

 土木工程拓展署
Civil Engineering and
Development Department

**Environmental Monitoring and Audit
for Contaminated Mud Pit at Sha
Chau (2009-2013) – Investigation
Agreement No. CE 4/2009(EP)**

**43rd Monthly Progress Report for
Contaminated Mud Pits at Sha Chau –
January 2013**

Revision 0

27 February 2013

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Environmental Monitoring and Audit for Contaminated Mud Pit at Sha Chau (2009-2013) – Investigation





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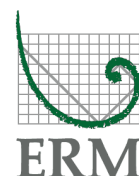
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43rd Monthly Progress Report for Contaminated Mud Pits at Sha Chau – January 2013

Revision 0

Document Code: 0103262 Monthly Progress Jan 13_v0.doc

Client:		Project No:			
Civil Engineering and Development Department (CEDD)		0103262			
Summary:		Date:			
This document presents progress of monitoring works on contaminated mud pits at Sha Chau in January 2013 under Agreement No. CE 4/2009 (EP).		27 February 2013			
		Approved by:			
		 Dr Robin Kennish Director			
0	43 rd Monthly Progress Report for CMP	CL	JT	RK	27/2/13
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 checked="" type="checkbox"/> Internal <input checked="" type="checkbox"/> Public <input type="checkbox"/> Confidential			
		  			



New Contaminated Mud Marine Disposal Facility at Airport East/East Sha
Chau Area

Environmental Certification Sheet
EP-312/2008/A

Reference Document/Plan

Document/~~Plan~~-to be-Certified/ Verified: 43rd Monthly Progress Report for Contaminated Mud Pits at
Sha Chau – January 2013

Date of Report: 21/02/2013

Date received by ET: 21/02/2013

Date received by IA: 21/02/2013

Reference EP Condition

Environmental Permit Condition: Condition No.: 3.4

Content:

Four hard copies and one electronic copy of monthly EM&A Report shall be submitted to the Director within 10 working days after the end of the reporting month. The EM&A Reports shall include a summary of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit Levels). The submissions shall be verified by the Independent Auditor. Additional copies of the submission shall be provided to the Director upon request by the Director.

ET Certification

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

Dr Robin Kennish,
Environmental Team Leader:



Date: 21/02/2013

IA Verification

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

Dr Wang Wen Xiong,
Independent Auditor:



Date: 22/2/2013

Notes:

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Agreement No. CE 4/2009 (EP)
Environmental Monitoring and Audit
for Contaminated Mud Pit at Sha Chau (2009-2013) - Investigation

43RD MONTHLY PROGRESS REPORT
FOR CONTAMINATED MUD PITS AT SHA CHAU
January 2013

1.1 BACKGROUND

1.1.1 Since 1992, the East of Sha Chau (ESC) area has been the site of a series of dredged contaminated mud pits (CMPs) designed to provide confined marine disposal capacity for contaminated mud arising from the HKSAR's dredging and reclamation projects. In January 2013, the following works were being undertaken at the CMPs:

- Capping was being undertaken at CMP IVc;
- Disposal of contaminated mud was taking place at CMP Va; and
- Dredging of CMP Vd was in progress.

1.1.2 The Environmental Monitoring and Audit (EM&A) programme for the CMPs at the ESC area presently covers the above operations.

1.2 REPORTING PERIOD

1.2.1 This Monthly Progress Report covers the monitoring period of January 2013.

1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES

1.3.1 The following monitoring activities have been undertaken for CMP V in January 2013:

- *Water Column Profiling* was conducted for CMP Va on 4 January 2013;
- *Pit Specific Sediment Chemistry* was conducted for CMP Va on 11 January 2013;
- *Demersal Trawling* was conducted for CMP Va on 17 and 18 January 2013;
- *Routine Water Quality Monitoring* was conducted for CMP Va on 18 January 2013; and
- *Impact Water Quality Monitoring during Dredging Operations* was conducted for CMP Vd on 23 January 2013.

1.3.2 A summary of field activities are presented in *Annex A*.

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

1.4.1 No outstanding sampling remained and laboratory analysis of *Pit Specific Sediment Chemistry* conducted in January 2013 was yet to be completed during preparation of this monthly report.

1.5 **BRIEF DISCUSSION OF THE MONITORING RESULTS FOR CMP V**

1.5.1 *Table 1.1* summarises the monitoring results that are presented in the current monthly report. Brief discussion of the monitoring results is presented in this section. Detailed discussion will be presented in the corresponding *Quarterly Report*.

Table 1.1 *Monitoring activities in December 2012/January 2013*

Monitoring activities	Date of Monitoring	Monitoring results presented in this report?
Cumulative Impact Sediment Chemistry Monitoring for CMP Va	3 Dec 2012	Yes
Pit Specific Sediment Chemistry Monitoring for CMP Va	7 Dec 2012	Yes
	11 Jan 2013	No. Laboratory analysis yet to be completed during preparation of this monthly report.
Water Column Profiling for CMP Va	4 Jan 2013	Yes
Demersal Trawling for CMP Va	17&18 Jan 2013	No. Laboratory analysis yet to be completed during preparation of this monthly report.
Routine Water Quality Monitoring for CMP Va	18 Jan 2013	Yes
Impact Water Quality Monitoring during Dredging Operations of CMP Vd	23 Jan 2013	Yes

1.5.2 *Pit Specific Sediment Chemistry of CMP Va – December 2012*

1.5.3 Monitoring locations for Pit Specific Sediment Chemistry for CMP Va are shown in *Figure 1.1*. A total of six monitoring stations were sampled in December 2012. Concentrations of Arsenic exceeded the Lower Chemical Exceedance Level (LCEL) at all stations except at Active Pit station NPDA while concentrations of Silver exceeded the LCEL at Active Pit station NPDA (*Figures 1-2 of Annex B*). Whilst the average concentration of Arsenic in the Earth's crust is generally ~2mg/kg, significantly higher Arsenic concentrations (median = 14 mg/kg) have been recorded in Hong Kong's onshore sediments ⁽¹⁾. It is presumed that the natural concentrations of Arsenic are similar in onshore and offshore sediments ⁽²⁾, and relatively high Arsenic levels may thus occur throughout Hong Kong. Therefore, the slight exceedances of the LCEL for Arsenic are unlikely to be caused by the disposal operations at CMP Va but rather as a result of naturally occurring deposits. In addition, the Active Pit stations are located within CMP Va which was receiving contaminated mud during the reporting period. As such, the exceedances of LCEL for Silver which were recorded at one Active Pit station only is not considered as indicating any dispersal of contaminated mud from CMP Va.

1.5.4 For organic contaminants, Total Organic Carbon (TOC) concentration was similar amongst all stations (*Figure 3 of Annex B*). Tributyltin (TBT) concentration was higher at Active Pit Station NPDA and Pit Edge Station NEDB when compared to other stations (*Figure 4 of Annex B*). High MW PAHs concentrations were below the limit of reporting at all stations except at Active Pit stations NPDA and NPDB and Pit-Edge station NEDB (*Figure 5 of Annex B*). Low Molecular Weight Polycyclic Aromatics Hydrocarbons (Low MW PAHs), Total Polychlorinated Biphenyls (PCBs), Total Dichloro-diphenyl-trichloroethane (DDT) and 4,4'-Dichloro-diphenyl-dichloroethylene (4,4'-DDE) were below the limit of reporting at all stations.

1.5.5 As described in *Section 1.5.3*, the higher concentrations of contaminants (including metals and organic contaminants) recorded at the Active Pit stations only are not considered as indicating any dispersal of contaminated mud from CMP Va. Nevertheless, detailed analysis will be presented in the *Quarterly Report* to reveal any trend of increasing sediment contaminant concentrations towards CMP Va.

1.5.6 Overall, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at CMP Va during this monthly period.

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

(2) Whiteside PGD (2000) Natural geochemistry and contamination of marine sediments in Hong Kong. In: The Urban Geology of Hong Kong (ed Page A & Reels SJ). Geological Society of Hong Kong Bulletin No. 6, p109-121

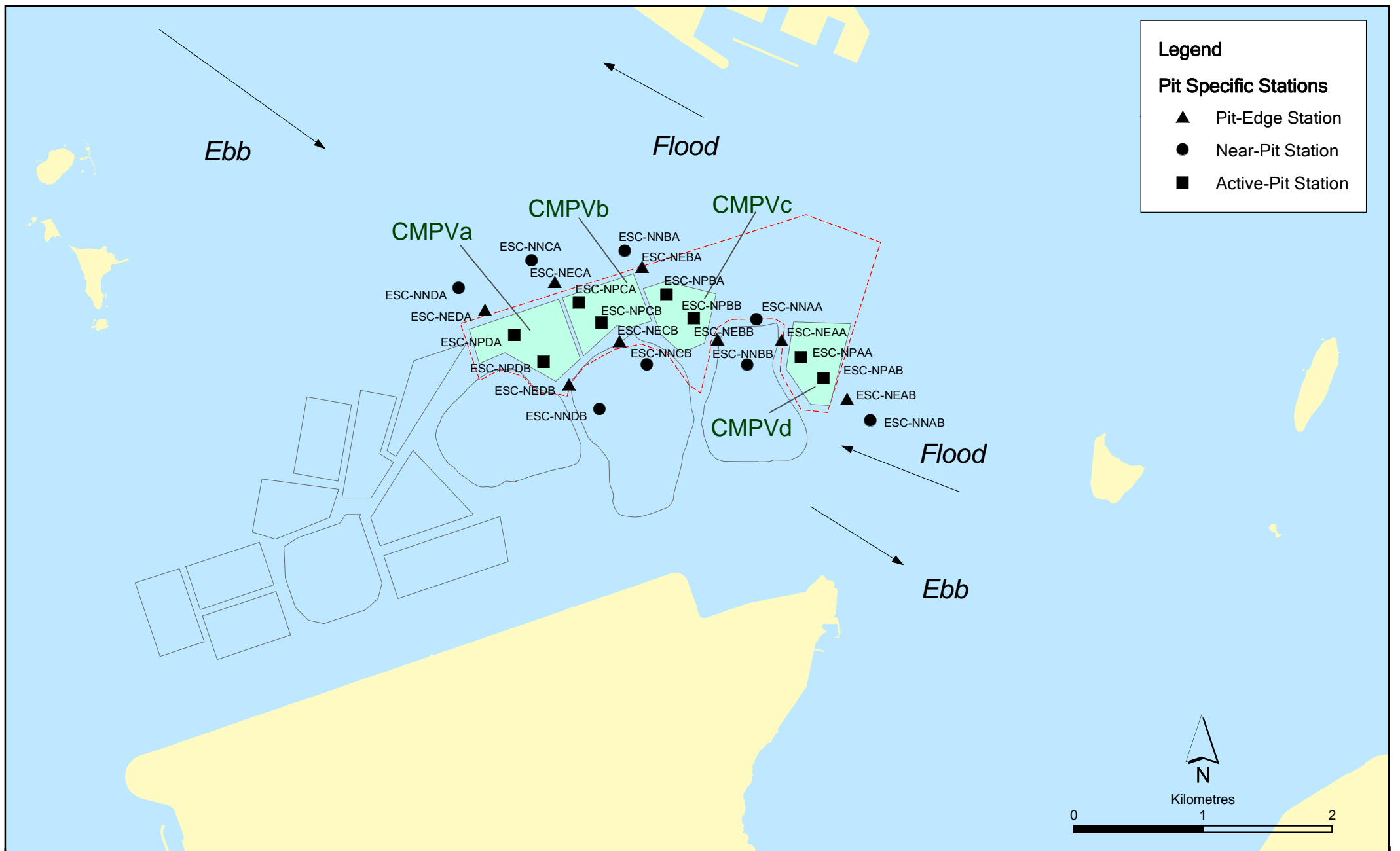


Figure 1.1

Pit Specific Sediment Quality Monitoring Stations for CMPV

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Date: 29/10/2009

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- 1.5.7** *Cumulative Impact Sediment Chemistry for CMP Va – December 2012*
- 1.5.8** Monitoring locations for Cumulative Impact Sediment Chemistry for CMP Va are shown in *Figure 1.2*. A total of nine monitoring stations were being sampled.
- 1.5.9** Analyses of results for the Cumulative Impact Sediment Chemistry Monitoring indicate that the concentrations of all metals, except Arsenic, were below the LCEL in December 2012 (*Figures 6 and 7 of Annex B*). Concentrations of Arsenic in sediments from all stations, except for Ma Wan station, Near Field stations RNA and RNB, exceeded the LCEL. As discussed in *Section 1.5.3* above, relatively high natural levels of Arsenic are present in Hong Kong's marine sediments and hence the slight exceedances of the LCEL for the Arsenic do not necessarily indicate any adverse impacts to sediment quality caused by disposal operation at CMP Va.
- 1.5.10** The concentration of TOC was similar amongst stations (*Figure 8 of Annex B*). TBTs were recorded in sediment samples from Near Field (RNA and RNB), Mid Field (RMA and RMB), Far-field (RFA), Capped Pit (RCA) and Ma Wan stations (*Figure 9 of Annex B*). Concentrations of Total DDT, 4,4'-DDE, Total PCBs, Low and High M.W. PAHs were below the limit of detection at all stations.
- 1.5.11** Overall, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at CMP Va during this monthly period.
- 1.5.12** *Impact Water Quality Monitoring during Dredging Operations of CMP Vd – January 2013*
- 1.5.13** *Impact Water Quality Monitoring during Dredging Operations of CMP Vd* was conducted on 23 January 2013. On the survey day, sampling was conducted during both mid-ebb and mid-flood tides at two Reference (Upstream) stations upstream and five Impact (Downstream) stations downstream of the dredging operations at CMP Vd (*Figure 1.3*). Monitoring was also conducted at Ma Wan station. At each station, *in-situ* measurements of water quality parameters as well as water samples were taken from three depths in the water column (ie surface: 1 m below sea surface, mid-depth and bottom: 1 m above the seabed). Where water depth is less than 6 m, the mid-depth station was omitted. If water depth is less than 3 m, only the mid-depth station was monitored.
- 1.5.14** Monitoring results are presented in *Table C1 of Annex C*. Levels of Dissolved Oxygen (DO), Turbidity and Suspended Solids (SS) complied with the Action and Limit Levels set in the Baseline Monitoring Report ⁽¹⁾.

(1) ERM (2009) Baseline Monitoring Report. Environmental Monitoring and Audit for Contaminated Mud Pit at Sha Chau (2009-2013) – Investigation. Agreement No. CE 4/2009(EP). Submitted to EPD in September 2009.



Figure 1.2

Cumulative Impacts Sediment Quality Monitoring Stations for CMPV

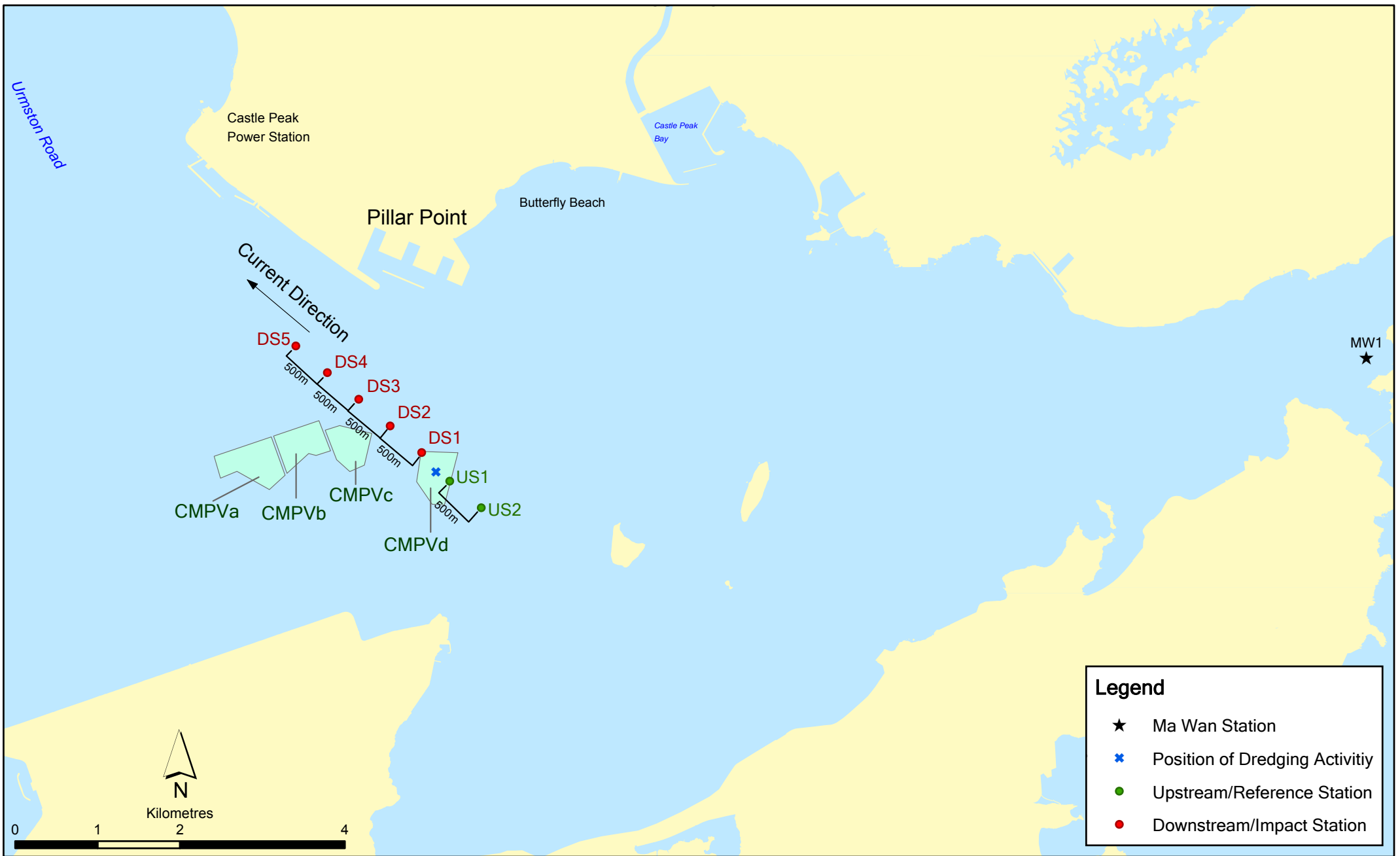


Figure 1.3

Indicative Dredging Impact Sampling Stations for CMPVd

Note: The locations of sampling stations will be determined on site based on current direction and position of dredging activities.

Legend

- ★ Ma Wan Station
- ✕ Position of Dredging Activity
- Upstream/Reference Station
- Downstream/Impact Station

1.5.15 Overall, there appears to be no unacceptable water quality impacts causing by the dredging operations at CMP Vd and no additional measures are thus considered required except for those stated in the Environmental Permit (EP-312/2008).

1.5.16 *Water Column Profiling for CMP Va – January 2013*

In-situ Measurements

1.5.17 Water Column Profiling was undertaken at a total of two sampling stations (Upstream and Downstream stations) in January 2013. The water quality monitoring results for January 2013 have been assessed for compliance with the Water Quality Objectives (WQOs) set by Environmental Protection Department (EPD). This consists of a review of the EPD routine water quality monitoring data for the dry season period (November to March) of 1999-2010 from stations in the Northwestern Water Control Zone, where the CMPs are located. For Salinity, the average value obtained from the Upstream station was used for the basis as the WQO. Graphical presentation of the monitoring results is provided in *Annex B*.

1.5.18 Analyses of results for January 2013 indicated that levels of Salinity, pH and DO complied with the WQOs at both Upstream and Downstream stations (*Figures 10 - 12 of Annex B*). DO and Turbidity complied with the Action and Limit Levels set in the *EM&A Manual* ⁽¹⁾.

Laboratory Measurements for Suspended Solids (SS)

1.5.19 Analyses of data obtained in January 2013 indicated that the SS levels at both Upstream and Downstream stations complied with the WQO (*Figure 13 of Annex B*). In addition, SS levels at all stations complied with the Action and Limit Levels set in the *EM&A Manual*.

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

(1) ERM (2009). Draft Second Review of the EM&A Manual. Prepared for CEDD for EM&A for Contaminated Mud Pit at Sha Chau (2009-2013) – Investigation Agreement No. CE 4/2009 (EP).

1.5.21 *Routine Water Quality Monitoring for CMP Va – January 2013*

1.5.22 The results for the Routine Water Quality Monitoring conducted during January 2013 in the dry season have been assessed for compliance with the WQOs set by EPD as presented in *Section 1.5.18* above (please see *Figure 1.4* for the monitoring locations). *In-situ* monitoring and laboratory results are shown in *Tables 1.2* and *1.3*, respectively, with graphical presentation provided in *Annex B*. Monitoring was undertaken at a total of ten stations in the reporting month.

In-situ Measurements

1.5.23 Analysis of results for January 2013 indicated that for all stations (Impact, Intermediate and Reference), levels of pH, DO and salinity complied with the WQOs (*Figures 14-17* of *Annex B*). Levels of DO and Turbidity within the reporting month complied with the Action and Limit Levels set in the *EM&A Manual* ⁽¹⁾ (*Figures 15 and 18* of *Annex B*). All *in-situ* water quality measurements showed relatively minor variations amongst Impact, Intermediate and Reference stations (*Figures 14-18* of *Annex B*).

Laboratory Measurements

1.5.24 Analyses of January 2013 results indicate that concentrations of Cadmium, Mercury and Silver were below their limit of reporting at all stations. Arsenic, Copper, Lead, Nickel and Zinc were detected in samples from all stations (*Figures 19 and 20* of *Annex B*). Concentrations of Arsenic, Chromium, Lead and Nickel appeared to be similar amongst all stations while concentration of Zinc was the highest at Reference stations. Levels of 5-day Biochemical Oxygen Demand (BOD₅), Total Inorganic Nitrogen (TIN) and NH₃-N were similar amongst all stations (*Figures 21 and 22* of *Annex C*). Concentrations of SS complied with the WQO (15.34 mg/L for dry season) and Action and Limit Levels at all stations within the reporting month (*Figure 23* of *Annex C*).

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

(1) ERM (2009). Draft Second Review of the EM&A Manual. Prepared for CEDD for EM&A for Contaminated Mud Pit at Sha Chau (2009-2013) – Investigation Agreement No. CE 4/2009 (EP).

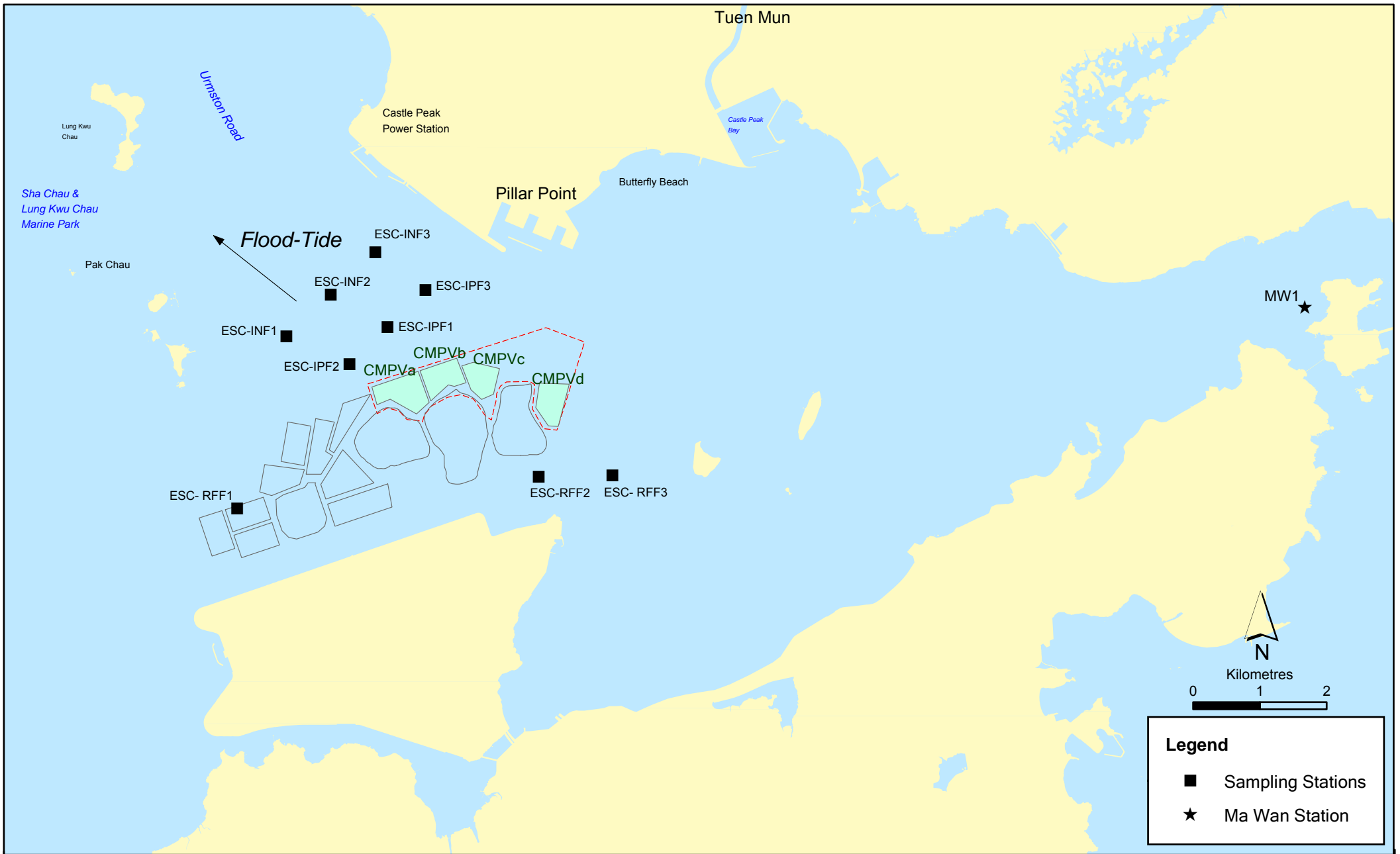


Figure 1.4

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

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Date: 3/12/2012

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Table 1.2 In-situ Monitoring Results for Routine Water Quality Monitoring during January 2013

Stations	Temp (°C)	Salinity	Turbidity (NTU)	pH	Dissolved Oxygen (%)	Dissolved Oxygen (mg L ⁻¹)
RFF (Reference)	17.36	32.12	3.12	7.79	100.47	7.94
IPF (Impact)	17.46	32.19	4.89	7.76	97.85	7.72
INF (Intermediate)	17.46	32.16	3.09	7.73	98.62	7.78
Ma Wan Station	17.60	32.87	2.54	7.73	93.10	7.29
WQO	N/A	28.91-35.33 [#]	N/A	6.5-8.5	N/A	>4

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

Table 1.3 Laboratory Results for Routine Water Quality Monitoring during January 2013

Stations	As (µg/L)	Ag (µg/L)	Cd (µg/L)	Cr (µg/L)	Cu (µg/L)	Hg (µg/L)	Pb (µg/L)	Ni (µg/L)	Zn (µg/L)	NH ₃ -N (mg/L)	TIN (mg/L)	BOD ₅ (mg/L)	SS (mg/L)
RFF	1.04	<LOR	<LOR	1.60	7.83	<LOR	4.42	3.83	10.79	0.17	0.38	2.41	4.88
IPF	1.13	<LOR	<LOR	1.00	11.08	<LOR	2.29	2.75	8.54	0.14	0.34	1.72	8.46
INF	<LOR	<LOR	<LOR	2.19	7.29	<LOR	2.63	4.58	8.88	0.12	0.34	2.15	5.08
Ma Wan Station	<LOR	<LOR	<LOR	1.44	7.56	<LOR	3.88	2.00	10.50	0.11	0.25	0.65	4.13
											WQO of SS		15.34

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 2013 for CMP V:

- *Pit Specific Sediment Chemistry* for CMP Va;
- *Cumulative Impact Sediment Chemistry* for CMP Va;
- *Sediment Toxicity* for CMP Va;
- *Tissue/ Whole Body Sampling* for CMP Va;
- *Demersal Trawling* for CMP Va;
- *Routine Water Quality Monitoring* for CMP Va;
- *Water Column Profiling* for CMP Va; and
- *Impact Water Quality Monitoring during Dredging Operations* for CMP Vd.

- 1.6.2 *Water Quality Monitoring during Capping* will be conducted for CMP IVc in the next monthly period of February 2013.
- 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 A1 - East of Sha Chau Environmental Monitoring and Audit Sampling Schedule for CMP IV (January 2012 - December 2013)

		2012												2013											
Tissue/ Whole Body Sampling		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Near-Pit Stations	INA		*																						
	INB		*																						
Reference North	TNA		*																						
	TNB		*																						
Reference South	TSA		*																						
	TSB		*																						
Demersal Trawling		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Near Pit Stations	INA 1-5		*	*																					
	INB 1-5		*	*																					
Reference North	TNA 1-5		*	*																					
	TNB 1-5		*	*																					
Reference South	TSA 1-5		*	*																					
	TSB 1-5		*	*																					
Capping		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
<i>Ebb Tide</i>																									
Impact Station Downcurrent	IPE1		*				*	*				*			*				*	*				*	
	IPE2		*				*	*				*			*				*	*				*	
	IPE3		*				*	*				*			*				*	*				*	
	IPE4		*				*	*				*			*				*	*				*	
	PFC1		*				*	*				*			*				*	*				*	
Intermediate Station Downcurrent	INE1		*				*	*				*			*				*	*				*	
	INE2		*				*	*				*			*				*	*				*	
	INE3		*				*	*				*			*				*	*				*	
	INE4		*				*	*				*			*				*	*				*	
	INE5		*				*	*				*			*				*	*				*	
Reference Station Upcurrent	RFE1		*				*	*				*			*				*	*				*	
	RFE2		*				*	*				*			*				*	*				*	
	RFE3		*				*	*				*			*				*	*				*	
	RFE4		*				*	*				*			*				*	*				*	
	RFE5		*				*	*				*			*				*	*				*	
<i>Flood Tide</i>																									
Impact Station Downcurrent	INF1		*				*	*				*			*				*	*				*	
	PFC2		*				*	*				*			*				*	*				*	
	INF3		*				*	*				*			*				*	*				*	
Intermediate Station Downcurrent	IPF1		*				*	*				*			*				*	*				*	
	IPF2		*				*	*				*			*				*	*				*	
	IPF3		*				*	*				*			*				*	*				*	
Reference Station Upcurrent	RFF1		*				*	*				*			*				*	*				*	
	RFF2		*				*	*				*			*				*	*				*	
	RFF3		*				*	*				*			*				*	*				*	
Water Column Profiling		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Plume Stations	WCP1		*																						
	WCP2		*																						
Benthic Recolonisation Studies		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Capped Contaminated Mud Pits III																									
CPA	1 grab per station							*				*								*				*	
CPB	1 grab per station							*				*								*				*	
CPC	1 grab per station							*				*								*				*	
Reference Stations																									
RBA	1 grab per station							*				*								*				*	
RBB	1 grab per station							*				*								*				*	
RBC	1 grab per station							*				*								*				*	

*n = Number of replicates depends on field catch or parameters

Light blue = Sampling completed
Yellow = Sampling to be completed

		2012												2013												2014	
Routine Water Quality Monitoring		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
Ebb Tide																											
Impact Station	ESC-IPE1		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-IPE2		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-IPE3		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-IPE4		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-IPE5		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
Intermediate Station	ESC-INE1		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-INE2		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-INE3		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-INE4		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-INE5		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
Reference Station	ESC-RFE1		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-RFE2		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-RFE3		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-RFE4		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-RFE5		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
Ma Wan Station	MW1		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
Flood Tide																											
Impact Station	ESC-IPF1		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-IPF2		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-IPF3		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
Intermediate Station	ESC-INF1		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-INF2		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-INF3		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
Reference Station	ESC-RFF1		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-RFF2		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
	ESC-RFF3		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
Ma Wan Station	MW1		*		*	*		*	*		*	*		*	*		*	*		*	*		*	*		*	*
Water Column Profiling		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
Plume Stations	WCP1		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	WCP2		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Benthic Recolonisation Studies		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
Capped Contaminated Mud Pits IVa-c																											
Reference Stations	ESC-CPA							*				*							*				*			*	
	ESC-CPB							*				*							*				*			*	
	ESC-CPC							*				*							*				*			*	
	ESC-RBA							*				*							*				*			*	
	ESC-RBB							*				*							*				*			*	
	ESC-RBC							*				*							*				*			*	
Impact Monitoring for Dredging		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
Upstream/Reference Stations	US1		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	US2		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Downstream/Impact Stations	DS1		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	DS2		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	DS3		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	DS4		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	DS5		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Ma Wan Station	MW1		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	

Sampling completed
 Sampling to be completed

Annex B

Monitoring Results

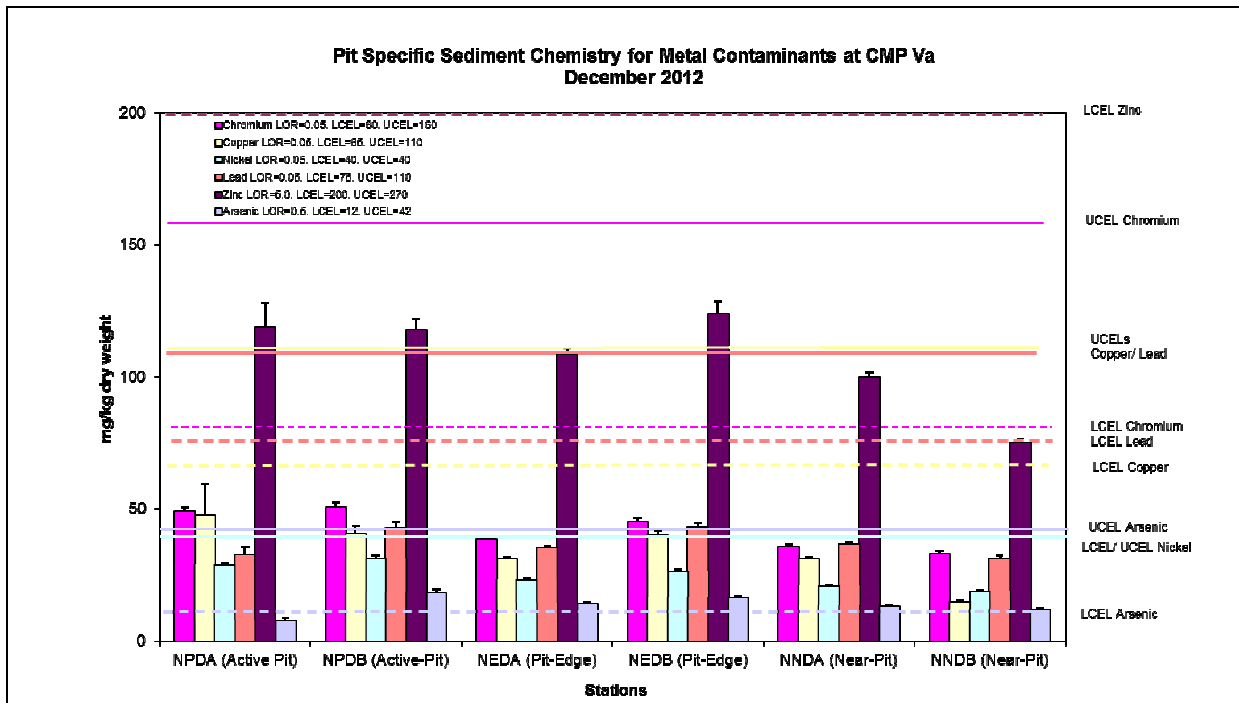


Figure 1: Concentration of Metals (Cr, Cu, Ni, Pb, Zn, As; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP Va in December 2012.

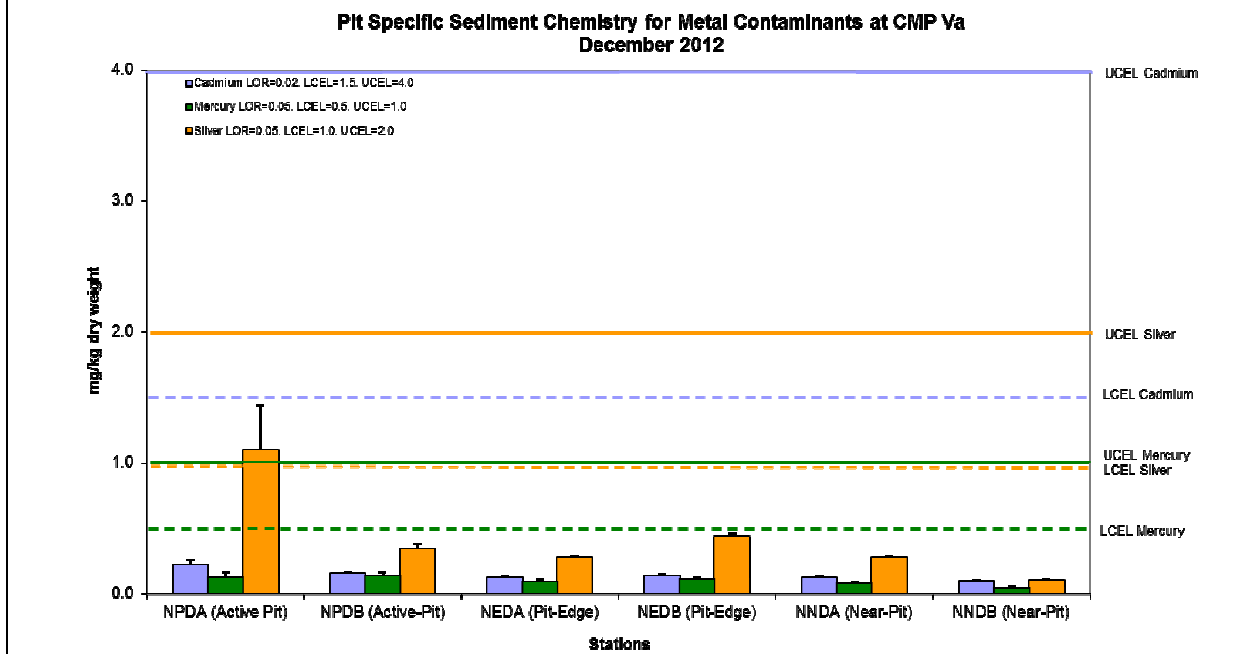


Figure 2: Concentration of Metals (Cd, Hg, Ag; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP Va in December 2012.

Source: H:\Team\EM\GMS Projects\0103262 CEDD EM&A for CMP at Sha Chau\05 Deliverables\01 CMP\05 Monthly Reports\43rd (Jan 13)

Date: 15/2/13

Environmental Resources Management



**Pit Specific Sediment Chemistry for Total Organic Carbon (TOC) at CMP Va
December 2012**

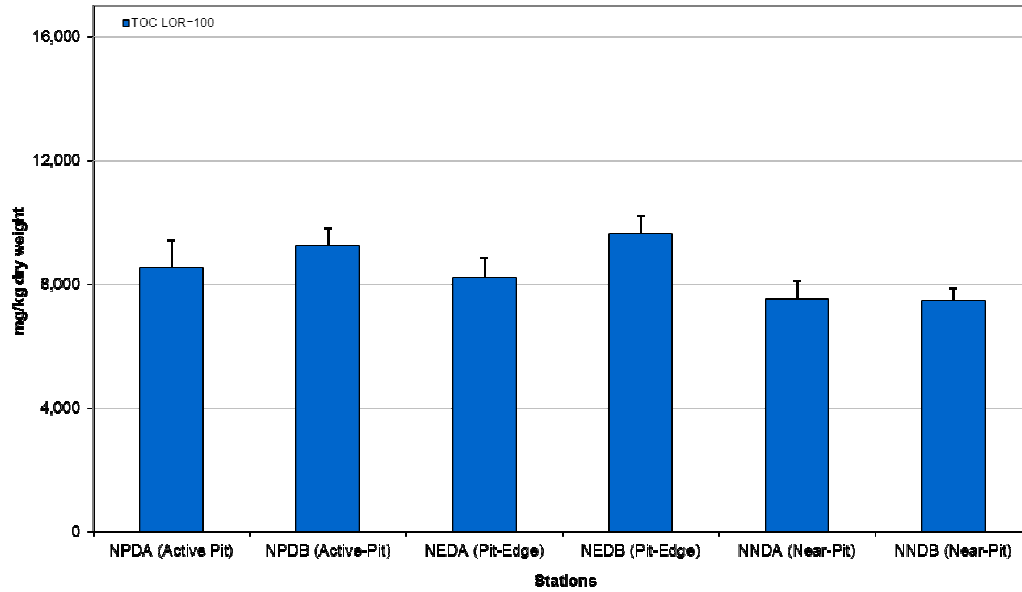


Figure 3: Concentration of Total Organic Carbon (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP Va in December 2012.

Pit Specific Sediment Chemistry for Tributyltin (TBT) at CMP Va in December 2012

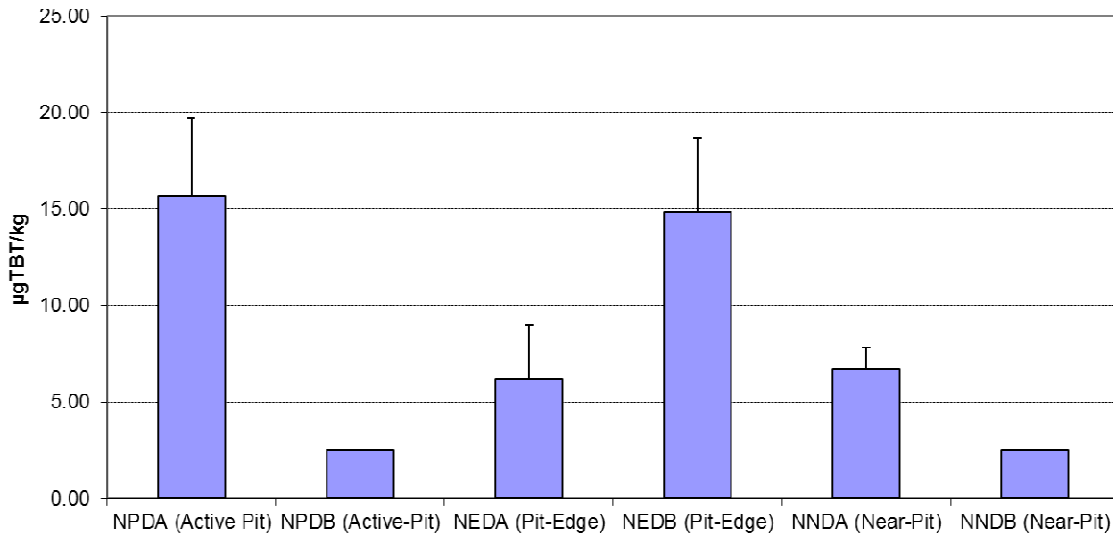


Figure 4: Concentration of Tributyltin (µg TBT/kg; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring of CMP Va in December 2012.

Source: H:\Team\EM\GMS Projects\0103262 CEDD EM&A for CMP at Sha Chau\05 Deliverables\01 CMP\05 Monthly Reports\43rd (Jan 13)

Date: 15/2/13

**Environmental
Resources
Management**



Pit Specific Sediment Chemistry for Low and High Molecular Weight Polycyclic Aromatics Hydrocarbons (PAHs) at CMP Va in December 2012

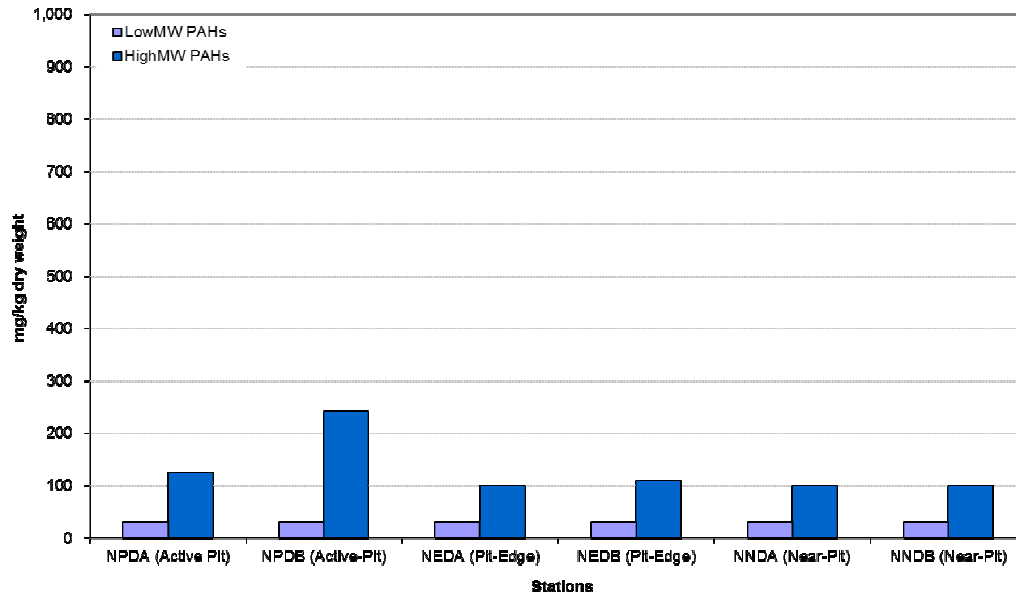


Figure 5: Concentration of Low and High Molecular Weight Polycyclic Aromatics Hydrocarbons (PAHs) ($\mu\text{g}/\text{kg}$; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP Va in December 2012.

Source: H:\Team\EM\GMS Projects\0103262 CEDD EM&A for CMP at Sha Chau\05 Deliverables\01 CMP\05 Monthly Reports\43rd (Jan 13)

Date: 15/2/13

**Environmental
Resources
Management**



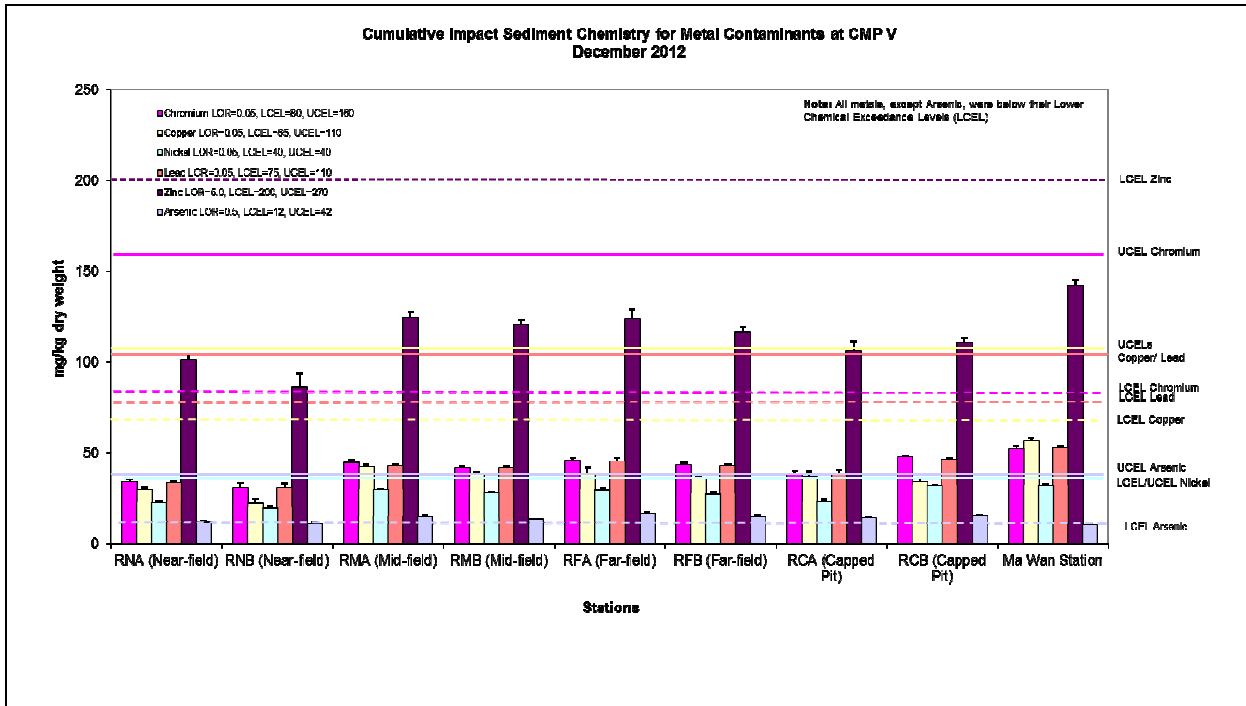


Figure 6: Concentration of Metals (Cr, Cu, Ni, Pb, Zn, As; mean + SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for CMP Va in December 2012.

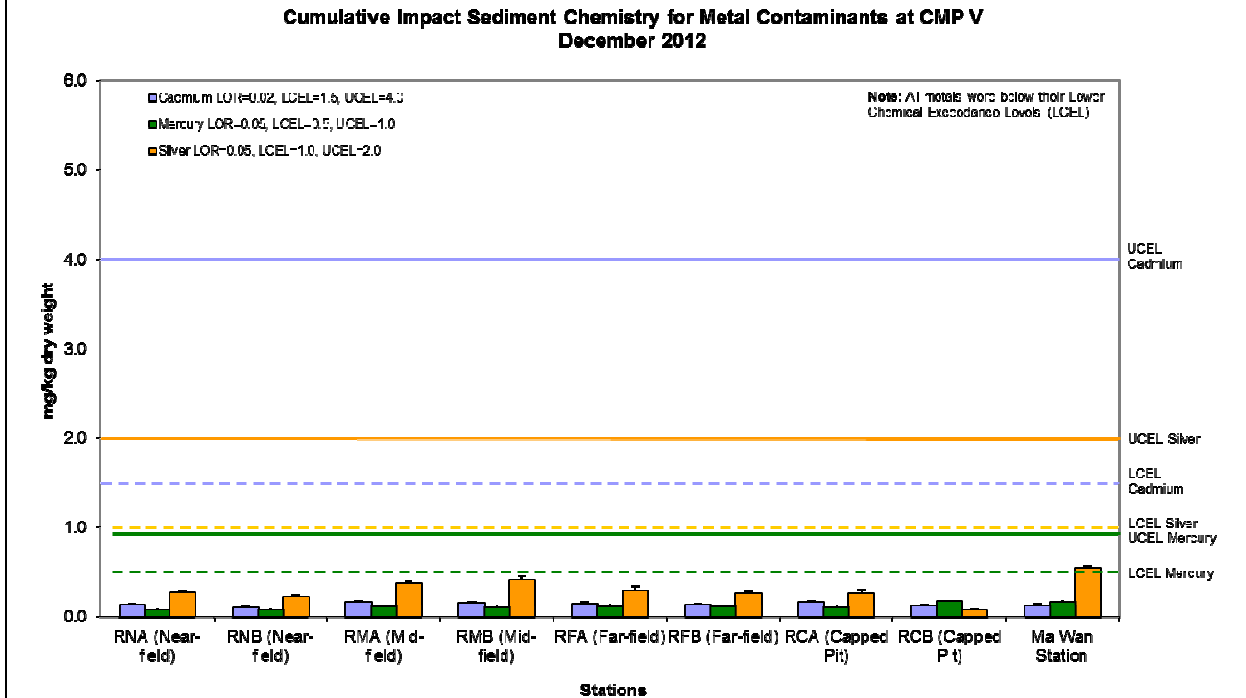


Figure 7: Concentration of Metals (Cd, Hg, Ag; mean + SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring of CMP Va in December 2012.

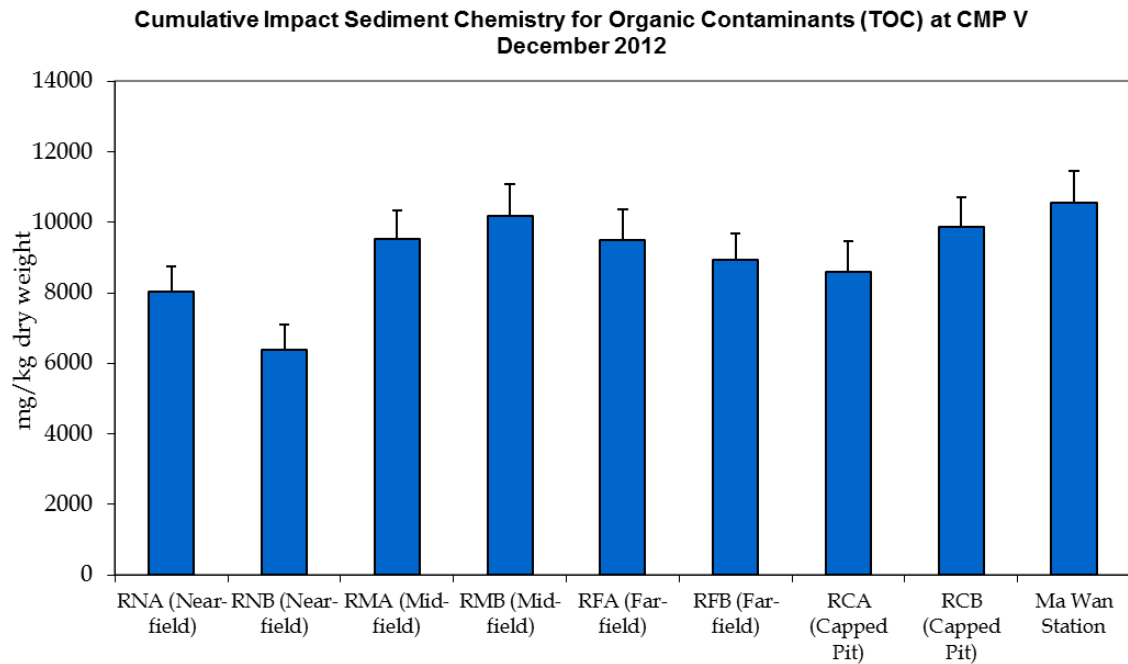


Figure 8: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean + SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring of CMP Va in December 2012.

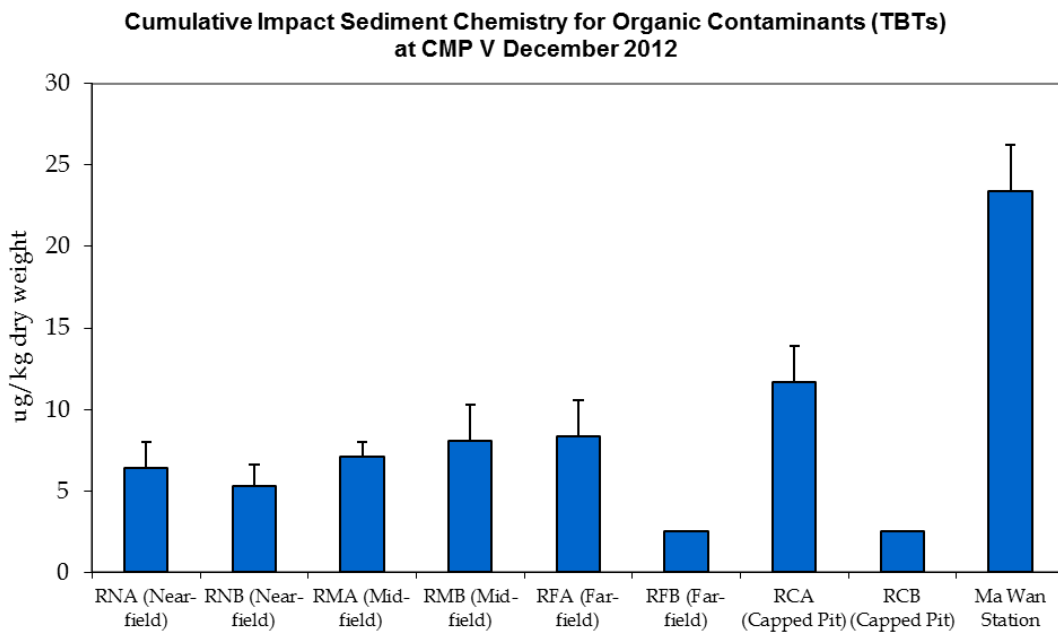


Figure 9: Concentration of Tributyltin ($\mu\text{g TBT/kg}$; mean + SD) in sediment samples collected from Cumulative Impact Chemistry Monitoring of CMP Va in December 2012.

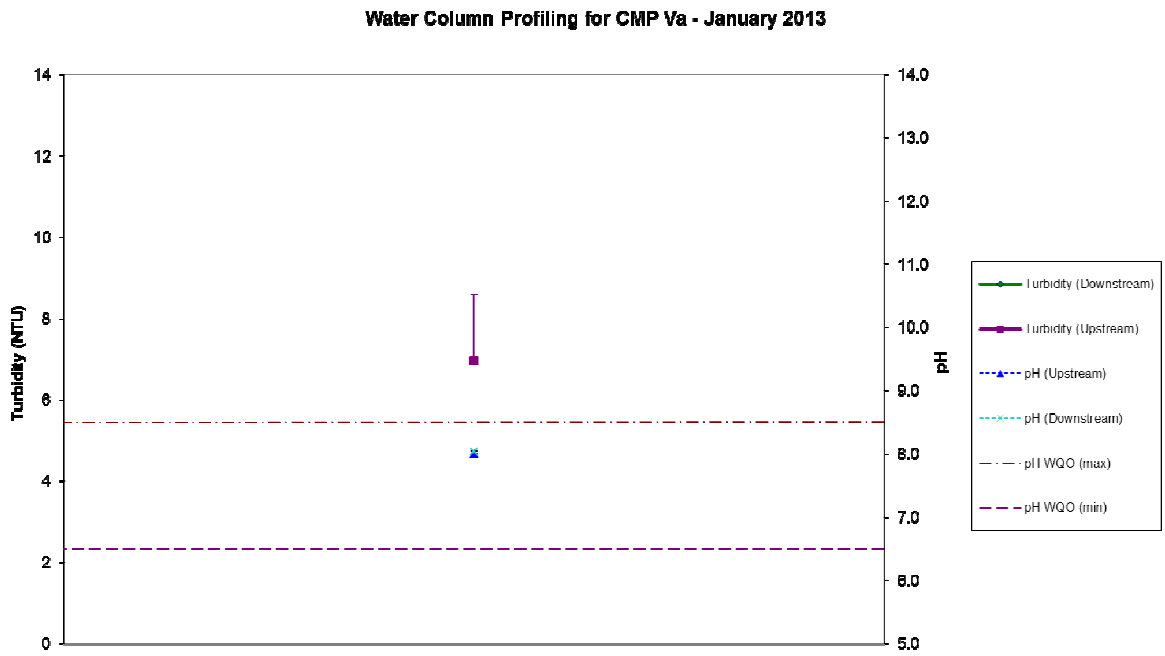


Figure 10: Turbidity and pH (mean + SD) recorded during Water Column Profiling for disposal operations at CMP Va in January 2013.

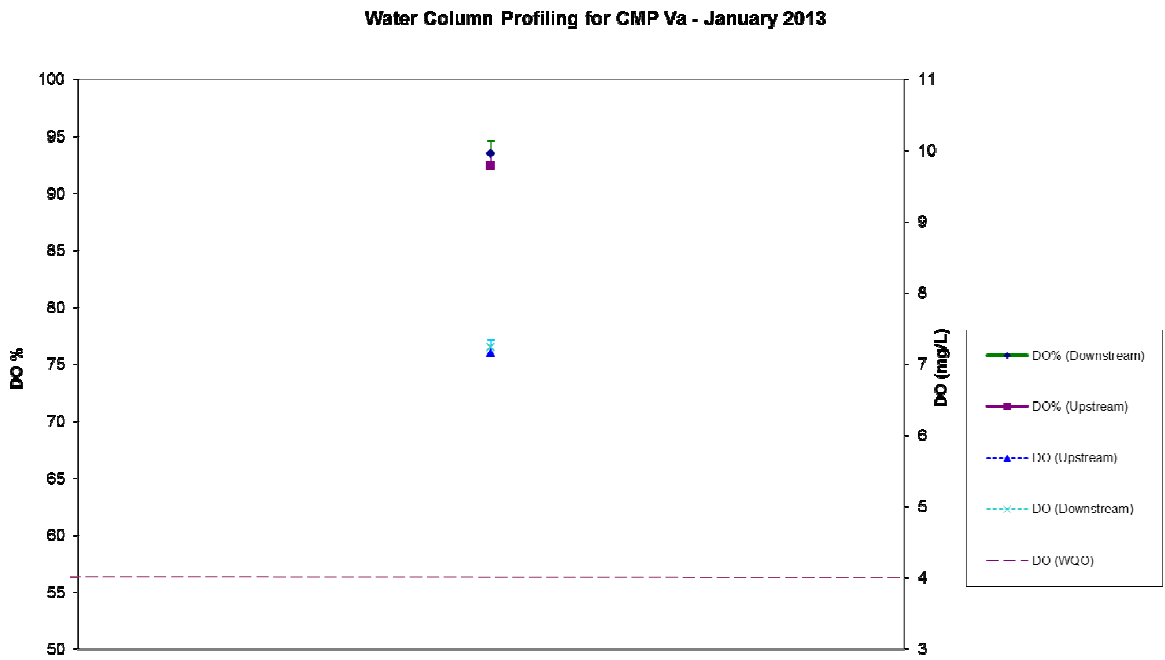


Figure 11: Dissolved Oxygen (mean + SD) recorded during Water Column Profiling for disposal operations at CMP Va in January 2013.

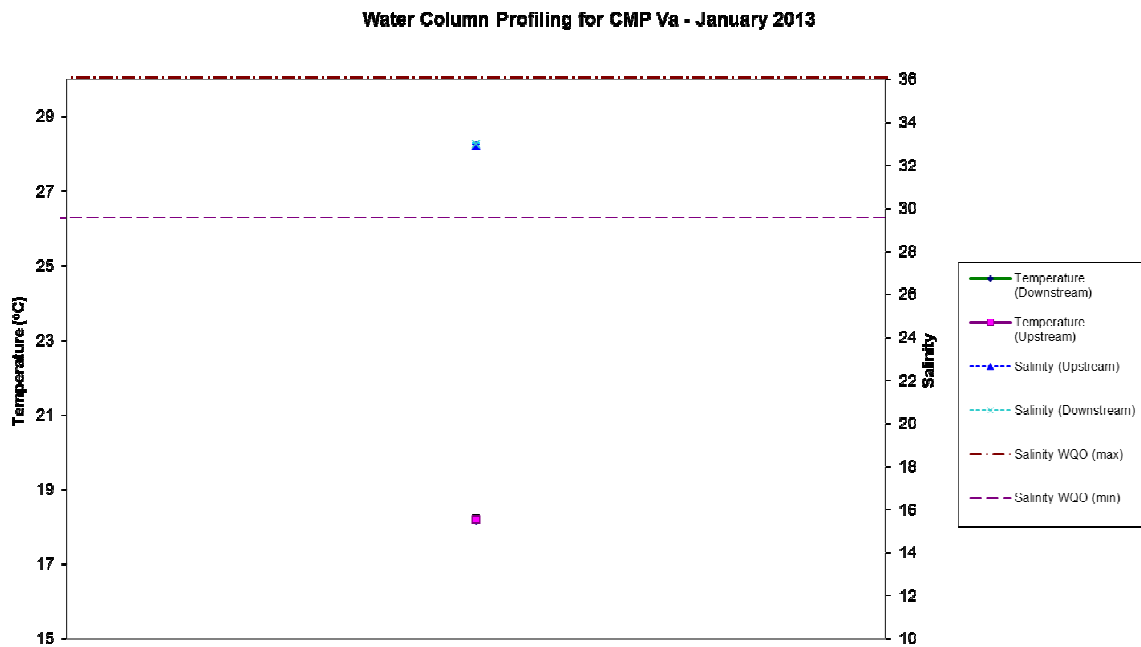


Figure 12: Salinity and Temperature (mean + SD) recorded during Water Column Profiling for disposal operations at CMP Va in January 2013.

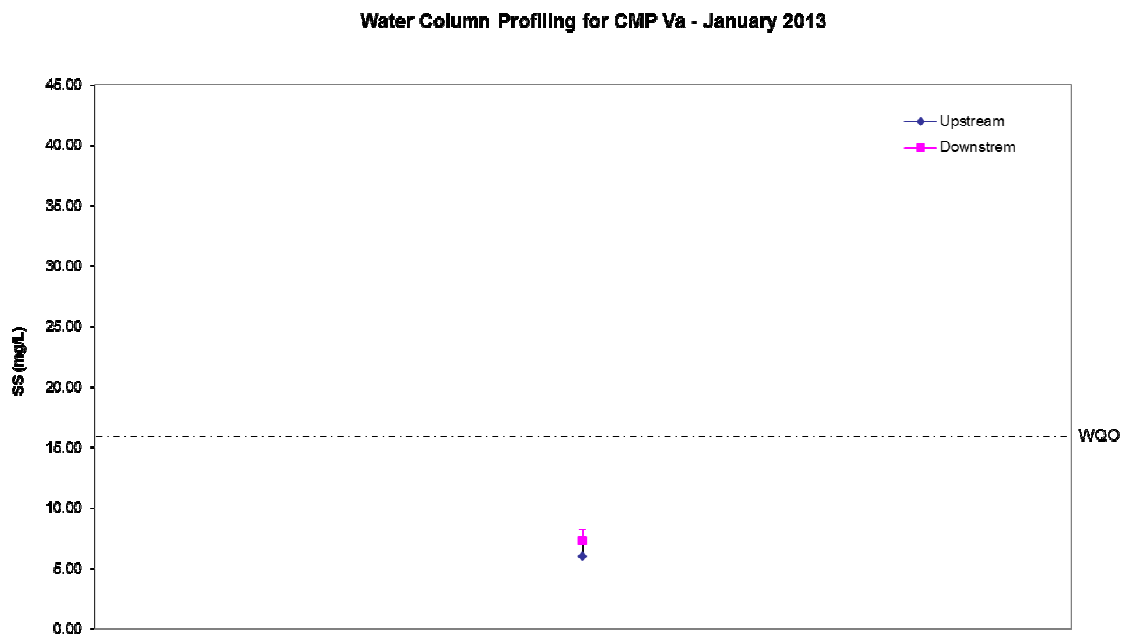


Figure 13: Suspended Solids (mean + SD) recorded during Water Column Profiling for disposal operations at CMP Va in January 2013.

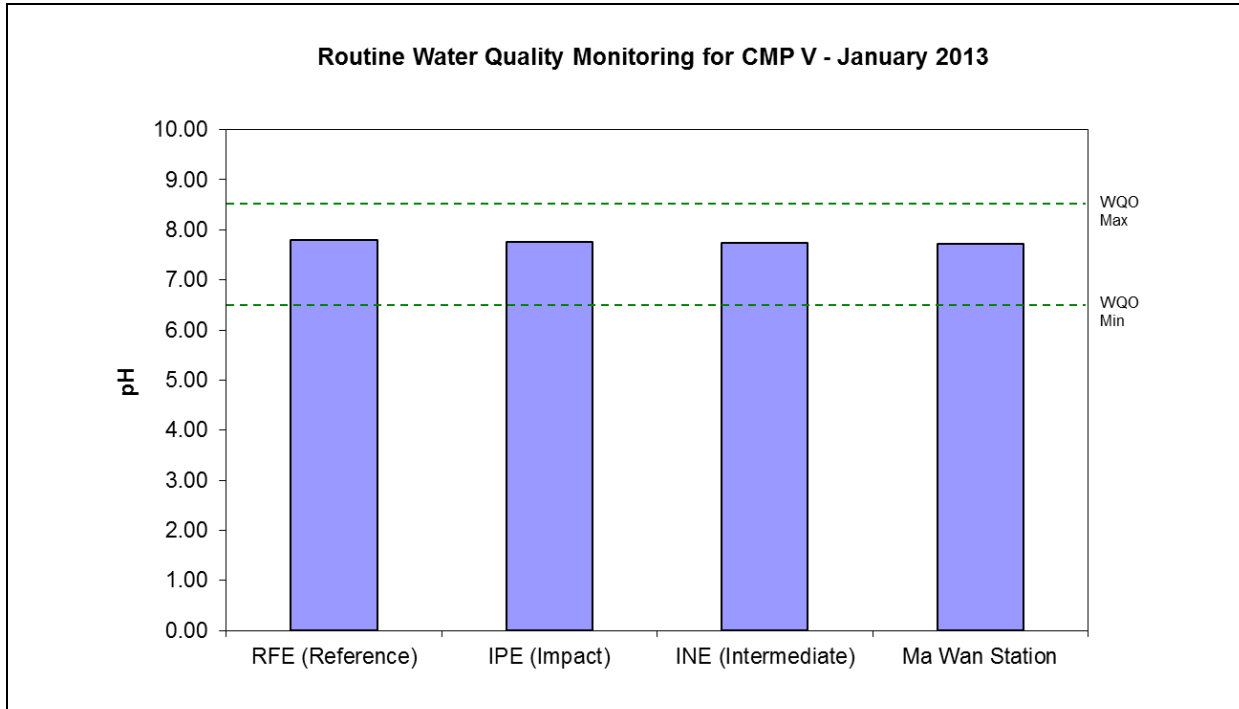


Figure 14: Level of pH (mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP Va in January 2013.

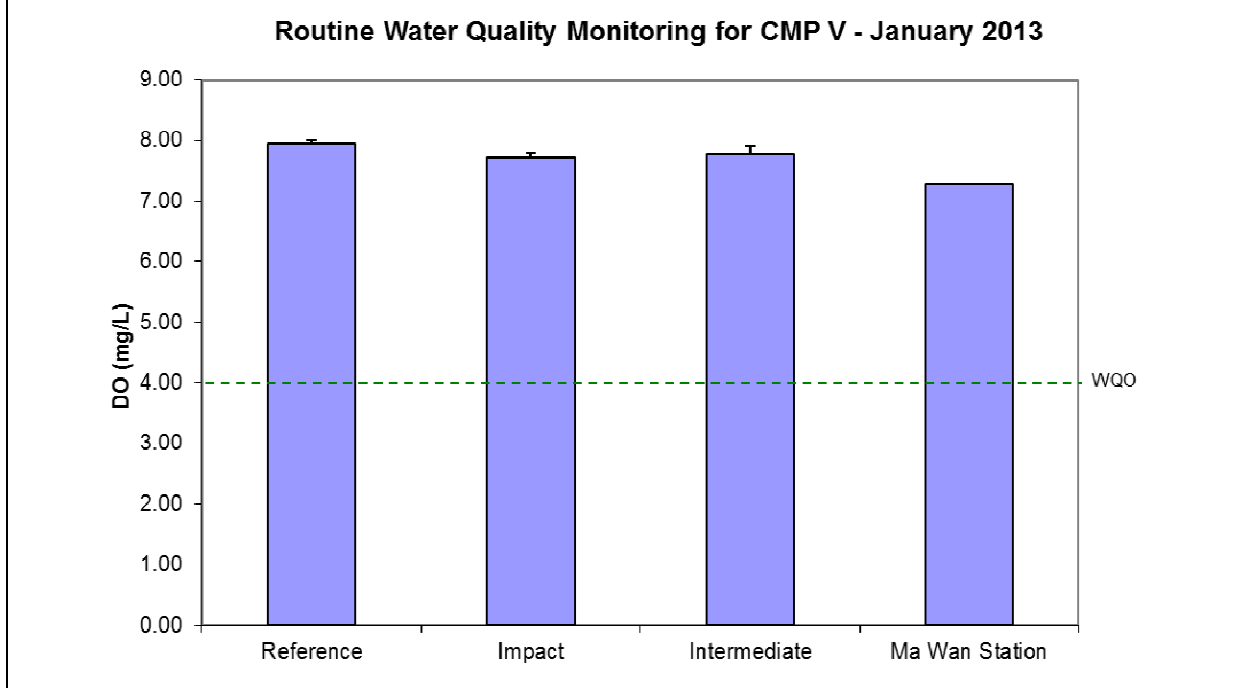


Figure 15: Concentration of Dissolved Oxygen (mg/L; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP Va in January 2013.

Routine Water Quality Monitoring for CMP V - January 2013

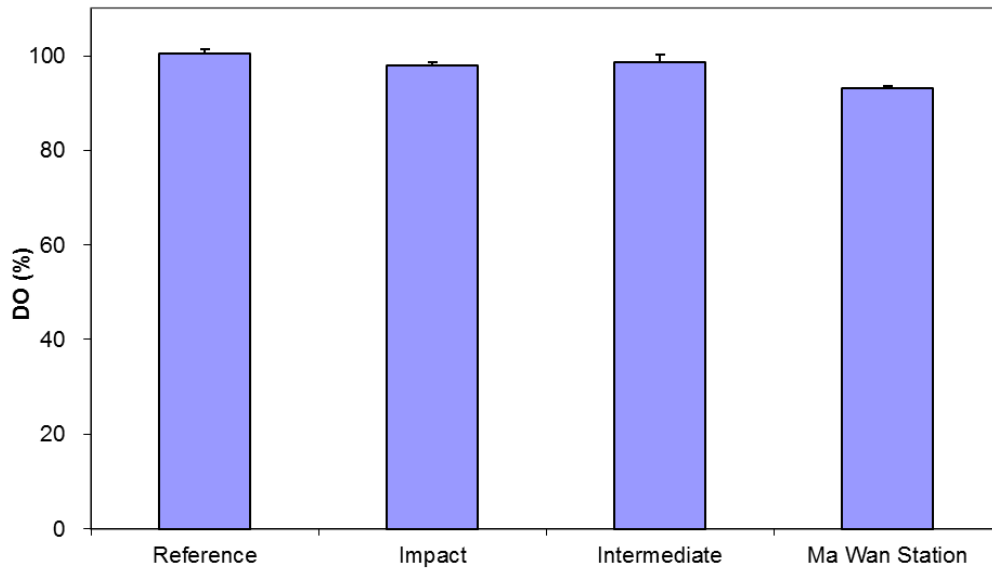


Figure 16: Level of Dissolved Oxygen (% saturation; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP Va in January 2013.

Routine Water Quality Monitoring for CMP V - January 2013

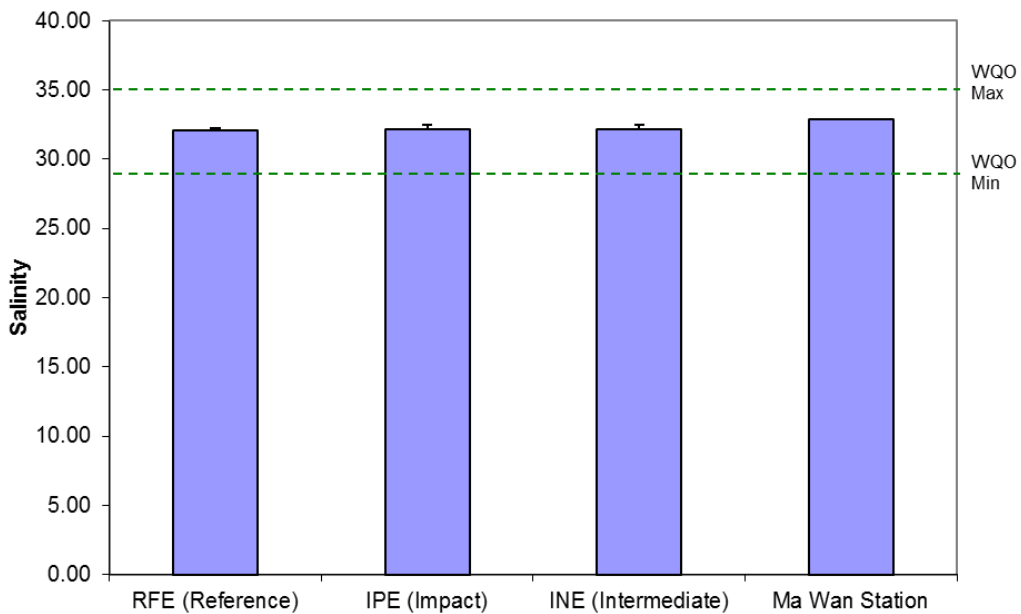


Figure 17: Level of Salinity (mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP Va in January 2013.

Routine Water Quality Monitoring for CMP V - January 2013

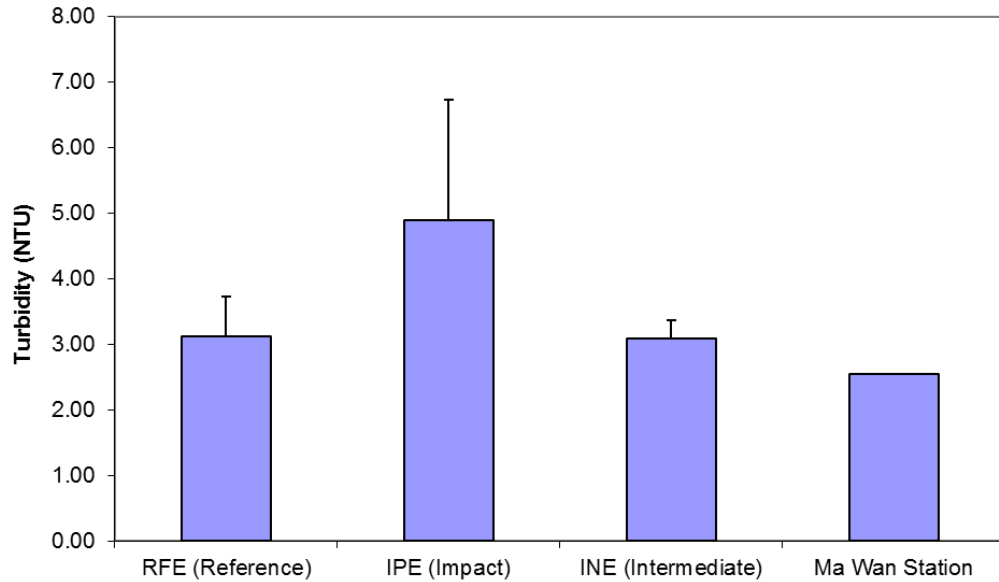


Figure 18: Level of Turbidity (NTU; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP Va in January 2013.

Routine Water Quality Monitoring Results for Metals January 2013

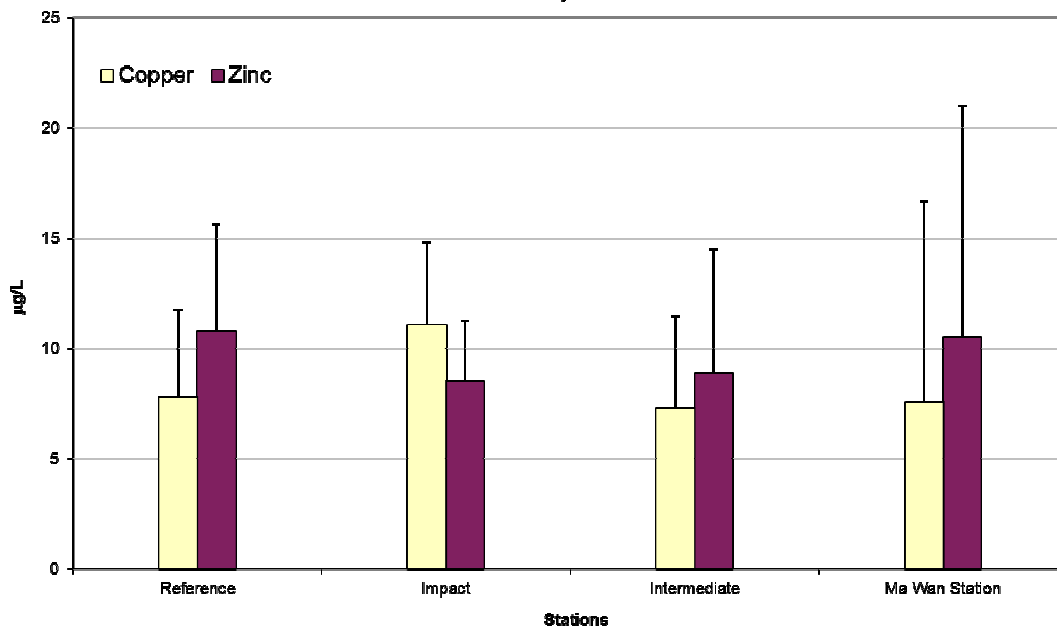


Figure 19: Concentration of Copper and Zinc (mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP Va in January 2013.

**Routine Water Quality Monitoring Results for Metals
January 2013**

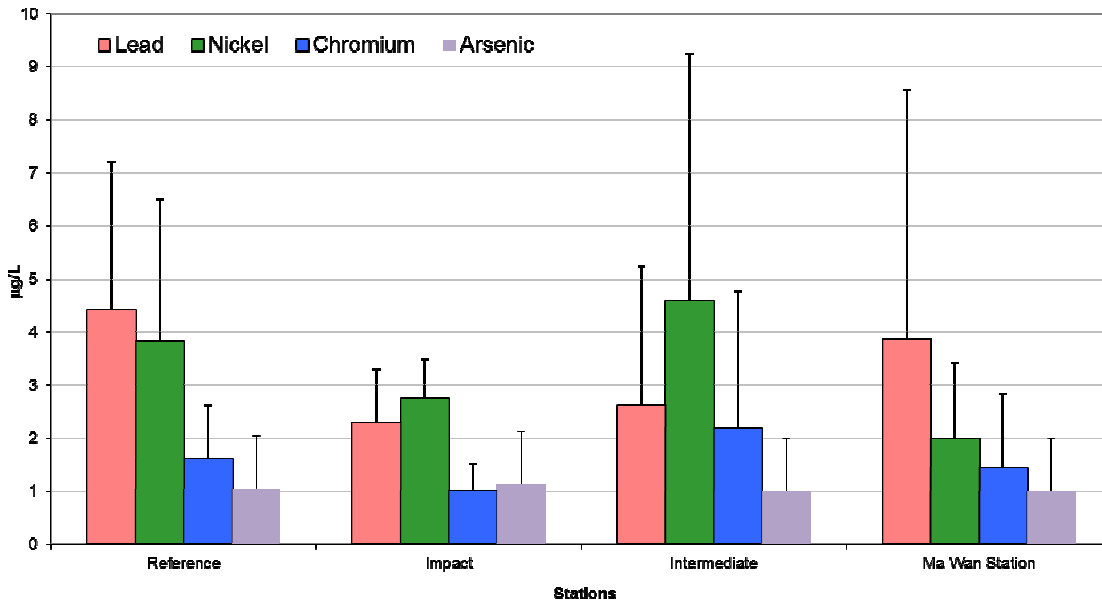


Figure 20: Concentration of Lead, Nickel, Chromium and Arsenic (mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP Va in January 2013.

**Routine Water Quality Monitoring Results for Biochemical Oxygen Demand (BOD₅)
January 2013**

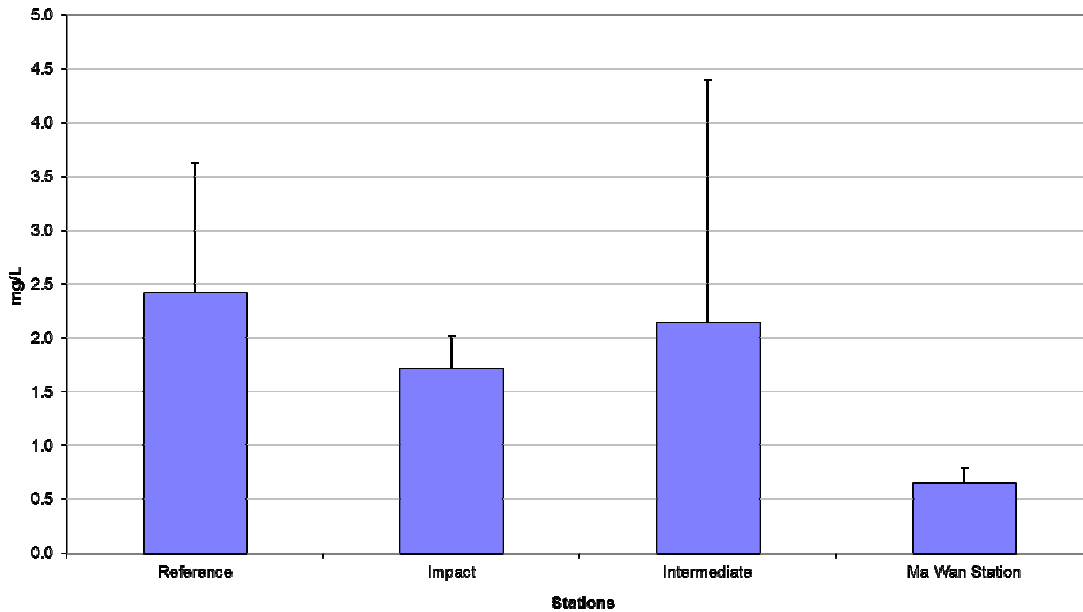


Figure 21: Level of Biochemical Oxygen Demand (BOD₅; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP Va in January 2013.

Source: H:\Team\EM\GMS Projects\0103262 CEDD EM&A for CMP at Sha Chau\05 Deliverables\01 CMP\05 Monthly Reports\43rd (Jan 13)

Date: 15/2/13

**Environmental
Resources
Management**



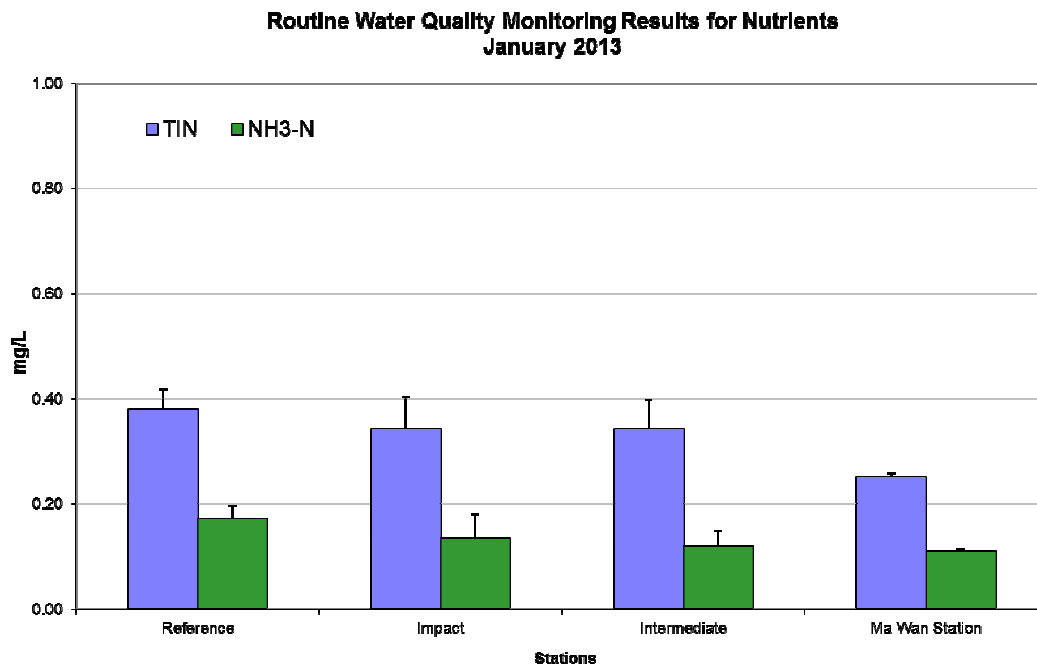


Figure 22: Concentration of Total Inorganic Nitrogen and NH₃-N (mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP Va in January 2013.

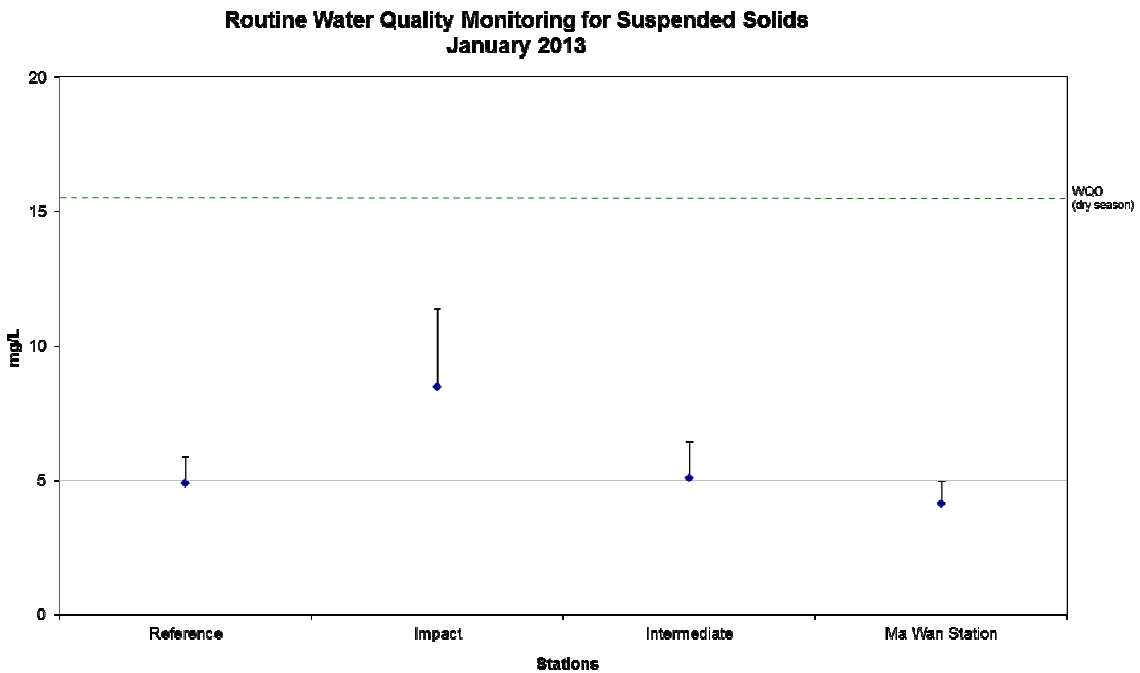


Figure 23: Concentration of Suspended Solids (mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP Va in January 2013.

Annex C

Results of Impact
Monitoring during CMP Vd
Dredging Operations for
January 2013

Table C1 *Summary Table of DO, Turbidity and SS Levels Recorded in January 2013*

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2013/1/23	ME	DS1	8.09	8.59	2.92	4.17
		DS2	8.32	8.69	2.34	3.33
		DS3	8.16	8.36	2.16	4.00
		DS4	8.19	8.47	1.77	3.17
		DS5	8.24	8.53	2.72	5.00
		MW1	7.32	7.30	2.16	4.00
		US1	8.41	8.60	4.09	6.17
		US2	7.99	8.63	2.97	5.00
	MF	DS1	7.93	8.68	10.09	14.33
		DS2	8.35	9.14	6.06	16.50
		DS3	7.84	8.30	2.26	3.00
		DS4	7.95	8.39	2.24	3.33
		DS5	8.13	8.76	3.21	4.50
		MW1	7.10	7.16	1.61	2.83
		US1	7.96	8.72	2.32	3.67
		US2	8.58	9.28	2.21	2.00

Notes:

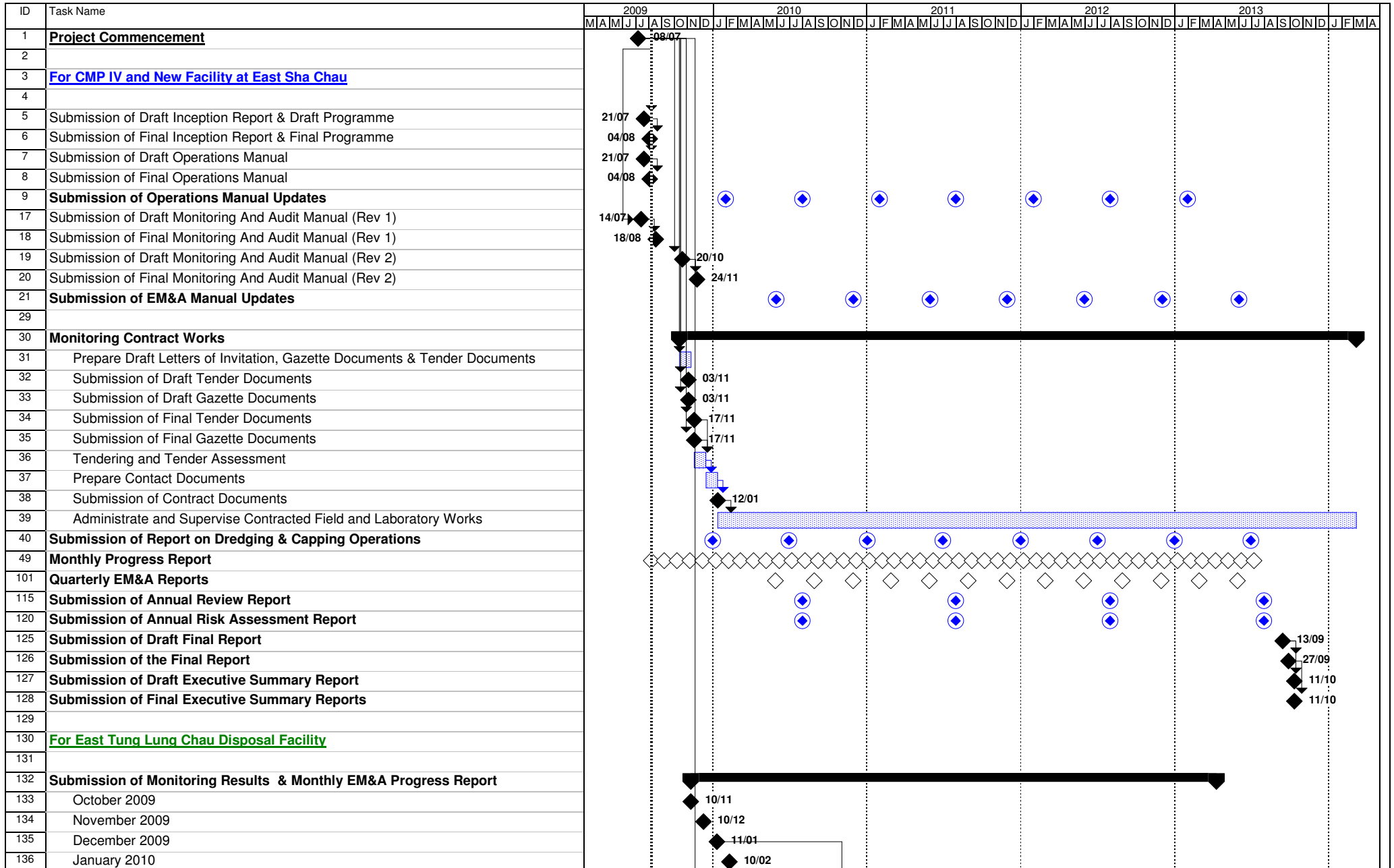
1. Please refer to Table C2 below for the Action and Limit Levels for dredging activities.
2. Cell shaded yellow indicated value exceeding the Action Level criteria.
3. Cell shaded red indicated value exceeding the Limit Level criteria.

Table C2 *Action and Limit Levels of Water Quality for Dredging Activities*

Parameter	Action Level	Limit Level
Dissolved Oxygen (DO) ⁽¹⁾	<u>Surface and Mid-depth</u> ⁽²⁾ 5%-ile of baseline data for surface and middle layer = 3.76 mg L ⁻¹	<u>Surface and Mid-depth</u> ⁽²⁾ 1%-ile of baseline data for surface and middle layer = 3.11 mg L ⁻¹ ⁽³⁾
	and	and
	Significantly less than the reference stations mean DO (at the same tide of the same day)	Significantly less than the reference stations mean DO (at the same tide of the same day)
	<u>Bottom</u> 5%-ile of baseline data for bottom layers = 2.96 mg L ⁻¹	<u>Bottom</u> The average of the impact station readings are <2 mg/L
	and	and
	Significantly less than the reference stations mean DO (at the same tide of the same day)	Significantly less than the reference stations mean DO (at the same tide of the same day)
Depth-averaged Suspended Solids (SS) ^{(4) (5)}	95%-ile of baseline data for depth average = 37.88 mg L ⁻¹	99%-ile of baseline data for depth average = 61.92 mg L ⁻¹
	and	and
	120% of control station's SS at the same tide of the same day	130% of control station's SS at the same tide of the same day
Depth-averaged Turbidity (Tby) ^{(4) (5)}	95%-ile of baseline data = 28.14 NTU	99%-ile of baseline data = 38.32 NTU
	and	and
	120% of control station's Tby at the same tide of the same day	130% of control station's Tby at the same tide of the same day
Notes:		
(1) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.		
(2) The Action and Limit Levels for DO for Surface & Middle layers were calculated from the combined pool of baseline surface layer data and baseline middle layer data.		
(3) Given the Action Level for DO for Surface & Middle layers has already been lower than 4 mg L ⁻¹ , it is proposed to set the Limit Level at 3.11 mg L ⁻¹ which is the first percentile of the baseline data.		
(4) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.		
(5) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.		

Annex D

Study Programme



Project: Agreement No. CE 4/2009 (EP) Environmental Monitoring and Audit for Contaminated Mud Pits at Sha Chau (2009-2013) - Investigation

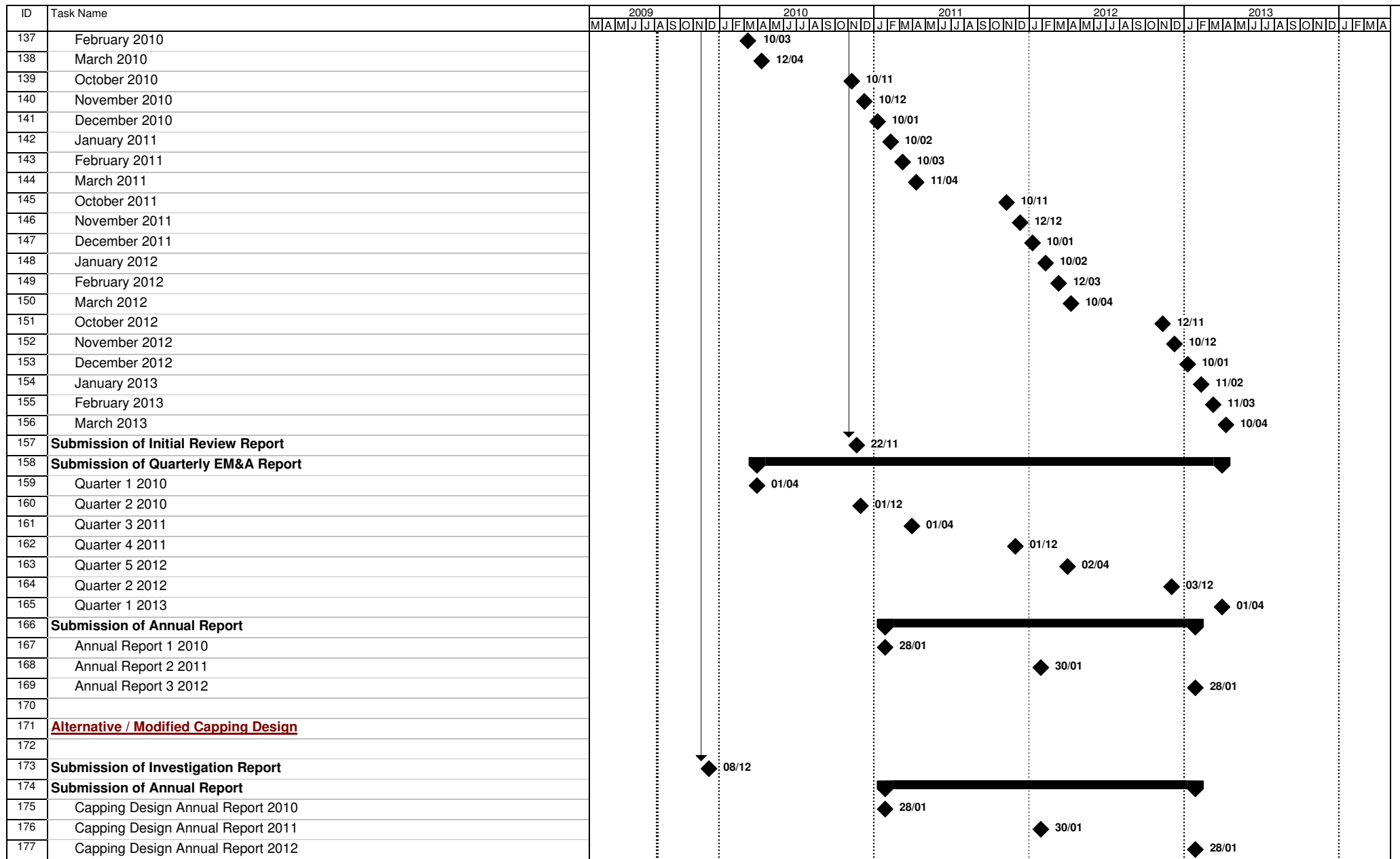


Figure 4.1 - Study Programme

