

Environmental Monitoring and Audit for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau (2012-2017) – Investigation Agreement No. CE 23/2012(EP)

29th Monthly Progress Report for Contaminated
Mud Pits to the South of The Brothers and at
East Sha Chau – January 2015

Revision 0

16 February 2015

Environmental Resources Management
16/F Berkshire House
25 Westlands Road
Quarry Bay, Hong Kong
Telephone (852) 2271 3000
Facsimile (852) 2723 5660
www.erm.com



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 Telephone: (852) 2271 3000
 Facsimile: (852) 2723 5660
 E-mail: post.hk@erm.com
 http://www.erm.com

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Summary: This document presents the 29 th monthly progress report for Contaminated Mud Pits at the South of The Brothers and at East Sha Chau.		Date: 16 February 2015			
		Approved by: 			
		Craig A. Reid Partner			
v0	29 th Monthly Progress Report for ESC CMPs and SB CMPs	CY	JT	CAR	16/2/15
Revision	Description	By	Checked	Approved	Date
<p>This report has been prepared by Environmental Resources Management the trading name of 'ERM Hong-Kong, Limited', with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.</p> <p>We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.</p> <p>This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.</p>		Distribution <input type="checkbox"/> Internal <input checked="" type="checkbox"/> Public <input type="checkbox"/> Confidential			
		 			



Dredging, Management and Capping of Contaminated Sediment Disposal Facility to the South of The Brothers

Environmental Certification Sheet EP-427/2011/A


Reference Document/Plan

Document/ Plan to be Certified / Verified:	29 th Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau – January 2015
Date of Report:	16 February 2015
Date prepared by ET:	16 February 2015
Date received by IA:	16 February 2015

Reference EP Condition

Environmental Permit Condition:	Condition No.: 4.4
4 hard copies and 1 electronic copy of monthly EM&A Report shall be submitted to the Director within 2 weeks after the end of the reporting month. The EM&A Reports shall include a summary of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit Levels). The submissions shall be certified by the ET Leader and verified by the Independent Auditor. Additional copies of the submission shall be provided to the Director upon request by the Director.	

ET Certification

I hereby certify that the above referenced document/ plan complies with the above referenced condition of EP-427/2011/A	
Craig A. Reid, Environmental Team Leader:	 Date: 16/2/2015

IA Verification

I hereby verify that the above referenced document/ plan complies with the above referenced condition of EP-427/2011/A	
Dr Wang Wen Xiong, Independent Auditor:	Date: 16/2/2015

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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) - Investigation

29TH MONTHLY PROGRESS REPORT FOR JANUARY 2015

1.1 BACKGROUND

1.1.1 Since early 1990s, contaminated sediment ⁽¹⁾ arising from various construction works (e.g. dredging and reclamation projects) in Hong Kong has been disposed of at a series of seabed pits at East of Sha Chau (ESC). In late 2008, a review indicated that the existing and planned facilities at ESC would not be able to meet the disposal demand after 2012. In order to meet this demand, the Hong Kong Special Administrative Region Government (HKSARG) decided to implement a new contained aquatic disposal (CAD) ⁽²⁾ facility at the South of The Brothers (SB CMPs) which had been under consideration for a number of years.

1.1.2 The environmental acceptability of the construction and operation of the Project had been confirmed by findings of the associated Environmental Impact Assessment (EIA) study completed in 2005 under *Agreement No. CE 12/2002(EP)* ⁽³⁾. The Director of Environmental Protection (DEP) approved this EIA report under the *Environmental Impact Assessment Ordinance (Cap. 499) (EIAO)* in September 2005 (*EIA Register No.: AEIAR-089/2005*).

1.1.3 In accordance with the EIA recommendation, prior to commencement of construction works for the SB CMPs, the Civil Engineering and Development Department (CEDD) undertook a detailed review and update of the EIA findings for the SB site ⁽⁴⁾. Findings of the EIA review undertaken in 2009/2010 confirmed that the construction and operation of the SB site had been predicted to be environmentally acceptable.

- (1) According to the Management Framework of Dredged/ Excavated Sediment of ETWB TC(W) No. 34/2002, contaminated sediment in general shall mean those sediment requiring Type 2 – Confined Marine Disposal as determined according to this TC(W).
- (2) CAD options may involve use of excavated borrow pits, or may involve purpose-built excavated pits. CAD sites are those which involve filling a seabed pit with contaminated mud and capping it with uncontaminated material such that the original seabed level is restored and the contaminated material is isolated from the surrounding marine environment.⁷
- (3) Detailed Site Selection Study for a Proposed Contaminated Mud Disposal Facility within the Airport East/ East of Sha Chau Area (*Agreement No. CE 12/2002(EP)*)
- (4) Under the CEDD study *Contaminated Sediment Disposal Facility to the South of The Brothers (Agreement No. FM 2/2009)*

- *Routine Water Quality Monitoring of CMP 2* was undertaken on 15 January 2015;
- *Pit Specific Sediment Chemistry of CMP 2* was undertaken on 16 January 2015; and
- *Demersal Trawling for SB CMP* was undertaken on 15 and 16 January 2015.

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

1.4.1 No outstanding sampling remained for January 2015. The following laboratory analyses were still in progress during the preparation of this monthly report and hence are not presented in this monthly report:

- Laboratory analyses of sediment samples collected for *Pit Specific Sediment Chemistry* in January 2015;
- Laboratory analyses of water samples collected for *Routine Water Quality Monitoring* in January 2015; and
- Taxonomic identification of fishery resources collected during *Demersal Trawling for SB CMP* in January 2015.

1.4.2 A summary of field activities conducted are presented in *Annex A*.

1.5 ***BRIEF DISCUSSION OF THE MONITORING RESULTS FOR SB CMPS***

1.5.1 A brief discussion of the monitoring results of the following activities for SB CMPS is presented in this 29th *Monthly Progress Report*:

- *Pit Specific Sediment Chemistry of CMP 2* conducted in December 2014;
- *In-situ* measurements of *Routine Water Quality Monitoring* conducted in January 2015;
- *Water Column Profiling* conducted in January 2015; and
- Laboratory analyses of samples collected for *Water Quality Monitoring during Capping of CMP 1* conducted in December 2014.

- 1.5.2 ***Pit Specific Sediment Chemistry of CMP 2 – December 2014***
- 1.5.3 Monitoring locations for *Pit Specific Sediment Chemistry for CMP 2* are shown in *Figure 1.2*. A total of six (6) monitoring stations were sampled in December 2014.
- 1.5.4 The concentrations of all inorganic contaminants were lower than the Lower Chemical Exceedance Level (LCEL) at all stations in December 2014 (*Figures 1 and 2 of Annex B*).
- 1.5.5 For organic contaminants, the concentrations of Total Organic Carbon (TOC) were similar amongst stations in December 2014 (*Figure 3 of Annex B*). Tributyltins (TBTs) were observed to be higher at Active Pit station SB-NPAB in December 2014 (*Figures 4 of Annex B*). High Molecular Weight Polycyclic Aromatic Hydrocarbons (MW PAHs) and Low MW PAHs were below the limit of reporting at all stations in December 2014 (*Figures 5 of Annex B*). Total Dichloro-Diphenyl-Trichloroethane (DDT), 4,4'-Dichloro-Diphenyl-Dichloroethylene (4,4'-DDE) and Total Polychlorinated Biphenyls (PCBs) were recorded below the limit of reporting at all stations in December 2014 as well.
- 1.5.6 Higher TBTs concentrations were recorded within the Active Pit stations only which were receiving contaminated mud during the reporting month, as such, there is no evidence indicating any dispersal of contaminants from CMP 2 (Active Pit) to nearby sensitive receivers.
- 1.5.7 Overall, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at CMP 2 in December 2014.
- 1.5.8 ***Routine Water Quality Monitoring of SB CMP 2 – January 2015***
- 1.5.9 The monitoring results for the *Routine Water Quality Monitoring* conducted in January 2015 in the dry season have been assessed for compliance with the Water Quality Objectives (WQOs) set by EPD. This consists of a review of the EPD routine water quality monitoring data for the dry season period (November to March) of 2004 - 2013 from stations in the Northwestern Water Control Zone, where the CMPs are located. For Salinity, the averaged value obtained from the Reference stations was used for the basis as the WQO. Levels of DO, Turbidity and SS were also assessed for compliance with the Action and Limit Levels (see *Table C1 of Annex C* for details). The monitoring results are shown in *Figures 6-10 of Annex B* and *Table C2 of Annex C*. A total of fourteen (14) monitoring stations were sampled in January 2015 as shown in *Figure 1.3*.

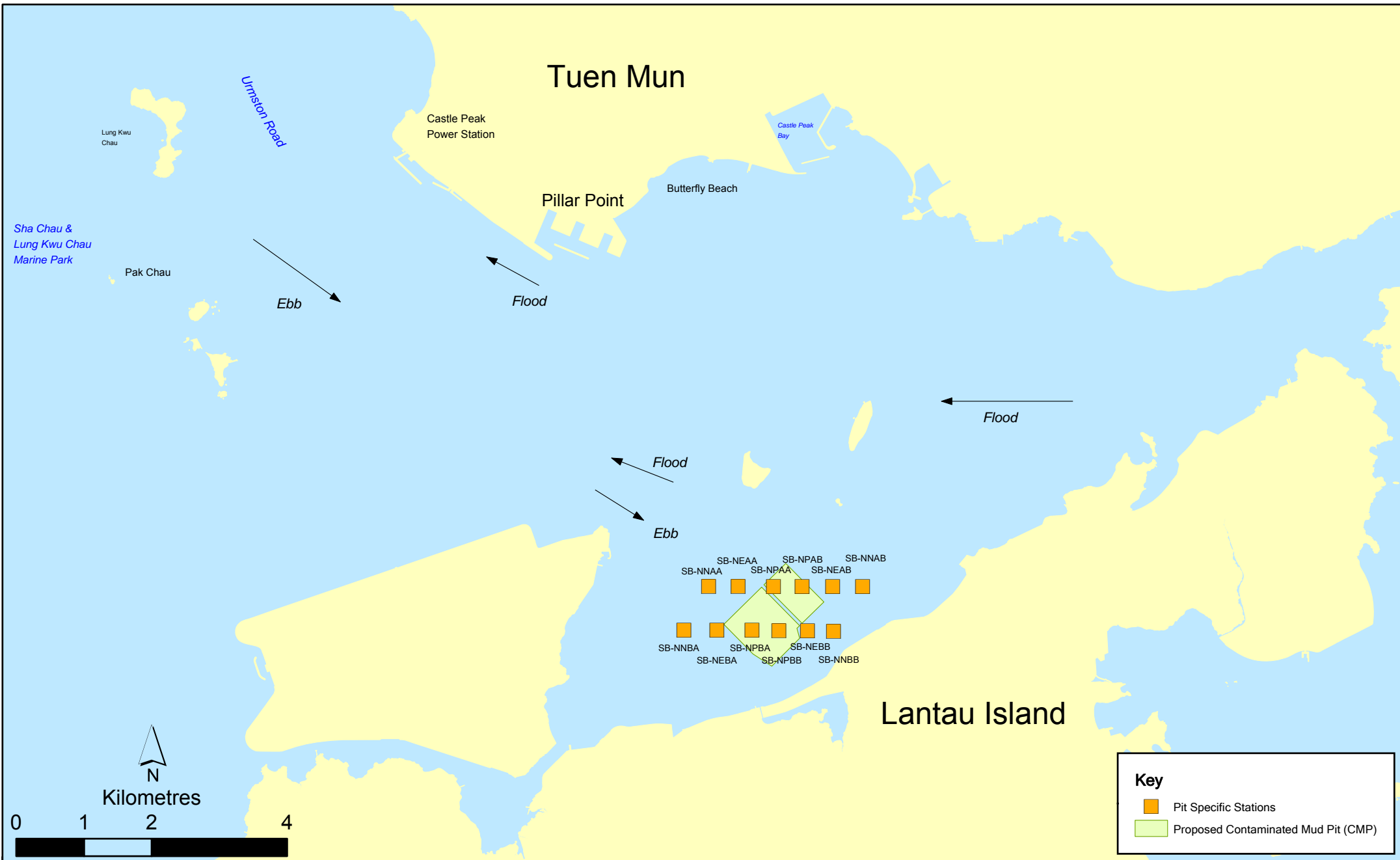


Figure 1.2

Pit Specific Sediment Quality Monitoring Stations for South Brothers Facility

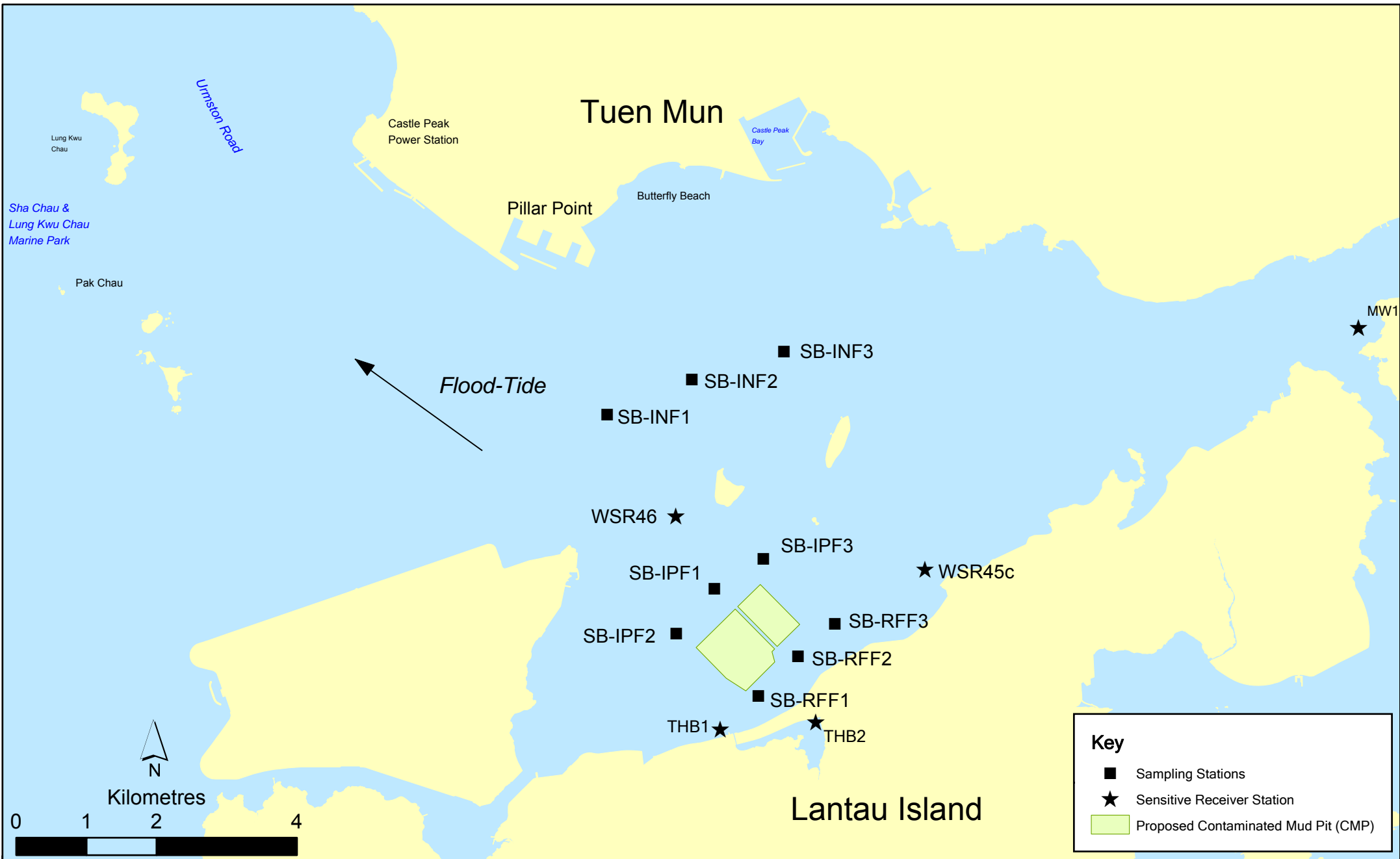


Figure 1.3

Routine & Capping Water Quality Sampling Stations (Flood-Tide) for South Brothers Facility

In-situ Measurements

- 1.5.10 Analyses of results for January 2015 indicated that the levels of pH, DO and Salinity complied with the WQOs at all stations (Impact, Intermediate, Reference and Water Sensitive Receiver stations) in January 2015 (*Figures 6-9 of Annex B*).
- 1.5.11 The levels of DO and Turbidity complied with the Action and Limit Levels at all stations (*Figures 8 and 10 of Annex B; Table C1 of Annex C*).
- 1.5.12 Overall, results of the *Routine Water Quality Monitoring* indicated that the disposal operation at CMP 1 did not appear to cause any unacceptable impacts in water quality in January 2015.
- 1.5.13 ***Water Column Profiling of CMP 2 – January 2015***
- 1.5.14 *Water Column Profiling* was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 14 January 2015. The water quality monitoring results have been assessed for compliance with the WQO (see *Section 1.5.9* for details). The monitoring results were also compared with the Action and Limit Levels set in *Baseline Monitoring Report* (see *Table C1 of Annex C* for details).

In-situ Measurements

- 1.5.15 Analyses of results for January 2015 indicated that levels of Salinity, DO and pH complied with the WQOs at both Downstream and Upstream stations (*Table C3 of Annex C*). DO and Turbidity levels at all stations complied with the Action and Limit Levels (*Tables C1 and C3 of Annex C*).

Laboratory Measurements for SS

- 1.5.16 Analyses of results for January 2015 indicated that the SS levels at both Upstream and Downstream stations complied with the WQO. SS levels at all stations also complied with the Action and Limit Levels (*Tables C1 and C3 of Annex C*).
- 1.5.17 Overall, the monitoring results indicated that the mud disposal operation at CMP 2 did not appear to cause any unacceptable impacts in water quality during this reporting period.

- 1.5.18 ***Water Quality Monitoring during Capping Operations of CMP 1- December 2014***
- 1.5.19 The monitoring results obtained during December 2014 sampling in the dry season have been assessed for compliance with the WQOs (see *Section 1.5.9* for details). A total of fourteen (14) monitoring stations were sampled in December 2014 as shown in *Figure 1.3*. Graphical presentation of the monitoring results is provided in *Annex B*.
- Laboratory Measurements*
- 1.5.20 Concentrations of SS complied with the WQO at all stations in December 2014 (*Figure 11 of Annex B*).
- 1.5.21 For nutrients, concentrations of Ammonia (NH₃) and 5-day Biochemical Oxygen Demand (BOD₅) were similar amongst all stations (*Figures 12 and 14 of Annex B*). Total Inorganic Nitrogen (TIN) at all stations complied with the WQO of 0.5 mg/L in December 2014 (*Figure 13 of Annex B*).
- 1.5.22 Statistical analysis will be undertaken in the quarterly report to investigate whether the capping operations at CMP 1 is causing any unacceptable impacts in water quality of the area.

1.6 ACTIVITIES SCHEDULED FOR THE NEXT MONTH

- 1.6.1 The following monitoring activities will be conducted in the next monthly period of February 2015 for SB CMPs:
- *Pit Specific Sediment Chemistry of CMP 2;*
 - *Cumulative Impact Sediment Chemistry of SB CMP;*
 - *Sediment Toxicity Tests of CMP 2;*
 - *Tissue /Whole Body Analysis of Trawled Samples for SB CMP;*
 - *Demersal Trawling for CMP 2;*
 - *Routine Water Quality Monitoring for CMP 2;*
 - *Water Column Profiling of CMP 2; and*
 - *Water Quality Monitoring during Capping Operations of CMP 1.*
- 1.6.2 *Water Quality Monitoring during Capping Operations of ESC CMPs* will be conducted in the next monthly period of February 2015 for ESC CMPs.
- 1.6.3 The sampling schedule is presented in *Annex A*.

1.7 ***STUDY PROGRAMME***

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

Annex A

Sampling Schedule

Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

			2012					2013					2014					2015					2016					2017																		
			J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Capping Water Quality Monitoring																																														
<i>Ebb Tide</i>																																														
Impact Stations Downcurrent																																														
	SB-IPE1	4 times per year																																												
	SB-IPE2	4 times per year																																												
	SB-IPE3	4 times per year																																												
	SB-IPE4	4 times per year																																												
	SB-IPE5	4 times per year																																												
Intermediate Stations Downcurrent																																														
	SB-INE1	4 times per year																																												
	SB-INE2	4 times per year																																												
	SB-INE3	4 times per year																																												
	SB-INE4	4 times per year																																												
	SB-INE5	4 times per year																																												
Reference Stations Upcurrent																																														
	SB-RFE1	4 times per year																																												
	SB-RFE2	4 times per year																																												
	SB-RFE3	4 times per year																																												
	SB-RFE4	4 times per year																																												
	SB-RFE5	4 times per year																																												
Sensitive Receiver Stations																																														
	MW1	4 times per year																																												
	THB1	4 times per year																																												
	THB2	4 times per year																																												
	WSR45C	4 times per year																																												
	WSR46	4 times per year																																												
<i>Flood Tide</i>																																														
Impact Stations Downcurrent																																														
	SB-IPF1	4 times per year																																												
	SB-IPF2	4 times per year																																												
	SB-IPF3	4 times per year																																												
Intermediate Stations Downcurrent																																														
	SB-INF1	4 times per year																																												
	SB-INF2	4 times per year																																												
	SB-INF3	4 times per year																																												
Reference Stations Upcurrent																																														
	SB-RFF1	4 times per year																																												
	SB-RFF2	4 times per year																																												
	SB-RFF3	4 times per year																																												
Sensitive Receiver Stations																																														
	MW1	4 times per year																																												
	THB1	4 times per year																																												
	THB2	4 times per year																																												
	WSR45C	4 times per year																																												
	WSR46	4 times per year																																												
Benthic Recolonisation Studies																																														
Capped Contaminated Mud Pits																																														
	SB-CPA	2 times per year																																												
	SB-CPB	2 times per year																																												
Reference Stations																																														
	RBA	2 times per year																																												
	RBB	2 times per year																																												
	RBC	2 times per year																																												

Notes:
 "n" = Number of replicates depends on parameters
 Naming of stations are tentative only and will be subjected to changes

Annex B

Graphical Presentations

**Pit Specific Sediment Chemistry for Metal and Metalloid Contaminants at CMP 2
December 2014**

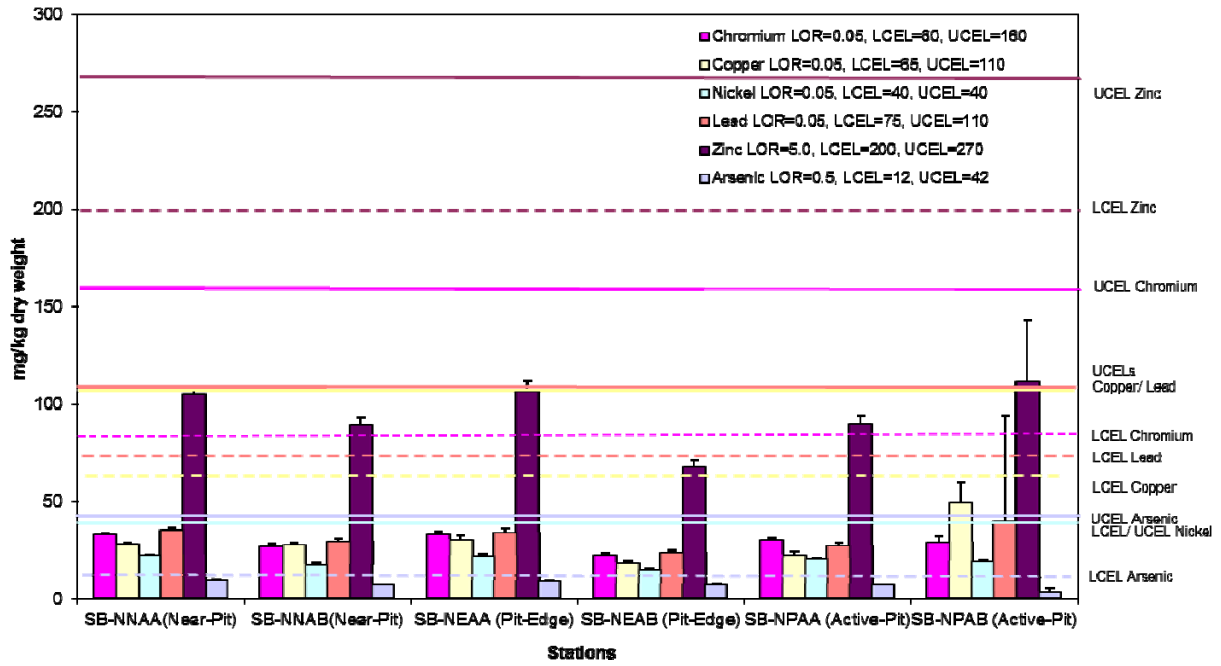


Figure 1: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mean +SD) in sediment samples collected for Pit Specific Sediment Chemistry Monitoring for CMP 2 in December 2014.

**Pit Specific Sediment Chemistry for Metal Contaminants at CMP 2
December 2014**

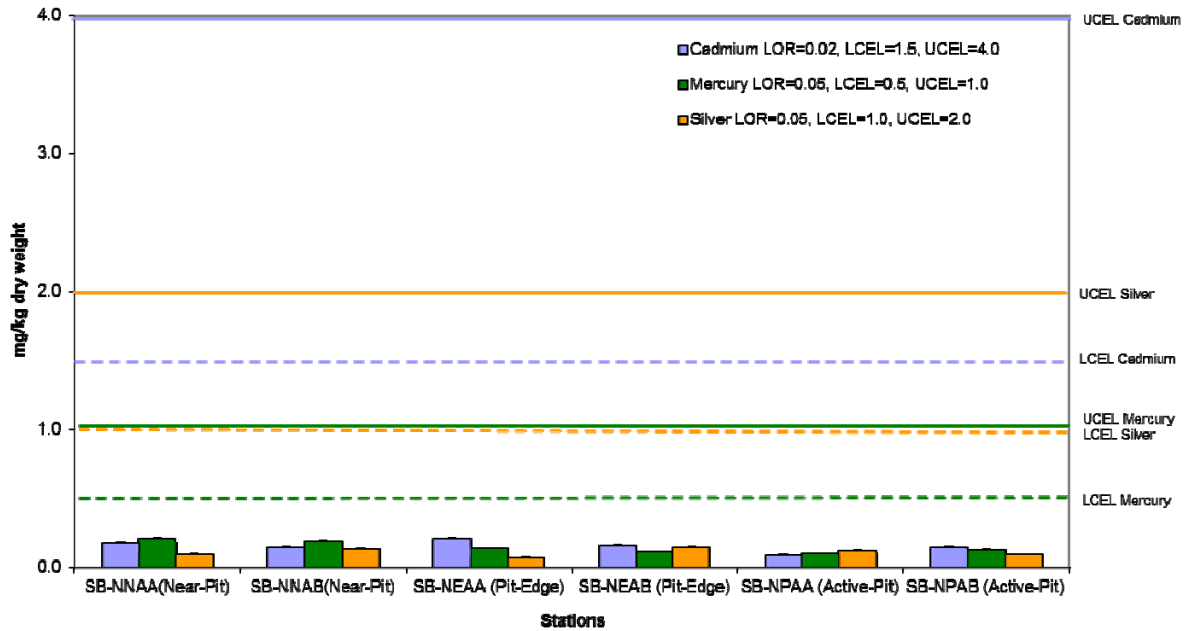


Figure 2: Concentration of Metals (Cd, Hg, Ag; mean +SD) in sediment samples collected for Pit Specific Sediment Chemistry Monitoring for CMP 2 in December 2014.

**Pit Specific Sediment Chemistry for Total Organic Carbon (TOC) at CMP 2
December 2014**

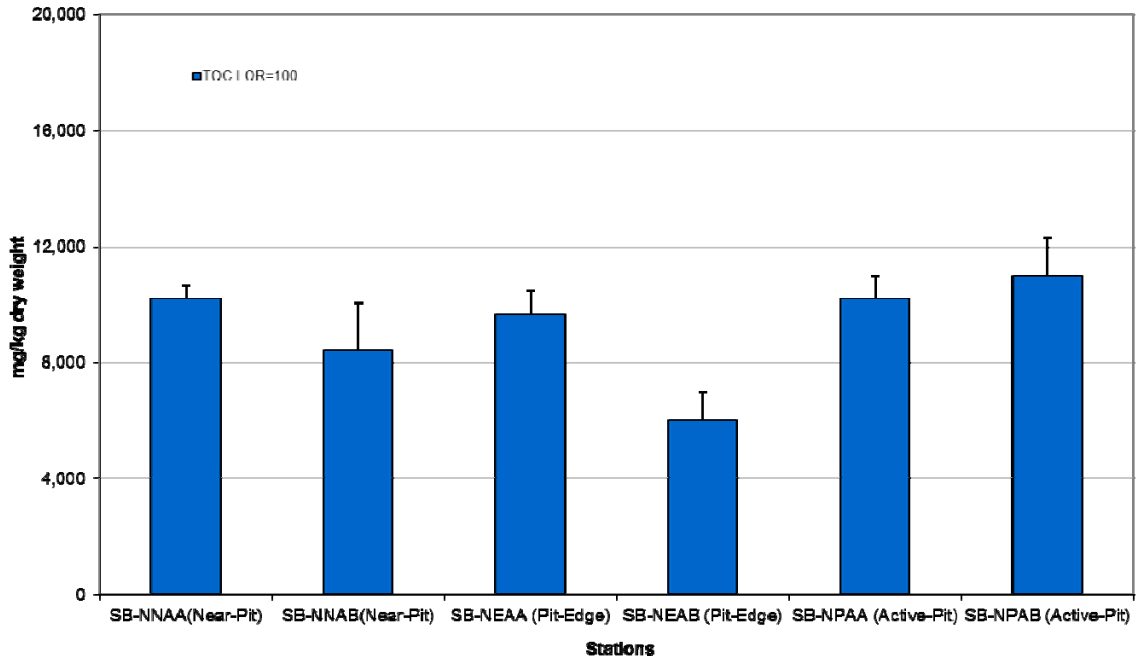


Figure 3: Concentration of Total Organic Carbon (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP 2 in December 2014.

**Pit Specific Sediment Chemistry for Tributyltin (TBT) at CMP 2
December 2014**

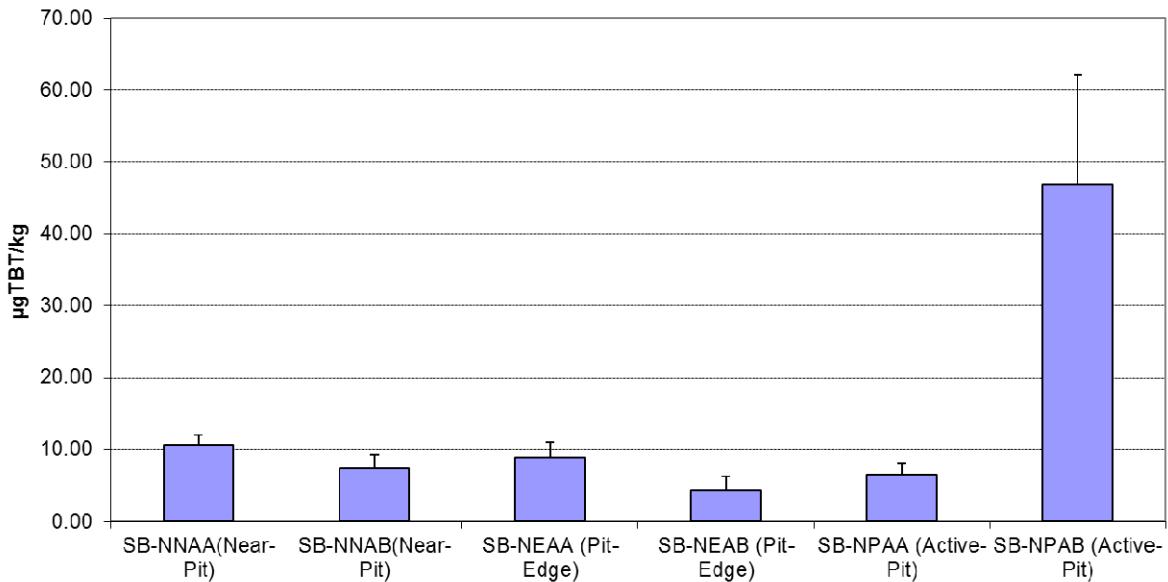


Figure 4: Concentration of Tributyltin (µg TBT/kg; mean +SD) in sediment samples collected for Pit Specific Sediment Chemistry Monitoring for CMP 2 in December 2014.

Pit Specific Sediment Chemistry for Low and High Molecular Weight Polycyclic Aromatics Hydrocarbons (PAHs) at CMP 2 in December 2014

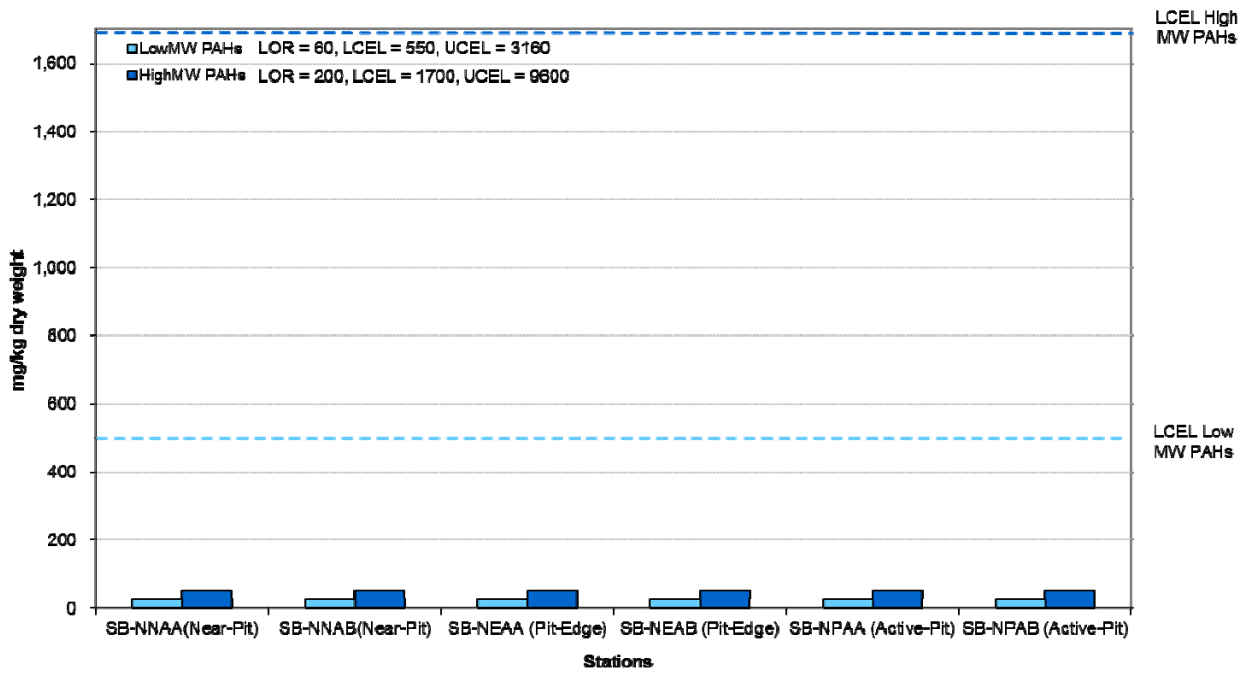


Figure 5: Concentration of Low and High Molecular Weight Polycyclic Aromatics Hydrocarbons (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP 2 in December 2014.

Routine Water Quality Monitoring for CMP 2 - January 2015

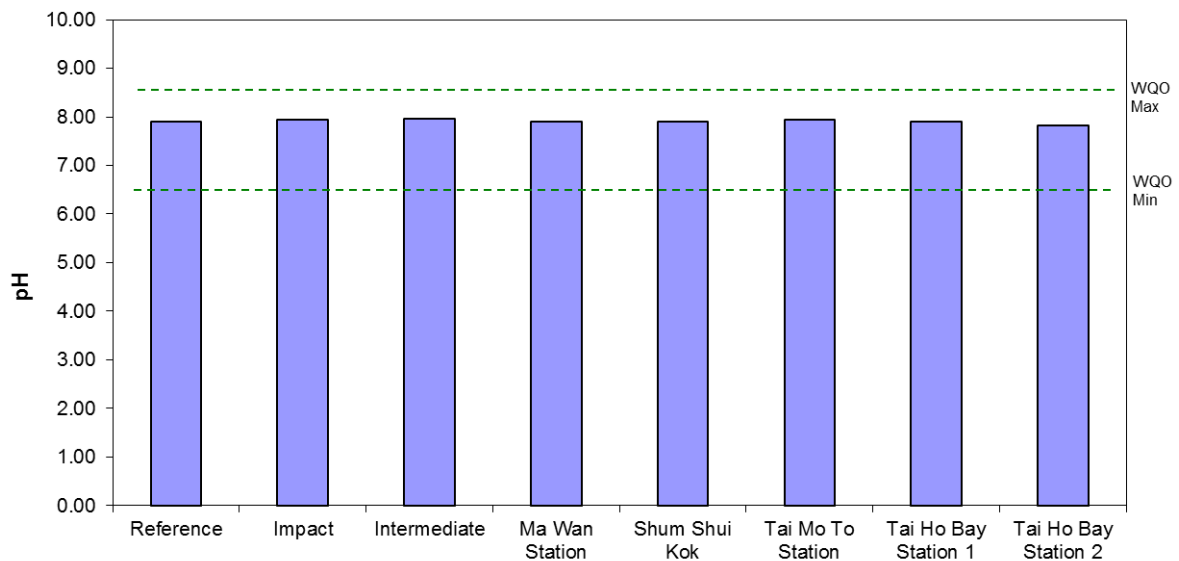


Figure 6: Level of pH recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2015.

Routine Water Quality Monitoring CMP 2 - January 2015

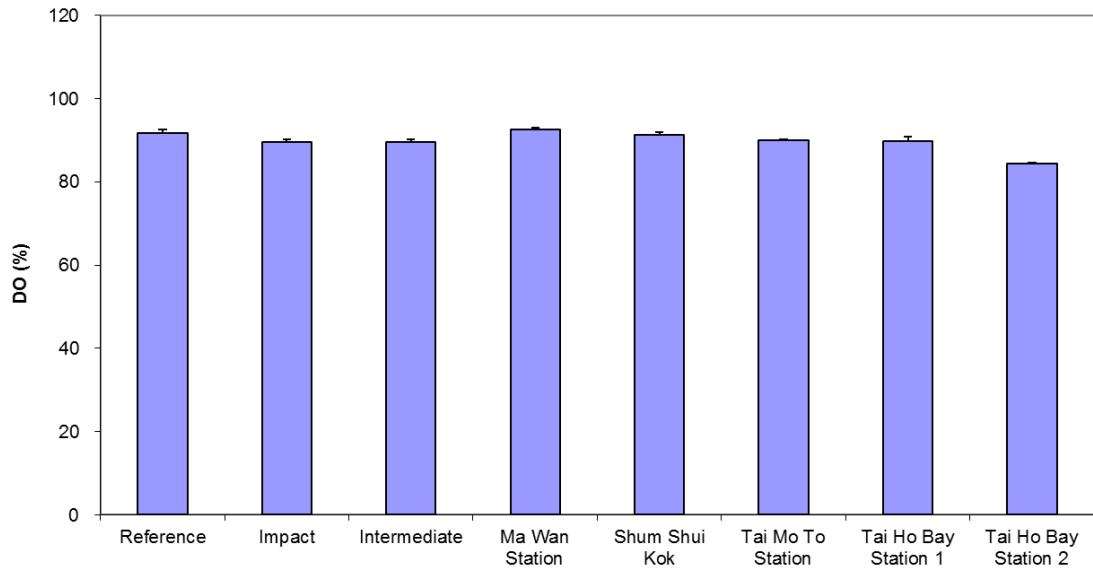


Figure 7: Level of Dissolved Oxygen (% saturation; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2015.

Routine Water Quality Monitoring for CMP 2 - January 2015

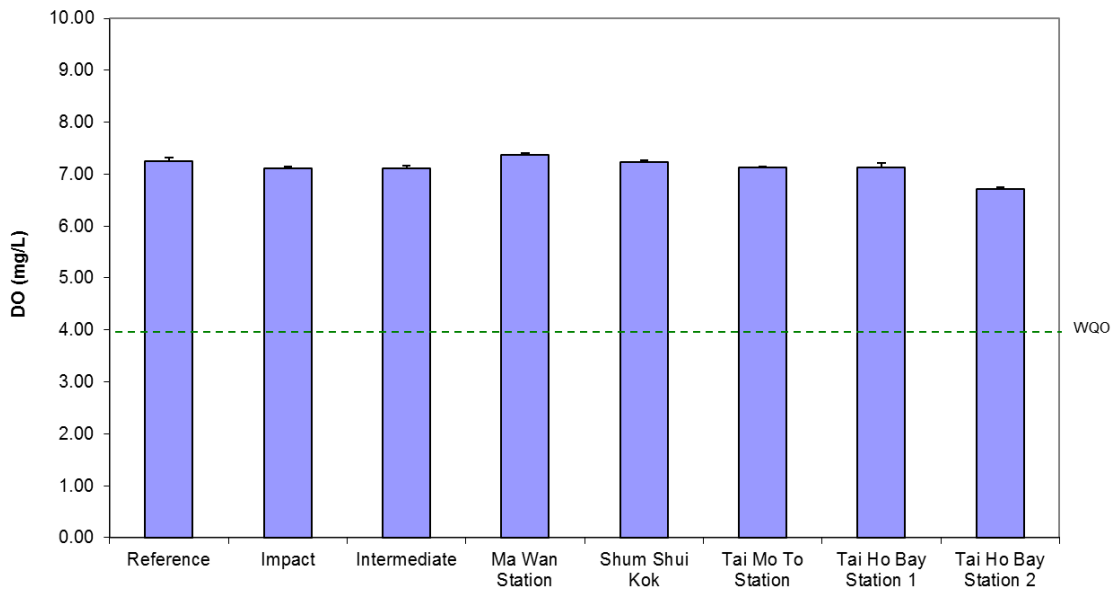


Figure 8: Concentration of Dissolved Oxygen (mg/L; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2015.

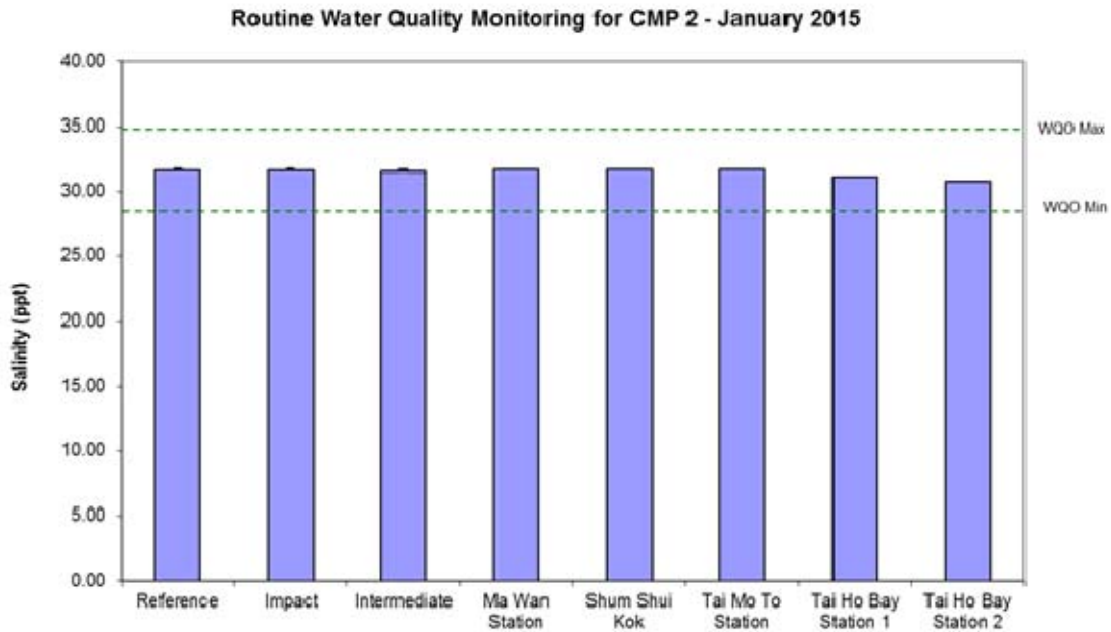


Figure 9: Level of Salinity (ppt; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2015.

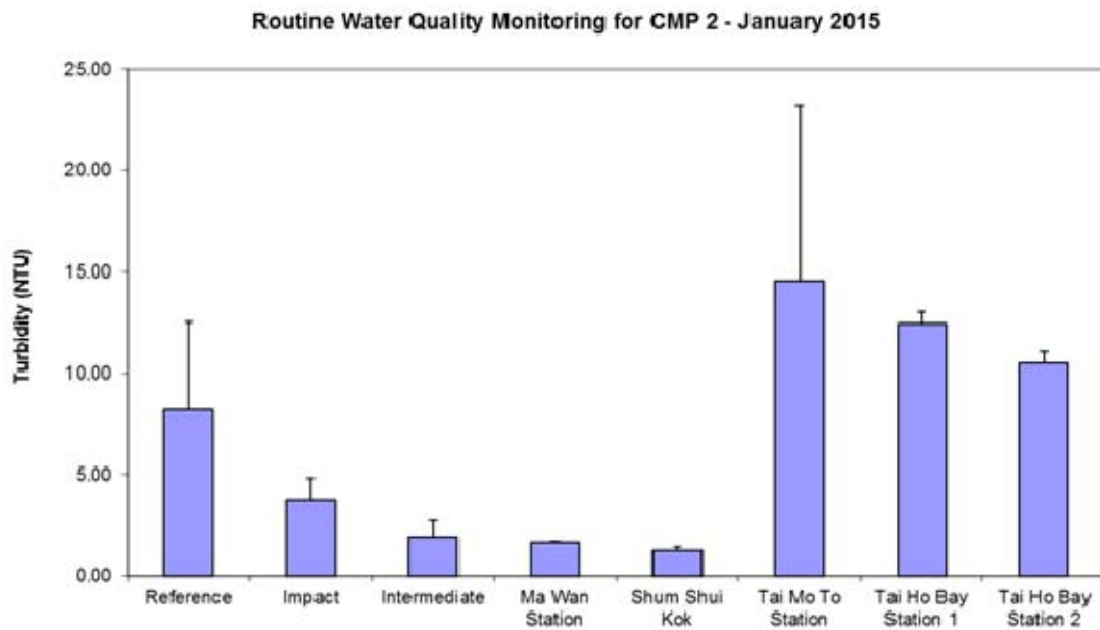


Figure 10: Levels of Turbidity (NTU; ,mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2015.

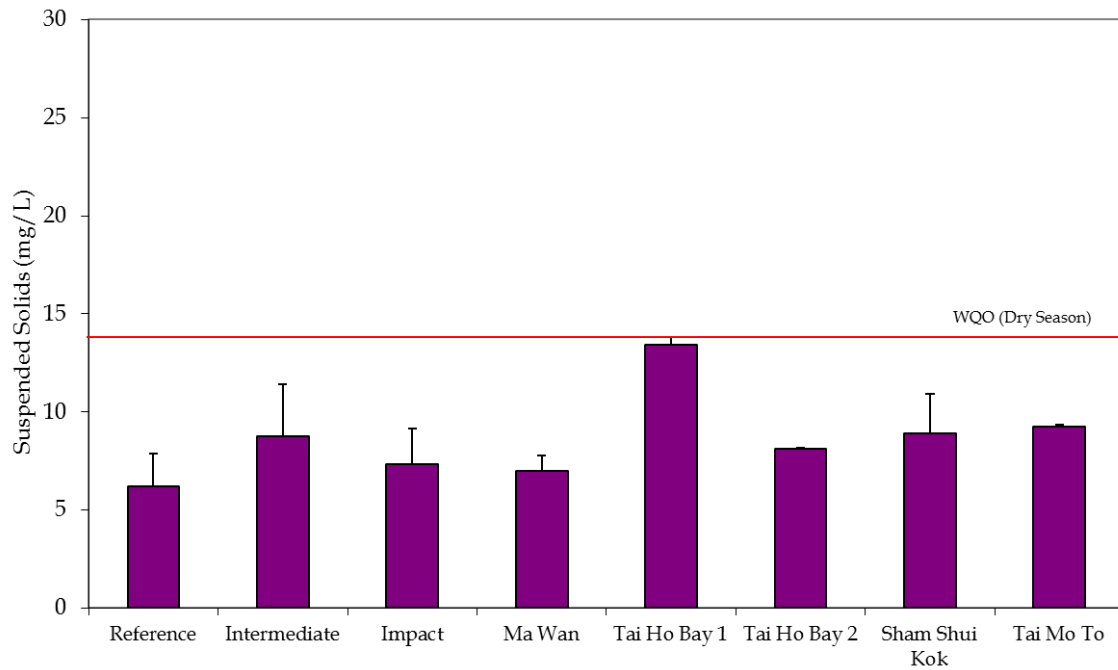


Figure 11: Levels of Suspended Solids (mg/L; mean + SD) recorded from Water Quality Monitoring during Capping of SB CMP 1 in December 2014.

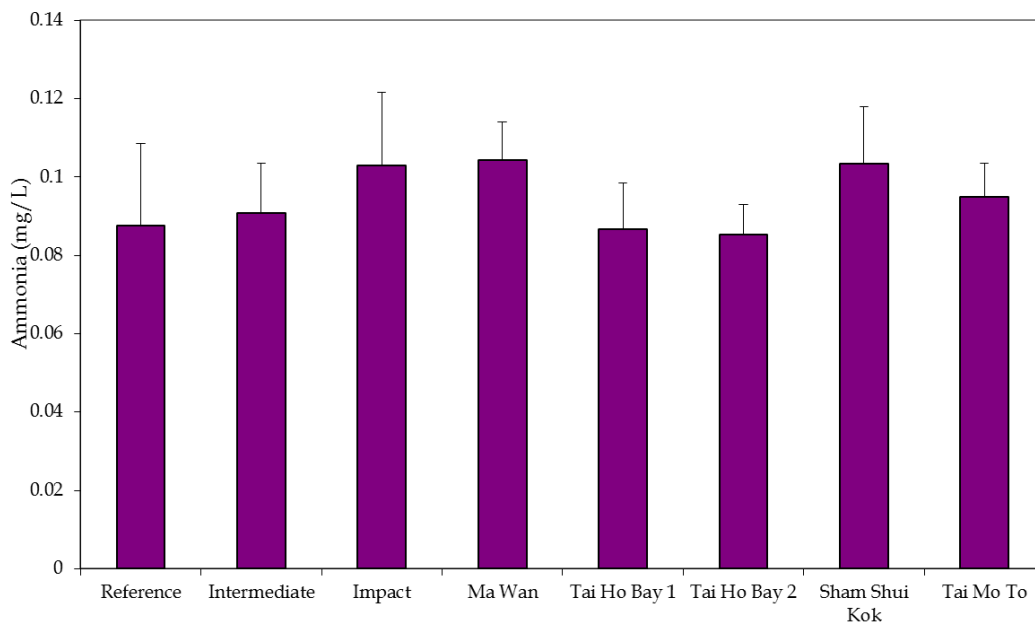


Figure 12: Levels of Ammonia (mg/L; mean + SD) recorded from Water Quality Monitoring during Capping of SB CMP 1 in December 2014.

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Date: 13/2/2015

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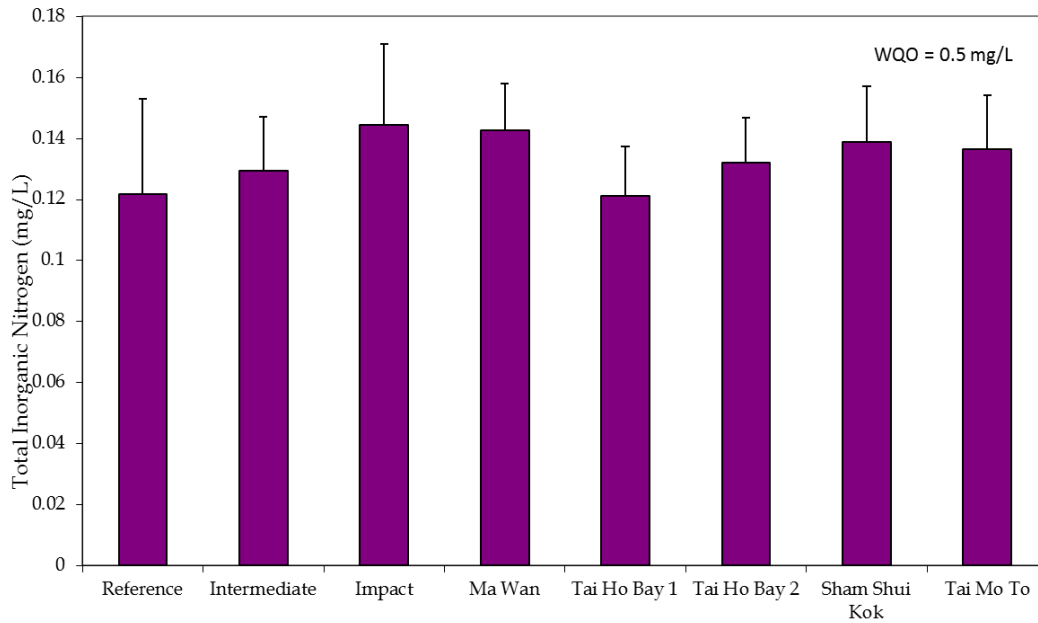


Figure 13: Levels of Total Inorganic Nitrogen (mg/L; mean + SD) recorded from Water Quality Monitoring during Capping of SB CMP 1 in December 2014.

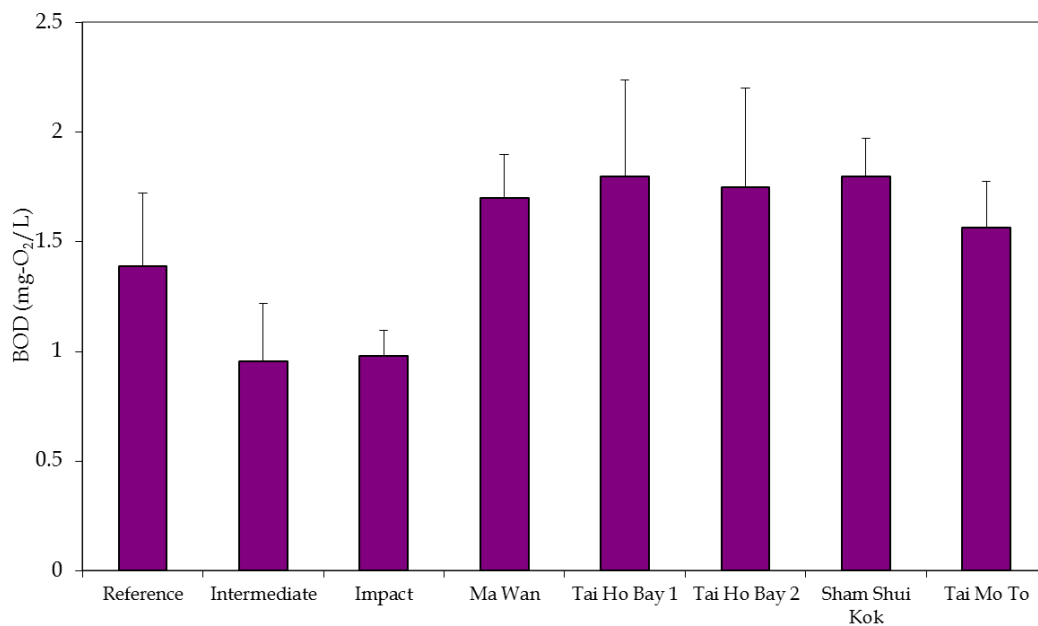


Figure 14: Levels of 5-Day Biochemical Oxygen Demand (mg/L; mean + SD) recorded from Water Quality Monitoring during Capping of SB CMP 1 in December 2014.

Annex C

Water Quality Monitoring Results

Table C1 Action and Limit Levels of Water Quality for Dredging, Backfilling and Capping Activities

Parameter	Action Level	Limit Level
Dissolved Oxygen (DO) ⁽¹⁾	<u>Surface and Mid-depth</u> ⁽²⁾ The average of the impact, WSR 45C and WSR 46 station readings are < 5%-ile of baseline data for surface and middle layer = 4.32 mg L⁻¹ and Significantly less than the reference stations mean DO (at the same tide of the same day)	<u>Surface and Mid-depth</u> ⁽²⁾ The average of the impact, WSR 45C and WSR 46 station readings are < 4 mg L⁻¹ and Significantly less than the reference stations mean DO (at the same tide of the same day)
	<u>Bottom</u> The average of the impact, WSR 45C and WSR 46 station readings are < 5%-ile of baseline data for bottom layers = 3.12 mg L⁻¹ and Significantly less than the reference stations mean DO (at the same tide of the same day)	<u>Bottom</u> The average of the impact station, WSR 45C and WSR 46 readings are < 2 mg L⁻¹ and Significantly less than the reference stations mean DO (at the same tide of the same day)
Depth-averaged Suspended Solids (SS) ^{(3) (4)}	The average of the impact, WSR 45C and WSR 46 station readings are > 95%-ile of baseline data for depth average = 21.60 mg L⁻¹ and 120% of control station's SS at the same tide of the same day	The average of the impact, WSR 45C and WSR 46 station readings are > 99%-ile of baseline data for depth average = 40.10 mg L⁻¹ and 130% of control station's SS at the same tide of the same day
Depth-averaged Turbidity (Tby) ^{(3) (4)}	The average of the impact, WSR 45C and WSR 46 station readings are > 95%-ile of baseline data = 25.04 NTU and 120% of control station's Tby at the same tide of the same day	The average of the impact, WSR 45C and WSR 46 station readings are > 99%-ile of baseline data = 32.68 NTU and 130% of control station's Tby at the same tide of the same day

Notes:

- (1) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
- (2) The Action and Limit Levels for DO for Surface & Middle layers were calculated from the combined pool of baseline surface layer data and baseline middle layer data.
- (3) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.
- (4) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

Table C2 *In-situ Monitoring Results for Routine Water Quality Monitoring of CMP 2 in January 2015*

Sampling Period	Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%)	Dissolved Oxygen (mg L ⁻¹)	pH (mg L ⁻¹)
January 2015	RFF (Reference)	17.48	31.63	8.18	91.72	7.25	7.91
	IPF (Impact)	17.38	31.61	3.69	89.62	7.11	7.93
	INF (Intermediate)	17.33	31.56	1.90	89.55	7.11	7.95
	Ma Wan	17.15	31.68	1.62	92.64	7.37	7.91
	Shum Shui Kok	17.44	31.70	1.21	91.37	7.23	7.90
	Tai Mo To	17.40	31.67	14.59	89.89	7.12	7.95
	Tai Ho Bay 1	17.38	31.10	12.43	89.68	7.13	7.90
	Tai Ho Bay 2	17.45	30.75	10.49	84.33	6.71	7.81
	WQO	N/A	28.47-34.80 [#]	N/A	N/A	>4	6.5-8.5

Notes:

[#]Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.

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

Table C3 *Water Column Profiling Results for CMP 2 on 14 January 2015*

Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%)	Dissolved Oxygen (mg L ⁻¹)	pH (mg L ⁻¹)	Suspended Solids (mg L ⁻¹)
WCP 1 (Downstream)	17.10	30.93	4.56	89.07	7.13	7.92	6.60
WCP 2 (Upstream)	17.66	31.58	1.27	88.01	6.94	7.92	4.65
WQO (dry season)	N/A	28.13-34.73 [#]	N/A	N/A	>4	6.5-8.5	13.7

Note: [#]Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.

Annex D

Study Programme

