Annex 8A

Agreed Marine Sediment Sampling and Testing Plan (MSSTP)

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9 August 2017

CLP Power Hong Kong Limited
Black Point Power Station
Yung Long Road,
Lung Kwu Tan,
Tuen Mun, New Territories
(Attn.: Mr. Graham Holland)

Dear Mr. Holland,

Environmental Impact Assessment Ordinance, Cap 499
Project Title: Hong Kong Offshore LNG Terminal
EIA Study Brief (No. ESB-292/2016)
Marine Sediment Sampling & Testing Plan

I refer to the letter of 27 July 2017 from your consultants, ERM-Hong Kong Ltd, submitting on your behalf the marine sediment sampling & testing plan (the Plan).

Pursuant to the section 3.4.8 and Appendix E of the EIA Study Brief (No.ESB-292/2016), please be advised that the submitted Plan is agreed by us for the purpose of carrying out field investigation, sampling and laboratory testings for providing information to evaluate and assess the waste management implication with respect to excavation/dredging and dumping in the captioned EIA study.

Yours sincerely,

(Matthew W.C Chan)
Senior Environmental Protection Officer
for Director of Environmental Protection

c.c. ERM (Attn: Jasmine NG) Fax: 2723 5660

Internal
S(RA)1/E(RA)14
S(RA)4/E(RA)42

Hong Kong Offshore LNG Terminal

Marine Sediment Sampling and Testing Plan

Rev 4 (with Addendum 1)

July 2017

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Hong Kong Offshore LNG Terminal

Marine Sediment Sampling and Testing Plan
Rev 4 (with Addendum 1)

ERM Document Code:
0359722_MSSTP_Rev4, 0359722_MSSTP_Addendum 1_Rev1_v2

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Client:	Project No:
CLP Power Hong Kong Limited	0359722
Summary:	Date: 25 July 2017
This document presents the marine sediment sampling and testing plan for the Hong Kong Offshore LNG Terminal Project.	Approved by:  *Dr Robin Kennish* *Project Director*

Revision	Description	By	Checked	Approved	Date
4r	MSSTP Rev 4 (with Addendum 1)	Var	JN	RK	25/07/17
4	MSSTP	Var	JN	RK	07/07/17
3	MSSTP	Var	JN	RK	21/06/17
2	MSSTP	Var	JN	RK	19/05/17
1	MSSTP	Var	JN	RK	06/04/17
0	MSSTP	Var	JN	RK	31/03/17

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1 INTRODUCTION

1.1 BACKGROUND

To support the increased use of natural gas in Hong Kong from 2020 onwards, CLP Power Hong Kong Limited (CLP) has identified that the development of an offshore liquefied natural gas (LNG) import facility in Hong Kong using Floating Storage and Regasification Unit (FSRU) technology ('the Project') presents a viable additional gas supply option that can access competitive gas supplies from world markets. The Project will involve the construction and operation of an offshore LNG import facility to be located in the southern waters of Hong Kong, a double berth jetty, and subsea pipelines that connect to the gas receiving stations (GRS) at the Black Point Power Station (BPPS) and Lamma Power Station (LPS), owned and operated by CLP and Hongkong Electric Co., Ltd. (HK Electric) respectively.

The Project requires an Environmental Permit from the Hong Kong SAR Government. In relation to this, CLP has prepared a Project Profile for application for an Environmental Impact Assessment (EIA) Study Brief, which was submitted to Environmental Protection Department (EPD) on 6 May 2016. The EIA Study Brief (No. ESB-292/2016) (hereafter referred to as "the Study Brief") was issued by EPD on 15 June 2016.

Environmental Resources Management (ERM) was commissioned by CLP for the EIA Study for the proposed Project. In accordance with *Clause 3.4.8* and *Appendix E Requirements for Assessment of Waste Management Implications* of the Study Brief, where if excavation/dredging are required for the Project, the EIA shall include a sediment quality assessment to identify and estimate dredging, dredged sediment/mud transportation and disposal activities and requirements. Potential treatment and/or disposal arrangements shall also be identified, as well as the categories of sediment/mud which are to be disposed of in accordance with the Dumping at Sea Ordinance (DASO).

1.2 OBJECTIVES OF THIS MARINE SEDIMENT SAMPLING AND TESTING PLAN (MSSTP)

This *Marine Sediment Sampling and Testing Plan (MSSTP)*, as part of the sediment quality assessment under the Study Brief, is prepared to identify the areas where dredging is needed, review existing sediment quality data and identify information gaps, and propose appropriate field investigation, sampling and chemical and biological laboratory tests to characterize the sediment/mud concerned, including the ranges of parameters to be analyzed; the number, type and methods of sampling; sample preservation; and chemical and biological laboratory test methods. This *MSSTP* shall serve for meeting the EIA requirement for evaluating and assessing waste management implication of the Project.

Sediment elutriate test will also be undertaken, as appropriate, to determine the potential of the release of sediment-bounded pollutants into the water column due to marine dredging and jetting works. The proposed sampling and testing procedures required for the elutriate test are also included in this document.

1.3 DESCRIPTION OF THE PROJECT

Based on the project design information available at the time of preparing this *MSSTP*, the Project involves the following marine construction activities:

- Offshore LNG Terminal Site: no capital or maintenance dredging is considered necessary at the offshore LNG terminal site (about 600 m x 600 m in size, including navigation approach and manoeuvring/ turning area for the FSRU vessel and LNG carriers) where a double berth jetty (approximate dimension of 450m in length and 50m in width) will be constructed. The double berth jetty will be constructed using typical construction methods including piling where about 25,000 m^3 of marine sediment would be excavated.

- BPPS Pipeline - a submarine pipeline will be installed to supply natural gas from the offshore LNG terminal to the GRS at the BPPS. A combination of dredged (by closed grab dredger and trailing suction hopper dredger) and non-dredged (jetting) methods will be employed for trenching for the BPPS pipeline. The length of the BPPS pipeline is approximately 45 km Approximately 17.6 km of the BPPS pipeline would require dredging and the width of the dredged trench is about 30 m. Depth of dredging is anticipated to be about 3-5m below existing seabed (subject to final engineering design). The pipeline will be laid within the trench by a pipelay barge, and rock armour will be placed over the pipeline within the trench for pipeline protection. A total of about 920,000 m^3 of sediment is estimated to be dredged from trenching and provision of marine access (1).

- LPS Pipeline - a submarine pipeline will be installed to supply natural gas from the offshore LNG terminal to the GRS at the LPS. The length of the LPS pipeline is approximately 18 km. The entire LPS pipeline trench will be formed by jetting and as such no dredging work will be required. However, an Alternative Shore Approach Route to LPS is being considered which involves forming of a pipe trench of around 1km off the LPS shore approach by closed grab dredging (2). The width and depth of the dredged trench is about 26 m and 3-4 m below existing seabed respectively,

(1) Dredging may be required due to shallow water depths at KP38.00 – 41.00. This section may pose installation difficulties if pipelay barge with draft more than 3m would be used. Pipeline installation contractor may consider additional dredging of 1m below existing seabed level to facilitate marine access. The estimated additional dredged volume is approximately 300,000 m^3, subject to the final barge type to be used.

(2) The requirement for dredging of this 1km shore approach route represents the worst scenario and as such this dredging will not be required unless the original plan of surface tie-in with the pre-installed subsea pipeline termination head is found technically unfeasible during construction stage

all subject to the final engineering design. The pipeline will be laid by a pipelay barge, and rock armour will be placed over the pipeline for pipeline protection. A total of about 120,000 m^3 of sediment is estimated to be dredged.

Figure 1.1 shows the trenching methods proposed for different sections of the two submarine pipelines and the indicative locations for the proposed marine dredging areas for this Project.

As there is no sediment dredging or disposal required for pipeline jetting, this *MSSTP* focuses on sediment to be dredged from piling at the double berth jetty and grab dredging and trailing suction hopper dredging at the submarine pipelines.

1.4 STRUCTURE OF THE MSSTP

The remainder of the *MSSTP* is structured as follows:

- *Section 2* reviews the existing baseline information on marine sediment quality in the proposed dredging areas;
- *Section 3* presents the sediment sampling and testing plan based on the current design of the Project;
- *Sections 4* to *5* outlines the procedures for sample collection, analysis and quality assurance / quality control; and
- *Section 6* describes the reporting requirements.

2 REVIEW OF EXISTING INFORMATION

2.1 INTRODUCTION

A review was conducted to identify whether any existing marine sediment quality information is available within the proposed dredging areas. The review also aims to identify whether information gap exists within the proposed dredging areas. Collectively the need for further investigation, i.e. marine sediment sampling and testing, is determined. This review has been conducted based on the best available information at the time of preparing this *MSSTP*, primarily results of previous sediment quality assessments in western and southern Hong Kong waters.

2.2 EXISTING INFORMATION

The Project, including the pipeline routes, is located in areas of other developments where marine sediment quality assessments have already been carried out (see *Figure 2.1*). These key references include:

- *Sediment Quality Data from EPD Monitoring Stations in Hong Kong's Water Control Zones (2011 to 2015);*
- *Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities Environmental Impact Assessment (EIA) (AEIAR-106/2007) (referred to as "HKLNG Terminal")* [(1)]*;*
- *Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road (AEIAR-144/2009) (herein referred to as "HK-Zhuhai-Macau Bridge")* [(2)] *;*
- *Black Point Gas Supply Project EIA (AEIAR-150/2010) (herein referred to as "Black Point Gas Supply")*[(3)] *;*
- *Expansion of Hong Kong International Airport into a Three-Runway System EIA (AEIAR-185/2014) (herein referred to as "Three Runway System")*[(4)] *;*
- *Additional Gas-fired Generation Units Project EIA (AEIAR-197/2016) (herein referred to as "Additional Gas-fired Generation Units Project")*[(1)] *;*

(1) Section 7 of the South Soko EIA
http://www.epd.gov.hk/eia/register/report/eiareport/eia_1252006/html/eiareport/Contents.htm

(2) Section 7 of the HK-Zhuha-Macau Bridge EIA
http://www.epd.gov.hk/eia/register/report/eiareport/eia_1722009/html/Section%207%20(Sediment)/Section%207%20(Sediment).htm

(3) Section 7 of the Black Point Gas Supply EIA
http://www.epd.gov.hk/eia/register/report/eiareport/eia_1782009/PDF/0104116_EIA_Rev%203_V1.pdf

(4) Section 10 of the Three Runway System EIA:
http://www.epd.gov.hk/eia/register/report/eiareport/eia_2232014/html/Ch%2010%20-%20Waste%20Management.htm

- *Environmental Monitoring and Audit (EM&A) (up to 2016) for the Dredging, Management and Capping of Contaminated Sediment Disposal Facilities to the South of the Brothers and at East of Sha Chau (herein referred to as "EM&A Programme for Contaminated Mud Pit")*[2] ;

- *Development of a 100MW Offshore Wind Farm in Hong Kong EIA (AEIAR 152/2010) (herein referred to as "Development of a 100MW Offshore Wind Farm"* [3]*;*

- *Development of the Integrated Waste Management Facilities Phase 1 (Artificial Island Near Shek Kwu Chau) EIA (AEIAR 163/2012) (herein referred to as "Development of the IWMF Phase 1"* [4]*; and*

- *Lamma Power Station Navigation Channel Improvement (AEIAR-69/2003) (herein referred to as "Lamma Navigation Channel Improvement") and Improvement Dredging for Lamma Power Station Navigation Channel (EIA-251/2017) (herein referred to as "Improvement Dredging for Lamma Station Navigation Channel")* [5].

Relevant marine sediment quality information is presented below for the BPPS pipeline and LPS pipeline. No existing marine sediment quality information is available for the specific location proposed for the offshore LNG terminal.

2.3 SEDIMENT QUALITY DATA FROM EPD MONITORING STATIONS

EPD has set up sediment monitoring stations in the ten (10) Water Control Zones (WCZ) within Hong Kong waters. This Project is located within the Outer Deep Bay WCZ, North Western WCZ, North Western Supplementary WCZ, Second Southern Supplementary WCZ and Southern WCZ. Monitoring stations, DS4 located in Outer Deep Bay WCZ, NS4 and NS6 located in the North Western WCZ, and SS3, SS4 and SS6 located in the Southern WCZ, are the nearest monitoring stations selected to represent the sediment quality in the vicinity of this Project (*Figure 2.2*). Sediment quality

(1) Section 8 of the Additional Gas-fired Generation Units Project EIA report: http://www.epd.gov.hk/eia/register/report/eiareport/eia_2372016/html/0308057_S8_Waste_Rev%203.htm

(2) The most updated EM&A Data: http://www.cmp-monitoring.com.hk/EM&A%20Data.html. Accessed on 2nd February 2017

(3) Sediment quality data can be obtained from Section 7 of the Development of a 100MW Offshore Wind Farm EIA Report: http://www.epd.gov.hk/eia/register/report/eiareport/eia_1772009/HTML%20version/EIA%20Report/Section7.htm

(4) Sediment quality data can be obtained from Section 6 of the Development of the IWMF Phase 1 EIA Report: http://www.epd.gov.hk/eia/register/report/eiareport/eia_2012011/EIA/EIA_HTML/S6b_Waste_SKC.htm

(5) Sediment quality data can be obtained from Section 6 of the Lamma Navigation Channel Improvement EIA Report): http://www.epd.gov.hk/eia/register/report/eiareport/eia_0882002/HTML/EIA-Full.htm#_Toc30584174 Sediment quality data (2014)can be obtained from Section 8 of the Improvement Dredging for Lamma Station Navigation Channel EIA Report (under public inspection at the time of preparing this MSSTP): http://www.epd.gov.hk/eia/register/report/eiareport/eia_2512017/html/Ch%2008%20Waste%20Management%20Impact%20Assessment.htm

data for these stations are summarised in Annual Marine Water Quality Reports published by EPD. The latest available version of these reports summarizing the sediment quality data from 2011 to 2015 is included as *Annex A*.

A preliminary review of the mean concentration of each contaminant listed under *PNAP ADV-21* against the corresponding Lower Chemical Exceedance Level (LCEL) and Upper Chemical Exceedance Level (UCEL) indicated that all mean concentrations of the concerned parameters were below the corresponding LCEL; the maximum Arsenic level in monitoring station DS4, NS4 and NS6, however, exceeded the corresponding LCEL but were below the UCEL. This suggests a high background value of Arsenic present in the sediment at the west of the Tuen Mun and Lantau Island.

Based on these EPD Monitoring Station sediment quality data from 2011 to 2015, the sediment quality along the BPPS pipeline route is expected to be Category M; and the sediment quality around the offshore LNG terminal and along the LPS pipeline route is expected to be Category L.

2.4 EXISTING INFORMATION IN THE VICINITY OF THE BPPS PIPELINE ROUTE

Five (5) other approved EIAs from 2009 to 2016 and one (1) EM&A programme listed in *Section 2.2* are also in the vicinity of the BPPS pipeline route and the results of their sediment quality assessments are summarised in the following sections.

2.4.1 *Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities (AEIAR-106/2007)*

An EIA was conducted in 2006 to assess the potential environmental impacts from the construction of a LNG receiving terminal and associated facilities at the Soko Islands, including a subsea pipeline to be connected to the BPPS. A total of 128 sediment samples were collected from 49 sediment sampling locations for chemical and biological analyses.

The BPPS pipeline route of this Project is proposed to follow the pipeline route previously approved under the HKLNG Terminal EIA report as closely as possible. Of all the sediment sampling locations from this EIA, 38 sampling locations, namely GSH6, GSH7, GSH8, CP11, GSH9, DC2, GSH10, GSH11, GSH12, GSH13, GSH14, GSH15, GV16, GV17, GV18, GV19, GSH35, GSH36, GSH37, GSH38, GSH20, GSH21, CP18, DC22, GSH39, GSH40, GSH22, GSH41, GSH42, GSH26, GV43, GV44, GSH27, GSH28, GSH29, GV30, GSH31 and GSH32, were located in the vicinity of the BPPS pipeline's proposed dredging areas (*Figure 2.3*). The classification of the sediment samples collected from these locations can be used as a reasonable reference of sediment quality along the BPPS pipeline route.

A total of 86 sediment samples were collected from the abovementioned 38 sampling locations for Tier II chemical screening. Tier III biological screening

was also performed on 55 samples where one or more contaminant levels exceeded the LCEL and/or exceeded ten times the LCEL. *Table 2.1* summarises the analytical results of the sediment samples collected from these sampling locations. In summary, 30 of the 86 samples collected were classified as Category L, 31 samples were classified as Category M_{pass}, 23 samples were classified as Category $M_{fail,}$ and the remaining two samples were identified as Category H.

Table 2.1 Analysis Results of Marine Sediments Collected at Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities

Sample Reference			Chemical Screening													Biological Screening	Sediment Category
			Heavy Metals (mg kg^{-1})									Organic (ug kg-1)			Organo-metallics		
Sampling Location	Depth (m) From-To	Sampling Method	Cd[a]	Cr[a]	Cu[a]	Ni[a]	Pb[a]	Zn[a]	Hg[a]	As[a]	Ag[a]	Total PCB	LMW PAHs	HMW PAHs	Tributyl-tin in Interstitial Water (ug/L)		
Reporting Limits			**0.1**	**1**	**1**	**1**	**1**	**10**	**0.05**	**1**	**0.1**	**2**	**550**	**1,700**	**0.015**		
LCEL			**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**12**	**1**	**23**	**550**	**1,700**	**0.15**		
UCFL			**4**	**160**	**110**	**40**	**110**	**270**	**1**	**42**	**2**	**180**	**3,160**	**9,600**	**0.15**		
GSH6	-	Grab	<0.2	51	57	35	46	140	0.16	**17**	**1.1**	<2.0	<550	<1,700	<0.015	Pass	M
GSH7	-	Grab	0.2	35	41	21	37	100	NA	11	NA	<2.0	<550	<1,700	<0.015	Pass	L
GSH8	-	Grab	0.4	49	61	32	44	135	0.18	**20**	0.5	<2.0	<550	<1,700	<0.015	Pass	M
CP11	0.43-0.90m	Vibrocore	0.3	39	61	28	45	130	NA	**17**	NA	2	<550	<1,700	<0.015	Pass	M
CP11	0.90-1.90m	Vibrocore	0.2	30	29	20	34	87	NA	**14**	NA	<2.0	<550	<1,700	<0.015	Pass	M
CP11	1.90-2.90m	Vibrocore	0.4	42	48	30	53	140	NA	**21**	NA	<2.0	<550	<1,700	NA	Pass	M
CP11	2.90-4.00m	Vibrocore	0.2	32	37	21	41	110	NA	**17**	NA	<2.0	<550	<1,700	NA	Pass	M
CP11	4.00-5.00m	Vibrocore	0.2	37	41	17	45	120	NA	**18**	NA	<2.0	<550	<1,700	NA	Pass	M
GSH9	-	Grab	0.4	54	65	35	49	150	0.18	**25**	0.5	<2.0	<550	<1,700	<0.015	Pass	M
GSH10	-	Grab	0.2	28	21	17	38	80	NA	**13**	NA	<2.0	<550	<1,700	<0.015	Pass	M
DC2	0.42-0.90m	Vibrocore	0.3	43	61	33	48	130	NA	**18**	NA	<2.0	<550	<1,700	<0.015	Pass	M
DC2	0.90-1.90m	Vibrocore	0.2	40	48	28	45	130	NA	**22**	NA	<2.0	<550	<1,700	<0.015	Pass	M
DC2	1.90-2.90m	Vibrocore	0.9	53	75	**41**	62	190	NA	**30**	NA	<2.0	<550	<1,700	NA	-	H
DC2	2.90-4.00m	Vibrocore	0.2	41	50	29	49	140	NA	**19**	NA	<2.0	<550	<1,700	NA	Fail	M_{fail}
DC2	4.00-5.00m	Vibrocore	0.7	45	58	33	62	180	NA	**32**	NA	<2.0	<550	<1,700	NA	Fail	M_{fail}
GSH11	-	Grab	<0.2	36	16	23	34	80	0.06	**14**	0.1	<2.0	<550	<1,700	<0.015	-	M
GSH12	-	Grab	<0.2	44	39	30	40	111	0.11	**19**	0.3	<2.0	<550	<1,700	<0.015	Pass	M
GSH13	-	Grab	0.3	38	38	21	50	110	NA	**18**	NA	<2.0	<550	<1,700	<0.015	Pass	M
GSH14	-	Grab	0.4	44	46	31	51	120	NA	**15**	NA	<2.0	<550	<1,700	<0.015	Pass	M
GSH15	-	Grab	0.2	47	40	33	44	120	0.15	**21**	0.3	<2.0	<550	<1,700	<0.015	Pass	M
GV16	-	Grab	0.2	57	57	39	49	147	0.17	**23**	0.4	<2.0	<550	<1,700	<0.015	Pass	M
GV16	0.00-1.00m	Vibrocore	0.2	50	32	36	51	100	NA	**16**	NA	<2.0	<550	<1,700	<0.015	Pass	M
GV16	1.00-2.00m	Vibrocore	0.1	35	12	20	35	69	NA	12	NA	<2.0	<550	<1,700	<0.015	-	L
GV16	2.00-3.00m	Vibrocore	0.1	29	9.5	16	**200**	54	NA	8.2	NA	<2.0	<550	<1,700	<0.015	-	H
GV16	3.00-4.00m	Vibrocore	0.1	36	15	27	29	75	NA	10	NA	<2.0	<550	<1,700	<0.015	-	L
GV16	4.00-5.00m	Vibrocore	0.1	43	15	30	48	79	NA	8.5	NA	<2.0	<550	<1,700	<0.015	Fail	M_{fail}
GV17	-	Grab	<0.2	39	32	26	34	99	0.18	**17**	0.2	<2.0	<550	<1,700	<0.015	Fail	M_{fail}
GV17	0.70-0.90m	Vibrocore	0.2	31	26	19	35	85	NA	**14**	NA	<2.0	<550	<1,700	<0.015	Fail	M_{fail}
GV17	0.90-1.90m	Vibrocore	0.1	32	22	19	31	66	NA	**13**	NA	<2.0	<550	<1,700	<0.015	Fail	M_{fail}

Sample Reference			Chemical Screening													Biological Screening	Sediment Category
			Heavy Metals (mg kg^{-1})									Organic (ug kg-1)			Organo-metallics		
Sampling Location	Depth (m) From-To	Sampling Method	Cd[(a)]	Cr[(a)]	Cu[(a)]	Ni[(a)]	Pb[(a)]	Zn[(a)]	Hg[(a)]	As[(a)]	Ag[(a)]	Total PCB	LMW PAHs	HMW PAHs	Tributyl-tin in Interstitial Water (ug/L)		
Reporting Limits			**0.1**	**1**	**1**	**1**	**1**	**10**	**0.05**	**1**	**0.1**	**2**	**550**	**1,700**	**0.015**		
LCEL			**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**12**	**1**	**23**	**550**	**1,700**	**0.15**		
UCFL			**4**	**160**	**110**	**40**	**110**	**270**	**1**	**42**	**2**	**180**	**3,160**	**9,600**	**0.15**		
GV17	1.90-2.90m	Vibrocore	0.1	26	14	16	28	58	NA	11	NA	<2.0	<550	<1,700	NA	Fail	M_{fail}
GV17	2.90-4.00m	Vibrocore	<0.1	24	14	16	29	62	NA	9.5	NA	<2.0	<550	<1,700	NA	Fail	M_{fail}
GV17	4.00-5.00m	Vibrocore	<0.1	24	10	18	25	63	NA	5.3	NA	<2.0	<550	<1,700	NA	Fail	M_{fail}
GV18	-	Grab	<0.2	38	29	25	34	94	0.14	**18**	0.2	<2.0	<550	<1,700	<0.015	Fail	M_{fail}
GV18	0.35-0.90m	Vibrocore	0.2	36	25	21	38	81	NA	**16**	NA	<2.0	<550	<1,700	<0.015	Fail	M_{fail}
GV18	0.90-1.90m	Vibrocore	0.1	37	23	21	39	76	NA	**17**	NA	<2.0	<550	<1,700	<0.015	Fail	M_{fail}
GV18	1.90-2.90m	Vibrocore	0.1	34	20	19	36	67	NA	**14**	NA	<2.0	<550	<1,700	NA	Fail	M_{fail}
GV18	2.90-4.00m	Vibrocore	0.3	50	43	29	31	83	NA	**17**	NA	<2.0	<550	<1,700	NA	Fail	M_{fail}
GV18	4.00-5.00m	Vibrocore	<0.1	26	12	16	28	56	NA	10	NA	<2.0	<550	<1,700	NA	Fail	M_{fail}
GV19	-	Grab	<0.2	39	32	25	34	96	0.15	**17**	0.2	<2.0	<550	<1,700	<0.015	Pass	M
GV19	0.25-0.90m	Vibrocore	0.2	33	25	20	32	79	NA	**13**	NA	<2.0	<550	<1,700	<0.015	Pass	M
GV19	0.90-1.90m	Vibrocore	0.1	38	26	21	39	73	NA	**18**	NA	<2.0	<550	<1,700	<0.015	Pass	M
GV19	1.90-2.90m	Vibrocore	0.1	37	22	21	39	74	NA	**16**	NA	<2.0	<550	<1,700	NA	Pass	M
GV19	2.90-4.00m	Vibrocore	0.1	33	20	19	30	61	NA	12	NA	<2.0	<550	<1,700	NA	Pass	L
GV19	4.00-5.00m	Vibrocore	0.1	27	15	16	24	57	NA	9.4	NA	<2.0	<550	<1,700	NA	Pass	L
GSH20	-	Grab	0.2	27	21	18	32	80	NA	**13**	NA	<2.0	<550	<1,700	<0.015	Pass	M
GSH21	-	Grab	<0.2	44	34	29	39	106	0.13	**21**	0.2	<2.0	<550	<1,700	<0.015	Pass	M
CP18	0.00-0.90m	Vibrocore	0.1	35	31	24	35	78	NA	**17**	NA	<2.0	<550	<1,700	<0.015	Pass	M
CP18	0.90-1.90m	Vibrocore	0.1	31	21	21	32	71	NA	12	NA	<2.0	<550	<1,700	<0.015	-	L
CP18	1.90-2.90m	Vibrocore	0.1	33	24	22	34	73	NA	**14**	NA	<2.0	<550	<1,700	NA	Pass	M
CP18	2.90-4.00m	Vibrocore	0.1	34	26	23	31	73	NA	**15**	NA	<2.0	<550	<1,700	NA	Pass	M
CP18	4.00-5.00m	Vibrocore	0.1	32	23	22	30	72	NA	**13**	NA	<2.0	<550	<1,700	NA	Pass	M
DC22	0.00-0.90m	Vibrocore	0.1	33	27	21	36	72	NA	**15**	NA	<2.0	<550	<1,700	<0.015	Pass	M
DC22	0.90-1.90m	Vibrocore	<0.1	30	22	21	33	72	NA	12	NA	<2.0	<550	<1,700	<0.015	-	L
DC22	1.90-2.90m	Vibrocore	0.2	36	32	24	37	78	NA	**16**	NA	<2.0	<550	<1,700	NA	Pass	M
DC22	2.90-4.00m	Vibrocore	0.1	31	20	22	32	72	NA	12	NA	<2.0	<550	<1,700	NA	-	L
DC22	4.00-5.00m	Vibrocore	<0.1	29	15	22	30	74	NA	9.7	NA	<2.0	<550	<1,700	NA	-	L
GSH22	-	Grab	0.1	23	14	15	29	57	NA	7.3	NA	<2.0	<550	<1,700	<0.015	-	L
GSH26	-	Grab	0.1	21	11	13	25	74	NA	6.7	NA	<2.0	<550	<1,700	<0.015	-	L
GSH27	-	Grab	0.2	27	16	17	31	66	NA	9	NA	<2.0	<550	<1,700	<0.015	-	L
GSH28	-	Grab	0.2	24	15	16	29	61	NA	9.2	NA	<2.0	<550	<1,700	<0.015	-	L
GSH29	-	Grab	0.2	32	21	20	38	77	NA	10	NA	<2.0	<550	<1,700	<0.015	-	L

Sample Reference			Chemical Screening													Biological Screening	Sediment Category
			Heavy Metals (mg kg^{-1})									Organic (ug kg-1)			Organo-metallics		
Sampling Location	**Depth (m) From-To**	**Sampling Method**	**Cd[(a)]**	**Cr[(a)]**	**Cu[(a)]**	**Ni[(a)]**	**Pb[(a)]**	**Zn[(a)]**	**Hg[(a)]**	**As[(a)]**	**Ag[(a)]**	**Total PCB**	**LMW PAHs**	**HMW PAHs**	**Tributyl-tin in Interstitial Water (ug/L)**		
Reporting Limits			**0.1**	**1**	**1**	**1**	**1**	**10**	**0.05**	**1**	**0.1**	**2**	**550**	**1,700**	**0.015**		
LCEL			**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**12**	**1**	**23**	**550**	**1,700**	**0.15**		
UCFL			**4**	**160**	**110**	**40**	**110**	**270**	**1**	**42**	**2**	**180**	**3,160**	**9,600**	**0.15**		
GV30	-	Grab	<0.2	38	26	25	33	91	0.13	**16**	0.2	<2.0	<550	<1,700	<0.015	Fail	M_{fail}
GV30	0.00-0.90m	Vibrocore	0.1	24	12	3.5	30	51	NA	10	NA	<2.0	<550	<1,700	<0.015	-	L
GV30	0.90-1.50m	Vibrocore	<0.1	11	4.4	<1	21	35	NA	4.2	NA	<2.0	<550	<1,700	<0.015	-	L
GSH31	-	Grab	<0.2	33	21	21	28	79	0.09	**14**	0.1	<2.0	<550	<1,700	<0.015	Fail	M_{fail}
GSH32	-	Grab	0.2	29	21	19	33	72	NA	11	NA	<2.0	<550	<1,700	<0.015	-	L
GSH35	-	Grab	<0.2	47	40	31	40	116	0.26	**21**	0.3	<2.0	<550	<1,700	<0.015	Fail	M_{fail}
GSH36	-	Grab	0.3	37	34	27	42	100	NA	**15**	NA	<2.0	<550	<1,700	<0.015	Fail	M_{fail}
GSH37	-	Grab	0.2	40	34	25	43	94	NA	**18**	NA	<2.0	<550	<1,700	<0.015	Fail	M_{fail}
GSH38	-	Grab	0.2	40	32	24	44	91	NA	**18**	NA	<2.0	<550	<1,700	<0.015	Fail	M_{fail}
GSH39	-	Grab	0.2	34	24	23	37	75	NA	**13**	NA	<2.0	<550	<1,700	<0.015	Fail	M_{fail}
GSH40	-	Grab	0.1	31	18	18	32	62	NA	**13**	NA	<2.0	<550	<1,700	<0.015	Fail	M_{fail}
GSH41	-	Grab	<0.1	16	8.5	10	29	44	NA	5.9	NA	<2.0	<550	<1,700	<0.015	-	L
GSH42	-	Grab	<0.1	15	7.5	10	20	45	NA	5.3	NA	<2.0	<550	<1,700	<0.015	-	L
GV43	-	Grab	0.1	15	8	9.9	21	38	NA	5	NA	<2.0	<550	<1,700	<0.015	-	L
GV43	0.18-0.90m	Vibrocore	<0.1	10	5	<1	15	27	NA	4.7	NA	<2.0	<550	<1,700	<0.015	-	L
GV43	0.90-1.90m	Vibrocore	0.1	9.6	4.3	<1	14	25	NA	5.2	NA	<2.0	<550	<1,700	<0.015	-	L
GV43	1.90-2.90m	Vibrocore	0.1	5.2	3.2	<1	13	22	NA	3.8	NA	<2.0	<550	<1,700	NA	-	L
GV43	2.90-4.00m	Vibrocore	<0.1	8.7	3.4	<1	12	24	NA	3.4	NA	<2.0	<550	<1,700	NA	-	L
GV43	4.00-5.00m	Vibrocore	0.1	7.3	4.2	<1	15	27	NA	4.3	NA	<2.0	<550	<1,700	NA	-	L
GV43	5.00-6.00m	Vibrocore	<0.1	6.6	3.4	<1	14	24	NA	3.2	NA	<2.0	<550	<1,700	NA	-	L
GV44	-	Grab	<0.2	13	6	2	16	31	<0.05	6	<0.1	<2.0	<550	<1,700	<0.015	-	L
GV44	0.05-0.90m	Vibrocore	0.1	7.8	6.9	<1	17	25	NA	3.5	NA	<2.0	<550	<1,700	<0.015	-	L
GV44	0.90-1.90m	Vibrocore	0.1	9.6	4.8	<1	12	22	NA	2.7	NA	<2.0	<550	<1,700	<0.015	-	L
GV44	1.90-2.90m	Vibrocore	<0.1	2.2	2.4	<1	9.9	15	NA	1.4	NA	<2.0	<550	<1,700	NA	-	L
GV44	2.90-3.20m	Vibrocore	<0.1	2.4	2.4	<1	12	16	NA	2.9	NA	<2.0	<550	<1,700	NA	-	L

Note:

(a) Heavy metals tested includes: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), zinc (Zn) and mercury (Hg). Cyanide, PAHs, PCBs, Chlorinated Pesticides and TBT in interstitial water were not detected.

(b) NA = Results not available, not tested

(c) Mercury and silver chemical testing results were not available for a number of samples due to laboratory equipment error occurred during the metal analysis. 17 additional grab samples (GV6, GSH8, GSH9, GSH11, GSH12, GSH15, GV16, GV17, GV18, GV19, GSH21, GSH23, GV30, GSH31, GSH35, GV44 and GSH45) were subsequently undertaken for metal and metalloid analysis (Cd, Cr, Cu, Ni, Pb, Zn, Hg, As, Ag, CN) to supplement the missing data and the metals and metalloid analytical results are presented in the table.

(d) **Bold** = Exceeding LCEL, classified as Category M

(e) **Bold and underlined** = Exceeding UCEL, classified as Category H

2.4.2 *Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road (AEIAR-144/2009)*

An EIA was conducted in 2009 to assess the potential environmental impacts from the construction of the Hong Kong- Zhuhai- Macao Bridge Hong Kong Boundary Crossing Facilities. A total of 52 sediment samples were collected from 13 sediment sampling locations for chemical and biological analyses.

Of all the sediment sampling locations from this EIA, four sampling locations, namely A1, A2, A3 and A4, were located in the vicinity of the BPPS pipeline's proposed dredging areas (*Figure 2.4*). The classification of sediment samples from these locations can be used as a reasonable reference of sediment quality for part of the BPPS pipeline route.

A total of 21 sediment samples were collected from the abovementioned sampling locations for Tier II chemical screening. Tier III biological screening was also performed on 10 samples where one or more contaminant levels exceeded the LCEL and/or exceeded ten times the LCEL. *Table 2.2* summarises the analytical results of the sediment samples collected from these sampling locations. In summary, 11 out of the 21 samples collected were classified as Category L, and the remaining 10 samples were identified as Category M_{pass} sediment.

Table 2.2 Analysis Results of Marine Sediments Collected at Hong Kong – Zhuhai – Macao Bridge

Sample Reference			Chemical Screening													Biological Screening	Sediment Category
			Heavy Metals (mg kg^{-1})									Organic (ug kg^{-1})			Organo-metallics		
Sampling Location	Depth (m) From-To	Sampling Method	Ag	As	Cd	Cr	Cu	Ni	Pb	Zn	Hg	Total PCB	LMW PAHs	HMW PAHs	Tributyl-tin in Interstitial Water (ug/L)		
Reporting Limits			**0.1**	**1**	**0.2**	**8**	**7**	**4**	**8**	**20**	**0.05**	**3**	**55**	**1,70**	**0.015**		
LCEL			**1**	**12**	**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**23**	**550**	**1,700**	**0.15**		
UCFL			**2**	**42**	**4**	**160**	**110**	**40**	**110**	**270**	**1**	**180**	**3,160**	**9,600**	**0.15**		
A1	0.55-1.00	Vibrocore	0.2	**15**	<0.2	33	24	21	29	83	0.1	<3.0	<55	<170	<0.015	Pass	M
A1	1.0-2.0	Vibrocore	0.1	**17**	<0.2	37	21	22	31	74	0.16	<3.0	<55	<170	<0.015	Pass	M
A1	2.0-3.0	Vibrocore	0.1	**15**	<0.2	37	20	23	29	71	0.13	<3.0	<55	<170	<0.015	Pass	M
A1	5.0-6.0	Vibrocore	<0.1	12	<0.2	32	15	20	28	64	0.08	<3.0	<55	<170	<0.015	-	L
A1	8.0-9.0	Vibrocore	0.1	11	<0.2	36	13	22	25	73	0.09	<3.0	<55	<170	<0.015	-	L
A1	14.0-15.0	Vibrocore	<0.1	8	<0.2	18	6	9	13	28	<0.05	<3.0	<55	<170	<0.015	-	L
A2	0.47-1.00	Vibrocore	0.2	**19**	<0.2	40	28	26	28	96	0.13	<3.0	<55	<170	<0.015	Pass	M
A2	2.0-3.0	Vibrocore	<0.1	**13**	<0.2	36	16	22	24	72	0.1	<3.0	<55	<170	<0.015	Pass	M
A2	5.0-6.0	Vibrocore	<0.1	7	<0.2	31	10	23	19	71	0.06	<3.0	<55	<170	<0.015	-	L
A2	8.0-9.0	Vibrocore	0.1	**13**	<0.2	38	14	25	22	79	0.07	<3.0	<55	<170	<0.015	Pass	M
A3	0.41-1.0	Vibrocore	0.1	12	<0.2	29	16	19	20	70	0.11	<3.0	<55	<170	<0.015	-	L
A3	2.0-3.0	Vibrocore	<0.1	7	<0.2	34	11	24	17	75	0.05	<3.0	<55	<170	<0.015	-	L
A3	5.0-6.0	Vibrocore	<0.1	**15**	<0.2	36	14	25	21	81	0.07	<3.0	<55	<170	<0.015	Pass	M
A3	8.0-9.0	Vibrocore	0.1	11	<0.2	37	14	24	22	79	0.08	<3.0	<55	<170	<0.015	-	L
A3	14.0-15.0	Vibrocore	<0.1	11	<0.2	35	14	24	21	80	0.07	<3.0	<55	<170	<0.015	-	L
A4	0.14-1.00	Vibrocore	0.1	**15**	<0.2	39	31	35	24	79	0.12	<3.0	<55	<170	<0.015	Pass	M
A4	1.0-2.0	Vibrocore	<0.1	7	<0.2	35	11	24	17	74	0.17	<3.0	<55	<170	<0.015	-	L
A4	2.0-3.0	Vibrocore	<0.1	9	<0.2	36	11	25	17	76	<0.05	<3.0	<55	<170	<0.015	-	L
A4	5.0-6.0	Vibrocore	<0.1	12	<0.2	38	15	26	22	84	0.06	<3.0	<55	<170	<0.015	-	L
A4	8.0-9.0	Vibrocore	0.1	**13**	<0.2	40	15	26	23	83	0.07	<3.0	<55	<170	<0.015	Pass	M
A4	14.0-15.0	Vibrocore	0.1	**13**	<0.2	40	15	26	25	84	0.07	<3.0	<55	<170	<0.015	Pass	M

Note:

(a) Heavy metals tested includes: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), zinc (Zn) and mercury (Hg). PAHs = Polyaromatic Hydrocarbon, PCBs = Polychlorinated Biphenyls.

(b) NA = Results not available, not tested

(c) **Bold** = Exceeding LCEL, classified as Category M

(d) **Bold and underlined** = Exceeding UCEL, classified as Category H

2.4.3 *Black Point Gas Supply Project (AEIAR-150/2010)*

An EIA was conducted in 2010 to assess the potential environmental impacts from the construction of two submarine pipelines to be connected to the BPPS for natural gas supply. A total of 60 sediment samples were collected from 22 sediment sampling locations (ten locations using grab sampling and 12 locations using vibrocore sampling) for chemical and biological analyses.

Of all the sediment sampling locations from this EIA, all 22 sampling locations were located in the vicinity of the BPPS pipeline's proposed dredging areas (*Figure 2.5*). The classification of sediment samples from these locations can be used as a reasonable reference of sediment quality for part of the BPPS pipeline route.

A total of 60 sediment samples were collected from the abovementioned sampling locations for Tier II chemical screening. Tier III biological screening was also performed on 49 samples where one or more contaminant levels exceeded the LCEL and/or exceeded ten times the LCEL. *Table 2.3* summarises the analytical result of the sediment samples collected from these sampling locations. In summary, 6 out of the 60 samples collected were classified as Category L and 14 samples were classified as Category M_{fail}. The remaining 40 samples were identified as Category M_{pass} sediment.

Table 2.3 Analysis Results of Marine Sediments Collected at BPPS Gas Supply Project in 2010

Sample Reference			Chemical Screening													Biological Screening	Sediment Category
			Heavy Metals (mg kg^{-1})									Organic (ug kg^{-1})			Organo-metallics		
Sampling Location	Depth (m) From-To	Sampling Method	Ag	As	Cd	Cr	Cu	Ni	Pb	Zn	Hg	Total PCB	LMW PAHs	HMW PAHs	Tributyl-tin in Interstitial Water (ug/L)		
Reporting Limits			**0.1**	**1**	**0.2**	**1**	**1**	**1**	**1**	**1**	**0.05**	**3**	**550**	**1,700**	**0.005**		
LCEL			**1**	**12**	**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**23**	**550**	**1,700**	**0.15**		
UCEL			**2**	**42**	**4**	**160**	**110**	**40**	**110**	**270**	**1**	**180**	**3,160**	**9,600**	**0.15**		
GS 09-01	-	Grab	0.5	**15**	< 0.2	54	63	37	55	155	0.14	< 3	< 550	< 1,700	--	-	M
GS 09-02	-	Grab	0.3	**14**	< 0.2	41	41	26	42	134	0.09	< 3	< 550	< 1,700	--	-	M
GS 09-03	-	Grab	0.3	**13**	< 0.2	35	34	23	41	122	0.08	< 3	< 550	< 1,700	--	-	M
GS 09-04	-	Grab	0.1	**24**	< 0.2	28	17	21	72	126	< 0.05	< 3	< 550	< 1,700	--	-	M
GS 09-05	-	Grab	0.1	**16**	< 0.2	28	12	14	29	70	< 0.05	< 3	< 550	< 1,700	--	-	M
GS 09-06	-	Grab	0.4	**20**	0.2	47	45	29	40	128	0.10	< 3	< 550	< 1,700	--	-	M
GS 09-07	-	Grab	0.2	**14**	< 0.2	29	23	18	28	80	0.06	< 3	< 550	< 1,700	--	-	M
GS 09-08	-	Grab	0.1	**14**	< 0.2	39	16	22	34	92	< 0.05	< 3	< 550	< 1,700	--	-	M
GS 09-09	-	Grab	0.2	**18**	< 0.2	41	22	25	40	107	< 0.05	< 3	< 550	< 1,700	--	-	M
GS 09-10	-	Grab	0.2	**18**	< 0.2	43	26	28	40	111	0.08	< 3	< 550	< 1,700	--	-	M
GSVB1	0.1-0.9m	Vibrocore	0.4	**18**	0.2	51	43	32	57	135	0.15	< 3	< 550	< 1,700	--	Pass	M
	0.9-1.9m	Vibrocore	0.4	**22**	0.3	57	56	35	59	147	0.18	< 3	< 550	< 1,700	--	Pass	M
	1.9-2.9m	Vibrocore	0.3	**18**	< 0.2	53	46	30	66	132	0.16	< 3	< 550	< 1,700	--	Pass	M
	6.0-6.9m	Vibrocore	0.3	**18**	< 0.2	49	40	30	52	124	0.11	< 3	< 550	< 1,700	--	Pass	M
	6.9-7.9m	Vibrocore	< 0.1	11	< 0.2	25	12	15	28	53	0.07	< 3	< 550	< 1,700	--	Pass	L
GSVB2	0.5-0.9m	Vibrocore	0.3	**17**	< 0.2	51	46	31	50	124	0.13	< 3	< 550	< 1,700	--	Pass	M
	0.9-1.9m	Vibrocore	0.2	**15**	< 0.2	46	36	26	54	107	0.12	< 3	< 550	< 1,700	--	Pass	M
	1.9-2.9m	Vibrocore	0.1	**17**	< 0.2	34	21	19	41	76	0.14	< 3	< 550	< 1,700	--	Fail	M_{fail}
	6.0-6.4m	Vibrocore	< 0.1	**14**	< 0.2	40	17	18	34	67	< 0.05	< 3	< 550	< 1,700	--	Pass	M
GSVB3	0.8-0.9m	Vibrocore	0.3	**14**	< 0.2	41	42	25	38	104	0.14	< 3	< 550	< 1,700	--	+	M
	0.9-1.9m	Vibrocore	0.1	**18**	< 0.2	37	23	22	43	87	0.11	< 3	< 550	< 1,700	--	Fail	M_{fail}
	1.9-2.9m	Vibrocore	0.1	**14**	< 0.2	41	17	27	30	94	0.07	< 3	< 550	< 1,700	--	Pass	M
	2.9-3.9m	Vibrocore	0.1	**14**	< 0.2	44	18	29	33	98	0.07	< 3	< 550	< 1,700	--	Fail	M_{fail}
GSVB4	0.1-0.9m	Vibrocore	0.1	10	< 0.2	30	12	17	40	80	0.08	< 3	< 550	< 1,700	--	Fail	M_{fail}
	0.9-1.9m	Vibrocore	0.1	**16**	< 0.2	40	15	25	34	94	0.09	< 3	< 550	< 1,700	--	Fail	M_{fail}
	1.9-2.9m	Vibrocore	0.1	**14**	< 0.2	39	16	25	34	93	0.09	< 3	< 550	< 1,700	--	Fail	M_{fail}
	2.9-3.9m	Vibrocore	0.2	**17**	< 0.2	44	16	26	35	96	0.07	< 3	< 550	< 1,700	--	Fail	M_{fail}
GSVB5	0.0-0.9m	Vibrocore	0.2	**27**	< 0.2	32	19	22	**81**	111	0.06	< 3	< 550	< 1,700	--	Pass	M

Sample Reference			Chemical Screening													Biological Screening	Sediment Category
			Heavy Metals (mg kg^{-1})									Organic (ug kg^{-1})			Organo-metallics		
Sampling Location	**Depth (m) From-To**	**Sampling Method**	**Ag**	**As**	**Cd**	**Cr**	**Cu**	**Ni**	**Pb**	**Zn**	**Hg**	**Total PCB**	**LMW PAHs**	**HMW PAHs**	**Tributyl-tin in Interstitial Water (ug/L)**		
Reporting Limits			**0.1**	**1**	**0.2**	**1**	**1**	**1**	**1**	**1**	**0.05**	**3**	**550**	**1,700**	**0.005**		
LCEL			**1**	**12**	**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**23**	**550**	**1,700**	**0.15**		
UCEL			**2**	**42**	**4**	**160**	**110**	**40**	**110**	**270**	**1**	**180**	**3,160**	**9,600**	**0.15**		
	0.9-1.9m	Vibrocore	0.1	**16**	< 0.2	45	18	30	35	105	0.09	< 3	< 550	< 1,700	--	Fail	M_{fail}
	1.9-2.9m	Vibrocore	0.1	**14**	< 0.2	38	16	25	29	89	0.07	< 3	< 550	< 1,700	--	Fail	M_{fail}
	2.9-3.9m	Vibrocore	0.1	**18**	< 0.2	39	16	25	29	88	0.09	< 3	< 550	< 1,700	--	Pass	M
GSVB6	0.1-0.9m	Vibrocore	0.1	**15**	< 0.2	29	12	17	55	78	< 0.05	< 3	< 550	< 1,700	--	Pass	M
	0.9-1.9m	Vibrocore	< 0.1	7	< 0.2	29	7	15	44	71	< 0.05	< 3	< 550	< 1,700	--	Pass	L
	1.9-2.9m	Vibrocore	< 0.1	7	< 0.2	32	8	17	34	73	< 0.05	< 3	< 550	< 1,700	--	Pass	L
	2.9-3.9m	Vibrocore	0.1	**15**	< 0.2	38	15	24	33	90	0.08	< 3	< 550	< 1,700	--	Pass	M
GSVB7	0.1-0.9m	Vibrocore	0.1	**13**	< 0.2	30	14	14	28	62	0.06	< 3	< 550	< 1,700	--	Pass	M
	0.9-1.9m	Vibrocore	0.1	**14**	< 0.2	43	16	24	42	96	0.06	< 3	< 550	< 1,700	--	Pass	M
	1.9-2.9m	Vibrocore	0.1	12	< 0.2	40	15	23	32	83	0.07	< 3	< 550	< 1,700	--	Pass	L
GSVB8	0.5-0.9m	Vibrocore	0.2	**13**	< 0.2	40	38	24	48	128	0.13	< 3	< 550	< 1,700	--	Fail	M_{fail}
	0.9-1.9m	Vibrocore	0.5	**17**	0.2	47	44	27	43	135	0.13	< 3	< 550	< 1,700	--	Pass	M
	1.9-2.9m	Vibrocore	0.2	**19**	0.3	40	26	24	36	97	0.11	< 3	< 550	< 1,700	--	Pass	M
	2.9-3.9m	Vibrocore	0.2	**16**	< 0.2	47	30	29	39	107	0.09	< 3	< 550	< 1,700	--	Pass	M
GSVB9	0.3-0.9m	Vibrocore	< 0.1	9	< 0.2	32	10	17	25	60	0.06	< 3	< 550	< 1,700	--	Pass	L
	0.9-1.9m	Vibrocore	< 0.1	**13**	< 0.2	23	22	11	25	79	0.08	< 3	< 550	< 1,700	--	Pass	M
	1.9-2.9m	Vibrocore	0.5	**26**	0.4	65	**81**	38	52	163	0.18	< 3	< 550	< 1,700	--	Pass	M
	2.9-3.9m	Vibrocore	0.5	**22**	0.2	53	55	32	48	142	0.2	< 3	< 550	< 1,700	--	Pass	M
GSVB10	0.3-0.9m	Vibrocore	0.1	**13**	< 0.2	31	13	18	29	70	0.07	< 3	< 550	< 1,700	--	Pass	M
	0.9-1.9m	Vibrocore	0.2	**13**	< 0.2	43	18	26	38	88	0.06	< 3	< 550	< 1,700	--	Pass	M
	1.9-2.9m	Vibrocore	0.6	**29**	0.4	55	48	35	60	169	0.22	< 3	< 550	< 1,700	--	Fail	M_{fail}
	2.9-3.9m	Vibrocore	0.4	**38**	1.2	60	52	38	**76**	192	0.24	< 3	< 550	< 1,700	--	Pass	M
GSVB11	0.0-0.9m	Vibrocore	0.6	**19**	0.2	57	52	34	54	151	0.13	< 3	< 550	< 1,700	--	Pass	M
	0.9-1.9m	Vibrocore	0.3	**18**	0.3	58	44	34	60	152	0.14	< 3	< 550	< 1,700	--	Pass	M
	1.9-2.9m	Vibrocore	0.3	**18**	0.2	52	51	29	59	129	0.12	< 3	< 550	< 1,700	--	Pass	M
	6.0-6.9m	Vibrocore	0.1	2	< 0.2	28	14	10	26	38	0.12	< 3	< 550	< 1,700	--	Fail	M_{fail}
	6.9-7.4m	Vibrocore	< 0.1	< 1	< 0.2	8	10	2	24	7	0.09	< 3	< 550	< 1,700	--	Fail	M_{fail}

Sample Reference			Chemical Screening													Biological Screening	Sediment Category
			Heavy Metals (mg kg^{-1})									Organic (ug kg^{-1})			Organo-metallics		
Sampling Location	**Depth (m) From-To**	**Sampling Method**	**Ag**	**As**	**Cd**	**Cr**	**Cu**	**Ni**	**Pb**	**Zn**	**Hg**	**Total PCB**	**LMW PAHs**	**HMW PAHs**	**Tributyl-tin in Interstitial Water (ug/L)**		
Reporting Limits			**0.1**	**1**	**0.2**	**1**	**1**	**1**	**1**	**1**	**0.05**	**3**	**550**	**1,700**	**0.005**		
LCEL			**1**	**12**	**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**23**	**550**	**1,700**	**0.15**		
UCEL			**2**	**42**	**4**	**160**	**110**	**40**	**110**	**270**	**1**	**180**	**3,160**	**9,600**	**0.15**		
GSVB12	0.1-0.9m	Vibrocore	0.5	**19**	< 0.2	57	52	35	55	152	0.15	< 3	< 550	< 1,700	--	Pass	M
	0.9-1.9m	Vibrocore	0.5	**20**	0.2	58	52	35	55	150	0.15	< 3	< 550	< 1,700	--	Pass	M
	1.9-2.9m	Vibrocore	0.2	**15**	< 0.2	39	34	23	50	104	0.1	< 3	< 550	< 1,700	--	Pass	M
	6.0-6.8m	Vibrocore	0.1	3	< 0.2	13	8	6	61	33	0.09	< 3	< 550	< 1,700	--	Pass	L

Note:

(a) Heavy metals tested includes: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), zinc (Zn) and mercury (Hg). PAHs = Polyaromatic Hydrocarbon, PCBs = Polychlorinated Biphenyls.

(b) NA = Results not available, not tested

(c) **Bold** = Exceeding LCEL, classified as Category M

(d) **Bold and underlined** = Exceeding UCEL, classified as Category H.

\+ **Not tested for biological screening due to insufficient sample as a result of significant core loss**

2.4.4 *Expansion of Hong Kong International Airport into a Three-Runway System (AEIAR-185/2014)*

An EIA was conducted in 2014 to assess the potential environmental impacts from the construction of the Three-Runway System of Hong Kong International Airport. A total of 44 sediment sampling locations using vibrocore were examined.

Of all the sediment sampling locations from the above EIA, four sampling locations, namely RV13, RV12, RV01 and RV02, were located in the vicinity of the BPPS pipeline's proposed dredging areas (*Figure 2.6*). The classification of sediment samples from these locations can be used as a reasonable reference of sediment quality for part of the BPPS pipeline route.

A total of 27 sediment samples were collected from the abovementioned four sampling locations for Tier II chemical screening. Tier III biological screening was also performed on 4 samples (at RV13) where one or more contaminant levels exceeded the LCEL and/or exceeded ten times the LCEL. *Table 2.4* summarises the analytical result of the sediment samples collected from these sampling locations. In summary, 18 out of the 27 samples collected were classified as Category L and the remaining nine samples were identified as Category M sediment.

No Tier III biological testing was conducted for sampling location RV01 as the sediment was proposed to be reused as backfilling material onsite after cement mixing and stabilisation / solidification in order to avoid disposal of the sediments generated from the foundation/piling work.

Table 2.4 Analysis Results of Marine Sediments Collected at the Expansion of Hong Kong International into a Three-Runway System

Sample Reference			Chemical Screening													Biological Screening	Sediment Category
			Heavy Metals (mg kg-1)									Organic (ug kg-1)			Organo-metallics		
Sampling Location	Depth (m) From-To	Sampling Method	Cd	Cr	Cu	Ni	Pb	Zn	Hg	As	Ag	Total PCBs	LMW PAHs	HMW PAHs	Tributyl-tin in Interstitial Water (ug/L)		
Reporting Limits			**0.1**	**1**	**1**	**1**	**1**	**1**	**0.05**	**1**	**0.1**	**18**	**550**	**1,700**	**0.015**		
LCEL			**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**12**	**1**	**23**	**550**	**1,700**	**0.15**		
UCEL			**4**	**160**	**110**	**40**	**110**	**270**	**1**	**42**	**2**	**180**	**3,160**	**9,600**	**0.15**		
RV12	0.10-0.90m	Vibrocore	<0.2	35	12	21	29	73	<0.05	12	<0.1	<18	<550	<1,700	<0.015		L
	0.90-1.90m	Vibrocore	<0.2	35	13	21	31	73	<0.05	11	<0.1	<18	<550	<1,700	<0.015		L
	1.90-2.90m	Vibrocore	<0.2	35	16	25	36	82	<0.05	12	<0.1	<18	<550	<1,700	<0.015		L
	2.90-5.90m	Vibrocore	<0.2	35	17	26	34	80	<0.05	11	<0.1	<18	<550	<1,700	<0.015		L
	6.00-8.90m	Vibrocore	<0.2	35	16	28	35	82	<0.05	9	<0.1	<18	<550	<1,700	<0.015		L
	8.90-11.90m	Vibrocore	<0.2	35	14	26	32	75	<0.05	9	<0.1	<18	<550	<1,700	<0.015		L
	12.00-14.90m	Vibrocore	<0.2	35	16	21	30	69	<0.05	10	<0.1	<18	<550	<1,700	<0.015		L
RV13	0.10-0.90m	Vibrocore	<0.2	35	26	29	43	92	<0.05	**18**	<0.1	<18	<550	<1,700	<0.015	Pass	M
	0.90-1.90m	Vibrocore	<0.2	35	14	24	32	83	<0.05	**14**	<0.1	<18	<550	<1,700	<0.015	Pass	M
	1.90-2.90m	Vibrocore	<0.2	35	14	22	32	76	<0.05	12	<0.1	<18	<550	<1,700	<0.015		L
	2.90-5.90m	Vibrocore	<0.2	35	18	26	37	84	<0.05	**15**	<0.1	<18	<550	<1,700	<0.015	Pass	M
	6.00-8.90m	Vibrocore	<0.2	35	16	27	35	81	<0.05	11	<0.1	<18	<550	<1,700	<0.015		L
	8.90-11.90m	Vibrocore	<0.2	35	15	27	34	78	<0.05	11	<0.1	<18	<550	<1,700	<0.015		L
	12.00-14.90m	Vibrocore	<0.2	35	15	26	33	75	<0.05	**13**	<0.1	<18	<550	<1,700	<0.015	Pass	M
RV01	0.00-0.90m	Vibrocore	<0.2	36	13	19	26	88	<0.05	**14**	<0.1	<18	<550	<1,700	<0.015	NA(d)	M
	0.90-1.90m	Vibrocore	<0.2	41	16	25	30	94	<0.05	**14**	0.1	<18	<550	<1,700	<0.015	NA	M
	1.90-2.90m	Vibrocore	<0.2	39	16	24	28	89	<0.05	**14**	0.1	<18	<550	<1,700	<0.015	NA	M
	2.90-5.90m	Vibrocore	<0.2	44	17	28	30	96	<0.05	**13**	0.1	<18	<550	<1,700	<0.015	NA	M
	6.00-8.90m	Vibrocore	<0.2	44	16	29	29	93	0.06	12	0.1	<18	<550	<1,700	<0.015	NA	L
	8.90-11.90m	Vibrocore	<0.2	42	15	27	28	87	<0.05	10	<0.1	<18	<550	<1,700	<0.015		L
	12.00-14.90m	Vibrocore	<0.2	32	16	15	21	56	<0.05	**16**	<0.1	<18	<550	<1,700	<0.015	NA	M
RV02	0.60-0.90m	Vibrocore	<0.2	32	12	22	31	81	<0.05	11	<0.1	<18	<550	<1,700	<0.015		L
	0.90-1.90m	Vibrocore	<0.2	29	12	18	31	68	<0.05	10	<0.1	<18	<550	<1,700	<0.015		L
	1.90-2.90m	Vibrocore	<0.2	31	13	20	33	72	0.06	10	<0.1	<18	<550	<1,700	<0.015		L
	2.90-5.90m	Vibrocore	<0.2	44	18	27	35	81	<0.05	12	<0.1	<18	<550	<1,700	<0.015		L
	6.00-8.90m	Vibrocore	<0.2	44	15	29	33	80	<0.05	9	<0.1	<18	<550	<1,700	<0.015		L
	8.90-11.80m	Vibrocore	<0.2	43	15	28	33	81	<0.05	10	<0.1	<18	<550	<1,700	<0.015		L

Sample Reference			Chemical Screening													Biological Screening	Sediment Category
			Heavy Metals (mg kg^{-1})									Organic (ug kg-1)			Organo-metallics		
Sampling Location	Depth (m) From-To	Sampling Method	Cd	Cr	Cu	Ni	Pb	Zn	Hg	As	Ag	Total PCBs	LMW PAHs	HMW PAHs	Tributyl-tin in Interstitial Water (ug/L)		
Reporting Limits			**0.1**	**1**	**1**	**1**	**1**	**1**	**0.05**	**1**	**0.1**	**18**	**550**	**1,700**	**0.015**		
LCEL			**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**12**	**1**	**23**	**550**	**1,700**	**0.15**		
UCEL			**4**	**160**	**110**	**40**	**110**	**270**	**1**	**42**	**2**	**180**	**3,160**	**9,600**	**0.15**		

Note:

(a) Heavy metals tested includes: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), zinc (Zn) and mercury (Hg). PAHs = Polyaromatic Hydrocarbon, PCBs = Polychlorinated Biphenyls.

(b) Bold = Exceeding LCEL, classified as Category M

(c) Bold and underlined = Exceeding UCEL, classified as Category H.

(d) No biological testing was conducted as the sediment was proposed to be reused as backfilling material onsite in order to avoid disposal of the sediments generated from the foundation/piling work

2.4.5 Additional Gas-fired Generation Units Project (AEIAR-197/2016)

An EIA was conducted in 2016 to assess the potential environmental impacts from the phased construction of two additional gas-fired generation units at the BPPS. A total of three sediment samples were collected from three sediment sampling locations for chemical and biological analyses.

Of all the sediment sampling locations from this EIA, all three sampling locations were located in the vicinity of the BPPS pipeline's proposed dredging areas (*Figure 2.7*). The classification of sediment samples from these locations can be used as a reasonable reference of sediment quality for part of the BPPS pipeline route.

Three sediment samples were collected from the abovementioned sampling locations for tier II chemical screening. Tier III biological screening was also performed on the three samples where one or more contaminant levels exceeded the LCEL and/or exceeded ten times the LCEL. *Table 2.5* summarises the analytical results of the sediment samples collected from these sampling locations. In summary, all three samples collected were classified as Category M_{pass} due to the exceedance of Arsenic.

Table 2.5 Analysis Results of Marine Sediments Collected at Additional Gas-fired Generation Unit Project

Sample Reference			Chemical Screening													Biological Screening	Sediment Category
			Heavy Metals (mg kg^{-1})									Organic (ug kg^{-1})			Organo-metallics		
Sampling Location	**Depth (m) From-To**	**Sampling Method**	**Ag**	**As**	**Cd**	**Cr**	**Cu**	**Ni**	**Pb**	**Zn**	**Hg**	**Total PCB**	**LMW PAHs**	**HMW PAHs**	**Tributyl-tin in Interstitial Water (ug/L)**		
Reporting Limits			**0.1**	**1**	**0.2**	**1**	**1**	**1**	**1**	**1**	**0.05**	**18**	**550**	**1,700**	**0.015**		
LCEL			**1**	**12**	**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**23**	**550**	**1,700**	**0.15**		
UCEL			**2**	**42**	**4**	**160**	**110**	**40**	**110**	**270**	**`1**	**180**	**3,160**	**9,600**	**0.15**		
IT1	-	Grab	0.5	**14**	0.2	50	63	35	53	151	0.13	<18	<550	<1,700	<0.015	Pass	M
IT2	-	Grab	0.4	**16**	0.3	49	53	32	51	137	0.1	<18	<550	<1,700	<0.015	Pass	M
OF1	-	Grab	0.4	**15**	<0.2	48	53	34	52	143	0.11	<18	<550	<1,700	<0.015	Pass	M

Note:

(a) Heavy metals tested includes: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), zinc (Zn) and mercury (Hg). PAHs = Polyaromatic Hydrocarbon, PCBs = Polychlorinated Biphenyls.

(b) **Bold** = Exceeding LCEL, classified as Category M

(c) **Bold and underlined** = Exceeding UCEL, classified as Category H.

2.4.6 *EM&A for Dredging, Management and Capping of Contaminated Sediment Disposal Facilities to the South of the Brothers and at East of Sha Chau*

An EM&A programme to examine sediment quality in the vicinity of the contaminated sediment disposal facilities is being conducted to verify the EIA predictions and ensure that there is no build-up in contamination adjacent to the Contaminated Mud Pits (CMPs).

Of all the sediment sampling locations from the above EM&A programme, two sampling locations, namely ESC-RFA and SB-RFA, are located in the vicinity of the BPPS pipeline's proposed dredging areas (*Figure 2.8*). The classification of sediment samples can be used as a reasonable reference of sediment quality for part of the BPPS pipeline route.

Based on the latest cumulative monitoring data for South Brothers CMP on February 2016 and the cumulative monitoring data for East Sha Chau CMP on August 2016, 24 sediment samples were collected from abovementioned sampling locations for tier II chemical screening. *Table 2.6* summarises the analytical results of the sediment samples collected from these sampling locations. In summary, all 24 samples collected were classified as Category L due to no exceedance of the LCEL.

Table 2.6 Analysis Results of EM&A Data from South Brothers Contaminated Mud Pit (CMP) and East Sha Chau CMP

Sample Reference				Chemical Screening												Sediment Category
				Heavy Metals (mg kg^{-1})									Organic (ug kg^{-1})			
Sampling Location	**Replicate**	**Depth (m) From-To**	**Sampling Method**	**Ag**	**As**	**Cd**	**Cr**	**Cu**	**Ni**	**Pb**	**Zn**	**Hg**	**Total PCB**	**LMW PAHs**	**HMW PAHs**	
Reporting Limits					**0.1**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.2**	**0.05**	**3**	**55**	**100**	
LCEL				**1**	**12**	**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**23**	**550**	**1,700**	
UCEL				**2**	**42**	**4**	**160**	**110**	**40**	**110**	**270**	**`1**	**180**	**3,160**	**9,600**	
ESC-RFA	1	-	Grab	0.22	4.1	0.10	26.04	28.95	14.11	32.16	86.3	0.13	<3.0	<55	<100	L
	2	-	Grab	0.21	4.3	0.12	25.20	27.62	13.51	31.48	82.2	0.10	<3.0	<55	<100	L
	3	-	Grab	0.23	4.6	0.13	26.31	32.07	14.26	32.22	86.2	0.13	<3.0	<55	<100	L
	4	-	Grab	0.23	4.8	0.12	26.00	30.88	14.01	33.39	85.8	0.14	<3.0	<55	<100	L
	5	-	Grab	0.20	4.2	0.10	21.76	24.31	11.65	28.41	75.5	0.12	<3.0	<55	<100	L
	6	-	Grab	0.22	4.7	0.11	23.54	26.60	12.74	30.59	79.1	0.10	<3.0	<55	<100	L
	7	-	Grab	0.21	4.9	0.10	24.15	27.30	13.12	30.97	79.5	0.05	<3.0	<55	<100	L
	8	-	Grab	0.22	6.0	0.12	26.24	32.42	14.30	32.11	87.1	0.10	<3.0	<55	<100	L
	9	-	Grab	0.29	5.7	0.13	25.02	30.94	13.72	31.39	83.3	0.12	<3.0	<55	<100	L
	10	-	Grab	0.23	6.2	0.13	26.33	31.70	14.52	33.45	86.5	0.10	<3.0	<55	<100	L
	11	-	Grab	0.22	5.7	0.15	23.89	28.61	13.39	32.53	81.3	0.16	<3.0	<55	<100	L
	12	-	Grab	0.25	7.4	0.15	25.53	31.24	14.36	33.49	85.4	0.13	<3.0	<55	<100	L
SB-RFA	1	-	Grab	0.14	11.3	0.07	29.19	29.91	20.94	31.03	99.1	0.29	1.5	28	50	L
	2	-	Grab	0.15	11.9	0.06	28.10	28.83	22.11	35.52	101.7	0.27	1.5	28	50	L
	3	-	Grab	0.12	10.8	0.07	30.96	29.93	20.17	34.20	95.0	0.25	1.5	28	50	L
	4	-	Grab	0.15	11.5	0.07	29.31	30.23	18.24	33.83	96.0	0.25	1.5	28	50	L
	5	-	Grab	0.14	9.8	0.07	30.01	31.56	20.85	34.75	98.0	0.25	1.5	28	50	L
	6	-	Grab	0.13	11.8	0.06	30.42	32.09	21.75	34.39	87.8	0.27	1.5	28	50	L
	7	-	Grab	0.14	11.0	0.07	31.57	30.09	21.08	35.83	96.2	0.23	1.5	28	50	L
	8	-	Grab	0.12	10.3	0.06	29.67	28.24	19.30	32.10	90.7	0.22	1.5	28	50	L
	9	-	Grab	0.13	11.0	0.07	31.74	30.42	20.36	34.27	96.3	0.25	1.5	28	50	L
	10	-	Grab	0.12	11.1	0.06	29.85	32.54	20.27	31.89	90.4	0.22	1.5	28	50	L
	11	-	Grab	0.11	10.4	0.06	28.17	29.86	21.32	31.18	96.7	0.29	1.5	28	50	L
	12	-	Grab	0.14	11.6	0.08	30.55	27.27	22.01	32.33	86.1	0.25	1.5	28	50	L

Note:
(a) Heavy metals tested includes: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), zinc (Zn) and mercury (Hg). PAHs = Polyaromatic Hydrocarbon, PCBs = Polychlorinated Biphenyls.
(b) **Bold** = Exceeding LCEL, classified as Category M
(c) **Bold and underlined** = Exceeding UCEL, classified as Category H.

2.4.7 *Summary of Existing Information in the Vicinity of BPPS Pipeline Route*

The BPPS pipeline route is proposed to follow the route that was approved in the HKLNG Terminal EIA report. According to the sediment sampling results stated in the HKLNG Terminal EIA report, the marine sediment along West of Tai O to South of Soko Island (KP 0 – 26.20) and West of HKIA to West of BPPS (KP 26.20 – 45.00) was generally categorised as Category L to M and Category M respectively. A review of the other approved EIAs and EM&A programmes in the vicinity of the BPPS pipeline route approved from 2009 to 2016 also shows similar sediment quality from West of Tai O to West of BPPS. *Table 2.7* presents the sediment categories from existing information in the vicinity of BPPS pipeline route.

Table 2.7 Sediment Categories in the Vicinity of BPPS Route

No.	**EIA**	Year of EIA	No. of Samples [a]	Category L	Category M ($_{Pass}$[d])	Category M_{fail}	Category H
1	HKLNG Terminal	2006	86	30	31 (8)	23	2
2	HK-Zhuhai-Macau Bridge Hong Kong Boundary Crossing Facilities	2009	21	11	10 (10)	-	-
3	Black Point Gas Supply	2010	60	6	40 (26)	14	-
4	Three Runway System	2014	27	18	9 (9)	-	-
5	Additional Gas-fired Generation Units Project	2016	3	-	3 (3)	-	-
6	EM&A Programme for Contaminated Mud Pit	2016[b]	24	24	-	-	-

Note:

a. Only the samples in the vicinity of this Project have been taken into account.
b. EM&A Data from 2016
c. M_{fail} present the sediment samples, the contamination concentration of which exceeded the Lower Chemical Exceedance level and fail the tier III biological test.
d. Number of samples passing the Tier III biological test.

Nevertheless, the route stated in the HKLNG Terminal EIA report only covered the route from the BPPS to South Soko Island. There was no representative sediment quality data for the section from the west and south of Soko Island to the offshore LNG terminal site available for review.

2.5 *EXISTING INFORMATION IN THE VICINITY OF THE LPS PIPELINE ROUTE*

Three (3) approved EIAs from 2002 to 2011 and one (1) EIA under public inspection from 2017 in the vicinity of the LPS pipeline route have been listed below and the results of their sediment quality assessments are summarised in the following sections.

2.5.1 *Lamma Power Station Navigation Channel Improvement (AEIAR-69/2003) and Improvement Dredging for Lamma Power Station Navigation Channel (EIA-251/2017)*

Lamma Power Station Navigation Channel Improvement EIA (AEIAR-69/2003)

An EIA for *Lamma Power Station Navigation Channel Improvement* was conducted in 2002 to assess the potential environmental impacts from the proposed maintenance dredging work to maintain the water depth of the navigation channel for the LPS. The EIA reports presented three sets of sediment quality data that were collected in or around the navigation channel between 1994 and 1998. A total of 74 sediment samples were collected from 34 sediment sampling locations for chemical analyses.

All 34 sediment sampling locations from this EIA were located in the vicinity of the LPS pipeline's proposed dredging areas (*Figure 2.9*). The classification of sediment samples can be used as a reasonable reference of sediment quality along part of the LPS pipeline route.

The first set of sampling data was collected in 1994. A total of 18 sediment samples were collected from 10 sampling locations in the navigation channel. Core samples of 2m depth were collected from eight of these 10 sample locations, while surface grab samples were collected from the remaining two locations. *Table 2.8* summarises the analytical results of the sediment samples collected from these sampling locations.

The second set of sampling data was collected in 1997. A total of 40 sediment samples were collected from eight sample locations in the turning basin of the navigation channel. *Table 2.9* summarises the analytical results of the sediment samples collected from these sampling locations.

The third set of sampling data was collected in 1998. A total of 16 sediment samples were collected from 16 sample locations at the new power station extension area. *Table 2.10* summarises the analytical results of the sediment samples collected from these sampling locations.

The sediment quality assessment for the abovementioned 34 sediment sampling locations was undertaken in accordance to the *Work Branch Technical Circular (WBTC) No.3/2000*. According to the Tier 1 screening standard stipulated in WBTC No.3/2000, all the measured contaminant levels were below the Lower Chemical Exceedance Level (LCEL) and were classified as Category L. The above EIA concluded that sediment to be dredged for the proposed navigation channel improvement is suitable for open sea disposal.

Improvement Dredging for Lamma Power Station Navigation Channel EIA (EIA-251/2017)

A long-term approach for addressing the maintenance needs of the Channel was considered necessary and another EIA was conducted in 2014 to assess the potential environmental impacts from the proposed improvement

dredging work to provide and maintain safe clearance for ocean going marine vessels delivering coal shipments to LPS via the channel. The EIA report, which is exhibited for public inspection at the time of preparing this MSSTP, presented the sediment quality data that were collected in or around the channel. A total of 45 sediment samples were collected from 45 sediment sampling locations for chemical analysis.

All 45 sediment sampling locations from this EIA were located in the vicinity of the LPS pipeline's proposed dredging areas (*Figure 2.9*). The classification of sediment samples can be used as reference of sediment quality along part of the LPS pipeline route. A total of 45 sediments samples were collected from the abovementioned sampling locations for Tier II chemical screening. Based on the chemical screening results, all samples collected were classified as Category L sediment. No Tier III biological testing was conducted. *Table 2.11* summarises the analytical results of the sediment samples collected from these sampling locations.

Table 2.8 Results of Sediment Sampling in 1994 for Lamma Power Station Navigation Channel Improvement

Sample Reference			Chemical Screening							Sediment Category
			Heavy Metals[(a)] (mg/kg)							
Location	**Depth (m) From-To**	**Sampling Method**	**Cu**	**Cd**	**Cr**	**Pb**	**Ni**	**Zn**	**Hg**	
LCEL			**65**	**1.5**	**80**	**75**	**40**	**200**	**0.5**	
UCEL			**110**	**4**	**160**	**110**	**40**	**270**	**1**	
1	Top	Vibrocore	25	BDL	39	37	16	88	0.15	L
	Middle	Vibrocore	30	BDL	35	36	15	83	0.17	L
2	Top	Vibrocore	36	BDL	45	43	19	100	0.21	L
	Middle	Vibrocore	35	BDL	39	41	17	92	0.23	L
3	Top	Vibrocore	25	BDL	38	35	17	86	0.18	L
	Middle	Vibrocore	8.3	BDL	27	19	13	53	BDL	L
4	Top	Vibrocore	24	BDL	37	36	16	86	0.13	L
	Middle	Vibrocore	19	BDL	35	32	17	77	0.14	L
5	Top	Vibrocore	22	BDL	36	33	17	79	0.12	L
	Middle	Vibrocore	10	BDL	28	33	14	67	BDL	L
6	Top	Vibrocore	20	BDL	34	27	15	79	0.12	L
	Middle	Vibrocore	8.6	BDL	31	35	15	58	BDL	L
7	Top	Vibrocore	23	BDL	37	19	17	83	0.12	L
	Middle	Vibrocore	11	BDL	27	24	14	58	0.08	L
8	Top	Vibrocore	27	BDL	38	37	17	87	0.15	L
	Middle	Vibrocore	7.2	BDL	32	17	15	60	BDL	L
9	Surface Grab	Grab	25	BDL	37	36	17	83	0.17	L
10		Grab	24	BDL	36	36	16	86	0.14	L

Note:

(a) Heavy metals tested includes: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), zinc (Zn) and mercury (Hg). PAHs = Polyaromatic Hydrocarbon, PCBs = Polychlorinated Biphenyls.

(b) BDL= Below Detection Limit

(c) **Bold** = Exceeding LCEL, classified as Category M

(d) **Bold and underlined** = Exceeding UCEL, classified as Category H

Table 2.9 Results of Sediment Sampling in 1997 for Lamma Power Station Navigation Channel Improvement

Sample Reference			Chemical Screening							Sediment Category
			Heavy Metals (mg/kg)							
Location	Depth (m) From-To	Sampling Method	Cu	Cd	Cr	Pb	Ni	Zn	Hg	
LCEL			65	1.5	80	75	40	200	0.5	
UCEL			110	4	160	110	40	270	1	
A	0 – 0.1 m	Vibrocore	10	BDL	25	26	9	65	BDL	L
	0.8 – 1 m	Vibrocore	10	BDL	32	20	17	73	BDL	L
	1.9 – 2 m	Vibrocore	10	BDL	36	20	20	82	BDL	L
	2.9 – 3 m	Vibrocore	10	BDL	36	21	20	81	BDL	L
	5.9 – 6 m	Vibrocore	10	BDL	38	20	22	80	BDL	L
B	0 – 0.1 m	Vibrocore	BDL	BDL	13	BDL	BDL	37	BDL	L
	0.8 – 1 m	Vibrocore	10	BDL	14	20	8	40	BDL	L
	1.9 – 2 m	Vibrocore	10	BDL	35	20	19	78	BDL	L
	2.9 – 3 m	Vibrocore	10	BDL	36	21	20	77	BDL	L
	5.9 – 6 m	Vibrocore	10	BDL	38	21	21	80	BDL	L
C	0 – 0.1 m	Vibrocore	23	BDL	27	29	13	74	BDL	L
	0.8 – 1 m	Vibrocore	BDL	BDL	25	20	12	61	BDL	L
	1.9 – 2 m	Vibrocore	10	BDL	36	21	19	76	BDL	L
	2.9 – 3 m	Vibrocore	10	BDL	36	20	22	77	BDL	L
	5.9 – 6 m	Vibrocore	10	BDL	36	21	21	79	BDL	L
D	0 – 0.1 m	Vibrocore	20	BDL	25	29	14	64	BDL	L
	0.8 – 1 m	Vibrocore	10	BDL	40	22	24	86	BDL	L
	1.9 – 2 m	Vibrocore	10	BDL	41	22	23	90	BDL	L
	2.9 – 3 m	Vibrocore	10	BDL	36	20	20	62	BDL	L
	5.9 – 6 m	Vibrocore	10	BDL	37	20	20	65	BDL	L
E	0 – 0.1 m	Vibrocore	10	BDL	34	24	17	73	BDL	L
	0.8 – 1 m	Vibrocore	BDL	BDL	30	BDL	17	62	BDL	L
	1.9 – 2 m	Vibrocore	BDL	BDL	33	20	19	72	BDL	L
	2.9 – 3 m	Vibrocore	10	BDL	34	20	19	73	BDL	L
	5.9 – 6 m	Vibrocore	10	BDL	38	20	21	76	BDL	L

Sample Reference			Chemical Screening							Sediment Category
			Heavy Metals (mg/kg)							
Location	**Depth (m) From-To**	**Sampling Method**	**Cu**	**Cd**	**Cr**	**Pb**	**Ni**	**Zn**	**Hg**	
LCEL			**65**	**1.5**	**80**	**75**	**40**	**200**	**0.5**	
UCEL			**110**	**4**	**160**	**110**	**40**	**270**	**1**	
F	0 – 0.1 m	Vibrocore	10	BDL	30	24	14	70	BDL	L
	0.8 – 1 m	Vibrocore	BDL	BDL	32	BDL	18	66	BDL	L
	1.9 – 2 m	Vibrocore	BDL	BDL	36	20	21	76	BDL	L
	2.9 – 3 m	Vibrocore	10	BDL	36	20	20	80	BDL	L
	5.9 – 6 m	Vibrocore	10	BDL	36	20	20	74	BDL	L
G	0 – 0.1 m	Vibrocore	BDL	BDL	27	20	14	58	BDL	L
	0.8 – 1 m	Vibrocore	BDL	BDL	32	BDL	17	65	BDL	L
	1.9 – 2 m	Vibrocore	BDL	BDL	35	20	19	72	BDL	L
	2.9 – 3 m	Vibrocore	10	BDL	36	20	20	76	BDL	L
	5.9 – 6 m	Vibrocore	10	BDL	42	20	23	83	BDL	L
H	0 – 0.1 m	Vibrocore	24	BDL	35	20	17	81	BDL	L
	0.8 – 1 m	Vibrocore	10	BDL	41	20	22	81	BDL	L
	1.9 – 2 m	Vibrocore	10	BDL	43	20	23	81	BDL	L
	2.9 – 3 m	Vibrocore	10	BDL	41	20	24	79	BDL	L
	5.9 – 6 m	Vibrocore	10	BDL	39	20	21	70	BDL	L

Note:

(a) Heavy metals tested includes: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), zinc (Zn) and mercury (Hg). PAHs = Polyaromatic Hydrocarbon, PCBs = Polychlorinated Biphenyls.

(b) BDL= Below Detection Limit

(c) **Bold** = Exceeding LCEL, classified as Category M

(d) **Bold and underlined** = Exceeding UCEL, classified as Category H

Table 2.10 Results of Sediment Sampling in 1998 for Lamma Power Station Navigation Channel Improvement

Sample Reference		Chemical Screening							Sediment Category
		Heavy Metals							
Location	**Depth (m) From-To**	**Cu**	**Cd**	**Cr**	**Pb**	**Ni**	**Zn**	**Hg**	
LCEL		**65**	**1.5**	**80**	**75**	**40**	**200**	**0.5**	
UCEL		**110**	**4**	**160**	**110**	**40**	**270**	**1**	
S1	Values shown in the table are ranges of metal levels measured in the sub-samples of different depths.	BDL	BDL	19-31	20-21	<6-20	27-72	BDL	L
S2		<10-20	BDL	25-36	20-39	14-22	65-87	BDL	L
S3		<10-20	BDL	26-36	<15-35	16-22	59-79	BDL	L
S4		<10-21	BDL	31-34	20-33	18-30	64-85	BDL	L
S5		<10-23	BDL	8-32	<15-36	<6-19	17-85	BDL	L
S6		<10-24	BDL	27-36	<15-36	17-21	54-86	BDL	L
S7		<10-24	BDL	19-46	<15-24	11-30	42-130	BDL	L
S8		<10-20	BDL	26-42	20-33	16-23	48-78	BDL	L
S9		<10-10	BDL	8-33	<15-22	<6-20	28-74	BDL	L
S10		<10-10	BDL	8-36	<15-28	<6-23	18-75	BDL	L
S11		BDL	BDL	17-38	<15-21	7-21	33-76	BDL	L
S12		<10-20	BDL	11-35	<15-33	<6-22	<15-79	BDL	L
S13		BDL	BDL	7-33	<15-21	<6-20	<15-75	BDL	L
S14		<10-10	BDL	18-35	<15-33	11-23	58-77	BDL	L
S15		<10-10	BDL	17-33	<15-27	<6-23	<15-75	BDL	L
S16		<10-10	BDL	26-35	<15-26	15-22	52-76	BDL	L

Note:

(a) Heavy metals tested includes: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), zinc (Zn) and mercury (Hg). PAHs = Polyaromatic Hydrocarbon, PCBs = Polychlorinated Biphenyls.

(b) BDL= Below Detection Limit

(c) **Bold** = Exceeding LCEL, classified as Category M

(d) **Bold and underlined** = Exceeding UCEL, classified as Category H

Table 2.11 Results of Sediment Sampling in 2014 for Improvement Dredging for Lamma Power Station Navigation Channel

Sample Reference			Chemical Screening												Sediment Category
			Heavy Metals (mg kg^{-1})									Organic (ug kg^{-1})			
Sampling Location	Depth (m) From-To	Sampling Method	Ag	As	Cd	Cr	Cu	Ni	Pb	Zn	Hg	Total PCB	LMW PAHs	HMW PAHs	
Reporting Limits			**1**	**0.1**	**0.2**	**0.05**	**1**	**1**	**1**	**1**	**0.05**	**18**	**550**	**1700**	
LCEL			**1**	**12**	**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**23**	**550**	**1,700**	
UCEL			**2**	**42**	**4**	**160**	**110**	**40**	**110**	**270**	**`1**	**180**	**3,160**	**9,600**	
S08	-	Grab	0.2	9	<0.2	44	25	26	39	110	0.08	<18	<550	<1700	L
S09	-	Grab	0.2	10	<0.2	45	23	28	39	113	0.08	<18	<550	<1700	L
S10	-	Grab	0.1	10	<0.2	49	24	31	39	119	0.06	<18	<550	<1700	L
S11	-	Grab	0.2	10	<0.2	48	25	30	42	118	0.09	<18	<550	<1700	L
S12	-	Grab	0.2	11	<0.2	47	24	29	39	117	0.07	<18	<550	<1700	L
S13	-	Grab	0.2	9	<0.2	50	27	31	42	127	0.07	<18	<550	<1700	L
S14	-	Grab	0.2	11	<0.2	44	23	27	38	113	0.07	<18	<550	<1700	L
S15	-	Grab	0.2	11	<0.2	46	24	29	39	114	0.10	<18	<550	<1700	L
S16	-	Grab	0.1	11	<0.2	42	22	26	36	107	0.07	<18	<550	<1700	L
S17	-	Grab	0.2	11	<0.2	49	25	30	41	122	0.07	<18	<550	<1700	L
S18	-	Grab	0.1	12	<0.2	34	15	21	32	85	0.05	<18	<550	<1700	L
S19	-	Grab	0.2	10	<0.2	49	27	30	43	123	0.09	<18	<550	<1700	L
S20	-	Grab	0.1	12	<0.2	35	14	21	33	86	0.06	<18	<550	<1700	L
S21	-	Grab	0.2	9	<0.2	46	26	28	41	118	0.08	<18	<550	<1700	L
S22	-	Grab	0.2	12	<0.2	38	21	24	36	106	0.16	<18	<550	<1700	L
S22	-	Grab	0.2	8	<0.2	46	26	29	41	120	0.10	<18	<550	<1700	L
S23	-	Grab	0.2	8	<0.2	36	20	22	32	93	0.32	<18	<550	<1700	L
S24	-	Grab	0.2	9	<0.2	46	24	29	40	116	0.09	<18	<550	<1700	L
S25	-	Grab	0.2	9	<0.2	43	24	27	38	112	0.10	<18	<550	<1700	L
S26	-	Grab	0.3	9	<0.2	40	22	26	35	106	0.15	<18	<550	<1700	L
S27	-	Grab	0.2	8	<0.2	43	23	27	38	111	0.08	<18	<550	<1700	L
S28	-	Grab	0.2	9	<0.2	43	24	27	38	111	0.07	<18	<550	<1700	L
S29	-	Grab	0.2	8	<0.2	46	27	29	40	124	0.08	<18	<550	<1700	L
S30	-	Grab	0.2	11	<0.2	34	19	22	33	96	0.08	<18	<550	<1700	L
S31	-	Grab	0.2	10	<0.2	44	28	28	41	119	0.10	<18	<550	<1700	L

Sample Reference			Chemical Screening												Sediment Category
			Heavy Metals (mg kg^{-1})									Organic (ug kg^{-1})			
Sampling Location	**Depth (m) From-To**	**Sampling Method**	**Ag**	**As**	**Cd**	**Cr**	**Cu**	**Ni**	**Pb**	**Zn**	**Hg**	**Total PCB**	**LMW PAHs**	**HMW PAHs**	
Reporting Limits			**1**	**0.1**	**0.2**	**0.05**	**1**	**1**	**1**	**1**	**0.05**	**18**	**550**	**1700**	
LCEL			**1**	**12**	**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**23**	**550**	**1,700**	
UCEL			**2**	**42**	**4**	**160**	**110**	**40**	**110**	**270**	**`1**	**180**	**3,160**	**9,600**	
S32	-	Grab	0.2	12	<0.2	44	25	27	38	114	0.12	<18	<550	<1700	L
S33	-	Grab	0.2	10	<0.2	48	28	30	42	126	0.10	<18	<550	<1700	L
S34	-	Grab	0.2	12	<0.2	40	25	25	38	104	0.06	<18	<550	<1700	L
S35	-	Grab	0.2	12	<0.2	36	23	23	33	100	0.09	<18	<550	<1700	L
S36	-	Grab	0.2	9	<0.2	48	28	30	42	126	0.10	<18	<550	<1700	L
S37	-	Grab	0.3	10	<0.2	51	33	32	46	135	0.09	<18	<550	<1700	L
S38	-	Grab	0.3	10	<0.2	49	30	30	42	129	0.10	<18	<550	<1700	L
S39	-	Grab	0.2	9	<0.2	44	27	27	41	119	0.09	<18	<550	<1700	L
S41	-	Grab	0.3	10	<0.2	45	30	28	42	122	0.09	<18	<550	<1700	L
S42	-	Grab	0.2	8	<0.2	43	28	27	45	115	0.10	<18	<550	<1700	L
S43	-	Grab	0.2	9	<0.2	48	28	30	42	129	0.09	<18	<550	<1700	L
S44	-	Grab	0.2	10	<0.2	48	28	30	44	126	0.10	<18	<550	<1700	L
S45	-	Grab	0.3	10	<0.2	45	29	29	40	122	0.11	<18	<550	<1700	L
S46	-	Grab	0.4	10	<0.2	49	35	30	46	136	0.11	<18	<550	<1700	L
S47	-	Grab	0.3	12	<0.2	52	36	32	48	142	0.14	<18	<550	<1700	L
S48	-	Grab	0.3	11	<0.2	52	33	32	50	139	0.13	<18	<550	<1700	L
S49	-	Grab	0.3	10	<0.2	47	28	29	42	128	0.17	<18	<550	<1700	L
S50	-	Grab	0.3	11	<0.2	49	30	31	46	129	0.10	<18	<550	<1700	L
S51	-	Grab	0.3	10	<0.2	49	34	30	45	134	0.10	<18	<550	<1700	L
S52	-	Grab	0.3	10	<0.2	46	29	29	43	125	0.10	<18	<550	<1700	L

(a) Heavy metals tested includes: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), zinc (Zn) and mercury (Hg). PAHs = Polyaromatic Hydrocarbon, PCBs = Polychlorinated Biphenyls.

(b) **Bold** = Exceeding LCEL, classified as Category M

(c) **Bold and underlined** = Exceeding UCEL, classified as Category H,

2.5.2 *Development of a 100MW Offshore Wind Farm in Hong Kong (AEIAR 152/2010)*

An EIA was conducted in 2009 to assess the potential environmental impacts associated with the construction of a proposed wind farm. A total of five sediment samples were collected from five sediment sampling locations for chemical analysis. The sampling locations are shown on *Figure 2.10*.

All five sediment sampling locations from the above EIA were located in the vicinity of the LPS pipeline's proposed dredging areas. The classification of sediment samples can be used as a reasonable reference of sediment quality along part of the LPS pipeline route.

All the measured contaminant levels in the five sediment samples were below the LCEL except Copper which exceeded the LCEL at one sampling locations. *Table 2.12* summarises the analytical results of the sediment samples collected from these sampling locations. In summary, four samples collected were classified as Category L, and one sample was classified as Category M.

Table 2.12 Results of Sediment Sampling in 2009 for Development of a 100MW Offshore Wind Farm in Hong Kong

Sampling Reference			Chemical Screening													Sediment Category
			Heavy Metals (mg kg^{-1})									Organic (ug kg^{-1})			Organo-metallics	
Sampling Location	**Depth (m) From-To**	**Sampling Method**	**Cd**	**Cr**	**Cu**	**Hg**	**Ni**	**Pb**	**Ag**	**Zn**	**As**	**LPAH**	**HPAH**	**Total PCB**	**Tributyl-tin**	
LCEL			**1.5**	**80**	**65**	**0.5**	**40**	**75**	**1**	**200**	**12**	**550**	**1,700**	**23**	**0.15**	
UCFL			**4**	**160**	**110**	**1**	**40**	**100**	**2**	**270**	**24**	**3,160**	**9,600**	**180**	**0.15**	
1	Samples were collected at seabed.	Grab	BDL	44	**74**	0.07	27	39	BDL	121	8	BDL	BDL	BDL	BDL	M
2		Grab	BDL	41	26	0.07	26	39	BDL	116	10	BDL	BDL	BDL	BDL	L
3		Grab	BDL	42	25	0.09	27	41	BDL	115	10	BDL	BDL	BDL	BDL	L
4		Grab	BDL	44	32	0.1	28	44	BDL	121	10	BDL	BDL	BDL	BDL	L
5		Grab	BDL	43	25	0.07	26	37	BDL	115	10	BDL	BDL	BDL	BDL	L

Note:

(a) Heavy metals tested includes: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), zinc (Zn) and mercury (Hg). PAHs = Polyaromatic Hydrocarbon, PCBs = Polychlorinated Biphenyls.

(b) BDL = Below Detection Limit

(c) **Bold** = Exceeding LCEL, classified as Category M

(d) **Bold and underlined** = Exceeding UCEL, classified as Category H

2.5.3 *Development of the Integrated Waste Management Facilities (IWMF) Phase 1 (Artificial Island Near Shek Kwu Chau) (AEIAR 163/2012)*

An EIA was conducted in 2011 to assess the potential environmental impacts from the construction and operation of an IWMF at two potential sites, i.e. Tsang Tsui Ash Lagoon Site and an Artificial Island near Shek Kwu Chau. Only the sediment quality data for the Artificial Island near Shek Kwu Chau (hereinafter referred as SKC) is relevant to the LPS pipeline route as it is located in the Southern WCZ. A total of 29 sediment samples were collected from 25 sediment sampling locations for chemical analysis.

All 25 sediment sampling locations from this EIA were located in the vicinity of the LPS pipeline's proposed dredging areas (*Figure 2.11*). The classification of sediment samples can be used as a reasonable reference of sediment quality along part of the LPS pipeline route.

Table 2.13 summarises the analytical results of the sediment samples collected from these sampling locations. All the measured contaminant levels in the 29 sediment samples were below the Lower Chemical Exceedance Level (LCEL) and thus were classified as Category L.

Table 2.13 Results of Sediment Sampling in 2009 for Development of the Integrated Waste Management Facilities Phase 1 (Artificial Island near Shek Kwu Chau)

Sample Reference			Chemical Screening													Overall Category
			Heavy Metals (mg kg-1)									Organic (ug kg-1)			Organo-metallics	
Sampling Location	Depth (m) From-To	Sampling Method	Cd	Cr	Cu	Ni	Pb	Zn	Hg	As	Ag	LMW PAHs	HMW PAHs	Total PCB	Tributyl-tin	
LCEL			**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**12**	**1**	**550**	**1,700**	**23**	**0.15**	
UCFL			**4**	**160**	**110**	**40**	**110**	**270**	**1**	**42**	**2**	**3,160**	**9,600**	**180**	**0.15**	
MI1	-	Grab	BDL	21	14	14	25	54	0.1	6	0.1	BDL	BDL	BDL	BDL	L
MI2	-	Grab	BDL	38	23	21	33	93	0.08	8	0.2	BDL	BDL	BDL	0.007	L
MI3	-	Grab	BDL	27	18	17	24	70	0.05	6	0.2	BDL	BDL	BDL	BDL	L
MI4	-	Grab	BDL	33	20	17	29	80	0.07	8	0.2	BDL	BDL	BDL	0.01	L
MI5	-	Grab	BDL	32	20	20	28	79	0.1	7	0.2	BDL	BDL	BDL	BDL	L
MI6	-	Grab	BDL	37	22	21	33	91	0.06	8	0.2	BDL	BDL	BDL	0.015	L
MI7	-	Grab	BDL	49	31	32	39	128	0.1	11	0.3	BDL	BDL	BDL	BDL	L
MI8	-	Grab	BDL	47	26	25	35	112	0.08	10	0.3	BDL	BDL	BDL	BDL	L
MI9	-	Grab	BDL	48	26	25	35	114	0.1	10	0.2	BDL	BDL	BDL	0.015	L
MI10	-	Grab	BDL	49	26	25	35	116	0.08	10	0.2	BDL	BDL	BDL	BDL	L
MI11	-	Grab	BDL	45	27	29	35	110	0.09	11	0.2	BDL	BDL	BDL	BDL	L
MI11	0 - 0.9	Vibrocore	BDL	38	13	25	25	82	<0.05	10	<0.1	BDL	BDL	BDL	-	L
MI11	0.9 - 1.96	Vibrocore	BDL	41	14	28	24	86	<0.05	9	<0.1	BDL	BDL	BDL	-	L
MI12	-	Grab	BDL	30	17	16	27	71	0.06	7	0.2	BDL	BDL	BDL	BDL	L
MI13	-	Grab	BDL	36	19	18	34	80	0.08	6	0.2	BDL	BDL	BDL	BDL	L
MI13	0.1 - 0.9	Vibrocore	BDL	12	5	3	11	21	<0.05	3	<0.1	BDL	BDL	BDL	0.013	L
MI13	0.9 - 1.96	Vibrocore	BDL	9	3	<1	8	17	<0.05	5	<0.1	BDL	BDL	BDL	-	L
MI14	-	Grab	BDL	44	25	27	35	107	0.08	9	0.2	BDL	BDL	BDL	BDL	L
MI15	-	Grab	BDL	53	31	32	41	128	0.1	11	0.3	BDL	BDL	BDL	0.016	L
MI16	-	Grab	BDL	43	27	27	35	109	0.1	10	0.2	BDL	BDL	BDL	BDL	L

Sample Reference			Chemical Screening												Overall Category
			Heavy Metals (mg kg-1)									Organic (ug kg-1)			Organo-metallics	
Sampling Location	**Depth (m) From-To**	**Sampling Method**	**Cd**	**Cr**	**Cu**	**Ni**	**Pb**	**Zn**	**Hg**	**As**	**Ag**	**LMW PAHs**	**HMW PAHs**	**Total PCB**	**Tributyl-tin**	
LCEL			**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**12**	**1**	**550**	**1,700**	**23**	**0.15**	
UCFL			**4**	**160**	**110**	**40**	**110**	**270**	**1**	**42**	**2**	**3,160**	**9,600**	**180**	**0.15**	
MI17	-	Grab	BDL	42	23	21	32	99	0.06	10	0.2	BDL	BDL	BDL	BDL	L
MI18	-	Grab	BDL	45	28	29	37	113	0.1	10	0.2	BDL	BDL	BDL	BDL	L
MI19	-	Grab	BDL	48	29	30	38	119	0.12	11	0.2	BDL	BDL	BDL	BDL	L
MI20	-	Grab	BDL	52	32	33	41	128	0.1	11	0.3	BDL	BDL	BDL	BDL	L
MI21	-	Grab	BDL	55	32	35	42	135	0.1	12	0.3	BDL	BDL	BDL	BDL	L
MI22	-	Grab	BDL	46	25	24	34	109	0.1	10	0.2	BDL	BDL	BDL	BDL	L
MI23	-	Grab	BDL	51	27	26	36	120	0.12	10	0.3	BDL	BDL	BDL	0.01	L
MI24	-	Grab	BDL	50	27	26	36	118	0.11	10	0.2	BDL	BDL	BDL	BDL	L
MI25	-	Grab	BDL	51	28	27	36	121	0.1	11	0.2	BDL	BDL	BDL	0.008	L

Note:

(a) Heavy metals tested includes: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), zinc (Zn) and mercury (Hg).

(b) BDL = Below Detection Limit

(c) **Bold** = Exceeding LCEL, classified as Category M

(d) **Bold and underlined** = Exceeding UCEL, classified as Category H,

2.5.4 *Summary of Existing Information in the Vicinity of the LPS Pipeline Route*

A review of previous approved EIAs in the vicinity of the LPS pipeline route approved from 2002 to 2011 and one EIA under public inspection provides data from 1994 to 2011, and shows that the sediment quality was generally classified as Category L. *Table 2.14* presents the sediment categories from existing information in the vicinity of LPS pipeline route.

Table 2.14 Sediment Categories in the Vicinity of LPS Route

No.	**EIA**	Year of EIA	Total No. of Samples	Category L	Category M_{pass}	Category M_{failed}	Category H
1	Lamma Power Station Navigation Channel Improvement	2002	34	34	-	-	-
2	Improvement Dredging for Lamma Power Station Navigation Channel	2017	45	45	-	-	-
3	Development of a 100MW Offshore Wind Farm	2009	5	4	1	-	-
4	Development of the IWMF Phase 1	2011	29	29	-	-	-

3 SURVEY PLANNING

3.1 SURVEY DESIGN

Based on the review of sediment quality data outlined in *Section 2*, it is considered that the anticipated contamination levels of the marine sediments along the BPPS pipeline route is likely to be low to mild. Sediments in areas near the proposed offshore LNG terminal site and LPS pipeline route are in general likely to show low level of contamination. The proposed offshore LNG terminal site is located in the vicinity of the South of Cheung Chau open sea disposal area for the disposal of uncontaminated sediment and thus it is likely that the expected contamination level of the marine sediment at this location is to be low.

The marine sediment data presented above shall be used as a reference for evaluating and conservatively assessing the waste management implication of the Project only. The construction of this Project is tentatively scheduled to commence in 2019.

3.1.1 *Sediment Sampling for Chemical and Biological Testing*

Offshore LNG Terminal Site

A double berth jetty (approximate dimension of 450m in length and 50m in width) will be located within the proposed site for the offshore LNG terminal. Considering that only the piling activities underneath the double berth jetty will involve marine sediment dredging (noting the exact piling locations are subject to final engineering design), two (2) sampling locations, namely F-GB01 and F-GB02 (*Figure 3.1*), are proposed for the purpose of the EIA and are considered representative of the 600m x 600m area for the proposed site for the offshore LNG terminal. Surface grab sampling method is proposed given the low level of contamination expected.

BPPS Pipeline

As there is no sediment dredging or disposal required for pipeline jetting along KP 0.50 – 7.90, KP 7.90 – 12.20, KP 21.40 – 26.20, KP 26.20 – 31.50, KP 37.50 – 41.10, and KP 42.90 – 44.90, no sediment sampling are proposed at these sections. Sediment sampling for chemical and biological testing is only proposed in areas where marine dredging is proposed (*Section 1.3* and *Figure 1.1* refer) and the sampling requirements are described in *Table 3.1*. The sampling locations are presented in *Figure 3.1*.

Table 3.1 Proposed Sediment Sampling for the BPPS Pipeline Route

Dredged Pipeline Section	Sampling Consideration
KP 0 – 0.50	• The required dredging area for pipeline trenching is estimated to be 30m wide and 500m long, with dredging depth of about 2.7m below existing seabed level. • As this section is located near the offshore LNG Terminal, testing results from the two (2) nearest proposed sediment sampling locations, F-GB01 and F-GB02, will be referenced to reflect the sediment quality.
KP 12.20 - 21.40	• The required dredging area for pipeline trenching is estimated to be 30m wide and 9,200m long, with dredging depth of about 2.2m below existing seabed level. • Sediment quality data obtained from the 2006 HKLNG Terminal EIA report showed that the sediment quality is generally low to mild. No recent sediment quality data is, however, available for reference along this section. • Nine (9) sediment sampling locations are proposed to collect seabed surface sample to verify the sediment quality.
KP 31.50 – 37.50	• The required dredging area for pipeline trenching is estimated to be 30m wide and 6,000m long, with dredging depth of about 2.2m below existing seabed level. • Sediment quality data obtained from the 2006 HKLNG Terminal EIA report showed that the sediment quality is classified as M_{pass}. This pipeline section is located adjacent to the Sha Chau and Lung Kwu Chau Marine Park (which was designated in November 1996), as such it can be reasonably be expected that no significant disturbance of the seabed by human activities was carried out along this section in the past 10 years. • Six (6) sediment sampling locations are proposed to collect seabed surface sample to verify the sediment quality.
KP 41.10 – 42.90	• The required dredging area for pipeline trenching is estimated to be 30m wide and 1,800m long, with dredging depth of about 3.9m below existing seabed level. • Sediment quality data obtained from the 2006 HKLNG Terminal EIA report and 2010 Black Point Gas Supply EIA showed that the sediment quality is generally low to mild. No recent sediment quality data is, however, available for reference. • Three (3) sediment sampling location are proposed to collect seabed surface sample to verify the sediment quality
KP 44.90 – 45.00	• The required dredging area for pipeline trenching is estimated to be 30m wide and 100m long, with dredging depth of about 2.8m below existing seabed level. • Sediment quality data from 2016 Additional Gas-fired Generation Units Project EIA will be referenced.

LPS Pipeline

There is no sediment dredging or disposal required for pipeline jetting for the majority of the pipeline route. Sediment sampling for chemical and biological testing is only proposed in areas where marine dredging is proposed which is only within about 1 km from the LPS extension area

(*Section 1.3* and *Figure 1.1* refer). Sediment quality data obtained from the 2010 Development of a 100MW Offshore Wind Farm EIA showed that the level of contamination in sediment is generally low; however no recent sediment quality data is available for reference. As such, one (1) sediment sample is proposed within the 1km near LPS at the shore approach to collect seabed surface sample to verify the sediment quality along this section. The sampling location is presented in *Figure 3.1*.

3.1.2 Sediment Elutriate Testing

A review of available elutriate data from approved EIA studies has been conducted and a summary of the findings as well as the consideration for the elutriate testing requirements for this Project are provided in *Annex C*.

No sediment elutriate test results exist for the proposed site for the offshore LNG terminal. Two (2) sediment elutriate testing locations are proposed in the same locations as the sediment sampling (*Figure 3.1*).

For the BPPS pipeline route, sediment sampling and elutriate testing was conducted under a number of approved EIAs in the vicinity, including the EIAs for the *HKLNG Terminal*, the *Black Point Gas Supply Project* and the *Additional Gas-fired Generation Units Project*. In general, the sediment sampling and elutriate testing under these projects are for the same locations as identified in *Section 3.1* above. Review of site history indicated that no major marine construction works have been conducted along the proposed BPPS pipeline route since 2007 (noting marine construction works under the *Black Point Gas Supply Project* completed in 2013 were approximately 250m away from the proposed BPPS pipeline route). No significant change would be expected and results of sediment elutriate tests conducted under these previous studies are considered to be representative of the existing condition.

Eleven (11) sampling locations along the BPPS pipeline route (between KP 0.50 to 12.20 and KP 26.20 to 31.50) are proposed for sediment elutriate testing to fill in the identified information gaps (*Figure 3.1;* see *Annex C*). In addition, sediment samples will be collected from eighteen (18) sampling locations at proposed dredging areas from KP 12.20 to 21.40, KP 31.50 to 37.50 and KP 41.10 to 42.90 (*Figure 3.1*). Elutriate testing will also be analysed as part of the sediment sampling scheme at these locations. Where existing data exists, adjacent proposed elutriate sampling points will be utilised to verify the existing data (eg B-GB10 and B-EL05 for KP21.40 to 26.20; B-GB04 and B-GB03 for KP37.50 to 41.10; and B-GB01 for 42.90 to 44.90).

No sediment elutriate test results exist for most of the LPS pipeline route. Fourteen (14) sampling locations are proposed along the pipeline alignment for sediment elutriate testing. Within the 1km LPS near shore approach, one (1) elutriate testing sample will also be collected at proposed location for sediment sampling (*Figure 3.1*).

3.2 SAMPLING LOCATIONS

Co-ordinates of the proposed sediment sampling locations for this Project are presented in *Table 3.2* for the BPPS pipeline and LPS pipeline route and *Table 3.3* for the double berth jetty potential site.

Table 3.2 ***Proposed Sediment Sampling Locations, Methods and Testing Required for the BPPS and LPS Pipeline Route***

Sampling Location	Proposed Sampling Method	Coordinates		Testing Required		Anticipated Sediment Category
		Easting	Northing	Sediment Testing	Elutriate Testing	
BPPS						
B-EL01	Surface Grab	804375.472	820438.029		✓	L to M
B-EL02	Surface Grab	804072.055	819387.215		✓	
B-EL03	Surface Grab	803768.638	818336.401		✓	
B-EL04	Surface Grab	803465.220	817285.588		✓	
B-EL05	Surface Grab	803161.803	816234.774		✓	
B-EL06	Surface Grab	804008.255	803667.903		✓	
B-EL07	Surface Grab	804993.008	802897.993		✓	
B-EL08	Surface Grab	805977.761	802128.083		✓	
B-EL09	Surface Grab	806962.514	801358.173		✓	
B-EL10	Surface Grab	808057.228	800772.905		✓	
B-EL11	Surface Grab	809294.609	800679.006		✓	
B-GB01	Surface Grab	806754.000	831310.719	✓	✓	
B-GB02	Surface Grab	806181.551	831130.990	✓	✓	
B-GB03	Surface Grab	805639.196	830879.530	✓	✓	
B-GB04	Surface Grab	804749.458	826784.824	✓	✓	
B-GB05	Surface Grab	804752.641	825784.829	✓	✓	
B-GB06	Surface Grab	804755.824	824784.834	✓	✓	
B-GB07	Surface Grab	804744.628	823784.985	✓	✓	
B-GB08	Surface Grab	804720.296	822785.281	✓	✓	
B-GB09	Surface Grab	804693.169	821785.686	✓	✓	
B-GB10	Surface Grab	800660.858	811573.795	✓	✓	
B-GB11	Surface Grab	800287.597	810622.431	✓	✓	
B-GB12	Surface Grab	800156.809	809613.613	✓	✓	
B-GB13	Surface Grab	800325.623	808606.861	✓	✓	
B-GB14	Surface Grab	800534.383	807606.182	✓	✓	
B-GB15	Surface Grab	800806.260	806623.340	✓	✓	
B-GB16	Surface Grab	801368.340	805775.465	✓	✓	
B-GB17	Surface Grab	802151.127	805119.862	✓	✓	
B-GB18	Surface Grab	802956.436	804490.247	✓	✓	
LPS						
L-EL01	Surface Grab	814204.941	803233.642		✓	L
L-EL02	Surface Grab	814792.833	804171.786		✓	
L-EL03	Surface Grab	815903.619	804244.519		✓	
L-EL04	Surface Grab	817019.040	803961.201		✓	
L-EL05	Surface Grab	818158.176	803865.386		✓	
L-EL06	Surface Grab	819308.850	803884.960		✓	
L-EL07	Surface Grab	820459.524	803904.534		✓	
L-EL08	Surface Grab	821610.198	803924.108		✓	
L-EL09	Surface Grab	822760.872	803943.682		✓	
L-EL10	Surface Grab	823911.546	803963.256		✓	
L-EL11	Surface Grab	825033.855	804184.157		✓	
L-EL12	Surface Grab	825991.737	804809.183		✓	
L-EL13	Surface Grab	826732.531	805689.036		✓	
L-EL14	Surface Grab	827457.194	806583.070		✓	
L-GB01	Surface Grab	828418.866	807783.939	✓	✓	

Table 3.3 ***Proposed Sediment Sampling Locations, Methods and Testing Required for Double Berth Jetty Potential Site***

Sampling Location	Proposed Sampling Method	Coordinates		Testing Required		Anticipated Sediment Category
		Easting	Northing	Sediment Testing	Elutriate Testing	
F-GB01	Surface Grab	814196.296	802009.943	✓	✓	L
F-GB02	Surface Grab	814267.403	801718.491	✓	✓	

3.3 SAMPLE COLLECTION

As discussed in *Section 3.1.1* it is considered that the anticipated contamination levels of the marine sediments along the BPPS pipeline route and offshore LNG terminal platform are considered to be low to mild and low respectively. Sampling of seabed surface sediment is considered sufficient to characterise the level of contamination of dredged materials arising from this Project. Seabed sediment samples for chemical screening (for testing all contaminants *stated in the Table 1 - Analytical Methodology in Appendix B of PNAP ADV-21*) including Tributyltin [TBT] in interstitial water), biological testing and sediment elutriate test shall be collected by means of grab sampling method. The grab samples testing results will be used as a referenced sediment category of the corresponding sampling locations to inform the waste management impact assessment.

A marine site investigation contractor will be engaged by CLP to carry out the sampling and provide all necessary equipment located on vessels. The typical equipment required is indicated in *Table 3.4*. The survey vessel for the grab sampling operations shall be equipped with a C-NAV GPS receiver unit for positioning. The positioning system shall be calibrated before the survey to ensure an accuracy of ±1 m or better. The coordinates of the sampling locations shall be recorded by the calibrated positioning equipment.

Table 3.4 ***List of Typical Sampling Equipment***

Equipment	Function
VESSELS	
• Class I Survey Boat	• Survey vessel
• Sampans	• Support vessels
POSITIONING EQUIPTMENT	
• DGPS survey system	• Setting out of sampling locations (provides a horizontal accuracy of +/- 1.0m)
SAMPLING EQUIPMENT	
• Van Veen sampler (24L)	• Collection of sediment samples from the seabed surface
SAMPLE HANDLING EQUIPMENT	
• Waterproof ink pens	• To mark on sample core
• Cool box with ice packs	• To chill collected samples pending daily collection by HOKLAS accredited laboratory

For the grab sampling method, a Van Veen grab (or equivalent) of capacity approximately 24L shall be deployed from marine vessels for the sampling. At each sampling location, the grab sampler will be lowered slowly through the water column from the survey vessel. The grab sampler will be triggered to close once it reaches the seabed surface. Subsequently, the closed grab sampler will be recovered at a constant rate to the survey vessel and the collected sediments will then be transferred into a plastic basin. The sediments will be examined for acceptance based upon the degree of disturbance, penetration depth and amount of leakage from the grab.

Sufficient sediment will be obtained at each sediment sampling location for laboratory testing purposes. The sediment samples for further biological testing, if deemed necessary based on results of chemical screening, shall also be collected at the same time. Individual grabs will be composited on-site and split into portions for packing for laboratory testing.

The contractor will ensure that adequate quantities of sediment are collected for chemical testing as well as the next Tier of biological testing, based on the laboratory requirement, as presented in *Table 3.5*. The volume of sediment required for chemical screening and biological testing shall be confirmed with the testing laboratory engaged by the contractor prior to the commencement of the sampling programme.

Table 3.5 Proposed Sample Volume

Tests	Sample Volume
Metals and Metalloids	0.5 litre
Organic	0.5 litre
Biological Response	6.0 litres
Elutriate Test	1 litre of sediment + 6 litres of marine water

3.4 SAMPLE HANDLING AND STORAGE

The sediment samples collected for testing shall be inventoried and logged on chain of custody forms for transportation. All samples will be double bagged and labelled internally and externally with indelible ink. Chain of custody forms will detail all information relevant to the samples including sample location, date and time of sampling. Samples will be delivered to a laboratory, whose chemical and biological tests have been accredited by HOKLAS, as soon as possible after collection. Samples will be stored at 4°C in the dark during transportation and at the laboratory storage prior to testing.

The sampling bottle and pre-treatment methods shall follow the recommendations stipulated in *PNAP ADV-21.* The proposed sample container for each test is described in *Table 3.6*.

Table 3.6 Proposed Sample Containers

Tests	Sampling Container	Pre-treatment Procedure**
Metals and Metalloids	High density polyethylene container*	US EPA SW-846***Chapter 3
Organic	Wide mouth borosilicate glass jar with Teflon-lined lid	US EPA SW-846Chapter 4
TBT in Interstitial Water	Food grade HDPE zip-lock bags	Krone et al. (1989) [(a)]
Biological Response	Wide mouth borosilicate glass jar with Teflon-lined lid or high density polyethylene container*	US EPA SW-846Chapter 3 or Chapter 4
Elutriate Test	Glass container (for sediment) Glass bottle (for marine water)	N/A

Note:

* Heavy duty plastic bags may be used for the storage of sediment sample for testing of metals, metalloid and biological response.

** Other equivalent methods may be used subject to approval of EPD.

*** Test Methods for evaluating solid wastes: physical/chemical methods, SW-846, 3rd edition, United States Environmental Protection Agency.

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

Samples for chemical testing shall be extracted and analysed within 14 days. The laboratory shall ensure that the chemical screening results are ready as soon as possible after the sampling finished so that a Tier III biological testing programme (where required) can be developed and commenced within 8 weeks from the date of sampling.

The sub-samples for potential biological testing (6 litres in total) shall also be stored in the same manner as described above (including for ancillary parameters). The decision on the necessity to proceed with biological testing will be made after examining results for chemical screening of sediment samples.

3.4.1 Reference Sample

If Tier III biological testing is considered to be necessary, according to the results of chemical screening of sediment samples, samples for reference sediment shall be taken. The proposed site for collecting reference sediment is in Port Shelter at PS6 (E850234, N820057) as presented in *Figure 3.2* Reference sediment (1 kg) and marine water sample (6 L) at the above location would also be required for sediment elutriate test.

3.4.2 Samples for Elutriate Test

One sediment sample of 1 L would be required at the proposed sampling locations for elutriate test *(Tables 3.2 to 3.3)*. Each sample would be stored in a glass container and be handled in the same way as other sediment samples stipulated above.

Marine water sample of 6 L would be required for each associated sediment sample for elutriate test. Marine water samples would be stored in glass containers and cooled before sending to the laboratory for analysis.

All sediment samples shall be tested for all the contaminants and TBT stated in the *Table 1 - Analytical Methodology* in *Appendix B* of *PNAP ADV-21*. The composite samples for biological testing will be tested, where required, for ancillary parameters, including moisture content, grain size distribution, pH, TOC, ammonia and salinity of pore water. The parameters to be analysed, methodology used and detection limits are presented in *Table 4.1*. A summary table presenting the details of chemical and biological testing for each sediment and elutriate sampling location is given in *Annex B*.

Table 4.1 Chemical Testing Parameters

Parameters	**Reporting Limit**	**Preparation Method** [a] ***US EPA Method***	**Determination Method** [a] ***USEPA Method***
Metal (mg/kg dry weight)			
Cadmium	0.2	3050B	6020A or 7000A or 7131A
Chromium	8	3050B	6010C or 7000A or 7190
Copper	7	3050B	6010C or 7000A or 7210
Mercury	0.05	7471A	7471A
Nickel	4	3050B	6010C or 7000A or 7520
Lead	8	3050B	6010C or 7000A or 7420
Silver	0.1	3050B	6020A or 7000A or 7761
Zinc	20	3050B	6010C or 7000A or 7950
Metalloid (mg/kg dry weight)			
Arsenic	1	3050B	6020A or 7000A or 7061A
Organic-PAHs (µg/kg dry weight)			
Low Molecular Weight PAHs [b]	55	3550B or 3540C and 3630C	8260B or 8270C
High Molecular Weight PAHs [c]	170	3550B or 3540C and 3630C	8260B or 8270C
Organic-non-PAHs (µg/kg dry weight)			
Total PCBs [d]	3	3550B or 3540C and 3665A	8082
Organometallics (µg TBT/L in Interstitial Water)			
Tributyltin	0.015	Krone et al. (1989) [f] GC/MS/UNEP /IOC/IAEA [g]	Krone et al. (1989) [f] GC/MS/UNEP/IOC/ IAEA [g]
Ancillary Parameters [e]			
Grain size distribution	2mm-63µm	-	BS1377 (1975)
Total Organic Carbon	0.05%	-	APHA 5310B
Ammonia	20 mg kg^{-1} dry weight	1:5 water extractable	APHA 17e 4500 NH_3-B,E
Moisture Content		Drying at 105˚C	AS1289.1-1991, test 2.3.2A
Salinity of Pore Water	0.1 gL^{-1}		

Notes:

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

(b) Low molecular weight PAHs = acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene and phenanthrene.

(c) High molecular weight PAHs = benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, ideno(1,2,3-c,d)pyrene and benzo(g,h,i)perylene.

(d) The reporting limit is for individual PCB congeners. Total PCBs include 2,4′ diCB, 2,2′,5 triCB, 2,4,4′ triCB, 2,2′,3,5′ tetraCB, 2,2′,5,5′ tetraCB, 2,3′,4,4′ tetraCB, 3,3′,4,4′ tetraCB, 2,2′,4,5,5′ pentaCB, 2,3,3′,4,4′ pentaCB, 2,3′,4,4′,5 pentaCB, 3,3′,4,4′,5 pentaCB, 2,2′,3,3′,44′ hexaCB, 2,2′,3,,4,4′,5′ hexaCB, 2,2′,4,4′,5,5′hexaCB, 3,3′,4,4′,5,5′hexaCB, 2,2′,3,3′,4,4′,5 heptaCB, 2,2′,3,4,4′,5,5′ heptaCB, 2,2′,3,4′,5,5′,6 heptaCB (ref. The "summation" column of the Table 9.3 of *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual* (*the Inland Testing Manual*) published by USEPA).

(e) Analysis of ancillary parameters will be carried out for composite samples of biological testing only.

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

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

4.1 SEDIMENT CLASSIFICATION

The tested sediment samples will be classified according to their level of contamination of metals (eight priority metals, including Cd, Cr, Cu, Hg, Ni, Pb, Ag and Zn), metalloid (arsenic), organic–PAHs (low molecular and high molecular weight PAHs), organic-non-PAHs (total polychlorinated biphenyls) and organometallics (tributyltin in interstitial water) as stipulated in the *PNAP ADV-21*. The Chemical Exceedance Levels (CEL) specified in *Appendix A* of the *PNAP ADV-21* serve as criteria for determining the testing and disposal requirements of marine dredged sediments. These include:

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

Category M: Sediment with any one or more contaminant levels exceeding the Lower Chemical Exceedance Level (LCEL) and none exceeding the Upper Chemical Exceedance Level (UCEL). The material must be dredged and transported with care, and must be effectively isolated from the environment upon 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 final disposal.

4.2 *NECESSITY TO PROCEED TO TIER III BIOLOGICAL SCREENING*

There is no need to proceed to Tier III for Category L material. However, the Tier III biological testing must be implemented for further analysis of Category M and certain Category H material. For the latter, Tier III screening is only required if one or more contaminant levels exceed 10 times the LCEL. Decision on the necessity to proceed with biological testing will be made after examining chemical screening results of sediment samples.

For biological screening, composite samples prepared for biological testing shall be mixed from 5 samples of the same Category (M or H) in continuous horizontal profile. Sediment classified as Category M shall be subject to biological screening summarized in *Tables 4.2* below.

Table 4.2 Biological Testing Parameters

Toxicity Test	Methodology	Endpoints Measured	Failure Criteria
10-day burrowing amphipod toxicity test	USEPA (1994)/ PSEP (1995)	Survival	Mean survival in test sediment is significantly different ($p \leq 0.05$) [(c)] from mean survival in reference sediment **and** mean survival in test sediment < 80% of mean survival in reference sediment.
20-day burrowing polychaete toxicity test	PSEP(1995)	Dry Weight[(a)]	Mean dry weight in test sediment is significantly different ($p \leq 0.05$) [(c)] 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) toxicity test	PSEP(1995)	Normality Survival[(b)]	Mean normality survival in test sediment is significantly different ($p \leq 0.05$) [(c)] from mean normality survival in reference sediment **and** mean normality survival in test sediment< 80% of mean normality survival in reference sediment.

Notes:

(a) Dry weight refers to total dry weight after deducting dead and missing worms

(b) Normality survival integrates the normality and survival end points and measures survival of only the normal larvae relative to the starting number.

(c) Statistically significantly differences should be determined using appropriate two-sample comparisons (e.g. t-tests) at a probability of $p \leq 0.05$.

Sediment classified as Category H with one or more contaminant levels exceeding 10 times LCEL shall be subject to biological screening in a diluted manner. The samples shall be prepared as in *Table 4.3* below.

Table 4.3 Sediment Sample Dilution

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

Note:

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

4.3 ELUTRIATE TEST

Preparation of elutriate will be 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, 199*8. The reference sediment and marine water samples will also be tested for comparison.

Six litres (6L) of marine water sample will be required for each elutriate test and blank test. The water samples will be collected from 1 m below the surface, mid-depth and 1 m above the seabed at each grab sampling location. Sufficient quantities of marine water will be collected by a water sampler prior to collection of the sediment samples to avoid disturbance to the seabed. Marine water collected on the same day will be composited on-site as one sample.

Elutriate samples will be prepared by sub-sampling approximately 1 L of sediment sample 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 stirring for 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). Analytical methods and reporting limits are given in *Table 4.4*.

Table 4.4 Analytical Methods for Parameters of Elutriate Tests

Parameters		Instrument	Analytical Method	Reporting Limit
Inorganic chemical test (mg/kg dry weight)	Cd	ICP-MS	USEPA6020	0.1 µg/L
	Cr	ICP-MS	USEPA6020	1 µg/L
	Cu	ICP-MS	USEPA6020	1 µg/L
	Ni	ICP-MS	USEPA6020	1 µg/L
	Pb	ICP-MS	USEPA6020	1 µg/L
	Zn	ICP-MS	USEPA6020	10 µg/L
	Hg	ICP-MS	USEPA6020	0.05 µg/L
	As	ICP-MS	USEPA6020	1 µg/L
	Ag	ICP-MS	USEPA6020	1 µg/L
Organic chemical test	Total PAHs (1)	GC-MSD	USEPA 8270C	3 µg/L
	Total PCBs	GC-ECD/ GC-MSD	USEPA 680 & USEPA 8270/8082	0.03 µg/L
	TBT	GC-MSD	USEPA 8323	0.015 µg/L
Ammonia		FIA	APHA 4500-NH_3H	0.1 mg/L
Nitrite as N		FIA	APHA 4500-NO_3 I	0.05 mg-N/L
Nitrate as N		FIA	APHA 4500-NO_3 I	0.05 mg-N/L
TKN as N		Kjeldahl	APHA 4500-Norg + NH_3C	0.1 mg/L-N/L
Total P		Colorimetric	APHA 4500-P B&E	0.1 mg-P/L
Reactive P		FIA	APAH 4500-P F	10 µg-P/L
Chlorinated Pesticides	Alpha-BHC	GC-MSD/ GC-ECD	USEPA 3510C, 3620B, 8270C, 8081A	0.1 µg/L (individually)
	Beta-BHC			
	Gamma-BHC			
	Delta-BHC			
	Heptachlor			
	Aldrin			
	Heptachlor epoxide			
	Endosulfan			
	p,p'-DDT			
	p,p-DDD			
	p,p-DDE			
	Endoselfan sulfate			

Notes:

(1) Low molecular weight PAHs include acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene
High molecular weight PAHs include benzo[a]anthracene, benzo[a]pyrene, chrysene, dibenzo[a,h]anthracene, fluoranthene, pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, indeno[1,2,3-c,d]pyrene and benzo[g,h,i]perylene

(2) The reporting limit is for total PCB including all 209 congeners.

The tests shall be conducted by a laboratory accredited by HOKLAS. The laboratory shall ensure that all equipment and instruments to be used for analysis meet the requirements and specifications of the reference method procedures. The laboratory shall set upper and lower control limits based on statistical analysis of historical performance data to monitor the acceptability of the QA/QC sample data. All instruments shall be calibrated prior to analysis to monitor sensitivity and precision.

The following QA/QC samples shall be analysed.

- *Laboratory Blanks* - an analyte free matrix to which all reagents are added in the same volumes or proportions as used in the standard sample preparation to monitor contamination introduced in the laboratory (inorganics and organics).

- *Batch Duplicates* - an intra laboratory split sample randomly selected from the sample batch to monitor method precision (intra batch) in a given sample matrix (inorganics only). It is proposed that duplicate samples of 5% from each batch shall be analysed.

- *Reference Materials* - analysis of a material with a known concentration of contamination to determine the accuracy of results in a given matrix (inorganics only) (eg CASS 3).

- *Single Control Samples* - a known, interference-free matrix spiked with target analytes used to monitor laboratory preparation techniques (organics only).

- *Duplicate Control Samples* - multiple single control samples designed to monitor preparation technique reproducibility (organics only).

- *Matrix Spike* - An intra laboratory split sample spiked with the target analytes prior to sample preparation and analysis to determine method bias in a given sample matrix (organics only).

A laboratory blank, a batch duplicate (5% of each batch) and a suitable reference material shall be analysed with each batch of samples. For organics, a matrix spike shall also be analysed with each batch of samples. Each batch will contain a maximum of 20 samples. Results of instrument calibration checks and QA/QC results shall be included in each laboratory report. Data Quality Objectives (DQOs) have been developed to address precision, accuracy and analyte recovery, as described below.

5.1 *PRECISION*

Duplicates (1 in every 10 samples) will be used to monitor the precision of the analysis. If the total number of samples collected is less than 10, at least 1 duplicate sample shall be collected for analysis. Results will be flagged for reference when:

- For all analytes, except metals, with concentration >4x Method Detection Limit (MDL), the duplicate results have more than a 20% Relative Percentage Deviation (RPD);
- For metals with a concentration >4x MDL, the duplicate results have more than a 25% RPD; and
- For all analytes with concentration <4x MDL, the duplicate results will be reported as analysed and no bounds will be quoted.

5.2 *ACCURACY*

Standard and Certified Reference Material (CRM) shall be used to monitor accuracy and precision within and between batches: Results should be flagged for reference if:

- The variation of the standard from its true value is more than 15% (for mercury: 20%).

5.3 *RECOVERY*

Post digest spikes are used to determine the recovery of determinants in complex sample matrices. Results should be rejected if:

- Spike recoveries are more than 25% from the theoretical recovery for waters, sediment and marine biota. An exceptional case would be if the sample concentration is greater than four times the spike value, the spike may be disregarded.

The sediment quality analytical results shall be reported in the EIA report. Information including the following shall be presented under the Waste Management Section:

- The number of sediment samples collected;
- The type of tests performed on each sample (chemical only/ chemical and biological);
- The analytical results of chemical and biological tests (if any);
- The classification (Category L, M or H) of each individual sediment sample; and
- The estimated volume of sediment to be disposed at open sea, dedicated sites and confined marine disposal sites, respectively.

The elutriate test analytical results shall be reported in the Water Quality Section of the EIA report.

Legend

- Proposed GRS at BPPS
- Proposed GRS at LPS
- Indicative Gas Pipeline Route to BPPS
- Indicative Gas Pipeline Route to LPS
- Alternative Shore Approach Route to LPS
- Boundary of HKSAR
- Potential Site for Offshore LNG Terminal

Trenching Method (Indicative) (1)

- Grab Dredging (GD)
- Jetting (J)
- Trailing Suction Hopper Dredging (TSHD)

Section	KP Range	Construction Locations	Trenching Method	Length (km)
BPPS Route	KP 0.00 - 0.50	Soko Island Approach	GD	0.5
	KP 0.50 - 7.90	Soko Island Approach	J	7.4
	KP 7.90 - 12.20	Southwest of Soko Islands	J	4.3
	KP 12.20 - 15.70	Adamasta Channel	TSHD	3.5
	KP 15.70 - 21.40	Southwest Lantau	TSHD	5.7
	KP 21.40 - 26.20	West of Tai O	J	4.8
	KP 26.20 - 31.50	West of HKIA	J	5.3
	KP 31.50 - 37.50	West of Sha Chau	GD	6
	KP 37.50 - 41.10	Lung Kwu Chau to Urmston Anchorage	J	3.6
	KP 41.10 - 42.90	Urmston Road	GD	1.8
	KP 42.90 - 44.90	West of BPPS	J	2
	KP 44.90 - 45.00	Black Point Approach	GD	0.1
LPS Route	NA	South of Shek Kwu Chau to South of Cheung Chau and West of Lamma Island	J	17.3
		LPS Near Shore	GD	0.9

Note:
(1) Not-to-scale. The width of trench is about 30m.

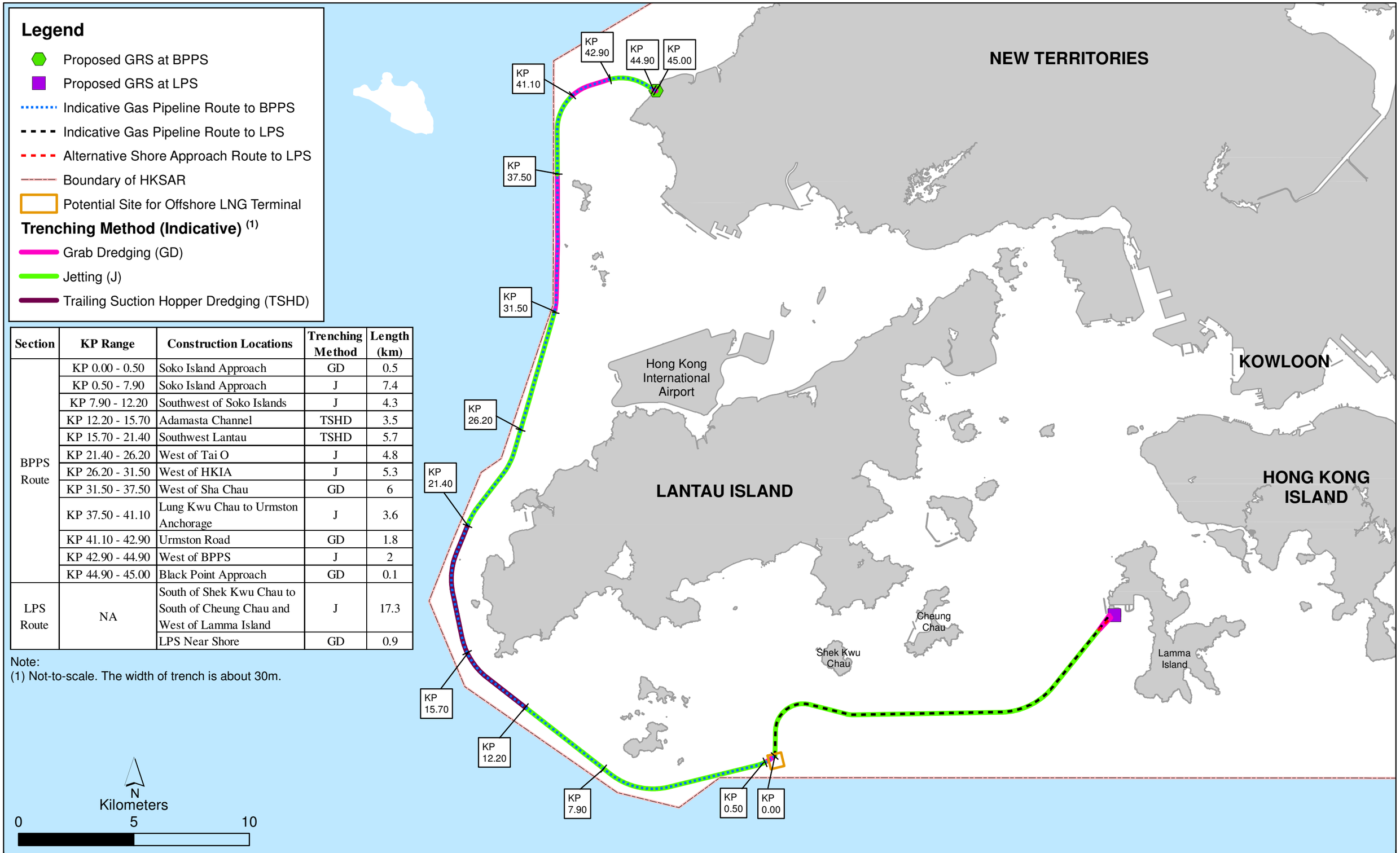


Figure 1.1

Indicative Locations for the Proposed Marine Trenching Work

File: T:\GIS\CONTRACT\0359722\Mxd\0359722_Engineering_Design.mxd
Date: 21/6/2017

Environmental Resources Management

ERM

Legend

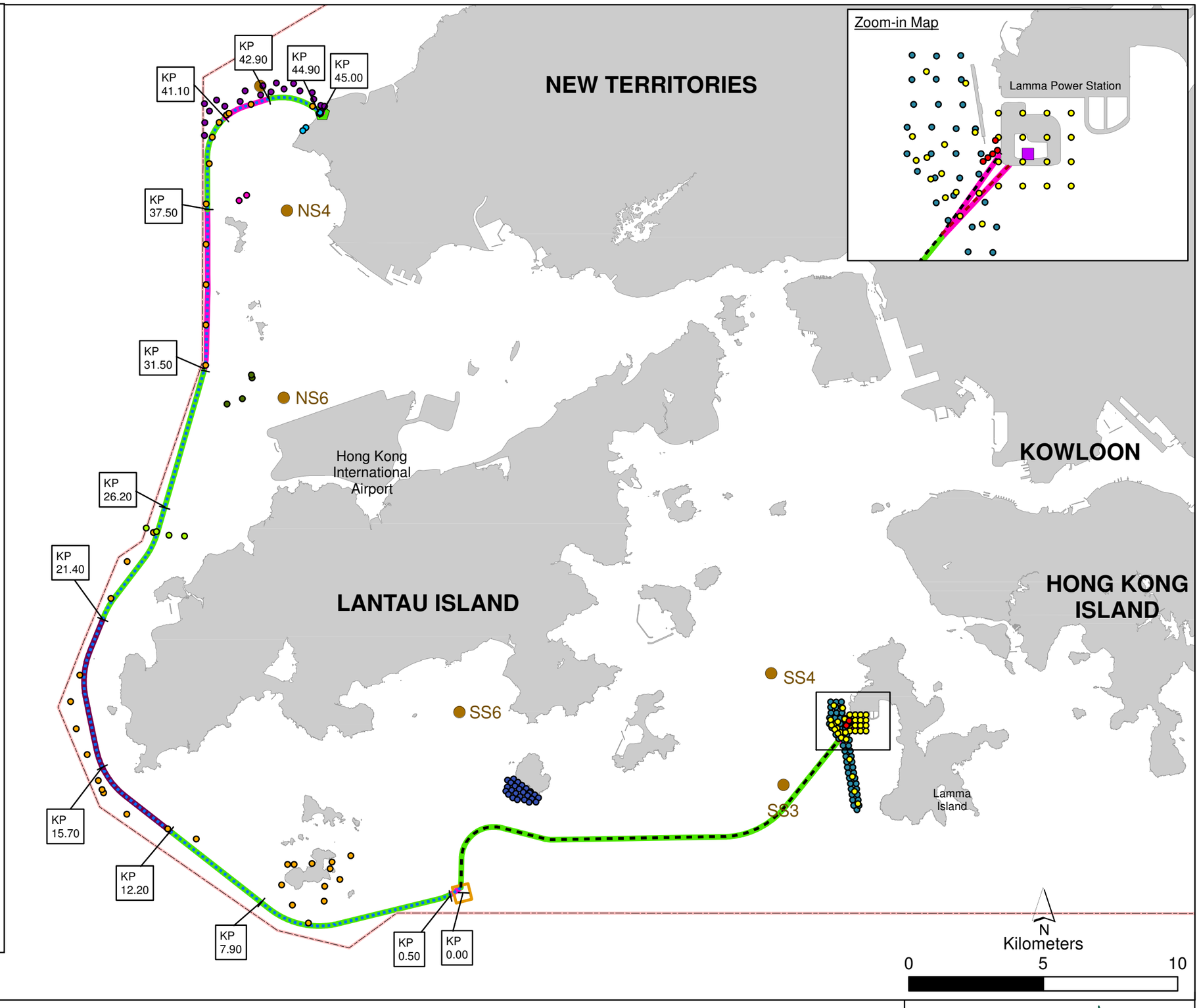
- EPD Sediment Monitoring Station
- Proposed GRS at BPPS
- Proposed GRS at LPS
- Indicative Gas Pipeline Route to LPS
- Alternative Shore Approach Route to LPS
- Indicative Gas Pipeline Route to BPPS
- Boundary of HKSAR
- Potential Site for Offshore LNG Terminal

Trenching Method (Indicative) (1)(2)

- Grab Dredging (GD)
- Jetting (J)
- Trailing Suction Hopper Dredging (TSHD)

Sediment Sampling Location

- Additional Gas-fired Generation Units Project (AEIAR - 197/2016)
- Black Point Gas Supply Project (AEIAR - 150/2010)
- Dredging, Management and Capping of Contaminated Sediment Disposal Facilities to the South of the Brothers and at East of Sha Chau
- Expansion of Hong Kong International Airport into a Three - Runway System (AEIAR - 185/2014)
- Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road (AEIAR-144/2009)
- Development of a 100MW Offshore Wind Farm in Hong Kong (AEIAR - 152/2010)
- Development of the Integrated Waste Management Facilities Phase I (AEIAR - 163/2012)
- Lamma Power Station Navigation Channel Improvement (AEIAR - 69/2003)
- Improvement Dredging of Navigation Channel of Lamma Power Station (EIA-271/2017)
- Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities (AEIAR - 106/2007)



Note:
(1) Details of Dredging Section refer to Figure 1.1
(2) Not-to-scale. The width of trench is about 30m.

Figure 2.1

Baseline Sediment Sampling Location from Previous Projects

File: T:\GIS\CONTRACT\0359722\Mxd\Sediment\0359722_Baseline_Sediment_Quality_All.mxd
Date: 21/6/2017

Environmental Resources Management

ERM

Legend

- EPD Sediment Monitoring Station
- Proposed GRS at BPPS
- Proposed GRS at LPS
- Indicative Gas Pipeline Route to BPPS
- Indicative Gas Pipeline Route to LPS
- Boundary of HKSAR
- Potential Site for Offshore LNG Terminal

NEW TERRITORIES

DS4

NS4

NS6

Hong Kong International Airport

KOWLOON

HONG KONG ISLAND

LANTAU ISLAND

SS4

SS6

SS3

Lamma Island

N

Kilometers

0 5 10

Figure 2.2

EPD Marine Sediment Monitoring Station

File: T:\GIS\CONTRACT\0359722\Mxd\Sediment\0359722_Baseline_Sediment_Quality_Key.mxd
Date: 21/3/2017

Environmental Resources Management

ERM

Legend

- Sediment Sampling Location
- Proposed GRS at BPPS
- Proposed GRS at LPS
- Indicative Gas Pipeline Route to BPPS
- Indicative Gas Pipeline Route to LPS
- Boundary of HKSAR
- Potential Site for Offshore LNG Terminal

GSH8, GSH7, GSH6, GSH9, CP11, GV2, GV1, DC2, GV3, GV4, GV5, GSH10, GSH11, GSH12, GSH13, GSH14, GSH15, GV16, GV17, GV18, GV19, GSH35, GSH36, GSH37, GSH38, GSH20, CP18, GSH21, DC22, GSH39, GSH40, GSH41, GSH42, GSH26, GSH22, GV43, GV44, GSH27, GSH32, GV30, GSH31, GSH28, GSH29

Tuen Mun

Hong Kong International Airport

Lantau Island

N

Kilometers

0 2.5 5

Figure 2.3

Baseline Sediment Sampling Location from Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities (AEIAR - 106/2007)

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Date: 21/3/2017

Environmental Resources Management

ERM

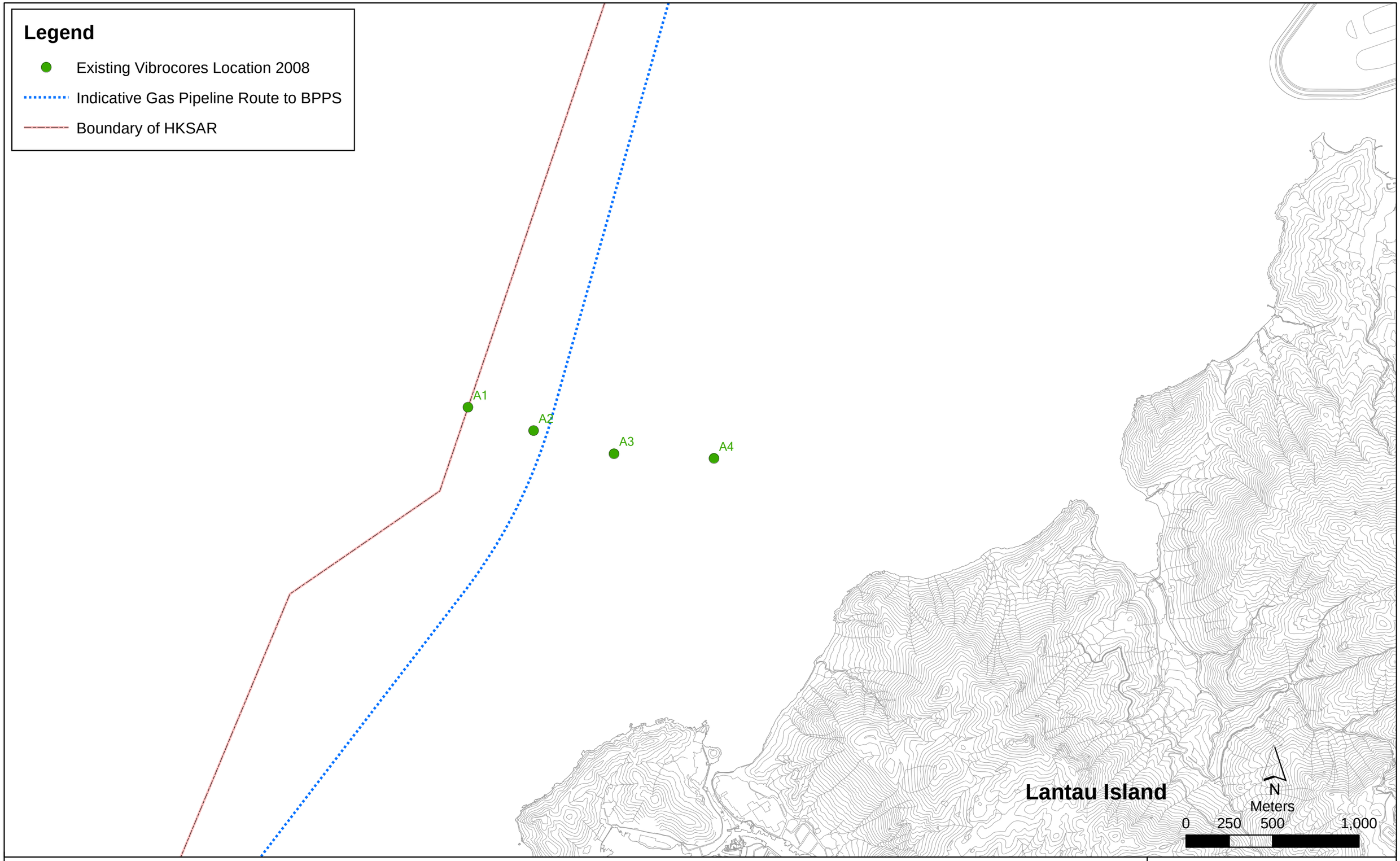


Figure 2.4

Baseline Sediment Sampling Location from Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road (AEIAR-144/2009)

File: T:\GIS\CONTRACT\0359722\Mxd\Sediment\0359722_Baseline_Sediment_Quality_d.mxd
Date: 27/3/2017

Environmental Resources Management

ERM

Legend

- Sediment Sampling Locations
- Proposed GRS at BPPS
- Indicative Gas Pipeline Route to BPPS
- Boundary of HKSAR

DEEP BAY (SHENZHEN WAN)

GS04
GS03
GS05
GSVB5
GS06
GSVB4
GSVB6
GS02
GSVB7
GSVB3
GS07
GSVB8
GS08
GSVB2
GS01
GSVB9
GSVB1
GSVB10
GSVB11
GSVB12
GS09
GS10

N
Meters
0 250 500 1,000

Black Point
(Lan Kok Tsui)

Figure 2.5

Baseline Sediment Sampling Location from Black Point Gas Supply Project (AEIAR - 150/2010)

File: T:\GIS\CONTRACT\0359722\Mxd\Sediment\0359722_Baseline_Sediment_Quality_b.mxd
Date: 21/3/2017

Environmental Resources Management

ERM

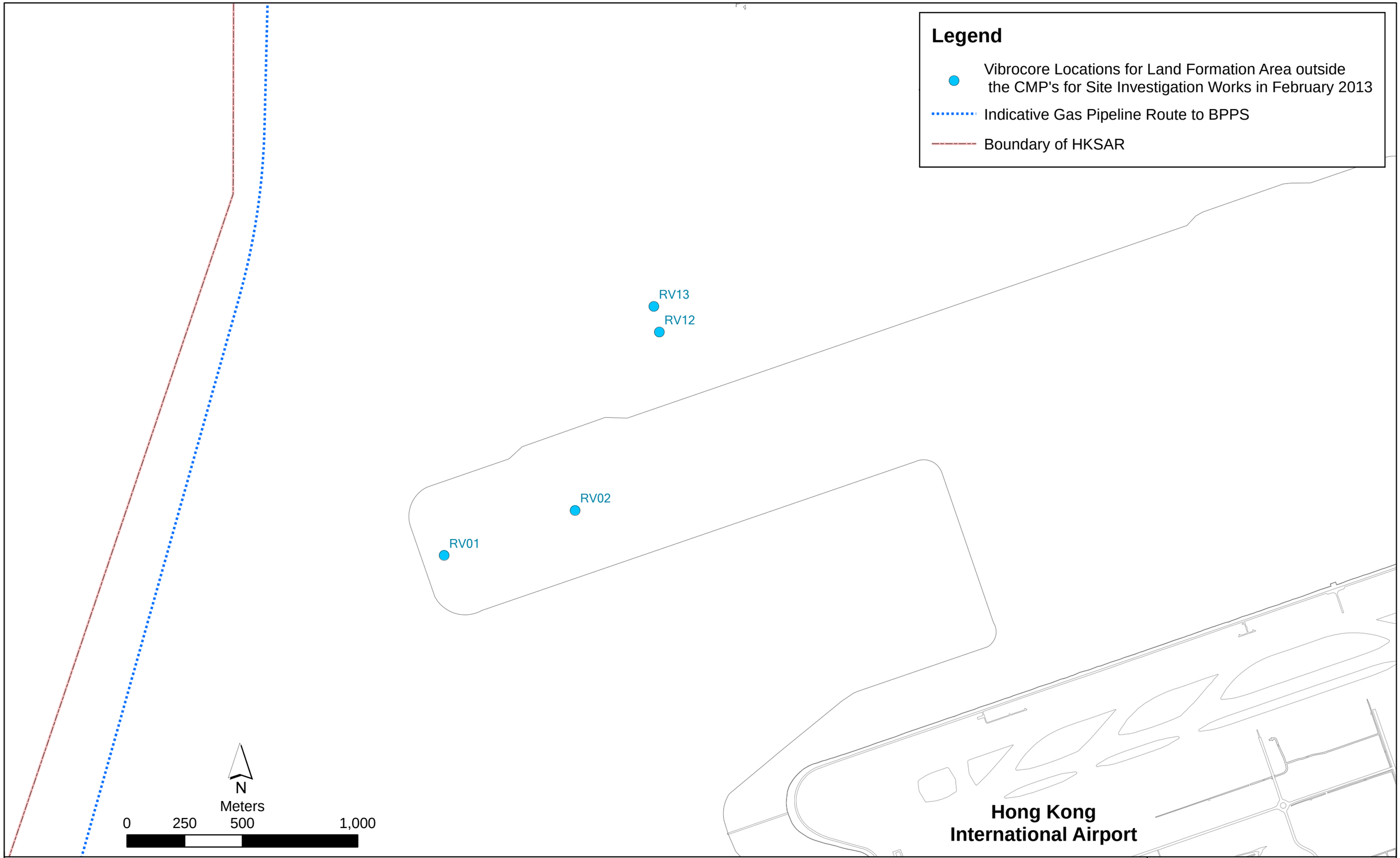


Figure 2.6

Baseline Sediment Sampling Location from
Expansion of Hong Kong International Airport into a Three - Runway System (AEIAR - 185/2014)

File: T:\GIS\CONTRACT\0359722\Mxd\Sediment\0359722_Baseline_Sediment_Quality_c.mxd
Date: 21/3/2017

Environmental Resources Management

ERM

Legend

- Sediment Sampling Location
- Proposed GRS at BPPS
- Indicative Gas Pipeline Route to BPPS

OF1

IT1

IT2

Dumping Area

Fence

Pipeline

HWM

Water Treatment Plant House

Water Tank

Chimney

Generator and Unit Transformer

Turbine Hall

Control Building

Black Point Power Station

Workshop

Switchgear House

Switchgear & Ancillary Block

Strategic Store

Pier

Fuel Tank

Wall

N

Meters

0 100 200 400

Figure 2.7

Baseline Sediment Sampling Location from Additional Gas-fired Generation Units Project (AEIAR - 197/2016)

File: T:\GIS\CONTRACT\0359722\Mxd\Sediment\0359722_Baseline_Sediment_Quality_a.mxd
Date: 21/3/2017

Environmental Resources Management

ERM

Legend

- Proposed GRS at BPPS
- Sediment Sampling Locations
- Indicative Gas Pipeline Route to BPPS
- Boundary of HKSAR

ESC-RFA

SB-RFA

URMSTON ROAD

Black Point
(Lan Kok Tsui)

Black Point Power Station

N

Meters

0 250 500 1,000

Figure 2.8

Cumulative Impacts Sediment Quality Monitoring Stations for Dredging, Management and Capping of Contaminated Sediment Disposal Facilities to the South of the Brothers and at East of Sha Chau

File: T:\GIS\CONTRACT\0359722\Mxd\Sediment\0359722_Baseline_Sediment_Quality_i.mxd
Date: 21/3/2017

Environmental Resources Management

ERM

Legend

- Sediment Sampling Locations (1994)
- Sediment Sampling Locations (1997)
- Sediment Sampling Locations (1998)
- Sediment Sampling Locations (2014)
- Elutriate test sampling location under AEIAR-69/2003
- Elutriate test sampling location under EIA-251/2017
- Proposed GRS at LPS
- Indicative Gas Pipeline Route to LPS

S51 S50 A S52 1 S47 S48 S49 2 S44 S45 S46 A S40 S41 S42 S43 10 A 3 S37 S36 S38 S39 E B B S32 S33 S34 S35 F C 4 D G S29 S30 S31 H S26 5 S27 C S28 S24 S25 B S22 S23 S20 S21 6 S18 S19 S16 S17 S14 S15 7 S12 S13 C S10 S11 S8 S9 8 S6 S7 S4 S5 9 S2 S3 S1

S1 S5 S9 S13 S2 S6 S10 S14 S3 S7 S11 S15 S4 S8 S12 S16

Lamma Island

N

Meters

0 250 500 1,000

Figure 2.9

Baseline Sediment Sampling Location from Lamma Power Station Navigation Channel Improvement (AEIAR - 69/2003) and Improvement Dredging of Navigation Channel of Lamma Power Station (EIA-271/2017)

File: T:\GIS\CONTRACT\0359722\Mxd\Sediment\0359722_Baseline_Sediment_Quality_f.mxd
Date: 4/7/2017

Environmental Resources Management

ERM

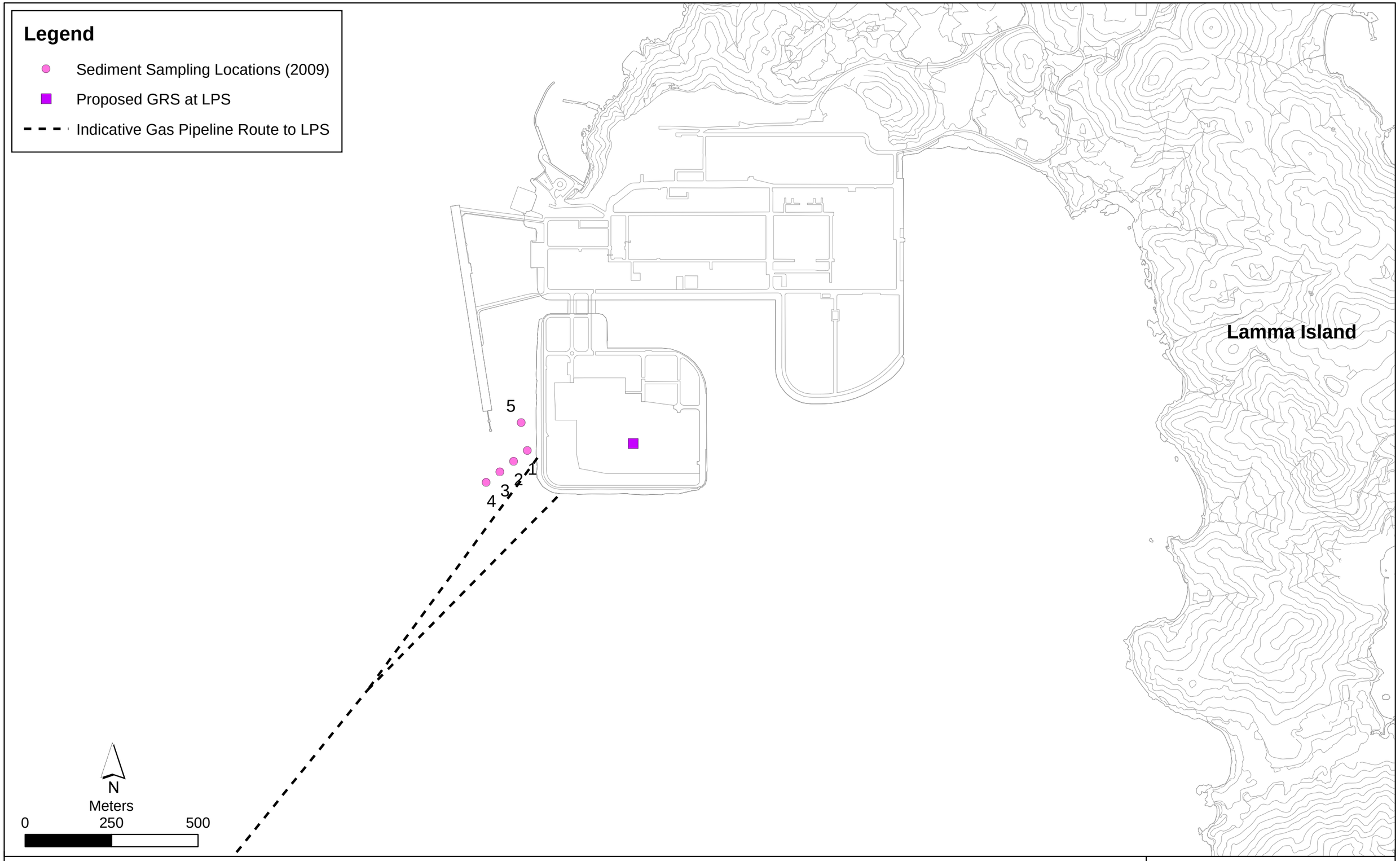


Figure 2.10

Baseline Sediment Sampling Location from Development of a 100MW Offshore Wind Farm in Hong Kong (AEIAR - 152/2010)

File: T:\GIS\CONTRACT\0359722\Mxd\Sediment\0359722_Baseline_Sediment_Quality_h.mxd
Date: 21/3/2017

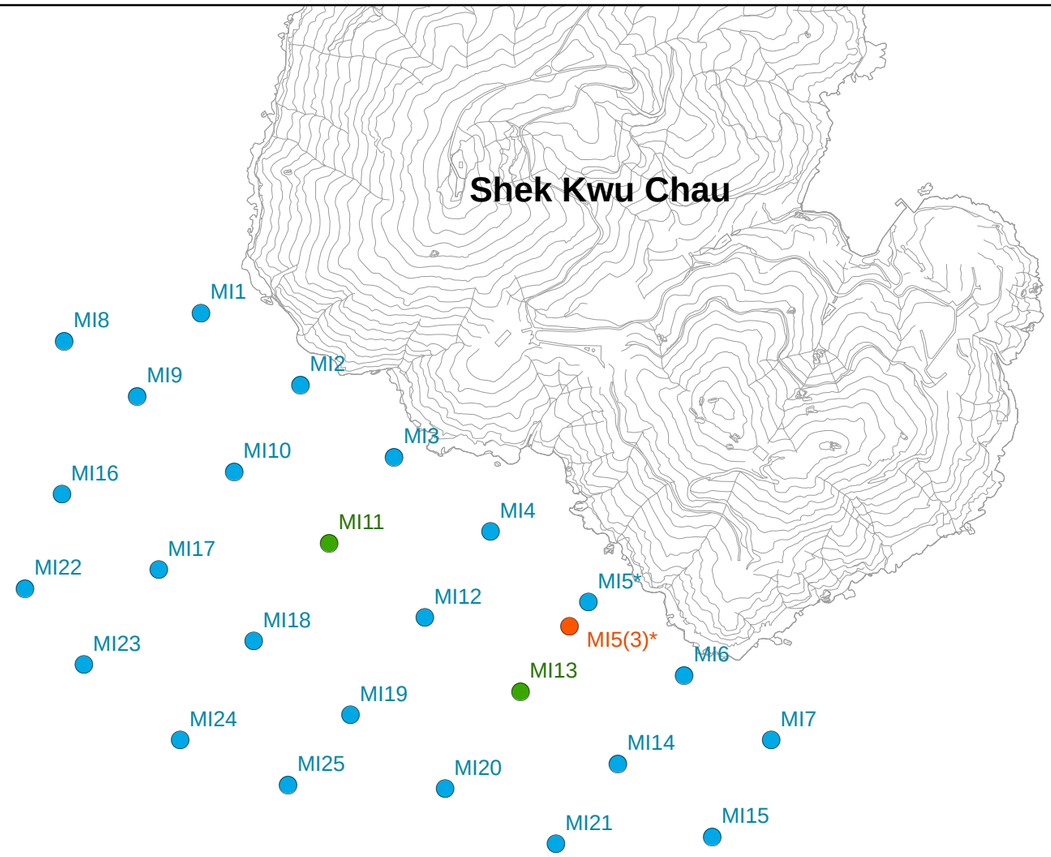
Environmental Resources Management

ERM

Legend

- Grab Sampling Locations for Tier II Screening
- Vibrocore Sampling Locations for Biogas Related Testing Only
- Grab and Vibrocore Sampling Locations for Tier II Screening and/or Biogas Related Testing
- Indicative Gas Pipeline Route to LPS

Note: Vibrocore MI5 was relocated to MI5(3) due to encountering of hard material



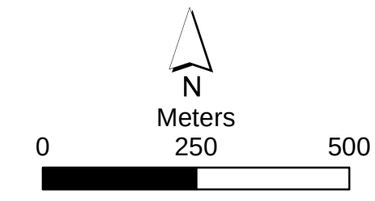


Figure 2.11

Baseline Sediment Sampling Location from Development of the Integrated Waste Management Facilities Phase I (AEIAR - 163/2012)

File: T:\GIS\CONTRACT\0359722\Mxd\Sediment\0359722_Baseline_Sediment_Quality_g.mxd
Date: 21/3/2017

Environmental Resources Management

ERM

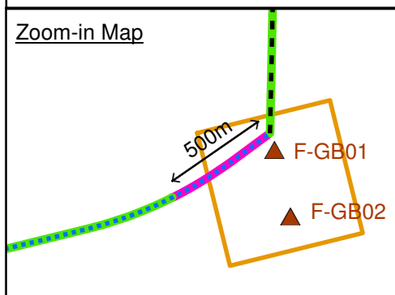
Legend

- Elutriate Sampling Location
- Sediment and Elutriate Sampling Location
- Proposed GRS at BPPS
- Proposed GRS at LPS
- Indicative Gas Pipeline Route to BPPS
- Indicative Gas Pipeline Route to LPS
- Alternative Shore Approach Route to LPS
- Boundary of HKSAR
- Potential Site for Offshore LNG Terminal

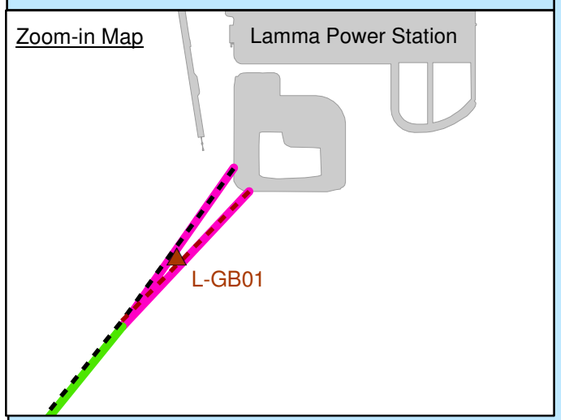
Trenching Method (Indicative)[1][2]

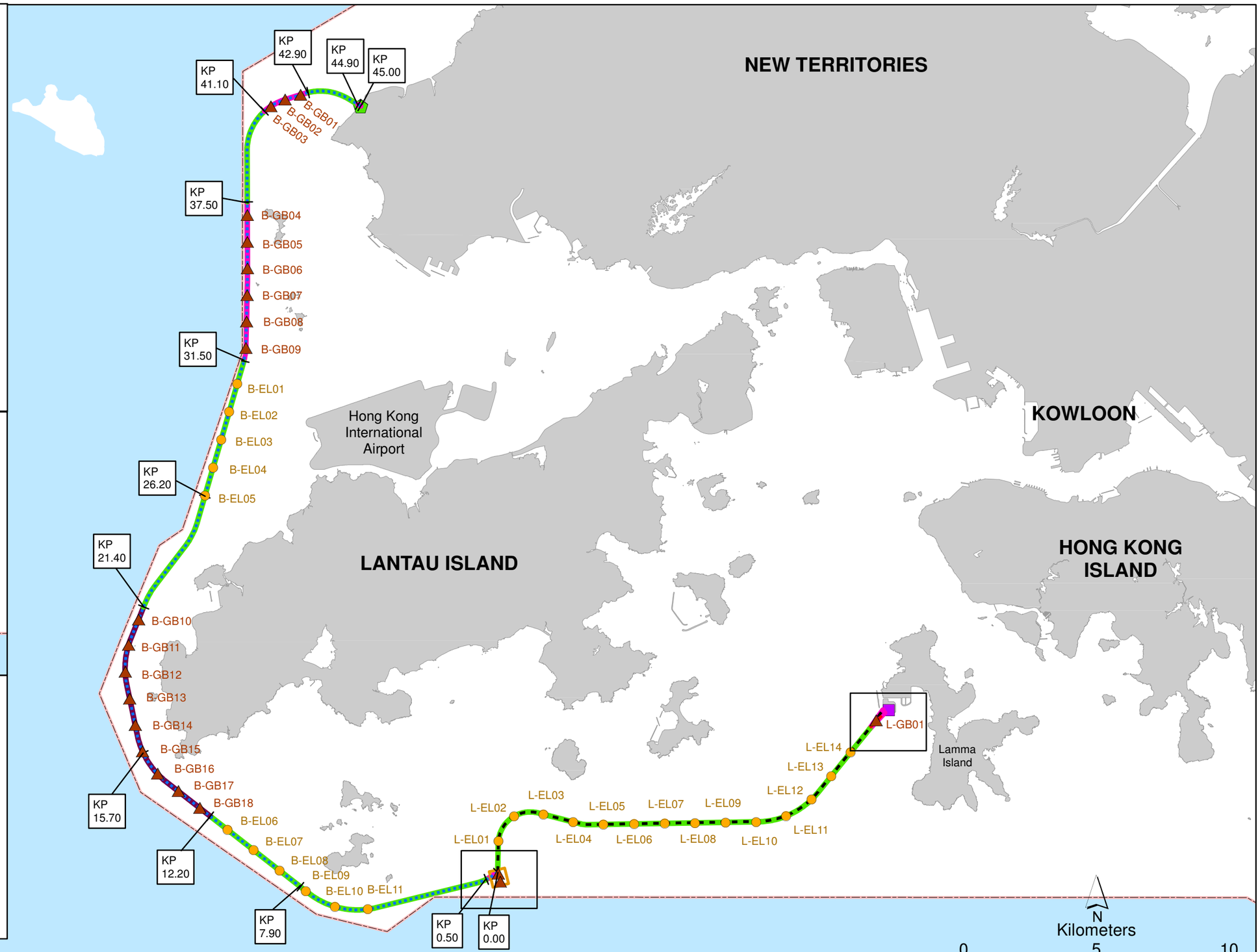
- Grab Dredging (GD)
- Jetting (J)
- Trailing Suction Hopper Dredging (TSHD)

Zoom-in Map



Zoom-in Map





Note:
(1) Details of Dredging Section refer to Figure 1.1
(2) Not-to-scale. The width of trench is about 30m.

Figure 3.1

Proposed Sediment and Elutriate Sampling Locations

File: T:\GIS\CONTRACT\0359722\Mxd\Sediment\0359722_Sediment_Elutriate_Sampling_Location_CAT_02.mxd
Date: 28/6/2017

Environmental Resources Management

ERM

Figure 3.2 Reference Sediment (Grab Sample) Location

File: 0359722
Date: 10/03/2017

Environmental Resources Management

ERM

Annex A

Extracted Sediment Quality Data from Marine Water Quality Report 2015

Summary statistics for bottom sediment quality in the Tolo Harbour and Channel and Southern WCZs, 2011 - 2015

	Tolo Harbour and Channel				Hong Kong Island (South)		West Lamma Channel	
	Harbour Subzone		Buffer Subzone	Channel Subzone				
Parameter	TS2	TS3	TS4	TS5	SS1	SS2	SS3	SS4
Number of samples	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Particle Size Fractionation <63µm (% w/w)	70 (57 - 83)	84 (71 - 94)	71 (54 - 88)	90 (84 - 96)	73 (54 - 95)	79 (62 - 88)	76 (66 - 87)	85 (62 - 95)
Electrochemical Potential (mV)	-300 (-408 - -179)	-314 (-418 - -165)	-293 (-419 - -128)	-333 (-444 - -239)	-246 (-433 - -82)	-265 (-443 - -91)	-247 (-419 - -92)	-249 (-424 - -112)
Total Solids (% w/w)	38 (31 - 47)	33 (28 - 43)	38 (31 - 45)	30 (28 - 33)	58 (53 - 60)	49 (45 - 54)	49 (40 - 54)	45 (42 - 51)
Total Volatile Soilds (% w/w)	9.2 (6.8 - 11.0)	9.3 (6.2 - 11.0)	9.2 (7.1 - 11.0)	10.6 (9.7 - 12.0)	5.4 (3.9 - 6.5)	6.7 (5.9 - 7.2)	6.5 (5.6 - 7.5)	7.0 (6.0 - 9.5)
Chemical Oxygen Demand (mg/kg)	20800 (18000 - 24000)	18200 (15000 - 21000)	16700 (15000 - 18000)	17000 (13000 - 21000)	9250 (7700 - 11000)	11490 (9100 - 15000)	12120 (9400 - 14000)	11560 (9600 - 14000)
Total Carbon (% w/w)	0.8 (0.6 - 1.2)	0.6 (0.6 - 0.8)	0.9 (0.8 - 1.2)	0.9 (0.8 - 1.0)	0.9 (0.8 - 1.0)	0.7 (0.6 - 0.9)	0.8 (0.6 - 1.0)	0.7 (0.6 - 1.1)
Ammonical Nitrogen (mg/kg)	6.08 (1.70 - 12.00)	4.42 (<0.05 - 8.20)	6.41 (1.30 - 14.00)	12.81 (7.90 - 25.00)	5.90 (0.26 - 16.00)	3.91 (1.50 - 7.50)	4.11 (<0.05 - 8.90)	3.80 (1.50 - 8.80)
Total Kjeldahl Nitrogen (mg/kg)	590 (440 - 780)	560 (440 - 690)	620 (400 - 740)	770 (620 - 940)	420 (340 - 500)	520 (360 - 600)	460 (360 - 530)	510 (440 - 610)
Total Phosphorus (mg/kg)	170 (150 - 210)	160 (140 - 190)	180 (140 - 220)	210 (180 - 250)	240 (200 - 290)	230 (170 - 270)	230 (150 - 260)	220 (190 - 250)
Total Sulphide (mg/kg)	130 (1 - 330)	95 (17 - 160)	120 (20 - 270)	110 (42 - 190)	26 (3 - 65)	29 (1 - 65)	29 (11 - 55)	25 (0 - 63)
Total Cyanide (mg/kg)	0.2 (0.1 - 0.2)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.3)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	0.1 (<0.1 - 0.2)	0.1 (<0.1 - 0.2)
Arsenic (mg/kg)	9.3 (7.4 - 11.0)	9.6 (6.6 - 11.0)	8.2 (6.0 - 11.0)	6.0 (5.3 - 6.9)	6.6 (5.9 - 7.0)	8.3 (6.6 - 10.0)	6.8 (4.7 - 8.4)	7.8 (6.2 - 9.9)
Cadmium (mg/kg)	0.6 (0.3 - 0.9)	0.6 (0.5 - 0.8)	0.4 (0.2 - 0.5)	0.3 (0.2 - 0.4)	<0.1 (<0.1 - <0.1)	0.1 (<0.1 - 0.1)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)
Chromium (mg/kg)	23 (15 - 27)	24 (14 - 29)	22 (16 - 27)	33 (26 - 37)	21 (18 - 23)	29 (27 - 32)	29 (21 - 39)	34 (26 - 39)
Copper (mg/kg)	33 (19 - 41)	37 (21 - 49)	22 (14 - 35)	21 (18 - 29)	9 (8 - 11)	18 (15 - 21)	16 (12 - 25)	29 (18 - 35)
Lead (mg/kg)	79 (46 - 96)	86 (50 - 110)	60 (36 - 91)	48 (35 - 54)	25 (22 - 28)	32 (20 - 37)	32 (20 - 46)	39 (25 - 46)
Mercury (mg/kg)	0.10 (<0.05 - 0.38)	0.09 (<0.05 - 0.30)	0.08 (<0.05 - 0.30)	0.08 (<0.05 - 0.30)	0.06 (<0.05 - 0.07)	0.09 (0.05 - 0.13)	0.10 (0.06 - 0.17)	0.13 (0.09 - 0.21)
Nickel (mg/kg)	14 (9 - 16)	14 (9 - 18)	15 (11 - 17)	23 (20 - 26)	15 (14 - 17)	19 (17 - 22)	19 (15 - 26)	21 (17 - 24)
Silver (mg/kg)	0.4 (0.2 - 0.6)	0.5 (0.3 - 0.8)	0.2 (<0.2 - 0.3)	0.2 (<0.2 - 0.3)	<0.2 (<0.2 - <0.2)	0.2 (<0.2 - 0.3)	<0.2 (<0.2 - <0.2)	0.3 (<0.2 - 0.4)
Zinc (mg/kg)	220 (130 - 270)	270 (180 - 360)	140 (110 - 160)	130 (100 - 140)	61 (51 - 68)	90 (82 - 98)	83 (67 - 120)	110 (92 - 120)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) [3]	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [4]	100 (90 - 170)	110 (90 - 240)	100 (90 - 110)	110 (90 - 160)	100 (90 - 180)	100 (90 - 150)	110 (94 - 160)	110 (94 - 160)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	53 (16 - 95)	47 (28 - 84)	46 (17 - 110)	63 (41 - 110)	51 (20 - 230)	92 (27 - 280)	68 (26 - 130)	120 (46 - 210)

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

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

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

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

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

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

Summary statistics for bottom sediment quality in the Southern, Junk Bay and Deep Bay WCZs, 2011 - 2015

	Lantau Island		Junk Bay	Inner Deep Bay		Outer Deep Bay	
Parameter	(East) SS5	(South) SS6	JS2	DS1	DS2	DS3	DS4
Number of samples	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Particle Size Fractionation <63µm (%w/w)	93 (82 - 97)	64 (52 - 86)	92 (80 - 99)	57 (36 - 78)	70 (52 - 86)	81 (44 - 95)	58 (34 - 81)
Electrochemical Potential (mV)	-256 (-408 - -88)	-219 (-379 - -73)	-244 (-395 - -75)	-287 (-401 - -92)	-278 (-420 - -52)	-294 (-396 - -129)	-300 (-398 - -93)
Total Solids (%w/w)	39 (33 - 43)	64 (59 - 68)	42 (40 - 48)	50 (43 - 61)	50 (47 - 55)	48 (40 - 61)	55 (48 - 63)
Total Volatile Soilds (%w/w)	7.5 (5.9 - 8.5)	3.7 (3.4 - 4.3)	7.4 (5.8 - 9.9)	5.8 (3.3 - 7.1)	6.7 (5.6 - 8.4)	6.8 (4.9 - 9.2)	5.7 (4.0 - 8.2)
Chemical Oxygen Demand (mg/kg)	12580 (9800 - 17000)	8750 (5900 - 18000)	13190 (8900 - 17000)	17000 (11000 - 21000)	14200 (12000 - 16000)	10920 (9300 - 13000)	11740 (7400 - 15000)
Total Carbon (%w/w)	0.6 (0.5 - 0.7)	0.5 (0.4 - 0.5)	0.7 (0.6 - 0.8)	0.6 (0.5 - 0.7)	0.6 (0.5 - 0.7)	0.6 (0.5 - 0.9)	0.7 (0.4 - 1.2)
Ammonical Nitrogen (mg/kg)	9.35 (0.79 - 13.00)	6.22 (0.46 - 13.00)	4.22 (0.14 - 9.00)	50.68 (1.10 - 260.00)	3.83 (0.13 - 13.00)	4.14 (0.22 - 23.00)	3.93 (0.23 - 9.20)
Total Kjeldahl Nitrogen (mg/kg)	560 (390 - 660)	360 (280 - 710)	570 (430 - 660)	580 (430 - 780)	430 (270 - 560)	430 (280 - 590)	340 (110 - 560)
Total Phosphorus (mg/kg)	200 (150 - 230)	200 (170 - 240)	210 (180 - 230)	300 (200 - 370)	260 (140 - 370)	240 (160 - 310)	190 (60 - 270)
Total Sulphide (mg/kg)	43 (6 - 93)	4 (1 - 7)	45 (15 - 81)	160 (14 - 360)	16 (3 - 39)	18 (8 - 30)	13 (1 - 59)
Total Cyanide (mg/kg)	0.2 (<0.1 - 0.2)	<0.1 (<0.1 - <0.1)	0.1 (<0.1 - 0.2)	0.2 (<0.1 - 0.3)	0.2 (<0.1 - 0.3)	0.2 (<0.1 - 0.3)	0.1 (<0.1 - 0.2)
Arsenic (mg/kg)	7.2 (5.8 - 8.0)	5.7 (4.4 - 9.0)	7.5 (6.8 - 8.6)	8.8 (6.1 - 12.0)	13.6 (10.0 - 17.0)	11.5 (8.8 - 14.0)	10.0 (6.6 - 15.0)
Cadmium (mg/kg)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)	0.1 (0.1 - 0.2)	0.3 (0.2 - 0.4)	0.2 (0.1 - 0.6)	0.1 (<0.1 - 0.2)	0.1 (<0.1 - 0.2)
Chromium (mg/kg)	37 (25 - 45)	20 (17 - 29)	41 (29 - 47)	38 (21 - 54)	39 (28 - 45)	37 (27 - 44)	29 (17 - 38)
Copper (mg/kg)	34 (26 - 44)	10 (7 - 14)	69 (55 - 78)	55 (22 - 73)	44 (28 - 73)	43 (25 - 61)	29 (13 - 53)
Lead (mg/kg)	47 (32 - 53)	23 (19 - 36)	46 (31 - 55)	44 (27 - 60)	58 (37 - 120)	43 (29 - 59)	35 (23 - 46)
Mercury (mg/kg)	0.14 (0.11 - 0.16)	0.06 (<0.05 - 0.11)	0.22 (0.18 - 0.25)	0.13 (0.07 - 0.26)	0.13 (0.09 - 0.19)	0.11 (0.06 - 0.14)	0.08 (<0.05 - 0.13)
Nickel (mg/kg)	22 (17 - 26)	12 (11 - 19)	20 (15 - 23)	21 (13 - 29)	22 (16 - 29)	23 (17 - 28)	18 (11 - 25)
Silver (mg/kg)	0.4 (0.2 - 0.5)	<0.2 (<0.2 - <0.2)	1.2 (0.9 - 1.6)	0.6 (0.3 - 0.9)	0.4 (<0.2 - 1.1)	0.3 (<0.2 - 0.5)	0.2 (<0.2 - 0.3)
Zinc (mg/kg)	130 (85 - 150)	57 (46 - 99)	140 (97 - 160)	210 (100 - 310)	160 (110 - 270)	120 (87 - 150)	97 (64 - 110)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) [3]	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [4] [6]	120 (90 - 200)	100 (90 - 160)	150 (96 - 350)	110 (95 - 130)	110 (90 - 150)	100 (90 - 120)	110 (90 - 210)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	94 (51 - 190)	30 (19 - 92)	300 (130 - 410)	190 (76 - 690)	80 (23 - 120)	80 (36 - 140)	54 (20 - 93)

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

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

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

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

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

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

Summary statistics for bottom sediment quality in the Port Shelter and Mirs Bay WCZs, 2011 – 2015

	Inner Port Shelter	Outer Port Shelter		Starling Inlet	Crooked Island		Port Island	Mirs Bay (North)
Parameter	**PS3**	**PS5**	**PS6**	**MS1**	**MS2**	**MS7**	**MS17**	**MS3**
Number of samples	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Particle Size Fractionation <63µm (%w/w)	84 (12 - 96)	62 (26 - 81)	72 (48 - 90)	91 (82 - 99)	93 (85 - 99)	92 (86 - 98)	91 (80 - 98)	69 (13 - 91)
Electrochemical Potential (mV)	-283 (-399 - -96)	-280 (-407 - -86)	-272 (-400 - -86)	-234 (-395 - -106)	-265 (-399 - -105)	-324 (-396 - -235)	-217 (-388 - -85)	-229 (-395 - -95)
Total Solids (%w/w)	35 (32 - 40)	48 (41 - 58)	48 (38 - 55)	38 (36 - 42)	33 (30 - 36)	30 (26 - 34)	34 (29 - 41)	46 (36 - 61)
Total Volatile Soilds (%w/w)	11.6 (10.0 - 13.0)	8.6 (6.0 - 11.0)	8.6 (6.5 - 10.0)	7.6 (6.7 - 8.4)	8.8 (7.6 - 10.0)	10.8 (9.0 - 15.0)	9.5 (8.4 - 11.0)	7.2 (3.1 - 8.9)
Chemical Oxygen Demand (mg/kg)	16000 (10000 - 19000)	11150 (7400 - 17000)	11460 (9600 - 14000)	13900 (11000 - 17000)	14600 (11000 - 18000)	15300 (13000 - 21000)	12840 (8400 - 16000)	12500 (10000 - 14000)
Total Carbon (%w/w)	1.1 (1.0 - 1.3)	1.5 (1.1 - 2.1)	1.3 (0.9 - 1.6)	0.6 (<0.1 - 0.8)	0.7 (0.6 - 0.8)	0.8 (0.7 - 1.0)	0.8 (0.6 - 1.1)	0.8 (0.6 - 1.3)
Ammonical Nitrogen (mg/kg)	7.07 (1.90 - 12.00)	6.25 (2.70 - 9.50)	12.12 (0.40 - 60.00)	6.89 (0.13 - 10.00)	8.78 (1.50 - 14.00)	9.94 (7.30 - 13.00)	8.19 (2.20 - 11.00)	10.31 (2.60 - 25.00)
Total Kjeldahl Nitrogen (mg/kg)	680 (310 - 850)	610 (400 - 710)	660 (450 - 770)	570 (460 - 620)	650 (500 - 770)	710 (640 - 800)	710 (580 - 880)	500 (250 - 610)
Total Phosphorus (mg/kg)	200 (160 - 240)	210 (180 - 280)	240 (190 - 280)	190 (170 - 200)	190 (160 - 210)	200 (170 - 240)	210 (190 - 280)	180 (100 - 220)
Total Sulphide (mg/kg)	35 (10 - 69)	22 (2 - 35)	37 (4 - 98)	42 (3 - 88)	55 (1 - 150)	66 (1 - 180)	38 (1 - 88)	51 (1 - 170)
Total Cyanide (mg/kg)	0.1 (<0.1 - 0.2)	0.1 (<0.1 - 0.2)	0.1 (<0.1 - 0.2)	0.2 (<0.1 - 0.3)	0.2 (<0.1 - 0.2)	0.2 (0.1 - 0.2)	0.2 (<0.1 - 0.3)	0.1 (<0.1 - 0.3)
Arsenic (mg/kg)	5.4 (3.6 - 6.0)	4.8 (3.2 - 6.1)	5.8 (5.2 - 7.2)	8.3 (7.1 - 9.5)	7.3 (6.0 - 8.6)	6.8 (5.8 - 7.8)	6.2 (5.1 - 7.0)	5.5 (3.8 - 6.4)
Cadmium (mg/kg)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)	0.2 (0.1 - 0.3)	0.3 (0.1 - 0.4)	0.3 (0.2 - 0.5)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - <0.1)
Chromium (mg/kg)	25 (16 - 28)	22 (14 - 31)	24 (20 - 28)	29 (19 - 36)	33 (27 - 39)	32 (27 - 36)	32 (26 - 35)	25 (21 - 33)
Copper (mg/kg)	20 (10 - 26)	11 (6 - 16)	11 (9 - 14)	23 (17 - 28)	22 (19 - 25)	21 (13 - 26)	15 (12 - 17)	10 (7 - 14)
Lead (mg/kg)	35 (21 - 44)	28 (18 - 38)	31 (24 - 40)	45 (34 - 54)	46 (34 - 50)	40 (27 - 45)	42 (34 - 46)	27 (20 - 33)
Mercury (mg/kg)	0.08 (0.06 - 0.10)	0.05 (<0.05 - 0.06)	0.05 (<0.05 - 0.06)	0.06 (<0.05 - 0.07)	0.06 (<0.05 - 0.07)	0.07 (0.05 - 0.10)	0.05 (<0.05 - 0.06)	<0.05 (<0.05 - <0.05)
Nickel (mg/kg)	16 (11 - 19)	16 (10 - 21)	17 (15 - 21)	17 (12 - 20)	22 (18 - 25)	22 (18 - 25)	22 (18 - 25)	17 (13 - 21)
Silver (mg/kg)	0.2 (<0.2 - 0.3)	<0.2 (<0.2 - 0.2)	<0.2 (<0.2 - <0.2)	0.5 (0.3 - 0.8)	0.3 (0.2 - 0.4)	0.2 (<0.2 - 0.3)	0.2 (<0.2 - 0.3)	<0.2 (<0.2 - <0.2)
Zinc (mg/kg)	91 (55 - 120)	69 (43 - 110)	71 (51 - 100)	100 (69 - 130)	110 (87 - 130)	96 (82 - 110)	94 (75 - 110)	66 (52 - 89)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) [3]	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [4]	130 (90 - 230)	100 (90 - 150)	120 (90 - 200)	120 (90 - 200)	140 (90 - 350)	130 (90 - 220)	120 (90 - 180)	100 (90 - 130)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	73 (32 - 160)	38 (18 - 78)	45 (18 - 91)	52 (29 - 90)	56 (32 - 88)	66 (31 - 110)	47 (31 - 92)	33 (18 - 65)

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

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

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

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

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

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

Summary statistics for bottom sediment quality in the Mirs Bay WCZ, 2011 - 2015

Parameter	Mirs Bay (North) MS4	Mirs Bay (North) MS5	Long Harbour MS6	Waglan Island MS8	Mirs Bay (South) MS13	Mirs Bay (Central) MS14	Mirs Bay (Central) MS15	Mirs Bay (Central) MS16
Number of samples	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Particle Size Fractionation <63µm (% w/w)	83 (18 - 95)	86 (77 - 94)	93 (83 - 97)	87 (52 - 97)	92 (83 - 97)	90 (75 - 99)	90 (86 - 98)	78 (64 - 95)
Electrochemical Potential (mV)	-212 (-392 - -68)	-194 (-383 - -95)	-261 (-375 - -115)	-202 (-366 - -79)	-223 (-360 - -110)	-219 (-389 - -112)	-224 (-384 - -106)	-210 (-380 - -99)
Total Solids (% w/w)	39 (34 - 53)	41 (35 - 45)	31 (28 - 36)	46 (38 - 51)	49 (44 - 53)	51 (48 - 53)	51 (44 - 54)	54 (49 - 57)
Total Volatile Soilds (% w/w)	8.1 (5.6 - 9.4)	7.9 (6.6 - 10.0)	10.6 (9.3 - 12.0)	6.6 (5.8 - 7.4)	6.4 (5.7 - 7.7)	5.9 (5.1 - 6.7)	6.0 (5.4 - 6.7)	6.0 (5.4 - 6.8)
Chemical Oxygen Demand (mg/kg)	12100 (10000 - 14000)	12050 (9500 - 14000)	14900 (12000 - 17000)	10130 (8600 - 12000)	8500 (6400 - 10000)	8090 (5200 - 9600)	8140 (5700 - 10000)	8730 (6300 - 11000)
Total Carbon (% w/w)	0.7 (0.7 - 0.9)	0.7 (0.6 - 0.8)	0.9 (0.7 - 1.2)	0.6 (0.5 - 0.7)	0.6 (0.5 - 0.7)	0.6 (0.5 - 0.6)	0.6 (0.5 - 0.7)	0.7 (0.6 - 0.8)
Ammonical Nitrogen (mg/kg)	5.73 (0.21 - 8.80)	5.97 (2.20 - 12.00)	9.17 (5.70 - 11.00)	3.52 (1.60 - 7.30)	2.52 (0.68 - 9.30)	2.66 (0.74 - 6.30)	3.35 (1.20 - 7.60)	3.84 (2.00 - 7.70)
Total Kjeldahl Nitrogen (mg/kg)	640 (500 - 730)	600 (450 - 670)	740 (680 - 810)	500 (400 - 550)	480 (320 - 550)	490 (380 - 550)	500 (420 - 560)	470 (350 - 540)
Total Phosphorus (mg/kg)	210 (190 - 240)	210 (180 - 240)	210 (190 - 220)	220 (190 - 240)	240 (160 - 260)	240 (190 - 270)	250 (210 - 270)	240 (160 - 280)
Total Sulphide (mg/kg)	16 (3 - 51)	21 (4 - 66)	44 (3 - 83)	14 (6 - 30)	8 (2 - 14)	10 (2 - 35)	8 (2 - 19)	10 (4 - 23)
Total Cyanide (mg/kg)	0.1 (<0.1 - 0.3)	0.1 (<0.1 - 0.2)	0.2 (<0.1 - 0.3)	0.1 (<0.1 - 0.2)	0.1 (<0.1 - 0.2)	<0.1 (<0.1 - 0.1)	0.1 (<0.1 - 0.2)	<0.1 (<0.1 - 0.1)
Arsenic (mg/kg)	6.8 (6.1 - 7.8)	6.7 (6.0 - 7.3)	5.9 (5.2 - 6.5)	7.3 (6.6 - 7.9)	7.7 (6.3 - 8.7)	7.3 (5.6 - 8.7)	6.8 (4.9 - 8.1)	6.8 (5.2 - 9.9)
Cadmium (mg/kg)	0.1 (<0.1 - 0.2)	<0.1 (<0.1 - <0.1)	0.1 (<0.1 - 0.1)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)
Chromium (mg/kg)	33 (29 - 38)	28 (24 - 31)	31 (28 - 35)	32 (28 - 33)	30 (24 - 34)	29 (19 - 33)	28 (19 - 35)	26 (18 - 40)
Copper (mg/kg)	14 (10 - 16)	13 (10 - 16)	17 (14 - 20)	13 (10 - 18)	12 (9 - 17)	11 (6 - 16)	10 (7 - 16)	9 (6 - 14)
Lead (mg/kg)	35 (29 - 39)	36 (26 - 41)	40 (32 - 45)	33 (30 - 37)	31 (25 - 35)	30 (21 - 34)	29 (22 - 33)	29 (22 - 35)
Mercury (mg/kg)	0.05 (<0.05 - 0.06)	0.05 (<0.05 - 0.06)	0.06 (<0.05 - 0.08)	0.05 (<0.05 - 0.06)	0.05 (<0.05 - 0.07)	<0.05 (<0.05 - <0.05)	<0.05 (<0.05 - <0.05)	<0.05 (<0.05 - 0.05)
Nickel (mg/kg)	22 (18 - 24)	21 (17 - 24)	22 (19 - 25)	22 (20 - 24)	22 (19 - 23)	20 (14 - 23)	20 (13 - 24)	18 (12 - 28)
Silver (mg/kg)	<0.2 (<0.2 - <0.2)	<0.2 (<0.2 - 0.2)	<0.2 (<0.2 - <0.2)	<0.2 (<0.2 - <0.2)	<0.2 (<0.2 - <0.2)	<0.2 (<0.2 - <0.2)	<0.2 (<0.2 - <0.2)	<0.2 (<0.2 - <0.2)
Zinc (mg/kg)	83 (71 - 100)	82 (66 - 92)	100 (92 - 120)	79 (72 - 89)	77 (62 - 86)	72 (52 - 83)	68 (50 - 75)	63 (48 - 77)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) [3]	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [4]	130 (90 - 250)	93 (90 - 100)	110 (90 - 140)	130 (90 - 260)	140 (90 - 330)	110 (90 - 200)	120 (90 - 220)	110 (90 - 160)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	49 (30 - 100)	35 (26 - 56)	55 (29 - 85)	70 (27 - 310)	44 (27 - 91)	30 (17 - 49)	32 (20 - 67)	30 (18 - 53)

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

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

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

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

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

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

Summary statistics for bottom sediment quality in the North Western and Western Buffer WCZs, 2011 - 2015

Parameter	Pearl Island NS2	Pillar Point NS3	Urmston Road NS4	Chek Lap Kok (North) NS6	Tsing Yi (South) WS1	Hong Kong Island (West) WS2
Number of samples	**10**	**10**	**10**	**10**	**10**	**10**
Particle Size Fractionation <63µm (%w/w)	57 (18 - 89)	53 (20 - 85)	54 (13 - 88)	66 (29 - 90)	75 (62 - 84)	87 (78 - 97)
Electrochemical Potential (mV)	-204 (-380 - -80)	-236 (-390 - -111)	-271 (-428 - -83)	-235 (-380 - -81)	-274 (-398 - -135)	-232 (-347 - -88)
Total Solids (%w/w)	50 (39 - 65)	53 (40 - 63)	55 (43 - 65)	57 (42 - 70)	47 (44 - 51)	45 (43 - 48)
Total Volatile Soilds (%w/w)	6.4 (4.8 - 9.2)	6.4 (4.9 - 9.6)	5.7 (4.2 - 7.1)	5.0 (3.0 - 7.2)	6.7 (6.2 - 7.3)	6.7 (5.9 - 7.6)
Chemical Oxygen Demand (mg/kg)	10890 (9000 - 12000)	11840 (9400 - 14000)	12610 (9100 - 17000)	11160 (8600 - 14000)	13900 (12000 - 17000)	11940 (9400 - 15000)
Total Carbon (%w/w)	0.9 (0.5 - 1.3)	0.8 (0.5 - 1.2)	0.6 (<0.1 - 0.8)	0.7 (0.4 - 1.2)	0.8 (0.7 - 0.9)	0.6 (0.5 - 0.7)
Ammonical Nitrogen (mg/kg)	5.57 (0.92 - 13.00)	7.82 (0.07 - 31.00)	3.48 (1.20 - 7.90)	10.47 (0.07 - 76.00)	7.95 (1.50 - 15.00)	5.57 (0.69 - 12.00)
Total Kjeldahl Nitrogen (mg/kg)	390 (300 - 580)	410 (250 - 570)	380 (260 - 600)	370 (180 - 510)	500 (400 - 590)	520 (430 - 620)
Total Phosphorus (mg/kg)	200 (150 - 230)	210 (160 - 260)	200 (140 - 260)	190 (100 - 260)	210 (180 - 250)	210 (180 - 240)
Total Sulphide (mg/kg)	37 (1 - 190)	39 (0 - 130)	64 (5 - 220)	21 (0 - 51)	100 (4 - 160)	31 (5 - 72)
Total Cyanide (mg/kg)	0.2 (<0.1 - 0.3)	0.1 (<0.1 - 0.2)	0.2 (<0.1 - 0.3)	0.1 (<0.1 - 0.2)	0.2 (<0.1 - 0.2)	0.1 (<0.1 - 0.2)
Arsenic (mg/kg)	8.2 (4.5 - 11.0)	10.5 (7.7 - 14.0)	10.3 (7.8 - 13.0)	12.0 (7.1 - 17.0)	8.0 (6.8 - 8.8)	7.8 (7.1 - 8.9)
Cadmium (mg/kg)	0.1 (<0.1 - 0.1)	0.1 (<0.1 - 0.1)	0.1 (<0.1 - 0.1)	0.1 (<0.1 - 0.2)	0.1 (<0.1 - 0.1)	<0.1 (<0.1 - <0.1)
Chromium (mg/kg)	29 (14 - 37)	30 (19 - 38)	29 (23 - 36)	28 (17 - 40)	35 (25 - 58)	34 (27 - 40)
Copper (mg/kg)	29 (13 - 46)	26 (13 - 38)	27 (17 - 38)	19 (9 - 34)	46 (31 - 62)	26 (18 - 33)
Lead (mg/kg)	34 (20 - 45)	36 (26 - 47)	35 (29 - 40)	33 (20 - 43)	36 (29 - 40)	35 (24 - 41)
Mercury (mg/kg)	0.11 (<0.05 - 0.16)	0.11 (0.07 - 0.15)	0.09 (0.06 - 0.12)	0.08 (<0.05 - 0.13)	0.22 (0.10 - 0.88)	0.13 (0.07 - 0.47)
Nickel (mg/kg)	17 (9 - 22)	18 (11 - 23)	17 (13 - 23)	17 (11 - 23)	18 (14 - 22)	21 (17 - 25)
Silver (mg/kg)	0.3 (<0.2 - 0.5)	0.3 (<0.2 - 0.4)	0.2 (<0.2 - 0.3)	<0.2 (<0.2 - 0.2)	0.6 (0.4 - 0.8)	0.3 (<0.2 - 0.3)
Zinc (mg/kg)	98 (50 - 120)	93 (63 - 120)	98 (83 - 110)	80 (42 - 110)	110 (83 - 130)	100 (79 - 110)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) [3]	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [4]	120 (90 - 340)	140 (90 - 500)	120 (90 - 240)	100 (90 - 150)	110 (90 - 170)	110 (90 - 180)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	77 (36 - 150)	160 (41 - 690)	86 (24 - 130)	40 (17 - 64)	230 (100 - 570)	87 (24 - 220)

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

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

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

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

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

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

Annex B

Sediment and Elutriate Testing Summary Table

Table 1 Sediment Sampling Summary Table

Section	Sample ID	Type of Sampling	Sampling Preservation	Range of Parameters	Chemical Testing Methods	Biological Testing Method (1)			
						Toxicity Test	Methodology	Endpoints Measured	Failure Criteria
BPPS	B-GB01	Surface Grab	All samples will be double bagged and labelled internally and externally with indelible ink.	Metal		10-day burrowing amphipod toxicity test	USEPA (1994)/ PSEP (1995)	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.
	B-GB02	Surface Grab		Cadmium	6020A or 7000A or 7131A				
	B-GB03	Surface Grab		Chromium	6010C or 7000A or 7190				
`	B-GB04	Surface Grab		Copper	6010C or 7000A or 7210				
	B-GB05	Surface Grab		Mercury	7471A				
	B-GB06	Surface Grab		Nickel	6010C or 7000A or 7520				
	B-GB07	Surface Grab	Chain of custody forms will detail all information relevant to the samples including sample location, date and time of sampling.	Lead	6010C or 7000A or 7420	20-day burrowing polychaete toxicity test	PSEP(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.
	B-GB08	Surface Grab		Silver	6020A or 7000A or 7761				
	B-GB09	Surface Grab		Zinc	6010C or 7000A or 7950				
	B-GB10	Surface Grab		Metalloid					
	B-GB11	Surface Grab		Arsenic	6020A or 7000A or 7061A				
	B-GB12	Surface Grab		Organic-PAHs					
	B-GB13	Surface Grab		Low Molecular Weight PAHs	8260B or 8270C	48-96 hour larvae (bivalve or echinoderm) toxicity test	PSEP(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.
	B-GB14	Surface Grab	Samples will be delivered to a laboratory, whose chemical and biological tests have been accredited by HOKLAS, as soon as possible after collection. Samples will be stored at 4°C in the dark during transportation and at the laboratory storage prior to testing.	High Molecular Weight PAHs	8260B or 8270C				
	B-GB15	Surface Grab		Organic-non-PAHs					
	B-GB16	Surface Grab		Total PCBs	8082				
				Organometallics					
Double Berth Jetty	F-GB01	Surface Grab		Tributyltin	Krone et al. (1989) GC/MS/UNEP/IOC/ IAEA				
	F-GB02	Surface Grab		Ancillary Parameters					
				Grain size distribution	BS1377 (1975)				
LPS	L-GB01	Surface Grab		Total Organic Carbon	APHA 5310B				
				Ammonia	APHA 17e 4500 NH3-B,E				
				Moisture Content	AS1289.1-1991, test 2.3.2A				
				Salinity of Pore Water					

Note: (1) Sediment quality categorized as Cat. M and Cat.H during Tier II screening will proceed to Tier III Biological Screening for identifying the most appropriate disposal option for Cat.M and Cat.H sediment.

Table 2 Elutriate Sampling Summary Table

Section	Sample ID	Type of Sampling	Sampling Preservation	Range of Parameters	Analytical Methods
BPPS	B-GB01	Surface Grab	All sediment samples will be double bagged and	Inorganic chemical test	
	B-GB02	Surface Grab	labelled internally and externally with indelible	Cd	USEPA6020
	B-GB03	Surface Grab	ink. Similarly, marine water samples will be	Cr	USEPA6020
	B-GB04	Surface Grab	stored in bottles provided by the laboratory with	Cu	USEPA6020
	B-GB05	Surface Grab	appropriate labelling.	Ni	USEPA6020
	B-GB06	Surface Grab		Pb	USEPA6020
	B-GB07	Surface Grab	Chain of custody forms will detail all information	Zn	USEPA6020
	B-GB08	Surface Grab	relevant to the samples including sample	Hg	USEPA6020
	B-GB09	Surface Grab	location, date and time of sampling.	As	USEPA6020
	B-GB10	Surface Grab		Ag	USEPA6020
	B-GB11	Surface Grab	Samples will be delivered to a laboratory, whose	Organic chemical test	USEPA 8270C
	B-GB12	Surface Grab	chemical tests have been accredited by HOKLAS,	Total PAHs (1)	USEPA 680 & USEPA 8270/8082
	B-GB13	Surface Grab	as soon as possible after collection.	Total PCBs	USEPA 8323
	B-GB14	Surface Grab		TBT	APHA 4500-NH_3H
	B-GB15	Surface Grab	Samples will be stored at 4°C in the dark during	Ammonia	APHA 4500-NO_3 I
	B-GB16	Surface Grab	transportation and at the laboratory storage prior	Nitrite as N	APHA 4500-NO_3 I
	B-EL01	Surface Grab	to testing.	Nitrate as N	APHA 4500-Norg + NH_3C
	B-EL02	Surface Grab		TKN as N	APHA 4500-P B&E
	B-EL03	Surface Grab		Total P	APAH 4500-P F
	B-EL04	Surface Grab		Reactive P	
	B-EL05	Surface Grab		Chlorinated Pesticides	USEPA 3510C, 3620B, 8270C, 8081A
	B-EL06	Surface Grab		Alpha-BHC	
	B-EL07	Surface Grab		Beta-BHC	
	B-EL08	Surface Grab		Gamma-BHC	
	B-EL09	Surface Grab		Delta-BHC	
	B-EL10	Surface Grab		Heptachlor	
	B-EL11	Surface Grab		Aldrin	
				Heptachlor epoxide	
Double Berth Jetty	F-GB01	Surface Grab		Endosulfan	
	F-GB02	Surface Grab		p,p'-DDT	
				p,p-DDD	
LPS	L-EL01	Surface Grab		p,p-DDE	
	L-EL02	Surface Grab		Endoselfan sulfate	
	L-EL03	Surface Grab			

Section	Sample ID	Type of Sampling	Sampling Preservation	Range of Parameters	Analytical Methods
	L-EL04	Surface Grab			
	L-EL05	Surface Grab			
	L-EL06	Surface Grab			
	L-EL07	Surface Grab			
	L-EL08	Surface Grab			
	L-EL09	Surface Grab			
	L-EL10	Surface Grab			
	L-EL11	Surface Grab			
	L-EL12	Surface Grab			
	L-EL13	Surface Grab			
	L-EL14	Surface Grab			
	L-GB01	Surface Grab			

Annex C

Review of Existing Data on Elutriate Test Results

1 REVIEW OF EXISTING DATA ON ELUTRIATE TEST RESULTS

1.1 INTRODUCTION

This *Annex* details the findings on the review of available elutriate test data, as well as the corresponding considerations on the sediment sampling and laboratory testing for elutriate test proposed to be conducted for this Project.

1.2 REVIEW OF AVAILABLE INFORMATION FROM APPROVED EIAS

Projects with elutriate test results and are in the vicinity of this Project are summarized in *Table 1.1*. A summary of elutriate test results from the approved EIAs of these projects is provided in *Table 1.2*. With a few exceptions, the coverage of elutriate data by these projects is similar to that reviewed under *Sections 2.4* and *2.5* of the *Marine Sediment Sampling and Testing Plan*. References are made to the corresponding figures in the *Marine Sediment Sampling and Testing Plan* to show the corresponding locations of the sampling stations for sediment elutriate test.

Table 1.1 Projects Nearby with Elutriate Test Results

Project (EIA Ref.)	Location	Maximum Dredging Depth (m)	Sediment Sampling Method for Elutriate Test	Nearby KP of this Project
Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities Environmental Impact Assessment (AEIAR-106/2007)	From Black Point to South Soko	5 (dredging for subsea pipeline)	Surface Grab	12.20-15.70, 21.40-26.20, 31.50-45.00
Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road (AEIAR-144/2009)	West to Lantau and Hong Kong International Airport (HKIA)	>10 (for piling)	Depth-profiled Vibrocore	26.20
Black Point Gas Supply Project EIA (AEIAR-150/2010)	Black Point and Urmston Road	5 (dredging for subsea pipeline)	Surface Grab	41.10-45.00
Additional Gas-fired Generation Units Project EIA (AEIAR-197/2016)	Off Black Point	2	Surface Grab	45.00
Lamma Power Station Navigation Channel Improvement EIA (AEIAR-69/2003)	West of Lamma	2.5	Surface Grab	Not applicable
Improvement Dredging for Lamma Power Station Navigation Channel (EIA-251/2017)	West of Lamma	<2	Surface Grab	Not applicable

Table 1.2 Results of Elutriate Testing for Marine Sediments conducted under various Past Approved EIAs in the vicinity of the Project

Station ID	Method [1]	Depth [2]	Nutrient						Heavy Metals									Aggregate Organics		PCB	PAHs		TBT	Chlorinated Pesticides																			
Parameters			NH_3-N	Reactive P / Ortho. P	TKN	TP	NO_3-N	NO_2-N	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	BOD	COD	Total PCB	Low M.W. PAHs	High M.W. PAHs	TBT	alpha-BHC	beta-BHC	delta-BHC	gamma-BHC	Heptachlor	Aldrin	Heptachlor epoxide	Endosulfan 1	Dieldrin	4,4'-DDE	Endrin	Endosulfan 2	4,4'-DDD	Endrin aldehyde	Endosulfan sulfate	4,4'-DDT	Endrin ketone	Methoxychlor	Cypermethrins(total)
Units: (A) = mg/L (B) = µg/L			(A)	(A)	(A)	(A)	(A)	(A)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)
Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities Environmental Impact Assessment EIA (AEIAR-106/2007) (Ref. Figure 2.3)																																										
GV1	G	S	0.62	<0.05	0.9	0.22	0.22	0.09	1.2	<0.5	<5	2.2	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GV2	G	S	0.88	<0.05	2.1	<0.1	0.18	0.05	<1	<0.5	<5	2.4	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GV3	G	S	3.9	<0.05	9.3	<0.1	0.1	0.06	<1	<0.5	<5	2.6	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GV4	G	S	0.54	<0.05	0.8	<0.1	0.5	0.273	<1	<0.5	<5	2.7	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GV5	G	S	<0.1	<0.05	<0.1	<0.1	0.85	0.2	<1	<0.5	<5	2.8	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
CP18	G	S	<0.1	<0.05	<0.1	<0.1	0.85	0.2	<1	<0.5	<5	2.4	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
DC22	G	S	<0.1	<0.05	<0.1	<0.1	0.27	0.02	<1	<0.5	<5	2.7	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GV16	G	S	0.96	<0.05	2.2	<0.1	0.38	0.06	<1	<0.5	<5	2.6	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GV17	G	S	0.63	<0.05	1.4	<0.1	0.41	0.08	<1	<0.5	<5	2.3	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GV18	G	S	<0.1	<0.05	<0.1	<0.1	0.3	0.08	<1	<0.5	<5	2.6	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GV19	G	S	0.15	<0.05	0.2	<0.1	0.31	0.09	<1	<0.5	<5	2.8	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GV30	G	S	0.54	<0.05	0.8	<0.1	0.5	0.273	<1	<0.5	<5	2.6	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GV34	G	S	0.62	<0.05	0.9	0.22	0.22	0.09	<1	<0.5	<5	2.6	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA

Station ID	Method [1]	Depth [2]	Nutrient						Heavy Metals									Aggregate Organics		PCB	PAHs		TBT	Chlorinated Pesticides																			
Parameters			NH_3-N	Reactive P / Ortho. P	TKN	TP	NO_3-N	NO_2-N	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	BOD	COD	Total PCB	Low M.W. PAHs	High M.W. PAHs	TBT	alpha-BHC	beta-BHC	delta-BHC	gamma-BHC	Heptachlor	Aldrin	Heptachlor epoxide	Endosulfan 1	Dieldrin	4,4'-DDE	Endrin	Endosulfan 2	4,4'-DDD	Endrin aldehyde	Endosulfan sulfate	4,4'-DDT	Endrin ketone	Methoxychlor	Cypermethrins(total)
Units: (A) = mg/L (B) = µg/L			(A)	(A)	(A)	(A)	(A)	(A)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)
GV43	G	S	0.88	<0.05	2.1	<0.1	0.18	0.05	<1	<0.5	<5	2.7	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GV44	G	S	3.9	<0.05	9.3	<0.1	0.1	0.06	<1	<0.5	<5	2.7	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GSH6	G	S	0.21	<0.05	0.3	0.11	0.84	0.27	<1	<0.5	<5	2.5	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GSH7	G	S	0.25	<0.05	0.4	<0.1	0.5	0.22	<1	<0.5	<5	1.9	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GSH8	G	S	4.7	<0.05	7	<0.1	0.26	0.06	<1	<0.5	<5	2.3	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GSH9	G	S	2.5	<0.05	3.8	<0.1	0.43	0.89	<1	<0.5	<5	2.5	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GSH10	G	S	2	<0.05	3	<0.1	0.62	0.47	<1	<0.5	<5	2.2	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GSH11	G	S	0.57	0.11	0.8	0.15	0.74	0.14	<1	<0.5	<5	2.2	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GSH12	G	S	0.68	<0.05	1	<0.1	0.46	0.47	<1	<0.5	<5	2.1	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GSH13	G	S	0.15	<0.05	0.2	<0.1	0.82	0.53	<1	<0.5	<5	2.9	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GSH14	G	S	0.47	<0.05	0.7	0.1	0.68	0.17	<1	<0.5	<5	2.2	<2	<0.2	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
GSH15	G	S	0.43	<0.05	1	<0.1	0.35	0.05	<1	<0.5	<5	2.4	<2	0.313	<2	<1	<10	NA	NA	<0.01	<0.6	<1.0	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	NA	<0.01	NA	<0.01	<0.01	NA	NA	NA
Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road (AEIAR-144/2009) (Ref. Figure 2.4)																																										
A01	VC	0.05 - 0.9	1.6	<0.10	1.9	0.12	0.15	0.21	3.7	<0.2	<1	1	<1	<0.1	2.1	<1	<4	NA	NA	<0.01	<0.20	<0.20	<0.015	<0.10																		
A01	VC	0.9 – 1.9	4	<0.10	4	0.12	0.19	0.11	4.4	<0.2	<1	<1	<1	<0.1	<1	<1	<4	NA	NA	<0.01	<0.20	<0.20	<0.015	<0.10																		

Station ID	Method [1]	Depth [2]	Nutrient						Heavy Metals									Aggregate Organics		PCB	PAHs		TBT	Chlorinated Pesticides																			
Parameters			NH_3-N	Reactive P / Ortho. P	TKN	TP	NO_3-N	NO_2-N	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	BOD	COD	Total PCB	Low M.W. PAHs	High M.W. PAHs	TBT	alpha-BHC	beta-BHC	delta-BHC	gamma-BHC	Heptachlor	Aldrin	Heptachlor epoxide	Endosulfan 1	Dieldrin	4.4'-DDE	Endrin	Endosulfan 2	4.4'-DDD	Endrin aldehyde	Endosulfan sulfate	4.4'-DDT	Endrin ketone	Methoxychlor	Cypermethrins(total)
Units: (A) = mg/L (B) = µg/L			(A)	(A)	(A)	(A)	(A)	(A)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)
A01	VC	2.9 – 3.9	3.2	<0.10	4	0.17	0.15	0.13	9.9	<0.2	<1	1.7	<1	<0.1	2.5	<1	<4	NA	NA	<0.01	<0.20	<0.20	<0.0015	<0.10																			
A01	VC	7.9-8.9	1.3	<0.10	1.6	<0.10	0.25	0.14	2.3	<0.2	<1	<1	<1	<0.1	1.1	<1	<4	NA	NA	<0.01	<0.20	<0.20	<0.0015	<0.10																			
A01	VC	9.9–10.8	1.2	<0.10	1.6	<0.10	0.25	0.14	<2	0.37	<1	<1	<1	<0.1	6.5	<1	8.5	NA	NA	<0.01	<0.20	<0.20	<0.0015	<0.10																			
A02	VC	0.2-0.9	0.32	<0.10	<1.0	0.21	0.39	0.3	23	<0.2	<1	<1	<1	<0.1	1.1	<1	<4	NA	NA	<0.01	<0.20	<0.20	<0.0015	<0.10																			
A02	VC	2.9-3.9	2	0.16	2.7	0.26	0.31	0.37	57	<0.2	<1	<1	<1	<0.1	2.2	<1	<4	NA	NA	<0.01	<0.20	<0.20	<0.0015	<0.10																			
A02	VC	7.9-8.9	3.8	<0.10	4.3	0.15	0.59	0.29	13	<0.2	<1	<1	<1	<0.1	2	<1	<4	NA	NA	<0.01	<0.20	<0.20	<0.0015	<0.10																			
A02	VC	14.9 - 15.9	9.2	<0.10	9.6	<0.10	0.41	0.25	7.5	<0.2	<1	1.2	<1	<0.1	1.7	<1	5	NA	NA	<0.01	<0.20	<0.20	<0.0015	<0.10																			
A02	VC	16.9 - 17.9	6.1	<0.10	7	<0.10	0.55	0.28	4.3	<0.2	<1	1.3	<1	<0.1	1.9	<1	5	NA	NA	<0.01	<0.20	<0.20	<0.0015	<0.10																			
A03	VC	0.2-0.9	0.43	<0.10	1.1	<0.10	0.25	0.18	2.9	<0.2	<1	<1	<1	<0.1	2	<1	<4	NA	NA	<0.01	<0.20	<0.20	<0.0015	<0.10																			
A03	VC	2.9-3.9	3	<0.10	3.9	0.18	0.23	0.14	28	<0.2	<1	<1	<1	<0.1	1.5	<1	<4	NA	NA	<0.01	<0.20	<0.20	<0.0015	<0.10																			
A03	VC	7.9-8.9	5.1	<0.10	6	0.13	0.34	0.17	6.5	<0.2	<1	<1	<1	<0.1	1.7	<0.1	4.3	NA	NA	<0.01	<0.20	<0.20	<0.0015	<0.10																			
A03	VC	14.9 - 15.9	6	<0.10	6.9	<0.10	0.33	0.18	3.1	<0.2	<1	<1	<1	<0.1	3	<1	<4	NA	NA	<0.01	<0.20	<0.20	<0.0015	<0.10																			
A03	VC	15.9 - 16.35	5	<0.10	5.1	<0.10	0.4	0.17	2.3	0.2	<1	1.3	<1	<0.1	9.1	<1	9.6	NA	NA	<0.01	<0.20	<0.20	<0.0015	<0.10																			

Station ID	Method [1]	Depth [2]	Nutrient						Heavy Metals									Aggregate Organics		PCB	PAHs		TBT	Chlorinated Pesticides																				
Parameters			NH_3-N	Reactive P / Ortho. P	TKN	TP	NO_3-N	NO_2-N	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	BOD	COD	Total PCB	Low M.W. PAHs	High M.W. PAHs	TBT	alpha-BHC	beta-BHC	delta-BHC	gamma-BHC	Heptachlor	Aldrin	Heptachlor epoxide	Endosulfan 1	Dieldrin	4.4'-DDE	Endrin	Endosulfan 2	4.4'-DDD	Endrin aldehyde	Endosulfan sulfate	4.4'-DDT	Endrin ketone	Methoxychlor	Cypermethrins(total)
Units: (A) = mg/L (B) = µg/L			(A)	(A)	(A)	(A)	(A)	(A)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)
A04	VC	0.0-0.9	<0.025	<0.10	<1.0	0.1	0.33	0.11	11	<0.2	<1	<1	<1	<0.1	1.2	<1	<4	NA	NA	<0.01	<0.20	<0.20	<0.015	<0.10																			
A04	VC	2.9-3.9	1	<0.10	1.8	<0.10	0.35	0.099	4.3	<0.2	<1	1.1	<1	<0.1	<1	<1	6.8	NA	NA	<0.01	<0.20	<0.20	<0.015	<0.10																			
A04	VC	7.9-8.9	4.7	0.13	5.4	0.23	0.33	0.099	9.9	<0.2	<1	1.1	<1	<0.1	3.1	<1	<4	NA	NA	<0.01	<0.20	<0.20	<0.015	<0.10																			
A04	VC	14.9 - 15.9	12	<0.10	12	0.11	0.35	0.094	5.7	<0.2	<1	2.9	<1	<0.1	3.3	<1	<4	NA	NA	<0.01	<0.20	<0.20	<0.015	<0.10																			
A04	VC	18.05-18.9	11	<0.10	12	0.15	0.32	0.094	8.9	<0.2	<1	1.5	<1	<0.1	2.8	<1	4.6	NA	NA	<0.01	<0.20	<0.20	<0.015	<0.10																			
Black Point Gas Supply Project EIA (AEIAR-150/2010) (Ref. Figure 2.5)																																											
Blank	-	-	<0.01	0.06	0.2	0.1	0.21	<0.01	<25	<1	<10	<5	<10	<0.1	<10	<10	<10	<2	<50	<54.00	<55	<170	NA	<0.10	<0.20	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.2	<0.2
GSVB3	G	S	1.02	0.07	1.6	0.2	0.23	0.36	<25	<1	<10	<5	<10	<0.1	<10	<10	<10	<2	<50	<54.00	<55	<170	NA	<0.10	<0.20	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.2	<0.2
GSVB4	G	S	0.11	0.07	0.5	0.2	0.29	0.16	<25	<1	<10	<5	<10	<0.1	<10	<10	<10	<2	<50	<54.00	<55	<170	NA	<0.10	<0.20	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.2	<0.2
GSVB5	G	S	8.3	0.19	10.6	0.3	0.01	0.01	<25	<1	<10	<5	<10	<0.1	<10	<10	<10	<2	<50	<54.00	<55	<170	NA	<0.10	<0.20	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.2	<0.2
GSVB6	G	S	9.01	0.14	11.5	0.2	<0.01	<0.01	26	<1	<10	<5	<10	<0.1	<10	<10	<10	<2	<50	<54.00	<55	<170	NA	<0.10	<0.20	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.2	<0.2
GSVB7	G	S	0.82	0.06	1.4	0.1	0.54	0.75	<25	<1	<10	<5	<10	<0.1	<10	<10	<10	<2	<50	<54.00	<55	<170	NA	<0.10	<0.20	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.2	<0.2
GSVB8	G	S	0.49	0.06	1	0.2	0.27	0.55	<25	<1	<10	<5	<10	<0.1	<10	<10	<10	<2	<50	<54.00	<55	<170	NA	<0.10	<0.20	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.2	<0.2
GSVB9	G	S	0.59	0.08	1.1	0.2	0.12	0.33	<25	<1	<10	<5	<10	<0.1	<10	<10	<10	<2	<50	<54.00	<55	<170	NA	<0.10	<0.20	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.2	<0.2
GSVB10	G	S	0.22	0.04	0.6	0.1	0.33	0.1	<25	<1	<10	<5	<10	<0.1	<10	<10	<10	<2	<50	<54.00	<55	<170	NA	<0.10	<0.20	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.2	<0.2

Station ID	Method [1]	Depth [2]	Nutrient						Heavy Metals									Aggregate Organics		PCB	PAHs		TBT	Chlorinated Pesticides																				
Parameters			NH_3-N	Reactive P / Ortho. P	TKN	TP	NO_3-N	NO_2-N	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	BOD	COD	Total PCB	Low M.W. PAHs	High M.W. PAHs	TBT	alpha-BHC	beta-BHC	delta-BHC	gamma-BHC	Heptachlor	Aldrin	Heptachlor epoxide	Endosulfan 1	Dieldrin	4.4'-DDE	Endrin	Endosulfan 2	4.4'-DDD	Endrin aldehyde	Endosulfan sulfate	4.4'-DDT	Endrin ketone	Methoxychlor	Cypermethrins(total)
Units: (A) = mg/L (B) = µg/L			(A)	(A)	(A)	(A)	(A)	(A)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)
GSVB11	G	S	1.67	0.1	2.3	0.2	0.12	0.39	<25	<1	<10	<5	<10	<0.1	<10	<10	<10	<2	<50	<54.00	<55	<170	NA	<0.10	<0.20	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.2	<0.2
GSVB12	G	S	0.17	0.07	0.6	0.2	0.25	<0.01	<25	<1	<10	<5	<10	<0.1	<10	<10	<10	<2	<50	<54.00	<55	<170	NA	<0.10	<0.20	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.10	<0.100	<0.10	<0.2	<0.2
Additional Gas-fired Generation Units Project EIA (AEIAR-197/2016) (Ref. Figure 2.7)																																										
IT1 Blank	-	-	NA	NA	NA	NA	NA	NA	<10	<0.1	<1	4	<1	<0.05	2	<1	<10	NA	NA	<0.03	<3		<0.015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
IT2 Blank	-	-	NA	NA	NA	NA	NA	NA	<10	<0.1	<1	2	<1	<0.05	1	<1	<10	NA	NA	<0.03	<3		<0.015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OF1 Blank	-	-	NA	NA	NA	NA	NA	NA	<10	<0.1	<1	5	<1	<0.05	2	<1	14	NA	NA	<0.03	<3		<0.015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
IT1	G	S	NA	NA	NA	NA	NA	NA	<10	<0.1	<1	<1	<1	<0.05	2	<1	<10	NA	NA	<0.03	<3		<0.015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
IT2	G	S	NA	NA	NA	NA	NA	NA	<10	<0.1	<1	<1	<1	<0.05	2	<1	<10	NA	NA	<0.03	<3		<0.015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OF1	G	S	NA	NA	NA	NA	NA	NA	<10	0.1	<1	<1	<1	<0.05	2	<1	<10	NA	NA	<0.03	<3		<0.015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lamma Power Station Navigation Channel Improvement EIA (AEIAR-69/2003) (Ref. Figure 2.9)																																										
Blank	-	-	0.01	NA	0.4	NA	0.11	<10	<0.5	<5	<1	<1	<0.05	<1	<1	<10	NA	NA	<21	<12	<20	<0.005	<0.5	<1 [5]	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<2	<0.5
A	G	S	1.76	NA	2.2	NA	0.02	<10	<0.5	<5	<1	<1	<0.05	<1	<1	<10	NA	NA	<21	<12	<20	<0.005	<0.5	<1 [5]	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<2	<0.5
B	G	S	2.74	NA	3	NA	0.02	<10	<0.5	<5	<1	<1	<0.05	<1	<1	<10	NA	NA	<21	<12	<20	<0.005	<0.5	<1 [5]	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<2	<0.5
C	G	S	1.23	NA	1.9	NA	0.02	<10	<0.5	<5	<1	<1	<0.05	<1	<1	<10	NA	NA	<21	<12	<20	<0.005	<0.5	<1 [5]	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<2	<0.5
Improvement Dredging for Lamma Power Station Navigation Channel (EIA-251/2017) (Ref. Figure 2.9)																																										

Station ID	Method [1]	Depth [2]	Nutrient						Heavy Metals									Aggregate Organics		PCB	PAHs		TBT	Chlorinated Pesticides																				
Parameters			NH_3-N	Reactive P / Ortho. P	TKN	TP	NO_3-N	NO_2-N	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	BOD	COD	Total PCB	Low M.W. PAHs	High M.W. PAHs	TBT	alpha-BHC	beta-BHC	delta-BHC	gamma-BHC	Heptachlor	Aldrin	Heptachlor epoxide	Endosulfan 1	Dieldrin	4,4'-DDE	Endrin	Endosulfan 2	4,4'-DDD	Endrin aldehyde	Endosulfan sulfate	4,4'-DDT	Endrin ketone	Methoxychlor	Cypermethrins(total)
Units: (A) = mg/L (B) = µg/L			(A)	(A)	(A)	(A)	(A)	(A)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)
Blank	-	-	<0.01	NA	NA	NA	0.14		3	<0.2	<1	2	<1	<0.05	1	<0.2	<10	NA	-	<0.18	<2.2	<6.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
A	G	S	1.04	NA	NA	NA	0.07		5	<0.2	<1	1	<1	<0.05	2	<0.2	<10	NA	760	<0.18	<2.2	<6.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B	G	S	1.41	NA	NA	NA	0.11		5	<0.2	<1	1	<1	<0.05	<1	<0.2	<10	NA	750	<0.18	<2.2	<6.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C	G	S	0.57	NA	NA	NA	0.12		6	<0.2	<1	1	<1	<0.05	1	<0.2	<10	NA	690	<0.18	<2.2	<6.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Note:
(1) G: Sampling conducted with grab sampling; VC Sampling conducted with vibrocore.
(2) S: Surface sample
(3) NA: Not measured
(4) Data for Beta- and Gamma-BHC

1.3 INFORMATION GAP AND RECOMMENDATIONS ON SEDIMENT SAMPLING AND TESTING FOR ELUTRIATE TEST

Sections of pipeline route without or with limited sediment elutriate test results from the approved EIA projects are identified as follow:

- KP 0.50 – 12.20 along the BPPS route;
- KP 26.20 – 31.50 along the BPPS route;
- Most of the Pipeline along the LPS Route; and
- The potential site for the proposed Offshore LNG Terminal.

It is proposed that sediment and marine water sampling should be conducted at the above locations to provide the required elutriate test results for the water quality assessment for the EIA Study for this Project. To facilitate the execution of the overall sediment sampling exercise, the same sampling locations and method (i.e. grab sampling) for the sediment sampling and testing exercise proposed would be adopted for elutriate testing. For sections of pipeline where sediment disposal would not be required (i.e. pipeline trenching by jetting), sediment sampling for elutriate testing would be conducted as a standalone exercise to provide data for water quality assessment of the EIA of this Project. The proposed sampling stations are shown in *Figure 3.1* of the *Marine Sediment Sampling and Testing Plan*. Since the level of disturbance to the bottom sediment under this Project would be similar to those under AEIAR-106/2007 and AEIAR-150/2010 as shown in *Table 12.1*, sediment sampling by grab would be sufficient for this Project. Required chemical parameters, testing method and reporting limits for elutriate test are shown in *Table 4.4* of the *Marine Sediment Sampling and Testing Plan* and are not detailed in this *Annex*.

ADDENDUM 1

CONTENTS

1 INTRODUCTION

1.1 BACKGROUND

The *Marine Sediment Sampling and Testing Plan (MSSTP)* (Revision 4) dated 7 July 2017 for the Hong Kong Offshore LNG (HKOLNG) Project, which has been agreed with the Environmental Protection Department (EPD), provides for sediment and elutriate sampling and testing along the BPPS and LPS pipelines and at the proposed HKOLNG Terminal site based on the pipeline construction scheme at the time of preparing the said *MSSTP*.

To take into account findings from on-going environmental assessments and engineering studies of the Project, CLP are continuing to consider alternative approaches to pipeline construction methods. As such, to enable a full and complete analysis of options to optimise environmental performance, CLP propose to carry out supplemental sediment sampling along the BPPS and LPS pipeline route sections which may potentially involve marine dredging to fully inform decision making and preparation of the environmental impact assessment report. The supplemental sediment sampling will provide samples for sediment chemical and biological testing only (*Section 4* of the MSSTP refers).

The *MSSTP* Revision 4 has already covered the elutriate sampling methodology throughout the BPPS and LPS pipelines, hence, no supplemental elutriate testing is required.

This Addendum to the agreed *MSSTP* Revision 4 sets out the locations of the supplemental sediment sampling. The survey planning, chemical and biological testing, quality assurance/quality control procedures and reporting of the agreed *MSSTP* Revision 4 remain valid, and are not duplicated in this Addendum.

2 SUPPLEMENTAL SURVEY PLANNING

2.1 SUPPLEMENTAL SURVEY DESIGN

Supplemental sediment sampling is proposed along the BPPS and LPS pipeline route sections where the pipeline construction approaches (including dredging options) are under review.

2.1.1 Supplemental Sediment Sampling for Chemical and Biological Testing

BPPS Pipeline

A portion of the BPPS pipeline section KP 0.50 – 4.77 between the Offshore LNG Terminal and South Soko Island will be jetted, hence no sediment dredging or disposal will be required.

Supplemental sediment sampling for chemical and biological testing is proposed in areas where the need for marine dredging is being considered. This includes the pipeline sections of KP4.77 – 7.90, KP 7.90 – 12.20, KP 21.40 – 26.20, KP 26.20 – 31.50, KP 37.50 – 41.10, and KP 42.90 – 44.90. The sampling locations are presented in *Figure 2.1*.

LPS Pipeline

Supplemental sediment sampling for chemical and biological testing is proposed in areas where the need for marine dredging is being considered. This includes a portion of the LPS pipeline from the KP 0.0 to LPS KP 4.27 and from LPS KP 13.00 to LPS KP 17.25. The sampling locations are presented in *Figure 2.1*.

The mid-section of the LPS pipeline will be jetted, hence no sediment dredging or disposal will be required.

The sampling requirements are described in *Table 2.1*.

Table 2.1 Proposed Supplemental Sediment Sampling for the BPPS and LPS Pipeline Route

Dredged Pipeline Section	Sampling Consideration[1]
BPPS Route	
KP 4.77 – 7.90	• The required dredging area for pipeline trenching is estimated to be 30m wide and 3,130m long, with dredging depth of about 2.2m below existing seabed level. • Sediment quality data obtained from 2006 HKLNG Terminal EIA report showed that the sediment quality is generally low except for one location GSH31(grab sample) is classified as M_{fail}. No recent sediment sampling quality is, however, available for reference along this section. • Three (3) sediment sampling locations are proposed to collect seabed surface sampling to verify the sediment quality.

Dredged Pipeline Section	Sampling Consideration[1]
KP 7.90 – 12.20	• The required dredging area for pipeline trenching is estimated to be 30m wide and 4,300m with dredging depth of about 2.2m below existing seabed level. • Sediment quality data obtained from 2006 HKLNG Terminal EIA report showed that the sediment quality is classified as low except for one location GSH40(grab sample) is classified as M_{fail}. No recent sediment sampling quality is, however, available for reference along this section. • Four (4) sediment sampling locations are proposed to collect seabed surface sampling to verify the sediment quality.
KP 21.40 – 26.20	• The required dredging area for pipeline trenching is estimated to be 30m wide and 4,800m long, with dredging depth of about 2.2m below existing seabed level. • Sediment data obtained from 2006 HKLNG Terminal EIA report showed that the sediment quality at GV17 (0 – 2.9 m below seabed) and GV18 (0 – 2.9 m below seabed) are classified as M_{fail} while sediment quality at GV19 (0 – 2.9 m below seabed) is classified as M_{pass}. • Sediment data obtained from 2009 HK - Zhuhai - Macao Bridge EIA report showed that the sediment quality is generally low to mild. No recent sediment quality data is, however, available for reference. • Five (5) sediment sampling locations are proposed to collect seabed surface sample to verify the sediment quality.
KP 26.20 – 31.50	• The required dredging area for pipeline trenching is estimated to be 30m wide and 5,300m long, with dredging depth of about 2.2m below existing seabed level. • Sediment data obtained from 2014 Three Runway System EIA report showed that the sediment quality is generally low to mild. • Five (5) sediment sampling locations are proposed to collect seabed surface sample to verify the sediment quality.
KP 37.50 – 41.10	• The required dredging area for pipeline trenching is estimated to be 30m wide and 3,600m long, with dredging depth of about 2.2m below existing seabed level. • Sediment quality data obtained from 2006 HKLNG Terminal EIA report and 2010 Black Point Gas Supply EIA showed that the sediment quality is classified as M_{pass} except for one location GSVB10 (1.9 - 2.9m below seabed) is classified as M_{fail}. No recent sediment quality data is, however, available for reference • Four (4) sediment sampling locations are proposed to collect seabed surface sample to verify the sediment quality.
KP 42.90 – 44.90	• The required dredging area for pipeline trenching is estimated to be 30m wide and 2,000m long, with dredging depth of about 2.2m below existing seabed level. • Sediment quality data obtained from 2006 HKLNG Terminal EIA report showed that the sediment quality is classified as low. Sediment quality data obtained from 2010 Black Point Gas Supply EIA showed that the sediment quality from 0 – 2.9m below seabed is generally M_{pass} to M_{fail}. No recent sediment quality data is, however, available for reference. • Two (2) sediment sampling locations are proposed to collect seabed surface sample to verify sediment quality.

Dredged Pipeline Section	Sampling Consideration(1)
LPPS Route	
KP 0.0 – 4.27	• The required dredging area for pipeline trenching is estimated to be 30m wide and 3,770m long, with dredging depth of about 2.2m below existing seabed level. • No recent sediment quality data is, however, available for reference. • Four (4) sediment sampling locations are proposed to collect seabed surface sample to verify the sediment quality
LPS KP 13 – LPS KP 17.25	• The required dredging area for pipeline trenching is estimated to be 30m wide and approx. 4,250m long, with dredging depth of about 2.2m below existing seabed level. • No recent sediment quality data is, however, available for reference. • Four (4) sediment sampling locations are proposed to collect seabed surface sample to verify the sediment quality

Notes: (1) Subject to final engineering design

2.2 *SUPPLEMENTAL SAMPLING LOCATIONS*

Co-ordinates of the proposed supplemental sediment sampling locations for this Project are presented in *Table 2.2* for the BPPS pipeline and LPS pipeline route. Similar to the distance between sediment sampling locations established in the agreed *MSSTP* (Revision 4), the supplemental sampling locations are approximately 1 km apart, or less.

Table 2.2 ***Proposed Supplemental Sediment Sampling Locations, Methods and Testing for the BPPS and LPS Pipeline Route***

Sampling Location	Proposed Sampling Method	Coordinates		Testing Required		Anticipated Sediment Category
		Easting	Northing	Sediment Testing	Elutriate Testing	
BPPS						
X-GB01	Surface Grab	808492.5425	831194.5061	✓		L to M
X-GB02	Surface Grab	807537.0498	831452.0438	✓		
X-GB03	Surface Grab	805104.4841	830359.8933	✓		
X-GB04	Surface Grab	804767.8840	829533.3980	✓		
X-GB05	Surface Grab	804743.5695	828634.8147	✓		
X-GB06	Surface Grab	804746.4342	827734.8192	✓		
X-GB07	Surface Grab	804474.7336	820781.7960	✓		
X-GB08	Surface Grab	804180.6766	819763.3999	✓		
X-GB09	Surface Grab	803886.6197	818745.0039	✓		
X-GB10	Surface Grab	803592.5627	817726.6078	✓		
X-GB11	Surface Grab	803298.5058	816708.2118	✓		
X-GB12	Surface Grab	803018.3194	815737.8533	✓		
X-GB13	Surface Grab	802715.5650	814828.1986	✓		
X-GB14	Surface Grab	802187.7978	814029.1909	✓		
X-GB15	Surface Grab	801603.1600	813267.7458	✓		
X-GB16	Surface Grab	801049.6726	812484.8989	✓		
X-GB17	Surface Grab	803756.9152	803864.4081	✓		
X-GB18	Surface Grab	804552.5640	803242.3456	✓		
X-GB19	Surface Grab	805348.2128	802620.2830	✓		
X-GB20	Surface Grab	806143.8616	801998.2204	✓		
X-GB21	Surface Grab	807149.4222	801215.3354	✓		
X-GB22	Surface Grab	808052.6399	800774.2440	✓		
X-GB23	Surface Grab	809050.8957	800656.5266	✓		
LPS						
Y-GB01	Surface Grab	814197.9588	803003.6142	✓		L
Y-GB02	Surface Grab	814449.8091	803869.0698	✓		
Y-GB03	Surface Grab	815224.2662	804323.9866	✓		
Y-GB04	Surface Grab	816127.5189	804191.0895	✓		
Y-GB05	Surface Grab	825811.3240	804666.6103	✓		
Y-GB06	Surface Grab	826432.2267	805339.2177	✓		
Y-GB07	Surface Grab	826990.7088	806030.4572	✓		
Y-GB08	Surface Grab	827589.7399	806771.8847	✓		

The supplemental sediment sampling and testing will follow the quality assurance/ quality control and chemical and biological testing methods outlined in the agreed *MSSTP* Revision 4.

Those sediment quality analytical results relevant to the finalised pipeline design and construction approach shall be reported in the EIA report, following the outline established in the agreed *MSSTP* Revision 4.

Legend

- Sediment Sampling Location
- Proposed GRS at BPPS
- Proposed GRS at LPS
- Indicative Gas Pipeline Route to BPPS
- Indicative Gas Pipeline Route to LPS
- Alternative Shore Approach Route to LPS
- Boundary of HKSAR
- Potential Site for Offshore LNG Terminal

Trenching Method (Indicative)[1][2]

- Grab Dredging (GD)
- Jetting (J)
- Trailing Suction Hopper Dredging (TSHD)

NEW TERRITORIES

KOWLOON

HONG KONG ISLAND

LANTAU ISLAND

Hong Kong International Airport

Lamma Island

KP 41.10
KP 42.90
KP 44.90
KP 45.00
KP 37.50
KP 31.50
KP 26.20
KP 21.40
KP 15.70
KP 12.20
KP 7.90
KP 4.77
KP 0.50
KP 0.00
LPS KP 4.27
LPS KP 13.00
LPS KP 17.25

X-GB01
X-GB02
X-GB03
X-GB04
X-GB05
X-GB06
X-GB07
X-GB08
X-GB09
X-GB10
X-GB11
X-GB12
X-GB13
X-GB14
X-GB15
X-GB16
X-GB17
X-GB18
X-GB19
X-GB20
X-GB21
X-GB22
X-GB23

Y-GB01
Y-GB02
Y-GB03
Y-GB04
Y-GB05
Y-GB06
Y-GB07
Y-GB08

N

Kilometers

0 5 10

Note:
(1) Details of Dredging Section refer to Figure 1.1
(2) Not-to-scale. The width of trench is about 30m.

Figure 2.1

Proposed Supplemental Sediment Sampling Locations

File: T:\GIS\CONTRACT\0359722\Mxd\Sediment\0359722_Sediment_Elutriate_Sampling_Location_CAT_06.mxd
Date: 21/7/2017

Environmental Resources Management

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