



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 – April 2020

**Revision 0** 

May 2020

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#### Environmental Resources Management

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Client:		Project N	0:		
Civil Eng	gineering and Development Department (CEDD)	040072	0		
Summary		Date:			
-		14 May	2020		
		Approved	by:		
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		Craig A Partner	. Reid		
v0	Monthly EM&A Report for ESC CMPs	GS	RC	CAR	14/05/20
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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 Ind taking account of the resources devoted to it by agreement with the client.	Distributio	on ernal		5 18001:2007 No. OHS 515956
We disclaim the scope o	any responsibility to the client and others in respect of any matters outside f the above.	🛛 Put	olic		
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.	Coi	nfidential	ISO 9 Certificat	001 : 2008 e No. FS 32515







# Dredging, Management and Capping of Contaminated Sediment Disposal Facility at Sha Chau

# **Environmental Certification Sheet** EP-312/2008/A

#### **Reference Document/Plan**

Document/ <del>Plan</del> to be Certified / Verified:	Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – April 2020
Date of Report:	14 May 2020
Date prepared by ET:	14 May 2020
Date received by IA:	14 May 2020

#### **Reference EP Condition**

**Environmental Permit Condition:** 

#### Condition 3.4 of EP-312/2008/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

Craig Reid, Environmental Team Leader:



14/05/2020 Date:

#### **IA Verification**

I hereby verify that the above referenced document/plan complies with the above referenced condition of EP-312/2008/A News M

Dr Wang Wen Xiong, Independent Auditor: 14/05/2020

Date:

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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 APRIL 2020

#### 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 <sup>(1)</sup> <sup>(2)</sup>. 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). The scheduled EM&A programme for SB CMPs was completed in December 2018. Detailed works schedule for ESC CMP V is shown in *Figure 1.1*. In April 2020, the following works were undertaken:
  - Disposal of contaminated mud at ESC CMP Vb; and
  - Capping operations at ESC CMP Vd.

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.

<sup>(2)</sup> 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.

# *Figure 1.1* Works Schedule for ESC CMP V

Dit	Oneration					20	17										20	18	1										20	19								_	_		202	0						20	21	Ī
Pit	Operation	Α	N	J	J	A	S	5	0	N	D	J	F	Μ	A	м	J	J	Α	s	0	Ν	D	J	F	М	Α	м	J	J	Α	s	ο	Ν	D	J	F	М	Α	М	J	J	4	s	D	N	э.	J	FI	N
	Dredging																																																	٦
ESC CMP V	Disposal																																																	
	Capping																																																	

#### 1.2 **REPORTING PERIOD**

- 1.2.1 This *Monthly EM&A Report for April 2020* covers the EM&A activities for the reporting month of April 2020.
- **1.3** DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES
- 1.3.1 The following monitoring activities were undertaken for ESC CMP V in April 2020:
  - Water Column Profiling of ESC CMP Vb;
  - Routine Water Quality Monitoring of ESC CMPs; and
  - Pit Specific Sediment Chemistry of ESC CMP Vb.
- 1.4 DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS
- 1.4.1 No outstanding sampling remained for April 2020.
- 1.5 BRIEF DISCUSSION OF THE MONITORING RESULTS FOR ESC CMP V
- 1.5.1 Brief discussion of the monitoring results of the following activities for ESC CMP V is presented in this *Monthly EM&A Report for April* 2020:
  - Water Column Profiling of ESC CMP Vb;
  - Routine Water Quality Monitoring of ESC CMPs; and
  - *Pit Specific Sediment Chemistry of ESC CMP Vb.*

## 1.5.2 Water Column Profiling of ESC CMP Vb – April 2020

1.5.3 *Water Column Profiling* was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 3 April 2020. 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 2009 - 2018 from stations in the Northwestern Water Control Zone (WCZ), where the ESC CMPs are located <sup>(1)</sup>. 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 April 2020 indicated that levels of Salinity, pH and DO complied with the WQOs at both Downstream and Upstream stations (*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*).

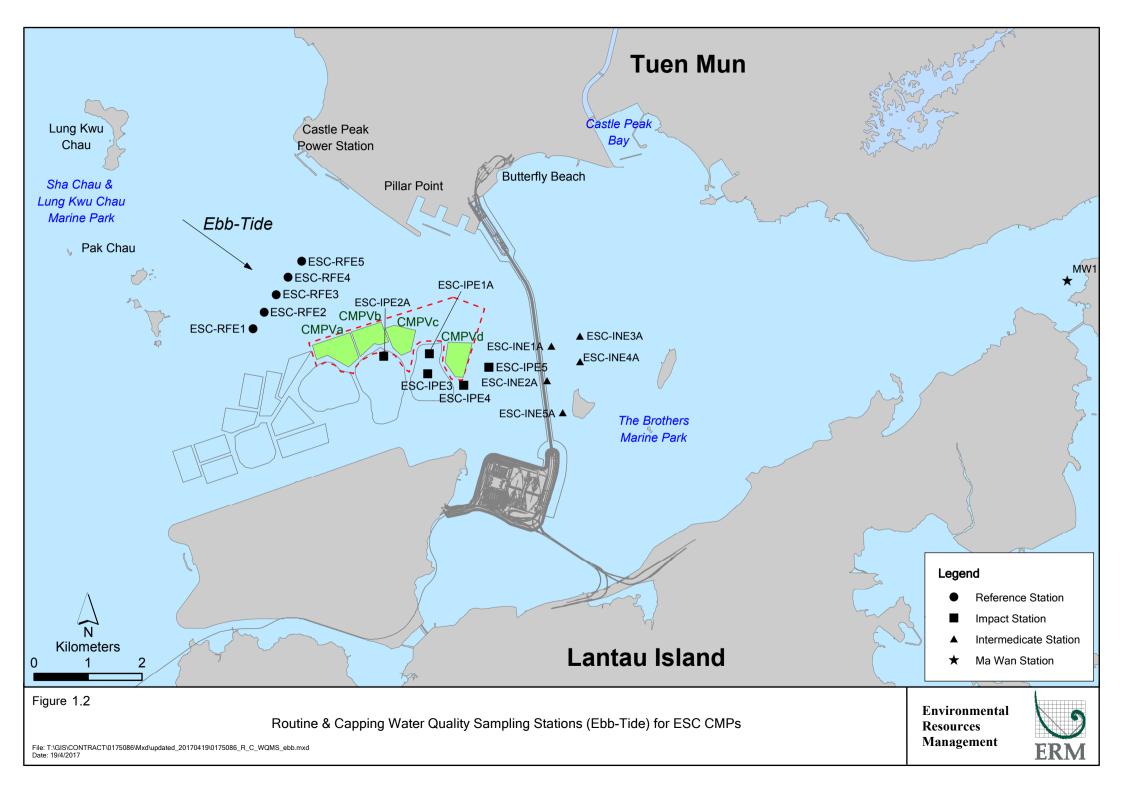
## Laboratory Measurements for Suspended Solids (SS)

- 1.5.5 Analyses of results April 2020 indicated that the SS levels at both Downstream and Upstream stations complied with the WQO and the Action and Limit Levels (*Tables B1* and *B2* of *Annex B*).
- 1.5.6 Overall, the monitoring results indicated that the mud disposal operation at ESC CMP Vb did not appear to cause any deterioration in water quality during this reporting period.

## 1.5.7 Routine Water Quality Monitoring of ESC CMPs – April 2020

1.5.8 Routine Water Quality Monitoring of ESC CMPs was undertaken on 8 April
2020. 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 sixteen
(16) monitoring stations were sampled in April 2020 as shown in Figure 1.2.

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



In-situ Measurements

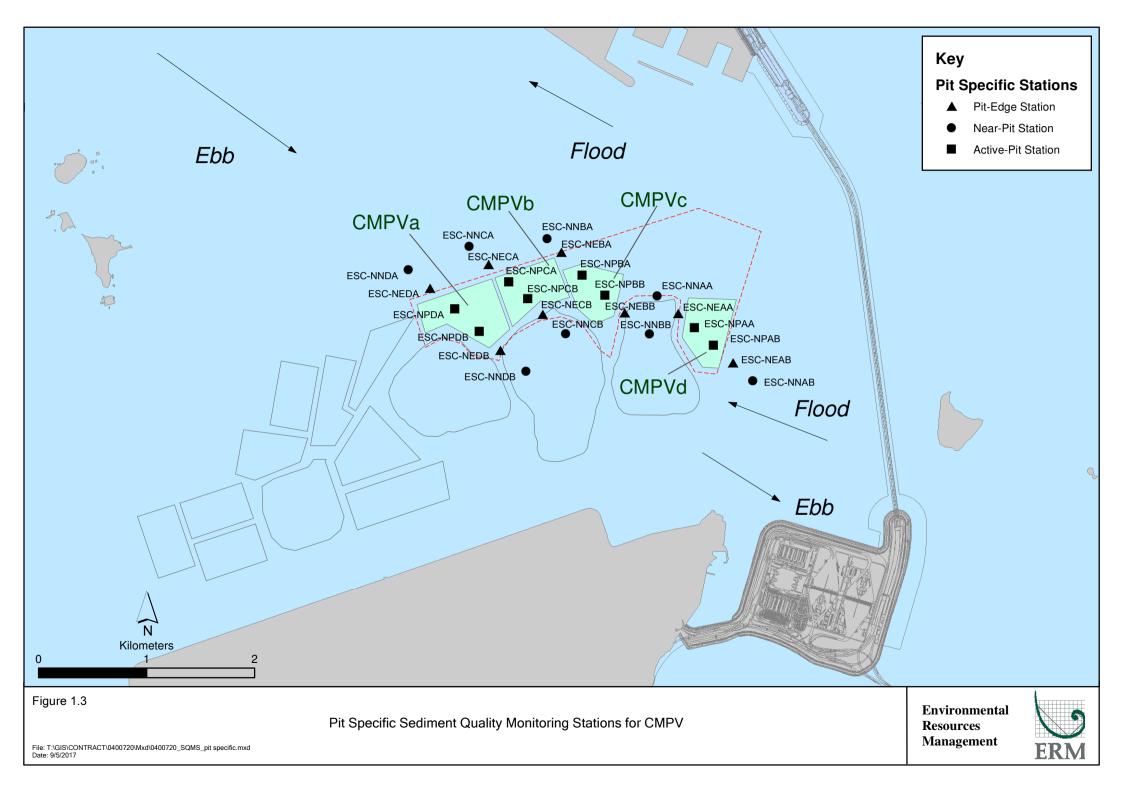
- 1.5.9 Graphical presentation of the monitoring results (Temperature, DO, pH, Salinity and Turbidity) is shown in *Figures 1 - 6* of *Annex C*. Analyses of results for April 2020 indicated that the levels of pH, Salinity and DO complied with the WQOs at most stations in April 2020, except the Salinity in Ma Wan was higher than WQO. The higher Salinities recorded at Ma Wan station are likely to be caused by the larger separation distance to Pearl River mouth, which release a large amount of freshwater runoff in the area during wet season, when compared to the Reference stations.
- 1.5.10 The levels of DO and Turbidity complied with the Action and Limit Levels at most stations, except the levels of Turbidity were higher than Action level at Impact stations (*Table B3* of *Annex B*; *Figures 3* and *6* of *Annex C*). Upon further investigation, it is noticed that capping activities at ESC CMP Vd were conducted during the time of sampling on 8 April 2020 and thus the higher levels of Turbidity recorded at Impact stations could be related to the capping operation. Considering that the action level exceedance of Turbidity occurred within Impact stations only but not at the Intermediate and Ma Wan stations, there is no evidence indicating any unacceptable environmental impacts to nearby water sensitive receivers as a result of the mud disposal operations at ESC CMPs in April 2020.

#### Laboratory Measurements

- 1.5.11 Laboratory analysis of April 2020 results indicated that concentrations of Arsenic, Chromium, Copper, Mercury, Lead, Nickel and Zinc were detected in April 2020 samples at most stations and the concentrations of these metals and metalloids were similar amongst the stations, except the concentrations of Zinc and Copper were higher at Ma Wan station and Reference stations, respectively (*Table B4* of *Annex B; Figure 7* of *Annex C*).
- 1.5.12 For nutrients, concentrations of Total Inorganic Nitrogen (TIN) at Reference, Impact and Intermediate stations were higher than the WQO (0.5 mg/L) (*Table B4* of *Annex B; Figure 8* of *Annex C*). It should be noted that due to the effect of the Pearl River, the North Western WCZ has historically experienced higher levels of TIN <sup>(1)</sup>. Therefore, the exceedances of TIN WQO at these stations are unlikely to be caused by the disposal operation at ESC CMPs. The concentrations of Ammonia Nitrogen (NH<sub>3</sub>-N) were similar across the stations and the concentrations of 5-day Biochemical Oxygen Demand (BOD<sub>5</sub>) were highest at Impact stations in April 2020 (*Table B4* of *Annex B; Figure 8 and 9* of *Annex C*).

- 1.5.13 Analyses of results for April 2020 indicated that the SS levels at most stations complied with the Action and Limit Levels, except the SS levels at Impact stations exceeded the Action level (*Tables B1 and B4* of *Annex B*; *Figure 10* of *Annex C*). As discussed in *Section 1.5.10* above, capping activities at ESC CMP Vd were conducted during the time of sampling on 8 April 2020 and the higher levels of SS recorded at Impact stations could be related to the capping operation. The action level exceedance was recorded for Impact stations only but not at the Intermediate and Ma Wan stations, thus there is no evidence indicating any unacceptable environmental impacts to nearby water sensitive receivers as a result of the mud disposal operations at ESC CMPs in April 2020.
- 1.5.14 Overall, results of the Routine Water Quality Monitoring indicated that the disposal operation at ESC CMPs did not appear to cause any unacceptable deterioration in water quality in April 2020. Detailed statistical analysis will be presented in the Quarterly Report to investigate any spatial and temporal trends of potential concern.
- 1.5.15 *Pit Specific Sediment Chemistry of ESC CMP Vb April 2020*
- 1.5.16 Monitoring locations for *Pit Specific Sediment Chemistry for ESC CMP Vb* are shown in *Figure 1.3.* A total of six (6) monitoring stations were sampled on 2 April 2020.
- 1.5.17 The concentrations of most inorganic contaminants were lower than the Lower Chemical Exceedance Levels (LCELs) at most stations, except for Arsenic and Copper (*Figures 11 and 12* of *Annex C*). The concentrations of Arsenic were higher than the LCEL at Pit-Edge stations ESC-NECA & ESC-NECB, while the concentrations of Copper were higher than the Upper Chemical Exceedance Level (UCEL) at Active-Pit station ESC-NPCB.
- 1.5.18 For organic contaminants, the concentrations of Total Organic Carbon (TOC) were higher at Active-Pit stations in April 2020 (*Figure 13 of Annex C*). The concentrations of Low Molecular Weight and High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) were lower than the LCELs at most stations except at Active-Pit station ESC-NPCB where concentrations of Low Molecular Weight and High Molecular Weight PAHs were higher than LCELs (*Figure 14 of Annex C*). Total Polychlorinated Biphenyls (PCBs) was below the limit of reporting at most stations except at Active-Pit station ESC-NPCB (*Figure 15 of Annex C*). The concentrations of Tributyltin (TBT), Total dichloro-diphenyl-trichloroethane (DDT) and 4,4'-dichlorodiphenyldichloroethylene (DDE) were below the limit of reporting at all stations in April 2020.

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 <sup>(1)</sup>. It is presumed that the natural concentrations of Arsenic are similar in onshore and offshore sediments <sup>(2)</sup>, 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 Vb but rather as a result of naturally occurring deposits.

- 1.5.19 Considering that the higher levels of Copper, Low Molecular Weight and High Molecular Weight PAHs occurred within Active-Pit station ESC-NPCB only but not at the Pit-Edge and Near-Pit stations, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at ESC CMP Vb in April 2020.
- 1.5.20 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.

#### 1.6 ACTIVITIES SCHEDULED FOR THE NEXT MONTH

- 1.6.1 The following monitoring activities will be conducted in the next monthly period of May 2020 for ESC CMP V (see *Annex A* for the sampling schedule <sup>(3)</sup>):
  - Water Column Profiling of ESC CMP Vb;
  - Routine Water Quality Monitoring of ESC CMPs; and
  - Pit Specific Sediment Chemistry of ESC CMP Vb.

#### 1.7 STUDY PROGRAMME

1.7.1 A summary of the Study Programme is presented in *Annex D*.

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

<sup>(2)</sup> 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

<sup>(3)</sup> The scheduled EM&A Programme for SB CMPs was completed in December 2018.

Annex A

Sampling Schedule

		-				2017							20		0							2019								020					2021	
Pit Specific Sediment Chemistry Active-Pit	Code ESC-NPAA	Frequency Monthly		M 12		J A 12 12		0 N			F M A			J A 12 12						A A 2 12		J J 12 12		5 O				M A M 12 12 12				5 O		D J	F 2 12	
Pit-Edge	ESC-NPAB ESC-NEAA	Monthly	12	12		12 12 12 12		12 1 12 1			12 12 1 12 12 1																	12 12 12 12 12 12					12		2 12 2 12	
Near-Pit	ESC-NEAB	Monthly	12	12	12	12 12	12	12 1	2 12	12	12 12 1	2 12	12	12 12	12	12 12	12	12	12 12	2 12	12	12 12	2 12	12 12	12 12	2 12	12	12 12 12	12	12	12	12 12	12	12 12	2 12	12
	ESC-NNAA ESC-NNAB			12 12		12 12 12 12		12 1 12 1			12 12 1 12 12 1																	12         12         12           12         12         12         12	12 12				12 12		2 12 2 12	
Cumulative Impact Sediment Cher Near-field Stations			A	М				0 1				A M		J A	S	0 N				A A	М			S O				M A M	J	J		S O			F	
Mid-field Stations	ESC-RNA 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		11		12 12		12 12		12 12			12	12	
	ESC-RMA ESC-RMB	4 times per year 4 times per year			12 12	12 12			12		12 12		12 12	12 12			12 12		12 12			12 12	12 12		11		12 12		12 12		12 12			12 12	12 12	
Capped Pit Stations	ESC-RCA1 ESC-RCB1	4 times per year 4 times per year			12 12	12			12		12 12	-	12 12	12 12			12 12		12 12			12 12	12 12	-	11		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 12	12			12		12		12 12	12 12			12 12		12			12 12	12 12		11		12 12		12 12		12 12			12 12	12 12	
Ma Wan Station	MW1	4 times per year			12	12			12		12		12	12			12		12			12	12		11		12		12		12			12	12	
Sediment Toxicity Tests Near-Pit Stations			A	М	J	J A	S	0 1	I D	J	F M A	A M	IJ	J A	S	0 N	D	J	F M	A A	M	JJ	A	S O	N E	J	F	M A M	J	J	Α	S O	N	D J	F	Μ
Reference Stations	ESC-TDA ESC-TDB1	2 times per year 2 times per year				5 5					5			5					5 5				5 5				5 5				5 5				5 5	
	ESC-TRA ESC-TRB	2 times per year 2 times per year				5 5					5			5					5 5				5 5				5 5				5 5				5 5	
Ma Wan Station	MW1	2 times per year				5					5			5		_			5				5				5				5				5	
Tissue/ Whole Body Sampling Near-Pit Stations	ESC-INA	2 times per year	A	M	J	J A *	S	O N	1 D	J	F M A	A M	IJ	J A	S	O N	D	J	F M	A A	М	JJ	*	s o	N E	) J	F *	M A M	J	J	*	s o	N	D J	*	M
Reference North	ESC-INB	2 times per year				*					*			*					*				*				*				*				*	
Reference South	TNA TNB	2 times per year 2 times per year				*					*			*					*				*				*				*				*	
	TSA TSB	2 times per year 2 times per year	$\vdash$			*					*			*					*				*			+	*				*		+		*	
Demersal Trawling Near Pit Stations	ECC DV:	4 tim	A	М		J A	S	0 1	1 D			A M	IJ	J A	S	0 N	D			A A	М			S O	N E			M A M	J			S O	N			Μ
Reference North	ESC-INA ESC-INB	4 times per year 4 times per year				5 5 5	E		+	5 5		+		5 5 5 5				5	5			5	5	+		5	5		E	5	5				5	
Reference South	TNA TNB	4 times per year 4 times per year				5 5 5 5				5	5			5 5 5 5					5			5		_		5	5			5	5			5		
	TSA TSB	4 times per year 4 times per year				5 5 5 5				5 5	5 5			5 5 5 5					5 5			5				5 5				5 5				5 5		
Capping Ebb Tide			Α	М	J	J A	S	0 1	I D	J	F M A	A M	J	J A	s	O N	D	J	F M	A A	М	JJ	A	s o	N E	J	F	M A M	J	J	Α	S 0	N	D J	F	Μ
Impact Station Downcurrent	ESC-IPE1A ESC-IPE2A	4 times per year 4 times per year																	_								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	
Intermediate Station Downcurrent	ESC-IPE5 ESC-INE1A	4 times per year 4 times per year																									3		3		3			3	3	
		4 times per year 4 times per year 4 times per year																	_								3		3		3 3 3			3 3 3	3 3 3	
Reference Station Upcurrent	ESC-INE5A	4 times per year																	-					-			3		3		3			3	3	
	ESC-RFE1 ESC-RFE2 ESC-RFE3	4 times per year 4 times per year 4 times per year																									3 3 3		3 3 3		3 3 3			3 3 3	3 3 3	
Ma Wan Station	ESC-RFE4 ESC-RFE5	4 times per year 4 times per year																									3		3		3		-	3 3	3	
Flood Tide	MW1	4 times per year								-																-	3		3		3			3	3	_
Impact Station Downcurrent	ESC-IPF1 ESC-IPF2	4 times per year 4 times per year							-			-	-								_						3		3		3 3		-	3 3	3	
Intermediate Station Downcurrent	ESC-IPF3 ESC-INF1	4 times per year 4 times per year																									3		3		3			3	3	
	ESC-INF2 ESC-INF3	4 times per year 4 times per year																	-					-			3		3		3			3	3	
Reference Station Upcurrent	ESC-RFF1A ESC-RFF2A	4 times per year 4 times per year																									3		3 3		3 3			3 3	3	
Ma Wan Station	ESC-RFF3 MW1	4 times per year 4 times per year								-														_		-	3		3		3			3	3	
Routine Water Quality Monitoring	ŝ	• •	A	М	J	J A	S	0 1	1 D	J	F M A	A M	IJ	J A	s	0 N	D	J	F M	A A	М	JJ	A	s o	N E	J	F	M A M	J	J	Α	s o	N	D J	F	М
Ebb Tide Impact Station Downcurrent	ESC-IPE1A	8 times per year	8	8		8 8		8 8	;	8	8 8	8 8		8 8		8 8		8	8	8	8	8	8	8	8	8	8	8 8		8	8	8	8	8	8	
	ESC-IPE2A ESC-IPE3 ESC-IPE4	8 times per year 8 times per year 8 times per year	8 8 8	8 8 8		8 8 8 8 8 8		8 8 8 8 8 8	;	8 8 8	8 8	8 8 8 8 8 8		8 8 8 8 8 8		8 8 8 8 8 8		8	8 8 8	8 8 8	8	8	8	8 8 8	8	8	8 8 8	8 8 8 8 8 8	-	8 8 8	8	8 8 8	8	8 8 8	8	
Intermediate Station Downcurrent	ESC-IPE5	8 times per year	8	8		8 8		8 8	;	8	8 8	8 8		8 8		8 8		8	8	8	8	8	8	8	8	8	8	8 8		8	8	8	8	8	8	
	ESC-INE1A ESC-INE2A ESC-INE3A	8 times per year 8 times per year 8 times per year	8	8		8 8 8 8 8 8		8 8 8 8 8 8	;	8 8 8	8 8 8 8	8 8 8 8 8 8		8 8 8 8 8 8		8 8 8 8 8 8		8 8	8 8 8	8 8 8	8 8	8	8 8	8	8 8	8 8	8 8 8	8 8 8 8 8 8		8 8 8	8	8	8 8	8	8	
Reference Station Upcurrent	ESC-INE4A ESC-INE5A	8 times per year 8 times per year	8	8		8 8 8 8	Ħ	8 8		8		8 8		8 8 8 8		8 8 8 8			8	8		8		8			8	8 8 8 8		8			8	8		
•	ESC-RFE1 ESC-RFE2 ESC-RFE3	8 times per year 8 times per year 8 times per year	8 8 8	8 8 8		8 8 8 8 8 8		8 8 8 8 8 8	;	8 8 8	8 8	8 8 8 8 8 8		8 8 8 8 8 8		8 8 8 8 8 8		8	8 8 8	8 8 8	8	8	8	8	8	8	8 8 8	8 8 8 8 8 8		8 8 8	8	8		8 8 8	8	
	ESC-RFE3 ESC-RFE4 ESC-RFE5	8 times per year 8 times per year 8 times per year	8 8 8	8 8 8		8 8 8 8 8 8		8 8 8 8 8 8	;	8 8 8	8 8	8 8 8 8 8 8		8 8 8 8 8 8		8 8 8 8 8 8		8	8 8	8	8	8	8	8	8		8	8 8 8 8 8 8		8 8 8			8	8	8	
Ma Wan Station Flood Tide	MW1	8 times per year	8	8		8 8	H	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	8	8	8	$\exists$
Impact Station Downcurrent	ESC-IPF1 ESC-IPF2	8 times per year 8 times per year	8	8		8 8 8 8	П	8 8		-		8 8		8 8 8 8		8 8 8 8			8	8	8	8	8	8		8	8	88		8	8	8	8	8		
Intermediate Station Downcurrent	ESC-IPF3	8 times per year 8 times per year	8	8		8 8		8 8	;		5	8 8		8 8		8 8		8	8	8	8	8	8	8	8	8	8	8 8		8	8	8	8	8	8	
	ESC-INF1 ESC-INF2 ESC-INF3	8 times per year 8 times per year 8 times per year	8 8 8	8 8 8		8 8 8 8 8 8		8 8 8 8 8 8	;	$\vdash$	8	8 8 8 8 8 8		8 8 8 8 8 8		8 8 8 8 8 8		8	8 8 8	8 8 8	8	8 8 8	8	8 8 8	8	8	8 8 8	8 8 8 8 8 8		8 8 8	8	8 8 8	8	8 8 8	8	
Reference Station Upcurrent	ESC-RFF1A	8 times per year	8	8		8 8		8 8	;	F	8	8 8	_	8 8		8 8		8	8	8	8	8	8	8	8	8	8	8 8		8	8	8	8	8	8	
Ma Wan Station	ESC-RFF2A ESC-RFF3	8 times per year 8 times per year	8	8		8 8 8 8		8 8		E	٤	8 8		8 8 8 8		8 8 8		8	8	8	8	8	8	8	8	8	8	8 8		8		8	8	8	8	
Water Column Profiling	MW1	8 times per year	8 A			8 8 J A	S	8 8 0 N	I D	I	1 1 1	8 8 A M		8 8 J A		8 8 0 N	D		8 F M	8 4 A		J J	1	8 5 0		8 ) J		8 8 M A M	I	8 J	8 A	8 5 0	1.1	8 D J		М
Plume Stations	WCP1 WCP2	Monthly 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	4	4 4	4 4	4	4	M         A         M           4         4         4         4           4         4         4         4	4	4	4	4 4	4	4 4	4	4
Benthic Recolonisation Studies Capped Stations at CMPV			Α	М	J	J A	S	0 1	I D	J	F M A	A M	IJ	J A	S	O N	D	J	F M	A A	М	JJ	A	S O	N E	) J	F	M A M	J	J	A	S O	N	D J	F	Μ
	ESCV-CPB	2 times per year 2 times per year 2 times per year			+	+	E		1	E		+				+	Ħ		+	$\square$			Ħ	+	Ħ	F					Ħ		Ħ	$\mp$	₽	
Reference Stations	ESCV-CPD	2 times per year					Ħ		+	F		+					Ħ		+				$\downarrow$	+		F								╞	╞	
	RBA RBB RBC1	2 times per year 2 times per year 2 times per year	H			+	H		+	╞		+				_	+		+				+	+	+	+					$\vdash$		+	+	$\downarrow$	
Impact Monitoring for Dredging			Α	М	J	J A	S	0 1	1 D	J	F M A	A M	IJ	J A	S	0 N	D	J	F M	A A	М	JJ	A	S O	N E	J	F	M A M	J	J	A	S O	N	D J	F	Μ
Upstream Stations	US1 US2	3 times per week 3 times per week	H			2 2 2 2			1	F									+						2 2 2 2				L							
Downstream Stations			1		T		1	1		1			1			T	1 1	-	T			1		T		1	1		1	1	. —	T	1	Т	1-1	

	US1	3 times per week	2	2											2	2						
	US2	3 times per week	2	2	2										2	2			-			
Downstream Stations																						
	DS1	3 times per week	2	2	2										2	2						
	DS2	3 times per week	2	2	2										2	2						
	DS3	3 times per week	2	2	2										2	2			-			
	DS4	3 times per week	2		2										2	2						
	DS5	3 times per week	2		2										2	2						
Ma Wan Station																						
	MW1	3 times per week	2		2										2	2						
Notes:																						_

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 B

Water Quality Monitoring Results

Parameter	Action Level	Limit Level
Dissolved Oxygen (DO) (1)	Surface and Mid-depth <sup>(2)</sup>	Surface and Mid-depth <sup>(2)</sup>
	5%-ile of baseline data for surface and	1%-ile of baseline data for surface and
	middle layer = <b>3.76 mg</b> L <sup>-1</sup>	middle layer = <b>3.11 mg L-1</b> <sup>(3)</sup>
	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 = <b>2.96 mg L</b> <sup>-1</sup>	readings are <b>&lt;2 mg/L</b> <sup>-1</sup>
	, ,	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 <sup>-1</sup>
	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
	2	2
Depth-averaged Turbidity (Tby) <sup>(4) (5)</sup>	95%-ile of baseline data = 28.14 NTU	99%-ile of baseline data = <b>38.32 NTU</b>
	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

# Table B1Action and Limit Levels of Water Quality for Dredging, Disposal and<br/>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<sup>-1</sup>, it is proposed to set the Limit Level at 3.11 mg L<sup>-1</sup> 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.

Stations	Temp	Salinity	Turbidity	Dissolved	l Oxygen	рН	Suspended Solids
	(°C)	(ppt)	(NTU)	(%)	(mg L-1)		(mg L-1)
WCP 1 (Downstream)	21.56	30.09	5.09	84.33	6.24	8.13	9.78
WCP 2 (Upstream)	21.52	30.19	7.05	85.46	6.32	8.10	7.43
WQO (Wet Season)	N/A	27.17-33.21#	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<br/>CMPs in April 2020

Sampling	Stations	Temp	Salinity	Turbidity	Dissolve	d Oxygen	pН
Period	Stations	(°C)	(ppt)	(NTU)	(%)	(mg L-1)	(mg L-1)
April	RFE (Reference)	21.06	26.08	18.57	83.24	6.36	7.96
2020	IPE (Impact)	21.09	25.81	35.17	85.21	6.52	8.01
	INE (Intermediate)	21.09	26.56	27.45	85.99	6.55	8.03
	Ma Wan	21.08	29.62	7.44	83.95	6.28	8.06
	WQO	N/A	23.47-28.69#	N/A	N/A	>4	6.5-8.5

#### 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 higher than the WQO.

Upon further investigation, it is noticed that capping activities at ESC CMP Vd were conducted during the time of sampling on 8 April 2020 and thus the higher levels of Turbidity recorded at Impact stations could be related to the capping operation. Considering that the action level exceedance of Turbidity occurred within Impact stations only but not at the Intermediate and Ma Wan stations, there is no evidence indicating any unacceptable environmental impacts to nearby water sensitive receivers as a result of the mud disposal operations at ESC CMPs in April 2020.

# Table B4Laboratory Results for Routine Water Quality Monitoring of ESC CMPs in<br/>April 2020

Sampling	Statio	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	NH <sub>3</sub>	TIN	BOD <sub>5</sub>	SS
Period	ns	(µg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)								
April	RFE	2.43	<0.5	1.53	16.62	0.70	0.25	1.83	<1	11.63	0.17	0.91	0.26	22.64
2020	IPE	2.22	< 0.5	1.60	2.90	1.68	0.47	1.83	<1	15.42	0.17	0.85	0.72	43.02
	INE	2.36	< 0.5	1.62	7.54	1.16	0.30	1.93	<1	16.81	0.17	0.70	0.35	26.60
	Ma Wan	2.11	<0.5	2.20	2.34	3.54	0.39	0.93	<1	28.35	0.18	0.43	0.29	9.63
												WQO of	TIN: 0.5	5 mg/L

Wet Season WQO of SS : 10.8 mg/L

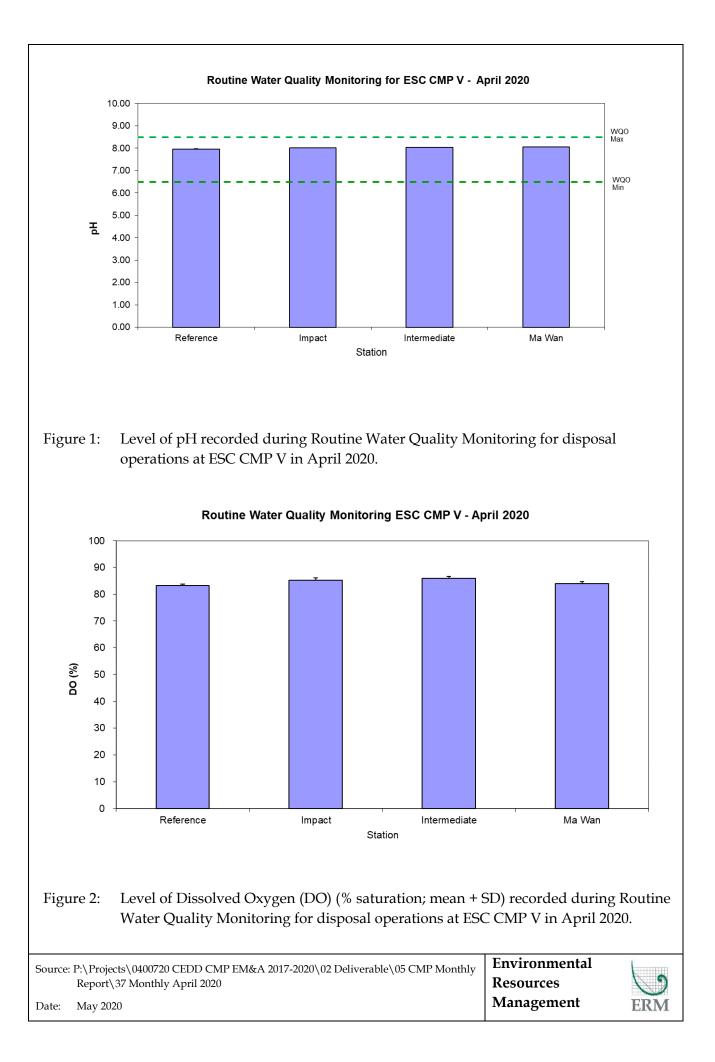
#### Notes:

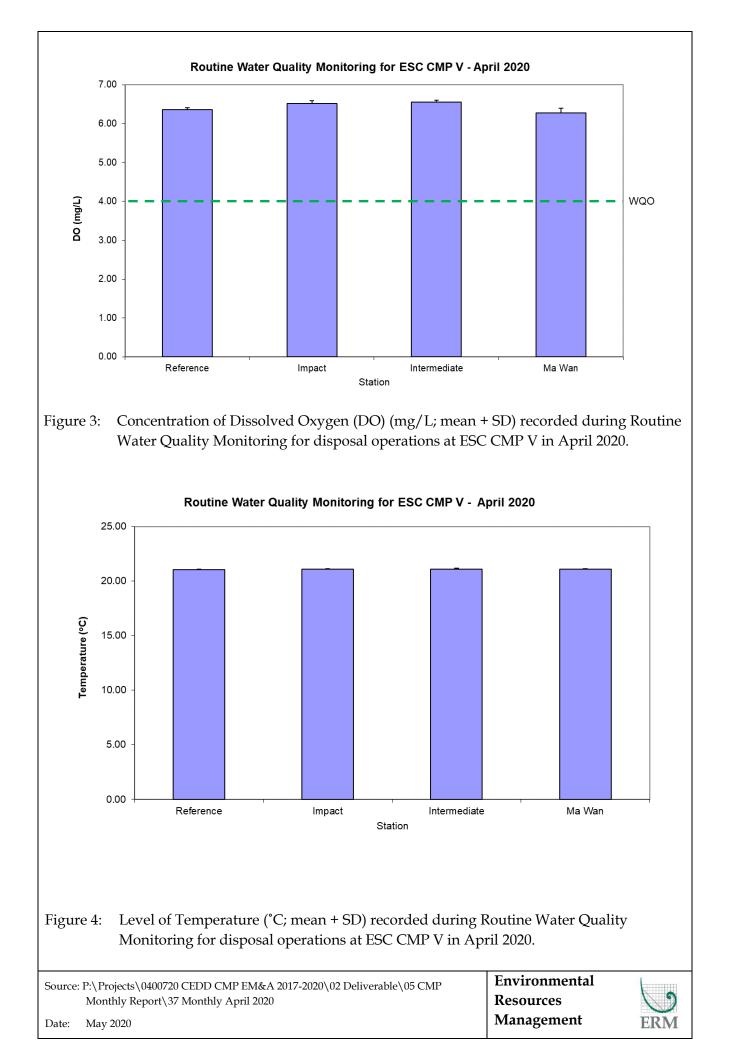
Cell shaded yellow / red indicate value exceeding the Action/Limit levels.

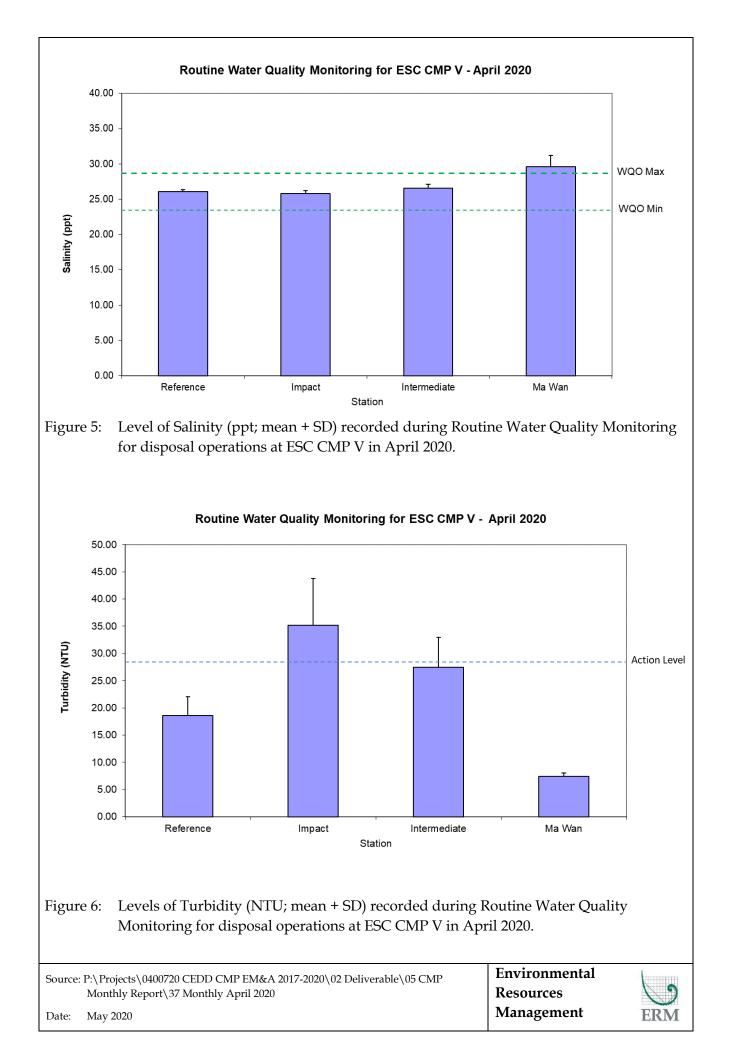
Cell shaded grey indicate value higher than the WQO.

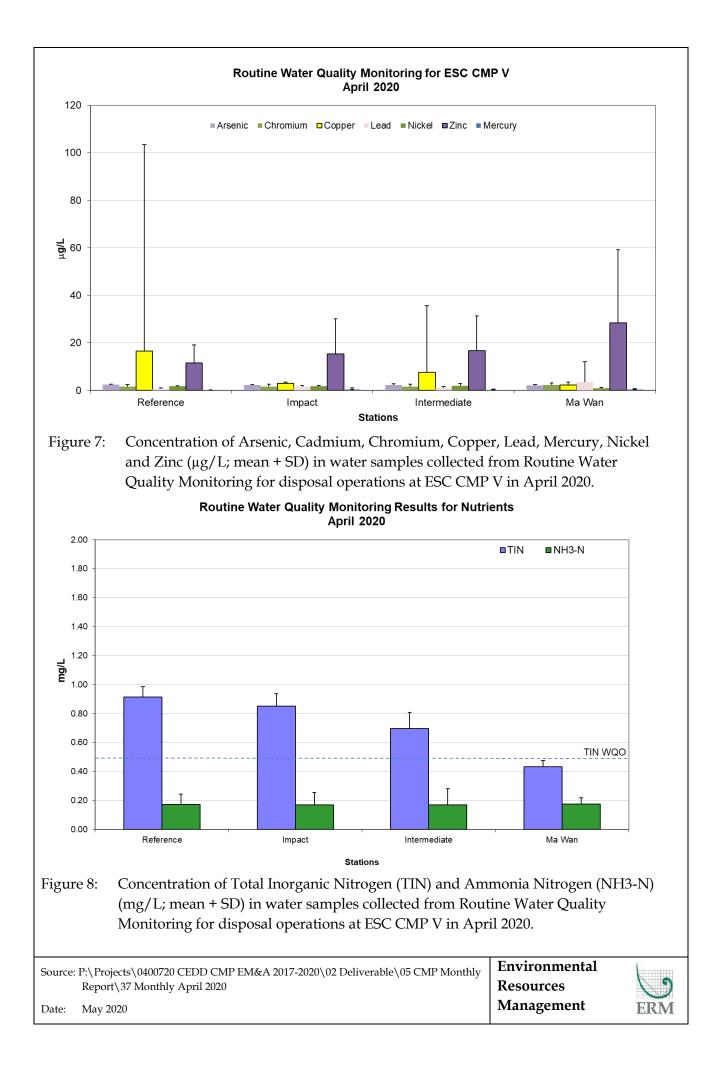
Upon further investigation, it is noticed that capping activities at ESC CMP Vd were conducted during the time of sampling on 8 April 2020 and thus the higher levels of Suspended Solids recorded at Impact stations could be related to the capping operation. Considering that the action level exceedance of Suspended Solids occurred within Impact stations only but not at the Intermediate and Ma Wan stations, there is no evidence indicating any unacceptable environmental impacts to nearby water sensitive receivers as a result of the mud disposal operations at ESC CMPs in April 2020. Annex C

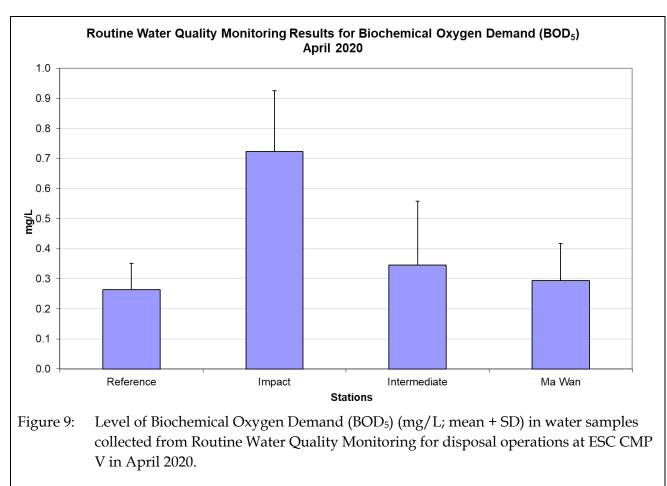
**Graphical Presentations** 

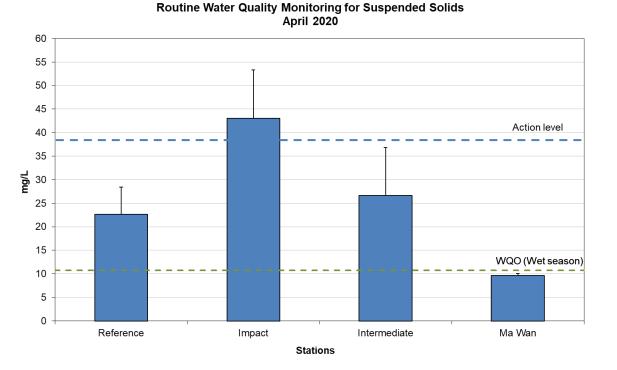












# Figure 10: Concentration of Suspended Solids (SS) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in April 2020.

Source	: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly	Environmental	
	Report\37 Monthly April 2020	Resources	$\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{$
Date:	May 2020	Management	ERM

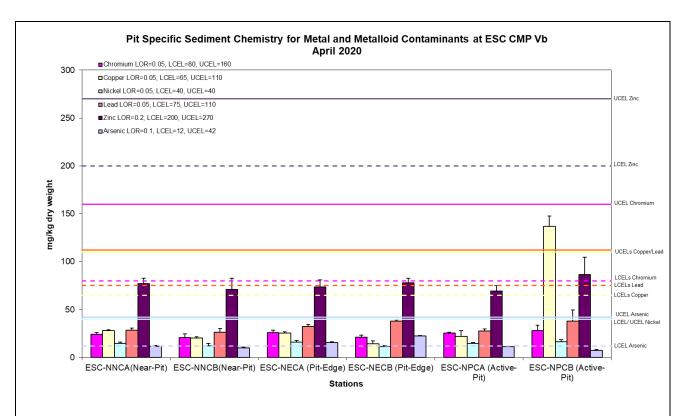
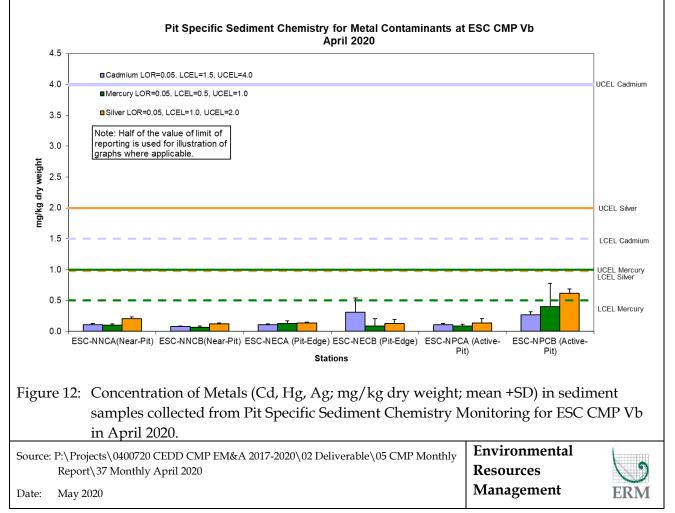
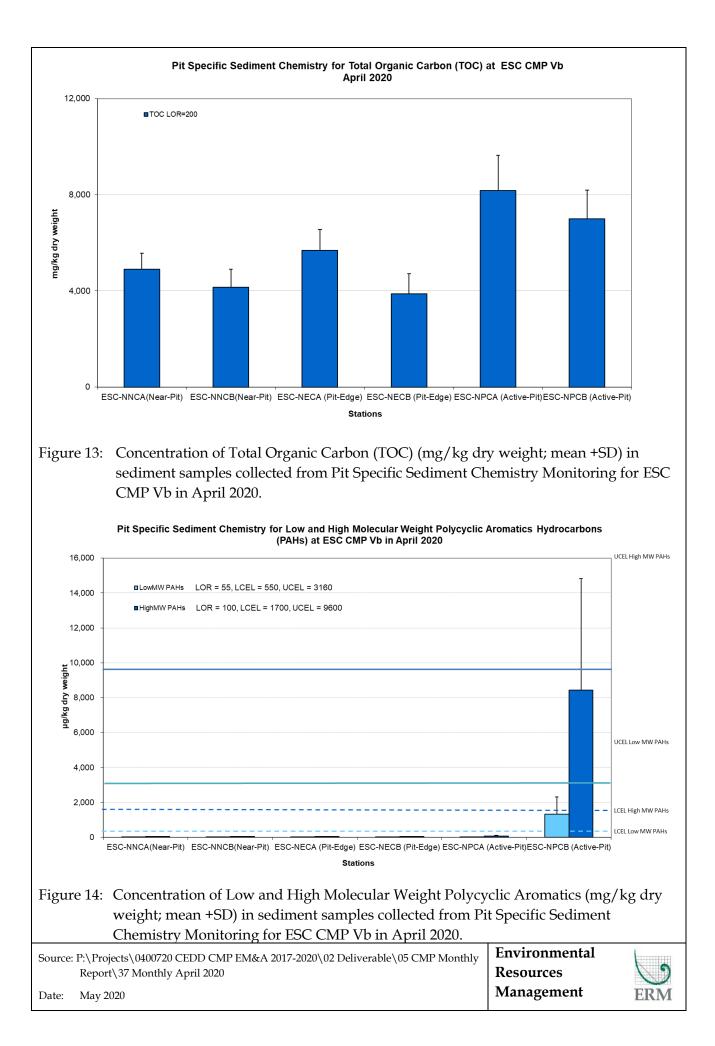
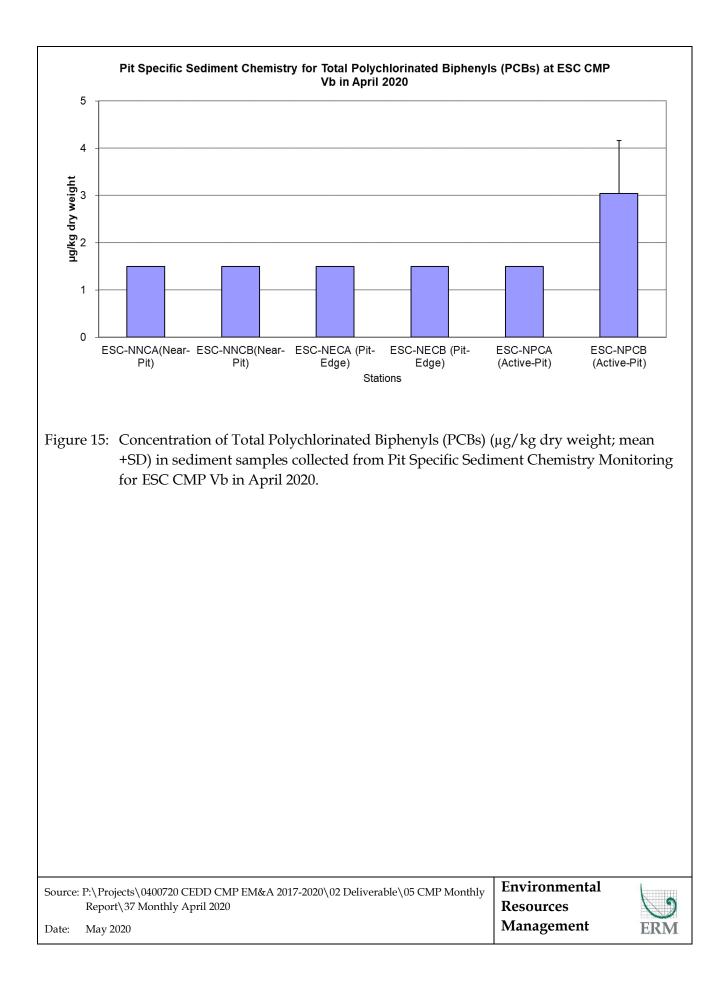


Figure 11: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in April 2020.







Annex D

# Study Programme

Task Name	Start	Finish		201	7				201	8				201	9				202	20			FMAN	2021			
Commencement of Agreement No. CE 63/2016 (EP)	Sat 1/4/17	Sat 1/4/17			JAS		JJF		MJ.	JAS	ONL	JIF	MA	MJ.	AS	ON	DJF	· MA	MJ.	JAS		DJI	MAN	NJJ	ASC	)ND	<u>1</u> 1
																					+++		+++		$\square$		$\downarrow$
	Nov 0/4/47	Mar 5/4/04																							$\square$		$\downarrow$
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 🐳															<b></b>	#		╪╤╤	÷	+++	++-			+
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																							T
Final Report on Review of EM&A Manual	Tue 23/5/17	Tue 23/5/17	$\left  \right $	23	3/5			++		++								++-	$\left  \right $		+++	++	+++	++-	$\left  \cdot \right  + \left  \cdot \right $	+++	+
Regular Review of EM&A Manual	Wed 2/5/18	Sat 2/5/20							Ŷ					<b>`</b>													
Regular Site Inspections of CMP Contractors	Sat 1/4/17	Wed 31/3/21																									+
Derticipate in Linian Occurs Martiner / Occurs Matines on required by OCDD	Sat 1/4/17	Wed 31/3/21																							$\square$		_
Participate in Liaison Group Meetings/ Consultations as required by CEDD	Sat 1/4/17	Weu 31/3/21					1																				
Submission of Monthly EM&A Report	Sun 14/5/17	Sun 14/3/21		>�	00			$\gg$	$\diamond \diamond$	$\diamond \diamond$	00	> <		>0	$\diamond \diamond$	$\diamond$		>0	$\diamond \diamond$	00		$\diamond$	>0				Ť
Submission of Quarterly EM&A Report	Fri 14/7/17	Wed 14/4/21	$\left  \right $		>	$\diamond$			·		$\diamond$		$\diamond$		>	$\diamond$				$\diamond$	$\diamond$	+		++	$\vdash$	++-	+
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Submission of Annual EM&A Report	Sun 14/1/18	Thu 14/1/21					$\diamond$					$\diamond$					$\diamond$					$\diamond$					
Submission of Annual Risk Assessment Report	Thu 14/6/18	Mon 14/6/21							$\diamond$					$\diamond$				++-	$\diamond$	++	+++	+	+++	$\diamond$	$\vdash$	++-	+
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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																							27	7/8	1
Submission of Draft Executive Summary	Fri 27/8/21	Fri 27/8/21	$\left  \cdot \right $			$\left  \right $		++		++			$\left  \right $	++	$\left  \right $			++-	$\left  \right $		+++		+++	++-	27	7/8	+
Submission of Drak Exceditive Summary																											
Submission of Final Executive Summary	Fri 1/10/21	Fri 1/10/21																								1/10	Τ
			$\left  \right $			+++		++										++-	$\left  \right $	++	+++	+	+++	++	$\vdash$	+++	+
For East Tung Lung Chau Disposal Facility (subject to the actual disposal	Sun 14/10/18	Fri 14/12/18	$\left  \right $			+++		++						+				++-	$\left  \right $	++-	+++	+	+++	++	$\vdash$	++-	+
programme to be confirmed by CEDD)																											
Submission of Monthly EM&A Report	Sun 14/10/18	Fri 14/12/18										>															+
Submission of Quarterly EM&A Report	Fri 14/12/18	Fri 14/12/18						$\parallel$				14/	42						$\square$		+++	$\rightarrow$	+++		$\square$		$\downarrow$
Submission of Quarterly EM&A Report	11114/12/10	111 14/12/10										"וך	12														
Submission of Annual EM&A Report	Fri 14/12/18	Fri 14/12/18										14/	12														T
Study Programme Task Milestone	•	S	Summa	ary		Ţ	)			•	Rollec	l Up I	Vilest	one ·	>												_
Tue 13/6/17											-		-														
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 Sh	a Ch	au (2	017-	2020	) - In	vesti	gati	on	040	00720	J_CM	P EM	&A Pi	rogram	ime_v	1_EM{	&A.mp	ур