



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 – January
2019

Revision 0

February 2019

Environmental Resources Management
2507, 25/F, One Harbourfront
18 Tak Fung Street
Hung Hom, Kowloon
Hong Kong
Telephone (852) 2271 3000
Facsimile (852) 2723 5660

www.erm.com

**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 – January 2019**

Revision 0

**Environmental Resources
Management**

2507, 25/F, One Harbourfront
18 Tak Fung Street
Hung Hom, Kowloon
Hong Kong
Telephone: (852) 2271 3000
Facsimile: (852) 2723 5660
E-mail: post.hk@erm.com
http://www.erm.com

Document Code: 0400720_Monthly January 2019_v0.doc

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: 14 February 2019			
		Approved by: 			
		Craig A. Reid Partner			
v0	Monthly EM&A Report for ESC CMPs	TT	RC	CAR	14/02/19
Revision	Description	By	Checked	Approved	Date
<p>This report has been prepared by Environmental Resources Management the trading name of 'ERM Hong-Kong, Limited', with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.</p> <p>We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.</p> <p>This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.</p>		<p>Distribution</p> <p><input type="checkbox"/> Internal</p> <p><input checked="" type="checkbox"/> Public</p> <p><input type="checkbox"/> Confidential</p>			
		 			

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 - January 2019
Date of Report:	14 February 2019
Date prepared by ET:	14 February 2019
Date received by IA:	14 February 2019

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: 14/02/2019

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: 14/02/2019

CONTENTS

1.1	BACKGROUND	1
1.2	REPORTING PERIOD	2
1.3	DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES	2
1.4	DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS	2
1.5	BRIEF DISCUSSION OF THE MONITORING RESULTS FOR ESC CMP V	2
1.6	ACTIVITIES SCHEDULED FOR THE NEXT MONTH	5
1.7	STUDY PROGRAMME	6

ANNEXES

ANNEX A	SAMPLING SCHEDULE
ANNEX B	WATER QUALITY MONITORING RESULTS
ANNEX C	GRAPHICAL PRESENTATIONS
ANNEX D	STUDY PROGRAMME

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 JANUARY 2019

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 ⁽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). 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 January 2019, disposal of contaminated mud at ESC CMP Vd was undertaken.

(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.

Figure 1.1 Works Schedule for ESC CMP V and SB CMPs

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	M				
ESC CMP V	Dredging																																								
	Disposal																																								
	Capping																																								

1.2 REPORTING PERIOD

1.2.1 This *Monthly EM&A Report for January 2019* covers the EM&A activities for the reporting month of January 2019.

1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES

1.3.1 The following monitoring activities were undertaken for ESC CMP V in January 2019:

- *Water Column Profiling of ESC CMP Vd;*
- *Routine Water Quality Monitoring of ESC CMPs;*
- *Pit Specific Sediment Chemistry of ESC CMP Vd; and*
- *Demersal Trawling for ESC CMPs.*

1.4 DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS

1.4.1 No outstanding sampling remained for January 2019.

1.4.2 The following analyses are in progress and will be presented in the corresponding quarterly report:

- *Species identification of the biota samples collected from Demersal Trawling for ESC CMPs in January 2019.*

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 January 2019*:

- *Water Column Profiling of ESC CMP Vd in January 2019;*
- *Routine Water Quality Monitoring of ESC CMPs in January 2019; and*
- *Pit Specific Sediment Chemistry of ESC CMP Vd in January 2019.*

1.5.2 ***Water Column Profiling of ESC CMP Vd - January 2019***

1.5.3 *Water Column Profiling* was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 4 January 2019. 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 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 January 2019 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 January 2019 indicated that the SS levels at both Downstream and Upstream stations complied with the WQO and the Action and Limit Levels at both Downstream and Upstream stations (*Tables B1 and B2 of Annex B*).

1.5.6 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.

1.5.7 ***Routine Water Quality Monitoring of ESC CMPs - January 2019***

1.5.8 *Routine Water Quality Monitoring of ESC CMPs* was undertaken on 9 January 2019. 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 January 2019 as shown in *Figure 1.2*.

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

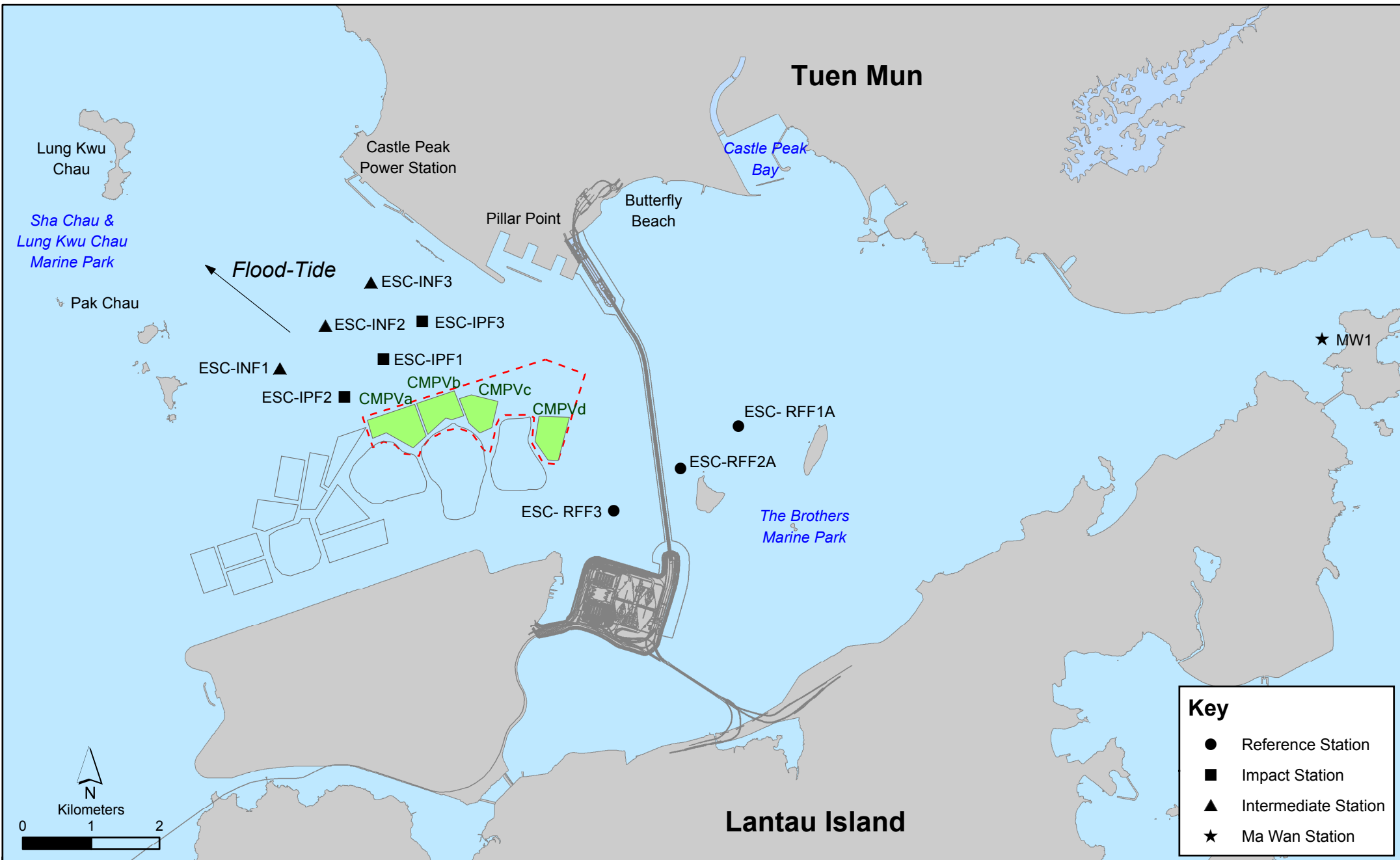


Figure 1.2

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

File: T:\GIS\CONTRACT\0175086\Wxd\updated_20170419\0175086_R_C_WQMS_flood.mxd
Date: 25/4/2017

Key	
●	Reference Station
■	Impact Station
▲	Intermediate Station
★	Ma Wan Station

Environmental
Resources
Management



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 January 2019 indicated that the levels of pH, Salinity and DO complied with the WQOs at all stations (Impact, Intermediate, Reference and Ma Wan stations) in January 2019.
- 1.5.10 The levels of DO and Turbidity also 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 operation at ESC CMP Vd did not appear to cause any unacceptable impacts in water quality in January 2019.

Laboratory Measurements

- 1.5.12 Laboratory analysis of January 2019 results indicated that concentrations of Cadmium, Silver and Mercury were below their limit of reporting at all stations, while the concentrations of Chromium, Lead and Nickel were below their limit of reporting at most stations expect at Impact stations. Arsenic, Copper and Zinc were detected in January 2019 samples at all stations and the concentrations of these metals and metalloids were similar amongst the stations (*Table B4 of Annex B; Figure 7 of Annex C*).
- 1.5.13 For nutrients, concentrations of Total Inorganic Nitrogen (TIN) at all stations in January 2019 complied with the WQO (*Table B4 of Annex B; Figure 8 of Annex C*). Concentrations of Ammonia Nitrogen (NH₃-N) and 5-day Biochemical Oxygen Demand (BOD₅) were generally similar amongst the stations in January 2019 (*Table B4 of Annex B; Figure 8 and 9 of Annex C*).
- 1.5.14 Analyses of results for January 2019 indicated that the SS levels were higher than the WQO (12.8 mg/L for dry season) for Reference, Impact and Intermediate stations, however, the SS levels complied with the Action and Limit Levels at all stations (*Tables B1 and B4 of Annex B; Figure 10 of Annex C*).
- 1.5.15 Overall, results of the Routine Water Quality Monitoring indicated that the disposal operation at ESC CMP Vd did not appear to cause any unacceptable deterioration in water quality in January 2019. 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 Vd - January 2019***
- 1.5.17 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 3 January 2019.

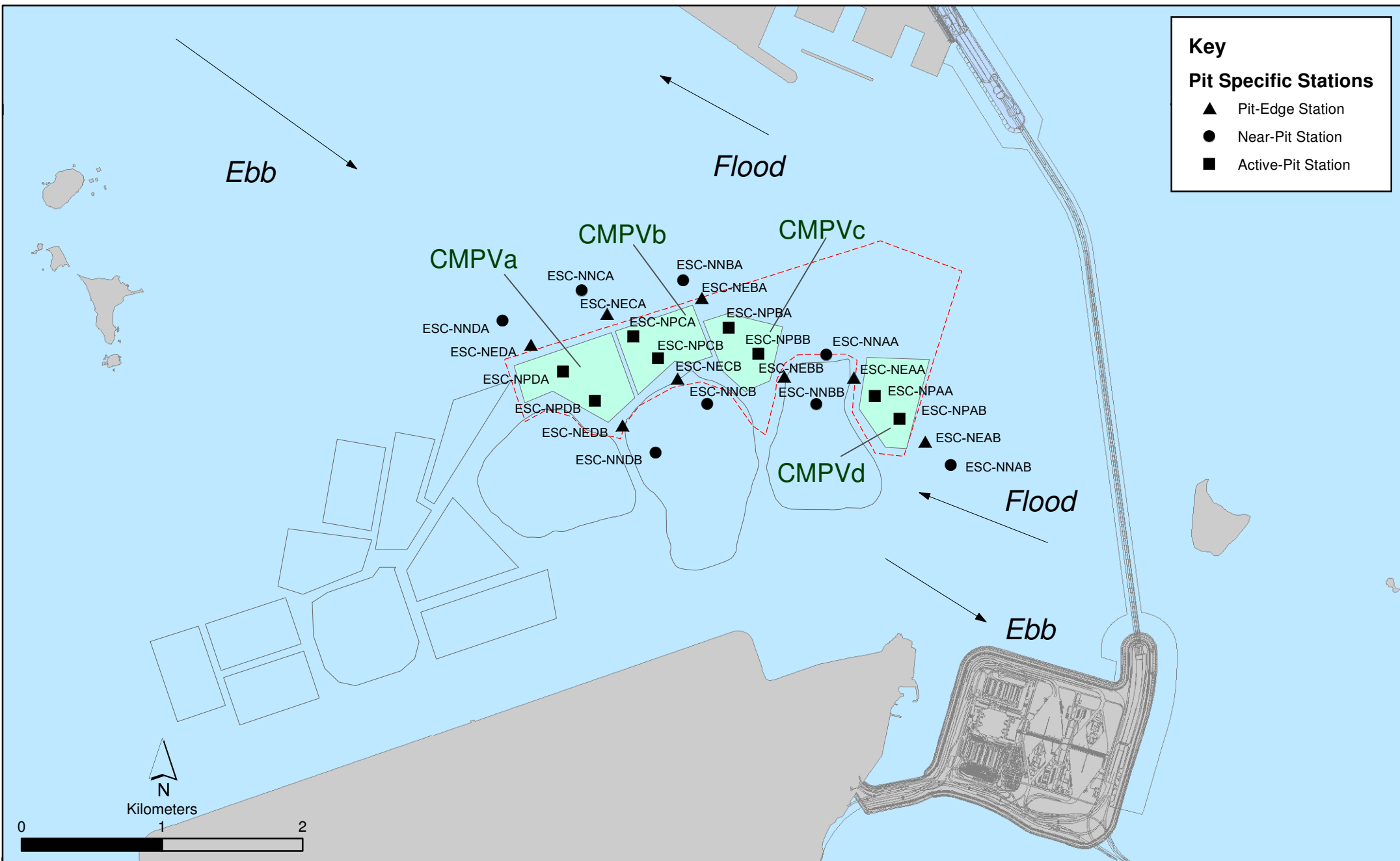


Figure 1.3

Pit Specific Sediment Quality Monitoring Stations for CMPV

- 1.5.18 The concentrations of all inorganic contaminants were lower than the Lower Chemical Exceedance Level (LCEL) at Pit-Edge and Near-Pit stations in January 2019. The concentrations of Arsenic were higher than the LCEL at Active Pit stations ESC-NPAA and ESC-NPAB. The concentrations of Chromium were higher than the LCEL at Active Pit station ESC-NPAB and the concentrations of Copper, Lead, Mercury, Nickel, Silver and Zinc were higher than the Upper Chemical Exceedance Level (UCEL) at Active Pit station ESC-NPAB (*Figures 11 and 12 of Annex C*).
- 1.5.19 For organic contaminants, the concentrations of Total Organic Carbon (TOC) varied between stations and were generally higher at Active-Pit ESC-NPAB station in January 2019 (*Figure 13 of Annex C*). Tributyltin (TBT), Total Polychlorinated Biphenyls (PCBs), Total dichloro-diphenyl-trichloroethane (DDT) and 4,4'-dichlorodiphenyldichloroethylene (DDE) concentrations were below the limit of reporting at all stations, while Low and High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) exceeded the UCEL at Active-Pit ESC-NPAB station in January 2019 (*Figures 14 and 15 of Annex C*).
- 1.5.20 Whilst the average concentration of Arsenic in the Earth's crust is generally ~2 mg/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 LCEL exceedances of Arsenic are unlikely to be caused by the disposal operations at ESC CMP Vd but rather as a result of naturally occurring deposits.
- 1.5.21 Considering that the higher levels of other contaminants occurred within one Active-Pit station ESC-NPAB 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 Vd in January 2019. 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 February 2019 for ESC CMP V (see *Annex A* for the sampling schedule ⁽³⁾):

- *Water Column Profiling of ESC CMP Vd;*

(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

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

- *Routine Water Quality Monitoring of ESC CMPs;*
- *Pit Specific Sediment Chemistry of ESC CMP Vd;*
- *Cumulative Impact Sediment Chemistry of ESC CMPs;*
- *Sediment Toxicity Tests of ESC CMPs; and*
- *Demersal Trawling for ESC CMPs.*

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*

Parameter	Action Level	Limit Level
Dissolved Oxygen (DO) ⁽¹⁾	<u>Surface and Mid-depth</u> ⁽²⁾ 5%-ile of baseline data for surface and middle layer = 3.76 mg L⁻¹	<u>Surface and Mid-depth</u> ⁽²⁾ 1%-ile of baseline data for surface and middle layer = 3.11 mg L⁻¹ ⁽³⁾
	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 = 2.96 mg L⁻¹	<u>Bottom</u> The average of the impact station readings are <2 mg/L⁻¹
	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) ^{(4) (5)}	95%-ile of baseline data for depth average = 37.88 mg L⁻¹	99%-ile of baseline data for depth average = 61.92 mg L⁻¹
	and	and
	120% of control station's SS at the same tide of the same day	130% of control station's SS at the same tide of the same day
Depth-averaged Turbidity (Tby) ^{(4) (5)}	95%-ile of baseline data = 28.14 NTU	99%-ile of baseline data = 38.32 NTU
	and	and
	120% of control station's Tby at the same tide of the same day	130% of control station's Tby at the same tide of the same day

Notes:

- (1) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
- (2) The Action and Limit Levels for DO for Surface & Middle layers were calculated from the combined pool of baseline surface layer data and baseline middle layer data.
- (3) Given the Action Level for DO for Surface & Middle layers has already been lower than 4 mg L⁻¹, it is proposed to set the Limit Level at 3.11 mg L⁻¹ which is the first percentile of the baseline data.
- (4) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.
- (5) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

Table B2 Water Column Profiling Results for ESC CMP Vd in January 2019

Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen		pH	Suspended Solids (mg L ⁻¹)
				(%)	(mg L ⁻¹)		
WCP 1 (Downstream)	18.81	33.31	5.51	93.34	7.13	8.12	6.88
WCP 2 (Upstream)	18.67	33.32	8.09	93.84	7.19	8.11	8.10
WQO (Dry Season)	N/A	29.99– 36.66#	N/A	N/A	>4	6.5-8.5	12.8

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 B3 In-situ Monitoring Results for Routine Water Quality Monitoring of ESC CMPs in January 2019

Sampling Period	Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen		pH (mg L ⁻¹)
					(%)	(mg L ⁻¹)	(mg L ⁻¹)
January 2019	RFF (Reference)	18.56	31.77	12.69	93.68	7.26	8.09
	IPF (Impact)	18.61	31.62	9.89	92.96	7.20	8.06
	INF (Intermediate)	18.65	31.61	10.19	92.71	7.17	8.05
	Ma Wan	18.84	32.52	6.30	90.35	6.93	8.05
	WQO	N/A	28.60 – 34.95#	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 exceeding the WQO.

Table B4 Laboratory Results for Routine Water Quality Monitoring of ESC CMPs in January 2019

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 ₃ (mg/L)	TIN (mg/L)	BOD ₅ (mg/L)	SS (mg/L)
January 2019	RFF	0.83	<0.50	<1.0	8.81	<1.0	<0.50	<1.0	<1.0	6.43	0.08	0.36	1.13	18.33
	IPF	1.06	<0.50	0.61	8.36	1.35	<0.50	1.01	<1.0	15.92	0.10	0.45	0.88	12.91
	INF	0.94	<0.50	<1.0	9.78	<1.0	<0.50	<1.0	<1.0	14.43	0.12	0.44	1.04	15.18
	Ma Wan	0.77	<0.50	<1.0	6.49	<1.0	<0.50	<1.0	<1.0	10.63	0.11	0.33	1.25	11.35

WQO of TIN: 0.5 mg/L

Dry Season WQO of SS : 12.8 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

Routine Water Quality Monitoring for ESC CMP V - January 2019

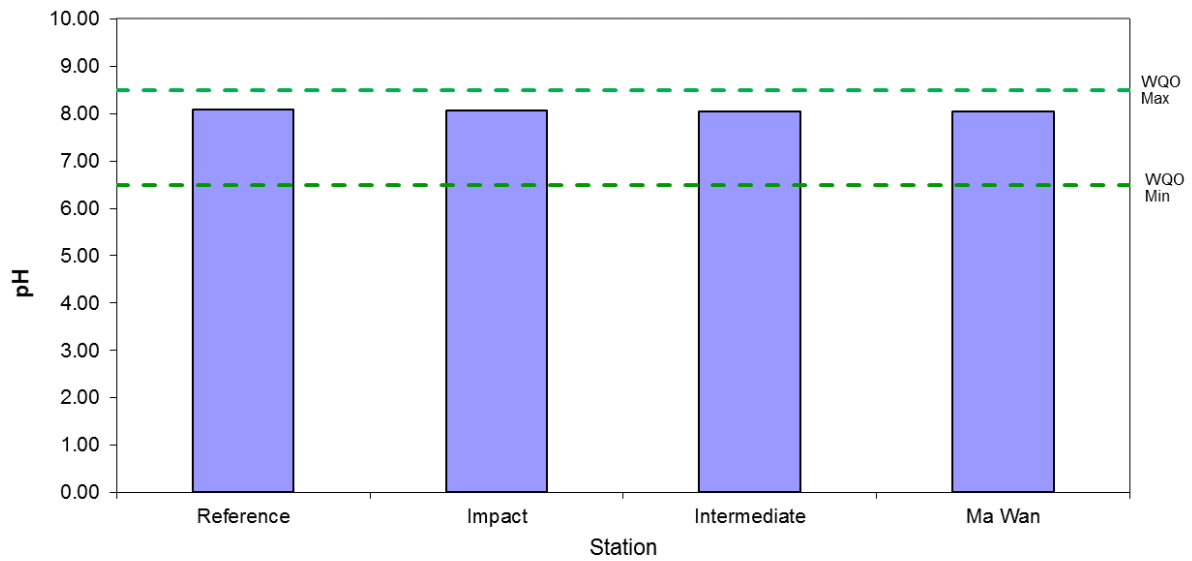


Figure 1: Level of pH recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in January 2019.

Routine Water Quality Monitoring ESC CMP V - January 2019

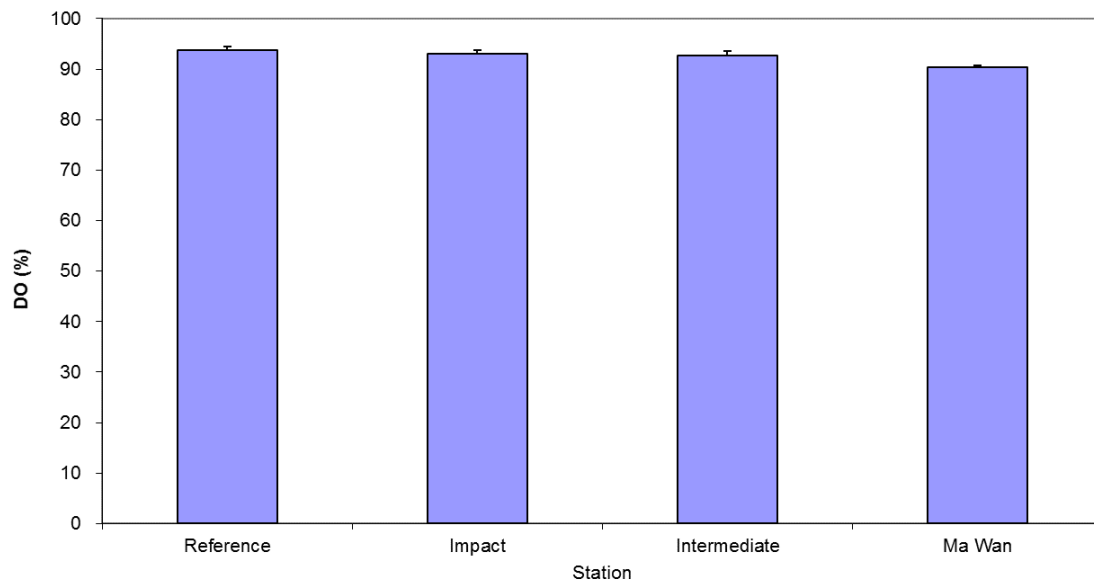


Figure 2: Level of Dissolved Oxygen (DO) (% saturation; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in January 2019.

Source: H:\Team\EM\GMS Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\January 2019

Date: February 2019

**Environmental
Resources
Management**



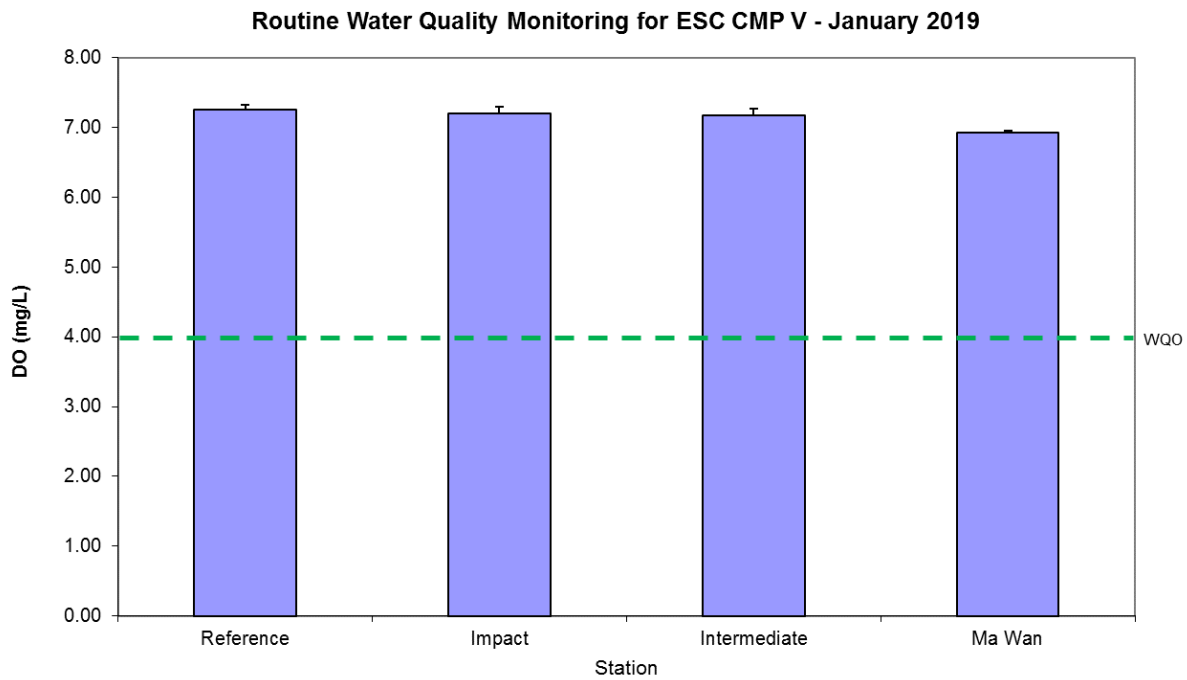


Figure 3: Concentration of Dissolved Oxygen (DO) (mg/L; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in January 2019.

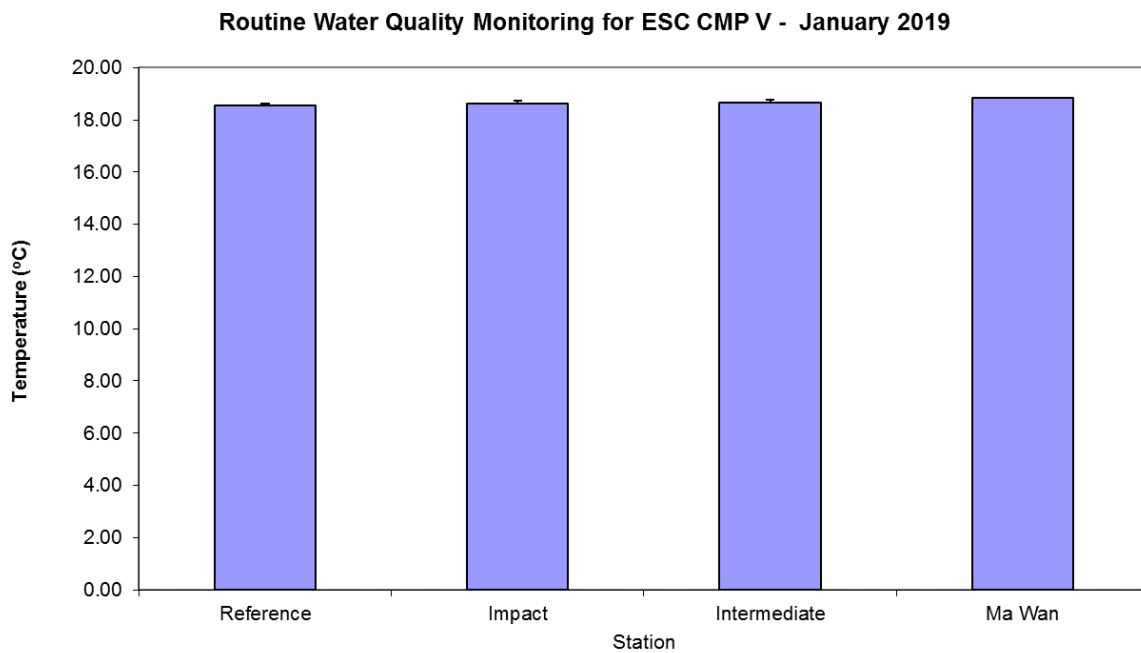


Figure 4: Level of Temperature (°C; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in January 2019.

Source: H:\Team\EM\GMS Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\January 2019)

Date: February 2019

**Environmental
Resources
Management**



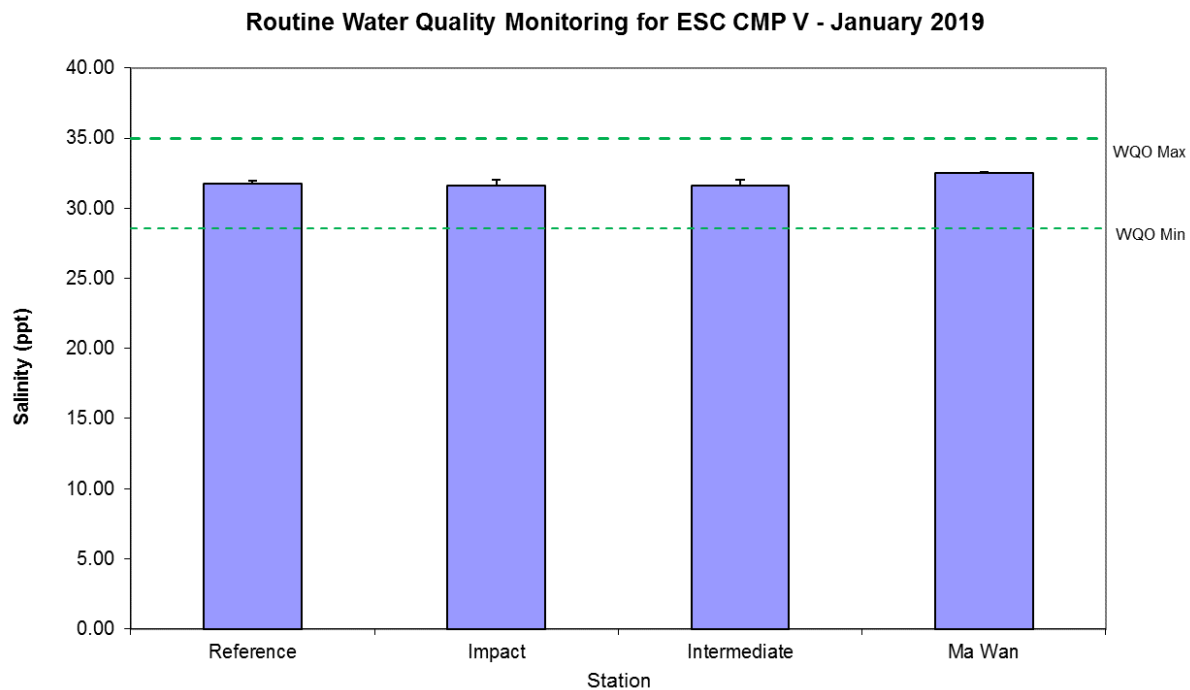


Figure 5: Level of Salinity (ppt; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in January 2019.

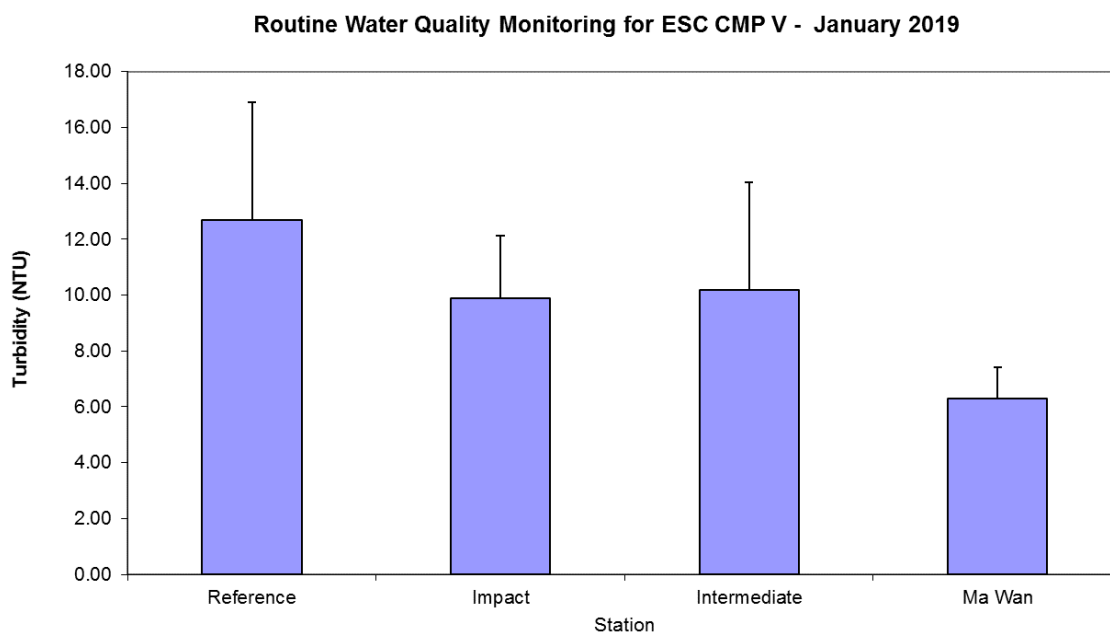


Figure 6: Levels of Turbidity (NTU; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in January 2019.

Source: H:\Team\EM\GMS Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\January 2019)

Date: February 2019

**Environmental
Resources
Management**



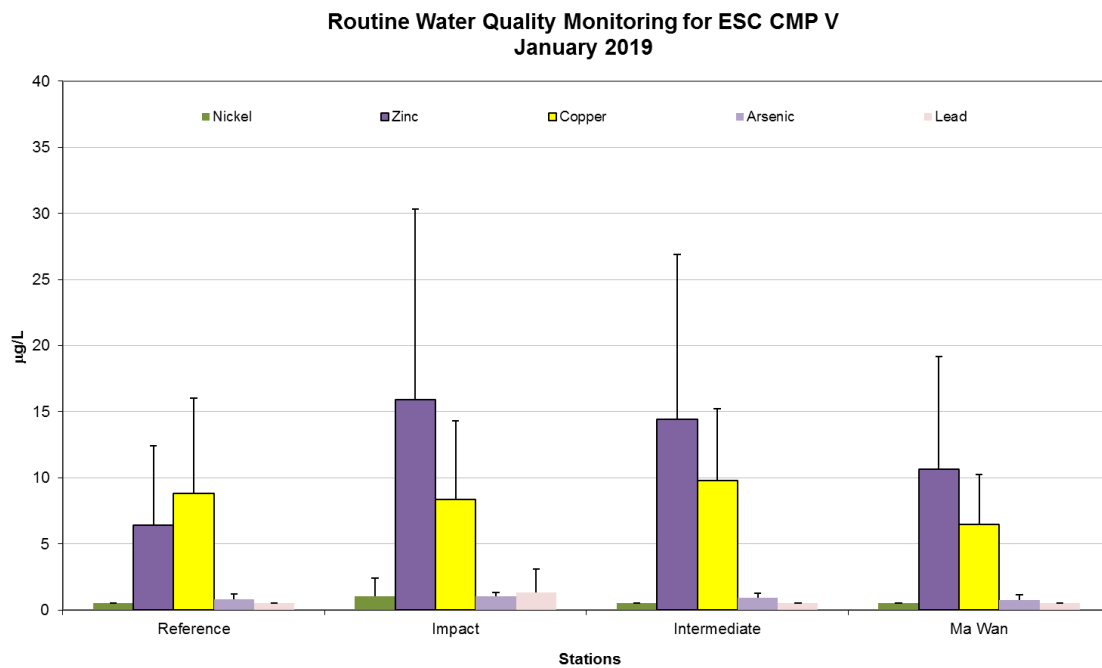


Figure 7: Concentration of Arsenic, Nickel, Lead, Copper and Zinc ($\mu\text{g/L}$; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in January 2019.

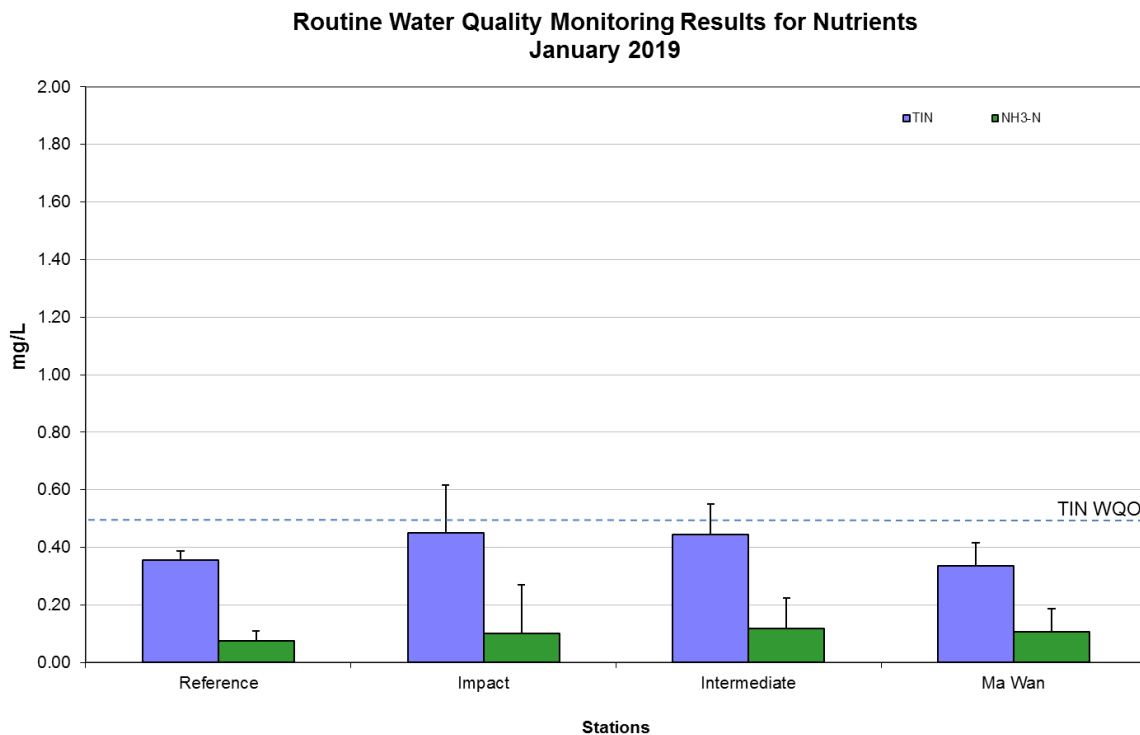


Figure 8: Concentration of Total Inorganic Nitrogen (TIN) and Ammonia Nitrogen ($\text{NH}_3\text{-N}$) ($\mu\text{g/L}$; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in January 2019.

Source: H:\Team\EM\GMS Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\January 2019)

Date: February 2019

**Environmental
Resources
Management**



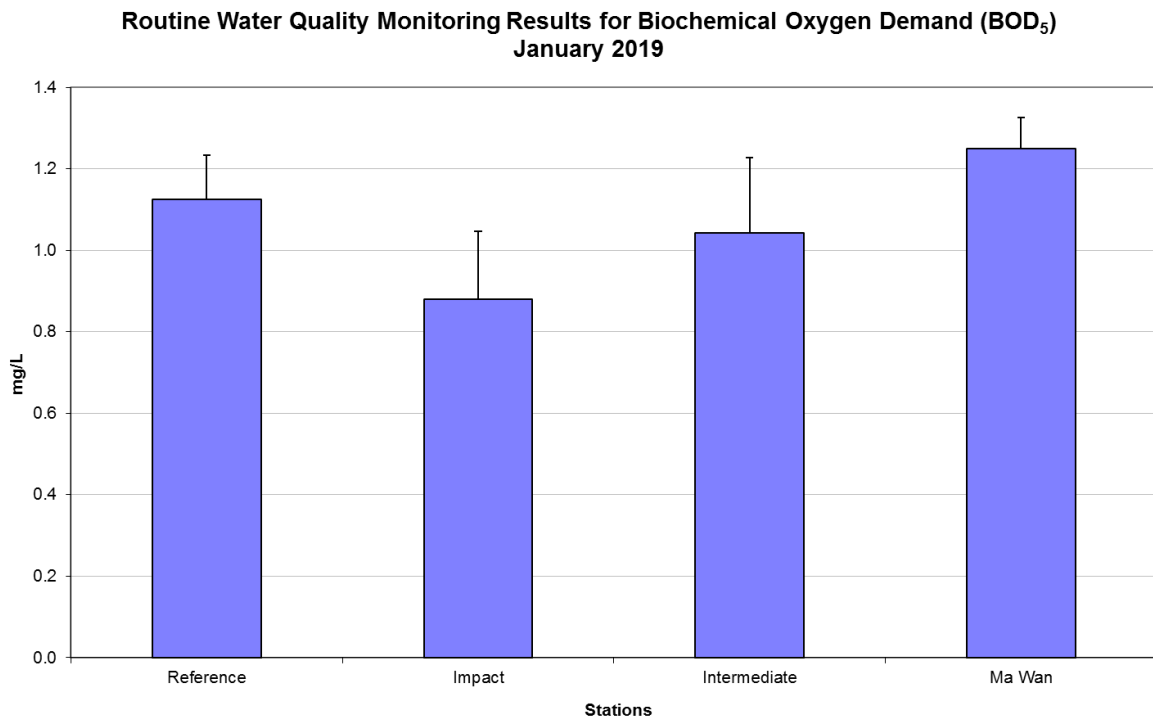


Figure 9: Level of Biochemical Oxygen Demand (BOD₅) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in January 2019.

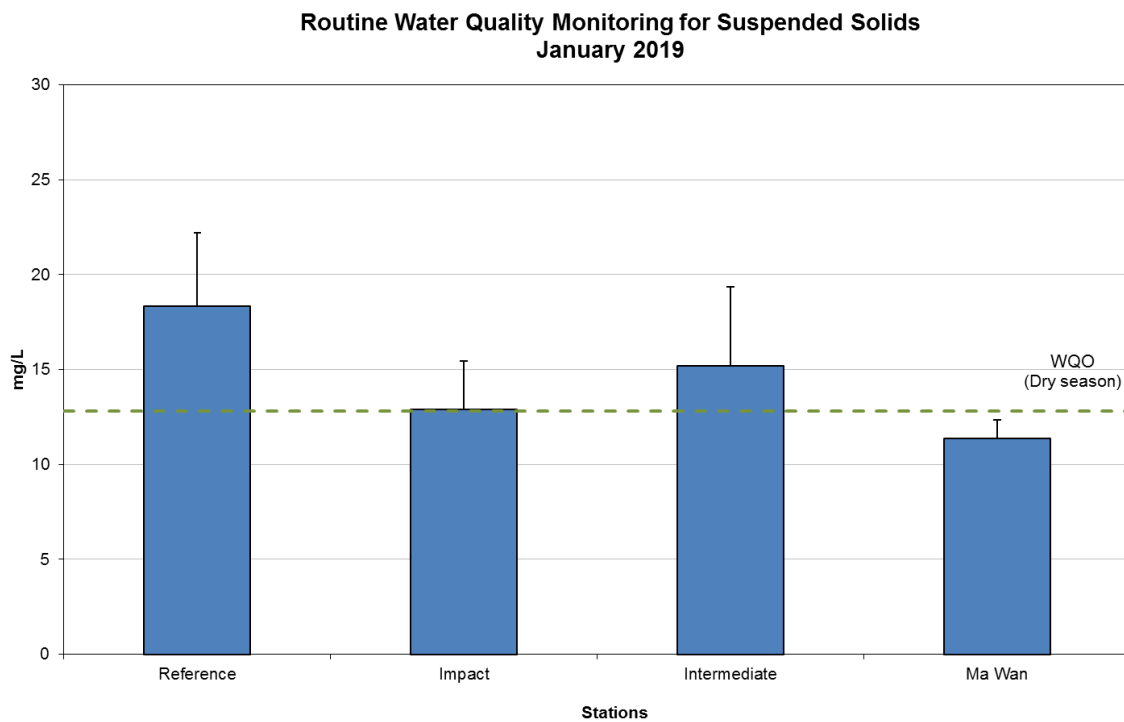


Figure 10: Concentration of Suspended Solids (SS) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in January 2019.

Source: H:\Team\EM\GMS Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\January 2019)

Date: February 2019

**Environmental
Resources
Management**



**Pit Specific Sediment Chemistry for Metal and Metalloid Contaminants at ESC CMP Vd
January 2019**

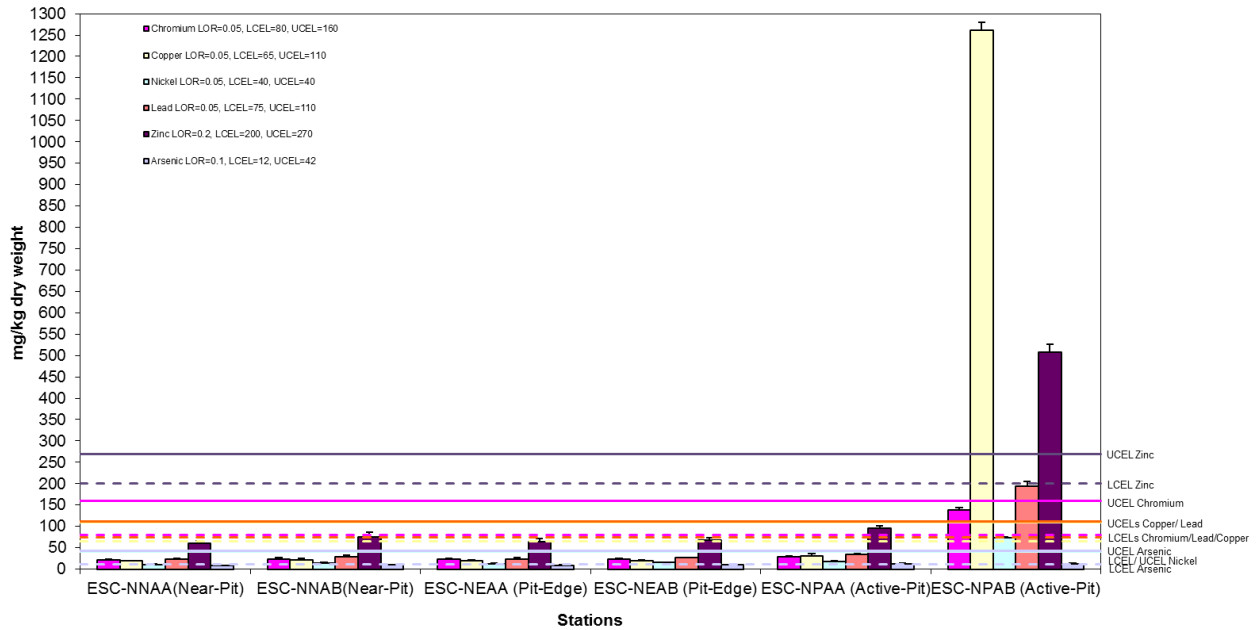


Figure 11: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in January 2019.

**Pit Specific Sediment Chemistry for Metal Contaminants at ESC CMP Vd
January 2019**

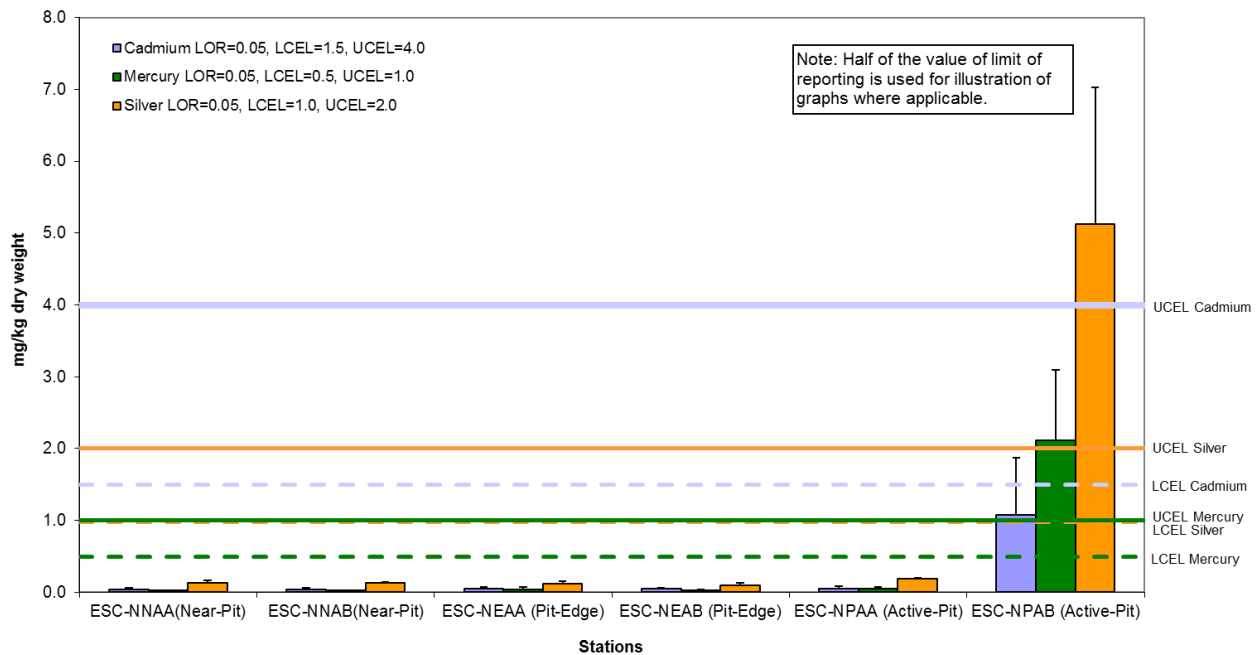


Figure 12: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in January 2019.

Source: H:\Team\EM\GMS Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\January 2019)

Date: February 2019

**Environmental
Resources
Management**



**Pit Specific Sediment Chemistry for Total Organic Carbon (TOC) at ESC CMP Vd
January 2019**

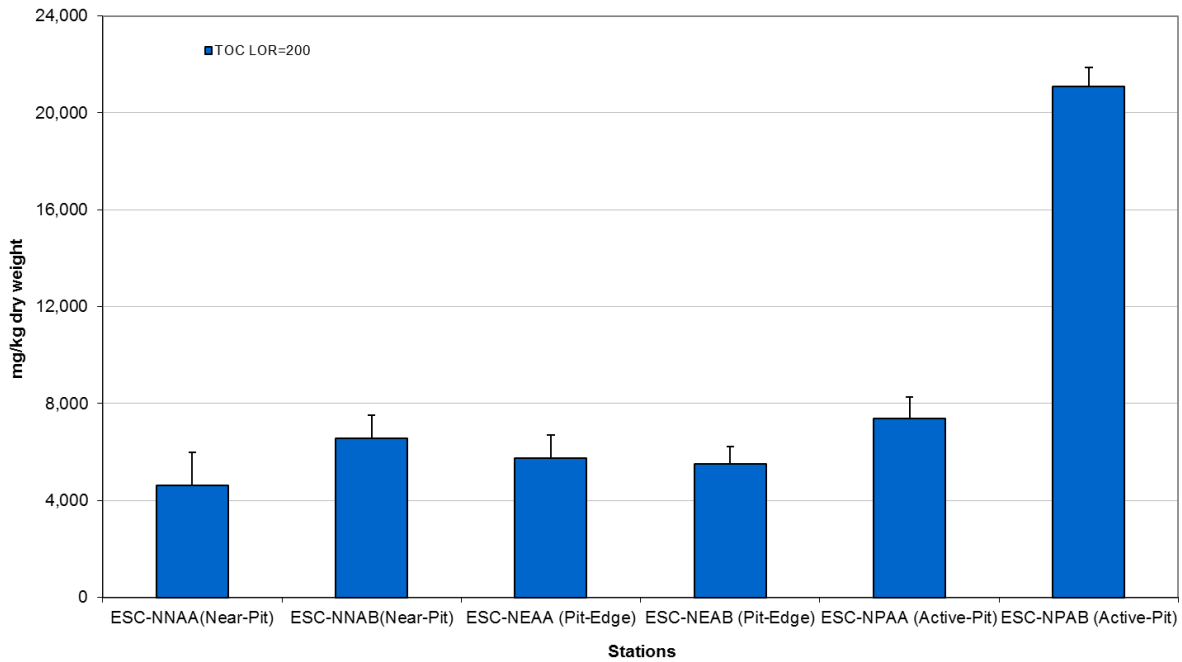


Figure 13: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in January 2019.

**Pit Specific Sediment Chemistry for Tributyltin (TBT) at ESC CMP Vd
January 2019**

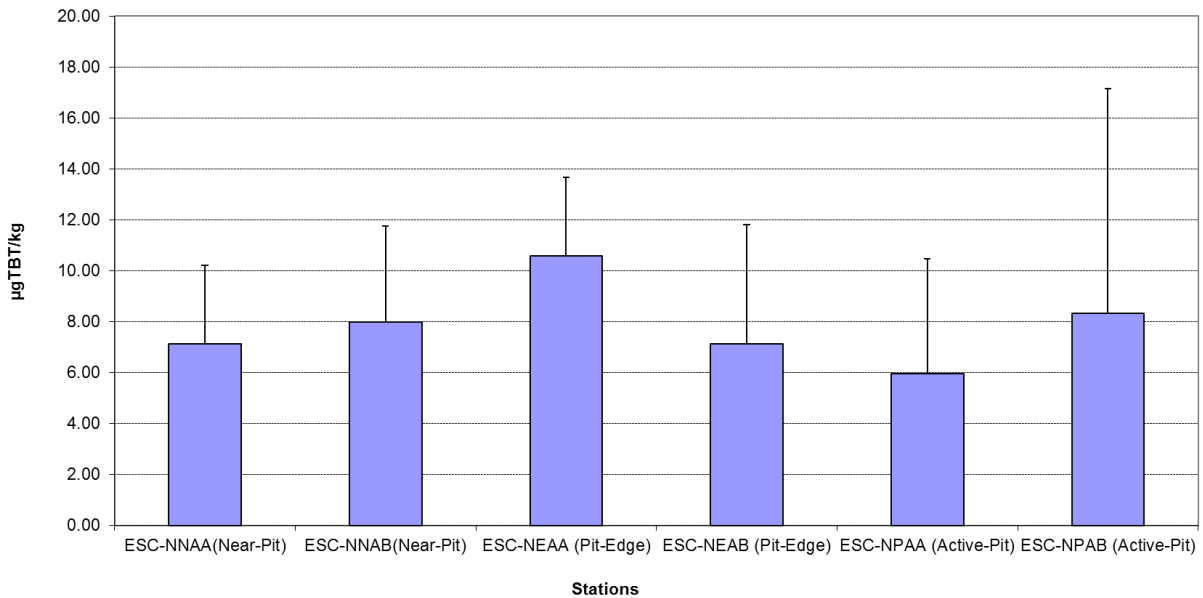


Figure 14: Concentration of Tributyltin (TBT) (µg TBT/kg; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in January 2019.

Source: H:\Team\EM\GMS Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\January 2019)

Date: February 2019

**Environmental
Resources
Management**



Pit Specific Sediment Chemistry for Low and High Molecular Weight Polycyclic Aromatics Hydrocarbons (PAHs) at ESC CMP Vd in January 2019

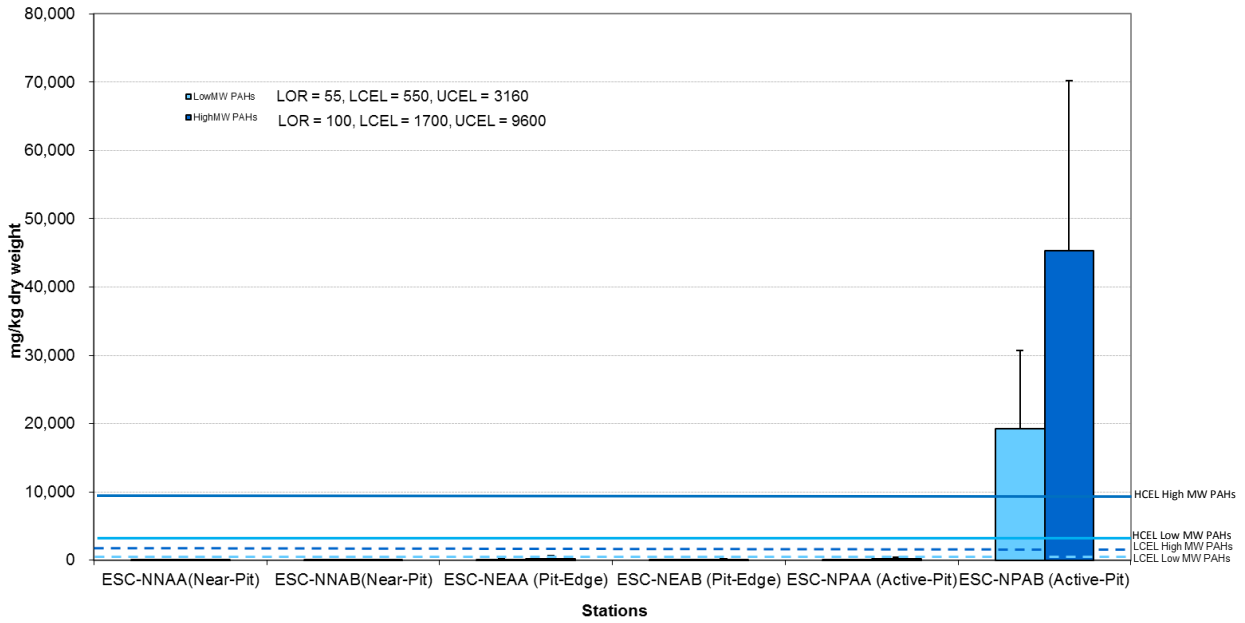


Figure 15: Concentration of Low and High Molecular Weight Polycyclic Aromatics (mg/kg dry weight; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in January 2019.

Source: H:\Team\EM\GMS Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\January 2019)

Date: February 2019

**Environmental
Resources
Management**



Annex D

Study Programme

