

**Land Contamination Study
for the Extension of Public Golf Course
at Kau Sai Chau, Sai Kung**

Contamination Assessment Report

Reference : R067-7.06
Client : China Harbour Engineering Company Limited
Prepared by : CH2M HILL Hong Kong Limited
Date : July 2006


For and on behalf of CH2M HILL Hong Kong Limited

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We confirm that this CAR conforms to the information and recommendations contained in the Approved EIA Report (Condition 2.4 of the Environmental Permit EP-224/2005).

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LIST OF ABBREVIATIONS

Approved EIA Report	Environmental Impact Assessment Report on the Extension of Public Golf Course at Kau Sai Chau, Sai Kung, approved by the EPD in November 2005 (EIAO Register No. AEIAR-091/2005)
Approved CAP	Contamination Assessment Plan prepared by the Consultant (CH2M's report ref.: R420-5.05 dated January 2006) and approved by the EPD in February 2006 (Ref. (36) in EP2/N8/O/47 IV)
Assignment	Land Contamination Study for the Extension of Public Golf Course at Kau Sai Chau, Sai Kung
CAP	Contamination Assessment Plan
CAR	Contamination Assessment Report
CHEC	China Harbour Engineering Company Limited
Client	China Harbour Engineering Company Limited
COC	Chain-Of-Custody
Consultant	CH2M HILL Hong Kong Limited (formerly traded as CH2M-IDC Hong Kong Limited)
Dutch List	Soil Criteria used in the Netherlands for Contaminated Land, and adopted by EPD as a General Guideline in Hong Kong
EIA	Environmental Impact Assessment
EIAO	Environmental Impact Assessment Ordinance (Cap. 499)
EP	Environmental Permit
EPD	Environmental Protection Department
ET	Environmental Team
Guidance Notes	Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repair/Dismantling Workshops, EPD (1999).
HKSAR	Hong Kong Special Administrative Region
HOKLAS	Hong Kong Laboratory Accreditation Scheme
IEC	Independent Environmental Checker
Laboratory	The HOKLAS accredited laboratory procured by the Consultant (Lam Geotechnics Limited)
Main Contractor	China Harbour Engineering Company Limited
PCAP	Preliminary Contamination Assessment Plan (as included in Section 11.8 of the Approved EIA Report)
PPE	Personal Protective Equipment
Project	Extension of Public Golf Course at Kau Sai Chau, Sai Kung
ProPECC Note	Practice Note for Professional Persons – Contaminated Land Assessment and Remediation, EPD (PN3/94)
QA/QC	Quality Assurance / Quality Control
RAP	Remediation Action Plan
SI	Site Investigation
SI Contractor	The contractor responsible for the site investigation works procured by the Consultant (Lam Geotechnics Limited)
Study Area	The area covered under the Project, i.e. Extension of Public Golf Course at Kau Sai Chau, Sai Kung
Supplementary SI	Supplementary Site Investigation

1. INTRODUCTION

1.1 Background Information

- 1.1.1 CH2M HILL Hong Kong Limited (formerly traded as CH2M-IDC Hong Kong Limited) (the Consultant) has been commissioned by the China Harbour Engineering Company Limited (CHEC or the Client) to undertake the land contamination study for the Project “Extension of Public Golf Course at Kau Sai Chau, Sai Kung” (the Assignment). The concerned area of the Assignment (Study Area) is located at the eastern part of Kau Sai Chau Island, Sai Kung, immediately south and east of the existing golf course. Figure 1-1 shows the location of the Study Area.
- 1.1.2 The construction and operation of an 18-hole public golf course is the major component of the overall Project, which also includes the construction and/or operation of other facilities such as a closed low flow drainage system, desalination facilities, and temporary barging point (construction phase only).
- 1.1.3 The Study Area is currently undeveloped, comprising scrubland and incised stream courses. It is reported that there are a number of locations within the Study Area where the former landuse as an artillery firing range has removed the thin surface vegetation that the resultant bare ground has led to surface soil erosion due to runoff. There has been no formal activity in this area since its cessation of use as an artillery firing range; with on-going checking of unexploded ordnance (none detected) during the current Project.
- 1.1.4 As it is reported that the artillery firing range on Kau Sai Chau Island was used between the 1930’s and mid-1970’s, it is possible that such previous landuse might induce contamination to the soil and groundwater. The assessment of the potential environmental issues related to land contamination and the potential for the occurrence of soil contamination within the Study Area has been addressed in Section 11 of the Approved Environmental Impact Assessment Report, EIAO Register No. AEIAR-091/2005 (the “Approved EIA Report”); and a Preliminary Contamination Assessment Plan (PCAP) was prepared as presented in Section 11.8 of the Approved EIA Report.
- 1.1.5 As recommended in the Approved EIA Report, further land contamination assessment during the construction phase of the Project is required. In addition, the work related to land contamination is warranted as described in Condition 2.4 of the Project Environmental Permit (EP) No. EP-224/2005 and quoted as follows:

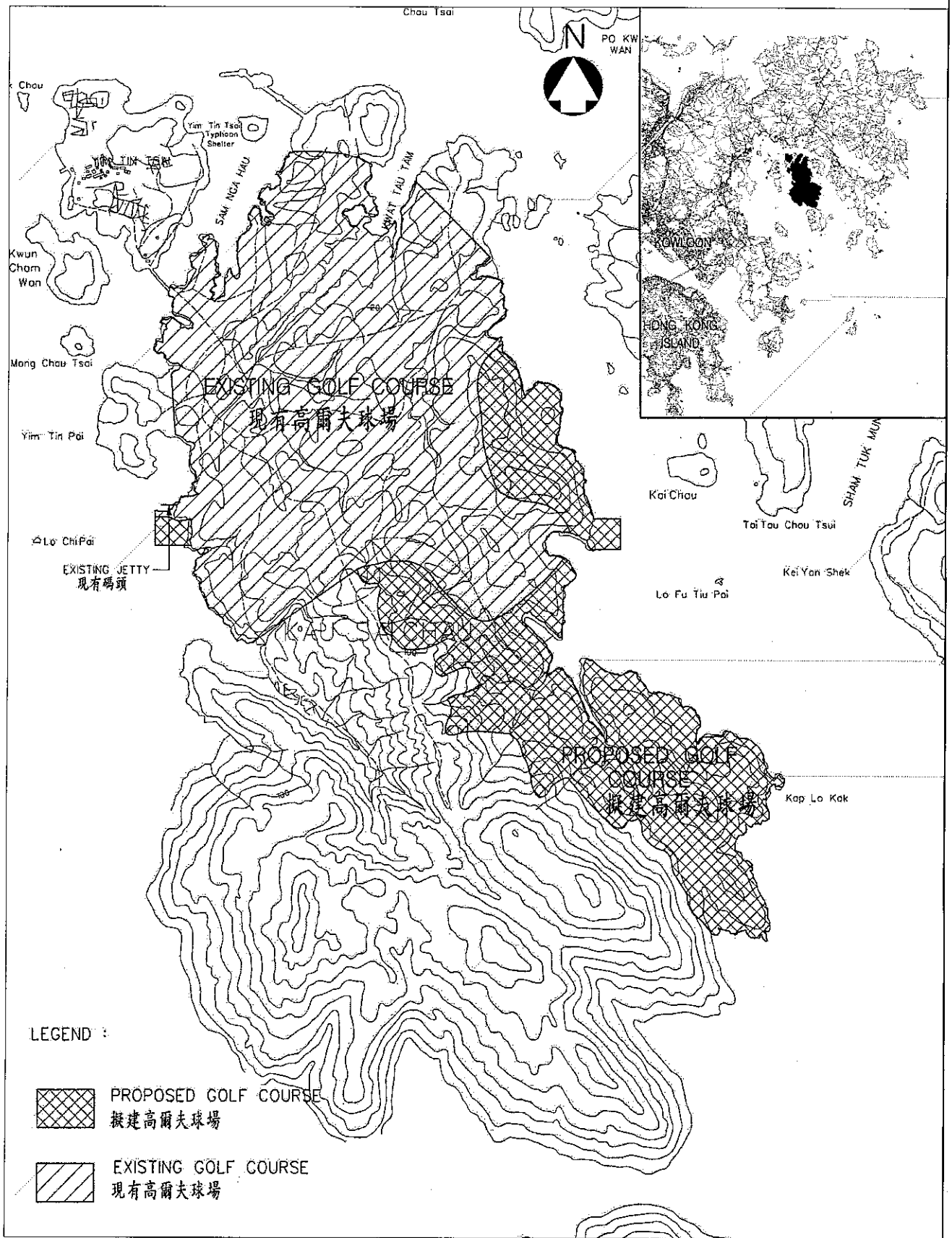
The Permit Holder shall, at least one month before the commencement of construction at the potentially contaminated land as indicated in Figure 2, submit to the Director for approval 3 hard copies and one electronic copy of the Contamination Assessment Plan (CAP) with exact sampling locations and testing parameters. A site investigation shall be carried out in accordance with the approved CAP. If land contamination is confirmed by the site investigation, the Permit Holder shall submit to the Director for approval 3 hard copies and one electronic copy of a Remediation Action Plan (RAP) including a Contamination Assessment Report (CAR). All remediation actions in the approved RAP shall be fully and properly implemented. No work on the identified potentially contaminated sites shall be carried out unless and until the CAP and RAP submitted under this condition are approved by the Director. Before submission to the Director, all plans and reports shall be certified by the ET Leader and verified by the IEC as conforming to the information and recommendations contained in the EIA Report.

1.1.6 A CAP was prepared by the Consultant (CH2M HILL's report ref.: R420-5.05 dated January 2006) and approved by the Environmental Protection Department (EPD) in February 2006 (Ref. (36) in EP2/N8/O/47 IV) (the "Approved CAP"). Detailed site investigation (SI) and laboratory analyses were subsequently conducted in February, May and June 2006 in accordance with the Approved CAP. This Contamination Assessment Report (CAR) serves to document the SI and laboratory results, and determine whether contamination exists in the Study Area which warrants the preparation of a Remediation Action Plan (RAP) and subsequent remediation.

1.2 Objectives and Outline

1.2.1 This CAR has been prepared following the guidance and steps outlined in the Practice Note for Professional Persons – Contaminated Land Assessment and Remediation ProPECC PN3/94 (ProPECC Note) and the Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repair/Dismantling Workshops (Guidance Notes), both published by the EPD of the Government of HKSAR. This CAR is structured as follows:

- Description of the Project and the objectives of this CAR as described in this Section 1;
- Site Investigation (SI), including methodology, preparation works, as-constructed details and observations, in Section 2;
- Assessment methodology of land contamination and laboratory analyses in Section 3;
- Details of the Supplementary Site Investigation in Section 4;
- Extent of Soil Contamination in Section 5; and
- Conclusions and Recommendations in Section 6.



Source: Fig. 1.1 of the Approved EIA Report

<p>Title: Location of the Study Area for the Land Contamination Study on Kau Sai Chau</p>	<p>CH2M HILL Hong Kong Limited</p>
<p>Project: Land Contamination Study for the Extension of Public Golf Course at Kau Sai Chau, Sai Kung - Contamination Assessment Report</p>	<p>Scale: NTS Figure: 1-1</p>

2. SITE INVESTIGATION

2.1 Introduction

2.1.1 This Section presents a summary of SI and fieldwork observations and factual information.

2.2 Procedures and Supervision

2.2.1 As required under the Approved CAP, the Main Contractor (CHEC) for safety reasons swept the vicinity of the sampling locations with a metal detector to check for the presence of unexploded ordnance prior to soil sampling fieldworks. It was confirmed from the Main Contractor that metal sweeping had been conducted at all sampling locations and no detection of metals was experienced.

2.2.2 In this assignment, Lam Geotechnics Limited was appointed and procured by the Consultant as the SI Contractor for site investigation works.

2.2.3 The fieldwork was then undertaken by the SI Contractor on 14 and 15 February 2006 under full-time management and on-site supervision by the Consultant and CHEC. Representatives from the Environmental Team (ET) and the Independent Environmental Checker (IEC) also joined the fieldwork sampling supervision in the morning of 14 February 2006.

2.2.4 Hand augering was adopted for the soil sampling, as described in the Approved CAP.

2.2.5 Health and safety procedures as described in the Approved CAP, such as provision of personal protective equipment (PPE), safety briefing to SI Contractor, prohibition of smoking or eating, etc. were implemented during the course of fieldwork.

2.2.6 All equipment in contact with the soil was decontaminated prior to use by rinsing thoroughly with potable water. A clean area immediately adjacent to the sampling location was established, using a plastic sheet, on which all cleaned equipment was placed.

2.2.7 As reported in the Approved CAP, boreholes at each location were drilled manually by means of a hand auger, with samples to be obtained at 0.5m, 1.5m and 3.0m below ground level for analyses of Lead (Pb) and Total Sulphur (S), subject to sub-surface geological conditions of the sampling locations at time of the SI. Sampling would stop if bedrock or hardstanding was encountered.

2.2.8 A total of twelve (12) soil samples from five (5) sampling locations were collected at depths shown in Table 2-1; with all soil samples accompanied by the following information:

- Sample identification number;
- Date and location number where sample was collected;
- Soil sampling depth (m below ground level);
- Volume and/or weight of soil sample;
- Qualitative physical characteristics (clay, silt, sand, gravel, stone, cobble, colour, odour, moisture, etc.); and
- Colour photograph.

2.2.9 No groundwater was encountered in any of the five sampling locations, therefore no groundwater monitoring well was constructed and no groundwater sample was collected.

2.3 Sampling Locations

- 2.3.1 A “hotspot” approach was adopted in the Approved EIA Report with reference to the identified previous landuses within the Study Area resulting in five follow-up sampling locations for further SI for land contamination assessment.
- 2.3.2 Referring to the Approved CAP, some adjustments were made to the five proposed sampling locations (as detailed in the Approved EIA Report) based on the following criteria:
- In the vicinity of the initial land contamination assessment locations (as detailed in the EIA Report);
 - In an area of maximum excavation; and
 - In the vicinity of the erosion scar, if such existed during initial land contamination assessment (note that there are no such features existing at Location L2 and Location L3).
- 2.3.3 Also, as mentioned in the Approved CAP, the actual sampling locations for the SI would be determined by the Consultant on-site during fieldwork taking into account the following considerations:
- Site conditions and sub-surface geological conditions of the sampling locations (i.e. sampling location was shifted to where encountering of bedrock or hardstanding would not be likely at the ground surface);
 - In closest proximity to the sampling locations as detailed in the Approved CAP; and
 - In closest proximity to an erosion scar, and away from dense vegetation.
- 2.3.4 The selected sampling locations for the SI are detailed in Table 2-1. The as-constructed coordinates (i.e. Northings and Eastings according to HK1980 Grid) for the sampling locations were then surveyed by the Main Contractor. The coordinates, sampling depths and particulars of the fieldwork are also summarised in Table 2-1. In addition, site photos taken during the course of the SI are included in Appendix 1 for reference.

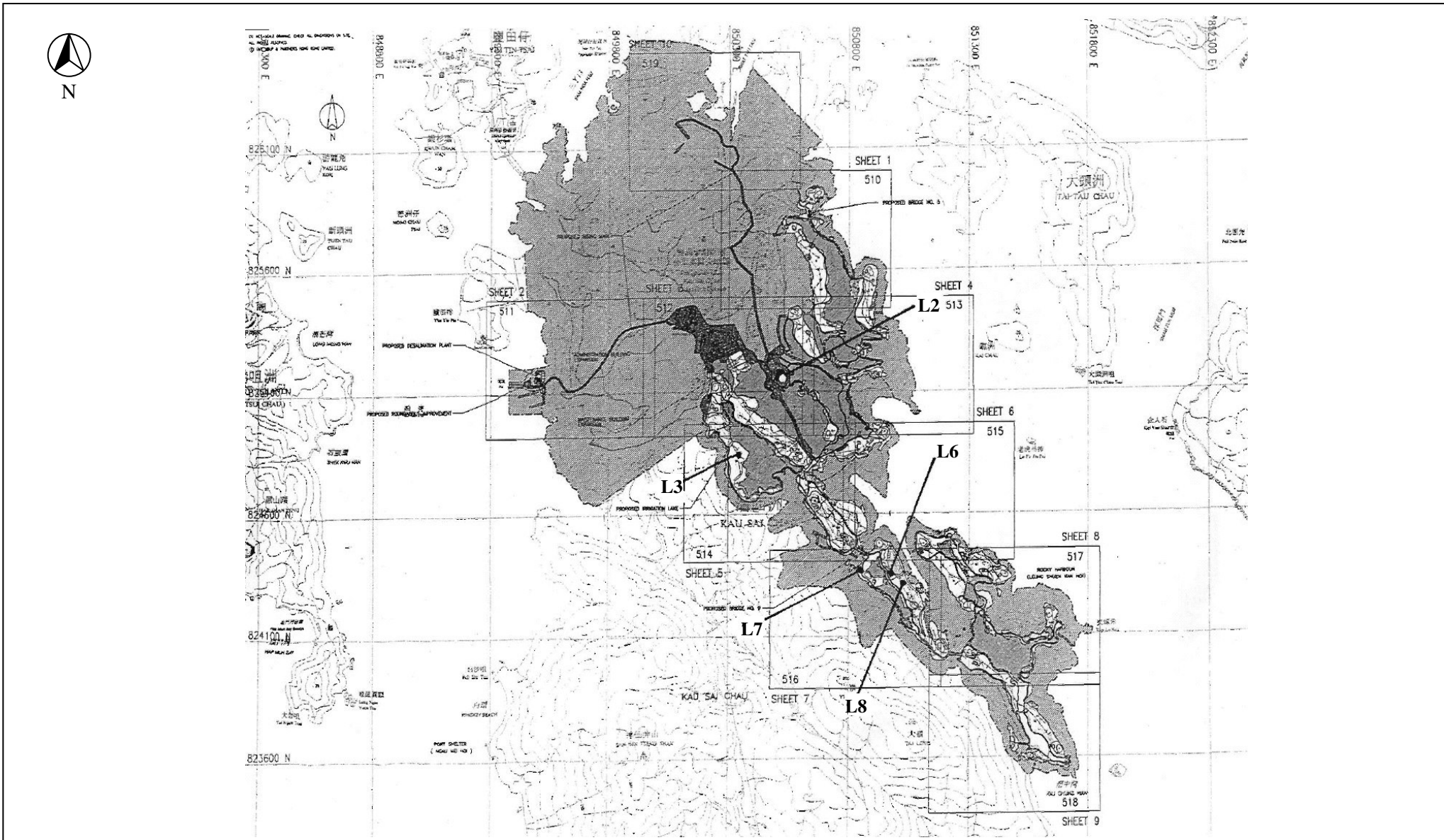
Table 2-1 As-constructed Details of Land Contamination Sampling Locations

Sampling Location and Date	Original Coordinates Contained in Approved CAP	As-constructed Coordinates during Fieldwork	Surrounding Environs and Observations
L2 (14 Feb 2006)	N: 825 150 E: 850 520 Proposed sampling depths: 0.5m, 1.5m, 3.0m	N: 825 152.410 E: 850523.064 Elevation: +26.439mPD Actual sampling depths: 0.5m, 1.5m Termination depth: 1.8m Encountered bedrock at 1.8m Remark: the selected location is in close proximity to that proposed in the Approved CAP.	The flat grassland of the golf course, scrubland and access road are next to the location. For the first 0.3m depth, the soil was dark brown in color. At 0.5m, the soil was sandy and brown in color. At 1.5m, the soil was sandy and khaki in color.

Sampling Location and Date	Original Coordinates Contained in Approved CAP	As-constructed Coordinates during Fieldwork	Surrounding Environs and Observations
L3 (15 Feb 2006)	N: 824 850 E: 850 350 Proposed sampling depths: 0.5m, 1.5m, 3.0m	N: 824 845.051 E: 850 350.793 Elevation: +99.411mPD Actual sampling depths: 0.5m, 1.5m Termination depth: 1.9m Encountered bedrock at 1.9m Remark: the selected sampling location is shifted 5m in the southern direction to avoid encountering of bedrock.	The sampling location was surrounded with grass and short scrubs. The soil was brown in color at 0.5m. The silty/sandy soil is reddish brown in the sample at 1.5m.
L6 (14 Feb 2006)	N: 824 400 E: 850 960 Proposed sampling depths: 0.5m, 1.5m, 3.0m	N: 824 330.807 E: 850 971.192 Elevation: +23.117mPD Actual sampling depths: 0.5m, 1.5m Termination depth: 1.9m Encountered bedrock at 1.9m Remark: the selected location is shifted to close proximity to the erosion scar and away from vegetation.	The sampling location was bare ground and full of cobbles. Vegetation was distributed on the slope facing to the sea. The soil was brown in color and sandy/silty in nature to 1.9m.
L7 (15 Feb 2006)	N: 824 370 E: 850 850 Proposed sampling depths: 0.5m, 1.5m, 3.0m	N: 824 371.703 E: 850 849.051 Elevation: +41.944mPD Actual sampling depths: 0.5m, 1.5m, 2.5m Termination depth: 2.5m Encountered bedrock at 2.5m Remark: the selected location is in close proximity to that proposed in the Approved CAP.	Erosion scar on top of a hill/ridge and vegetation was found scattered across the area. The brown soil at 0.5m was silty in nature. The soil sampled at 1.5m was brown clay and plastic-like in nature. At 2.5m, the soil was light brown silty sand.
L8 (14 Feb 2006)	N: 824 320 E: 851 000 Proposed sampling depths: 0.5m, 1.5m, 3.0m	N: 824 330.807 E: 851 016.126 Elevation: +22.446mPD Actual sampling depths: 0.5m, 1.5m, 3.0m Termination depth: 3.0m Remark: the selected sampling location is shifted in the middle of an erosion scar to avoid the rocky surfaced slope.	Erosion scar on top of a hill/ridge and the environs are full of cobble on the ground surface. Vegetation and scrubs were at the perimeter of the sampling location. The soil was yellowish brown silt for the samples at 0.5m and 1.5m. At 3.0m, the sample was sandy and greyish white in color.

2.4 Sampling, Description, Preservation and Delivery to Laboratory

- 2.4.1 Soil samples obtained at the required depths were spread on clean plastic sheet adjacent to the sampling location for examination by the Consultant. The Consultant then indicated the portion of soil to be collected and it was transferred to a sealable plastic bag. Approximately 2kg of soil was collected for each soil sample.
- 2.4.2 All of the soil samples were natural sandy/silty material with apparent low moisture content. One exception was at 0.5m below ground at Sampling Location L2, which was reported to be imported fill from an excavation location elsewhere on Kau Sai Chau placed during the construction of the existing golf course. No particular discoloration of soil or odour was noticed by the Consultant.
- 2.4.3 The samples were properly labelled and then preserved on-site by placing them within an ice chest below 4°C but not frozen. The whole ice chest was delivered by the SI Contractor to the appointed HOKLAS accredited Laboratory on the same day of sample collection, accompanied with the completed chain-of-custody (COC) forms. The acknowledgement COC forms returned from the Laboratory are provided in Appendix 3 for information.



Title: As-constructed Land Contamination Sampling Locations		CH2M HILL Hong Kong Limited	
Project: Land Contamination Study for the Extension of Public Golf Course at Kau Sai Chau, Sai Kung - Contamination Assessment Report		Scale: NTS	Figure: 2-1

3. ASSESSMENT METHODOLOGY AND LABORATORY ANALYSIS

3.1 Introduction

3.1.1 This Section presents the assessment methodology for land contamination and the results of laboratory analyses for the collected samples during the SI.

3.2 Assessment Methodology

Dutch List

3.2.1 ProPECC Note (PN3/94) refers to the guideline developed in the Netherlands for the assessment of contaminated land (“Dutch List”). The Dutch List is a series of generic numerical standards and is one of the most comprehensive references worldwide for land contamination assessment. The said criteria consist of three levels of standards for a range of contaminants, representing the following three scenarios:

- Level A – implies unpolluted
- Level B – implies potential pollution, requiring further investigation or remediation
- Level C – implies pollution and necessity for remediation

3.2.2 The EPD has adopted the Dutch List as a general guideline in Hong Kong. In this CAR, the land contamination assessment was carried out based on the Dutch List. Table 3-1 below summarises the criteria for the parameters investigated (i.e. Lead and Total Sulphur).

Table 3-1 Assessment Criteria Adopted from Dutch List for Soil Contamination

Parameter	Dutch List Level	Soil (mg/kg dry soil)		
		Level A	Level B	Level C
Heavy Metal / Inorganics				
Lead (Pb)		50	150	600
Total Sulphur (S)		2	20	200

3.2.3 For soil contamination assessment, Dutch B levels are adopted as the criteria to determine whether the soil is contaminated. Soil samples identified with Dutch B exceedance is considered contaminated and the strata/proximity of the soil would require remediation.

3.3 Laboratory Analysis

3.3.1 In this Assignment, Lam Geotechnics Limited (HOKLAS-accredited laboratory for environmental testing, Registration No. HOKLAS 013) (Laboratory) was appointed and procured by the Consultant as the Laboratory for analysis of soil samples.

3.3.2 According to the Approved CAP, the parameters of laboratory analysis for all soil samples are detailed in Table 3-2.

Table 3-2 Parameters of Laboratory Analysis for Site Investigation

Target Contaminant(s)	Reference Analytical Method	Soil Reporting Limit ¹ (mg/kg dry weight)
Lead (Pb)	Analysis: USEPA 6020A / ICPMS	15
Total Sulphur	Analysis: APHA 4500S D	2

Note:

1. Reporting Limit refers to the minimum concentration that can be reported by the overall test procedures employed by the Laboratory. For a particular test, it refers to the overall precision that covers the proposed sample preparation and test methods, instruments and personnel employed and other elements as covered by the QA/QC system for such a test. The reporting limits are adopted to be 1/10 of the Dutch B standards as referred to in the EPD's ProPECC PN 3/94 for the respective contaminants.

3.4 Laboratory Analytical Results

- 3.4.1 A summary of the soil samples analysed by the Laboratory is given in Table 3-3 below. The detailed laboratory analysis report is provided in Appendix 4 of this CAR.

Table 3-3 Summary of Analysed Soil Samples

Location	Depth of Soil Sample (m below ground level)	Lead (mg/kg dry weight)	Total Sulphur (mg/kg dry weight)
L2	0.5	38	<2
	1.5	87	<2
L3	0.5	55	<2
	1.5	67	<2
L6	0.5	51	<2
	1.5	78	<2
L7	0.5	34	<2
	1.5	29	<2
	2.5	100	<2
L8	0.5	33	<2
	1.5	31	<2
	3.0	54	<2
Dutch B Criteria		150	20

3.5 Discussion

- 3.5.1 As shown in Table 3-3, no soil samples with analytical results exceeding Dutch B criteria were identified.
- 3.5.2 Although no exceedance of contamination assessment criteria was confirmed from the SI, the discrete hotspot of Lead (Pb) exceedance at original sampling location 3 presented in the Approved EIA Report shall instigate environmental concerns of land contamination at that discrete hotspot.
- 3.5.3 Supplementary Site Investigation (the "Supplementary SI") was therefore proposed to address and delineate the extent of contamination at the concerned discrete location, hereafter referred as "OL3, Pt1". The details of the Supplementary SI are presented in Section 4 below.

4. SUPPLEMENTARY SITE INVESTIGATION

4.1 Introduction

4.1.1 This Section presents a summary of the Supplementary SI and fieldwork observations and factual information.

4.1.2 The purpose of this Supplementary SI was to define and locate the extent of contamination in four compass directions of OL3, Pt1. Soil samples at two (2) metres extended in each compass direction from the concerned location were obtained for laboratory analysis of Lead (Pb). If contamination is identified, the same exercise in the three “out-going” compass directions shall apply. The logic is repeated until soil samples in all “out-going” compass directions showed no contamination of Pb.

4.2 Procedures and Supervision

4.2.1 Hand augering was adopted for all the soil sampling exercises which were undertaken by the Main Contractor on 16 May 2006 and 6 June 2006 under full-time management and on-site supervision by the Consultant.

4.2.2 Boreholes at each locations was drilled manually by means of a hand auger and samples at the surface (5cm to 10cm), 0.5m, 1.5m and 3.0m below ground level were obtained for analyses of Lead (Pb), subject to sub-surface geological conditions of the sampling locations at time of the Supplementary SI. Sampling was stopped if bedrock or hardstanding was encountered.

4.2.3 A total of thirteen (13) soil samples from the five (5) Supplementary SI locations (OL3 Pt1 through Pt5) and a total of nine (9) soil samples from the three (3) additional locations (A1 through C1) were collected at depths shown in Table 4-1 and Table 4-2 respectively; with all soil samples accompanied with the following information:

- Sample identification number;
- Date and location number where sample was collected;
- Soil sampling depth (m below ground level);
- Weight of soil sample;
- Qualitative physical characteristics (clay, silt, sand, gravel, stone, cobble, colour, odour, moisture, etc.); and
- Colour photograph.

4.2.4 All equipment in contact with the soil was thoroughly decontaminated prior to use by rinsing thoroughly with potable water. A clean area immediately adjacent to the sampling location was established, using a plastic sheet, on which all cleaned equipment was placed.

4.2.5 No groundwater was encountered in any of the sampling locations, therefore no groundwater monitoring well was constructed and no groundwater sample was collected.

4.3 Description of Soil Sampling Sequence

4.3.1 In the first round of Supplementary SI, soil sampling was conducted at sampling location OL3, Pt1 and four (4) surrounding compass locations (OL3 Pt2 to OL3 Pt5) selected within 2m from that location (OL3, Pt1). Refer to Table 4-1 for detailed descriptions of these five (5) Supplementary SI locations.

- 4.3.2 With reference to the laboratory results in the first round of Supplementary SI (see Table 4-3), only Pb exceedance at OL3 Pt4 was identified and there was no Pb exceedance at other locations. Subsequently, soil sampling was conducted at three (3) additional locations (referred to as “A1, B1 and C1”) selected within 2m from OL3 Pt4 to quantify the extent of identified contamination. Please refer to Table 4-2 for detailed descriptions of these three (3) additional locations.
- 4.3.3 Since the laboratory results of Pb at all soil samples obtained from the three additional locations showed no exceedance (see Table 4-4), the boundary or extent of contamination is thus defined. Figure 4-1 presents the as-constructed Supplementary SI sampling locations.

4.4 Sampling Locations

- 4.4.1 Particulars of all selected sampling locations for the Supplementary SI are detailed in Table 4-1 and Table 4-2. The as-constructed coordinates (i.e. Northings and Eastings according to HK1980 Grid) for all sampling locations were surveyed by the Main Contractor. In addition, site photos taken during the course of the Supplementary SI are included in Appendix 2 for reference.

Table 4-1 As-constructed Details of the Supplementary SI Sampling Locations

Sampling Location and Date	As-constructed Coordinates	Surrounding Environs and Observations
OL3 Pt1 (16 May 2006)	N: 824 850.000 E: 850 350.000 Elevation: +98.928mPD Actual sampling depths: Surface, 0.5m Termination depth: 0.6m Encountered bedrock at 0.6m	The sampling location was bare ground with rare surface vegetation; slight disturbance to the soil due to previous works was observed. The soil at surface level was sandy in nature. At 0.5m, the soil was brown clay.
OL3 Pt2 (16 May 2006)	N: 824 851.537 E: 850 348.720 Elevation: +98.669mPD Actual sampling depths: Surface, 0.5m, 1.5m Termination depth: 1.9m Encountered bedrock at 1.9m	The sampling location was bare ground with rare surface vegetation; slight disturbance to the soil due to previous works was observed. Surface soil was reddish brown and sandy. The soil was sandy and white from 0.5m to 1.5m.
OL3 Pt3 (16 May 2006)	N: 824 851.280 E: 850 351.537 Elevation: +99.859mPD Actual sampling depths: Surface, 0.5m, 1.2m Termination depth: 1.3m Encountered bedrock at 1.3m	The sampling location was bare ground with rare surface vegetation; slight disturbance to the soil due to previous works was observed. Surface soil was sandy and dark-brown in colour. From 0.5m to 1.2m, soil was sandy and white.

Sampling Location and Date	As-constructed Coordinates	Surrounding Environs and Observations
OL3 Pt4 (16 May 2006)	N: 824 848.463 E: 850 351.280 Elevation: +99.112mPD Actual sampling depths: Surface, 0.5m Termination depth: 0.6m Encountered bedrock at 0.6m	The sampling location was bare ground with rare surface vegetation; slight disturbance to the soil due to previous works was observed. Surface soil was sandy and brown. At 0.5m, soil was sandy and white.
OL3 Pt5 (16 May 2006)	N: 824 848.720 E: 850 348.463 Elevation: +98.231mPD Actual sampling depths: Surface, 0.5m, 1.5m Termination depth: 2m Encountered bedrock at 2m	The sampling location was bare ground with rare surface vegetation; slight disturbance to the soil due to previous works was observed. Soil from surface level to 0.5m was brown clay. Soil at 1.5m was white and sandy.

Table 4-2 As-constructed Details of the Additional Three SI Sampling Locations

Sampling Location and Date	As-constructed Coordinates	Surrounding Environs and Observations
A1 (6 June 2006)	N: 824 846.892 E: 850 349.637 Elevation: +99.383mPD Actual sampling depths: Surface, 0.5m, 1.5m, 2.4m Termination depth: 2.6m Encountered bedrock at 2.6m	The sampling location was bare ground with rare surface vegetation; slight disturbance to the soil due to previous works was observed. The soil from surface level to 0.5m was brown clay. From 1.5m to 2.4m, the soil was sandy and white.
B1 (6 June 2006)	N: 824 847.138 E: 850 352.745 Elevation: +99.193mPD Actual sampling depths: Surface, 0.5m, 1.5m Termination depth: 1.8m Encountered bedrock at 1.8m	The sampling location was bare ground with rare surface vegetation; slight disturbance to the soil due to previous works was observed. Soil at surface and 0.5m was reddish brown clay. At 1.5m soil was white and sandy in nature.
C1 (6 June 2006)	N: 824 849.677 E: 850 353.097 Elevation: +98.941mPD Actual sampling depths: Surface, 0.5m Termination depth: 1m Encountered bedrock at 1m	The sampling location was bare ground with rare surface vegetation; slight disturbance to the soil due to previous works was observed. Soil at surface was reddish brown clay. At 0.5m soil was brown and sandy in nature.

4.5 Samples Preservation and Delivery to Laboratory

4.5.1 All the samples collected were properly labelled and preserved on-site by placing within an ice chest below 4°C but not frozen. The ice chest was delivered by the Consultant to the appointed HOKLAS accredited Laboratory on the same day of sample collection, accompanied with the completed chain-of-custody (COC) forms. The acknowledgement COC forms returned from the Laboratory are provided in Appendix 3 for information.

4.6 Assessment Methodology and Laboratory Analysis

4.6.1 All the soil samples collected were tested for Lead (Pb) by the Laboratory in accordance with the same assessment and analysis methodology as stated in Section 3 of this CAR.

4.7 Laboratory Analysis Results

4.7.1 Summary of laboratory analysis results for the samples collected from the supplementary SI are provided in Table 4-3 and Table 4-4. The detailed laboratory analysis reports are provided in Appendix 5 of this CAR.

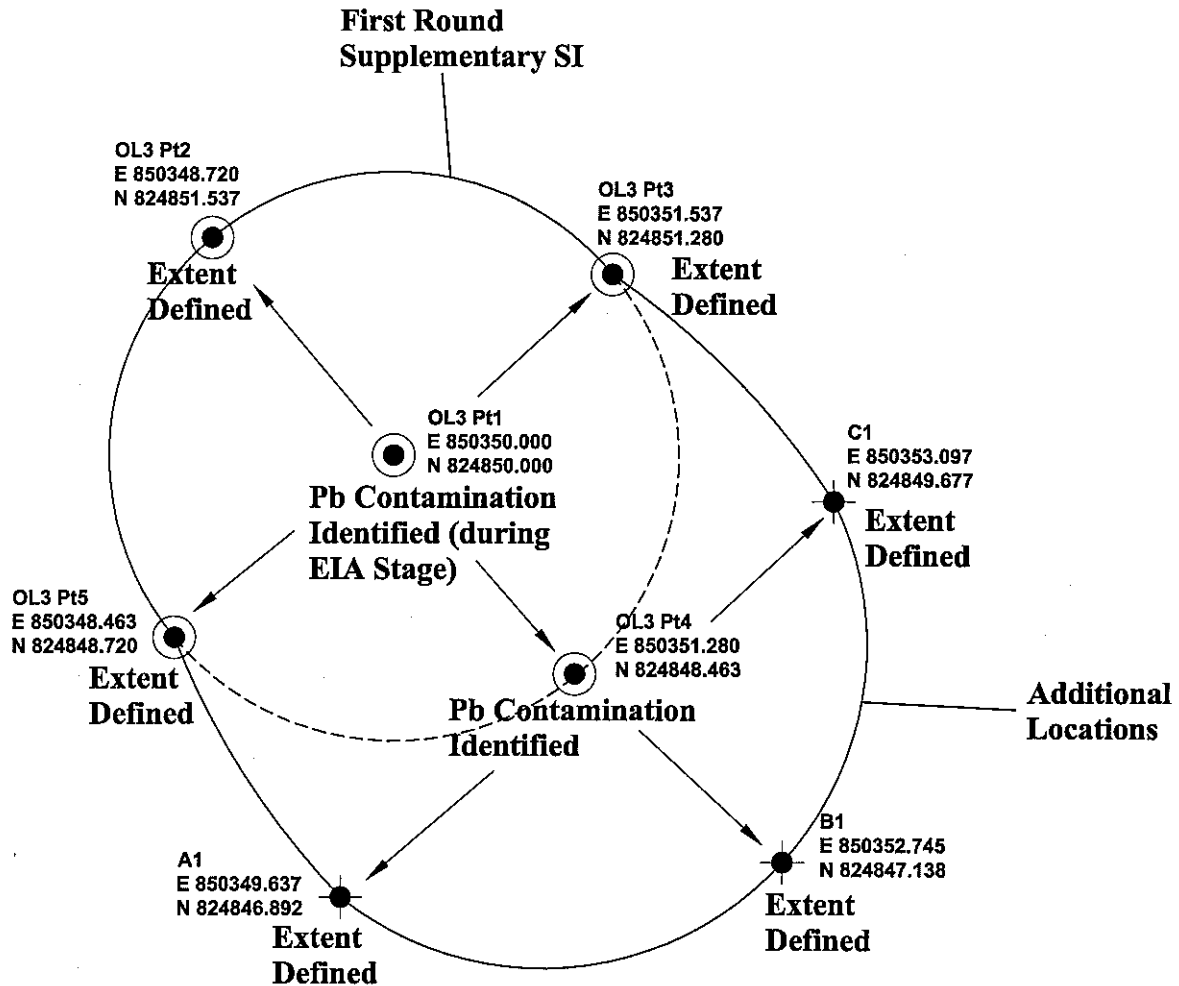
Table 4-3 Summary of Laboratory Results for the Supplementary SI Samples

Location	Depth of Soil Sample (m below ground level)	Lead (mg/kg dry weight)
OL3 Pt1	Surface	25
	0.5m	58
OL3 Pt2	Surface	45
	0.5m	63
	1.5m	46
OL3 Pt3	Surface	20
	0.5m	29
	1.2m	65
OL3 Pt4	Surface	19
	0.5m	210*
OL3 Pt5	Surface	19
	0.5m	33
	1.5m	32
Dutch B Criteria		150

Note: The soil sample collected at a depth of 0.5m at OL3 Pt4 was found to have exceeded the Dutch B criteria for Lead. Three additional sampling locations (A1 to C1) were selected within 2m from OL3 Pt4 and investigated for the extent of contamination with the results presented in Table 4-4 below.

Table 4-4 Summary of Laboratory Results for the Additional SI Samples

Location	Depth of Soil Sample (m below ground level)	Lead (mg/kg dry weight)
A1	Surface	25
	0.5m	49
	1.5m	33
	2.4m	51
B1	Surface	22
	0.5m	100
	1.5m	52
C1	Surface	35
	0.5m	59
Dutch B Criteria		150



Legend

- OL3 Pt1 - Supplementary Sampling Location
OL3 Pt5
- ◆ A1 - C1 Additional Sampling Location

<p>Title: As-constructed Supplementary Site Investigation Sampling Locations</p>	<p>CH2M HILL Hong Kong Limited</p>
<p>Project: Land Contamination Study for the Extension of Public Golf Course at Kau Sai Chau, Sai Kung - Contamination Assessment Report</p>	<p>Scale: NTS Figure: 4-1</p>

5. EXTENT OF CONTAMINATION

5.1 Extent of the Amount of Contaminated Soil

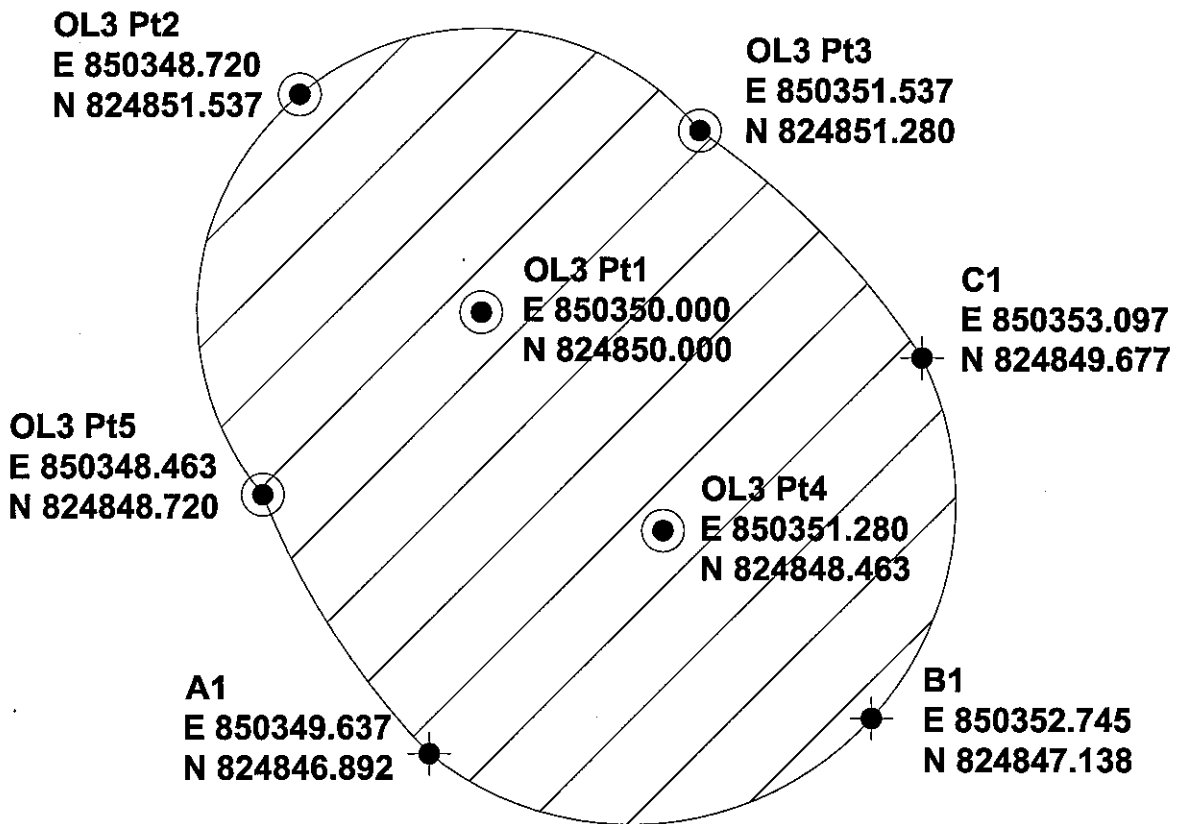
- 5.1.1 Based on laboratory analysis results, Lead (Pb) exceedance was confirmed at one soil sample collected at depth of 0.5m at one of the five supplementary SI sampling locations (OL3, Pt4).
- 5.1.2 To delineate the extent of soil contamination at the concerned discrete location, three additional sampling locations (A1 through C1) were selected within 2m from the OL3 Pt4 location, and a total of nine additional soil samples were collected and analysed. No exceedance was recorded in these nine additional samples.
- 5.1.3 The extent of contaminated soil at the concerned discrete location requiring remediation is delineated and presented in Figure 5-1.
- 5.1.4 The estimated depth of remediation and the volume of contaminated soil are summarised in Table 5-1.

Table 5-1 Estimated Volume of Contaminated Soil Requiring Remediation

Area of the Concerned Discrete Location (m ²)	Depth of Remediation (m) ¹	Estimated Volume of Contaminated Soil Requiring Remediation (m ³)
24	1.5m	36

Note:

- 1 Remediation depth for the entire concerned discrete location is conservatively taken to be 1.5m or the bedrock level whichever shallower, as the maximum depth showing no contamination among all soil samples collected during supplementary SI was recorded as 1.5m.



Legend

- OL3 Pt1 - Supplementary Sampling Location
OL3 Pt5
- ✦ A1 - C1 Additional Sampling Location
- ▨ Extent of Soil Contamination

Title: Extent of Soil Contamination at the Concerned Discrete Location

CH2M HILL Hong Kong Limited

Project: Land Contamination Study for the Extension of Public Golf Course
at Kau Sai Chau, Sai Kung - Contamination Assessment Report

Scale: NTS

Figure: 5-1

6. SUMMARY / CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary / Conclusions

- 6.1.1 Upon endorsement of the CAP for the Assignment, the SI fieldwork and subsequent laboratory analyses for land contamination study for the extension of public golf course at Kau Sai Chau, Sai Kung was conducted in February, May and June 2006.
- 6.1.2 Upon completion of precautionary safety measures of sweeping for buried metals and ordnances by the Main Contractor, the SI fieldwork was undertaken by the SI Contractor with full-time site supervision by the Consultant. Hand augering was used for soil sampling and all health and safety precautions as mentioned in the Approved CAP were properly implemented.
- 6.1.3 A total of twelve soil samples at pre-determined depths (i.e. 0.5m, 1.5m and 3.0m below ground level) were collected at five sampling locations within the Study Area. The as-constructed coordinates in HK1980 Grid were surveyed and provided by the Main Contractor.
- 6.1.4 Soil samples were preserved on-site and transferred to the appointed HOKLAS-accredited Laboratory on a daily basis. Contaminants of concern as indicated in the Approved EIA Report and the Approved CAP, Lead (Pb) and Total Sulphur (S), were analysed by the Laboratory according to the required analytical methods.
- 6.1.5 With reference to analytical results provided by the Laboratory, no soil samples collected during the SI were found exceeding the respective soil contamination criteria.
- 6.1.6 However, the discrete hotspot of Pb exceedance at original sampling location 3 recorded during preliminary SI in the EIA stage shall instigate environmental concerns of land contamination at that location. Thus, a supplementary SI was conducted at the concerned location ("OL3, Pt1) to quantify the extent of any contamination if it does exist at that discrete location.
- 6.1.7 In the Supplementary SI, it was designed such that soil samples at two (2) metres extended in each compass direction from OL3, Pt1 were obtained for laboratory analysis of Lead (Pb). If contamination is identified, the same exercise in the three "out-going" compass directions shall apply. The logic is repeated until soil samples in all "out-going" compass directions showed no contamination of Pb.
- 6.1.8 Following the same approach and assessment methodology as adopted in the SI, a total of thirteen (13) soil samples were collected at the five (5) sampling locations around OL3, Pt1 to determine if contamination does exist in that discrete location. Based on laboratory analysis results, Pb exceedance was found at one of the sampling locations. Subsequently a total of nine additional samples were collected at three (3) locations to quantify the extent of Pb contamination at that location.
- 6.1.9 The extent of Pb contamination at the discrete location requiring remediation was delineated in this CAR.

6.2 Recommendations

- 6.2.1 As contamination of Lead (Pb) was identified from the Supplementary SI at the discrete location, preparation of a RAP and necessity of remediation works as indicated in EP Condition 2.4 are thus necessary.
- 6.2.2 To avoid the possibility of any potential disturbance to the concerned discrete location, it is recommended that the entire area requiring remediation shall be totally segregated and fenced off until the commencement of remediation work as approved by EPD.
- 6.2.3 The lateral extent, depth and approach of soil remediation will be detailed in the RAP, which is to be submitted separately.

7. REFERENCES

1. Approved Environmental Impact Assessment (EIA) Report (EIAO Register No. AEIAR-091/2005) for the Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung.
2. Environmental Monitoring & Audit (EM&A) Manual (EIAO Register No. AEIAR-091/2005) for the Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung.
3. American Public Health Association (1998), Standard Methods for the Examination of Water and Wastewater (20th Edition).
4. CH2M-IDC Hong Kong Ltd. (January 2006), Land Contamination Study for the Extension of Public Golf Course at Kau Sai Chau, Sai Kung – Contamination Assessment Plan.
5. HKEPD (1993), Practice Note for Professional Persons – Contaminated Land Assessment and Remediation (“ProPECC PN 3/94”).
6. HKEPD (1999), Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repair/Dismantling Workshops.
7. USEPA, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, available at <http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm>

Appendix 1

Site Investigation Photos Summary



Location L2



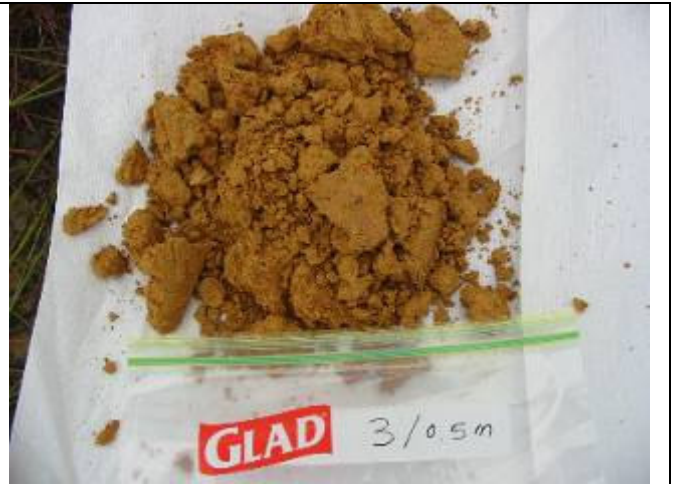
Soil sample taken at depth of 0.5m at location L2



Soil sample taken at depth of 1.5m at location L2



Location L3



Soil sample taken at depth of 0.5m at location L3



Soil sample taken at depth of 1.5m at location L3



Location L6



Soil sample taken at depth of 0.5m at location L6



Soil sample taken at depth of 1.5m at location L6



Location L7



Soil sample taken at depth of 0.5m at location L7



Soil sample taken at depth of 1.5m at location L7



Soil sample taken at depth of 2.5m at location L7



Location L8



Soil sample taken at depth of 0.5m at location L8



Soil sample taken at depth of 1.5m at location L8



Soil sample taken at depth of 3.0m at location L8

Appendix 2

Supplementary Site Investigation Photos Summary



Location OL3 Pt1



Soil sample taken at surface at location OL3 Pt1



Soil sample taken at depth of 0.5m at location OL3 Pt1



Location OL3 Pt2



Soil sample taken at surface at location OL3 Pt2



Soil sample taken at depth of 0.5m at location OL3 Pt2



Soil sample taken at depth of 1.5m at location OL3 Pt2



Location OL3 Pt3



Soil sample taken at surface at location OL3 Pt3



Soil sample taken at depth of 0.5m at location OL3 Pt3



Soil sample taken at depth of 1.2 at location OL3 Pt3



Location OL3 Pt4



Soil sample taken at surface at location OL3 Pt4



Soil sample taken at depth of 0.5m at location OL3 Pt4



Location OL3 Pt5



Soil sample taken at surface at location OL3 Pt5



Soil sample taken at depth of 0.5m at location OL3 Pt5



Soil sample taken at depth of 1.5m at location OL3 Pt5



Location A1



Soil sample taken at surface at location A1



Soil sample taken at depth of 0.5m at location A1



Soil sample taken at depth of 1.5m at location A1



Soil sample taken at depth of 2.4m at location A1



Soil sample taken at surface at location B1



Soil sample taken at depth of 0.5m at location B1



Soil sample taken at depth of 1.5m at location B1



Soil sample taken at surface at location C1



Soil sample taken at depth of 0.5m at location C1

Appendix 3

Chain-Of-Custody (COC) Forms

To: Harry Lee

DATE: 25/06/2/14
SHEET 1 OF 1

File to: (1) CH2C-KSC6500/0
(2)
Circulate to:

Harry Lee				
LL				

ANALYSIS REQUEST

CHAIN OF CUSTODY
LAM GEOTECHNICS LIMITED

PROJECT: Land Contamination Study for the Extension of Public Golf Course at Kam Sai Chau, Sai Kung.

JOB/REF. NO.: 1889

LOCATION: Kam Sai Chau, Sai Kung

CONTRACTOR: Lam

SAMPLER SIGNATURE: *Harry Lee* (HARRY LEE, of CH2M)

DRILL HOLE NO.	SAMPLE NO.	SAMPLE DEPTH	SAMPLING DATE	SAMPLING TIME	MATRIX	# CONTAINERS	Lead	Total Sulphur	REMARKS
2	2/0.5m	0.5m	25/06/2/14	9:18	Soil	Plastic Bag (Zip Lock)	✓	✓	
2	2/1.5m	1.5m	"	9:20	"	"	✓	✓	
6	6/0.5m	0.5m	"	11:15	"	"	✓	✓	
6	6/1.5m	1.5m	"	11:35	"	"	✓	✓	
8	8/0.5m	0.5m	"	14:26	"	"	✓	✓	
8	8/1.5m	1.5m	"	15:00	"	"	✓	✓	
8	8/3.0m	3.0m	"	15:23	"	"	✓	✓	

RELINQUISHED BY: *Harry Lee* DATE: 25/06/2/14 TIME: 16:05
RECEIVED BY: _____
RELINQUISHED BY: *Harry Lee* DATE: 14/2/08 TIME: 18:08
RECEIVED BY: _____

REMARKS: Please fork the signed form to CH2M (2507 2293)

DATE: 15 Feb 2006
SHEET 1 OF 1

ANALYSIS REQUEST

CHAIN OF CUSTODY
LAM GEOTECHNICS LIMITED

PROJECT: Land Contamination Study for the
Extension of Public Golf Course at Kau Sai
Chau, Sai Kung

JOB/REF. NO.:

LOCATION: Kau Sai Chau, Sai Kung

CONTRACTOR: Lam

SAMPLER SIGNATURE:

DRILL HOLE NO.	SAMPLE NO.	SAMPLE DEPTH	SAMPLING DATE	SAMPLING TIME	MATRIX	# CONTAINERS	Lead	Total Sulphur	COMMENTS
3	3/0.5m	0.5m	15 Feb 2006	09:50	Soil	Plastic	✓	✓	
3	3/1.5m	1.5m	-	10:10	-	Bag	✓	✓	
7	7/0.5m	0.5m	-	11:35	-	(Zip)	✓	✓	
7	7/1.5m	1.5m	-	11:55	-	Lock	✓	✓	
7	7/2.5m	2.5m	-	12:20	-	-	✓	✓	

RELINQUISHED BY:

DATE: 15 Feb 2006

TIME: 13:00

RECEIVED BY:

REMARKS: Please fax the signed form to CH2M

RELINQUISHED BY:

DATE:

TIME:

RECEIVED BY:

(2507 2293)

CHAIN OF CUSTODY



Laboratories

CONSIGNOR: CH2M HILL Hong Kong Ltd.
 ADDRESS: Suite 1801, Harcourt TEL: 25072203
 H&W E FAX: 25072293

PROJECT: Land Contamination Study for the
 Extension of Public Golf Course at Kowloon
 Cheung Sai Lung

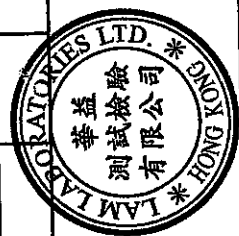
SEND TO:
 ADDRESS:
 TEL:
 FAX:
 E-MAIL:
 CONTACT PERSON:

LAB. JOB NO.:
 LAB. BATCH NO.:
 RESULTS DUE DATE:

ANALYSIS REQUESTED

SAMPLE IDENTIFICATION (SAMPLING LOCATION / NO., DEPTH, ETC.)	SAMPLING INFORMATION (DATE, TIME, ETC.)	SAMPLE MATRIX	SAMPLE SIZE	Lead	ANALYSIS REQUESTED	PRESERVATION MODE	COMMENTS
OL3 pt1 (surface)	16/5/06 10:15	Soil		✓			
OL3 pt1 (0.5m)	16/5/06 10:33	"		✓			
OL3 pt2 (surface)	" 10:41	"		✓			
OL3 pt2 (0.5m)	" 10:51	"		✓			
OL3 pt2 (1.5m)	" 11:17	"		✓			
OL3 pt3 (surface)	" 11:33	"		✓			
OL3 pt3 (0.5m)	" 11:49	"		✓			
OL3 pt3 (1.2m)	" 13:42	"		✓			
OL3 pt4 (surface)	" 11:44	"		✓			
OL3 pt4 (0.5m)	" 13:52	"		✓			

RECEIVED BY: *do.*
 PRINT NAME:
 DATE & TIME: 16/5/06
 SIGNATURE:





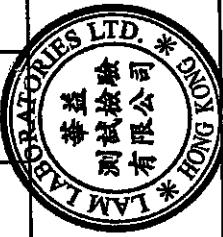
Laboratories

CHAIN OF CUSTODY

CONSIGNOR: ADDRESS: CONTACT PERSON:	TEL: FAX: E-MAIL:	SEND TO: ADDRESS: CONTACT PERSON:	TEL: FAX: E-MAIL:
PROJECT: Land Contamination Study for the Extension of Public Golf Course at Kau Sai Chau, Sai Kung			
LAB. JOB NO.: LAB. BATCH NO.: RESULTS DUE DATE:			

SAMPLE IDENTIFICATION (SAMPLING LOCATION / NO., DEPTH, ETC.)	SAMPLING INFORMATION (DATE, TIME, ETC.)	SAMPLE MATRIX	SAMPLE SIZE	ANALYSIS REQUESTED	PRESERVATION MODE	COMMENTS
OL3 pt 5 (Surface)	16/5/06 11:46	Soil				
OL3 pt 5 (0.5m)	16/5/06 14:02	"				
OL3 pt 5 (1.5m)	16/5/06 14:16	"				

RELINQUISHED BY	RECEIVED BY
PRINT NAME:	PRINT NAME:
DATE & TIME:	DATE & TIME:
SIGNATURE:	SIGNATURE:





Laboratories

CHAIN OF CUSTODY

Revision No.: 0

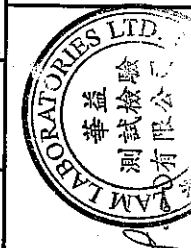
CONSIGNOR: CH2M HILL HK Ltd.
 ADDRESS: TEL: 28722951
 FAX: 25072293
 CONTACT PERSON: Leo Law E-MAIL: leo.law@ch2m.com

PROJECT: Land Contamination Assessment
 for proposed third golf course at
 Kau Sai Chau
 LAB. JOB NO.: J493
 LAB. BATCH NO.:
 RESULTS DUE DATE:

SEND TO:
 ADDRESS:
 TEL.:
 FAX:
 E-MAIL:
 CONTACT PERSON:

SAMPLE IDENTIFICATION (SAMPLING LOCATION / NO., DEPTH, ETC.)	SAMPLING INFORMATION (DATE, TIME, ETC.)	SAMPLE MATRIX	SAMPLE SIZE	ANALYSIS REQUESTED						PRESERVATION MODE	COMMENTS	
A1 surface	6/6/06 11:30	soil		Lead								
A1 0.5M	11:39	soil		✓								
B1 surface	11:48	soil		✓								
A1 1.5M	11:58	soil		✓								
C1 surface	13:52	soil		✓								
A1 2.4M	14:00	soil		✓								
B1 0.5M	14:26	soil		✓								
B1 1.5M	14:43	soil		✓								
C1 0.5M	15:10	soil		✓								

RELINQUISHED BY: [Signature]
 PRINT NAME:
 DATE & TIME: 6/6/06
 SIGNATURE: [Signature]



Appendix 4

Laboratory Analysis Report - Detailed Site Investigation

TEST REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Client Name : CH2M-IDC Hong Kong Limited
 Client Address : Suite 3201, Central Plaza, 18 Harbour Road, Wanchai, Hong Kong
 Contract No. : Nil.
 Works Order No. : Nil.

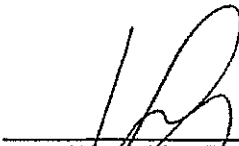
Lab. Job No. : J493
 Lab. Sample Ref. No. : 16891/1-7(A)
 Sample Description : Seven (7) Sample said to be Soil.
 Sampling Date : 14-Feb-2006
 Sample Receive Date : 14-Feb-2006
 Test Date : 15 - 20 February 2006

Test Parameter(s) : As listed.
 Test Method Code : As listed.
 Test Standard : As listed.

Code	Test Parameter	Reporting Limits	Test Standard
S ²⁻	Total Sulphide	2 mg S ²⁻ /kg	APHA 4500S ²⁻ D

Note(s) : 1. Results relate to samples as received.
2. This report supersedes the one dated 24 Feb 06.

Approved Signatory :



 Wong Yau Tim

Date : 28-Feb-2006

Remark(s) : This report shall not be reproduced, except in full, without prior written approval from Lam Geotechnics Ltd.

TEST REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
Client Name : CH2M-IDC Hong Kong Limited
Contract No. : Nil.
Works Order No. : Nil.
Lab. Sample Ref. No. : 16891/1-7(A)
Test Parameter(s) : As listed.

Client Ref.	Lab. Sample Ref. No.	S ₂ -mg-S ² /kg
2 0.5m 9:18	16891/1	<2
2 1.5m 9:50	16891/2	<2
6 0.5m 11:15	16891/3	<2
6 1.5m 11:35	16891/4	<2
8 0.5m 14:20	16891/5	<2
8 1.5m 15:00	16891/6	<2
8 3.0m 15:23	16891/7	<2

Note(s) : 1. < = less than.
2. Test results satisfy all in-house QA/QC protocols as attached.
3. N/A denotes "Not Applicable".

- END OF REPORT -

Remark(s) : This report shall not be reproduced, except in full, without prior written approval from Lam Geotechnics Ltd.

Lam Geotechnics Limited Unit 12, 14/F, Honour Industrial Centre, 6 Sun Yip Street, Chai Wan, Hong Kong.
Tel: 2897 3282 Fax 2987 5509

QUALITY CONTROL REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Client Name : CH2M-IDC Hong Kong Limited
 Contract No. : Nil.
 Works Order No. : Nil.
 Lab. Sample Ref. No. : 16891/1-7(A)
 Test Parameter(s) : As listed.

Method Blank	S ²⁻
	mg-S ²⁻ /kg
	<2
Acceptable Criteria	2

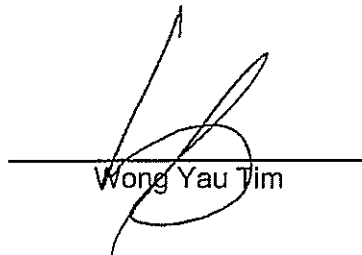
Sample Duplicate	S ²⁻
Lab. Sample Ref. No.	Relative Deviation
16891/1	1.0
Acceptable Criteria	RD < 20%

Quality Control Standard	S ²⁻
	Recovery
	108
Acceptable Criteria	80 - 120%

Sample Spike	S ²⁻
Lab. Sample Ref. No.	Recovery
16891/1	95
Acceptable Criteria	80 - 120%

Note(s) : 1. < = less than.
 2. N/A denotes Not Applicable.

Approved Signatory :



 Wong Yau Tim

Date : 24-Feb-2006

Remark(s) : This report shall not be reproduced, except in full, without prior written approval from Lam Geotechnics Ltd.

TEST REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Client Name : CH2M-IDC Hong Kong Limited
 Client Address : Suite 3201, Central Plaza, 18 Harbour Road, Wanchai, Hong Kong
 Contract No. : Nil.
 Works Order No. : Nil.


Lab. Job No. : J493
 Lab. Sample Ref. No. : 16901/1-5(A)
 Sample Description : Five (5) Sample said to be Soil.
 Sampling Date : 15-Feb-2006
 Sample Receive Date : 15-Feb-2006
 Test Date : 16 - 20 February 2006

Test Parameter(s) : As listed.
 Test Method Code : As listed.
 Test Standard : As listed.

Code	Test Parameter	Reporting Limits	Test Standard
S ²⁻	Total Sulphide	2 mg S ²⁻ /kg	APHA 4500S ²⁻ D

Note(s) : 1. Results relate to samples as received.
2. This report supersedes the one dated 24 Feb 06.

Approved Signatory :


Wong Yau Tim

Date : 28-Feb-2006

Remark(s) : This report shall not be reproduced, except in full, without prior written approval from Lam Geotechnics Ltd.

Lam Geotechnics Limited Unit 12, 14/F, Honour Industrial Centre, 6 Sun Yip Street, Chai Wan, Hong Kong.
Tel: 2897 3282 Fax: 2897 5509

TEST REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Client Name : CH2M-IDC Hong Kong Limited
 Contract No. : Nil.
 Works Order No. : Nil.
 Lab. Sample Ref. No. : 16901/1-5(A)
 Test Parameter(s) : As listed.

Client Ref.	Lab. Sample Ref. No.	S2- mg-S ² /kg
3 0.5m 9:50	16901/1	<2
3 1.5m 10:10	16901/2	<2
7 0.5m 11:35	16901/3	<2
7 1.5m 11:55	16901/4	<2
7 2.5m 12:20	16901/5	<2

Note(s) : 1. < = less than.
 2. Test results satisfy all in-house QA/QC protocols as attached.
 3. N/A denotes "Not Applicable".

- END OF REPORT -

Remark(s) : This report shall not be reproduced, except in full, without prior written approval from Lam Geotechnics Ltd.

Lam Geotechnics Limited Unit 12, 14/F, Honour Industrial Centre, 6 Sun Yip Street, Chai Wan, Hong Kong.
 Tel: 2897 3282 Fax 2987 5509

QUALITY CONTROL REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Client Name : CH2M-IDC Hong Kong Limited
 Contract No. : Nil.
 Works Order No. : Nil.
 Lab. Sample Ref. No. : 16901/1-5(A)
 Test Parameter(s) : As listed.

Method Blank	S ²⁻
	mg-S ²⁻ /kg
	<2
Acceptable Criteria	2

Sample Duplicate	S ²⁻
Lab. Sample Ref. No.	Relative Deviation
16891/1	1.0
Acceptable Criteria	RD < 20%

Quality Control Standard	S ²⁻
	Recovery
	108
Acceptable Criteria	80 - 120%

Sample Spike	S ²⁻
Lab. Sample Ref. No.	Recovery
16891/1	95
Acceptable Criteria	80 - 120%

Note(s) : 1. < = less than.
 2. N/A denotes Not Applicable.

Approved Signatory :

Wong Yau Tim

Date : 24-Feb-2006

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Lam Geotechnics Limited Unit 12, 14/F, Honour Industrial Centre, 6 Sun Yip Street, Chai Wan, Hong Kong.
 Tel: 2897 3282 Fax 2987 5509

TEST REPORT

Certificate Number : A31944
 Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Client Name : CH2M-IDC Hong Kong Limited
 Client Address : Suite 3201, Central Plaza, 18 Harbour Road, Wanchai, Hong Kong
 Contract No. : Nil.
 Works Order No. : Nil.

Lab. Job No. : J493
 Lab. Sample Ref. No. : 16891,16901
 No. of Sample(s) : 12 samples said to be soil samples
 & Description
 Sample Receive Date : 14 February 2006 - 15 February 2006
 Test Date : 15 February 2006 - 20 February 2006

Test Parameter(s)

CODE	Parameter	Reporting Limits	Test Method
		Sediment/Soil	
		mg/kg	
Pb	Lead	15	S/M/DIG-S & M/ICP-MS

- Notes :
1. Results relate to samples as received.
 2. Results are based on dry sample weight.
 3. < = less than
 4. N/A = Not applicable
 5. Test results satisfy all in-house QA/QC protocols as attached.
 6. Test description (for in-house methods) as follows:
 S/M/DIG-S: Samples were digested with concentrated nitric acid and hydrochloric acid mixture at 95°C for 2.5 hours.
 M/ICP-MS: ICP-MS Quantification.

Approved Signatory :

Wong Yau Tim

Date: 24 Feb. 2006

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Lam Geotechnics Limited Unit 12, 14/F, Honour Industrial Centre, 6 Sun Yip Street, Chaiwan, Hong Kong. Tel: 2897 3282 Fax: 28975509
 Hong Kong Accreditation Service (HKAS) has accredited this laboratory under the Hong Kong Laboratory Accreditation Scheme (HOKLAS) for specific laboratory activities as listed in the HOKLAS directory of accredited laboratories. The results shown in this certificate were determined by this laboratory in accordance with its terms of accreditation.

TEST REPORT

Certificate Number : A31944
 Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Client Name : CH2M-IDC Hong Kong Limited
 Contract No. : Nil.
 Works Order No. : Nil.
 Lab. Sample Ref. No. : 16891,16901

Test Parameter(s)

Client Reference Drillhole No.	Sample				Specimen Depth, m	Pb mg/kg
	Depth, m			Type		
	No.	From	To			
2	NA	NA	NA		0.50	38
2	NA	NA	NA		1.50	87
6	NA	NA	NA		0.50	51
6	NA	NA	NA		1.50	78
8	NA	NA	NA		0.50	33
8	NA	NA	NA		1.50	31
8	NA	NA	NA		3.00	54
3	NA	NA	NA		0.50	55
3	NA	NA	NA		1.50	67
7	NA	NA	NA		0.50	34
7	NA	NA	NA		1.50	29
7	NA	NA	NA		2.50	100

---End of Report---

QC REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Client Name : CH2M-IDC Hong Kong Limited
 Contract No. : Nil.
 Works Order No. : Nil.
 Lab. Sample Ref. No. : 16891,16901

Test Parameter(s)

1.1 Sample Duplicate (Relative deviation)

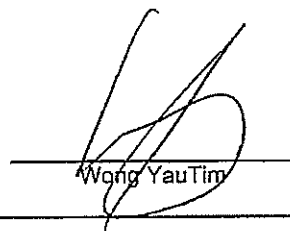
Client Reference Drillhole No.	Sample				Specimen Depth m	Batch	Pb
	Depth, m			Type			%
	No.	From	To				
2	NA	NA	NA		0.50	1	18
Control Limits							+/- 30 % of the mean

1.2 Method Spike (Standard Addition)

Client Reference Drillhole No.	Sample				Specimen Depth m	Batch	Pb
	Depth, m			Type			%
	No.	From	To				
2	NA	NA	NA		0.50	1	120
Control Limits							75 - 125 %

Note: 1. *na = Relative deviation(RD) for duplicates cannot be evaluated as the value determined is lower than reporting limits.
 2. Results are based on dry sample weight
 3. < = less than

Approved Signatory :



Wong Yau Tim

Date : 24 Feb. 2006

Remark(s) :

QC REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Client Name : CH2M-IDC Hong Kong Limited
 Contract No. : Nil.
 Works Order No. : Nil.
 Lab. Sample Ref. No. : 16891,16901

Test Parameter(s)

1.3 Sample Reference Material (ISE 2003.4.2)

Reference	Sample					Batch	Pb
	Depth, m			Type	Specimen Depth m		%
	No.	From	To				
ISE 2003.4.2	N/A	N/A	N/A		N/A	1	96
Control Limits							75 - 125% of nominal value

1.4 Method Blank

Reference	Sample					Batch	Pb
	Depth, m			Type	Specimen Depth m		mg/kg
	No.	From	To				
N/A	N/A	N/A	N/A		N/A	1	<15
Control Limits							Less than reporting limit

Note: 1. Results are based on dry sample weight
 2. < = less than

Remark(s) :

Appendix 5

Laboratory Analysis Report - Supplementary Site Investigation

TEST REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Customer : CH2M HILL Hong Kong Limited
 Address : Suite 1801, Harcourt House, 39 Gloucester Road, Wanchai, Hong Kong

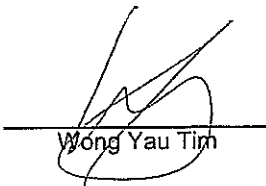
 Lab Job No. : J493
 Lab Sample No. : 17353/1-13
 Sample Description : 13 solid samples said to be soil samples
 Sample Receipt Date : 16 May 2006
 Test Period : 17 May 2006 - 23 May 2006

Test Information

Code	Test Parameter	Reporting Limits		Test Procedure
		Sediment/Soil		
		mg/kg		
Pb	Lead	15		S/M/DIG-S & M/ICP-MS

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 2. Results related to samples as received.
 3. Results are based on dry sample weight.
 4. < = less than
 5. N/A = Not applicable
 6. Test results satisfy all in-house QA/QC protocols as attached.
 7. Test description (for in-house methods) as follows:
 S/M/DIG-S: Samples were digested with concentrated nitric acid and hydrochloric acid mixture at 95°C for 2.5 hours.
 M/ICP-MS: ICP-MS Quantification.

Authorized Signatory :



Wong Yau Tim

Issue Date: 24 May 2006

TEST REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
Customer : CH2M HILL Hong Kong Limited
 Suite 1801, Harcourt House, 39 Gloucester Road, Wanchai, Hong Kong

Lab Job No. : J493
Lab Sample No. : 17353/1-13

Test Results

Customer Ref.	Sample				Pb mg/kg
	Drillhole No.	Depth, m		Type Specimen Depth, m	
		No.	From		
OL3 Pt 1	NA	NA	NA	0.00	25
OL3 Pt 1	NA	NA	NA	0.50	58
OL3 Pt 2	NA	NA	NA	0.00	45
OL3 Pt 2	NA	NA	NA	0.50	63
OL3 Pt 2	NA	NA	NA	1.50	46
OL3 Pt 3	NA	NA	NA	0.00	20
OL3 Pt 3	NA	NA	NA	0.50	29
OL3 Pt 3	NA	NA	NA	1.20	65
OL3 Pt 4	NA	NA	NA	0.00	19
OL3 Pt 4	NA	NA	NA	0.50	210
OL3 Pt 5	NA	NA	NA	0.00	19
OL3 Pt 5	NA	NA	NA	0.50	33
OL3 Pt 5	NA	NA	NA	1.50	32

----End of Report----

QUALITY CONTROL REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Customer : CH2M HILL Hong Kong Limited
 Suite 1801, Harcourt House, 39 Gloucester Road, Wanchai, Hong Kong

Lab Job No. : J493
 Lab Sample No. : 17353/1-13

Test Results

1.1 Sample Duplicate (Relative deviation)


Customer Ref. Drillhole No.	Sample			Type	Specimen Depth m	Batch	Pb
	Depth, m						%
	No.	From	To				
OL3 Pt 1	NA	NA	NA		0.00	1	1.5
Control Limits							+/- 30 % of the mean

1.2 Method Spike (Standard Addition)

Customer Ref. Drillhole No.	Sample			Type	Specimen Depth m	Batch	Pb
	Depth, m						%
	No.	From	To				
OL3 Pt 1	NA	NA	NA		0.00	1	111
Control Limits							75 - 125 %

Note: 1. *na = Relative deviation(RD) for duplicates cannot be evaluated as the value determined is lower than reporting limits.
 2. Results are based on dry sample weight
 3. < = less than

Authorized Signatory :


 Wong Yau Tim

Issue Date: 24 May 2006

QUALITY CONTROL REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Customer : CH2M HILL Hong Kong Limited
 Suite 1801, Harcourt House, 39 Gloucester Road, Wanchai, Hong Kong

Lab Job No. : J493
 Lab Sample No. : 17353/1-13

Test Results**1.3 Sample Reference Material (ISE 2004.3.2)**

Reference	Sample					Batch	Pb	
	Depth, m			Type	Specimen Depth m			%
	No.	From	To					
ISE 2004.3.2	N/A	N/A	N/A		N/A	1	104	
Control Limits							75 - 125% of nominal value	

1.4 Method Blank

Reference	Sample					Batch	Pb	
	Depth, m			Type	Specimen Depth m			mg/kg
	No.	From	To					
N/A	N/A	N/A	N/A		N/A	1	<15	
Control Limits							Less than reporting limit	

Note: 1. Results are based on dry sample weight
 2. < = less than

TEST REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Customer : CH2M HILL Hong Kong Limited
 Address : Suite 1801, Harcourt House, 39 Gloucester Road, Wanchai, Hong Kong

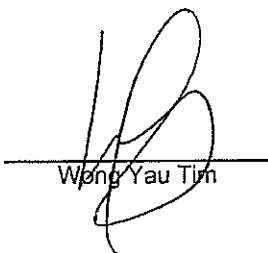
 Lab Job No. : J493
 Lab Sample No. : 17450/1-9
 Sample Description : 9 solid samples said to be soil samples
 Sample Receipt Date : 6 June 2006
 Test Period : 7 June 2006 - 13 June 2006

Test Information

Code	Test Parameter	Reporting Limits		Test Procedure
		Sediment/Soil		
		mg/kg		
Pb	Lead	15		S/M/DIG-S & M/ICP-MS

- Notes :
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 2. Results related to samples as received.
 3. Results are based on dry sample weight.
 4. < = less than
 5. N/A = Not applicable
 6. Test results satisfy all in-house QA/QC protocols as attached.
 7. Test description (for in-house methods) as follows:
 S/M/DIG-S: Samples were digested with concentrated nitric acid and hydrochloric acid mixture at 95°C for 2.5 hours.
 M/ICP-MS: ICP-MS Quantification.

Authorized Signatory :



Wong Yau Tim

Issue Date: 14 June 2006

TEST REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Customer : CH2M HILL Hong Kong Limited
 Lab Job No. : J493
 Lab Sample No. : 17450/1-9

Test Results

Customer Ref. Drillhole No.	Sample				Specimen Depth, m	Pb mg/kg
	Depth, m			Type		
	No.	From	To			
A1	NA	NA	NA		0.00	25
A1	NA	NA	NA		0.50	49
A1	NA	NA	NA		1.50	33
A1	NA	NA	NA		2.40	51
B1	NA	NA	NA		0.00	22
B1	NA	NA	NA		0.50	100
B1	NA	NA	NA		1.50	52
C1	NA	NA	NA		0.00	35
C1	NA	NA	NA		0.50	59

----End of Report----

QUALITY CONTROL REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Customer : CH2M HILL Hong Kong Limited
 Lab Job No. : J493
 Lab Sample No. : 17450/1-9

Test Results

1.1 Sample Duplicate (Relative deviation)

Customer Ref. Drillhole No.	Sample			Type	Specimen Depth m	Batch	Pb %
	Depth, m						
	No.	From	To				
A1	NA	NA	NA		0.00	1	1.4
Control Limits							+/- 30 % of the mean

1.2 Method Spike (Standard Addition)

Customer Ref. Drillhole No.	Sample			Type	Specimen Depth m	Batch	Pb %
	Depth, m						
	No.	From	To				
A1	NA	NA	NA		0.00	1	97
Control Limits							75 - 125 %

Note: 1. *na = Relative deviation(RD) for duplicates cannot be evaluated as the value determined is lower than reporting limits.
 2. Results are based on dry sample weight
 3. < = less than

Authorized Signatory :


 Wong Yau Tim

Issue Date: 14 June 2006

QUALITY CONTROL REPORT

Project Name : Soil Sampling and Analysis at Kau Sai Chau
 Customer : CH2M HILL Hong Kong Limited
 Lab Job No. : J493
 Lab Sample No. : 17450/1-9

Test Results**1.3 Sample Reference Material (ISE 2004.3.2)**

Reference	Sample					Batch	Pb	
	Depth, m			Type	Specimen Depth m			%
	No.	From	To					
ISE 2004.3.2	N/A	N/A	N/A		N/A	1	124	
Control Limits							75 - 125% of nominal value	

1.4 Method Blank

Reference	Sample					Batch	Pb	
	Depth, m			Type	Specimen Depth m			mg/kg
	No.	From	To					
N/A	N/A	N/A	N/A		N/A	1	<15	
Control Limits							Less than reporting limit	

Note: 1. Results are based on dry sample weight
 2. < = less than