



**Monthly EM&A Report for Contaminated**  
**Mud Pits to the East of Sha Chau –**  
**December 2020**

Revision 0

January 2021

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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 Contaminated Mud Pits to  
the East of Sha Chau – December 2020**

**Revision 0**

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Client:  Civil Engineering and Development Department (CEDD)		Project No:  0400720			
Summary:  This document presents the Monthly EM&A Report for <i>Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau</i> .		Date: 12 January 2021			
		Approved by:  			
		Craig A. Reid Partner			
v0	Monthly EM&A Report for ESC CMPs	GS	RC	CAR	12/01/21
Revision	Description	By	Checked	Approved	Date
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## Dredging, Management and Capping of Contaminated Sediment Disposal Facility at Sha Chau

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

#### Reference Document/Plan

Document/Plan-to be Certified/ Verified:	Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau - December 2020
Date of Report:	12 January 2021
Date prepared by ET:	12 January 2021
Date received by IA:	12 January 2021

#### 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 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/~~plan~~ complies with the above referenced condition of EP-312/2008/A

Craig Reid,  
Environmental Team Leader:



Date: 12/01/2021

#### IA Verification

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

Dr Wang Wen Xiong,  
Independent Auditor:



Date: 12/01/2021

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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 DECEMBER 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 open-sea 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 A proposal on the change of number of sample replication of water quality & sediment monitoring and combination of routine water quality monitoring and water quality monitoring during capping operation was submitted to EPD and agreed by EPD on 3 December 2020. The proposed changes have been effective for the EM&A activities since December 2020. The latest sampling schedule is provided in *Annex A*.

(1) 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.

(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.

1.1.4 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 December 2020, the following works were undertaken:

- Disposal of contaminated mud at ESC CMP Vb; and
- Capping operations at ESC CMP Vd.

**Figure 1.1 Works Schedule for ESC CMP V**

Pit	Operation	2017					2018					2019					2020					2021														
		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
ESC CMP V	Dredging																																			
	Disposal																																			
	Capping																																			

**1.2 REPORTING PERIOD**

1.2.1 This *Monthly EM&A Report for December 2020* covers the EM&A activities for the reporting month of December 2020.

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

1.3.1 The following monitoring activities were undertaken for ESC CMP V in December 2020:

- *Water Column Profiling of ESC CMP Vb;*
- *Routine Water Quality Monitoring of ESC CMPs;*
- *Pit Specific Sediment Chemistry of ESC CMP Vb; and*
- *Cumulative Impact Sediment Chemistry of ESC CMPs.*

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

1.4.1 No outstanding sampling remained for December 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 December 2020*:

- *Water Column Profiling of ESC CMP Vb;*
- *Routine Water Quality Monitoring of ESC CMPs;*

- *Pit Specific Sediment Chemistry of ESC CMP Vb; and*
- *Cumulative Impact Sediment Chemistry of ESC CMPs.*

#### 1.5.2 ***Water Column Profiling of ESC CMP Vb – December 2020***

1.5.3 *Water Column Profiling* was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 3 December 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 dry season period (November to March) of 2010 - 2019 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 December 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 for December 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 – December 2020***

1.5.8 *Routine Water Quality Monitoring of ESC CMPs* was undertaken on 4 December 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 ten (10) monitoring stations were sampled in December 2020 as shown in *Figure 1.2*.

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

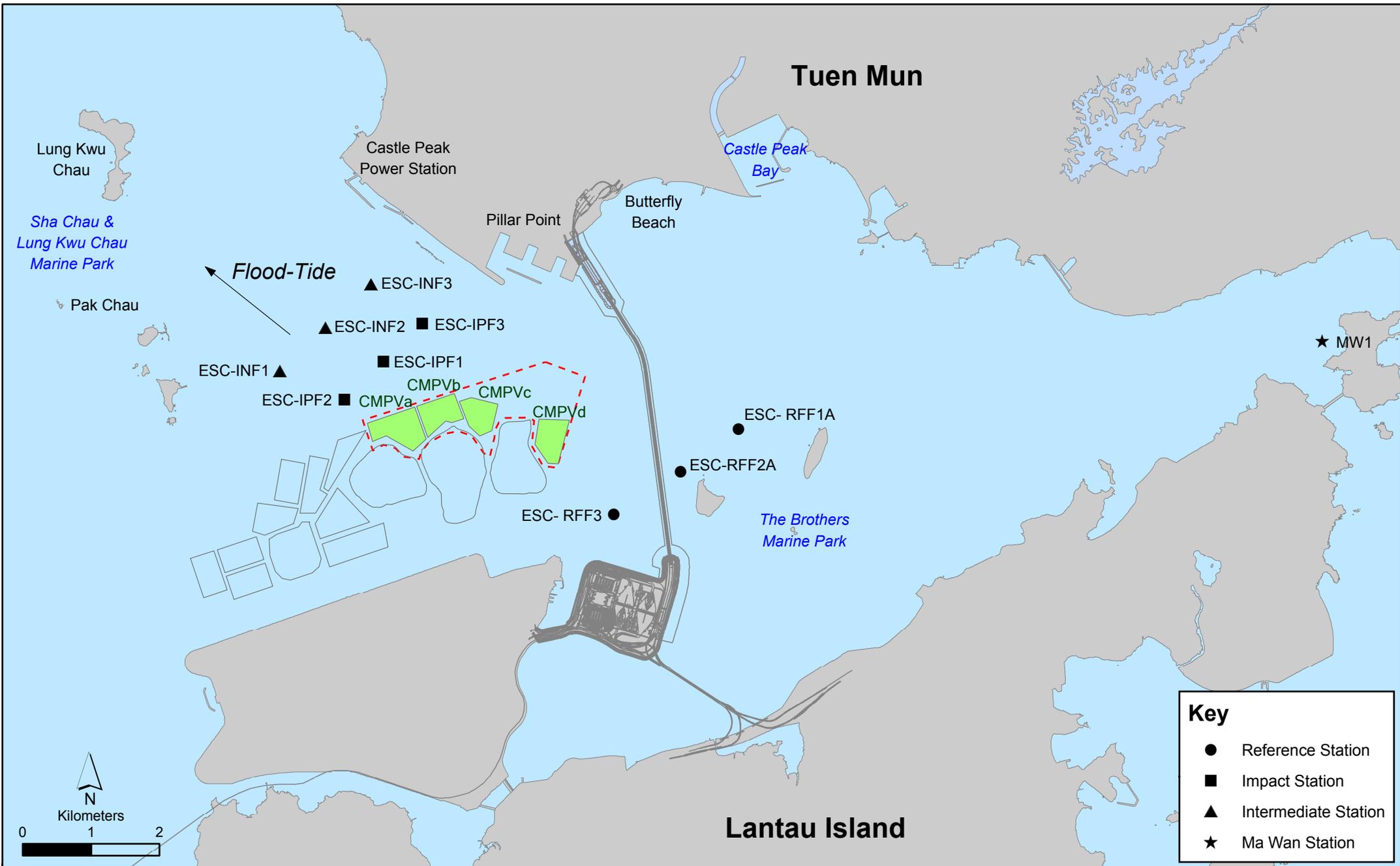


Figure 1.2

Routine & Capping Water Quality Sampling Stations (Flood-Tide) for ESC CMPs

### *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 indicated that the levels of pH, Salinity and DO complied with the WQOs at all stations in December 2020.
- 1.5.10 The levels of DO and Turbidity complied with the Action and Limit Levels at all stations (*Table B3 of Annex B; Figures 3 and 6 of Annex C*).
- 1.5.11 Overall, *in-situ* measurement results of the *Routine Water Quality Monitoring* indicated that the disposal and capping operation at ESC CMPs did not appear to cause any unacceptable impacts in water quality in December 2020.

### *Laboratory Measurements*

- 1.5.12 Laboratory analysis of December 2020 results indicated that concentrations of Arsenic, Chromium, Copper, Lead, Nickel and Zinc were detected in December 2020 samples at most stations. The concentrations of Arsenic, Chromium, Lead and Zinc were generally similar across stations; the concentrations of Nickel were higher at Impact stations; and the concentrations of Copper were higher at Ma Wan station (*Table B4 of Annex B; Figure 7 of Annex C*).
- 1.5.13 For nutrients, concentrations of Total Inorganic Nitrogen (TIN) at all stations complied with the WQO (0.5 mg/L) (*Table B4 of Annex B; Figure 8 of Annex C*). The concentrations of Ammonia Nitrogen (NH<sub>3</sub>-N) were similar across all stations in December 2020 (*Table B4 of Annex B; Figure 8 of Annex C*). The concentrations of Biochemical Oxygen Demand (BOD<sub>5</sub>) were lower at Ma Wan stations (*Table B4 of Annex B; Figure 9 of Annex C*).
- 1.5.14 Analyses of results for December 2020 indicated that the SS levels at Impact, Intermediate, Reference and Ma Wan stations were higher than the WQO (12.8 mg/L), but all stations complied with the Action and Limit Levels (*Tables B1 and B4 of Annex B; Figure 10 of Annex C*). Considering the higher values were recorded not only at Impact and intermediate stations, but also at Reference and Ma Wan stations, the exceedances of SS WQO at these stations were unlikely to be caused by the disposal operation at ESC CMPs.
- 1.5.15 Overall, results of the *Routine Water Quality Monitoring* indicated that the disposal and capping operation at ESC CMPs did not appear to cause any unacceptable deterioration in water quality in December 2020. Detailed statistical analysis will be presented in the Quarterly Report to investigate any spatial and temporal trends of potential concern.

- 1.5.16 *Pit Specific Sediment Chemistry of ESC CMP Vb – December 2020*
- 1.5.17 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 7 December 2020.
- 1.5.18 The concentrations of most inorganic contaminants were lower than the Lower Chemical Exceedance Levels (LCELs) at most stations, except for Arsenic (*Figures 11 and 12 of Annex C*). The concentrations of Arsenic were higher than the LCEL at Near-Pit station ESC-NNCA, Pit-Edge station ESC-NECA, Active-Pit stations ESC-NPCA and ESC-NPCB.
- 1.5.19 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.
- 1.5.20 For organic contaminants, the concentrations of Total Organic Carbon (TOC) were higher at Active-Pit stations ESC-NPCA and ESC-NPCB in December 2020 (*Figure 13 of Annex C*). The concentrations of Low Molecular Weight and High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) were lower than the LECLs at Near-Pit and Pit-Edge stations. However, the concentrations of Low Molecular Weight PAHs and the concentrations of High Molecular Weight PAHs were higher than the LCEL at Active-Pit stations ESC-NPCA and ESC-NPCB (*Figure 14 of Annex C*). The concentrations of Tributyltin (TBT) were higher at Active-Pit stations ESC-NPCA and ESC-NPCB (*Figure 15 of Annex C*). The concentrations of Total Polychlorinated Biphenyls (PCBs), Total dichloro-diphenyl-trichloroethane (DDT) and 4,4’-dichlorodiphenyldichloroethylene (DDE) were below the limit of reporting at all stations in December 2020.
- 1.5.21 Considering that the higher levels of TOC, TBT, Low Molecular Weight and High Molecular Weight PAHs occurred within Active-Pit stations ESC-NPCA and ESC-NPCB only, there is no evidence indicating any unacceptable environmental impacts to sediment quality outside the pit area as a result of the contaminated mud disposal operations at ESC CMP Vb in December 2020.
- 1.5.22 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) 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



- 1.5.23 ***Cumulative Impact Sediment Chemistry of ESC CMPs – December 2020***
- 1.5.24 Monitoring locations for Cumulative Impact Sediment Chemistry for ESC CMPs are shown in *Figure 1.4*. A total of nine (9) monitoring stations were sampled on 8 and 9 December 2020.
- 1.5.25 Analyses of results for the *Cumulative Impact Sediment Chemistry Monitoring* indicated that the concentrations of most inorganic contaminants were below the LCEL at most stations in December 2020, except concentrations of Arsenic were higher than the LCEL at Mid-field stations ESC-RMA, ESC-RMB, Near-field station ESC-RNB1, Capped Pit stations ESC-RCA1, ESC-RCB1 and Ma Wan station (*Figures 16 and 17 of Annex C*). As discussed in *Section 1.5.19*, 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.
- 1.5.26 For organic contaminants, the concentrations of TOC were higher at Far-field stations ESC-RFA and ESC-RFB (*Figure 18 of Annex C*). The concentrations of TBT were higher at Ma Wan station (*Figure 19 of Annex C*). The concentrations of High Molecular Weight PAHs were below LECL (*Figure 20 of Annex C*). The concentrations of Total PCBs, Total DDT, 4,4'- DDE and Low Molecular Weight PAHs were below the limit of reporting at all stations in December 2020.
- 1.5.27 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 Vb in December 2020. 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 January 2021 for ESC CMP V (see *Annex A* for the sampling schedule):
- *Water Column Profiling of ESC CMP Vb;*
  - *Routine Water Quality Monitoring of ESC CMPs;*
  - *Pit Specific Sediment Chemistry of ESC CMP Vb; and*
  - *Demersal Trawling for ESC CMPs.*

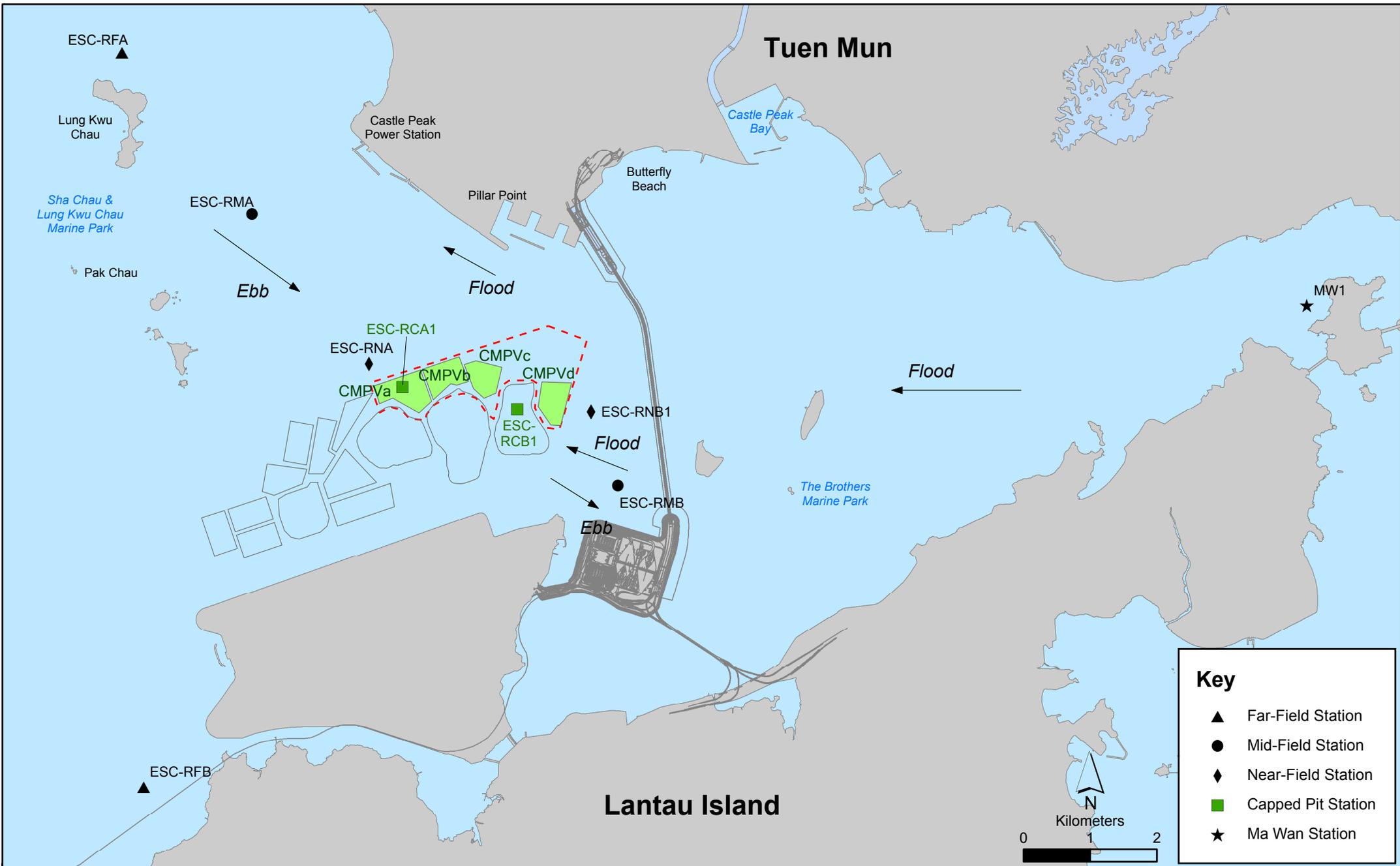


Figure 1.4

Cumulative Impacts Sediment Quality Monitoring Stations for ESC CMPs

**Key**

- ▲ Far-Field Station
- Mid-Field Station
- ◆ Near-Field Station
- Capped Pit Station
- ★ Ma Wan Station

## **1.7**            ***STUDY PROGRAMME***

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

Annex A

## Sampling Schedule



Annex B

## Water Quality Monitoring Results

**Table B1** *Action and Limit Levels of Water Quality for Dredging, Disposal and Capping Activities at ESC CMP V*

<b>Parameter</b>	<b>Action Level</b>	<b>Limit Level</b>
Dissolved Oxygen (DO) <sup>(1)</sup>	<u>Surface and Mid-depth</u> <sup>(2)</sup> 5%-ile of baseline data for surface and middle layer = <b>3.76 mg L<sup>-1</sup></b>	<u>Surface and Mid-depth</u> <sup>(2)</sup> 1%-ile of baseline data for surface and middle layer = <b>3.11 mg L<sup>-1</sup></b> <sup>(3)</sup>
	and	and
	Significantly less than the reference stations mean DO (at the same tide of the same day)	Significantly less than the reference stations mean DO (at the same tide of the same day)
	<u>Bottom</u> 5%-ile of baseline data for bottom layers = <b>2.96 mg L<sup>-1</sup></b>	<u>Bottom</u> The average of the impact station readings are <b>&lt;2 mg/L<sup>-1</sup></b>
	and	and
	Significantly less than the reference stations mean DO (at the same tide of the same day)	Significantly less than the reference stations mean DO (at the same tide of the same day)
Depth-averaged Suspended Solids (SS) <sup>(4)(5)</sup>	95%-ile of baseline data for depth average = <b>37.88 mg L<sup>-1</sup></b>	99%-ile of baseline data for depth average = <b>61.92 mg L<sup>-1</sup></b>
	and	and
	120% of control station's SS at the same tide of the same day	130% of control station's SS at the same tide of the same day
Depth-averaged Turbidity (Tby) <sup>(4)(5)</sup>	95%-ile of baseline data = <b>28.14 NTU</b>	99%-ile of baseline data = <b>38.32 NTU</b>
	and	and
	120% of control station's Tby at the same tide of the same day	130% of control station's Tby at the same tide of the same day

**Notes:**

- (1) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
- (2) The Action and Limit Levels for DO for Surface & Middle layers were calculated from the combined pool of baseline surface layer data and baseline middle layer data.
- (3) 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.

**Table B2** *Water Column Profiling Results for ESC CMP Vb in December 2020*

Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen		pH	Suspended Solids (mg L <sup>-1</sup> )
				(%)	(mg L <sup>-1</sup> )		
WCP 1 (Downstream)	22.11	31.75	5.23	94.74	6.87	8.13	7.15
WCP 2 (Upstream)	22.26	31.77	3.80	94.45	6.84	8.10	5.50
WQO (Dry Season)	N/A	28.59-34.94 <sup>#</sup>	N/A	N/A	>4	6.5-8.5	12.8

**Note:**

<sup>#</sup>Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.

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

Cell shaded grey indicate value exceeding the WQO.

**Table B3** *In-situ Monitoring Results for Routine Water Quality Monitoring of ESC CMPs in December 2020*

Sampling Period	Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen		pH (mg L <sup>-1</sup> )
					(%)	(mg L <sup>-1</sup> )	
December 2020	RFF (Reference)	21.83	31.89	13.10	93.84	6.84	8.13
	IPF (Impact)	21.78	31.87	14.45	93.56	6.82	8.12
	INF (Intermediate)	21.60	31.85	12.07	94.29	6.90	8.13
	Ma Wan	22.23	31.97	7.24	90.60	6.55	8.12
	WQO	N/A	28.70- 35.08 <sup>#</sup>	N/A	N/A	>4	6.5-8.5

**Notes:**

<sup>#</sup>Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.

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

Cell shaded grey indicate value higher than the WQO.

**Table B4** *Laboratory Results for Routine Water Quality Monitoring of ESC CMPs in December 2020*

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)	NH <sub>3</sub> (mg/L)	TIN (mg/L)	BOD <sub>5</sub> (mg/L)	SS (mg/L)
December 2020	RFF	2.64	<LOR	1.25	2.06	0.71	<LOR	0.73	<LOR	41.12	0.19	0.34	0.68	17.31
	IPF	2.52	<LOR	1.48	2.32	0.63	<LOR	1.57	<LOR	35.96	0.16	0.32	0.63	20.40
	INF	2.58	<LOR	1.35	2.19	0.56	0.27	1.08	<LOR	47.52	0.15	0.32	0.73	18.83
	Ma Wan	2.53	<LOR	1.23	3.50	<LOR	<LOR	<LOR	<LOR	36.33	0.17	0.30	0.31	12.90

WQO of TIN: 0.5 mg/L

Dry Season WQO of SS : 12.8 mg/L

**Notes:**

<LOR indicates the concentrations of metals and metalloids are below the limit of reporting

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

Cell shaded grey indicate value higher than the WQO.

Annex C

## Graphical Presentations

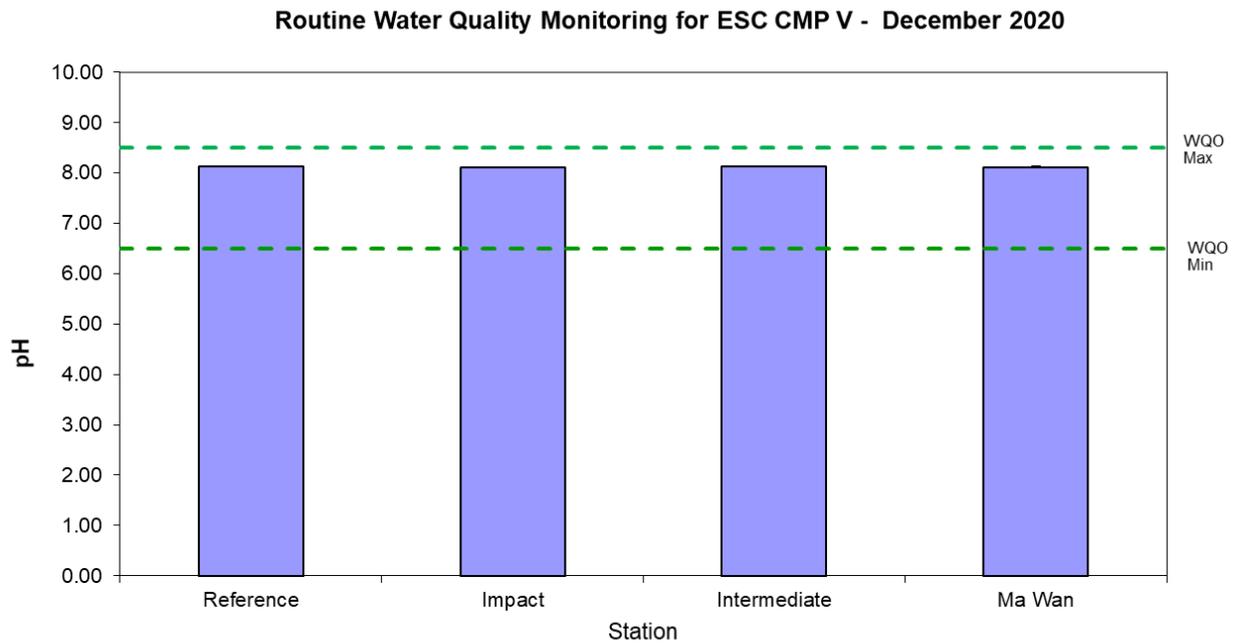


Figure 1: Level of pH recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in December 2020.

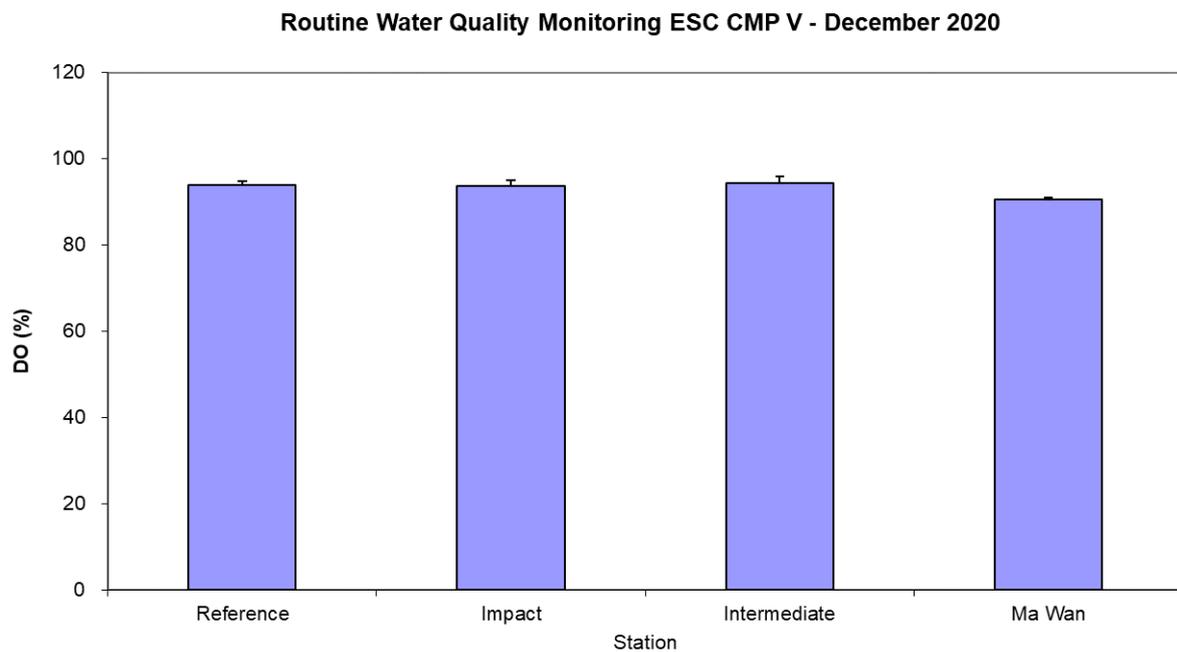


Figure 2: Level of Dissolved Oxygen (DO) (% saturation; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in December 2020.

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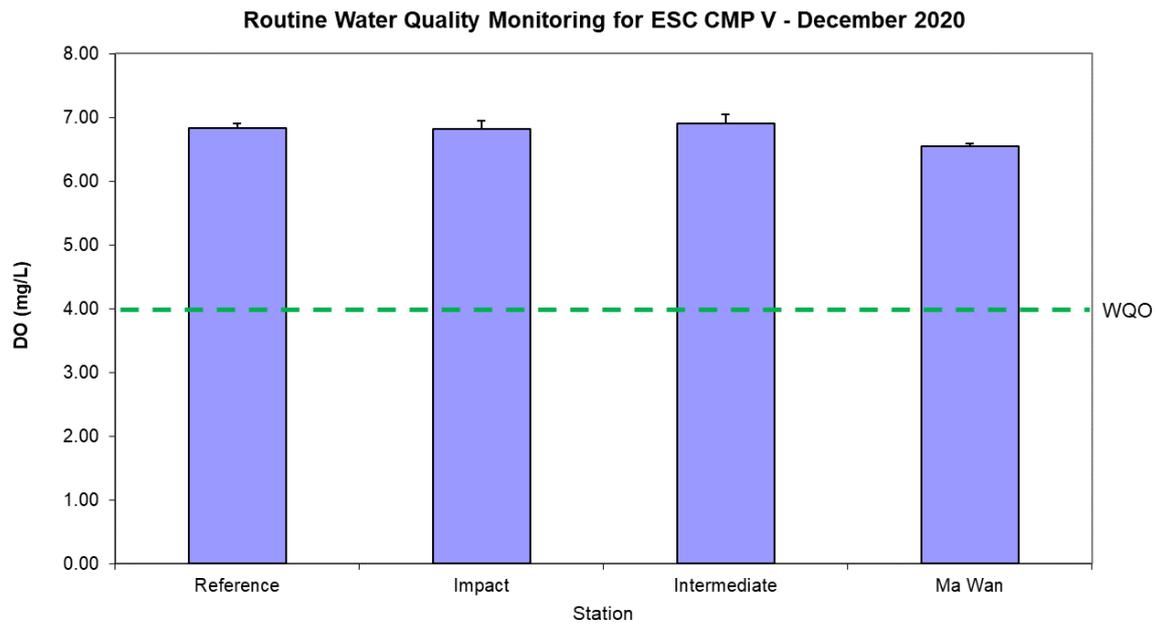


Figure 3: Concentration of Dissolved Oxygen (DO) (mg/L; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in December 2020.

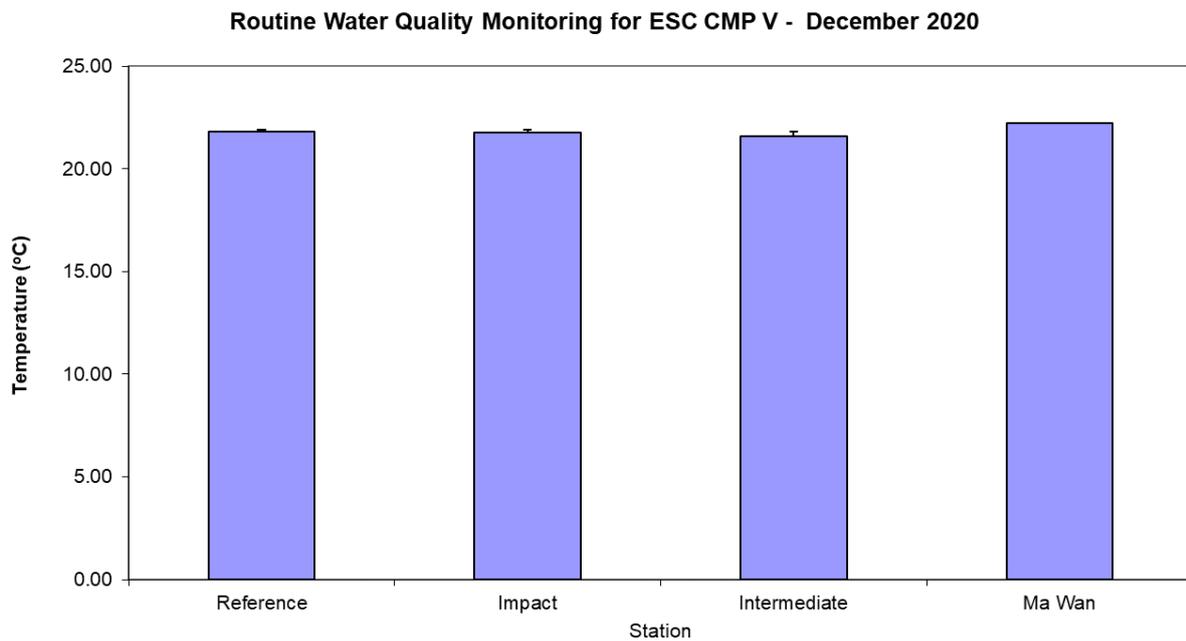


Figure 4: Level of Temperature (°C; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in December 2020.

**Routine Water Quality Monitoring for ESC CMP V - December 2020**

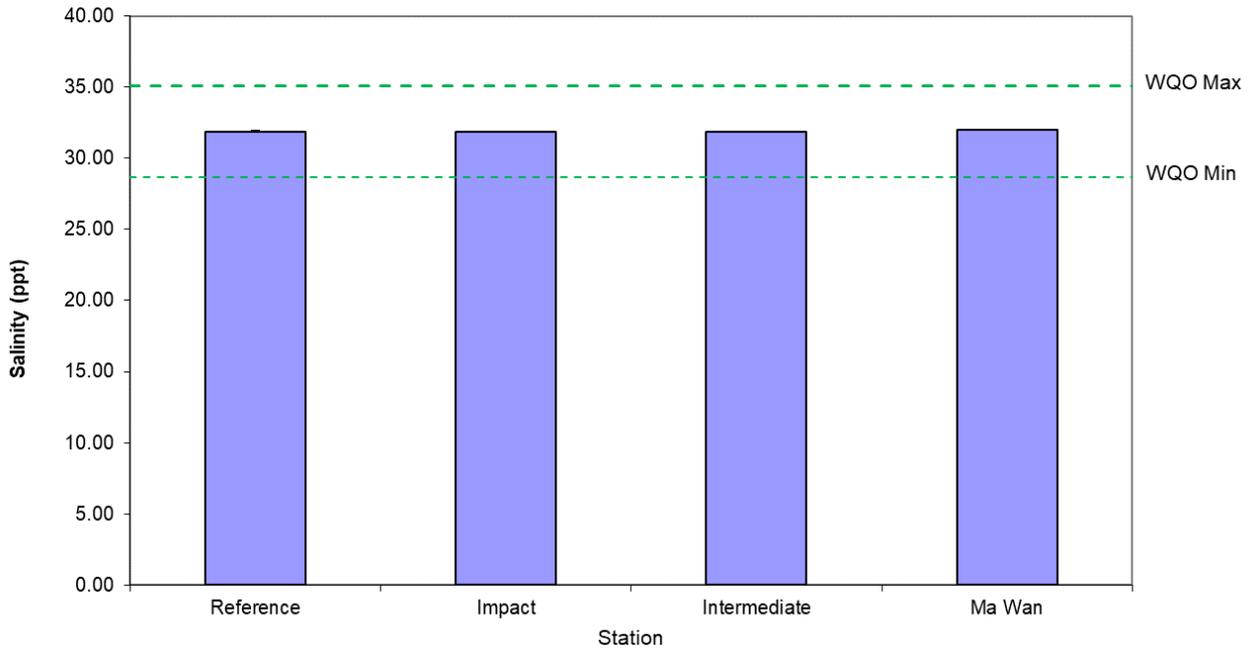


Figure 5: Level of Salinity (ppt; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in December 2020.

**Routine Water Quality Monitoring for ESC CMP V - December 2020**

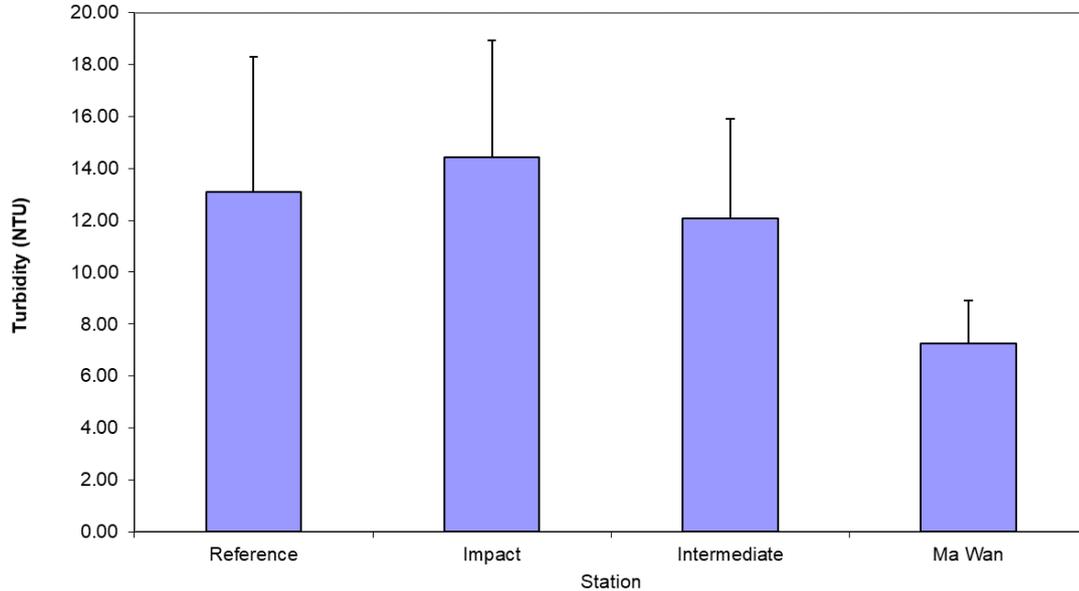


Figure 6: Levels of Turbidity (NTU; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in December 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\45 Monthly December 2020

Date: January 2021

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**Routine Water Quality Monitoring for ESC CMP V  
December 2020**

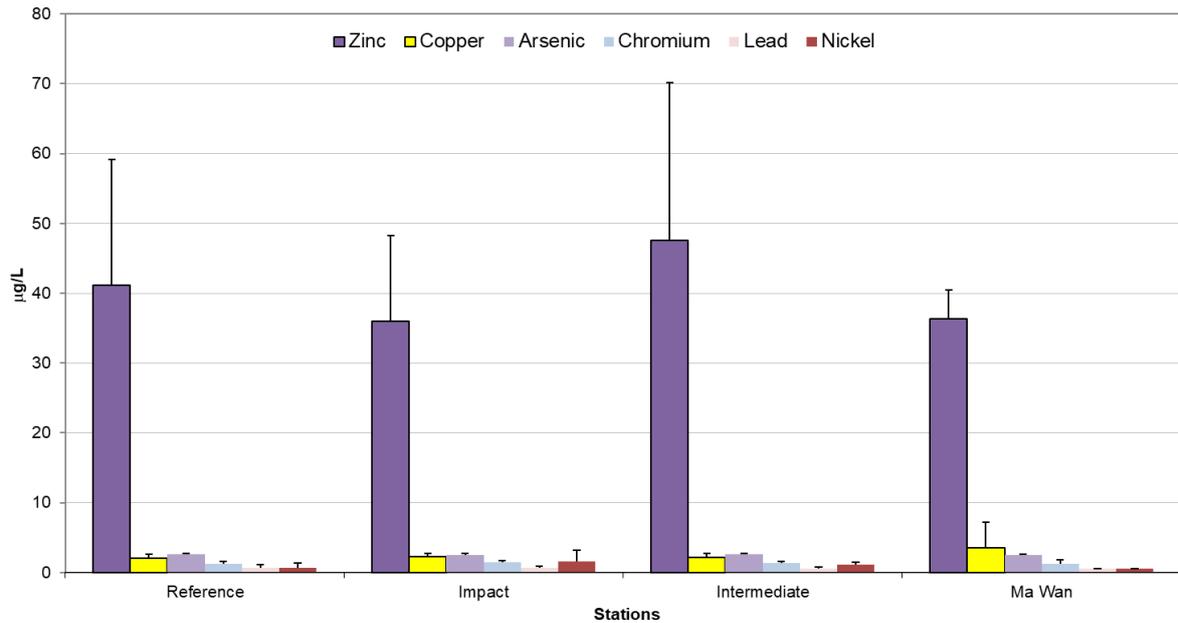


Figure 7: Concentration of Arsenic, Chromium, Copper, Lead, Nickel and Zinc (µg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in December 2020.

**Routine Water Quality Monitoring Results for Nutrients  
December 2020**

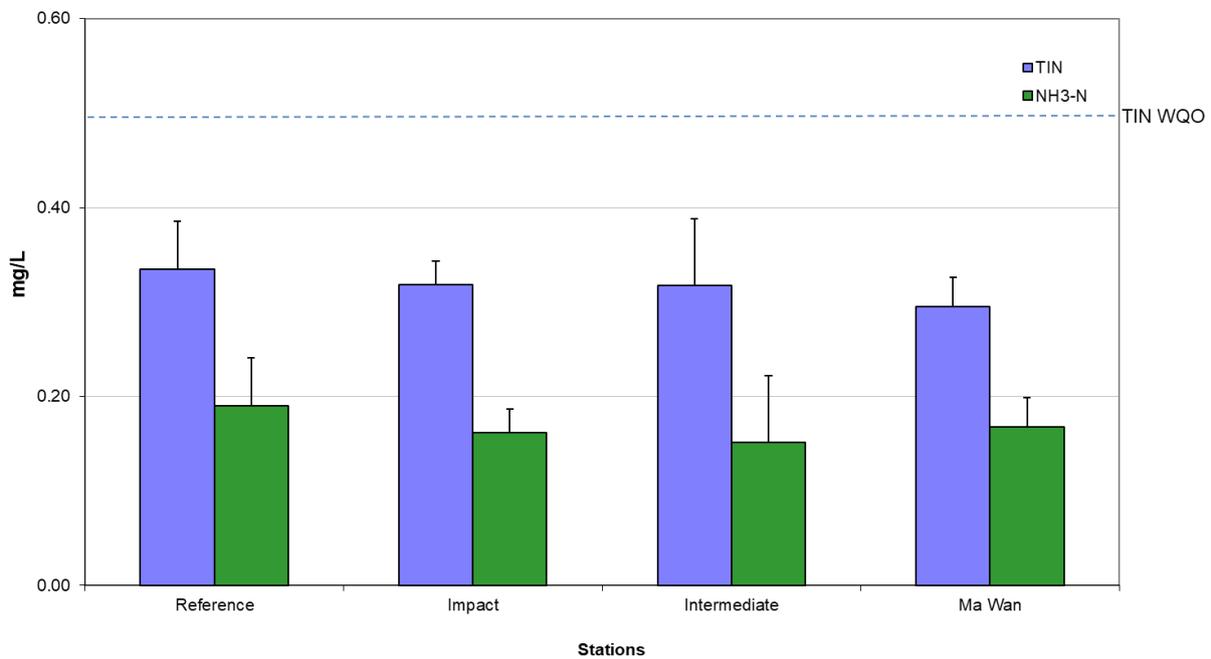


Figure 8: Concentration of Total Inorganic Nitrogen (TIN) and Ammonia Nitrogen (NH3-N) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in December 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\45 Monthly December 2020

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**Routine Water Quality Monitoring Results for Biochemical Oxygen Demand (BOD<sub>5</sub>)  
December 2020**

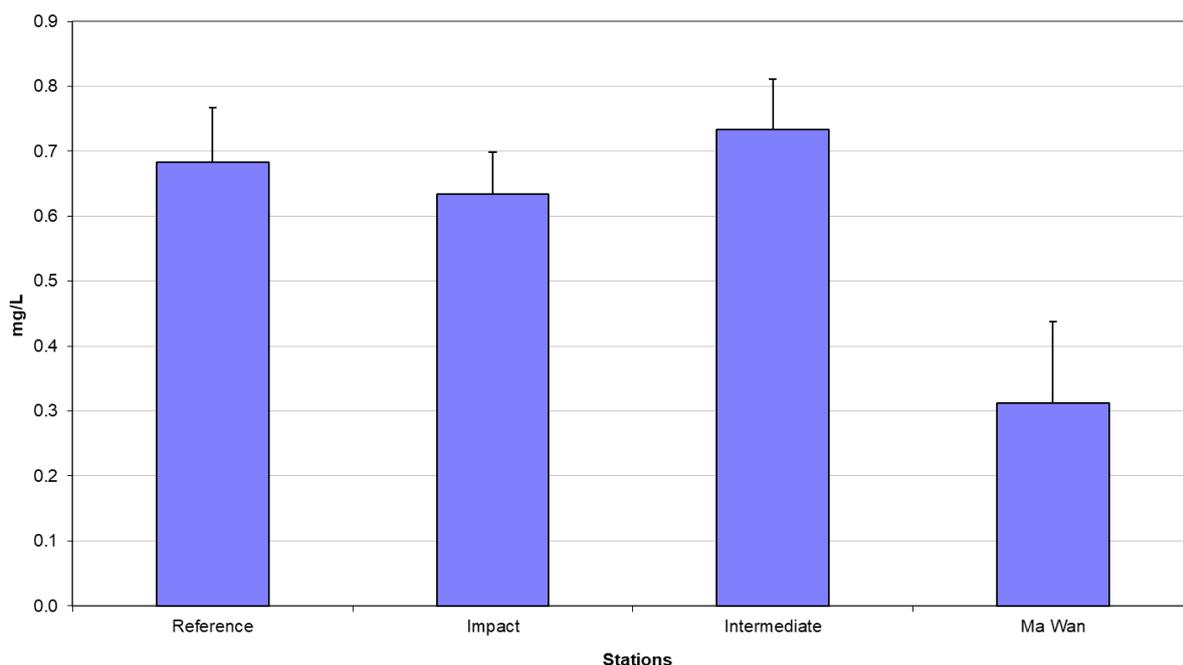


Figure 9: Level of Biochemical Oxygen Demand (BOD<sub>5</sub>) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in December 2020.

**Routine Water Quality Monitoring for Suspended Solids  
December 2020**

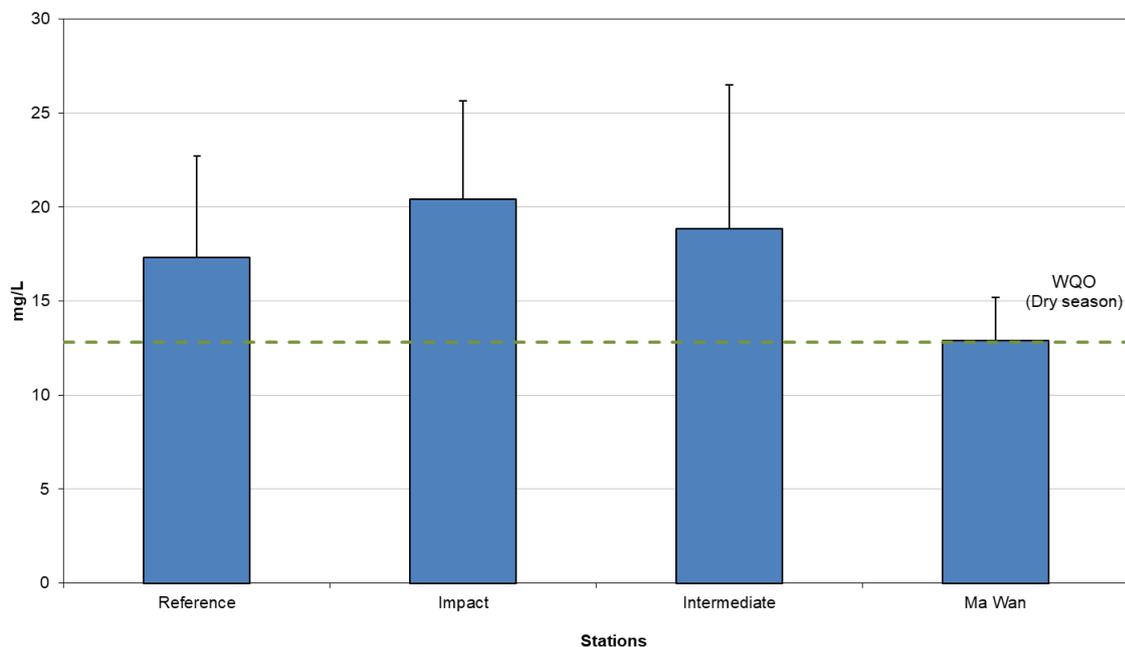


Figure 10: Concentration of Suspended Solids (SS) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in December 2020.

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**Pit Specific Sediment Chemistry for Metal and Metalloid Contaminants at ESC CMP Vb  
December 2020**

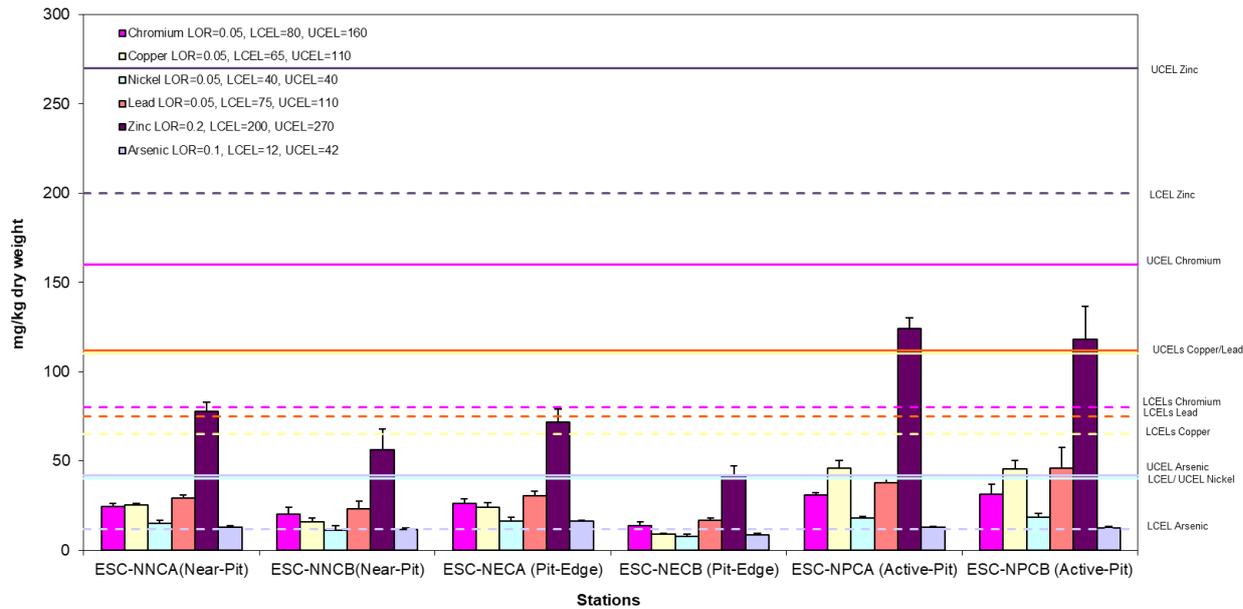


Figure 11: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in December 2020.

**Pit Specific Sediment Chemistry for Metal Contaminants at ESC CMP Vb  
December 2020**

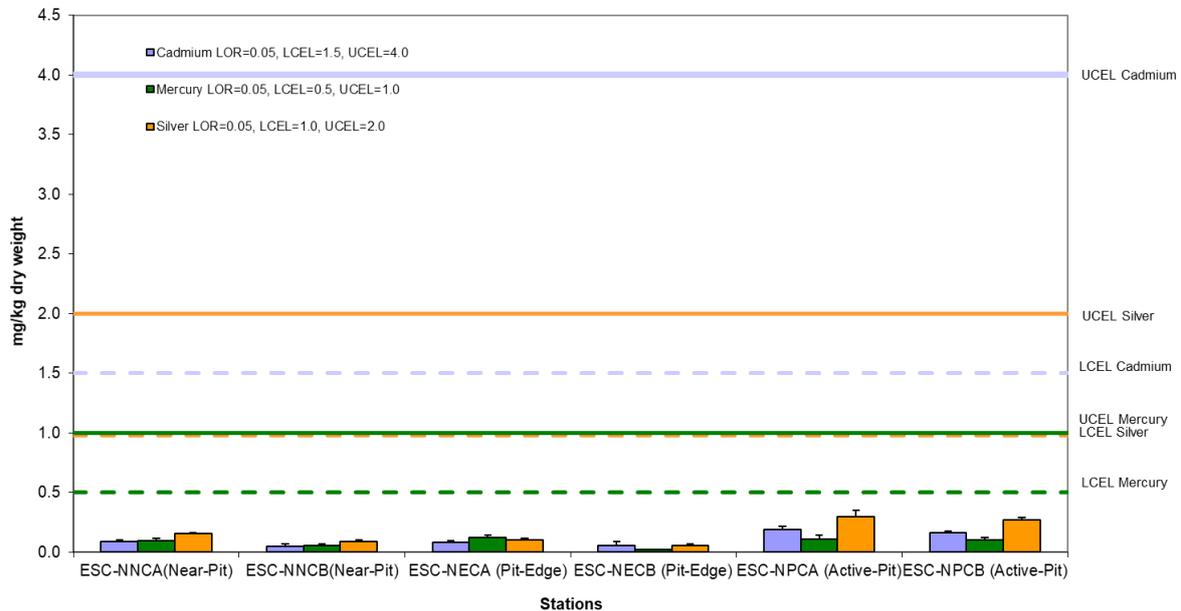


Figure 12: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in December 2020.

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**Pit Specific Sediment Chemistry for Total Organic Carbon (TOC) at ESC CMP Vb  
December 2020**

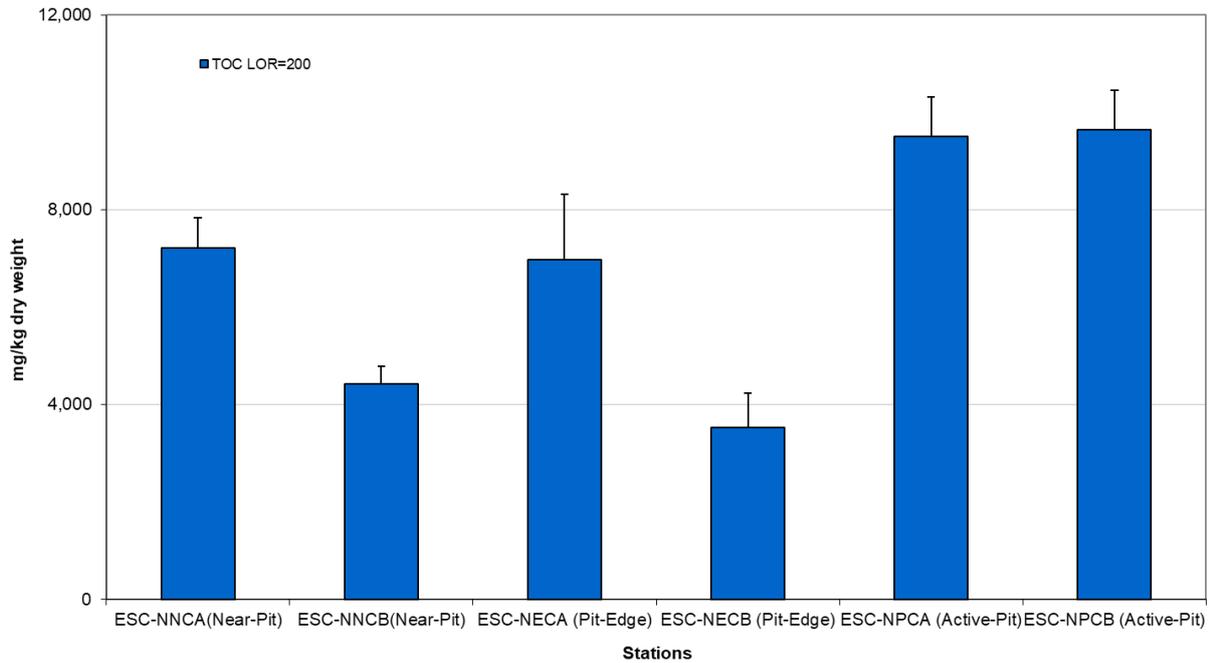


Figure 13: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in December 2020.

**Pit Specific Sediment Chemistry for Low and High Molecular Weight Polycyclic Aromatics Hydrocarbons (PAHs) at ESC CMP Vb in December 2020**

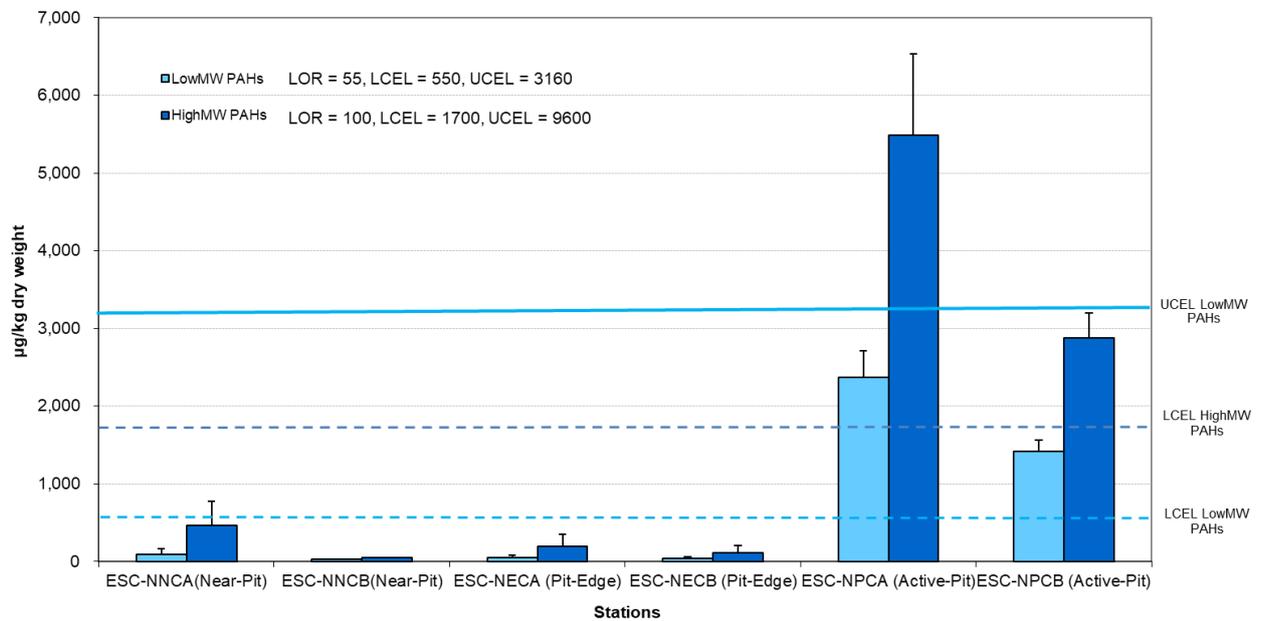


Figure 14: Concentration of Low and High Molecular Weight Polycyclic Aromatic Hydrocarbons (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in December 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\45 Monthly December 2020

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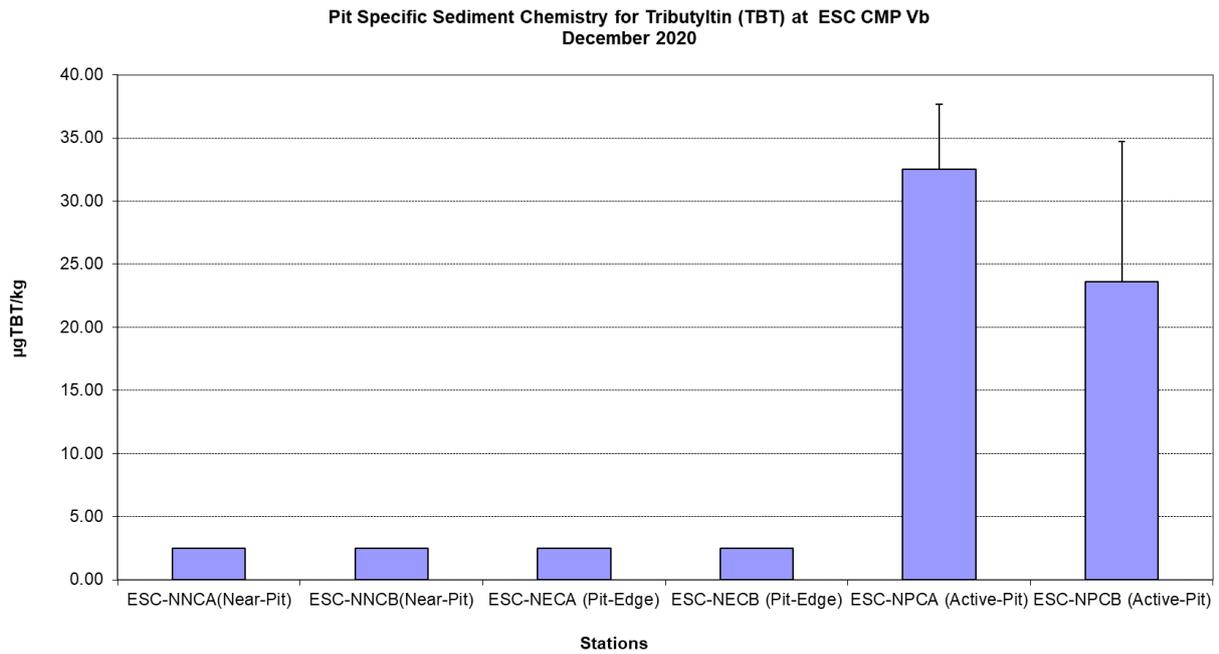


Figure 15: Concentration of Tributyltin (TBT) ( $\mu\text{g TBT/kg}$ ; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in December 2020.

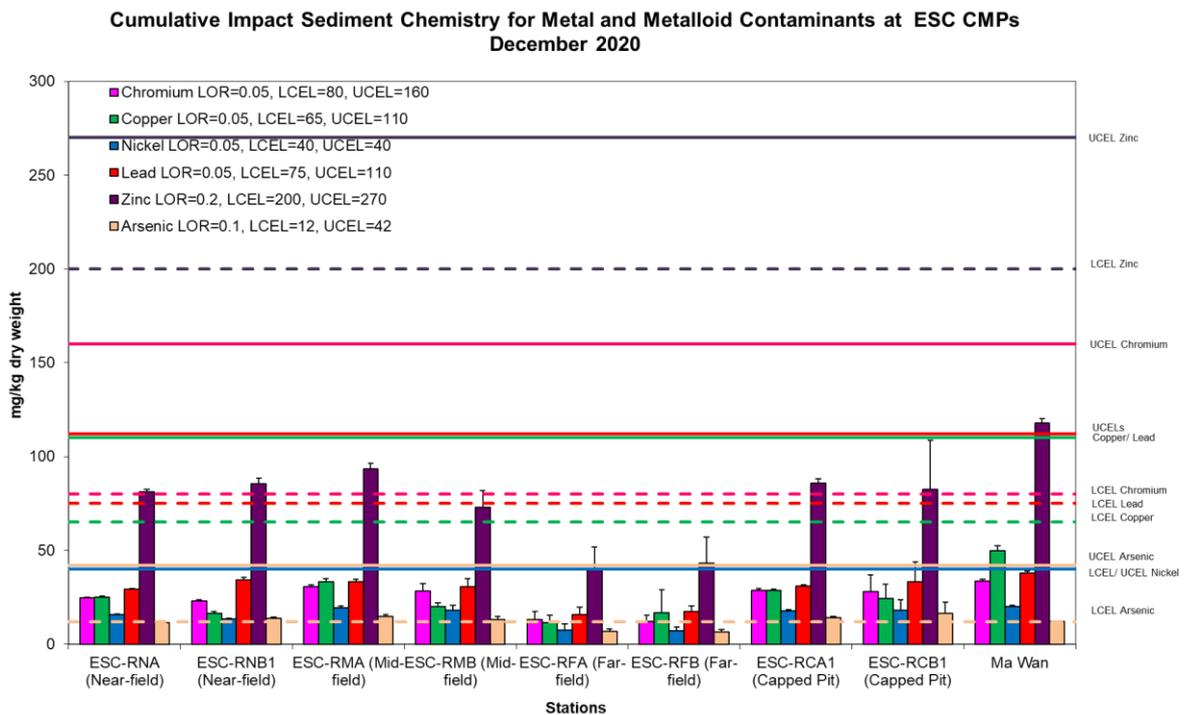


Figure 16: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in December 2020.

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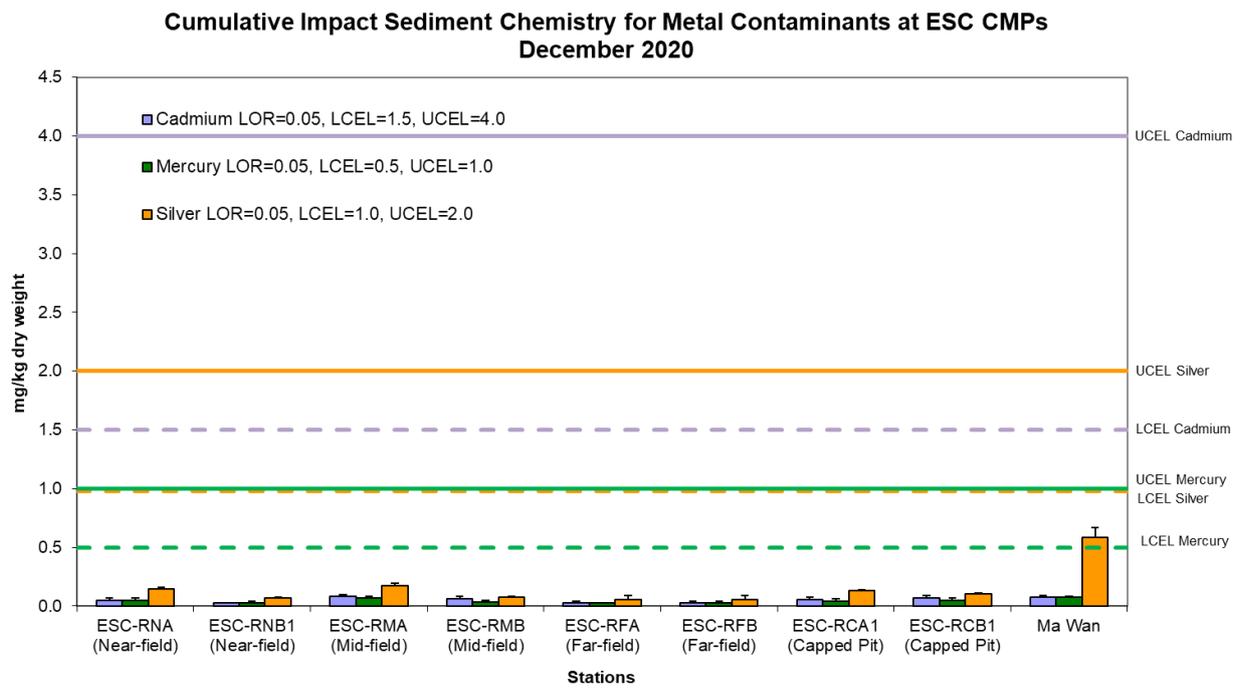


Figure 17: Concentration of Metals (Cd, Hg, Ag; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in December 2020.

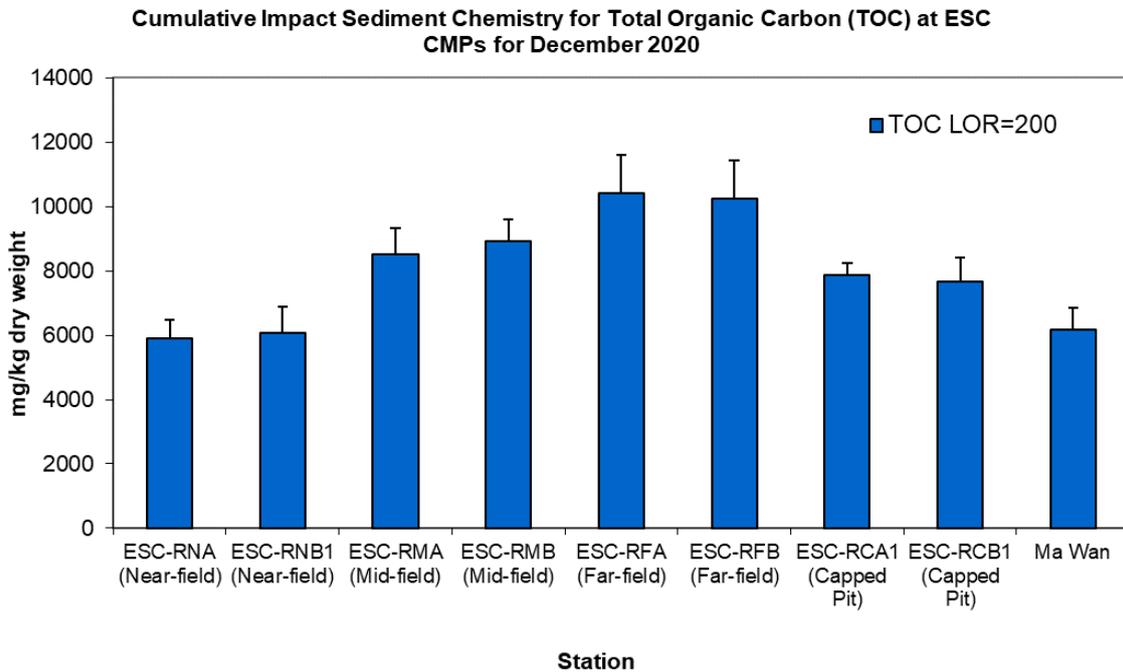


Figure 18: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in December 2020.

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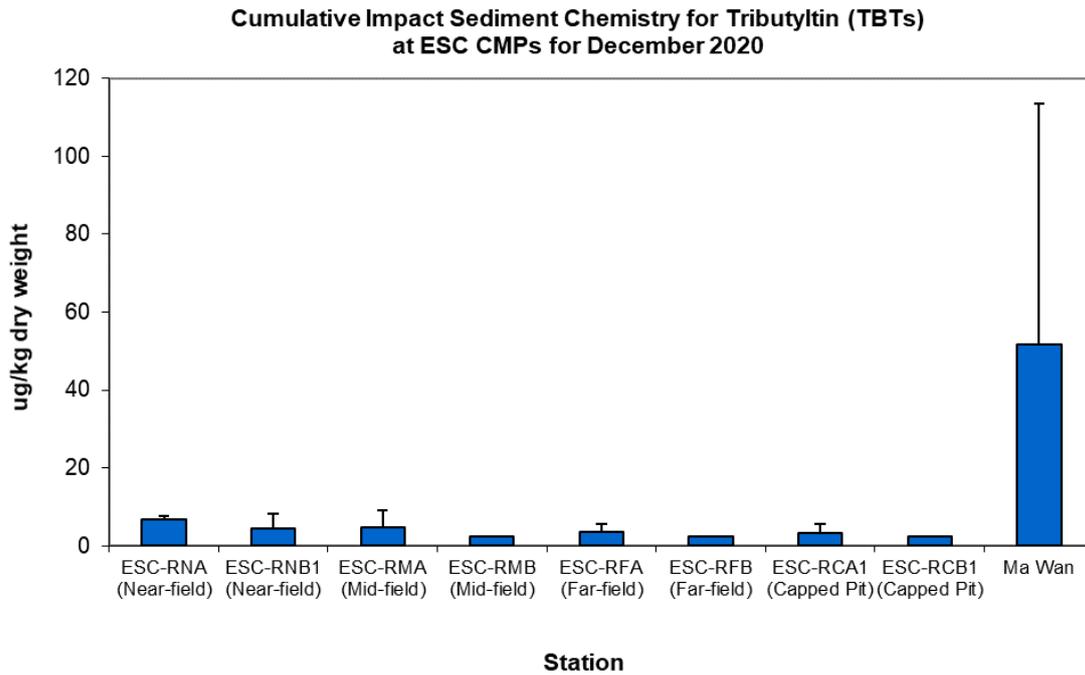


Figure 19: Concentration of Tributyltin (TBT) ( $\mu\text{g}/\text{kg}$  dry weight; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in December 2020.

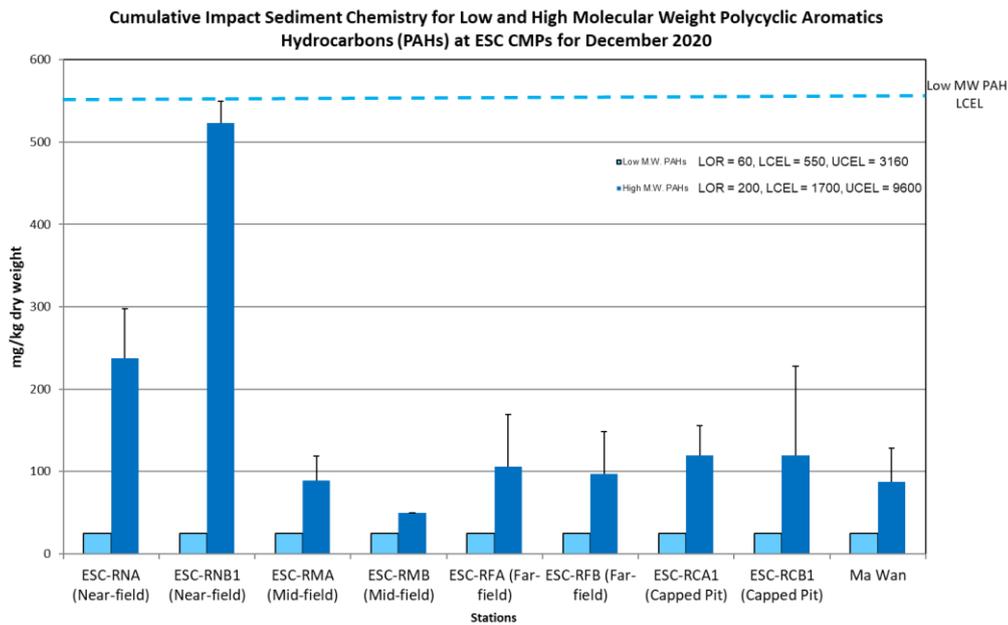


Figure 20: Concentration of Low and High Molecular Weight Polycyclic Aromatics ( $\text{mg}/\text{kg}$  dry weight; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in December 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\45 Monthly December 2020

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Annex D

## Study Programme

