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1 INTRODUCTION

1.1 Project Background

1.1.1 The Hong Kong-Zhuhai-Macao Bridge (HZMB), when completed, will enhance accessibility between the Hong Kong International Airport (HKIA) and the Pearl River Delta (PRD). To capitalize on the HZMB, the Airport Authority Hong Kong (AAHK) is planning to introduce a hassle-free bonded vehicle service between existing HKIA and the PRD West through Hong Kong Boundary Crossing Facilities (HKBCF), similar to the bonded ferry service plying between the HKIA's SkyPier and nine ports in the PRD, which would be substantially strengthen HKIA's capability in extending its catchment area to PRD West. To meet this demand, the AAHK plans to construct the ITT adjacent to the SkyPier and it is necessary to build a bonded connection between the ITT and the HKBCF to enable intermodal transfer of HKIA's air passengers to/from the HZMB without the need to go through Hong Kong's immigration clearance. The provision of land connection between ITT and HKBCF has been proposed by the AAHK.

1.1.2 After thorough consideration, AAHK decided to provide the land connection in the form of a bridge, namely Bonded Vehicular Bridge, to provide a direct and effective linkage between the ITT and the HKBCF (hereafter referred to as the "Project"). The location of the Project is shown in **Figure 1.1**. Only air transit passengers by bonded vehicles will be permitted to access the area, and no public vehicle will be allowed to access the Bonded Vehicular Bridge.

1.1.3 An application for an Environmental Impact Assessment (EIA) Study Brief under Section 5(1)(a) of the Environmental Impact Assessment Ordinance (EIAO) was submitted on 30 August 2017 with a Project Profile (No. PP-556/2017) for the Project. An EIA Study Brief (No. ESB-302/2017) was issued by EPD on 10 October 2017.

1.2 Designated Projects

1.2.1 The Project is classified as the following Designated Projects (DPs) under Part I, Schedule 2 of the EIAO.

- Item A.8 - A road or railway bridge more than 100 m in length between abutments; and
- Item C.3(a) - Reclamation works resulting in 5% decrease in cross sectional area calculated on the basis of 0.0 mPD in a sea channel.

1.3 Description of Site Location of the Project and History

1.3.1 The Project site is situated between the HKBCF Island and the HKIA, at the south of the existing SkyPier. The Bonded Vehicular Bridge serves as a connection between the ITT at the south of SkyPier at HKIA and HKBCF Island. Location of the Project site and layout are shown in **Figure 1.1**.

1.3.2 The marine section of the site is a sea channel between HKIA and HKBCF Island, which exists before the reclamation of the airport island and the recent reclamation of the HKBCF Island in 2011.

1.4 Size, Scale, Shape and Design of the Project

1.4.1 The Bonded Vehicular Bridge consists of a marine section and a land section on HKBCF. The marine section is a 5-span continuous deck marine viaduct connecting with the transition deck at Level 5 of ITT, with a total length of approximately 360 m supported by 6 piers; span length of ~76 m is generally adopted. The land section viaduct is on curve going over the HKBCF seawall and proposed Topside Development. The land viaduct is a 3-span continuous deck with a total length of approximately 210 m and span length up to ~70 m. Box girder bridge deck section is recommended for the whole bridge, which has an overall

deck width between ~11 m and ~15 m, and a constant deck thickness of ~3 m. As advised by AAHK, electric vehicles will be adopted for the hassle-free bonded vehicle service, i.e. cross boundary bus trips and limousine trips, between the ITT and the HKBCF through the bonded vehicular bridge and associated roads.

1.5 Construction Methods and Engineering Requirements

1.5.1 No open sea dredging will be involved for the Bonded Vehicular Bridge construction. Marine bored piles with temporary casing will be adopted for construction of the sea portion of the bridge foundation. Oscillator and Reverse Circulation Drill will be used for excavation of soil and rock socket respectively and then installing steel reinforcement fixing with permanent casing for concreting. This construction method could minimize the risk of disturbance to the seabed and the adjacent marine environment. The foundations and piers on top are located away from the sea walls such that the sea walls will not be disturbed during the bridge construction. The marine bridge deck section will be constructed and casted in an off-site fabrication yard. The precast bridge deck sections will be transported by barges and lifted into position.

1.5.2 The construction of the bridge land portion of the Project on the HKBCF Island composes of viaducts and associated staging facilities and underground utilities. Conventional method such as bored pile and pre-cast bridge span construction method with corresponding environmental impact mitigation measures will be adopted.

1.6 Works Programme

1.6.1 The construction works of the Project will tentatively commence in 2020 for completion in 2022.

1.7 Objective of this Plan

1.7.1 In accordance with the Clause 3 in Appendix D of the EIA Study Brief (No. ESB-302/2017), the Applicant shall identify and estimate dredging/excavation, dredged/excavated sediment/mud transportation and disposal activities and requirements. Potential dumping ground to be involved shall also be identified. Appropriate field investigation, sampling and chemical and biological laboratory tests to characterise the sediment/mud concerned shall be conducted. The ranges of parameters to be analysed; the number, type and methods of sampling; sample preservation; chemical and biological laboratory test methods to be used shall be agreed with the Director of Environmental Protection (DEP) prior to the commencement of the tests.

1.7.2 This Sediment Sampling and Testing Plan (SSTP) is to present the above sediment sampling and testing requirements according to the Clause 3 in Appendix D of the EIA Study Brief for DEP agreement. The SSTP is prepared with reference to the *Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers ADV-21 - Management Framework for Disposal of Dredged/Excavated Sediment* (PNAP ADV-21). Findings from the sediment sampling and testing exercise will be used to assess the waste management implications associated with the sediment dredging/excavation under the EIA Study.

1.7.3 It should be noted that to fulfil the requirements under the Dumping at Sea Ordinance (DASO), the Applicant should also submit a separate SSTP to EPD for agreement for the application of the dumping permit. Furthermore, the rationale for sediment removal should also be provided to the Secretary of Marine Fill Committee (MFC) for agreement in accordance with PNAP ADV-21.

2 Environmental Guidelines and Criteria

2.1 General

2.1.1 The PNAP ADV-21 sets out the procedure for seeking approval to and the management framework for marine disposal of dredged/excavated sediment. It outlines the requirements to be followed in assessing and classifying the sediment and explains the marine disposal arrangement for the classified material. Based on the PNAP ADV-21, there are 3 types of disposal options for dredged/excavated sediments:

- Type 1 - Open Sea Disposal or Open Sea Disposal in Dedicated Sites;
- Type 2 - Confined Marine Disposal; and
- Type 3 - Special Treatment / Disposal.

2.1.2 According to Appendix C of PNAP ADV-21, the management framework of dredged/excavated sediment in Hong Kong is implemented under the following three-tier approach. The management framework for dredged/excavated sediment is shown in **Appendix 2.1.**

2.2 Tier I Screening

2.2.1 Tier I screening is a desktop study to review the available information and to determine whether the sediment of concern belongs to Category L materials that are suitable for open sea disposal. If there is insufficient information to arrive at such conclusion, Tier II chemical screening should be proceeded accordingly.

2.3 Tier II Chemical Screening

2.3.1 The Tier II chemical screening is designed to categorise the sediment based on its chemical contaminant levels and to determine whether the sediment is suitable for open sea disposal without further testing. Sediment will be assessed according to the sediment quality criteria for the classification of sediment as stipulated in PNAP ADV-21 and as shown in **Table 2.1** below.

Table 2.1 Sediment Quality Criteria for the Classification of Sediment

Contaminants	Lower Chemical Exceedance Level (LCEL)	Upper Chemical Exceedance Level (UCEL)
Metals (mg/kg dry wt.)		
Cadmium (Cd)	1.5	4
Chromium (Cr)	80	160
Copper (Cu)	65	110
Mercury (Hg)	0.5	1
Nickel (Ni)*	40	40
Lead (Pb)	75	110
Silver (Ag)	1	2
Zinc (Zn)	200	270
Metalloid (mg/kg dry wt.)		
Arsenic	12	42
Organic-PAHs (μg/kg dry wt.)		
Low Molecular Weight PAHs	550	3160
High Molecular Weight PAHs	1700	9600
Organic-non-PAHs (μg/kg dry wt.)		
Total PCBs	23	180
Organometallics (μg TBT/L in Interstitial water)		
Tributyltin*	0.15	0.15

Remark:
* The contaminant level is considered to have exceeded the UCEL if it is greater than the value shown.

2.3.2 Sediment will be classified into the following 3 categories based on the sediment quality criteria:

Category L Sediment with all contaminant levels not exceeding the Lower Chemical Exceedance Level (LCEL). The material must be dredged, transported and disposed of in a manner which minimizes the loss of contaminants either into solution or by resuspension.

Category M Sediment with any one or more contaminant levels exceeding the Lower Chemical Exceedance Level (LCEL) and none exceeding the Upper Chemical Exceedance Level (UCEL). The material must be dredged and transported with care, and must be effectively isolated from the environment upon the final disposal unless appropriate biological tests demonstrate that the material will not adversely affect the marine environment.

Category H Sediment with any one or more contaminant levels exceeding the Upper Chemical Exceedance Level (UCEL). The material must be dredged and transported with great care, and must be effectively isolated from the environment upon the final disposal.

2.3.3 Category L and Category H sediment with all contaminant levels at or below the 10 times the LCEL will require Type 1 and Type 2 disposal respectively. For Category M and Category H sediment with one or more contaminant levels exceeding 10 times the LCEL, Tier III biological screening will be required to determine the disposal options.

2.4 Tier III Biological Screening

2.4.1 The Tier III biological screening is to identify the most appropriate disposal option for Category M (either Type 1 or Type 2 disposal) and Category H sediment with one or more contaminant levels exceeding 10 times the LCEL (either Type 2 or Type 3 disposal).

2.4.2 Sediment classified as Category M will be subjected to the following 3 toxicity tests:

- A 10-day burrowing amphipod toxicity test;
- A 20-day burrowing polychaete toxicity test; and
- A 48-96 hour larvae (bivalve or echinoderm) toxicity test.

2.4.3 Sediment classified as Category H and with one or more contaminant levels exceeding 10 times the LCEL will also be subjected to the above 3 toxicity tests but in a diluted manner (dilution test).

2.4.4 **Table 2.2** summarises the details of the test endpoints and failure criteria of the 3 toxicity tests. The sediment is deemed to have failed the biological test if it fails in any one of the toxicity tests.

Table 2.2 Test Endpoints and Decision Criteria for Tier III Biological Screening

Toxicity Test	Endpoints Measured	Test Methods	Failure Criteria
10-day amphipod	Survival	USEPA Standard Methods for Assessing Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods, 1994	Mean survival in test sediment is significantly different ($p \leq 0.05$)[1] from mean survival in reference sediment and mean survival in test sediment <80% of mean survival in reference sediment.
20-day polychaete worm	Dry Weight[2]	PSEP Standard Recommended Guidelines for Conducting Laboratory Bioassays on the Puget Sound Sediments – Juvenile Polychaete Sediment Bioassay, 1995	Mean dry weight in test sediment is significantly different ($p \leq 0.05$)[1] from mean dry weight in reference sediment and mean dry weight in test sediment <90% of mean dry weight in reference sediment.
48-96 hour larvae (bivalve or echinoderm)	Normality Survival[3]	PSEP Standard Recommended Guidelines for Conducting Laboratory Bioassays on the Puget Sound Sediments – Juvenile Polychaete Sediment Bioassay, 1995	Mean normality survival in test sediment is significantly different ($p \leq 0.05$)[1] from mean normality survival in reference sediment and mean normality survival in test sediment <80% of mean normality survival in reference sediment.

Remark:
1. Statistically significant differences should be determined using appropriate two-sample comparisons (e.g. *t-tests*) at a probability of $p \leq 0.05$.
2. Dry weight means total dry weight after deducting dead and missing worms.
3. Normality survival integrates the normality and survival end points, and measures survival of only the normal larvae relative to the starting number.

2.4.5 Category M sediment that fails the biological test will require Type 2 disposal whereas Category H sediment that fails the dilution test will require Type 3 special treatment / disposal.

3 Description of Proposed Sediment Excavation Works and Existing Sediment Quality

3.1 Proposed Sediment Excavation Works

3.1.1 As discussed in **Section 1**, the Bonded Vehicular Bridge consists of a land section viaduct on HKBCF Island and marine viaduct between HKIA and HKBCF.

Land-Based Viaduct

3.1.2 The HKBCF Island is a reclaimed land and there is land-based sediment underlying the existing fill stratum. Based on the latest geological profile, the top of the land-based sediment near the proposed Project site is approximately -5 to -20 mPD. However, according to the latest engineering design, mainly shallow excavation of about 0 to +5 mPD for pile cap would be required for the construction of the Project. As such, it is anticipated that sediment will not be encountered during such shallow excavation works for pile cap.

3.1.3 Having said that, the southern end of the viaduct, connecting to the marine viaduct, would require the construction of bridge piers and abutment. The bridge piers and abutment would be constructed using bored pile method and there may be some land-based sediment (not more than 400 m^3) generated during construction. The excavated sediment is proposed to be reused on site (say as backfilling materials) and no off-site disposal will be necessary. The lateral view of the bridge piers and abutment is shown in **Appendix 3.1**.

3.1.4 The area is currently occupied by Highways Department and, as advised by AAHK, the area would not be accessible to carry out any site investigation works during the EIA study.

Marine Viaduct

3.1.5 For marine viaduct between HKIA and HKBCF, although no open sea dredging will be involved, the construction of the bridge foundation using the adopted marine bored piles method will require sediment excavation within the bored piles. The preliminary quantities of sediment to be dredged is estimated to be 650 m^3.

3.1.6 Given the above, this SSTP will focus on the proposed marine viaduct between HKIA and HKBCF.

3.2 Review of Existing Sediment Quality

EPD's Monitoring Data (2010 – 2014)

3.2.1 EPD conducts routine monitoring of the bottom sediment quality at 60 stations across the territory of Hong Kong waters. Among these 60 stations, Chek Lap Kok (North) (NS6) is the closest to the proposed marine works areas. Location and monitoring data of NS6 are shown in **Appendix 3.2**.

3.2.2 Based on the available data, 10 sediment samples have been collected from NS6 between 2010 and 2014 (i.e. 2 samples per year). As summarised in **Table 3.1**, metals and organic contaminants were below the LCEL. For metalloid (Arsenic), 6 of the 10 samples were detected with concentrations above the LCEL but below the UCEL. Hence, out of the total 10 samples, 4 were classified as Category L and 6 were classified as Category M due to exceedance in Arsenic. It should be noted that there was no measurement of TBT of the sediment and no biological screening test was conducted.

Table 3.1 Summary of EPD Monitoring Data (2010 - 2014)

Contaminants	LCEL	UCEL	EPD's Monitoring Data[1]
Metals (mg/kg dry wt.)			
Cadmium (Cd)	1.5	4	<0.1 – 0.2
Chromium (Cr)	80	160	17 - 40
Copper (Cu)	65	110	9 – 34
Mercury (Hg)	0.5	1	<0.05 – 0.13
Nickel (Ni)[2]	40	40	11 – 23
Lead (Pb)	75	110	20 – 47
Silver (Ag)	1	2	<0.2 – 0.2
Zinc (Zn)	200	270	42 – 110
Metalloid (mg/kg dry wt.)			
Arsenic (As)	12	42	7.1 – **17**
Organic-PAHs (µg/kg dry wt.)			
Low Molecular Weight PAHs	550	3160	90 – 150
High Molecular Weight PAHs	1700	9600	17 – 64
Organic-non-PAHs (µg/kg dry wt.)			
Total PCBs	23	180	18
Organometallics (µg TBT/L in interstitial water)			
Tributyltin[2]	0.15	0.15	N/A[3]
No. of Samples under Different Categories[4]			
Category L			4
Category M			6 (no biological test conducted)
Category H			0
Total Number of Samples Analysed			10

Remarks:
1. Bold value denotes the contaminant level exceeds the LCEL but below the UCEL.
2. The contaminant level is considered to have exceeded the UCEL if it is greater than the value shown.
3. Sediment data is not available.
4. Category L sediment – no exceedance of either LCEL or UCEL.
   Category M sediment – exceedance of LCEL but equal to or below the UCEL
   Category H sediment – exceedance of UCEL.

EIA Study for HZMB HKBCF

3.2.3 Sediment sampling and testing works have been carried out under the EIA Study for HZMB HKBCF[1]. Sediment samples were collected from 16 sampling locations for the proposed reclamation site of HKBCF and HKLR at the time of the EIA study. The sampling works were carried out in 2008 and 2009. The as-built locations and sediment quality data are shown in **Appendix 3.3**.

[1] Highways Department, *Environmental Impact Assessment Report for Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing Facilities* (Agreement No. CE 14/2008 (HY)) (EPD Register No.: AEIAR-145/2009), 2009.

3.2.4 Of the 16 sampling locations, 2 locations (viz. BCF/VC-A03 and BCF/VC-C11) were in close proximity of the proposed marine viaduct. Fourteen sediment samples from the 2 locations were tested and reported in the EIA Study for HZMB HKBCF. Based on the laboratory testing results, 9 samples were classified as Category L and 5 samples as Category M. Amongst the 5 Category M samples, 3 samples had passed the biological test whereas the remaining 2 samples had failed the biological test. The laboratory testing results and the determined contamination categories and disposal types are summarised in **Table 3.2** below.

Table 3.2 Summary of Relevant Sediment Quality Data under EIA Report for HZMB HKBCF

Sampling Location ID	Sampling Depth (m below Seabed)	Metals (mg/kg)								Metalloid (mg/kg)	Organic-PAHs (µg/kg)		Organic-non-PAHs (µg/kg)	Organo-metallics (µg/L in pore water)	Classification	Biological Results	Disposal Type
		Cd	Cr	Cu	Hg	Ni	Pb	Ag	Zn	As	LMW PAH	HMW PAH	Total PCBs	TBT			
LCEL		**1.5**	**80**	**65**	**0.5**	**40**	**75**	**1**	**200**	**12**	**550**	**1700**	**23**	**0.15**			
UCEL		**4**	**160**	**110**	**1**	**40**	**110**	**2**	**270**	**42**	**3160**	**9600**	**180**	**0.15**			
BCF/VC-A03	0.2-0.9	<0.20	34	29	0.15	22	49	0.21	100	11.9	<55	<170	<3.0	<0.015	Category L	No Required	Type 1
	0.9-1.9	<0.20	29	14	0.09	19	33	<0.10	75	8.0	<55	<170	<3.0	<0.015	Category L	No Required	Type 1
	1.9-2.9	<0.20	30	12	0.07	20	32	<0.10	77	6.1	<55	<170	<3.0	<0.015	Category L	No Required	Type 1
	4.9-5.9	<0.20	29	12	0.07	19	33	<0.10	72	6.3	<55	<170	<3.0	<0.015	Category L	No Required	Type 1
	7.9-8.9	<0.20	34	14	0.08	23	36	<0.10	81	7.4	<55	<170	<3.0	<0.015	Category L	No Required	Type 1
	12.0-12.9	<0.20	31	15	0.07	20	43	<0.10	78	**14**	<55	<170	<3.0	<0.015	Category M	Pass	Type 1
	14.9-15.9	0.27	29	14	0.08	16	42	<0.10	70	**15**	<55	<170	<3.0	<0.015	Category M	Pass	Type1
	15.9-16.35	<0.20	30	13	0.05	9.3	39	<0.10	48	**15**	<55	<170	<3.0	<0.015	Category M	Pass	Type1
BCF/VC-C11	0.3-0.9	<0.2	39	16	0.05	27	34	<0.1	99	8	<550	<1700	<3.0	N/A*	Category L	No Required	Type 1
	0.9-1.9	<0.2	39	15	0.07	26	38	<0.1	96	9	<550	<1700	<3.0	N/A*	Category L	No Required	Type 1
	1.9-2.9	<0.2	39	14	0.06	26	32	<0.1	97	10	<550	<1700	<3.0	N/A*	Category L	No Required	Type 1
	4.9-5.9	<0.2	39	15	0.06	28	37	<0.1	93	8	<550	<1700	<3.0	N/A*	Category L	No Required	Type 1
	7.9-8.9	<0.2	41	14	<0.05	26	35	<0.1	81	**14**	<550	<1700	<3.0	N/A*	Category M	Fail	Type 2
	9.9-10.8	<0.2	19	6	<0.05	6	22	<0.1	28	**13**	<550	<1700	<3.0	N/A*	Category M	Fail	Type 2

Remarks:

(1) Bold value denotes the contaminant level exceeds the LCEL but below the UCEL.

(2) Low molecular weight PAHs include naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene and anthracene; high molecular weight PAHs include chrysene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenzo(a.h.)anthracene, fluoranthene, indeno(1.2.3-cd)pyrene, pyrene and benzo(g.h.i)perylene.

(3) Total PCBs include 2,4' dichlorobiphenyl, 2,2',5 trichlorobiphenyl, 2,4',4 trichlorobiphenyl, 2,2',3,5 tetrachlrobiphenyl, 2,2',5,5' tetrachlrobiphenyl, 2,3',4,4' tetrachlrobiphenyl, 3,3',4,4' tetrachlrobiphenyl, 2,2',4,5,5' pentachlrobiphenyl, 2,3,3',4,4' pentachlrobiphenyl, 2,3',4,4',5' pentachlrobiphenyl, 3,3',4,4,5' pentachlrobiphenyl, 2,2',3,3',4,4' hexachlrobiphenyl, 2,2',3,4,4',5' hexachlrobiphenyl, 2,2',4,4',5,5' hexachlrobiphenyl, 3,3',4,4',5,5' hexachlrobiphenyl, 2,2',3,3',4,4',5 heptachlrobiphenyl, 2,2',3,4,4',5,5' heptachlrobiphenyl and 2,2'3,4',5,5',6 heptachlrobiphenyl.

(4) N/A* - Insufficient interstitial water for analysis of TBT.

4 Proposed Sediment Sampling and Testing

4.1 Sediment Sampling

4.1.1 Based on the review of the existing data in **Section 3**, the expected sediment contamination level in the vicinity of the proposed marine viaduct is Category L and M. As Category M sediment are expected, a 200m x 200m sampling grid arrangement with reference to paragraph 4(a) of memo issued by Development Bureau on 6 October 2010, "*Control Measures for Management of Dredged/Excavated Contaminated Sediment"* (ref: 0 in DevB(W) 515/83/04) will be adopted. The memo is presented in **Appendix 4.1**.

4.1.2 Based on the existing data from EIA Study for HZMB HKBCF (refer to **Appendix 3.3**), marine deposit of approximately 16 m thick was observed near the proposed marine viaduct. With a grid size of 200m x 200m, 2 marine-based sediment sampling locations (viz. MBS01 and MBS02) are proposed. The proposed sampling locations are given in **Table 4.1** and **Figure 4.1**.

Table 4.1 Proposed Sediment Sampling Locations

Sampling Location ID	Sampling Method	Sampling Depth	Coordinates	
			Easting	Northing
MBS01	Grab and Vibrocore Sample	Seabed Level, 0.9m, 1.9m, 2.9m, thereafter 3m to the bottom of marine deposit[2]	812335.00	819755.00
MBS02			812558.00	819710. 00
Reference[1]	Grab Sample	Seabed Level	850234.00	820057.00

Notes:
1 Reference sample will be collected at Port Shelter.
2 Based on the existing data, the thickness of the marine deposit in the area is approximately 16m. As such, it is estimated that there will be approximately 7 to 8 vibrocore sub-samples for each sampling location (i.e. 0.9m, 1.9m, 2.9m, 5.9m, 8.9m, 11.9m, 14.9m and/or 17.9m).

4.1.3 Vibrocore is proposed for collecting sediment samples at MBS01 and MBS02 with the aid of barges. Modified Van Veen grab (or equivalent) of capacity ~2L will be deployed from vessel to collect approximately 30L of sediment at each grab sampling location. Vibrocore samples will be collected at seabed, 0.9m, 1.9m, 2.9m, and thereafter every 3m to the bottom of the marine deposit as listed in **Table 4.1**. Both cut ends of each vibrocore sub-sample will then be sealed up with tightly fitting rubber caps and duct-taped in place. Each sub-sample will be clearly labelled 'top' and 'bottom' and with sample identity (e.g. station number, sample depth, sampling date and time, together with full description of the sample).

4.1.4 For reference sediment sample, modified Van Veen grab (or equivalent) of capacity ~2L will be deployed from vessel and surface grab samples of ~30L will be collected at Port Shelter (PS6, E850234, N820057). Individual grabs will be composited on-site and split into portions for packing. The containers will be labelled with station number, sample depth, sampling date and time, together with full description of the sample.

4.1.5 Samples will be delivered to laboratory within 24 hours of the samples being collected.

4.1.6 Prior to sampling, the laboratory responsible for analysis will be consulted for the particular sample size for chemical / biological testing as well as the preservation procedures that are necessary for each chemical analysis. The recommended sample sizes for each parameter and test are shown in **Table 4.2**. The actual sample size would however be subjected to agreement with the laboratory.

Table 4.2 Recommended Sediment Sample Size

Parameters to be Tested	Sample Size
Metals and metalloid	0.5 L
Others	0.5 L
Biological response	6 L

4.2 Sample Handling and Storage

4.2.1 All sediment samples will be stored at 4^{o}C in the dark and should not be frozen during transportation and at the laboratory prior to testing. The sampling bottle and pre-treatment methods will follow the recommendation stipulated in PNAP ADV-21. Sediment samples will be extracted in the laboratory and placed in the appropriate containers directly after the sampling. All samples will be double-bagged and labelled internally and externally with indelible ink. Samples for biological testing (if any) will be stored in the same manner as described above (including for ancillary parameters).

4.2.2 Samples for chemical testing will be extracted and analysed within 2 weeks to ensure a Tier III biological testing programme (where required) can be developed and commenced within 8 weeks from the date of sampling.

4.3 Chemical and Biological Test

4.3.1 The sediment samples will be subjected to Tier II chemical testing and Tier III biological testing (if required). It should be noted that based on the sediment information collected at this EIA Study, strategy for the next round of sediment sampling and testing exercise to be conducted at a later stage of the Project under the DASO application process will be recommended in accordance with PNAP ADV-21.

4.3.2 Sediment quality will be assessed through laboratory analysis of sediment samples for the chemical and/or biological parameters. The reference sediment (clean sample) will also be tested for comparison. Based on the chemical contaminant levels, sediment will be classified into either Category L, M or H sediment according to the criteria stated in PNAP No. ADV-21. Tier III biological screening test will only be implemented for Category M sediment. Sediment classified as Category H and with one or more contaminant levels exceeding 10 x LCEL will also undergo the biological screening test but in a diluted manner (dilution test). The chemical and biological screening parameters are summarised in **Table 4.3** and **Table 4.4** respectively and the preparation method for the dilution test is presented in **Table 4.5**.

Table 4.3 Chemical Screening Parameters for Sediment Quality Assessment

Parameters	Preparation Method US EPA Method	Determination Method US EPA Method	Reporting Limit
Metals (mg/kg dry wt.)			
Cadmium (Cd)	3050B	6020A or 7000A or 7131A	0.2
Chromium (Cr)	3050B	6010C or 7000A or 7190	8
Copper (Cu)	3050B	6010C or 7000A or 7210	7
Mercury (Hg)	7471A	7471A	0.05
Nickel (Ni)	3050B	6010C or 7000A or 7520	4
Lead (Pb)	3050B	6010C or 7000A or 7420	8
Silver (Ag)	3050B	6020A or 7000A or 7761	0.1
Zinc (Zn)	3050B	6010C or 7000A or 7950	20
Metalloids (mg/kg dry wt.)			
Arsenic (As)	3050B	6020A or 7000A or 7061A	1
Organic-PAHs (µg/kg dry wt.)			
Low Molecular Weight PAHs+	3550B or 3540C and 3630C	8260B or 8270C	55
High Molecular Weight PAH++	3550B or 3540C and 3630C	8260B or 8270C	170
Organic-non-PAHs (µg/kg dry wt.)			
Total PCBs+++	3550B or 3540C and 3665A	8082	3
Organometallics (µg TBT/L in interstitial water)			
Tributyltin	Krone et al. (1989)* – GC/MS UNEP/IOC/IAEA**	Krone et al. (1989)* – GC/MS UNEP/IOC/IAEA**	0.015

Notes:

(i) The reporting limits shown in this table are the most stringent limits which will be specified by the DEP.

(ii) Any methodology for which the laboratory is accredited that will produce equivalent or better results/reporting limits as required may be used subject to approval by DEP.

\+ Low molecular weight PAHs include acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene

++ High molecular weight PAHs include benzo[a]anthracene, benzo[a]pyrene, chrysene,dibenzo[a,h]anthracene, fluoranthene, pyrene, benzo[b]fluoranthene, benzo[k] fluoranthen, indeno[1,2,3-c,d]pyrene and benzo[g,h,i]perylene

+++ The reporting limit is for individual PCB congeners. Total PCBs include 2,4' diCB, 2,2',5 triCB, 2,4,4' triCB, 2,2',3,5' tetraCB, 2,2',5,5' tetraCB, 2,3',4,4' tetraCB, 3,3',4,4' tetraCB, 2,2',4,5,5' pentaCB, 2,3,3',4,4' pentaCB, 2,3',4,4',5 pentaCB, 3,3',4,4',5 pentaCB, 2,2',3,3',4,4' hexaCB, 2,2',3,4,4',5' hexaCB, 2,2',4,4',5,5' hexaCB, 3,3',4,4',5,5' hexaCB, 2,2',3,3',4,4',5 heptaCB, 2,2',3,4,4',5,5' heptaCB, 2,2',3,4',5,5',6 heptaCB (ref: the "summation" column of Table 9.3 of *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual (The Inland Testing Manual)* published by USEPA).

* Krone et al. (1989), A method for analysis of butyltin species and measurement of butyltins in sediment and English Sole livers from Puget Sound, Marine Environmental Research 27 (1989) 1-18. Interstitial water to be obtained by centrifuging the sediment and collecting the overlying water.

** UNEP/ICO/IAEA refers to IAEA's Marine Environment Laboratory reference methods. These methods are available free of charge from UNEP/Water or Marine Environmental Studies Laboratory at IAEA's Marine Environment Laboratory. Interstitial water to be obtained by centrifuging the sediment and collecting the overlying water.

Table 4.4 Biological Screening Parameters for Sediment Quality Assessment

Toxicity Test	Test Method	Endpoints Measured	Failure Criteria
10-day amphipod	USEPA Standard Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods, 1994	Survival	Mean survival in test sediment is significantly different (p≤ 0.05)* from mean survival in reference sediment **and** mean survival in test sediment < 80% of mean survival in reference sediment.
20-day polychaete worm	PSEP Standard Recommended Guidelines for Conducting Laboratory Bioassays on the Puget Sound Sediments – Juvenile Polychaete Sediment Bioassay, 1995	Dry Weight**	Mean dry weight in test sediment is significantly different (p≤ 0.05)* from mean dry weight in reference sediment **and** mean dry weight in test sediment <90% of mean dry weight in reference sediment.
48-96 hour larvae (bivalve or echinoderm)	PSEP Standard Recommended Guidelines for Conducting Laboratory Bioassays on the Puget Sound Sediments – Bivalve Larvae Sediment Bioassay, 1995	Normality Survival***	Mean normality survival in test sediment is significantly different (p≤ 0.05)* from mean normality survival in reference sediment **and** mean normality survival in test sediment <80% of mean normality survival in reference sediment.

Note:
* Statistically significantly differences should be determined using appropriate two-sample comparisons (e.g. *t-tests*) at a probability of p ≤ 0.05.
** Dry weight means total dry weight after deducting dead and missing worms.
*** Normality survival integrates the normality and survival end points, and measures survival of only the normal larvae relative to the starting number.

Table 4.5 Preparation Method of Dilution Test

Sediment Characteristics	Preparation Method
Category H sediment (> 10 x LCEL)	Sample to be mixed with 9 portions of reference sediment.
Category M sediment or Category H sediment (> 10 x LCEL) suspected of ammonia contamination	Additional set of sample (after dilution for Cat. H sediment) to be purged# for ammonia removal (for amphipod test only).

Note:
If the ammonia concentration in the overlaying water of the test system is ≥20mg/L, purging of sediment is required. This is performed by replacing the overlying water at a rate of 6 volume replacement / 24 h for 24 hours, and repeated once only if the ammonia level still exceeds 20mg/L.

4.3.3 Only ecologically relevant species should be used for carrying out the biological screening tests. The species to be used for each type of test are summarised in **Table 4.6**.

Table 4.6 Species to Be Used for Biological Screening Test

Test Types	Species	Reference Test Conditions*
10-day burrowing amphipod toxicity test	*Ampelisca abdita* *Leptocheirus plumulosus* *Eohaustorius estuarius*	U.S.EPA (1994) / PSEP (1995) U.S.EPA (1994) U.S.EPA (1994) / PSEP (1995)
20-day burrowing polychaete toxicity test	*Neanthes arenaceodentata*	PSEP(1995)
48-96 hour larvae (bivalve or echinoderm) toxicity test	Bivalve: *Mytilus spp*. *Crassostrea gigas*	 PSEP(1995) PSEP(1995)
	Echinoderm: *Dendraster excentricus* *Strongylocentrotus* spp	 PSEP(1995) PSEP(1995)

Notes:

* U.S.EPA (U.S. Environmental Protection Agency) 1994. Methods for assessing the toxicity of sediment-associated contaminants with estuarine and marine amphipods. Office of Research and Development. U.S. Environmental Protection Agency, Cincinnati, OH. EPA/600/R94/025.
PSEP (Puget Sound Estuary Program) 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound Sediments.

4.4 QA/QC Requirements

4.4.1 Field logs and site diary will be maintained for all on-site sampling works with date, equipment used, site activities and observations, undertaken as far as possible. Any deviation from the standard procedures and reasons will be recorded in the logs.

4.4.2 Laboratory QA/QC requirements, including analyses by HOKLAS accredited laboratory, certified reference materials, spike recovery, blank samples, duplicate samples (for every 20 samples), negative/positive control for biological test, etc. will be strictly complied.

Figures

ISO A1 594mm x 841mm

Approved:

Checked:

Designer:

Project Management Initials:

812000 E

812500 E

813000 E

820500 N

820000 N

819500 N

ASIAWORLD-EXPO

SKYPIER

HKBCF

NORTH COMMERCIAL DISTRICT

HKIA

N

LEGEND:

SITE BOUNDARY

PROPOSED LAYOUT

Plot File by: PENGW 2018/1/23
PATH : P:\PROJECTS\60546907\DRAWING\REPORT\EIA\EIA_711.dgn

AECOM

PROJECT
項目

INTERMODAL TRANSFER TERMINAL - BONDED VEHICULAR BRIDGE AND ASSOCIATED ROADS

CLIENT
業主

香港機場管理局 AIRPORT AUTHORITY HONG KONG

CONSULTANT
工程顧問公司

AECOM Asia Company Ltd.
www.aecom.com

SUB-CONSULTANTS
分判工程顧問公司

ISSUE/REVISION
修訂

I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 核對

STATUS
狀況

SCALE
比例

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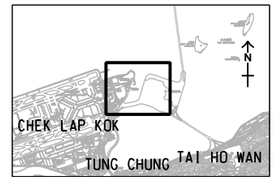
DIMENSION UNIT
尺寸單位

METRES

KEY PLAN
索引圖

A3 1 : 200000



PROJECT NO.
項目編號

60546907

AGREEMENT NO.
協議編號

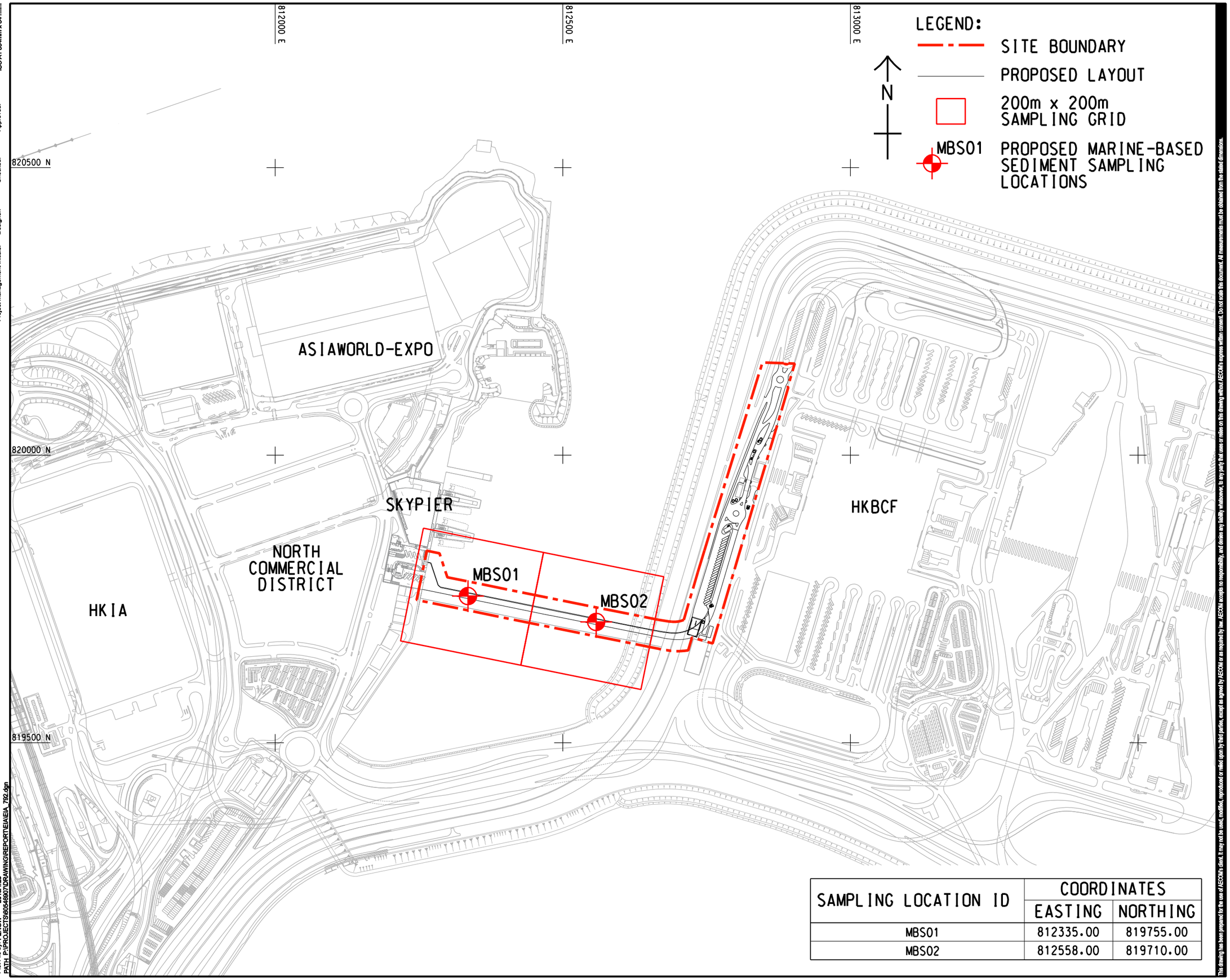
C17C03

SHEET TITLE
圖紙名稱

LOCATION OF THE PROJECT

SHEET NUMBER
圖紙編號

FIGURE 1.1



SAMPLING LOCATION ID	COORDINATES	
	EASTING	NORTHING
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MBS02	812558.00	819710.00

Project Management Initials: Designer: Checked: Approved: ISO A1 594mm x 841mm

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PROJECT
項目

INTERMODAL TRANSFER TERMINAL - BONDED VEHICULAR BRIDGE AND ASSOCIATED ROADS

CLIENT
業主

香港機場管理局 AIRPORT AUTHORITY HONG KONG

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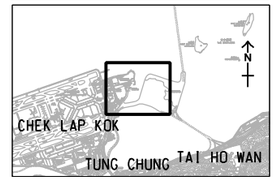
STATUS
狀況

SCALE 比例
A3 1 : 6000

DIMENSION UNIT 尺寸單位
METRES

KEY PLAN 索引圖 A3 1 : 200000



PROJECT NO. 項目編號
60546907

AGREEMENT NO. 協議編號
C17C03

SHEET TITLE
圖紙名稱

PROPOSED MARINE-BASED SEDIMENT SAMPLING LOCATIONS

SHEET NUMBER
圖紙編號

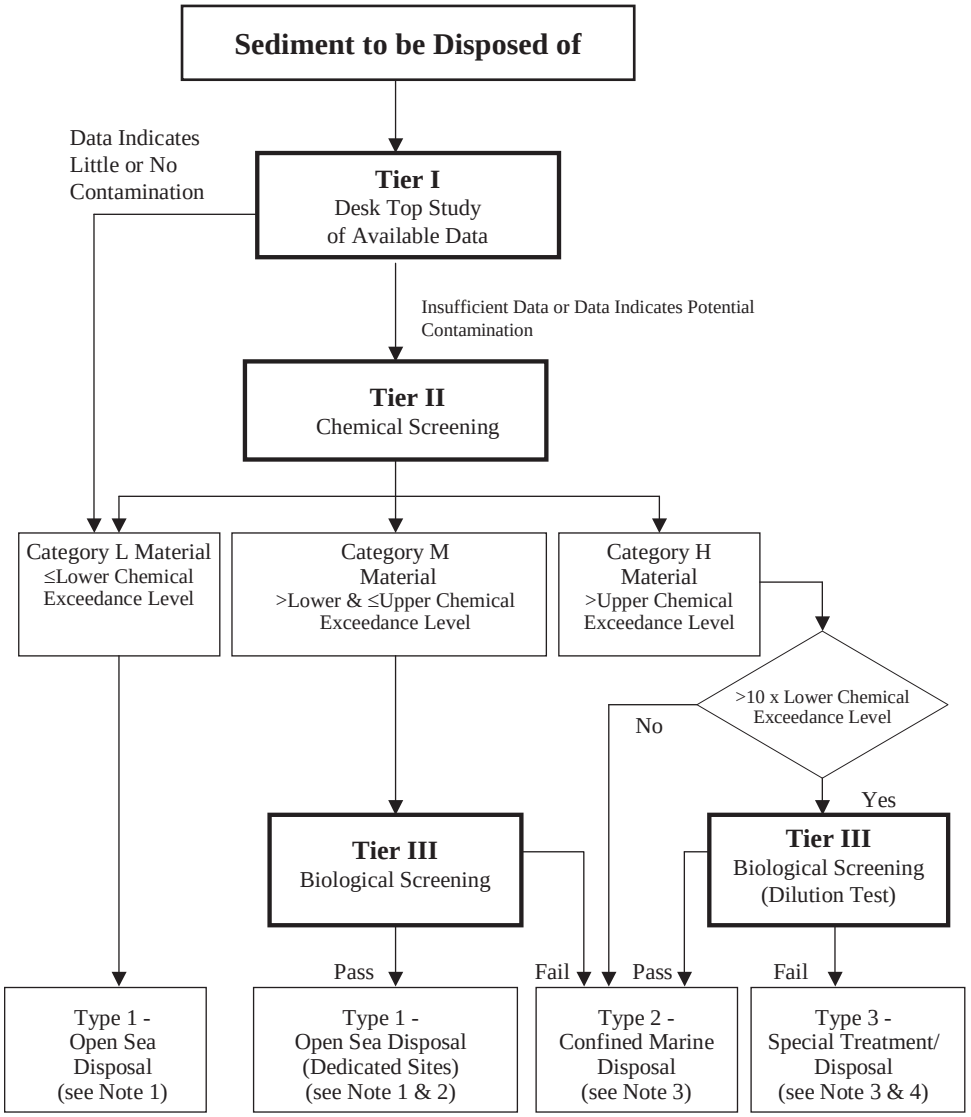
FIGURE 4.1

Appendix 2.1

Management Framework for Dredged/Excavated Sediment

Appendix C
(PNAP 252)
(ADV-21)

Management Framework for Dredged/Excavated Sediment



Notes

(1) Most open sea disposal sites are multi-user facilities and as a consequence their management involves a flexibility to accommodate varying and unpredictable circumstances. Contract documents should include provisions to allow the same degree of flexibility should it be necessary to divert from one disposal site to another during the construction period of a contract.

(2) Dedicated Sites will be monitored to confirm that there is no adverse impact.

(3) For sediment requiring Type 2 or Type 3 disposal, contract documents should state the allocation conditions of MFC and DEP. At present, East Sha Chau mud pits are designated for confined marine disposal.

(4) If any sediment suitable for Type 3 disposal (Category H sediment failing the biological dilution test) is identified, it is the responsibility of the AP/RSE, in consultation with DEP, to identify and agree with him/her, the most appropriate treatment and/or disposal arrangement. Such a proposal is likely to be very site and project specific and therefore cannot be prescribed. This will not preclude treatment of this sediment to render it suitable for confined marine disposal.

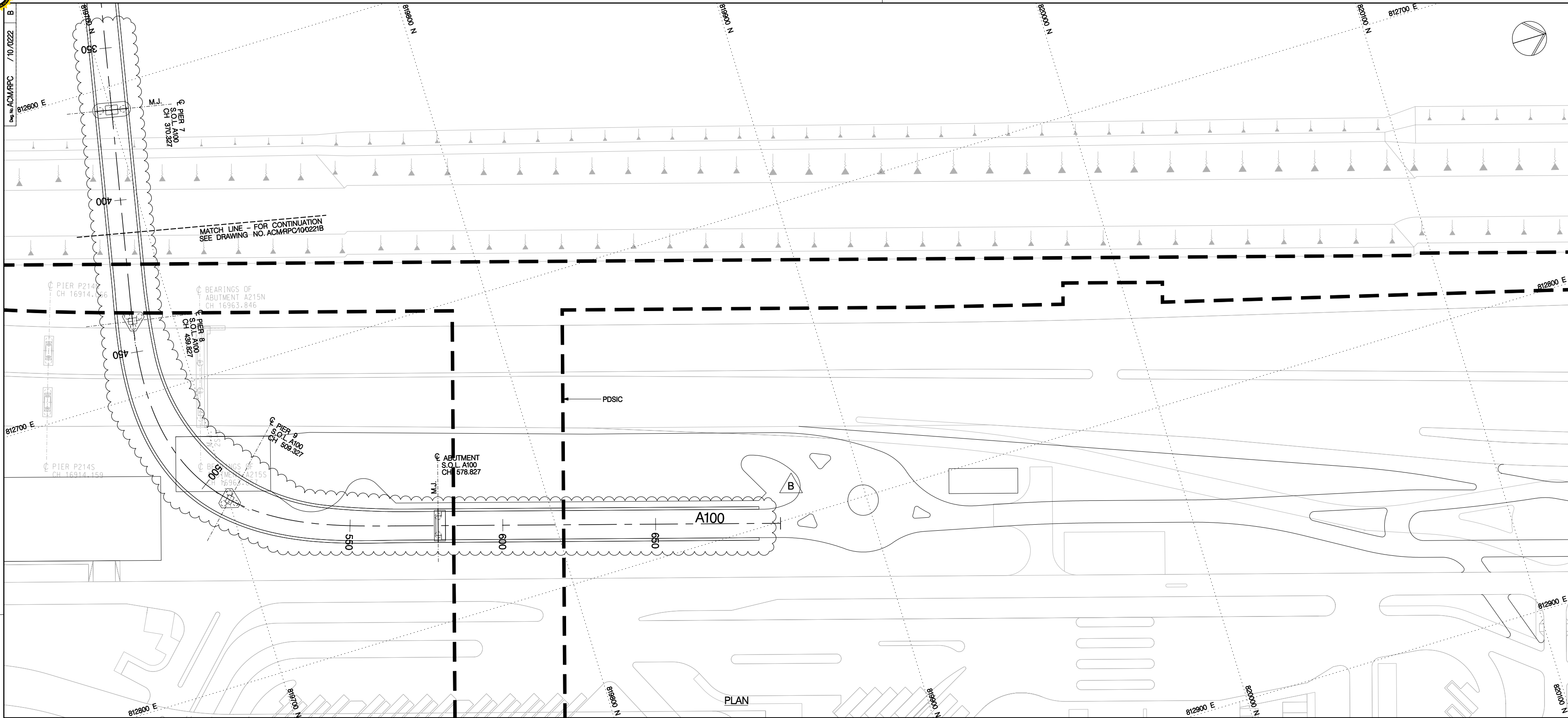
(5) The allocation of disposal space may carry a requirement for the project proponent to arrange for chemical analysis of the sediment sampled from 5% of the vessels en-route to the disposal site. For Category M and certain Category H sediment, the chemical tests will be augmented by biological tests. Vessel sampling will normally entail mixing five samples to form a composite sample from the vessel and undertaking laboratory tests on this composite sample. All marine disposal sites will be monitored under the general direction of the Civil Engineering and Development Department. However, exceptionally large allocations might require some additional disposal site monitoring. These will be stipulated at the time of allocation.

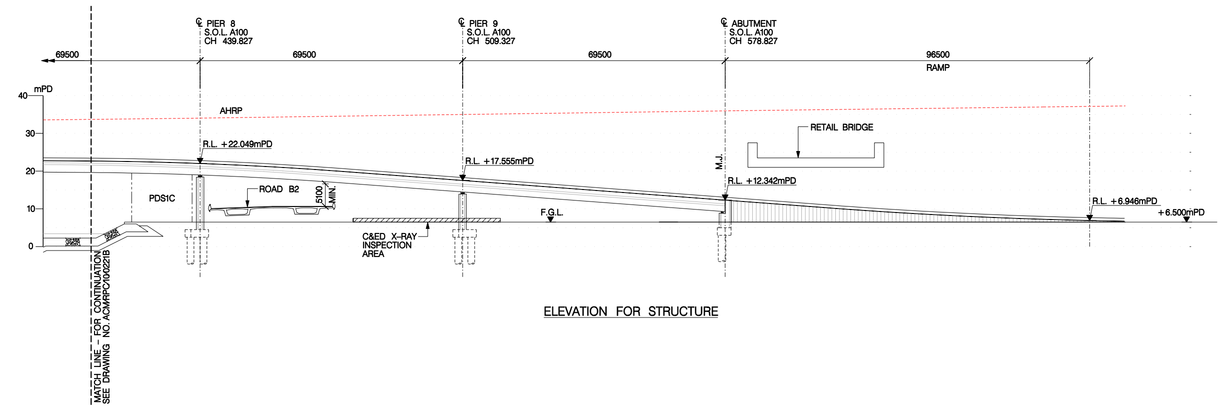
(6) Trailer suction hopper dredgers disposing of sediment at East Sha Chau must use a down-a-pipe disposal method, the design of which must be approved in advance by DCE. The dredging contractor must provide equipment for such disposal.

(Rev. 1/2003)

Appendix 3.1

Lateral View of Land Section of Bonded Vehicular Bridge





ELEVATION FOR STRUCTURE

Notes :
1. Measurements are based on metric system.
2. All levels are in metres to Principal Datum (mPD) unless noted otherwise.
3. Do not scale drawing.
4. Figure dimensions are to be followed.
5. Do not use for construction unless expressly permitted.
6. The Contractor shall verify all conditions on the Site & notify the Employer's Representative of any variations from dimensions before construction.

Rev.	Date	Description	Checked
A	29SEP16		SHRS
B	23JAN17	BRIDGE ALIGNMENT REVISED	SHRS

Signatures for Approval

Role	Name	Date
Drawn	CQ	29SEP16
Design	YONG JANG	29SEP16
Checkers	ROBIN SHAM	29SEP16
Plot Date		2017/2/10
Design Supervisor	ROBIN SHAM	29SEP16
Authorised Representative	HELEN LEUNG	29SEP16

User Name : CHENQ2

Consultant: AECOM in association with Aedas, OTC
● AECOM ○ AEDAS ○ OTC ○ LICHTVISION ○ OTHERS

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Tel: (852) 2188 7111 Fax : (852) 2824 0717

0 5 10 15 20 25 METRES 1:500

Hong Kong International Airport

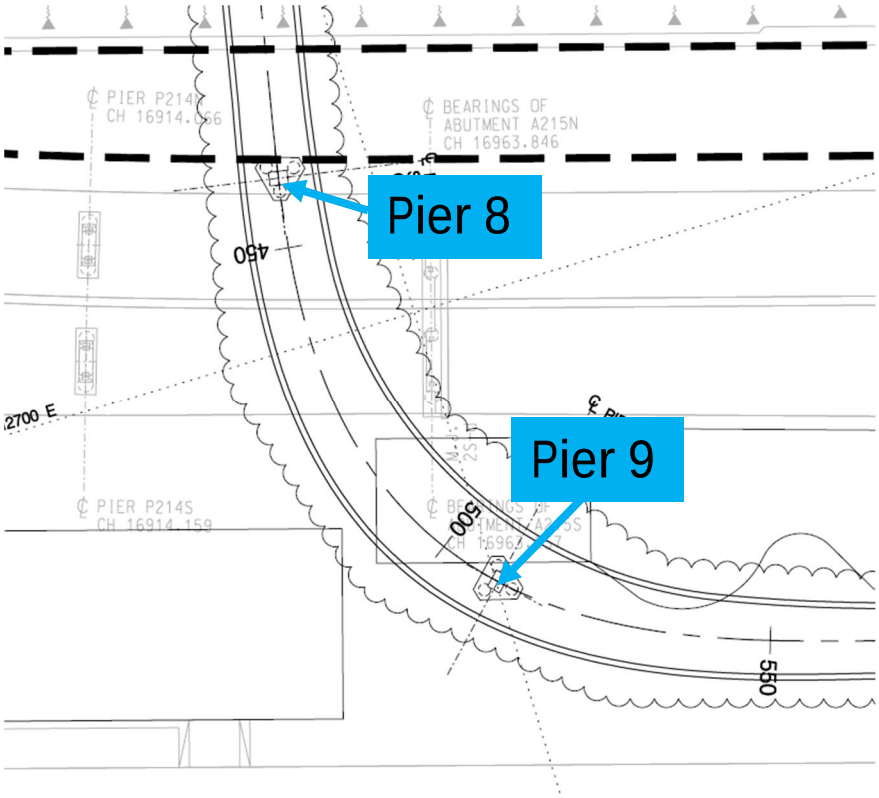
Title
CONTRACT C16C001 CONSULTANCY SERVICES FOR INTERMODAL TRANSFER TERMINAL
BRIDGE PLAN AND ELEVATION
SHEET 2 OF 2

Scale	Location	Drawing No.	Status	Revision
1 : 500 @ A0		ACM /RPC / 10 / 0222		B

Plot Date : 2017/2/10

File Name : P:\Projects\60515167\01_AECOM\B_CADD\04_REPORT_FIGURE\CONTRACT\R1_ROAD_WORK\ACM_RPC_10_0222B.dgn

Appendix 3.1 – Top View and Lateral View – Land Section of Bonded Vehicular Bridge



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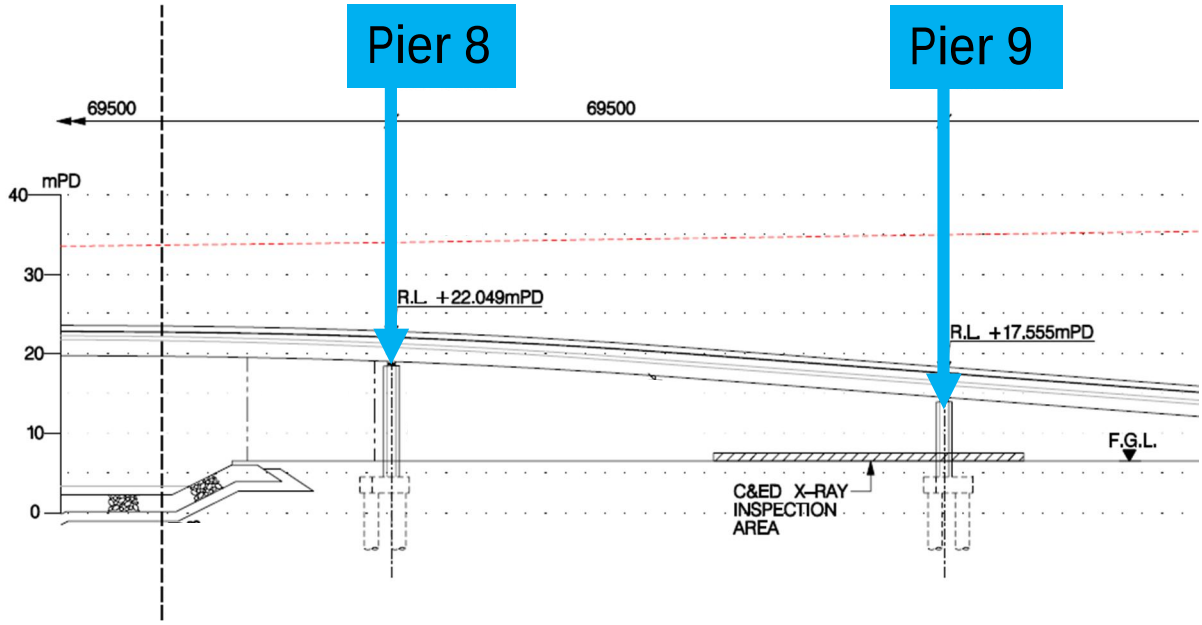
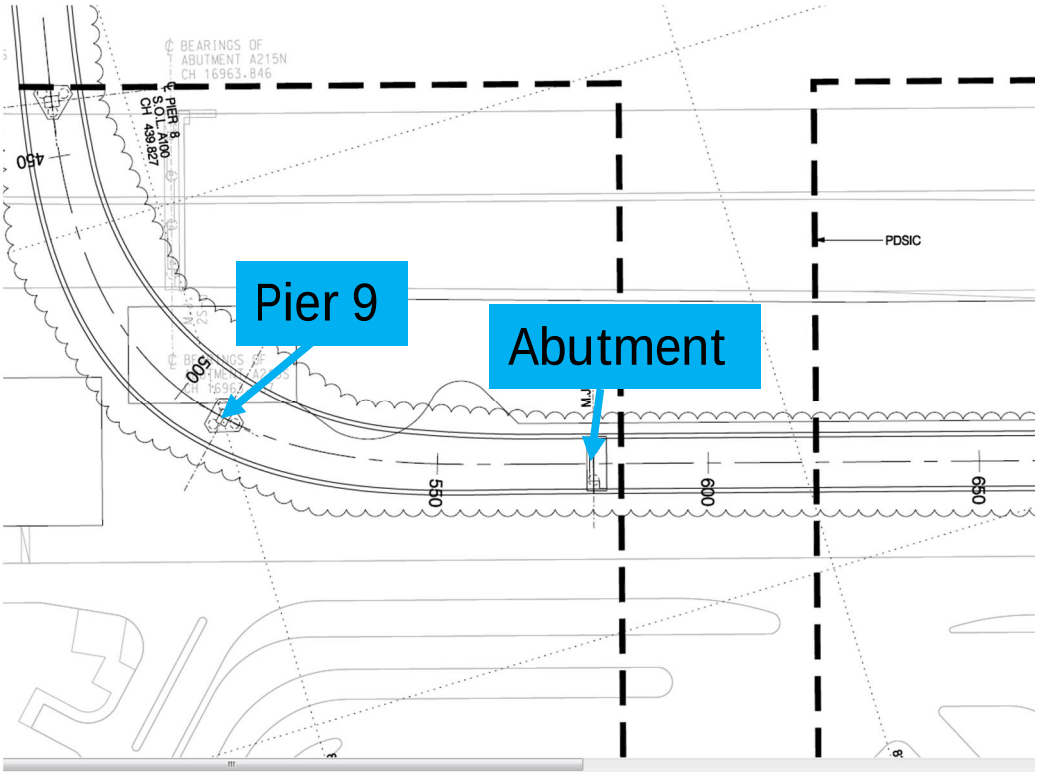


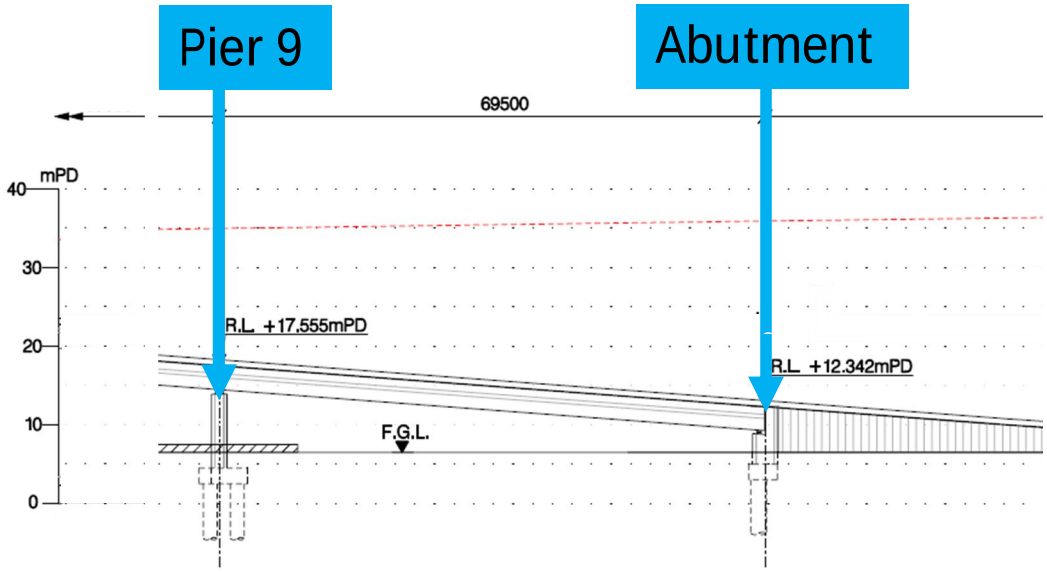
Lateral View

Land Section of Bonded Vehicular Bridge, Piers 8 and 9

*subject to detail design



Top View



Lateral View

Land Section of Bonded Vehicular Bridge, Pier 9 and Abutment

*subject to detail design

Appendix 3.2

Location and Monitoring Data of EPD Monitoring Station (NS6)

ISO A1 594mm x 841mm

Approved:

Checked:

Designer:

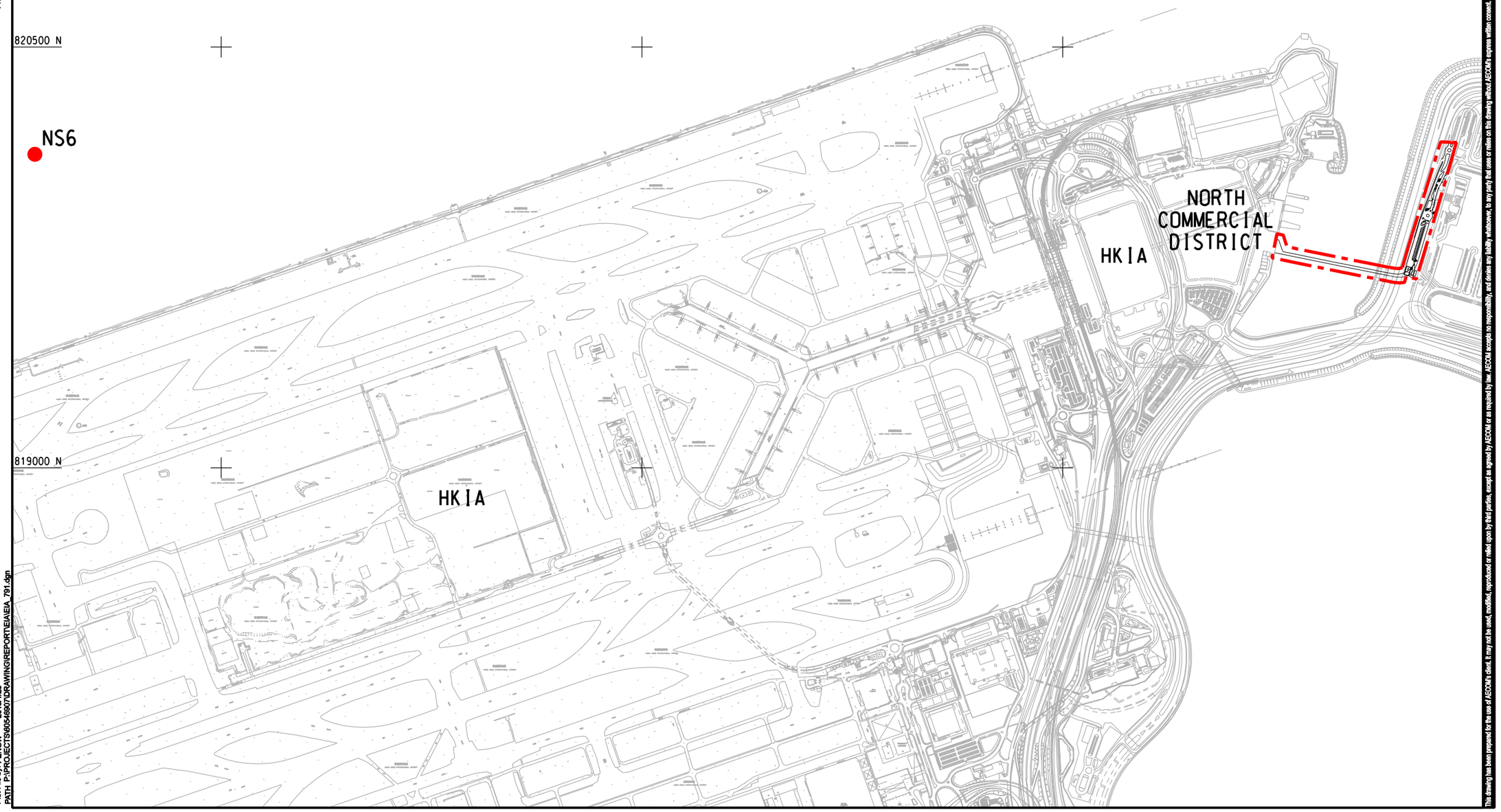
Project Management Initials:

808500 E

810000 E

820500 N

819000 N



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AECOM

PROJECT 項目

INTERMODAL TRANSFER TERMINAL - BONDED VEHICULAR BRIDGE AND ASSOCIATED ROADS

CLIENT 業主

香港機場管理局 AIRPORT AUTHORITY HONG KONG

CONSULTANT 工程顧問公司

AECOM Asia Company Ltd.
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ISSUE/REVISION 修訂

I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 核對

STATUS 階段

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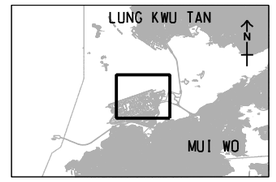
DIMENSION UNIT 尺寸單位
METRES

KEY PLAN 索引圖 A3 1 : 600000



PROJECT NO. 項目編號
60546907

AGREEMENT NO. 協議編號
C17C03

SHEET TITLE 圖紙名稱
LOCATION OF EPD MONITORING STATION (NS6)

SHEET NUMBER 圖紙編號
FIGURE A3.1

Summary statistics for bottom sediment quality in the North Western and Western Buffer WCZs, 2010 – 2014

Parameter	Pearl Island NS2	Pillar Point NS3	Urmston Road NS4	Chek Lap Kok (North) NS6	Tsing Yi (South) WS1	Hong Kong Island (West) WS2
Number of samples	10	10	10	10	10	10
Particle Size Fractionation <63µm (%w/w)	65 (18 - 90)	61 (20 - 95)	61 (13 - 95)	70 (29 - 90)	76 (62 - 90)	86 (74 - 97)
Electrochemical Potential (mV)	-166 (-380 - -57)	-185 (-390 - -42)	-226 (-428 - -83)	-178 (-380 - -57)	-236 (-398 - -88)	-184 (-347 - -58)
Total Solids (%w/w)	47 (39 - 59)	50 (40 - 62)	53 (43 - 65)	57 (42 - 67)	46 (44 - 50)	45 (43 - 47)
Total Volatile Soilds (%w/w)	6.5 (4.9 - 9.2)	6.6 (4.9 - 9.6)	5.8 (4.2 - 7.1)	5.1 (3.3 - 7.2)	6.6 (6.2 - 7.3)	6.4 (5.4 - 7.6)
Chemical Oxygen Demand (mg/kg)	11600 (9900 - 14000)	12400 (9400 - 15000)	12700 (9100 - 17000)	11900 (8600 - 15000)	14100 (12000 - 16000)	11800 (9400 - 14000)
Total Carbon (%w/w)	0.8 (0.5 - 1.3)	0.7 (0.5 - 1.2)	0.6 (0.5 - 0.8)	0.7 (0.4 - 1.2)	0.7 (0.6 - 0.8)	0.6 (0.5 - 0.6)
Ammonical Nitrogen (mg/kg)	4.19 (0.05 - 8.20)	5.22 (0.05 - 15.00)	3.49 (0.11 - 7.90)	3.13 (0.07 - 17.00)	7.62 (0.17 - 15.00)	3.75 (0.30 - 6.70)
Total Kjeldahl Nitrogen (mg/kg)	400 (310 - 580)	400 (250 - 570)	380 (260 - 600)	340 (180 - 510)	480 (400 - 590)	490 (350 - 620)
Total Phosphorus (mg/kg)	190 (150 - 230)	200 (160 - 240)	200 (140 - 260)	180 (100 - 260)	200 (180 - 250)	200 (140 - 240)
Total Sulphide (mg/kg)	40 (1 - 190)	52 (0 - 130)	62 (2 - 220)	18 (0 - 51)	97 (4 - 160)	28 (5 - 72)
Total Cyanide (mg/kg)	0.2 (<0.1 - 0.3)	0.1 (<0.1 - 0.2)	0.2 (<0.1 - 0.3)	0.1 (<0.1 - 0.2)	0.2 (<0.1 - 0.2)	0.1 (<0.1 - 0.2)
Arsenic (mg/kg)	8.8 (4.5 - 11.0)	11.0 (8.4 - 14.0)	10.9 (8.1 - 15.0)	11.8 (7.1 - 17.0)	8.1 (6.8 - 8.8)	7.9 (7.2 - 8.9)
Cadmium (mg/kg)	0.1 (<0.1 - 0.1)	0.1 (<0.1 - 0.1)	0.1 (<0.1 - 0.1)	0.1 (<0.1 - 0.2)	0.1 (<0.1 - 0.2)	<0.1 (<0.1 - <0.1)
Chromium (mg/kg)	32 (14 - 41)	33 (19 - 44)	31 (23 - 47)	29 (17 - 40)	37 (25 - 58)	34 (27 - 40)
Copper (mg/kg)	34 (13 - 49)	31 (13 - 45)	30 (17 - 51)	19 (9 - 34)	49 (31 - 68)	26 (18 - 33)
Lead (mg/kg)	37 (20 - 45)	39 (26 - 51)	37 (29 - 53)	34 (20 - 47)	38 (29 - 46)	36 (24 - 41)
Mercury (mg/kg)	0.11 (<0.05 - 0.16)	0.11 (0.07 - 0.15)	0.09 (0.06 - 0.14)	0.08 (<0.05 - 0.13)	0.22 (0.10 - 0.88)	0.13 (0.07 - 0.47)
Nickel (mg/kg)	19 (9 - 23)	20 (11 - 24)	19 (13 - 27)	18 (11 - 23)	19 (14 - 23)	21 (17 - 25)
Silver (mg/kg)	0.3 (<0.2 - 0.5)	0.3 (<0.2 - 0.4)	0.2 (<0.2 - 0.4)	<0.2 (<0.2 - 0.2)	0.7 (0.4 - 1.3)	0.3 (<0.2 - 0.4)
Zinc (mg/kg)	100 (50 - 120)	100 (63 - 130)	99 (78 - 130)	79 (42 - 110)	110 (83 - 140)	97 (79 - 110)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) [3]	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [4]	120 (90 - 340)	140 (90 - 500)	120 (90 - 240)	100 (90 - 150)	110 (90 - 170)	110 (90 - 180)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	93 (39 - 150)	160 (41 - 690)	80 (24 - 130)	35 (17 - 64)	240 (100 - 570)	89 (24 - 220)

Note: 1 Data presented are arithmetic means ; data in brackets indicate ranges.

2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.

3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

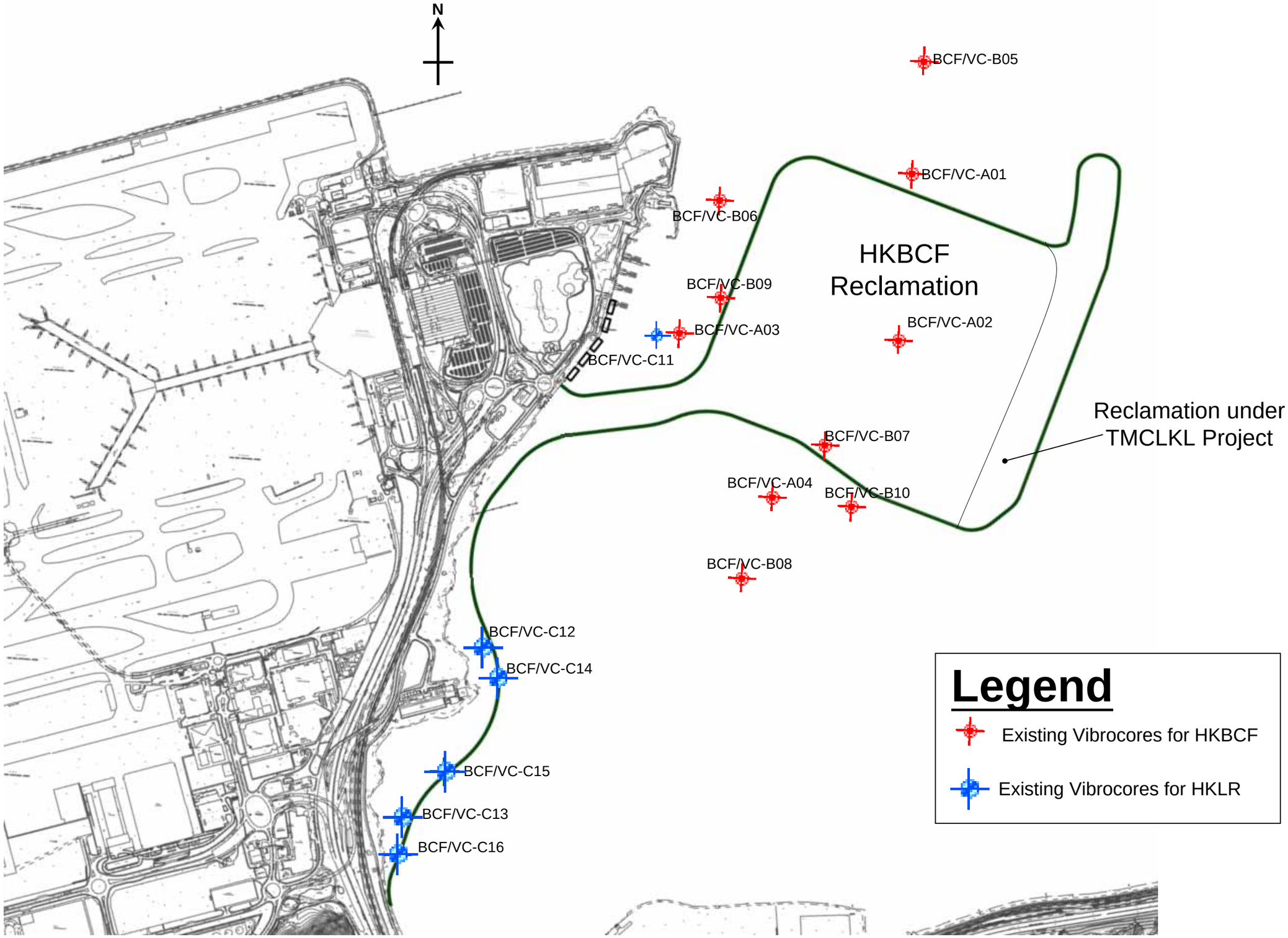
4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Flourene, Naphthalene and Phenanthrene.

5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

Appendix 3.3

As-Built Sampling Locations and Relevant Sediment Quality Data under EIA Study for HZMB HKBCF



路政署 HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處
Hong Kong - Zhuhai - Macao Bridge
Hong Kong Project Management Office

ARUP
奧雅納工程顧問
Ove Arup & Partners
Hong Kong Limited

Drawing Title

Locations of Existing Vibrocores for the Reclamation of HKBCF and HKLR

Drawing No.

Figure 7.2

Table 7-10 Sediment Chemical Quality Data and Proposed Biological Composite Schedule

Sample	Sampling Location	Sampling Depth below Seabed (m)	Metals (mg/kg)								Metalloid (mg/kg)	Organic-PAHs (µg/kg)		Organic-non-PAHs (µg/kg)	Organo-metallics (µg/L in pore water)	Classification under ETWBTC (Works) No. 34/2002	Biological Screening
			Cd	Cr	Cu	Hg	Ni	Pb	Ag	Zn	As	LMW PAH	HMW PAH	Total PCBs	TBT		
HKBCF																	
Sample in 2008	A01	0.05 - 0.9	<0.20	37	26	0.24	23	48	<0.10	84	15	<55	<170	<3.0	<0.015	Category M	√
	A01	0.9 – 1.9	<0.20	35	22	0.22	22	43	<0.10	78	14	<55	<170	<3.0	<0.015	Category M	√
	A01	1.9 – 2.9	<0.20	35	21	0.13	23	41	<0.10	80	13	<55	<170	<3.0	<0.015	Category M	√
	A01	4.9 – 5.9	<0.20	27	11	0.07	17	29	<0.10	68	7.8	<55	<170	<3.0	<0.015	Category L	N/A
	A01	7.9-8.9	0.21	29	14	0.09	16	44	<0.10	75	16	<55	<170	<3.0	<0.015	Category M	√
	A01	9.9-10.8	0.32	33	12	0.06	16	84	<0.10	70	12	<55	<170	<3.0	<0.015	Category M	√
	A02	0.2-0.9	<0.20	29	12	0.07	20	33	<0.10	74	8.0	<55	<170	<3.0	<0.015	Category L	NA
	A02	0.9-1.9	<0.20	34	13	0.07	23	34	<0.10	84	7.9	<55	<170	<3.0	<0.015	Category L	NA
	A02	1.9-2.9	<0.20	31	13	0.08	21	32	<0.10	80	7.1	<55	<170	<3.0	<0.015	Category L	NA
	A02	2.9-39	<0.20	30	12	0.07	20	32	<0.10	75	7.1	<55	<170	<3.0	<0.015	Category L	NA
	A02	4.9-5.9	<0.20	29	12	0.07	19	31	<0.10	72	7.7	<55	<170	<3.0	<0.015	Category L	NA
	A02	7.9-8.9	<0.20	29	13	0.08	19	32	<0.10	69	6.7	<55	<170	<3.0	<0.015	Category L	NA
	A02	12.0-12.9	<0.20	32	13	0.07	21	36	<0.10	78	7.2	<55	<170	<3.0	<0.015	Category L	NA
	A02	14.9-15.9	<0.20	30	14	0.07	16	45	<0.10	72	13	<55	<170	<3.0	<0.015	Category M	√
	A02	16.9-17.9	0.26	29	14	0.07	16	44	<0.10	74	15	<55	<170	<3.0	<0.015	Category M	√
	A03	0.2-0.9	<0.20	34	29	0.15	22	49	0.21	100	11.9	<55	<170	<3.0	<0.015	Category L	NA
	A03	0.9-1.9	<0.20	29	14	0.09	19	33	<0.10	75	8.0	<55	<170	<3.0	<0.015	Category L	NA
	A03	1.9-2.9	<0.20	30	12	0.07	20	32	<0.10	77	6.1	<55	<170	<3.0	<0.015	Category L	NA
	A03	4.9-5.9	<0.20	29	12	0.07	19	33	<0.10	72	6.3	<55	<170	<3.0	<0.015	Category L	NA
	A03	7.9-8.9	<0.20	34	14	0.08	23	36	<0.10	81	7.4	<55	<170	<3.0	<0.015	Category L	NA
	A03	12.0-12.9	<0.20	31	15	0.07	20	43	<0.10	78	14	<55	<170	<3.0	<0.015	Category M	√
	A03	14.9-15.9	0.27	29	14	0.08	16	42	<0.10	70	15	<55	<170	<3.0	<0.015	Category M	√
	A03	15.9-16.35	<0.20	30	13	0.05	9.3	39	<0.10	48	15	<55	<170	<3.0	<0.015	Category M	√

Sample	Sampling Location	Sampling Depth below Seabed (m)	Metals (mg/kg)								Metalloid (mg/kg)	Organic-PAHs (µg/kg)		Organic-non-PAHs (µg/kg)	Organo-metallics (µg/L in pore water)	Classification under ETWBTC (Works) No. 34/2002	Biological Screening
			Cd	Cr	Cu	Hg	Ni	Pb	Ag	Zn	As	LMW PAH	HMW PAH	Total PCBs	TBT		
	A04	0.0-0.9	<0.20	32	11	0.05	23	27	<0.10	72	8.0	<55	<170	<3.0	<0.015	Category L	NA
	A04	0.9-1.9	<0.20	34	13	0.06	24	32	<0.10	81	9.2	<55	<170	<3.0	<0.015	Category L	NA
	A04	1.9-2.9	<0.20	34	14	0.06	24	33	<0.10	80	6.7	<55	<170	<3.0	<0.015	Category L	NA
	A04	2.9-3.9	<0.20	33	13	0.05	23	31	<0.10	77	6.7	<55	<170	<3.0	<0.015	Category L	NA
	A04	4.9-5.9	<0.20	30	13	0.06	22	34	<0.10	77	5.9	<55	<170	<3.0	<0.015	Category L	NA
	A04	7.9-8.9	<0.20	34	14	0.09	22	36	<0.10	80	6.7	<55	<170	<3.0	<0.015	Category L	NA
	A04	12.15-12.9	<0.20	33	14	0.08	22	35	<0.10	77	6.6	<55	<170	<3.0	<0.015	Category L	NA
	A04	14.9-15.9	<0.20	31	14	0.08	20	37	<0.10	70	11	<55	<170	<3.0	<0.015	Category L	NA
	A04	18.05-18.9	0.20	33	16	0.08	20	44	0.11	82	14	<55	<170	<3.0	<0.015	Category M	√
	B05	0.25-0.9	0.20	39	31	0.28	26	50	0.12	90	17	<55	<170	<3.0	<0.015	Category M	√
	B05	0.9-1.9	0.20	41	32	0.25	28	48	0.11	91	17	<55	<170	<3.0	<0.015	Category M	√
	B05	1.9-2.9	<0.20	38	24	0.16	25	44	0.11	83	15	<55	<170	<3.0	<0.015	Category M	√
	B05	4.9-5.9	<0.20	35	15	0.07	25	40	<0.10	86	9.3	<55	<170	<3.0	<0.015	Category L	NA
	B05	7.9-8.9	0.27	32	15	0.08	20	42	0.10	78	14	<55	<170	<3.0	<0.015	Category M	√
	B05	12.0-12.9	0.41	26	15	0.08	14	47	0.11	74	8.4	<55	<170	<3.0	<0.015	Category L	NA
	B05	14.9-15.9	<0.20	<8.0	<7.0	<0.05	<4.0	16	<0.10	13	2.0	<55	<170	<3.0	<0.015	Category L	NA
	B05	15.9-16.1	<0.20	<8.0	<7.0	0.05	<4.0	21	<0.10	18	15	<55	<170	<3.0	<0.015	Category M	√
	B06	0.35-0.9	<0.20	35	14	0.08	25	34	<0.10	90	9.7	<55	<170	<3.0	<0.015	Category L	NA
	B06	0.9-1.9	<0.20	33	14	0.08	24	33	<0.10	85	8.5	<55	<170	<3.0	<0.015	Category L	NA
	B06	1.9-2.9	<0.20	31	14	0.07	22	30	<0.10	75	7.4	<55	<170	<3.0	<0.015	Category L	NA
	B06	4.9-5.9	<0.20	34	14	0.08	23	35	<0.10	85	8.3	<55	<170	<3.0	<0.015	Category L	NA
	B06	7.9-8.9	<0.20	33	14	0.07	22	34	<0.10	78	5.8	<55	<170	<3.0	<0.015	Category L	NA
	B06	9.9-10.9	<0.20	28	11	0.06	19	29	<0.10	61	7.6	<55	<170	<3.0	<0.015	Category L	NA
	B06	10.9-11.35	<0.20	25	21	<0.05	20	35	<0.10	88	5.4	<55	<170	<3.0	<0.015	Category L	NA
	B07	0.0-0.9	<0.20	33	14	0.06	24	35	<0.10	74	8.0	<55	<170	<3.0	<0.015	Category L	NA
	B07	0.9-1.9	<0.20	34	12	0.06	24	29	<0.10	77	8.6	<55	<170	<3.0	<0.015	Category L	NA

Sample	Sampling Location	Sampling Depth below Seabed (m)	Metals (mg/kg)								Metalloid (mg/kg)	Organic-PAHs (µg/kg)		Organic-non-PAHs (µg/kg)	Organo-metallics (µg/L in pore water)	Classification under ETWBTC (Works) No. 34/2002	Biological Screening
			Cd	Cr	Cu	Hg	Ni	Pb	Ag	Zn	As	LMW PAH	HMW PAH	Total PCBs	TBT		
	B07	1.9-2.9	<0.20	33	13	0.07	23	32	<0.10	77	7.4	<55	<170	<3.0	<0.015	Category L	NA
	B07	2.9-3.9	<0.20	33	13	0.05	23	32	<0.10	77	6.3	<55	<170	<3.0	<0.015	Category L	NA
	B07	4.9-5.9	<0.20	32	13	0.06	21	32	<0.10	72	6.2	<55	<170	<3.0	<0.015	Category L	NA
	B07	7.9-8.9	<0.20	35	14	0.07	23	36	<0.10	77	6.9	<55	<170	<3.0	<0.015	Category L	NA
	B07	12.0-12.9	<0.20	32	12	0.06	20	31	<0.10	61	9.5	<55	<170	<3.0	<0.015	Category L	NA
	B07	14.9-15.9	0.22	28	14	0.06	15	40	<0.10	64	14	<55	<170	<3.0	<0.015	Category M	√
	B08	0.0-0.9	<0.20	29	12	0.08	21	30	<0.10	76	8.1	<55	<170	<3.0	<0.015	Category L	NA
	B08	0.9-1.9	<0.20	30	12	0.08	22	30	<0.10	75	7.0	<55	<170	<3.0	<0.015	Category L	NA
	B08	1.9-2.9	<0.20	32	13	0.07	23	34	0.12	83	5.9	<55	<170	<3.0	<0.015	Category L	NA
	B08	2.9-3.9	<0.20	31	13	0.08	21	33	<0.10	79	6.9	<55	<170	<3.0	<0.015	Category L	NA
	B08	4.9-5.9	<0.20	31	14	0.07	21	38	<0.10	75	6.2	<55	<170	<3.0	<0.015	Category L	NA
	B08	7.9-8.9	<0.20	32	14	0.08	23	36	<0.10	81	7.2	<55	<170	<3.0	<0.015	Category L	NA
	B08	12.1-12.9	<0.20	33	14	0.07	22	35	<0.10	77	7.7	<55	<170	<3.0	<0.015	Category L	NA
	B08	14.9-15.9	<0.20	32	13	0.07	22	35	<0.10	71	9.3	<55	<170	<3.0	<0.015	Category L	NA
	B08	18.0-18.9	<0.20	35	17	0.08	21	47	<0.10	83	13	<55	<170	<3.0	<0.015	Category M	√
	B09	0.1-0.9	<0.20	39	34	0.15	25	52	0.37	110	12	<55	<170	<3.0	<0.015	Category M	√
	B09	0.9-1.9	0.24	37	26	0.12	22	47	0.19	97	14	<55	<170	<3.0	<0.015	Category M	√
	B09	1.9-2.9	<0.20	32	13	0.07	23	30	<0.10	75	8.0	<55	<170	<3.0	<0.015	Category L	NA
	B09	4.9-5.9	<0.20	32	14	0.07	22	33	<0.10	80	6.9	<55	<170	<3.0	<0.015	Category L	NA
	B09	7.9-8.9	<0.20	34	14	0.07	23	36	<0.10	82	6.4	<55	<170	<3.0	<0.015	Category L	NA
	B09	12.1-12.9	<0.20	32	15	0.07	20	40	<0.10	74	11	<55	<170	<3.0	<0.015	Category L	NA
	B09	14.9-15.9	0.27	31	15	0.07	18	46	0.14	80	14	<55	<170	<3.0	<0.015	Category M	√
	B09	18.0-18.9	0.28	29	16	0.08	16	45	0.10	73	13	<55	<170	<3.0	<0.015	Category M	√
	B10	0.05-0.9	0.22	41	29	0.19	26	51	0.17	92	19	<55	<170	<3.0	<0.015	Category M	√
	B10	0.9-1.9	<0.20	35	14	0.06	24	32	<0.10	79	8.7	<55	<170	<3.0	<0.015	Category L	NA
	B10	1.9-2.9	<0.20	34	14	0.07	23	31	<0.10	78	7.1	<55	<170	<3.0	<0.015	Category L	NA

Sample	Sampling Location	Sampling Depth below Seabed (m)	Metals (mg/kg)								Metalloid (mg/kg)	Organic-PAHs (µg/kg)		Organic-non-PAHs (µg/kg)	Organo-metallics (µg/L in pore water)	Classification under ETWBTC (Works) No. 34/2002	Biological Screening
			Cd	Cr	Cu	Hg	Ni	Pb	Ag	Zn	As	LMW PAH	HMW PAH	Total PCBs	TBT		
	B10	2.9-3.9	<0.20	34	13	0.06	23	32	<0.10	78	7.7	<55	<170	<3.0	<0.015	Category L	NA
	B10	4.9-5.9	<0.20	36	14	0.07	23	36	<0.10	78	6.1	<55	<170	<3.0	<0.015	Category L	NA
	B10	7.9-8.9	<0.20	34	14	0.07	23	33	<0.10	73	7.4	<55	<170	<3.0	<0.015	Category L	NA
	B10	12.0-12.9	<0.20	34	13	0.06	21	34	<0.10	65	8.0	<55	<170	<3.0	<0.015	Category L	NA
	B10	13.9-14.7	<0.20	34	15	0.06	20	42	<0.10	70	23	<55	<170	<3.0	<0.015	Category M	√
Hong Kong Link Road																	
Sample in 2004	A1	0.55-1.00	<0.2	33	24	0.1	21	29	0.2	83	15	<55	<170	<3.0	<0.015	Category M	√
	A1	1.0-2.0	<0.2	37	21	0.16	22	31	0.1	74	17	<55	<170	<3.0	<0.015	Category M	√
	A1	2.0-3.0	<0.2	37	20	0.13	23	29	0.1	71	15	<55	<170	<3.0	<0.015	Category M	√
	A1	5.0-6.0	<0.2	32	15	0.08	20	28	<0.1	64	12	<55	<170	<3.0	<0.015	Category L	NA
	A1	8.0-9.0	<0.2	36	13	0.09	22	25	0.1	73	11	<55	<170	<3.0	<0.015	Category L	NA
	A1	14.0-15.0	<0.2	18	6	<0.05	9	13	<0.1	28	8	<55	<170	<3.0	<0.015	Category L	NA
	A2	0.47-1.00	<0.2	40	28	0.13	26	28	0.2	96	19	<55	<170	<3.0	<0.015	Category M	√
	A2	2.0-3.0	<0.2	36	16	0.1	22	24	<0.1	72	13	<55	<170	<3.0	<0.015	Category M	√
	A2	5.0-6.0	<0.2	31	10	0.06	23	19	<0.1	71	7	<55	<170	<3.0	<0.015	Category L	NA
	A2	8.0-9.0	<0.2	38	14	0.07	25	22	0.1	79	13	<55	<170	<3.0	<0.015	Category M	√
	A3	0.41-1.0	<0.2	29	16	0.11	19	20	0.1	70	12	<55	<170	<3.0	<0.015	Category L	NA
	A3	2.0-3.0	<0.2	34	11	0.05	24	17	<0.1	75	7	<55	<170	<3.0	<0.015	Category L	NA
	A3	5.0-6.0	<0.2	36	14	0.07	25	21	<0.1	81	15	<55	<170	<3.0	<0.015	Category M	√
	A3	8.0-9.0	<0.2	37	14	0.08	24	22	0.1	79	11	<55	<170	<3.0	<0.015	Category L	NA
	A3	14.0-15.0	<0.2	35	14	0.07	24	21	<0.1	80	11	<55	<170	<3.0	<0.015	Category L	NA
	A4	0.14-1.00	<0.2	39	31	0.12	35	24	0.1	79	15	<55	<170	<3.0	<0.015	Category M	√
	A4	1.0-2.0	<0.2	35	11	0.17	24	17	<0.1	74	7	<55	<170	<3.0	<0.015	Category L	NA
	A4	2.0-3.0	<0.2	36	11	<0.05	25	17	<0.1	76	9	<55	<170	<3.0	<0.015	Category L	NA
	A4	5.0-6.0	<0.2	38	15	0.06	26	22	<0.1	84	12	<55	<170	<3.0	<0.015	Category L	NA
	A4	8.0-9.0	<0.2	40	15	0.07	26	23	0.1	83	13	<55	<170	<3.0	<0.015	Category M	√
	A4	14.0-15.0	<0.2	40	15	0.07	26	25	0.1	84	13	<55	<170	<3.0	<0.015	Category M	√

Sample	Sampling Location	Sampling Depth below Seabed (m)	Metals (mg/kg)								Metalloid (mg/kg)	Organic-PAHs (µg/kg)		Organic-non-PAHs (µg/kg)	Organo-metallics (µg/L in pore water)	Classification under ETWBTC (Works) No. 34/2002	Biological Screening
			Cd	Cr	Cu	Hg	Ni	Pb	Ag	Zn	As	LMW PAH	HMW PAH	Total PCBs	TBT		
	A5	0.17-1.00	<0.2	39	11	<0.05	23	20	0.2	70	8	<55	<170	<3.0	<0.015	Category L	NA
	A5	2.0-3.0	<0.2	43	12	<0.05	25	22	0.2	77	8	<55	<170	<3.0	<0.015	Category L	NA
	A5	5.0-6.0	<0.2	45	15	0.06	26	27	0.2	84	11	<55	<170	<3.0	<0.015	Category L	NA
	A5	8.0-9.0	<0.2	49	21	0.06	27	29	0.2	79	13	<55	<170	<3.0	<0.015	Category M	√
	A5	14.0-15.0	<0.2	50	20	0.08	27	28	0.2	78	14	<55	<170	<3.0	<0.015	Category M	√
	B8	0.25-1.00	<0.2	45	32	0.17	28	40	0.2	108	19	<55	<170	<3.0	<0.015	Category M	√
	B8	1.0-2.0	<0.2	34	13	0.06	22	24	<0.1	71	10	<55	<170	<3.0	<0.015	Category L	NA
	B8	2.0-3.0	<0.2	37	13	0.06	24	25	0.1	78	12	<55	<170	<3.0	<0.015	Category L	NA
	B8	5.0-6.0	<0.2	28	9	<0.05	15	20	<0.1	52	11	<55	<170	<3.0	<0.015	Category L	NA
	B8	8.0-9.0	<0.2	25	8	<0.05	14	20	<0.1	45	11	<55	<170	<3.0	<0.015	Category L	NA
	B8	14.0-15.0	<0.2	42	16	0.07	26	29	0.1	74	12	<55	<170	<3.0	<0.015	Category L	NA
	B9	0.90-1.00	<0.2	60	21	0.08	39	39	0.2	125	18	<55	<170	<3.0	<0.015	Category M	√
	B9	1.0-2.0	<0.2	30	11	0.06	19	21	<0.1	64	10	<55	<170	<3.0	<0.015	Category L	NA
	B9	2.0-3.0	<0.2	29	11	0.07	18	21	<0.1	63	11	<55	<170	<3.0	<0.015	Category L	NA
	B9	5.0-6.0	<0.2	35	9	<0.05	15	32	<0.1	47	23	<55	<170	<3.0	<0.015	Category M	√
	B9	7.0-8.0	<0.2	56	18	0.06	28	32	0.1	82	14	<55	<170	<3.0	<0.015	Category M	√
	B14	0.25-1.00	<0.2	46	27	0.14	29	30	0.2	101	18	<55	<170	<3.0	<0.015	Category M	√
	B14	2.0-3.0	<0.2	43	15	0.07	28	22	0.1	89	11	<55	<170	<3.0	<0.015	Category L	NA
	B14	5.0-6.0	<0.2	43	16	0.08	28	26	0.1	89	13	<55	<170	<3.0	<0.015	Category M	√
	B14	7.0-8.0	<0.2	31	11	0.06	13	22	<0.1	47	11	<55	<170	<3.0	<0.015	Category L	NA
	B15	0.45-1.00	<0.2	47	32	0.19	28	41	0.2	109	20	<55	<170	<3.0	<0.015	Category M	√
	B15	1.0-2.0	<0.2	39	20	0.1	24	31	0.1	82	15	<55	<170	<3.0	<0.015	Category M	√
	B15	2.0-3.0	<0.2	37	12	<0.05	24	24	<0.1	78	10	<55	<170	<3.0	<0.015	Category L	NA
	B15	5.0-6.0	<0.2	36	13	0.06	23	24	<0.1	73	11	<55	<170	<3.0	<0.015	Category L	NA
	B15	8.0-9.0	<0.2	42	15	0.05	24	36	0.1	68	18	<55	<170	<3.0	<0.015	Category M	√
	B16	0.0-1.0	<0.2	46	13	<0.05	23	24	<0.1	76	11	<55	<170	<3.0	<0.015	Category L	NA
	B16	1.0-2.0	<0.2	28	8	<0.05	12	16	<0.1	42	9	<55	<170	<3.0	<0.015	Category L	NA

Sample	Sampling Location	Sampling Depth below Seabed (m)	Metals (mg/kg)								Metalloid (mg/kg)	Organic-PAHs (µg/kg)		Organic-non-PAHs (µg/kg)	Organo-metallics (µg/L in pore water)	Classification under ETWBTC (Works) No. 34/2002	Biological Screening
			Cd	Cr	Cu	Hg	Ni	Pb	Ag	Zn	As	LMW PAH	HMW PAH	Total PCBs	TBT		
	B16	2.0-3.0	<0.2	16	4	<0.05	5	10	<0.1	19	6	<55	<170	<3.0	<0.015	Category L	NA
	B17	0.0-1.0	<0.2	28	10	<0.05	13	20	<0.1	49	9	<55	<170	<3.0	<0.015	Category L	NA
	G13	Surface	<0.2	41	28	0.18	26	33	0.2	101	18	<55	<170	<3.0	<0.015	Category M	√
	G14	surface	<0.2	44	31	0.18	28	38	0.2	113	18	<55	<170	<3.0	<0.015	Category M	√
Sample in 2009	C11	0.3-0.9	<0.2	39	16	0.05	27	34	<0.1	99	8	<550	<1700	<3.0	N/A*	Category L	NA
	C11	0.9-1.9	<0.2	39	15	0.07	26	38	<0.1	96	9	<550	<1700	<3.0	N/A*	Category L	NA
	C11	1.9-2.9	<0.2	39	14	0.06	26	32	<0.1	97	10	<550	<1700	<3.0	N/A*	Category L	NA
	C11	4.9-5.9	<0.2	39	15	0.06	28	37	<0.1	93	8	<550	<1700	<3.0	N/A*	Category L	NA
	C11	7.9-8.9	<0.2	41	14	<0.05	26	35	<0.1	81	14	<550	<1700	<3.0	N/A*	Category M	√
	C11	9.9-10.8	<0.2	19	6	<0.05	6	22	<0.1	28	13	<550	<1700	<3.0	N/A*	Category M	√
	C12	0.2-0.9	<0.2	38	10	<0.05	25	20	<0.1	81	7	<550	<1700	<3.0	N/A*	Category L	NA
	C12	0.9-1.9	<0.2	48	15	<0.05	29	29	0.1	109	10	<550	<1700	<3.0	N/A*	Category L	NA
	C12	1.9-2.9	<0.2	52	17	<0.05	31	33	0.1	112	11	<550	<1700	<3.0	N/A*	Category L	NA
	C12	4.9-5.9	<0.2	53	17	0.06	31	37	0.1	113	8	<550	<1700	<3.0	N/A*	Category L	NA
	C12	7.9-8.9	<0.2	48	16	0.05	30	34	0.1	98	9	<550	<1700	<3.0	N/A*	Category L	NA
	C12	8.9-9.9	<0.2	48	15	<0.05	28	35	0.1	93	10	<550	<1700	<3.0	N/A*	Category L	NA
	C12	9.9-10.4	<0.2	11	4	<0.05	6	12	<0.1	26	4	<550	<1700	<3.0	N/A*	Category L	NA
	C13	0.2-0.9	<0.2	29	12	<0.05	25	25	<0.1	71	7	<550	<1700	<3.0	N/A*	Category L	NA
	C13	0.9-1.9	<0.2	35	14	<0.05	27	28	0.1	86	9	<550	<1700	<3.0	N/A*	Category L	NA
	C13	1.9-2.9	<0.2	37	15	<0.05	27	31	0.1	91	8	<550	<1700	<3.0	N/A*	Category L	NA
	C13	4.9-5.9	<0.2	41	16	0.06	28	33	0.1	91	6	<550	<1700	<3.0	N/A*	Category L	NA
	C13	7.9-8.9	<0.2	40	16	0.05	29	34	0.1	88	8	<550	<1700	<3.0	N/A*	Category L	NA
	C13	9.9-10.9	<0.2	7	2	<0.05	4	29	<0.1	14	4	<550	<1700	<3.0	N/A*	Category L	NA
	C14	0.3-0.9	<0.2	37	10	<0.05	24	21	<0.1	88	7	<550	<1700	<3.0	N/A*	Category L	NA
	C14	0.9-1.9	<0.2	49	17	0.07	31	34	0.1	115	11	<550	<1700	<3.0	N/A*	Category L	NA
	C14	1.9-2.9	<0.2	48	16	0.05	30	31	0.1	112	8	<550	<1700	<3.0	N/A*	Category L	NA

Sample	Sampling Location	Sampling Depth below Seabed (m)	Metals (mg/kg)								Metalloid (mg/kg)	Organic-PAHs (µg/kg)		Organic-non-PAHs (µg/kg)	Organo-metallics (µg/L in pore water)	Classification under ETWBTC (Works) No. 34/2002	Biological Screening
			Cd	Cr	Cu	Hg	Ni	Pb	Ag	Zn	As	LMW PAH	HMW PAH	Total PCBs	TBT		
	C14	4.9-5.9	<0.2	55	17	0.05	32	36	0.1	118	9	<550	<1700	<3.0	N/A*	Category L	NA
	C14	7.9-8.9	<0.2	55	18	<0.05	32	35	0.2	116	14	<550	<1700	<3.0	N/A*	Category M	√
	C14	10.9-11.9	<0.2	19	6	<0.05	10	20	0.1	36	5	<550	<1700	<3.0	N/A*	Category L	NA
	C14	12.0-12.6	<0.2	10	3	<0.05	4	19	<0.1	22	2	<550	<1700	<3.0	N/A*	Category L	NA
	C15	0.1-0.9	<0.2	36	10	<0.05	24	20	<0.1	83	6	<550	<1700	<3.0	N/A*	Category L	NA
	C15	0.9-1.9	<0.2	45	15	<0.05	28	31	0.1	107	8	<550	<1700	<3.0	N/A*	Category L	NA
	C15	1.9-2.9	<0.2	48	15	<0.05	28	30	0.1	108	8	<550	<1700	<3.0	N/A*	Category L	NA
	C15	4.9-5.9	<0.2	49	16	<0.05	29	35	0.1	111	8	<550	<1700	<3.0	N/A*	Category L	NA
	C15	7.9-8.9	<0.2	49	16	<0.05	28	36	0.1	101	9	<550	<1700	<3.0	N/A*	Category L	NA
	C15	10.9-11.8	<0.2	35	8	<0.05	9	48	<0.1	28	9	<550	<1700	<3.0	N/A*	Category L	NA
	C16	0.2-0.9	<0.2	26	12	<0.05	22	30	<0.1	65	8	<550	<1700	<3.0	N/A*	Category L	NA
	C16	0.9-1.9	<0.2	33	12	<0.05	27	25	<0.1	81	8	<550	<1700	<3.0	N/A*	Category L	NA
	C16	1.9-2.9	<0.2	36	15	<0.05	27	28	0.1	87	7	<550	<1700	<3.0	N/A*	Category L	NA
	C16	4.9-5.9	<0.2	35	14	<0.05	26	30	0.1	81	8	<550	<1700	<3.0	N/A*	Category L	NA
	C16	7.9-8.9	<0.2	36	14	<0.05	26	32	0.1	75	7	<550	<1700	<3.0	N/A*	Category L	N/A

(1) Bold value in shaded cell denote the contaminate level exceeds the Lower Chemical Exceedance Level (LCEL) but not exceeding the Upper Chemical Exceedance Level (UCEL);

(2) Bold value with # denoted the contaminate level exceeds both the LCEL and UCEL;

(3) Low molecular weight PAHs include naphthalene, acenaphthylene. acenaphthene, fluorene, phenanthrene and anthracene; high molecular weight PAHs include chrysene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenzo(a.h.)anthracene, fluoranthene, indeno(1.2.3-cd)pyrene, pyrene and benzo(g.h.i)perylene; and

(4) Total PCBs include 2,4' dichlorobiphenyl, 2,2',5 trichlorobiphenyl, 2,4',4 trichlorobiphenyl, 2,2',3,5 tetrachlrobiphenyl, 2,2',5,5' tetrachlrobiphenyl, 2,3',4,4' tetrachlrobiphenyl, 3,3',4,4' tetrachlrobiphenyl, 2,2',4,5,5' pentachlrobiphenyl, 2,3,3',4,4' pentachlrobiphenyl, 2,3',4,4',5' pentachlrobiphenyl, 3,3',4,4,5' pentachlrobiphenyl, 2,2',3,3',4,4' hexachlrobiphenyl, 2,2',3,4,4',5' hexachlrobiphenyl, 2,2',4,4',5,5' hexachlrobiphenyl, 3,3',4,4',5,5' hexachlrobiphenyl, 2,2',3,3',4,4',5 heptachlrobiphenyl, 2,2',3,4,4',5,5' heptachlrobiphenyl and 2,2'3,4',5,5',6 heptachlrobiphenyl;

(5) *N/A*-Insufficient interstitial water for analysis of TBT.*

7.6.2 Biological Screening

7.6.2.1 A total of 50 sediment samples (24 samples for HKBCF reclamation, 23 samples for the marine viaducts in HKLR and 3 samples for HKLR reclamation) are classified as Category M and biological screening of these samples is required. **Table 7-11** summarized the samples requiring biological screening test.

7.6.2.2 Not Used.

7.6.2.3 The results of 10-day burrowing amphipod toxicity test, 20-day burrowing polychaete toxicity test, and 48-96 hours larvae (bivalve or echinoderm) toxicity test are summarised in **Tables 7-12 – 7-14** respectively, whereas the results of ancillary parameters including grain size, moisture content, total organic carbon (TOC), ammonia, and salinity are summarised in **Table 7-15**.

7.6.2.4 The results showed that all the samples were passed the biological tests except the samples A01 (9.9 -10.8m), A5 (8.0-9.0m & 14.0-15.0m), B9 (0.9-1.0m, 5.0-6.0m & 7.0-8.0m), B15 (0.45-1.00m, 1.0-2.0m & 8.0-9.0m), G14, C11 (7.9-8.9m, 9.9-10.8m) and C14 (7.9-8.9m). The results of ancillary parameters showed that interstitial ammonia ranged from <0.03 - 36mgNH_3/L while TOC levels (% dry weight) ranged from 010 - 0.94%.

7.6.2.5 The highest levels of interstitial ammonia and TOC content were determined in sample B05 (1.9 - 2.9m) and A01 (9.9 - 10.8m) respectively. The grain size (<63μm) ranges from 71 - 101%. The highest moisture content (107%) and interstitial salinity (35ppt) were found at sample B09 (0.1 - 0.9m) and B05 (0.25 - 0.9m) respectively.

Table 7-11 Schedule of Sediment Sample for Biological Screening

Sample	Sample Location	Sampling Depth below seabed (m)	No. of Sample
HKBCF			
Sampling for HKBCF reclamation (2008)	A01	0.05 - 0.9	1
	A01	0.9 – 1.9	1
	A01	1.9 – 2.9	1
	A01	7.9-8.9	1
	A01	9.9-10.8	1
	A02	14.9-15.9	1
	A02	16.9-17.9	1
	A03	12.0-12.9	1
	A03	14.9-15.9	1
	A03	15.9-16.35	1
	A04	18.05-18.9	1
	B05	0.25-0.9	1
	B05	0.9-1.9	1
	B05	1.9-2.9	1
	B05	7.9-8.9	1
	B05	15.9-16.1	1
	B07	14.9-15.9	1
	B08	18.0-18.9	1
	B09	0.1-0.9	1
	B09	0.9-1.9	1
	B09	14.9-15.9	1
	B09	18.0-18.9	1
	B10	0.05-0.9	1
	B10	13.9-14.7	1
HKLR			
Sampling for HKLR viaduct (2004)	A1	0.55-1.00	1
	A1	1.0–2.0	1
	A1	2.0–3.0	1
	A2	0.47–1.00	1

Sample	Sample Location	Sampling Depth below seabed (m)	No. of Sample
	A2	2.0–3.0	1
	A2	8.0–9.0	1
	A3	5.0–6.0	1
	A4	0.14–1.00	1
	A4	8.0-9.0	1
	A4	14.0–15.0	1
	A5	8.0–9.0	1
	A5	14.0-15.0	1
	B8	0.25–1.00	1
	B9	0.9–1.0	1
	B9	5.0-6.0	1
	B9	7.0-8.0	1
	B14	0.25-1.00	1
	B14	5.0-6.0	1
	B15	0.45-1.00	1
	B15	1.0-2.0	1
	B15	8.0-9.0	1
	G13	Surface	1
	G14	Surface	1
Sampling for HKLR reclamation (2009)	C11	7.9-8.9	1
	C11	9.9–10.8	1
	C14	7.9-8.9	1

Table 7-12 Amphipod Survival in Relation to Reference Sediment

Sample	Sample Location	Sampling Depth below seabed (m)	Survival in Relation to Reference (%)	Statistical difference with Reference	Result
HKBCF					
Sampling for HKBCF reclamation (2008)	A01	0.05 - 0.9	96.8	Note 1	Pass
	A01	0.9 – 1.9	95.8	Note 1	Pass
	A01	1.9 – 2.9	96.8	Note 1	Pass
	A01	7.9-8.9	96.8	Note 1	Pass
	A01	9.9-10.8	91.6	Note 1	Pass
	A02	14.9-15.9	100.0	Note 1	Pass
	A02	16.9-17.9	N/A*	N/A*	N/A*
	A03	12.0-12.9	97.9	Note 1	Pass
	A03	14.9-15.9	100.0	Note 1	Pass
	A03	15.9-16.35	97.9	Note 1	Pass
	A04	18.05-18.9	93.7	Note 1	Pass
	B05	0.25-0.9	96.8	Note 1	Pass
	B05	0.9-1.9	96.8	Note 1	Pass
	B05	1.9-2.9	96.8	Note 1	Pass
	B05	7.9-8.9	95.8	Note 1	Pass
	B05	15.9-16.1	N/A*	N/A*	N/A*
	B07	14.9-15.9	95.8	Note 1	Pass
	B08	18.0-18.9	93.7	Note 1	Pass
	B09	0.1-0.9	93.7	Note 1	Pass
	B09	0.9-1.9	93.7	Note 1	Pass
	B09	14.9-15.9	100.0	Note 1	Pass

Sample	Sample Location	Sampling Depth below seabed (m)	Survival in Relation to Reference (%)	Statistical difference with Reference	Result
	B09	18.0-18.9	96.8	Note 1	Pass
	B10	0.05-0.9	96.8	Note 1	Pass
	B10	13.9-14.7	96.8	Note 1	Pass
HKLR					
Sampling for HKLR viaduct (2004)	A1	0.55-1.00	105.6	Note 1	Pass
	A1	1.0–2.0			
	A1	2.0–3.0			
	A2	0.47–1.00	93.7	Note 1	Pass
	A2	2.0–3.0			
	A2	8.0–9.0			
	A3	5.0–6.0	91.7	Note 1	Pass
	A4	0.14–1.00	81.9	Note 1	Pass
	A4	8.0-9.0			
	A4	14.0–15.0			
	A5	8.0–9.0	81.9	Note 1	Pass
	A5	14.0-15.0			
	B8	0.25–1.00	93.1	Note 1	Pass
	B9	0.9–1.0	79.2	P=0.0008	Fail
	B9	5.0-6.0			
	B9	7.0-8.0			
	B14	0.25-1.00	81.9	Note 1	Pass
	B14	5.0-6.0			
	B15	0.45-1.00	76.4	P=0.0005	Fail
	B15	1.0-2.0			
	B15	8.0-9.0			
	G13	Surface	88	Note 1	Pass
	G14	Surface	82.6	Note 1	Pass
Sampling for HKLR reclamation (2009)	C11	7.9-8.9	51.0	P<0.05	Fail
	C11	9.9–10.8	48.0	P<0.05	Fail
	C14	7.9-8.9	48.0	P<0.05	Fail

Note: 1) As the average survival rate of amphipods for test sediment was greater than 80% of that of the reference sediment, statistical analysis was not required

2) N/A – Insufficient sample for biological test.

Table 7-13 Total Dry Weight of Polychaete in Relation to Reference Sediment

Sample	Sample Location	Sampling Depth below seabed (m)	Total Dry Weight in Relation to Reference Site (%)	Statistical difference with Reference	Result
HKBCF					
Sampling for HKBCF reclamation (2008)	A01	0.05 - 0.9	101.9	Note 1	Pass
	A01	0.9 – 1.9	87.2	P=0.082	Pass
	A01	1.9 – 2.9	87.6	P=0.156	Pass
	A01	7.9-8.9	92.6	Note 1	Pass
	A01	9.9-10.8	71.9	P<0.05	Fail
	A02	14.9-15.9	98.8	Note 1	Pass
	A02	16.9-17.9	N/A*	N/A*	N/A*
	A03	12.0-12.9	96.9	Note 1	Pass

Sample	Sample Location	Sampling Depth below seabed (m)	Total Dry Weight in Relation to Reference Site (%)	Statistical difference with Reference	Result
	A03	14.9-15.9	73.3	P=0.116	Pass
	A03	15.9-16.35	74.4	P=0.126	Pass
	A04	18.05-18.9	93.1	Note 1	Pass
	B05	0.25-0.9	71.3	P=0.1	Pass
	B05	0.9-1.9	71.3	P=0.102	Pass
	B05	1.9-2.9	76.9	P=0.147	Pass
	B05	7.9-8.9	68.8	P=0.089	Pass
	B05	15.9-16.1	N/A*	N/A*	N/A*
	B07	14.9-15.9	108.1	Note 1	Pass
	B08	18.0-18.9	83.4	P=0.074	Pass
	B09	0.1-0.9	71.2	P=0.101	Pass
	B09	0.9-1.9	83.2	P=0.237	Pass
	B09	14.9-15.9	73.4	P=0.118	Pass
	B09	18.0-18.9	74.7	P=0.123	Pass
	B10	0.05-0.9	98.6	Note 1	Pass
	B10	13.9-14.7	103.9	Note 1	Pass
HKLR					
Sampling for HKLR viaduct (2004)	A1	0.55-1.00	140.3	Note 1	Pass
	A1	1.0–2.0			
	A1	2.0–3.0			
	A2	0.47–1.00	109.8	Note 1	Pass
	A2	2.0–3.0			
	A2	8.0–9.0			
	A3	5.0–6.0	82.8	P=0.1146	Pass
	A4	0.14–1.00	74.9	P=0.0642	Pass
	A4	8.0-9.0			
	A4	14.0–15.0			
	A5	8.0–9.0	54.7	P=0.0028	Fail
	A5	14.0-15.0			
	B8	0.25–1.00	130.8	Note 1	Pass
	B9	0.9–1.0	70.5	P=0.0174	Fail
	B9	5.0-6.0			
	B9	7.0-8.0			
	B14	0.25-1.00	82.9	P=0.0822	Pass
	B14	5.0-6.0			
	B15	0.45-1.00	97.9	Note 1	Pass
	B15	1.0-2.0			
	B15	8.0-9.0			
	G13	Surface	113.2	Note 1	Pass
	G14	Surface	114.3	Note 1	Pass
Sampling for HKLR reclamation (2009)	C11	7.9-8.9	79.0	P=0.154	Pass
	C11	9.9–10.8	61.6	P=0.0030	Fail
	C14	7.9-8.9	98.0	Note 1	Pass

Note: 1) As the average total dry weight for the test sediment was greater than 90% of that of the reference sediment, statistical analysis was not required

2) N/A – Insufficient sample for biological test.

Table 7-14 Normality Survival of Bivalve Larvae in Relation to Reference Sediment

Sample	Sample Location	Sampling Depth below seabed (m)	Survival in Relation to Reference Site (%)	Statistical difference with Reference	Result
HKBCF					
Sampling for HKBCF reclamation (2008)	A01	0.05 - 0.9	99.3	Note 1	Pass
	A01	0.9 – 1.9	98.9	Note 1	Pass
	A01	1.9 – 2.9	100.1	Note 1	Pass
	A01	7.9-8.9	101.4	Note 1	Pass
	A01	9.9-10.8	100.7	Note 1	Pass
	A02	14.9-15.9	100.2	Note 1	Pass
	A02	16.9-17.9	N/A*	N/A*	N/A*
	A03	12.0-12.9	103.7	Note 1	Pass
	A03	14.9-15.9	98.4	Note 1	Pass
	A03	15.9-16.35	101.9	Note 1	Pass
	A04	18.05-18.9	99.6	Note 1	Pass
	B05	0.25-0.9	101.2	Note 1	Pass
	B05	0.9-1.9	99.8	Note 1	Pass
	B05	1.9-2.9	101.7	Note 1	Pass
	B05	7.9-8.9	98.6	Note 1	Pass
	B05	15.9-16.1	N/A*	N/A*	N/A*
	B07	14.9-15.9	99.4	Note 1	Pass
	B08	18.0-18.9	100.1	Note 1	Pass
	B09	0.1-0.9	100.9	Note 1	Pass
	B09	0.9-1.9	99.2	Note 1	Pass
	B09	14.9-15.9	99.2	Note 1	Pass
	B09	18.0-18.9	97.8	Note 1	Pass
	B10	0.05-0.9	99.6	Note 1	Pass
	B10	13.9-14.7	97.9	Note 1	Pass
HKLR					
Sampling for HKLR viaduct (2004)	A1	0.55-1.00	94.9	Note 1	Pass
	A1	1.0–2.0			
	A1	2.0–3.0			
	A2	0.47–1.00	88.7	Note 1	Pass
	A2	2.0–3.0			
	A2	8.0–9.0			
	A3	5.0–6.0	90.0	Note 1	Pass
	A4	0.14–1.00	97.6	Note 1	Pass
	A4	8.0-9.0			
	A4	14.0–15.0			
	A5	8.0–9.0	100.7	Note 1	Pass
	A5	14.0-15.0			
	B8	0.25–1.00	101.2	Note 1	Pass
	B9	0.9–1.0	96.3	Note 1	Pass
	B9	5.0-6.0			
	B9	7.0-8.0			
	B14	0.25-1.00	121.0	Note 1	Pass
	B14	5.0-6.0			
	B15	0.45-1.00	98.3	Note 1	Pass

Sample	Sample Location	Sampling Depth below seabed (m)	Survival in Relation to Reference Site (%)	Statistical difference with Reference	Result
	B15	1.0-2.0			
	B15	8.0-9.0			
	G13	Surface	88.7	Note 1	Pass
	G14	Surface	63.9	P=0.0001	Fail
Sampling for HKLR reclamation (2009)	C11	7.9-8.9	43.7	P <0.05	Fail
	C11	9.9–10.8	42.8	P <0.05	Fail
	C14	7.9-8.9	110.4	Note 1	Pass

Note: 1) As the average survival rate of bivalve larve for test sediment was greater than 80% of that of the reference sediment, statistical analysis was not required
2) N/A – Insufficient sample for biological test.

Table 7-15 Ancillary Test Results

Sample	Sample Location	Sampling Depth (m)	Interstitial Ammonia ($mgNH_3/L$)	Interstitial Salinity (ppt)	Grain Size <63m (%)	Moisture Content* (%)	TOC (% Wet Weight)	TOC (% Dry Weight)
HKBCF								
HKBCF reclamation (2008)	A01	0.05 - 0.9	1.4	31	99	92	0.39	0.75
	A01	0.9 – 1.9	0.62	25	98	88	0.41	0.77
	A01	1.9 – 2.9	11	30	98	89	0.41	0.77
	A01	7.9-8.9	4.9	20	99	78	0.48	0.85
	A01	9.9–10.8	6.6	23	94	56	0.60	0.94
	A02	14.9-15.9	<0.03	25	99	89	0.39	0.75
	A02	16.9-17.9	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*
	A03	12.0-12.9	4.2	25	100	77	0.45	0.80
	A03	14.9-15.9	3.8	25	99	71	0.53	0.91
	A03	15.9-16.35	N/A**	N/A**	71	29	0.08	0.10
	A04	18.05-18.9	1.8	20	99	79	0.47	0.84
	B05	0.25-0.9	1.3	35	99	86	0.42	0.78
	B05	0.9-1.9	3.2	27	99	86	0.42	0.78
	B05	1.9-2.9	24	30	99	83	0.40	0.73
	B05	7.9-8.9	<0.03	33	98	85	0.50	0.93
	B05	15.9-16.1	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*
	B07	14.9-15.9	0.38	23	97	64	0.49	0.80
	B08	18.0-18.9	0.84	20	99	76	0.41	0.72
	B09	0.1-0.9	0.87	32	99	107	0.42	0.87
	B09	0.9-1.9	2.0	32	99	98	0.40	0.79
	B09	14.9-15.9	7.1	25	100	72	0.54	0.93
	B09	18.0-18.9	6.5	25	101	72	0.52	0.89
	B10	0.05-0.9	0.92	30	76	73	0.38	0.66
	B10	13.9-14.7	1.7	25	100	65	0.40	0.66
HKLR								
Sampling for HKLR viaduct (2004)	A1	0.55-1.00	6.1	27	82	58	0.50	0.79
	A1	1.0–2.0						
	A1	2.0–3.0						
	A2	0.47–1.00	6.5	25	85	72	0.40	0.69
	A2	2.0–3.0						
	A2	8.0–9.0						

Sample	Sample Location	Sampling Depth (m)	Interstitial Ammonia ($mgNH_3/L$)	Interstitial Salinity (ppt)	Grain Size <63m (%)	Moisture Content* (%)	TOC (% Wet Weight)	TOC (% Dry Weight)
	A3	5.0–6.0	21	25	93	78	0.45	0.80
	A4	0.14–1.00	7.5	26	90	79	0.45	0.81
	A4	8.0-9.0						
	A4	14.0–15.0						
	A5	6.0–9.0	N/A**	24	98	67	0.30	0.50
	A5	14.0-15.0						
	B8	0.25–1.00	4.3	26	96	83	0.45	0.82
	B9	0.9–1.0	12	24	42	46	0.25	0.36
	B9	5.0-6.0						
	B9	7.0-8.0						
	B14	0.25-1.00	6.7	25	92	83	0.40	0.73
	B14	5.0-6.0						
	B15	0.45-1.00	36	23	91	42	0.40	0.57
	B15	1.0-2.0						
	B15	8.0-9.0						
	G13	Surface	1.8	32	95	89	0.45	0.85
	G14	Surface	7.1	28	89	77	0.35	0.62

Note: N/A – Insufficient sample for biological test.*
*N/A**- Analysis was not performed due to insufficient amount of porewater obtained.*

7.6.3 Elutriate Samples

7.6.3.1 Elutriate tests were conducted for the purpose of water quality assessment (see **Section 9**) of the extent of contaminant release when dredging activities take place. The testing parameters included heavy metals (cadmium, chromium, copper, mercury, nickel, lead, zinc and silver), metalloid (arsenic) and organic micro-pollutants (PCB, PAH and TBT), chlorinated pesticides and nutrients including NH_3-N, PO_4-P, and total phosphorus.

7.6.3.2 The elutriate test results are summarised in **Tables 7-16 and 7-17**. In general, the levels of PAHs, PCBs and TBT, metals were all below the reporting limits.

Table 7.16 Elutriate Test Results (Metals, Metalloid and PAHs)

Sample location	Sampling Depth below seabed (m)	Metals (ug/L)								Metalloid (ug/L)	Organic-PAHs (µg/L)	
		Cd	Cr	Cu	Hg	Ni	Pb	Ag	Zn	As	LMW PAH	HMW PAH
A01	0.05 - 0.9	<0.2	<1	1	<0.1	2.1	<1	<1	<4	3.7	<0.20	<0.20
A01	0.9 – 1.9	<0.2	<1	<1	<0.1	<1	<1	<1	<4	4.4	<0.20	<0.20
A01	2.9 – 3.9	<0.2	<1	1.7	<0.1	2.5	<1	<1	<4	9.9	<0.20	<0.20
A01	7.9-8.9	<0.2	<1	<1	<0.1	1.1	<1	<1	<4	2.3	<0.20	<0.20
A01	9.9–10.8	0.37	<1	<1	<0.1	6.5	<1	<1	8.5	<2	<0.20	<0.20
A02	0.2-0.9	<0.2	<1	<1	<0.1	1.1	<1	<1	<4	23	<0.20	<0.20
A02	2.9-3.9	<0.2	<1	<1	<0.1	2.2	<1	<1	<4	57	<0.20	<0.20
A02	7.9-8.9	<0.2	<1	<1	<0.1	2.0	<1	<1	<4	13	<0.20	<0.20
A02	14.9-15.9	<0.2	<1	1.2	<0.1	1.7	<1	<1	5	7.5	<0.20	<0.20
A02	16.9-17.9	<0.2	<1	1.3	<0.1	1.9	<1	<1	5	4.3	<0.20	<0.20
A03	0.2-0.9	<0.2	<1	<1	<0.1	2	<1	<1	<4	2.9	<0.20	<0.20
A03	2.9-3.9	<0.2	<1	<1	<0.1	1.5	<1	<1	<4	28	<0.20	<0.20
A03	7.9-8.9	<0.2	<1	<1	<0.1	1.7	<1	<0.1	4.3	6.5	<0.20	<0.20
A03	14.9-15.9	<0.2	<1	<1	<0.1	3	<1	<1	<4	3.1	<0.20	<0.20
A03	15.9-16.35	0.2	<1	1.3	<0.1	9.1	<1	<1	9.6	2.3	<0.20	<0.20
A04	0.0-0.9	<0.2	<1	<1	<0.1	1.2	<1	<1	<4	11	<0.20	<0.20

7.7 Classification of Sediment

7.7.1 Based on the chemical and biological test results, the classification of sediment samples according to ETWBTC (Works) No. 34/2002 is summarised in **Table 7-20**. It is anticipated that the sediments generally belong to Category L (Type 1 open sea disposal), Category Mp (Type 1 open sea disposal at dedicated sites) and Category Mf (Type 2 confined marine disposal). No Category H sediment is found according to the findings of this study.

Table 7-20 Classification of Sediment

Sample	Sampling Location	Sampling Depth (m)	Category			Disposal Method according to ETWBTC (Works) No. 34/2002
			L	Mp	Mf	
HKBCF						
Sampling for HKBCF reclamation (2008)	A01	0.05 - 0.9		#		Open Sea Disposal (Dedicated Sites)
	A01	0.9 – 1.9		#		Open Sea Disposal (Dedicated Sites)
	A01	1.9 – 2.9		#		Open Sea Disposal (Dedicated Sites)
	A01	4.9 – 5.9	#			Open Sea Disposal
	A01	7.9-8.9		#		Open Sea Disposal (Dedicated Sites)
	A01	9.9–10.8			#	Confined Marine Disposal
	A02	0.2-0.9	#			Open Sea Disposal
	A02	0.9-1.9	#			Open Sea Disposal
	A02	1.9-2.9	#			Open Sea Disposal
	A02	2.9-39	#			Open Sea Disposal
	A02	4.9-5.9	#			Open Sea Disposal
	A02	7.9-8.9	#			Open Sea Disposal
	A02	12.0-12.9	#			Open Sea Disposal
	A02	14.9-15.9		#		Open Sea Disposal (Dedicated Sites)
	A02	16.9-17.9			# [Note 1]	Confined Marine Disposal
	A03	0.2-0.9	#			Open Sea Disposal
	A03	0.9-1.9	#			Open Sea Disposal
	A03	1.9-2.9	#			Open Sea Disposal
	A03	4.9-5.9	#			Open Sea Disposal
	A03	7.9-8.9	#			Open Sea Disposal
	A03	12.0-12.9		#		Open Sea Disposal (Dedicated Sites)
	A03	14.9-15.9		#		Open Sea Disposal (Dedicated Sites)
	A03	15.9-16.35		#		Open Sea Disposal (Dedicated Sites)
	A04	0.0-0.9	#			Open Sea Disposal
	A04	0.9-1.9	#			Open Sea Disposal
	A04	1.9-2.9	#			Open Sea Disposal
	A04	2.9-3.9	#			Open Sea Disposal
	A04	4.9-5.9	#			Open Sea Disposal
	A04	7.9-8.9	#			Open Sea Disposal
	A04	12.15-12.9	#			Open Sea Disposal
	A04	14.9-15.9	#			Open Sea Disposal
	A04	18.05-18.9		#		Open Sea Disposal (Dedicated Sites)
	B05	0.25-0.9		#		Open Sea Disposal (Dedicated Sites)
	B05	0.9-1.9		#		Open Sea Disposal (Dedicated Sites)
	B05	1.9-2.9		#		Open Sea Disposal (Dedicated Sites)
	B05	4.9-5.9	#			Open Sea Disposal
	B05	7.9-8.9		#		Open Sea Disposal (Dedicated Sites)
	B05	12.0-12.9	#			Open Sea Disposal
	B05	14.9-15.9	#			Open Sea Disposal
	B05	15.9-16.1			# [Note 1]	Confined Marine Disposal
	B06	0.35-0.9	#			Open Sea Disposal
	B06	0.9-1.9	#			Open Sea Disposal

Sample	Sampling Location	Sampling Depth (m)	Category			Disposal Method according to ETWBTC (Works) No. 34/2002
			L	Mp	Mf	
	B06	1.9-2.9	#			Open Sea Disposal
	B06	4.9-5.9	#			Open Sea Disposal
	B06	7.9-8.9	#			Open Sea Disposal
	B06	9.9-10.9	#			Open Sea Disposal
	B06	10.9-11.35	#			Open Sea Disposal
	B07	0.0-0.9	#			Open Sea Disposal
	B07	0.9-1.9	#			Open Sea Disposal
	B07	1.9-2.9	#			Open Sea Disposal
	B07	2.9-3.9	#			Open Sea Disposal
	B07	4.9-5.9	#			Open Sea Disposal
	B07	7.9-8.9	#			Open Sea Disposal
	B07	12.0-12.9	#			Open Sea Disposal
	B07	14.9-15.9		#		Open Sea Disposal (Dedicated Sites)
	B08	0.0-0.9	#			Open Sea Disposal
	B08	0.9-1.9	#			Open Sea Disposal
	B08	1.9-2.9	#			Open Sea Disposal
	B08	2.9-3.9	#			Open Sea Disposal
	B08	4.9-5.9	#			Open Sea Disposal
	B08	7.9-8.9	#			Open Sea Disposal
	B08	12.1-12.9	#			Open Sea Disposal
	B08	14.9-15.9	#			Open Sea Disposal
	B08	18.0-18.9		#		Open Sea Disposal (Dedicated Sites)
	B09	0.1-0.9		#		Open Sea Disposal (Dedicated Sites)
	B09	0.9-1.9		#		Open Sea Disposal (Dedicated Sites)
	B09	1.9-2.9	#			Open Sea Disposal
	B09	4.9-5.9	#			Open Sea Disposal
	B09	7.9-8.9	#			Open Sea Disposal
	B09	12.1-12.9	#			Open Sea Disposal
	B09	14.9-15.9		#		Open Sea Disposal (Dedicated Sites)
	B09	18.0-18.9		#		Open Sea Disposal (Dedicated Sites)
	B10	0.05-0.9		#		Open Sea Disposal (Dedicated Sites)
	B10	0.9-1.9	#			Open Sea Disposal
	B10	1.9-2.9	#			Open Sea Disposal
	B10	2.9-3.9	#			Open Sea Disposal
	B10	4.9-5.9	#			Open Sea Disposal
	B10	7.9-8.9	#			Open Sea Disposal
	B10	12.0-12.9	#			Open Sea Disposal
	B10	13.9-14.7		#		Open Sea Disposal (Dedicated Sites)
HKLR						
Sampling for HKLR viaduct (2004)	A1	0.55-1.00		#		Open Sea Disposal (Dedicated Sites)
	A1	1.0-2.0		#		Open Sea Disposal (Dedicated Sites)
	A1	2.0-3.0		#		Open Sea Disposal (Dedicated Sites)
	A1	5.0-6.0	#			Open Sea Disposal
	A1	8.0-9.0	#			Open Sea Disposal
	A1	14.0-15.0	#			Open Sea Disposal
	A2	0.47-1.00		#		Open Sea Disposal (Dedicated Sites)
	A2	2.0-3.0		#		Open Sea Disposal (Dedicated Sites)
	A2	5.0-6.0	#			Open Sea Disposal
	A2	8.0-9.0		#		Open Sea Disposal (Dedicated Sites)
	A3	0.41-1.0	#			Open Sea Disposal
	A3	2.0-3.0	#			Open Sea Disposal
	A3	5.0-6.0		#		Open Sea Disposal (Dedicated Sites)

Sample	Sampling Location	Sampling Depth (m)	Category			Disposal Method according to ETWBTC (Works) No. 34/2002
			L	Mp	Mf	
	A3	8.0-9.0	#			Open Sea Disposal
	A3	14.0-15.0	#			Open Sea Disposal
	A4	0.14-1.00		#		Open Sea Disposal (Dedicated Sites)
	A4	1.0-2.0	#			Open Sea Disposal
	A4	2.0-3.0	#			Open Sea Disposal
	A4	5.0-6.0	#			Open Sea Disposal
	A4	8.0-9.0		#		Open Sea Disposal (Dedicated Sites)
	A4	14.0-15.0		#		Open Sea Disposal (Dedicated Sites)
	A5	0.17-1.00	#			Open Sea Disposal
	A5	2.0-3.0	#			Open Sea Disposal
	A5	5.0-6.0	#			Open Sea Disposal
	A5	8.0-9.0			#	Confined Marine Disposal
	A5	14.0-15.0			#	Confined Marine Disposal
	B8	0.25-1.00		#		Open Sea Disposal (Dedicated Sites)
	B8	1.0-2.0	#			Open Sea Disposal
	B8	2.0-3.0	#			Open Sea Disposal
	B8	5.0-6.0	#			Open Sea Disposal
	B8	8.0-9.0	#			Open Sea Disposal
	B8	14.0-15.0	#			Open Sea Disposal
	B9	0.90-1.00			#	Confined Marine Disposal
	B9	1.0-2.0	#			Open Sea Disposal
	B9	2.0-3.0	#			Open Sea Disposal
	B9	5.0-6.0			#	Confined Marine Disposal
	B9	7.0-8.0			#	Confined Marine Disposal
	B14	0.25-1.00		#		Open Sea Disposal (Dedicated Sites)
	B14	2.0-3.0	#			Open Sea Disposal
	B14	5.0-6.0		#		Open Sea Disposal (Dedicated Sites)
	B14	7.0-8.0	#			Open Sea Disposal
	B15	0.45-1.00			#	Confined Marine Disposal
	B15	1.0-2.0			#	Confined Marine Disposal
	B15	2.0-3.0	#			Open Sea Disposal
	B15	5.0-6.0	#			Open Sea Disposal
	B15	8.0-9.0			#	Confined Marine Disposal
	B16	0.0-1.0	#			Open Sea Disposal
	B16	1.0-2.0	#			Open Sea Disposal
	B16	2.0-3.0	#			Open Sea Disposal
	B17	0.0-1.0	#			Open Sea Disposal
	G13	Surface		#		Open Sea Disposal (Dedicated Sites)
	G14	surface			#	Confined Marine Disposal
Sampling for HKLR reclamation (2009)	C11	0.3-0.9	#			Open Sea Disposal
	C11	0.9-1.9	#			Open Sea Disposal
	C11	1.9-2.9	#			Open Sea Disposal
	C11	4.9-5.9	#			Open Sea Disposal
	C11	7.9-8.9			#	Confined Marine Disposal
	C11	9.9-10.8			#	Confined Marine Disposal
	C12	0.2-0.9	#			Open Sea Disposal
	C12	0.9-1.9	#			Open Sea Disposal
	C12	1.9-2.9	#			Open Sea Disposal
	C12	4.9-5.9	#			Open Sea Disposal
	C12	7.9-8.9	#			Open Sea Disposal
	C12	8.9-9.9	#			Open Sea Disposal
	C12	9.9-10.4	#			Open Sea Disposal

Sample	Sampling Location	Sampling Depth (m)	Category			Disposal Method according to ETWBTC (Works) No. 34/2002
			L	Mp	Mf	
	C13	0.2-0.9	#			Open Sea Disposal
	C13	0.9-1.9	#			Open Sea Disposal
	C13	1.9-2.9	#			Open Sea Disposal
	C13	4.9-5.9	#			Open Sea Disposal
	C13	7.9-8.9	#			Open Sea Disposal
	C13	9.9-10.9	#			Open Sea Disposal
	C14	0.3-0.9	#			Open Sea Disposal
	C14	0.9-1.9	#			Open Sea Disposal
	C14	1.9-2.9	#			Open Sea Disposal
	C14	4.9-5.9	#			Open Sea Disposal
	C14	7.9-8.9			#	Confined Marine Disposal
	C14	10.9-11.9	#			Open Sea Disposal
	C14	12.0-12.6	#			Open Sea Disposal
	C15	0.1-0.9	#			Open Sea Disposal
	C15	0.9-1.9	#			Open Sea Disposal
	C15	1.9-2.9	#			Open Sea Disposal
	C15	4.9-5.9	#			Open Sea Disposal
	C15	7.9-8.9	#			Open Sea Disposal
	C15	10.9-11.8	#			Open Sea Disposal
	C16	0.2-0.9	#			Open Sea Disposal
	C16	0.9-1.9	#			Open Sea Disposal
	C16	1.9-2.9	#			Open Sea Disposal
	C16	4.9-5.9	#			Open Sea Disposal
	C16	7.9-8.9	#			Open Sea Disposal

Note: *1) There were insufficient samples to carry out the biological test for sample A02 (16.9-17.9m) and B05 (15.9-16.1m). Therefore, no biological test results are available for these two samples. As a conservative assumption, it is assumed that these two samples failed the biological test and they are classified as Mf materials.*

2) The biological test for Samples C11 (7.9-8.9m & 9.9-10.8m) and C14 (7.9-8.9m) for HKLR are being carried out and it could be Mp or Mf depending on the biological test results. Review will be made when the test results are available.

7.7.2 For Samples A02 (16.9-17.9m) and B05 (15.9–16.1m), there were insufficient samples for the biological test and therefore no biological test results are available for these two samples. To be conservative, it is assumed that these two samples failed the biological test and they are classified as Mf sediment. This will be reviewed later when future ground investigation is carried out.

7.7.3 The classification of sediment samples given in **Table 7-20** above is used to estimate the quantities of different category of marine deposit to be dredged and disposed from HKBCF and HKLR. This information is vital to determine the disposal method of dredged marine deposit in accordance with ETWBTC (Works) No. 34/2002. The method to determine the portion of different category of dredged marine deposit in HKBCF and HKLR is given below:

7.7.4 HKBCF - Reclamation

7.7.4.1 As shown in **Figure 7.4**, the whole reclamation site of HKBCF is divided into portions and the classification of dredged sediment in each portion is represented by the corresponding vibrocore carried out in this Project. As discussed in **Section 4.4**, Sequence B of the reclamation method should be adopted in HKBCF and the reclamation layout is shown in **Figure 4.7** in **Section 4**. The area to be dredged is also plotted in **Figure 7.4**. In this way, the proportion of different Category of marine deposit to be dredged could be estimated by considering the dredge area and the result of the corresponding vibrocore. The estimate of the proportion of different category of dredged marine deposit is shown in **Table 7-21**.

Appendix 4.1

Memo issued by Development Bureau on Control Measures for Management of Dredged/Excavated Contaminated Sediment

MEMO

From	Secretary for Development	*To*	Distribution
Ref	() *in* DEVB(W) 515/83/04	*(Attn :*	RECEIVED ON
Tel. No.	2848 2704	*Your Ref.*	
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Date	6 October 2010	*Total Pages*	4 + Encl.

TM/COM/21

Control Measures for Management of
Dredged/Excavated Contaminated Sediment

This memo is to promulgate control measures about management of dredged/excavated contaminated sediment.

2. Dredged/excavated contaminated sediment has been disposed of at mud pits at East of Sha Chau since 1992. However, with environmental, marine traffic and development constraints, the mud pits now under construction at East of Sha Chau and the mud pits being planned at South of the Brothers are the last mud pits available in Hong Kong.

3. To ensure maximum effort is made by the project proponent to reduce the consumption of the very limited mud pit capacity, it is necessary to tighten the control on management of dredged/excavated contaminated sediment, including the stepping up of sampling requirement at early stage of project planning, the exhaustive examination of options to reduce sediment generation and disposal, the requirement for cross-boundary disposal of Category Mp sediment and the enhancement of accountability of sediment disposal proposal.

4. The control measures to tighten up the control on management of dredged/excavated contaminated sediment are as follows:

(a) To enable a more accurate estimate of mud disposal volume be made available for consideration when provisional agreement for sediment disposal allocation is sought for projects involving dredging and excavation in areas where the expected contamination level is Category M/H, Marine Fill Committee (MFC) requires that the project proponent should take sediment samples at a 200m x 200m grid. The samples should be continuous and with a vertical profile. The top level of the sub-samples should be at seabed, 0.9m down, 1.9m

down, 2.9m down and then every 3m to the bottom of the dredged layers. The project proponent should as early as practicable submit the proposed sampling plan to the Dumping At Sea Ordinance (DASO) Team of the Environmental Protection Department (EPD) for comment.

(b) The project proponent is required to carry out an assessment on sediment management as outlined on the "Flow Chart for Management of Contaminated Sediment" at **Appendix A**. This requirement ensures that the project proponent has exhausted all management options to keep the sediment in place and explored in details all possible ex-situ treatment, disposal and beneficial reuse options before a decision is made to remove the sediment off site. Reference should be made to the consultancy study – FM01/2007 by the Civil Engineering and Development Department (CEDD) on various management options. A copy of the report is available on CEDD's website.

(c) Project proponents should apply for cross-boundary disposal of Category Mp sediment generated from their projects in accordance with the Agreement on Cross-boundary Marine Dumping and the Implementation Scheme on the Management of Cross-boundary Marine Dumping unless the genuinely estimated quantity of Category Mp sediment is less than 100,000 m^3. Other non-mud pit options for Category Mp sediment should also be examined. In case the application is not successful and there is no other feasible non-mud pit options, the project proponent should liaise with the Secretary of MFC about fall-back options.

(d) To enhance the accountability of the sediment disposal proposal, endorsement by the appropriate directorate officer of the works departments or the Authorized Person (AP) of the private project as indicated on the attached Flow Chart at **Appendix A** is required to be obtained prior to submission of the disposal option to the Secretary of MFC. Project proponents may seek advice from the Secretary of MFC, if necessary.

FM									
	CE	SE/P1	SE/P2	SE/P3		SE/BP	SE/HF	SE/S1	SE/S2
Initial									
Date									
E/			GR			CIR			
PS II			FM / /			BU			

(e) Project proponents are required to exhaust all management options and work out the estimated quantities of contaminated sediments to be disposed of based on the results of the sampling carried out as early as practicable according to (a) above and seek provisional agreement from MFC on allocation of disposal space at mud pit. Such allocation will have to be re-confirmed after the sediment quality report (SQR) is completed and approved by DASO team of EPD during the detailed design stage. During construction, a project proponent should review from time to time the estimated final quantity of contaminated sediment disposal and advise MFC of any changes in advance before the actual disposed quantity has reached 80% of the approved quantity. If the latest estimated final quantity **exceeds** the approved quantity by 5,000 m^3 (or 5% of the approved quantity, whichever is more), the project proponent should seek further approval from MFC as a new application with appropriate endorsement as follows:

Scenario		Endorsement
(I) Public Works Projects		
(i)	The estimated final quantity **does not exceed** the approved quantity by 100,000m^3 (or 5% of the approved quantity, whichever is more)	By a D2 officer for MFC's approval
(ii)	The estimated final quantity **exceeds** the approved quantity by 100,000m^3 (or 5% of the approved quantity, whichever is more)	By a D3 officer for MFC's approval
(II) Private Projects		Endorsement by the AP for MFC's approval

Examples illustrating how the threshold quantities are determined and how the requirements of new applications and endorsements apply are shown in **Appendix B**.

(f) If a public project proponent disposes a quantity of 5,000 m^3 (or 5% of the approved quantity, whichever is more) more

than the approved quantity without the prior approval of MFC, or a quantity less than the approved quantity by more than 5,000 m^3 (or 5% of the approved quantity, whichever is more) without prior notification to MFC, the respective Director should personally provide an explanation to MFC and copy it to the Permanent Secretary for Development (Works).

5. This memo should be read in conjunction with ETWB TCW No. 34/2002 - Management of Dredged/Excavated Sediment.

6. This memo takes immediate effect. Paragraph 4 (c) should only apply to those projects for which provisional agreement of MFC for allocation of sediment disposal space has not yet been granted.

7. If you require further information, please contact Mr M Y Tang, AS(WP)6, at 2848 2585.

(W W CHUI)
for Secretary for Development

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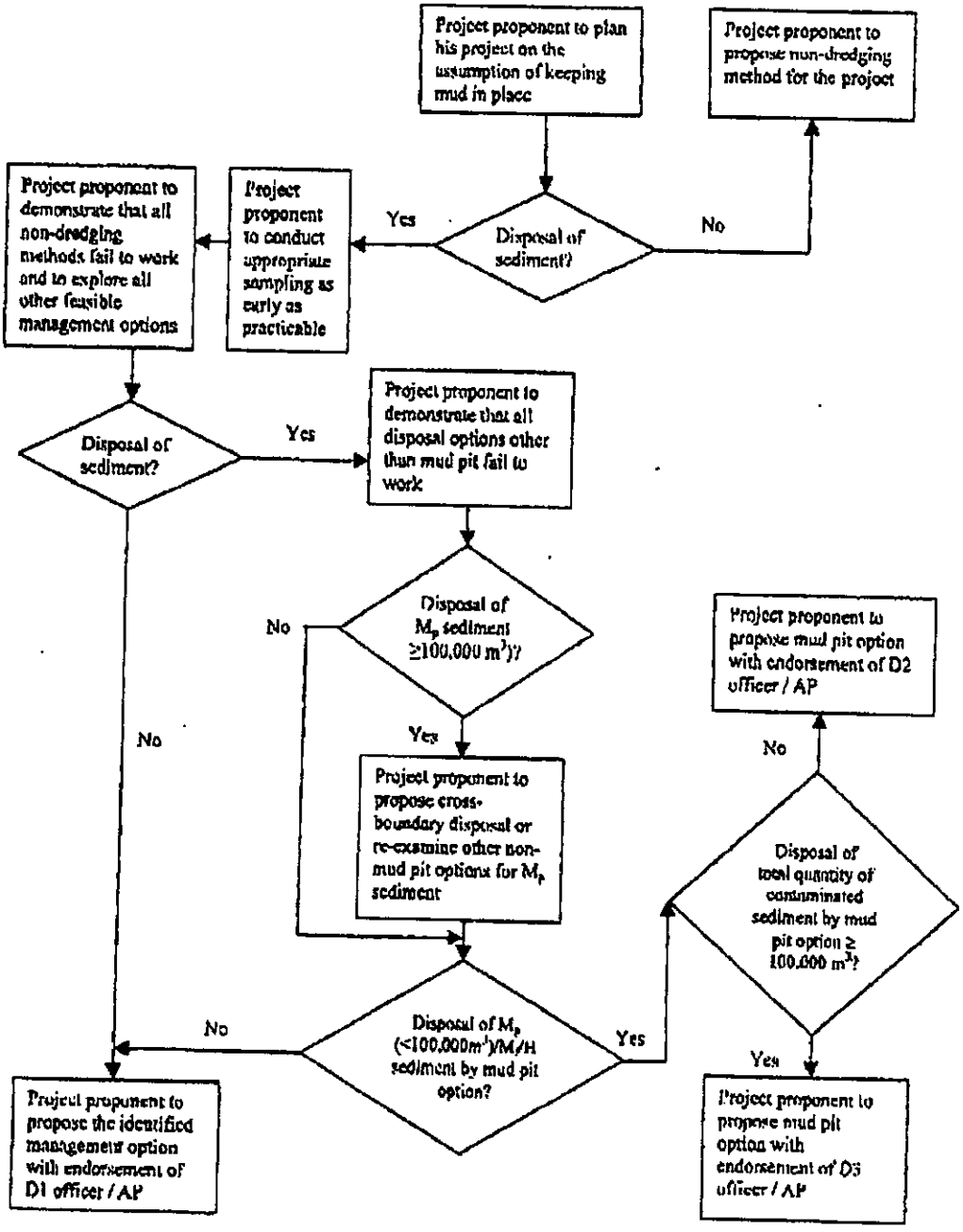
Appendix A

Flow Chart for Management of Contaminated Sediment#



This flow chart shall be read in conjunction with Appendix C of ETWB TC(W) No. 34/2002. M_p and M_f sediment refer to Category M sediment passing and failing respectively the biological screening.

Note: The volume refers to bulk volume.

Appendix B

Examples to illustrate how the threshold quantities are determined and how the requirements of new applications and endorsement apply

	Example	Threshold quantity for requirement of new application	Threshold quantity for requirement of endorsement by a D2/D3 Officer
		5,000m^3 or 5% of the approved quantity, whichever is more	**100,000m^3** or 5% of the approved quantity, whichever is more
(a)	Project with **large** quantity of contaminated sediment Approved Quantity: 2,500,000m^3 Estimated Quantity: 2,750,000m^3 (i.e. increase by 250,000m^3)	**125,000m^3** because 5% of approved quantity, i.e.125,000m^3 is more than 5,000m^3. A new application is required because the increased quantity i.e. 250,000m^3 exceeds 125,000m^3.	**125,000m^3** because 5% of the approved quantity, i.e. 125,000 m^3 is more than 100,000m^3. The new application shall be endorsed by a D3 officer because the increased quantity exceeds 125,000m^3.
(b)	Project with **medium** quantity of contaminated sediment Approved Quantity: 120,000m^3 Estimated Quantity: 132,00 m^3 (i.e. increase by 12,000m^3)	**6,000m^3** because 5% of approved quantity, i.e.6,000m^3 is more than 5,000m^3. A new application is required because the increased quantity i.e. 12,000m^3 exceeds 6,000m^3.	**100,000m^3** because 100,000m^3 is more than 5% of the approved quantity, i.e. 6,000 m^3. The new application shall be endorsed by a D2 officer because the increased quantity does not exceed 100,000m^3.
(c)	Project with **small** quantity of contaminated sediment Approved Quantity: 10,000m^3 Estimated Quantity: 11,000m^3 (i.e. increase by 1,000m^3)	**5,000m^3** because 5,000m^3 is more than 5% of approved quantity, i.e.500m^3. A new application is <u>not</u> required because the increased quantity, i.e. 1,000m^3 does not exceed 5,000m^3.	NA

* The threshold quantities determined for the respective example cases are shown in bold.