

**Agreement No. CE 59/2020 (EP)
Environmental Monitoring and
Audit for Disposal Facility to the
East of Sha Chau (2021-2026)
– Investigation**

Monthly EM&A Report for
Contaminated Mud Pits to the East of Sha Chau
– June 2022

July 2022

Mott MacDonald
3/F Manulife Place
348 Kwun Tong Road
Kwun Tong
Kowloon
Hong Kong

T +852 2828 5757
mottmac.hk

Civil Engineering and
Development Department
Fill Management Division
5/F, Civil Engineering and
Development Building
101 Princess Margaret
Road
Homantin, Kowloon

Agreement No. CE 59/2020 (EP) Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau (2021-2026) – Investigation

Monthly EM&A Report for
Contaminated Mud Pits to the East of Sha Chau
– June 2022

July 2022

Dredging, Management and Capping of Contaminated Sediment Disposal

Facility at Sha Chau

Environmental Certification Sheet

Environmental Permit No. 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 – June 2022
Date of Report:	12 July 2022
Date prepared by ET:	12 July 2022
Date received by IA:	12 July 2022


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 10 working days 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 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.	
Ir Thomas Chan, Environmental Team Leader (ETL): 	Date: 12 July 2022

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 (IA): 	Date: 12 July 2022

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	Jul 2022	Various	Thomas Chan	Eric Ching	Revision A for Submission
B	Jul 2022	Various	Thomas Chan	Eric Ching	Revision B for Record [Finalised]

Document reference: 423134 | 06/05/15 | B

Information class: Standard

This document is issued for the party which commissioned it and for specific purposes connected with the above-captioned project only. It should not be relied upon by any other party or used for any other purpose.

We accept no responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose, or containing any error or omission which is due to an error or omission in data supplied to us by other parties.

This document contains confidential information and proprietary intellectual property. It should not be shown to other parties without consent from us and from the party which commissioned it.

Contents

1	Introduction	1
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 or Analysis	2
2	Brief Discussion of Monitoring Results for ESC CMP V	3
2.1	Introduction	3
2.2	Water Column Profiling of ESC CMP Vb – in June 2022	3
2.2.1	In-situ Measurements	3
2.2.2	Laboratory Measurements for Suspended Solids (SS)	3
2.3	Routine Water Quality Monitoring of ESC CMPs – in June 2022	3
2.3.1	In-situ Measurements	4
2.3.2	Laboratory Measurements	4
2.4	Pit Specific Sediment Chemistry of ESC CMP Vb – in June 2022	4
2.5	Cumulative Impact Sediment Chemistry of ESC CMPs – in June 2022	5
2.6	Impact Water Quality Monitoring during Dredging Operations of ESC CMP Vc – June 2022	6
3	Future Key Issues	7
3.1	Activities Scheduled for the Next Reporting Period	7
3.2	Study Programme	7

Tables

Table 1.1	Works Schedule for ESC CMP V
Table 2.1	Details of Exceedances Recorded at ESC CMP Vc during the Reporting Period

Figures

Figure 2.1	Routine & Capping Water Quality Sampling Stations (Ebb-Tide) for ESC CMPs
Figure 2.2	Pit Specific Sediment Quality Monitoring Stations for CMP V
Figure 2.3	Cumulative Impacts Sediment Quality Monitoring Stations for ESC CMPs
Figure 2.4	Indicative Dredging Impact Sampling Stations for ESC CMPs

Appendices

- Appendix A Sampling Schedule
- Appendix B Water Quality Monitoring Results
- Appendix C Graphical Presentations
- Appendix D Dredging Record
- Appendix E Study Programme

1 Introduction

1.1 Background

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 East of Sha Chau (ESC) for the disposal of contaminated sediment, and various 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.

Environmental Permits (EPs) (Ref. No. EP-312/2008/A) was issued by the Environmental Protection Department (EPD) to the CEDD, the Permit Holder, on 28 November 2008 for the Project - Disposal of Contaminated Sediment – Dredging, Management and Capping of Sediment Disposal Facility at Sha Chau.

Under the requirements of the EP, 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. 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.

A proposal on the change of number of sample replication of water quality and sediment monitoring as well as 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 **Appendix A**.

The present EM&A programme under Agreement No. CE 59/2020 (EP) covers the dredging, disposal and capping operations of the ESC CMP V (see **Appendix A** for the EM&A programme.) Detailed works schedule for ESC CMP V is shown in **Table 1.1**. In June 2022, the following works were undertaken:

- Dredging of accumulated natural deposits at ESC CMP Vc;
- Disposal of contaminated mud at ESC CMP Vb; and
- Capping operations at ESC CMP Vd.

Table 1.1: Works Schedule for ESC CMP V

Pit	Operation	2021			2022			2023			2024			2025			2026										
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar		
ESC CMP V	Dredging																										
	Disposal																										
	Capping																										

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.

1.2 Reporting Period

This *Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – June 2022* covers the EM&A activities for the reporting period of June 2022 (from 1 to 30 June 2022).

1.3 Details of Sampling and Laboratory Testing Activities

The following monitoring activities were undertaken for ESC CMP V during the reporting period:

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

1.4 Details of Outstanding Sampling or Analysis

No outstanding sampling remained for the reporting month (June 2022).

2 Brief Discussion of Monitoring Results for ESC CMP V

2.1 Introduction

This section presents a brief discussion of the results obtained from the following monitoring activities for ESC CMP V during the reporting period:

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

2.2 Water Column Profiling of ESC CMP Vb – in June 2022

Water Column Profiling was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 7 June 2022. 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 2011 – 2020 from stations in the North Western Water Control Zone (WCZ), where the ESC CMPs are located.³ 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 **Appendix B** for details).

2.2.1 In-situ Measurements

Analyses of results for June 2022 indicated that levels of Salinity, pH and DO complied with the WQOs at both Downstream and Upstream stations (**Table B2** of **Appendix B**). Levels of DO and Turbidity at all stations complied with the Action and Limit Levels (**Tables B1 and B2** of **Appendix B**).

2.2.2 Laboratory Measurements for Suspended Solids (SS)

Analyses of results for June 2022 indicated that the SS level at both Downstream and Upstream stations complied with the WQO and the Action and Limit Levels (**Tables B1 and B2** of **Appendix B**).

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.

2.3 Routine Water Quality Monitoring of ESC CMPs – in June 2022

Routine Water Quality Monitoring of ESC CMPs was undertaken on 9 June 2022. The monitoring results have been assessed for compliance with the WQOs (see **Section 2.2** above for details). The monitoring results are shown in **Tables B3 and B4** of **Appendix B** and **Figures 1 to 10** of **Appendix C**. A total of sixteen (16) monitoring stations were sampled in June 2022 as shown in **Figure 2.1**.

³ <http://epic.epd.gov.hk/EPICRIVER/marine/?lang=en>

2.3.1 In-situ Measurements

Graphical presentation of the monitoring results (Temperature, DO, pH, Salinity and Turbidity) is shown in **Figures 1 to 6 of Appendix C**. Analyses of results indicated that the levels of pH, Salinity and DO complied with the WQOs at all stations in June 2022, except for higher levels of Salinity were recorded at Ma Wan station and slightly lower Salinities was recorded at Impact station. The higher Salinities recorded at Ma Wan station are likely to be caused by the larger separation distance to Pearl River Delta mouth, which releases a large amount of freshwater runoff in the area during wet season, when compared to the Reference stations. The slightly lower Salinities recorded at Impact station could possibility related to the current at the vicinity.

The levels of DO and Turbidity complied with the Action and Limit Levels at all stations (**Table B3 of Appendix B; Figures 3 and 6 of Appendix C**).

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 June 2022.

2.3.2 Laboratory Measurements

Laboratory analysis of samples obtained during the reporting period indicated that the concentrations of Arsenic, Chromium, Copper, Lead, Nickel and Zinc were detected in the samples at all stations and their concentrations of most metals and metalloids were generally similar across stations, except the concentration of Zinc which was lower at Impact (IPE) station (**Table B4 of Appendix B; Figure 7 of Appendix C**).

For nutrients, concentrations of Total Inorganic Nitrogen (TIN) were higher than the WQO (0.5 mg/L) at Reference (RFE), Impact (IPE) and Intermediate (INE) stations (**Table B4 of Appendix B; Figure 8 of Appendix 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.⁴ Therefore, the exceedances of TIN WQO at these stations are unlikely to be caused by the disposal operation at ESC CMPs. The concentration of Ammonia Nitrogen (NH₃-N) were generally similar across stations (**Table B4 of Appendix B; Figure 8 of Appendix C**). The concentrations of Biochemical Oxygen Demand (BOD₅) were higher at Impact (IPE) station (**Table B4 of Appendix B; Figure 9 of Appendix C**).

Analyses of results for the reporting period indicated that the SS levels at all stations complied with the wet season WQO (12.0 mg/L) and the Action and Limit Levels (**Tables B1 and B4 of Appendix B; Figure 10 of Appendix C**).

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 during the reporting period. Detailed statistical analysis will be presented in the Quarterly EM&A Report to investigate any spatial and temporal trends of potential concern.

2.4 Pit Specific Sediment Chemistry of ESC CMP Vb – in June 2022

Monitoring locations for Pit Specific Sediment Chemistry for ESC CMP Vb are shown in **Figure 2.2**. A total of six (6) monitoring stations were sampled on 1 June 2022.

The concentrations of most inorganic contaminants were lower than the Lower Chemical Exceedance Levels (LCELs) at most stations, except for Arsenic. The concentrations of Arsenic were higher than the LCEL at Near-Pit station ESC-NNCA, Pit-Edge stations ESC-NECA, ESC-NECB and Active-Pit stations ESC-NPCA, ESC-NPCB (**Figures 11 and 12 of Appendix C**).

⁴ http://www.epd.gov.hk/epd/misc/marine_quality/1986-2005/textonly/eng/index.htm

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.⁵ It is presumed that the natural concentrations of Arsenic are similar in onshore and offshore sediments,⁶ 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 Vb but rather as a result of naturally occurring deposits.

For organic contaminants, the concentration of Total Organic Carbon (TOC) was higher at Active-Pit station ESC-NPCA during the reporting period (**Figure 13 of Appendix C**). The concentrations of Tributyltin (TBT), Total Polychlorinated Biphenyls (PCBs), Total dichloro-diphenyl-trichloroethane (DDT), 4,4'-dichlorodiphenyldichloroethylene (DDE), Low Molecular Weight and High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) were below the limit of reporting at all stations during the reporting period.

Overall, 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 during the reporting period.

Statistical analysis will be undertaken and presented in the corresponding Quarterly EM&A Report to investigate whether there are any unacceptable impacts in the area caused by the contaminated mud disposal.

2.5 Cumulative Impact Sediment Chemistry of ESC CMPs – in June 2022

Monitoring locations for Cumulative Impact Sediment Chemistry for ESC CMPs are shown in **Figure 2.3**. A total of nine (9) monitoring stations were sampled on 16 June 2022.

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 during the reporting period, except concentrations of Arsenic were higher than the LCEL at Near-field station ESC-RNB1, Mid-field station ESC-RMA and Far-field stations ESC-RFB (**Figures 14 and 15 of Appendix C**). As discussed in **Section 2.4**, the LCEL 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.

For organic contaminants, the concentration of TOC was higher at Far-field station ESC-RFB (**Figure 16 of Appendix C**). The concentrations of Total PCBs, Total DDT, 4,4'-DDE, High & Low Molecular Weight PAHs and TBT were below the limit of reporting at all stations during the reporting period.

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 during the reporting period. Statistical analysis will be undertaken and presented in the corresponding Quarterly EM&A Report to investigate whether there are any unacceptable impacts in the area caused by the contaminated mud disposal.

⁵ Sewell RJ (1999) Geochemical Atlas of Hong Kong. Geotechnical Engineering Office, Government of the Hong Kong Special Administrative Region

⁶ 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

2.6 Impact Water Quality Monitoring during Dredging Operations of ESC CMP Vc – June 2022

Dredging activities were carried out from 1 to 12 June 2022 during this reporting period. As advised by the Project Proponent and the Contractor, the dredging activities in 2022 was completed on 12 June 2022. Water quality monitoring was conducted during the reporting period on 2, 4, 6, 8, 10 and 13 June 2022. During each survey day, monitoring was conducted during both mid-ebb and mid-flood tides at two Reference (Upstream) stations and five Impact (Downstream) stations around the dredging operations at ESC CMP Vc. Monitoring was also conducted at one Sensitive Receiver station situated in Ma Wan. A total of eight (8) stations were monitored and locations of the sampling stations are shown in **Figure 2.4**.

Monitoring results are presented in **Table B5 of Appendix B**. Daily dredging volume in June 2022 is reported in **Appendix D**. Levels of DO, Turbidity and SS generally complied with the Action and Limit Levels (see **Table B1 of Appendix B** for details). The results indicated that the dredging operations at ESC CMP Vc did not appear to cause any unacceptable deterioration in water quality during this reporting period. Therefore, no further action, except for those recommended in the Environmental Permit (EP-312/2008/A), are considered necessary for the dredging operations.

3 Future Key Issues

3.1 Activities Scheduled for the Next Reporting Period

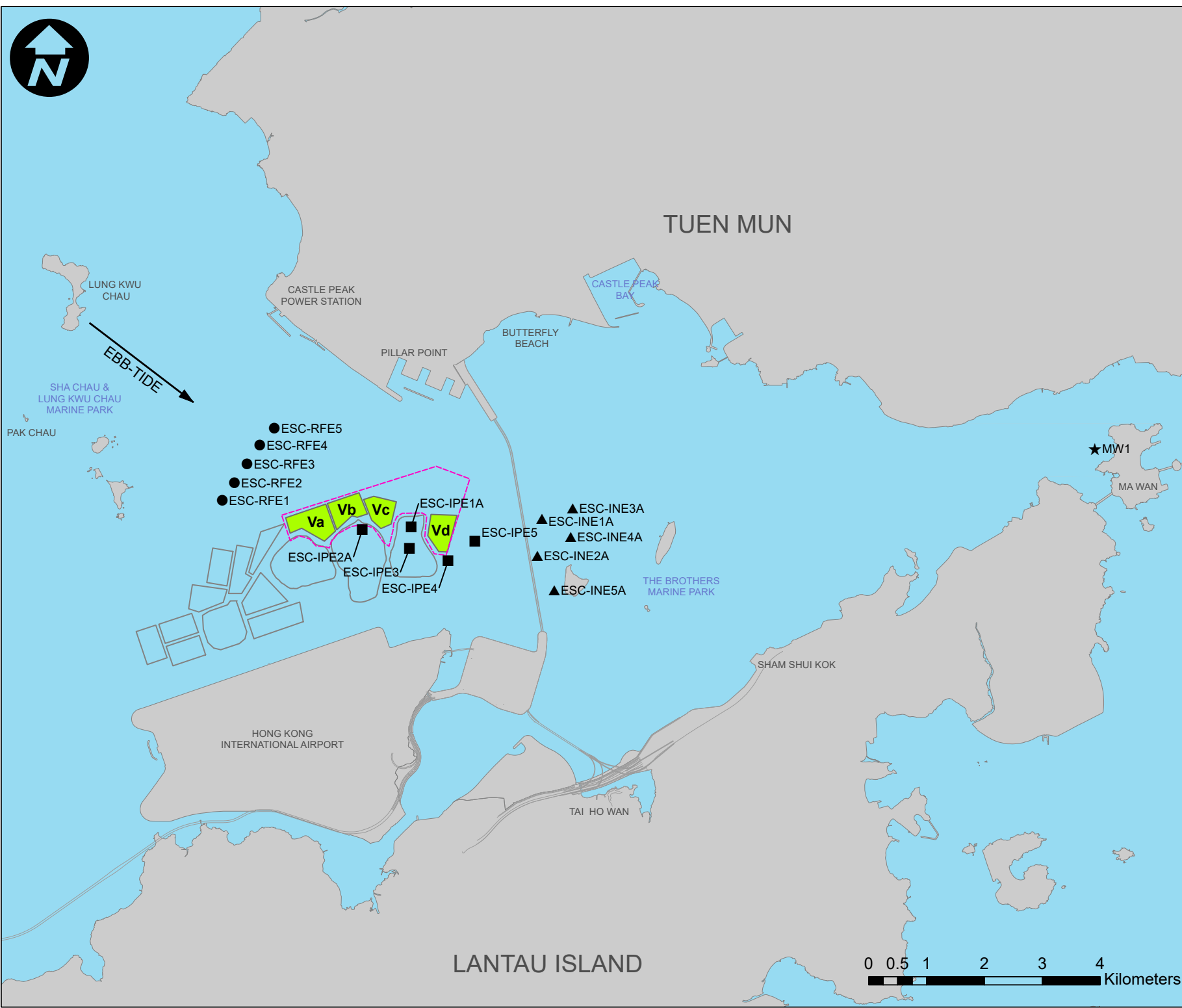
The following monitoring activities will be conducted in the next reporting period of July 2022 for ESC CMP V (see **Appendix A** for the sampling schedule):

- 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.

3.2 Study Programme

A summary of the Study Programme is presented in **Appendix E**.

Figures



Notes:

Key to symbols:

LEGEND

- ESC CMP V
 - ESC USABLE AREA 1
- #### WATER QUALITY SAMPLING STATIONS
- IMPACT STATION
 - INTERMEDIATE STATION
 - REFERENCE STATION
 - MA WAN STATION

Rev	Date	Drawn	Description	Ch'kd	App'd
P1	APR 2021	KN			

M M
MOTT
MACDONALD

3/F International Trade Tower
348 Kwun Tong Road
Kwun Tong, Kowloon
Hong Kong
T +852 2828 5757
F +852 2821823
W motmac.com

Client

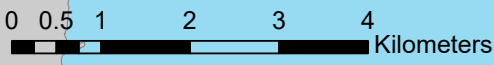
CEDD 土木工程拓展署
Civil Engineering and
Development Department

Project **AGREEMENT NO. CE 59/2020 (EP)
ENVIRONMENTAL MONITORING AND AUDIT
FOR DISPOSAL FACILITY
TO THE EAST OF SHA CHAU (2021-2026)
- INVESTIGATION**

Title **ROUTINE & CAPPING WATER QUALITY
SAMPLING STATIONS (EBB-TIDE)
FOR ESC CMPS**

Designed		Eng check	
Drawn		Coordination	
Dwg check		Approved	
Scale at A3	Status	Rev	

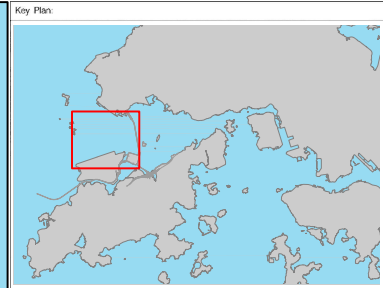
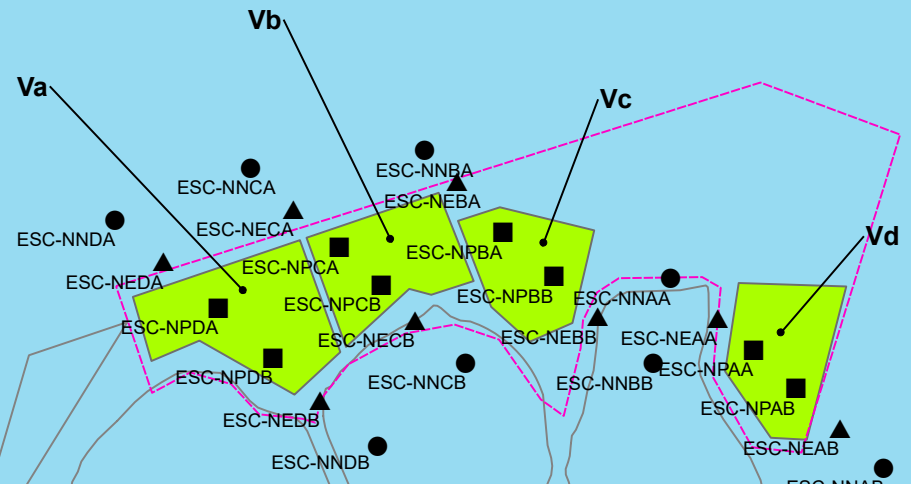
Drawing Number **FIGURE 2.1**





EBB-TIDE

FLOOD-TIDE



Notes:

Key to symbols:

LEGEND

- ESC CMP V
- ESC USABLE AREA 1
- ACTIVE-PIT STATION
- PIT-EDGE STATION
- NEAR-PIT STATION

PIT SPECIFIC SEDIMENT MONITORING STATIONS

Rev	Date	Drawn	Description	Ch'kd	App'd
P1	APR 2021	KN			

M M
MOTT
MACDONALD

3/F International Trade Tower
348 Kwun Tong Road
Kwun Tong, Kowloon
Hong Kong
T +852 2828 5757
F +852 2821823
W motmac.com

Client

CEDD 土木工程拓展署
Civil Engineering and
Development Department

Project **AGREEMENT NO. CE 59/2020 (EP)
ENVIRONMENTAL MONITORING AND AUDIT
FOR DISPOSAL FACILITY
TO THE EAST OF SHA CHAU (2021-2026)
- INVESTIGATION**

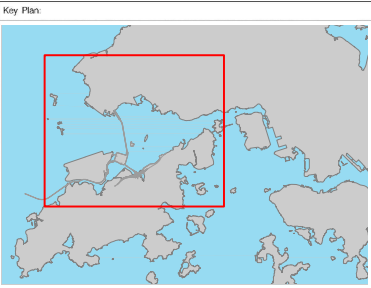
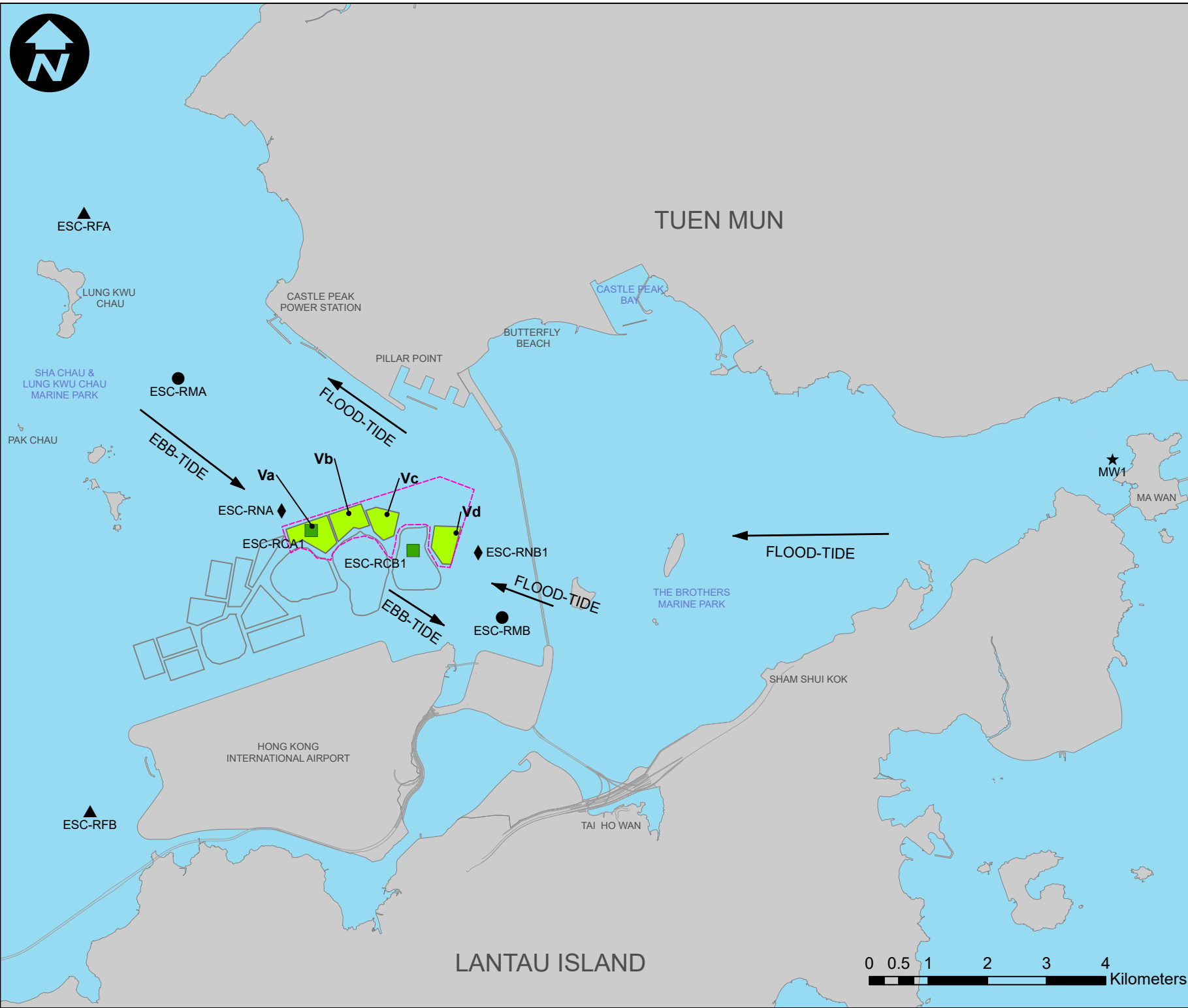
PIT SPECIFIC SEDIMENT QUALITY MONITORING STATIONS FOR CMP V

Designed		Eng check	
Drawn		Coordination	
Dwg check		Approved	
Scale at A3	Status	Rev	

Drawing Number **FIGURE 2.2**

HONG KONG INTERNATIONAL AIRPORT





Notes:

Key to symbols:

LEGEND

- ESC CMP V
- ESC USABLE AREA 1

CUMULATIVE IMPACT SEDIMENT MONITORING STATIONS

- CAPPED PIT STATION
- NEAR-FIELD STATION
- MID-FIELD STATION
- FAR-FIELD STATION
- MA WAN STATION

Rev	Date	Drawn	Description	Ch'kd	App'd
P1	APR 2021	KN			

M M
MOTT
MACDONALD

3/F International Trade Tower
348 Kwun Tong Road
Kwun Tong, Kowloon
Hong Kong
T +852 2828 5757
F +852 2821823
W mottmac.com

Client

CEDD 土木工程拓展署
Civil Engineering and
Development Department

Project **AGREEMENT NO. CE 59/2020 (EP)
ENVIRONMENTAL MONITORING AND AUDIT
FOR DISPOSAL FACILITY
TO THE EAST OF SHA CHAU (2021-2026)
- INVESTIGATION**

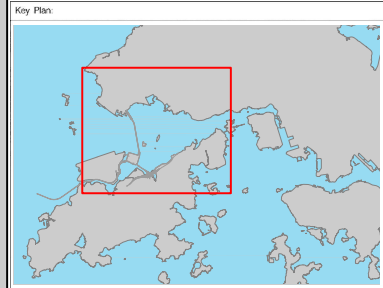
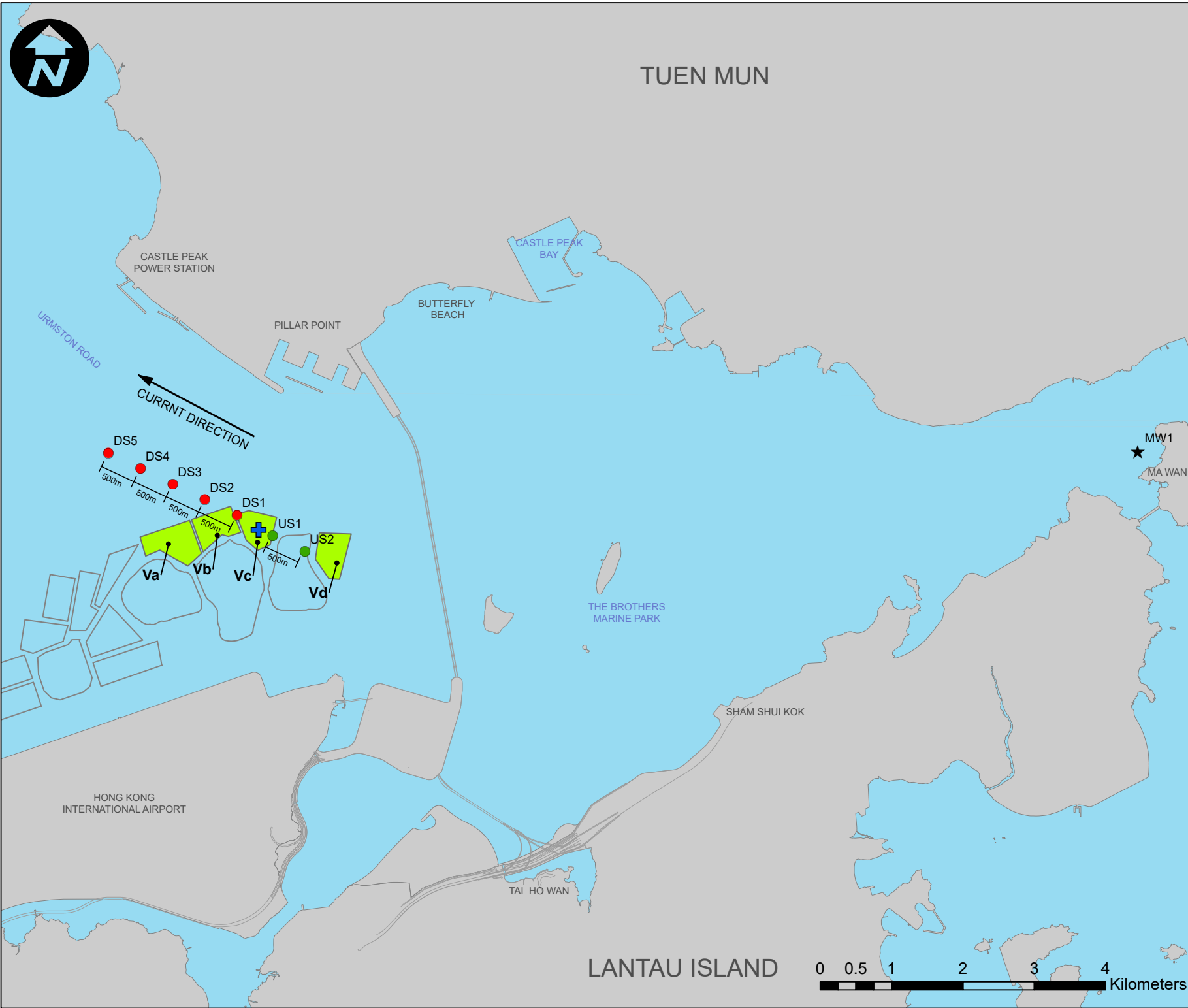
Title **CUMULATIVE IMPACTS SEDIMENT
QUALITY MONITORING STATIONS
FOR ESC CMPS**

Designed		Eng check	
Drawn		Coordination	
Dwg check		Approved	
Scale at A3	Status	Rev	

Drawing Number **FIGURE 2.3**



TUEN MUN



Notes:

Key to symbols:

LEGEND

- ESC CMP V
- + POSITION OF DREDGING ACTIVITY
- DOWNSTREAM/ IMPACT STATION
- UPSTREAM/ REFERENCE STATION
- ★ MA WAN STATION

Rev	Date	Drawn	Description	Ch'kd	App'd
P1	AUG 2021	KN			

M M
MOTT
MACDONALD

3/F International Trade Tower
348 Kwun Tong Road
Kwun Tong, Kowloon
Hong Kong
T +852 2828 5757
F +852 2821823
W motmac.com

Client

CEDD 土木工程拓展署
Civil Engineering and
Development Department

Project **AGREEMENT NO. CE 59/2020 (EP)
ENVIRONMENTAL MONITORING AND AUDIT
FOR DISPOSAL FACILITY
TO THE EAST OF SHA CHAU (2021-2026)
- INVESTIGATION**

Title **INDICATIVE DREDGING IMPACT
SAMPLING STATIONS FOR ESC CMPS**

Designed		Eng check	
Drawn		Coordination	
Dwg check		Approved	
Scale at A3	Status	Rev	

Drawing Number **FIGURE 2.4**

LANTAU ISLAND



Appendices

- Appendix A Sampling Schedule
- Appendix B Water Quality Monitoring Results
- Appendix C Graphical Presentations
- Appendix D Dredging Record
- Appendix E Study Programme

Appendix A. Sampling Schedule

Appendix B. Water Quality Monitoring Results

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

Parameters	Action	Limit
Dissolved Oxygen (DO) in mg L ⁻¹ (Surface, Middle & Bottom) ⁽¹⁾	Surface and Middle Depth⁽²⁾ 5%-ile of baseline data for surface and middle layer = 3.76 and Significantly less than the reference station's mean DO (at the same tide of the same day)	Surface and Middle Depth⁽²⁾ 1%-ile of baseline data for surface and middle layer = 3.11 ⁽³⁾ and Significantly less than the reference station's mean DO (at the same tide of the same day)
	Bottom 5%-ile of baseline data for surface and middle layer = 2.96 and Significantly less than the reference station's mean DO (at the same tide of the same day)	Bottom The average of the impact station readings are < 2 and Significantly less than the reference station's mean DO (at the same tide of the same day)
Suspended Solids (SS) in mg L ⁻¹ (depth-averaged) ⁽⁵⁾	95%-ile of baseline data for depth-averaged = 37.88 and 120% of control station's SS at the same tide of the same day	99%-ile of baseline data for depth-averaged = 61.92 and 130% of control station's SS at the same tide of the same day
Turbidity in NTU (depth-averaged) ⁽⁴⁾⁽⁵⁾	95%-ile of baseline data = 28.14 and 120% of control station's Turbidity at the same tide of the same day	99%-ile of baseline data = 38.32 and 130% of control station's Turbidity 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. Action and Limit Levels for DO for Surface and 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 and 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 Vb in June 2022

Station	Temp. (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%)	(mg L ⁻¹)	pH	Suspended Solids (mg L ⁻¹)
WCP 1 (Downstream)	27.39	16.90	2.67	82.89	5.98	7.99	3.0
WCP 2 (Upstream)	27.37	17.76	2.47	83.58	6.01	7.97	4.0
WQO (Wet Season)	N/A	15.99-19.54 [#]	N/A	N/A	>4	6.5-8.5	12.0

Notes:

1. [#] Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.
2. Cell shaded yellow / red indicates value exceeding the Action/Limit levels.
3. Cell shaded grey indicates value exceeding the WQO.

Table B3: In-situ Monitoring Results for Routine Water Quality Monitoring of ESC CMPs in June 2022

Station	Temp. (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%)	(mg L ⁻¹)	pH
RFE (Reference)	26.63	20.35	4.29	70.97	5.09	7.88
IPE (Impact)	26.82	18.06	3.65	72.50	5.24	7.84
INE (Intermediate)	26.60	20.77	3.96	73.77	5.28	7.86
Ma Wan	26.33	23.58	1.88	76.99	5.46	7.91
WQO (Wet Season)	N/A	18.32-22.39	N/A	N/A	>4	6.5-8.5

Notes:

1. [#] Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.
2. Cell shaded yellow / red indicates value exceeding the Action/Limit levels.
3. Cell shaded grey indicates value exceeding the WQO.

Table B4: Laboratory Results for Routine Water Quality Monitoring of ESC CMPs in June 2022

Station	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)
RFE	2.22	<LOR	2.00	10.77	1.60	<LOR	1.97	<LOR	17.86	0.17	0.97	2.02	6.9
IPE	2.08	<LOR	1.95	7.18	1.79	<LOR	2.19	<LOR	13.75	0.17	0.97	2.43	5.6
INE	2.11	<LOR	2.30	6.57	2.09	<LOR	2.40	<LOR	16.46	0.14	0.92	2.32	6.0
Ma Wan	2.33	<LOR	2.43	3.28	2.60	<LOR	2.18	<LOR	15.83	0.15	0.48	2.20	5.9

WQO of TIN: 0.5 mg/L
 Wet Season WQO of SS: 12.0 mg/L

Notes:

1. "<LOR" indicates the concentrations of metals and metalloids are below the limit of reporting.
2. Cell shaded yellow / red indicates value exceeding the Action/Limit levels.
3. Cell shaded grey indicates value exceeding the WQO.

Table B5: Summary Table of DO, Turbidity and SS Levels Recorded in June 2022 for Impact Water Quality Monitoring during Dredging Operations of ESC CMP Vc

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
02/06/2022	Mid Ebb	US1	5.26	5.73	8.23	9.13
		US2	5.34	5.94	8.71	15.93
		DS1	5.39	5.74	10.73	13.85
		DS2	5.48	5.96	7.79	11.00
		DS3	5.44	6.08	9.86	12.80
		DS4	5.41	5.81	5.48	7.62
		DS5	5.34	5.82	6.43	10.22
	MW	6.36	6.62	1.71	8.87	
	Mid Flood	US1	5.56	5.94	4.96	7.53
		US2	5.53	6.08	9.49	16.20
		DS1	5.45	5.83	4.89	14.75
		DS2	5.55	5.93	4.16	8.60
		DS3	5.28	5.87	5.54	15.15
		DS4	5.29	6.00	6.61	15.93
DS5		5.21	5.99	7.16	9.45	
MW	5.52	6.00	3.38	7.97		
04/06/2022	Mid Ebb	US1	5.21	6.05	4.98	11.77
		US2	4.97	5.68	7.88	13.25
		DS1	5.17	5.94	4.33	21.70
		DS2	5.27	6.30	3.34	10.10
		DS3	5.07	5.89	8.14	36.53
		DS4	5.43	6.23	3.39	9.33
		DS5	5.83	6.39	3.09	8.80
	MW	5.55	6.57	1.23	6.97	
	Mid Flood	US1	5.22	6.08	4.56	13.78
		US2	5.36	6.34	4.66	9.63
		DS1	5.46	6.39	5.88	10.62
		DS2	5.03	5.83	6.44	17.13
		DS3	5.65	6.49	2.81	9.97
		DS4	5.68	6.36	2.71	6.72
DS5		5.60	6.57	3.11	14.82	
MW	5.16	5.98	3.46	10.52		

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
06/06/2022	Mid Ebb	US1	4.99	6.29	4.19	5.17
		US2	4.80	6.18	5.53	5.83
		DS1	4.95	6.12	6.96	7.08
		DS2	5.15	6.46	6.74	8.05
		DS3	5.11	6.48	4.71	6.52
		DS4	5.72	6.61	2.88	4.47
		DS5	6.02	7.00	2.53	3.27
		MW	5.22	6.90	1.66	2.70
	Mid Flood	US1	5.26	6.75	3.34	4.47
		US2	5.01	6.75	3.69	3.88
		DS1	5.78	6.55	2.69	3.67
		DS2	5.12	6.08	5.09	5.12
		DS3	5.08	6.87	3.68	4.52
		DS4	5.10	6.88	3.46	4.38
		DS5	5.14	6.91	3.19	4.68
		MW	5.01	5.82	1.96	3.15
08/06/2022	Mid Ebb	US1	4.77	5.73	4.05	7.48
		US2	4.88	5.69	4.03	7.08
		DS1	4.83	5.87	4.25	4.75
		DS2	4.71	5.65	5.48	8.85
		DS3	4.97	5.85	3.13	6.08
		DS4	4.81	5.67	3.27	6.32
		DS5	5.03	5.89	3.07	6.03
		MW	5.00	5.88	2.45	5.87
	Mid Flood	US1	4.97	5.80	2.98	5.78
		US2	4.53	5.52	4.52	8.60
		DS1	5.13	5.54	2.47	4.20
		DS2	4.86	5.67	3.13	6.55
		DS3	4.67	5.44	4.82	8.37
		DS4	5.32	5.89	2.53	5.07
		DS5	5.63	6.09	2.57	3.95
		MW	4.82	5.39	3.55	6.88

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
10/06/2022	Mid Ebb	US1	4.60	5.69	5.98	10.35
		US2	4.41	5.48	7.38	8.70
		DS1	4.69	5.53	7.19	9.05
		DS2	4.89	5.81	5.91	7.15
		DS3	4.63	5.62	7.01	9.53
		DS4	5.24	6.51	5.14	6.68
		DS5	5.31	6.45	5.16	5.95
		MW	4.75	5.77	2.94	4.62
	Mid Flood	US1	5.46	6.31	5.11	5.83
		US2	5.17	6.34	5.16	6.80
		DS1	5.81	6.24	5.83	6.47
		DS2	4.40	5.50	6.81	8.90
		DS3	5.27	6.07	6.53	8.15
		DS4	5.35	5.93	5.18	8.73
		DS5	5.44	6.02	5.49	6.27
		MW	4.69	5.55	2.88	5.93
13/06/2022	Mid Ebb	US1	4.91	5.54	8.96	8.23
		US2	4.93	5.55	10.71	9.82
		DS1	4.93	5.32	11.54	10.98
		DS2	4.93	5.72	10.13	9.20
		DS3	4.92	5.71	12.84	10.78
		DS4	5.09	5.51	13.84	13.22
		DS5	5.12	5.89	10.21	9.57
		MW	4.65	5.87	2.49	3.77
	Mid Flood	US1	5.59	6.44	9.23	11.50
		US2	5.23	5.82	10.94	15.53
		DS1	5.58	6.36	11.13	10.15
		DS2	4.81	5.70	22.73	14.45
		DS3	5.15	6.22	12.21	10.18
		DS4	5.42	6.22	11.31	10.25
		DS5	5.26	6.24	11.48	10.50
		MW	4.38	4.75	7.34	9.40

Notes:

1. Please refer to Table B1 above for the Action and Limit Levels for dredging activities.
2. Cell shaded yellow indicates value exceeding the Action Level criteria.
3. Cell shaded red indicates value exceeding the Limit Level criteria.

Appendix C. Graphical Presentations

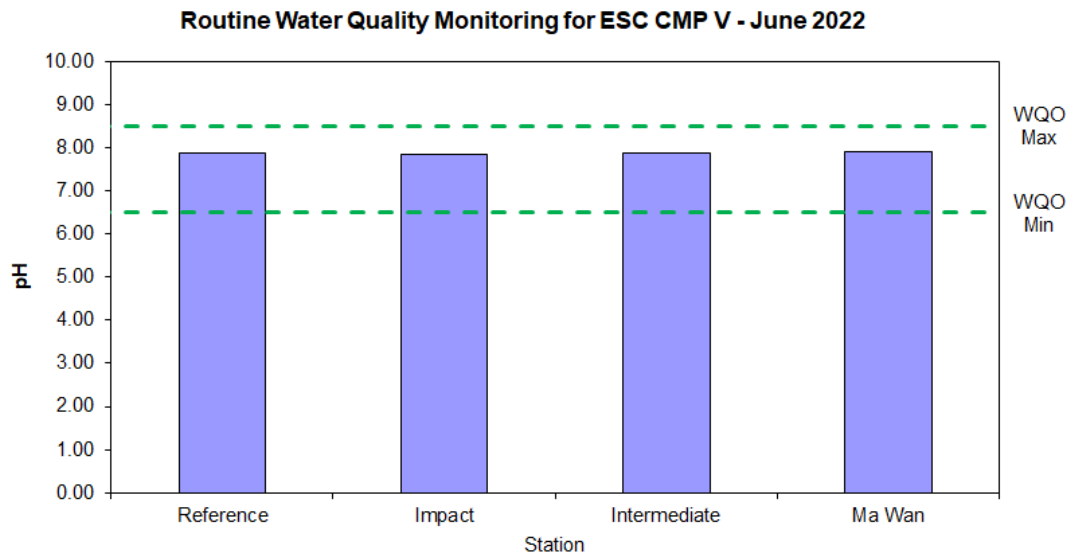


Figure 1: Level of pH recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in June 2022

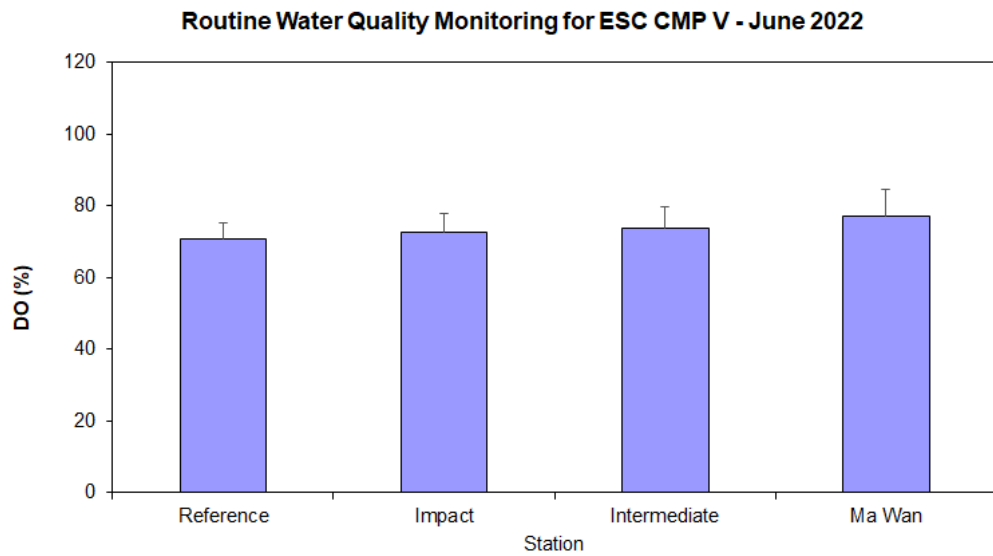


Figure 2: Level of Dissolved Oxygen (DO) (% saturation; mean + SD)¹ recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in June 2022

¹ The mean and standard deviation (SD) for in-situ data are the mean and SD for water columns within the area.

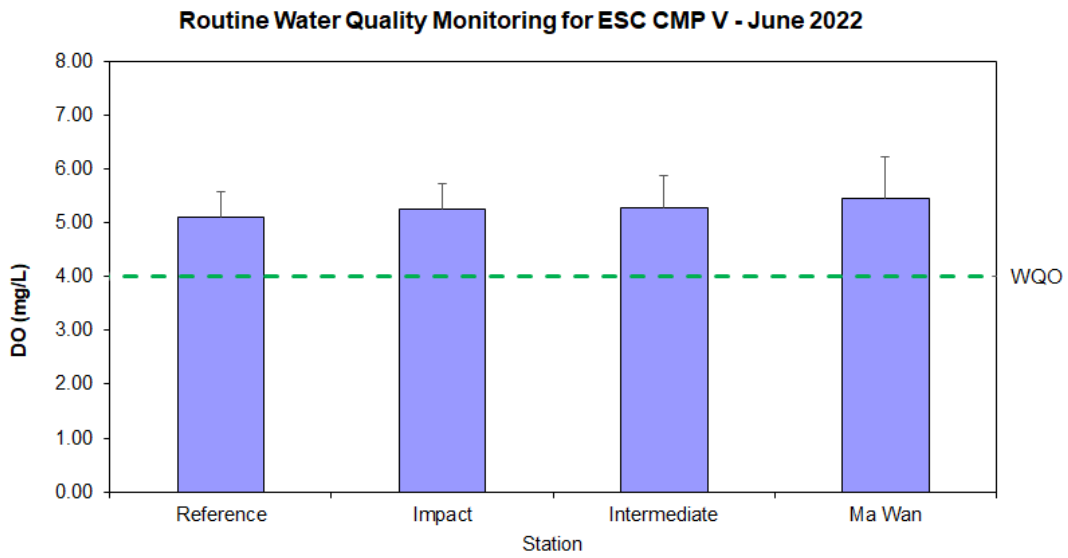


Figure 3: Concentration of Dissolved Oxygen (DO) (mg/L; mean + SD¹) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in June 2022

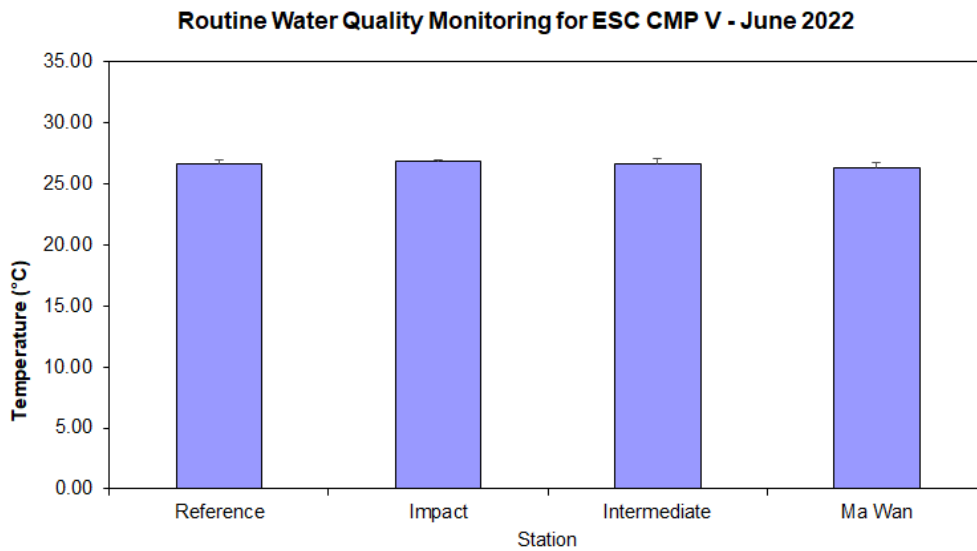


Figure 4: Level of Temperature (°C; mean + SD¹) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in June 2022

¹ The mean and standard deviation (SD) for in-situ data are the mean and SD for water columns within the area.

Routine Water Quality Monitoring for ESC CMP V - June 2022

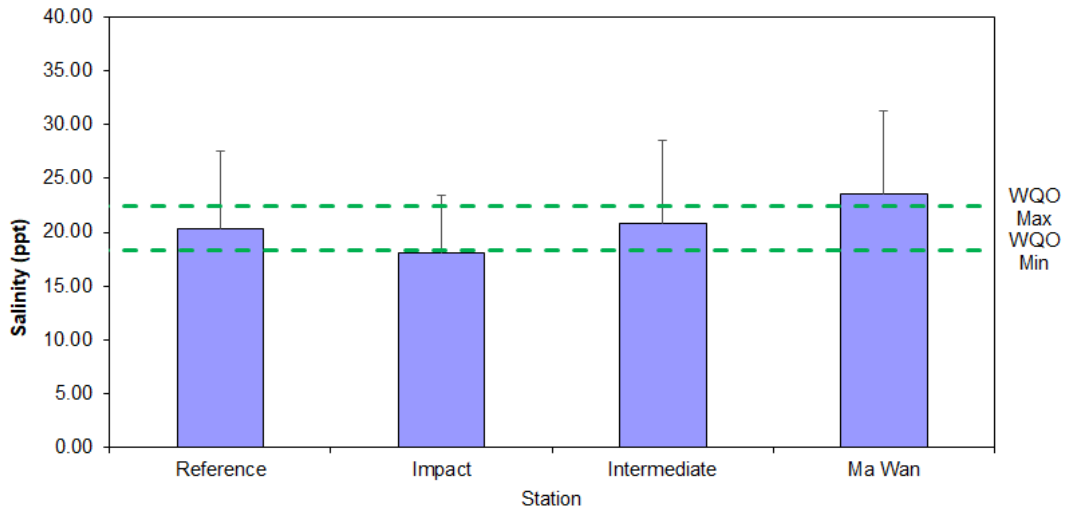


Figure 5: Level of Salinity (ppt; mean + SD¹) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in June 2022

Routine Water Quality Monitoring for ESC CMP V - June 2022

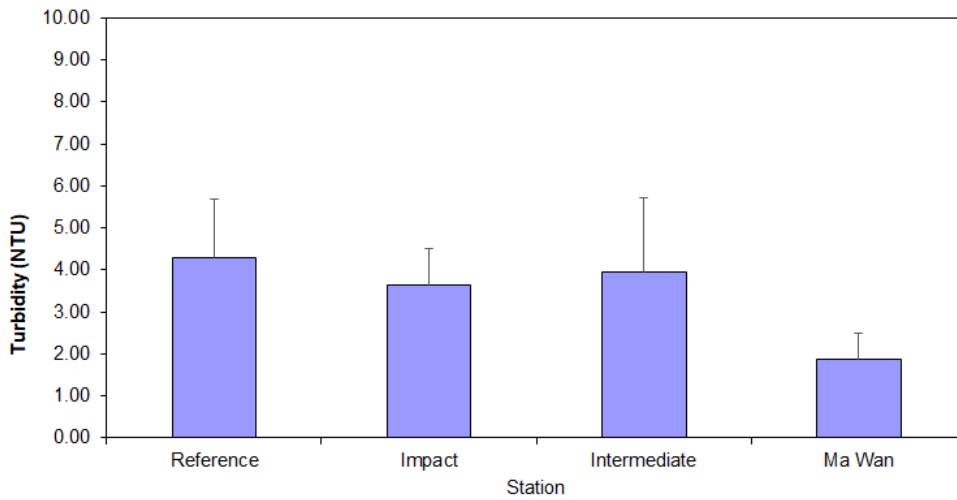


Figure 6: Level of Turbidity (NTU; mean + SD¹) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in June 2022

¹ The mean and standard deviation (SD) for in-situ data are the mean and SD for water columns within the area.

Routine Water Quality Monitoring for ESC CMP V June 2022

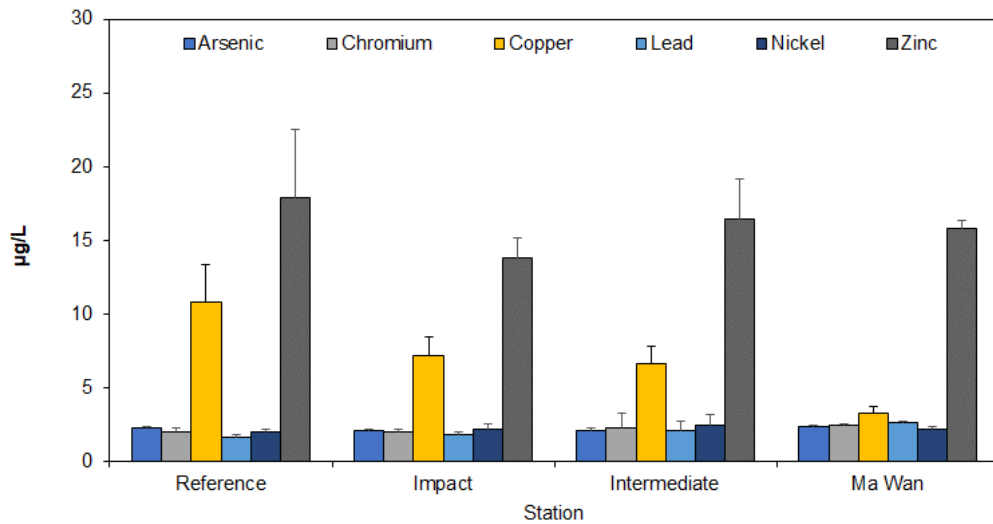


Figure 7: Concentration of Arsenic, Chromium, Copper, Lead, Nickel, and Zinc (µg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in June 2022

Routine Water Quality Monitoring for Nutrients - June 2022

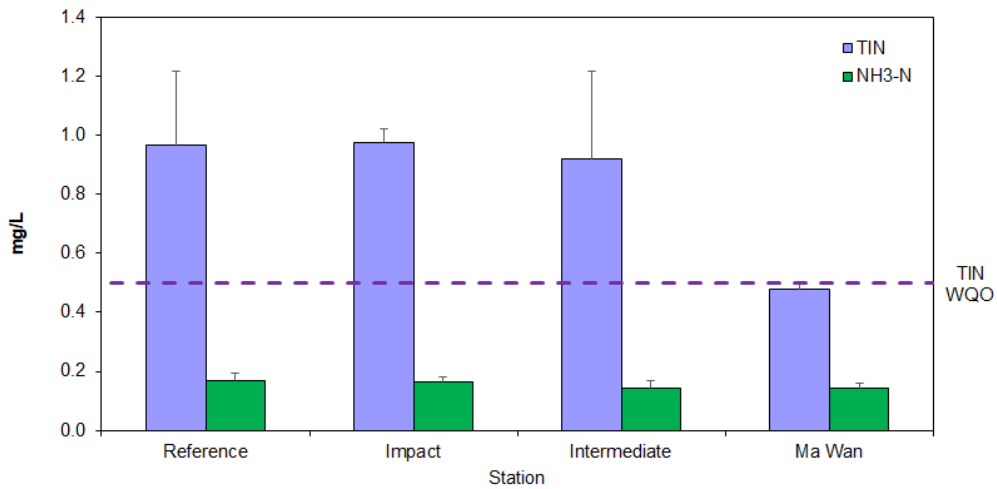


Figure 8: Concentration of Total Inorganic Nitrogen (TIN) and Ammonia Nitrogen (NH3-N) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in June 2022

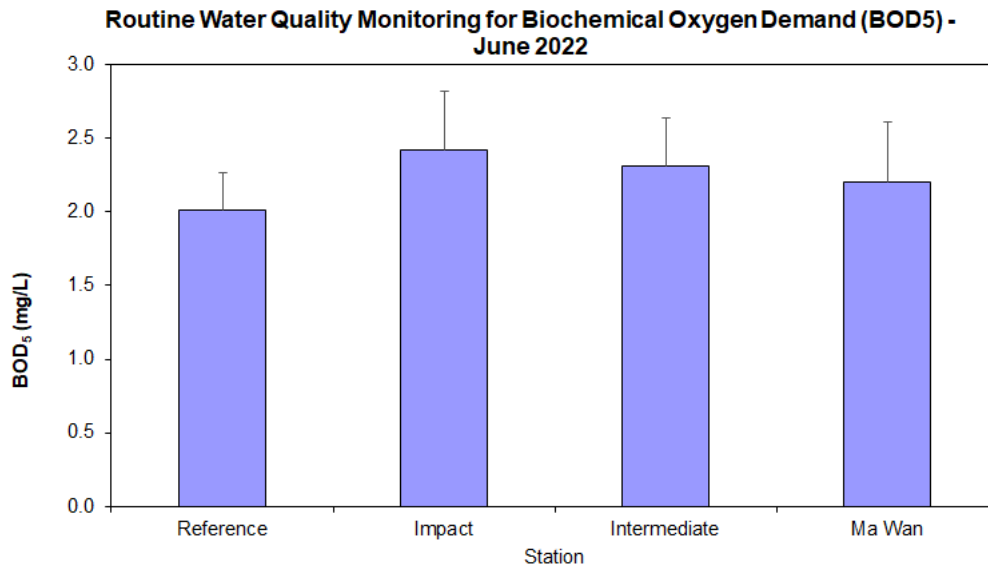


Figure 9: Level of Biochemical Oxygen Demand (BOD₅) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in June 2022

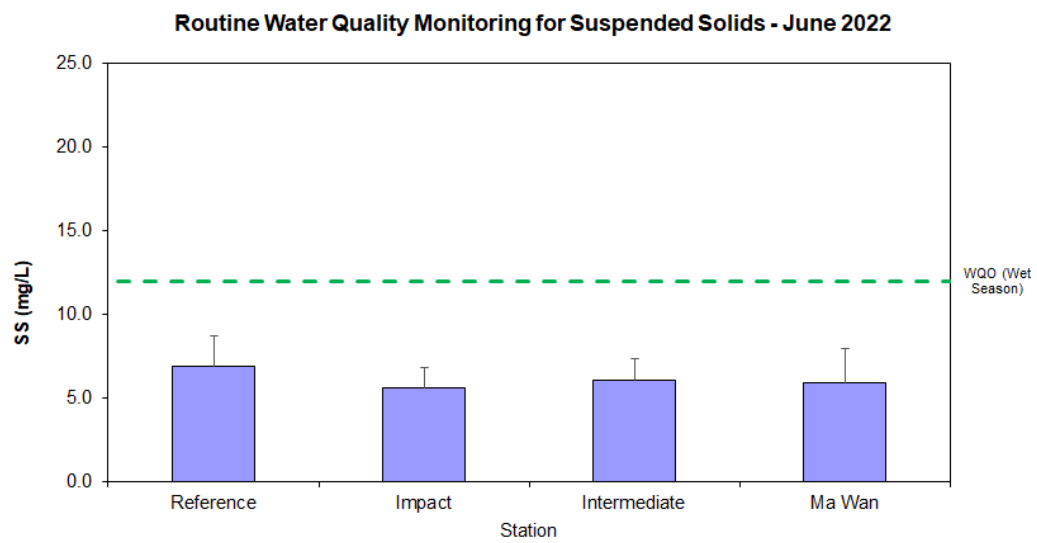


Figure 10: Concentration of Suspended Solids (SS) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in June 2022

Pit Specific Sediment Chemistry for Metal and Metalloid Contaminants at ESC CMP Vb - June 2022

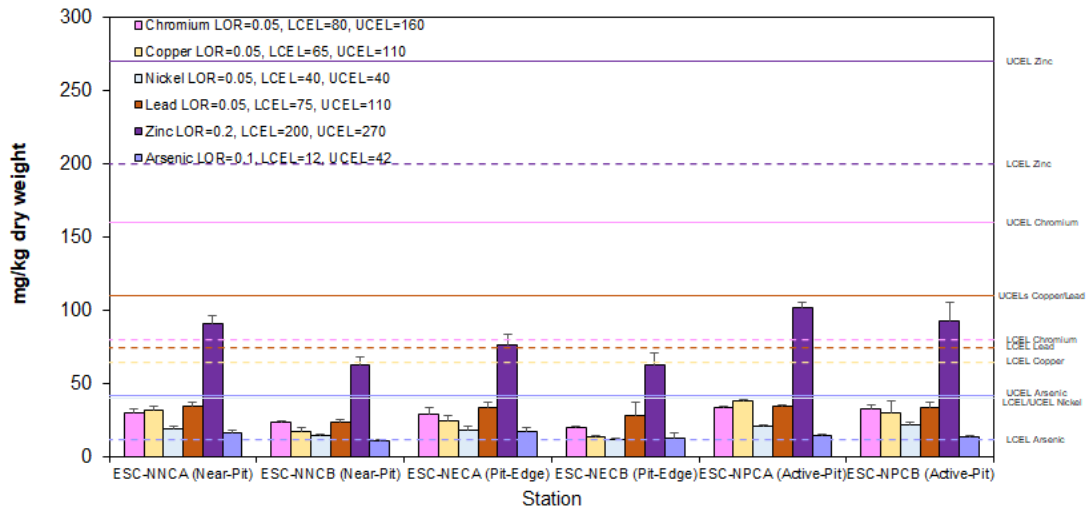


Figure 11: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean + SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in June 2022

Pit Specific Sediment Chemistry for Metal Contaminants at ESC CMP Vb - June 2022

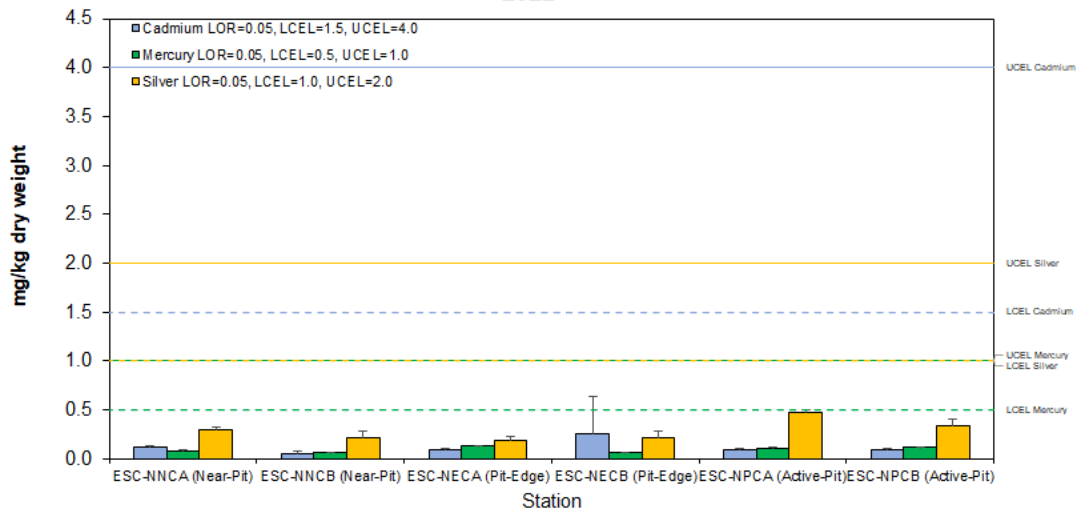


Figure 12: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean + SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in June 2022

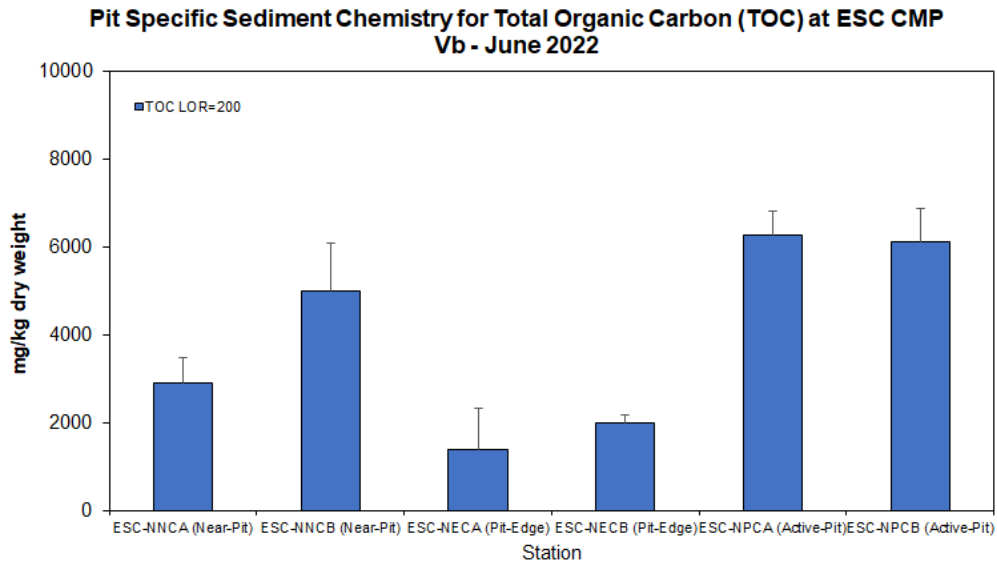


Figure 13: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean + SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in June 2022

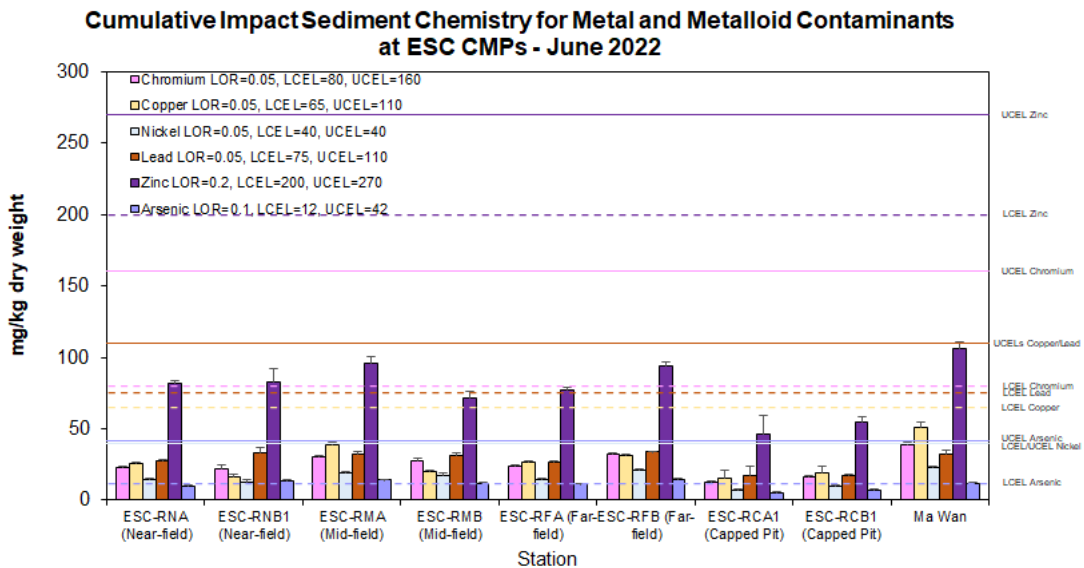


Figure 14: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean + SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in June 2022

Cumulative Impact Sediment Chemistry for Metal Contaminants at ESC CMPs - June 2022

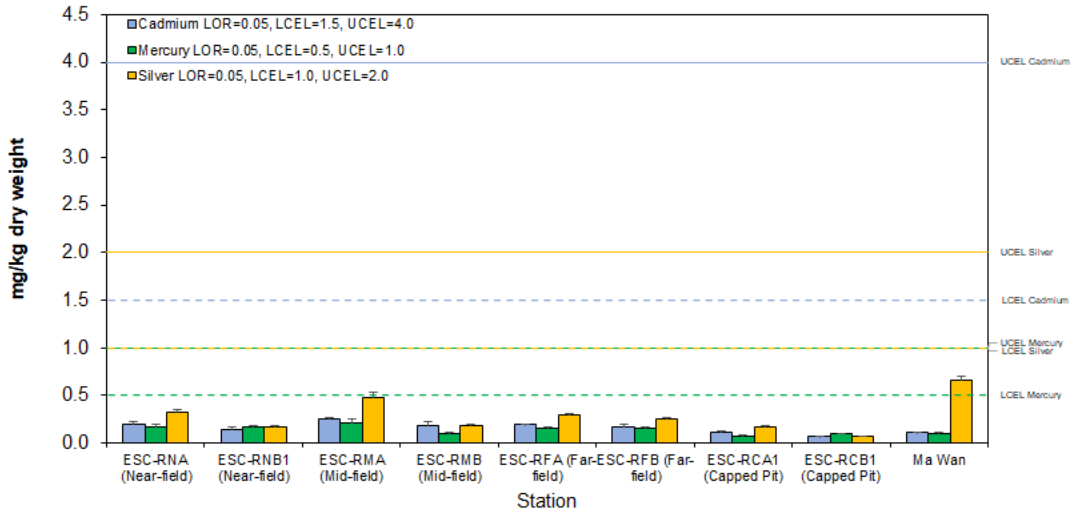


Figure 15: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean + SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in June 2022

Cumulative Impact Sediment Chemistry for Total Organic Carbon (TOC) at ESC CMPs - June 2022

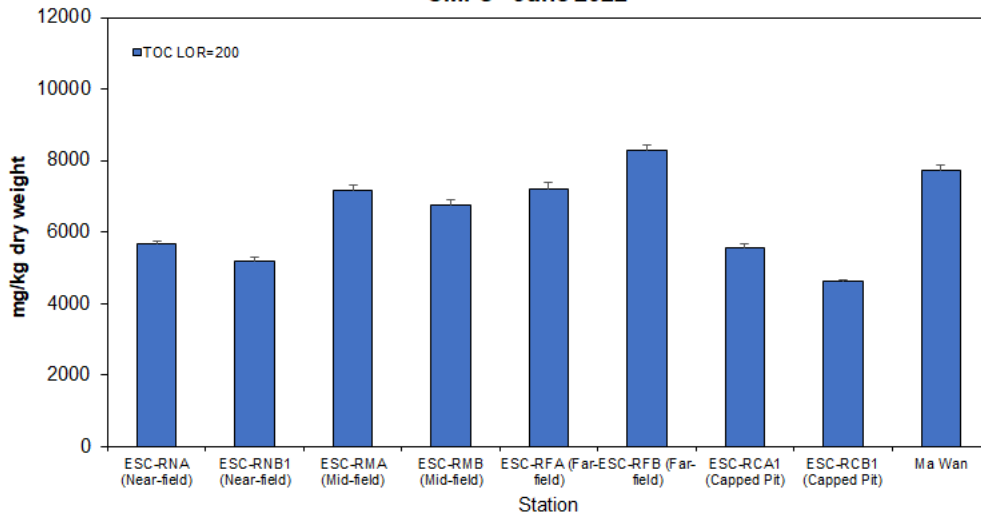


Figure 16: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean + SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in June 2022

Appendix D. Dredging Record

D1. Dredging Record at ESC CMP Vc

Date	Daily Dredging Volume (m ³)	Weekly Dredging Volume (m ³) (From Sunday to Saturday)
29 May 2022	2,600	16,250
30 May 2022	3,250	
31 May 2022	1,300	
1 Jun 2022	3,250	
2 Jun 2022	1,300	
3 Jun 2022	1,950	
4 Jun 2022	2,600	
5 Jun 2022	1,950	14,950
6 Jun 2022	2,600	
7 Jun 2022	1,950	
8 Jun 2022	650	
9 Jun 2022	2,600	
10 Jun 2022	2,600	
11 Jun 2022	2,600	
12 Jun 2022	1,950	1,950
13 Jun 2022	0	
14 Jun 2022	0	
15 Jun 2022	0	
16 Jun 2022	0	
17 Jun 2022	0	
18 Jun 2022	0	
19 Jun 2022	0	0
20 Jun 2022	0	
21 Jun 2022	0	
22 Jun 2022	0	
23 Jun 2022	0	
24 Jun 2022	0	
25 Jun 2022	0	
26 Jun 2022	0	0
27 Jun 2022	0	
28 Jun 2022	0	
29 Jun 2022	0	
30 Jun 2022	0	
1 Jul 2022	0	
2 Jul 2022	0	

Appendix E. Study Programme

