Appendix 5.2b

Contamination Assessment Report/ Remediation Action Plan (CAR/RAP) for the ex-GFS Building

土木工程拓展署
Civil Engineering and Development Department
Kowloon Development Office

Agreement No. CE 35/2006 (CE)

Kai Tak Development Engineering Study cum Design and Construction of Advance Works – Investigation, Design and Construction

Contamination Assessment Report/ Remediation Action Plan (CAR/RAP)
For Ex-Government Flying Services Building (Rev.2)

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MAUNSELL CONSULTANTS ASIA LTD

Agreement No. CE 35/2006(CE)
Kai Tak Development Engineering Study
cum Design and Construction of Advance Works
– Investigation, Design and Construction

CONTAMINATION ASSESSMENT REPORT / REMEDIATION ACTION PLAN (CAR/RAP) FOR THE EX-GFS BUILDING (REV.2)

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1 INTRODUCTION

1.1 Background

1.1.1 The former Kai Tak airport started its operation since 1920s and was replaced by the new airport at Chek Lap Kok in 1998. It is located at south east Kowloon and has covered a total land area of about 260 hectares comprising of the north and south aprons and the runway areas extending into the Kowloon Bay.

1.1.2 Kai Tak Development (KTD) is a designated project in accordance with item 1 of schedule 3 under the Environmental Impact Assessment Ordinance (EIAO). The objectives of the Project is to provide information on the nature and extent of environmental impacts arising from the construction and operation of the development under this Project and related works that take place concurrently.

1.1.3 The ex-Government Flying Services (GFS) building was found to be located within the planning boundary of Kai Tak Development and has not been assessed for land contamination in the previous EIA studies and land contamination studies. As commissioned by the Civil Engineering and Development Department (CEDD) to assess the extent of residual land contamination associated with the historical operation of the former Kai Tak Airport under *Agreement No. CE 35/2006(CE) Kai Tak Development Engineering Study cum Design and Construction of Cruise Terminal Advance Works – Investigation, Design and Construction*, a Contamination Assessment Plan (CAP) for the ex-GFS building (hereinafter called the "Study Area") was prepared. The Study Area covered an area of approximately 17,000m^2 , consisting of (a) ex-GFS hangar, (b) an underground fuel storage tank, (c) a dangerous goods (D.G) store, (d) a playground (previously used as an car parking area), and a grassland (previously used as a tennis court), as depicted in **Drawing 1.1.**

1.1.4 The CAP which outlined the sampling locations and the testing schedule for site investigation (SI) in the Study Area was approved by Environmental Protection Department (EPD). A total of a total of 4 trial pits and 14 boreholes have been proposed and constructed within the Study Area for soil and groundwater sampling and testing.

1.1.5 The SI for land contamination assessment in the Study Area was commenced on 14 September 2007 and completed on 16 November 2007. The SI works, including rotary drilling of boreholes, logging of ground materials, installation of groundwater monitoring wells, water level monitoring and reinstatement of excavations, were all conducted by Vibro (H.K.) Ltd. (Vibro) under CEDD Term Contract No.GE/2007/03 (Works Order No. GE/2007/03.61&61A) while laboratory analyses were carried out by Lam Laboratories Limited (LAM) under CEDD term Contract No.GE/2005/49 (Works Order No. GE/2005/49.28)).

1.2 Objectives

1.2.1 The objectives of this Contamination assessment Report/ Remediation Action Plan (CAR/RAP) are to summarize findings of the SI (including fieldworks and laboratory analyses) and to determine the nature and extent of contamination based on the findings of the SI (**Section 3**). Once contamination is confirmed, remediation proposal suggesting appropriate remediation actions for the contaminated area are provided in the Remediation Action Plan (**Section 4**).

1.2.2 This CAR/RAP is submitted to seek endorsement from the Director of Environmental Protection (DEP) in accordance with *Section 3.4.10.5 of the EIA Study Brief for Kai Tak Development (ESB-152/2006)*.

2 FINDINGS OF CONTAMINATION ASSESSMENT PLAN

2.1.1 According to the approved CAP, the activities identified at the Study Area are summarized in **Table 2.1**.

Table 2.1 Potential Sources of Land Contamination Identified in the Study Area

Contamination Site Concern	Potential Source of Land Contamination
Ex-GFS building	• The Site consisted of a hanger and more than 40 rooms/ workshops. • Hanger, transformer room and other rooms such as Electrical Workshop, Instrument Workshop, Ni-Cad Battery Room, Lead-acid Battery Room, Generator Room, Metal / Machine Workshop, Welding Workshop, Component Overhaul Workshop, Engine / Module Workshop and Ground Equipment Workshop were identified as potential source of land contamination.
Dangerous Goods store	• The Site had been used for storing Category 2 items (oxygen, nitrogen, feron 12, carbon dioxide and acetylene) and Category 5 items (paint and thinner). During site inspection, the D.G store was reported to be emptied except one of the rooms occupied by GFS for chemical waste storage. Waste oil was found to be stored in well lidded glass jars and oil drums during site inspection. • In order to assess any potential land contamination induced from mishandling of dangerous goods, SI was proposed in this area.
Underground tank and underground pipelines	• The 18,000L underground tank was used for diesel fuel storage and the pipe trench was found connecting the D.G. Store and the welding workshop within the Site. • The underground fuel tanks and the underground pipelines were identified as potential sources of land contamination in this Site.
Grassland, playground and remaining area of the ex-GFS building	• The playground area had been used for car parking and used as kennels for the Immigration Department Dog Team while the grassland area was reported to be used for Immigration Department Dog Team training. Both areas were vacant areas and no activities were observed during site inspection. • In order to check for potential land contamination in these two vacant areas and to provide information on general soil and groundwater conditions, site investigation was proposed within the area.

2.1.2 In light of potential sources of land contamination identified in the Study Area, a total of 34 locations were identified as potential land contamination hotspots. The criteria for identification of contamination hotspots were based upon the site observation of stain/ground discolourization, machine/ chemical storage locations or areas with contamination activities undertaken.

2.1.3 Since transformer room and generator room located within the ex-GFS building were still in operation during the SI and un-recorded underground chambers were found underneath the potential contaminative rooms within the ex-GFS building, SI works at 16 of the 34 hotspots within the Study Area, were not possible to be carried out. Therefore only 4 trial pits and 14 boreholes were proposed within the Study Area. Detailed rationales for selecting sampling locations in the approved CAP are provided in **Appendix A**.

2.1.4 Since the battery rooms, electrical, instrument, metal / machine, welding, overhaul, engine/module and ground equipment workshops were well paved with concrete and the presence of underground chamber has prevented a direct contact of potential contaminants with the soil underneath. No issue of land contamination in relation to the site activities is therefore expected and thus no sampling was proposed at these rooms.

2.1.5 For the hotspots identified at transformer room and generator room, it was recommended that a supplementary land contamination assessment should be carried out upon the cessation of the operations and prior to the redevelopment. A supplementary sampling plan providing the sampling and laboratory analysis information for the SI in these areas are attached in **Appendix B.**

3 CONTAMINATION ASSESSMENT REPORT

3.1 Assessment Methodology

Soil Boring and Sampling

3.1.1 The SI works were carried out from 14 September 2007 to 16 November 2007. During the SI, sampling at GFSB-02 and GFSB-03 was not feasible to complete according to the approved CAP.

3.1.2 Soil boring at GFSB-02 and GFSB-03 was only proceeded down to 0.5m below base of existing concrete pavement (BBC) due to the presence of hard concrete.

3.1.3 A total of 4 trial pits and 14 boreholes were constructed within the Study Area as illustrated in **Drawing 3.1**. Soil samples were collected at about 1m, 2.5m and 3.5m BBC for boreholes located at GFSA-17 to A-22, GFSC-03 to C-04 and GFSD-01 to D-04. For GFSC-01 to C-02, soil samples were collected at about 1m, 2.5m, 3.5m, 5m and 6m BBC while for trial pits located within D.G Store (GFSB-01 to B04), soil samples were generally collected at about 0.5m, 1.5m and 2.5m. It should be noted that, soil sampling in GFSB-01 was not able to be conducted exactly at 2.5m but close to the desired depth due to the presence of concrete slab.

3.1.4 Before drilling/excavation, the sampler and all equipment in contact with the ground were thoroughly decontaminated prior to use at each borehole by laboratory-grade detergent and steam-cleaning/ high-pressure hot water jet.

3.1.5 Soil samples were properly labeled and stored in cool boxes at around 4℃ until delivered to the analytical laboratory. All the collected soil samples in the SI were analyzed in accordance with the analysis schedules detailed in the approved CAP.

Strata Logging

3.1.6 Strata logging for boreholes / trial pits was undertaken during the course of drilling and sampling by a qualified geologists. The logs included the general stratigraphic descriptions, depth of soil sampling, sample notation and level of groundwater (if encountered). The presence of rocks/boulders/cobbles and foreign materials such as metals, wood and plastics was also recorded. Photographic records were also taken for trial pits.

Groundwater Sampling

3.1.7 After completion of soil sampling, groundwater monitoring wells were installed at all 14 boreholes with groundwater encountered. After installation, well development (approximately 5 well volumes) was carried out to remove silt and drilling fluid, if any, reside from the wells. Groundwater level and thickness of free product layer, if present, were measured at each well before groundwater samples were taken.

3.1.8 Prior to groundwater sampling, monitoring wells were purged (at least 3 well volumes) to remove fine-grained materials and to collect freshly refilled representative groundwater samples.

3.1.9 Immediate after collection, groundwater samples were transferred to new, clean, laboratory-prepared “darken type” sample containers. Groundwater samples were placed in the glass jars with zero headspace and promptly sealed with a septum-lined cap. All samples were clearly labeled. Immediately following collection, samples were subsequently stored in cool box at about 4℃ and delivery to analytical laboratory on the same day.

3.1.10 All groundwater samples were analyzed in accordance with the analysis schedules detailed in the approved CAP (**Appendix A**). .

3.2 Assessment Criteria

Criteria for Soil and Groundwater Contamination

3.2.1 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 the EPD.

3.2.2 The Practice Note 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.

3.2.3 The Dutch Criteria are very stringent as they are developed based on a "good for all uses" philosophy. The EPD generally requires remediation for soil contamination above the Dutch B level. In other words, the Dutch B level is the cleanup target for remediation of soil. Relevant soil and groundwater Dutch 'ABC' levels for this Study 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) (as 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)						
Naphthalene	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
Phenols	0.02	1	10	0.5	15	50
Chlorinated Hydrocarbons-Aliphatics (for individual)	0.1	5	50	1	10	50
Metals						
Cadmium (Cd)	1	5	20	1	2.5	10
Lead (Pb)	50	150	600	20	50	200
Copper (Cu)	50	100	500	20	50	200

Parameter	Soil (mg/kg)			Groundwater(μg/L)		
	Dutch A	Dutch B	Dutch C	Dutch A	Dutch B	Dutch C
Tin (Sn)	20	50	300	10	30	150
Chromium (Cr)	100	250	800	20	50	200
Nickel (Ni)	50	100	500	20	50	200
Zinc (Zn)	200	500	3000	50	200	800
Cobalt (Co)	20	50	300	20	50	200
Arsenic (As)	20	30	50	10	30	100
Molybdenum (Mo)	10	40	200	5	20	100
Barium (Ba)	200	400	2000	50	100	500
Mercury (Hg)	0.5	2	10	0.2	0.5	2

Risk-based Criteria for Groundwater

3.2.4 The Dutch 'ABC' criteria were established based on the assumption that groundwater is used as potable water. However, it is too stringent to be applied directly to Hong Kong where groundwater is not generally for potable use. Hence, the Dutch B levels would be 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.

3.2.5 The risk-based assessment that has been adopted in US Environmental Protection Agency (USEPA) takes into account concentrations of individual contaminants in groundwater, the anticipated most sensitive human receptor and the potential exposure pathways. For a worst-case scenario, the largest contaminant concentrations in the groundwater samples would be taken as the source concentration for the risk calculation.

3.2.6 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 recognized oral reference dose. For carcinogens, the first is the Total Carcinogenic Risk that is the sum of contaminant carcinogenic risk exceeds $1x10^{-6}$ (i.e. USEPA lifetime cancer risk level). The second is the largest carcinogenic contaminant concentration exceeds the corresponding RBSL that is derived from the recognized carcinogenic oral slop factor. It should be noted that risk assessment could only be undertaken for those chemicals that have a recognized oral slope factor or oral reference dose.

3.3 Analytical Results and Interpretation

Fieldwork and On-site Measurements

3.3.1 The SI was undertaken in accordance with the sampling plan detailed in the approved CAP. No distinctive, characteristic smell of soil and groundwater sample exhibiting signs of contamination was noticeable during the site investigation. Soil boring logs are included in **Appendix C**.

<u>On-site PID Measurement</u>

3.3.2 The volatile organic compounds (VOCs) concentrations were measured by the photoionization detector (PID) for soil samples obtained.

3.3.3 The VOC levels of the soil samples are generally low (i.e. below 5.2ppm) and harmful effects posed to site workers during decontamination is not expected.

Thickness of Free Product Measurement

3.3.4 Floating oil / free product (of TPH) has not been found in all sampling point.

3.3.5 As no free product was encountered during the SI, only the results of PID measurement are presented in **Appendix D**.

Laboratory Analytical Results

Results of Soil Analysis

3.3.6 A total of 54 soil samples excluding those for QA/QC purposes were collected in the SI for laboratory analysis and the laboratory testing results for all soil samples are presented in **Appendix E**.

3.3.7 Among these samples collected, TPH, PAHs (Phenanthrene, Benzo(a)pyrene, Fluoranthene and Pyrene) and metals (copper, lead, zinc, cadmium, nickel and cobalt) are found exceeding Dutch B/C levels in the soil samples collected at GFSA-17 to A-18, GFSA-20, GFSA-22, GFSB-01 and GFSD-03 to D-04. The exceedances are summarized in **Table 3.2** below.

Table 3.2 Summary of Soil Sample Exceeding the Dutch B/C Levels

Sample I.D.	Depth (m BBC)	Contaminant	Dutch Level (mg/kg)		Concentration (mg/kg)	Dutch Level Exceeded
			B	C		
GFSA-17	3.25-3.7	Lead	150	600	200	>B
GFSA-18	1	Phenanthrene	10	100	14	>B
		Benzo(a)pyrene	1	10	11	>C
		Fluoranthene	10	100	19	>B
		Pyrene	10	100	17	>B
GFSA-20	1	Zinc	500	3000	2000	>B
GFSA-22	3.25-3.7	Copper	100	500	150	>B
GFSB-01	1.65	TPH	1000	5000	2875	>B
GFSD-03	1	Cadmium	5	20	6	>B
		Lead	150	600	480	>B
		Zinc	500	3000	2300	>B
	3.3-3.75	Cadmium	5	20	510	>C
		Nickel	100	500	410	>B
		Cobalt	50	300	1200	>C
GFSD-04	2.2-2.65	Cadmium	5	20	15	>B
		Lead	150	600	430	>B
	3.2-3.65	Lead	150	600	300	>B

Remarks:
BBC= Below Base of Existing Concrete Pavement

Results of Groundwater Analysis

3.3.8 During the SI, groundwater was encountered at all the sampling location except GFSB-01 to B-04. A total of 14 groundwater samples were therefore collected from these boreholes. **Table 3.3** shows the termination depth for boreholes and their corresponding groundwater level. The measured groundwater level contour is presented in **Drawing 3.2**.

Table 3.3 Summary of the Borehole Termination Depths and Groundwater Level

Sample I.D.	Groundwater Level		Termination Depth of Borehole
	m Below Ground	mPD	m Below Ground
GFSA-17	2.62	2.11	6.25
GFSA-18	2.58	2.29	6.60
GFSA -19	2.54	2.41	6.35
GFSA-20	2.73	2.26	6.65
GFSA-21	2.53	2.42	6.44
GFSA-22	2.68	2.28	6.29
GFSC-01	2.48	2.18	6.50
GFSC-02	2.47	2.17	6.50
GFSC-03	2.66	2.10	6.38
GFSC-04	2.53	2.10	6.28
GFSD-01	2.69	2.23	6.00
GFSD-02	2.83	2.24	6.70
GFSD-03	2.63	2.08	6.20
GFSD-04	2.31	2.21	6.66

3.3.9 Analytical results showed that exceedances of Dutch B/C levels in TPH, metals (mercury, molybdenum, lead, zinc, barium, chromium, cobalt, copper, cadmium) were found in 10 groundwater samples and they have been summarized in **Table 3.4**. In addition, the laboratory testing results for all groundwater samples are provided in **Appendix E**.

Table 3.4 Summary of Groundwater Samples Exceeding the Dutch B/C Values

Sample I.D.	GW depth (m below ground)	Contaminant	Dutch Level (µg/L)		Concentration (µg/L)	Dutch Level Exceeded
			B	C		
GFSA-17	2.62	Mercury	0.5	2	1.2	>B
		Molybdenum	20	100	31	>B
		TPH	200	600	231	>B
GFSA-18	2.58	Lead	50	200	77	>B
		Zinc	200	800	250	>B
		Molybdenum	20	100	21	>B
		Barium	100	500	150	>B
		TPH	200	600	327	>B
GFSA-19	2.54	Lead	50	200	72	>B
		Molybdenum	20	100	39	>B
		Barium	100	500	120	>B
GFSA-20	2.73	Barium	100	500	110	>B
GFSA-21	2.53	Chromium	50	200	64	>B
		Lead	50	200	590	>C
		Zinc	200	800	420	>B
		Barium	100	500	610	>C
GFSA-22	2.68	Chromium	50	200	57	>B
		Lead	50	200	130	>B
		Zinc	200	800	250	>B
		Barium	100	500	220	>B

Sample I.D.	GW depth (m below ground)	Contaminant	Dutch Level (µg/L)		Concentration (µg/L)	Dutch Level Exceeded
			B	C		
GFSD-01	2.69	Copper	50	200	55	>B
		Lead	50	200	550	>C
		Zinc	200	800	480	>B
		Barium	100	500	340	>B
		TPH	200	600	365	>B
GFSD-02	2.83	Cadmium	2.5	10	2.7	>B
		Copper	50	200	59	>B
		Lead	50	200	2100	>C
		Zinc	200	800	1000	>C
		Barium	100	500	680	>C
GFSD-03	2.63	Cadmium	2.5	10	27	>C
		Lead	50	200	240	>C
		Zinc	200	800	470	>B
		Cobalt	50	200	200	>B
		Barium	100	500	650	>C
		TPH	200	600	740	>C
GFSD-04	2.31	Cadmium	2.5	10	3	>B
		Lead	50	200	320	>C
		Zinc	200	800	290	>B
		Barium	100	500	160	>B
		TPH	200	600	369	>B

3.3.10 As discussed earlier, the Dutch values for groundwater would serve to indicate the chemical-of-concerns (COCs) for risk assessment. A risk-based assessment was thus carried out for parameters which exceeded the Dutch B/C levels to evaluate the risks posed to the anticipated most sensitive human receptor. It can be seen from **Table 3.5** that the risk due to ingestion of groundwater by construction workers is warranted. It should be noted that the risk due to dermal contact with groundwater by site workers is uncertain. It is because risk assessment regarding to dermal contact cannot be undertaken as the toxicity and / or chemical specific data for the chemicals of concern (COCs) do not exist. As such, it is recommended that personnel protective equipment be used by site workers as a mitigation measure.

Table 3.5 Evaluation of Significance of Risk Due to Groundwater Contamination

Receptor	Significance of Risk due to Groundwater Contamination	Rationale
Construction workers for decommissioning / decontamination works (by ingestion)	Significant	Existence of potential risk.
Construction workers for decommissioning / decontamination works (by inhalation)	Insignificant	Decommissioning and decontamination works would be located in the outdoor area. Also, it is recommended that personal protective equipment (PPE) should be used by site workers as a mitigation measures.
Construction workers for decommissioning / decontamination works (by dermal contact)	Uncertain	Toxicity and / or chemical specific data do not exist for the COCs for risk assessment to be undertaken. As such, it is recommended that personal protective equipment (PPE) be used by site workers as a mitigation measure.

Receptor	Significance of Risk due to Groundwater Contamination	Rationale
Future land users	Insignificant	As most of the contamination in the site would be removed after the decontamination works, the soil quality would be within Dutch B level and the groundwater contamination would be much reduced. In addition, the site will be covered by filling materials / concrete. Groundwater at the site will not be used as potable water or used for recreation / irrigation purposes.
Future construction workers (including construction workers for future Kai Tak Development works)	Insignificant	Contaminated soil is considered as the major contributor for elevated COCs in the groundwater. As most of the contamination in the site would be removed after the decontamination works, the soil quality would be less than Dutch B level and the contaminants in groundwater would be much reduced.

3.3.11 Compared with the future land users and future construction workers, the construction workers for carrying out decommissioning / decontamination works are regarded as the most sensitive since they would be possible to have direct contact with groundwater by incidental ingestion or dermal exposure. In addition, as discussed in **Table 3.5**, the risk for future land users / future construction workers is considered insignificant as the groundwater at the Site will not be used as potable water or used for recreation / irrigation purposed and the future ground surface of the Site should be of urban nature and to be covered by filling materials / concrete.

3.3.12 The maximum contaminant concentration recorded in the groundwater samples irrespective of their locations, the anticipated most sensitive human receptor (i.e. the construction workers for carrying out decommissioning / decontamination works), and the potential exposure pathway (i.e. by ingestion) were taken into account in the risk assessment. Details of groundwater risk assessment are given in **Appendix F**.

3.3.13 The results of the groundwater risk assessment indicate that concentration of the COCs in the groundwater, including TPH and metals (mercury, molybdenum, lead, zinc, barium, chromium, cobalt, copper, cadmium), do not exceed the calculated "allowable" concentrations (i.e. the risk-based criteria for remediation).

3.3.14 For the case of TPH, as the "allowable" concentration for TPH derived from the risk assessment (2.13E+02 mg/L) is above the solubility limit of TPH in water, the remediation criterion for TPH should be interpreted as "no free product" present in groundwater which is in consistency with the on-site measurement record. Thus, no remediation is considered necessary with reference to the remediation criterion.

Results of QA/QC Analysis

3.3.15 QA/QC is the practice of making sure that collection and analysis techniques provide precise and accurate information. This process is to ensure 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 Study, 3 sets of field blank, equipment blank and trip blank were collected and analyzed during the course of sampling. The laboratory results for QA/QC samples are presented in **Appendix E**.

3.3.16 The laboratory results showed that detectable metals (copper, lead, nickel, tin, barium) and TPH was found among the QA/QC samples. The potential source of contamination in the blanks could be due to (1) sampling or laboratory testing equipments not being decontaminated completely; (2) cross-contamination from the ambient conditions during sampling and laboratory testing; 3) from the blank container itself; and (4) contamination of volatile organic compounds during transportation. Though, there is possible cross-contamination which would cause a higher reported value than actual, given that the COC do not exceed the risk-based criteria for remediation, the results would not influence the outcome of this assessment. QA/QC procedures for sample collection and preparation are therefore considered acceptable.

3.4 Estimation of Soil Contamination Extent and Remediation

3.4.1 Based on the analytical results of soil presented above, soil samples in 7 locations (GFSA-17 to A-18, GFSA-20, GFSA-22, GFSB-01 and GFSD-03 to D-04) were found to have organic (TPH, Phenanthrene, Benzo(a)pyrene, Fluoranthene, Pyrene) or metals (copper, lead, zinc, cadmium, nickel and cobalt) contamination.

3.4.2 In an attempt to confine the area of contaminated soil for handling, a 6m X 6m square centered at the sampling location with contamination level lies above the Dutch B/C level would be adopted. This approach was justified by considering the contaminated soil from these sampling location were due to localized / discrete sources. For vertical distribution of contaminants, the depth of contamination is assumed to be 0.5m above and below the particular sampling depth with contamination identified for conservative estimation.

3.4.3 Based on the above approach, the extents of soil contamination with organic contaminants or metals have been estimated and summarized in **Table 3.6**. Locations of proposed zones for excavation are depicted in **Drawings 3.3 – 3.4**.

Table 3.6 Location, Depth and Estimated Quantity of Contaminated Soil

Zone I.D.	Sample I.D.	Depth (m BBC)	Contaminant	Concentration (mg/kg)	Estimated Contamination Extent		
					Vertical (m BBC)	Horizontal (m^2)	Estimated Volume (m^3)
Exceedances found in the soil samples collected below 0m to 1m BBC							
A	GFSA-18	1	Phenanthrene	14	0.5-1.5	36	36
			Benzo(a)pyrene	11			
			Fluoranthene	19			
			Pyrene	17			
B	GFSA-20	1	Zinc	2000	0.5-1.5	36	36
C	GFSD-03	1	Cadmium	6	0.5-1.5	36	36
			Lead	480			
			Zinc	2300			
Exceedances found in the soil samples collected below 1m to 6m BBC							
D	GFSB-01	1.65	TPH	2875	1.15-2.15	36*	36
E	GFSD-04	2.2-2.65	Cadmium	15	1.7-4.15	36	88.2
			Lead	430			
		3.2-3.65	Lead	300			
F	GFSA-17	3.25-3.7	Lead	200	2.75-4.2	36	52.2
G	GFSA-22	3.25-3.7	Copper	150	2.75-4.2	36	52.2

Zone I.D.	Sample I.D.	Depth (m BBC)	Contaminant	Concentration (mg/kg)	Estimated Contamination Extent		
					Vertical (m BBC)	Horizontal (m^2)	Estimated Volume (m^3)
H	GFSD-03	3.3-3.75	Cadmium	510	2.8-4.25	36	52.2
			Nickel	410			
			Cobalt	1200			
Total Volume of Estimated Contaminated Soil=388.8m^3							

Remarks:
BBC= Below Base of Existing Concrete Pavement
* Due to space constraint within the D.G. Store, 6m X 6m square centered at GFSB-01 may not be feasible. The frame for excavation would have to be adjusted on site based on the actual site condition.

3.5 Conclusions and Recommendations

3.5.1 According to the results of site investigation, a total of 7 soil samples collected at GFSA-17 to A18, GFSA20, GFSA-22, GFSB-01, GFSD-03 to D-04 were found to have TPH, PAHs (Phenanthrene, Benzo(a)pyrene, Fluoranthene and Pyrene) and metals (copper, lead, zinc, cadmium, nickel and cobalt) exceeding the Dutch B/C levels.

3.5.2 The results of the groundwater risk assessment indicate that concentration of the COCs in the groundwater, including TPH and metals (mercury, molybdenum, lead, zinc, barium, chromium, cobalt and copper), do not exceed risk-based criteria for remediation. No floating free product was observed in all the groundwater wells during site investigation.

3.5.3 A Remediation Action Plan (RAP) should be prepared to identify appropriate remediation actions for the contaminated soil before decommissioning and development of this Study Area. The RAP is presented in **Section 4** of this Report.

3.5.4 For the battery rooms, electrical, instrument, metal / machine, welding, overhaul, engine/module and ground equipment workshops located inside ex-GFS building, as the rooms were found to be well paved with concrete and the presence of underground chamber has prevented a direct contact of potential contaminants with the soil underneath. No issue of land contamination in relation to the site activities is therefore expected.

3.5.5 Since the generator room and the transformer room will still be in operation at the time of the site investigation, 3 potential contamination hotspots within the transformer room and generator room could not be completed. Therefore it is recommended that a supplementary land contamination investigation should be carried out upon the cessation of the operations and prior to the redevelopment. The supplementary sampling plan for the areas of concern has been attached in **Appendix B.** Based on the results of samples analysis, no significant contamination was found around the areas of concerns. The scale of the contamination as reviewed by the activities and the size of hotspots would therefore be considered small. In addition, as the inaccessible sampling locations are located inside the building. They are much protected by the solid concrete floor. Hence, the uncertainty in decontamination work is considered limited and surmountable.

4 REMEDIATION ACTION PLAN

4.1 Objectives of Remediation Plan

4.1.1 The objectives of the remediation action are as follows:

(i) To propose remediation method(s) for the soil contamination;

(ii) To propose a mean to confirm completed excavation of contaminated soil;

(iii) To provide guidelines regarding handling and disposal of contaminated soil.

4.2 Selection of Remediation Methods

4.2.1 As summarized in **Table 3.7**, about 388.8m^3 of contaminated soils identified within the ex-GFS building would need to be excavated and treated. There are 2 types of contaminated soil being identified based on the nature of contaminants:

- Metals contaminated soil (316.8 m^3)
- TPH / SVOC contaminated soil (72 m^3)

4.2.2 As the estimated quantity of contaminated soil is small, all contaminated soil identified within the ex-GFS building is recommended to be treated together with other contaminated soil identified in South Apron of the former Kai Tak Airport, ex-GFS apron area and at the narrow strip of the North Apron under the Decommissioning of the Former Kai Tak Airport Other than the North Apron (KTA Decommissioning EIA) for the sake of efficiency. As identified in the KTA Decommissioning EIA, biopiling is regarded as the most practical way to remediate the organic contaminated soil while solidification/stabilization is best suited for metal contaminated soil based on the (1) technical and cost effectiveness, (2) technology development status, (3) commercial availability, (4) experience and (5) expertise requirement.

4.3 Outline Process and Operation Remediation

Excavation

4.3.1 Contaminated soil identified within the ex-GFS building shall be excavated from the ground prior to any construction works on site. Detailed design drawings for planned excavations in the indicated areas shall be prepared by the Contractor. Factors such as excavation areas and depths, engineering properties and stability of the soils shall be considered for safe working conditions. The excavations shall be designed in accordance with the geotechnical properties of the soils and appropriate safety factors as determined by the Engineer. All excavated areas shall be set out by an appropriate qualified and licensed land surveyor based upon the excavation plans shown in **Drawings 3.3- 3.4**.

4.3.2 The excavation sequence would be as follows:

- Excavate the contaminated soil and properly packed until no contaminants are found (confirmed by field and laboratory tests);
- Soils contaminated with different types of contaminants shall not be mixed to avoid the increase the volume of soil that would require treatment by different remediation methods;
- Transport the excavated soil by roll-off trucks for on-site treatment;
- Any free product encountered during excavation should be recovered and drummed properly and collected by licensed chemical waste collector for proper disposal;
- Finally, backfill the excavation with suitable materials.

4.3.3 A closure assessment to confirm the closure/completion for the excavation of contaminated areas should be undertaken. The excavation work shall be supervised by Land Contamination Specialist. Subsequent construction activities could only be carried out after the site closure.

4.3.4 Following excavation and before backfilling, confirmation sampling and testing shall be carried out at limits of excavation to confirm that all the identified contaminated soil has been excavated. It is proposed that one confirmation sample shall be collected from the pit bottom and one from each sidewall of the excavation pit. The depth of sampling shall be based on the depth of the original SI sample result that triggered excavation in that area. If there are any visible indications of impact, samples shall be collected from the apparent impact zone(s). Soil samples collected at the limits of excavation should be analysed for contaminants with exceedance of Dutch B/C levels at the sampling location and if the analytical results are below the relevant Dutch B/C levels, removal of contaminated soil shall be considered complete. However, if the analytical samples exceed the relevant action levels, more soil shall be excavated (either with 0.5m increment in vertical or 1m in horizontal direction depending on whether the exceeding confirmation sample is collected from a sidewall or excavation base) and additional confirmation samples shall be collected and analysed until all confirmation samples are below the relevant action levels.

4.3.5 Shall any *in-situ* decommissioned underground fuel tanks hinder any necessary excavation works, the following procedures / plants should be followed. Fire Services Department (FSD) and relevant government department / authorities may be consulted as necessary.

- The soil / fill material from around the tank / pipeline shall be removed adequately, except for the identified contaminated material which shall be separately stockpiled on site for further decontamination treatment to be agreed by the Engineer and the Land Decontamination Specialist;
- Appropriate heavy equipment shall be used for the underground fuel tank / pipeline removal / lifting. Relevant safety precautions should be formulated in the method statement to be prepared by the Contractor;
- The excavated tank should be transferred to a secure area on site. The excavated tank / pipeline should be examined for structural integrity and signs of leakage if any. Contamination on the exterior surface of excavated tank, if any, should be properly washed and/or treated; and
- The excavated tank should then be sent for off-site disposal as general C&D waste.

4.3.6 In addition, for proper decommissioning of underground fuel tank / pipelines, the following fire safety advice should be adhered to:

- The gas freeing, abandoning, removing and disposal of all tanks / pipelines should be in accordance with the guidelines contained in Chapter 15 of the “Guidance for the Design, Construction, Modification, Maintenance and Decommissioning of Filling Stations”, jointly published by the APEA and Energy Institute;
- Precautionary guidelines for hot works (as provided in **Appendix G**) are to be observed at all times through the demolition process; and
- A competent person should be assigned in writing to supervise all hot works and method statement should be submitted to FSD for scrutinizing before the commencement of the demolition works.

4.3.7 Spoils generated during excavation shall be placed on heavy-duty and impermeable sheeting adjacent to the excavation. The temporary stockpiles should be properly covered by impermeable sheeting to avoid leaching out of contaminants during wet season.

4.3.8 All construction activities shall be carried out by persons appropriately trained in health and

safety and appropriated personal protective equipment shall be used by the persons engaged in decontamination activities. The following guidelines of Health and Safety shall be strictly followed by all site personnel working on the site at all times:

- Temporary fencing or warning ribbons will be provided to the boundary of excavation, slope crest and temporarily stockpiled areas. Where necessary, the exposed areas will be temporarily covered with impermeable sheeting during heavy rainstorm.
- Workers are required to wear appropriate protective clothing and safety equipment.
- Smoking, eating, drinking and hotworks are strictly prohibited.
- Monitoring for Lower Explosive Limit in the work zone, and total VOCs (with a PID) in the breathing zone shall be undertaken. If the PID reading in the breathing zone is greater than 100ppm, monitoring for benzene in the breathing zone shall also be undertaken.
- Relevant occupational health and safety regulations and guidelines during excavation shall be observed.

Biopiling

4.3.9 Approximately 72m^3 of organic (TPH / Phenanthrene, Benzo(a)pyrene, Fluoranthene and Pyrene) contaminated soil has been proposed for biopile treatment and summarized in **Table 4.1**. The soil required for excavation should follow the 'zone of excavation' as shown in **Drawing 3.3** – **3.4**.

Table 4.1 Estimated Volume of TPH / Phenanthrene/ Benzo(a)pyrene/ Fluoranthene/ Pyrene Contaminated Soil for Biopiling

Zone I.D.	Sample I.D.	Depth (m BBC)	Contaminant	Concentration (mg/kg)	Estimated Contamination Extent		
					Vertical (m BBC)	Horizontal (m^2)	Estimated Volume (m^3)
A	GFSA-18	1	Phenanthrene	14	0.5-1.5m	36	36
			Benzo(a)pyrene	11			
			Fluoranthene	19			
			Pyrene	17			
D	GFSB-01	1.65	TPH	2875	1.15-2.15	36*	36
Total Volume of Estimated Contaminated Soil=72m^3							

Remarks:
BBC= Below Base of Existing Concrete Pavement
* Due to space constraint within the D.G. Store, 6m X 6m square centered at GFSB-01 may not be feasible. The frame for excavation would have to be adjusted on site based on the actual site condition.

4.3.10 Biopiling is a commonly accepted bioremediation method for the restoration of site contaminated with TPH and other organic contaminants. By using microorganisms to degrade contaminants in soil, biopile(s) transform hazardous / toxic materials into harmless elements such as water, carbon dioxide, and other innocuous products. The schematic layout of a typical biopile is shown in **Drawing 4.2** and the essential steps of biopiling are outlined in the following paragraphs:

Biopile Formation

4.3.11 The formation of a biopile should be started from one end and along the longitudinal

direction. Uniform starting concentrations will facilitate the control of the bioremediation and ensure a short cleanup time (as decontamination will not be controlled by patches of soil with high initial concentrations). Compaction of the biopile by excavation machinery shall be avoided in order have uniform density of the biopile. Bulking agents are not usually added as they are hard to be compacted during backfilling. The biopile should be covered by impermeable sheeting (such that not longer than 5m of a biopile shall be exposed to open air) to avoid fugitive emissions of dust or any pollutants from the biopile affecting the surrounding environment. Adequate turning should be undertaken during biopile formation (and installation of piping) to maximize sufficient air circulation. Turning of soil may also be used during operation to enhance air circulation. Nevertheless, this should be confirmed by the cleanup progress monitoring.

4.3.12 Impermeable sheeting shall be placed at the bottom of the biopiles and leachate collection sump shall be constructed along the perimeter of the biopiles to prevent leachate from contaminating the underlying soil / groundwater. All leachate generated from the operation of biopiling shall be collected and recycled to the biopile.

4.3.13 The carbon filter system should be designed, constructed, operated and maintained to ensure adequate adsorption efficiency to prevent air pollution impact to the surrounding air sensitive receivers (ASRs). The location of the exhaust of the carbon filter should be sited as far away as possible from the nearby ASRs. The carbon adsorption system should also be monitored regularly to check the performance of the carbon filter.

4.3.14 The first soil samples should be taken once the construction of a biopile is completed to serve as the baseline samples. The baseline conditions should be used as the reference conditions for assessing the cleanup progress of the subsequent biopile operation.

Biopile Operation

4.3.15 The biopile operation involves the mechanical induction of air into each biopile resulting from the establishment of a negative pressure field within each biopile. The negative pressure encourages the “evaporation” or volatilization of part of the hydrocarbon contamination that is adsorbed to the soil particles. The inducted air collects the vapour and transports it via the extraction pipes out of the biopile. The inducted air also maintains aerobic conditions in the soil pores which encourage biodegradation of the remaining non-volatile petroleum hydrocarbons.

4.3.16 As a large part of the hydrocarbon contaminant is not expected to be volatilized, cleanup of the non-volatile contaminant will depend on the biodegradation process, which produces CO_2. Thus, the gas obtained from the biopile shall comprise a mixture of air, water vapour, CO_2, and vapourized hydrocarbons. Exhaust air shall be passed through the activated carbon filters prior to discharge the atmosphere to remove any contaminants.

4.3.17 Suitable conditions in the biopile should be maintained for the growth of microbes. Moisture would be periodically added to the soil to maintain the moisture content within 10-20%. The optimal oxygen concentration in soil gas is 15% to 20%. The soil pH should be maintained between 5 and 8 for bacteria to survive. Nutrients may be required for microbial activities in small amounts. Regular progress monitoring of the soil conditions should be conducted to ascertain these conditions have been maintained. In addition, TPH and BTEX levels in the soil should also be tested to assess the decontamination performance of the system. Bacterial numbers in soil (Colony-Forming Unit (CFU) heterotrophs or CFU degraders/gram soil) is a good indicator of the health of biopile. This parameter should be measured too whenever soil samples are collected for TPH analysis during progress monitoring.

4.3.18 Upon achieving the relevant cleanup targets, soil from the biopile should reused on-site as fill material as far as practical.

Biopile Cleanup Progress Monitoring

4.3.19 The objective of the operation progress monitoring is twofold: i) to maintain the progress of contaminant cleanup, and ii) to ensure suitable conditions of the soil to support microbial growth. Progress monitoring would involve periodic soil gas monitoring, soil sampling, and physical parameter monitoring.

4.3.20 Soil gas monitoring points are installed within the biopiles. Sampling of oxygen, carbon dioxide, methane and VOC concentrations in the soil gas should be conducted once every month. Soil gas samples are taken by pulling a gas sample from the monitoring points through a vacuum pump. *In-situ* measurement of soil moisture should be included for monitoring. Soil gas sampling after placing the system in operation can establish the effectiveness of the aeration system.

4.3.21 It is proposed to undertake soil sampling monthly for the analysis of pH, nutrients, and bacterial number. Analyses for TPH and PAH (Phenanthrene, Benzo(a)pyrene, Fluoranthene and Pyrene) for soil samples shall be conducted at least once every 3 months. Monitoring should continue until the cleanup targets are achieved. Once the cleanup targets for a location have been achieved, soil sampling at that particular location may discontinue.

Biopile Closure Assessment

4.3.22 Biopile closure assessment should be conducted to ensure that the soil contaminant levels in the biopile are meeting the cleanup target for TPH and PAH (Phenanthrene, Benzo(a)pyrene, Fluoranthene and Pyrene).

4.3.23 The sampling frequency of one sample per 100 m^3 for biopile closure assessment is reference to the CAR & RAP of previous projects in Hong Kong. The biopile shall be divided into lots for sampling and testing for contaminants.

4.3.24 Access to the sampling locations should be through opening of heat bonded cover panels. These openings shall be closed after each access. Extracting this soil samples shall be accomplished using a hand auger or other methods approved by the Engineer.

4.3.25 All soil samples shall be analyzed for TPH and PAH (Phenanthrene, Benzo(a)pyrene, Fluoranthene and Pyrene). The laboratory results are considered satisfactory when the levels of TPH and PAH (Phenanthrene, Benzo(a)pyrene, Fluoranthene and Pyrene) meet the cleanup target (Dutch B levels for TPH and individual PAH). Individual soil lot which has demonstrated meeting the cleanup target could be removed from the biopile provided the lot would not affect the operation of biopile or would not be affected by adjacent soil lots still under treatment.

Solidification/Stabilization (S/S)

4.3.26 The contaminated soil with heavy metal contamination with volume of approximately 316.8m^3 proposed for S/S treatment has been summarized in **Table 4.2**. The soil required for excavation should follow the 'zone of excavation' as shown in **Drawings 3.3 – 3.4**.

Table 4.2 Estimated Volume of Metal Contaminated Soil for Solidification/Stabilization

Zone I.D.	Sample I.D.	Depth (m BBC)	Contaminant	Concentration (mg/kg)	Estimated Contamination Extent		
					Vertical (m BBC)	Horizontal (m^2)	Estimated Volume (m^3)
B	GFSA-20	1	Zinc	2000	0.5-1.5m	36	36

Zone I.D.	Sample I.D.	Depth (m BBC)	Contaminant	Concentration (mg/kg)	Estimated Contamination Extent		
					Vertical (m BBC)	Horizontal (m^2)	Estimated Volume (m^3)
C	GFSD-03	1	Cadmium	6	0.5-1.5m	36	36
			Lead	480			
			Zinc	2300			
E	GFSD-04	2.2-2.65	Cadmium	15	1.7-4.15	36	88.2
			Lead	430			
		3.2-3.65	Lead	300			
F	GFSA-17	3.25-3.7	Lead	200	2.75-4.2	36	52.2
G	GFSA-22	3.25-3.7	Copper	150	2.75-4.2	36	52.2
H	GFSD-03	3.3-3.75	Cadmium	510	2.8-4.25	36	52.2
			Nickel	410			
			Cobalt	1200			
Total Volume of Estimated Contaminated Soil=316.8 m^3							

Remarks:
BBC = Below Base of Existing Concrete pavement

4.3.27 A treatment area should be confined for carrying out the S/S mixing and temporary soil stockpile. Prior to solidification, metal contaminated soils should be screened to segregate soil from debris, rock fragments and other materials and to break soil clumps into sizes allow effective mixing with solidifying agents.

4.3.28 During the solidification / stabilization process, portland cement (or other equivalent), water and/or other additive(s) (such as fly ash, lime, soluble silicates and clays) should be added to the contaminated soils to form a solid matrix. Uniform mixing of contaminated soils, cement, water and other additives(s) should be taken by using a skip (or other equivalent) at the designated treatment area to minimise the potential for leaching during the solidification process.

4.3.29 The mixture should be placed in moulds made from wooden formwork to set for approximately one week. The blocks formed should be of a suitable size to allow handling and transporting and larger blocks should be broken down into smaller sizes for transportation.

4.3.30 The soil mixture in the concrete blocks would be solidified within about 1 week. After setting, the samples of the blocks should be collected for testing to confirm if the contaminated materials meet the (i) Toxicity Characteristic Leaching Procedure (TCLP) and (ii) unconfined compressive strength (UCS) tests i.e. achievement of the stabilization targets.

Toxicity Characteristics Leaching Procedure Test

4.3.31 The sampling frequency for the TCLP test should be 1 TCLP sample per $50m^3$ of broken up hardened mixture after CS/S treatment. Each TCLP sample should be a composite sample collected at 5 locations throughout the $50m^3$ broken up hardened mixture. Same volume of sample should be collected at each of the 5 locations in order to ensure unbiased composite sample to be collected.

4.3.32 Any hardened samples to be submitted to laboratory for TCLP analysis should be broken up 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 analyzed is 1cm. As such, the samples

should be further broken up in the laboratory prior to TCLP analysis.

4.3.33 TCLP tests should be conducted in accordance with USEPA Method 1311 and USEPA Method 6020 for the concerned metals in this Study. "Universal Treatment Standards" (UTS) can be used for interpretation of the TCLP test results (these standards were derived from the performance of the Best Demonstrated Available Technologies (BDAT) for treating most prohibited hazardous wastes and were adopted in previous land contamination studies e.g. decontamination works at the Cheoy Lee Shipyard at Penny's Bay and reclamation works at North Tsing Yi Shipyard site). The UTS for the concerned heavy metals are summarized in **Table 4.3**.

Table 4.3 Universal Treatment Standards (UTS) for the Concerned Metals

Parameter	Universal Treatment Standard*
Lead	0.75 mg/L as TCLP
Copper	7.8** mg/L as TCLP
Zinc	4.3 mg/L as TCLP
Cadmium	0.11 mg/L as TCLP
Nickel	11 mg/L as TCLP
Cobalt	Not Available**

Remarks:

* Reference to Universal Treatment Standards (UTS) of U.S. Resource Conservation and Recovery Act (RCRA) in Title 40 of the Code of Federal Regulations (CFR) Parts 268.

**It should be noted that the UTS standard for copper and cobalt are unavailable. To determine the UTS for copper, a comparison has been made between Drinking Water Standards for the USEPA and the USEPA Federal Register. It was found that the 2 sets of standards differ by a factor of ~6 (for Chromium) to ~2950 (for Cyanide). Using a more conservative approach, the factor of 6 is taken. Therefore, the UTS for copper is taken to be the Drinking Water Standard value of 1.3mg/L times a factor of 6, giving a value of 7.8mg/L. For cobalt, it should be noted that there is no UTS or USEPA Drinking Water Standard for Cobalt. Therefore, a cleanup standard is not established for Cobalt. However, it is expected that the solidification process will likely isolate the Cobalt in the same manner as the other COC present.

4.3.34 Any pile of broken up solidified mixture that meets the concerned UTS should be stockpiled on site for future reuses on-site due to their stable and inert properties.

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

Unconfined Compressive Strength (UCS)

4.3.36 The treated material should be allowed to set to achieve the unconfined compressive strength (UCS) of not less than 1mPa with reference to the USEPA guidelines (1986) – Handbook of Stabilization/ Solidification of Hazardous Wastes, EPA/540/2-86-00. The test procedure of UCS test should be based on BS 1377.

4.3.37 The solidified materials should then be broken into mass with maximum size of 250mm for backfilling or reuse on-site. Whenever the soil is to be reused as fill material, the treated soil should be put at a depth of not less than 1m above the groundwater level and be covered by 1m of clean fill to minimize the long term potential impacts of leaching to the underground water.

4.4 Remediation Report

4.4.1 A Remediation Report shall be prepared by the Land Contamination Specialist and submitted to EPD to report on the remediation process and demonstrate that contaminated

soils and groundwater are all treated to meet the relevant standards or properly handled. All relevant information, including details of closure assessment, sampling results, photographs and certification of independent checker, the quantities of treated soil and recovered free product, final backfill site of treated soil and disposal site of free product shall be included in the remediation report.

4.5 Mitigation Measures and Safety Measures

4.5.1 In order to minimize the potentially adverse environmental impacts arising from the handling of potentially contaminated materials, the following environmental mitigation measures are proposed during the course of the site remediation:

Excavation and Transportation

- Excavation profiles must be properly designed and executed.
- Stockpiling site(s) shall be lined with impermeable sheeting and bunded. Stockpiles shall be properly covered by impermeable sheeting to reduce dust emission. If this is not practicable due to frequent usage, regular misting shall be applied. Watering shall be avoided on stockpiles of contaminated soil to minimise contaminated runoff.
- Stockpiles of contaminated soil shall be properly covered by impermeable sheeting to minimize contaminated runoff from the stockpiles.
- Excavation and stockpiling shall be carried out during dry season as far as possible to minimise contaminated runoff from contaminated soils.
- Supply of suitable clean backfill material is needed after excavation.
- Vehicles containing any excavated materials should be suitably covered to limit potential dust emissions or contaminated wastewater run-off, and truck bodies and tailgates should be sealed to prevent any discharge during transport or during wet conditions.
- Speed control for the trucks carrying contaminated materials should be enforced;
- Vehicle wheel and body washing facilities at the site's exist points shall be established and used.

Biopiling

- To avoid fugitive emissions of dust or any air pollutants from the biopile(s) and to minimise runoff from the stockpiled soils, the stockpiled soils at the biopiles shall be covered by impermeable sheeting such that not longer than 5m of the biopile is exposed to open air.
- Impermeable sheeting shall be placed at the bottom of the biopiles and leachate collection sump shall be constructed along the perimeter of the biopiles to prevent leachate from contaminating the underlying soil / groundwater. All leachate generated from the operation of biopiling shall be collected and recycled to the biopile.
- The vented air from the biopile(s) shall be connected to blower and carbon adsorption system for treatment before release to the atmosphere. Exhaust air from the blower and carbon adsorption system shall be monitored for VOCs regularly.
- Spent activated carbon of the carbon adsorption system shall be replaced at appropriate intervals such that the VOC emission rate from the system is acceptable.
- Silencers shall be installed at the biopile blowers to minimise noise impact.
- Contaminated runoff from biopile(s) shall be prevented by constructing a concrete bund along the perimeter of the biopiles.

Solidification / Stabilization

- Mixing process and other associated material handling activities should be properly scheduled to minimise potential noise impact.
- Mixing of contaminated soils and cement / water / other additive(s) should be undertaken at a solidification plant to minimise the potential for leaching.
- Runoff from the solidification / stabilization area should be prevented by constructing a concrete bund along the perimeter of the solidification / stabilization area.

4.5.2 In order to minimise the potentially adverse effects on health and safety of construction workers during the course of site remediation, the Occupation Safety and Health Ordinance (OSHO) (Chapter 509) and its subsidiary Regulations shall be followed by all site personnel working on the site at all times. In addition, the following basic health and safety measures should be implemented as far as possible:

- Set up a list of safety measures for site workers;
- Provide written information and training on safety for site workers;
- Keep a log-book and plan showing the contaminated zones and clean zones;
- Maintain a hygienic working environment;
- Avoid dust generation;
- Provide face and respiratory protection gear to site workers;
- Provide personal protective clothing (e.g. chemical resistant jackboot, liquid tight gloves) to site workers; and
- Provide first aid training and materials to site workers

5 CONCLUSIONS AND RECOMMENDATIONS

5.1.1 A contamination site investigation has been undertaken in accordance with the sampling and testing schedule in CAP approved by EPD. SI was conducted from 14 September 2007 and completed on 16 November 2007 within the Study Area.

5.1.2 During the SI, a total of 4 trial pits and 14 boreholes were drilled and a total of 54 soil samples and 14 groundwater samples were collected and analyzed for a range of metals, benzene, toluene, ethylbenzene and xylenes (BTEX), total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs) and halogenated and non-halogenated hydrocarbons.

5.1.3 Laboratory testing results indicated that altogether 2 types of contaminated soil being identified for remediation, including i) organic contaminated soil (TPH and PAH (Phenanthrene, Benzo(a)pyrene, Fluoranthene and Pyrene) (72m^3) and ii) metals contaminated soil (copper, lead, zinc, cadmium, nickel and cobalt) (316.8m^3).

5.1.4 Since the estimated quantity of contaminated soil is small, all contaminated soil identified within the ex-GFS building is recommended to be treated together with other contaminated soil identified in South Apron of the former Kai Tak Airport, ex-GFS apron area and at the narrow strip of the North Apron under the KTA Decommissioning EIA for the sake of efficiency. As identified in the KTA Decommissioning EIA, biopiling is regarded as the most practical way to remediate the organic contaminated soil while solidification/stabilization is best suited for metal contaminated soil.

5.1.5 Biopile cleanup progress monitoring and closure assessment are proposed for biopiling to ensure a satisfactory cleanup progress and all the target contaminants have to be treated to below the cleanup targets. For the soil contaminated with metals, solidification/stabilization treatment is proposed. TCLP test is proposed to be undertaken after solidification/stabilization in order to ensure that the metal contaminants will not leach to the environment. It is recommended that the soil treated by biopiling should be reused on-site as fill material as far as practical while the soil treated by solidification/stabilization should be backfilled on-site at a depth of not less than 1m above the groundwater level and covered by 1m of clean fill.

5.1.6 Results of the groundwater risk assessment indicate that concentration of the COCs in the groundwater, including TPH and metals (mercury, molybdenum, lead, zinc, barium, chromium, cobalt, copper and cadmium), do not exceed risk-based criteria for remediation.

5.1.7 To ensure complete removal of contaminated soil, a closure assessment in the form of confirmatory test should be conducted after excavation to confirm complete clean-up of the site. A remediation report should be submitted for EPD's approval upon completion of all the remediation works.

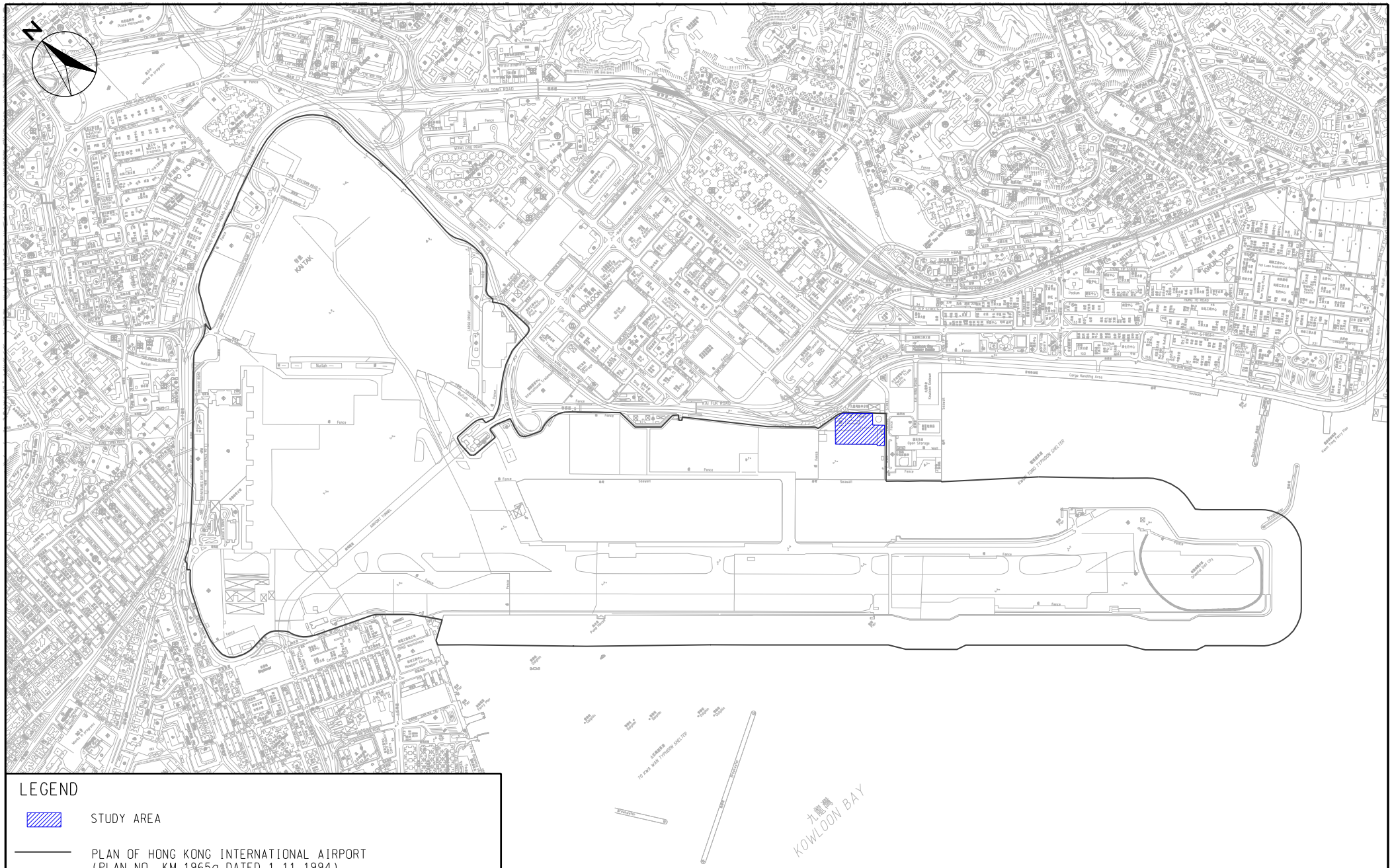
5.1.8 Appropriate environmental mitigation measures have been proposed to minimize the potential environmental impacts of the remediation activities. Health and safety measures should be followed to minimize safety hazard posed to site workers.

5.1.9 For the battery rooms, electrical, instrument, metal / machine, welding, overhaul, engine/module and ground equipment workshops located inside ex-GFS building, as the rooms were found to be well paved with concrete and the presence of underground chamber has prevented a direct contact of potential contaminants with the soil underneath. No issue of land contamination in relation to the site activities is therefore expected.

5.1.10 For the transformer room and generator room of the ex-GFS building with potential land contamination concerns, a supplementary land contamination investigation is recommended to be carried out upon the cessation of the operations and prior to the redevelopment. Since no significant contamination issues were identified at the vicinity of the transformer room and the generator room during the site investigation, the scale of the contamination, if any,

as reviewed by the activities and the size of hotspots would therefore be considered small. In addition, as the inaccessible sampling locations are located inside the building, they are much protected by the solid concrete floor. Hence, the uncertainty in decontamination work is considered limited and surmountable and would not significantly impact the surrounding environment. If contamination is found, the decontamination method shall make reference to this RAP.

Drawings



LEGEND

STUDY AREA

PLAN OF HONG KONG INTERNATIONAL AIRPORT
(PLAN NO. KM 1965g DATED 1.11.1994)
(LANDS DEPT. LETTER REF: (20) IN LND KEPD/103/13(II))

MAUNSELL AECOM
Maunsell Consultants Asia Ltd

AGREEMENT NO. CE 35/2006 (CE)
KAI TAK DEVELOPMENT ENGINEERING STUDY CUM DESIGN AND
CONSTRUCTION OF ADVANCE WORKS-INVESTIGATION, DESIGN AND CONSTRUCTION

SITE LOCATION PLAN

SCALE	A3 1:12000	DATE	JAN 08
CHECK	ELYC	DRAWN	POHM
JOB No.	60022503	DRAWING No.	1.1
		REV	–

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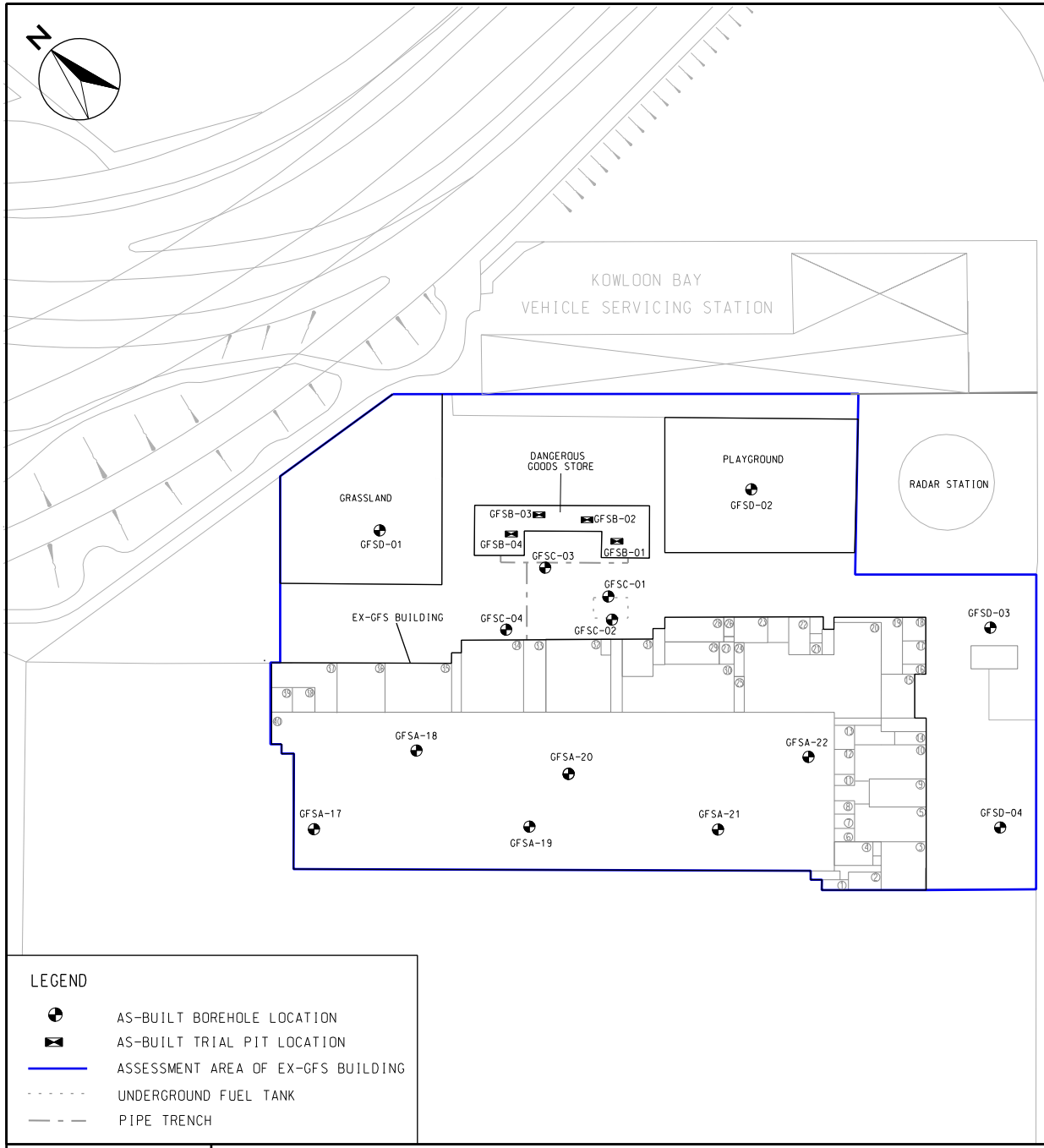

EX-GFS BUILDING LAYOUT DESCRIPTION

(REFERENCE TO DRAWINGS PROVIDED BY ARCH.S.D (DRAWING NOS. AW-A-2 TO AW-A-4))

1. AHU ROOM
2. PASSENGER WAITING ROOM
3. ROLE STORE
4. AIR SURVEY EQUIPMENT STORE
5. ELECTRICAL WORKSHOP
6. STORE
7. CLEANING ROOM
8. CALIBRATION ROOM
9. INSTRUMENT WORKSHOP
10. RADIO WORKSHOP
11. STORE
12. NI-CAD BATTERY ROOM
13. LEAD ACID BATTERY ROOM
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19. PROCUREMENT OFFICE
20. AIRCRAFT BONDED STORE
21. LIFT MACHINE ROOM
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23. DESPATCH QUARANTINE STORE
24. TYPE AND RUBBER PARTS STORE
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35. ENGINE / MODULE WORKSHOP
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37. GROUND EQUIPMENT WORKSHOP
38. TECHNICAL DEMONSTRATION ROOM
39. MEDICAL CENTRE
40. HANGER

SAMPLING LOCATION	COORDINATES	
	EASTING	NORTHING
GFSA-17	839616.33	819691.39
GFSA-18	839644.82	819688.15
GFSA-19	839651.13	819658.62
GFSA-20	839665.51	819661.01
GFSA-21	839680.79	819629.10
GFSA-22	829706.42	819626.78
GFSB-01	839709.04	819690.70
GFSB-02	839707.59	819698.73
GFSB-03	839700.70	819706.91
GFSB-04	839693.32	819708.12
GFSC-01	839699.17	819683.21
GFSC-02	839696.19	819678.94
GFSC-03	839693.53	819697.53
GFSC-04	839677.75	819693.64
GFSD-01	839672.85	819728.97
GFSD-02	839738.49	819678.29
GFSD-03	839755.36	819619.40
GFSD-04	839726.14	819585.98

LEGEND

- AS-BUILT BOREHOLE LOCATION
- AS-BUILT TRIAL PIT LOCATION
- ASSESSMENT AREA OF EX-GFS BUILDING
- UNDERGROUND FUEL TANK
- PIPE TRENCH

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AS-BUILT SAMPLING LOCATIONS

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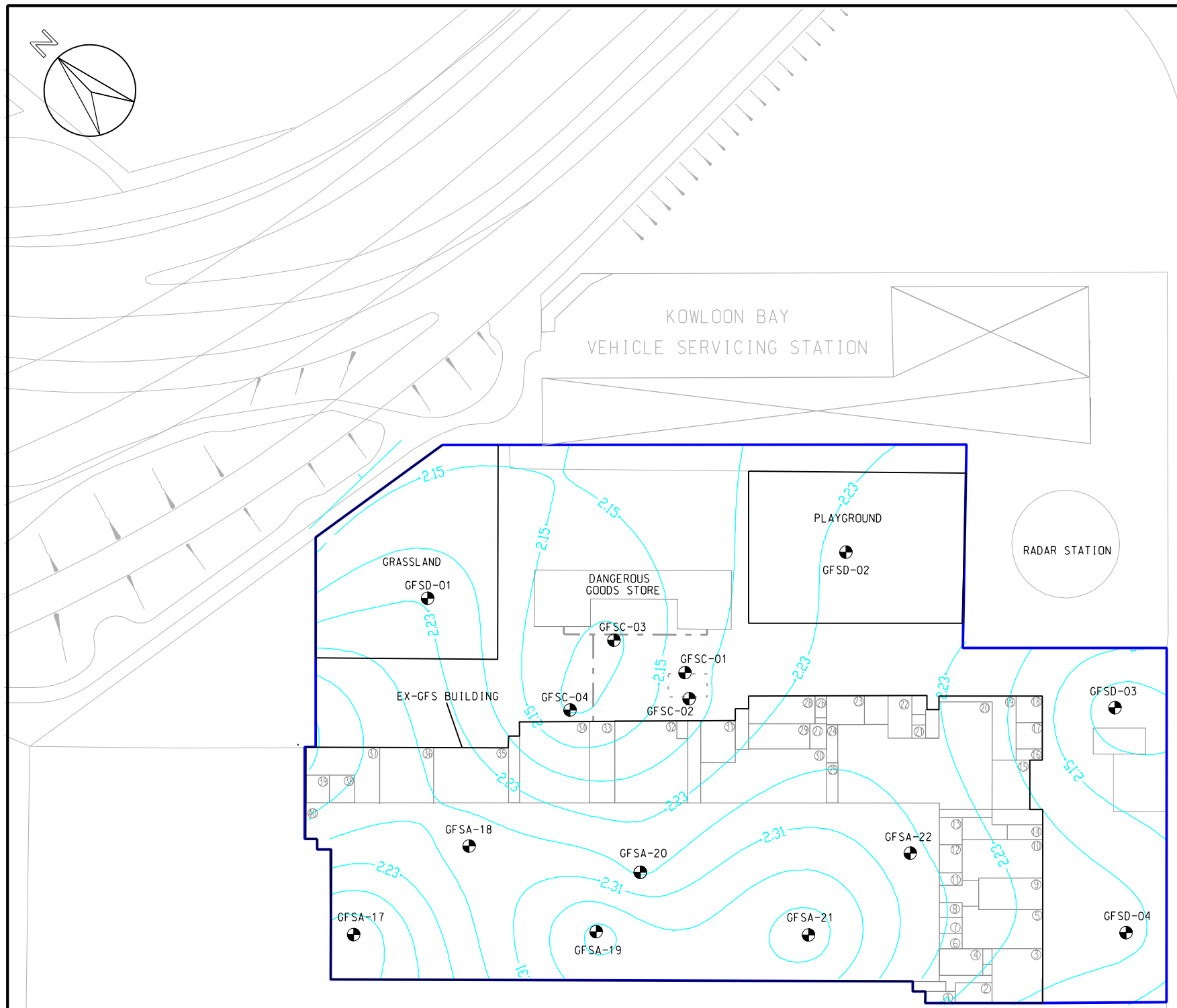

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Sample I.D.	Groundwater Level	
	m Below Ground	mPD
GFSA - 17	2.62	2.11
GFSA - 18	2.58	2.29
GFSA - 19	2.54	2.41
GFSA - 20	2.73	2.26
GFSA - 21	2.53	2.42
GFSA - 22	2.68	2.28
GFSC - 01	2.48	2.18
GFSC - 02	2.47	2.17
GFSC - 03	2.66	2.1
GFSC - 04	2.53	2.1
GFSD - 01	2.69	2.23
GFSD - 02	2.83	2.24
GFSD - 03	2.63	2.08
GFSD - 04	2.31	2.21

LEGEND

- AS-BUILT SAMPLING LOCATION WITH GROUNDWATER MEASUREMENT
- CONTOURS OF ESTIMATED GROUNDWATER LEVEL
- ASSESSMENT AREA OF EX-GFS BUILDING
- UNDERGROUND FUEL TANK
- PIPE TRENCH

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CONTOURS OF ESTIMATED GROUNDWATER LEVEL

SCALE	1:1000	DATE	FEB 08
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JOB No.	60022503	DRAWING No.	3.2
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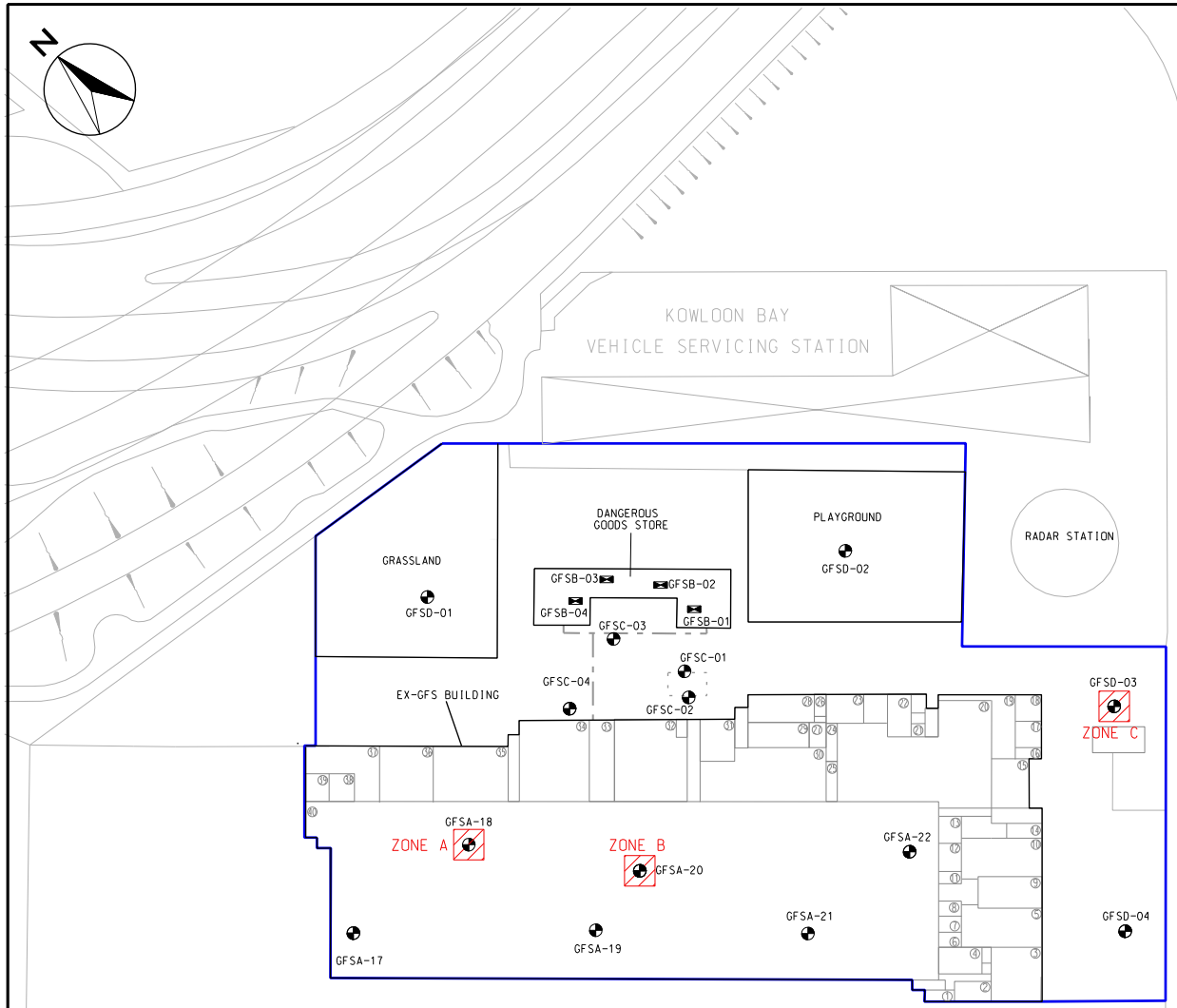

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Zone I.D.	Sample	Depth (m BBC)	Contaminant	Concentration (mg/kg)	Estimated Contamination Extent		
					Vertical (m BBC)	Horizontal (m^2)	Estimated Volume (m^3)
Exceedances found in the soil samples collected below 0m to 1m BBC							
A	GFSA-18	1	Phenanthrene	14	0.5-1.5m	36	36
			Benzo(a)pyrene	11			
			Fluoranthene	19			
			Pyrene	17			
B	GFSA-20	1	Zinc	2000	0.5-1.5m	36	36
C	GFSD-03	1	Cadmium	6	0.5-1.5m	36	36
			Lead	480			
			Zinc	2300			

Remarks:
BBC= Below Base of Existing Concrete Pavement

LEGEND

- PROPOSED CONTAMINATED ZONE FOR EXCAVATION (6m x 6m)
- AS-BUILT BOREHOLE LOCATION
- AS-BUILT TRIAL PIT LOCATION
- ASSESSMENT AREA OF EX-GFS BUILDING
- UNDERGROUND FUEL TANK
- PIPE TRENCH

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LOCATIONS OF PROPOSED CONTAMINATED ZONES FOR EXCAVATION (A-C)

SCALE	1:1000	DATE	JAN 08
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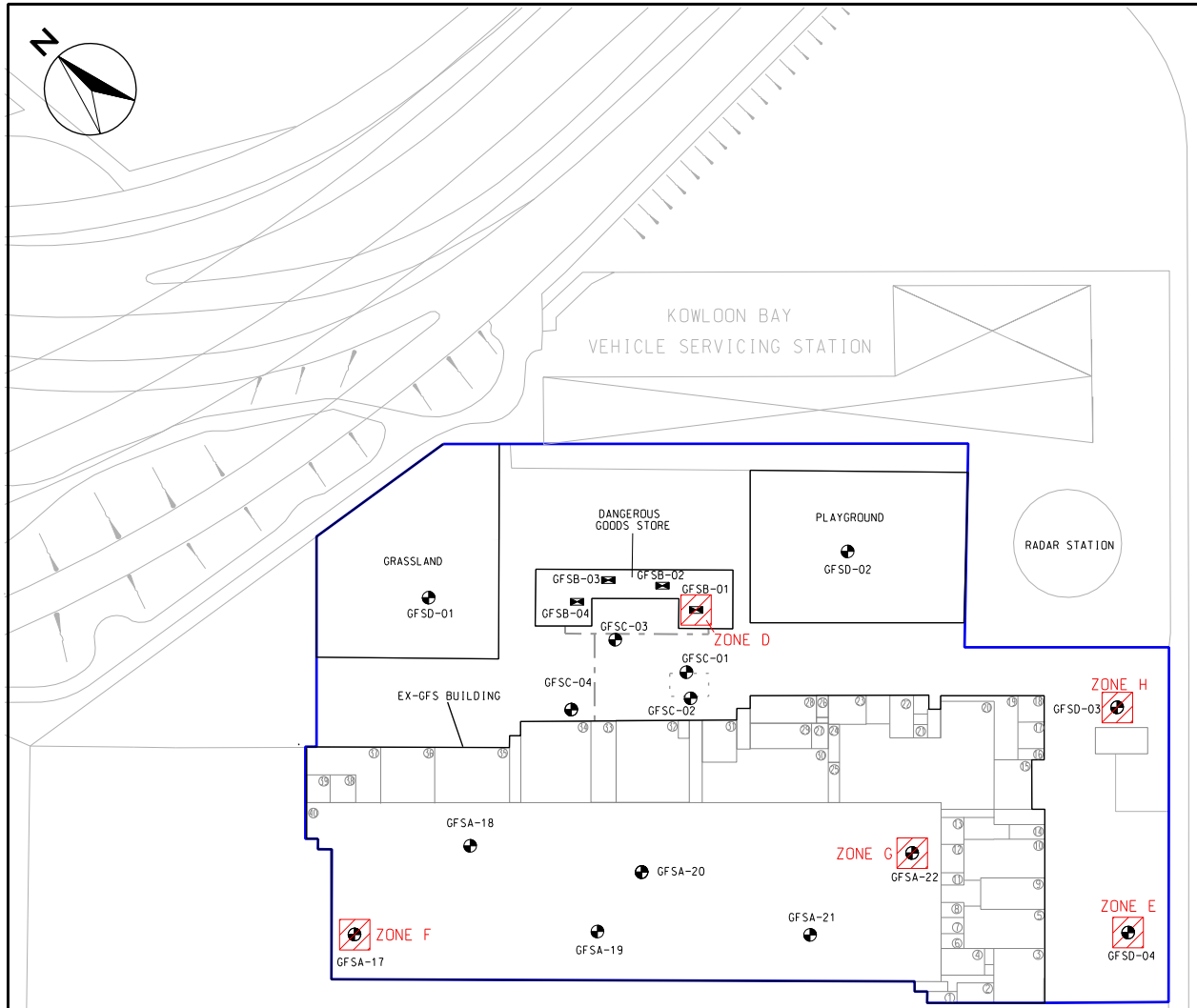

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Zone I.D.	Sample	Depth (m BBC)	Contaminant	Concentration (mg/kg)	Estimated Contamination Extent		
					Vertical (m BBC)	Horizontal (m^2)	Estimated Volume (m^3)
Exceedances found in the soil samples collected below 1m to 6m BBC							
D	GFSB-01	1.65	TPH	2875	1.15-2.15	36*	36
E	GFSD-04	2.2-2.65	Cadmium	15	1.7-4.15	36	88.2
			Lead	430			
		3.2-3.65	Lead	300			
F	GFSA-17	3.25-3.7	Lead	200	2.75-4.2	36	52.2
G	GFSA-22	3.25-3.7	Copper	150	2.75-4.2	36	52.2
H	GFSD-03	3.3-3.75	Cadmium	510	2.8-4.25	36	52.2
			Nickel	410			
			Cobalt	1200			

Remarks:
BBC= Below Base of Existing Concrete Pavement
* Due to space constraint within the D.G. Store, 6m X 6m square centered at GFSB-01 may not be feasible. The frame for excavation would have to be adjusted on site based on the actual site condition.

LEGEND

- PROPOSED CONTAMINATED ZONE FOR EXCAVATION
- AS-BUILT BOREHOLE LOCATION
- AS-BUILT TRIAL PIT LOCATION
- ASSESSMENT AREA OF EX-GFS BUILDING
- UNDERGROUND FUEL TANK
- PIPE TRENCH

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LOCATIONS OF PROPOSED CONTAMINATED ZONES FOR EXCAVATION (D-H)

SCALE	1:1000	DATE	FEB 08
CHECK	ELYC	DRAWN	POHM
JOB NO.	60022503	DRAWING NO.	3.4
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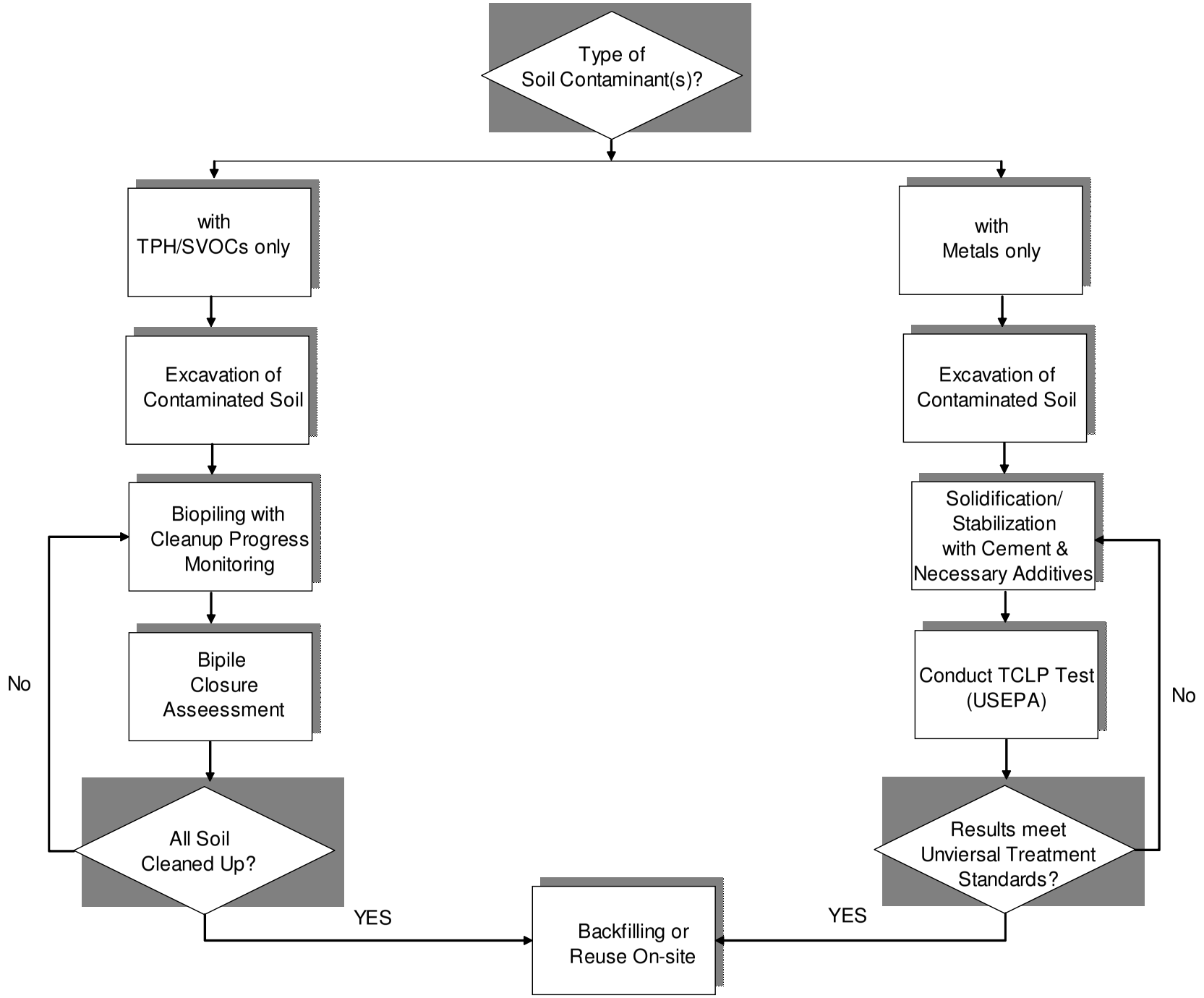

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PROPOSED REMEDIATION STRATEGY FOR CONTAMINATED SOIL

SCALE	N.T.S.	DATE	FEB 08
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JOB No.	60022503	DRAWING No.	4.1
		REV	–

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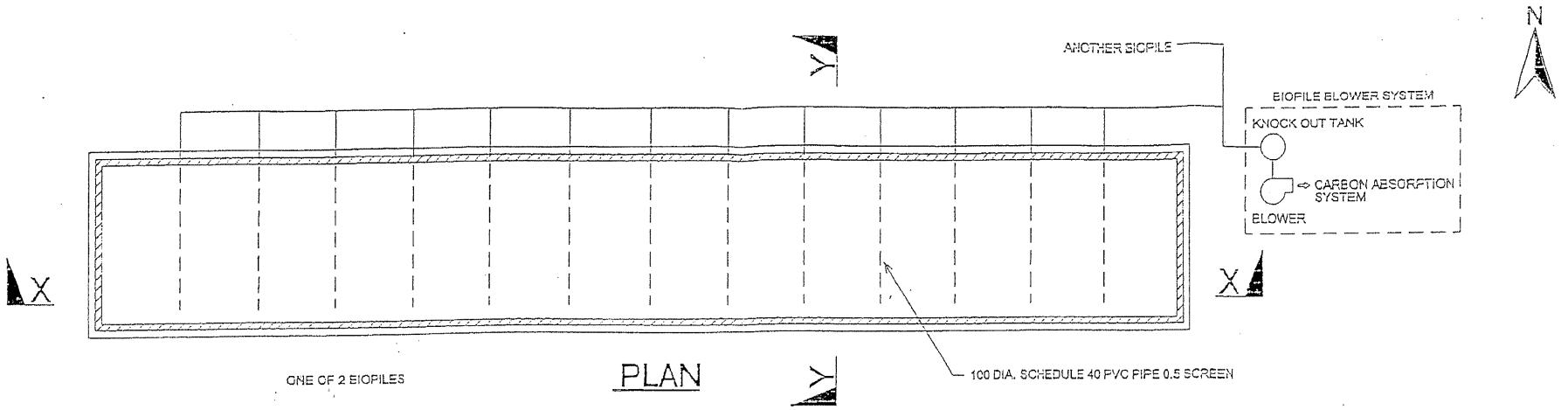

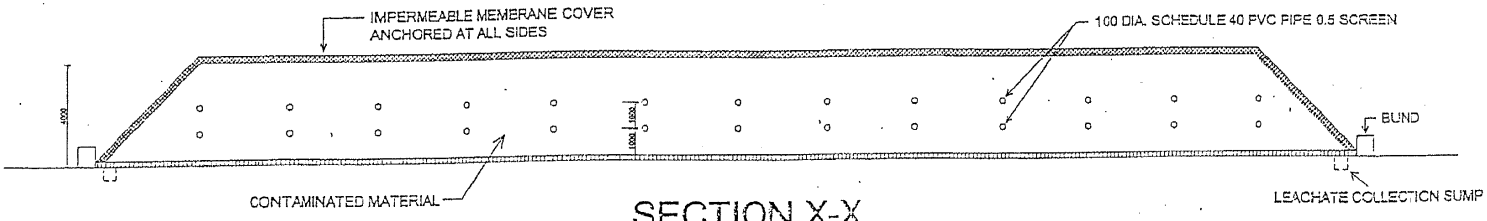

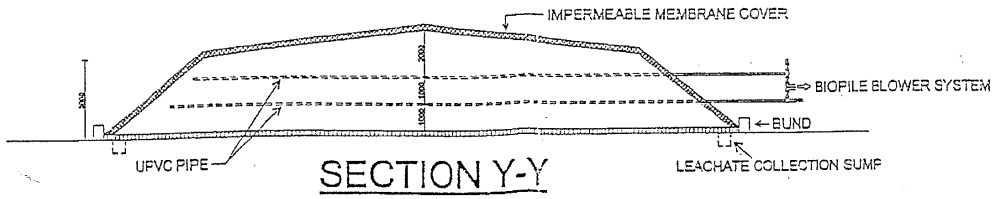

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SCHEMATIC OF A TYPICAL SINGLE BIOPILE

SCALE	N.T.S.	DATE	JAN 08
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JOB NO.	60022503	DRAWING NO.	4.2
		REV	–

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Appendices

Appendix A

(Sampling and Testing Schedule Proposed in the Approved CAP)

Table 4.1 Sampling and Testing Plan for the Study Area
(Concerned Site Area: ~17,000m^2; Proposed 18 Sampling Locations)

Proposed Sampling Location	Sampling Method	Sample Matrix		Parameters to be Tested						Rationale of Sampling
				TPH	BTEX	PAHs	Phenols	Chlorinated Hydrocarbons	Heavy Metals	
GFSA-17 (Hangar)	Borehole down to 6m	Soil	1m BBC	X	X	X	X	X	X	2 boreholes are proposed to assess any potential land contamination within the ex-GFS hangar currently occupied by GFS.
		Soil	2.5m BBC	X	X	X	X	X	X	
		Soil	3.5m BBC	X	X	X	X	X	X	
		GW	If present	X	X	X	X	X	X	
GFSA-18 (Hangar)	Borehole down to 6m	Soil	1m BBC	X	X	X	X	X	X	
		Soil	2.5m BBC	X	X	X	X	X	X	
		Soil	3.5m BBC	X	X	X	X	X	X	
		GW	If present	X	X	X	X	X	X	
GFSA-19 (Hangar)	Borehole down to 6m	Soil	1m BBC	X	X	X	X	X	X	4 boreholes are proposed to assess any potential land contamination within the remaining ex-GFS hangar currently occupied by C&ED.
		Soil	2.5m BBC	X	X	X	X	X	X	
		Soil	3.5m BBC	X	X	X	X	X	X	
		GW	If present	X	X	X	X	X	X	
GFSA-20 (Hangar)	Borehole down to 6m	Soil	1m BBC	X	X	X	X	X	X	
		Soil	2.5m BBC	X	X	X	X	X	X	
		Soil	3.5m BBC	X	X	X	X	X	X	
		GW	If present	X	X	X	X	X	X	

Proposed Sampling Location	Sampling Method	Sample Matrix		Parameters to be Tested						Rationale of Sampling
				TPH	BTEX	PAHs	Phenols	Chlorinated Hydrocarbons	Heavy Metals	
GFSA-21 (Hangar)	Borehole down to 6m	Soil	1m BBC	X	X	X	X	X	X	
		Soil	2.5m BBC	X	X	X	X	X	X	
		Soil	3.5m BBC	X	X	X	X	X	X	
		GW	If present	X	X	X	X	X	X	
GFSA-22 (Hangar)	Borehole down to 6m	Soil	1m BBC	X	X	X	X	X	X	
		Soil	2.5m BBC	X	X	X	X	X	X	
		Soil	3.5m BBC	X	X	X	X	X	X	
		GW	If present	X	X	X	X	X	X	
GFSB-01 (D.G. Store)	Trial pit down to 1.5m^	Soil	0.5m BBC	X	X	X	X	X	X	4 trial pits are proposed to assess any potential land contamination induced from the mishandling of dangerous goods.
		Soil	1.5m BBC	X	X	X	X	X	X	
		GW	If present	X	X	X	X	X	X	
GFSB-02 (D.G. Store)	Trial pit down to 1.5m^	Soil	0.5mBBC	X	X	X	X	X	X	
		Soil	1.5m BBC	X	X	X	X	X	X	
		GW	If present	X	X	X	X	X	X	
GFSB-03 (D.G. Store)	Trial pit down to 1.5m^	Soil	0.5m BBC	X	X	X	X	X	X	
		Soil	1.5m BBC	X	X	X	X	X	X	
		GW	If present	X	X	X	X	X	X	
GFSB-04 (D.G. Store)	Trial pit down to 1.5m^	Soil	0.5m BBC	X	X	X	X	X	X	
		Soil	1.5m BBc	X	X	X	X	X	X	
		GW	If present	X	X	X	X	X	X	

Proposed Sampling Location	Sampling Method	Sample Matrix		Parameters to be Tested						Rationale of Sampling
				TPH	BTEX	PAHs	Phenols	Chlorinated Hydrocarbons	Heavy Metals	
GFSC-01 (Underground Fuel Tank)	Borehole to 6m BBC	Soil	1m BBC	X	X	X				In order to assess potential land contamination impacts from any leakage /spillage of the underground diesel tank, 1 borehole is proposed to be located at the upstream of the tank area.
		Soil	2.5m BBC	X	X	X				
		Soil	3.5m BBC	X	X	X				
		Soil	5m BBC	X	X	X				
		Soil	6m BBC	X	X	X				
		G.W.	If present	X	X	X				
GFSC-02 (Underground Fuel Tank)	Borehole to 6m BBC	Soil	1m BBC	X	X	X				In order to assess potential land contamination impacts from any leakage /spillage of the underground diesel tank, 1borehole is proposed to be located at the downstream of the tank area.
		Soil	2.5m BBC	X	X	X				
		Soil	3.5m BBC	X	X	X				
		Soil	5m BBC	X	X	X				
		Soil	6m BBC	X	X	X				
		G.W.	If present	X	X	X				
GFSC-03 (Underground Pipelines)	Borehole to 6m BBC	Soil	1m BBC	X	X	X				In order to assess any potential land contamination impacts from underground pipelines protected by the pipe trench, 2 boreholes are proposed to be drilled along the pipe trench.
		Soil	2.5m BBC	X	X	X				
		Soil	3.5m BBC	X	X	X				
		GW	If present	X	X	X				
GFSC-04 (Underground Pipelines)	Borehole to 6m BBC	Soil	1m BBC	X	X	X				
		Soil	2.5m BBC	X	X	X				
		Soil	3.5m BBC	X	X	X				
		GW	If present	X	X	X				

Proposed Sampling Location	Sampling Method	Sample Matrix		Parameters to be Tested						Rationale of Sampling
				TPH	BTEX	PAHs	Phenols	Chlorinated Hydrocarbons	Heavy Metals	
GFSD-01	Borehole to 6m BBC	Soil	1m BBC	X	X	X	X	X	X	2 boreholes are proposed to assess any potential land contamination within the grassland and the playground.
		Soil	2.5m BBC	X	X	X	X	X	X	
		Soil	3.5m BBC	X	X	X	X	X	X	
		GW	If present	X	X	X	X	X	X	
GFSD-02	Borehole to 6m BBC	Soil	1m BBC	X	X	X	X	X	X	
		Soil	2.5m BBC	X	X	X	X	X	X	
		Soil	3.5m BBC	X	X	X	X	X	X	
		GW	If present	X	X	X	X	X	X	
GFSD-03	Borehole to 6m BBC	Soil	1m BBC	X	X	X	X	X	X	2 boreholes are proposed to assess any potential migration of contaminants from the activities undertaken in the ex-GFS building area.
		Soil	2.5m BBC	X	X	X	X	X	X	
		Soil	3.5m BBC	X	X	X	X	X	X	
		GW	If present	X	X	X	X	X	X	
GFSD-04	Borehole to 6m BBC	Soil	1m BBC	X	X	X	X	X	X	
		Soil	2.5m BBC	X	X	X	X	X	X	
		Soil	3.5m BBC	X	X	X	X	X	X	
		GW	If present	X	X	X	X	X	X	

Remarks:
BBC = Below Base of Existing Concrete Pavement; GW=groundwater; X = testing proposed
^ For proposed trial pits, a third soil sample may be necessary if contamination is found at the sample collected at 1.5m.

Appendix B

(Supplementary Sampling Plan for the Remaining Areas within the ex-GFS Building)

Agreement No. CE 35/2006(CE)
Kai Tak Development Engineering Study
cum Design and Construction of Advance Works
– Investigation, Design and Construction

SUPPLEMENTARY SAMPLING PLAN FOR EX-GOVERNMENT FLYING SERVICE BUILDING (EX-GFS BUILDING)

Contents

List of Tables

List of Drawings

1 INTRODUCTION

1.1 Background

1.1.1 The site investigation (SI) works for land contamination assessment in the Study Area were commenced on 14 September 2007 and completed on 16 November 2007. A total of 4 trial pits and 14 boreholes were constructed and completed for the purpose of identifying possible land contamination at hotspot areas. Since the generator room and the transformer room will still be in operation at the time of the site investigation within the ex-GFS building, 3 potential contamination hotspots within the transformer room and generator room could not be completed. .Therefore it is recommended that a land contamination investigation should be carried out upon the cessation of the operations and prior to the redevelopment. This supplementary sampling plan (This Plan) is therefore provided for the additional investigation, if necessary, to supplement the approved CAP.

1.1.2 This Plan is to supplement the approved CAP by providing the sampling and laboratory analysis information for the SI works in the generator room and transformer room within the ex-GFS building area. Assessment of land contamination sources shall be conducted in accordance with the environmental standards and non-statutory guidelines recommended in the approved CAP.

1.1.3 In general, the sampling methods for soil and groundwater (if any), requirements of strata logging and procedures for free product and groundwater level measurement, decontamination, sample collection and delivery shall be conducted as delineated in the approved CAP. The general health and safety measures suggested in the approved CAP shall also be taken as described.

2 SAMPLING PLAN FOR SITE INVESTIGATION

2.1 Sampling Locations

2.1.1 Potential sources of land contamination within the Study Area were studied in the approved CAP based on information obtained from the desktop studies, site inspections, interviews and site observations.

2.1.2 Contamination hotspots were identified in the approved CAP by investigation of the potential sources of land contamination. Identified hotspots are summarized in the following table.

Table 2.1 Potential Contaminants Associated with Historical/Current Land Uses

Uses	Site Observation	Potential Source of Contaminants	SI proposed
Transformer room	• Operated for more than 10 years • Insulating oil was reported to be used in transformer room and the quality of oil would be checked annually on site. • Ground was found to be well paved with concrete and no apparent stains have been observed	• Spillage from improper handling of Polychlorinated Biphenyls (PCBs) / transformer fluids	• 1 trial pit is proposed in this area
Generator Room	• Cannot be assessed during site inspections,	• Not Applicable	• 2 trail pits are proposed to assess for potential land contamination within the area.

2.1.3 As summarized in the above table, a total of 3 sampling drillholes are proposed for the identified hotspots within the CLP's transformer room and generator room The indicative location plans of the proposed SI sampling locations are illustrated in **Drawing A2.1**.

2.1.4 It should be noted that if significant contamination was revealed during the SI, additional sampling locations would be required to determine the exact extent of contamination. The rationales for selecting the sampling locations are summarized in **Table 2.2**.

Table 2.2 Sampling and Testing Plan for the Study Area

Proposed Sampling Location	Sampling Method	Sample Matrix		Parameters to be Tested							Rationale of Sampling
				TPH	BTEX	PAHs	Phenols	Chlorinated Hydrocarbons	Heavy Metals	PCB	
GFSA-05 (Transformer Room)	Trial Pit down to 1.5m^	Soil	0.5m BBC	X	X	X	X	X	X	X	To assess any potential land contamination within the transformer room
		Soil	1.5m BBC	X	X	X	X	X	X	X	
		Groundwater	If present	X	X	X	X	X	X	X	
GFSA-06 (Generator Room)	Trial Pit down to 1.5m^	Soil	0.5m BBC	X	X	X	X	X	X		2 sampling locations are proposed to assess any potential land contamination within the generator room.
		Soil	1.5m BBC	X	X	X	X	X	X		
		Groundwater	If present	X	X	X	X	X	X		
GFSA-07 (Generator Room)	Trial Pit down to 1.5m^	Soil	0.5m BBC	X	X	X	X	X	X		
		Soil	1.5m BBC	X	X	X	X	X	X		
		Groundwater	If present	X	X	X	X	X	X		

Remarks:
BBC = Below Base of Existing Concrete Pavement; GW=groundwater; X = testing proposed
^ For proposed trial pits, a third soil sample may be necessary if contamination is found at the sample collected at 1.5m.
Details of the chemical parameters shall be referred to Table 4.2 of the approved CAP and **Table 2.3** below.
This table shall be read in conjunction with **Drawing A2.1**.

2.2 QA/QC Procedures

2.2.1 QA/QC samples shall be collected in the following frequency during the SI. Chain of Custody protocol shall be adopted.

- 1 equipment blank per 20 samples for full suite analysis
- 1 field blank per 20 samples for full suite analysis
- 1 trip blank per 20 samples for full suite of analysis

2.2.2 According to the supplementary sampling plan detailed in **Table 2.2**, the total sample number would be less than 10. The minimum number of QA/QC samples which meet the frequency stated in Section2.2.1 will be expected as follow:

- 1 equipment blank and field blank for the analysis of TPH, BTEX, PAHs, Phenols, Chlorinated hydrocarbons, heavy metal an PCB
- 1 trip blank for analysis of BTEX and TPH (C6-C9)

2.3 Laboratory Analysis

Laboratory Analysis

2.3.1 Laboratory analysis covering total petroleum hydrocarbons, BTEX, PAHs, phenols, chlorinated hydrocarbons, PCBs and heavy metals, is proposed in order to screen the presence of potential contaminants that are of concern within the generator room and transformer room within the ex-GFS building. The laboratory analysis of the samples shall follow the same requirements set out in the approved CAP

2.3.2 **Table 2.3** lists out the parameter which was not included in the approved CAP and the detection limit and reference method of the parameter for the laboratory analyses of soil and groundwater samples.

Table 2.3 Parameters, Detection Limits and Reference Methods for Laboratory Analyses

Item	Parameter	Soil		Groundwater	
		Detection Limit (mg/kg) or otherwise stated	Reference Method	Detection Limit (µg/L) or otherwise stated	Reference Method
1	Total Polychlorinated Biphenyls (Total PCBs)	0.1	USEPA 8070	0.2	USEPA 8070

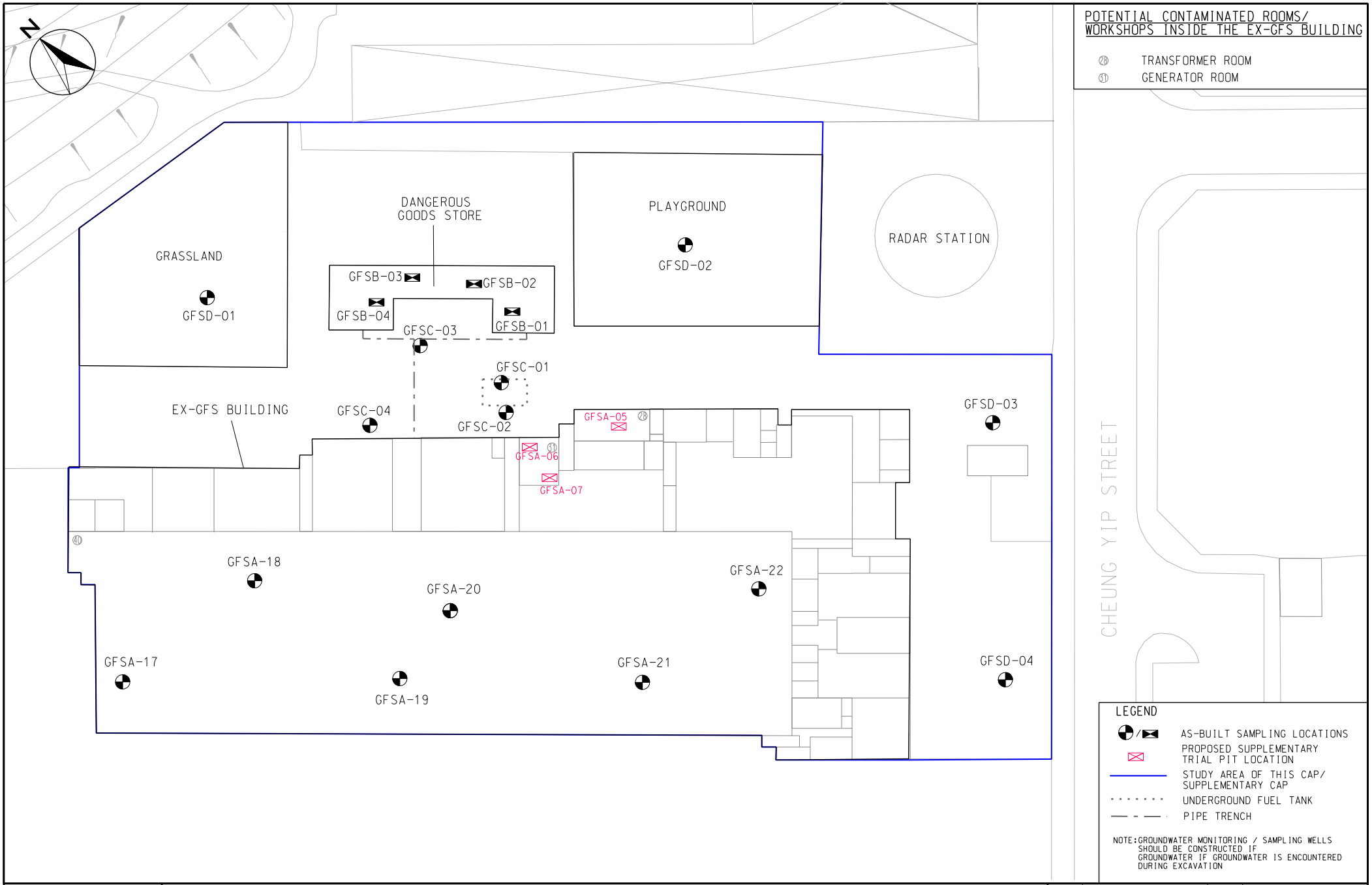
Results Interpretation

2.3.3 The results of the laboratory analyses shall be interpreted in accordance with the guidance documents recommended in the approved CAP.

2.3.4 Relevant criteria for soil and groundwater contamination assessment for this study have been documented in the approved CAP. For the parameter which was not included in the previous testing, the criteria for contamination assessment has been included in the following table

Table 2.4 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 Polychlorinated Biphenyls (Total PCBs)	0.05	1	10	0.01	0.2	1



POTENTIAL CONTAMINATED ROOMS/ WORKSHOPS INSIDE THE EX-GFS BUILDING

㉘ TRANSFORMER ROOM
㉛ GENERATOR ROOM

LEGEND

- AS-BUILT SAMPLING LOCATIONS
- PROPOSED SUPPLEMENTARY TRIAL PIT LOCATION
- STUDY AREA OF THIS CAP/ SUPPLEMENTARY CAP
- UNDERGROUND FUEL TANK
- PIPE TRENCH

NOTE: GROUNDWATER MONITORING / SAMPLING WELLS SHOULD BE CONSTRUCTED IF GROUNDWATER IF GROUNDWATER IS ENCOUNTERED DURING EXCAVATION

MAUNSELL AECOM
Maunsell Consultants Asia Ltd

AGREEMENT NO. CE 35/2006 (CE)
KAI TAK DEVELOPMENT ENGINEERING STUDY CUM DESIGN AND CONSTRUCTION OF ADVANCE WORKS-INVESTIGATION, DESIGN AND CONSTRUCTION

PROPOSED SUPPLEMENTARY SI LOCATIONS AT POTENTIAL CONTAMINATED HOTSPOTS

SCALE	A3 1:600	DATE	APR 08
CHECK	ELYC	DRAWN	POHM
JOB No.	60022503	DRAWING No.	A 2.1
		REV	-

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Appendix C

(Site Boring Log)

VIBRO — DRILLHOLE RECORD

CONTRACT NO. GE/2007/03	HOLE NO. GFSA-17
	SHEET 1 OF 1

PROJECT Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

METHOD Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.61
MACHINE & NO. VBM29	E 839616.33 N 819691.39	DATE : 21/09/2007 to 21/09/2007
FLUSHING MEDIUM NA	ORIENTATION Vertical	GROUND LEVEL + 4.73 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	Water Returns %	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
21/09/2007	HW			80					0.00	+4.73	0.00			Concrete surface.
									0.25	+4.48	0.25			Brown (7.5YR 5/4), silty fine to coarse SAND with some angular to subangular fine to medium gravel sized highly decomposed and moderately decomposed rock fragments. (FILL)
									A 0.50 (INSPECTION PIT)					
									B 1.00					
									1 En 1.20 1.25					
									C 1.50					
									2 2.50 2.62	+2.23	2.50			
				78				35 bls	3 2.95 3.00					Greyish brown (2.5Y 5/2), silty / clayey fine to coarse SAND with some angular to subangular fine gravel sized highly decomposed and moderately decomposed rock fragments. (FILL)
								33 bls	4 3.50					
				84					5 3.95 4.00					
									6 4.50					
									7 5.50	-0.77	5.50			
										-1.27	6.00			Brown (7.5YR 5/4), dappled greyish brown, slightly silty fine to coarse SAND with some angular to subangular fine to medium gravel sized moderately decomposed rock fragments and occasional brick fragments. (FILL)
21/09/2007	HW 6.25	3.70m at 18:00		100				T2	6.00 6.25	-1.52	6.25			Grey (N 5), angular medium to coarse GRAVEL sized concrete and slightly decomposed rock fragments with some angular cobbles (SDG, Concrete) and wood pieces. (FILL)
														End of Investigation Hole at 6.25m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- En Environmental Sample
- Standard penetration test
- V In-situ vane shear test
- Permeability test
- Impression packer test
- Pressuremeter test
- Packer Test
- Acoustic or optical televiewer survey
- Piezometer tip
- Standpipe
- Groundwater monitoring well
- Extensometer

LOGGED	T. C. Yip
DATE	25/09/2007
CHECKED	C. M. Sham
DATE	28/09/2007

REMARKS

1. An inspection pit was excavated to a depth of 1.50m.
2. Groundwater monitoring well was installed to 6.25m below ground level on 21/09/2007.
3. A groundwater sample was taken from the monitoring well on 25/09/2007. The water level in the well prior to sampling was 2.62m below ground level.

J200707_03061

DRILLHOLE RECORD

VIBRO

CONTRACT NO. GE/2007/03	HOLE NO. GFSA-18
	SHEET 1 OF 1

PROJECT Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.61
MACHINE & NO.	VBM29	E 839644.82 N 819688.15	DATE : 21/09/2007 to 24/09/2007
FLUSHING MEDIUM	NA	ORIENTATION Vertical	GROUND LEVEL + 4.87 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	Water Returns %	T C R %	S C R %	R Q D %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
										+4.87	0.00			
21/09/2007	PW			100					0.00	+4.62	0.25			Concrete surface.
									A INSPECTION PIT 0.50					Brown (7.5YR 5/4), silty fine to coarse SAND with some angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
									B 1.00					
		Dry at 18:00							1.20					
									1 En 1.25	+3.62	1.25			
21/09/2007									C 1.50					Firm, light brown (7.5YR 6/4), sandy SILT with some angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
24/09/2007		Dry at 08:00												
									2 2.50					
								19 bls	8 2.58	+2.37	2.50			Greyish brown (2.5Y 5/2), slightly clayey / silty fine to coarse SAND with some angular fine to medium gravel sized moderately decomposed rock fragments. (FILL)
				66										
									3 2.95 3.00					
	PW 3.30													
	HW								3.30	+1.57	3.30			Grey (N 5), dappled light brown, angular COBBLES (SDG) with some angular coarse gravel sized slightly decomposed rock fragments. (FILL)
				100					T2 IOI					
								69 bls	4 3.70	+1.17	3.70			From 3.30m to 3.52m : Angular boulders (SDG).
				60										Dark grey (N 3), dappled light brown, sandy SILT with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments. (FILL)
									5 4.15 4.20					
									6 4.50					
									7 5.50	-0.63	5.50			Brown (7.5YR 5/4), dappled greyish brown, slightly silty / clayey fine to coarse SAND with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments. (FILL)
	HW 6.00								5.90	-1.03	5.90			Grey (N 5), angular to subangular COBBLES (Concrete, wood pieces) with some angular to subangular medium to coarse gravel sized moderately decomposed rock fragments and occasional brick fragments.(FILL)
									T2 IOI					
		1.80m at 18:00		79										
24/09/2007									6.60	-1.73	6.60			End of Investigation Hole at 6.60m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- En Environmental Sample
- Standard penetration test
- V In-situ vane shear test
- Permeability test
- Impression packer test
- Pressuremeter test
- Packer Test
- Acoustic or optical televiewer survey
- Piezometer tip
- Standpipe
- Groundwater monitoring well
- Extensometer

LOGGED	T. C. Yip
DATE	25/09/2007
CHECKED	C. M. Sham
DATE	28/09/2007

REMARKS

1. An inspection pit was excavated to a depth of 1.50m.
2. Groundwater monitoring well was installed to 6.60m below ground level on 25/09/2007.
3. A groundwater sample was taken from the monitoring well on 27/09/2007. The water level in the well prior to sampling was 2.58m below ground level.

VIBRO

DRILLHOLE RECORD

HOLE NO. GFSA-19

CONTRACT NO. GE/2007/03

SHEET 1 OF 1

PROJECT Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.61A
MACHINE & NO.	BM28	E 839651.13 N 819658.62	DATE : 03/11/2007 to 05/11/2007
FLUSHING MEDIUM	NA	ORIENTATION Vertical	GROUND LEVEL +4.73 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	Water Returns %	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
03/11/2007	HW			100					0.00	+4.73	0.00			Concrete surface.
									0.27	+4.46	0.27			Greyish brown (2.5Y 5/2), silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized asphalt fragments. (FILL)
									A 0.50 INSPECTION PIT B 1.00					
									1 En 1.27	+3.46	1.27			Greyish brown (2.5Y 5/2), dappled brown, very silty fine to coarse SAND with some angular to subangular fine gravel sized highly decomposed and moderately decomposed rock fragments. (FILL)
									C 1.50					
				95				31 bls	2 2.50 2.54					
									3 2.95 3.00					
								51 bls		+1.23	3.50			
		2.50m at 18:00		98					4 3.50					Greyish brown (2.5Y 5/2), dappled reddish brown, slightly clayey sandy angular to subangular fine to coarse GRAVEL sized concrete and brick fragments. (FILL)
03/11/2007 05/11/2007		2.60m at 08:00							5 3.95 4.00					
									6 5.00					
									7 6.00					
05/11/2007	HW 6.35	2.60m at 12:00								-1.62	6.35			End of Investigation Hole at 6.35m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- En Environmental Sample
- Standard penetration test
- V In-situ vane shear test
- Permeability test
- Impression packer test
- Pressuremeter test
- Packer Test
- Acoustic or optical televiewer survey
- Piezometer tip
- Standpipe
- Groundwater monitoring well
- Extensometer

LOGGED T. C. Yip

DATE 09/11/2007

CHECKED C. M. Sham

DATE 13/11/2007

REMARKS

1. An inspection pit was excavated to a depth of 1.50m.
2. A groundwater monitoring well was installed to 6.35m below ground level on 05/11/2007.
3. A groundwater sample was taken from the monitoring well on 09/11/2007. The water level in the well prior to sampling was 2.54m below ground level.

J200707_03061A

DRILLHOLE RECORD

VIBRO

CONTRACT NO. GE/2007/03	HOLE NO. GFSA-20
	SHEET 1 OF 1

PROJECT Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

METHOD	Rotary	CO-ORDINATES		W.O.NO.	GE/2007/03.61A
MACHINE & NO.	BM28	E 839665.51	N 819661.01	DATE :	06/11/2007 to 06/11/2007
FLUSHING MEDIUM	NA	ORIENTATION	Vertical	GROUND LEVEL	+4.84 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	Water Returns %	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
06/11/2007	HW			100					0.00	+4.84	0.00			Concrete surface.
									0.30	+4.54	0.30			Greyish brown (2.5Y 5/2), silty fine to coarse SAND with some angular to subangular fine gravel sized highly decomposed and moderately decomposed rock fragments. (FILL)
									A INSPECTION PIT 0.50					
									B 1.00					
									1 En 1.30					
									C 1.50	+3.34	1.50			
														Firm, greyish brown (2.5Y 5/2), sandy SILT with some angular to subangular fine to medium gravel sized highly decomposed and moderately decomposed rock fragments and trace of wood fragments. (FILL)
										+2.34	2.50			
				66				30 blows	2 2.50					Greyish brown (2.5Y 5/2), slightly silty fine to coarse SAND with some angular to subangular fine gravel sized highly decomposed and moderately decomposed rock fragments. (FILL)
									8 2.73					
									3 2.95 3.00					
										+1.34	3.50			
				55				69 blows	4 3.50					brown (7.5YR 5/4), dappled reddish brown, silty fine to coarse SAND with some angular to subangular fine to medium gravel sized highly decomposed and moderately decomposed rock fragments and occasional angular cobbles (Brick). (FILL)
									5 3.95 4.00					
									6 5.00					
									7 6.00	-1.16	6.00			
06/11/2007	HW 6.65	2.60m at 18:00								-1.81	6.65			Grey (N 5), dappled reddish brown, silty sandy angular to subangular GRAVEL sized moderately decomposed and slightly decomposed rock fragments, some concrete fragments and wood pieces. (FILL)
														End of Investigation Hole at 6.65m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- En Environmental Sample
- Standard penetration test
- V In-situ vane shear test
- Permeability test
- Impression packer test
- Pressuremeter test
- Packer Test
- Acoustic or optical televiewer survey
- Piezometer tip
- Standpipe
- Groundwater monitoring well
- Extensometer

LOGGED	T. C. Yip
DATE	09/11/2007
CHECKED	C. M. Sham
DATE	13/11/2007

REMARKS

1. An inspection pit was excavated to a depth of 1.50m.
2. A groundwater monitoring well was installed to 6.65m below ground level on 06/11/2007.
3. A groundwater sample was taken from the monitoring well on 09/11/2007. The water level in the well prior to sampling was 2.73m below ground level.

J200707_03061A

VIBRO — DRILLHOLE RECORD

CONTRACT NO. GE/2007/03	HOLE NO. GFSA-21	SHEET 1 OF 1

PROJECT Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

METHOD Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.61A
MACHINE & NO. BM28	E 839680.79 N 819629.10	DATE : 07/11/2007 to 07/11/2007
FLUSHING MEDIUM NA	ORIENTATION Vertical	GROUND LEVEL +4.71 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	Water Returns %	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
07/11/2007	HW			100					0.00	+4.71	0.00			Concrete surface.
									0.25	+4.46	0.25			Greyish brown (2.5Y 5/2), very silty fine to coarse SAND with some angular to subangular fine gravel sized highly decomposed and moderately decomposed rock fragments. (FILL)
									A INSPECTION PIT 0.50					
									B 1.00					
									1 En 1.25					
									C 1.50					
									2 2.50					
				95				36 bls	8 2.53	+2.21	2.50			Light brown (7.5YR 6/4), dappled greyish brown and brown, silty / clayey fine to coarse SAND with some angular to subangular fine to medium gravel sized moderately decomposed rock fragments. (FILL)
									3 2.95 3.00					
				69				19 bls	4 3.50					
									5 3.95 4.00					
									6 5.00	-0.29	5.00			Greyish brown (2.5Y 5/2), dappled brown, silty sandy angular fine to coarse GRAVEL sized moderately decomposed and slightly decomposed rock fragments and occasional concrete fragments. (FILL)
									7 6.00					
07/11/2007	HW 6.44	1.65m at 18:00								-1.73	6.44			End of Investigation Hole at 6.44m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- En Environmental Sample
- Standard penetration test
- V In-situ vane shear test
- Permeability test
- Impression packer test
- Pressuremeter test
- Packer Test
- Acoustic or optical televiewer survey
- Piezometer tip
- Standpipe
- Groundwater monitoring well
- Extensometer

LOGGED T. C. Yip

DATE 09/11/2007

CHECKED C. M. Sham

DATE 13/11/2007

REMARKS

1. An inspection pit was excavated to a depth of 1.50m.
2. A groundwater monitoring well was installed to 6.44m below ground level on 08/11/2007.
3. A groundwater sample was taken from the monitoring well on 12/11/2007. The water level in the well prior to sampling was 2.53m below ground level.

J200707_03061A

DRILLHOLE RECORD

VIBRO

CONTRACT NO. GE/2007/03		HOLE NO. GFSA-22
		SHEET 1 OF 1

PROJECT Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

METHOD Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.61A
MACHINE & NO. BM28	E 839706.42 N 819626.78	DATE : 09/11/2007 to 09/11/2007
FLUSHING MEDIUM NA	ORIENTATION Vertical	GROUND LEVEL + 4.87 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	Water Returns %	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
09/11/2007	HW			100					0.00	+4.87	0.00			Concrete surface.
									A INSPECTION PIT 0.25 0.50	+4.62	0.25			Greyish brown (2.5Y 5/2), silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized concrete and moderately decomposed rock fragments and wood fragments. (FILL)
									B 1.00	+3.87	1.00			Light brown (7.5YR 6/4), very silty fine to coarse SAND with some angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
									1 En 1.25 C 1.50					
										+2.37	2.50			
				100				44 bls	2 2.50 8 2.68 3 2.95 3.00					Light brown (7.5YR 6/4), silty fine to medium SAND with occasional angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
										+1.37	3.50			
				92				41 bls	4 3.50 5 3.95 4.00					Light brown (7.5YR 6/4), dappled light grey, silty / clayey fine to coarse SAND with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments. (FILL)
									6 5.00					
									7 6.00	-1.13	6.00			
09/11/2007	HW 6.29	1.95m at 18:00								-1.42	6.29			Greyish brown (2.5Y 5/2), dappled brown, sandy angular to subangular fine to coarse GRAVEL sized concrete and brick fragments and some wood pieces. (FILL)
														End of Investigation Hole at 6.29m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- En Environmental Sample
- Standard penetration test
- V In-situ vane shear test
- Permeability test
- Impression packer test
- Pressuremeter test
- Packer Test
- Acoustic or optical televiewer survey
- Piezometer tip
- Standpipe
- Groundwater monitoring well
- Extensometer

LOGGED	T. C. Yip
DATE	25/11/2007
CHECKED	C. M. Sham
DATE	27/11/2007

REMARKS

1. An inspection pit was excavated to a depth of 1.50m.
2. A groundwater monitoring well was installed to 6.29m below ground level on 09/11/2007.
3. A groundwater sample was taken from the monitoring well on 12/11/2007. The water level in the well prior to sampling was 2.68m below ground level.

VIBRO

Contract No. : GE/2007/03

Project : Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

Works Order No. : GE/2007/03.61

LOGGED BY : T. C. Yip
DATE : 26/10/2007
CHECKED BY : C. M. Sham
DATE : 27/10/2007

CO-ORDINATES :
E 839709.04
N 819690.70

GROUND LEVEL : + 4.95 mPD
EXCAVATION DATES : 20/10/2007 to 25/10/2007
BACKFILL DATES : 09/11/2007

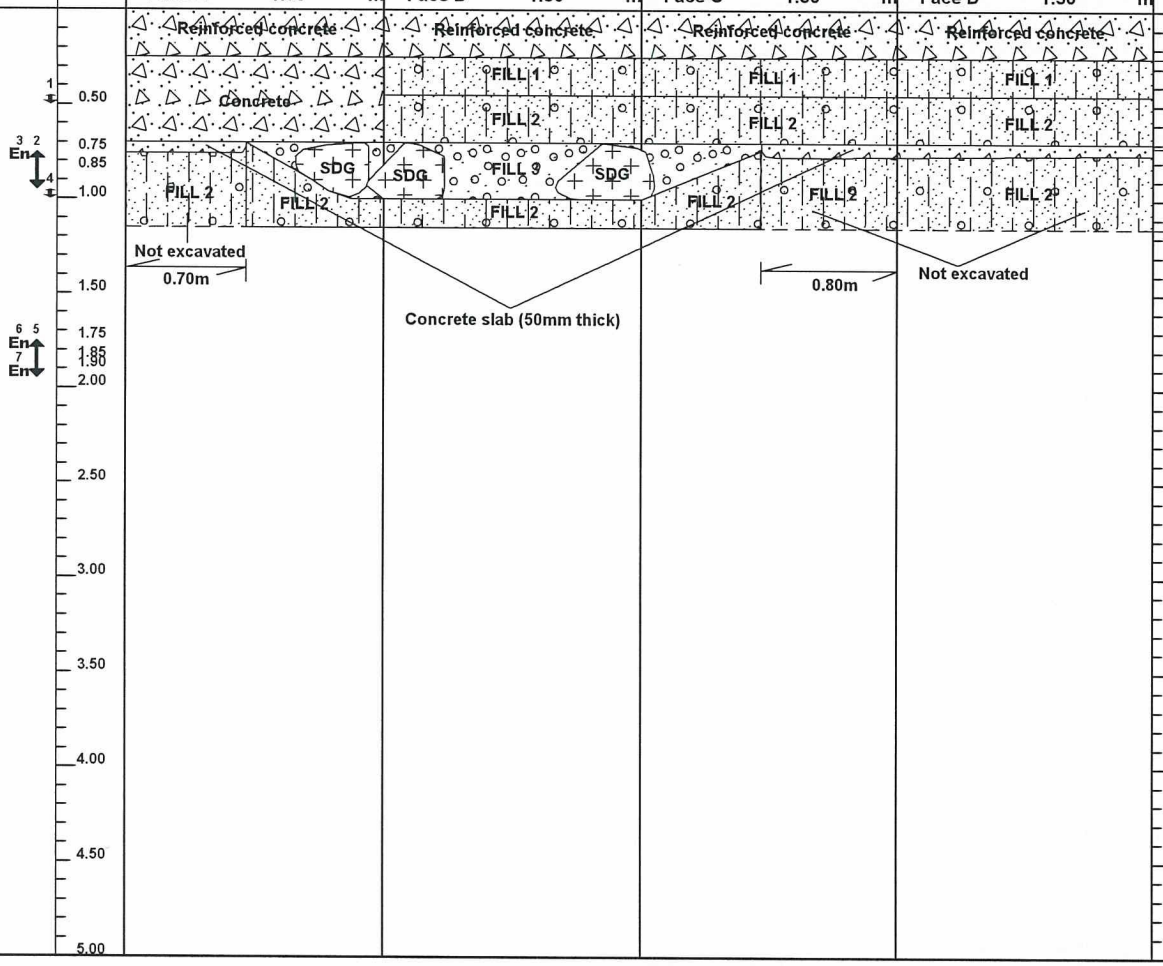
TRIAL PIT NO.
GFSB-01

TRIAL PIT RECORD

Samples & Tests | Depth (m)

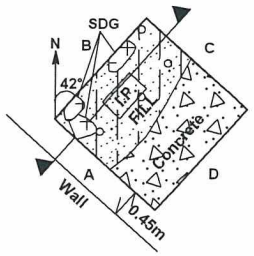
Sketch

Face A 1.50 m | Face B 1.50 m | Face C 1.50 m | Face D 1.50 m



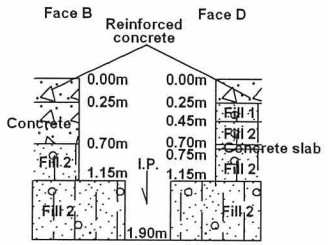
Depth (m)	Legend	Weathering Grade	Description
0.25			Reinforced concrete surface.
0.40			Dense, dry, grey (N 5), slightly silty fine to coarse SAND with much angular to subangular fine to coarse gravel sized moderately decomposed and slightly decomposed rock fragments, concrete fragments and wood fragments. (Sub-base Material) (FILL 1)
0.50			
0.72			Dense, moist, brown (7.5YR 5/4), dappled greyish brown, silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized highly decomposed rock fragments. (FILL 2)
1.00			
1.15			Loose, dry, grey (N 5), slightly sandy angular COBBLES (SDG) with some angular medium to coarse gravel sized slightly decomposed rock fragments and occasional angular boulders (SDG) sized up to 400mm. (Sub-base Material) (FILL 3)
1.50			Dense, moist, brown (7.5YR 5/4), dappled greyish brown, silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized highly decomposed rock fragments. (FILL 2)
2.00			End of Trial Pit at 1.15m.
2.50			
3.00			
3.50			
4.00			
4.50			
5.00			

PLAN



SECTION

GFSB-04



SYMBOL

- Large Disturbed Sample
- Undisturbed Sample Hori.
- Undisturbed Sample Vert.
- Block Sample
- En Environmental Sample
- In Situ Density Test
- Water Seepage
- Water Sample
- Standpipe Tip
- N - Schmidt Hammer Test

REMARKS

Shoring : No shoring
Water Seepage : NIL
Stability : Stable
Maximum Depth : 1.90 m
Average Depth : 1.15 m

1. All sample depths are related to mid-point of Face A below ground level.
2. An inspection pit was excavated from 1.15m to 1.90m below ground level. (An obstruction was encountered at depth of 1.90m below ground level)
3. Small disturbed samples were taken at 0.50m and 1.00m.
4. Large disturbed samples were taken at 0.75m and 1.75m.
5. Environmental Samples were taken at 0.75m, 1.75m and 1.90m.
6. SDG = Slightly decomposed GRANITE.

VIBRO

Contract No. : GE/2007/03

Project : Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

Works Order No. : GE/2007/03.61

LOGGED BY : T. C. Yip
DATE : 25/10/2007
CHECKED BY : C. M. Sham
DATE : 26/10/2007

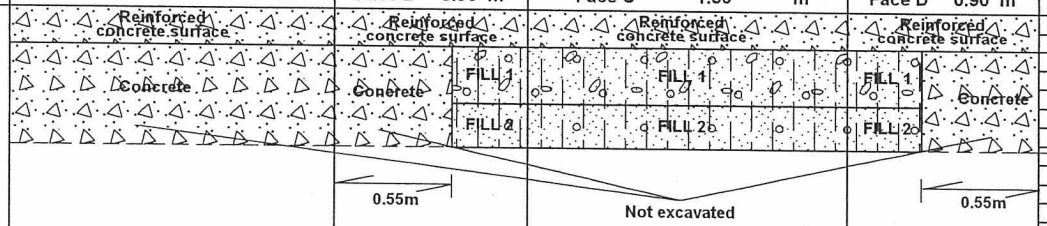
CO-ORDINATES :
E 839707.59
N 819698.73

GROUND LEVEL : + 4.99 mPD
EXCAVATION DATES : 20/10/2007 to 23/10/2007
BACKFILL DATES : 09/11/2007

TRIAL PIT NO.
GFSB-02

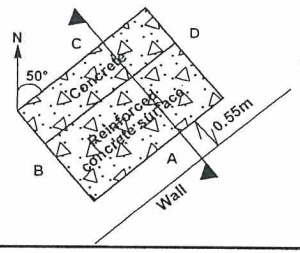
TRIAL PIT RECORD

Sketch



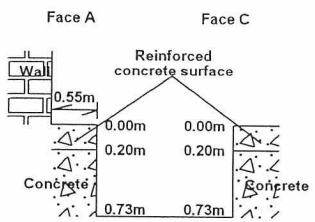
Samples & Tests	Depth (m)	Legend	Weathering Grade	Description
	0.00			Reinforced concrete surface.
1	0.20			Loose, dry, grey (N 5), slightly silty fine to coarse SAND with much angular fine to coarse gravel sized moderately decomposed rock fragments, occasional subangular cobbles (MDG) and concrete fragments. (Sub-base Material) (FILL 1)
2 3 En	0.50			
	0.70			
	0.73			Dense, moist, brown (7.5YR 5/4), silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments, trace of plastic and tree root. (FILL 2)
	0.80			
	1.00			End of Trial Pit at 0.73m.
	1.50			At Base : CONCRETE.
	2.00			
	2.50			
	3.00			
	3.50			
	4.00			
	4.50			
	5.00			

PLAN



SECTION

GFSB-02



SYMBOL

- Large Disturbed Sample
- Undisturbed Sample Hori.
- Undisturbed Sample Vert.
- Block Sample
- En Environmental Sample
- In Situ Density Test
- Water Seepage
- Water Sample
- Standpipe Tip
- N - Schmidt Hammer Test

REMARKS

Shoring : No shoring
Water Seepage : NIL
Stability : Stable
Maximum Depth : 0.73 m
Average Depth : 0.73 m

1. All sample depths are related to mid-point of Face A below ground level.
2. A small disturbed sample was taken at 0.50m.
3. MDG = Moderately decomposed GRANITE.
4. An environmental sample was taken at 0.70m.
5. A large disturbed sample was taken at 0.70m.

VIBRO

Contract No. : GE/2007/03

Project : Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

Works Order No. : GE/2007/03.61

LOGGED BY : T. C. Yip
DATE : 25/10/2007
CHECKED BY : C. M. Sham
DATE : 26/10/2007

CO-ORDINATES :
E 839700.70
N 819706.91

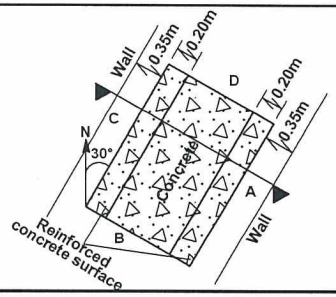
GROUND LEVEL : + 4.95 mPD
EXCAVATION DATES : 24/10/2007
BACKFILL DATES : 09/11/2007

TRIAL PIT NO.
GFSB-03

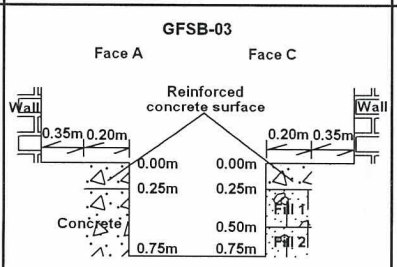
TRIAL PIT RECORD

Samples & Tests	Depth (m)	Sketch	Depth (m)	Legend	Weathering Grade	Description
1 @ 0.50 2 3 En @ 0.75 – 0.85	0.00 – 5.00	Face A 1.50 m: Reinforced concrete surface; Concrete Face B 1.20 m: Reinforced concrete surface; FILL 1; FILL 2; Concrete; 0.20m; 0.55m; 0.20m Face C 1.50 m: Reinforced concrete surface; Concrete; Not excavated Face D 1.20 m: Reinforced concrete surface; FILL 1; FILL 2; Concrete; 0.20m; 0.20m	0.25 0.35 0.50 0.75 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00			Reinforced concrete surface. Dense, dry, grey (N 5), slightly silty fine to coarse SAND with much angular to subangular fine to coarse gravel sized moderately decomposed and slightly decomposed rock fragments and concrete fragments. (Sub-base Material) (FILL 1) Dense, moist, brown (7.5YR 5/4), silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized highly decomposed and moderately decomposed rock fragments. (FILL 2) End of Trial Pit at 0.75m. At Base : CONCRETE.

PLAN



SECTION



SYMBOL

- Large Disturbed Sample
- Undisturbed Sample Hori.
- Undisturbed Sample Vert.
- Block Sample
- En Environmental Sample
- In Situ Density Test
- Water Seepage
- Water Sample
- Standpipe Tip
- N - Schmidt Hammer Test

REMARKS

Shoring : No shoring
Water Seepage : NIL
Stability : Stable
Maximum Depth : 0.75 m
Average Depth : 0.75 m

1. All sample depths are related to mid-point of Face A below ground level.
2. A small disturbed sample was taken at 0.50m.
3. An environmental sample was taken at 0.75m.
4. A large disturbed sample was taken at 0.75m.

VIBRO

Contract No. : GE/2007/03

Project : Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

Works Order No. : GE/2007/03.61

LOGGED BY : T. C. Yip
DATE : 26/10/2007
CHECKED BY : C. M. Sham
DATE : 27/10/2007

CO-ORDINATES :
E 839693.32
N 819708.12

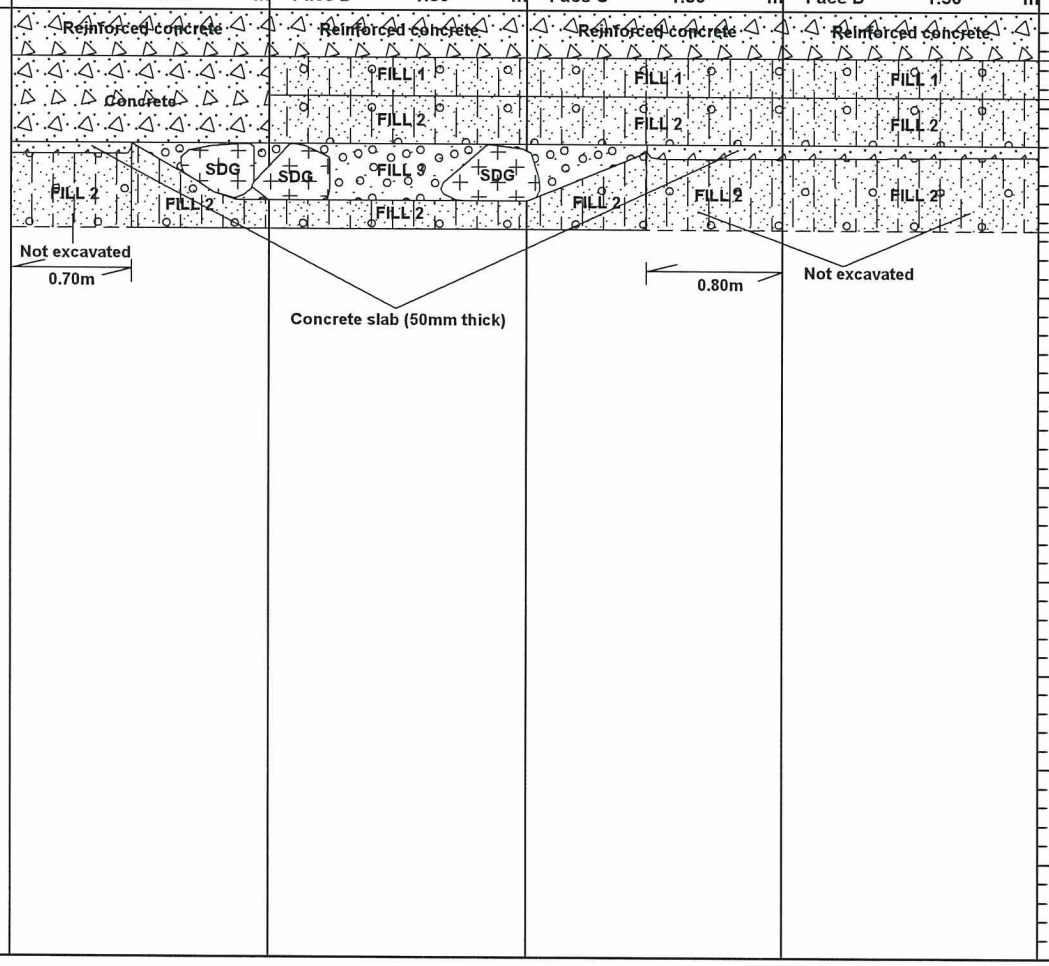
GROUND LEVEL : + 4.96 mPD
EXCAVATION DATES : 23/10/2007 to 25/10/2007
BACKFILL DATES : 09/11/2007

TRIAL PIT NO.
GFSB-04

TRIAL PIT RECORD

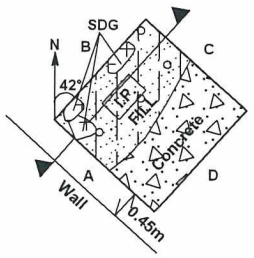
Samples & Tests | Depth (m)

Sketch



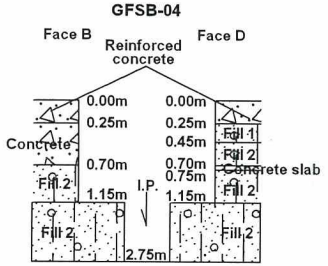
Depth (m)	Legend	Weathering Grade	Description
0.25			Reinforced concrete surface.
0.45			Dense, dry, grey (N 5), slightly silty fine to coarse SAND with much angular to subangular fine to coarse gravel sized concrete and moderately decomposed rock fragments and occasional subangular boulders (Concrete) sized up to 300mm. (Sub-base Material) (FILL 1)
0.50			Dense, moist, brown (7.5YR 5/4), dappled greyish brown, silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized highly decomposed and moderately decomposed rock fragments and concrete fragments. (FILL 2) From 0.70m to 1.00m (Faces B and C) : Loose, dry, grey (N 5), sandy angular medium to coarse GRAVEL (SDG) with some angular boulders (SDG) sized up to 300mm. (Sub-base Material) (FILL 3)
1.00			
1.15			End of Trial Pit at 1.15m.
1.50			
2.00			
2.50			
3.00			
3.50			
4.00			
4.50			
5.00			

PLAN



SECTION

GFSB-04



SYMBOL

- Large Disturbed Sample
- Undisturbed Sample Hori.
- Undisturbed Sample Vert.
- Block Sample
- En Environmental Sample
- In Situ Density Test
- Water Seepage
- Water Sample
- Standpipe Tip
- N - Schmidt Hammer Test

REMARKS

Shoring : No shoring
Water Seepage : NIL
Stability : Stable
Maximum Depth : 2.75 m
Average Depth : 1.15 m

1. All sample depths are related to mid-point of Face A below ground level.
2. An inspection pit was excavated from 1.15m to 2.75m below ground level.
3. Small disturbed samples were taken at 0.50m and 1.00m.
4. Large disturbed samples were taken at 0.75m and 1.75m.
5. Environmental Samples were taken at 0.75m, 1.75m and 2.75m.
6. SDG = Slightly decomposed GRANITE.

DRILLHOLE RECORD

VIBRO

CONTRACT NO.	GE/2007/03
HOLE NO.	GFSC-01
SHEET	1 OF 1

PROJECT Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.61A
MACHINE & NO.	BM41	E 839699.17 N 819683.21	DATE : 05/11/2007 to 06/11/2007
FLUSHING MEDIUM	NA	ORIENTATION Vertical	GROUND LEVEL +4.66 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	Water Returns %	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
05/11/2007	HW			100					0.00	+4.66	0.00			Concrete surface.
									0.23	+4.43	0.23			Greyish brown (2.5Y 5/2), silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized highly decomposed and moderately decomposed rock fragments and occasional brick fragments. (FILL)
05/11/2007 06/11/2007									A 0.50 INSPECTION PIT B 1.00 1 En 1.23 C 1.50					
										+3.16	1.50			Greyish brown (2.5Y 5/2), dappled light brown, very silty fine to coarse SAND with some angular to subangular fine gravel sized highly decomposed and moderately decomposed rock fragments and occasional brick fragments. (FILL)
				48				10 bls	11 2.48 2 2.50 3 2.95 3.00					
								6 bls		+1.16	3.50			
				100					4 3.50 5 3.95 4.00					Grey (N 5), sandy angular to subangular fine to coarse GRAVEL sized concrete fragments and occasional angular cobbles (Concrete). (FILL)
									6 4.50	+0.16	4.50			Soft, greyish brown (2.5Y 5/2), sandy silty CLAY with some angular to subangular fine gravel sized highly decomposed and moderately decomposed rock fragments. (FILL)
								37 bls		-0.34	5.00			
				86					7 5.00 8 5.45 5.50					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 and occasional angular cobbles (MDG). (FILL)
								51 bls						
06/11/2007	HW 6.50	2.11m at 18:00		60					9 6.00 10 6.45 6.50	-1.84	6.50			
														End of Investigation Hole at 6.50m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- En Environmental Sample
- Standard penetration test
- V In-situ vane shear test
- Permeability test
- Impression packer test
- Pressuremeter test
- Packer Test
- Acoustic or optical televiewer survey
- Piezometer tip
- Standpipe
- Groundwater monitoring well
- Extensometer

LOGGED	T. C. Yip
DATE	09/11/2007
CHECKED	C. M. Sham
DATE	13/11/2007

REMARKS

1. An inspection pit was excavated to a depth of 1.50m.
2. A groundwater monitoring well was installed to 6.27m below ground level on 06/11/2007.
3. A groundwater sample was taken from the monitoring well on 09/11/2007. The water level in the well prior to sampling was 2.48m below ground level.

VIBRO — DRILLHOLE RECORD

CONTRACT NO. GE/2007/03		HOLE NO. GFSC-02
		SHEET 1 OF 1

PROJECT Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

METHOD Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.61A
MACHINE & NO. BM41	E 839696.19 N 819678.94	DATE : 03/11/2007 to 05/11/2007
FLUSHING MEDIUM NA	ORIENTATION Vertical	GROUND LEVEL + 4.64 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	Water Returns %	T C R %	S C R %	R Q D %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
03/11/2007	HW			100					0.00	+4.64	0.00			Concrete surface.
									0.25	+4.39	0.25			Brown (7.5YR 5/4), dappled greyish brown, silty fine to coarse SAND with some angular to subangular fine gravel sized highly decomposed and moderately decomposed rock fragments. (FILL)
									A INSPECTION PIT 0.50					
									B 1.00					
1									1 En 1.25					
									C 1.50					
									1.88	+2.76	1.88			
2			70	100					T2 IOI 2.20	+2.44	2.20			Light brown (7.5YR 6/4), dappled grey, angular BOULDERS (MDG) sized up to 320mm. (FILL)
									2.30	+2.34	2.30			WASH BORING.
			70	29					11 2.47 T2 IOI					Brown (7.5YR 5/4), dappled greyish brown, angular coarse GRAVEL sized moderately decomposed rock fragments with some wood pieces. (FILL)
3								14 bls	2 2.85	+1.79	2.85			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 and slightly decomposed rock fragments. (FILL)
				44					3 3.30 3.35					
								30 bls	4 3.50					
		Dry at 18:00		100					5 3.95 4.00					
4	03/11/2007								6 4.50	+0.14	4.50			
	05/11/2007	2.50m at 08:00												Brown (7.5YR 5/4), dappled light brown and greyish brown, silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized highly decomposed and moderately decomposed rock fragments. (FILL)
5								40 bls	7 5.12					
				100					8 5.57 5.62					
										-1.36	6.00			
6								68 bls	9 6.00					Dark brown (7.5YR 3/4), dappled brown, very silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized highly decomposed and moderately decomposed rock fragments. (FILL)
	HW 6.50	2.45m at 12:00		78					10 6.45 6.50	-1.86	6.50			
05/11/2007														End of Investigation Hole at 6.50m.
7														
8														
9														
10														

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- En Environmental Sample
- Standard penetration test
- V In-situ vane shear test
- Permeability test
- Impression packer test
- Pressuremeter test
- Packer Test
- Acoustic or optical televiewer survey
- Piezometer tip
- Standpipe
- Groundwater monitoring well
- Extensometer

LOGGED	T. C. Yip
DATE	09/11/2007
CHECKED	C. M. Shaw
DATE	13/11/2007

REMARKS

1. An inspection pit was excavated to a depth of 1.50m.
2. A groundwater monitoring well was installed to 6.32m below ground level on 05/11/2007.
3. A groundwater sample was taken from the monitoring well on 09/11/2007. The water level in the well prior to sampling was 2.47m below ground level.

J200707_03061A

DRILLHOLE RECORD

VIBRO

CONTRACT NO. GE/2007/03		HOLE NO. GFSC-03
		SHEET 1 OF 1

PROJECT Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

METHOD Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.61A
MACHINE & NO. BM41	E 839693.53 N 819697.53	DATE : 07/11/2007 to 07/11/2007
FLUSHING MEDIUM NA	ORIENTATION Vertical	GROUND LEVEL + 4.76 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	Water Returns %	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
07/11/2007	HW			100					0.00	+4.76	0.00			Concrete surface.
									0.25	+4.51	0.25			Greyish brown (2.5Y 5/2), dappled light brown, silty fine to coarse SAND with some angular to subangular fine to medium gravel sized moderately decomposed rock fragments. (FILL)
									A INSPECTION PIT 0.50					
									B 1.00					
									1 En 1.25					
									C 1.50					
								34 bls	2 2.50	+2.26	2.50			
				36					8 2.66					Grey (N 5), dappled greyish brown and dark grey, silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments and concrete fragments. (FILL)
									3 2.95 3.00					
								18 bls	4 3.50					
				78					5 3.95 4.00					
									6 4.50					
									7 5.50	-0.74	5.50			Light grey (N 6), dappled reddish brown and brown, slightly sandy angular to subangular medium to coarse GRAVEL sized slightly decomposed rock fragments with some brick and wood pieces. (FILL)
07/11/2007	HW 6.38	1.65m at 18:00								-1.62	6.38			End of Investigation Hole at 6.38m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- En Environmental Sample
- Standard penetration test
- V In-situ vane shear test
- Permeability test
- Impression packer test
- Pressuremeter test
- Packer Test
- Acoustic or optical televiewer survey
- Piezometer tip
- Standpipe
- Groundwater monitoring well
- Extensometer

LOGGED T. C. Yip

DATE 25/11/2007

CHECKED C. M. Sham

DATE 29/11/2007

REMARKS

1. An inspection pit was excavated to a depth of 1.50m.
2. A groundwater monitoring well was installed to 6.38m below ground level on 08/11/2007.
3. A groundwater sample was taken from the monitoring well on 12/11/2007. The water level in the well prior to sampling was 2.66m below ground level.

J200707_03061A

DRILLHOLE RECORD

VIBRO

CONTRACT NO. GE/2007/03	HOLE NO. GFSC-04
	SHEET 1 OF 1

PROJECT Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.61A
MACHINE & NO.	BM41	E 839677.75 N 819693.64	DATE : 08/11/2007 to 09/11/2007
FLUSHING MEDIUM	NA	ORIENTATION Vertical	GROUND LEVEL + 4.63 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	Water Returns %	T C R %	S C R %	R Q D %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
08/11/2007	HW			100						+4.63	0.00			
										+4.40	0.23			Concrete surface.
08/11/2007 09/11/2007									A INSPECTION PIT 0.23 0.50 B 1.00 1 En 1.23 C 1.50					Greyish brown (2.5Y 5/2), dappled light brown and grey, silty fine to coarse SAND with some angular to subangular medium gravel sized moderately decomposed rock fragments and occasional wood pieces. (FILL)
				78				14 bls	2 2.50 8 2.53 3 2.95 3.00					
				93				17 bls	4 3.50 5 3.95 4.00	+1.13	3.50			Firm, reddish brown (2.5YR 5/4), sandy SILT with some angular to subangular fine to medium gravel sized brick fragments and occasional fine to coarse gravel sized rock fragments. (FILL)
									6 4.50	+0.13	4.50			Grey (N 5), dappled greyish brown, slightly silty / clayey fine to coarse SAND with much angular to subangular fine to coarse gravel sized concrete fragments. (FILL)
09/11/2007	HW 6.28	2.61m at 18:00							7 5.50	-1.65	6.28			End of Investigation Hole at 6.28m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- En Environmental Sample
- Standard penetration test
- In-situ vane shear test
- Permeability test
- Impression packer test
- Pressuremeter test
- Packer Test
- Acoustic or optical televiewer survey
- Piezometer tip
- Standpipe
- Groundwater monitoring well
- Extensometer

LOGGED	T. C. Yip
DATE	25/11/2007
CHECKED	C. M. Sham
DATE	27/11/2007

REMARKS

1. An inspection pit was excavated to a depth of 1.50m.
2. A groundwater monitoring well was installed to 6.28m below ground level on 09/11/2007.
3. A groundwater sample was taken from the monitoring well on 12/11/2007. The water level in the well prior to sampling was 2.53m below ground level.

DRILLHOLE RECORD

VIBRO

CONTRACT NO. GE/2007/03	HOLE NO. GFSD-01
	SHEET 1 OF 1

PROJECT Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.61
MACHINE & NO.	VBM29	E 839672.85 N 819728.97	DATE : 29/09/2007 to 29/09/2007
FLUSHING MEDIUM	NA	ORIENTATION Vertical	GROUND LEVEL + 4.92 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	Water Returns %	T C R %	S C R %	R Q D %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
29/09/2007	HW									+4.92	0.00			Greyish brown (2.5Y 5/2), dappled brown, silty fine to coarse SAND with some angular to subangular fine to medium gravel sized moderately decomposed rock fragments. (FILL)
									A 0.50 INSPECTION PIT 1B En 1.00 C 1.50					
				70				28 bls	2 2.30 8 2.69 3 2.75 2.80	+2.62	2.30			Firm, greyish brown (2.5Y 5/2), dappled brown, sandy SILT with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments and occasional vegetation fragments. (FILL)
				60				19 bls	4 3.80 5 4.25 4.30 6 5.00	+1.12	3.80			Greyish brown (2.5Y 5/2), dappled brown, slightly silty fine to coarse SAND with some angular to subangular fine to medium gravel sized moderately decomposed rock fragments and occasional subangular cobbles (Concrete). (FILL)
29/09/2007	HW 6.00	1.80m at 18:00							7 6.00	-1.08	6.00			End of Investigation Hole at 6.00m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- En Environmental Sample
- Standard penetration test
- V In-situ vane shear test
- Permeability test
- Impression packer test
- Pressuremeter test
- Packer Test
- Acoustic or optical televiewer survey
- Piezometer tip
- Standpipe
- Groundwater monitoring well
- Extensometer

LOGGED	T. C. Yip
DATE	06/10/2007
CHECKED	C. M. Sham
DATE	08/10/2007

REMARKS

1. An inspection pit was excavated to a depth of 1.50m.
2. Groundwater monitoring well was installed to 6.00m below ground level on 02/10/2007.
3. A groundwater sample was taken from the monitoring well on 04/10/2007. The water level in the well prior to sampling was 2.69m below ground level.

DRILLHOLE RECORD

VIBRO

CONTRACT NO. GE/2007/03	HOLE NO. GFSD-02
	SHEET 1 OF 1

PROJECT Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.61
MACHINE & NO.	VBM29	E 839738.49 N 819678.29	DATE : 02/10/2007 to 03/10/2007
FLUSHING MEDIUM	NA	ORIENTATION Vertical	GROUND LEVEL + 5.07 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	Water Returns %	TCR %	SCR %	RQD %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
02/10/2007	HW			100					0.00	+5.07	0.00			Concrete surface.
									0.50	+4.57	0.50			Light brown (7.5YR 6/4), silty fine to coarse SAND with some angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
									A INSPECTION PIT 1.00					
									1 B En 1.50					
									2 C 2.00	+3.07	2.00			Firm, light brown (7.5YR 6/4), dappled grey, sandy SILT with some angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
								11 blows	2.80	+2.27	2.80			Light brown (7.5YR 6/4), dappled dark grey and greyish brown, slightly silty fine to coarse SAND with some angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
				94					3 9 2.83					
									4 3.25 3.30					
								19 blows	5 3.80					
		2.70m at 18:00		90					6 4.25 4.30					
02/10/2007														
03/10/2007		2.30m at 08:00							7 5.30	-0.23	5.30			Soft, light brown (7.5YR 6/4), sandy silty CLAY with some angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
									8 6.30					
03/10/2007	HW 6.70	2.30m at 13:00								-1.63	6.70			End of Investigation Hole at 6.70m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- En Environmental Sample
- Standard penetration test
- In-situ vane shear test
- Permeability test
- Impression packer test
- Pressuremeter test
- Packer Test
- Acoustic or optical televiewer survey
- Piezometer tip
- Standpipe
- Groundwater monitoring well
- Extensometer

LOGGED	T. C. Yip
DATE	06/10/2007
CHECKED	C. M. Sham
DATE	08/10/2007

REMARKS

1. An inspection pit was excavated to a depth of 2.00m.
2. Groundwater monitoring well was installed to 6.70m below ground level on 03/10/2007.
3. A groundwater sample was taken from the monitoring well on 04/10/2007. The water level in the well prior to sampling was 2.83m below ground level.

VIBRO

DRILLHOLE RECORD

HOLE NO. GFSD-03

CONTRACT NO. GE/2007/03

SHEET 1 OF 1

PROJECT Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.61
MACHINE & NO.	VBM29	E 839755.36 N 819619.40	DATE : 03/10/2007 to 04/10/2007
FLUSHING MEDIUM	NA	ORIENTATION Vertical	GROUND LEVEL + 4.71 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	Water Returns %	T C R %	S C R %	R Q D %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
03/10/2007	HW									+4.71	0.00			
									A 0.50					Light brown (7.5YR 6/4), dappled greyish brown, silty fine to coarse SAND with some angular to subangular fine to medium gravel sized moderately decomposed rock fragments and asphalt fragments. (FILL)
									1B INSPECTION PIT En 1.00					
									C 1.50	+3.21	1.50			
		Dry at 18:00												Firm, brown (7.5YR 5/4), dappled greyish brown, sandy SILT with some angular to subangular fine gravel sized moderately decomposed rock fragments. (FILL)
03/10/2007														
04/10/2007		Dry at 08:00		64				24 bls	2 2.30					
									8 2.63					
									3 2.75 2.80	+1.41	3.30			
				74				30 bls	4 3.30					Firm to stiff, yellowish brown (10YR 5/4), sandy SILT with angular to subangular coarse gravel sized moderately decomposed rock fragments. (FILL)
									5 3.75 3.80					
									6 4.30	+0.41	4.30			Soft, grey (N 5), dappled brown and light brown, sandy clayey SILT with some angular to subangular fine to medium gravel sized moderately decomposed rock fragments, occasional wood pieces and asphalt fragments. (FILL)
									7 5.30					
04/10/2007	HW 6.20	2.48m at 18:00								-1.49	6.20			End of Investigation Hole at 6.20m.

Disturbed sample
Piston sample
Split spoon sample
U76 undisturbed sample
U100 undisturbed sample
Mazier sample
SPT liner sample
Water sample
En Environmental Sample

Standard penetration test
V In-situ vane shear test
Permeability test
Impression packer test
Pressuremeter test
Packer Test
Acoustic or optical televiewer survey
Piezometer tip
Standpipe
Groundwater monitoring well
Extensometer

LOGGED T. C. Yip

DATE 06/10/2007

CHECKED C. M. Sham

DATE 08/10/2007

REMARKS

1. An inspection pit was excavated to a depth of 1.50m.
2. Groundwater monitoring well was installed to 6.20m below ground level on 04/10/2007.
3. A groundwater sample was taken from the monitoring well on 05/10/2007. The water level in the well prior to sampling was 2.63m below ground level.

DRILLHOLE RECORD

VIBRO

CONTRACT NO. GE/2007/03	HOLE NO. GFSD-04
	SHEET 1 OF 1

PROJECT Agreement No. CE35/2006 (CE), Kai Tak Development Engineering Study cum Design and Construction of Advance Work - Investigation, Design and Construction

METHOD	Rotary	CO-ORDINATES	W.O.NO. GE/2007/03.61
MACHINE & NO.	VBM38	E 839726.14 N 819585.98	DATE : 02/10/2007 to 03/10/2007
FLUSHING MEDIUM	NA	ORIENTATION Vertical	GROUND LEVEL + 4.52 mPD

Drilling Progress	Casing Depth/Size	Water Level (m) Shift start / end	Water Returns %	T C R %	S C R %	R Q D %	FI	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
02/10/2007	PW			100						+4.52	0.00			Concrete surface.
									A 0.30 / 0.50 INSPECTION PIT	+4.22	0.30			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)
									B 1.00 / 1 En 1.30 / C 1.50					
		Dry at 18:00							9 ▲ 2.31					
02/10/2007								18 bls	2 2.50	+2.02	2.50			Firm, grey (N 5), slightly sandy SILT. (FILL)
03/10/2007		Dry at 08:00		90					3 2.95 / 3.00					
	PW 3.00 / HW							49 bls	4 3.50	+1.02	3.50			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)
				40					5 3.95 / 4.00					
									6 4.50	+0.02	4.50			Firm to stiff, grey (N 5), dappled dark grey and reddish brown, sandy SILT with some angular to subangular fine to coarse gravel sized moderately decomposed rock fragments, occasional wood pieces and brick pieces. (FILL)
									7 5.50					
									8 6.30	-1.78	6.30			
03/10/2007	HW 6.66	2.67m at 18:00								-2.14	6.66			Dark grey (N 3), slightly silty fine to coarse SAND with some angular to subangular fine gravel sized highly to moderately decomposed rock fragments.(FILL)
														End of Investigation Hole at 6.66m.

- Disturbed sample
- Piston sample
- Split spoon sample
- U76 undisturbed sample
- U100 undisturbed sample
- Mazier sample
- SPT liner sample
- Water sample
- En Environmental Sample
- Standard penetration test
- V In-situ vane shear test
- Permeability test
- Impression packer test
- Pressuremeter test
- Packer Test
- Acoustic or optical televiewer survey
- Piezometer tip
- Standpipe
- Groundwater monitoring well
- Extensometer

LOGGED	T. C. Yip
DATE	06/10/2007
CHECKED	C. M. Sham
DATE	08/10/2007

REMARKS

1. An inspection pit was excavated to a depth of 1.50m.
2. Groundwater monitoring well was installed to 6.66m below ground level on 03/10/2007.
3. A groundwater sample was taken from the monitoring well on 05/10/2007. The water level in the well prior to sampling was 2.31m below ground level.

Appendix D

(On-site Measurement Results)

Appendix D PID Measurement

Sample ID	Sampling Date	Sampling Depth		PID Results (ppm)
		m Below Base of Existing Concrete Pavement		
		From	To	
GFSA-17	21/09/2007	1	1	0
	21/09/2007	2.25	2.7	0
	21/09/2007	3.25	3.7	0
GFSA-18	21/09/2007	1	1	0
	24/09/2007	2.25	2.7	0.2
	24/09/2007	3.45	3.9	0
GFSA-19	03/11/2007	1	1	0
	03/11/2007	2.23	2.68	0.2
	03/11/2007	3.23	3.68	0.4
GFSA-20	06/11/2007	1	1	1.8
	06/11/2007	2.2	2.65	0
	06/11/2007	3.2	3.65	0
GFSA-21	07/11/2007	1	1	0
	07/11/2007	2.25	2.7	1.8
	07/11/2007	3.25	3.7	0
GFSA-22	09/11/2007	1	1	0.9
	09/11/2007	2.25	2.7	1.1
	09/11/2007	3.25	3.7	0.9
GFSB-01	23/10/2007	0.5	0.5	0
	24/10/2007	1.5	1.5	0
	25/10/2007	1.65	1.65	0
GFSB-02	23/10/2007	0.5	0.5	0
GFSB-03	24/10/2007	0.5	0.5	0
GFSB-04	23/10/2007	0.5	0.5	0
	24/10/2007	1.5	1.5	0
	25/10/2007	2.5	2.5	0
GFSC-01	06/11/2007	1	1	0
	06/11/2007	2.27	2.72	0
	06/11/2007	3.27	3.72	0
	06/11/2007	4.77	5.22	0
	06/11/2007	5.77	6.22	0
GFSC-02	03/11/2007	1	1	0
	03/11/2007	2.6	3.05	0.1
	03/11/2007	3.25	3.7	0
	05/11/2007	4.87	5.32	0
	05/11/2007	5.75	6.2	0.2
GFSC-03	07/11/2007	1	1	0
	07/11/2007	2.25	2.7	0
	07/11/2007	3.25	3.7	1
GFSC-04	09/11/2007	1	1	0
	09/11/2007	2.27	2.72	0
	09/11/2007	3.27	3.72	0.5
GFSD-01	29/09/2007	1	1	0.1
	29/09/2007	2.3	2.75	0
	29/09/2007	3.8	4.25	0.1
GFSD-02	02/10/2007	1	1	0.2
	02/10/2007	2.3	2.75	5.2
	02/10/2007	3.3	3.75	4.1
GFSD-03	03/10/2007	1	1	0.2
	04/10/2007	2.3	2.75	0.5
	04/10/2007	3.3	3.75	0.3
GFSD-04	02/10/2007	1	1	0.1
	03/10/2007	2.2	2.65	3.6
	03/10/2007	3.2	3.65	1.6

Appendix E

(Laboratory Results)

Laboratory Results of Soil Samples (ex-GFS building)

Soil Sample Identification			Metals											
Location	Depth (m BBC) From	To	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)	Mercury (Hg)	Arsenic (As)	Cobalt (Co)	Molybdenum (Mo)	Tin (Sn)	Barium (Ba)
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Reporting Limit (mg/kg)			0.2	1	1	1	1	20	0.05	1	0.5	1	0.5	0.5
Dutch A			1	100	50	50	50	200	0.5	20	20	10	20	200
Dutch B			5	250	100	100	150	500	2	30	50	40	50	400
Dutch C			20	800	500	500	600	3000	10	50	300	200	300	2000
GFSA - 17	1	1	<0.2	2.7	6.3	2	110	45	<0.05	<1	2.4	2.6	2.2	42
GFSA - 17	2.25	2.7	<0.2	3.2	9.5	3.9	120	61	0.1	1.7	4.1	2.2	3.1	26
GFSA - 17	3.25	3.7	<0.2	3.1	17	8.1	**200**	90	0.12	1.5	4.7	1.2	12	43
GFSA - 18	1	1	<0.2	2.4	6.5	1.8	110	67	0.07	1.3	3.2	1.5	3.5	39
GFSA - 18	2.25	2.7	<0.2	<1	1.8	<1	75	56	<0.05	<1	2.4	1.6	1.1	18
GFSA - 18	3.45	3.9	<0.2	3.2	7.6	2.1	120	92	0.06	1.6	3.2	4.1	2.7	43
GFSA - 19	1	1	<0.2	3.2	10	4.4	89	60	<0.05	1.4	3.6	1.3	2.9	44
GFSA - 19	2.23	2.68	0.21	2.9	7.8	2.4	150	78	<0.05	1.5	4.7	1.5	2.5	45
GFSA - 19	3.23	3.68	<0.2	3.4	8.9	1.6	60	46	0.12	<1	1.8	<1	3.8	41
GFSA - 20	1	1	1	2.7	8.2	2.8	110	**2000**	<0.05	<1	2.5	1.5	0.97	31
GFSA - 20	2.2	2.65	<0.2	1.5	4	1.5	51	38	<0.05	<1	1.3	1.1	0.69	15
GFSA - 20	3.2	3.65	<0.2	4.3	27	1.8	35	63	0.06	1.6	1.5	2.1	1	39
GFSA - 21	1	1	<0.2	9.7	9.6	4.7	41	120	0.15	4	3	<1	3.3	72
GFSA - 21	2.25	2.7	<0.2	2.4	2.3	1.6	81	<20	<0.05	1.2	3	1.6	1.8	14
GFSA - 21	3.25	3.7	<0.2	3	6.4	1.7	21	41	<0.05	<1	1.1	1.4	0.55	30
GFSA - 22	1	1	<0.2	4.5	<1	2	30	<20	<0.05	1.6	<0.5	2	2.6	2.7
GFSA - 22	2.25	2.7	<0.2	2.2	17	1.3	83	47	<0.05	<1	1.7	<1	1.1	15
GFSA - 22	3.25	3.7	0.38	55	**150**	37	82	110	0.06	8.1	5.3	3.7	5.6	61
GFSB - 01	0.5	0.5	0.32	<1	<1	<1	41	23	<0.05	0.38	0.71	<1	1.6	30
GFSB - 01	1.5	1.5	<0.2	2.2	9	21	52	39	0.14	4.9	2.4	1.1	3.3	38
GFSB - 01	1.65	1.65	<0.2	2.4	7.7	6.1	58	42	0.14	4	3	<1	2.5	47
GFSB - 02	0.5	0.5	0.34	<1	1.4	<1	37	23	<0.05	0.4	2.1	<1	1.7	23
GFSB - 03	0.5	0.5	0.31	<1	<1	<1	39	<20	<0.05	<1	<0.5	<1	1.5	30
GFSB - 04	0.5	0.5	0.25	<1	<1	<1	32	<20	<0.05	<1	<0.5	<1	1.2	18
GFSB - 04	1.5	1.5	<0.2	1.3	3.1	<1	100	<20	<0.05	1.1	2.6	1.3	1.6	17
GFSB - 04	2.5	2.5	<0.2	<1	2.2	<1	41	39	<0.05	<1	3.3	<1	1.9	69
GFSC - 01	1	1												
GFSC - 01	2.27	2.72												
GFSC - 01	3.27	3.72												
GFSC - 01	4.77	5.22												
GFSC - 01	5.77	6.22												
GFSC - 02	1	1												
GFSC - 02	2.6	3.05												
GFSC - 02	3.25	3.7												
GFSC - 02	4.87	5.32												
GFSC - 02	5.75	6.2												
GFSC - 03	1	1												
GFSC - 03	2.25	2.7												
GFSC - 03	3.25	3.7												
GFSC - 04	1	1												
GFSC - 04	2.27	2.72												
GFSC - 04	3.27	3.72												
GFSD - 01	1	1	<0.2	2.9	39	1.6	54	51	0.77	1.2	1.6	<1	4.5	43
GFSD - 01	2.3	2.75	<0.2	3.2	55	2	86	110	0.07	1.2	1.5	<1	3.1	64
GFSD - 01	3.8	4.25	<0.2	3.5	5.5	1.9	20	44	0.06	<1	1.1	<1	0.86	26
GFSD - 02	1	1	<0.2	2.6	2	1.6	85	26	<0.05	1.6	1.4	2.6	2.4	20
GFSD - 02	2.3	2.75	<0.2	4.2	12	2.5	81	94	0.1	3	1.4	1.3	3.7	28
GFSD - 02	3.3	3.75	<0.2	2.2	22	1.2	69	54	0.08	1.3	2.2	4.3	2	30
GFSD - 03	1	1	**6**	21	31	6.6	**480**	**2300**	0.13	3.8	5.2	1.2	23	98
GFSD - 03	2.3	2.75	0.2	2.7	9.8	<1	30	130	0.06	<1	0.83	<1	2.4	42
GFSD - 03	3.3	3.75	**510**	14	34	**410**	73	250	<0.05	11	**1200**	2.7	2.7	240
GFSD - 04	1	1	<0.2	2.9	1.7	1.6	59	20	0.05	<1	1	2.5	2.5	20
GFSD - 04	2.2	2.65	**15**	26	45	32	**430**	160	0.5	9.9	8.3	<1	6.1	270
GFSD - 04	3.2	3.65	2.3	7.4	24	7	**300**	150	0.18	3.6	3.2	1.1	3.5	58

Soil Sample Identification			TPH					PAHs					
Location	From	To	C6-C9	C10-C14	C15-C28	C29-C36	Total TPH	Naphthalene	Phenanthrene	Anthracene	1,2-benzopyrene (as benzo(a)pyrene)	Fluoranthene	Pyrene
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Reporting Limit (mg/kg)			2	50	100	100	-	0.05	0.05	0.05	0.05	0.05	0.05
Dutch A			-	-	-	-	100	0.1	0.1	0.1	0.05	0.1	0.1
Dutch B			-	-	-	-	1000	5	10	10	1	10	10
Dutch C			-	-	-	-	5000	50	100	100	10	100	100
GFSA - 17	1	1	<2	<50	120	<100	272	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 17	2.25	2.7	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 17	3.25	3.7	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	0.06
GFSA - 18	1	1	<2	<50	<100	<100	<252	0.27	**14**	6	**11**	**19**	**17**
GFSA - 18	2.25	2.7	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 18	3.45	3.9	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 19	1	1	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 19	2.23	2.68	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 19	3.23	3.68	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 20	1	1	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 20	2.2	2.65	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 20	3.2	3.65	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 21	1	1	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 21	2.25	2.7	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 21	3.25	3.7	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 22	1	1	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 22	2.25	2.7	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSA - 22	3.25	3.7	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSB - 01	0.5	0.5	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSB - 01	1.5	1.5	<2	<50	<100	<100	<252	<0.05	0.2	0.12	0.39	1.1	1.2
GFSB - 01	1.65	1.65	<2	73	1500	1300	**2875**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSB - 02	0.5	0.5	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSB - 03	0.5	0.5	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSB - 04	0.5	0.5	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSB - 04	1.5	1.5	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSB - 04	2.5	2.5	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSC - 01	1	1	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSC - 01	2.27	2.72	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSC - 01	3.27	3.72	<2	<50	<100	<100	<252	<0.05	1	0.27	0.35	1.5	1
GFSC - 01	4.77	5.22	<2	<50	<100	<100	<252	<0.05	0.46	0.12	0.15	0.54	0.37
GFSC - 01	5.77	6.22	<2	<50	<100	<100	<252	<0.05	0.08	<0.05	<0.05	0.05	<0.05
GFSC - 02	1	1	<2	<50	<100	<100	<252	<0.05	0.07	<0.05	0.06	0.16	0.12
GFSC - 02	2.6	3.05	<2	<50	160	380	592	<0.05	0.09	<0.05	<0.05	0.08	0.08
GFSC - 02	3.25	3.7	<2	<50	<100	<100	<252	<0.05	0.15	<0.05	<0.05	0.08	0.06
GFSC - 02	4.87	5.32	<2	<50	<100	<100	<252	<0.05	0.17	<0.05	<0.05	0.09	0.11
GFSC - 02	5.75	6.2	<2	<50	<100	<100	<252	<0.05	0.12	<0.05	<0.05	0.27	0.31
GFSC - 03	1	1	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSC - 03	2.25	2.7	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSC - 03	3.25	3.7	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSC - 04	1	1	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSC - 04	2.27	2.72	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSC - 04	3.27	3.72	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSD - 01	1	1	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSD - 01	2.3	2.75	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSD - 01	3.8	4.25	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSD - 02	1	1	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSD - 02	2.3	2.75	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSD - 02	3.3	3.75	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSD - 03	1	1	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSD - 03	2.3	2.75	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSD - 03	3.3	3.75	<2	150	220	350	722	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSD - 04	1	1	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSD - 04	2.2	2.65	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GFSD - 04	3.2	3.65	<2	<50	<100	<100	<252	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Soil Sample Identification			BTEX						Phenols		
Location	From	To	Benzene	Toluene	Ethylbenzene	m, p-Xylene	o-Xylene	Xylenes	Phenol	2-methylphenol	3/4-methylphenol
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Reporting Limit (mg/kg)			0.2	0.2	0.2	0.4	0.2	-	0.2	0.2	0.2
Dutch A			0.01	0.05	0.05	-	-	0.05	0.02	0.02	0.02
Dutch B			0.5	3	5	-	-	5	1	1	1
Dutch C			5	30	50	-	-	50	10	10	10
GFSA - 17	1	1	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 17	2.25	2.7	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 17	3.25	3.7	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 18	1	1	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 18	2.25	2.7	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 18	3.45	3.9	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 19	1	1	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 19	2.23	2.68	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 19	3.23	3.68	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 20	1	1	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 20	2.2	2.65	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 20	3.2	3.65	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 21	1	1	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 21	2.25	2.7	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 21	3.25	3.7	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 22	1	1	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 22	2.25	2.7	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSA - 22	3.25	3.7	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSB - 01	0.5	0.5	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSB - 01	1.5	1.5	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSB - 01	1.65	1.65	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSB - 02	0.5	0.5	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSB - 03	0.5	0.5	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSB - 04	0.5	0.5	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSB - 04	1.5	1.5	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSB - 04	2.5	2.5	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSC - 01	1	1	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 01	2.27	2.72	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 01	3.27	3.72	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 01	4.77	5.22	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 01	5.77	6.22	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 02	1	1	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 02	2.6	3.05	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 02	3.25	3.7	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 02	4.87	5.32	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 02	5.75	6.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 03	1	1	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 03	2.25	2.7	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 03	3.25	3.7	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 04	1	1	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 04	2.27	2.72	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSC - 04	3.27	3.72	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6			
GFSD - 01	1	1	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSD - 01	2.3	2.75	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSD - 01	3.8	4.25	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSD - 02	1	1	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSD - 02	2.3	2.75	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSD - 02	3.3	3.75	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSD - 03	1	1	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSD - 03	2.3	2.75	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSD - 03	3.3	3.75	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSD - 04	1	1	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSD - 04	2.2	2.65	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20
GFSD - 04	3.2	3.65	<0.2	<0.2	<0.2	<0.4	<0.2	<0.6	<0.20	<0.20	<0.20

Soil Sample Identification			Halogenated Hydrocarbons - Aliphatics																		
Location	From	To	1,1-dichloroethene	trans-1,2-dichloroethene	1,1-dichloroethane	cis-1,2-dichloroethene	1,1,1-trichloroethane	1,1-dichloropropylene	Tetrachloromethane	1,2-dichloroethane	trichloroethene	dibromomethane	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
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Reporting Limit (mg/kg)			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
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
Dutch B			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Dutch C			50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
GFSA - 17	1	1	< 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
GFSA - 17	2.25	2.7	< 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
GFSA - 17	3.25	3.7	< 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
GFSA - 18	1	1	< 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
GFSA - 18	2.25	2.7	< 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
GFSA - 18	3.45	3.9	< 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
GFSA - 19	1	1	< 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
GFSA - 19	2.23	2.68	< 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
GFSA - 19	3.23	3.68	< 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
GFSA - 20	1	1	< 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
GFSA - 20	2.2	2.65	< 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
GFSA - 20	3.2	3.65	< 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
GFSA - 21	1	1	< 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
GFSA - 21	2.25	2.7	< 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
GFSA - 21	3.25	3.7	< 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
GFSA - 22	1	1	< 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
GFSA - 22	2.25	2.7	< 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
GFSA - 22	3.25	3.7	< 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
GFSB - 01	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
GFSB - 01	1.5	1.5	< 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
GFSB - 01	1.65	1.65	< 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
GFSB - 02	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
GFSB - 03	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
GFSB - 04	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
GFSB - 04	1.5	1.5	< 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
GFSB - 04	2.5	2.5	< 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
GFSC - 01	1	1																		
GFSC - 01	2.27	2.72																		
GFSC - 01	3.27	3.72																		
GFSC - 01	4.77	5.22																		
GFSC - 01	5.77	6.22																		
GFSC - 02	1	1																		
GFSC - 02	2.6	3.05																		
GFSC - 02	3.25	3.7																		
GFSC - 02	4.87	5.32																		
GFSC - 02	5.75	6.2																		
GFSC - 03	1	1																		
GFSC - 03	2.25	2.7																		
GFSC - 03	3.25	3.7																		
GFSC - 04	1	1																		
GFSC - 04	2.27	2.72																		
GFSC - 04	3.27	3.72																		
GFSD - 01	1	1	< 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
GFSD - 01	2.3	2.75	< 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
GFSD - 01	3.8	4.25	< 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
GFSD - 02	1	1	< 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
GFSD - 02	2.3	2.75	< 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
GFSD - 02	3.3	3.75	< 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
GFSD - 03	1	1	< 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
GFSD - 03	2.3	2.75	< 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
GFSD - 03	3.3	3.75	< 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
GFSD - 04	1	1	< 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
GFSD - 04	2.2	2.65	< 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
GFSD - 04	3.2	3.65	< 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

Notes:
BBC= Below Base of Existing Concrete
Square in bolded line indicates exceedance of Dutch B Level
Shaded square indicates exceedance of Dutch C Level
Full analytical results should be referred to laboratory report

Laboratory Results of Groundwater Samples (ex-GFS building)

Location	Depth (m BGL)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)	Mercury (Hg)	Arsenic (As)	Cobalt (Co)	Molybdenum (Mo)	Tin (Sn)	Barium (Ba)	C6-C9	C10-C14	C15-C28	C29-C36	Total TPH
Sample Identification		Metals												TPH				
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Reorting Limit		1.0	1.0	1.0	1.0	1.0	50	0.5	10	1.0	1.0	1.0	1.0	20	25	25	25	-
Dutch A		1	20	20	20	20	50	0.2	10	20	5.0	10	50	-	-	-	-	20
Dutch B		2.5	50	50	50	50	200	0.5	30	50	20	30	100	-	-	-	-	200
Dutch C		10	200	200	200	200	800	2	100	200	100	150	500	-	-	-	-	600
GFSA - 17	2.62	<1	1	1.4	1.6	7.5	<50	1.2	<10	<1	31	3.7	24	<20	26	160	<25	231
GFSA - 18	2.58	1.4	2.4	2.4	18	77	250	<0.5	<10	49	21	3.6	150	<20	<25	200	82	327
GFSA - 19	2.54	<1	17	1.3	10	72	92	<0.5	<10	6.4	39	5.4	120	<20	<25	<25	<25	<95
GFSA - 20	2.73	<1	14	1.5	6.7	45	87	<0.5	<10	4.1	6.9	2	110	<20	<25	<25	<25	<95
GFSA - 21	2.53	2.4	64	23	16	590	420	<0.5	11	14	18	4.8	610	<20	<25	<25	<25	<95
GFSA - 22	2.68	<1	57	2.8	23	130	250	<0.5	<10	12	11	3.6	220	<20	<25	<25	<25	<95
GFSC - 01	2.48													<20	<25	<25	<25	<95
GFSC - 02	2.47													<20	<25	<25	<25	<95
GFSC - 03	2.66													<20	<25	<25	<25	<95
GFSC - 04	2.53													<20	<25	31	<25	101
GFSD - 01	2.69	2.5	6.1	55	7.4	550	480	<0.5	<10	7.3	3	3.4	340	<20	45	170	130	365
GFSD - 02	2.83	2.7	23	59	9.3	2100	1000	<0.5	<10	33	5.4	4.1	680	<20	31	92	<25	168
GFSD - 03	2.63	27	12	2.6	50	240	470	<0.5	<10	200	3.7	5.4	650	<20	160	350	210	740
GFSD - 04	2.31	3	12	<1	11	320	290	<0.5	<10	4.4	2.5	6.3	160	<20	69	160	120	369

Location	Depth (m BGL)	Naphthalene	Phenanthrene	Anthracene	1,2-benzopyrene (as benzo(a)pyrene)	Fluoranthene	Pyrene	Benzene	Toluene	Ethylbenzene	m, p-Xylene	o-Xylene	Xylenes	Phenol	2-methylphenol	3/4-methylphenol
Sample Identification		PAHs (Low Molecular Weight)						BTEX						Phenols		
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Reorting Limit		0.1	0.1	0.1	0.1	0.1	0.1	1.0	15	15	15	15	-	0.5	0.5	0.5
Dutch A		0.2	0.1	0.1	0.01	0.02	0.02	0.2	0.5	0.5	-	-	0.5	0.5	0.5	0.5
Dutch B		7	2	2	0.2	1	1	1	15	20	-	-	20	15	15	15
Dutch C		30	10	10	1	5	5	5	50	60	-	-	60	50	50	50
GFSA - 17	2.62	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5
GFSA - 18	2.58	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5
GFSA - 19	2.54	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5
GFSA - 20	2.73	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5
GFSA - 21	2.53	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5
GFSA - 22	2.68	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5
GFSC - 01	2.48	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30			
GFSC - 02	2.47	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30			
GFSC - 03	2.66	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30			
GFSC - 04	2.53	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30			
GFSD - 01	2.69	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5
GFSD - 02	2.83	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5
GFSD - 03	2.63	1.3	1.1	0.14	<0.10	0.47	0.43	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5
GFSD - 04	2.31	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5

Location	Depth (m BGL)	1,1-dichloroethene	trans-1,2-dichloroethene	1,1-dichloroethane	cis-1,2-dichloroethene	1,1,1-trichloroethane	1,1-dichloropropylene	Tetrachloromethane	1,2-dichloroethane	trichloroethene	dibromomethane	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
Sample Identification		Halogenated Hydrocarbons - Aliphatics																	
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Reorting Limit		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Dutch A		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dutch B		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Dutch C		50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
GFSA - 17	2.62	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
GFSA - 18	2.58	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
GFSA - 19	2.54	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
GFSA - 20	2.73	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
GFSA - 21	2.53	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
GFSA - 22	2.68	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
GFSC - 01	2.48																		
GFSC - 02	2.47																		
GFSC - 03	2.66																		
GFSC - 04	2.53																		
GFSD - 01	2.69	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
GFSD - 02	2.83	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
GFSD - 03	2.63	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
GFSD - 04	2.31	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2

Notes:
BGL= Below Ground Level
Square in bolded line indicates exceedance of Dutch B Level
Shaded square indicates exceedance of Dutch C Level
Full analytical results should be referred to laboratory report

Laboratory Results of QA/QC (ex-GFS building)

Sample Identification	Metals												TPH					PAHs (Low Molecular Weight)						BTEX						Phenols			Halogenated Hydrocarbons - Aliphatics																							
Location	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)	Mercury (Hg)	Arsenic (As)	Cobalt (Co)	Molybdenum (Mo)	Tin (Sn)	Barium (Ba)	C6-C9	C10-C14	C15-C28	C29-C36	Total TPH	Naphthalene	Phenanthrene	Anthracene	1,2-benzopyrene (as benzo(a)pyrene)	Fluoranthene	Pyrene	Benzene	Toluene	Ethylbenzene	m, p-Xylene	o-Xylene	Xylenes	Phenol	2-methylphenol	3/4-methylphenol	1,1-dichloroethene	trans-1,2-dichloroethene	1,1-dichloroethane	cis-1,2-dichloroethene	1,1,1-trichloroethane	1,1-dichloropropylene	Tetrachloromethane	1,2-dichloroethane	trichloroethene	dibromomethane	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
	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Reorting Limit	1.0	1.0	1.0	1.0	1.0	50	0.5	10	1.0	1.0	1.0	1.0	20	25	25	25		0.1	0.1	0.1	0.1	0.1	0.1	1.0	15	15	15	15	-	0.5	0.5	0.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Dutch A	1	20	20	20	20	50	0.2	10	20	5.0	10	50	-	-	-	-	20	0.2	0.1	0.1	0.01	0.02	0.02	0.2	0.5	0.5	-	-	0.5	0.5	0.5	0.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dutch B	**2.5**	**50**	**50**	**50**	**50**	**200**	**0.5**	**30**	**50**	**20**	**30**	**100**	**-**	**-**	**-**	**-**	**200**	**7**	**2**	**2**	**0.2**	**1**	**1**	**1**	**15**	**20**	**-**	**-**	**20**	**15**	**15**	**15**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Dutch C	**10**	**200**	**200**	**200**	**200**	**800**	**2**	**100**	**200**	**100**	**150**	**500**	-	-	-	-	**600**	**30**	**10**	**10**	**1**	**5**	**5**	**5**	**50**	**60**	**-**	**-**	**60**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**
Equipment Blank 1	<1	<1	1.1	1	2	<50	<0.5	<10	<1	<1	1.9	1.8	<20	<25	83	<25	153	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Equipment Blank 2	<1	<1	14	<1	<1	<50	<0.5	<10	<1	<1	<1	1.1	<20	<25	<25	<25	<95	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Equipment Blank 3	<1	<1	16	3.4	<1	<50	<0.5	<10	<1	<1	<1	<1	<20	<25	<25	<25	<95	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Field Blank 1	<1	<1	20	<1	<1	<50	<0.5	<10	<1	<1	1.9	<1	<20	<25	42	<25	112	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Field Blank 2	<1	<1	**72**	<1	<1	<50	<0.5	<10	<1	<1	<1	<1	<20	<25	<25	<25	<95	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Field Blank 3	<1	<1	5.7	1.8	<1	<50	<0.5	<10	<1	<1	<1	<1	<20	<25	<25	<25	<95	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Trip Blank 1	<1	<1	49	<1	<1	<50	<0.5	<10	<1	<1	1.9	<1	<20	<25	28	<25	98	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30	<0.5	<0.5	<0.5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Trip Blank 2	<1	<1	4.3	<1	<1	<50	<0.5	<10	<1	<1	<1	<1	<20	<25	<25	<25	<95	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30																									
Trip Blank 3	<1	<1	9.7	1.5	<1	<50	<0.5	<10	<1	<1	<1	<1	<20	<25	<25	<25	<95	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<15	<15	<15	<15	<30																									

Notes:
Square in bolded line indicates exceedance of Dutch B Level
Shaded square indicates exceedance of Dutch C Level
Full analytical results should be referred to laboratory report

Appendix F

(Groundwater Risk Assessment Results)

Risk-Based Assessment for Groundwater Remediation for ex-GFS building

Table 1 - Source Concentrations & Oral Slope Factor/Oral Reference Dose for Risk Assessment

Parameter	Source Concentration	Sample I.D.	Noncarcinogenic Oral Reference Dose[a] (RfDo)	Minimum Noncarcinogenic Oral Reference Dose[a] (RfDo)	Carcinogenic Oral Slope Factor[b] (CSFo)
	[mg/L]		[mg/kg-day]	[mg/kg-day]	1/[mg/kg-day]
TPHs	7.40E-01	GFSD-03	3.00E-02 to 5.00E+00	3.00E-02	Not applicable
Barium	6.80E-01	GFSD-02	7.00E-02	Not applicable	Not applicable
Cadmium	2.70E-02	GFSD-03	5.00E-04	Not applicable	Not applicable
Chromium*	6.40E-02	GFSA-21	3.00E-03	Not applicable	Not applicable
Copper	7.20E-02	Field Blank 2	4.00E-02	Not applicable	Not applicable
Lead	2.10E+00	GFSD-02	3.60E-03	Not applicable	Not applicable
Zinc	1.00E+00	GFSD-02	3.00E-01	Not applicable	Not applicable
Mercury	1.20E-03	GFSA-17	3.00E-04	Not applicable	Not applicable
Cobalt	2.00E-01	GFSD-03	2.00E-02	Not applicable	Not applicable
Molybdenum	3.90E-02	GFSA-19	5.00E-03	Not applicable	Not applicable
Xylenes	3.00E-02	All	2.00E-01	Not applicable	Not applicable

[a] Source for TPHs : TPH Criteria Working Group, 1999. *Total Petroleum Hydrocarbons Criteria Working Group Series Volume 5 – Human Health Risk-Based Evaluation of Petroleum Release Sites: Implementing the Working Group Approach*. Massachusetts, U.S.A., Amherst Scientific Publishers.

* Chromium is assumed to be Cr(VI) as conservative assessment.

Source for Ba, Cd, Cr, Co, Cu, Mo, Zn, Hg, Xylenes : USEPA Region IX Risk-based Concentration Table (revised on Oct 04), USEPA Region IX.

Source for Pb: The value is referenced to the tolerable daily intake (TDI) from the National Institute of Public Health and the Environment (RIVM), The Netherlands, 2001.

[b] Source for TPHs, Ba, Cd, Co, Cr, Cu, Mo, Pb, Zn, Hg, Xylenes: USEPA Region IX Risk-based Concentration Table (revised on Oct 04), USEPA Region IX.

Assumptions:

Exposure Pathway:

The applicable and dominant complete pathway is considered to be direct groundwater ingestion.

Receptor:

The most sensitive receptors are considered to be the construction workers.

Input Parameters for Calculations (for Direct Groundwater Ingestion):

IR = water ingestion rate [L/day] =	0.02	(The assumed water ingestion rate of 0.02 L/d is two orders of magnitude lower than the USEPA default drinking water rate of 2 L/day for adults. In addition, the 0.02 L/d water ingestion rate was adopted for many groundwater risk assessment in previous land contamination studies, such as South East Kowloon Development Infrastructure at North Apron Area of Kai Tak Airport; Reclamation Works for DOS&GIC Facilities in North Tsing Yi and Decommissioning of Cheoy Lee Shipyard at Penny's Bay EIA Study. As a result, the assumed water ingestion rate of 0.02L/d is adequate for groundwater risk assessment.)
EF = exposure frequency [day/yr] =	180	(assume construction workers expose for 6 months of site formation works)
ED = exposure duration [yr] =	1	
BW = body weight [kg] =	70	
AT = Averaging time [day] =	365	(for non-carcinogens: ED x 365 days)
	25550	(for carcinogens: 70 yrs x 365 days)

Risk-Based Assessment for Groundwater Remediation for ex-GFS building

Table 2 - Calculations for Direct Groundwater Ingestion

Calculations	TPHs	Barium	Cadmium	Chromium*	Copper	Lead	Zinc	Mercury	Cobalt	Molybdenum	Xylenes
1. Groundwater conc. [mg/L] =	7.40E-01	6.80E-01	2.70E-02	6.40E-02	7.20E-02	2.10E+00	1.00E+00	1.20E-03	2.00E-01	3.90E-02	3.00E-02
2. Natural attenuation factor =	1	1	1	1	1	1	1	1	1	1	1
3. Exposure medium [mg/L] = (1) / (2) =	7.40E-01	6.80E-01	2.70E-02	6.40E-02	7.20E-02	2.10E+00	1.00E+00	1.20E-03	2.00E-01	3.90E-02	3.00E-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	1.41E-04
5. Average Daily Intake Rate [mg/kg/day] = (3) x (4) =	1.04E-04	9.58E-05	3.80E-06	9.02E-06	1.01E-05	2.96E-04	1.41E-04	1.69E-07	2.82E-05	5.50E-06	4.23E-06
6. Maximum Pathway Intake [mg/kg/day] = (groundwater ingestion as dominant pathway)	1.04E-04	9.58E-05	3.80E-06	9.02E-06	1.01E-05	2.96E-04	1.41E-04	1.69E-07	2.82E-05	5.50E-06	4.23E-06
7. Maximum Toxicant Intake Rate [mg/kg/day] =	1.04E-04	9.58E-05	3.80E-06	9.02E-06	1.01E-05	2.96E-04	1.41E-04	1.69E-07	2.82E-05	5.50E-06	4.23E-06
8. Noncarcinogenic Oral Reference Dose [mg/kg-day] =	3.00E-02	7.00E-02	5.00E-04	3.00E-03	4.00E-02	3.60E-03	3.00E-01	3.00E-04	2.00E-02	5.00E-03	2.00E-01
9. Individual Chemical of Concern Hazard Index = (7) / (8) =	3.48E-03	1.37E-03	7.61E-03	3.01E-03	2.54E-04	8.22E-02	4.70E-04	5.64E-04	1.41E-03	1.10E-03	2.11E-05
10. Maximum Carcinogenic Intake Rate [mg/kg/day] =											
11. Carcinogenic Oral Slope Factor (1/[mg/kg-day]) =											
12. Individual Chemical of Concern (COC) Risk = (10) x (11) =											
Total pathway hazard index = (after adding contributions from all chemical of concern)	**1.01E-01**	(< 1 (USEPA recommended hazard index))									
Total pathway carcinorgenic risk = (contribuited by Bezo(a)Pyrene and Benzene)	**Nil**	(< 1.00E-06 (USEPA lifetime cancer risk level))									

	TPHs	Barium	Cadmium	Chromium*	Copper	Lead	Zinc	Mercury	Cobalt	Molybdenum	Xylenes
RBSL [mg/L] = Min. of (Groundwater Conc./ Hazard Quotient) or (Groundwater Conc. x Cancer Risk / Risk of Contaminant)											
= Minimum of	**2.13E+02**	**4.97E+02**	**3.55E+00**	**2.13E+01**	**2.84E+02**	**2.56E+01**	**2.13E+03**	**2.13E+00**	**1.42E+02**	**3.55E+01**	**1.42E+03**
	>>	>>	>>	>>	>>	>>	>>	>>	>>	>>	>>
Groundwater conc. [mg/L] =	**7.40E-01**	**6.80E-01**	**2.70E-02**	**6.40E-02**	**7.20E-02**	**2.10E+00**	**1.00E+00**	**1.20E-03**	**2.00E-01**	**3.90E-02**	**3.00E-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)	(in mg/L)
Risk	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Appendix G

(Hot Works Requirements for Petrol Filling Station)

Hot Works Requirements for Petrol Filling Station

1 A work permit for hot work should be issued by the supervisor of the PFS himself or a competent staff appointed by him.

2 The supervisor of the PFS himself or the competent staff appointed by him should sign on the permit certifying that the following safety measures have been taken before the work commences:

(a) Explosive gas tests have been conducted to ensure that the area where hot work would be conducted is free from explosives and flammable conditions.

(b) The hot work area has been cordoned off from unauthorized persons.

(c) In the course of hot work, all fuel supply to/from the affected oil tank(s) or the affected section(s) of the pipeline system has been temporarily suspended/cut off.

(d) Appropriate precautionary measures have been taken to prevent any liquid contaminated with petroleum substance(s) from approaching the area where the work is being carried out. This may be achieved by the provision of liquid retaining walls/bunds, firewalls or screens, etc. where necessary according to the situation of work site.

(e) Any sewers, drains or ducts in the vicinity of the hot work have been checked to ensure that they are clear of any oil residue. If necessary, the sewers, drains or ducts should be sealed off or protected suitably by fire resisting covers.

(f) Special precautions for fire protection should be taken where necessary. These include the provision for cooling adjacent tanks and clearing away or wetting down combustibles.

3 Clear instructions on actions to be taken to prevent the outbreak of fire as well as in the event of fire to be displayed in a prominent position of the affected works area(s) and should be given to all workers engaged on works.

4 Earthing of all electrical installation and equipment to be properly provided.

5 Fire resisting shield with 2 hours F.R.P. should be provided to limit the spreading of heat and globules of molten metal over a wide area during the hot work operation.

6 "HOT WORK IN PROGRESS 高溫/明火工程在進行中" notices in block letters and characters of not less than 125mm high with 15mm strokes to be displayed in a prominent position of the affected works area(s).

7 A staff with one 4.5 kg dry powder fire extinguisher and two sand buckets to be assigned to standby at each works area where hot work is in progress.

8 Upon completion of hot work, the area should be thoroughly inspected to ensure safety from the outbreak of fire before being left unattended.

9 All fire precautionary measures as stipulated in Part 19 of the Model Codes of Safe Practice for the Petroleum Industry: Fire Precautions at petroleum refineries and bulk storage installations to be properly observed.