caused by the disposal of contaminated mud at ESC CMPs but rather as a result of naturally occurring deposits.

1.5.24 Overall, there appeared to be no evidence showing the failure of ESC CMP V in retaining disposed mud or causing contamination of sediments after the major storm event in September 2018.

1.6 ACTIVITIES SCHEDULED FOR THE NEXT MONTH

- 1.6.1 The following monitoring activities will be conducted in the next monthly period of November 2018 for ESC CMP V (see *Annex A* for the sampling schedule):
 - Water Column Profiling of ESC CMP Vd;
 - Routine Water Quality Monitoring of ESC CMPs; and
 - Pit Specific Sediment Chemistry of ESC CMP Vd.
- 1.6.2 No monitoring activities are scheduled to be undertaken in the next monthly period of November 2018 for SB CMPs.
- 1.7 STUDY PROGRAMME
- 1.7.1 A summary of the Study Programme is presented in *Annex D*.

(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

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

Annex A

Sampling Schedule

					2012	7					2018						2019						2	2020				2021
Pit Specific Sediment Chemistry Active-Pit	Code	Frequency	Α	M J			N E	J 1	F M	A M		A S	6 0 N	D	J F M				S O N	D J	F	M A			A S	0 1	N D	
Active-Fit	ESC-NPAA			12 12						12 12						12 1						12 12	12 12					12 12 12
Pit-Edge	ESC-NPAB	Monthly	12	12 12	12 12	12 12	12 12	2 12 1	2 12	12 12	12 1	2 12 1	2 12 12	12 3	2 12 12	12 1	2 12 1	2 12	12 12 12	12 12	12	12 12	12 12	. 12	12 12	2 12 1	2 12 1	12 12 12
	ESC-NEAA ESC-NEAB	Monthly Monthly		12 12 12 12	12 12 12 12					12 12 12 12							2 12 1		12 12 12 12 12 12			12 12 12 12						12 12 12 12 12 12
Near-Pit																												
	ESC-NNAA ESC-NNAB	Monthly Monthly		12 12 12 12			12 12 12 12			12 12 12 12				12 1 12 1		12 1 12 1				12 12 12 12		12 12 12 12	12 12 12 12					12 12 12 12 12 12
Cumulative Impact Sediment Che	mistry		Α	M J	IA	S O	NE		FM	A M	III	A S	6 0 N	D	IFN	AN		A	S O N	DJ	F	M A	M J	TI	A S		N D	I F M
Near-field Stations	ESC-RNA			12	12		1	2 1			12	12		12	12		12	12	_	12	12			É			12	12
	ESC-RNB1	4 times per year 4 times per year		12			12				12	12		12	12		12	12		12	12		12		12 12		12	12
Mid-field Stations	ESC-RMA	4 times per year		12	12		12	2 1	2		12	12		12	12		12	12		12	12		12	2	12		12	12
Capped Pit Stations	ESC-RMB	4 times per year	-	12	12		12	2 1	2		12	12		12	12	++	12	12		12	12		12	-	12		12	12
* *	ESC-RCA1 ESC-RCB1	4 times per year 4 times per year		12			11		2		12 12	12 12		12 12	12		12	12 12		12 12	12 12		12		12 12		12	12
Far-Field Stations																												
	ESC-RFA ESC-RFB	4 times per year 4 times per year		12			11		2		12 12	12 12		12 12	12		12	12 12		12 12	12 12		12		12 12		12	12
Ma Wan Station	MW1	4 times per year	-	12	12		12	2 1	2		12	12		12	12	++	12	12		12	12		12	2	12		12	12
Sediment Toxicity Tests				M J	JA	S O	N E		F M	A M	JJ	A S	6 0 N	D	TEN	AN	A I I	A	S O N	DI	F	M A	M J	J	A S		N D	IFM
Near-Pit Stations			A	IVI J	JA	3 0	IN L			AW))			D		A	vi j j		3 0 N	D J		MA	IVI J					
	ESC-TDA ESC-TDB1	2 times per year 2 times per year			5				5			5			5			5			5 5			\pm	5 5			5
Reference Stations	ESC-TRA	2 times per year			5				5			5		\square	5			5			5			—	5		++	5
Ma Wan Station	ESC-TRB	2 times per year			5							5			5			5			5			1	5			5
ivia wan station	MW1	2 times per year			5				5			5			5			5			5				5			5
Tissue/ Whole Body Sampling			A	M J	J A	S O	N E	J	F M	A M	JJ	A S	6 0 N	D	J F M	A	vi j j	A	S O N	D J	F	M A	M J	J	A S	0 1	N D	J F M
Near-Pit Stations	ESC-INA	2 times per year	\vdash		*		\vdash	<u> </u> ,	-		\vdash	*		+	*		$\pm +$	*			*			+-	*			*
Reference North	ESC-INB	2 times per year			*	\square	F		•		H	*		F	*		++	*			*			\mp	*	\square	\mp	*
	TNA	2 times per year			*						$ \uparrow$	*			*	++		*			*			+	*	++	\mp	*
Reference South	TNB	2 times per year	F		*			,	1			*			*			*			*			士	*			*
	TSA TSB	2 times per year 2 times per year	F	\vdash	*	\vdash	\vdash		•	++	+ -	*	++	ΗŦ	*	$+ \mathbb{F}$	++	*	+F	\vdash	*			+	*	$+ \square$	+	*
Demersal Trawling			A	M J	T A	S O	NE		F M	A 34					IEN		u I I I		S O N		F	M	M	T			ND	IEN
Near Pit Stations			A	171			-14 L			AM						AI			5 0 N			A	141					
	ESC-INA ESC-INB	4 times per year 4 times per year	F		5 5 5 5			5 5			5			┢╋	5 5 5 5		5			5	5 5			5	5 5			5 5 5 5
Reference North	TNA	4 times per year	F	$+ \overline{+}$	5 5	\vdash	$+ \overline{+}$	5 5	5	++	5	5	$+\top$	HT	5 5	$+\top$	5	5 5	$+\mp$	5	5			5	5	$+\mp$	$+\mp$	5 5
Reference Courts	TNB	4 times per year			5 5			5 8			5				5 5		5			5				5	5	+		5 5
Reference South	TSA	4 times per year	F		5 5			5 5			5				5 5		5			5				5	5			5 5
L	TSB	4 times per year			5 5			5 5	>		5	5			5 5		5	5		5	5			5	5			5 5
Capping Ebb Tide			Α	M J	J A	S O	N E) J 1	F M	A M	JJ	A S	O N	D	J F M	AN	M J J	A	S O N	D J	F	M A	M J	J	A S	0 1	N D	J F M
Impact Station Downcurrent	ECC IPPS -	4 timo	F					$\downarrow \downarrow$	+						3			3		3	3		3	+	3	$\downarrow \downarrow$	3	3
	ESC-IPE1A ESC-IPE2A	4 times per year 4 times per year													3		3	3		3	3		3		3		3	3
	ESC-IPE3 ESC-IPE4	4 times per year 4 times per year	-						-					+	3		3	3		3	3		3	_	3 3		3	3
Intermediate Station Downcurrent	ESC-IPE5	4 times per year							_					\square	3		3	3		3	3		3	F	3		3	3
		4 times per year													3		3	3		3	3		3	_	3		3	3
	ESC-INE2A ESC-INE3A	4 times per year 4 times per year													3		3	3		3	3		3		3		3	3
	ESC-INE4A ESC-INE5A	4 times per year 4 times per year							-						3		3	3		3	3		3	_	3		3	3
Reference Station Upcurrent	ESC-RFE1	4 times per year												\square	3		3	3		3	3		3	F	3		3	3
	ESC-RFE2	4 times per year													3		3	3		3	3		3	_	3		3	3
	ESC-RFE3 ESC-RFE4	4 times per year 4 times per year													3		3	3		3 3	3 3		3		3 3		3	3
Ma Wan Station	ESC-RFE5	4 times per year	-				$\left \right $					+		$\left \right $	3	+ +	3	3		3	3		3	+-	3	++	3	3
Flood Tide	MW1	4 times per year												Ц	3		3	3		3	3		3		3		3	3
Impact Station Downcurrent															1.1		1.1	1										
	ESC-IPF1 ESC-IPF2	4 times per year 4 times per year													3		3	3		3	3		3		3		3	3
Intermediate Station Downcurrent	ESC-IPF3	4 times per year	\vdash		+			++	+		++	++	\pm	<u></u> ↓	3	++	3	3		3	3		3	╞	3	++	3	3
	ESC-INF1 ESC-INF2	4 times per year 4 times per year		\square		\square	F	\square	+		F	\square		Ħ	3	\square	3	3		3	3		3	F	3	\square	3	3
	ESC-INF2 ESC-INF3	4 times per year 4 times per year	F					$\downarrow \downarrow$	1					$ \downarrow \rangle$	3		3	3		3	3		3	1	3		3	3
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	ESC-IPE4	8 times per year 8 times per year	8	8	8 8	8	8	8 8	3	8 8	8	8	8 8		8 8	8	8 8	8	8 8	8	8	8	8	8	8	8	8	8 8
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Benthic Recolonisation Studies			Α	Μ	JJ	A	S	0	Ν	D	J	F N	1 A	M	IJ	J	Α	S (1 C	N 1	DJ	F	Μ	Α	M	JJ	J A	S	0	Ν	D	J	F N	A A	. M	J	J	Α	S	O N	D	J	F N
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Impact Monitoring for Dredging			Α	Μ	J	I A	S	C) N	D	J	F	Μ	Α	М	J	J.	A S	6 C) N	D	J	F	Μ	Α	M	J	J A	. S	0	Ν	D	J	F N	í A	Μ	J	J	Α	S	O N	N D	J	F	М
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Notes: The number shown in each cell represents the numbers of replicates per monitoring station Impact Monitoring for Dredging will be scheduled when dredging operations commence. Benthic Recolonisation Studies for CMP V will be scheduled when capping operation for CMP V is completed.

Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (April 2017 - December 2018)

Suppose Matrix Quality Monitoring A M T T N D T T N A N D T T N A N D T T N A N D T T N A N D T T N A N D T T N A N D T T N A N D T T N A N D T T N A N D T T N A N D T T N A N D T T N A N D T T N D D D T T N D T T N D D D D D D D D D D D D D								2017												2018				
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Notes: The number shown in each cell represents the numbers of replicates per monitoring station

Capping works are planned to be conducted between May and December 2017.

Annex B

Water Quality Monitoring Results

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⁾
	, 0	, ,
	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
	2	0 0
	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)
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
× 57	and	and
	120% of control station's Tby at the	130% of control station's Tby at the
	same tide of the same day	same tide of the same day
	calle due of the bulle duy	same due of the same duy

Table B1Action and Limit Levels of Water Quality for Dredging, Disposal and
Capping Activities at ESC CMP V

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 B2Water Column Profiling Results for ESC CMP Vd in October 2018

Stations	Temp	Salinity	Turbidity	Dissolved	l Oxygen	pН	Suspended Solids
Stations	(°C)	(ppt)	(NTU)	(%)	(mg L- 1)		(mg L-1)
WCP 1	27.70	27.57	13.62	75.11	5.07	7.94	8.60
(Downstream) WCP 2	27.66	27.96	8.64	74.47	5.02	7.93	8.23
(Upstream) WQO (Wet Season)	N/A	25.17– 30.76#	N/A	N/A	>4	6.5-8.5	10.8

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.

Table B3In-situ Monitoring Results for Routine Water Quality Monitoring of ESC
CMPs in October 2018

Sampling	Stations	Temp	Salinity	Turbidity	Dissolve	d Oxygen	pН
Period	Stations	(°C)	(ppt)	(NTU)	(%)	(mg L-1)	(mg L-1)
October	RFF (Reference)	27.60	27.16	7.47	79.66	5.40	8.02
2018	IPF (Impact)	27.64	27.00	7.91	80.15	5.43	7.99
	INF (Intermediate)	27.65	26.66	6.80	79.39	5.39	7.95
	Ma Wan	27.47	28.77	5.30	73.52	4.95	7.99
	WOO	N/A	24.45 -	N/A	N/A	>4	6.5-8.5
	WQO	N/A	29.88#	N/A	N/A	~4	0.3-0.3

Notes:

*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.

Table B4Laboratory Results for Routine Water Quality Monitoring of ESC CMPs in
October 2018

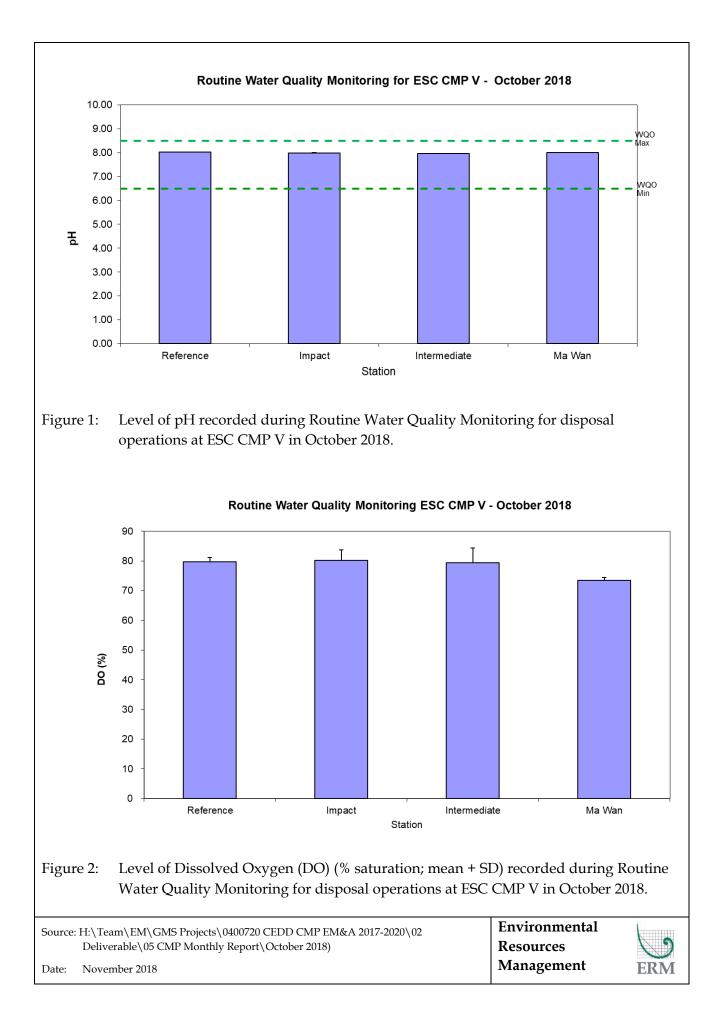
Sampling Period	Stations	As (µg/L)	Cd (µg/L)	Cr (µg/L)	Cu (µg/L)	Pb (µg/L)	Hg (µg/L)	Ni (µg/L)	Ag (µg/L)	Zn (µg/L)	NH3 (mg/L)	TIN (mg/L)	BOD5 (mg/L)	SS (mg/L)	
	222	« U /									-		,		
October	RFE	1.86	< 0.50	<1.0	8.95	1.33	< 0.50	1.32	<1.0	17.25	0.05	0.56	1.37	9.12	
2018	IPE	1.68	< 0.50	<1.0	7.58	1.18	< 0.50	1.73	<1.0	12.39	0.03	0.54	1.10	11.54	
	INE	1.74	< 0.50	<1.0	8.53	2.04	< 0.50	1.73	<1.0	12.90	0.05	0.56	1.57	8.74	
	Ma Wan	1.71	< 0.50	<1.0	6.06	<1.0	< 0.50	1.28	<1.0	17.34	0.07	0.40	1.29	8.23	
				WQO of TIN: 0.5 mg/L											
	Wet Season WQO of SS : 10.8 mg/L														

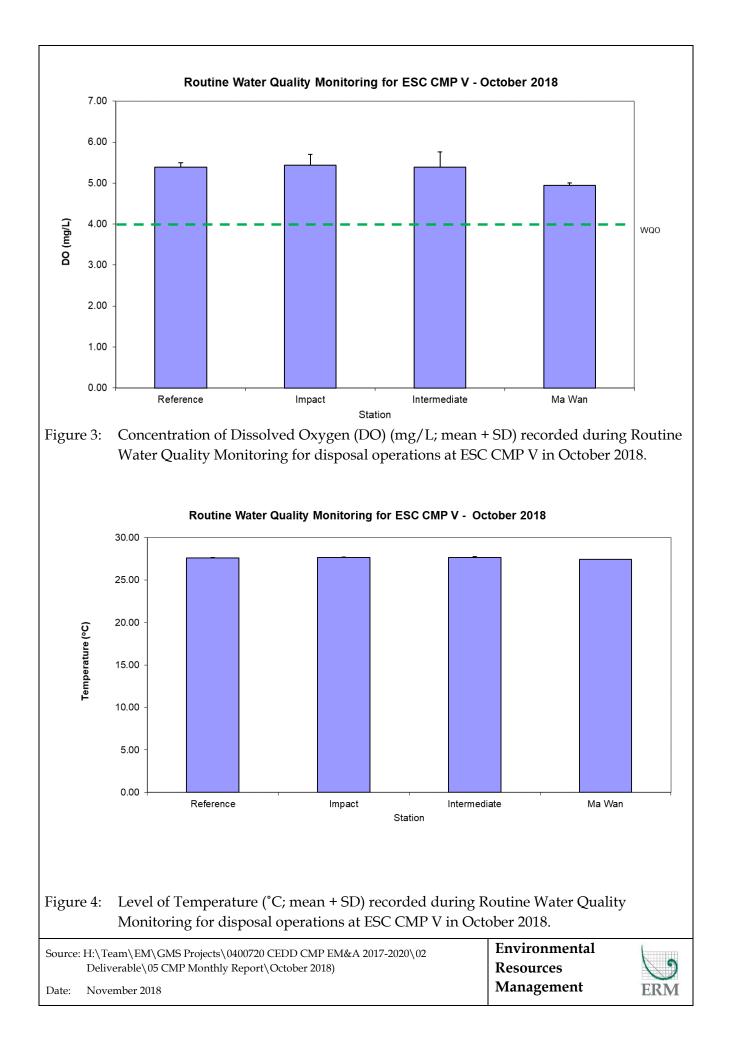
Notes:

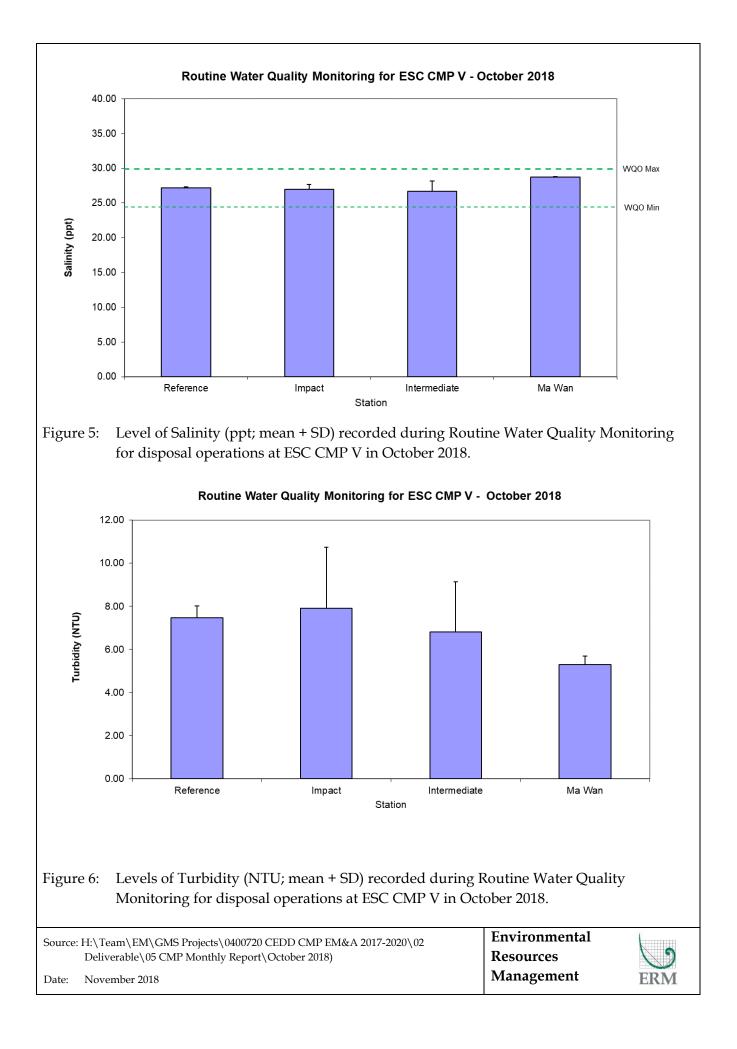
Cell shaded yellow / red indicate value exceeding the Action/Limit levels. Cell shaded grey indicate value exceeding the WQO.

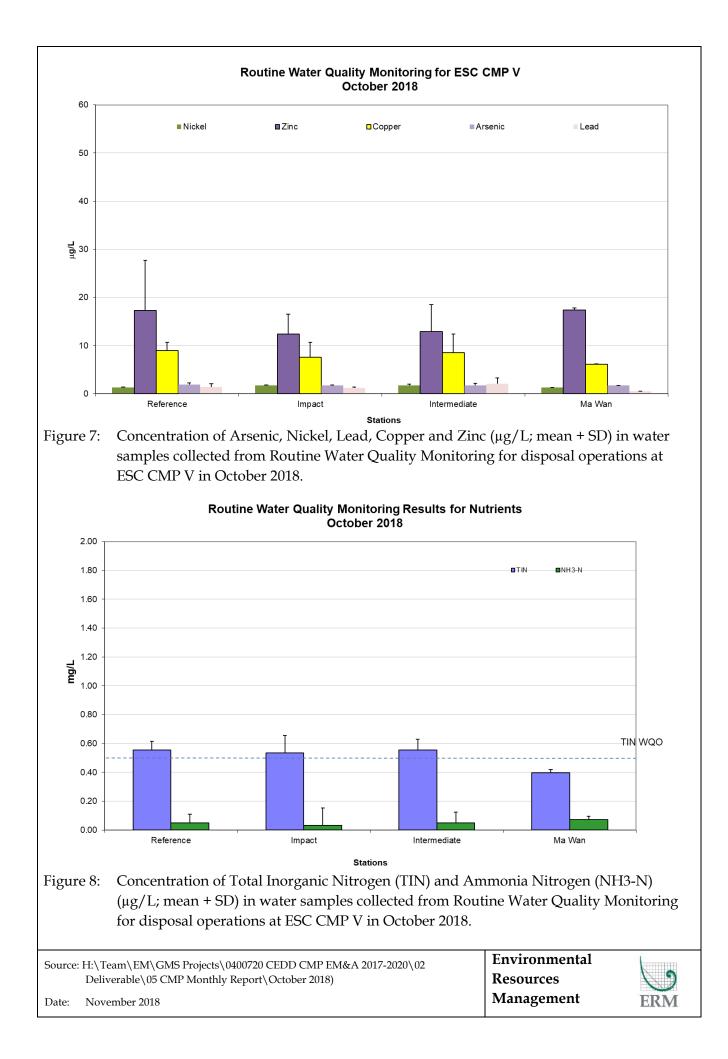
Annex C

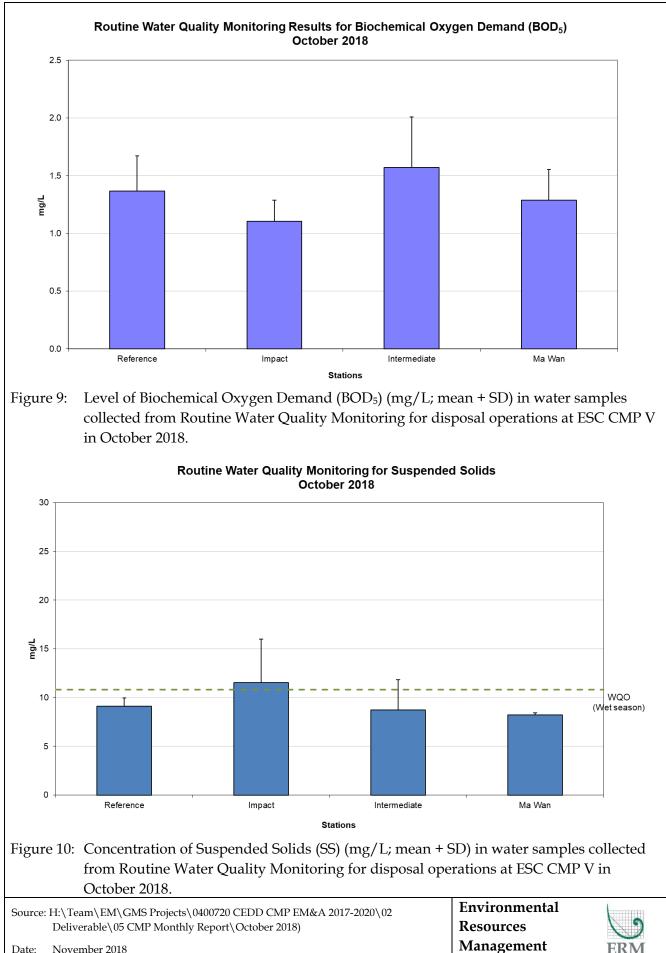
Graphical Presentations





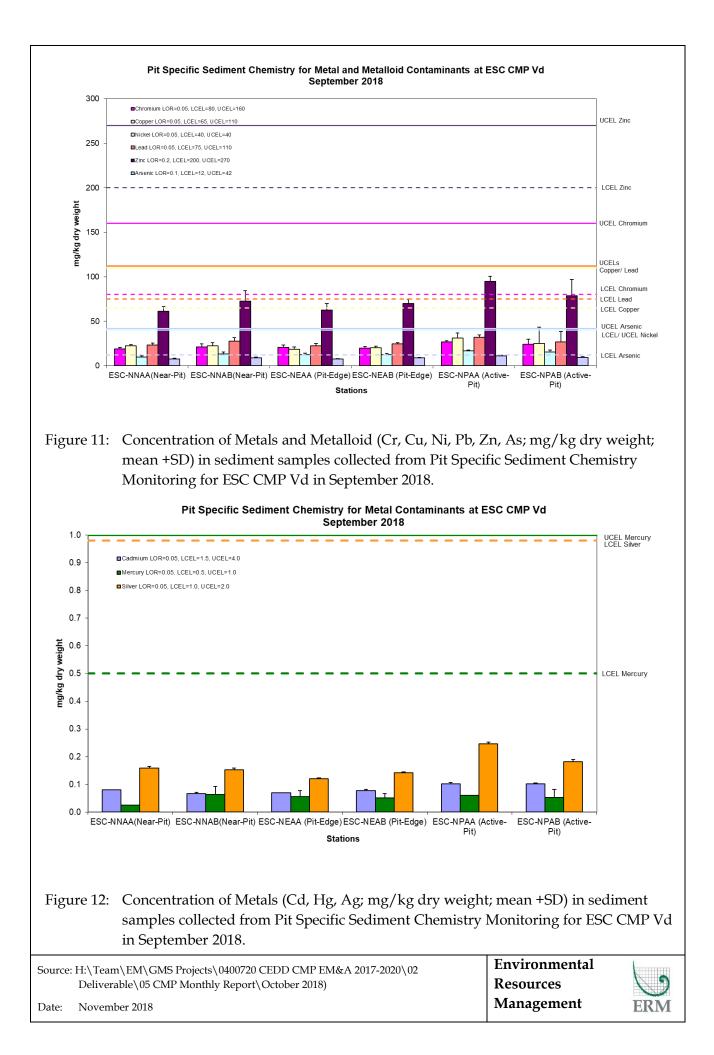


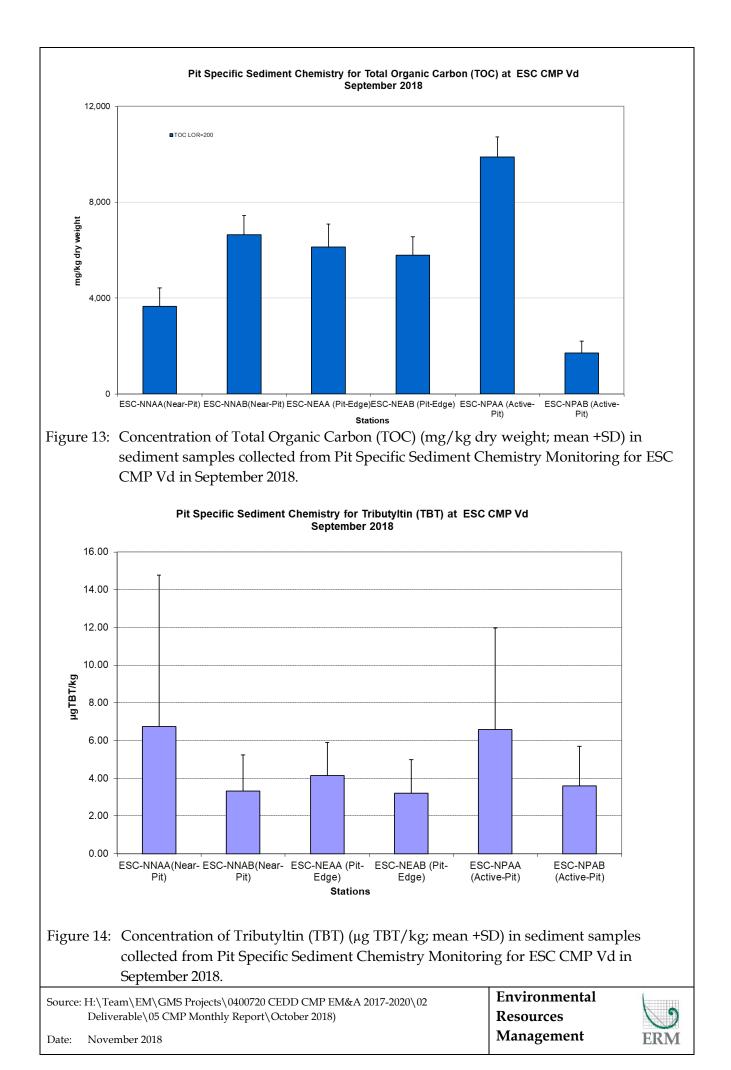


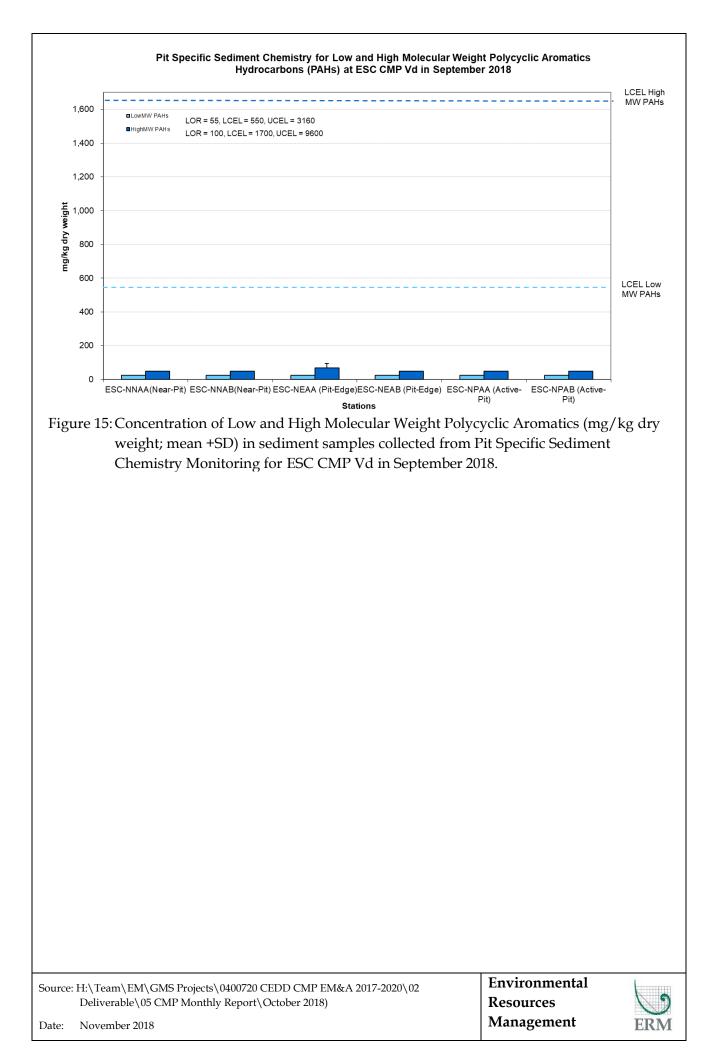


November 2018 Date:

ERM







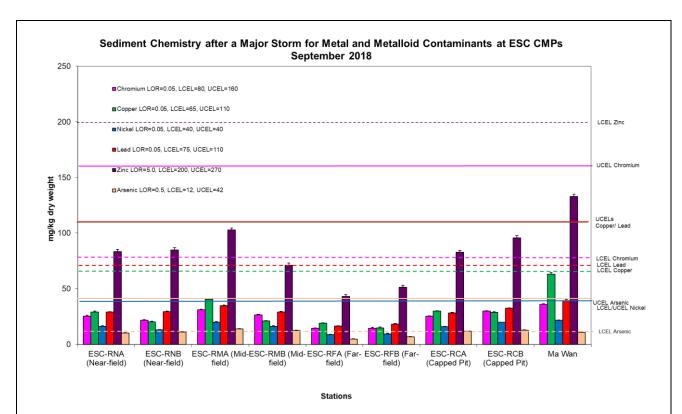


Figure 16: Concentration of Metals (Cr, Cu, Ni, Pb, Zn, As; mean +SD) in sediment samples collected from Sediment Chemistry after a Major Storm for ESC CMPs in September 2018.

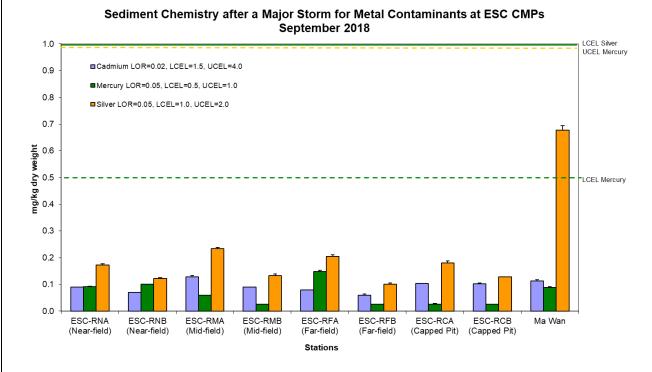


Figure 17: Concentration of Metals (Cd, Hg, Ag; mean +SD) in sediment samples collected from Sediment Chemistry after a Major Storm for ESC CMPs in September 2018.

Source	: H:\Team\EM\GMS Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\October 2018)	Environmental Resources	6
Date:	November 2018	Management	ERM

Annex D

Study Programme

Task Name	Start	Finish		201	7				201	8	olula			201	9				20	20				20	21	SONI	<u> </u>
Commencement of Agreement No. CE 63/2016 (EP)	Sat 1/4/17	Sat 1/4/17			JAS		JJF	MA	MJJ	IAS	ONL	JF	MAR	MJ.	JAS	ON	DJ	- MA	MJ	JAS	<u> 50 N</u>	DJ		(MJ	JAS	<u>30NI</u>	DJI
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	Nov 0/4/47	Mar 5/4/04																		Ш			Ш			\square	
Project Management and General Deliverables	Mon 3/4/17	Mon 5/4/21																									
																			+++								
For the disposal facilities to the East of Sha Chau (ESC) (between 2017 and 2021)	Sat 1/4/17	Fri 1/10/21	i 🐳															÷	+	+	┿	₩	╞┿╤	╪╤╤		↓ †	
and the South of The Brothers (SB) (between 2017 and 2018)																											
Draft Report on Review of EM&A Manual	Tue 2/5/17	Tue 2/5/17		2/5																\square							
Final Report on Review of EM&A Manual	Tue 23/5/17	Tue 23/5/17	$\left \cdot \right $	23	3/5										++			++	++	\vdash	++		┝┼┼╴	+++	++	+++	
																				Ш			Ш				
Regular Review of EM&A Manual	Wed 2/5/18	Sat 2/5/20												`					Ŷ								
Regular Site Inspections of CMP Contractors	Sat 1/4/17	Wed 31/3/21																									
Participate in Linian Occur Masting / Occur Mating as a serviced by OFDD	Sat 1/4/17	Wed 31/3/21																		Ш				+++		+++	
Participate in Liaison Group Meetings/ Consultations as required by CEDD	3dt 1/4/17	Weu 31/3/21										Ī															
Submission of Monthly EM&A Report	Sun 14/5/17	Sun 14/3/21		>�	00		> <		$\diamond \diamond$	$\diamond \diamond$	00	> (>		>0	00	\diamond	\diamond		$\diamond \diamond$		> 0	×	$\Diamond \Diamond$				
Submission of Quarterly EM&A Report	Fri 14/7/17	Wed 14/4/21	$\left \right $		>	\diamond				>	\diamond		\diamond		>	\diamond			<u>_</u>	\diamond	\diamond			<u></u>		+++	
Submission of Quarterly Emark Report						Ň					~		ľ			Ť.				Ň	Ň						
Submission of Annual EM&A Report	Sun 14/1/18	Thu 14/1/21					\diamond					\diamond					\diamond										
Submission of Annual Risk Assessment Report	Thu 14/6/18	Mon 14/6/21							\diamond					\diamond				++-	\diamond		++-		H		++	+++	
	Eri 00/7/04	Eri 02/7/01																	<u> </u>	\square	++		\square	+++	◆_23		\rightarrow
Submission of Draft Final Report (including database of all data collected)	Fri 23/7/21	Fri 23/7/21																								"	
Submission of Final Report (including database of all data collected) Fri 27/8/21 Fri 27/8/21 V V V V V V V V V V V V V V V V V V V																											
Submission of Draft Executive Summary	Fri 27/8/21	Fri 27/8/21	$\left \cdot \right $			$\left \right $		$\left \right $					+ +	++	++			++-	++-	\vdash	++-	$\left - \right $	┝┼┼┾	+++		27/8	
Submission of Dran Excedure Summary																											
Submission of Final Executive Summary	Fri 1/10/21	Fri 1/10/21																								1/1	0
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For East Tung Lung Chau Disposal Facility (subject to the actual disposal	Sun 14/10/18	Fri 14/12/18	$\left \right $										$\left \right $	+	++			++	++-	\vdash	++	$\left - \right $	H	+++	++	+++	+
programme to be confirmed by CEDD)																											
Submission of Monthly EM&A Report	Sun 14/10/18	Fri 14/12/18									000	>							+++	H							
Ocharization of Oceandratic ENIXA Descent	Fri 14/12/18	Fri 14/12/18										h14/	12					++	<u> </u>	\square	\parallel	<u> </u>	\square	+++		\square	
Submission of Quarterly EM&A Report	FII 14/12/10	FII 14/12/10											12														
Submission of Annual EM&A Report	ubmission of Annual EM&A Report Fri 14/12/18 Fri 14/12/18 V V V V V V V V V V V V V V V V V V V																										
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Study Programme Task Milestone	•	5	Summa	ary						•	Rolled	Up	/ilesto	one ·	\diamond												
Tue 13/6/17	•			.,						• •		- 4 -			~												
Agreement No. CE 63/2016 (EP) Environmenta	al Monitoring a	nd Audit for Di	spos	al Fa	acilit	y to t	he E	ast o	of Sha	a Cha	au (2	017-:	2020) - In	vest	igati	on	04	10072	.0_CN	/IP EN	i&A F	rogra	.mme_	_v1_E	M&A.r	mpp