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7 SEDIMENT QUALITY

7.1 Introduction

7.1.1 In HKLR, Section 3.4.3 of the EIA Study Brief (No ESB-110/2003) defines the scope of water quality impact assessment for the construction and operation of HKLR. Sub-section 3.4.3.5 (viii) specifies the requirements for identifying and quantifying all dredging, fill extraction, filling, mud/ sediment transportation and disposal activities and requirements.

7.1.2 Section 3.4.4 of EIA Study Brief for HKLR also defines the scope of waste management, in which sub-section 3.4.4.2 (iii) specified that the categories of sediments which require different types of disposal in accordance with ETWBTC (Works) No. 34/2002 shall be identified by both chemical and biological tests and their quantities shall be estimated.

7.1.3 In HKBCF, Section 3.4.3 of the EIA Study Brief (No ESB-183/2008) defines the scope of water quality impact assessment for the construction and operation of HKBCF. Sub-section 3.4.3.5 (ix) specifies the requirements for identifying and quantifying all dredging, fill extraction, filling, mud/ sediment transportation and disposal activities and requirements.

7.1.4 Section 3.4.4 of EIA Study Brief for HKBCF also defines the scope of waste management, in which sub-section 3.4.4.2 (iii) specified that the categories of sediments which require different types of disposal in accordance with ETWBTC (Works) No. 34/2002 shall be identified by both chemical and biological tests and their quantities shall be estimated.

7.1.5 Field investigation, sampling and chemical and biological laboratory tests to characterise the sediment/ mud concerned shall be conducted as appropriate. The potential release of contaminants during dredging shall be addressed using the chemical testing results derived from sediment samples collected on site and relevant historic data. Appropriate laboratory tests such as elutriate tests and sediment pore water (interstitial water) analyses shall be performed on the sediment samples to simulate and quantify the degree of mobilization of various contaminants such as metals, ammonia, trace organic contaminants into the water column.

7.1.6 The objectives of this section are to:

- Identify and quantifies dredging, fill extraction, filling, sediment/ mud transportation and disposal activities and requirements;
- Review available sediment quality data from EPD's routine monitoring programme and other previous EIA studies near the present study area;
- Present the findings in site investigation (SI), sampling and laboratory (chemical and biological) testing exercise for characterisation of sediment/mud of concern, including elutriate tests; and
- Define categories of sediment which may arise from construction of HKLR and HKBCF requiring different types of disposal, their estimated quantities, and potential treatment and/or disposal arrangement where necessary.

7.2 Legislation and Guidelines

7.2.1 Relevant legislation and guidelines for disposal of contaminated sediments at marine disposal sites are listed below.

- Dumping at Sea Ordinance (Cap.466);

- Environment, Transport and Works Bureau Technical Circular (Works) No. 34/2002 "Management of Dredged / Excavated Sediment"; and
- Works Bureau Technical Circular (WBTC) No. 12/2000 Fill Management.

7.2.2 The DASO is the principal statutory legislation to control dumping of sediment at sea. It safeguards the water quality and ecology of Hong Kong waters.

7.2.3 ETWBTC (Works) No. 34/2002 sets out the procedure for seeking approval to dredge/ excavate sediment and the management framework for marine disposal of such sediment. It covers the approval of dredging/ excavation proposals and marine disposal of dredged/ excavated sediment. ETWBTC (Works) No. 34/2002 also provides guidelines for the classification of sediment based on their contaminant levels. Sediment quality criteria for classification include:

- Metals (cadmium, chromium, copper, mercury, nickel, lead, silver and zinc);
- Metalloid (arsenic); and
- Organic micro-pollutants (PAHs, PCBs and TBT).

7.2.4 Based on the criteria, sediment is classified into Category L (low contamination level), Category M (medium contamination level) or Category H (high contamination level).

7.2.5 This technical circular also stipulates a three-tiered screening for sediment assessment for determining the disposal options. Details of this 3-tier approach are given in **Section 7.4**.

7.3 Methodology for Sediment Quality Assessment

7.3.1 The management framework of dredged/ excavated sediment in Hong Kong is implemented under a three-tiered approach as illustrated in **Appendix 7A** in accordance with the ETWBTC (Works) No. 34/2002. Sediment will be classified as 3 categories as follows.

- 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 minimises 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.

7.3.2 **Table 7-1** summarises the guidelines for the assessment, sampling, testing and classification of sediment. Detailed description of the 3-tier approach stipulated in the ETWBTC (Works) No. 34/2002 is described below.

Table 7-1 Sediment Quality Criteria for 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) (1)	40	40
Lead (Pb)	75	110
Silver (Ag)	1	2
Zinc (Zn)	200	270
Metalloid (mg/kg dry wt.)		
Arsenic (As)	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 (1)	0.15	0.15

(1) Contaminant level is considered to have exceeded the UCEL if it is greater than the value shown.

7.3.3 Tier I Screening

7.3.3.1 Tier I screening is a desktop screening process to review the available information and determine whether the sediment of concern belongs to Category L material suitable for open sea disposal. If there is insufficient information to arrive at such conclusion, Tier II chemical screening shall be proceeded directly.

7.3.4 Tier II Screening

7.3.4.1 Tier II screening is a chemical screening process to categorise sediment based on its chemical contaminant levels and to determine whether the sediment is suitable for open sea disposal without further testing. Upon Type II screening, the sediment shall be classified as Category L, M or H material. Category L material is suitable for Type 1 disposal - Open Sea Disposal, but Categories M and H will require Tier III screening to further determine the disposal option.

7.3.5 Tier III Screening

7.3.5.1 Tier III screening is a biological screening process for further analysis of Category M and certain Category H sediment (contaminant levels exceed 10 times Lower Chemical Exceedance Level). Sediment classified as Category M shall be subjected to the following three toxicity tests:

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

7.3.5.2 **Table 7-2** summarises the details of the test endpoints and failure criteria of the three toxicity tests. Sediment classified as Category H and with one or more contaminant levels exceeding 10 times LCEL shall also be subjected the above three toxicity tests but in a diluted manner (dilution test). If the Category M material passes the biological test (i.e. Mp material), Type 1 disposal - Open Sea Disposal (Dedicated Sites) is required. In case of failure of biological test on Category M material (i.e. Mf material), Type 2 disposal - Confined Marine Disposal shall be required. For Category H material which passes the biological test (i.e. Hp material), Type 2 disposal - Confined Marine Disposal shall be required. However, Type 3 disposal - Special Treatment/Disposal shall be required for Category H material if biological test is failed (i.e. Hf material).

Table 7-2 Test Endpoints and Decision Criteria for Tier III Biological Screening under ETWBTC (Works) No. 34/2002

Toxicity Test	Endpoints Measured	Test Methods	Failure Criteria
10-day amphipod	Survival	USEPA Standard Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods	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 Pudget 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 Pudget Sound Sediments – Bivalve Larvae 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.

(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.

7.4 Review of Previous Sediment Quality Data

7.4.1 Monitoring Data for Chek Lap Kok Airport

7.4.1.1 Sediment monitoring programme was commissioned by the Airport Authority in 2000 and 2003. Grab sediment samples were collected at the designated locations around the Airport Island (**Figure 7.1**) with a view to monitoring any potential impacts due to the storm water discharge from the Airport.

7.4.1.2 **Table 7-3** summarises the chemical testing results extracted from the relevant monitoring Reports (Mouchel Asia Limited, 2000; ERM 2004a), in which all parameters except most of the Arsenic (As) levels were below the LCELs. No biological screening test results were provided in the Reports. These samples shall be classified as Category M sediment.

Table 7-3 Sediment Quality Monitoring Data around Chek Lap Kok Airport Island in 2000 and 2003

Location	Cd	Cr	Cu	Hg	Ni	Pb	Ag	Zn	As
Monitoring Data in 2000									
1	0.14	24	17	<0.05	17	33	<1	92	12
2	0.12	36	37	<0.05	24	46	<1	120	17
3	0.12	25	19	<0.05	18	35	<1	92	11
4	0.15	33	31	<0.05	24	45	<1	120	17
5	0.17	29	28	<0.05	21	46	<1	110	16
6	0.11	23	16	<0.05	16	33	<1	76	10
7	0.17	38	36	<0.05	27	49	<1	130	19
8	0.15	38	35	<0.05	27	48	<1	130	18
9	0.13	24	12	<0.05	17	25	<1	77	12
10	0.15	27	20	<0.05	18	30	<1	86	12
Monitoring Data in 2003									
1	0.16	41	23	0.1	25	37	<1	98	15.6
2	0.16	52	38	0.21	33	48	<1	131	19.6
3	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-
5	0.13	29	22	0.09	20	32	<1	91	10.9
6	0.19	49	37	0.15	33	48	<1	143	18.6
7	0.29	53	41	0.17	36	53	<1	157	24.7
8	0.2	51	38	0.17	35	49	<1	144	21.2
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-

Remarks:

- Data represent the vertical range of contaminants into seabed sediment.
- All results for LMW & HMW PAHs, Total PCBs and chlorinated pesticides were below reporting limits of analytical methods. No analysis for TBT was undertaken.
- "-" denotes no data available from the relevant Report.
- Underlined data represents Category M sediment being determined at that specific location.
- Data were extracted from Mouchel Asia Limited (2000) and ERM (2004a).

7.4.2 Study for New Contaminated Mud Disposal Facility

7.4.2.1 There were 7 sediment quality monitoring stations (V6-V12) for Agreement No. CE12/2002(EP) Detailed Site Selection Study for a Proposed Contaminated Mud Disposal Facility within the Airport East/ East of Sha Chau Area, which were the nearest locations to the LLP site (**Figure 7.1**).

7.4.2.2 **Table 7-4** summarises the classification of sediment quality extracted from the relevant Report (ERM, 2004a). The data indicate that most of the sediment samples were classified as Category L (uncontaminated).

7.4.2.3 The samples at V10 (9m–10m) and V11 (15m–16m) exceeded the UCEL for nickel and zinc, but were below 10 times of LCEL, so both of them belong to Category H. Arsenic in samples at V7 (0.9m–1.9m), V8 (9m–10m and 15m–16m), and V9 (0m–2.9m) exceeded the LCEL but were within UCEL. Most of the samples undergone biological screening passed the test, except those at V7 (0.9m–1.9m) and V8 (9m–10m). 3 out of 5 composite samples with exceedances of LCEL for arsenic failed the subsequent biological test.

Table 7-4 Sediment Quality Data for Investigation of Contaminated Mud Disposal Facility within the Airport East/ East of Sha Chau Area in 2002

Location	Cd	Cr	Cu	Hg	Ni	Pb	Ag	Zn	As
V6 (0-15m)	0.05-0.2	9.1-29	4.9-19	0.078-0.728	5-19	13-35	0.05-0.2	21-68	2.6-9.9
V7 (0-18m)	0.05-0.1	13-28	3.9-20	0.07-0.386	4.3-19	10-39	0.05-0.3	15-60	5.3-13
V8 (1-20m)	0.1-0.2	16-32	6.1-25	0.071-0.468	6.7-19	16-43	0.05-0.7	32-72	3.9-15
V9 (0-15m)	0.05-0.2	10-35	4.6-28	0.086-0.512	3.5-20	5.9-42	0.05-0.3	13-74	2.2-15
V10 (1-12m)	0.05-1.4	15-28	5.4-17	0.05-0.166	2.4-55	8.9-49	0.05	10-260	2.6-13
V11 (0-17m)	0.05-0.2	6.7-27	5.9-13	0.09-0.266	2.7-18	8.4-35	0.05-0.2	12-310	3.5-7.9
V12 (1-12m)	0.05	11-21	4.1-44	0.086-0.125	6.2-15	13-22	0.05-0.1	16-52	1.5-7

Remarks:

- Data represent the vertical range of contaminants into seabed sediment.
- All results for LMW & HMW PAHs and Total PCBs were below reporting limits of analytical methods. No analyses for TBT and chlorinated pesticides were undertaken.
- Underlined data represents Category M sediment being determined at that specific location.
- Underlined and bolded data represents Category H sediment being determined at that specific location.
- Data were extracted from ERM (2004b).

7.4.3 EPD's Monitoring Data

7.4.3.1 EPD also conducts routine monitoring of sediment quality at 45 stations within the Hong Kong waters (EPD, 2007). The nearest monitoring station is located at Chek Lap Kok North (NS6, as indicated in **Figure 7.1**).

7.4.3.2 **Table 7-5** summarises the sediment contaminant levels (mean values of data collected between 2003 and 2007) and classification, from which all the measurement parameters including heavy metals and organic contaminants were below the LCEL, except there was no measurement of TBT. Based on the data, the sediment could be classified as Category L (uncontaminated).

Table 7-5 EPD Sediment Quality Data between 2003 and 2007 at Chek Lap Kok North (NS6)

Contaminant	Mean Concentration (between 2003 and 2007)	Sediment Classification under ETWBTC (Works) No. 34/2002
Cadmium (Cd)	0.1 mg/kg	Category L
Chromium (Cr)	31 mg/kg	Category L
Copper (Cu)	28 mg/kg	Category L
Mercury (Hg)	0.11mg/kg	Category L
Nickel (Ni)	20 mg/kg	Category L
Lead (Pb)	37 mg/kg	Category L
Silver (Ag)	0.3 mg/kg	Category L
Zinc (Zn)	93 mg/kg	Category L
Arsenic (As)	10.8 mg/kg	Category L
Low Molecular Weight PAHs	91 μg/kg	Category L
High Molecular Weight PAHs	60 μg/kg	Category L
Total PCBs	18 μg/kg	Category L

7.5 Sample Collection and Laboratory Analysis

7.5.1 Objectives

7.5.1.1 The purpose of ground investigation for HKBCF and HKLR is to obtain relevant information for the physical and geo-chemical characteristics of the seabed sediment to be dredged or excavated from the study site through identification of the geological conditions, presence of contaminants, and their levels and distribution, so that the subsequent decision for the sediment disposal arrangement could be made. The SI works were accomplished by collecting vibrocore, grab sediment and in-situ seawater samples for the subsequent laboratory analyses.

7.5.2 Sampling

7.5.2.1 Two sampling works were conducted for HKBCF and HKLR. In 2004, vibrocores and grab samples were collected at 13 locations along the proposed marine viaducts of HKLR from the HKSAR boundary to the Airport Channel. In the second sampling work, 10 vibrocores were collected at the proposed reclamation site of HKBCF in September 2008 and 6 vibrocores were collected at the proposed reclamation site of HKLR in March 2009. Both sampling works were carried out by the Term Contractor of Geotechnical Engineering Office (GEO) of the Civil Engineering and Development Department (CEDD). Locations of the above vibrocores and grab samples are shown in **Figures 7.2 and 7.3**.

7.5.2.2 Sediment samples were retrieved by vibrocoring in the marine deposit layer. Vibrocore of 100mm in diameter and 4m long was deployed from marine vessels. The sampling depth was down to a maximum of 20m below seabed, or to the base of unconsolidated mud layer at each location. The sediment depth was checked by visual observation of the vibrocores and strata-logging was conducted on-site.

7.5.2.3 For the sampling work in 2004 for the marine viaducts of HKLR, vibrocore sub-sampling was conducted as follows:

- Seabed depth < 6m: 3 sub-samples at 0-1m, 2-3m, 5-6m below seabed
- Seabed depth 6-12m: 1 sub-samples at 8-9m below seabed (or mid-depth)
- Seabed depth 12-20m: 1 sub-sample at 14-15m below seabed (or at mid-depth)

7.5.2.4 For the sampling work in 2008 and 2009, vibrocore sub-sampling was conducted for the reclamation of HKBCF and HKLR according to **Table 7-6** below:

Table 7-6 Preliminary Schedule of Vibrocore Sub-sampling in 2008 & 2009

Depth of sub-sample	Laboratory testing
0-1m below seabed	Chemical and/or biological testing
0-1m below seabed	Elutriate (at ~0-1.0m)
1-2m below seabed	Chemical and/or biological testing
2-3m below seabed	Chemical and/or biological testing
3-4m below seabed	Elutriate (at ~3.0-4.0m)
5-6m below seabed	Chemical and/or biological testing
8-9m below seabed	Chemical and/or biological testing
8-9m below seabed	Elutriate (at ~8.0-9.0m)
12-13m below seabed	Chemical and/or biological testing
15-16m below seabed	Chemical and/or biological testing
15-16m below seabed	Elutriate (at ~15.0-16.0m)
18-19m below seabed	Chemical and/or biological testing
18-19m below seabed	Elutriate (at ~18.0-19.0m)

7.5.2.5 Grab samples of the upper deposits of seabed were collected for pore water testing at all the vibrocore locations for the reclamation of HKBCF and HKLR in 2008 and 2009. Modified van Veen grabs (or equivalent) of capacity ~2L were deployed from marine vessels and ~20L of sediment at each location were required. Individual grabs were composited on-site and split into portions for packing for laboratory pore water testing.

7.5.2.6 All sediment samples were kept at 4ºC after sampling on-site and delivered to the laboratory for storage at 4ºC prior to laboratory testing. The sample holding time for chemical and biological testing was 2 weeks and 8 weeks respectively.

7.5.2.7 Marine water of ~5L was required for preparation of elutriate in the laboratory for sediment samples. Sufficient quantity of marine water was collected at one location during each day of vibrocoring. The sample holding time for elutriate samples was 1 week.

7.5.2.8 A reference sediment (surface grab) of ~30L was collected at Port Shelter (PS6, E850234, N820057). Modified van Veen grab (or equivalent) of capacity ~2L was deployed from marine vessel and ~30L of sediment was required. Individual grabs was composited on-site and split into portions for packing, of which ~4L for elutriate testing, ~20L for pore water testing, and ~6L for biological testing respectively. Marine water of ~5L was collected at the same time for preparation of elutriate samples.

7.5.3 Laboratory Testing

<u>Testing for Sediment Quality Assessment</u>

7.5.3.1 The sediment quality was assessed through laboratory analyses of sediment samples at all vibrocore locations (as in **Table 7-1**) for the chemical and/or biological parameters (in case exceedance of chemical parameters with reference to the chemical screening criteria in ETWBTC (Works) No. 34/2002). The reference sediment (clean sample) was also tested for comparison.

7.5.3.2 Chemical screening parameters include:

- 9 metals/metalloid: cadmium, chromium, copper, mercury, nickel, lead, silver, zinc and arsenic for all vibrocore sub-samples; and
- 3 organic micro-pollutants: polyaromatic hydrocarbons (PAHs) (low and high molecular weights), polychlorinated biphenyls (PCBs) (total), tributyltin (TBT) (in pore water) for all vibrocore sub-samples.

7.5.3.3 Biological screening parameters include:

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

7.5.3.4 Based on the chemical test results, the necessity and arrangement of biological tests were concluded. For every sample which required biological test based on the chemical test results and subsequent classification in accordance with the ETWBTC (Works) No. 34/2002, biological test of each sample was conducted. All analytical methods were based on the U.S. Environmental Protection Agency (U.S. EPA) or equivalent.

7.5.3.5 The details of chemical and biological testing parameters, methodology and reporting limits for sediment quality assessment are summarised in **Tables 7-7 and 7-8** respectively. Ancillary testing parameters including moisture content, grain size (<63 µm), total organic carbon, ammonia (as mg N/L), and salinity in porewater were analysed for those samples undergoing biological testing.

Table 7-7 Chemical Screening Parameters for Sediment Quality

Parameters	Instrumentation	Analytical Method	Reporting Limit
Cadmium (Cd)	ICP-MS	U.S. EPA 6020A	0.2 mg/kg
Chromium (Cr)	ICP-MS	U.S. EPA 6020A	8 mg/kg
Copper (Cu)	ICP-MS	U.S. EPA 6020A	7 mg/kg
Mercury (Hg)	ICP-MS	U.S. EPA 6020A	0.05 mg/kg
Nickel (Ni)	ICP-MS	U.S. EPA 6020A	4 mg/kg
Lead (Pb)	ICP-MS	U.S. EPA 6020A	8 mg/kg
Silver (Ag)	ICP-MS	U.S. EPA 6020A	0.1 mg/kg
Zinc (Zn)	ICP-MS	U.S. EPA 6020A	20 mg/kg
Arsenic (As)	ICP-MS	U.S. EPA 6020A	1 mg/kg
PAHs (Low MW)	GC-MSD	U.S. EPA 8270C	55 µg/kg
PAHs (High MW)	GC-MSD	U.S. EPA 8270C	170 µg/kg
Total PCBs	GC-MSD	U.S. EPA 8082	3 µg/kg
Tributyltin(1) (TBT)	GC-MSD	UNEP/IOC/IAEA	0.015 µg/L

Remarks:
(1) In interstitial water
(2) Reporting limit for individual chlorinated pesticides analyses

Table 7-8 Biological Screening* Parameters for Sediment Quality

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	Survival	Mean survival in test sediment is significantly different ($p \leq 0.05$)** 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 Pudget Sound Sediments – Juvenile Polychaete Sediment Bioassay, 1995	Dry weight***	Mean dry weight in test sediment is significantly different ($p \leq 0.05$)** 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 Pudget Sound Sediments – Bivalve Larvae Sediment Bioassay, 1995	Normality survival****	Mean normality survival in test sediment is significantly different ($p \leq 0.05$)** from mean normality survival in reference sediment and mean normality survival in test sediment <80% of mean normality survival in reference sediment.

Remarks:
* Ancillary testing parameters to be analysed for all sediment samples include moisture content, grain size (<63 µm), total organic carbon, ammonia (as mg N/L), and salinity in porewater.
** Statistically significantly differences should be determined using appropriate two-sample composite (e.g. t-tests) at a probability of $p \leq 0.05$.
*** 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.

<u>Elutriate and Pore Water Testing for Water Quality Assessment</u>

7.5.3.6 Preparation of elutriate for vibrocore samples and marine water samples were conducted in accordance with the Evaluation of Dredged Material Proposed for Discharge in Waters of the US – Testing Manual (Inland Testing Manual), USEPA and USACE, 1998. The reference sediment and marine water samples were also tested for comparison.

7.5.3.7 Standard elutriate samples will be prepared by sub-sampling approximately 1L of sediment combined with unfiltered marine water collected on-site in a sediment-to-water ratio of 1:4 by volume in a pre-cleaned container in the laboratory. The mixture will be stirred for 30 minutes on a platform shaker. After the 30 minutes, the mixture will be allowed to settle for 1 hour and the supernatant will then be siphoned off without disturbing the settled material. The decanted solution will be centrifuged to remove particulates prior to chemical analysis (approximately 2000 rpm for 30 min, until visually clear). The elutriate testing parameters will include:

- 9 metals/metalloid: cadmium, chromium, copper, mercury, nickel, lead, silver, zinc and arsenic;
- 3 organic micro-pollutants: PAHs (low and high molecular weights), total PCBs and TBT;
- Ammonia, Nitrite, Nitrate, Total Kjeldahl Nitrogen, Reactive Phosphate, pH and Chlorinated pesticides.

7.5.3.8 Preparation of pore water from all grab sediment samples was conducted in accordance with “Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual, USEPA 2001” (or equivalent). The reference sediment will also be tested for comparison.

7.5.3.9 Pore water samples were prepared by sub-sampling approximately 1L of sediment in a pre-cleaned container in the laboratory and centrifuged at rotation speed at 3,000 rpm for 10 minutes. After that, the supernatant were decanted without disturbing the sediment material. The pore water testing parameters and assessment criteria will be same as those for elutriate samples.

7.5.3.10 All analytical methods were based on U.S. EPA or equivalent. The details of elutriate and pore water testing parameters for water quality assessment are summarised in **Table 7-9** (including the reporting limits for the respective analytical methods). The reporting limits were specified based on the fact that they should be sufficiently low compared with the international water quality criteria and the average background concentration in North Western Water Control Zone in 2007, which are applied for the water quality impact assessment. The lowest reporting limit of 0.015µg/L for TBT (with accreditation) was proposed.

Table 7-9 Chemical Parameters for Sediment Elutriate and Pore Water Testing

Parameters	Instrumentation	Analytical Method	Reporting Limit
Cadmium (Cd)	ICP-MS	USEPA 6020A	0.2 µg/L
Chromium (Cr)	ICP-MS	USEPA 6020A	1 µg/L
Copper (Cu)	ICP-MS	USEPA 6020A	1 µg/L
Mercury (Hg)	ICP-MS	USEPA 6020A	0.1 µg/L
Nickel (Ni)	ICP-MS	USEPA 6020A	1 µg/L
Lead (Pb)	ICP-MS	USEPA 6020A	1 µg/L
Silver (Ag)	ICP-MS	USEPA 6020A	1 µg/L
Zinc (Zn)	ICP-MS	USEPA 6020A	4 µg/L
Arsenic (As)	ICP-MS	USEPA 6020A	10 µg/L
PAHs	GC-MSD	USEPA 3510C USEPA 3630C USEPA 8270C	0.2 µg/L*

Parameters	Instrumentation	Analytical Method	Reporting Limit
Total PCBs	GC-MSD	USEPA 3510C USEPA 3620B USEPA 8270C	0.01 µg/L
Tributyltin (TBT)	GC-MSD	UNEP/IOC/IAEA	0.015 µg/L
Ammonia	FIA	APHA 4500-NH_3 H	0.025mg/L
Nitrite as N	FIA	APHA 4500-NO_3 I	0.025mg/L
Nitrate as N	FIA	APHA 4500-NO_3 I	0.025mg/L
TKN as N	Titration	APHA 4500-N_{org} + NH_3 H	1mg/L
Reactive P	FIA	APHA 4500-P G	0.1mg/L
pH	pH meter	APHA 4500-NH_3 H	0.1unit
Chlorinated Pesticides: Alpha-BHC Beta- BHC Gamma-BHC Delta-BHC Heptachlor Aldrin Heptachlor epoxide Endosulfan 1 p,p'-DDE p,p'-DDD p,p'-DDT Endosulfan sulphate	GC-MSD	USEPA 3510C USEPA 3620B USEPA 8270C	0.1 µg/L**

Remarks:
* Method detection limit for both low and high molecular weights PAHs
** Reporting limit for individual chlorinated pesticides analyses

QA/QC Requirements

7.5.3.11 Field logs and site diary were 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 the reasons were recorded in the logs. 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, proper documentation (e.g. completion of chain-of-custody forms, analysis request forms), etc. were strictly followed.

7.6 Sediment Quality and Classification

7.6.1 Chemical Screening

7.6.1.1 The results of chemical screening of sediment samples obtained in the following three sampling works are summarised in **Table 7-10**.

- Sampling in 2004 for HKLR marine viaduct;
- Sampling in 2008 for HKBCF reclamation; and
- Sampling in 2009 for HKLR reclamation.

7.6.1.2 There were 169 sub-samples from 27 vibrocores and 2 grab samples in the above sampling works for HKBCF and HKLR. Most of the chemical parameters in sediment were lower than the LCELs, except for arsenic and lead which exceeded LCELs. The maximum concentration of arsenic and lead in sediment is 23 mg/kg at B10 (13.9 – 14.7m) and 84 mg/kg at A01 (9.9 – 10.8m).

7.6.1.3 The levels of other heavy metals including cadmium, chromium, copper, nickel, lead and zinc were all below LCELs, with concentration ranged from:

- Cadmium : <0.2 - 0.41 mg/kg,
- Chromium : <8 - 55 mg/kg,
- Copper : <7 - 34 mg/kg,
- Nickel : <4 - 39 mg/kg,
- Mercury: <0.05 - 0.28 mg/kg,
- Silver: <0.1 - 0.37 mg/kg,
- Zinc: 13 - 125 mg/kg.

7.6.1.4 The concentrations of PAHs, PCBs and TBT were all below the LCELs.

7.6.1.5 To summarise, there were 50 vibrocore sub-samples classified as Category M and 119 sub-samples as Category L. The distribution of Category M sub-samples at different locations of HKBCF and HKLR is summarised below. Biological screening was proposed for Category M sediment to determine the subsequent disposal and was shown in **Table 7-10**.

- There were 24 out of 80 sub-samples (about 30%) classified as Category M in HKBCF reclamation.
- There were 23 out of 52 sub-samples (about 44%) classified as Category M along HKLR marine viaduct in western water of Airport Island and Airport Channel.
- There were 3 out of 37 sub-samples (about 8%) classified as Category M in HKLR reclamation.

7.6.1.6 It could be generalised from the chemical screening data that the sediment in HKLR reclamation site is apparently less contaminated than that along the HKLR marine viaduct and HKBCF reclamation site. The majority of sediment samples classified as Category M material exhibited elevated concentrations of arsenic in sediment than LCEL, which is commonly recorded in the western waters of Hong Kong territory, likely coming from natural sources (probably arsenic bearing mineral). This phenomenon has triggered most of the biological screening of Category M sediments.

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

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
A04	2.9-3.9	<0.2	<1	1.1	<0.1	<1	<1	<1	6.8	4.3	<0.20	<0.20
A04	7.9-8.9	<0.2	<1	1.1	<0.1	3.1	<1	<1	<4	9.9	<0.20	<0.20
A04	14.9-15.9	<0.2	<1	2.9	<0.1	3.3	<1	<1	<4	5.7	<0.20	<0.20
A04	18.05-18.9	<0.2	<1	1.5	<0.1	2.8	<1	<1	4.6	8.9	<0.20	<0.20
B05	0.25-0.9	<0.2	<1	<1	<0.1	1.5	1.4	<1	<4	2.3	<0.20	<0.20
B05	2.9-3.9	<0.2	<1	1.2	<0.1	2.1	<1	<1	4.3	2.9	<0.20	<0.20
B05	7.9-8.9	<0.2	<1	1.3	<0.1	1.4	<1	<1	5.1	6.5	<0.20	<0.20
B05	14.9-15.9	<0.2	<1	1.5	<0.1	1.5	2.9	<1	<4	4	<0.20	<0.20
B05	15.9-16.1	<0.2	<1	<1	<0.1	1.5	2.1	<1	<4	<2	<0.20	<0.20
B06	0.35-0.9	<0.2	<1	1.2	<0.1	4.1	<1	<1	<4	17	<0.20	<0.20
B06	2.9-3.9	<0.2	1.1	1.3	<0.1	2.4	1.5	<1	9	18	<0.20	<0.20
B06	7.9-8.9	<0.2	<1	<1	<0.1	1.7	<1	<1	<4	3.4	<0.20	<0.20
B06	9.9-10.9	<0.2	<1	1.2	<0.1	2.3	<1	<1	14	3.8	<0.20	<0.20
B06	10.9-11.35	<0.2	<1	2.2	<0.1	11	1	<1	7.6	<2	<0.20	<0.20
B07	0.0-0.9	<0.2	<1	1.1	<0.1	1.5	<1	<1	7.4	4.7	<0.20	<0.20
B07	0.9-1.9	0.34	<1	1.6	<0.1	2.3	<1	<1	<4	22	<0.20	<0.20
B07	2.9-3.9	0.26	<1	1.1	<0.1	2.8	1	<1	<4	9.3	<0.20	<0.20
B07	7.9-8.9	<0.2	<1	1.5	<0.1	2.5	<1	<1	8.9	9.9	<0.20	<0.20
B07	14.9-15.9	0.38	<1	1.3	<0.1	2.9	<1	<1	<4	3.2	<0.20	<0.20
B08	0.0-0.9	<0.2	<1	<1	<0.1	3.1	<1	<1	<4	24	<0.20	<0.20
B08	2.9-3.9	<0.2	<1	<1	<0.1	1.1	<1	<1	<4	5.4	<0.20	<0.20
B08	7.9-8.9	<0.2	<1	<1	<0.1	<1	<1	<1	<4	6.8	<0.20	<0.20
B08	14.9-15.9	<0.2	<1	1.8	<0.1	3.9	1.9	<1	6.7	11	<0.20	<0.20
B08	18.0-18.9	<0.2	<1	<1	<0.1	1.8	<1	<1	<4	5.9	<0.20	<0.20
B09	0.1-0.9	<0.2	<1	<1	<0.1	2.2	<1	<1	5.4	3.4	<0.20	<0.20
B09	2.9-3.9	<0.2	<1	<1	<0.1	1.1	<1	<1	<4	4.8	<0.20	<0.20
B09	7.9-8.9	<0.2	<1	1.1	<0.1	2.7	<1	<1	5.3	13	<0.20	<0.20
B09	14.9-15.9	0.24	1	<1	<0.1	3.5	1.9	<1	6	3	<0.20	<0.20
B09	18.0-18.9	<0.2	<1	<1	<0.1	2.4	<1	<1	5.7	6.4	<0.20	<0.20
B10	0.05-0.9	<0.2	<1	1.6	<0.1	1.4	<1	<1	6.6	3.6	<0.20	<0.20
B10	0.9-1.9	<0.2	<1	1	<0.1	2.1	<1	<1	8.1	19	<0.20	<0.20
B10	2.9-3.9	<0.2	<1	1.3	<0.1	2.5	1	<1	4.6	14	<0.20	<0.20
B10	7.9-8.9	<0.2	<1	1.4	<0.1	2.7	<1	<1	5.4	10	<0.20	<0.20
B10	13.9-14.7	0.22	<1	1.8	<0.1	4	<1	<1	5.5	6.8	<0.20	<0.20
Ref. Sed.	/	<0.2	<1	<1	<0.1	<1	<1	<1	<4	9.4	<0.20	<0.20

Table 7.17 Elutriate Test Results for Grab Samples (PCBs, TBT, Chlorinated Pesticides and Nutrients)

Sample Location	Sampling Depth below seabed (m)	Organic-non-PAHs (µg/L)	Organo-metallics (µg/L)	Chlorinated Pesticides (µg/L)	TKN (mg/L)	NH_3-N (mg/L)	NO_3-N (mg/L)	NO_2-N (mg/L)	Total P (mg/L)	Ortho-P (mg/L)
		Total PCBs	TBT							
A01	0.05 - 0.9	<0.01	<0.015	<0.10	1.9	1.6	0.15	0.21	0.12	<0.10
A01	0.9 – 1.9	<0.01	<0.015	<0.10	4.0	4.0	0.19	0.11	0.12	<0.10
A01	2.9 – 3.9	<0.01	<0.015	<0.10	4.0	3.2	0.15	0.13	0.17	<0.10
A01	7.9-8.9	<0.01	<0.015	<0.10	1.6	1.3	0.25	0.14	<0.10	<0.10
A01	9.9–10.8	<0.01	<0.015	<0.10	1.6	1.2	0.25	0.14	<0.10	<0.10
A02	0.2-0.9	<0.01	<0.015	<0.10	<1.0	0.32	0.39	0.30	0.21	<0.10
A02	2.9-3.9	<0.01	<0.015	<0.10	2.7	2.0	0.31	0.37	0.26	0.16

Sample Location	Sampling Depth below seabed (m)	Organic-non-PAHs (µg/L)	Organo-metallics (µg/L)	Chlorinated Pesticides (µg/L)	TKN (mg/L)	NH_3-N (mg/L)	NO_3-N (mg/L)	NO_2-N (mg/L)	Total P (mg/L)	Ortho-P (mg/L)
		Total PCBs	TBT							
A02	7.9-8.9	<0.01	<0.015	<0.10	4.3	3.8	0.59	0.29	0.15	<0.10
A02	14.9-15.9	<0.01	<0.015	<0.10	9.6	9.2	0.41	0.25	<0.10	<0.10
A02	16.9-17.9	<0.01	<0.015	<0.10	7.0	6.1	0.55	0.28	<0.10	<0.10
A03	0.2-0.9	<0.01	<0.015	<0.10	1.1	0.43	0.25	0.18	<0.10	<0.10
A03	2.9-3.9	<0.01	<0.015	<0.10	3.9	3.0	0.23	0.14	0.18	<0.10
A03	7.9-8.9	<0.01	<0.015	<0.10	6.0	5.1	0.34	0.17	0.13	<0.10
A03	14.9-15.9	<0.01	<0.015	<0.10	6.9	6.0	0.33	0.18	<0.10	<0.10
A03	15.9-16.35	<0.01	<0.015	<0.10	5.1	5.0	0.40	0.17	<0.10	<0.10
A04	0.0-0.9	<0.01	<0.015	<0.10	<1.0	<0.025	0.33	0.11	0.10	<0.10
A04	2.9-3.9	<0.01	<0.015	<0.10	1.8	1.0	0.35	0.099	<0.10	<0.10
A04	7.9-8.9	<0.01	<0.015	<0.10	5.4	4.7	0.33	0.099	0.23	0.13
A04	14.9-15.9	<0.01	<0.015	<0.10	12	12	0.35	0.094	0.11	<0.10
A04	18.05-18.9	<0.01	<0.015	<0.10	12	11	0.32	0.094	0.15	<0.10
B05	0.25-0.9	<0.01	<0.015	<0.10	3.2	2.7	0.24	0.14	<0.10	<0.10
B05	2.9-3.9	<0.01	<0.015	<0.10	5.0	4.8	0.30	0.17	0.15	0.10
B05	7.9-8.9	<0.01	<0.015	<0.10	2.9	2.4	0.34	0.16	<0.10	<0.10
B05	14.9-15.9	<0.01	<0.015	<0.10	2.2	1.3	0.19	0.50	0.11	<0.10
B05	15.9-16.1	<0.01	<0.015	<0.10	2.2	2.0	0.28	0.22	<0.10	<0.10
B06	0.35-0.9	<0.01	<0.015	<0.10	1.9	1.1	0.53	0.092	<0.10	<0.10
B06	2.9-3.9	<0.01	<0.015	<0.10	4.6	4.2	0.50	0.09	0.31	0.20
B06	7.9-8.9	<0.01	<0.015	<0.10	4.9	4.4	0.69	0.087	<0.10	<0.10
B06	9.9-10.9	<0.01	<0.015	<0.10	6.1	5.4	0.64	0.081	<0.10	<0.10
B06	10.9-11.35	<0.01	<0.015	<0.10	1.9	1.7	0.82	0.063	<0.10	<0.10
B07	0.0-0.9	<0.01	<0.015	<0.10	<1.0	<0.025	0.29	0.045	0.13	<0.10
B07	0.9-1.9	<0.01	<0.015	<0.10	1.0	0.39	0.28	0.091	<0.10	<0.10
B07	2.9-3.9	<0.01	<0.015	<0.10	1.6	1.3	0.28	0.046	<0.10	<0.10
B07	7.9-8.9	<0.01	<0.015	<0.10	4.0	3.8	0.28	0.058	0.14	<0.10
B07	14.9-15.9	<0.01	<0.015	<0.10	6.4	6.2	0.27	0.044	<0.10	<0.10
B08	0.0-0.9	<0.01	<0.015	<0.10	<1.0	0.20	0.35	0.14	<0.10	<0.10
B08	2.9-3.9	<0.01	<0.015	<0.10	1.9	1.7	0.33	0.13	0.10	<0.10
B08	7.9-8.9	<0.01	<0.015	<0.10	4.9	4.8	0.34	0.12	0.26	0.12
B08	14.9-15.9	<0.01	<0.015	<0.10	12	12	0.31	0.14	0.21	<0.10
B08	18.0-18.9	<0.01	<0.015	<0.10	11	10	0.35	0.13	0.11	<0.10
B09	0.1-0.9	<0.01	<0.015	<0.10	<1.0	0.060	0.50	0.33	0.14	<0.10
B09	2.9-3.9	<0.01	<0.015	<0.10	<1.0	0.16	0.58	0.42	0.12	<0.10
B09	7.9-8.9	<0.01	<0.015	<0.10	7.9	7.0	0.57	0.27	0.29	0.44
B09	14.9-15.9	<0.01	<0.015	<0.10	14	13	0.40	0.32	<0.10	<0.10
B09	18.0-18.9	<0.01	<0.015	<0.10	14	13	0.41	0.33	0.10	<0.10
B10	0.05-0.9	<0.01	N/A*	<0.10	<1.0	0.059	0.29	0.048	<0.10	<0.10
B10	0.9-1.9	<0.01	<0.015	<0.10	<1.0	0.33	0.26	0.084	<0.10	<0.10
B10	2.9-3.9	<0.01	<0.015	<0.10	1.4	0.85	0.27	0.084	<0.10	<0.10
B10	7.9-8.9	<0.01	<0.015	<0.10	3.9	3.8	0.26	0.064	0.11	<0.10
B10	13.9-14.7	<0.01	<0.015	<0.10	5.5	5.3	0.28	0.062	<0.10	<0.10
Ref. Sed.	/	<0.01	<0.015	<0.10	1.1	0.87	<0.025	<0.025	<0.10	<0.10

Note: N/A-Insufficient porewaterr for analysis of TBT.*

7.6.4 Pore Water Samples

7.6.4.1 Pore water tests were conducted also for the purpose of water quality assessment (see **Section 9**) of the potential of contaminant release when dredging and filling 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.

7.6.4.2 The pore water test results of this investigation are summarised in **Tables 7-18 and 7-19**. In general, the levels of PAHs, PCBs and TBT were all below the reporting limits.

Table 7-18 Pore Water Test Results (Metals, Metalloid and PAHs)

Sample Location	Metals (ug/L)								Metalloid (ug/L)	Organic-PAHs (µg/L)	
	Cd	Cr	Cu	Hg	Ni	Pb	Ag	Zn	As	LMW PAH	HMW PAH
A01	<0.2	<1	1.7	<0.1	1.2	1.9	<1	<4	4	<0.20	<0.20
A02	<0.2	<1	<1	<0.1	2.7	<1	<1	<4	8.7	<0.20	<0.20
A03	<0.2	<1	3.6	<0.1	2.1	1.5	<1	7.7	3.4	<0.20	<0.20
A04	<0.2	<1	<1	<0.1	1.2	<1	<1	<4	4.4	<0.20	<0.20
B05	<0.2	<1	<1	<0.1	<1	<1	<1	4.2	9	<0.20	<0.20
B06	<0.2	<1	1.2	<0.1	<1	<1	<1	<4	7.5	<0.20	<0.20
B07	<0.2	<1	2.4	<0.1	2.4	<1	<1	4.4	3.1	<0.20	<0.20
B08	<0.2	<1	<1	<0.1	<1	<1	<1	<4	4	<0.20	<0.20
B09	<0.2	1.2	3.1	<0.1	1.8	3.6	<1	10	6.1	<0.20	<0.20
B10	<0.2	<1	1.7	<0.1	1.7	<1	<1	4.2	3.3	<0.20	1.8
Ref. Sample.	<0.2	<1	<1	<0.1	1.5	<1	<1	<4	11	<0.20	<0.20

Table 7-19 Pore Water Test Results (PCBs, TBT, Chlorinated Pesticides and Nutrients)

Sample Location	Organic-non-PAHs (µg/L)	Organo-metallics (µg/L)	Chlorinated Pesticides (µg/L)	TKN (mg/L)	NH_3-N (mg/L)	NO_3-N (mg/L)	NO_2-N (mg/L)	Total P (mg/L)	Ortho-P (mg/L)
	Total PCBs	TBT							
A01	<0.01	<0.015	<0.10	1.4	0.80	0.095	0.093	0.17	<0.10
A02	<0.01	<0.015	<0.10	3.3	3.30	880	<0.025	0.22	0.18
A03	<0.01	<0.015	<0.10	1.3	0.40	0.26	0.10	0.12	<0.10
A04	<0.01	<0.015	<0.10	<1.0	0.23	0.054	0.043	0.19	<0.10
B05	<0.01	<0.015	<0.10	2.8	2.50	<0.025	0.062	0.14	<0.10
B06	<0.01	<0.015	<0.10	2.8	2.50	<0.025	<0.025	0.25	0.13
B07	<0.01	<0.015	<0.10	<1.0	0.052	0.033	0.059	0.22	<0.10
B08	<0.01	<0.015	<0.10	1.4	1.00	<0.025	0.032	0.17	<0.10
B09	<0.01	<0.015	<0.10	1.8	1.60	<0.025	<0.025	0.49	0.32
B10	<0.01	<0.015	<0.10	<1.0	0.62	<0.025	<0.025	0.17	<0.10
Ref. Sed.	<0.01	<0.015	<0.10	4.0	3.7	<0.025	<0.025	0.73	0.68

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**.

Table 7-21 Estimate for the Proportion of Different Category of Dredged Maine Deposit in HKBCF Reclamation

Vibrocore	Approx. dredged area within the portion represented by the vibrocore (m²), A	Category of Sediment	Length of Sediment in vibrocore (m). L	Quantity in each portion (m³), V = A x L
A01	165,000 (10,200)	L	3.0 (2.1)	495,000 (21,420)
		Mp	6.4 (3.9)	1,056,000 (39,780)
		Mf	1.4	231,000
A02	12,000 (40,800)	L	13.9 (6.0)	166,800 (244,800)
		Mp	2.5	30,000
		Mf	1.5	18,000
A03	150,000	L	10.45	1,575,500
		Mp	5.9	885,000
		Mf	0	0
A04	80,000	L	17.0	1,360,000
		Mp	1.9	152,000
		Mf	0	0
B05	Not considered (outside the site)	L	--	--
		Mp	--	--
		Mf	--	--
B06	140,000	L	11.35	1,596,000
		Mp	0	0
		Mf	0	0
B07	55,000	L	13.9	764,500
		Mp	2.0	110,000
		Mf	0	0
B08	Not considered (outside the site)	L	--	--
		Mp	--	--
		Mf	--	--
B09	105,000	L	12.0	1,260,000
		Mp	6.9	724,500
		Mf	0	0
B10	90,000	L	12.5	1,125,000
		Mp	2.2	198,000
		Mf	0	0
AS02	60,000	L	5.95	360,000
		Mp	3.45	204,000
		Mf	0	0
LS01	60,000 (33,000)	L	12.9 (6.0)	774,000 (198,000)
		Mp	0	0
		Mf	0	0
			Total of Cat.L =	9,940,520 (73.15%)
			Total of Cat.Mp =	3,399,280 (25.02%)
			Total of Cat.Mf =	249,000 (1.83%)

Note: 1) Figures in bracket are for the dredging to form the pits to receive Mf sediment from the site.

7.7.4.2 The vibrocores AS02 and LS01 shown in **Table 7-21** above is carried out under TMCLKL project and their results are covered in the sediment quality report to be issued under TMCLKL project. As these two vibrocores are located within HKBCF reclamation site (see **Figure 7.4**), the results of these two vibrocores are also utilised in the estimate of the proportion of different Category of marine deposit to be dredged in HKBCF.

7.7.4.3 The result in **Table 7-21** above shows that about 73.15% (say 73.2%) of the dredged marine deposit is Category L material. About 25.02% (say 25.0%) and 1.83% (say 1.8%) of the dredged marine deposit is Category Mp and Mf materials respectively. The proportion of different Category of sediment will be used in estimate of the quantities of dredged marine deposit in **Section 8**.

7.7.5 HKLR – Viaducts

7.7.5.1 To estimate the proportion of different Category of sediments to be dredged form the foundation of marine viaducts in HKLR, the calculation method adopted is similar to that in HKBCF reclamation. In this regard, the entire length of marine viaduct is divided into portions as shown in **Figure 7.5.** The classification of dredged sediment in each portion is determined based on the estimated dredge volume and the result of the corresponding vibrocore

7.7.5.2 The estimate of the proportion of different category of dredged marine deposit is shown in **Table 7-22.**

Table 7-22 Estimate for the Proportion of Different Category of Dredged Maine Deposit in HKLR (Viaduct)

Vibrocore	Approx. Area of the portion represented by the vibrocore (m), A	Category of Sediment	Length of Sediment in vibrocore (m). L	Quantity in each portion (m^3), V = A x L
A1	915	L	11.0	10,065
		Mp	4.0	3,660
		Mf	0	0
A2	1,602	L	3.0	4,806
		Mp	6.0	9,612
		Mf	0	0
A3	2,679	L	12.0	32,148
		Mp	3.0	8,037
		Mf	0	0
A4	1,479	L	6.0	8,874
		Mp	9.0	13,311
		Mf	0	0
A5	2,958	L	7.0	20,706
		Mp	0.0	0
		Mf	8.0	23,664
B14	3,081	L	4.5	13,866
		Mp	3.5	10,785
		Mf	0	0
B15	2,079	L	5.0	10,395
		Mp	0	0
		Mf	4.0	8,316
B8	4,302	L	14.0	60,228
		Mp	1.0	4,302
		Mf	0	0

Vibrocore	Approx. Area of the portion represented by the vibrocore (m), A	Category of Sediment	Length of Sediment in vibrocore (m). L	Quantity in each portion (m^3), V = A x L
B9	3,066	L	3.0	9,198
		Mp	0	0
		Mf	5.0	15,330
B16	2,958	L	3.0	8,874
		Mp	0	0
		Mf	0	0
B17	3,681	L	1.0	3,681
		Mp	0	0
		Mf	0	0
			Total of Cat.L =	182,841 (65.33%)
			Total of Cat.Mp =	49,707 (17.76%)
			Total of Cat.Mf =	47,310 (16.91%)

7.7.5.3 The result in **Table 7-22** above shows that about 65.33% (say 65.5%) of the dredged marine deposit is Category L material. About 17.76% (say 17.5%) and 16.91% (say 17.0%) of the dredged marine deposit is Category Mp and Mf materials respectively. The proportion of different Category of sediments will be used in estimate of the quantities of dredged marine deposit in **Section 7.7.7** below.

7.7.6 HKLR – Reclamation

7.7.6.1 To estimate the proportion of different Category of sediments to be dredged form the reclamation of HKLR, the calculation method adopted is similar to that in HKBCF reclamation. In this regard, the whole reclamation area of HKLR is divided into portions as shown in **Figure 7.6**. The classification of dredged sediment in each portion is represented by the corresponding vibrocore carried out in this Project. The area to be dredged is also plotted in **Figure 7.6**. 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.

7.7.6.2 The estimate of the proportion of different category of dredged marine deposit is shown in **Table 7-23.**

Table 7-23 Estimated Proportion of Different Category of Dredged Maine Deposit in HKLR Reclamation

Vibrocore	Approx. dredged area within the portion represented by the vibrocore (m^2), A	Category of Sediment	Length of Sediment in vibrocore (m). L	Quantity in each portion (m^3), V = A x L
C11	20,000	L	6.6	132,000
		Mp	0	0
		Mf	3.9	78,000
C12	85,000	L	10.2	867,000
		Mp	0	0
		Mf	0	0
C13	35,000 (18,000)	L	10.7 (12.5)	374,500 (225,000)
		Mp	0	0
		Mf	0	0
C14	45,000	L	9.3	418,500
		Mp	0	0
		Mf	3	135,000

Vibrocore	Approx. dredged area within the portion represented by the vibrocore (m²), A	Category of Sediment	Length of Sediment in vibrocore (m). L	Quantity in each portion (m³), V = A x L
C15	70,000 (22,000)	L	11.7 (12.5)	819,000 (275,000)
		Mp	0	0
		Mf	0	0
C16	40,000	L	8.7	348,000
		Mp	0	0
		Mf	0	0
B08 [Note 2]	45,000	L	16.95	762,750
		Mp	1.95	87,750
		Mf	0	0
			Total of Cat.L =	4,221,750 (93.3%)
			Total of Cat.Mp =	87,750 (2.0%)
			Total of Cat.Mf =	213,000 (4.7%)

Note: 1) Figures in bracket are for the dredging to form the pits to receive Mf sediment from the site.

2) Although vibrocore B08 was carried out under HKBCF project, the location of this vibrocore is close to the northern portion of HKLR reclamation. Therefore, test results of this vibrocore are also used in assessing the proportion of different Category of marine sediment to be dredged from HKLR.

7.7.6.3 The result in **Table 7-23** above shows that about 93.3% of the dredged marine deposit is Category L material. About 2.0% and 4.7% of the dredged marine deposit is Category Mp and Mf materials respectively. The proportion of different Category of sediments will be used in estimate of the quantities of dredged marine deposit in **Section 7.7.7** below.

7.7.7 Estimated Quantities Different Category of Marine Sediments to be Dredged

7.7.7.1 **Tables 7-21 to 7-23** above provide estimate of the proportion of different Category of sediments to be dredged in the reclamation of HKBCF and HKLR, and the foundation of marine viaducts in HKLR. Although the estimated quantity of different Category of sediments is also given in the above tables based on the information of vibrocores carried out, it is more accurate to estimate the quantity of dredging works based on the geophysical survey of the seabed level and the bottom level of marine sediments as the data available is at a more closer spacing and thus more representative than that obtained from the completed vibrocores. A comparison of the estimated quantities of dredging works based on the results of vibrocores and geophysical survey is given in **Table 7-24**.

Table 7-24 Estimated Quantities of Dredging Works

		Based on Vibrocores (Mm³) [Note 1]				Based on survey
		Category L	Category Mp	Category Mf	Total	
HKBCF Reclamation	In-situ volume	9.94	3.40	0.25	13.59	14.39
	Bulk volume	12.92	4.42	0.33	17.67	18.71
HKLR Piling works	In-situ volume	0.18	0.05	0.05	0.28	0.31
	Bulk volume	0.23	0.07	0.07	0.37	0.40
HKLR Reclamation	In-situ volume	4.22	0.09	0.22	4.53	4.27
	Bulk volume	5.49	0.12	0.29	5.90	5.55

Note: 1) in-situ volume is based on the figures in Tables 7-21 to 7-23. The bulk volume = 1.3 (bulking factor) x in-situ volume.

2) The figure includes dredging for pits to receive Mf sediment and the sediment excavated from the bored pile excavation works at non-dredged areas.

7.7.7.2 As shown in **Table 7-24** above, difference between the estimated quantities of dredging works based on vibrocores and geophysical survey results is not substantial. However, as the estimate based on the geophysical survey results should be more accurate, the estimated quantities of different Category of marine sediments to be dredged is adjusted based on the percentages of Category L, Mp and Mf sediments determined in **Tables 7-21 to 7-23** and the estimated quantities of dredging works based on geophysical survey results. The estimated quantities of different Category of marine sediments to be dredged are given in **Table 7-25**.

Table 7-25 Estimated Quantities of Different Category of Marine Sediments to be Dredged

		Estimated Volume (Mm^3)			
		Category L	Category Mp	Category Mf	Total
HKBCF Reclamation	In-situ volume	10.53 (73.2%)	3.60 (25.0%)	0.26 (1.8%)	14.39
	Bulk volume	13.69 (73.2%)	4.68 (25.0%)	0.35 (1.8%)	18.72
HKLR Piling works	In-situ volume	0.20 (65.5%)	0.06 (17.5%)	0.05 (17%)	0.31
	Bulk volume	0.26 (65.5%)	0.07 (17.5%)	0.07 (17%)	0.40
HKLR Reclamation	In-situ volume	3.98 (93.3%)	0.09 (2.0%)	0.20 (4.7%)	4.27
	Bulk volume	5.18 (93.3%)	0.11 (2.0%)	0.26 (4.7%)	5.55

7.8 Conclusion

7.8.1 This Section reviewed the sediment quality data and summarised the findings of the site investigation for sediment quality in relation to the current study area for HKBCF and HKLR in order to classify the sediment to be dredged and disposal requirements in accordance with ETWBTC (Works) No. 34/2002.

7.8.2 Classification of the sediment samples based on the chemical and biological test results and estimate of the proportion of different Category of marine deposit to be dredged from the marine works of HKBCF and HKLR including reclamation and foundation of marine viaduct are provided in this Section.

7.9 References

EPD (2007). Marine Water Quality in Hong Kong in 2007. Environmental Protection Department: Government Printer, Hong Kong.

U.S. EPA (1994). Standard Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods.

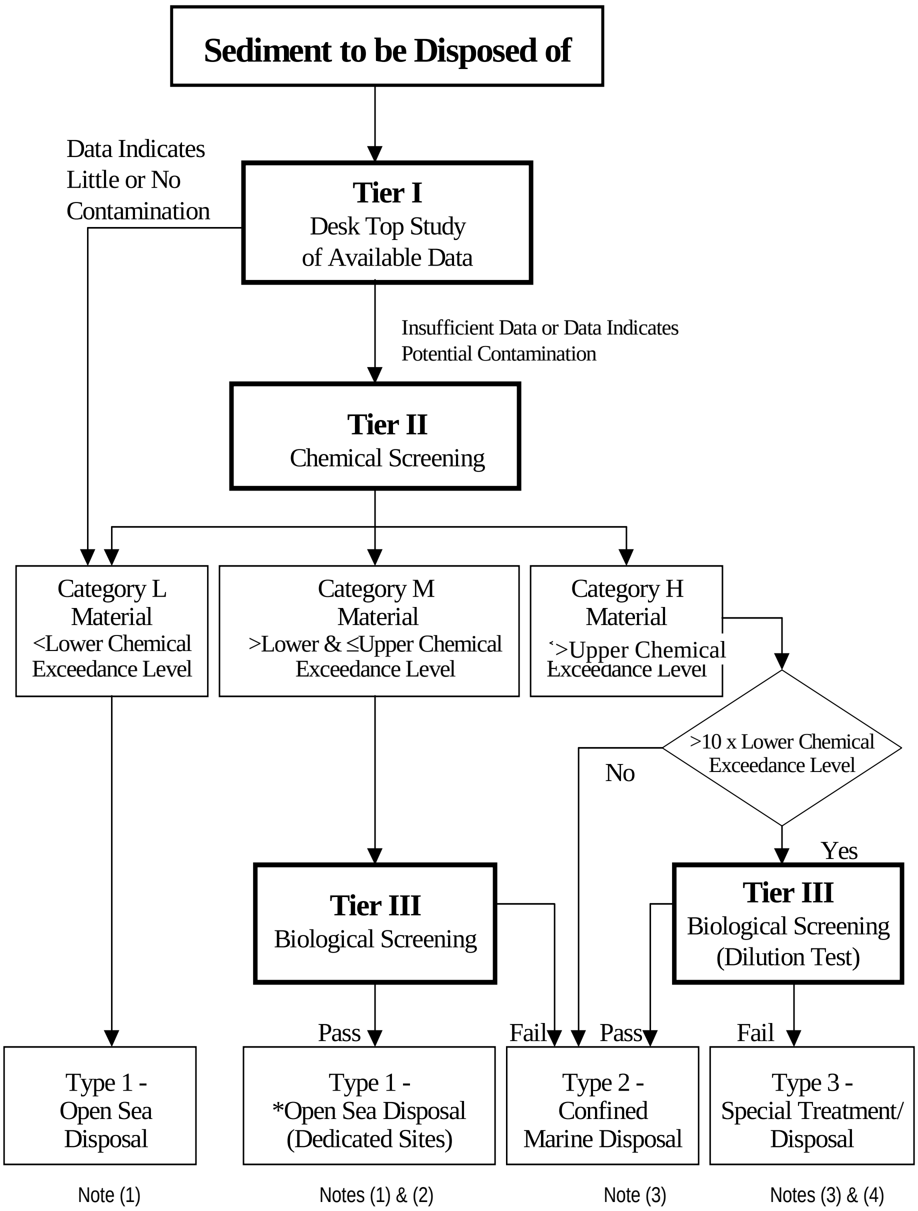
U.S. EPA and U.S. ACE (1998). Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual – Inland Testing Manual.

U.S. EPA (2001). Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual.

APPENDIX 7A

Management Framework of Dredged / Excavated Sediment in Hong Kong

Appendix 7A: Management Framework of Dredged/ Excavated Sediment in Hong Kong



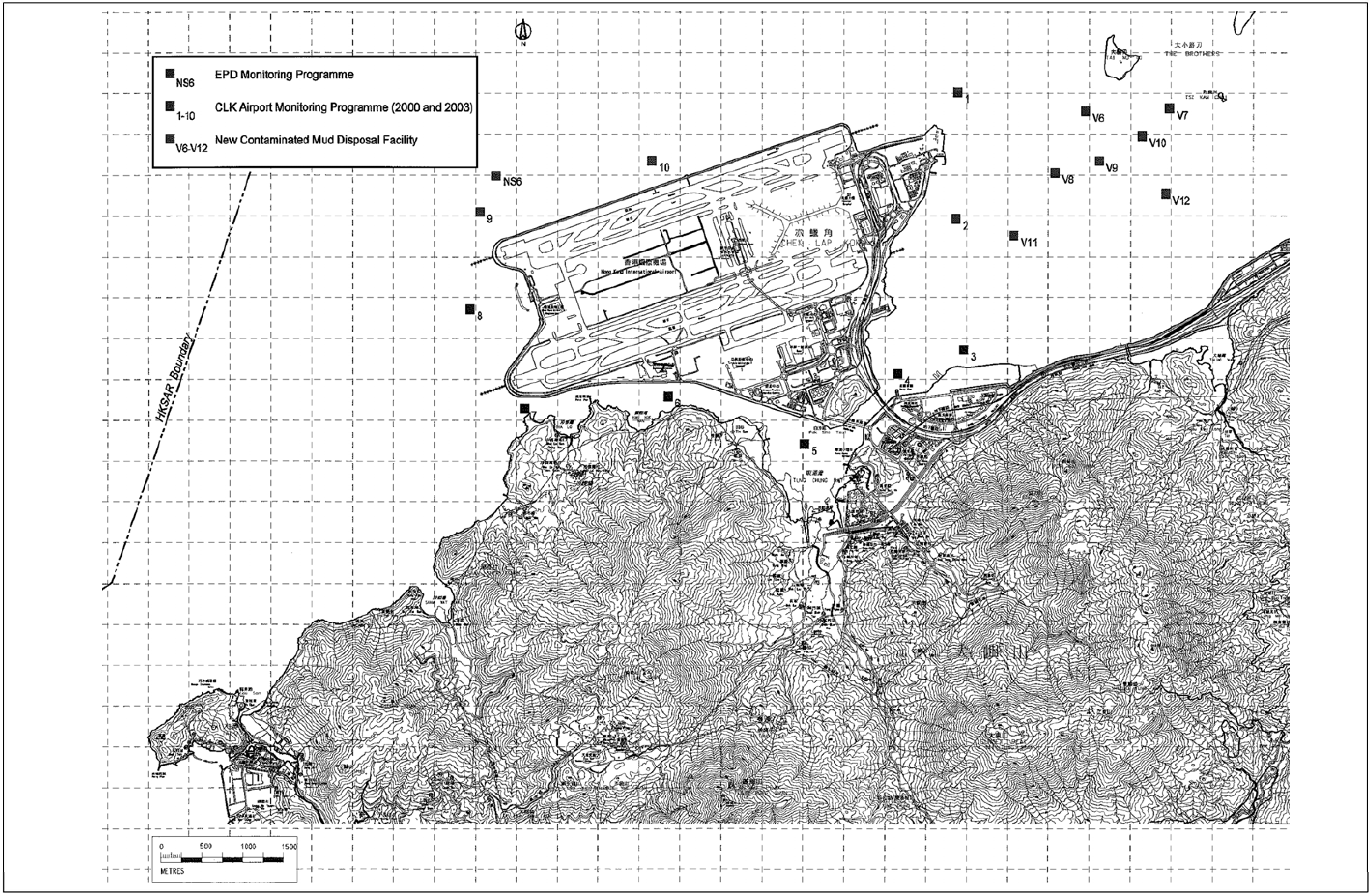
Notes

(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 shall state the allocation conditions of MFC and Director of Environmental Protection (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 project proponent, 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.*



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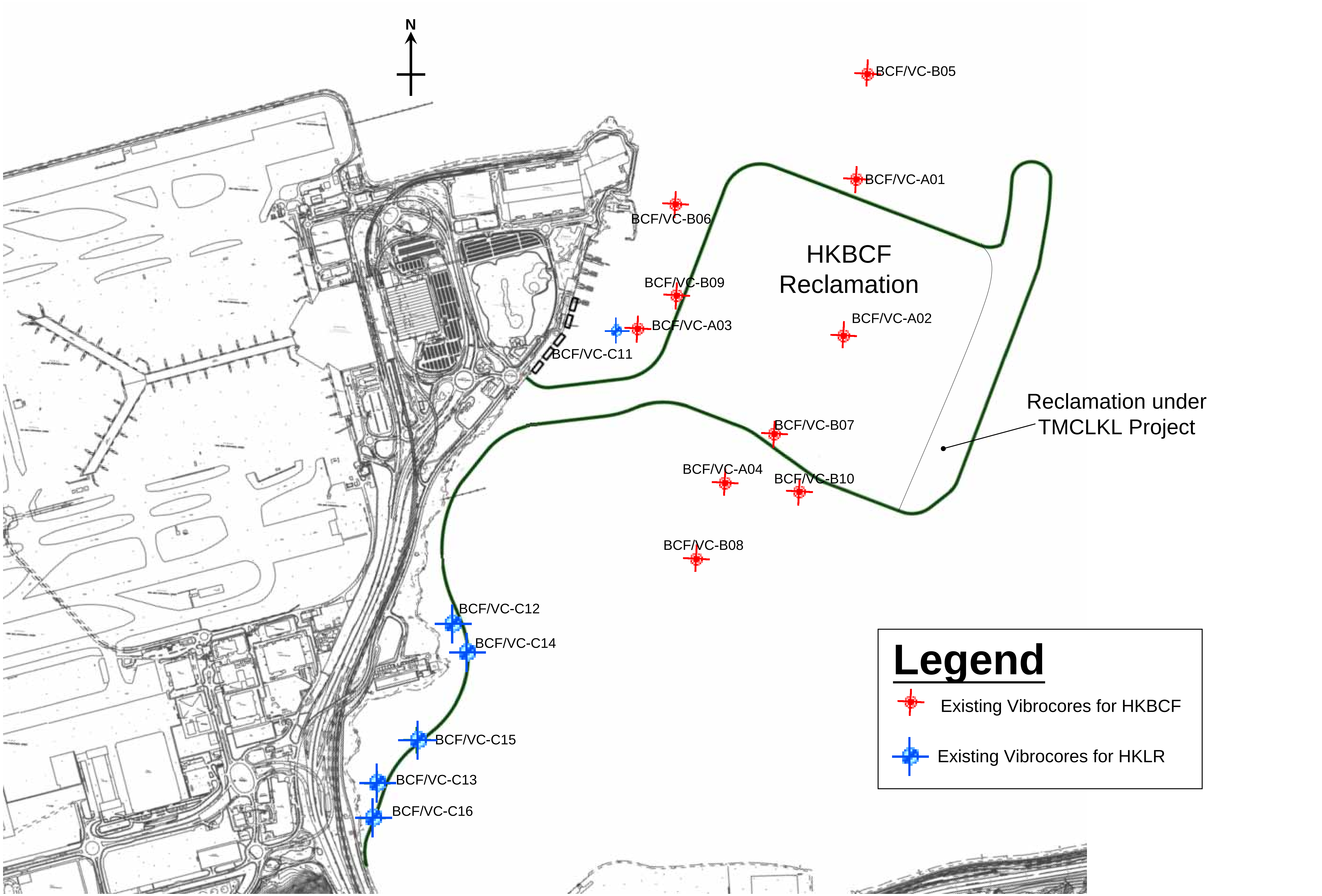
Drawing Title

Sediment Sampling Locations From Other Studies

Drawing No.

Figure 7.1



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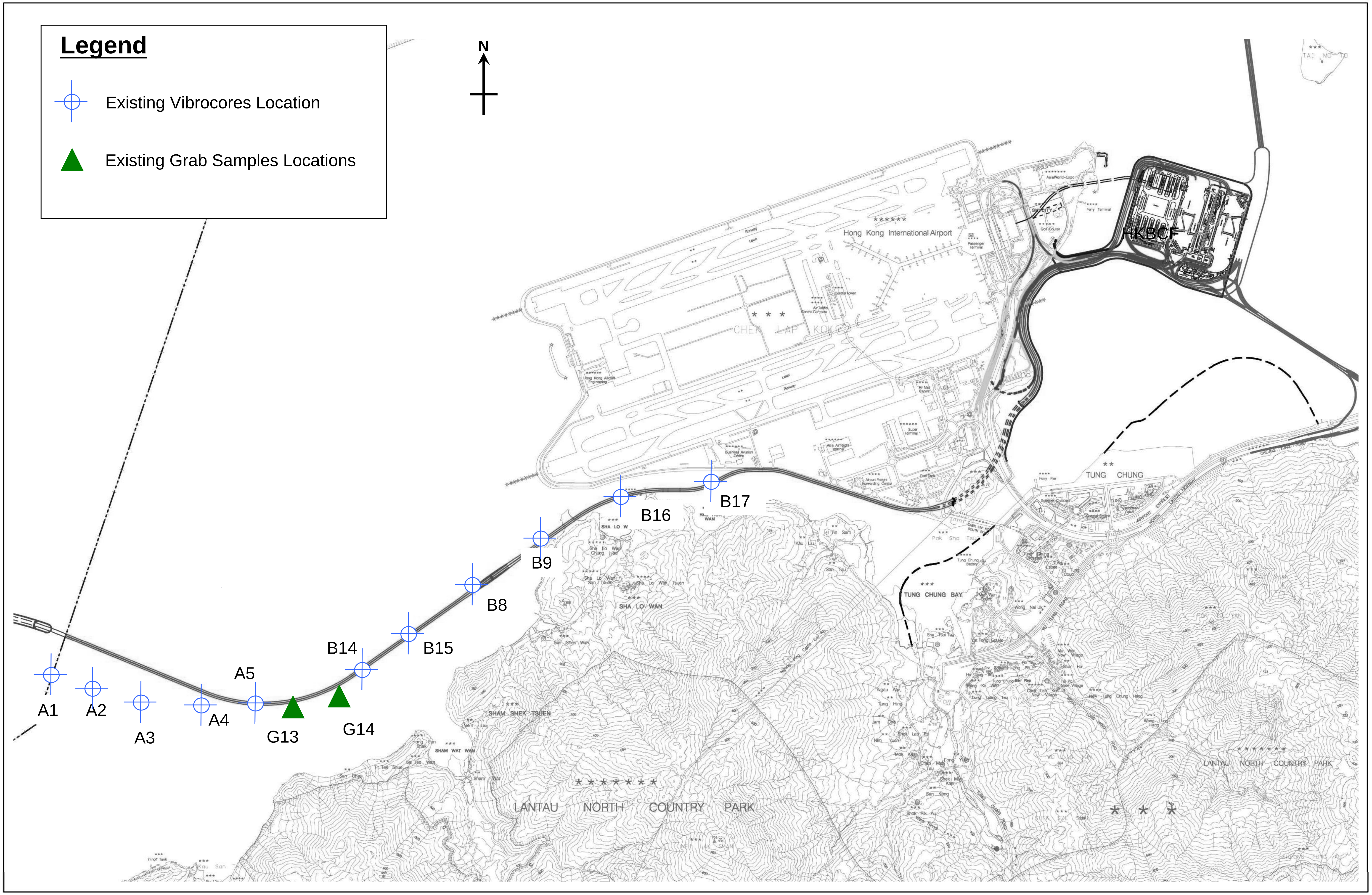
Drawing Title

Locations of Existing Vibrocores for the Reclamation of HKBCF and HKLR

Drawing No.

Figure 7.2



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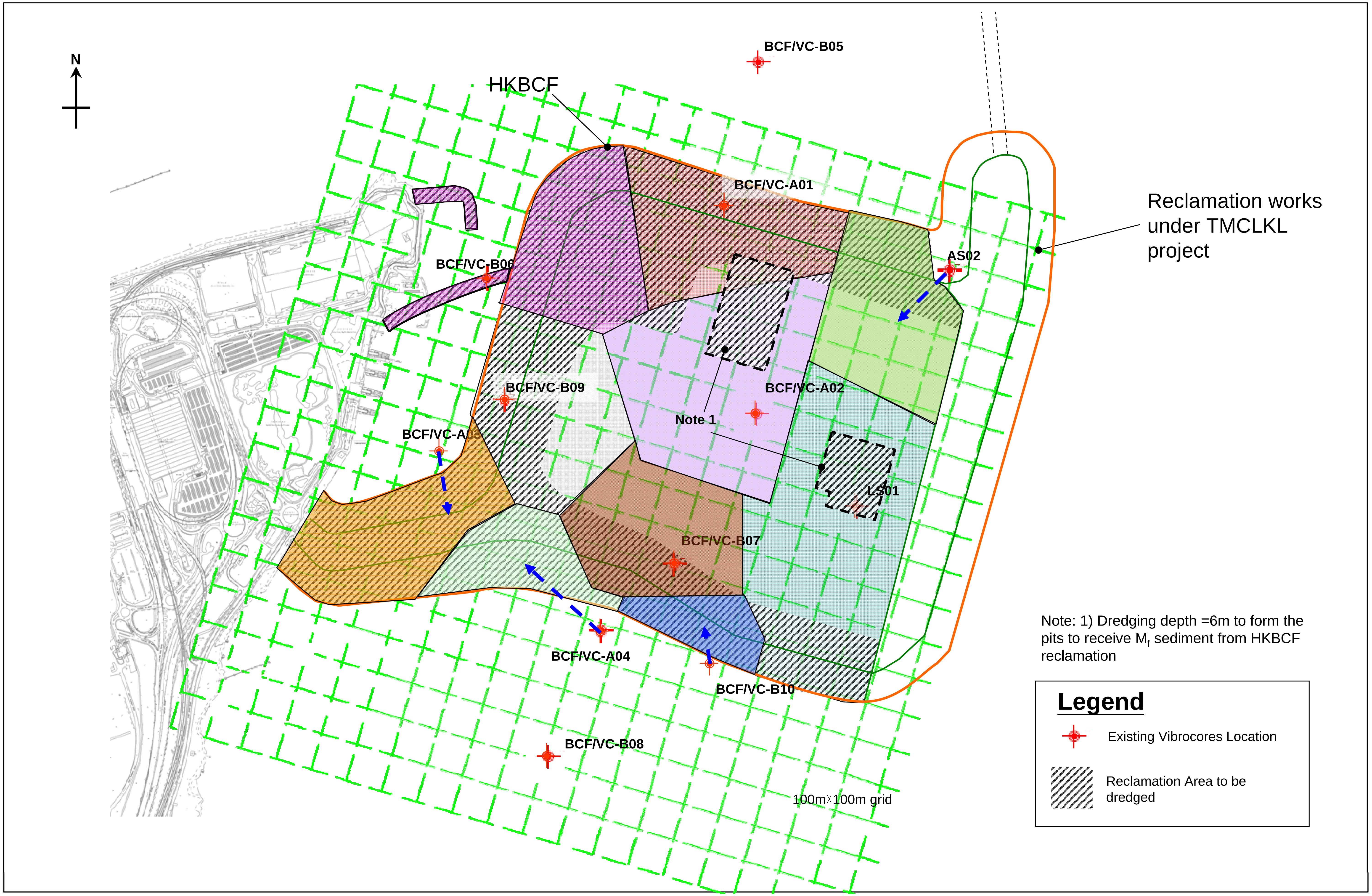
Locations of Existing Vibrocores for HKLR Viaduct

Drawing No.

Figure 7.3



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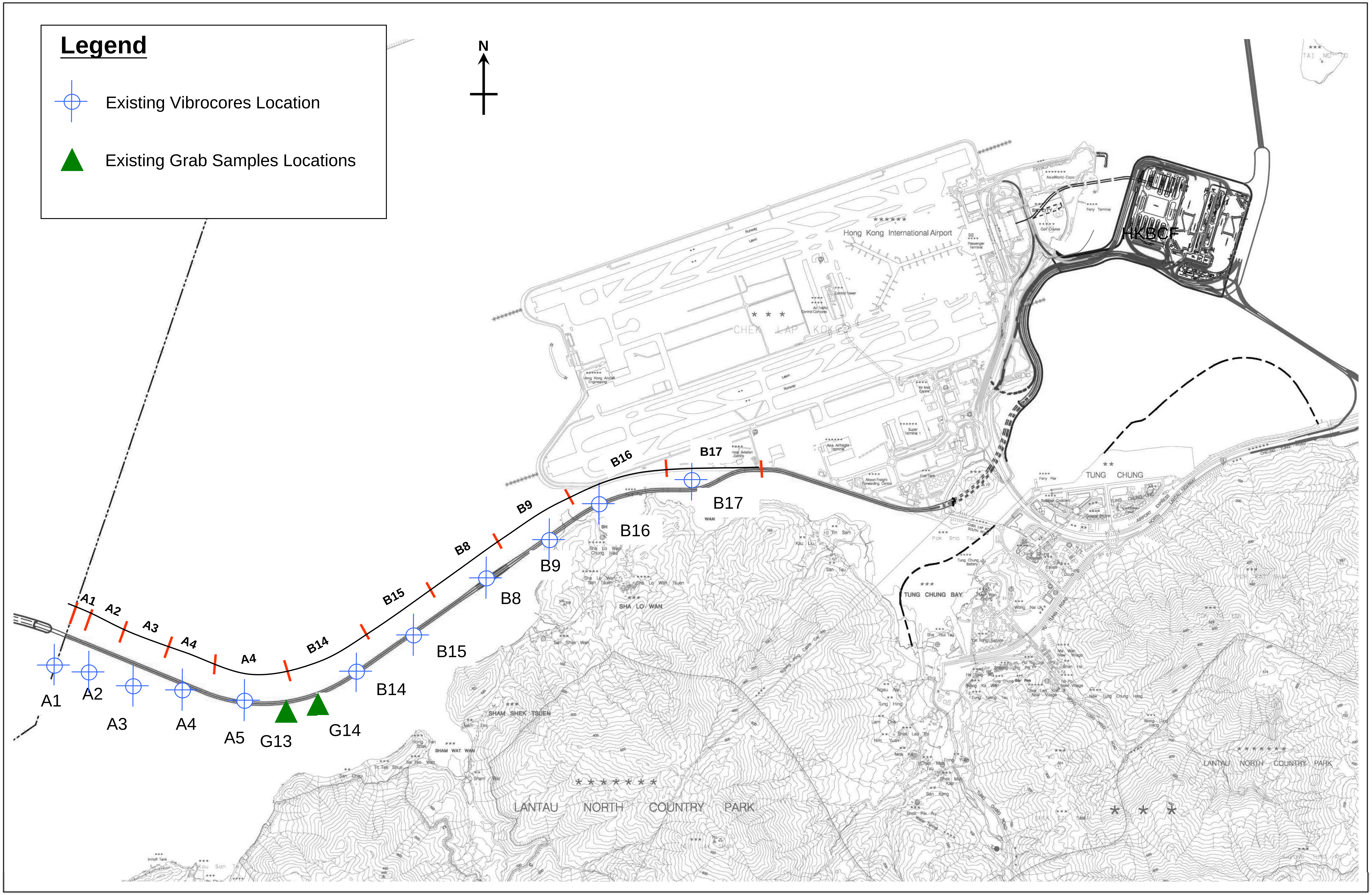
Demarcation of Portion of HKBCF Reclamation Represented by the Vibrocores

Drawing No.

Figure 7.4



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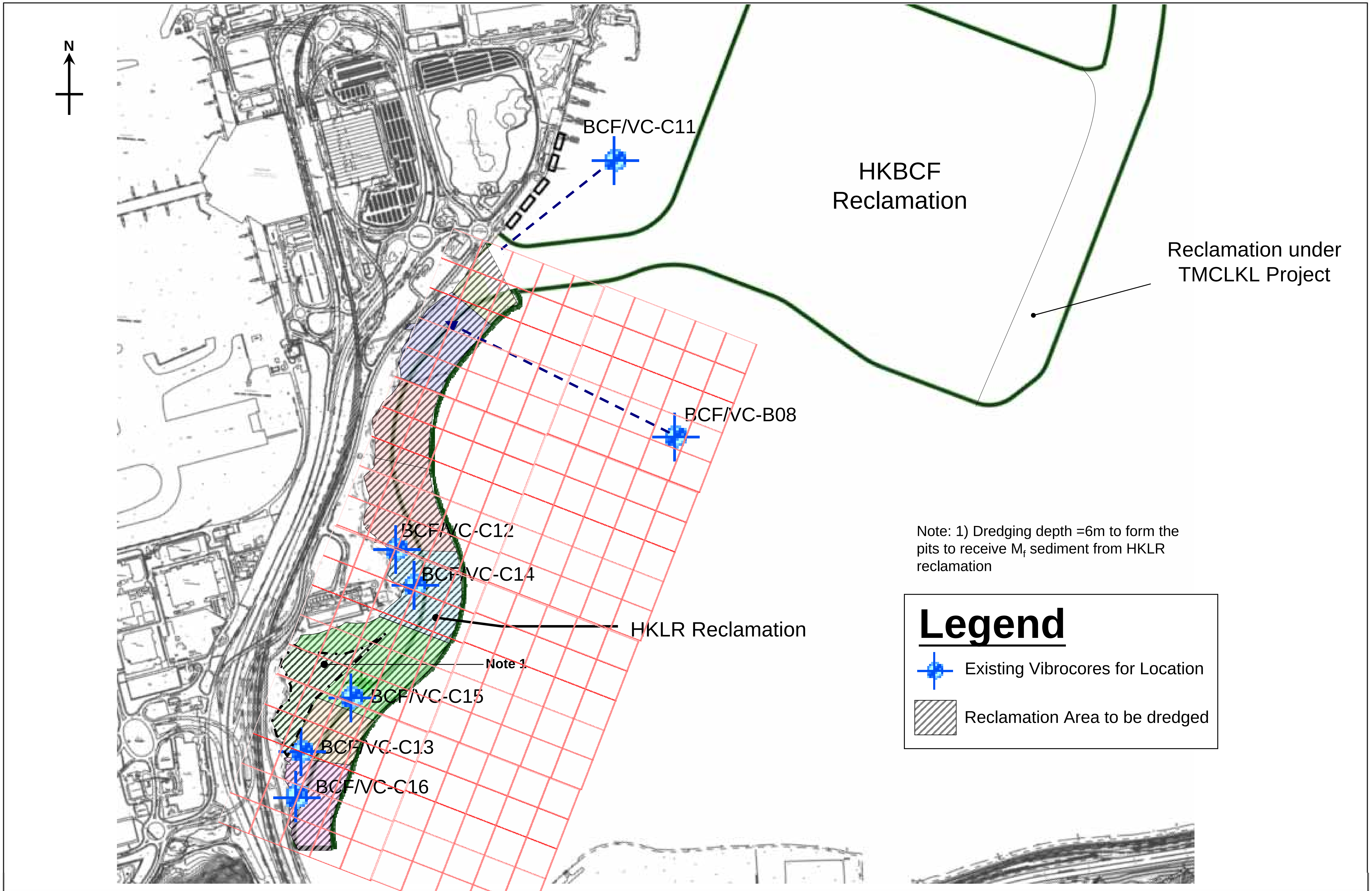
Drawing Title

Demarcation of Portion of HKLR Marine Viaduct Represented by the Vibrocores

Drawing No.

Figure 7.5



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Demarcation of Portion of HKLR Reclamation Represented by the Vibrocores

Drawing No.

Figure 7.6