MOTT MACDONALD

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

Quarterly EM&A Report for
Contaminated Mud Pits to the East of Sha Chau
– January to March 2024

May 2024

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Mott MacDonald Hong Kong Limited
registered in Hong Kong no. 236497

土木工程拓展署
Civil Engineering and Development Department

MOTT MACDONALD

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:	Quarterly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – January to March 2024
Date of Report:	13 May 2024
Date prepared by ET:	13 May 2024
Date received by IA:	13 May 2024

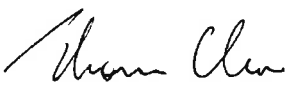
Reference EP Condition

Environmental Permit Condition:

Condition 3.1 of EP-312/2008/A:
The EM&A programme shall be implemented in accordance with the procedures and requirements as set out in the EM&A Manual. Any changes to the programme shall be justified by the ET leader and verified by the Independent Auditor as conforming to the information and requirements contained in the EM&A Manual before submission to the Director for approval.

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: 13 May 2024

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: 13 May 2024

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Water Column Profiling, Routine Water Quality Monitoring, Pit Specific Sediment Chemistry, Cumulative Impact Sediment Chemistry, Sediment Toxicity Test and Demersal Trawling were carried out for the Contaminated Mud Pits (CMPs) to the East of Sha Chau (ESC) during the quarterly reporting period of January to March 2024. This report presents the results of these monitoring activities to identify whether the disposal and capping operations at ESC CMP V are causing any unacceptable impact(s) to the surrounding aquatic environment or to those marine organisms that utilize these habitats.

Water Quality Monitoring for ESC CMPs

Water Column Profiling of ESC CMP Vb – January to March 2024

Results indicated that levels of Salinity, pH, DO and SS complied with the Water Quality Objectives (WQOs) at both Upstream and Downstream stations. Levels of DO, Turbidity and SS also complied with the Action and Limit Levels at all stations.

Overall, the results indicated that the mud disposal operation at ESC CMP Vb did not appear to cause any unacceptable impact in water quality during this reporting period.

Routine Water Quality Monitoring of ESC CMPs – January to March 2024

Results of Routine Water Quality Monitoring conducted in January, February and March 2024 showed that the levels of DO, pH, salinity and SS complied with the WQOs at all stations. Levels of DO, Turbidity and SS complied with the Action and Limit Levels at all stations. From the monitoring results and statistical analysis, there were no trends indicating any increase in the concentrations of contaminants with proximity to the pit or with time. Thus, it appears that mud disposal operations at ESC CMPs have not caused any unacceptable impact in water quality during the reporting period.

Sediment Quality Monitoring for ESC CMPs

Pit Specific Sediment Chemistry of ESC CMP Vb – January to March 2024

Monitoring results showed that the concentrations of most inorganic contaminants were below the Lower Chemical Exceedance Levels (LCELs) and Upper Chemical Exceedance Levels (UCELs) at most monitoring stations. Statistical analysis indicated that there did not appear any trend of increasing sediment contaminants' concentrations with proximity to the pit or with time. Thus, it appears that mud disposal operation at ESC CMP Vb have not caused any unacceptable impact in sediment quality during the reporting period.

Cumulative Impact Sediment Chemistry of ESC CMPs – February 2024

Monitoring results showed that the concentrations of most inorganic contaminants were below the LCELs at most monitoring stations. Statistical analysis indicated that there did not appear to be any significant trend of increasing concentrations of contaminants with proximity to the pit or with time. Thus, it appears that mud disposal operation at ESC CMP Vb have not caused any unacceptable impact in sediment quality during the reporting period.

Sediment Toxicity Tests of ESC CMPs – February 2024

Statistical analysis showed either no significant differences between Impact and Reference stations, or no project related trend in the toxicity tests of most tested marine benthos. There did not appear to be any evidence of unacceptable impacts to sediment toxicity due to the mud disposal operations at ESC CMPs.

Demersal Trawling for ESC CMPs – January and February 2024

During the sampling period in January and February 2024, the mean number of faunal species caught was generally lower at Impact stations. Biotic abundance, Biomass, Catch per Unit Effort (CPUE) and Yield per Unit Effort (YPUE) were also generally lower at Impact stations ESC-INA and ESC-INB. Fluctuations in mean number of faunal species caught, Biotic abundance, Biomass, CPUE and YPUE were also observed amongst Reference stations.

行政摘要

在 2024 年 1 月至 3 月的季度報告期內，環境小組在沙洲以東海泥卸置設施進行了水層質量監察、例行水質監察、指定污泥坑沉積物化學監察、沉積物化學累積性影響監察、沉積物毒性測試及底棲漁業資源監察。本報告詳述以上的環境監察結果，從而分析在沙洲以東海泥卸置設施 CMP V 的卸置及覆蓋作業有否對鄰近水體環境及利用這水體為棲身地的海洋生物造成不可接受的環境影響。

沙洲以東海泥卸置設施 (ESC CMPs)之水質監察

水層質量監察 – 2024 年 1 月至 3 月

監察結果顯示上游及下游監測站的鹽度、酸鹼值、溶解氧及懸浮固體含量均符合海水水質指標。上游及下游監測站的溶解氧含量、混濁度及懸浮固體含量也符合行動及極限水平。總體而言，水層質量監察結果表明報告期內沙洲以東海泥卸置設施 CMP Vb 的污泥卸置活動沒有引致任何不可接受的水質影響。

例行水質監察 – 2024 年 1 月至 3 月

2024 年 1 月至 3 月的例行水質監察結果顯示，所有監測站的溶解氧濃度、酸鹼值、鹽度及懸浮固體含量均符合海水水質指標。所有監測站的溶解氧含量，混濁度及懸浮固體含量也符合行動及極限水平。從監察數據和統計結果顯示，海水的污染物濃度沒有因越接近泥坑而趨向增加，亦沒有隨著時間而增加。總體而言，沒有證據顯示在報告期內沙洲以東海泥卸置運作對周邊水體環境產生任何不可接受的水質影響。

沙洲以東海泥卸置設施 (ESC CMPs)之沉積物監察

指定污泥坑沉積物化學監察 – 2024 年 1 月至 3 月

監察結果顯示，大部分監測站的無機污染物含量均大致低於化學物質低量值及化學物質高量值。從統計結果顯示，沉積物的污染物濃度沒有因越接近泥坑而趨向增加，亦沒有隨著時間而增加。總體而言，沒有證據顯示在報告期內沙洲以東海泥卸置運作對沉積物質素造成任何不可接受的影響。

沉積物化學累積性影響監察 – 2024 年 2 月

監察結果顯示，大部分監測站的無機污染物含量均大致低於化學物質低量值。從統計結果顯示，沉積物的污染物濃度沒有因越接近泥坑而趨向增加，亦沒有隨著時間而增加。總體而言，沒有證據顯示在報告期內沙洲以東海泥卸置運作對沉積物質素造成任何不可接受的影響。

沙洲以東污泥坑之沉積物毒性測試 – 2024 年 2 月

統計結果顯示，大部份已測試的海洋底棲生物在受影響監測站及參考監測站的沉積物毒性測試沒有明顯分別，且在沉積物毒性測試中亦沒有偵測到與項目相關的趨勢。總體而言，沒有證據顯示在報告期內沙洲以東海泥卸置運作對沉積物毒性造成任何不可接受的影響。

沙洲以東污泥坑之底棲漁業資源監察 – 2024 年 1 月及 2 月

監察結果顯示，2024 年 1 月和 2 月的底棲漁業資源在受影響監測站普遍錄得較低的品種數量。而在 2024 年 1 月及 2 月受影響監測站 ESC-INA 及 ESC-INB 的生物量、生物重量、單位努力漁獲量及單位努力生產量錄得稍低的數值。而在參考監測站之中的監察結果也錄得波動。

1 Introduction

1.1 Project Description

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. In early 2022, after implementing the Phase 1 optimisation for at least one year, a further data review was conducted. The monitoring data has been reviewed and demonstrated that the data robustness and representativeness are maintained. Therefore, a technical note presenting the data review results served as a supplementary information was submitted to EPD and presented that Phase 2 optimization of sample replication of water quality and sediment monitoring for the Project will be implemented in 2022. EPD expressed no comment on the review and note the implementation of Phase 2 optimization of sample replication on 18 May 2022, and thus this optimization has been effective for the EM&A activities since July 2022.

The present EM&A programme under Agreement No. CE 59/2020 (EP) ("the Study") covers the dredging, disposal and capping operations of the ESC CMP V (see **Appendix A** for the EM&A programme.)

1.2 Activities Conducted during the Reporting Period

Detailed works schedule for ESC CMP V is shown in **Table 1.1**. During the reporting period of January to March 2024, the following works were undertaken at the CMPs:

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

[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.

Table 1.1: Works Schedule for ESC CMP V

The records for contaminated mud disposal at ESC CMP Vb and capping operation at ESC CMP Vd during the reporting period are presented in **Appendix B1** and **B2**, respectively.

1.3 Objectives of the Monitoring and Audit Programme

The objectives of the EM&A programme are as follows:

1. To monitor and report on the environmental impacts of the dredging operations associated with the construction of the disposal pits at CMP V;
2. To monitor and report on the environmental impacts due to capping operations of the exhausted pits at CMP V;
3. To monitor and report on the environmental impacts of the disposal of contaminated marine sediments in the active pits at CMP V and specifically to determine:
   a. changes/trends caused by disposal activities in the concentrations of contaminants in sediments adjacent to the pits;
   b. changes/trends caused by disposal activities in the concentrations of contaminants in tissues of demersal marine life adjacent to and remote from the pits;
   c. impacts on water quality and benthic ecology caused by the disposal activities; and
   d. the risks to human health and dolphin of eating seafood taken in the marine area around the active pits.
4. To monitor and report on the environmental impacts of the disposal operation at CMP V and specifically to determine whether the methods of disposal are effective in minimising the risks of unacceptable environmental impacts.
5. To monitor and report on the benthic recolonisation of the capped pits at CMP V and specifically to determine the difference in infauna between the capped pits and adjacent sites.
6. To assess the impact of a major storm (Typhoon Signal No. 8 or above) on the containment of any uncapped or partially capped pits at CMP V.
7. To design and continually review the operation and monitoring programme and:
   a. to make recommendations for changes to the operation that will rectify any unacceptable environmental impacts; and
   b. to make recommendations for changes to the monitoring programme that will improve the ability to cost effectively detect environmental changes caused by the disposal activities.
8. To establish numerical decision criteria for defining impacts for each monitoring component.
9. To provide supervision on the field works and laboratory works to be carried out by contractors/laboratories.

1.4 Purpose of this Report

The purpose of this *Quarterly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – January to March 2024* is to provide information regarding the findings in the reporting period of January to March 2024 (from 1 January to 31 March 2024) on the environmental impacts resulting from backfilling operation at ESC CMP Vb and capping operation at ESC CMP Vd. Although the EM&A programme has been conducted since 1997, this report presents the analytical and statistical results of the quarterly reporting period. Results from previous monitoring will be presented and discussed in the Annual Review Report. Readers are referred to the Monthly EM&A Reports for this Study for graphical and tabular presentations of the monitoring results.

The objectives of this report are to:

- Confirm that all activities, tests, analyses, assessments etc. have been carried out as stated in the Updated EM&A Manual[3]; and
- Report on any trend resulting from dredging, backfilling and capping operations at the CMPs.

[3] Mott MacDonald Hong Kong Limited (2023) Updated Environmental Monitoring and Audit (EM&A) Manual for ESC CMP V. Agreement No. CE 59/2020 (EP) Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau (2021-2026) – Investigation. Submitted to EPD in April 2023.

2 Summary of EM&A Programme

2.1 EM&A Tasks

Six key elements were designed for the EM&A Programme for assessing whether key environmental parameters are being affected by dredging, backfilling and capping operations at the CMPs. Key tasks are as follows:

- Sediment Quality Monitoring;
- Sediment Toxicity Testing;
- Trawling & Tissue/Whole Body Contaminant Testing;
- Water Quality Monitoring;
- Human Health and Ecological Risk Assessment; and
- Benthic Recolonisation.

2.2 EM&A Sampling and Analysis

Details regarding the methodologies for the field sampling and laboratory analysis of the monitoring tasks listed in **Section 2.1** are presented in the Updated EM&A Manual as well as in the following sampling and laboratory analysis contracts:

- Contract No. CV/2022/05 Sediment Disposal Facilities to the East of Sha Chau and East of Tung Lung Chau – Sampling (2022-2027); and
- Contract No. CV/2022/06 Sediment Disposal Facilities to the East of Sha Chau and East of Tung Lung Chau – Sample Testing (2022-2027).

Lam Geotechnics Limited and ALS Technichem (HK) Pty Limited (hereinafter known as “Contractors”) were responsible for sampling under Contract No. CV/2022/05 and laboratory analysis under Contract No. CV/2022/06, respectively, during the reporting period.

3 Summary of Monitoring and Audit Activities

3.1 Sampling and Laboratory Analysis

Schedules of the EM&A programme are presented in **Appendix A**. The sampling, *in-situ* measurements and analysis of samples were conducted in accordance with the Updated EM&A Manual during this reporting period. The sampling conducted as well as the monitoring results received from the Contractors for this reporting period are shown in **Table 3.1**.

Table 3.1: Samplings Conducted and Monitoring Results Received from the Contractors for the Reporting Period

Key Task	Date of Sampling and *In-situ* Measurement	Date of Results Received from the Contractors
ESC CMPs		
Water Column Profiling of ESC CMP Vb	4 Jan 2024	11 Jan 2024
	5 Feb 2024	8 Feb 2024
	5 Mar 2024	7 Mar 2024
Routine Water Quality Monitoring of ESC CMPs	3 Jan 2024	17 Jan 2024
	7 Feb 2024	23 Feb 2024
	8 Mar 2024	22 Mar 2024
Pit Specific Sediment Chemistry of ESC CMP Vb	2 Jan 2024	16 Jan 2024
	1 Feb 2024	20 Feb 2024
	4 Mar 2024	21 Mar 2024
Cumulative Impact Sediment Chemistry of ESC CMPs	2 Feb 2024	20 Feb 2024
Sediment Toxicity Test of ESC CMPs	2 Feb 2024	19 Apr 2024
Demersal Trawling of ESC CMPs	17 & 18 Jan 2024	5 Apr 2024
	19 & 20 Feb 2024	5 Apr 2024

The monitoring results of the above environmental monitoring components for ESC CMPs have been presented in the respective Monthly EM&A Reports. The statistical analysis of these environmental monitoring components, where applicable, are presented in the following sections to report any trends caused by disposal activities at ESC CMPs during the reporting period. It should be noted that statistical analysis was not conducted for Water Column Profiling for ESC CMP Vb as the monitoring stations were mobile depending on the location of backfilling operation during the monitoring event.

4 Summary of Monitoring Results and Statistical Analysis for ESC CMPs

4.1 Water Column Profiling of ESC CMP Vb

Water Column Profiling for ESC CMP Vb was conducted once every month from January to March 2024 as presented in **Table 3.1**. A total of two (2) stations were sampled, one located 100 m Upstream and one located 100 m Downstream of the disposal area. The monitoring results indicated that levels of Salinity, pH, DO and SS complied with the WQOs at both Upstream and Downstream stations in January, February and March 2024.

Overall, the results indicated that the mud disposal operation at ESC CMP Vb did not appear to cause any unacceptable deterioration in water quality during this reporting period.

4.2 Routine Water Quality Monitoring of ESC CMPs

4.2.1 Background

Routine Water Quality Monitoring for ESC CMPs was conducted once every month from January to March 2024 as presented in **Table 3.1**. A total of sixteen (16) stations were sampled during ebb tide in March 2024 with locations of the monitoring stations presented in **Figure 4.1**; while a total of ten (10) stations were sampled during flood tide in January and February 2024 with locations of the monitoring stations presented in **Figure 4.2**. The disposal and capping volumes during the reporting period are detailed in **Appendix B1** and **B2**, respectively. The monitoring results showed that levels of DO, pH, Salinity and SS complied with the WQOs at all stations; and the levels of DO, Turbidity and SS complied with the Action and Limit Levels at all stations during the reporting period.

4.2.2 Summary of Statistical Analysis

The aim of the statistical analysis is to reveal any trends of increasing concentration of contaminants with proximity to the pit or with time. Data obtained during this reporting period were statistically compared with data obtained since monitoring began at CMP V in February 2012 except for metals and metalloid of which data prior to July 2022 collected under a more conservative method were excluded, where those metals and metalloid data demonstrated no consistent project related spatial trends.

For most parameters, only low concentrations were measured throughout the study period and some parameters have majority of their recorded values below the limit of reporting. Statistical analysis was performed on parameters for which at least 60% of data were above the limit of reporting since monitoring of CMP V began in February 2012. For metals and metalloid, starting from July 2022, dissolved metal and metalloid concentrations for which at least 60% of data were detectable were taken into account in the statistical analysis to review if any trends of increasing concentration of contaminants with proximity to the pit or with time.

Improvements have been made to the statistical analysis whereby the spatio-temporal differences in in-situ parameters, dissolved metal, inorganic and organic contaminant contents were tested by two-factor Analysis of Variance (ANOVA) separately for ebb tide and flood tide. Area and Period were treated as fixed factors under investigation.

Should spatial trend of potential concern (i.e. increasing contaminant concentration with proximity to the pit) be detected by ANOVA and subsequent SNK post-hoc tests, further evaluation would be conducted to evaluate if the mud disposal activities were causing consistent and adverse

impact to the water body. If potential concern was detected by SNK results for consecutive reporting months, linear regression analyses would be performed to examine the temporal change of contaminant levels in each area over the concerned months in consideration of tidal effects. Further analysis may also include assessing the concentration variation between stations. Details regarding the statistical analysis results are presented in **Appendix C**.

4.2.3 In-situ Measurements

Dissolved Oxygen (DO)

DO levels varied significantly with sampling periods and areas during ebb tide and flood tide. There was no consistent spatial trend of decreasing concentrations of DO with proximity to the pit. DO levels were generally the highest at Impact stations for ebb tide, and were similar at Reference and Intermediate stations for flood tide, thus there was no significant project related impact.

Turbidity

Turbidity levels varied significantly with sampling periods and areas during ebb tide and flood tide. During ebb tide, the relationship between turbidity levels and proximity to the pit (i.e. Area) indicated a significant overall spatial trend due to historic data from past reporting quarters. No potential project related spatial trend was detected within this reporting quarter. During flood tide, the turbidity levels were generally similar at Reference, Impact and Intermediate stations, thus there was no significant project related impact.

4.2.4 Metals and Metalloid

Statistical analysis was performed for both ebb and flood tides data of all dissolved metal and metalloid contaminants except Lead and Silver which had high percentage of their values not detected (i.e. > 60% of values were not detected from July 2022 to March 2024). The concentration of Nickel and Zinc varied significantly over sampling periods and area. Other dissolved metal and metalloid varied significantly over either sampling periods or area as indicated by results of the ANOVA tests (**Appendix C**). There were no consistent project related spatial trends detected for all dissolved metals and metalloid, and the concentrations were generally the highest at Reference and Intermediate stations.

4.2.5 Inorganic Contaminants

Ammonia Nitrogen (NH_3-N)

NH_3-N concentrations varied significantly with sampling periods and areas during ebb tide and flood tide. There was no consistent spatial trend of increasing concentrations of NH_3-N with proximity to the pit. Concentrations of NH_3-N were generally similar at all stations and slightly higher at Ma Wan station, thus there was no significant project related impact.

Total Inorganic Nitrogen (TIN)

TIN concentrations varied significantly with sampling periods and areas during ebb tide and flood tide. There was no consistent spatial trend of increasing concentrations of TIN with proximity to the pit. Concentrations of TIN at Reference and Impact stations were generally similar, thus there was no significant project related impact.

5-Day Biochemical Oxygen Demand (BOD_5)

Levels of BOD_5 varied significantly with sampling periods and areas during ebb tide and flood tide. There was no consistent spatial trend of increasing concentrations of BOD_5 with proximity to the pit. Levels of BOD_5 were generally the highest at Reference and Ma Wan stations.

Suspended Solids (SS)

SS levels varied significantly with sampling periods and areas during ebb tide and flood tide. During ebb tide, the relationship between SS levels and proximity to the pit (i.e. Area) indicated a significant overall spatial trend, but no potential project related spatial trend was detected in this reporting period, thus there was no evidence showing consistent project related impact. During flood tide, there was no consistent spatial trend of increasing SS levels with proximity to the pit, where SS levels were generally the highest at Impact and Reference stations.

4.2.6 Conclusions

Overall, results of statistical analyses for the water quality data did not appear to provide any evidence of unacceptable water quality impacts caused by the mud disposal and capping operations at CMP V of the ESC area.

4.3 Pit Specific Sediment Chemistry of ESC CMP Vb

4.3.1 Background

Pit Specific Sediment Chemistry of ESC CMP Vb was conducted once every month from January to March 2024 as presented in **Table 3.1**. A total of six (6) monitoring stations for ESC CMP Vb were sampled in each monitoring event and the monitoring locations are shown in **Figure 4.3**. The monitoring results showed that the concentrations of most inorganic contaminants were below the Lower Chemical Exceedance Levels (LCELs) at most stations from January to March 2024, except for Arsenic at Near-Pit and Pit-Edge stations; Copper and Silver at Active-Pit stations in January, February and March 2024. In January 2024, the concentrations of Silver were higher than the LCELs at Active-Pit stations ESC-NPCA and ESC-NPCB. The concentrations of Copper were higher than the Upper Chemical Exceedance Levels (UCELs) at Active-Pit stations ESC-NPCA and ESC-NPCB, and the concentrations of Arsenic were higher than the LCEL at Near-Pit station ESC-NNCA, Pit-Edge stations ESC-NECA and ESC-NECB. In February 2024, the concentrations of Silver were higher than the LCELs at Active-Pit stations ESC-NPCA and ESC-NPCB; and the concentrations of Copper were higher than the Upper Chemical Exceedance Levels (UCELs) at Active-Pit stations ESC-NPCA and ESC-NPCB. In March 2024, the concentrations of Silver were higher than the LCEL at Active-Pit station ESC-NPCB; and the concentrations of Copper were higher than the LCEL at Active-Pit stations ESC-NPCB and higher than UCEL at Active-Pit station ESC-NPCA.

4.3.2 Summary of Statistical Analysis

Statistical analysis was performed for data obtained from Pit Specific Sediment Chemistry of ESC CMP Vb since February 2020. Improved statistical tests were run to examine the difference in contaminant concentrations between Active-Pit, Pit-Edge and Near-Pit stations and between sampling periods. ANOVA was employed as the statistical test, with Period, Area, and Direction as fixed factors.

Should temporal trend of potential concern (i.e. increasing contaminant concentration with proximity to the pit) be detected by ANOVA and subsequent SNK post-hoc tests for consecutive reporting months, further evaluation would be conducted to evaluate if the mud disposal activities were causing consistent and adverse impact to the sediment quality. Linear regression analyses would be performed to examine the temporal change of contaminant levels in each area over the concerned months. Detailed results of statistical analysis are presented in **Appendix C**.

Metals and Metalloids

There were significant spatial and temporal variations in the concentrations of all metal and metalloid contaminants (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver and Zinc). No potential project related spatial trend was detected for the reporting months for all

metal and metalloid contaminants, except for Copper and Zinc. According to the SNK post-hoc test results for Copper and Zinc, no consecutive spatial trend was detected over the reporting period. Thus, there appears no evidence of consistent spatial trend of increasing contaminant concentrations with proximity to the pit over time.

Organic Contaminants

Concentrations of majority of organic contaminants were below their limits of reporting. Statistical analyses were only performed for contaminants for which 60% of data were over their limits of reporting.

In this reporting period, only Total Organic Carbon (TOC) concentrations were statistically analysed. Levels of TOC varied significantly with sampling periods and areas. Potential project related spatial trend was detected during both flood and ebb tide in March 2024, but no significant spatial trend was detected in consecutive month. Therefore, there is no evidence indicating consistent or increasing project related impact over time.

4.3.3 Conclusions

From the results of the above statistical analyses, there did not appear to be any significant trend of increasing sediment contaminants' concentrations with proximity to the pit or with time. Therefore, 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.

4.4 Cumulative Impact Sediment Chemistry of ESC CMPs

4.4.1 Background

Cumulative Impact Sediment Chemistry of ESC CMPs was conducted in February 2024 as presented in **Table 3.1**. A total of nine (9) monitoring stations were sampled and the monitoring locations are shown in **Figure 4.4**. The monitoring results showed that the concentrations of most inorganic contaminants were below the LCELs at most monitoring stations in February 2024, except concentrations of Arsenic were higher than the LCEL at Near-field station ESC-RNB1, Mid-field stations ESC-RMA, ESC-RMB and Far-field station ESC-RFB, as well as concentrations of Silver were higher than the LCEL at Ma Wan station MW1.

4.4.2 Summary of Statistical Analysis

Data obtained during this reporting period were statistically compared with previous data obtained since monitoring began for ESC CMPs in June 2016. Improved statistical tests were run to examine the difference in contaminant concentrations amongst Near-Field, Mid-Field, Far-Field stations. ANOVA was employed as the statistical test, with Area and Station as fixed factors.

Should spatial trend of potential concern (i.e. increasing contaminant concentration with proximity to the pit) be detected by ANOVA and subsequent SNK post-hoc tests for a considerable period over the whole sampling period, further evaluation would be conducted to evaluate if the mud disposal activities were causing consistent and adverse cumulative impact to the sediment quality. Regression analysis would be performed to examine the potential increase on the sediment contaminant concentration over time. Detailed results of statistical analysis are presented in **Appendix C**.

Metals and Metalloid

There were significant spatial variations in the concentrations of all metal and metalloid contaminants (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver and Zinc), but no consistent spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) was

observed. In most cases, metal concentrations were the highest at Ma Wan or Mid-Field stations, thus there was no significant project related impact.

Organic Contaminants

Concentrations of the majority of organic contaminants were below their limits of reporting. Statistical analyses were only performed for contaminants for which 60% of data were over their limits of reporting.

In this reporting period, only TOC concentrations were statistically analysed. Levels of TOC varied significantly with sampling area and time, with generally higher concentrations recorded at Ma Wan station. There was no consistent spatial trend of increasing concentrations of TOC with proximity to the pit.

4.4.3 Conclusions

From the results of the above statistical analysis, there did not appear to be any significant trend of increasing sediment contaminants' concentrations with proximity to the pit or over time. Therefore, 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.

4.5 Sediment Toxicity Tests – February 2024

Sediment Toxicity Tests were undertaken for sediments collected from the Impact (Near Pit), Reference and Ma Wan stations (see **Figure 4.5** for the sampling locations) in February 2024.

Appropriate statistical test, i.e. ANOVA, was applied for comparing and determining the level of significance in the results of February 2024 between Impact and Reference Stations. When significant difference was detected then multiple comparison procedures would be used (e.g. Tukey's Test) to isolate where the difference is occurring.

Results of the Sediment Toxicity Tests in February 2024 showed that there were no significant differences between Impact and Reference stations in the toxicity tests for all tested marine benthos except the survival rate for burrowing amphipod. In detailed analysis, the potential project related spatial trend was detected in the survival rate for burrowing amphipod in February 2024; however, during our further investigation on the analysis results of the Cumulative Impact Monitoring of Sediment Quality, no unacceptable project related impact to sediment quality was observed. Therefore, in overall, there did not appear to be any evidence of unacceptable impacts to sediment toxicity due to the mud disposal operations at ESC CMP Vb. Detailed results of statistical analyses are presented in **Appendix C.**

4.6 Demersal Trawling – January and February 2024

Fishery resources monitoring by demersal trawling was carried out at two (2) impact and four (4) reference stations (see **Figure 4.6** for locations) in January and February 2024. Monitoring results are presented in the following sections.

Abundance and Biomass

The average number of species collected in the period of January and February 2024 is presented in **Table 4.1**. Mean number of faunal species caught at Impact stations was generally lower than at Reference stations in January and February 2024. Fluctuations in mean number of faunal species caught were also observed amongst Reference stations.

Biotic abundance, Biomass, Catch per Unit Effort (CPUE) and Yield per Unit Effort (YPUE) were generally lower at Impact stations ESC-INA and ESC-INB in January and February 2024 (**Table**

4.2). Fluctuations in Biotic abundance, Biomass, CPUE and YPUE were also observed amongst Reference stations.

Annual trend and statistical analyses will be conducted in the Annual EM&A Review Report to determine whether there is any significant difference that shows a considerable impact to fishery resources caused by the mud disposal operations at ESC CMP Vb.

Table 4.1: Summary of the Mean Number of Faunal Species Caught during Monitoring in January and February 2024

Mean Number of Faunal Species	Impact Stations		Reference Stations			
	ESC-INA	ESC-INB	TNA	TNB	TSA	TSB
Jan 2024	12.4	10.4	22.4	20.8	17.8	29.2
Feb 2024	9.4	11.0	15.0	16.0	15.4	17.8

Table 4.2: Summary of CPUE and YPUE during Monitoring in January and February 2024

Date	Station	Type of Station	No. of Individuals per Station	Total Biomass per Station (g)	Mean CPUE(1) per Tow (no./hr/net)	Mean YPUE(2) per Tow (g/hr/net)
Jan 2024	ESC-INA	Impact	168	5906.4	33.6	1181.3
Jan 2024	ESC-INB	Impact	107	4009.0	21.4	801.8
Jan 2024	TNA	Reference	15062	21766.7	3012.4	4353.3
Jan 2024	TNB	Reference	34223	44919.2	6844.6	8983.8
Jan 2024	TSA	Reference	31930	130557.6	6386.0	26111.5
Jan 2024	TSB	Reference	2251	28907.9	450.2	5781.6
Feb 2024	ESC-INA	Impact	264	5829.4	52.8	1165.9
Feb 2024	ESC-INB	Impact	233	4937.9	46.6	987.6
Feb 2024	TNA	Reference	356	17070.1	71.2	3414.0
Feb 2024	TNB	Reference	414	9629.8	82.8	1926.0
Feb 2024	TSA	Reference	11007	57627.7	2201.4	11525.5
Feb 2024	TSB	Reference	7636	34601.7	1527.2	6920.3

Notes:
(1) CPUE is calculated by dividing the number of individuals with the trawling time and number of nets (in hour and number of nets).
(2) YPUE is calculated by dividing the weight (g) of fish with trawling effort (in hour and number of nets).

5 Findings of the Field Events and Laboratory Tests and Analyses by the Independent Auditor

During the reporting period, the Independent Auditor (IA) conducted an inspection for Pit Specific Sediment Chemistry on 1 February 2024. A total of 6 stations were sampled on this day, including ESC-NNCB, ESC-NECB, ESC-NPCB, ESC-NPCA, ESC-NECA, and ESC-NNCA. The IA was generally satisfied with the sample collection and confirmed that the requirements as stated in the EM&A Manual were implemented accordingly.

6 Future Key Issues

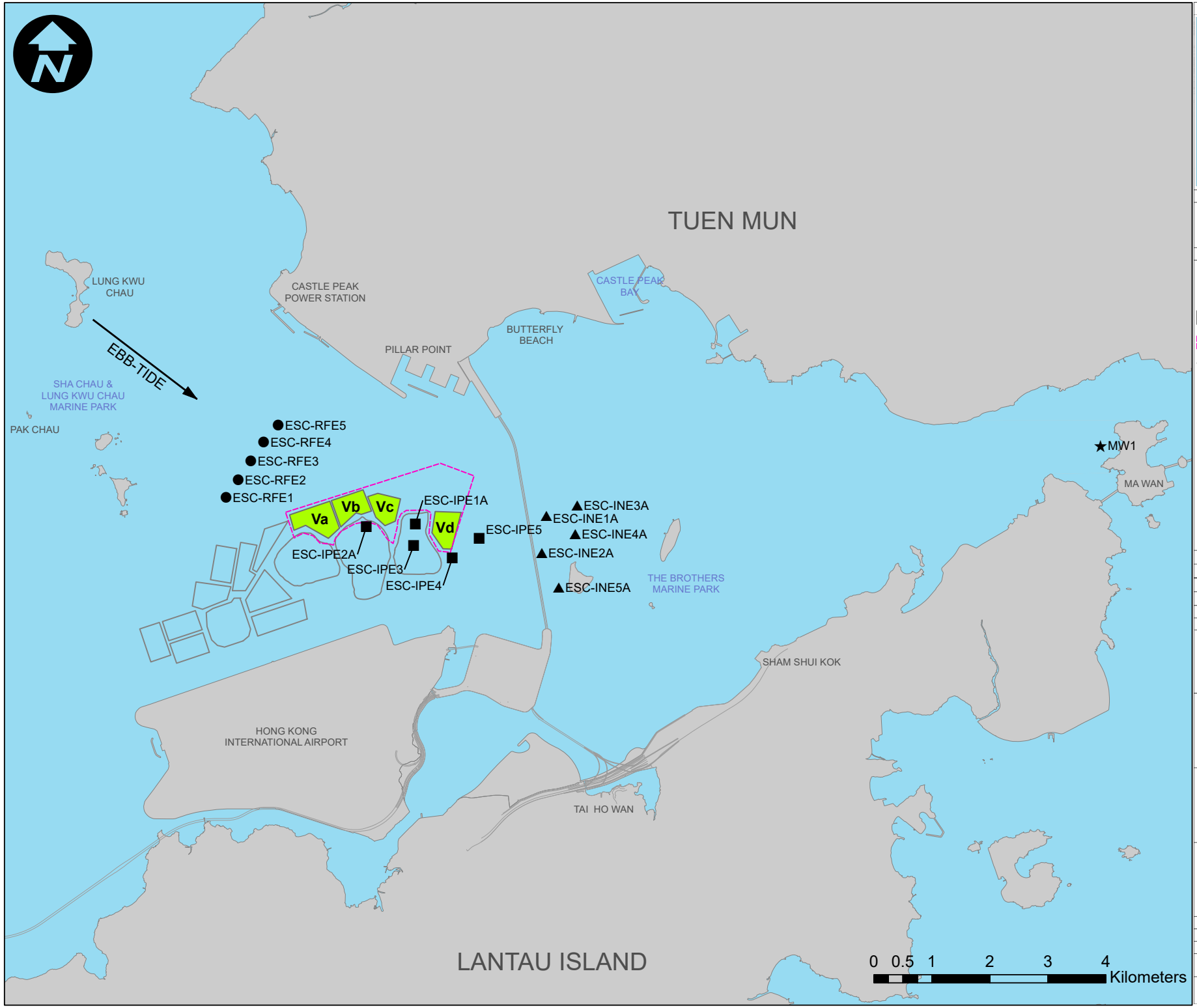
6.1 Activities Scheduled for the Next Reporting Period

The following monitoring activities will be conducted in the next quarterly reporting period of April to June 2024 for ESC CMPs including:

- Water Column Profiling of ESC CMP Vb in April, May and June 2024;
- Routine Water Quality Monitoring of ESC CMPs in April, May and June 2024;
- Pit Specific Sediment Chemistry of ESC CMP Vb in April, May and June 2024; and
- Cumulative Impact Sediment Chemistry of ESC CMPs in June 2024.

The sampling schedule for ESC CMPs is presented in **Appendix A**.

Figures



Key Plan:

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

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Project

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Title

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

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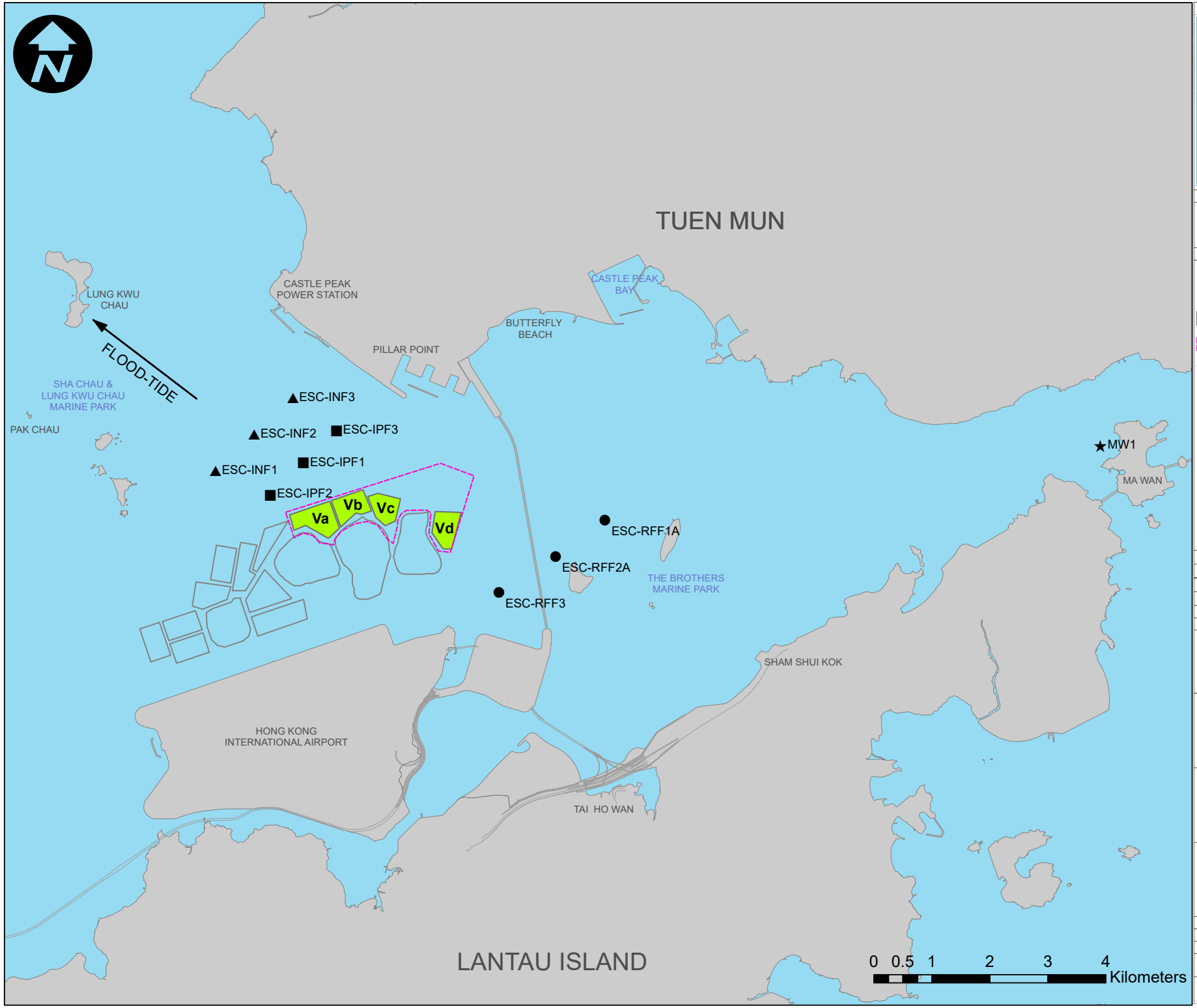
Drawn			Coordination		
Dwg check			Approved		
Scale at A3		Status		Rev	

Drawing Number

FIGURE 4.1



Key Plan:

Notes:

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LEGEND

- ESC CMP V
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WATER QUALITY SAMPLING STATIONS

- IMPACT STATION
- INTERMEDIATE STATION
- REFERENCE STATION
- MA WAN STATION

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Title

ROUTINE & CAPPING WATER QUALITY SAMPLING STATIONS (FLOOD-TIDE) FOR ESC CMPS

Designed			Eng check		
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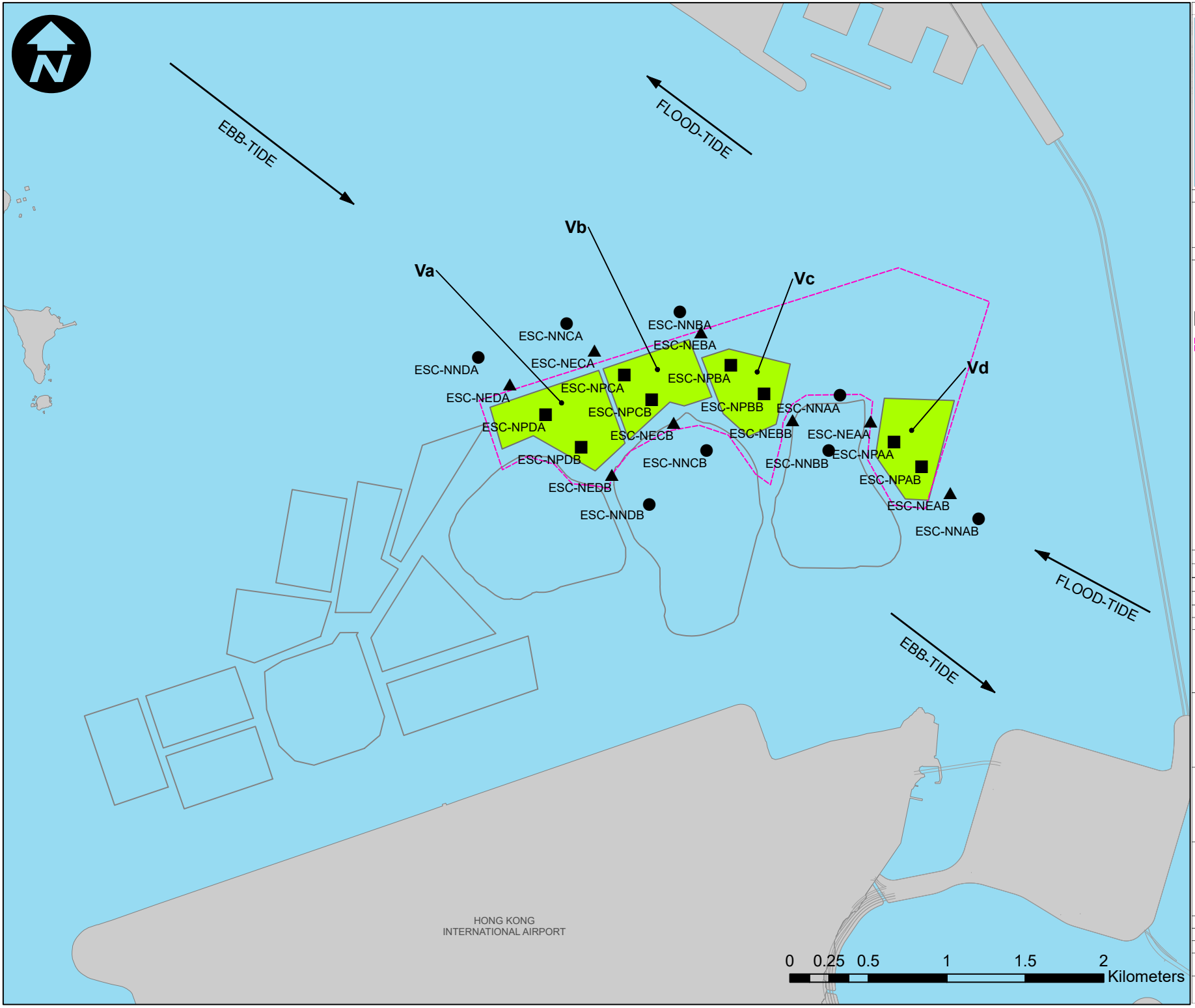
FIGURE 4.2



Key Plan:

Notes:

Key to symbols:

LEGEND

ESC CMP V

ESC USABLE AREA 1

PIT SPECIFIC SEDIMENT MONITORING STATIONS

ACTIVE-PIT STATION

PIT-EDGE STATION

NEAR-PIT STATION

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Title

PIT SPECIFIC SEDIMENT QUALITY MONITORING STATIONS FOR CMP V

Designed			Eng check		
Drawn			Coordination		
Dwg check			Approved		
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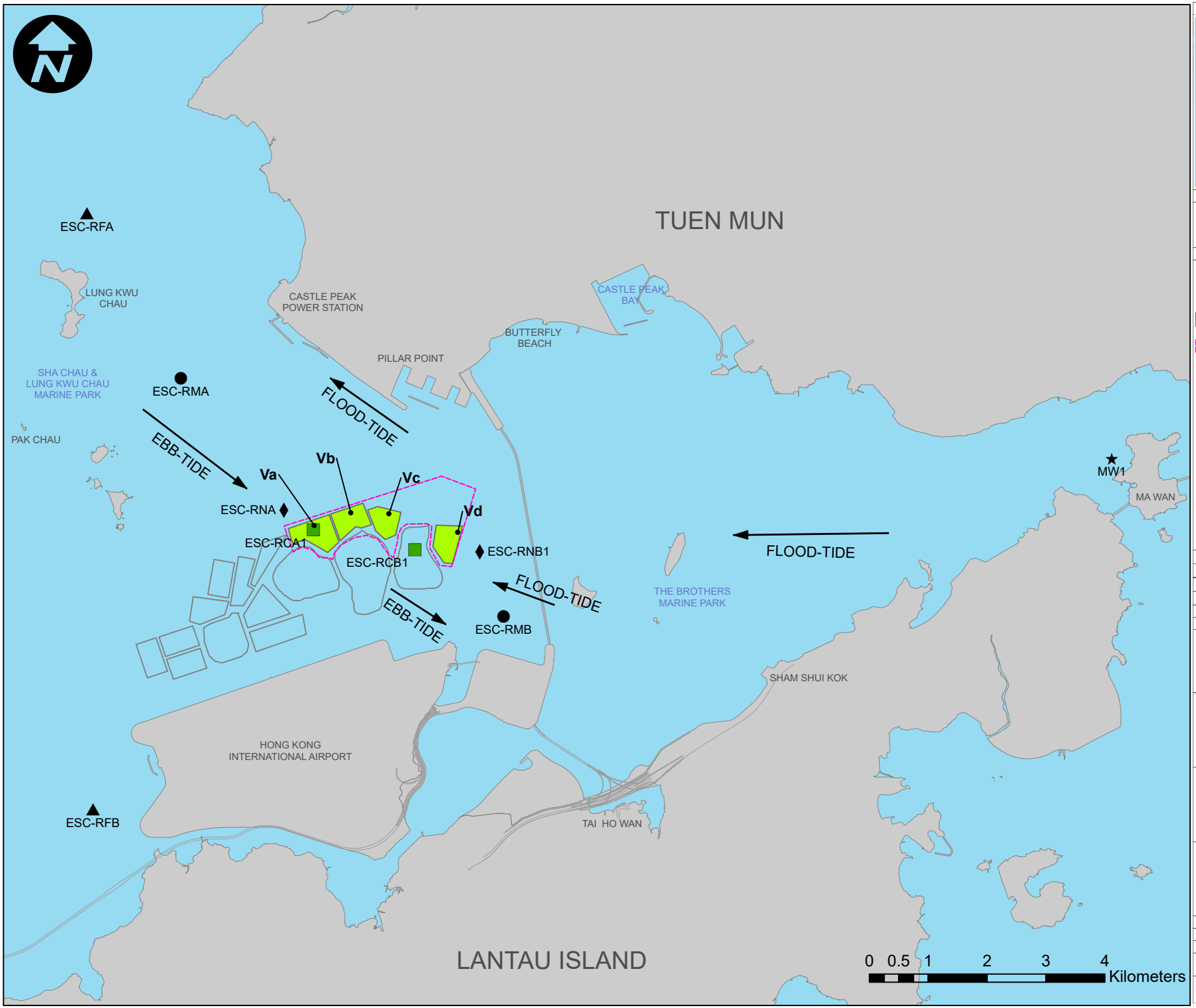
Drawing Number

FIGURE 4.3



Key Plan:

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

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Title

CUMULATIVE IMPACTS SEDIMENT QUALITY MONITORING STATIONS FOR ESC CMPS

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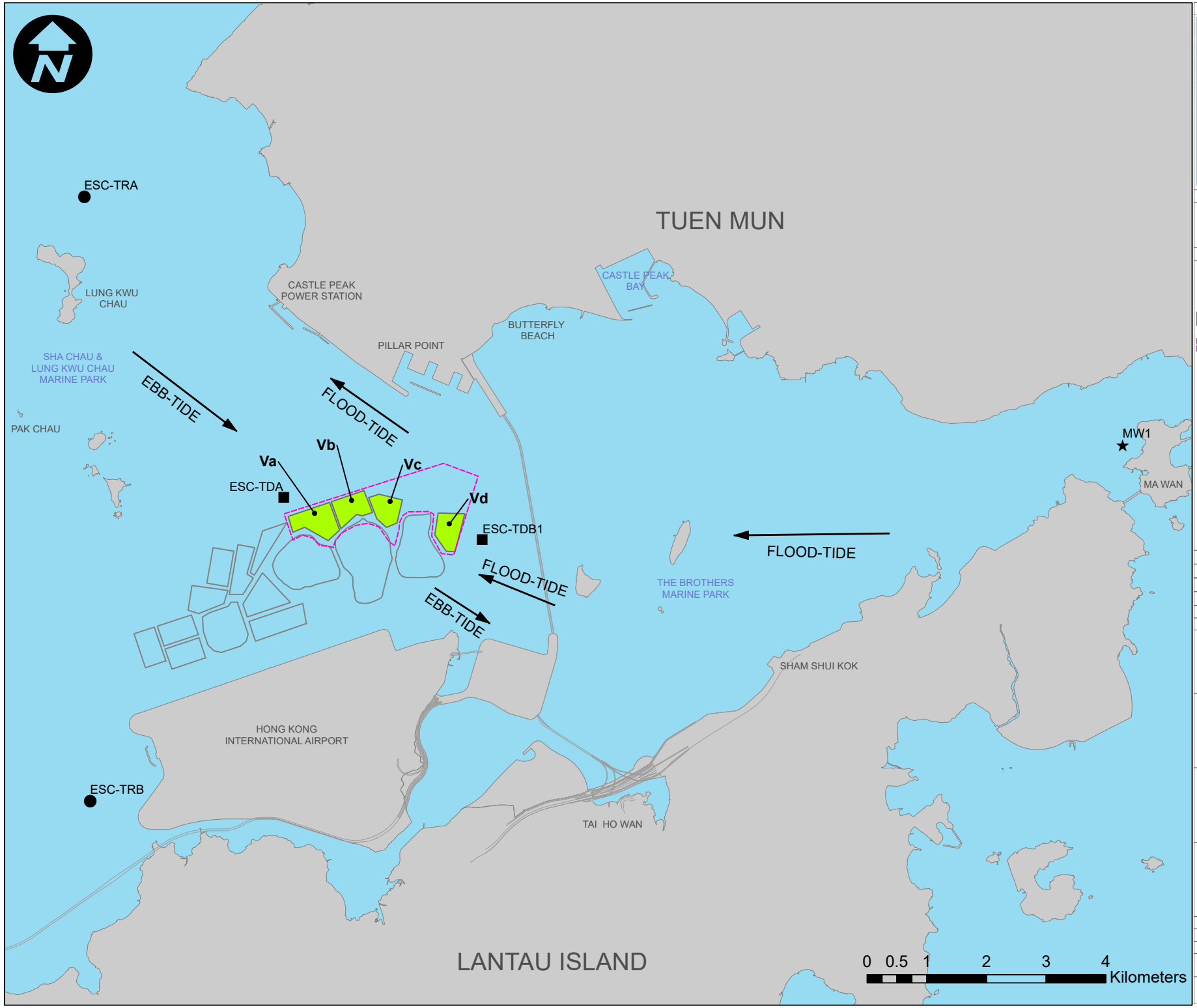
FIGURE 4.4



Key Plan:

Notes:

Key to symbols:

LEGEND

- ESC CMP V
- ESC USABLE AREA 1

SEDIMENT TOXICITY MONITORING STATIONS

- NEAR-FIELD STATION
- REFERENCE STATION
- MA WAN STATION

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Title

SEDIMENT TOXICITY MONITORING STATIONS FOR ESC CMPS

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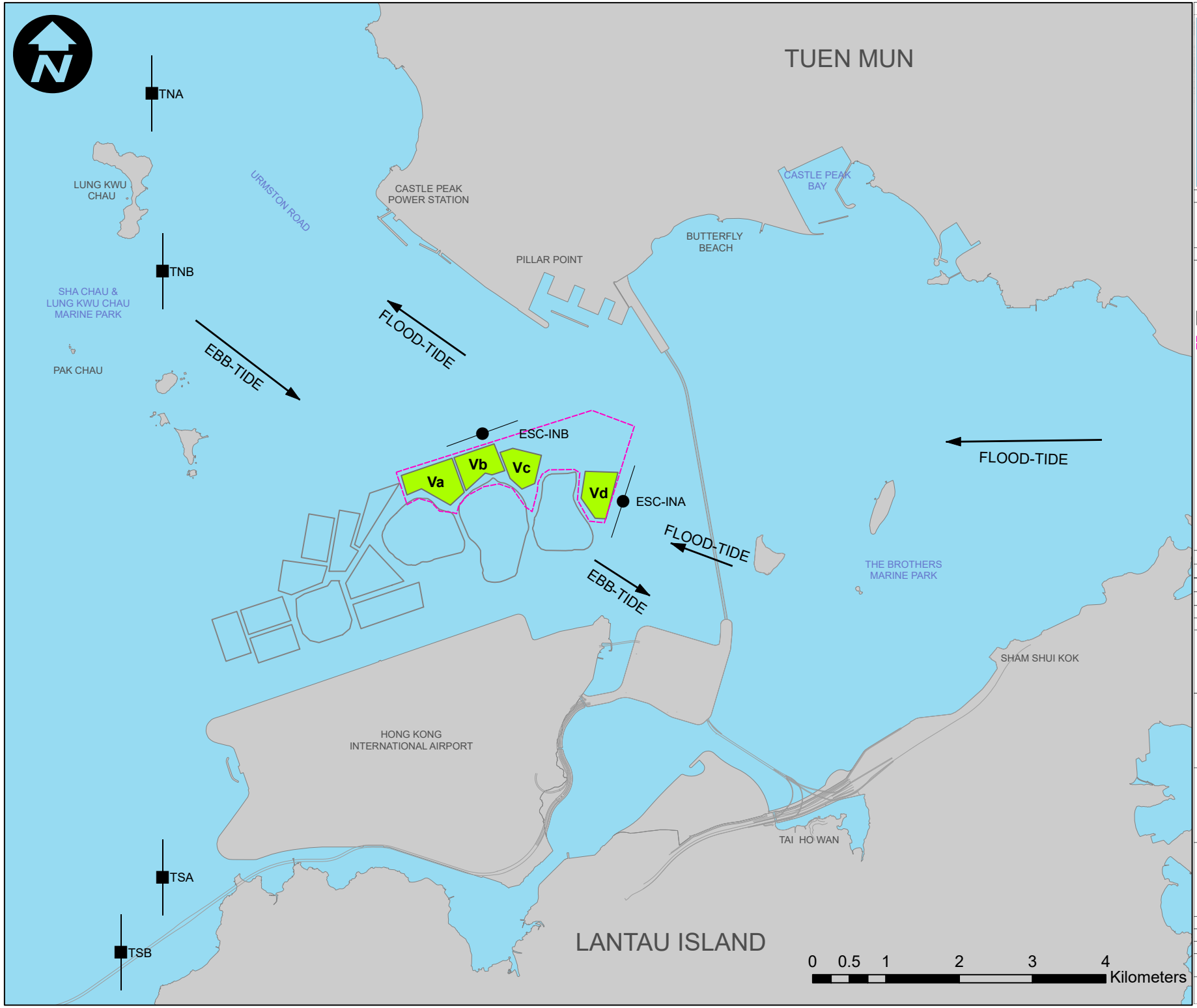
Drawn			Coordination		
Dwg check			Approved		
Scale at A3		Status		Rev	

Drawing Number

FIGURE 4.5



Key Plan:

Notes:

Key to symbols:

LEGEND

ESC CMP V

ESC USABLE AREA 1

DEMERSAL TRAWL SAMPLING STATIONS

IMPACT TRAWL STATION

REFERENCE TRAWL STATION

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Title

MARINE BIOTA MONITORING STATIONS FOR ESC CMPS

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

Drawing Number

FIGURE 4.6

Appendices

Appendix A. Sampling Schedule

East of Sha Chau CMPs
Environmental Monitoring and Audit Sampling Schedule
(January 2021 - March 2026)

Parameter / Station Type	Station ID	Frequency	2021												2022												2023												2024												2025												2026		
Pit Specific Sediment Chemistry *			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Active-Pit																																																															
	ESC-NPAA	Monthly	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-NPAB	Monthly	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pit-Edge																																																															
	ESC-NEAA	Monthly	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-NEAB	Monthly	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Near-Pit																																																															
	ESC-NNAA	Monthly	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-NNAB	Monthly	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Cumulative Impact Sediment Chemistry *			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Near-field Stations																																																															
	ESC-RNA	4 times per year		6				6		6				6		6				6		2				2		2				2		2				2		2				2		2				2		2				2		2				2		2	
	ESC-RNB1	4 times per year		6				6		6				6		6				6		2				2		2				2		2				2		2				2		2				2		2				2		2				2		2	
Mid-field Stations																																																															
	ESC-RMA	4 times per year		6				6		6				6		6				6		2				2		2				2		2				2		2				2		2				2		2				2		2				2		2	
	ESC-RMB	4 times per year		6				6		6				6		6				6		2				2		2				2		2				2		2				2		2				2		2				2		2				2		2	
Capped Pit Stations																																																															
	ESC-RCA1	4 times per year		6				6		6				6		6				6		2				2		2				2		2				2		2				2		2				2		2				2		2				2		2	
	ESC-RCB1	4 times per year		6				6		6				6		6				6		2				2		2				2		2				2		2				2		2				2		2				2		2				2		2	
Far-field Stations																																																															
	ESC-RFA	4 times per year		6				6		6				6		6				6		2				2		2				2		2				2		2				2		2				2		2				2		2				2		2	
	ESC-RFB	4 times per year		6				6		6				6		6				6		2				2		2				2		2				2		2				2		2				2		2				2		2				2		2	
Ma Wan Station																																																															
	MW1	4 times per year		6				6		6				6		6				6		2				2		2				2		2				2		2				2		2				2		2				2		2				2		2	
Sediment Toxicity Tests			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Near-pit Stations																																																															
	ESC-TDA	2 times per year		5						5							5#					5						5						5						5						5						5						5						5	
	ESC-TDB1	2 times per year		5						5							5#					5						5						5						5						5						5						5						5	
Reference Stations																																																															
	ESC-TRA	2 times per year		5						5							5#					5						5						5						5						5						5						5						5	
	ESC-TRB	2 times per year		5						5							5#					5						5						5						5						5						5						5						5	
Ma Wan Station																																																															
	MW1	2 times per year		5						5							5#					5						5						5						5						5						5						5						5	
Tissue / Whole Body Sampling			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Near-pit Stations																																																															
	ESC-INA	2 times per year		*						*						*							*					*						*						*						*						*						*						*	
	ESC-INB	2 times per year		*						*						*							*					*						*						*						*						*						*						*	
Reference North																																																															
	TNA	2 times per year		*						*						*							*					*						*						*						*						*						*						*	
	TNB	2 times per year		*						*						*							*					*						*						*						*						*						*						*	
Reference South																																																															
	TSA	2 times per year		*						*						*							*					*						*						*						*						*						*						*	
	TSB	2 times per year		*						*						*							*					*						*						*						*						*						*						*	
Demersal Trawling			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Near-pit Stations																																																															
	ESC-INA	4 times per year	5	5					5	5					5	5						5^	5^				5	5					5	5					5	5					5	5					5	5					5	5					5	5	
	ESC-INB	4 times per year	5	5					5	5					5	5						5^	5^				5	5					5	5					5	5					5	5					5	5					5	5					5	5	
Reference North																																																															
	TNA	4 times per year	5	5					5	5					5	5						5^	5^				5	5					5	5					5	5					5	5					5	5					5	5					5	5	
	TNB	4 times per year	5	5					5	5					5	5						5^	5^				5	5					5	5					5	5					5	5					5	5					5	5					5	5	
Reference South																																																															
	TSA	4 times per year	5	5					5	5					5	5						5^	5^				5	5					5	5					5	5					5	5					5	5					5	5					5	5	
	TSB	4 times per year	5	5					5	5					5	5						5^	5^				5	5					5	5					5	5					5	5					5	5					5	5					5	5	
Capping *			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Ebb Tide																																																															
Impact Station Downcurrent																																																															
	ESC-IPE1A	4 times per year *																																																															
	ESC-IPE2A	4 times per year *																																																															
	ESC-IPE3	4 times per year *																																																															
	ESC-IPE4	4 times per year *																																																															
	ESC-IPE5	4 times per year *																																																															
Intermediate Station Downcurrent																																																															
	ESC-INE1A	4 times per year *																																																															
	ESC-INE2A	4 times per year *																																																															
	ESC-INE3A	4 times per year *																																																															
	ESC-INE4A	4 times per year *																																																															
	ESC-INE5A	4 times per year *																																																															
Reference Station Upcurrent																																																															
	ESC-RFE1	4 times per year *																																																															
	ESC-RFE2	4 times per year *																																																															
	ESC-RFE3	4 times per year *																																																															
	ESC-RFE4	4 times per year *																																																															
	ESC-RFE5	4 times per year *																																																															
Ma Wan Station																																																															
	MW1	4 times per year *																																																															
Flood Tide																																																															
Impact Station Downcurrent																																																															
	ESC-IPF1	4 times per year *																																																															
	ESC-IPF2	4 times per year *																																																															
	ESC-IPF3	4 times per year *																																																															
Intermediate Station Downcurrent																																																															
	ESC-INF1	4 times per year *																																																															
	ESC-INF2	4 times per year *																																																															
	ESC-INF3	4 times per year *																																																															
Reference Station Upcurrent																																																															
	ESC-RFF1A	4 times per year *																																																															
	ESC-RFF2A	4 times per year *																																																															
	ESC-RFF3	4 times per year *																																																															
Ma Wan Station																																																															
	MW1	4 times per year *																																																															
Routine Water Quality Monitoring *			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Ebb Tide																																																															
Impact Station Downcurrent																																																															
	ESC-IPE1A	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-IPE2A	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-IPE3	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-IPE4	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-IPE5	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Intermediate Station Downcurrent																																																															
	ESC-INE1A	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-INE2A	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-INE3A	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-INE4A	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-INE5A	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Reference Station Upcurrent																																																															
	ESC-RFE1	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-RFE2	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-RFE3	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-RFE4	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-RFE5	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Ma Wan Station																																																															
	MW1	Monthly*				4	4	4		4		4	4			4		4	4	4		2		2			2	2		2	2		2				2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Flood Tide																																																															
Impact Station Downcurrent																																																															
	ESC-IPF1	Monthly*	4	4	4				4		4			4	4		4				2		2		2	2			2			2		2	2	2		2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-IPF2	Monthly*	4	4	4				4		4			4	4		4				2		2		2	2			2			2		2	2	2		2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-IPF3	Monthly*	4	4	4				4		4			4	4		4				2		2		2	2			2			2		2	2	2		2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Intermediate Station Downcurrent																																																															
	ESC-INF1	Monthly*	4	4	4				4		4			4	4		4				2		2		2	2			2			2		2	2	2		2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-INF2	Monthly*	4	4	4				4		4			4	4		4				2		2		2	2			2			2		2	2	2		2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-INF3	Monthly*	4	4	4				4		4			4	4		4				2		2		2	2			2			2		2	2	2		2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Reference Station Upcurrent																																																															
	ESC-RFF1A	Monthly*	4	4	4				4		4			4	4		4				2		2		2	2			2			2		2	2	2		2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-RFF2A	Monthly*	4	4	4				4		4			4	4		4				2		2		2	2			2			2		2	2	2		2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	ESC-RFF3	Monthly*	4	4	4				4		4			4	4		4				2		2		2	2			2			2		2	2	2		2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Ma Wan Station																																																															
	MW1	Monthly*	4	4	4				4		4			4	4		4				2		2		2	2			2			2		2	2	2		2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Water Column Profiling *			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Plume Stations																																																															
	WCP1	Monthly*	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	WCP2	Monthly*	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Benthic Recoloinisation Studies			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Capped Stations at CMP V																																																															
	ESCV-CPA	2 times per year																																																															
	ESCV-CPB	2 times per year																																																															
	ESCV-CPC	2 times per year																																																															
	ESCV-CPD	2 times per year																																																															
Reference Stations																																																															
	RBA	2 times per year																																																															
	RBB	2 times per year																																																															
	RBC1	2 times per year																																																															
Impact Monitoring for Dredging			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Upstream Stations																																																															
	US1	3 times per week														2	2	2	2	2																																											
	US2	3 times per week														2	2	2	2	2																																											
Downstream Stations																																																															
	DS1	3 times per week														2	2	2	2	2																																											
	DS2	3 times per week														2	2	2	2	2																																											
	DS3	3 times per week														2	2	2	2	2																																											
	DS4	3 times per week														2	2	2	2	2																																											
	DS5	3 times per week														2	2	2	2	2																																											
Ma Wan Station																																																															
	MW1	3 times per week														2	2	2	2	2																																											

Notes:

(1) The number shown in each cell represents the numbers of replicates per monitoring station. The number shown in **green bolded text** represented monitoring works have been conducted before/ during the reporting period of this Monthly EM&A Report, while the number shown in black represent planned monitoring works after the reporting period of this Monthly EM&A Report.

(2) For the planned Routine Water Quality Monitoring (i.e. the numbers of replicates per monitoring station shown in black), the monitoring will be conducted at mid-ebb OR mid-flood tide. The yearly tidal selection of this monitoring will be based on a principle to obtain 6 months monitoring data at mid-ebb, and 6 months monitoring data at mid-flood.

(3) Impact Monitoring for Dredging will be scheduled when dredging operations commence.

(4) Benthic Recolonisation Studies for CMP V will be scheduled when capping operation for CMP V is completed.

Remarks:

***** 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 implemented for the EM&A activities since December 2020. Water Quality Monitoring during Capping Operation and Routine Water Quality Monitoring are combined such that Routine Water Quality Monitoring have been conducted monthly starting in December 2020. A technical note presenting the data review results served as a supplementary information was submitted to EPD and presented that Phase 2 optimization of sample replication of water quality and sediment monitoring for the Project will be implemented in 2022 was provided to EPD in April 2022. Phase 2 optimization of sample replication has been effective for the EM&A activities since July 2022.

Due to the logistic problem induced by the pandemic which adversely affecting the supply of international species adopted in testing programme of Sediment Toxicity Tests, as such, Sediment Toxicity Tests of ESC CMPs originally scheduled in February 2022 were postponed to March 2022.

^ To enable the required Research Fishing Permit could be granted by the time undertaking the Demersal Trawling, trawling originally scheduled in July and August 2022 was postponed to August and September 2022.

Appendix B. Disposal and Capping Records

B1. Disposal Record at ESC CMP Vb

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
1 Jan 2024	1,000	1,028,578
2 Jan 2024	1,600	1,030,178
3 Jan 2024	850	1,031,028
4 Jan 2024	2,000	1,033,028
5 Jan 2024	1,050	1,034,078
6 Jan 2024	2,050	1,036,128
7 Jan 2024	2,050	1,038,178
8 Jan 2024	450	1,038,628
9 Jan 2024	1,950	1,040,578
10 Jan 2024	500	1,041,078
11 Jan 2024	3,100	1,044,178
12 Jan 2024	550	1,044,728
13 Jan 2024	1,100	1,045,828
14 Jan 2024	0	1,045,828
15 Jan 2024	2,000	1,047,828
16 Jan 2024	850	1,048,678
17 Jan 2024	0	1,048,678
18 Jan 2024	0	1,048,678
19 Jan 2024	0	1,048,678
20 Jan 2024	1,100	1,049,778
21 Jan 2024	550	1,050,328
22 Jan 2024	550	1,050,878
23 Jan 2024	550	1,051,428
24 Jan 2024	550	1,051,978
25 Jan 2024	500	1,052,478
26 Jan 2024	1,050	1,053,528
27 Jan 2024	850	1,054,378
28 Jan 2024	0	1,054,378
29 Jan 2024	550	1,054,928
30 Jan 2024	550	1,055,478
31 Jan 2024	670	1,056,148

B1. Disposal Record at ESC CMP Vb

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
1 Feb 2024	550	1,056,698
2 Feb 2024	230	1,056,928
3 Feb 2024	850	1,057,778
4 Feb 2024	550	1,058,328
5 Feb 2024	150	1,058,478
6 Feb 2024	550	1,059,028
7 Feb 2024	950	1,059,978
8 Feb 2024	0	1,059,978
9 Feb 2024	0	1,059,978
10 Feb 2024	0	1,059,978
11 Feb 2024	0	1,059,978
12 Feb 2024	0	1,059,978
13 Feb 2024	0	1,059,978
14 Feb 2024	0	1,059,978
15 Feb 2024	0	1,059,978
16 Feb 2024	0	1,059,978
17 Feb 2024	1,600	1,061,578
18 Feb 2024	2,000	1,063,578
19 Feb 2024	1,600	1,065,178
20 Feb 2024	2,000	1,067,178
21 Feb 2024	2,000	1,069,178
22 Feb 2024	1,600	1,070,778
23 Feb 2024	2,000	1,072,778
24 Feb 2024	2,000	1,074,778
25 Feb 2024	1,600	1,076,378
26 Feb 2024	2,400	1,078,778
27 Feb 2024	1,800	1,080,578
28 Feb 2024	1,500	1,082,078
29 Feb 2024	1,500	1,083,578

B1. Disposal Record at ESC CMP Vb

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
1 Mar 2024	2,014	1,085,592
2 Mar 2024	1,200	1,086,792
3 Mar 2024	1,500	1,088,292
4 Mar 2024	1,500	1,089,792
5 Mar 2024	1,340	1,091,132
6 Mar 2024	600	1,091,732
7 Mar 2024	300	1,092,032
8 Mar 2024	837	1,092,869
9 Mar 2024	0	1,092,869
10 Mar 2024	0	1,092,869
11 Mar 2024	0	1,092,869
12 Mar 2024	185	1,093,054
13 Mar 2024	0	1,093,054
14 Mar 2024	0	1,093,054
15 Mar 2024	0	1,093,054
16 Mar 2024	0	1,093,054
17 Mar 2024	0	1,093,054
18 Mar 2024	0	1,093,054
19 Mar 2024	0	1,093,054
20 Mar 2024	0	1,093,054
21 Mar 2024	0	1,093,054
22 Mar 2024	0	1,093,054
23 Mar 2024	0	1,093,054
24 Mar 2024	0	1,093,054
25 Mar 2024	440	1,093,494
26 Mar 2024	0	1,093,494
27 Mar 2024	0	1,093,494
28 Mar 2024	0	1,093,494
29 Mar 2024	0	1,093,494
30 Mar 2024	0	1,093,494
31 Mar 2024	0	1,093,494

B2. Capping Record at ESC CMP Vd

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
1 Jan 2024	0	700,039
2 Jan 2024	0	700,039
3 Jan 2024	0	700,039
4 Jan 2024	0	700,039
5 Jan 2024	0	700,039
6 Jan 2024	0	700,039
7 Jan 2024	0	700,039
8 Jan 2024	0	700,039
9 Jan 2024	725	700,764
10 Jan 2024	0	700,764
11 Jan 2024	0	700,764
12 Jan 2024	1,717	702,481
13 Jan 2024	0	702,481
14 Jan 2024	0	702,481
15 Jan 2024	1,648	704,129
16 Jan 2024	0	704,129
17 Jan 2024	1,794	705,923
18 Jan 2024	550	706,473
19 Jan 2024	0	706,473
20 Jan 2024	0	706,473
21 Jan 2024	0	706,473
22 Jan 2024	0	706,473
23 Jan 2024	2,189	708,662
24 Jan 2024	0	708,662
25 Jan 2024	0	708,662
26 Jan 2024	0	708,662
27 Jan 2024	0	708,662
28 Jan 2024	0	708,662
29 Jan 2024	0	708,662
30 Jan 2024	981	709,643
31 Jan 2024	0	709,643

B2. Capping Record at ESC CMP Vd

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
1 Feb 2024	0	709,643
2 Feb 2024	0	709,643
3 Feb 2024	1,305	710,948
4 Feb 2024	0	710,948
5 Feb 2024	0	710,948
6 Feb 2024	0	710,948
7 Feb 2024	0	710,948
8 Feb 2024	2,027	712,975
9 Feb 2024	0	712,975
10 Feb 2024	0	712,975
11 Feb 2024	0	712,975
12 Feb 2024	0	712,975
13 Feb 2024	0	712,975
14 Feb 2024	0	712,975
15 Feb 2024	2,214	715,189
16 Feb 2024	0	715,189
17 Feb 2024	0	715,189
18 Feb 2024	0	715,189
19 Feb 2024	0	715,189
20 Feb 2024	0	715,189
21 Feb 2024	0	715,189
22 Feb 2024	0	715,189
23 Feb 2024	0	715,189
24 Feb 2024	0	715,189
25 Feb 2024	0	715,189
26 Feb 2024	0	715,189
27 Feb 2024	0	715,189
28 Feb 2024	0	715,189
29 Feb 2024	0	715,189

B2. Capping Record at ESC CMP Vd

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
1 Mar 2024	0	715,189
2 Mar 2024	0	715,189
3 Mar 2024	0	715,189
4 Mar 2024	0	715,189
5 Mar 2024	0	715,189
6 Mar 2024	0	715,189
7 Mar 2024	0	715,189
8 Mar 2024	0	715,189
9 Mar 2024	0	715,189
10 Mar 2024	0	715,189
11 Mar 2024	0	715,189
12 Mar 2024	0	715,189
13 Mar 2024	0	715,189
14 Mar 2024	0	715,189
15 Mar 2024	692	715,881
16 Mar 2024	0	715,881
17 Mar 2024	0	715,881
18 Mar 2024	0	715,881
19 Mar 2024	0	715,881
20 Mar 2024	0	715,881
21 Mar 2024	0	715,881
22 Mar 2024	0	715,881
23 Mar 2024	0	715,881
24 Mar 2024	0	715,881
25 Mar 2024	0	715,881
26 Mar 2024	0	715,881
27 Mar 2024	0	715,881
28 Mar 2024	0	715,881
29 Mar 2024	0	715,881
30 Mar 2024	0	715,881
31 Mar 2024	0	715,881

Appendix C. Statistical Analysis

Routine Water Quality Monitoring for ESC CMPs – Statistical Analysis up to Mar 2024

Dissolved Oxygen

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	161.45	43	385.34	**
Area	0.81	3	27.74	**
Period:Area	7.93	129	6.31	**
Residuals	51.34	5269		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result[1]:
  $\text{Impact} > \text{Intermediate} > \text{Reference} > \text{Ma Wan}\}$ ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact < Intermediate < Reference) were detected for all months over the study period.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	6637.83	46	1155.24	**
Area	76.72	3	204.73	**
Period:Area	68.43	138	3.97	**
Residuals	479.28	3837		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  $\left.\begin{matrix}\text{Reference} = \text{Intermediate} \\ \text{Reference}, \text{Intermediate} > \text{Impact} > \text{Ma Wan}\end{matrix}\right\}$ ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact < Intermediate < Reference) were detected for all months over the study period.

[1] The overall result represents the SNK tests on fixed factor Area.

Turbidity

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	2535.70	43	297.66	**
Area	160.55	3	270.14	**
Period:Area	295.68	129	11.57	**
Residuals	1043.86	5269		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  $\text{Impact} > \text{Intermediate} > \text{Reference} > \text{Ma Wan}\ \}$ ∴ potential overall significant project related impact.
- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Apr 2012, Aug 2012, Apr 2013, May 2016, Apr 2017, Apr 2020, Nov 2021
- No potential project related spatial trend detected for the reporting months.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	101788.01	46	129.05	**
Area	3153.74	3	61.31	**
Period:Area	13868.21	138	5.86	**
Residuals	65789.87	3837		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  $\left.\begin{matrix}\text{Reference} = \text{Impact} = \text{Intermediate} \\ \text{Reference, Impact, Intermediate} > \text{Ma Wan}\end{matrix}\right\}$ ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

Arsenic

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	12.66	8	54.23	**
Area	0.05	3	0.52	N.S.
Period:Area	1.32	24	1.89	**
Residuals	7.38	253		

Note:

1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  $\text{Ma Wan} = \text{Impact} = \text{Reference} = \text{Intermediate}\}$ ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months since July 2022.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	3.05	11	38.25	**
Area	0.06	3	2.84	**
Period:Area	0.59	33	2.49	**
Residuals	1.39	192		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  $\left.\begin{matrix}\text{Impact} = \text{Intermediate} = \text{Reference} \\ \text{Impact, Intermediate, Reference} > \text{Ma Wan}\end{matrix}\right\}$ ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months since July 2022.

Cadmium

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	0.01255	8	9.89	**
Area	0.00069	3	1.45	N.S.
Period:Area	0.00512	24	1.34	N.S.
Residuals	0.04011	253		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  Reference = Intermediate = Impact = Ma Wan} ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months since July 2022.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	0.01160	11	6.57	**
Area	0.00055	3	1.14	N.S.
Period:Area	0.00476	33	0.90	N.S.
Residuals	0.03079	192		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  Impact = Intermediate = Reference = Ma Wan} ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months since July 2022.

Chromium

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	10.72	8	8.40	**
Area	0.53	3	1.10	N.S.
Period:Area	6.54	24	1.71	**
Residuals	40.37	253		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  Intermediate = Impact = Reference = Ma Wan } ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months since July 2022.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	5.93	11	4.04	**
Area	0.44	3	1.09	N.S.
Period:Area	5.17	33	1.17	N.S.
Residuals	25.60	192		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  Reference = Ma Wan = Intermediate = Impact} ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months since July 2022.

Copper

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	14.17	8	27.11	**
Area	0.11	3	0.57	N.S.
Period:Area	4.48	24	2.86	**
Residuals	16.53	253		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  $\text{Reference} = \text{Impact} = \text{Intermediate} = \text{Ma Wan}\}$ ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months since July 2022.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	3.59	11	11.71	**
Area	1.75	3	20.93	**
Period:Area	2.37	33	2.58	**
Residuals	5.36	192		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  $\left.\begin{matrix}\text{Intermediate} = \text{Impact} = \text{Reference} \\ \text{Intermediate, Impact, Reference} > \text{Ma Wan}\end{matrix}\right\}$ ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months since July 2022.

Mercury

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	1.78×10^{-04}	8	5.29	**
Area	4.10×10^{-06}	3	0.32	N.S.
Period:Area	7.63×10^{-05}	24	0.76	N.S.
Residuals	1.06×10^{-03}	253		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  Impact = Reference = Intermediate = Ma Wan} ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months since July 2022.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	4.87×10^{-03}	11	8.60	**
Area	1.50×10^{-04}	3	0.97	N.S.
Period:Area	1.08×10^{-03}	33	0.64	N.S.
Residuals	9.87×10^{-03}	192		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  Reference = Impact = Ma Wan = Intermediate} ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months since July 2022.

Nickel

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	14.42	8	123.50	**
Area	0.63	3	14.44	**
Period:Area	0.75	24	2.13	**
Residuals	3.69	253		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:

$$\left.\begin{array}{l}\text{Reference} = \text{Impact} = \text{Intermediate} \\ \text{Reference, Impact, Intermediate} > \text{Ma Wan}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months since July 2022.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	5.89	11	31.10	**
Area	2.77	3	53.51	**
Period:Area	0.91	33	1.60	**
Residuals	3.31	192		

Note:

3. Assume Gamma distribution
4. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:

$$\left.\begin{array}{l}\text{Impact} = \text{Reference} \\ \text{Intermediate} > \text{Impact, Reference} > \text{Ma Wan}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months since July 2022.

Zinc

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	172.96	8	18.37	**
Area	13.79	3	3.91	**
Period:Area	50.89	24	1.80	**
Residuals	297.81	253		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{l}\text{Impact} = \text{Reference} \\ \text{Intermediate} > \text{Impact, Reference} > \text{Ma Wan}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months since July 2022.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	62.06	11	12.56	**
Area	52.31	3	38.81	**
Period:Area	247.93	33	16.73	**
Residuals	86.25	192		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{l}\text{Impact} = \text{Intermediate} = \text{Reference} \\ \text{Ma Wan} > \text{Impact, Intermediate, Reference}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months since July 2022.

Ammonia Nitrogen

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	1202.92	43	335.46	**
Area	16.71	3	66.78	**
Period:Area	103.69	129	9.64	**
Residuals	329.65	3953		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  Ma Wan = Reference = Impact = Intermediate } ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	912.14	46	106.83	**
Area	8.61	3	15.46	**
Period:Area	65.86	138	2.57	**
Residuals	477.04	2570		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  Ma Wan = Reference = Intermediate = Impact } ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

Total Inorganic Nitrogen

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	598.78	43	477.54	**
Area	21.89	3	250.25	**
Period:Area	40.29	129	10.71	**
Residuals	115.27	3953		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{c}\text{Impact} = \text{Reference} \\ \text{Impact, Reference} > \text{Intermediate} > \text{Ma Wan}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	669.93	46	291.75	**
Area	13.36	3	89.24	**
Period:Area	42.36	138	6.15	**
Residuals	128.29	2570		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{c}\text{Reference} = \text{Intermediate} = \text{Impact} \\ \text{Reference, Intermediate, Impact} > \text{Ma Wan}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

BOD_5

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	611.98	43	111.24	**
Area	13.06	3	34.03	**
Period:Area	194.63	129	11.79	**
Residuals	505.74	3953		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{c}\text{Reference} = \text{Ma Wan} \\ \text{Impact} = \text{Intermediate} \\ \text{Reference, Ma Wan} > \text{Impact, Imtermediate}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	771.25	46	178.35	**
Area	18.92	3	67.10	**
Period:Area	160.74	138	12.39	**
Residuals	241.61	2570		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{c}\text{Intermediate} = \text{Impact} \\ \text{Ma Wan} > \text{Reference} > \text{Intermediate, Impact}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

Suspended Solids

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	954.07	43	246.44	**
Area	42.00	3	155.49	**
Period:Area	152.36	129	13.12	**
Residuals	355.90	3953		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  $\text{Impact} > \text{Intermediate} > \text{Reference} > \text{Ma Wan}\ \}$ ∴ potential overall significant project related impact.
- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Apr 2012, Aug 2012, May 2016, Jul 2017, Jul 2018, Apr 2020
- No potential project related spatial trend were detected for the reporting months.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	704.28	46	154.93	**
Area	15.93	3	53.74	**
Period:Area	129.35	138	9.48	**
Residuals	253.97	2570		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  $\left.\begin{array}{l}\text{Impact} = \text{Intermediate} \\ \text{Reference} > \text{Impact}, \text{Intermediate} > \text{Ma Wan}\end{array}\right\}$ ∴ no overall significant project related impact.
- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Nov 2012, Jul 2013, Nov 2017, Aug 2018, Dec 2020, Sep 2021, Feb 2024
- Potential project related spatial trend was detected in one month for flood tide direction over the reporting period.

Pit Specific Sediment Chemistry for ESC CMPs – Statistical Analysis up to March 2024

Arsenic

Source	Type II Sum of Square	Df	F value	Significance Level
Period	81.08	49	102.49	**
Area	7.60	2	235.43	**
Direction	10.16	1	629.31	**
Period:Area	19.76	98	12.49	**
Period:Direction	6.90	49	8.72	**
Area:Direction	9.16	2	283.83	**
Period:Area:Direction	17.44	98	11.03	**
Residuals	21.94	1359		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:

$$\left.\begin{array}{l}\text{Pit Edge} > \text{Active Pit} \\ \text{Pit Edge} > \text{Near Pit} \\ \text{Active Pit} > \text{Near Pit}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- Months showing potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit): Direction[2]
  - Flood Tide: Jun 2021, Aug 2021
  - Ebb Tide: Feb 2020, Nov 2020, Jul 2021, Mar 2022, Apr 2022[3], Jun 2022, Jul 2022, Aug 2022
- No potential project related spatial trend were detected for the reporting months.

Cadmium

Source	Type II Sum of Square	Df	F value	Significance Level
Period	87.25	49	17.18	**
Area	131.79	2	635.99	**
Direction	2.76	1	26.65	**
Period:Area	71.43	98	7.03	**
Period:Direction	31.16	49	6.14	**
Area:Direction	36.60	2	176.60	**
Period:Area:Direction	50.62	98	4.99	**
Residuals	140.81	1359		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:

$$\left.\begin{array}{l}\text{Pit Edge} = \text{Near Pit} \\ \text{Active Pit} > \text{Pit Edge} \\ \text{Active Pit} > \text{Near Pit}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit) were detected for all months over the study period.

[2] Direction: Stations located at downstream of the active pit during corresponding tide.

[3] Circled months represents consecutive months with significant spatial trend.

Chromium

Source	Type II Sum of Square	Df	F value	Significance Level
Period	37.65	49	53.11	**
Area	24.86	2	859.08	**
Direction	7.14	1	493.72	**
Period:Area	11.24	98	7.93	**
Period:Direction	4.42	49	6.23	**
Area:Direction	17.83	2	616.05	**
Period:Area:Direction	9.29	98	6.55	**
Residuals	19.66	1359		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  $\left.\begin{array}{l}\text{Active Pit} > \text{Near Pit}\\ \text{Near Pit} > \text{Pit Edge}\\ \text{Active Pit} > \text{Pit Edge}\end{array}\right\}$ ∴ no overall significant project related impact.
- Months showing potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit): Direction
  - Flood Tide: Feb 2020, Mar 2020, Oct 2020, Nov 2020, Dec 2020, Apr 2021, May 2021, Jun 2021, July 2021, Aug 2021, Oct 2021, Nov 2021, Dec 2021, Apr 2022, May 2022, Jul 2022, Aug 2023, Dec 2023
  - Ebb Tide: Apr 2020, Oct 2020, Nov 2020, May 2021, Oct 2021, Jan 2022, Feb 2022, Sep 2022, Mar 2023, Dec 2023
- No potential project related spatial trend were detected for the reporting months.

Copper

Source	Type II Sum of Square	Df	F value	Significance Level
Period	102.55	49	60.10	**
Area	228.48	2	3280.57	**
Direction	20.19	1	579.89	**
Period:Area	57.20	98	16.76	**
Period:Direction	18.55	49	10.87	**
Area:Direction	53.23	2	764.34	**
Period:Area:Direction	45.71	98	13.39	**
Residuals	47.33	1359		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  $\left.\begin{array}{l}\text{Active Pit} > \text{Near Pit}\\ \text{Near Pit} > \text{Pit Edge}\\ \text{Active Pit} > \text{Pit Edge}\end{array}\right\}$ ∴ no overall significant project related impact.
- Months showing potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit): Direction
  - Flood Tide: Jul 2020, Oct 2020, May 2021, Jan 2023, Jan 2024, Mar 2024
  - Ebb Tide: Jul 2020, Oct 2020, Sep 2021, Jan 2022, Feb 2022, Dec 2023
- Potential project related spatial trend was detected in two months for flood tide direction over the reporting period.

Lead

Source	Type II Sum of Square	Df	F value	Significance Level
Period	24.61	49	15.63	**
Area	31.61	2	491.94	**
Direction	9.15	1	284.62	**
Period:Area	15.42	98	4.90	**
Period:Direction	5.09	49	3.23	**
Area:Direction	9.31	2	144.80	**
Period:Area:Direction	7.98	98	2.54	**
Residuals	43.67	1359		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{l}\text{Active Pit} > \text{Pit Edge}\\ \text{Pit Edge} > \text{Near Pit}\\ \text{Active Pit} > \text{Near Pit}\end{array}\right\} \therefore \text{potential overall significant project related impact.}$$

- Months showing potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit): Direction
  - Flood Tide: Jun 2020, Jul 2020, Aug 2020, Sep 2020, Oct 2020, Nov 2020, Dec 2020, Apr 2021, May 2021, Jun 2021, Aug 2021, Oct 2021, Nov 2021, Dec 2021, Jan 2022, Feb 2022, Mar 2022, Jul 2022, Aug 2023, Nov 2023, Dec 2023
  - Ebb Tide: May 2020, Jul 2020, Mar 2021, May 2021, Jun 2021, Sep 2021, Oct 2021, Jan 2022, Feb 2022, Jun 2022, Jul 2022, Sep 2022, Mar 2023, Dec 2023
- No potential project related spatial trend were detected for the reporting months.

Mercury

Source	Type II Sum of Square	Df	F value	Significance Level
Period	162.00	49	15.87	**
Area	125.10	2	300.19	**
Direction	81.56	1	391.43	**
Period:Area	89.74	98	4.39	**
Period:Direction	38.87	49	3.81	**
Area:Direction	112.41	2	269.74	**
Period:Area:Direction	46.32	98	2.27	**
Residuals	283.18	1359		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{l}\text{Pit Edge} = \text{Near Pit}\\ \text{Active Pit} > \text{Pit Edge}\\ \text{Active Pit} > \text{Near Pit}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit) were detected for all months over the study period.

Nickel

Source	Type II Sum of Square	Df	F value	Significance Level
Period	30.52	49	63.37	**
Area	25.44	2	1294.06	**
Direction	14.89	1	1515.28	**
Period:Area	13.40	98	13.91	**
Period:Direction	6.12	49	12.70	**
Area:Direction	22.52	2	1145.69	**
Period:Area:Direction	11.02	98	11.44	**
Residuals	13.36	1359		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{l}\text{Active Pit} > \text{Near Pit}\\ \text{Near Pit} > \text{Pit Edge}\\ \text{Active Pit} > \text{Pit Edge}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- Months showing potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit): Direction
  - Flood Tide: Feb 2020, Mar 2020, Oct 2020, Nov 2020, Dec 2020, Apr 2021, May 2021, Jun 2021, Jul 2021, Aug 2021, Oct 2021, Nov 2021, Dec 2021, Apr 2022, May 2022, Jul 2022, Aug 2023, Dec 2023
  - Ebb Tide: Jun 2020, Jul 2020, Oct 2020, Oct 2021, Jan 2022, Feb 2022, Sep 2022, Mar 2023, Apr 2023, Dec 2023
- No potential project related spatial trend were detected for the reporting months.

Silver

Source	Type II Sum of Square	Df	F value	Significance Level
Period	212.26	49	51.53	**
Area	394.84	2	2348.54	**
Direction	3.97	1	47.23	**
Period:Area	102.40	98	12.43	**
Period:Direction	38.84	49	9.43	**
Area:Direction	40.55	2	241.17	**
Period:Area:Direction	66.96	98	8.13	**
Residuals	114.24	1359		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{l}\text{Active Pit} > \text{Near Pit}\\ \text{Active Pit} > \text{Pit Edge}\\ \text{Near Pit} > \text{Pit Edge}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit) were detected for all months over the study period.

Zinc

Source	Type II Sum of Square	Df	F value	Significance Level
Period	23.49	49	41.98	**
Area	63.24	2	2769.14	**
Direction	4.13	1	361.37	**
Period:Area	19.89	98	17.78	**
Period:Direction	7.51	49	13.42	**
Area:Direction	9.78	2	428.42	**
Period:Area:Direction	13.46	98	12.03	**
Residuals	15.52	1359		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  Active Pit > Near Pit
  Active Pit > Pit Edge
  Near Pit > Pit Edge
  ∴ no overall significant project related impact.
- Months showing potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit): Direction
  - Flood Tide: Jun 2020, Jul 2020, Oct 2020, Nov 2020, Apr 2021, May 2021, Feb 2022, Nov 2022, Jan 2023, Mar 2024
  - Ebb Tide: Apr 2020, Jun 2020, Jul 2020, Oct 2020, Mar 2021, May 2021, Jun 2021, Sep 2021, Feb 2022, Jun 2022, Jul 2022, Mar 2023, Dec 2023
- Potential project related spatial trend was detected in one month for flood tide direction over the reporting period.

Total Organic Carbon

Source	Type II Sum of Square	Df	F value	Significance Level
Period	118.20	49	126.73	**
Area	78.50	2	2062.19	**
Direction	9.27	1	487.18	**
Period:Area	47.48	98	25.45	**
Period:Direction	14.79	49	15.86	**
Area:Direction	12.93	2	339.75	**
Period:Area:Direction	33.29	98	17.85	**
Residuals	25.87	1359		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:

  Active Pit > Near Pit
  Active Pit > Pit Edge
  Near Pit > Pit Edge
  } ∴ no overall significant project related impact.

- Months showing potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit): Direction
  - Flood Tide: Feb 2020, Apr 2020, May 2020, Aug 2020, Oct 2020, May 2021, Jun 2021, Jul 2021, Sep 2021, Nov 2021, Feb 2022, Mar 2022, Jul 2022, Aug 2022, Jan 2023, Oct 2023, Dec 2023, Mar 2024
  - Ebb Tide: Jul 2020, Oct 2020, May 2021, Jun 2021, Oct 2021, Jul 2022, Feb 2023, Mar 2023, Aug 2023, Dec 2023, Mar 2024
- Potential project related spatial trend was detected in one month for flood tide and one month for ebb tide direction over the reporting period.

Cumulative Sediment Chemistry for ESC CMPs – Statistical Analysis up to March 2024

Arsenic

Source	Type II Sum of Square	Df	F value	Significance Level
Period	70.83	31	115.93	**
Area	106.22	4	1347.36	**
Period:Area	68.26	124	27.93	**
Residuals	45.09	2288		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  - Mid-Field > Far-Field > Ma Wan > Near-Field > Capped-pit, ∴no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Cadmium

Source	Type II Sum of Square	Df	F value	Significance Level
Period	75.48	31	20.67	**
Area	72.47	4	153.82	**
Period:Area	60.70	124	4.16	**
Residuals	269.48	2288		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  - Mid-Field = Far-Field = Ma Wan = Near-Field = Capped-pit, ∴no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Chromium

Source	Type II Sum of Square	Df	F value	Significance Level
Period	11230.23	31	37.73	**
Area	82034.47	4	2136.22	**
Period:Area	19128.62	124	16.07	**
Residuals	21965.74	2288		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  - Ma Wan > Mid-Field > Far-Field > Near-Field > Capped-pit, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Copper

Source	Type II Sum of Square	Df	F value	Significance Level
Period	13731.36	31	14.70	**
Area	269424.26	4	2235.73	**
Period:Area	28491.16	124	7.63	**
Residuals	68930.85	2288		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  - Ma Wan > Mid-Field > Far-Field > Near-Field > Capped-pit, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Lead

Source	Type II Sum of Square	Df	F value	Significance Level
Period	34172.49	31	77.65	**
Area	79797.97	4	1405.23	**
Period:Area	21233.75	124	12.06	**
Residuals	32481.81	2288		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  - Ma Wan > Mid-Field > Far-Field > Near-Field > Capped-pit, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Mercury

Source	Type II Sum of Square	Df	F value	Significance Level
Period	417.16	31	30.69	**
Area	50.07	4	28.55	**
Period:Area	240.84	124	4.43	**
Residuals	1003.15	2288		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  - Ma Wan = Capped-pit = Far-Field = Mid-Field = Near-Field, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Nickel

Source	Type II Sum of Square	Df	F value	Significance Level
Period	3422.88	31	24.69	**
Area	30061.52	4	1680.85	**
Period:Area	9653.49	124	17.41	**
Residuals	10230.05	2288		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  - Ma Wan > Mid-Field > Far-Field > Near-Field > Capped-pit, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Silver

Source	Type II Sum of Square	Df	F value	Significance Level
Period	179.72	31	35.61	**
Area	845.81	4	1298.88	**
Period:Area	90.55	124	4.49	**
Residuals	372.48	2288		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  - $\begin{cases} \text{Mid-Field} = \text{Far-Field} = \text{Near-Field} = \text{Capped-pit} \\ \text{Ma Wan} > \text{Mid-Field, Far-Field, Near-Field, Capped-pit} \end{cases}$ ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Zinc

Source	Type II Sum of Square	Df	F value	Significance Level
Period	18.07	31	24.75	**
Area	150.33	4	1596.15	**
Period:Area	49.91	124	17.10	**
Residuals	53.87	2288		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  - Ma Wan > Far-Field > Mid-Field > Near-Field > Capped-pit, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Total Organic Carbon

Source	Type II Sum of Square	Df	F value	Significance Level
Period	2273303268	31	48.31	**
Area	3553555529	4	585.23	**
Period:Area	4522990341	124	24.03	**
Residuals	3473246296	2288		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  - Ma Wan > Mid-Field > Far-Field > Near-Field > Capped-pit, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Sediment Toxicity for ESC CMPs – February 2024

Survival rate for burrowing amphipod *Leptochirus plumulosus*

Source	Type II Sum of Square	Df	F value	Significance Level
Area	0.014	2	12.92	**
Residuals	0.012	22		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- $\begin{cases} \text{Reference} = \text{Ma Wan} \\ \text{Reference, Ma Wan} > \text{Near-Field} \end{cases}$ $\therefore$ potential significant project related impact.

Growth rate for benthic polychaete *Neanthes arenaceodentata*

Source	Type II Sum of Square	Df	F value	Significance Level
Area	5.15×10^{-04}	2	1.21	N.S.
Residuals	4.69×10^{-03}	22		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

Survival rate for marine bivalve *Crassostrea gigas*

Source	Type II Sum of Square	Df	F value	Significance Level
Area	7.18×10^{-05}	2	0.38	N.S.
Residuals	2.10×10^{-03}	22		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

Mortality rate for barnacles *Balanus Amphitrite*

Source	Df	F value	Significance Level
Area	2	0.814	N.S.
Residuals	21		

Note:
1. Assume Beta distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

Mortality rate for shrimp *Penaeus vannaamei*

Source	Df	F value	Significance Level
Area	2	0.484	N.S.
Residuals	21		

Note:
1. Assume Beta distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)