Appendix 7.2
Contamination Assessment Report / Remediation Action Plan for A King Marine

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1 INTRODUCTION

1.1 Background

1.1.1 This Project is the second phase of Wan Chai Development (WDII) to make provision for the construction of a section of Central-Wan Chai bypass (the Trunk Road) which runs along the Wan Chai shoreline in tunnel and connects to the existing elevated Island Eastern Corridor (IEC) in North Point. Any land formed for this transport infrastructure will be developed into an attractive waterfront promenade for the enjoyment of the public. The Project Proponent is Civil Engineering Development Department (CEDD).

1.1.2 Based on the EIA Study carried out under this Project, A King Marine (an abandoned shipyard) is considered to be a potential contaminated site that may pose land contamination impacts to the WDII and further site investigation at the Site is required. A Contamination Assessment Plan (CAP) which proposed a site investigation plan for further assessment was submitted by Maunsell Consultants Asia Ltd. (MCAL) and agreed by Environmental Protection Department (EPD).

1.1.3 Soil boring and sampling works were carried out according to the agreed CAP in the period from 26 to 28 February 2007 by Vibro (HK) Ltd. and under the supervision of MCAL. Laboratory analysis on the collected soil and groundwater samples were performed by Lam Laboratory Ltd. (Lam).

1.2 Objectives of Contamination Assessment Report (CAR) and Remediation Action Plan (RAP)

1.2.1 The objectives of the CAR are to report the results of the Site Investigation (SI) work and based on the findings of the SI, to estimate, if any, the nature and extent of contamination within the Subject Site. If contamination were confirmed, a RAP will be prepared based upon the findings of the CAR and submitted as a combined report to EPD for approval. The objectives of the RAP are to (i) propose a remediation method for the soil contamination (ii) propose a remediation action plan, (iii) If situation warrant, propose a means to confirm completed excavation of contaminated soil; and (iv) provide guidelines regarding handling and disposal for contaminated soil.

1.2.2 The combined CAR / RAP was prepared in accordance with EPD's *ProPECC PN 3/94 Contaminated Land Assessment and Remediation* and EPD's *Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repairing/Dismantling Workshops.*

1.3 General Site Context

1.3.1 A King Marine is located at the eastern portion of Causeway Bay Typhoon Shelter (CWBTS) and is bounded by Hing Fat Street to the east, Victoria Road to the south and Island Eastern Corridor to the west. The approximate land area is 1,500m^2. The surrounding land uses are mainly commercial and residential properties. Tung Lo Wan Fire Station is located to the east of shipyard while Victoria Park is at the south of the shipyard. The site location is shown in **Figure 1.**

2 FIELD SAMPLING WORKS

2.1 Soil Boring and Sampling

2.1.1 A total of 9 sampling locations, as proposed in the agreed CAP, were carried out within the Site in the period from 26 – 28 February 2007 and as there are sufficient headroom, borehole method was adopted for all of the sampling works. For the ease of reference, trial pit, TP1, as proposed in the CAP, was renamed to BH-9. The field works were conducted by Vibro (HK) Ltd. and supervised by MCAL.

2.1.2 The sampling locations were slightly adjusted on site due to site constraints (eg presence of obstructions / foundations). The as-built locations for the site investigation are depicted in **Figure 2**. The rationale of selecting the sampling locations and schedules for laboratory analysis as outlined in the CAP are attached in **Appendix A**. As the seawall was encountered at borehole BH-9 at depth 1.05m bgl, another sampling location (IP-1) was carried out just north of BH-9 in order to collect additional samples at lower soil stratum.

2.1.3 At all 9 borehole locations, inspection pit was firstly excavated down to approximately 1.5m below ground to inspect for any underground utilities.

2.1.4 Soil boring using drill rigs was then performed from 1.5m to maximum boring depth, as far as practicable, by dry drilling method. Stainless steel split spoon samplers were used to collect the undisturbed samples. At each borehole sampling location, soil samples, if possible, were taken at approximately 0.5 m, 1.5 m and 3.0m below ground level (m bgl) and/or at groundwater level. The deepest depth of sampling (if seawall was not encountered) was 3m below ground, below the apparent groundwater level. It should be noted that some of the soil samples could only be collected close to the specified depth due to the presence of hard materials/rocks. Details of the sampling locations, including depths of collected soil samples and termination depths are summarised in **Table 2.1** below.

Table 2.1 Details of Sampling Locations

Sampling Location	Coordinates		Depth of Collected Soil Samples (mbgl)	Termination Depth (mbgl)	Remarks
	Easting	Northing			
BH-1	837603.91	816311.98	0.50, 1.50, 3.00	4.40	-
BH-2	837603.48	816299.74	0.50, 1.50, 3.00	3.86	-
BH-3	837616.45	816281.12	0.50, 0.95, 1.50, 3.00	4.00	-
BH-4	837613.35	816265.86	0.50, 0.95, 1.50, 3.00	3.45	-
BH-5	837606.03	816249.01	0.50, 1.50, 3.00	4.00	-
BH-6	837597.00	816245.53	0.50, 1.95	4.80	Seawall was encountered at 1.95m bgl. Soil samples were collected at 0.5m 1.95m bgl.
BH-7	837588.02	816244.90	0.50	6.07	Seawall was encountered at depth 1.20m bgl. Soil sample was collected at 0.5m bgl.
BH-8	837597.77	816250.93	0.50, 1.50, 3.00	4.00	-
BH-9	837580.11	816238.86	0.50	4.10	Seawall was encountered at depth 1.05m bgl. Soil sample was collected at 0.5m bgl.
IP-1	837579.36	816240.90	0.50, 1.50	2.20	Seawall was encountered

Sampling Location	Coordinates		Depth of Collected Soil Samples (mbgl)	Termination Depth (mbgl)	Remarks
	Easting	Northing			
					at depth 2.20m bgl. Soil samples were collected at 0.5 and 1.5m bgl.

2.1.5 The soil samples taken at each sampling depth were also subject to on-site measurement of VOCs with a PID meter. For the PID measurement, a handful of the soil sample was firstly placed in a ziplock bag. After few minutes, the probe of a calibrated PID was then inserted into the bag to take the measurement. The PID used on site was equipped with lamp having energy of 10.6eV with measurement range of 0.0 to 99.9 ppm.

2.1.6 The soil samples were properly labelled and stored in cool boxes chilled at a temperature of around 4°C until delivered to the analytical laboratory. All the collected soil samples were analysed in accordance with the analysis schedules detailed in the CAP in a laboratory accredited by the Hong Kong Laboratory Accreditation Scheme (HOKLAS).

2.2 Strata Logging

2.2.1 Strata logging for the boreholes was undertaken during the course of drilling/digging and sampling by a qualified geologist. The logs included the general stratigraphic descriptions, depth of soil sampling, sample notation and level of groundwater. The presence of rocks/boulders/cobbles and foreign materials such as metals, wood and plastics were also recorded. Soil boring logs are attached in **Appendix B**.

2.3 Free Product Measurement

2.3.1 No free product (floating oily layer) was encountered at all the sampling locations during the site investigation works. As such, no free product was collected and sent to laboratory for identification analysis.

2.4 Groundwater Sampling

2.4.1 In order to investigate the general conditions of the groundwater at the Subject Site, groundwater samples were collected at each of the borehole location. No groundwater was encountered at IP1. Installation of groundwater monitoring wells was undertaken at all boreholes, after completion of soil sampling. The groundwater monitoring wells are shown in **Appendix A.**

2.4.2 After installation of the monitoring wells, the depth to water table at all monitoring wells was measured. Well developments (approximately five well volumes) were carried out first to remove silt and drilling fluid residue from the wells. The wells were then allowed to stand for a day to permit groundwater conditions to equilibrate. Groundwater level was measured at each well using interface probe before groundwater samples were taken.

2.4.3 Prior to groundwater sampling, the monitoring wells were purged (~ three well volumes) to remove fine-grained materials and to collect freshly refilled representative groundwater samples.

2.4.4 After purging, one groundwater sample was then collected at each well using Teflon bailer and decanted into appropriate sample bottles in a manner that minimised agitation and volatilisation of any VOCs from the samples. All samples were uniquely labelled.

2.4.5 Immediately after collection, groundwater samples were transferred to appropriate new, clean, laboratory-supplied containers for sample storage/transport. Groundwater samples were placed in the

appropriate containers with zero headspace and promptly sealed with a septum-lined cap. Immediately following collection, samples were placed in ice chests and chilled and maintained at temperature of around 0-4°C until delivery to the analytical laboratory at the same day.

2.4.6 All groundwater samples were analysed in accordance with the analysis schedules detailed in the CAP in a laboratory accredited by the Hong Kong Laboratory Accreditation Scheme (HOKLAS).

2.5 Sample Size and Handling Procedures

2.5.1 All equipments in contact with the ground (including drilling pit, digging tools and soil/groundwater samplers) were thoroughly cleaned between each excavation and drilling and sampling event using high-pressure hot water jet, then washed by phosphate-free detergent and finally rinsed with distilled water.

2.5.2 Prior to sampling, the laboratory responsible for analysis was consulted on the particular sample size and preservation procedures that are necessary for each chemical analysis.

2.5.3 The sample containers were laboratory cleaned, sealable, water-tight, made of glass or other suitable materials with aluminium or Teflon-lined lids, so that the container surface will not react with the sample or adsorb contaminants. No headspace was allowed in the containers which contain samples to be analysed for VOCs, TPH or other volatile chemicals.

2.5.4 The containers were marked with the sampling location codes and the depths at which the samples were taken. Samples were stored at between 0-4°C. Samples were delivered to laboratory within 24 hours of the samples being collected and analysed within 7 days of delivery.

2.6 QA/QC Procedures

2.6.1 The following QC samples were collected during the site investigation. Chain of Custody (COC) protocol was adopted.

- 1 equipment blank per 20 samples for analysis
- 1 field blank per 20 samples for analysis

2.6.2 Based on the above, a total of 2 sets of equipment and field blanks were collected for analysed.

3 ASSESSMENT CRITERIA

3.1 Cleanup Action Criteria for Soil

3.1.1 The assessment methodology of this Study was developed in accordance with the *Practice Note ProPECC PN3/94 "Contaminated Land Assessment and Remediation"* and *"Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repair / Dismantling Workshops"* issued by EPD.

3.1.2 The ProPECC Note PN 3/94 was used in setting the soil contamination criteria. The Practice Note makes reference to criteria developed in the Netherlands (Dutch 'ABC' Levels), which are most comprehensive and widely used for contaminated site assessment. The preliminary screening approach adopted in this study was based on the Dutch criteria which consist of 3 levels of guidelines, namely A, B, and C. The simplified explanation of the ABC levels is as follows:

- 'A' level implies unpolluted;
- 'B' level implies potential pollution present that requires further investigation or remediation; and
- 'C' level implies pollution which requires remediation.

3.1.3 Relevant soil and groundwater Dutch 'ABC' levels are presented in **Table 3.1**.

Table 3.1 Dutch ABC Values for Soil and Groundwater Contamination

Parameter	Soil (mg/kg)			Groundwater (µg/L)		
	Dutch A	Dutch B	Dutch C	Dutch A	Dutch B	Dutch C
Total Petroleum Hydrocarbons (TPH) (using mineral oil)	100	1000	5000	20	200	600
<BTEX>						
Benzene	0.01	0.5	5	0.2	1	5
Toluene	0.05	3	30	0.5	15	50
Ethylbenzene	0.05	5	50	0.5	20	60
Xylenes	0.05	5	50	0.5	20	60
<Polyaromatic Hydrocarbons, PAHs>						
Naphthelene	0.1	5	50	0.2	7	30
Phenanthrene	0.1	10	100	0.1	2	10
Anthracene	0.1	10	100	0.1	2	10
Fluoranthene	0.1	10	100	0.02	1	5
Benzo(a)pyrene	0.05	1	10	0.01	0.2	1
Pyrene	0.1	10	100	0.02	1	5
<Heavy Metals>						
Arsenic (As)	20	30	50	10	30	100
Barium (Ba)	200	400	2000	50	100	500
Cadmium (Cd)	1	5	20	1	2.5	10
Cobalt (Co)	20	50	300	20	50	200
Chromium (Cr)	100	250	800	20	50	200
Copper (Cu)	50	100	500	20	50	200
Molybdenum (Mo)	10	40	200	5	20	100
Nickel (Ni)	50	100	500	20	50	200
Lead (Pb)	50	150	600	20	50	200
Tin (Sn)	20	50	300	10	30	150
Zinc (Zn)	200	500	3000	50	200	800
Mercury (Hg)	0.5	2	10	0.2	0.5	2
Cyanide (total	5	50	500	10	50	200

Parameter	Soil (mg/kg)			Groundwater (µg/L)		
	Dutch A	Dutch B	Dutch C	Dutch A	Dutch B	Dutch C
comb.)						
<Volatile Organic Compounds (VOC)>						
Chlorinated Hydrocarbons (of Aliphatics (individual)	0.1	5	50	1	10	50
Chlorinated Hydrocarbons (of Chlorobenzenes (individual))	0.05	1	10	0.02	0.5	2
Styrene	0.1	5	50	0.5	20	60

3.2 Clean up Criteria for Groundwater

3.2.1 The Dutch 'ABC' criteria were established based on the assumption that groundwater is used as potable water. However, it is not so appropriate to be applied directly in Hong Kong where groundwater is not for potable use. Hence, the Dutch B levels would be used only for screening out the chemicals-of-concern (COCs) for risk assessment and are not for assessing groundwater contamination in Hong Kong. A risk-based assessment would be carried out for contaminants with the concentration exceeding the Dutch B level to evaluate the risks posed to the sensitive receptors.

3.2.2 The risk-based assessment that has been adopted in USEPA takes into account concentrations of individual contaminants in groundwater, the anticipated most sensitive human receptor and the potential exposure pathways. For each parameter, the source concentration is the maximum concentration of that parameter found in the groundwater samples irrespective of their locations.

3.2.3 Exceedance of the risk-based criteria would be qualified in two tiers. Firstly, the Total Pathway Hazard Index that is the sum of contaminant hazard quotients exceeds one (i.e. USEPA recommended hazard index). Secondly the largest contaminant concentration exceeds the corresponding Risk Based Screening Level (RBSL) that is derived from the recognised oral reference dose. For carcinogens, the first is the Total Carcinogenic Risk that is the sum of contaminant carcinogenic risk exceeds 1×10^{-6} (i.e. USEPA lifetime cancer risk level). The second is the largest carcinogenic contaminant concentration exceeds the corresponding RBSL that is derived from the recognised carcinogenic oral slope factor. It should be noted that risk assessment could only be undertaken for those chemicals that have a recognised oral slope factor or oral reference dose.

3.3 Clean up Criteria for Tributyl-Tin (TBT) and Additional Metals in Soil and Groundwater

3.3.1 As there are no Dutch B levels for TBT and additional metals: Sb, Be, Se, Ag, Ti and V, another guideline 'USEPA Region IX Preliminary Remediation Goal (PRG), which has been widely used in other countries for initial soil screening for remediation, was adopted. Although the future land use of the study site is not residential and groundwater is not used for drinking purposes, for conservative approach, the 'residential soil' and 'tap water' PRGs will be adopted for the Study. Furthermore, for groundwater, risk-based assessment, as discussed above, will be carried out for contaminants that exceeded the relevant PRGs.

3.3.2 For TBT, the USEPA Region IX PRGs for TBT-oxide are 18 mg/kg for residential soil and 11 µg/L for tap water. There are some reasons supporting the use of TBT-oxide standard for TBT. Firstly, according to the Extension Toxicity Network maintained by University of California at Davis, Michigan State University, Cornell University and Oregon State University, TBT by itself is unstable and will break down in the environmental unless it is combined with an element such as oxygen. One

of the most common TBT compounds is *bis* (Tributyltin) Oxide (TBTO) and therefore, it is considered that the TBT found at shipyards exist predominantly in the oxide form.

3.3.3 For the analysis of TBT in laboratory, the analysis method usually gives a result of total TBT, which includes the predominant TBTO and other possible forms of TBT. As the TBT in soil is expected to be in the predominant form of TBTO, the use of TBT-oxide standard for TBT is therefore justifiable. The use of TBT-oxide PRG as assessment criteria was also been adopted in the Environmental Impact Assessment for the *Decommissioning of Cheoy Lee Shipyard at Penny's Bay.*

3.3.4 As the analytical results for TBT in soil and groundwater are reported in μg Sn/kg and μg Sn/L respectively, the PRG for TBT oxides are converted to equivalent concentration of tin for comparison.

3.3.5 Given the chemical formula of TBT-oxide as $C_{24}H_{54}OSn_2$, 18 mg of TBT-oxide (the PRG for TBT-oxide) in 1 kg soil is equivalent to 7 mg/kg of tin in soil. Similarly, 11μg of TBT oxide (the PRG for TBT-oxide) in 1L groundwater is equivalent to 4.3μg/L of Tin in groundwater. Therefore, the action levels for TBT, in terms of Sn in soil and groundwater, are 7 mg/kg of tin (or 7,000μg Sn/kg) in soil and 4.3μg/L of tin (4,3000ηg Sn/L) in groundwater respectively.

3.3.6 The converted PRG for TBT and the PRGs for additional heavy metals are summarised in **Table 3.2**.

Table 3.2 Converted PRG for TBT and PRGs for Additional Heavy Metals

Parameter	Soil (mg/kg)	Groundwater (μg/L)
<Tributyl-Tin (TBT)>	7	4.3
<Additional Heavy Metals>		
Antimony (Sb)	31	15
Beryllium (Be)	150	73
Selenium (Se)	390	180
Silver (Ag)	390	180
Thallium (Ti)	5.2	2.4
Vanadium (V)	78	36

4 ANALYTICAL RESULTS AND INTERPRETATION

4.1 On-site PID Measurement

4.1.1 Prior to site investigation, the PID was calibrated to isobutylene standard reference gas at 100ppm. Calibration was performed by the Manufacturer, RAE. Daily zero-span checks were also conducted to assure the accuracy of the PID measurement. The PID used on site was equipped with lamp having energy of 10.6eV.

4.1.2 The volatile organic compounds (VOC) concentrations were measured by the PID for all soil samples obtained. The VOC vapour concentrations detected by the PID were low which indicates apparent low volatile organic contents in the soil samples. The maximum PID reading of the soil samples recorded was 6.3 ppm at BH-4 (at 1.5m bgl). The full results of PID readings are provided in **Table 4.1**.

Table 4.1 Summary of On-site PID Measurement Results

Sampling Location	Depth of the sample collected (m below grade)	PID Reading (ppm)*
BH-1	0.50	0.1
BH-1	1.50	4.8
BH-1	3.00	2.5
BH-2	0.50	0.1
BH-2	1.50	0.1
BH-2	3.00	0.1
BH-3	0.50	0.3
BH-3	0.95	0.1
BH-3	1.50	0.1
BH-3	3.00	0.1
BH-4	0.50	6.0
BH-4	0.95	0.1
BH-4	1.50	6.3
BH-4	3.00	4.2
BH-5	0.50	1.9
BH-5	1.50	6.0
BH-5	3.00	3.9
BH-6	0.50	0.1
BH-6	1.95	0.1
BH-7	0.50	0.1
BH-8	0.50	0.1
BH-8	1.50	0.1
BH-8	3.00	0.1
BH-9	0.50	0.1
IP1	0.50	0.7
IP1	1.50	2.4

Remarks: * PID readings were corrected with the background concentration. Measurements are averaged reading over a period of 10 seconds.

4.2 Results of Groundwater Level Measurements

4.2.1 The groundwater levels were recorded and shown in **Table 4.2** below. The groundwater levels were measured in the morning of 28 February 2007, after the installation of all monitoring wells. Based on the measurement results, the groundwater profiles within the Site were relatively flat.

Table 4.2 Summary of Groundwater Level and Depth of Monitoring Well

Sampling Location	Ground Level	Groundwater Level		Monitoring Well Depth (mPD)
	mPD	m bgl	mPD	
BH-1	+3.44	2.14	+1.30	-0.96
BH-2	+3.64	2.33	+1.31	-0.22
BH-3	+2.26	0.62	+1.64	-1.74
BH-4	+2.23	0.68	+1.55	-0.77
BH-5	+3.52	2.20	+1.32	-0.48
BH-6	+3.67	2.30	+1.37	-0.33
BH-7	+3.58	2.19	+1.39	-2.49
BH-8	+3.48	2.20	+1.28	-0.52
BH-9	+3.57	2.24	+1.33	-0.23
IP-1*	+3.56	N/A	N/A	N/A

* No groundwater was encountered at IP1

4.3 Discussion on Laboratory Analytical Results

Results of Soil Analysis

4.3.1 Amongst the 26 soil samples analysed, elevated concentrations of total petroleum hydrocarbons (TPH), barium, copper, lead and/or zinc which exceeded the Dutch B/C criteria were detected at 5 soil samples, namely BH-3 at 0.5m, BH-4 at 0.5m, BH-4 at 1.5m, BH-5 at 3m and BH-8 at 1.5m. No exceedances in other parameters were observed in the collected soil samples. **Table 4.3** summarizes the soil exceedances. The full laboratory results for the soil samples are presented in **Appendix C**.

Table 4.3 Summary of Soil Sample Exceeding Dutch B/C Value

Sampling Location	Depth (m bgl)	Contaminant	Dutch Level (mg/kg)		Concentration (mg/kg)	Dutch Level Exceeded
			B	C		
BH-3	0.5	TPH	1000	5000	8000	>C
		Barium	400	2000	600	>B
		Copper	100	500	660	>C
		Lead	150	600	880	>C
		Zinc	500	3000	940	>B
BH-4	0.5	Copper	100	500	110	>B
		Lead	150	600	170	>B
BH-4	1.5	Copper	100	500	120	>B
BH-5	3	Lead	150	600	180	>B
BH-8	1.5	Lead	150	600	190	>B

4.3.2 Amongst the sampling locations, exceedance of Dutch levels was most severe at BH-3. Five exceedances, namely TPH, barium, copper, lead and zinc were recorded in BH-3 at 0.5m with TPH copper and lead exceeded Dutch C level. BH-3 is located at 'Area B' of the abandoned shipyard, where former slipways and open boat storage area were situated. Given the permeable nature of the ground and common chemicals used in shipyards eg petroleum products, contaminants generated from past activities in the area could possibly infiltrated in the underlying soil.

4.3.3 For BH-4 (0.5m and 1.5m), BH-5 (3.0m) and BH-8 (1.5m), the concentration of lead/or copper exceeded the Dutch B level by approximately 10 – 27%.

4.3.4 Based on the above, heavy metals are considered as the major contaminant of Subject Site. Heavy metal exceedances in particular lead and copper were shown from soil samples in Area B (ie BH-3 and BH-4) and Area C (ie BH-5 and BH-8) of the Subject Site.

4.3.5 Other than heavy metals, exceedance in Dutch C TPH criteria was recorded at BH-3 (0.5m). However, as no exceedances in Dutch levels were observed in lower soil stratum (ie 0.95m bgl and deeper) and other sampling locations, the organic contamination is likely to be localised. This is further supported by the fact that apart from TPH, other organic contaminants, namely BTEX, PAHs and VOCs, were not detected in all of the collected soil samples.

4.3.6 A brief summary of health effects of the contaminants with Dutch B level exceedance in the soil samples is shown in **Appendix D**.

Results of Groundwater Analysis

4.3.7 All groundwater samples were recorded with concentrations exceeding the assessment criteria for heavy metals (ie barium, cadmium, chromium, copper, molybdenum, lead, zinc, mercury and vanadium). Due to the proximity of the sampling locations to the Causeway Bay Typhoon Shelter, the groundwater quality is expected to be greatly influenced by the nearby marine water. **Table 4.4** summarises the groundwater samples with concentrations exceeding the assessment criteria. The full laboratory results for all groundwater samples are presented in **Appendix C**.

Table 4.4 Summary of Groundwater Samples Exceeding the Assessment Criteria

Sampling Location	Contaminant	Dutch Level (µg/L)		Concentration (µg/L)	Dutch Level Exceedance
		B	C		
BH-1	Barium	100	500	190	>B
	Copper	50	200	180	>B
	Lead	50	200	76	>B
BH-2	Barium	100	500	140	>B
	Copper	50	200	370	>C
	Lead	50	200	640	>C
BH-3	Barium	100	500	300	>B
	Cadmium	2.5	10	2.8	>B
	Chromium	50	200	65	>B
	Copper	50	200	640	>C
	Lead	50	200	880	>C
	Zinc	200	800	470	>B
BH-4	Barium	100	500	210	>B
	Cadmium	2.5	10	4.2	>B
	Chromium	50	200	59	>B
	Copper	50	200	5900	>C
	Lead	50	200	1700	>C
	Zinc	200	800	300	>B
BH-5	Barium	100	500	210	>B
	Copper	50	200	740	>C
	Lead	50	200	4400	>C
	Zinc	200	800	1200	>C
BH-6	Barium	100	500	180	>B
	Copper	50	200	280	>C
	Lead	50	200	360	>C

Sampling Location	Contaminant	Dutch Level (µg/L)		Concentration (µg/L)	Dutch Level Exceedance
		B	C		
BH-7	Barium	100	500	150	>B
	Copper	50	200	380	>C
	Molybdenum	20	100	31	>B
	Lead	50	200	99	>B
	Mercury	0.5	2	0.79	>B
BH-8	Barium	100	500	160	>B
	Copper	50	200	310	>C
	Zinc	200	800	290	>B
	Vanadium	36*		38	N/A*
BH-9	Copper	50	200	370	>C
	Lead	50	200	81	>B

* No Dutch Levels for Vanadium. USEPA Region IX PRG was adopted. (see **Section 3** above)

4.3.8 As discussed earlier, the Dutch values for groundwater only serve to indicate the chemical-of-concern for risk assessment and are not appropriate for assessing groundwater contamination in Hong Kong. A risk-based assessment is thus carried out for the chemical-of-concerns (i.e. with concentration exceeding the Dutch B/C level) to evaluate the risks posed to the sensitive receptors. In view of the reporting limit of m-xylene / p-xylene and ortho-xylene as 15 µg/L, the detection limit for the sum of the xylenes are therefore equals to 30 µg/L, which is greater than the corresponding Dutch B level (20 µg/L). As a result, xylenes are included in the assessment although it is not detected in all of the groundwater samples.

4.3.9 The maximum source concentration recorded in the groundwater samples irrespective of their locations would be taken as the source concentration for the risk calculation. **Table 4.5** shows the maximum source concentration (of groundwater samples) of the chemicals-of-concerns and their corresponding non-carcinogenic oral reference dose.

Table 4.5 Maximum Source Concentration and Oral Slope Factors/Oral Reference Doses used for Risk Assessment

Parameter	Maximum Source Concentration (of groundwater samples) (mg/L)	Oral Reference Dose[a] (mg/kg/d)	Oral Slope factor (1/mg/kg/d)
Xylenes	3.00E-02	2.00E-01	Not applicable
Barium	3.00E-01	7.00E-02	Not applicable
Cadmium	4.20E-03	5.00E-04	Not applicable
Chromium	6.50E-02	1.50E+00	Not applicable
Copper	5.90E+00	4.00E-02	Not applicable
Molybdenum	3.10E-02	5.00E-03	Not applicable
Lead	4.40E+00	3.60E-03	Not applicable
Zinc	1.20E+00	3.00E-01	Not applicable
Mercury	7.90E-04	3.00E-04	Not applicable
Vanadium	3.80E-02	1.00E-03	Not applicable

Source: [a] Source (other than Lead): USEPA Region IX Risk-based Concentration Table (revised in Oct 2004, USEPA Region IX)
Source for Lead: World Health Organization

4.3.10 The details of the risk assessment for groundwater are given in **Appendix E**. According to the results of the risk assessment, the concentration of all COCs in groundwater, including xylenes, barium, cadmium, chromium, copper, molybdenum, lead, zinc, mercury and vanadium, do not exceed the remediation criteria. In addition, according to the on-site measurement records, there was no apparent

thickness of free product encountered at all boreholes which echoes with the low TPH value measured in all groundwater samples. In this regard, risk of all tested dissolved contaminants in groundwater to workers during construction works may be considered acceptable and groundwater remediation would not be necessary.

Results of QA/QC Analysis

4.3.11 QA/QC is the practice of making sure that collection and analysis techniques provide precise and accurate information. This process is to ensure that the levels of contamination measured in the environmental samples reflect the actual environmental levels and are not due to accidental contamination of the sample or sample container. In this assessment, two sets of field blank and equipment blank were collected during the course of sampling.

4.3.12 The analytical results, as shown in **Appendix C**, showed that concentration of all tested parameters were below the respective detection limits, indicating that acceptable quality control/quality assurance procedures were achieved.

5 SOIL CONTAMINATION EXTENT

5.1 Approach of Estimation for Soil Contamination Extent

5.1.1 The extent of contamination was estimated based on the results from the SI works. The estimation made the best use of available information to delineate the vertical and horizontal extent of soil contamination presented at the Site and would be used for the formulation of any necessary soil remediation. Limitation to the estimation would exist due to unknown contamination levels between sampling locations and the actual contamination may deviate from the estimated volume.

5.1.2 In general, in the horizontal extent, a distance of about 3.5m extended from the centre of the sampling locations (with contamination identified) and/or along the contaminated sources (e.g. storage facility), building boundary and /or site boundary was employed to confine the area in which soil has to be treated/ handled.

5.1.3 For vertical distribution of the contaminants, 0.5m above and below the sampling point (with contamination identified) or mid-point between contaminated and non-contaminated layer would be adopted as the vertical contamination extent.

5.2 Soil Contamination Extent

5.2.1 Based on the analytical results from the SI works, some of the soil samples collected from Area B and Area C had exceeded the assessment criteria. The estimations of contamination extent for these areas are discussed below.

Area B

5.2.2 Area B was previously identified as slipways and open boat storage area. Elevated TPH levels were found at BH-3 (0.5m) while elevated heavy metal levels were identified at BH-3 (0.5m), BH-4 (0.5m and 1.5m). No exceedances in assessment criteria were identified at other sampling depths (ie 0.95m, 1.50m and 3.00m for BH-3 and 0.95m and 3.00m for BH-4).

5.2.3 Due to the discrete nature of TPH, barium and zinc exceedances, the contamination for these parameters are likely to be localised. The horizontal extent of contamination is therefore estimated to be 7m x 7m square in dimension (i.e. 3.5m from the centre of BH-3). Given that no TPH, barium and zinc exceedances were identified at deeper soil stratum (ie at depth 0.95m, 1.50m and 3.00m), the vertical extent would be from surface to 0.8m bgl. The extent of contamination for TPH, barium and zinc is shown as 'Area B1' in **Figure 3**.

5.2.4 As elevated levels of copper and lead were identified at BH-3 (0.5m) and BH-4 (0.5m), the entire Area B is estimated to be the horizontal extent of contamination. Given that no heavy metals exceedances were observed from soil samples collected at BH-3 (0.95m) and BH-4 (0.95m), the vertical extent is estimated to be from surface to 0.8m bgl (shown as 'Area B2' in **Figure 3**).

5.2.5 For the elevated copper level at BH4 (1.5m), as no exceedance in the assessment criteria was noted at BH-4 (0.95m and 3.00m) and BH-3 (0.95m, 1.50m and 3.00m), the exceedance is also likely to be localised. A 7m x 7m square (i.e. 3.5m from the centre of BH-4) with depth 1.2 to 2.0m bgl is estimated to be the extent of soil contamination (shown as 'Area B3' in **Figure 3**).

5.2.6 The estimated volumes of soil contamination at Area B1 to B3 are shown in **Table 5.1**.

Area C

5.2.7 Elevated lead contamination was found at BH-5 (3.00m) and BH-8 (1.50m). Given the discrete nature of lead contamination, the contamination at Area C is considered to be localized. As such, 7m x 7m squares (i.e. 3.5m from the centre of BH-5 and BH-8) are estimated as the zone of soil contamination. The vertical extent of contamination at BH-5 and BH-8 would be from 2.5m to 3.5m and 1m to 2m respectively.

5.2.8 The estimated extent of contamination for exceedances at BH-5 and BH-8 are shown as 'Area C1' and 'Area C2' in **Figure 3.** The estimated volumes of soil contamination are shown in **Table 5.1.**

5.3 Estimated Quantity of Contaminated Soil

5.3.1 Based on the above, the estimated volumes of contaminated soil are shown in **Table 5.1** below. A Remediation Action Plan (RAP) is recommended for handling the identified contaminated soil.

Table 5.1 Estimated Quantity of Contaminated Soil

Area ID	Corresponding Sampling Location	Contaminants	Estimated Vertical Contamination Extent (m below ground)	Estimated Horizontal Contamination Extent (m^2)	Estimated Volume of Contaminated Soil * (m^3)
Area B1	BH-3	TPH, copper, lead, zinc and barium	0.0-0.8	49	39.2
Area B2	BH-3 & BH-4	Copper and lead	0.0-0.8	570.5	456.4
Area B3	BH-4	Copper	1.2-2.0	49	39.2
Area C1	BH-5	Lead	2.5-3.5	49	49
Area C2	BH-8	Lead	1.0-2.0	49	49
Total Estimated Volume of Contaminated Soil:					632.8
					(TPH and Heavy Metals: 39.2m^3; Heavy Metals only: 593.6m^3)

Notes: * The soil volume may vary subject to the testing of confirmatory samples collected at the defined contaminated zone boundary as well as the site specific conditions (e.g. encountering of boulders).

5.3.2 The contaminated soil extents as stated in **Table 5.1** were estimated based on the laboratory testing results. The total volume of contaminated soil may vary depending on results of the confirmation test. If there is a presence of elevated contamination indicated in the confirmation test after excavation of the initial defined contaminated area, excavation shall be further extended until all contaminated soils are removed and, in such case, the volume of contaminated soil will be increased. Details of the confirmation test are presented in the subsequent section of this Report.

6 REMEDIATION ACTION PLAN

6.1.1 Soil remediation options applicable to the Subject Site were addressed based on the following criteria:

- Technical and cost effectiveness;
- Technology development status;
- Commercial availability
- Experience; and
- Expertise requirements

6.2 Remediation for TPH Contaminated Soil

6.2.1 Biopiling is a proven remediation technology which is effective for the treatment of organic-contaminated soils. It makes use of biological processes to turn contaminants into harmless products, ultimately to carbon dioxide, water and simple inorganic compounds. Biopiling had also been adopted in several previous land contamination projects such as *Decommissioning of Kai Tak Airport, North Apron of former Kai Tak Airport, Decontamination of North Tsing Yi Shipyards* and *Decommissioning of Cheoy Lee Shipyards* with soil treatment capacity over 10,000m^3. The treatment results demonstrated that biopiling is successful for treating organic-contaminated soil.

6.2.2 As shown in **Table 6.1**, the estimated TPH-contaminated soil volume from the Site is just below 40m^3. This quantity of soil is significantly smaller than the soil volume as treated in the above biopiling projects. There would be uncertainty in the practicability of constructing a very small biopile. Factors such as maintaining moisture content and uniform aeration rate would be a concern subject to trial runs and researches. Therefore, it is considered not practical to use on-site biopiling in this Project. Considering also the quantity of contaminated soil is small, excavation and landfill disposal is proposed to be the remediation method.

Table 6.1 Estimated Quantity of TPH Contaminated Soil

Area ID	Contaminants	Estimated Vertical Contamination Extent (m bgl)	Estimated Horizontal Contamination Extent (m^2)	Estimated Volume of Contaminated Soil * (m^3)
Area B1	TPH, copper, lead, zinc and barium	0.0-0.8	49	39.2

6.2.3 According to the *Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repair/Dismantling Workshops* published by EPD, excavated soil should meet certain criteria before disposal to landfills. Toxicity Characteristics Leaching Procedure (TCLP) test for full suite of parameters was conducted in accordance with USEPA Method 1311 for the soil samples collected at BH-3 (0.5m), BH-4 (0.5m), BH-5 (3.0m) and BH8 (1.5m). The laboratory results indicated that no exceedances in the TCLP criteria were noted in all 4 soil samples. The full analytical results are shown in **Appendix C**.

6.3 Remediation for Heavy Metals Contaminated Soil

6.3.1 *Ex-situ* cement solidification / stabilisation (CS/S) is considered as the preferred remediation method for treatment of contaminated soil with heavy metals. It is an immobilisation technique applicable to the treatment of soil contaminated with heavy metals. By mixing contaminated soil with cement, the metal contaminants in soil become physically bound within a stable mass. The solid monolithic block is extremely resistant to the leaching of metal contaminants. *Ex-situ* CS/S as soil remediation method had been successfully applied to a number of contaminated sites in Hong Kong, including *Cheoy Lee*

Shipyard at Penny's Bay, North Tsing Yi Shipyard and *Deep Bay Link - Northern Section. Ex situ* treatment has the advantages of better control of reagent addition/mixing and quality control sampling.

6.3.2 Cement-based solidification/stabilisation involves mixing contaminated materials with an appropriate ratio of cement, and possibly water and other additives. The fundamental materials used to perform this technology are Portland-type cements.

6.3.3 The heavy metal contaminated soil for CS/S treatment is located at Area B2, B3, C1 and C2 with estimated quantity as shown in **Table 6.2** below.

Table 6.2 Estimated Quantity of Heavy Metals Contaminated Soil

Area ID	Contaminants	Estimated Vertical Contamination Extent (m below ground)	Estimated Horizontal Contamination Extent (m^2)	Estimated Volume of Contaminated Soil (m^3)
Area B2	Copper and lead	0.0-0.8	570.5	456.4
Area B3	Copper only	1.2-2.0	49	39.2
Area C1	Lead only	2.5-3.5	49	49
Area C2		1.0-2.0	49	49
Total Estimated Volume of Contaminated Soil:				593.6

6.4 Implementation Programme

6.4.1 The following key steps/milestones are proposed for the handling/treatment of contaminated soil:

(i) Landfill disposal for TPH contaminated soil

(ii) Excavation and stockpile of heavy metals contaminated soil

(iii) Cement solidification / stabilisation and treatment performance criteria

(iv) Handling of treated soil

(v) Preparation and submission of Remediation Report

Landfill Disposal for TPH contaminated soil

6.4.2 The essential steps for the excavation and landfill disposal are attached in **Appendix F**.

6.4.3 It is proposed that the excavation of TPH contaminated soil be carried out as shown in **Figure 4** (Area B1). It is anticipated that the excavation works will be of short duration and where practicable, no excavation shall be allowed on rainy days to avoid possible migration of contaminants while working on site and during disposal. No stockpiling is recommended, as all excavated soil should be transported to a designated landfill on every working day. A disposal license / permit should be granted from EPD for the disposal of the contaminated soil to EPD's designated landfill prior to excavation.

6.4.4 While stockpiling of contamination soil is required, the stockpile should be fully covered by impermeable sheeting to prevent dust emission and runoff. The assigned area should have suitable warning posted. Impermeable sheeting should also be placed at the bottom of the stockpile and leachate collection sump should be constructed along the perimeter of the stockpile to prevent leachate

from contaminating the underlying soil / groundwater. The collected leachate should be disposed of as chemical waste.

6.4.5 General construction practice should be exercised to control the spread of dust from the site to the nearby residential areas. Decontamination should be properly executed to workers and vehicles before leaving the site.

6.4.6 Due care must be exercised during the transportation of the excavated contaminated soil to the landfill for disposal. The soil should be properly contained and covered to avoid spillage during transportation. Suitable warning signs about the nature of the contaminated soil should be displayed on both the vehicle and the soil itself.

6.4.7 A closure assessment should be undertaken after the excavation to confirm the clean-up for the excavation of contaminated areas. The objective is to determine if all organic contaminated soils have been fully removed.

6.4.8 At least one sample from the base of the excavation and four samples evenly distributed along the boundary of the excavation pit shall be collected for laboratory analysis for TPH. The parameters, detection limits and reference methods for the laboratory analysis of soil samples for closure assessment are tabulated in **Table 6.3.**

Table 6.3 Parameters, Detection Limits, Reference Methods and Assessment Criteria for Confirmatory Test on TPH Contaminated Soil Samples

Item	Parameter	Detection Limit (mg/kg)	Reference Method	Dutch B Criteria (mg/L)
1	TPH	C6-C9: 2 C10-C14: 50 C15-C28: 100 C29-C36: 100	USEPA 8015	1,000

6.4.9 If the laboratory analysis indicated that there is presence of contamination (ie above relevant Dutch B criteria), the excavation shall be extended further (with 0.5m increment in vertical direction and 1.0m in horizontal direction). Further sampling and confirmation test shall be undertaken. The process of excavation, sampling and confirmation test shall continue until all organic contaminated soils are removed.

Excavation and Stockpile of Heavy Metals Contaminated Soil

6.4.10 It is proposed that the excavation should be carried out as shown in **Figures 4** (Area B2, B3, C1 and C2). Excavation at Area B2 and B3 should only be carried out after the confirmation of clean-up at Area B1 for TPH as discussed above.

6.4.11 The contaminated soil would be excavated and transported to a designated area for treatment. The treatment area would be preferably conducted near the designated area to minimise transportation of contaminated soil. No excavation shall be allowed on rainy days to avoid possible migration of contaminants while working on site and during disposal.

6.4.12 Measures as discussed in **Paragraph 6.4.4 to 6.4.6** above shall also be implemented if applicable.

6.4.13 A closure assessment to confirm the clean-up for the excavation of contaminated areas should be undertaken. The objective is to determine if all contaminated soil has been removed before filling takes place.

6.4.14 Confirmatory soil sampling would be collected at the side walls and at the bottom of the excavation pit. It is proposed that one soil sample at the base of the excavation and *at least* four samples at mid-depth of the excavation pit boundary be collected for laboratory analysis. The soil sampling and testing procedures must be carried out to confirm soil at the final boundary of the excavation pit is '*clean*' (ie below relevant Dutch B criteria), before the backfilling takes place.

6.4.15 The confirmatory soil samples should be collected using stainless steel hand tools and contained in appropriate containers as provided by the laboratory. During sampling, the sampling tools shall be decontaminated by thoroughly washing with laboratory-grade detergent and then rinsing by clean water. At each sampling point, sufficient soil sample should be taken to fill up the container upon sample collection. The collected soil samples shall be analyzed by a HOKLAS accredited laboratory. The parameters, detection limits, reference methods and corresponding Dutch B criteria for the laboratory analysis of soil samples for the closure assessment are tabulated in **Table 6.4**.

Table 6.4 Parameters, Detection Limits, Reference Methods and Assessment Criteria for Confirmatory Tests on Heavy Metals Contaminated Soil

Item	Parameter	Applicable Contaminated Area	Detection Limit (mg/kg)	Reference Method	Dutch B Criteria (mg/L)
1	Lead (Pb)	B2, C1 & C2	1.0	USEPA 6020	150
2	Copper (Cu)	B2 & B3	1.0	USEPA 6020	100
3	Barium (Ba)	B2	0.5	USEPA 6020	400
4	Zinc (Zn)	B2	20	USEPA 6020	500

6.4.16 If the laboratory analysis indicated that there is presence of contamination (ie above relevant Dutch B criteria), the excavation shall be extended further (with 0.5m increment in vertical direction and 1.0m in horizontal direction). Further sampling and confirmation test shall be undertaken. The process of excavation, sampling and confirmation test shall continue until all contaminated soils are removed.

Cement Solidification/Stabilisation and Treatment Performance Test

6.4.17 Prior to solidification, metal-contaminated soils shall be screened to segregate soil from debris, rock fragments, and other materials and to break soil clumps into sizes to allow effective mixing with solidifying agents.

6.4.18 During the cement SS process, cement, water and other additive(s) (such as fly ash, lime, soluble silicates and clays) are added to the contaminated soils to form soil block. It is important that soil/cement/water is uniformly mixed. The cement solidification / stabilization mixing process can be carried out within a pugmill, lorry mixer or equivalent.

6.4.19 The total volume of the concrete blocks could increase by up to about 10% from the original soil volume. For easy handling, the solidified blocks shall be broken up into a number of smaller blocks after verification procedure. Considerations for cement solidification /stabilisation shall include the followings:

- Soil characteristics (e.g. metal content, physical characteristics);
- Required solidified soil properties (e.g. leachability, permeability, compressive strength);
- Operational and economical factors (e.g. cost of cement and availability & cost of other additives, materials handling, volume and weight increase) and;
- Test methods (e.g. leachability)

6.4.20 The soil mixture in the concrete blocks should be solidified within about 1 week. Test for leachability shall then be carried out. The sampling frequency for the leachability test should be 1 TCLP sample per 100 m^3 of broken up hardened mixture after cement SS treatment. Each TCLP sample will be a composite sample collected at 5 locations over the treated pile and roughly the same volume of sample will be collected at each of the 5 locations so that the composite sample is not biased.

6.4.21 Any hardened samples to be submitted to laboratory for TCLP analysis will be broken up by the Contractor to small pieces with maximum diameter of 10cm. The sample preparation method of USEPA Method 1311 will be followed for the TCLP analysis. It is specified in USEPA Method 1311 that the maximum grain size of samples to be analysed is 1cm. As such, the samples will be further broken up in the laboratory prior to TCLP analysis. TCLP tests will be conducted in accordance with USEPA Method 1311 and USEPA Method 6020 for metals lead, copper, barium and zinc. The results of the TCLP tests shall comply with the "Universal Treatment Standards" (UTS) before reuse on site. As there are no UTS standards for copper, the acceptance criteria for copper adopted in the *Decommissioning of Cheoy Lee Shipyard,* which made comparison between Drinking Water Standards for the USEPA and the USEPA Federal Register, was therefore used. The UTS for the concerned heavy metals are listed in **Table 6.5** below.

Table 6.5 Universal Treatment Standards for Soil Remediation

Parameter	Universal Treatment Standard (mg/L as TCLP)
Barium	21
Copper*	7.8
Lead	0.75
Zinc	4.3

* Adopted acceptance criteria from the remediation of *Decommissioning of Cheoy Lee Shipyard.*

6.4.22 Any pile of broken up solidified mixture that does not meet the concerned UTS will be crushed and re-treated by cement solidification. The re-treated pile will be tested again for TCLP to confirm if it can be reused on site.

6.4.23 The treated material shall be allowed to set to achieve the unconfined compressive strength (UCS) of not less than 1 mPa with reference to the USEPA guidelines (1986) – Handbook for Stabilization / Solidification of Hazardous Wastes, EPA/540/2-96-00. The test procedure of UCS test shall be based on BS 1377.

Handling of Treated Soil

6.4.24 Upon completion of the leachability testing and meeting the UTS and the UCS requirements, the solidified materials should be reused on site as filling materials. As the maximum grain size of filling material is 250mm (according to the general practice), the solidified soil shall be broken down to below this size before being used as filling materials. Whenever the soil is to be reused as filling materials, the soil should be put below at least 1m of clean fill layer.

Preparation and Submission of Remediation Report

6.4.25 A Remediation Report shall be prepared and submitted to EPD for record. The Remediation Report shall demonstrate that the clean-up is adequate and all excavated contaminated soil has either undergone the proper soil remediation to meet the relevant standards or disposed properly at designated landfill. All relevant information, including details of closure assessment, sampling results, photographs, certification of independent checker, quantity of treated soil and final backfill site of treated soil shall be included in the report.

7 ENVIRONMENTAL MITIGATION MEASURES AND SAFETY MEASURES

7.1 Environmental Mitigation Measures

7.1.1 The Contractor for the excavation works shall take note of the following points for excavation:

- Excavation profiles must be properly designed and executed;
- In case the soil to be excavated is situated beneath the groundwater table, it may be necessary to lower the groundwater table by installing well points or similar means;
- Quantities of soil to be excavated must be estimated;
- It maybe necessary to split quantities of soil according to soil type, degree and nature of contamination.
- Temporary storage of soil at intermediate depot or on-site maybe required. The storage site should include protection facilities for leaching into the ground. eg. Liner maybe required.
- Supply of suitable clean backfill materials is needed after excavation.
- Care must be taken of existing buildings and utilities.
- Precautions must be taken to control of ground settlement
- Speed controls for vehicles should be imposed on dusty site areas.
- Vehicle wheel and body washing facilities at the site's exit points should be established and used.

7.1.2 The following environmental mitigation measures should be strictly followed during the operation and/or maintenance of the CS/S facilities:

Air Quality Mitigation Measures

- The loading, unloading, handling, transfer or storage of cement should be carried out in an enclosed system.
- The loading, unloading, handling, transfer or storage of other materials which may generate airborne dust emissions such as untreated soil and oversize materials sorted out from the screening plant and stabilized soil stockpiled in the designated handling area, should be carried out in such a manner to prevent or minimise dust emissions. These materials should be adequately wetted prior to and during the loading, unloading and handling operations.
- All practicable measures, including speed controls for vehicles, should be taken to prevent or minimize the dust emission caused by vehicle movement.
- Tarpaulin or low permeable sheet should be put on dusty vehicle loads transported between site locations.

Noise Mitigation Measures

- The mixing facilities should be sited as far as practicable to the nearby noise sensitive receivers.
- Simultaneous operation of mixing facilities and other equipment should be avoided.
- Mixing process and other associated material handling activities should be properly scheduled to minimise potential cumulative noise impact on the nearby noise sensitive receivers.
- Construction Noise Permit should be applied for the operation of powered mechanical equipment during restricted hours (if any).

Water Quality Mitigation Measures

- Stockpile of untreated soil should be covered as far as practicable to prevent the contaminated material from leaching out. The leachate should be discharged following the requirements of WPCO.

Waste Mitigation Measures

- Treated oversize materials will be used as filling material for backfilling within the site. Sorted materials of size smaller than 5 cm will be collected and transferred to the mixing plant for further decontamination treatment.
- Stabilized soils should be broken into suitable size for backfilling or reuse on site.
- A high standard of housekeeping should be maintained within the mixing plant area.
- If necessary, there should be clear and separated areas for stockpiling of untreated and treated materials.

7.2 Safety Measures

7.2.1 During the course of the site remediation, the following basic health and safety measures should be implemented as far as practicable:

i) Set up a list of safety measures for site workers;
ii) Provide written information and training on safety for site workers;
iii) Keep a log-book and plan showing the contaminated zones and clean zones;
iv) Maintain a hygienic working environment;
v) Avoid dust generation;
vi) Provide face and respiratory protection gear to site workers;
vii) Provide personal protective clothing (e.g. chemical resistant jackboot, liquid tight gloves) to site workers;
viii) Provide first aid training and materials to site workers;
ix) Bulk earth moving equipment shall be utilized as much as possible to minimize workers' handling and contact of the contaminant materials; and

x) Eating, drinking and smoking shall not be allowed in contaminated areas to avoid inadvertent ingestion of contaminants

7.3 Points to Note Concerning Excavation

7.3.1 The Contractor for the excavation works shall take note of the following points for excavation:

- Excavation profiles must be properly designed and executed.
- In case the soil to be excavated is situated beneath the groundwater table, it may be necessary to lower the groundwater table by installing well points or similar means.
- Quantities of soil to be excavated must be estimated.
- It may be necessary to split quantities of soil according to soil type, degree and nature of contamination.
- Temporary storage of soil at intermediate depot or on-site may be required. The storage site should include protection facilities for leaching into the ground e.g. a liner may be required.
- Supply of suitable clean backfill material is needed after excavation.
- Warning sign should be placed at the contaminated area.
- Contaminate area should be fenced off throughout the remediation and closure assessment were completed.
- The excavation program for each contaminated site should forward to relevant parties for information before commenced the excavation.

7.3.2 To facilitate excavation work, the following precautions must be taken by the Contractor:

- Care must be taken of existing buildings and utilities
- Control of ground settlement
- Protect the integrity of existing structures
- Traffic diversions
- Provisions concerning hygienic and safe working conditions

8 CONCLUSIONS AND RECOMMENDATIONS

8.1.1 Site investigation had been carried out at A King Marine to estimate the nature and extent of contamination within the abandoned shipyard. A total of 26 soil and 9 water samples were collected from 10 sampling locations. According to the results of site investigation, a total of 4 out of 10 sampling locations (viz. BH-3, BH-4, BH-5 and BH-8) had soil contamination levels above the relevant assessment criteria. The 4 sampling locations showed exceedances in heavy metals (ie barium, copper, lead and/or zinc). One soil sample at BH-3 (0.5m bgl) also showed exceedance in TPH.

8.1.2 Based on the analytical results from the SI works, five (5) contaminated areas in Area B and C of the abandoned shipyard were identified. The extent of soil contamination is illustrated in **Figure 3** and the quantity of contaminated soil is estimated to be approximately 632.8m^3. Of the estimated volume, 593.6m^3 are contaminated with heavy metals and 39.2m^3 are contaminated with both heavy metals and TPH. The actual quantity of contaminated soil will be subject to site specific conditions (e.g. encountering of boulders) and results of the confirmatory tests.

8.1.3 In terms of groundwater quality, the results of the risk assessment indicate that concentration of the COCs in the groundwater, including xylenes, barium, cadmium, chromium, copper, molybdenum, lead, zinc, mercury and vanadium, do not exceed the 'allowable' concentration. Furthermore, no apparent free product (float oily layer) was identified in the groundwater during the field works. Nevertheless, the use of groundwater as a potable water sources or other uses could not be found on the site. As a result, remediation of groundwater is considered not necessary.

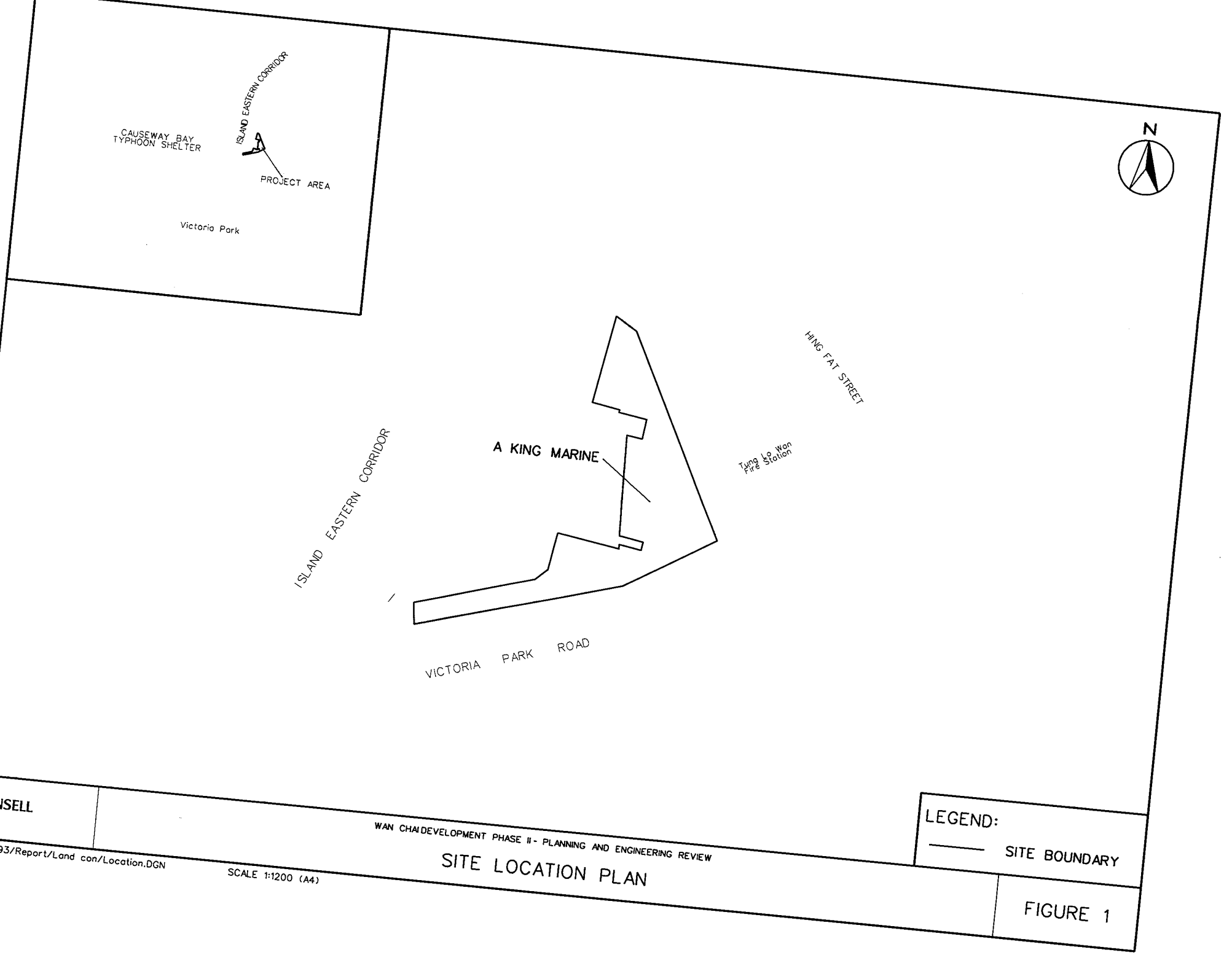
8.1.4 Identified contamination soil will be excavated for handling and/or treatment. To ensure complete removal of contaminated soil, a closure assessment in the form of confirmatory test has been proposed to be conducted after excavation to confirm complete clean-up of the site. A Remediation Report shall be submitted for EPD's approval upon completion of all the remediation works.

8.1.5 Landfill disposal and cement solidification/stabilization (CS/S) treatment are proposed as the soil remediation method for heavy metal and TPH contaminated soil. The estimated volumes of soil contamination for cement solidification / stabilisation and landfill disposal are 593.6m^3 and 39.2m^3 respectively. For heavy metals contaminated soil, both the Universal Treatment Standards in the TCLP test and the unconfined compressive strength (UCS) test of not less than 1 MPa shall be met prior to backfilling on site.

8.1.6 Environmental mitigation measures have been proposed to minimise the potential environmental impacts of the remediation activities. Health and safety measures should be followed to minimize safety hazard posed to site workers.

8.1.7 The site shall be remediated to the satisfaction of EPD before commencement of any site clearance and construction works.

Figures



MAUNSELL

WAN CHAI DEVELOPMENT PHASE II - PLANNING AND ENGINEERING REVIEW

SITE LOCATION PLAN

LEGEND:

SITE BOUNDARY

FIGURE 1

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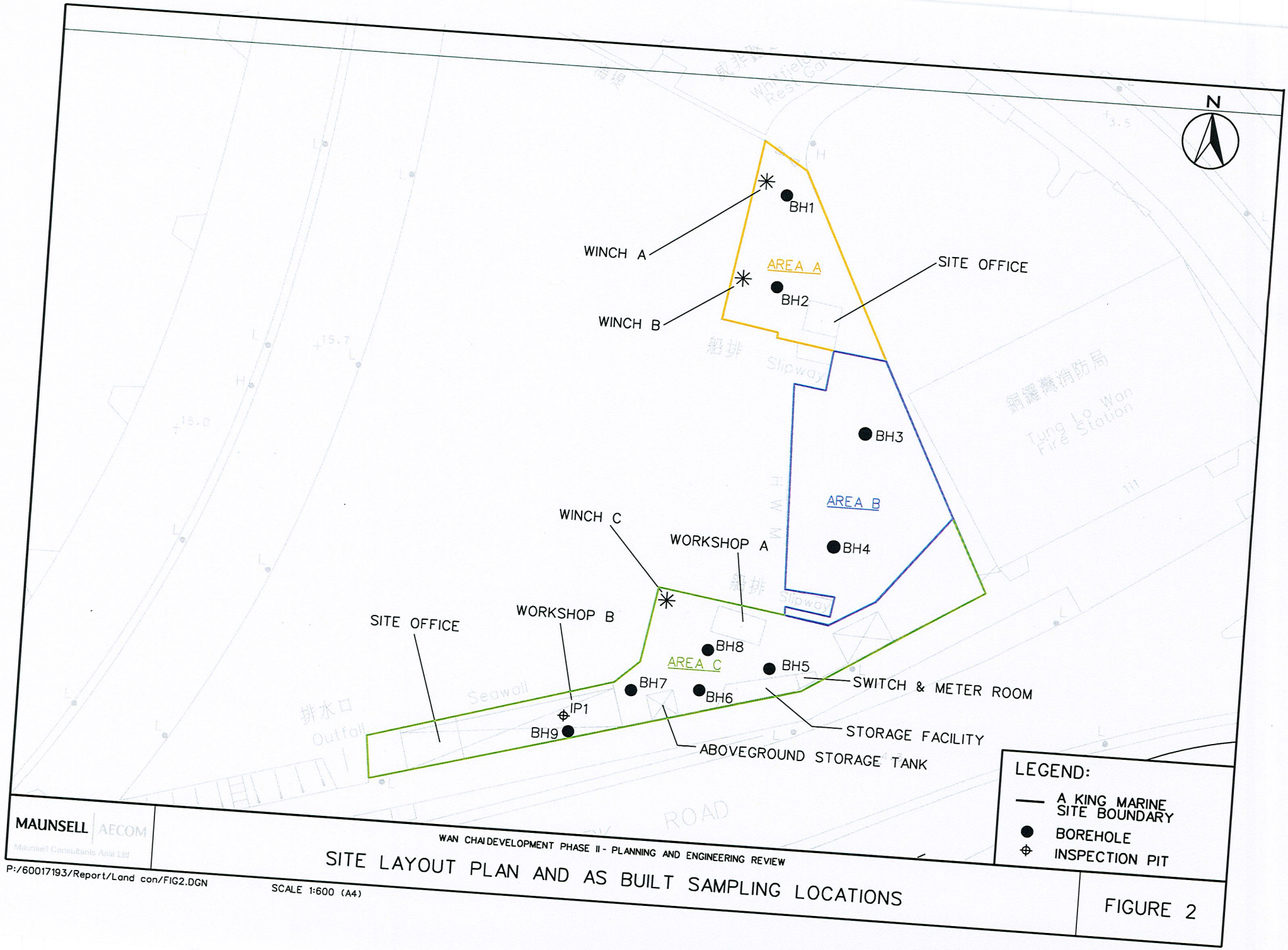

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WAN CHAI DEVELOPMENT PHASE II - PLANNING AND ENGINEERING REVIEW

SITE LAYOUT PLAN AND AS BUILT SAMPLING LOCATIONS

FIGURE 2

P:/60017193/Report/Land con/FIG2.DGN

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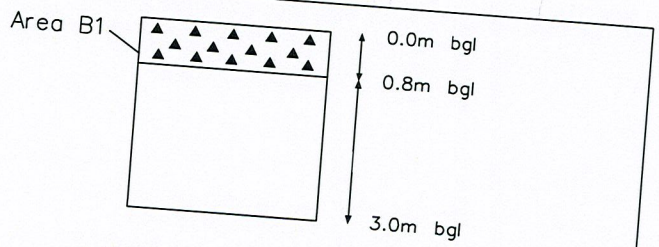
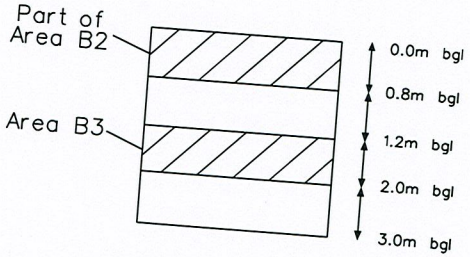
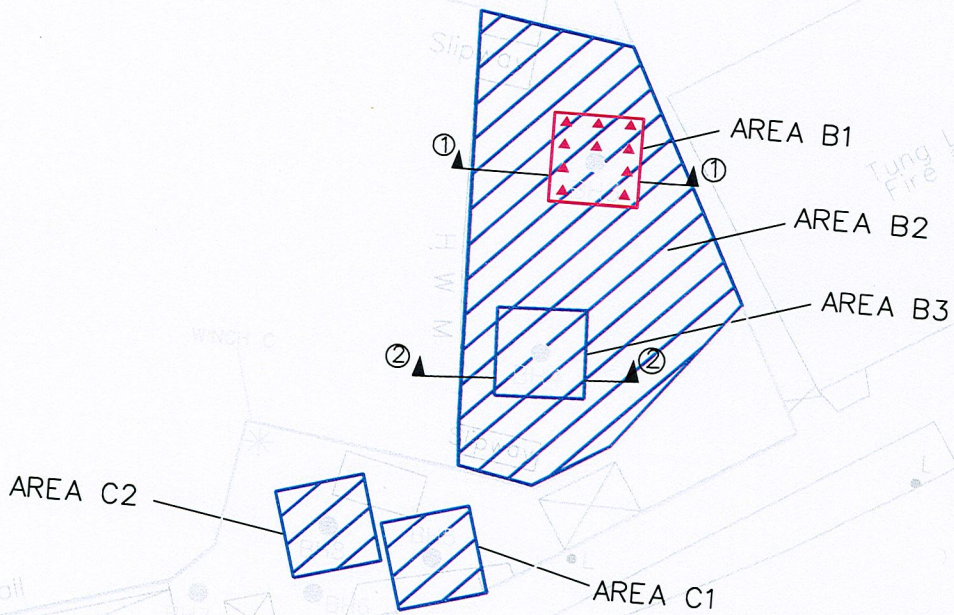


SECTION 1 [N.T.S.]



SECTION 2 [N.T.S.]

Area	Vertical Extent of Contamination (mbgl)	Nature of Contamination
B1	0 - 0.8	TPH, Copper, Lead, Zinc and Barium
B2	0 - 0.8	Copper and Lead
B3	1.2 - 2.0	Copper
C1	2.5 - 3.5	Lead
C2	1.0 - 2.0	Lead



LEGEND:

- SOIL CONTAMINATED WITH TPH & HEAVY METALS
- SOIL CONTAMINATED WITH HEAVY METALS
- BOREHOLE
- INSPECTION PIT

MAUNSELL AECOM
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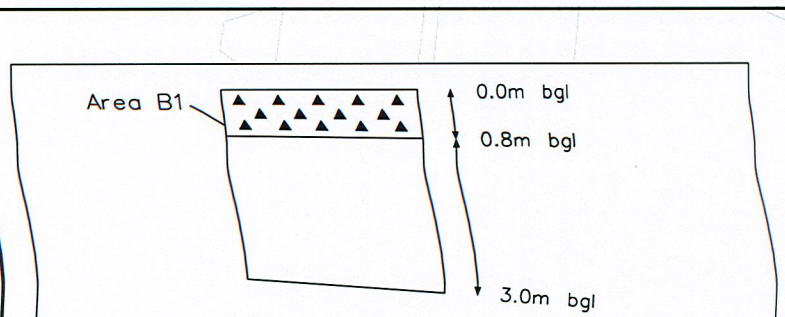
WAN CHAI DEVELOPMENT PHASE II - PLANNING AND ENGINEERING REVIEW

ESTIMATED EXTENT OF SOIL CONTAMINATION

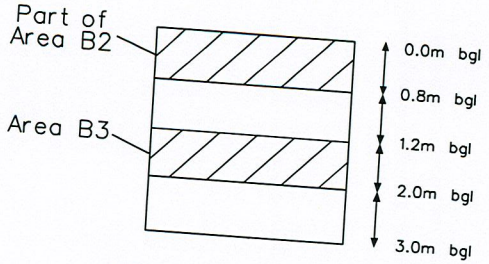
FIGURE 3

\A01604\DRAWING\REPORT\MAY07\FIGURE 3_2.DGN

SCALE 1:600 (A4)

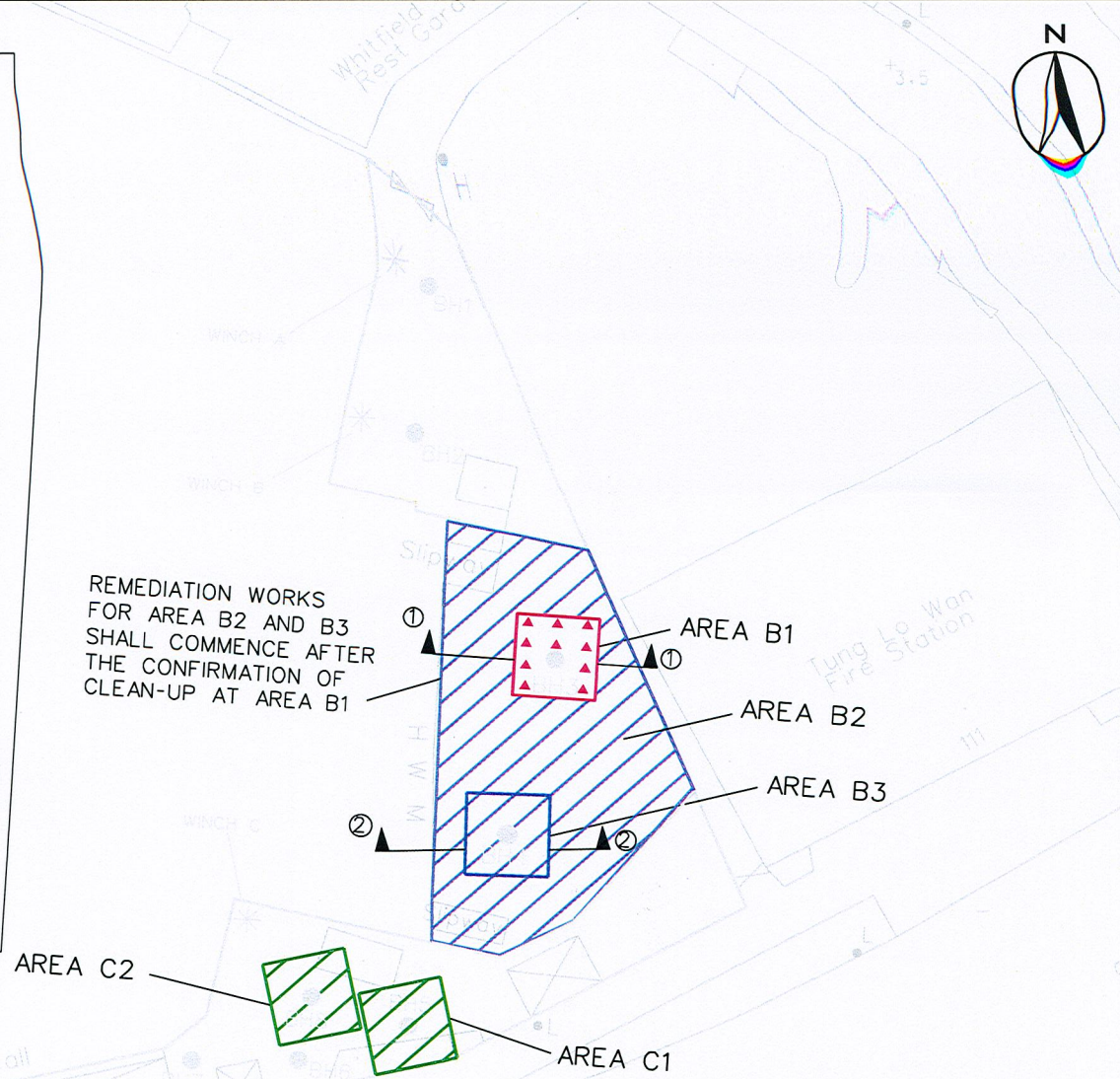


SECTION 1 [N.T.S.]



SECTION 2 [N.T.S.]

Area	Vertical Extent of Contamination (mbgl)	Nature of Contamination
B1	0 - 0.8	TPH, Copper, Lead, Zinc and Barium
B2	0 - 0.8	Copper and Lead
B3	1.2 - 2.0	Copper
C1	2.5 - 3.5	Lead
C2	1.0 - 2.0	Lead



MAUNSELL AECOM
Maunsell Consultants Asia Ltd

WAN CHAI DEVELOPMENT PHASE II - PLANNING AND ENGINEERING REVIEW

REMEDIATION METHOD OF CONTAMINATED SOIL

FIGURE 4

K:\A01604\DRAWING\REPORT\MAY07\FIGURE 4_2.DGN

SCALE 1:600 (A4)

Appendix A
Excerpt of Sampling and Testing Plan From Approved CAP

Appendix A Sampling and Testing Plan for Land Contamination Site Investigation (Extracted from Approved CAP)

(i) Sampling Locations and Rationale

Sampling ID	Potential Source of Contamination	Rationale of Sampling
BH-1*	Winch	Possible loading area for ships
BH-2*	Winch	Possible loading area for ships
BH-3	Slipway / Open Boat Storage Area	Potential contamination from past activities on the permeable ground.
BH-4	Slipway / Open Boat Storage Area	
BH-5*	Storage Facility	Potential contamination as a result of spillage / leakage of chemicals near the storage facility / AGT.
BH-6*	Aboveground Storage Tank	
BH7*		
BH-8*	Winch / Workshop	Potential contamination due to operation of Winch C / Workshop A
TP-1*	Workshop	Potential contamination due to operation of Workshop B. (Trial pit is proposed due to headroom constraint).

Note * Sampling would only be required if the underlying ground is made up of permeable materials.

(ii) Testing Parameters Proposed for Laboratory Analysis

Item	Parameter	Soil		Groundwater	
		Detection Limit (mg/kg) or otherwise stated	Reference Method	Detection Limit (µg/L) or otherwise stated	Reference Method
1	Total Petroleum Hydrocarbons (TPH)	C6-C9: 2 C10-C14: 50 C15-C28: 100 C29-C36: 100	USEPA 8015	C6-C9: 20 C10-C14: 25 C15-C28: 25 C29-C36: 25	USEPA 8015
2	Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)	0.2 for benzene 0.3-0.5 for others	USEPA 8260	1 for benzene 15 for others	USPEA 8260
3	Polyaromatic Hydrocarbons (PAHs) [a]	1.0 for benzo(a)pyrene 2.0 for others	USEPA 8270	0.2 for benzo(a)pyrene 1.0 for others	USEPA 8270C
4	*Heavy Metals*				
	Cadmium (Cd)	0.2	USEPA 6020	1	USEPA 6020
	Lead (Pb)	1	USEPA 6020	1	USEPA 6020
	Copper (Cu)	1	USEPA 6020	1	USEPA 6020
	Tin (Sn)	0.5	USEPA 6020	1	USEPA 6020
	Chromium (Cr)	1	USEPA 6020	1	USEPA 6020
	Nickel (Ni)	1	USEPA 6020	1	USEPA 6020
	Zinc (Zn)	20	USEPA 6020	50	USEPA 6020
	Cobalt (Co)	0.5	USEPA 6020	1	USEPA 6020
	Arsenic (As)	1	USEPA 6020	10	USEPA 6020
	Molybdenum (Mo)	1	USEPA 6020	1	USEPA 6020
	Barium (Ba)	0.5	USEPA 6020	1	USEPA 6020
	Mercury (Hg)	0.05	USEPA 6020	0.5	USEPA 6020
5	*Additional Metals*[b]				
	Antimony (Sb)	1	USEPA 6020	1	USEPA 6020
	Beryllium (Be)	1	USEPA 6020	1	USEPA 6020
	Selenium (Se)	1	USEPA 6020	1	USEPA 6020
	Silver (Ag)	1	USEPA 6020	1	USEPA 6020
	Thallium (Ti)	1	USEPA 6020	1	USEPA 6020
	Vanadium (V)	1	USEPA 6020	1	USEPA 6020
6	Cyanide (CN)	1	APHA4500CD: C & E	30	APHA4500CD: C & E
7	Tributyltin (TBT)	1 µgSn/Kg	Krone et al (1989) – CG/MS UNEP/IOC/IAEA	6.5ngSn/L	Krone et al (1989) – CG/MS UNEP/IOC/IAEA
8	Volatile Organic Compounds (VOC)	0.5	USEPA 8260A	5	USEPA 8260A

Remarks:

a) The full list of 6 Polycyclic Aromatic Hydrocarbons (PAHs) are tabulated below:

1) Naphthalene	2) Phenanthrene	3) Anthracene
4) Fluoranthene	5) Benzo (a) pyrene	6) Pyrene

b) At least 3 samples from the most contaminated areas within the Shipyard shall be tested for the additional metals.

Other than the whole suite of heavy metals covered in the Dutch List (ie Cr, Co, Ni, Cu, Zn, As, Mo, Cd, Sn, Ba, Hg and Pb), at least 3 soil and groundwater samples from the most contaminated areas within the Site shall be subject to screening tests for additional metals (ie Sb, Be, Se, Ag, Ti and V). (see remarks (b) in table above).

In addition to the chemical testing above, physical parameters such as moisture content and Total Organic Carbon (TOC) shall also be tested for each soil samples.

For sampling and laboratory analysis, chain of custody procedure shall be included as QC/QA procedure.

Extra soil samples shall be stored at 0-4°C and tested for Toxicity Characteristics Leaching Procedure (TCLP) before submission of Remediation Action Plan (RAP) if significant contamination were identified and excavation and landfill disposal were proposed as the remediation method.

Appendix B
Site Boring Log and Groundwater Well Configuration

VIBRO

DRILLHOLE RECORD

HOLE NO. BH 1

CONTRACT No. GE/2007/03

SHEET 1 OF 1

PROJECT SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.02
MACHINE & NO.	VBM44	E 837603.91 N 816311.98	DATE : 26/02/2007 to 27/02/2007
FLUSHING MEDIUM	NIL	ORIENTATION Vertical	GROUND LEVEL + 3.44 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	TCR %	SCR %	RQD %	FI	Tests	Samples No.	Type	Depth	Reduced Level	Depth (m)	Legend	Grade	Description
26/02/2007	HW										+3.44	0.00			Concrete slab.
			100					1		0.50					Greyish brown (2.5Y 5/2) and light brown (7.5YR 6/4), silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized moderately decomposed rock and concrete fragments. (FILL)
								2							
								3		0.95 1.00					
								4		1.50	+1.94	1.50			Greyish brown (2.5Y 5/2), silty clayey fine to coarse SAND with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments, brick and concrete fragments. (FILL)
			100					5		1.95 2.00					
26/02/2007		1.95m at 18:00													
27/02/2007		2.46m at 08:00						6		3.00	+0.44	3.00			Grey (N 5), clayey fine to coarse SAND with some angular to subangular fine to medium gravel sized moderately decomposed rock fragments. (FILL)
			100							3.45					
27/02/2007	HW 4.40	2.30m at 18:00						7			-0.96	4.40			End of Investigation Hole at 4.40m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- Standard penetration test
- In-situ vane shear test
- Permeability test
- Impression packer test
- Packer Test
- Piezometer tip
- Standpipe
- Inclinometer access tube
- Extensometer

LOGGED T. C. Yip

DATE 02/03/2007

CHECKED C. M. Shan

DATE 02/03/2007

REMARKS

1. An inspection pit was excavated by hand to 1.50m.
2. A water sample was taken at bottom (4.40m).
3. A groundwater well was installed at 4.40m.
4. Photo-ionization detection test were carried out at 0.50m, 1.50m and 3.45m.

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VIBRO

DRILLHOLE RECORD

HOLE NO. BH 2

CONTRACT No. GE/2007/03

SHEET 1 OF 1

PROJECT SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.02
MACHINE & NO.	VBM46	E 837603.48 N 816299.74	DATE : 26/02/2007 to 26/02/2007
FLUSHING MEDIUM	NIL	ORIENTATION Vertical	GROUND LEVEL + 3.64 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
26/02/2007	HW								+3.64	0.00			
									+3.54	0.10			Concrete slab.
			100					1 0.50 2 INSPECTION PIT 3 0.95 1.00					Light brown (7.5YR 6/4) and greyish brown (2.5Y 5/2), slightly silty fine to coarse SAND with some angular to subangular fine to medium gravel sized moderately decomposed rock fragments. (FILL)
									+2.14	1.50			
			100					4 1.50 5 1.95 2.00					Light brown (7.5YR 6/4) and greyish brown (2.5Y 5/2), clayey fine to coarse SAND with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments. (FILL)
			100					6 3.00 3.45					
26/02/2007	HW 3.86	1.86m at 18:00						7	-0.22	3.86			End of Investigation Hole at 3.86m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- Standard penetration test
- In-situ vane shear test
- Permeability test
- Impression packer test
- Packer Test
- Piezometer tip
- Standpipe
- Inclinometer access tube
- Extensometer

LOGGED T. C. Yip

DATE 02/03/2007

CHECKED C. M. Sham

DATE 02/03/2007

REMARKS

1. An inspection pit was excavated by hand to 1.50m.
2. A water sample was taken at bottom (3.86m).
3. A groundwater well was installed at 3.86m.
4. Photo-ionization detection test were carried out at 0.50m, 1.50m and 3.00m.

J200707_0302

VIBRO

DRILLHOLE RECORD

HOLE NO. BH 3

CONTRACT No. GE/2007/03

SHEET 1 OF 1

PROJECT SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.02
MACHINE & NO.	BM16	E 837616.45 N 816281.12	DATE : 26/02/2007 to 27/02/2007
FLUSHING MEDIUM	NIL	ORIENTATION Vertical	GROUND LEVEL + 2.26 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
26/02/2007	HW							INSPECTION PIT 1 2 0.50	+2.26	0.00			Dark grey (N 3), slightly silty fine to coarse SAND with some angular to subangular fine to medium gravel sized moderately decomposed rock fragments, occasional shell fragments and organic matters. (FILL)
			100					3 0.95	+1.31	0.95			Greyish brown (2.5Y 5/2), slightly clayey fine to coarse SAND with some angular to subangular fine gravel and occasional angular cobbles (SDG). (FILL)
			100					1.40	+0.86	1.40			Soft to firm, light brown (7.5YR 6/4), dappled grey, slightly sandy CLAY with occasional angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
			100					4 1.50	+0.76	1.50			Greyish brown (2.5Y 5/2), slightly clayey fine to coarse SAND with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments. (FILL)
								5 1.95 2.00					
26/02/2007		0.95m at 18:00											
27/02/2007		0.75m at 08:00	100					6 3.00 3.45					
27/02/2007	HW 4.00	0.75m at 18:00						7	-1.74	4.00			End of Investigation Hole at 4.00m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- Standard penetration test
- In-situ vane shear test
- Permeability test
- Impression packer test
- Packer Test
- Piezometer tip
- Standpipe
- Inclinometer access tube
- Extensometer

LOGGED T. C. Yip

DATE 02/03/2007

CHECKED C. M. Sham

DATE 02/03/2007

REMARKS

1. An inspection pit was excavated by hand to 0.95m as instructed by the Consultant / Engineer.
2. A water sample was taken at bottom (4.00m).
3. A groundwater well was installed at 4.00m.
4. Photo-ionization detection test were carried out at 0.50m, 0.95m, 1.50m and 3.00m.

J200707_0302

DRILLHOLE RECORD

VIBRO

HOLE NO. BH 4

CONTRACT No. GE/2007/03

SHEET 1 OF 1

PROJECT SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.02
MACHINE & NO.	BM51	E 837613.35 N 816265.86	DATE : 26/02/2007 to 26/02/2007
FLUSHING MEDIUM	NIL	ORIENTATION Vertical	GROUND LEVEL + 2.23 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
26/02/2007	PW							INSPECTION PIT 1 2 0.50	+2.23	0.00			Greyish brown (2.5Y 5/2), dappled brown, slightly silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments. (FILL)
			100						+1.73	0.50			Greyish brown (2.5Y 5/2), dappled grey, clayey fine to coarse SAND with some angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
								3 0.95	+1.28	0.95			Greyish brown (2.5Y 5/2), slightly silty fine to coarse SAND with some angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
			100					1.40					
	PW 1.50							4 1.50					
	HW		100					1.95					
								5 2.00					
									-0.77	3.00			
								6 3.00					Greyish brown (2.5Y 5/2), slightly silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments. (FILL)
26/02/2007	HW 3.45	0.95m at 18:00	100					7 3.45	-1.22	3.45			End of Investigation Hole at 3.45m.

Disturbed sample
Piston sample
Split spoon sample
U76 undisturbed sample
U100 undisturbed sample
Mazier sample
SPT liner sample
Water sample
Standard penetration test
In-situ vane shear test
Permeability test
Impression packer test
Packer Test
Piezometer tip
Standpipe
Inclinometer access tube
Extensometer

LOGGED T. C. Yip

DATE 02/03/2007

CHECKED C. M. Sham

DATE 02/03/2007

REMARKS
1. An inspection pit was excavated by hand to 0.95m as instructed by the Consultant / Engineer.
2. A water sample was taken at bottom (3.45m).
3. A groundwater well was installed at 3.00m.
4. Photo-Ionization detection test were carried out at 0.50m, 0.95m, 1.50m and 3.00m.

J200707_0302

DRILLHOLE RECORD

VIBRO

HOLE NO. BH 5

CONTRACT No. GE/2007/03

SHEET 1 OF 1

PROJECT SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.02
MACHINE & NO.	BM49	E. 837606.03 N 816249.01	DATE : 26/02/2007 to 27/02/2007
FLUSHING MEDIUM	NIL	ORIENTATION Vertical	GROUND LEVEL + 3.52 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	T C R %	S C R %	R Q D %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
26/02/2007	HW								+3.52	0.00			Concrete slab.
									+3.42	0.10			Light brown (7.5YR 6/4), dappled greyish brown, silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments. (FILL)
			100					1 2 0.50					
								3 0.95 1.00	+2.52	1.00			Light brown (7.5YR 6/4), very silty fine to coarse SAND with some angular to subangular fine to medium gravel sized moderately decomposed rock fragments. (FILL)
								4 1.50	+2.02	1.50			Light brown (7.5YR 6/4), dappled dark grey and greyish brown, slightly clayey fine to coarse SAND with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments and occasional cobbles (MDG). (FILL)
		Dry at 18:00	100					5 1.95 2.00					
26/02/2007 27/02/2007		Dry at 08:00											
								6 3.00 3.45					
			100										
27/02/2007	HW 4.00	2.05m at 18:00						7 ▲	-0.48	4.00			End of Investigation Hole at 4.00m.

Disturbed sample
Piston sample
Split spoon sample
U76 undisturbed sample
U100 undisturbed sample
Mazier sample
SPT liner sample
▲ Water sample

Standard penetration test
In-situ vane shear test
Permeability test
Impression packer test
Packer Test
Piezometer tip
Standpipe
Inclinometer access tube
Extensometer

LOGGED T. C. Yip
DATE 02/03/2007
CHECKED C. M. Sham
DATE 02/03/2007

REMARKS
1. An inspection pit was excavated by hand to 1.50m.
2. A water sample was taken at bottom (4.00m).
3. A groundwater well was installed at 4.00m.
4. Photo-ionization detection test were carried out at 0.50m, 1.50m and 3.00m.

J260707_0302

VIBRO

DRILLHOLE RECORD

HOLE NO. BH 6

CONTRACT No. GE/2007/03

SHEET 1 OF 1

PROJECT SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.02
MACHINE & NO.	VBM15	E 837597.00 N 816245.53	DATE : 26/02/2007 to 27/02/2007
FLUSHING MEDIUM	Water	ORIENTATION Vertical	GROUND LEVEL + 3.67 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
26/02/2007	HW								+3.67	0.00			
									+3.57	0.10			Concrete slab.
			100					1 0.50					Light brown (7.5YR 6/4), dappled grey, slightly silty fine to coarse SAND with some angular to subangular fine gravel sized moderately decomposed rock fragments, occasional shell and concrete fragments. (FILL)
								2 INSPECTION PIT 3 0.95 1.00	+2.67	1.00			
								4 1.50					
									+1.72	1.95			
		1.90m at 18:00	100					5 1.95 2.40					Soft, greyish brown (2.5Y 5/2), sandy CLAY with occasional angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
26/02/2007 27/02/2007		1.95m at 08:00											
								3.00	+0.67	3.00			
			63					T2IOI					Light grey (N 6), angular BOULDERS (SDG) sized up to 250mm with some angular cobbles (SDG) and medium to coarse gravel (SDG). (FILL)
								6 3.80	-0.13	3.80			Dark grey (N 3), dappled grey, sandy angular medium to coarse GRAVEL (M/SDG) with some angular cobbles (MDG) and occasional shell fragments. (FILL)
			10					7 4.25					
	HW 4.50		10					4.50	-0.83	4.50			Light grey (N 6), dappled dark grey, angular COBBLES (SDG). (FILL)
27/02/2007		1.95m at 13:00	63					T2IOI 8	-1.13	4.80			End of Investigation Hole at 4.80m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- Standard penetration test
- In-situ vane shear test
- Permeability test
- Impression packer test
- Packer Test
- Piezometer tip
- Standpipe
- Inclinometer access tube
- Extensometer

LOGGED T. C. Yip

DATE 02/03/2007

CHECKED C. M. Sham

DATE 02/03/2007

REMARKS

1. An inspection pit was excavated by hand to 1.50m.
2. A water sample was taken at bottom (4.80m).
3. A groundwater well was installed at 4.00m.
4. Photo-ionization detection test were carried out at 0.50m, and 1.95m.

VIBRO

DRILLHOLE RECORD

HOLE NO. BH 7

CONTRACT No. GE/2007/03

SHEET 1 OF 1

PROJECT SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.02
MACHINE & NO.	BM20	E 837588.02 N 816244.90	DATE : 26/02/2007 to 27/02/2007
FLUSHING MEDIUM	Water	ORIENTATION Vertical	GROUND LEVEL + 3.58 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
26/02/2007	HW								+3.58	0.00			
									+3.48	0.10			Concrete slab.
			100					1 2 Inspection Pit 0.50					Brown (7.5YR 5/4), dappled light brown, silty fine to coarse SAND with some angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
								0.95					
1								1.20	+2.38	1.20			
		1.00m at 18:00	92					T2IOI 1.71					Grey (N 5), dappled dark grey and pink, angular BOULDERS (Concrete). (SEA WALL)
26/02/2007 27/02/2007		1.10m at 08:00											
2			96					T2IOI 2.52					
			56					T2IOI 3.32					
3									+0.11	3.47			
			73					T2IOI					Light grey (N 6), dappled light brown, angular BOULDERS (SDG) sized up to 470mm. (FILL)
4								4.60					From 4.60m to 4.70m : Angular cobbles (SDG).
			51					T2IOI 5.32					
5													From 5.32m to 5.42m : Angular medium to coarse gravel sized highly to moderately decomposed rock fragments. (FILL)
			100					T2IOI					
6	HW 6.07	1.80m at 18:00						3	-2.49	6.07			End of Investigation Hole at 6.07m.
27/02/2007													
7													
8													
9													
10													

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- Standard penetration test
- In-situ vane shear test
- Permeability test
- Impression packer test
- Packer Test
- Piezometer tip
- Standpipe
- Inclinometer access tube
- Extensometer

LOGGED T. C. Yip

DATE 02/03/2007

CHECKED C. M. Sham

DATE 02/03/2007

REMARKS

1. An inspection pit was excavated by hand to 1.20m as instructed by the Consultant / Engineer.
2. A water sample was taken at bottom (6.07m).
3. A groundwater well was installed at 6.07m.
4. A photo-ionization detection test was carried out at 0.50m.

J200707_0302

VIBRO

DRILLHOLE RECORD

HOLE NO. BH 8

CONTRACT No. GE/2007/03

SHEET 1 OF 1

PROJECT SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.02
MACHINE & NO.	VBM52	E 837597.77 N 816250.93	DATE : 26/02/2007 to 27/02/2007
FLUSHING MEDIUM	NIL	ORIENTATION Vertical	GROUND LEVEL + 3.48 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
26/02/2007	HW								+3.48	0.00			
									+3.38	0.10			Concrete slab.
			100					1 0.50 2 INSPECT PIT 3 0.95 1.00					Light brown (7.5YR 6/4), silty fine to coarse SAND with some angular to subangular fine to medium gravel sized moderately decomposed rock and concrete fragments. (FILL)
									+2.48	1.00			Firm, brown (7.5YR 5/4), sandy SILT with some angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
									+1.98	1.50			
		Dry at 18:00	100					4 1.50 5 1.95 2.00					Brown (7.5YR 5/4), slightly clayey fine to coarse SAND with some angular to subangular fine gravel sized moderately decomposed rock fragments and occasional angular cobbles (MDG). (FILL)
26/02/2007 27/02/2007		Dry at 08:00											
									+0.48	3.00			
			100					6 3.00 3.45					Grey (N 5), clayey fine to coarse SAND with some angular to subangular fine gravel sized moderately decomposed rock fragments and occasional angular cobbles (MDG). (FILL)
	HW 4.00	2.05m at 18:00						7					
27/02/2007									-0.52	4.00			End of Investigation Hole at 4.00m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- Standard penetration test
- In-situ vane shear test
- Permeability test
- Impression packer test
- Packer Test
- Piezometer tip
- Standpipe
- Inclinometer access tube
- Extensometer

LOGGED T. C. Yip

DATE 02/03/2007

CHECKED C. M. Sham

DATE 02/03/2007

REMARKS

1. An inspection pit was excavated by hand to 1.50m.
2. A water sample was taken at bottom (4.00m).
3. A groundwater well was installed at 4.00m.
4. Photo-Ionization detection test were carried out at 0.50m, 1.50m and 3.00m.

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DRILLHOLE RECORD

VIBRO

CONTRACT No. GE/2007/03	HOLE NO. BH 9
	SHEET 1 OF 1

PROJECT: SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.02
MACHINE & NO.	BM19	E 837580.11 N 816238.86	DATE : 26/02/2007 to 27/02/2007
FLUSHING MEDIUM	Water	ORIENTATION Vertical	GROUND LEVEL + 3.57 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
26/02/2007	HW								+3.57	0.00			
									+3.47	0.10			Concrete slab.
			100					1 INSPECTION PIT 0.50					Brown (2.5YR 5/4), silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments. (FILL)
								2 0.95					
1			100					1.05	+2.52	1.05			Grey (N 5), angular BOULDERS (SDG, Concrete) sized up to 850mm. (FILL)
		Dry at 18:00 26/02/2007						T2 IOI					
		Dry at 08:00 27/02/2007	100					1.37					
								T2 IOI					
			100					1.83	+1.67	1.90			Grey (N 5), dappled light brown, angular COBBLES (SDG) with occasional angular coarse gravel. (FILL)
2			75					T2 IOI					
								2.50					
			86					T2 IOI					
								3.00					
3			100					T2 IOI 3 3.10	+0.47	3.10			Greyish brown (2.5Y 5/2), dappled dark grey, fine to coarse SAND with much angular fine to coarse gravel sized highly to moderately decomposed rock fragments and occasional shell fragments. (FILL)
			10					4 3.55					
			10					5 4.00					
4 27/02/2007	HW 4.10	2.20m at 18:00							-0.53	4.10			End of Investigation Hole at 4.10m.
5													
6													
7													
8													
9													
10													

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- Standard penetration test
- In-situ vane shear test
- Permeability test
- Impression packer test
- Packer Test
- Piezometer tip
- Standpipe
- Inclinometer access tube
- Extensometer

LOGGED T. C. Yip

DATE 02/03/2007

CHECKED C. M. Sham

DATE 02/03/2007

REMARKS
1. An inspection pit was excavated by hand to 1.05m as instructed by the Consultant / Engineer.
2. A water sample was taken at bottom (4.10m).
3. A groundwater well was installed at 3.80m.
4. A photo-ionization detection test was carried out at 0.50m.

J700707_0302

DRILLHOLE RECORD

VIBRO

HOLE NO. IP 1

CONTRACT No. GE/2007/03

SHEET 1 OF 1

PROJECT SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay

METHOD	Hand Excavation	CO-ORDINATES	W.O.NO. GE/2007/03.02
MACHINE & NO.	Hand tools	E 837579.36 N 816240.90	DATE : 28/02/2007 to 28/02/2007
FLUSHING MEDIUM	NIL	ORIENTATION Vertical	GROUND LEVEL + 3.56 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	TCR %	SCR %	RQD %	FI	Tests	Samples No.	Samples Type	Samples Depth	Reduced Level	Depth (m)	Legend	Grade	Description
28/02/2007	HW										+3.56	0.00			Concrete slab.
											+3.46	0.10			Light brown (7.5YR 6/4), slightly silty fine to coarse SAND with some angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
			100					1		0.50					
								2	INSPECTION PIT						
								3		0.95 1.00					
											+2.36	1.20			Light brown (7.5YR 6/4), dappled greyish brown, slightly clayey fine to coarse SAND with some angular to subangular fine to medium gravel sized moderately decomposed rock fragments. (FILL)
			100					4		1.50					
										1.95					
28/02/2007	HW 2.20							5		2.20	+1.36	2.20			End of Investigation Hole at 2.20m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- Standard penetration test
- In-situ vane shear test
- Permeability test
- Impression packer test
- Packer Test
- Piezometer tip
- Standpipe
- Inclinometer access tube
- Extensometer

LOGGED T. C. Yip

DATE 02/03/2007

CHECKED C. M. Sham

DATE 02/03/2007

REMARKS
1. An inspection pit was excavated by hand to 2.20m.
2. Photo-Ionization detection test were carried out at 0.50m, and 1.50m.

J200707_0302

GROUNDWATER WELL DETAIL AND RESPONSE TEST RECORD SHEET

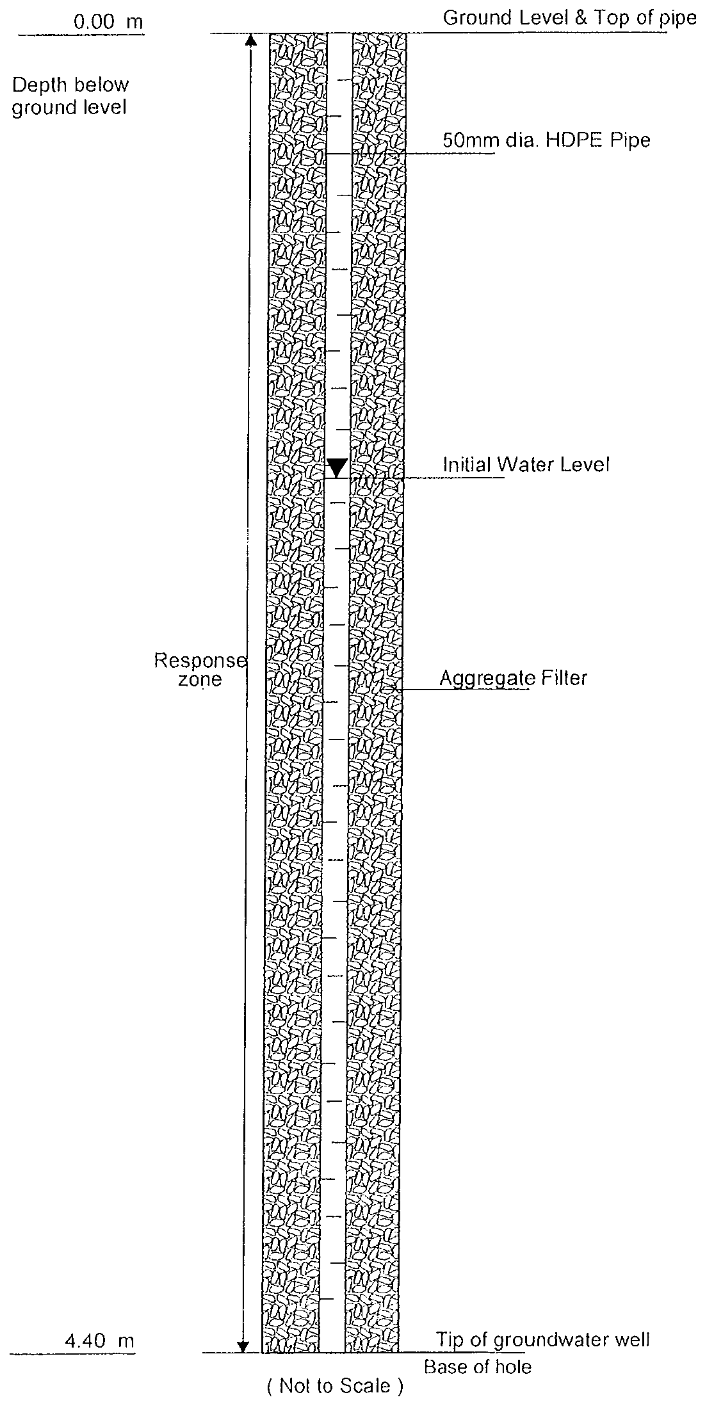
VIBRO

Contractor : VIBRO (H.K.) LIMITED	Drillhole No. : BH 1
Contract No. : GE/2007/03	Date of test : -
Works Order No. : GE/2007/03.02	Ground level : + 3.44 mPD
Project : SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay,	Co-ordinates : E 837603.91 N 816311.98
Initial Water Level : - m below G. L.	Groundwater well tip level : - 0.96 mPD
Tested / Supervised by : H. M. Chan	Checked by : C. M. Sham

Time Elapsed (minutes)	Depth of Water from top of pipe (m)

Remarks :

1, No response test required.



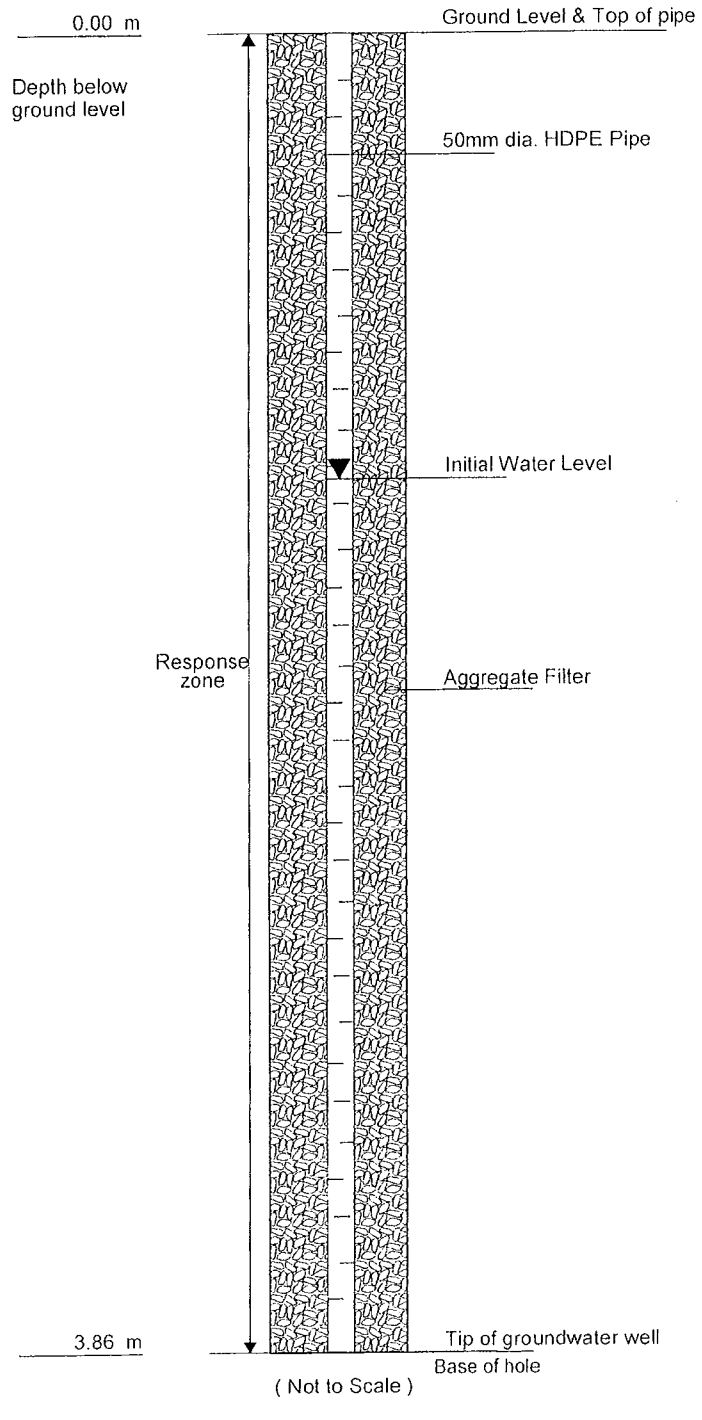
GROUNDWATER WELL DETAIL AND RESPONSE TEST RECORD SHEET

Contractor : VIBRO (H.K.) LIMITED	Drillhole No. : BH 2
Contract No. : GE/2007/03	Date of test : -
Works Order No. : GE/2007/03.02	Ground level : + 3.64 mPD
Project : SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay,	Co-ordinates : E 837603.48 N 816299.74
Initial Water Level : - m below G. L.	Groundwater well tip level : - 0.22 mPD
Tested / Supervised by : H. M. Chan	Checked by : C. M. Sham

Time Elapsed (minutes)	Depth of Water from top of pipe (m)

Remarks :

1, No response test required.



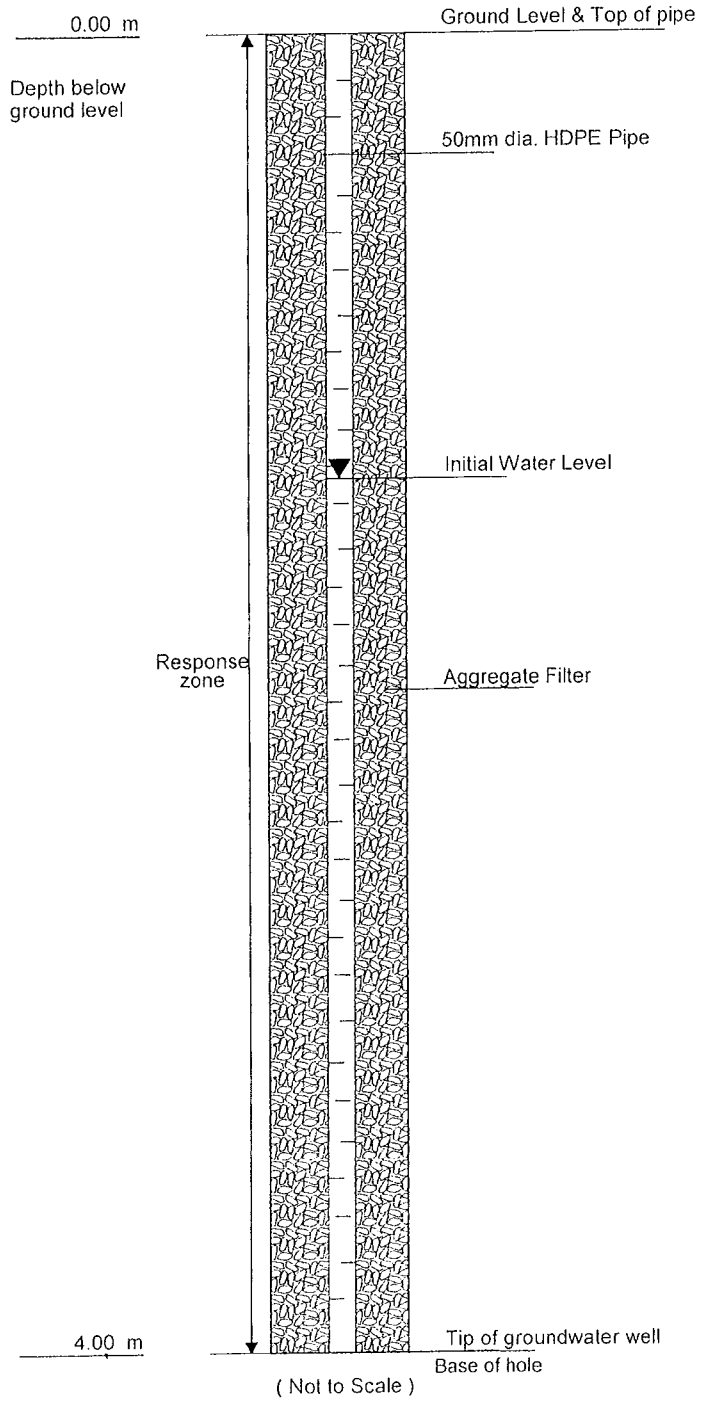
GROUNDWATER WELL DETAIL AND RESPONSE TEST RECORD SHEET

Contractor : VIBRO (H.K.) LIMITED	Drillhole No. : BH 3
Contract No. : GE/2007/03	Date of test : -
Works Order No. : GE/2007/03.02	Ground level : + 2.26 mPD
Project : SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay,	Co-ordinates : E 837616.45 N 816281.12
Initial Water Level : - m below G. L.	Groundwater well tip level : - 1.74 mPD
Tested / Supervised by : H. M. Chan	Checked by : C. M. Sham

Time Elapsed (minutes)	Depth of Water from top of pipe (m)

Remarks :

1, No response test required.

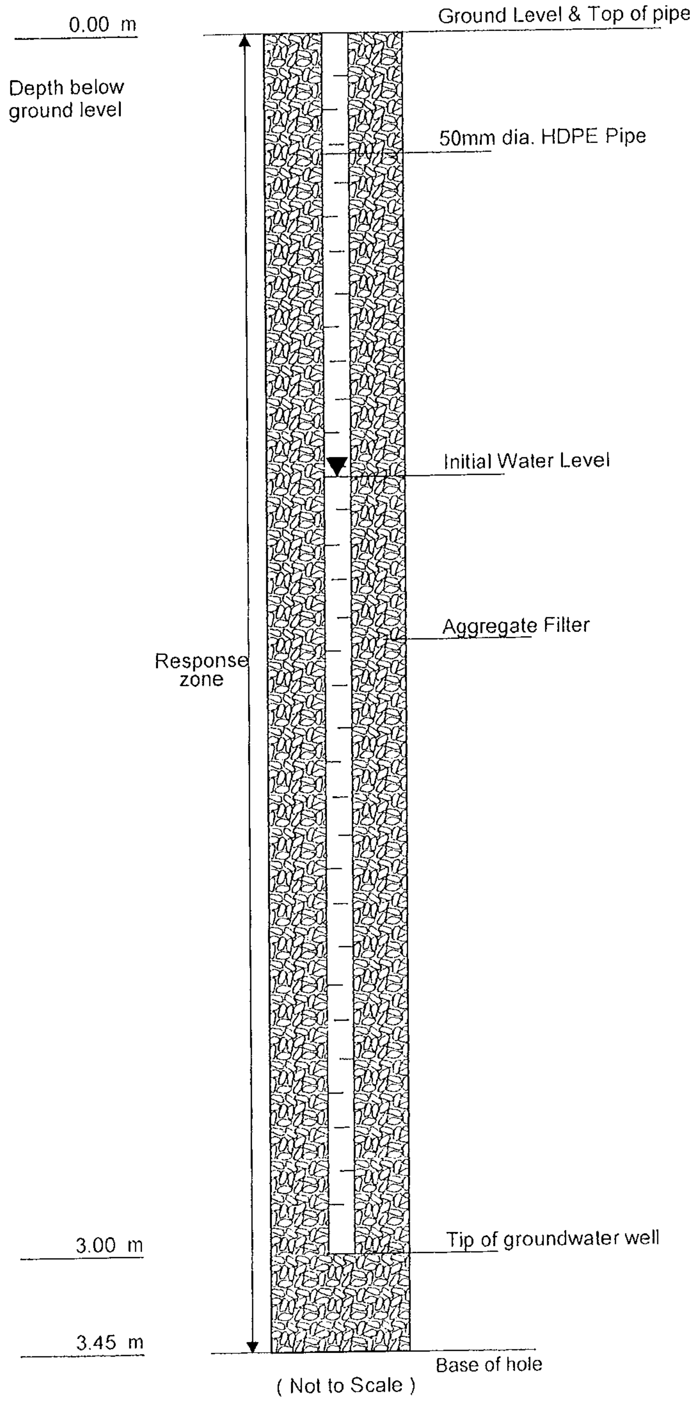


GROUNDWATER WELL DETAIL AND RESPONSE TEST RECORD SHEET

VIBRO

Contractor :	VIBRO (H.K.) LIMITED	Drillhole No. :	BH 4
Contract No. :	GE/2007/03	Date of test :	-
Works Order No. :	GE/2007/03.02	Ground level :	+ 2.23 mPD
Project :	SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay,	Co-ordinates :	E 837613.35 N 816265.86
Initial Water Level :	- m below G. L.	Groundwater well tip level :	- 0.77 mPD
Tested / Supervised by :	H. M. Chan	Checked by :	C. M. Sham

Time Elapsed (minutes)	Depth of Water from top of pipe (m)



Remarks :

1, No response test required.

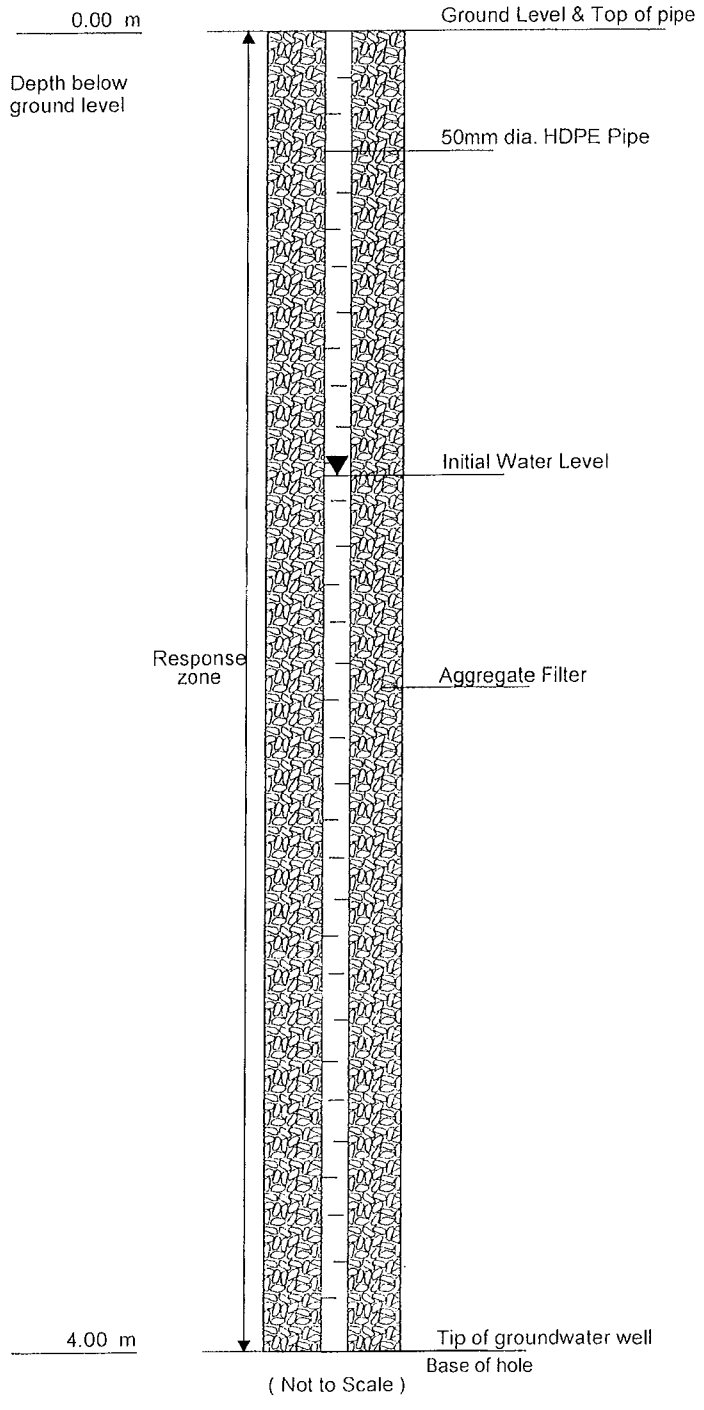
GROUNDWATER WELL DETAIL AND RESPONSE TEST RECORD SHEET

Contractor : VIBRO (H.K.) LIMITED	Drillhole No. : BH 5
Contract No. : GE/2007/03	Date of test : -
Works Order No. : GE/2007/03.02	Ground level : + 3.52 mPD
Project : SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay,	Co-ordinates : E 837606.03 N 816249.01
Initial Water Level : - m below G. L.	Groundwater well tip level : - 0.48 mPD
Tested / Supervised by : H. M. Chan	Checked by : C. M. Sham

Time Elapsed (minutes)	Depth of Water from top of pipe (m)

Remarks :

1, No response test required.



GROUNDWATER WELL DETAIL AND RESPONSE TEST RECORD SHEET

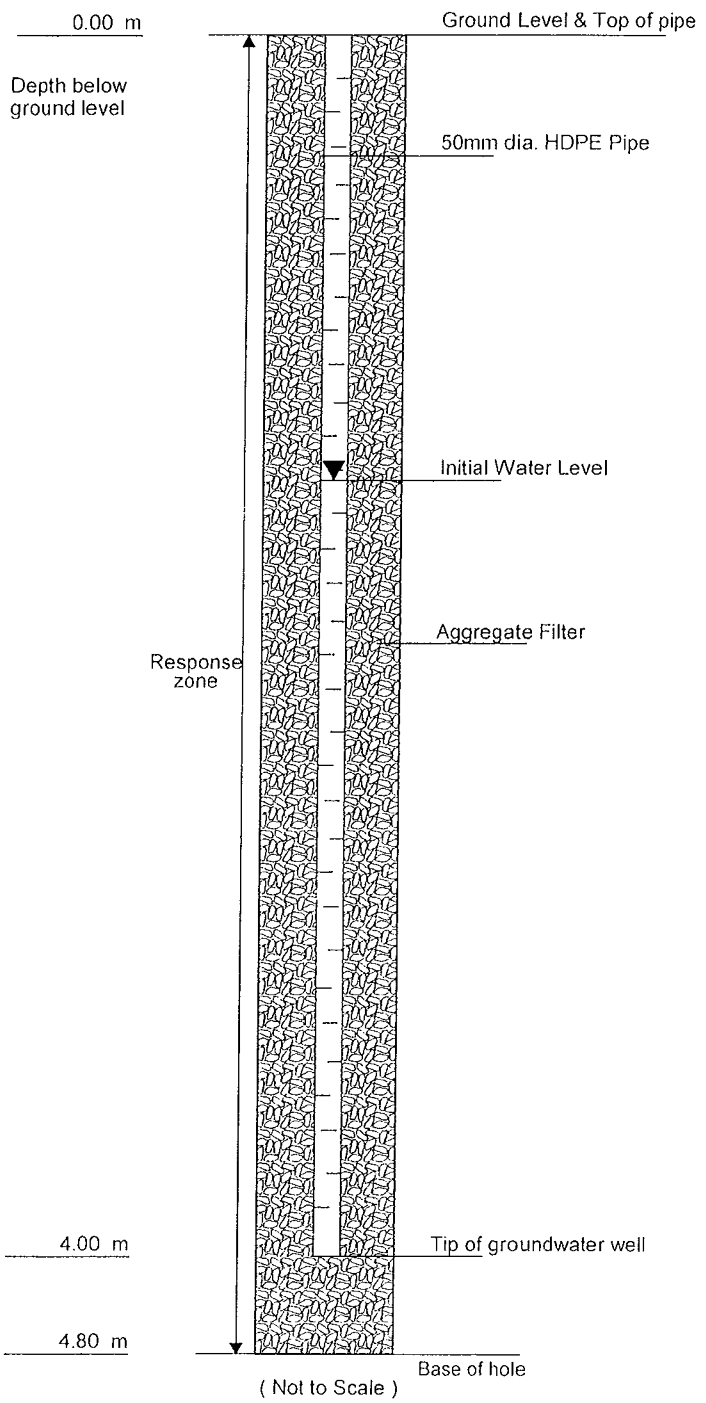
VIBRO

Contractor : VIBRO (H.K.) LIMITED	Drillhole No. : BH 6
Contract No. : GE/2007/03	Date of test : -
Works Order No. : GE/2007/03.02	Ground level : + 3.67 mPD
Project : SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay,	Co-ordinates : E 837597.00 N 816245.53
Initial Water Level : - m below G. L.	Groundwater well tip level : - 0.33 mPD
Tested / Supervised by : H. M. Chan	Checked by : C. M. Sham

Time Elapsed (minutes)	Depth of Water from top of pipe (m)

Remarks :

1, No response test required.



GROUNDWATER WELL DETAIL AND RESPONSE TEST RECORD SHEET

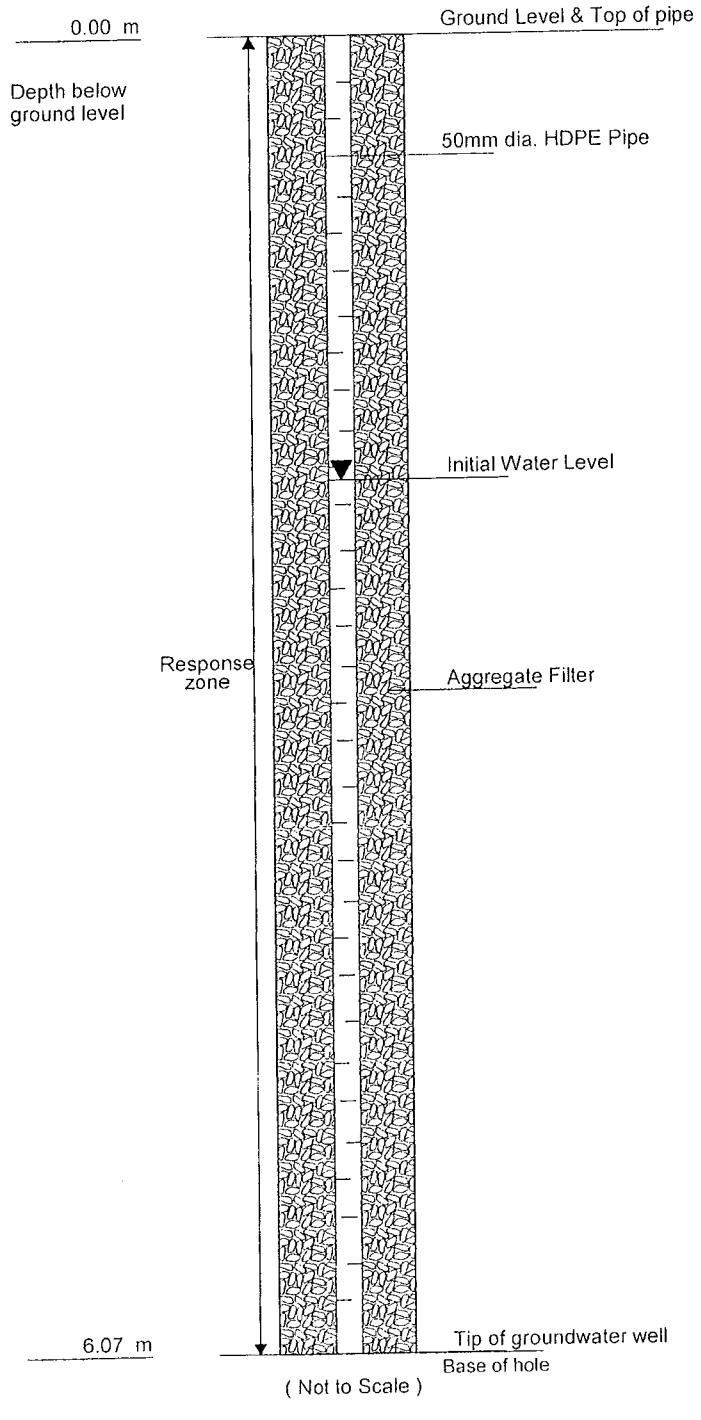
VIBRO

Contractor : VIBRO (H.K.) LIMITED	Drillhole No. : BH 7
Contract No. : GE/2007/03	Date of test : -
Works Order No. : GE/2007/03.02	Ground level : + 3.58 mPD
Project : SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay,	Co-ordinates : E 837588.02 N 816244.90
Initial Water Level : - m below G. L.	Groundwater well tip level : - 2.49 mPD
Tested / Supervised by : H. M. Chan	Checked by : C. M. Sham

Time Elapsed (minutes)	Depth of Water from top of pipe (m)

Remarks :

1, No response test required.

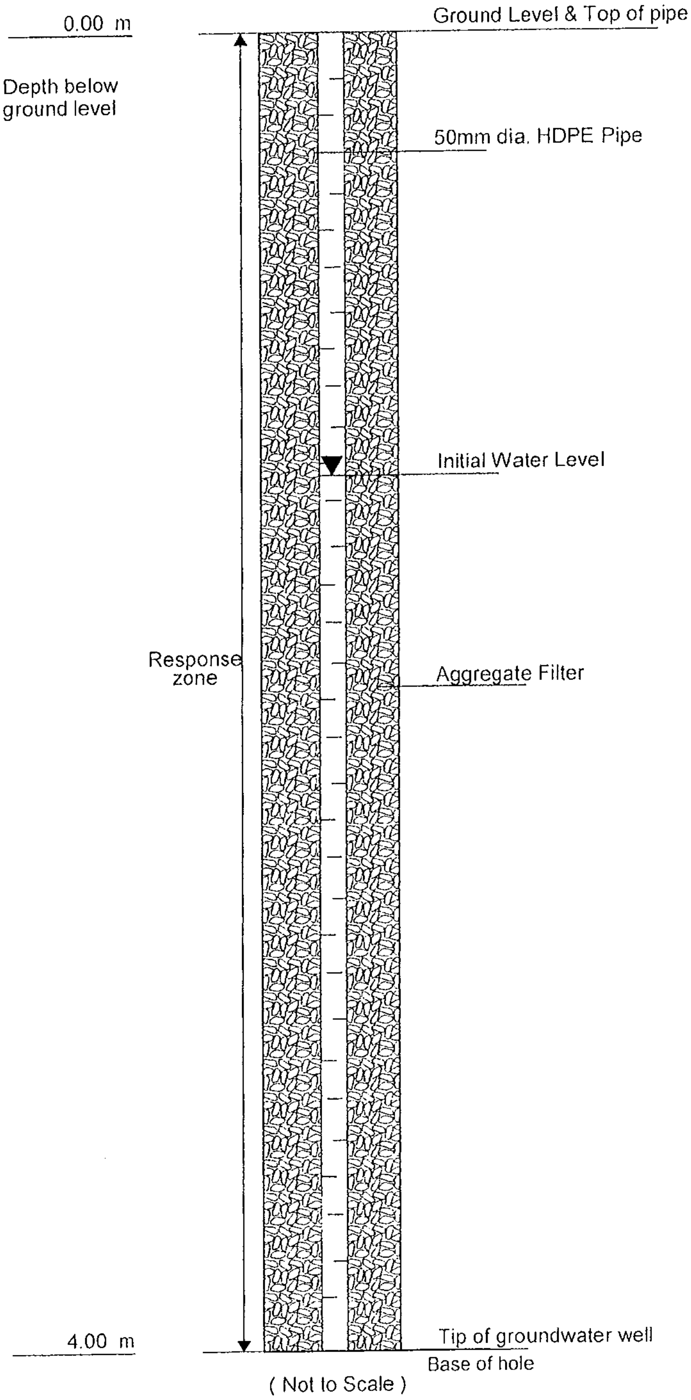


VIBRO

GROUNDWATER WELL DETAIL AND RESPONSE TEST RECORD SHEET

Contractor : VIBRO (H.K.) LIMITED	Drillhole No. : BH 8
Contract No. : GE/2007/03	Date of test : -
Works Order No. : GE/2007/03.02	Ground level : + 3.48 mPD
Project : SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay,	Co-ordinates : E 837597.77 N 816250.93
Initial Water Level : - m below G. L.	Groundwater well tip level : - 0.52 mPD
Tested / Supervised by : H. M. Chan	Checked by : C. M. Sham

Time Elapsed (minutes)	Depth of Water from top of pipe (m)



Remarks :

1. No response test required.

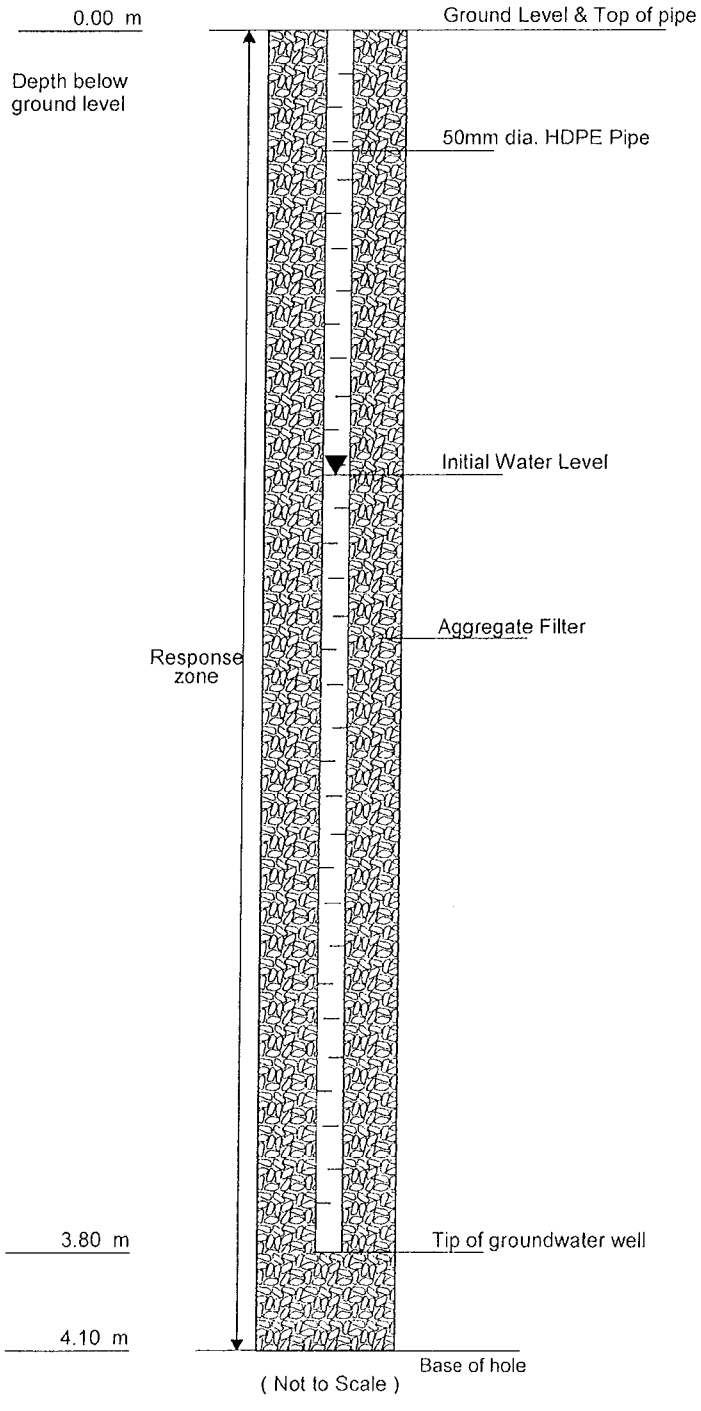
GROUNDWATER WELL DETAIL AND RESPONSE TEST RECORD SHEET

Contractor : VIBRO (H.K.) LIMITED	Drillhole No. : BH 9
Contract No. : GE/2007/03	Date of test : -
Works Order No. : GE/2007/03.02	Ground level : + 3.57 mPD
Project : SA1 to Agreement No. CE54/2001(CE), Wan Chai Development Phase II - Planning and Engineering Review, Land Contamination Assessment Plan - Ground Investigation at A King Shipyard, Causeway Bay,	Co-ordinates : E 837580.11 N 816238.86
Initial Water Level : - m below G. L.	Groundwater well tip level : - 0.23 mPD
Tested / Supervised by : H. M. Chan	Checked by : C. M. Sham

Time Elapsed (minutes)	Depth of Water from top of pipe (m)

Remarks :

1, No response test required.



Appendix C
Laboratory Results

Wan Chai Development Phase II Central-Wan Chai Bypass
Land Contamination Study at A King Shipyard
Analytical Results for Soil Samples

Criteria			Total petroleum hydrocarbon (TPH), mg/kg					BTEX, mg/kg						Polyaromatic Hydrocarbons (PAH), mg/kg					
			C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	Total TPH	Benzene	Toluene	Ethylbenzene	m-xylene & p-xylene	ortho-xylene	Total xylenes	Naphthelene	Phenanthrene	Anthracene	Fluoranthene	Benzo(a)pyrene	Pyrene
Dutch A			-		-	-	100	0.01	0.05	0.05	-	-	0.05	0.1	0.1	0.1	0.1	0.05	0.1
Dutch B			-		-	-	**1000**	**0.5**	**3**	**5**	-	-	**5**	**5**	**10**	**10**	**10**	**1**	**10**
Dutch C			-		-	-	**5000**	**5**	**30**	**50**	-	-	**50**	**50**	**100**	**100**	**100**	**10**	**100**
Sample identification																			
Location	Depth (m)	Sampling Date																	
BH-1	0.50	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-1	1.50	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-1	3.00	27-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-2	0.50	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-2	1.50	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-2	3.00	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-3	0.50	26-Feb-07	<2.0	<50	1500	6500	**8000**	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-3	0.95	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-3	1.50	26-Feb-07	<2.0	<50	<100	230	<382	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-3	3.00	27-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-4	0.50	26-Feb-07	<2.0	<50	120	<100	<272	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-4	0.95	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-4	1.50	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-4	3.00	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-5	0.50	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-5	1.50	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-5	3.00	27-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-6	0.50	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-6	1.95	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-7	0.50	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-8	0.50	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-8	1.50	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-8	3.00	27-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
BH-9	0.50	26-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
IP1	0.50	28-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0
IP1	1.50	28-Feb-07	<2.0	<50	<100	<100	<252	<0.20	<0.20	<0.20	<0.40	<0.20	<0.60	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0

Notes:

1. Cell in bolded line indicates exceedance of Dutch B Level
2. Shaded cell indicates exceedance of Dutch C Level or USEPA Region IX PRGs Standard
3. As there are no Dutch Levels for TBT and additional heavy metals, the USEPA Region IX PRGs for Residential Soil was adopted

Wan Chai Development Phase II Central-Wan Chai Bypass
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Analytical Results for Soil Samples

Criteria			Heavy metals, mg/kg											Additional Metals, mg/kg^3								Tributyltin (TBT), ug Sn/kg^3
			Arsenic (As)	Barium (Ba)	Cadmium (Cd)	Cobalt (Co)	Chromium (Cr)	Copper (Cu)	Molybdenum (Mo)	Nickel (Ni)	Lead (Pb)	Tin (Sn)	Zinc (Zn)	Mercury (Hg)	Antimony (Sb)	Beryllium (Be)	Selenium (Se)	Silver (Ag)	Thallium (Ti)	Vanadium (V)	Cyanide (CN)	
Dutch A			20	200	1	20	100	50	10	50	50	20	200	0.50	31	150	390	390	5.2	78	5	7000
Dutch B			**30**	**400**	**5**	**50**	**250**	**100**	**40**	**100**	**150**	**50**	**500**	**2**							**50**	
Dutch C			**50**	**2000**	**20**	**300**	**800**	**500**	**200**	**500**	**600**	**300**	**3000**	**10**							**500**	
Sample identification																						
Location	Depth (m)	Sampling Date																				
BH-1	0.50	26-Feb-07	4.0	18	<0.20	0.75	6.8	9.9	2.6	4.9	39	1.3	<20	<0.05	<1.0	<1.0	<1.0	<1.0	<1.0	7.3	<1.0	<1.0
BH-1	1.50	26-Feb-07	5.0	22	<0.20	2.3	6.8	12	3.3	8.8	48	1.6	42	0.23	<1.0	<1.0	<1.0	<1.0	<1.0	5.4	<1.0	<1.0
BH-1	3.00	27-Feb-07	4.3	18	<0.20	1.8	8.6	14	3.9	7.6	40	1.4	47	0.10	<1.0	<1.0	<1.0	<1.0	<1.0	4.5	<1.0	<1.0
BH-2	0.50	26-Feb-07	<1.0	40	<0.20	2.2	1.1	1.8	<1.0	1.9	82	0.89	<20	<0.05	<1.0	<1.0	<1.0	<1.0	<1.0	2.9	<1.0	<1.0
BH-2	1.50	26-Feb-07	3.3	28	<0.20	2.4	6.1	48	3.1	3.1	55	1.9	74	0.12	<1.0	<1.0	<1.0	<1.0	<1.0	4.5	<1.0	<1.0
BH-2	3.00	26-Feb-07	2.8	16	<0.20	0.84	1.5	6.9	1.9	2.2	60	1.4	21	0.06	<1.0	<1.0	<1.0	<1.0	<1.0	2.1	<1.0	<1.0
BH-3	0.50	26-Feb-07	10	600	0.86	7.7	31	660	3.4	16	880	15	940	1.40	13	<1.0	<1.0	<1.0	<1.0	5.2	<1.0	<1.0
BH-3	0.95	26-Feb-07	1.6	10	<0.20	0.60	<1.0	2.8	<1.0	<1.0	20	0.78	<20	0.06	<1.0	<1.0	<1.0	<1.0	<1.0	2.0	<1.0	<1.0
BH-3	1.50	26-Feb-07	2.6	39	<0.20	1.0	2.4	30	<1.0	1.3	70	1.6	72	0.19	<1.0	<1.0	<1.0	<1.0	<1.0	2.8	<1.0	<1.0
BH-3	3.00	27-Feb-07	2.0	12	<0.20	0.70	1.3	6.3	1.3	1.0	30	0.66	<20	<0.05	<1.0	<1.0	<1.0	<1.0	<1.0	1.8	<1.0	<1.0
BH-4	0.50	26-Feb-07	4.5	32	0.65	4.0	6.2	110	1.3	5.0	170	6.4	380	0.25	<1.0	<1.0	<1.0	<1.0	<1.0	3.4	<1.0	<1.0
BH-4	0.95	26-Feb-07	5.0	14	0.21	1.2	5.0	70	2.5	4.2	49	1.1	180	0.20	<1.0	<1.0	<1.0	<1.0	<1.0	3.2	<1.0	<1.0
BH-4	1.50	26-Feb-07	4.4	18	0.30	1.8	8.0	120	2.5	3.5	54	2.2	240	0.17	<1.0	<1.0	<1.0	<1.0	<1.0	3.4	<1.0	<1.0
BH-4	3.00	26-Feb-07	3.8	22	<0.20	1.7	5.2	40	2.1	3.0	45	2.4	97	0.08	<1.0	<1.0	<1.0	<1.0	<1.0	4.9	<1.0	<1.0
BH-5	0.50	26-Feb-07	1.3	13	<0.20	0.82	2.4	2.1	1.3	1.8	58	0.56	<20	<0.05	<1.0	<1.0	<1.0	<1.0	<1.0	2.9	<1.0	<1.0
BH-5	1.50	26-Feb-07	3.7	15	0.23	1.5	9.2	12	2.9	2.0	48	1.0	68	0.07	<1.0	<1.0	<1.0	<1.0	<1.0	6.4	<1.0	<1.0
BH-5	3.00	27-Feb-07	2.2	21	<0.20	0.92	2.2	64.0	1.4	1.8	180	3.2	110	0.05	<1.0	<1.0	<1.0	<1.0	<1.0	3.8	<1.0	<1.0
BH-6	0.50	26-Feb-07	3.2	25	<0.20	1.6	3.5	7.1	2.3	2.4	70	0.74	35	0.12	<1.0	<1.0	<1.0	<1.0	<1.0	4.6	<1.0	<1.0
BH-6	1.95	26-Feb-07	2.7	29	<0.20	4.1	7.3	8.3	<1.0	5.2	64	1.9	37	0.16	<1.0	<1.0	<1.0	<1.0	<1.0	9.9	<1.0	<1.0
BH-7	0.50	26-Feb-07	1.5	39	<0.20	1.8	1.8	3.0	1.3	1.2	120	0.77	<20	0.05	<1.0	<1.0	<1.0	<1.0	<1.0	3.0	<1.0	<1.0
BH-8	0.50	26-Feb-07	1.6	18	<0.20	1.6	1.8	5.4	<1.0	1.3	74	<0.50	24	<0.05	<1.0	<1.0	<1.0	<1.0	<1.0	3.2	<1.0	<1.0
BH-8	1.50	26-Feb-07	16	44	<0.20	1.7	3.4	8.8	1.6	1.9	190	3.6	100	0.27	<1.0	<1.0	<1.0	1.4	<1.0	7.2	<1.0	<1.0
BH-8	3.00	27-Feb-07	3.4	65	<0.20	1.6	9.1	12	1.4	3.9	99	1.4	53	0.09	<1.0	<1.0	<1.0	<1.0	<1.0	6.2	<1.0	<1.0
BH-9	0.50	26-Feb-07	1.1	21	<0.20	1.0	2.2	3.1	<1.0	1.4	56	<0.50	24	0.09	<1.0	<1.0	<1.0	<1.0	<1.0	3.2	<1.0	<1.0
IP1	0.50	23-Feb-07	<1.0	8.8	<0.20	0.69	3.8	1.7	<1.0	1.7	41	0.56	<20	<0.05	<1.0	<1.0	<1.0	<1.0	<1.0	2.2	<1.0	<1.0
IP1	1.50	28-Feb-07	2.2	28	<0.20	2.2	4.6	8.1	1.6	3.2	110	1.4	34	0.15	<1.0	<1.0	<1.0	<1.0	<1.0	7.9	<1.0	<1.0

Notes:

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2. Shaded cell indicates exceedance of Dutch C Level or USEPA Region IX PRGs Standard
3. As there are no Dutch Levels for TBT and additional heavy metals, the USEPA Region IX PRGs for Residential Soil was adopted

Wan Chai Development Phase II Central-Wan Chai Bypass
Land Contamination Study at A King Shipyard
Analytical Results for Soil Samples

Volatile Organic Compounc

Criteria			1,1-Dichloroethene	trans-1,2-Dichloroethene	1,1-Dichloroethane	cis-1,2-Dichloroethene	1,1,1-Trichloroethane	1,1-Dichloropropene	Tetrachloroethene	1,2-Dichloroethane	Trichloroethene	1,1,2-Trichloroethane	1,3-Dichloropropane	Tetrachloroethene	1,1,1,2-Tetrachloroethane	1,1,2,2-Tetrachloroethane	1,2,3-Trichloropropane	1,2-Dibromo-3-chloroprop	Hexachlorobutadiene	2,2-Dichloropropane	1,2-Dichloropropane	cis-1,3-Dichloropropylene	trans-1,3-Dichloropropyler	Dibromomethane	1,2-Dibromethane	Stryene	Isopropylbenzene	1,3,5-Trimethylbenzene
Dutch A			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	0.1	0.1	0.1	NA	NA
Dutch B			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	NA	NA
Dutch C			50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50		
Sample identification																												
Location	Depth (m)	Sampling Date																										
BH-1	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-1	1.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-1	3.00	27-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-2	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-2	1.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-2	3.00	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-3	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-3	0.95	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-3	1.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-3	3.00	27-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-4	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-4	0.95	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-4	1.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-4	3.00	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-5	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-5	1.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-5	3.00	27-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-6	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-6	1.95	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-7	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-8	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-8	1.50	27-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-8	3.00	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BH-9	0.50	28-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
IP1	0.50	28-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
IP1	1.50	28-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50

Notes:

1. Cell in bolded line indicates exceedance of Dutch B Level
2. Shaded cell indicates exceedance of Dutch C Level or USEPA Region IX PRGs Standard
3. As there are no Dutch Levels for TBT and additional heavy metals, the USEPA Region IX PRGs for Residential Soil was adopted

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Criteria			ds (VOC), mg/kg																								Total Organic Carbon (TOC)	Moisture Content
			1,2,4-Trimethylbenzene	sec-Butylbenzene	tert-Butylbenzene	p-Isopropyltoluene	n-Butylbenzene	Vinyl Acetate	2-Butanone	4-Methyl-2-pentanone	2-Hexanone	Carbon disulfide	Vinyl chloride	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,2-Dichlorobenzene	1,2,4-Trichlorobenzene	1,2,3-Trichlorobenzene	Chlorobenzene	Bromobenzene	2-Chlorotoluene	4-Chlorotoluene	Chloroform	Bromodichloromethane	Dibromochloromethane	Bromoform	n-Propylbenzene		
Dutch A			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05	0.05	0.05	0.05	0.05	0.05	NA	NA	NA	NA	0.1	0.1	NA	NA	NA	NA
Dutch B			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1**	**1**	**1**	**1**	**1**	**1**	NA	NA	NA	NA	**5**	**5**	NA	NA	NA	NA
Dutch C			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**10**	**10**	**10**	**10**	**10**	**10**	NA	NA	NA	NA	**50**	**50**	NA	NA	NA	NA
Sample identification																												
Location	Depth (m)	Sampling Date																										
BH-1	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.14%	12
BH-1	1.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.07%	21
BH-1	3.00	27-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.21%	22
BH-2	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.05%	13
BH-2	1.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.09%	21
BH-2	3.00	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.05%	23
BH-3	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	2.57%	22
BH-3	0.95	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.12%	24
BH-3	1.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.38%	23
BH-3	3.00	27-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.05%	25
BH-4	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.98%	21
BH-4	0.95	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.13%	26
BH-4	1.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.18%	21
BH-4	3.00	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.05%	27
BH-5	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.05%	14
BH-5	1.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.20%	18
BH-5	3.00	27-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.39%	23
BH-6	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.14%	7.4
BH-6	1.95	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.06%	17
BH-7	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.06%	12
BH-8	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.20%	14
BH-8	1.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.05%	25
BH-8	3.00	27-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.39%	27
BH-9	0.50	26-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.06%	16
IP1	0.50	28-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.05%	16
IP1	1.50	28-Feb-07	<0.50	<0.50	<0.50	<0.50	<0.50	<5	<5	<5	<5	<0.50	<5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.05%	21

Notes:

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Criteria			Total petroleum hydrocarbon (TPH), ug/L					BTEX, ug/L						Polyaromatic Hydrocarbons (PAH), ug/L					
			C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	Total TPH	Benzene	Toluene	Ethylbenzene	m-xylene & p-xylene	ortho-xylene	Total xylenes	Naphthelene	Phenanthrene	Anthracene	Fluoranthene	Benzo(a)pyrene	Pyrene
Dutch A			-	-	-	-	20	0.2	0.5	0.5	-	-	0.5	0.2	0.1	0.1	0.02	0.01	0.02
Dutch B			-	-	-	-	**200**	**1**	**15**	**20**	-	-	**20**	**7**	**2**	**2**	**1**	**0.2**	**1**
Dutch C			-	-	-	-	**600**	**5**	**50**	**60**	-	-	**60**	**30**	**10**	**10**	**5**	**1**	**5**
Sample identification																			
Location	Depth (m)	Sampling Date																	
BH-1	NA	28 Feb 2007	<20	<25	<25	<25	<95	<1.0	<15	<15	<15	<15	<30	<1.0	<1.0	<1.0	<1.0	<0.20	<1.0
BH-2	NA	28 Feb 2007	<20	<25	<25	<25	<95	<1.0	<15	<15	<15	<15	<30	<1.0	<1.0	<1.0	<1.0	<0.20	<1.0
BH-3	NA	28 Feb 2007	<20	<25	<25	<25	<95	<1.0	<15	<15	<15	<15	<30	<1.0	<1.0	<1.0	<1.0	<0.20	<1.0
BH-4	NA	28 Feb 2007	<20	<25	48	59	<152	<1.0	<15	<15	<15	<15	<30	<1.0	<1.0	<1.0	<1.0	<0.20	<1.0
BH-5	NA	28 Feb 2007	<20	<25	<25	<25	<95	<1.0	<15	<15	<15	<15	<30	<1.0	<1.0	<1.0	<1.0	<0.20	<1.0
BH-6	NA	28 Feb 2007	<20	<25	<25	<25	<95	<1.0	<15	<15	<15	<15	<30	<1.0	<1.0	<1.0	<1.0	<0.20	<1.0
BH-7	NA	28 Feb 2007	<20	<25	<25	<25	<95	<1.0	<15	<15	<15	<15	<30	<1.0	<1.0	<1.0	<1.0	<0.20	<1.0
BH-8	NA	28 Feb 2007	<20	<25	<25	<25	<95	<1.0	<15	<15	<15	<15	<30	<1.0	<1.0	<1.0	<1.0	<0.20	<1.0
BH-9	NA	28 Feb 2007	<20	<25	<25	<25	<95	<1.0	<15	<15	<15	<15	<30	<1.0	<1.0	<1.0	<1.0	<0.20	<1.0

Notes:

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3. As there are no Dutch Levels for TBT and additional heavy metals, the USEPA Region IX PRGs for Residential Soil was adopted

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Criteria			Heavy metals, ug/L												Additional Metals, ug/L[3]							
			Arsenic (As)	Barium (Ba)	Cadmium (Cd)	Cobalt (Co)	Chromium (Cr)	Copper (Cu)	Molybdenum (Mo)	Nickel (Ni)	Lead (Pb)	Tin (Sn)	Zinc (Zn)	Mercury (Hg)	Antimony (Sb)	Beryllium (Be)	Selenium (Se)	Silver (Ag)	Thallium (Ti)	Vanadium (V)	Cyanide (CN), ug/L[3]	Tributyltin (TBT), ng Sn/L
Dutch A			10	50	1	20	20	20	5	20	20	10	50	0.2	15	73	180	180	2.4	36	5	4,300
Dutch B			30	100	2.5	50	50	50	20	50	50	30	200	0.5							30	
Dutch C			100	500	10	200	200	200	100	200	200	150	800	2							100	
Sample identification																						
Location	Depth (m)	Sampling Date																				
BH-1	NA	28 Feb 2007	11	190	<1.0	1.8	<1.0	180	13	5.8	76	1.0	<50	<0.50	<1.0	<1.0	32	<1.0	<1.0	2.5	<0.005	<6.5
BH-2	NA	28 Feb 2007	10	140	<1.0	12	34	370	13	21	640	1.0	130	<0.50	1.2	1.1	40	<1.0	<1.0	12	<0.005	<6.5
BH-3	NA	28 Feb 2007	13	300	2.8	10	65	640	11	19	880	1.2	470	<0.50	1.6	1.6	35	<1.0	1.0	12	<0.005	<6.5
BH-4	NA	28 Feb 2007	23	210	4.2	26	59	5900	9.4	41	1700	2.1	300	<0.50	2.0	3.3	35	<1.0	1.4	21	<0.005	<6.5
BH-5	NA	28 Feb 2007	15	210	2.2	20	40	740	9.0	25	4400	1.3	1200	<0.50	2.1	2.2	33	1.7	1.5	32	<0.005	<6.5
BH-6	NA	28 Feb 2007	14	180	<1.0	7.8	17	280	15	11	360	<1.0	170	<0.50	1.5	1.0	29	<1.0	<1.0	7.0	<0.005	<6.5
BH-7	NA	28 Feb 2007	11	150	<1.0	9.2	8.1	380	31	20	99	<1.0	190	0.79	1.7	<1.0	32	6.9	<1.0	7.0	<0.005	<6.5
BH-8	NA	28 Feb 2007	11	160	<1.0	20	24	310	6.0	17	31	<1.0	290	<0.50	<1.0	1.8	36	<1.0	<1.0	38	<0.005	<6.5
BH-9	NA	28 Feb 2007	11	42.0	<1.0	4.2	<1.0	370	18	9.4	81	<1.0	66	<0.50	<1.0	<1.0	40	2.5	<1.0	<1.0	<0.005	<6.5

Notes:

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Volatile Organic Compou

Criteria			1,1-Dichloroethene	trans-1,2-Dichloroethene	1,1-Dichloroethane	cis-1,2-Dichloroethene	1,1,1-Trichloroethane	1,1-Dichloropropene	Tetrachloroethene	1,2-Dichloroethane	Trichloroethene	1,1,2-Trichloroethane	1,3-Dichloropropane	Tetrachloroethene	1,1,1,2-Tetrachloroethane	1,1,2,2-Tetrachloroethane	1,2,3-Trichloropropane	1,2-Dibromo-3-chloropropane	Hexachlorobutadiene	2,2-Dichloropropane	1,2-Dichloropropane	cis-1,3-Dichloropropylene	trans-1,3-Dichloropropylene	Dibromomethane	1,2-Dibromethane	Stryene	Isopropylbenzene	1,3,5-Trimethylbenzene
Dutch A			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	NA	NA
Dutch B			10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	NA	NA
Dutch C			50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50		
Sample identification																												
Location	Depth (m)	Sampling Date																										
BH-1	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-2	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-3	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-4	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-5	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-6	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-7	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-8	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-9	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:

1. Cell in bolded line indicates exceedance of Dutch B Level
2. Shaded cell indicates exceedance of Dutch C Level or USEPA Region IX PRGs Standard
3. As there are no Dutch Levels for TBT and additional heavy metals, the USEPA Region IX PRGs for Residential Soil was adopted

Wan Chai Development Phase II Central-Wan Chai Bypass
Land Contamination Study at A King Shipyard
Analytical Results for Groundwater Samples

Criteria			nds (VOC), ug/L																							
			1,2,4-Trimethylbenzene	sec-Butylbenzene	tert-Butylbenzene	p-Isopropyltoluene	n-Butylbenzene	Vinyl Acetate	2-Butanone	4-Methyl-2-pentanone	2-Hexanone	Carbon disulfide	Vinyl chloride	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,2-Dichlorobenzene	1,2,4-Trichlorobenzene	1,2,3-Trichlorobenzene	Chlorobenzene	Bromobenzene	2-Chlorotoluene	4-Chlorotoluene	Chloroform	Bromodichloromethane	Debromochloromethane	Bromoform	n-Propylbenzene
Dutch A			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02	0.02	0.02	0.02	0.02	0.02	NA	NA	NA	NA	1	1	NA	NA
Dutch B			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	NA	NA	NA	NA	**10**	**10**	NA	NA
Dutch C			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2**	**2**	**2**	**2**	**2**	**2**	NA	NA	NA	NA	**50**	**50**	NA	NA
Sample identification																										
Location	Depth (m)	Sampling Date																								
BH-1	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<50	<50	<50	<50	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-2	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<50	<50	<50	<50	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-3	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<50	<50	<50	<50	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-4	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<50	<50	<50	<50	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-5	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<50	<50	<50	<50	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-6	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<50	<50	<50	<50	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-7	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<50	<50	<50	<50	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-8	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<50	<50	<50	<50	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BH-9	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<50	<50	<50	<50	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:

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3. As there are no Dutch Levels for TBT and additional heavy metals, the USEPA Region IX PRGs for Residential Soil was adopted

Wan Chai Development Phase II Central-Wan Chai Bypass
Land Contamination Study at A King Shipyard
Analytical Results for QA/QC Samples

Criteria			Total petroleum hydrocarbon (TPH), ug/L					BTEX, ug/L						Polyaromatic Hydrocarbons (PAH), ug/L					
			C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C28-C36 Fraction	Total TPH	Benzene	Toluene	Ethylbenzene	m-xylene & p-xylene	ortho-xylene	Total xylenes	Naphthelene	Phenanthrene	Anthracene	Fluoranthene	Benzo(a)pyrene	Pyrene
Dutch A			-	-	-	-	20	0.2	0.5	0.5	-	-	0.5	0.2	0.1	0.1	0.02	0.01	0.02
Dutch B			-	-	-	-	**200**	**1**	**15**	**20**	-	-	**20**	**7**	**2**	**2**	**1**	**0.2**	**1**
Dutch C			-	-	-	-	**600**	**5**	**50**	**60**	-	-	**60**	**30**	**10**	**10**	**5**	**1**	**5**
Sample identification																			
Location	**Depth (m)**	**Sampling Date**																	
Field Blank 1	NA	27 Feb 2007	<20	<25	<25	<25	<95	<1.0	<15	<15	<15	<15	<30	<1.0	<1.0	<1.0	<1.0	<0.20	<1.0
Equipment Blank 1	NA	27 Feb 2007	<20	<25	<25	<25	<95	<1.0	<15	<15	<15	<15	<30	<1.0	<1.0	<1.0	<1.0	<0.20	<1.0
Field Blank 2	NA	28 Feb 2007	<20	<25	<25	<25	<95	<1.0	<15	<15	<15	<15	<30	<1.0	<1.0	<1.0	<1.0	<0.20	<1.0
Equipment Blank 2	NA	28 Feb 2007	<20	<25	<25	<25	<95	<1.0	<15	<15	<15	<15	<30	<1.0	<1.0	<1.0	<1.0	<0.20	<1.0

Notes:

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2. Shaded cell indicates exceedance of Dutch C Level or USEPA Region IX PRGs Standard

3. As there are no Dutch Levels for TBT and additional heavy metals, the USEPA Region IX PRGs for Residential Soil was adopted

Wan Chai Development Phase II Central-Wan Chai B
Land Contamination Study at A King Shipyard
Analytical Results for QA/QC Samples

Criteria			Heavy metals, ug/L												Additional Metals, ug/L							
			Arsenic (As)	Barium (Ba)	Cadmium (Cd)	Cobalt (Co)	Chromium (Cr)	Copper (Cu)	Molybdenum (Mo)	Nickel (Ni)	Lead (Pb)	Tin (Sn)	Zinc (Zn)	Mercury (Hg)	Antimony (Sb)	Beryllium (Be)	Selenium (Se)	Silver (Ag)	Thallium (Ti)	Vanadium (V)	Cyanide (CN), ug/L	Tributyltin (TBT), ng Sn/L
Dutch A			10	50	1	20	20	20	5	20	20	10	50	0.2							5	
Dutch B			**30**	**100**	**2.5**	**50**	**50**	**50**	**20**	**50**	**50**	**30**	**200**	**0.5**	**15**	**73**	**180**	**180**	**2.4**	**36**	**30**	**4,300**
Dutch C			**100**	**500**	**10**	**200**	**200**	**200**	**100**	**200**	**200**	**150**	**800**	**2**							**100**	
Sample identification																						
Location	**Depth (m)**	**Sampling Date**																				
Field Blank 1	NA	27 Feb 2007	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<50	<0.50	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.005	<6.5
Equipment Blank 1	NA	27 Feb 2007	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<50	<0.50	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.005	<6.5
Field Blank 2	NA	28 Feb 2007	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<50	<0.50	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.005	<6.5
Equipment Blank 2	NA	28 Feb 2007	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<50	<0.50	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.005	<6.5

Notes:

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3. As there are no Dutch Levels for TBT and additional heavy metals, the USEPA Region IX PRGs for Residential Soil was adopted

Wan Chai Development Phase II Central-Wan Chai B
Land Contamination Study at A King Shipyard
Analytical Results for QA/QC Samples

Volatile Organic Compounds (VO

Criteria			1,1-Dichloroethene	trans-1,2-Dichloroethene	1,1-Dichloroethane	1,2-Dichloroeth-ene	1,1,1-Trichloroethane	1,1-Dichloropropene	Tetrachloroethene	1,2-Dichloroethane	Trichloroethene	1,1,2-Trichloroethane	1,3-Dichloropropane	Tetrachloroethene	1,1,1,2-Tetrachloroethar	1,1,2,2-Tetrachloroethar	1,2,3-Trichloropropane	1,2-Dibromo-3-chloropro	Hexachlorobutadiene	2,2-Dichloropropane	1,2-Dichloropropane	cis-1,3-Dichloropropylen	trans-1,3-Dichloropropy	Dibromomethane	1,2-Dibromethane	Stryene	Isopropylbenzene	1,3,5-Trimethylbenzene	1,2,4-Trimethylbenzene
Dutch A			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	NA	NA	NA
Dutch B			10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	NA	NA	NA
Dutch C			50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50			
Sample identification																													
Location	Depth (m)	Sampling Date																											
Field Blank 1	NA	27 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Equipment Blank 1	NA	27 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Field Blank 2	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Equipment Blank 2	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

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Wan Chai Development Phase II Central-Wan Chai B
Land Contamination Study at A King Shipyard
Analytical Results for QA/QC Samples

Criteria			C), ug/L																								
			sec-Butylbenzene	tert-Butylbenzene	p-Isopropyltoluene	n-Butylbenzene	Vinyl Acetate	2-Butanone	4-Methyl-2-pentanone	2-Hexanone	Carbon disulfide	Vinyl chloride	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,2-Dichlorobenzene	1,2,4-Trichlorobenzene	1,2,3-Trichlorobenzene	Chlorobenzene	Bromobenzene	2-Chlorotoluene	4-Chlorotoluene	Chloroform	Bromodichloromethane	Debromochloromethane	Bromoform	n-Propylbenzene
Dutch A			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02	0.02	0.02	0.02	0.02	0.02	NA	NA	NA	NA	1	1	NA	NA
Dutch B			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	NA	NA	NA	NA	**10**	**10**	NA	NA
Dutch C			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2**	**2**	**2**	**2**	**2**	**2**	NA	NA	NA	NA	**50**	**50**	NA	NA
Sample identification																											
Location	**Depth (m)**	**Sampling Date**																									
Field Blank 1	NA	27 Feb 2007	<5.0	<5.0	<5.0	<5.0	<50	<50	<50	<50	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Equipment Blank 1	NA	27 Feb 2007	<5.0	<5.0	<5.0	<5.0	<50	<50	<50	<50	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Field Blank 2	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<50	<50	<50	<50	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Equipment Blank 2	NA	28 Feb 2007	<5.0	<5.0	<5.0	<5.0	<50	<50	<50	<50	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

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Wan Chai Development Phase II Central-Wan Chai Bypass
Land Contamination Study at A King Shipyard
TCLP Analysis Results for Selected Soil Samples

Criteria			Parameters (mg/L)															
			Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)	Mercury (Hg)	Arsenic (As)	Sliver (Ag)	Tin (Sn)	Antimony (Sb)	Beryllium (Be)	Thallium (Tl)	Vanadium (V)	Selenium (Se)	Barium (Ba)
TCLP Limit (ppm)			**10**	**50**	**250**	**250**	**50**	**250**	**1**	**50**	**50**	**250**	**150**	**10**	**50**	**250**	**1**	**1000**
Sample identification																		
Location	**Depth (m)**	**Sampling Date**																
BH-8	1.50	26-Feb-07	<1.0	<1.0	<2.0	<1.5	<3.0	<10	<0.02	<2.0	<2.0	<2.5	<2.0	<1.0	<0.10	<4.0	<0.10	<2.0
BH-4	0.50	26-Feb-07	<1.0	<1.0	2.2	<1.5	<3.0	16	<0.02	<2.0	<2.0	<2.5	<2.0	<1.0	<0.10	<4.0	<0.10	<2.0
BH-3	0.50	26-Feb-07	<1.0	<1.0	<2.0	<1.5	<3.0	19	<0.02	<2.0	<2.0	<2.5	<2.0	<1.0	<0.10	<4.0	<0.10	<2.0
BH-5	3.00	27-Feb-07	<1.0	<1.0	<2.0	<1.5	<3.0	<10	<0.02	<2.0	<2.0	<2.5	<2.0	<1.0	<0.10	<4.0	<0.10	<2.0

Appendix D
Brief Summary of Health Effects of Contaminants Identified in the Soil Samples

Brief Summary of Health Effects of Contaminants Identified in the Soil Samples

Total Petroleum Hydrocarbon (TPH)

Some of the TPH compounds can affect human's central nervous system, causing headaches and dizziness at high levels in the air, a nerve disorder called "peripheral neuropathy," and/ or effects on the blood, immune system, lungs, skin, and eyes. Animal studies have shown effects on the lungs, central nervous system, liver, and kidney from exposure to TPH compounds. Some TPH compounds have also been shown to affect reproduction and the developing fetus in animals.

The International Agency for Research on Cancer (IARC) has determined that one TPH compound (benzene) is carcinogenic to humans. IARC has determined that other TPH compounds (benzo[a]pyrene and gasoline) are probably and possibly carcinogenic to humans. Most of the other TPH compounds are considered not to be classifiable by IARC.

Barium

Barium has been found to potentially cause gastrointestinal disturbances and muscular weakness when people are exposed to it at levels above the USEPA drinking water standards for relatively short periods of time. Some people who eat or drink amounts of barium above background levels found in food and water for a short period may experience vomiting, abdominal cramps, diarrhea, difficulties in breathing, increased or decreased blood pressure, numbness around the face, and muscle weakness. Eating or drinking very large amounts of barium compounds that easily dissolve can cause changes in heart rhythm or paralysis and possibly death. Animals that drank barium over long periods had damage to the kidneys, decreases in body weight, and some died.

Nevertheless, the Department of Health and Human Services (DHHS) (US) and the IARC have not classified barium as to its carcinogenicity. The USEPA has determined that barium is not likely to be carcinogenic to humans following ingestion and that there is insufficient information to determine whether it will be carcinogenic to humans following inhalation exposure.

Copper

Everyone must absorb small amounts of copper every day because copper is essential for good health. High levels of copper can be harmful. Breathing high levels of copper can cause irritation of your nose and throat. Ingesting high levels of copper can cause nausea, vomiting, and diarrhea. Very-high doses of copper can cause damage to your liver and kidneys, and can even cause death. The USEPA has determined that copper is not classifiable as to human carcinogenicity.

Lead

Lead can affect almost every organ and system in the human body. The most sensitive is the central nervous system, particularly in children. Lead also damages kidneys and the reproductive system. The effects are the same whether it is breathed or swallowed. At high levels, lead may decrease reaction time, cause weakness in fingers, wrists, or ankles, and possibly affect the memory. Lead may cause anemia, a disorder of the blood. It can also damage the male reproductive system.

Zinc

Harmful effects generally begin at levels 10-15 times higher than the amount needed for good health. Large doses taken by mouth even for a short time can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia and decrease the levels of your good cholesterol. Inhaling large amounts of zinc (as dusts or fumes) can cause a specific short-term disease called metal fume fever.

Putting low levels of zinc acetate and zinc chloride on the skin of rabbits, guinea pigs, and mice caused skin irritation. Skin irritation will probably occur in people. The DHHS (US) and the IARC have not classified zinc for carcinogenicity. Based on incomplete information from human and animal studies, the USEPA has determined that zinc is not classifiable as to its human carcinogenicity.

Information extracted from Agency for Toxic Substances and Disease Registry (ATSDR) website (http://www.atsdr.cdc.gov/), (2006).

Appendix E
Groundwater Risk Assessment

	A	B	C	D
1	**Wan Chai Development Phase II - Planning and Engineering Review**			
2	**Land Contamination Assessment at A King Shipyard**			
3	**Calculations of Risk-Based Assessment Criteria for Groundwater Contamination**			
4				
5	**Table 1 - Source Concentrations & Oral Reference Dose for Risk Assessment**			
6	**Parameter**	**Source Concentration[1]**	**Sampling Location[1]**	**Noncarcinogenic Oral Reference Dose[a] (RfDo)**
7		**[mg/L]**		**[mg/kg-day]**
8	**Xylenes**	3.00E-02	All	2.00E-01
9	**Barium**	3.00E-01	BH3	7.00E-02
10	**Cadmium**	4.20E-03	BH4	5.00E-04
11	**Chromium**	6.50E-02	BH3	1.50E+00
12	**Copper**	5.90E+00	BH4	4.00E-02
13	**Molybdenum**	3.10E-02	BH3	5.00E-03
14	**Lead**	4.40E+00	BH5	3.60E-03
15	**Zinc**	1.20E+00	BH5	3.00E-01
16	**Mercury**	7.90E-04	BH7	3.00E-04
17	**Vanadium**	3.80E-02	BH8	1.00E-03
18				
19	[1] Maximum concentrations reported in the Study were adopted.			
20	[a] Source (other than Lead): USEPA Region IX Risk-based Concentration Table (revised in Oct 2004), USEPA Region IX.			
21	Source for Lead: World Health Organisation			
22				
23	**Assumptions:**			
24	*Exposure Pathway:*			
25	The applicable and dominant complete pathway is considered to be direct groundwater ingestion.			
26				
27	*Receptor:*			
28	The most sensitive receptors are considered to be the construction workers.			
29				
30	*Input Parameters for Calculations (for Direct Groundwater Ingestion)*			
31				
32				
33	IR = water ingestion rate [L/day] =		0.02	
34				
35	EF = exposure frequency [day/yr] =		180	(assume construction workers expose for 6 months of site formation works)
36				
37	ED = exposure duration [yr] =		1	(construction workers)
38				
39	BW = body weight [kg] =		70	
40				
41	AT = Averaging time [day] =		365	(ED x 365 days)
42				

Wan Chai Development Phase II - Planning and Engineering Review
Land Contamination Assessment at A King Shipyard
Calculations of Risk-Based Assessment Criteria for Groundwater Contamination

Table 2 - Calculations for Direct Groundwater Ingestion

Calculations	Xylenes	Barium	Cadmium	Chromium	Copper	Molybdenum	Lead	Zinc	Mercury	Vanadium
1. Groundwater conc. [mg/L] =	3.00E-02	3.00E-01	4.20E-03	6.50E-02	5.90E+00	3.10E-02	4.40E+00	1.20E+00	7.90E-04	3.80E-02
2. Natural attenuation factor =	1	1	1	1	1	1	1	1	1	1
3. Exposure medium [mg/L] = (1) / (2) =	3.00E-02	3.00E-01	4.20E-03	6.50E-02	5.90E+00	3.10E-02	4.40E+00	1.20E+00	7.90E-04	3.80E-02
4. Exposure multiplier [L/kg/day] = (IR x EF x ED) / (BW x AT) =	1.41E-04	1.41E-04	1.41E-04	1.41E-04	1.41E-04	1.41E-04	1.41E-04	1.41E-04	1.41E-04	1.41E-04
5. Average Daily Intake Rate [mg/kg/day] = (3) x (4) =	4.23E-06	4.23E-05	5.92E-07	9.16E-06	8.31E-04	4.37E-06	6.20E-04	1.69E-04	1.11E-07	5.35E-06
6. Maximum Pathway Intake [mg/kg/day] = (groundwater ingestion as dominant pathway)	4.23E-06	4.23E-05	5.92E-07	9.16E-06	8.31E-04	4.37E-06	6.20E-04	1.69E-04	1.11E-07	5.35E-06
7. Maximum Toxicant Intake Rate [mg/kg/day] =	4.23E-06	4.23E-05	5.92E-07	9.16E-06	8.31E-04	4.37E-06	6.20E-04	1.69E-04	1.11E-07	5.35E-06
8. Noncarcinogenic Oral Reference Dose [mg/kg-day] =	2.00E-01	7.00E-02	5.00E-04	1.50E+00	4.00E-02	5.00E-03	3.60E-03	3.00E-01	3.00E-04	1.00E-03
9. Individual Chemical of Concern Hazard Index = (7) / (8) =	2.11E-05	6.04E-04	1.18E-03	6.11E-06	2.08E-02	8.74E-04	1.72E-01	5.64E-04	3.71E-04	5.35E-03
Total pathway hazard index = (after adding contributions from all chemical of concern)		**2.02E-01**	(< 1 (USEPA recommended hazard index))							

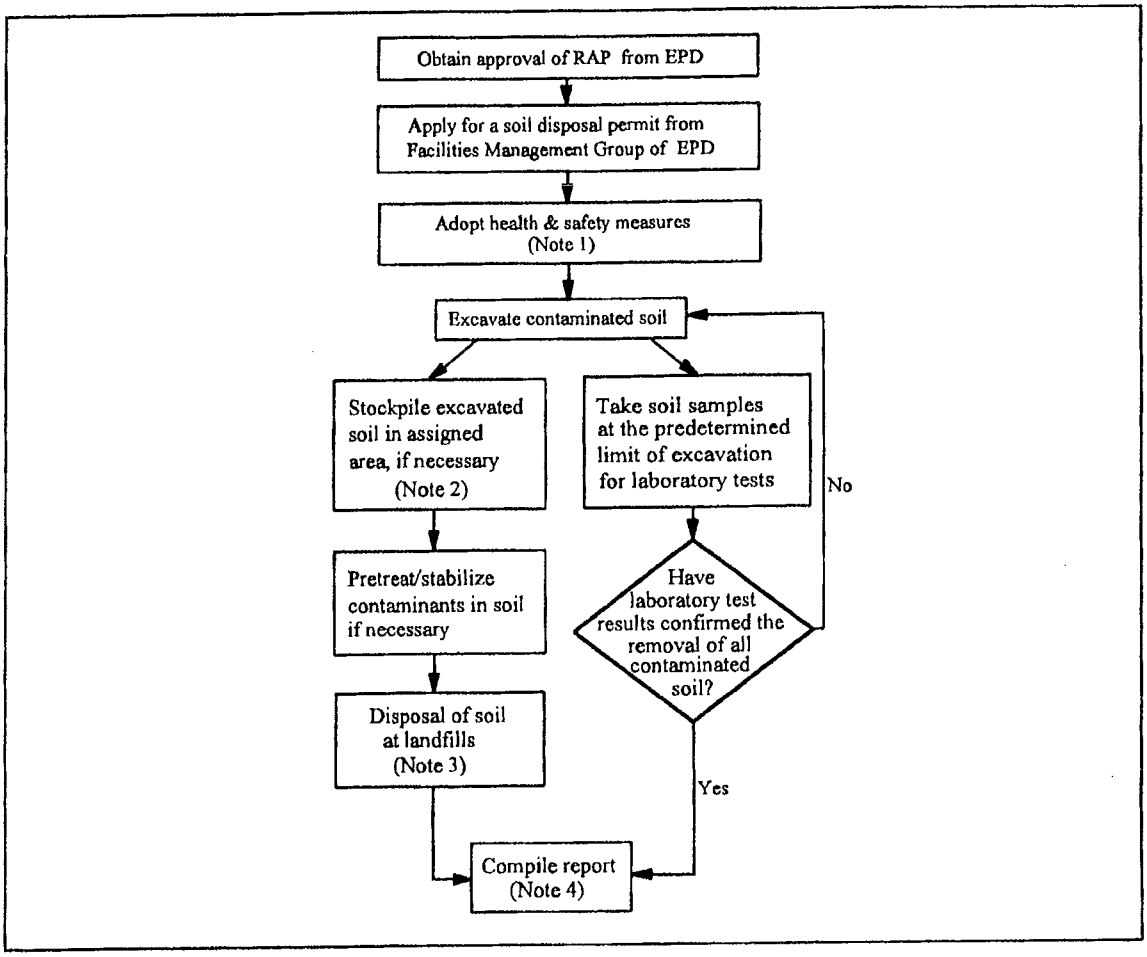
	Xylenes	Barium	Cadmium	Chromium	Copper	Molybdenum	Lead	Zinc	Mercury	Vanadium
RBSL [mg/L] = (Groundwater Conc./ Hazard Quotient)	**1.42E+03**	**4.97E+02**	**3.55E+00**	**1.06E+04**	**2.84E+02**	**3.55E+01**	**2.56E+01**	**2.13E+03**	**2.13E+00**	7.10E+00
	>>	>>	>>	>>	>>	>>	>>	>>	>>	>>
Groundwater conc. [mg/L] =	3.00E-02	3.00E-01	4.20E-03	6.50E-02	5.90E+00	3.10E-02	4.40E+00	1.20E+00	7.90E-04	3.80E-02
	(in mg/L)	(in mg/L)	(in mg/L)	(in mg/L)	(in mg/L)	(in mg/L)	(in mg/L)	(in mg/L)	(in mg/L)	(in mg/L)
Risk	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Appendix F
Essential Steps for the Excavation and Landfill Disposal

7.2 Excavation and Landfill Disposal

The essential steps involved in the implementation of the excavation and landfill disposal option are given in Figure 7.2. A more detailed description of this option is in Annex E.

Figure 7.2 Essential Steps of Excavation and Landfill Disposal



Note 1: Example of excavation safety measures can be found in OSHA Excavations Rule 29 CFR 1926 SUBPART P. Further guidance is set out in Section 8.

Note 2: Excavated soil intended for disposal should be placed in an assigned area with warning posted. Assigned areas are those in which the general public and site staff cannot readily gain access. In any event, the soil should be stockpiled in a safe and effective manner. This requires a proper setup on an impervious surface with provision to deal with leachate and runoff properly. The stockpile should be covered with a plastic sheet to keep off wind and rain.

Note 3: Due care must be exercised during the transportation of the excavated contaminated soil to the landfill for disposal. The soil should be properly contained and covered to avoid spillage during transport. Suitable warning signs about the nature of the contaminated soil should be displayed on both the vehicle and the soil itself.

Note 4: A Remediation Report should be prepared and submitted to EPD to demonstrate that the clean-up is adequate. Information such as soil disposal records, sampling results, photographs and certification of independent checker should be included in the report.

TCLP or other relevant tests on soil samples should be included during the early stage of contamination assessment. Table E2 below summarizes the appropriate action at each stage of assessment and remediation.

Table E2 Procedure of Contaminated Soil Disposal

Stage	Action
Preparation of CAP	a. If exceedance of the relevant land contamination standards is likely, and excavation and disposal is envisaged to be the only suitable cleanup method during site appraisal, then the investigation plan should include TCLP or other relevant tests on every soil sample that will be analyzed for land contamination standards. Furthermore, TCLP or other relevant **screening tests** must be done on at least 3 samples from the most contaminated areas. A **screening test** is one that analyzes for the full suite of parameters in Table E1 irrespective of whether a parameter has been identified as a contaminant of concern during site appraisal. b. If the most suitable cleanup method has not been identified during site appraisal, extra soil samples should be collected and stored for TCLP or other relevant tests in the future (except the parameter of mercury, see note to Table E1), should exceedance of land contamination standards be confirmed and excavation and disposal be selected as the cleanup method. This approach may save the costs of unnecessary TCLP or other relevant tests during the CAP stage, but would require extra time in the project programme if TCLP or other relevant tests become necessary during CAR and RAP preparation.
Preparation of CAR and RAP	If any TCLP or other relevant test results exceed the disposal criteria, the "non-complying" part of contaminated soil must first be pretreated or stabilized before disposal. The RAP should propose the most suitable method of pretreatment or stabilization.
After approval of CAR and RAP	A copy of the approved CAR and RAP must be submitted together with an application to Facilities Management Group (FMG) of EPD 3 months before disposal. FMG may limit the daily disposal quantity and require additional testing to confirm that other pollutants of concern are not present.
Implementation of RAP	The authorized person or resident engineer on site will be required to certify on an admission ticket that excavation, segregation and delivery of soil for disposal is done according to the approved RAP. For soils requiring pretreatment or stabilization, typically one sample per 400 tonnes of treated or stabilized soil is to be taken and subjected to TCLP or other relevant tests to confirm that the soil can be accepted at landfills according to the criteria in Table E1 or other relevant criteria. Only those parameters with concentrations exceeding the criteria during the initial testing need to be included in the confirmatory test. Every load of contaminated soil to be disposed of at landfills should be accompanied by an admission ticket and if applicable, confirmatory test results.