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
– July to September 2021 (Rev. A)

October 2021

Mott MacDonald
3/F International Trade Tower
348 Kwun Tong Road
Kwun Tong
Kowloon
Hong Kong

T +852 2828 5757
mottmac.hk

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

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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

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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 – July to September 2021
Date of Report:	29 October 2021
Date prepared by ET:	29 October 2021
Date received by IA:	29 October 2021

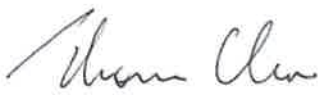
Reference EP Condition

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: 29 October 2021

IA Verification

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

Dr Wang Wen Xiong,
Independent Auditor (IA):  Date: 29 October 2021

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
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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 July to September 2021. 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 – July to September 2021

Results indicated that levels of Salinity, pH and Dissolved Oxygen (DO) complied with the Water Quality Objectives (WQOs) at both Upstream and Downstream stations. Levels of Suspended Solids (SS) mostly complied with the WQO at the Upstream and Downstream stations. Levels of DO, Turbidity and SS 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 – July to September 2021

Results of Routine Water Quality Monitoring conducted in July, August and September 2021 showed that the levels of DO, Turbidity and SS complied with the Action and Limit Levels at most 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 – July to September 2021

Monitoring results showed that the concentrations of inorganic contaminants were generally below the Lower Chemical Exceedance Levels (LCELs) 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 – August 2021

Monitoring results showed that the concentrations of inorganic contaminants were generally below the LCELs at all 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.

Demersal Trawling for ESC CMPs – July and August 2021

During the sampling period in July and August 2021, 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.

行政摘要

在 2021 年 7 月至 9 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 – 2021 年 7 月至 9 月

監察結果顯示上游及下游監測站的鹽度、酸鹼值及溶解氧含量均符合海水水質指標。另外，大部分上游及下游監測站的溶解氧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 – 2021 年 7 月至 9 月

2021 年 7 月至 9 月的例行水質監察結果顯示，大部分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 – 2021 年 7 月至 9 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。

沉積物化學累積性影響監察 – 2021 年 8 月

監察結果顯示，所有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。

沙洲以東污泥坑之底棲漁業資源監察 – 2021 年 7 月和 8 月

監察結果顯示，2021 年 7 月和 8 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 2021 年 7 月及 8 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亦普遍錄得較低的數值。

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.

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 July to September 2021, the following works were undertaken at the CMPs:

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

Table 1.1: Works Schedule for ESC CMP V

Pit	Operation	2021								
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ESC CMP V	Dredging									
	Disposal									
	Capping									

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

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

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

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

Pit	Operation	2026		
		Jan	Feb	Mar
ESC CMP V	Dredging			
	Disposal			
	Capping			

[1] ERM (2013) Final Report. Submitted under Agreement No. CE 4/2009 (EP) Environmental Monitoring and Audit for Contaminated Mud Pit at East Sha Chau. For CEDD.

[2] ERM (2017) Final Report. Submitted under Agreement No. CE 23/2012 (EP) Environmental Monitoring and Audit for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau (2012 – 2017). For CEDD.

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

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 – July to September 2021* is to provide information regarding the findings in the reporting period of July to September 2021 (from 1 July to 30 September 2021) 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] ERM (2017) Updated Environmental Monitoring and Audit (EM&A) Manual. Environmental Monitoring and Audit for Contaminated Mud Pit at Sha Chau (2017-2020) – Investigation. Agreement No. CE 63/2016(EP). Submitted to EPD in July 2017.

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/2017/04 Sediment Disposal Facilities to the East of Sha Chau and East of Tung Lung Chau – Sampling (2018-2022); and
- Contract No. CV/2017/05 Sediment Disposal Facilities to the East of Sha Chau and East of Tung Lung Chau – Testing (2018-2022).

Lam Geotechnics Limited and Wellab Limited (hereinafter known as “Contractors”) were responsible for sampling under Contract No. CV/2017/04 and laboratory analysis under Contract No. CV/2017/05, 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	14 Jul 2021	3 Aug 2021
	13 Aug 2021	6 Sep 2021
	7 Sep 2021	6 Oct 2021
Routine Water Quality Monitoring of ESC CMPs	15 Jul 2021	3 Aug 2021
	5 Aug 2021	6 Sep 2021
	9 Sep 2021	6 Oct 2021
Pit Specific Sediment Chemistry of ESC CMP Vb	13 Jul 2021	3 Aug 2021
	3 Aug 2021	6 Sep 2021
	2 Sep 2021	6 Oct 2021
Cumulative Impact Sediment Chemistry of ESC CMPs	10 & 11 Aug 2021	6 Sep 2021
Sediment Toxicity Test of ESC CMPs	10 & 11 Aug 2021	27 Sep 2021
Demersal Trawling of ESC CMPs	7 & 8 Jul 2021 9 & 10 Aug 2021	6 Sep 2021 7 Oct 2021

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 July to September 2021 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 and Dissolved Oxygen (DO) complied with the Water Quality Objectives (WQOs) at both Upstream and Downstream stations in July, August and September 2021. Levels of Suspended Solids (SS) complied with the WQO at both Upstream and Downstream stations during the reporting period. Levels of DO, Turbidity and SS also complied with the Action and Limit Levels at all stations during the reporting period.

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 July to September 2021 as presented in **Table 3.1**. A total of ten (10) stations were sampled during flood tide in July and September 2021 with locations of the monitoring stations presented in **Figure 2.1**, while a total of sixteen (16) stations were sampled during ebb tide in August 2021 with locations of the monitoring stations presented in **Figure 2.2**. 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, Salinity and pH complied with the WQOs at most stations, except for the Salinity in Ma Wan was higher than WQO in July and August 2021. The higher Salinities recorded at Ma Wan station are likely to be caused by the larger separation distance to Pearl River Delta, which releases a large amount of freshwater discharge in the area during wet season. The levels of DO, Turbidity and SS complied with the Action and Limit Levels at all stations during the reporting period, but it is noted that some SS levels which were above the wet season WQO but in compliance with the Action and Limit Levels.

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. For most parameters, only low concentrations were measured from February 2012 to September 2021 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. 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 Intermediate and Impact stations, 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, but no potential project related spatial trend was detected for the reporting months in this quarter. During flood tide, there was no consistent spatial trend of increasing concentrations of turbidity with proximity to the pit, where the turbidity levels were generally the highest at Reference stations.

4.2.4 Metals and Metalloid

The majority of dissolved metals had high percentage of their values below the limit of reporting (i.e. > 60% of values were below the limit of reporting during February 2012 to September 2021). Copper, Nickel and Zinc were the exceptions, and all varied significantly over sampling periods and area as indicated by results of the ANOVA tests (**Appendix C**), but without any consistent project related spatial trends for both ebb and flood tide. The concentrations of Copper and Nickel were the highest at Reference and Impact stations. The concentrations of Zinc were generally the highest at Ma Wan and at Reference 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 lower 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 were generally the highest at Reference, Impact and Intermediate stations, 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 Ma Wan and Reference 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 for consecutive reporting months, 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 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 July to September 2021 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 2.3**. The monitoring results showed that the concentrations of most inorganic contaminants were below the Lower Chemical Exceedance Levels (LCELs) at most stations from July to September 2021, except the concentrations of Arsenic which were higher than LCEL at Pit-Edge stations ESC-NECA (in July 2021).

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). The relationship between contaminant levels and proximity to the pit (i.e. Area) was not significant for Arsenic, Cadmium, Copper, Lead, Mercury, Silver and Zinc. Subsequent linear regression analysis was conducted for Chromium (flood tide direction) and Nickel (flood tide direction). The overall contaminant concentrations had returned to a lower level in August compared to July 2021, and the potential project related spatial trend was not detected in September 2021, such that there was no consistent or increasing project related impact over time. Therefore, there was no unacceptable project-related impact to the sediment quality.

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, but the overall project related spatial trend was not significant. In detailed analysis, potential project related spatial trend were detected for two reporting months in July and September 2021 for flood tide direction, but such trend was not detected in August 2021. Therefore, there is no evidence indicating unacceptable 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 August 2021 as presented in **Table 3.1**. A total of nine (9) monitoring stations were sampled and the monitoring locations are shown in **Figure 2.4**. The monitoring results showed that the concentrations of all inorganic contaminants were generally below the LCELs at all monitoring stations in August 2021.

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 and Mid-field stations. 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 Test – August 2021

Sediment Toxicity Tests were undertaken for sediments collected from the Impact (Near Pit), Reference and Ma Wan stations (see **Figure 2.5** for the sampling locations) in August 2021 using three international species (burrowing amphipod *Leptocheirus plumulosus*, marine benthic polychaete *Neanthes arenaceodentata* and marine bivalve *Crassostrea gigas*) and two local species (barnacles *Balanus amphitrite* and shrimp *Penaeus vannaamei*).

Appropriate statistical test, i.e. ANOVA, was applied for comparing and determining the level of significance in the results in August 2021 between Impact and Reference Stations. When significant difference was detected then multiple comparison procedures would be used (e.g. Turkey's Test) to isolate where the differences is occurring.

Results of the Sediment Toxicity Tests in August 2021 showed that there were no significant differences between Impact and Reference stations in the toxicity tests for the survival rate for marine bivalve. In detailed analysis, the potential project related spatial trend was not detected in the growth rate for benthic polychaete and mortality rate for barnacles. Although the potential project related impacts were detected for survival rate for burrowing amphipod and mortality rate for shrimp in August 2021, such trend was not detected during last reporting quarter, thus was not considered as consistent or increasing project related impact over time. In addition, the analysis results of the cumulative sediment chemistry indicates that there are no unacceptable project related impacts to sediment quality. Therefore, 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 – July and August 2021

Fishery resources monitoring by demersal trawling was carried out at two (2) impact and four (4) reference stations (see **Figure 2.6** for locations) in July and August 2021. Monitoring results are presented in the following sections.

Abundance and Biomass

The average number of species collected in the period of July and August 2021 is presented in **Table 4.1**. Mean number of faunal species caught at Impact stations was generally lower than at Reference stations in July and August 2021.

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 July and August 2021 (**Table 4.2**). 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 July and August 2021

Mean Number of Faunal Species	Impact Stations		Reference Stations			
	ESC-INA	ESC-INB	TNA	TNB	TSA	TSB
Jul 2021	24.8	25.4	42	37.6	44.4	41.2
Aug 2021	25.4	24.4	27.8	35	47	47.8

Table 4.2: Summary of CPUE and YPUE during Monitoring in July and August 2021

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)
Jul 2021	ESC-INA	Impact	1499	17277.5	299.8	3455.50
Jul 2021	ESC-INB	Impact	1748	21325.2	349.6	4265.04
Jul 2021	TNA	Reference	3722	44417.4	744.4	8883.48
Jul 2021	TNB	Reference	3010	56818.9	602.0	11363.78
Jul 2021	TSA	Reference	4231	94290.6	846.2	18858.12
Jul 2021	TSB	Reference	3102	60732.7	620.4	12146.54
Aug 2021	ESC-INA	Impact	704	12724.1	106.8	2544.82
Aug 2021	ESC-INB	Impact	1674	20824.2	256.8	4164.84
Aug 2021	TNA	Reference	3468	57412.2	693.6	11482.44
Aug 2021	TNB	Reference	3156	52385.8	631.2	10477.16
Aug 2021	TSA	Reference	3291	72422.7	658.2	14484.54
Aug 2021	TSB	Reference	3053	49528.0	610.6	9905.60

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 Demersal Trawling on 7 July 2021. A total of 3 stations (ESC-INA, TSA and TSB) were sampled on this day. 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

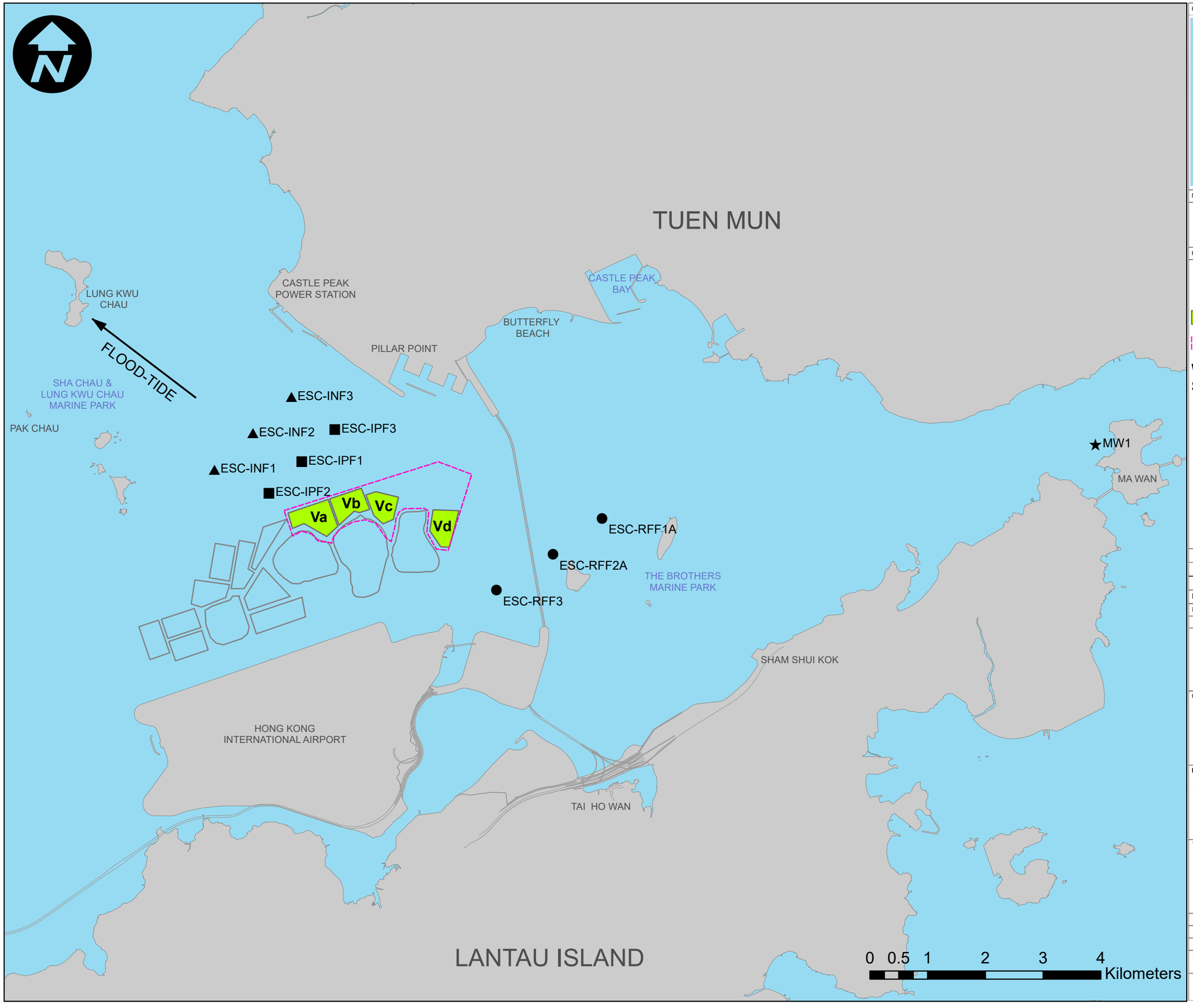
6.1 Activities Scheduled for the Next Reporting Period

The following monitoring activities will be conducted in the next quarterly reporting period of October to December 2021 for ESC CMPs including:

- Water Column Profiling of ESC CMP Vb in October, November and December 2021;
- Routine Water Quality Monitoring of ESC CMPs in October, November and December 2021;
- Pit Specific Sediment Chemistry of ESC CMP Vb in October, November and December 2021; and
- Cumulative Impact Sediment Chemistry of ESC CMPs in December 2021.

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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MOTT MACDONALD

3/F International Trade Tower
348 Kwun Tong Road
Kwun Tong, Kowloon
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T +852 2828 5757
F +852 2821823
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Project

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ENVIRONMENTAL MONITORING AND AUDIT FOR DISPOSAL FACILITY TO THE EAST OF SHA CHAU (2021-2026) – INVESTIGATION

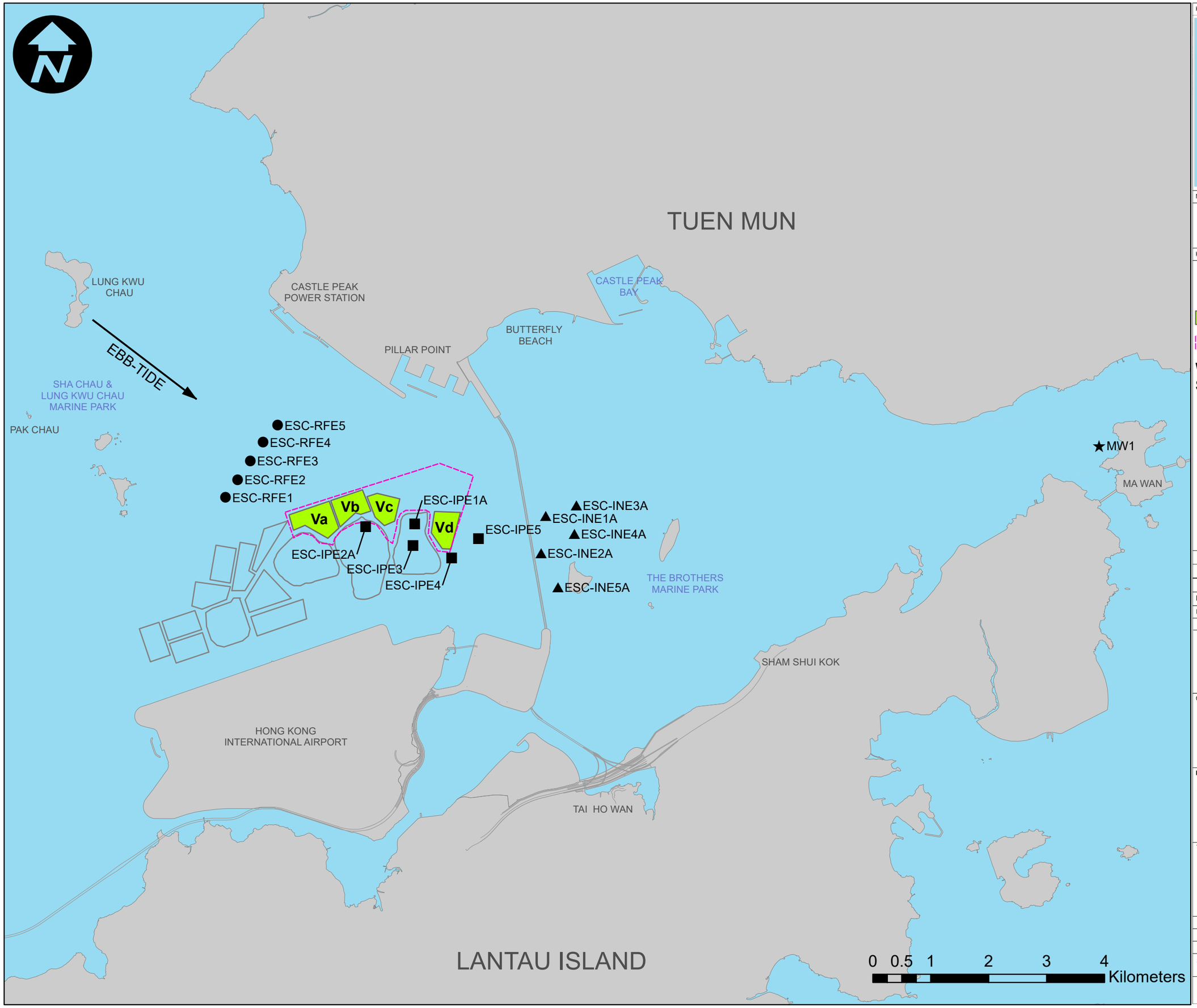
Title

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

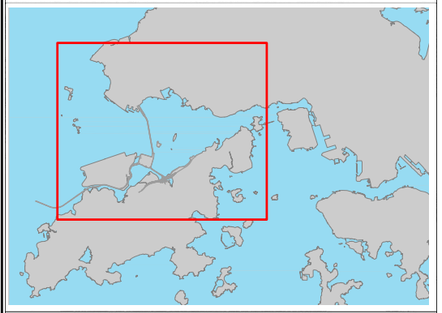
Designed			Eng check		
Drawn			Coordination		
Dwg check			Approved		
Scale at A3		Status		Rev	

Drawing Number

FIGURE 2.1



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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3/F International Trade Tower
348 Kwun Tong Road
Kwun Tong, Kowloon
Hong Kong
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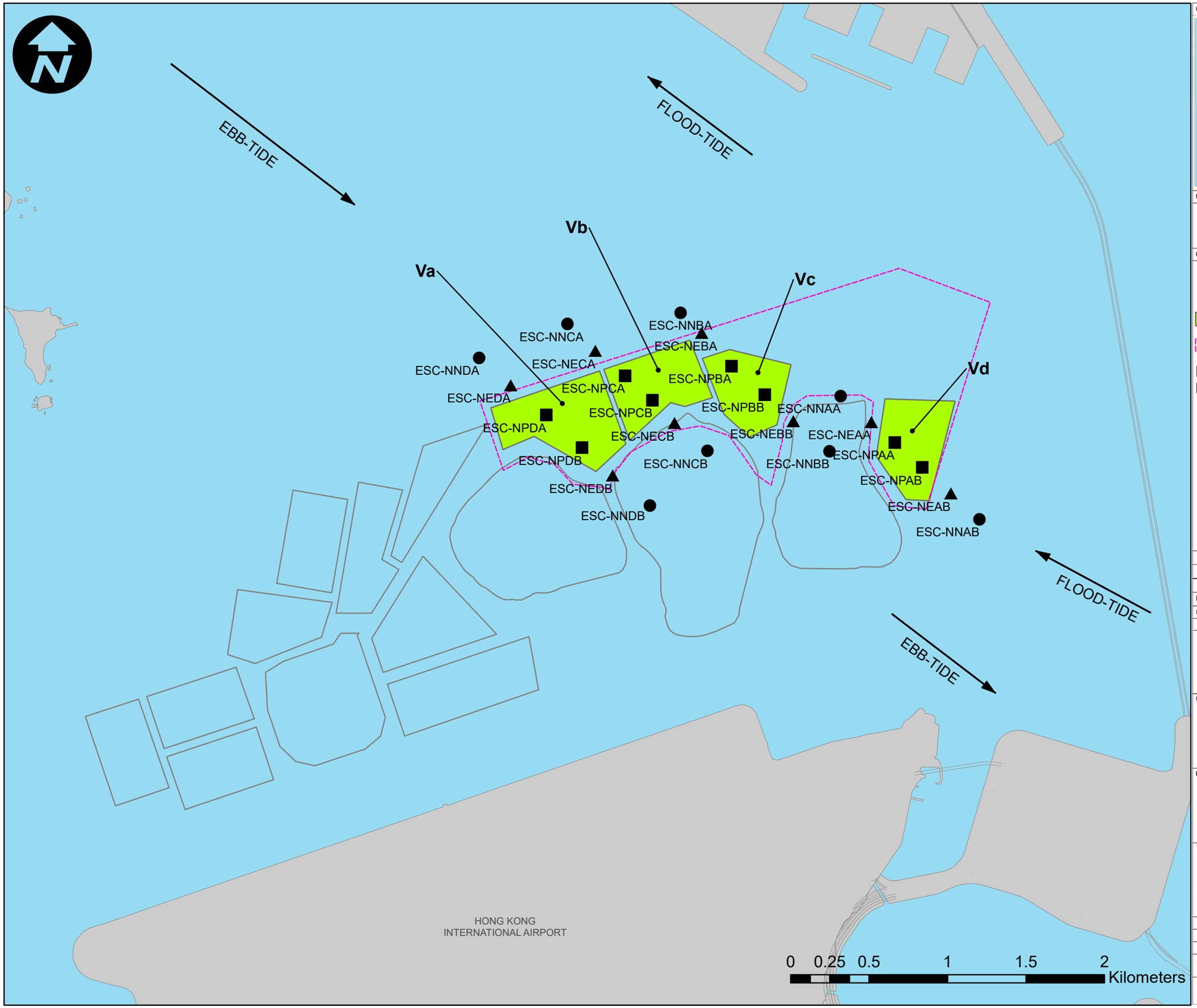
Title

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

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

Drawing Number

FIGURE 2.2



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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348 Kwun Tong Road
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ENVIRONMENTAL MONITORING AND AUDIT
FOR DISPOSAL FACILITY
TO THE EAST OF SHA CHAU (2021-2026)
– INVESTIGATION**

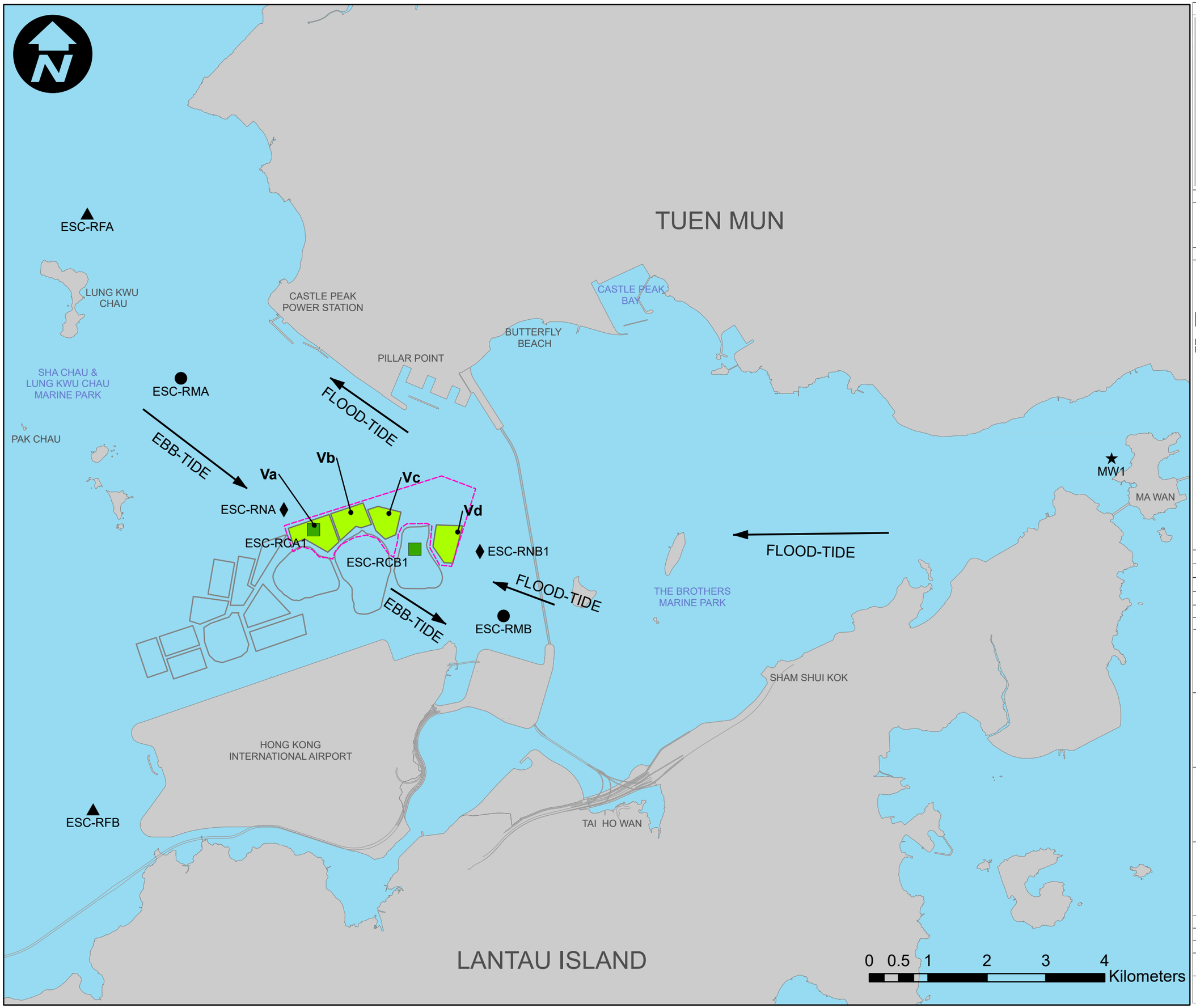
Title

**PIT SPECIFIC SEDIMENT QUALITY
MONITORING STATIONS FOR CMP V**

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

Drawing Number

FIGURE 2.3



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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348 Kwun Tong Road
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Hong Kong
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F +852 2821823
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Title

CUMULATIVE IMPACTS SEDIMENT QUALITY MONITORING STATIONS FOR ESC CMPS

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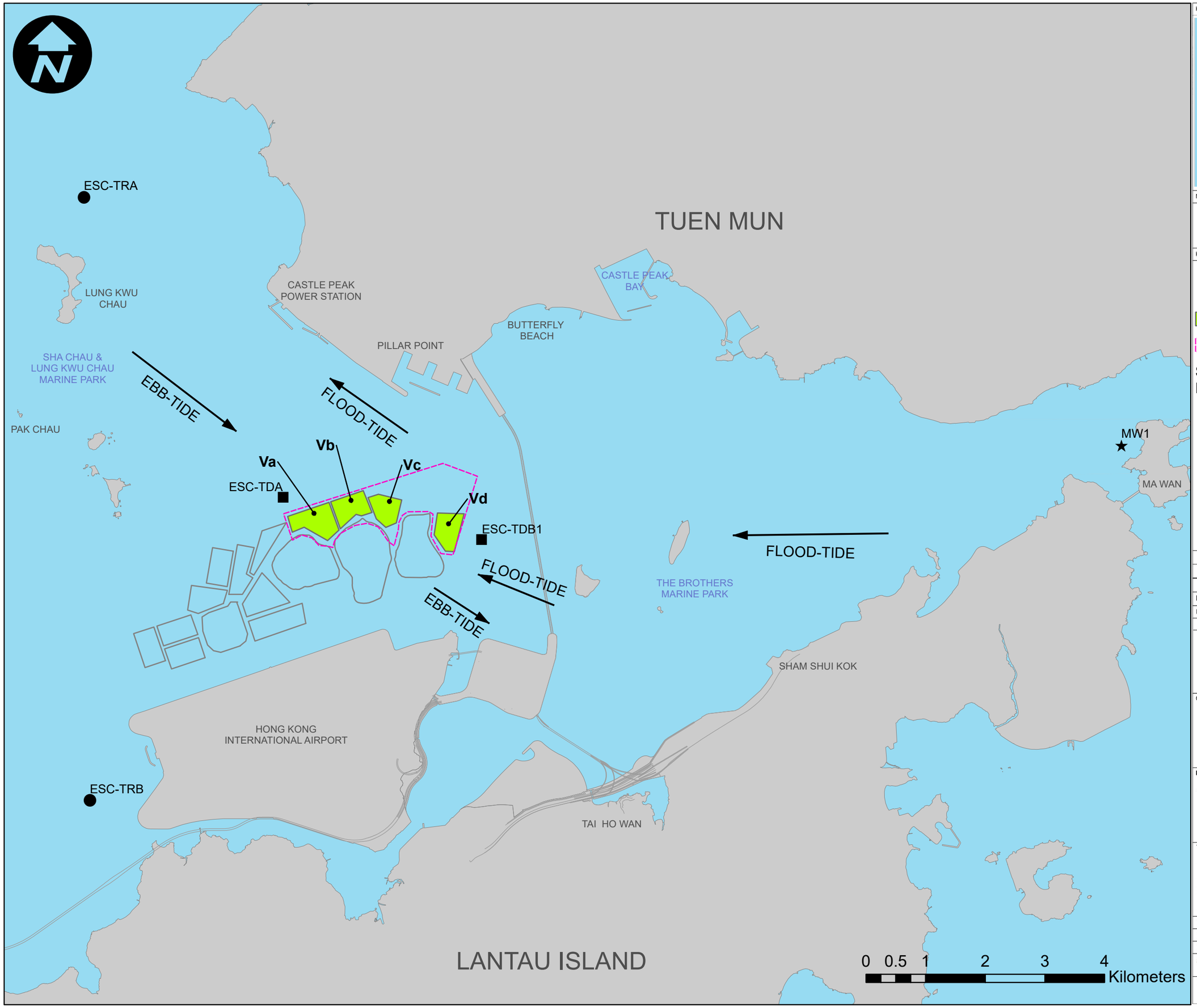
Drawn			Coordination		
Dwg check			Approved		
Scale at A3		Status		Rev	

Drawing Number

FIGURE 2.4



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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348 Kwun Tong Road
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F +852 2821823
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Title

SEDIMENT TOXICITY MONITORING STATIONS FOR ESC CMPS

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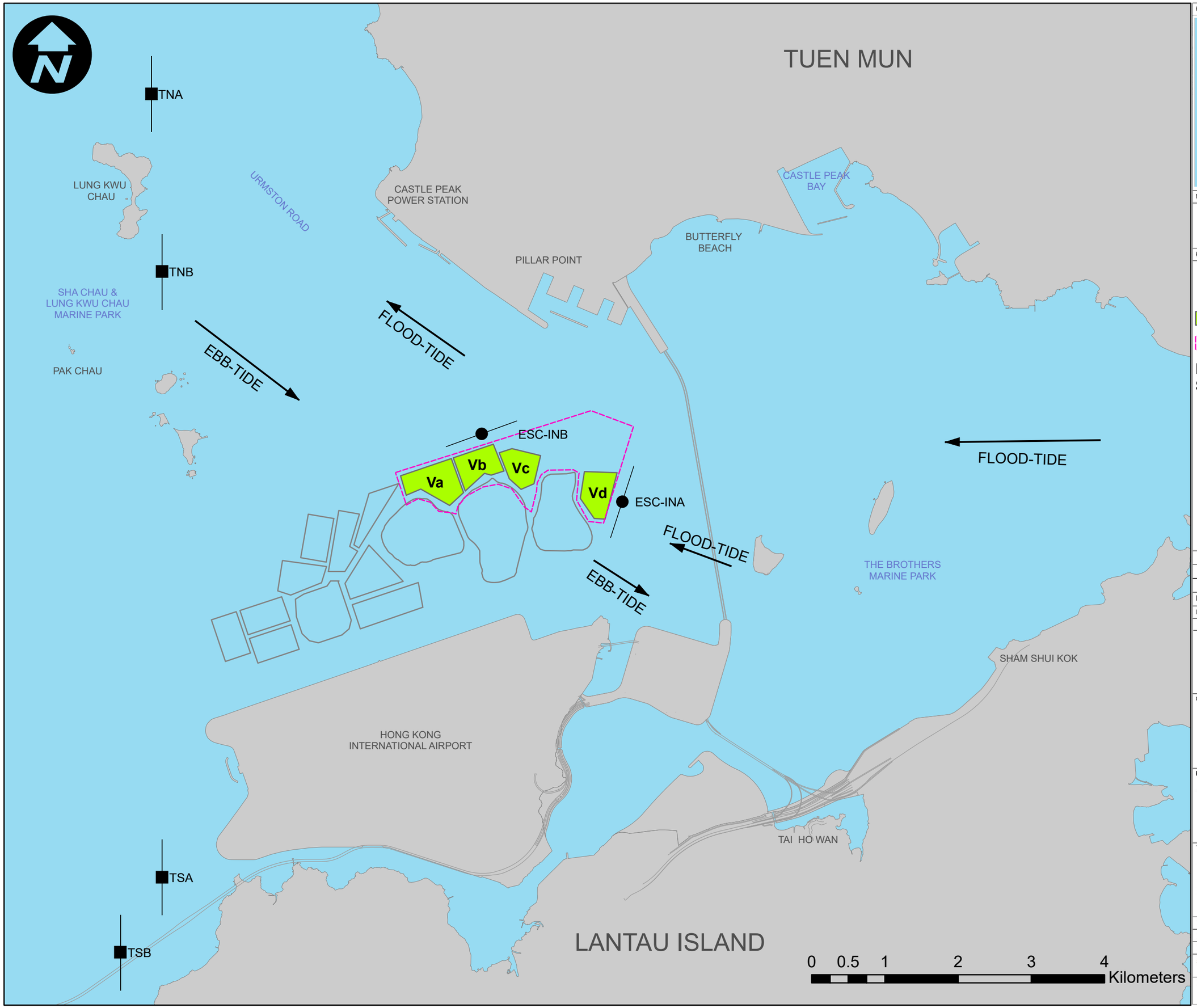
Drawn			Coordination		
Dwg check			Approved		
Scale at A3		Status		Rev	

Drawing Number

FIGURE 2.5



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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ENVIRONMENTAL MONITORING AND AUDIT FOR DISPOSAL FACILITY TO THE EAST OF SHA CHAU (2021-2026) – INVESTIGATION

Title

MARINE BIOTA MONITORING STATIONS FOR ESC CMPS

Designed			Eng check		
Drawn			Coordination		
Dwg check			Approved		

Scale at A3 | Status | Rev

Drawing Number

FIGURE 2.6

Appendices

A. Sampling Schedule
B. Disposal and Capping Records
C. Statistical Analysis

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	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	ESC-NPAB	Monthly	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Pit-Edge																																																																		
	ESC-NEAA	Monthly	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	ESC-NEAB	Monthly	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Near-Pit																																																																		
	ESC-NNAA	Monthly	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	ESC-NNAB	Monthly	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

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		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
	ESC-RNB1	4 times per year		**6**				**6**		**6**				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
Mid-field Stations																																																																		
	ESC-RMA	4 times per year		**6**				**6**		**6**				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
	ESC-RMB	4 times per year		**6**				**6**		**6**				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
Capped Pit Stations																																																																		
	ESC-RCA1	4 times per year		**6**				**6**		**6**				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
	ESC-RCA2	4 times per year		**6**				**6**		**6**				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
Far-field Stations																																																																		
	ESC-RFA	4 times per year		**6**				**6**		**6**				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
	ESC-RFB	4 times per year		**6**				**6**		**6**				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
Ma Wan Station																																																																		
	MW1	4 times per year		**6**				**6**		**6**				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	

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	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-IPE2A	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-IPE3	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-IPE4	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-IPE5	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Intermediate Station Downcurrent																																																																		
	ESC-INE1A	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-INE2A	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-INE3A	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-INE4A	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-INE5A	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Reference Station Upcurrent																																																																		
	ESC-RFE1	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-RFE2	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-RFE3	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-RFE4	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-RFE5	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Ma Wan Station																																																																		
	MW1	Monthly*				**4**	**4**	**4**		**4**		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Flood Tide																																																																		
Impact Station Downcurrent																																																																		
	ESC-IPF1	Monthly*	**4**	**4**	**4**				**4**		**4**	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-IPF2	Monthly*	**4**	**4**	**4**				**4**		**4**	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-IPF3	Monthly*	**4**	**4**	**4**				**4**		**4**	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Intermediate Station Downcurrent																																																																		
	ESC-INF1	Monthly*	**4**	**4**	**4**				**4**		**4**	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-INF2	Monthly*	**4**	**4**	**4**				**4**		**4**	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-INF3	Monthly*	**4**	**4**	**4**				**4**		**4**	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Reference Station Upcurrent																																																																		
	ESC-RFF1A	Monthly*	**4**	**4**	**4**				**4**		**4**	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-RFF2A	Monthly*	**4**	**4**	**4**				**4**		**4**	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-RFF3	Monthly*	**4**	**4**	**4**				**4**		**4**	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Ma Wan Station																																																																		
	MW1	Monthly*	**4**	**4**	**4**				**4**		**4**	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

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																																																															
	US2	3 times per week																																																															
Downstream Stations																																																																		
	DS1	3 times per week																																																															
	DS2	3 times per week																																																															
	DS3	3 times per week																																																															
	DS4	3 times per week																																																															
	DS5	3 times per week																																																															
Ma Wan Station																																																																		
	MW1	3 times per week																																																															

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 be conducted monthly starting in December 2020. The number of sampling replicates can be further reduced according to Sections 3 and 4, subject to the findings of the further data review.

B. Disposal and Capping Records

B1. Disposal Record at ESC CMP Vb

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
1 Jul 2021	0	529,263
2 Jul 2021	0	529,263
3 Jul 2021	200	529,463
4 Jul 2021	0	529,463
5 Jul 2021	0	529,463
6 Jul 2021	0	529,463
7 Jul 2021	0	529,463
8 Jul 2021	800	530,263
9 Jul 2021	0	530,263
10 Jul 2021	0	530,263
11 Jul 2021	0	530,263
12 Jul 2021	666	530,929
13 Jul 2021	1,911	532,840
14 Jul 2021	0	532,840
15 Jul 2021	0	532,840
16 Jul 2021	1,200	534,040
17 Jul 2021	500	534,540
18 Jul 2021	0	534,540
19 Jul 2021	1,000	535,540
20 Jul 2021	0	535,540
21 Jul 2021	1,236	536,776
22 Jul 2021	400	537,176
23 Jul 2021	931	538,107
24 Jul 2021	0	538,107
25 Jul 2021	0	538,107
26 Jul 2021	500	538,607
27 Jul 2021	0	538,607
28 Jul 2021	400	539,007
29 Jul 2021	900	539,907
30 Jul 2021	894	540,801
31 Jul 2021	994	541,795
1 Aug 2021	500	542,295
2 Aug 2021	499	542,794
3 Aug 2021	0	542,794
4 Aug 2021	936	543,730
5 Aug 2021	442	544,172
6 Aug 2021	0	544,172
7 Aug 2021	1,832	546,004
8 Aug 2021	0	546,004
9 Aug 2021	900	546,904
10 Aug 2021	300	547,204
11 Aug 2021	0	547,204
12 Aug 2021	600	547,804
13 Aug 2021	0	547,804
14 Aug 2021	0	547,804
15 Aug 2021	400	548,204
16 Aug 2021	400	548,604
17 Aug 2021	700	549,304
18 Aug 2021	0	549,304

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
19 Aug 2021	0	549,304
20 Aug 2021	400	549,704
21 Aug 2021	0	549,704
22 Aug 2021	0	549,704
23 Aug 2021	0	549,704
24 Aug 2021	0	549,704
25 Aug 2021	0	549,704
26 Aug 2021	0	549,704
27 Aug 2021	0	549,704
28 Aug 2021	0	549,704
29 Aug 2021	0	549,704
30 Aug 2021	556	550,260
31 Aug 2021	0	550,260
1 Sep 2021	314	550,574
2 Sep 2021	364	550,938
3 Sep 2021	862	551,800
4 Sep 2021	364	552,164
5 Sep 2021	358	552,522
6 Sep 2021	364	552,886
7 Sep 2021	358	553,244
8 Sep 2021	364	553,608
9 Sep 2021	735	554,343
10 Sep 2021	724	555,067
11 Sep 2021	1,448	556,515
12 Sep 2021	345	556,860
13 Sep 2021	741	557,601
14 Sep 2021	736	558,337
15 Sep 2021	704	559,041
16 Sep 2021	770	559,811
17 Sep 2021	2,308	562,119
18 Sep 2021	1,932	564,051
19 Sep 2021	371	564,422
20 Sep 2021	362	564,784
21 Sep 2021	729	565,513
22 Sep 2021	0	565,513
23 Sep 2021	371	565,884
24 Sep 2021	1,506	567,390
25 Sep 2021	2,257	569,647
26 Sep 2021	400	570,047
27 Sep 2021	748	570,795
28 Sep 2021	403	571,198
29 Sep 2021	384	571,582
30 Sep 2021	761	572,343

B2. Capping Record at ESC CMP Vd

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
1 Jul 2021	0	217,480
2 Jul 2021	0	217,480
3 Jul 2021	0	217,480
4 Jul 2021	0	217,480
5 Jul 2021	0	217,480
6 Jul 2021	0	217,480
7 Jul 2021	0	217,480
8 Jul 2021	0	217,480
9 Jul 2021	0	217,480
10 Jul 2021	0	217,480
11 Jul 2021	0	217,480
12 Jul 2021	0	217,480
13 Jul 2021	0	217,480
14 Jul 2021	0	217,480
15 Jul 2021	0	217,480
16 Jul 2021	0	217,480
17 Jul 2021	0	217,480
18 Jul 2021	0	217,480
19 Jul 2021	0	217,480
20 Jul 2021	0	217,480
21 Jul 2021	0	217,480
22 Jul 2021	0	217,480
23 Jul 2021	0	217,480
24 Jul 2021	0	217,480
25 Jul 2021	0	217,480
26 Jul 2021	0	217,480
27 Jul 2021	0	217,480
28 Jul 2021	0	217,480
29 Jul 2021	0	217,480
30 Jul 2021	0	217,480
31 Jul 2021	0	217,480
1 Aug 2021	0	217,480
2 Aug 2021	0	217,480
3 Aug 2021	0	217,480
4 Aug 2021	0	217,480
5 Aug 2021	0	217,480
6 Aug 2021	0	217,480
7 Aug 2021	0	217,480
8 Aug 2021	0	217,480
9 Aug 2021	0	217,480
10 Aug 2021	0	217,480
11 Aug 2021	0	217,480
12 Aug 2021	0	217,480
13 Aug 2021	0	217,480
14 Aug 2021	0	217,480
15 Aug 2021	0	217,480
16 Aug 2021	0	217,480
17 Aug 2021	0	217,480
18 Aug 2021	0	217,480

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
19 Aug 2021	0	217,480
20 Aug 2021	0	217,480
21 Aug 2021	0	217,480
22 Aug 2021	0	217,480
23 Aug 2021	0	217,480
24 Aug 2021	0	217,480
25 Aug 2021	0	217,480
26 Aug 2021	0	217,480
27 Aug 2021	0	217,480
28 Aug 2021	0	217,480
29 Aug 2021	0	217,480
30 Aug 2021	0	217,480
31 Aug 2021	0	217,480
1 Sep 2021	0	217,480
2 Sep 2021	0	217,480
3 Sep 2021	0	217,480
4 Sep 2021	0	217,480
5 Sep 2021	0	217,480
6 Sep 2021	0	217,480
7 Sep 2021	0	217,480
8 Sep 2021	0	217,480
9 Sep 2021	0	217,480
10 Sep 2021	0	217,480
11 Sep 2021	0	217,480
12 Sep 2021	0	217,480
13 Sep 2021	0	217,480
14 Sep 2021	0	217,480
15 Sep 2021	0	217,480
16 Sep 2021	0	217,480
17 Sep 2021	0	217,480
18 Sep 2021	0	217,480
19 Sep 2021	0	217,480
20 Sep 2021	0	217,480
21 Sep 2021	0	217,480
22 Sep 2021	0	217,480
23 Sep 2021	0	217,480
24 Sep 2021	0	217,480
25 Sep 2021	0	217,480
26 Sep 2021	0	217,480
27 Sep 2021	0	217,480
28 Sep 2021	0	217,480
29 Sep 2021	0	217,480
30 Sep 2021	0	217,480

C. Statistical Analysis

Routine Water Quality Monitoring for ESC CMPs – Statistical Analysis up to Sep 2021

Dissolved Oxygen

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	2214.10	28	278.03	**
Area	26.73	3	31.32	**
Period:Area	195.64	84	8.19	**
Residuals	905.00	3182		

Note:
1. Assume Gaussian 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	3935.15	31	1140.41	**
Area	45.38	3	135.89	**
Period:Area	48.86	93	4.72	**
Residuals	243.33	2186		

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

SNK Results:
- Overall result:
  $\left.\begin{array}{c}\text{Reference} = \text{Intermediate} \\ \text{Intermediate} = \text{Impact} \\ \text{Reference, Intermediate, Impact} > \text{Ma Wan}\end{array}\right\}$ ∴ 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	1111.66	28	243.89	**
Area	62.79	3	128.58	**
Period:Area	189.14	84	13.83	**
Residuals	517.99	3182		

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

SNK Results:
- Overall result:
  Impact > Intermediate > Reference > 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
- 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	55066.82	31	84.32	**
Area	3570.82	3	56.50	**
Period:Area	8997.50	93	4.59	**
Residuals	46050.06	2186		

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

SNK Results:
- Overall result:
  Reference > Impact > 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 over the study period.

Copper

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	2861.99	28	116.42	**
Area	37.59	3	14.27	**
Period:Area	463.09	84	6.28	**
Residuals	2932.38	3340		

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

SNK Results:
- Overall result:
  Reference > Impact > Intermediate > Ma Wan } ∴ no overall significant project related impact.
- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Aug 2020
- 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	2046.82	31	190.30	**
Area	21.17	3	20.34	**
Period:Area	349.41	93	10.83	**
Residuals	788.30	2272		

Note:
1. Assume Gamma 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.
- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Feb 2012
- No potential project related spatial trend detected for the reporting months.

Nickel

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	974.67	28	151.45	**
Area	21.21	3	30.76	**
Period:Area	155.71	84	8.07	**
Residuals	767.67	3340		

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

SNK Results:
- Overall result:

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

- 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	793.58	31	178.59	**
Area	3.70	3	8.61	**
Period:Area	146.79	93	11.01	**
Residuals	325.68	2272		

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

SNK Results:
- Overall result:

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

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

Zinc

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	1574.48	28	166.31	**
Area	40.77	3	40.19	**
Period:Area	231.09	84	8.14	**
Residuals	1129.30	3340		

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.
- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Apr 2013, Jul 2016
- 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	1257.20	31	144.12	**
Area	40.80	3	48.33	**
Period:Area	165.17	93	6.31	**
Residuals	639.31	2272		

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.
- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Apr 2016, Jan 2019
- No potential project related spatial trend were detected for the reporting months.

Ammonia Nitrogen

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	889.82	28	385.97	**
Area	17.97	3	72.74	**
Period:Area	82.84	84	11.98	**
Residuals	275.00	3340		

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

SNK Results:
- Overall result:
  Ma Wa = 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	771.27	31	126.68	**
Area	5.76	3	9.78	**
Period:Area	59.36	93	3.25	**
Residuals	446.21	2272		

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	375.01	27	445.38	**
Area	24.86	3	265.77	**
Period:Area	31.56	81	12.49	**
Residuals	100.29	3216		

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	590.84	31	348.01	**
Area	12.08	3	73.51	**
Period:Area	39.15	93	7.69	**
Residuals	124.43	2272		

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

SNK Results:
- Overall result:

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

- 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	416.89	28	102.64	**
Area	16.45	3	37.80	**
Period:Area	184.51	84	15.14	**
Residuals	484.48	3340		

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	558.82	31	177.28	**
Area	21.08	3	69.10	**
Period:Area	142.99	93	15.12	**
Residuals	231.02	2272		

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

SNK Results:
- Overall result:

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

- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Jan 2017
- No potential project related spatial trend were detected for the reporting months.

Suspended Solids

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	739.66	28	280.96	**
Area	40.01	3	141.84	**
Period:Area	123.56	84	15.64	**
Residuals	314.03	3340		

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

SNK Results:
- Overall result:
  Impact > Intermediate > Reference > 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, May 2021
- 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	539.65	31	173.00	**
Area	14.48	3	47.98	**
Period:Area	114.14	93	12.20	**
Residuals	228.62	2272		

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

SNK Results:
- Overall result:
  Reference > Impact > Intermediate > Ma Wan } ∴ 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
- Potential project related spatial trend was detected in one month during the reporting period.

Pit Specific Sediment Chemistry for ESC CMPs – Statistical Analysis up to September 2021

Arsenic

Source	Type II Sum of Square	Df	F value	Significance Level
Period	20.92	19	59.974	**
Area	9.35	2	254.630	**
Direction	2.67	1	145.623	**
Period:Area	12.09	38	17.328	**
Period:Direction	1.74	19	4.998	**
Area:Direction	6.78	2	184.748	**
Period:Area:Direction	12.91	38	18.513	**
Residuals	17.62	960		

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, August 2021
  - Ebb Tide: Sep 2020, Nov 2020, July 2021
- Project related spatial trend was detected in one month during the reporting period for both flood and ebb tide directions.

Cadmium

Source	Type II Sum of Square	Df	F value	Significance Level
Period	44.41	19	20.950	**
Area	76.05	2	340.822	**
Direction	0.14	1	1.274	N.S.
Period:Area	30.98	38	7.307	**
Period:Direction	17.02	19	8.030	**
Area:Direction	27.69	2	124.094	**
Period:Area:Direction	23.14	38	5.458	**
Residuals	107.10	960		

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

SNK Results:
- Overall result:

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

- 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.

Chromium

Source	Type II Sum of Square	Df	F value	Significance Level
Period	6.34	19	19.456	**
Area	13.56	2	395.129	**
Direction	3.09	1	180.198	**
Period:Area	5.19	38	7.962	**
Period:Direction	1.99	19	6.105	**
Area:Direction	12.19	2	355.264	**
Period:Area:Direction	3.42	38	5.249	**
Residuals	16.47	960		

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: Feb 2020, Mar 2020, Oct 2020, Nov 2020, Dec 2020, Apr 2021, May 2021, Jun 2021, July 2021, Aug 2021[3]
  - Ebb Tide: Apr 2020, Oct 2020, Nov 2020, May 2021
- Potential project related spatial trend were detected for consecutive two months over the reporting period for flood tide direction.

Regression Analysis Results:

Period	R Square	Adjusted R Square	Y-intercept	Slope	Significance Level
Apr-21	0.72	0.71	30.38	-1.50	**
May-21	0.82	0.81	30.55	-1.28	**
Jun-21	0.56	0.53	24.41	-0.76	**
Jul-21	0.65	0.63	29.68	-1.12	**
Aug-21	0.63	0.61	26.17	-0.91	**

Note: Linear regression analysis on spatial changes of contaminant concentrations in flood tide direction for the two concerned reporting months.

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

Copper

Source	Type II Sum of Square	Df	F value	Significance Level
Period	19.32	19	26.965	**
Area	139.02	2	1843.194	**
Direction	10.84	1	287.533	**
Period:Area	14.72	38	10.271	**
Period:Direction	9.85	19	13.749	**
Area:Direction	45.38	2	601.633	**
Period:Area:Direction	20.56	38	14.347	**
Residuals	36.20	960		

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: Jul 2020, Oct 2020, May 2021
  - Ebb Tide: Jul 2020, Oct 2020, Sep 2021
- Project related spatial trend was detected in one month during the reporting period for ebb tide direction.

Lead

Source	Type II Sum of Square	Df	F value	Significance Level
Period	11.50	19	15.489	**
Area	21.40	2	273.868	**
Direction	3.95	1	101.114	**
Period:Area	10.04	38	6.764	**
Period:Direction	2.74	19	3.687	**
Area:Direction	5.06	2	64.761	**
Period:Area:Direction	3.63	38	2.446	**
Residuals	37.51	960		

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
  - Ebb Tide: May 2020, Jul 2020, Mar 2021, May 2021, Jun 2021, Sep 2021
- Potential project related spatial trend was detected in one month during the reporting period for both flood and ebb tide directions.

Mercury

Source	Type II Sum of Square	Df	F value	Significance Level
Period	112.97	19	21.318	**
Area	98.13	2	175.913	**
Direction	53.99	1	193.569	**
Period:Area	58.57	38	5.526	**
Period:Direction	33.59	19	6.338	**
Area:Direction	71.44	2	128.069	**
Period:Area:Direction	25.93	38	2.447	**
Residuals	267.75	960		

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

SNK Results:
- Overall result:

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

- 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	9.11	19	45.181	**
Area	14.03	2	661.152	**
Direction	7.62	1	717.680	**
Period:Area	5.90	38	14.621	**
Period:Direction	3.67	19	18.186	**
Area:Direction	15.35	2	723.408	**
Period:Area:Direction	4.08	38	10.108	**
Residuals	10.19	960		

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

SNK Results:

- Overall result:

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

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

Regression Analysis Results:

Period	R Square	Adjusted R Square	Y-intercept	Slope	Significance Level
Apr-21	0.62	0.60	18.44	-0.84	**
May-21	0.75	0.73	18.70	-0.72	**
Jun-21	0.46	0.42	15.44	-0.40	**
Jul-21	0.61	0.59	18.75	-0.69	**
Aug-21	0.67	0.65	17.71	-0.64	**

Note: Linear regression analysis on spatial changes of contaminant concentrations in flood tide direction for the two concerning reporting months.

Silver

Source	Type II Sum of Square	Df	F value	Significance Level
Period	42.71	19	22.936	**
Area	245.76	2	1253.851	**
Direction	2.03	1	20.722	**
Period:Area	40.52	38	10.881	**
Period:Direction	21.48	19	11.537	**
Area:Direction	40.36	2	205.907	**
Period:Area:Direction	26.82	38	7.202	**
Residuals	94.08	960		

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	8.45	19	34.413	**
Area	35.43	2	1370.983	**
Direction	1.64	1	126.763	**
Period:Area	9.28	38	18.894	**
Period:Direction	3.44	19	13.992	**
Area:Direction	8.18	2	316.452	**
Period:Area:Direction	2.53	38	5.160	**
Residuals	12.40	960		

Note:

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

SNK Results:

- Overall result:

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

- 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
  - Ebb Tide: Apr 2020, Jun 2020, Jul 2020, Oct 2020, Mar 2021, May 2021, Jun 2021, Sep 2021
- Potential project related spatial trend was detected in one month during the reporting period for both ebb tide direction.

Total Organic Carbon

Source	Type II Sum of Square	Df	F value	Significance Level
Period	59.73	19	155.008	**
Area	43.17	2	1064.318	**
Direction	7.41	1	365.457	**
Period:Area	17.05	38	22.127	**
Period:Direction	7.23	19	18.776	**
Area:Direction	10.46	2	258.000	**
Period:Area:Direction	15.54	38	20.170	**
Residuals	19.47	960		

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
  - Ebb Tide: Jul 2020, Oct 2020, May 2021, Jun 2021
- Potential project related spatial trend was detected in two months during the reporting period in flood tide direction.

Cumulative Sediment Chemistry for ESC CMPs – Statistical Analysis up to August 2021

Arsenic

Source	Type II Sum of Square	Df	F value	Significance Level
Period	65.62	21	159.96	**
Area	87.23	4	1116.26	**
Period:Area	63.09	84	38.44	**
Residuals	40.05	2050		

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	51.12	21	20.54	**
Area	53.59	4	113.03	**
Period:Area	44.39	84	4.46	**
Residuals	242.97	2050		

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	4955.08	21	26.27	**
Area	66302.76	4	1845.64	**
Period:Area	16051.40	84	21.28	**
Residuals	18411.05	2050		

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	11548.36	21	18.27	**
Area	242931.86	4	2017.47	**
Period:Area	25258.27	84	9.99	**
Residuals	61712.22	2050		

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	29446.77	21	102.23	**
Area	66991.67	4	1220.96	**
Period:Area	18746.11	84	16.27	**
Residuals	28119.82	2050		

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	395.48	21	39.57	**
Area	64.64	4	33.96	**
Period:Area	187.24	84	4.68	**
Residuals	975.67	2050		

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 = Mid-Field = Far-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	2194.04	21	24.48	**
Area	23993.46	4	1405.42	**
Period:Area	8361.00	84	23.32	**
Residuals	8749.42	2050		

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	104.85	21	29.80	**
Area	736.49	4	1098.74	**
Period:Area	72.12	84	5.12	**
Residuals	343.53	2050		

Note:
1. Assume Gamma 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.

Zinc

Source	Type II Sum of Square	Df	F value	Significance Level
Period	15.82	21	32.15	**
Area	129.41	4	1380.78	**
Period:Area	45.77	84	23.25	**
Residuals	48.03	2050		

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	1820123395	21	56.44	**
Area	3411567351	4	555.37	**
Period:Area	3727650278	84	28.90	**
Residuals	3148250463	2050		

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 – August 2021

Survival rate for burrowing amphipod *Leptochirus plumulosus*

Source	Type II Sum of Square	Df	F value	Significance Level
Area	0.0127	2	9.722	**
Residuals	0.0144	22		

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

SNK Results:
- Ma Wan = Reference > Near-Field ∴ potential significant project related impact.

Growth rate for benthic polychaete *Neanthes arenaceodentata*

Source	Type II Sum of Square	Df	F value	Significance Level
Area	0.0009	2	4.831	**
Residuals	0.0021	22		

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

SNK Results:
- Ma Wan = Reference = Near-Field ∴ no significant project related impact.

Survival rate for marine bivalve *Crassostrea gigas*

Source	Type II Sum of Square	Df	F value	Significance Level
Area	0.0003	2	1.135	N.S.
Residuals	0.0027	22		

Note:
1. Assume Beta 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	6.478	**
Residuals	22		

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

Post-hoc (Turkey's Tests) Results:
- Reference > Near-Field = Ma Wan ∴ no significant project related impact.

Mortality rate for shrimp *Penaeus vannaamei*

Source	Df	F value	Significance Level
Area	2	14.820	**
Residuals	22		

Note:

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

Post-hoc (Turkey's Tests) Results:

- Ma Wan = Near-Field > Reference ∴ potential significant project related impact.