Architectural Services Department

PWP No. 016NB

Phased Reprovisioning of Cape Collinson Crematorium Environmental Impact Assessment Study

Contamination Assessment Report/ Remediation Action Plan

June 2008

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1 INTRODUCTION

Background

1.1 The existing Cape Collinson Crematorium (The Existing Crematorium) consists of four service halls with twelve cremators. The Existing Crematorium was first used in 1962 and had several cremators upgraded in 1995 and 2001. To cope with the growing service demand while meeting the emission standards, the Food and Environmental Hygiene Department (FEHD), as the Project Proponent, will replace all the existing cremators by new ones with higher capacity and more efficiency. The construction of the replacement crematorium was proposed in two phases. Phase 1 works involve the site formation work for the new crematorium, the construction of four new cremators and the provision of ancillary facilities. After commissioning of the four new cremators and their ancillary facilities, Phase 2 works will proceed to demolish the existing twelve cremators and construct six new cremators with ancillary facilities.

1.2 This "*Phased Reprovisioning of Cape Collinson Crematorium*" (The Project) is a designated project under part 1, Schedule 2, Item N4 of the *Environmental Impact Assessment Ordinance (EIAO).* In October, 2007, ENSR Asia (HK) Limited (ENSR) is commissioned by the Architectural Services Department (ArchSD) to undertake the Environmental Impact Assessment. The site location plan is shown in **Drawing No. 1.**

1.3 Potential land contamination resulting from the operation of the Existing Crematorium has been identified in the Project Profile (No. PP 338/2007). The Environment Protection Department (EPD) issued the EIA Study Brief (No. ESB-177/2008) in January 2008 which demands a detailed assessment of land contamination impacts for the Project Area and its works area (Study Area). A Contamination Assessment Plan (CAP) was submitted and approved by the EPD on 2 April 2008.

1.4 The CAP recommended a site investigation (SI) for the land contamination associated with historic and current land uses in the Study Area. This Contamination Assessment Report (CAR) is prepared to present findings of the SI and associated laboratory analysis which were carried out in accordance with the approved CAP.

1.5 ENSR consolidated all field logs and laboratory test results for preparation of this CAR.

Objectives

1.6 This CAR presents the findings of the site investigation and to determine the nature and extent of contamination based on the findings of the site investigation. If contamination is confirmed, corresponding remediation actions will be recommended in the Remediation Action Plan (RAP).

2 FINDINGS OF CONTAMINATION ASSESSMENT PLAN

2.1 The Project Area is located at Cape Collinson Road, Eastern District near Buddhist Cemetery, with site area of approximately 2000m^2. The Existing Crematorium consists of four service halls for carrying out ceremonies, two crematorium rooms consisting of twelve cremators and several offices.

2.2 As reported in the CAP, a capacity of 15,000L underground storage tank (UST) using for diesel storage, located at the south of the Existing Crematorium. The diesel fuel stored in the UST was pumped via the underground pipeline to the aboveground storage tank (AST) which situated at ground floor of the Existing Crematorium. Detailed rationales for selecting sampling locations in the CAP are shown in **Appendix A**.

2.3 Since the cremators are still in operation, it is not possible to carry out site investigation inside the cremator rooms at this stage. Referring to approved CAP Section 4.5, potential land contamination at cremator rooms would mainly due to fuel spillage and leakage from the cremators. Further site inspection is recommended after decommissiong and prior to the demolition of the existing crematorium. A supplementary CAP shall be prepared for EPD endorsement to present detailed sampling and testing plan. Findings of site investigation and appropriate remediation methods shall be presented in supplementary CAR/ RAP for EPD endorsement prior to the commencement of any earthworks.

3 CONTAMINATION ASSESSMENT REPORT

Assessment Methodology

Soil Boring and Sampling

3.1 The site investigation (SI) works were carried out from 15 March to 20 March 2008. Four boreholes and five surface soil sampling locations were proposed at the hotspots within the Study Area in accordance with the approved CAP. The locations of the sampling points are shown in **Drawing No. 2.**

3.2 In accordance with the CAP, one trial pit (TP-1) was proposed underneath the pipeline of the underground storage tank system. According to the drawing provided by Electrical and Mechanical Services Department (EMSD) (presented in **Appendix B**), the existing pipeline is running parallel to the drive at the southwest side of the Project Area, which was now possessed by Civil Engineering and Development Department (CEDD) for 10-Year Extended Landslip Preventive Measures (LPM) Project, Phase 5, Package D – Landslip Preventive Works or Slopes in Hong Kong Island Project. Access to the proposed trial pit location for sampling during the SI was not able to possess. Replies from CEDD and ArchSD are presented in **Appendix C**. Further site investigation for TP-1 shall be conducted together with the cremator rooms after decommissiong and prior to the demolition of the existing crematorium.

3.3 For boreholes, advanced by an inspection pit which in general, a disturbed soil sample was collected at 0.5m below concrete layer (bcl). Below 1.5m bcl, soil boring was performed by dry rotary drilling without the use of flushing medium. Undisturbed U76 (open sample tube with internal diameter 76mm) soil samples were collected at 1.5m bcl and upon termination of borehole (approximately 5.5m to 6.0m bcl). The deepest depth of the soil sample collected was from 5.8m to 6.25m bcl in this SI. For BH-4, hard strata were encountered from 0.6m - 6.25m bcl. It is believed that contaminants were not likely migrating downwards through the hard strata, therefore only one disturbed soil sample was collected at 0.5m bcl. All soil sampling works were supervised by a qualified land contamination specialist.

3.4 Before drilling and excavation of each borehole, the sampler and all equipment in contact with the ground were thoroughly decontaminated by laboratory-graded detergent and high pressure hot water jet.

3.5 At each sampling location, sufficient quantity of soil sample (as specified by the laboratory) was collected. The soil samples were properly labelled and stored in the cool boxes chilled at a temperature of around 4°C without frozen until delivered to the analytical laboratory. All the collected soil samples in boreholes and surface soil samples at 0.1m were analyzed in accordance with the

analysis schedules detailed in the CAP by a Hong Kong Laboratory Accreditation Scheme (HOKLAS) accredited laboratory.

Surface Sample Sampling

3.6 Ten soil samples were collected at 0.1m and 0.5m respectively at the five designated surface soil sampling locations by hand tools.

3.7 All surface soil samples at 0.1m were analyzed in accordance with the analysis schedules detailed in the CAP by a Hong Kong Laboratory Accreditation Scheme (HOKLAS) accredited laboratory. Should the results of 0.1m surface soil samples exceed the relevant criteria, analysis for the 0.5m surface soil samples would be carried out.

Strata Logging

3.8 Strata logging for boreholes were undertaken during the course of sampling. Logs include the general stratigraphic descriptions, depth of soil sampling and sample notation. The presence of rocks/boulders/cobbles and foreign materials such as metals, wood and plastics was also recorded.

Groundwater Sampling

3.9 No groundwater was encountered at the course of SI, therefore, no groundwater sample was collected.

Assessment Criteria

Criteria for Soil Contamination

3.10 The results of the laboratory analyses were interpreted in accordance with "*Guidance Note for Contaminated Land Assessment and Remediation*" (Guidance Note 1) and "*Guidance Note for Contaminated Land Assessment and Remediation and Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repairing/Dismantling Workshops*" (Guidance Note 2), published by EPD.

3.11 The Guidance Note 1 makes reference to the Risk-Based Remediation Goals (RBRGs) as the soil and groundwater contamination criteria. The *Guidance Manual for Use of Risk-based Remediation Goals for Contaminated Land Management* (Guidance Manual), launched by EPD on 15 August 2007, states that land contamination assessment results shall be compared with the RBRGs developed for the future land-use of site.

3.12 It is understood that the future land use of Project Area will be crematorium. As workers are likely the group exposed to potential contaminated soil during excavation and maintenance works, RBRGs for

industrial are adopted as the land contamination assessment criteria. Relevant RBRGs for industrial for soil and soil saturation limits are presented in **Table 3.1**.

Table 3.1 RBRGs for Industrial and Soil Saturation Limits for Soil

Parameter	Soil (mg/kg)	
	Industrial RBRGs	**Soil Saturation Limit**
VOCs		
Benzene	9.21	336
Toluene	10,000	235
Ethylbenzene	8,240	138
Xylenes (total)	1,230	150
Total Petroleum Hydrocarbons (TPH)		
C6-C8	10,000	1,000
C9-C16	10,000	3,000
C17-C35	10,000	5,000
Heavy Metals		
Antimony	261	NA
Arsenic	196	NA
Barium	10,000	NA
Cadmium	653	NA
Chromium III	10,000	NA
Chromium VI	1,960	NA
Cobalt	10,000	NA
Copper	10,000	NA
Lead	2,290	NA
Manganese	10,000	NA
Mercury	38.4	NA
Molybdenum	3,260	NA
Nickel	10,000	NA
Tin	10,000	NA
Zinc	10,000	NA
Dioxins		
Dioxins (I-TEQ)	0.005	NA

Analytical Results and Interpretation

Fieldwork

3.13 Site investigation was undertaken in accordance with the sampling plan detailed in the approved CAP.

No noticeable odour or apparent soil discolourization were observed during the site investigation. Soil boring logs are included in **Appendix D.** The sampling depths for each borehole and surface soil sampling location are presented in **Table 3.2**.

Table 3.2 Sampling Depths

Locations	Sampling ID	Sampling Depth
Fuel Tank System	BH1	0.5m, 1.5-1.95m, 5.5-5.95m
	BH2	0.5m, 2.0-2.45m, 5.80-6.25m
	BH3	0.5m, 1.50-2.00m, 5.50-5.95m
	BH4	0.5m
West of Chimneys	S1	0.1m and 0.5m
North of Chimneys	S2 – S3	0.1m and 0.5m
East of Chimneys	S4 – S5	0.1m and 0.5m

Laboratory Analytical Results

Soil Sampling (for underground fuel tank system)

3.14 10 soil samples were collected from 4 boreholes for laboratory analysis. Among these samples analyzed, only one soil sample from BH-1 at 1.5m to 1.95m bcl having lead concentration of 180,000 mg/kg, which exceeds the relevant RBRG for lead (2,290mg/kg). No detectable VOCs or TPHs was reported for all soil samples. Results summary table and detailed laboratory results are presented in **Appendix E**.

Soil sampling (for surface deposition)

3.15 Among five 0.1m samples analyzed, no samples were found to have testing parameters exceeding the relevant RBRGs. In accordance with the approved CAP, the 0.5m samples shall be analyzed only if the 0.1m samples exceed the relevant RBRGs. Since no 0.1m samples were found to have testing parameters exceeding the relevant RBRGs, no further laboratory analysis on 0.5m samples were carried out. Detailed laboratory results are presented in **Appendix E**.

QA/QC Sampling

3.16 QA/QC sampling was conducted during the SI. QA/QC is the practice of making sure that collection and analysis techniques provide precise and accurate information. This process is to ensure that the levels of contamination measured in the environmental samples reflect the actual environmental levels and are not due to accidental contamination of the sample or sample container. The laboratory results of QA/QC samples are presented in **Appendix E**.

3.17 A total of one set of equipment, field and/or trip blanks were collected in this Study. All testing

parameters were recorded below their respective detection limits for all the QA/QC samples. QA/QC procedures for sample collection and preparation are therefore considered acceptable.

Estimation of Soil Contamination Extent

3.18 Based on the analytical results of soil presented above, soil sample at location BH-1 at the depth of 1.5m to 1.95m bcl has exceeded the relevant RBRG for lead.

Horizontal Extent of Contaminated Soil

3.19 In order to define the area of contaminated soil, a 5m x 5m square encompassing the sampling location with contamination level lied above the RBRG would be adopted. **Drawing No. 4** presents the schematic diagram for the horizontal extent. This approach is mainly based on the distribution properties of concerned contaminant and the spatial distribution of sampling points. The consultant's professional experience gained from other similar land contamination projects would also be considered to assign the excavated area.

Vertical Extent of Contaminated Soil

3.20 Vertical extent of contamination is estimated based on i) the distribution properties of contaminant and ii) the sampling depth with contaminant found. In general, the proposed vertical extent of excavation is 0.5m above and below the sampling depth with heavy metals exceeding the RBRGs.

3.21 Based on the above approach, the vertical excavation depth was estimated to be 1.0m-2.45m bcl while the horizontal excavation extent was estimated to be 25 m^2. The overall estimated soil quantity was 37m^3.

Conclusion and Recommendations

3.22 According to the results of the site investigation, soil sample in BH-1 was found to have lead concentration exceeding the relevant RBRG. A 5m x 5m square would be applied in estimating the horizontal extent of soil contamination for excavation. 0.5m above and below the particular soil contaminated depth would be set as the vertical extent of soil contamination. Based on this approach, the quantity of contaminated soil is estimated to be about 37m^3.

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

3.24 Since the cremators are still in operation and the proposed trial pit location (TP-1) is possessed by CEDD, it is not possible to carry out site investigation inside the cremator rooms and underneath the

pipeline at this stage. Further site investigation for these locations shall be carried out after decommissioning and prior to the demolition of the existing crematorium. Upon completion of further site investigation, a supplementary CAR shall be prepared to present the findings for EPD's approval. If contamination is found, a supplementary RAP shall be prepared and submitted to EPD and all contaminated soils shall be treated prior to the commencement of any earthworks.

4 REMEDIATION ACTION PLAN

Objective of Remediation Action Plan

4.1 The objectives of the remediation action plan are as follows:

- To propose remediation method(s) for the soil contamination
- To propose a mean to confirm completed excavation of contaminated soil
- To provide guidelines for handling of contaminated soil

Selection Criteria

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

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

4.3 In assisting the formulation of appropriate remedial measures, the following factors suggested in the "*Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repair/Dismantling Workshops*" issued by EPD would be also taken into consideration when evaluating different available remediation methods:

- Degree and extent of the contamination
- Anticipated future use of the site
- Nature of the contaminants
- Soil characteristics
- Time available for remediation

Potential Remediation Methods

4.4 One soil sample (BH-1) was found to be contaminated with lead. About $37m^3$ of soil would need to be excavated and treated as recommended in the CAR.

4.5 **Table 4.1** tabulates the applicability and limitations of some common remediation techniques for heavy metals contaminated soil.

Table 4.1 List of Possible Remedial Measures for Heavy Metals Contaminated Soil

Remediation Measures	Descriptions	Applicability	Limitations
Cement Solidification/ Stabilization	*Ex situ* immobilization technique treats contaminated soil by mixing soil with binding agents, e.g. cement so that the contaminants become physically bound within stable mass.	• Applicable to clean-up inorganic contaminants, including heavy metals. • Solidification/stabilization has been used on certain contaminated sites in Hong Kong and demonstrated as a successful treatment method for inorganic contaminated soil, e.g. decontamination works at Cheoy Lee Shipyard at Penny's Bay, reclamation works at North Tsing Yi Shipyard site and few isolated sites identified in the Deep Bay Link project.	• The effectiveness reduces with the presence of organic contaminants (N.B. No organic contaminants were found in the heavy metal contaminated soil in this Study). • Large boulders may hinder the mixing process. Soil sorting is necessary before the treatment taken place. • The process may result in volume increase. • Pilot test is required to set the appropriate ratio of cement to soil for complete immobilization.
Electronkinetic Separation	In situ remediation uses electrochemical and electrokinetic processes to desorb and remove metals and polar organics from soil. Low intensity direct current is applied to the soil to mobilize the charged species.	• Applicable to treat low permeability soil contaminated with heavy metals.	• The effectiveness depends on moisture content of soil. It decreases with moisture content less than 10%. • Require further treatment to remove the desorbed contaminants and thus increase the cost of remediation. • Presence of anomalies such as large gravels and insulating material in soil can induce variability of electrical conductivity in soil. This may reduce the effectiveness.
Excavation and Landfill Disposal	*Ex-situ* method whereby contaminants are removed by excavation of the contaminated soil and direct disposal to landfill	• Most simple and quickest way to dispose of small volume of contaminated soil • Contamination is removed definitely • Higher certainty of success • Wide experience in Hong Kong • Applicable to all waste or mixture that meet land disposal restriction treatment standards. • Common practice for shallow, highly-contaminated soils.	• Pre-treatment may be required for contaminated soil to meet landfill disposal criteria • Landfill space limited and valuable. • Indirect costs to the landfill management on monitoring and maintenance. • Potential long-term liabilities to landfill • Need large volume of clean backfill materials • No access to the working site until completion of backfilling • Least desirable management option.

Heavy metals contaminated soil

4.6 Approximately 37m^3 lead contaminated soil has been found in this SI. Considering the cost effectiveness and applicability of different remediation techniques listed above in **Table 4.1**, cement solidification/stabilization (CS/S) is the comparatively most practical and cost effective method to treat the heavy metals contaminated soil in this Study. The solid monolithic block adopted in this CS/S technique is extremely resistant to the leaching of inorganic contaminants. Additives can be added to assist in chemically binding the contaminants in a matrix that typically shows unconfined compressive strengths similar to a soil-cement mix. With numerous successful cases in Hong Kong as stated in **Table 4.1**, on site solidification/stabilization technique is considered to be most appropriate method for remediation of lead contaminated soil in this Study.

Soil Excavation and Transportation of Contaminated Soil

4.7 CS/S recommended in this Study requires excavation of contaminated soil from the ground prior to treatment. In order to minimize the duration of contact between contaminated soil and workers, excavation works should be done within short period of time. No excavation should be held during rainy days to avoid the migration of contaminants on sites.

4.8 Temporary storage of contaminated soil for CS/S is allowed at the designated area where it is paved and is not intercepting with groundwater table. Stockpile should fully covered by impermeable sheet to prevent dust emission. Impermeable sheet should be placed at the bottom of stockpile and leachate from contaminated the underlying soil and groundwater. The collected leachate should be handled and disposed of as chemical waste. The assigned stockpiling area should have warning post.

4.9 General construction practice should be exercised to control the spread of dust from site to the nearby areas. Decontamination shall be properly executed to workers and vehicles before leaving the site. Vehicle wheels and body washing facilities should be provided on site at the exit point.

Cement Solidification/Stabilization Treatment (CS/S)

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

4.11 During the CS/S 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 additive(s) should be

taken up using a skip (or other equivalent) at the designated treatment area to minimise the potential for leaching during the solidification process.

4.12 Trial test on the mixing ratio on cement to soil shall be conducted prior to the commencement of full scale CS/S.

4.13 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 contaminated materials meet the i) Toxicity Characteristics Leaching Procedure (TCLP) and ii) unconfined compressive strength (UCS) tests i.e. achievement of the stabilization targets.

Toxicity Characteristics Leaching Procedure Test

4.14 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 will 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.

4.15 The sample preparation method of USEPA Method 1311 will be followed for the TCLP analysis. It is specified in USEPA Method 1311 that the maximum grain size of samples to be analysed is 1cm. As such, the samples should be further broken up in the laboratory prior to TCLP analysis. TCLP tests should be conducted in accordance with USEPA Method 1311 and USEPA Method 6020 for the concerned metals in this Study. The TCLP test of the CS/S treated soil should comply with the "Universal Treatment Standards" (UTS), as shown in **Table 4.2**, before using the soil on-site.

Table 4.2 Universal Treatment Standard (UTS) for Lead

Parameters	Universal Treatment Standard
Lead	0.75 mg/L as TCLP

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

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

Unconfined compressive strength (UCS)

4.18 The treated material should be allowed to set to achieve the unconfined compressive strength (UCS) of not less than 1 MPa with reference to the USEPA guidelines (1986) – handbook for

Stabilisation/Solidification of Hazardous Wastes, EPA/540/2-86-00. The test procedure of UCS test shall be based on BS 1377.

4.19 The solidified materials shall than be broken into mass with maximum size of 250mm for backfilling or reuse on-site. Whenever the soil is to be reused as filling materials, the soil shall be put below 1m of clean fill.

Closure Assessment

4.20 A closure assessment to confirm the clean–up for the excavation of contaminated areas should be undertaken. The objective is to determine if all contaminated soils have been removed before backfilling takes place. Following excavation and before backfilling, the soil at the boundary should be visually inspected by a qualified land contamination specialist. If sign of contamination is still found, further excavation should be initiated and more soil samples should be analysed to determine whether extended excavation is necessary.

4.21 Confirmatory soil sampling for closure assessment should be carried out to confirm the clean-up for the excavation of the contaminated site. In general, at least one sample from the base of the excavation pit and four samples from the side wall should be collected for confirmatory testing. Recommended confirmatory sampling locations are indicated in **Drawing No. 5**.

4.22 Parameter, detection limit and reference method for the laboratory analysis of confirmatory soil samples for the closure assessment are tabulated in **Table 4.3.**

Table 4.3 Parameter, Detection Limit and Reference Method for Laboratory Analysis of Confirmatory Soil Samples

Parameter	Detection Limit (mg/kg) or otherwise stated	Reference Method
Lead	1	USEPA 6020

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

4.24 A Remediation Report shall be prepared by the qualified land contamination specialists and submitted to EPD to demonstrate that the cleanup is adequate. Information such as soil disposal records, sampling results and photographs shall be included in the report.

Health and Safety Measures

4.25 During the course of the site remediation, 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.

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

- Excavation profiles must be properly designed and executed.
- In case the soil to be excavated is situated beneath the groundwater table, it may be necessary to lower the groundwater table by installing well points or similar means. The discharge of groundwater, if any, should follow the requirements under the Water Pollution Control Ordinance (WPCO).
- Excavation zone should be fenced off.
- Quantities of soil to be excavated must be estimated.
- It may be necessary to split quantities of soil according to soil type, degree and nature of contamination.
- Temporary storage of soil at intermediate depot or on-site may be required. The storage site should include protection facilities for leaching into the ground e.g. a liner may be required.
- Supply of suitable clean backfill material is needed after excavation.
- Care must be taken of existing buildings and utilities.
- Precautions must be taken to control of ground settlement.

4.27 The following environmental mitigation measures should be strictly followed during the operation and/or maintenance of the cement solidification/stabilization:

Air Quality Mitigation Measures

- The loading, unloading, handling, transfer or storage of cement should be carried out in an enclosed system.
- The loading, unloading, handling, transfer or storage of other materials which may generate airborne dust emissions such as untreated soil and oversize materials sorted out from the

screening plant and stabilized soil stockpiled in the designated handling area, should be carried out in such a manner to prevent or minimise dust emissions. These materials should be adequately wetted prior to and during the loading, unloading and handling operations.

- All practicable measures should be taken to prevent or minimize the dust emission caused by vehicle movement.

Noise Mitigation Measures

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

Water Quality Mitigation Measures

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

Waste Mitigation Measures

- The oversize materials should be screened out, cleaned the soil attached and used as filling material within the site. Contaminated materials (soil or rock fragments) of size smaller than 5 cm should be collected and transferred to the mixing area for decontamination treatment.
- Stabilized soils should be broken into suitable size for backfilling or reuse on site.
- A high standard of housekeeping should be maintained within the mixing area.
- There should be clear and separated areas for stockpiling of untreated and treated materials.

5 CONCLUSION AND RECOMMENDATION

5.1 According to the Contamination Assessment Plan (CAP) approved by EPD in 2 April 2008, altogether 4 boreholes were constructed and surface soil samples were collected in five sampling locations. Site investigation was carried out in accordance with the CAP in late March 2008.

5.2 10 soil samples were collected from 4 boreholes for contamination assessment around the fuel tank system, while 5 surface soil samples were collected for laboratory analysis for surface deposition contamination assessment. The results indicated that only 1 soil sample (BH-1, 1.5 – 1.95m bcl) was found exceeding the relevant RBRG for lead. The amount of contaminated soil required for remediation is estimated to be ~37m^3. There was no groundwater encountered at all boreholes, therefore, no groundwater sample was collected.

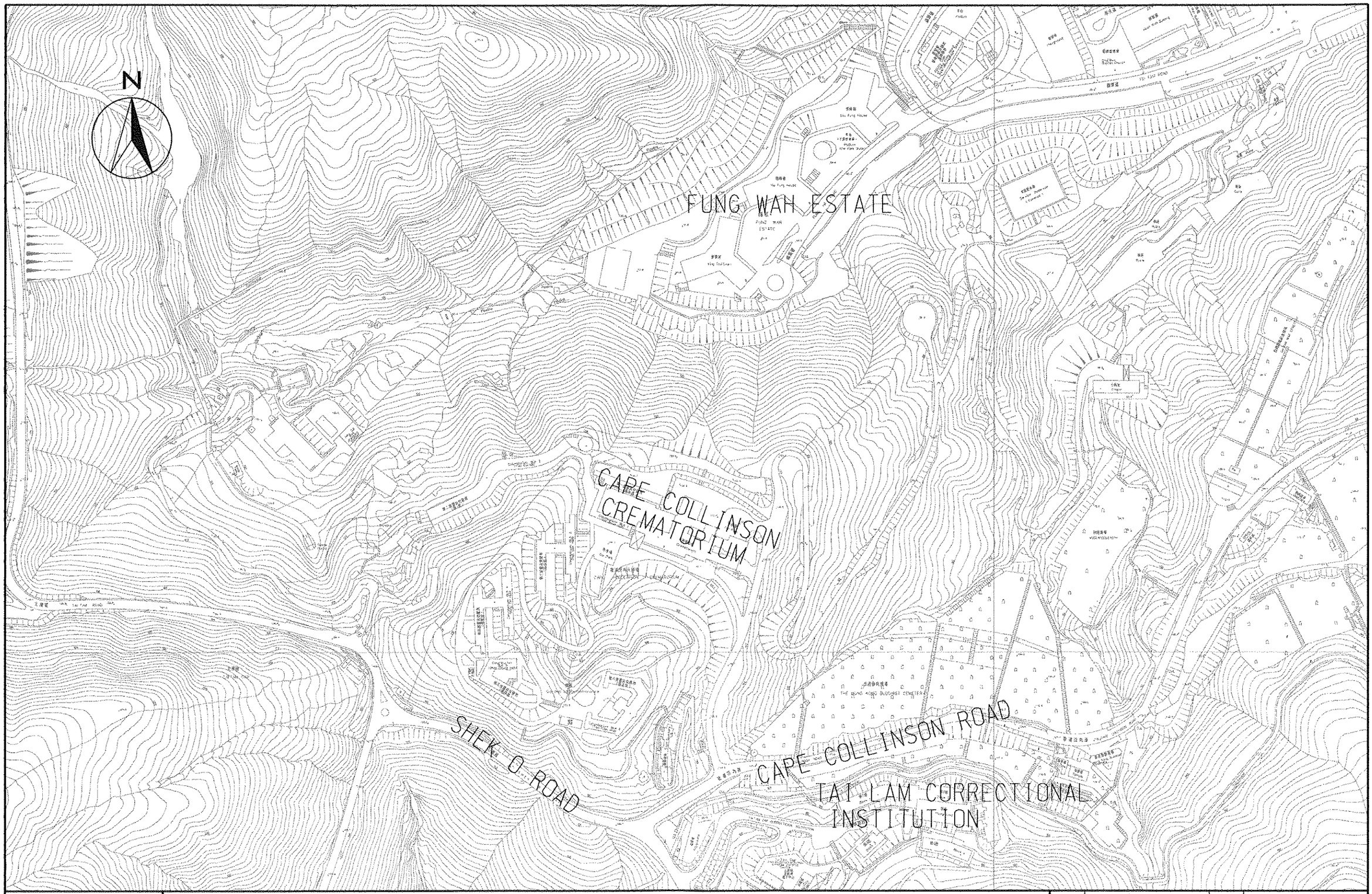
5.3 Cement solidification/stabilization (CS/S) treatment is proposed for the ~37m^3 soils contaminated with heavy metals in this Study. The treated soils have to meet both the universal treatment standards in the TCLP test and the unconfined compressive strength (UCS) test of not less than 1 MPa before backfilling on site.

5.4 To ensure complete removal of contaminated soil, a closure assessment in the form of confirmatory test has been proposed to be conducted after excavation of contaminated site. A remediation report (RR) shall be submitted for EPD's approval upon completion of the remediation works.

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

5.6 Since the cremators are still in operation and the proposed trial pit location (TP-1) is possessed by CEDD, it is not possible to carry out site investigation inside the cremator rooms and underneath the pipeline at this stage. Further site investigation for TP-1 shall be carried out prior to any demolition works according to the approved CAP. A supplementary CAP shall be prepared to detail the sampling and testing plan for the cremator rooms before the site investigation carrying out. Upon completion of further site investigation, a supplementary CAR shall be prepared to present the findings of the further site investigation for EPD's approval. If contamination is found, a supplementary RAP shall be prepared and submitted to EPD and all contaminated soils shall be treated prior to the commencement of any earthworks.

Drawings



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PHASED REPROVISIONING OF CAPE COLLINSON CREMATORIUM ENVIRONMETNAL IMPACT ASSESSEMENT STUDY

LOCATION PLAN

SCALE	A3 1:2500	DATE	FEB 08
CHECK	IWSL	DRAWN	CHKM
JOB No.	60028568	DRAWING No. 1	REV –

P:/60028568/1.01/CAD/Drawing/Report/CAP/DRAWING NO. 1.DGN

LEGEND:

——— CEDD SITE HOARDING FOR THE 10 - YEAR EXTENDED LPM PROJECT, PHASE 5, PACKAGE D - LANDSLIP PREVENTIVE WORKS FOR SLOPES IN HONG KONG ISLAND

N

EXISTING CREMATORIUM BUILDING

NEW CAPE COLLINSON GARDEN OF REMEMBRANCE

第一座靈灰安置所 (務本堂)

Columbarium BLK 1 (Mo Been Tah)

Columbarium BLK 3 (Hak Lim Hall)

第二座靈灰安置所 (忘念堂)

停車場 Car Park

6 CHIMNEYS

CREMATION ROOM 1

CREMATION ROOM 2

火葬場遺房 Crematorium

UNDERGROUND STORAGE TANK

FUEL PUMP

ABOVEGROUND STORAGE TANK TOOM

CAPE COLLINSON CREMATORIUM

ESS

AECOM
ENSR
MAUNSELL
ENSR Asia (HK) Ltd

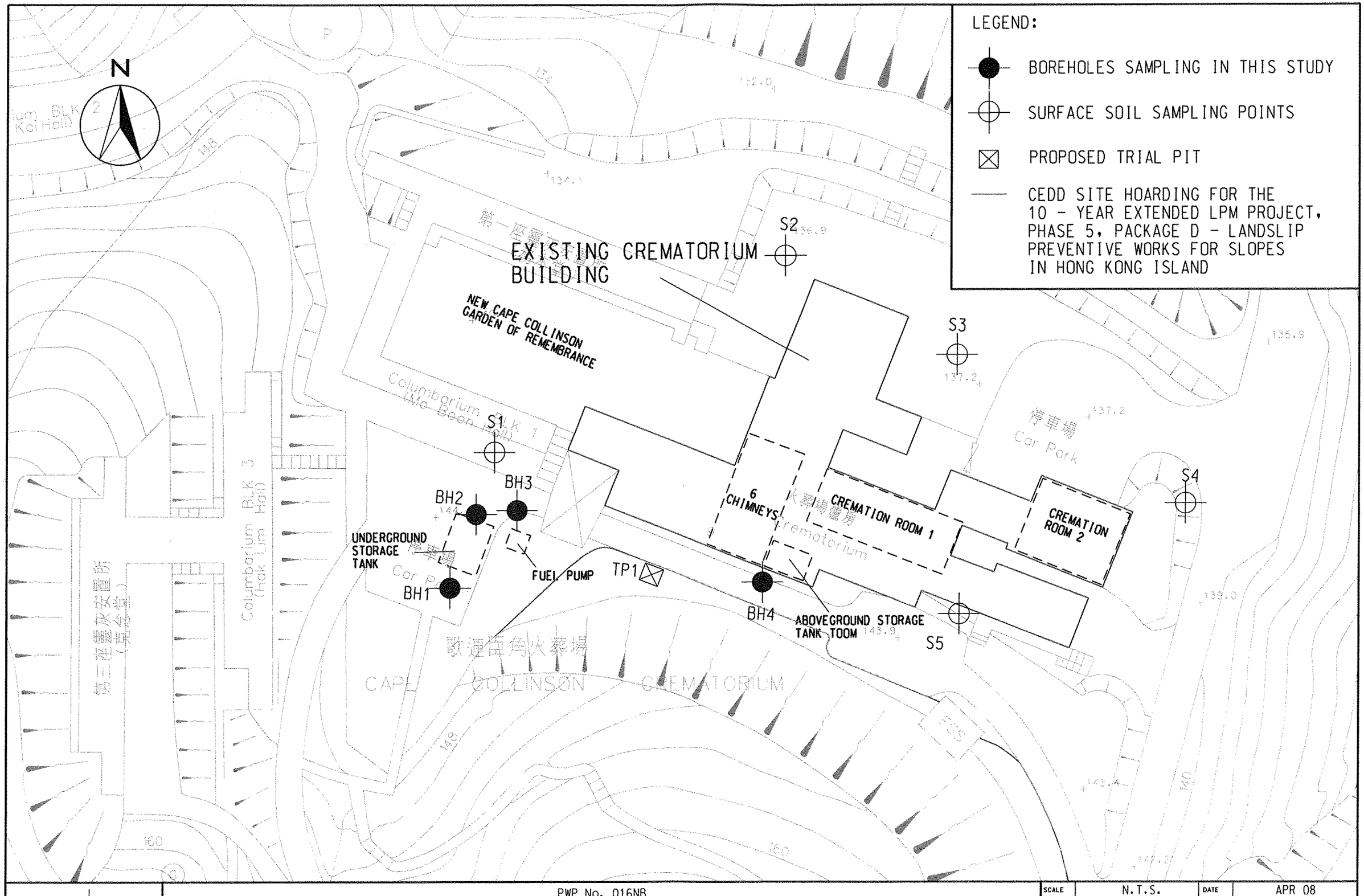
PWP No. 016NB

PHASED REPROVISIONING OF CAPE CLLINSON CREMATORIUM ENVIRONMENTAL IMPACT ASSESSMENT STUDY

STRUCTURAL LAYOUT OF THE EXISTING CREMATORIUM

SCALE	N.T.S.	DATE	FEB 08
CHECK	IWSL	DRAWN	CHKM
JOB NO.	60028568	DRAWING NO.	2
		REV	–

P:/60028568/1.01/CAD/Drawing/Report/CAR/DRAWING NO 2.DGN



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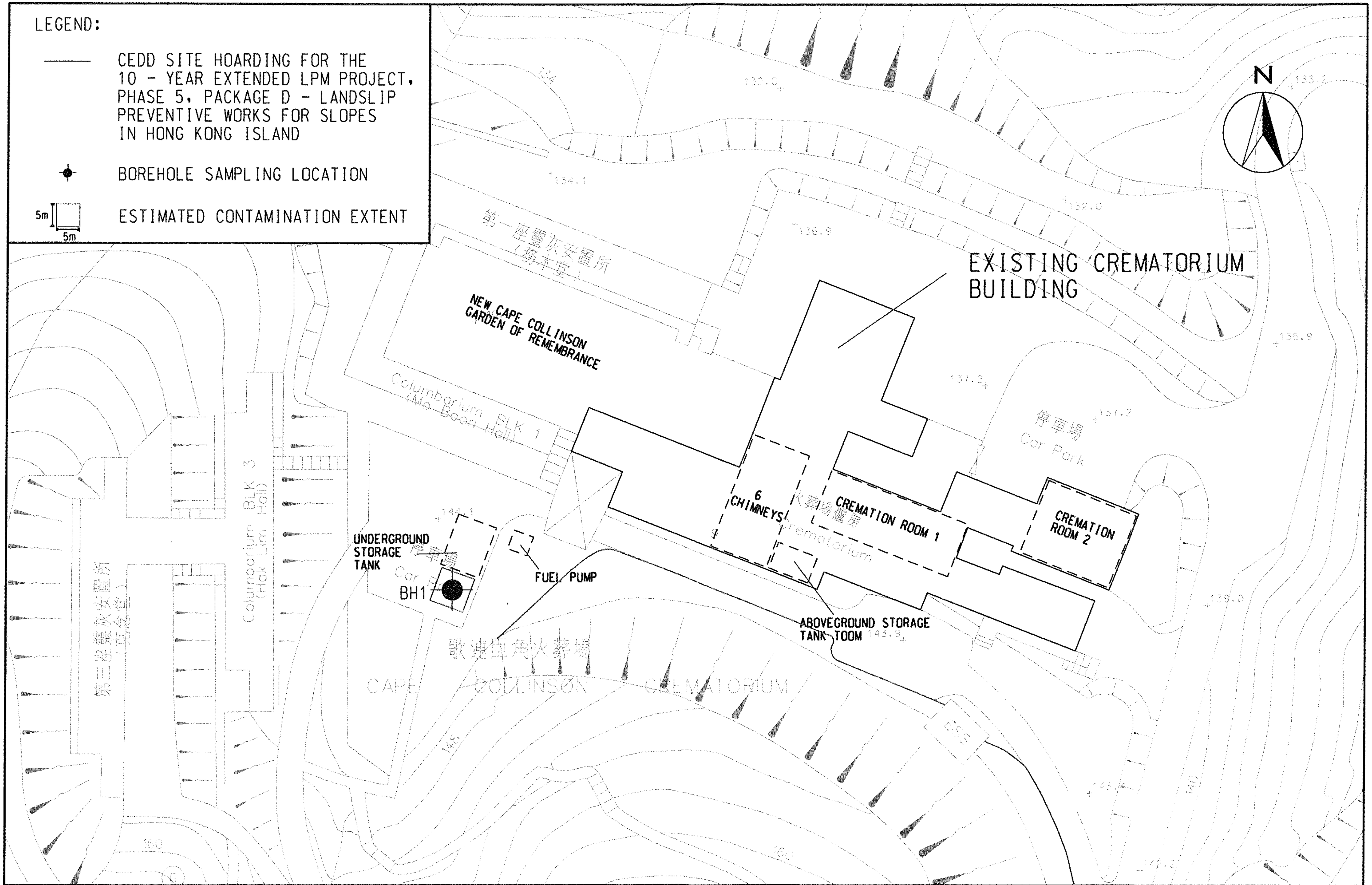
PWP No. 016NB
PHASED REPROVISIONING OF CAPE CLLINSON CREMATORIUM ENVIRONMENTAL IMPACT ASSESSMENT STUDY

SAMPLING LOCATIONS

SCALE	N.T.S.	DATE	APR 08
CHECK	IWSL	DRAWN	CHKM
JOB No.	60028568	DRAWING No.	3
		REV	–

P:/60028568/1.01/CAD/Drawing/Report/CAR/DRAWING NO 3.DGN



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PHASED REPROVISIONING OF CAPE CLLINSON CREMATORIUM ENVIRONMENTAL IMPACT ASSESSMENT STUDY

ESTIMATED CONTAMINATION EXTENT

SCALE	N.T.S.	DATE	APR 08
CHECK	IWSL	DRAWN	CHKM
JOB No.	60028568	DRAWING No.	4
		REV	-

P:/60028568/1.01/CAD/Drawing/Report/CAR/DRAWING NO 4.DGN

LEGEND:

——— CEDD SITE HOARDING FOR THE 10 - YEAR EXTENDED LPM PROJECT, PHASE 5, PACKAGE D - LANDSLIP PREVENTIVE WORKS FOR SLOPES IN HONG KONG ISLAND

R1 ⊕ PROPOSED CONFIRMATORY SAMPLING LOCATIONS

5m × 5m ESTIMATED EXCAVATION ZONE

N

EXISTING CREMATORIUM BUILDING

NEW CAPE COLLINSON GARDEN OF REMEMBRANCE

第一座靈灰安置所 (勝太堂)

Columbarium BLK 1 (Mo Boon Hall)

Columbarium BLK 3 (Yuk Lim Hall)

第二座靈灰安置所 (德合堂)

6 CHIMNEYS

CREMATION ROOM 1

CREMATION ROOM 2

UNDERGROUND STORAGE TANK

FUEL PUMP

ABOVEGROUND STORAGE TANK TOOM

停車場 Car Park

火葬場 Crematorium

歌連臣角火葬場 CAPE COLLINSON CREMATORIUM

R1 R2 R3 R4 R5

Sampling ID	Type of Samples	Sampling Depth (m below concrete layer)	Confirmatory Testing Parameter
R1	Sidewall Sample	1.8	Lead
R2	Sidewall Sample	1.8	Lead
R3	Sidewall Sample	1.8	Lead
R4	Sidewall Sample	1.8	Lead
R5	Pit Bottom Sample	2.45	Lead

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PWP No. 016NB

PHASED REPROVISIONING OF CAPE CLLINSON CREMATORIUM ENVIRONMENTAL IMPACT ASSESSMENT STUDY

PROPOSED CONFIRMATORY SAMPLING LOCATIONS

SCALE	N.T.S.	DATE	APR 08
CHECK	IWSL	DRAWN	CHKM
JOB No.	60028568	DRAWING No.	5
		REV	–

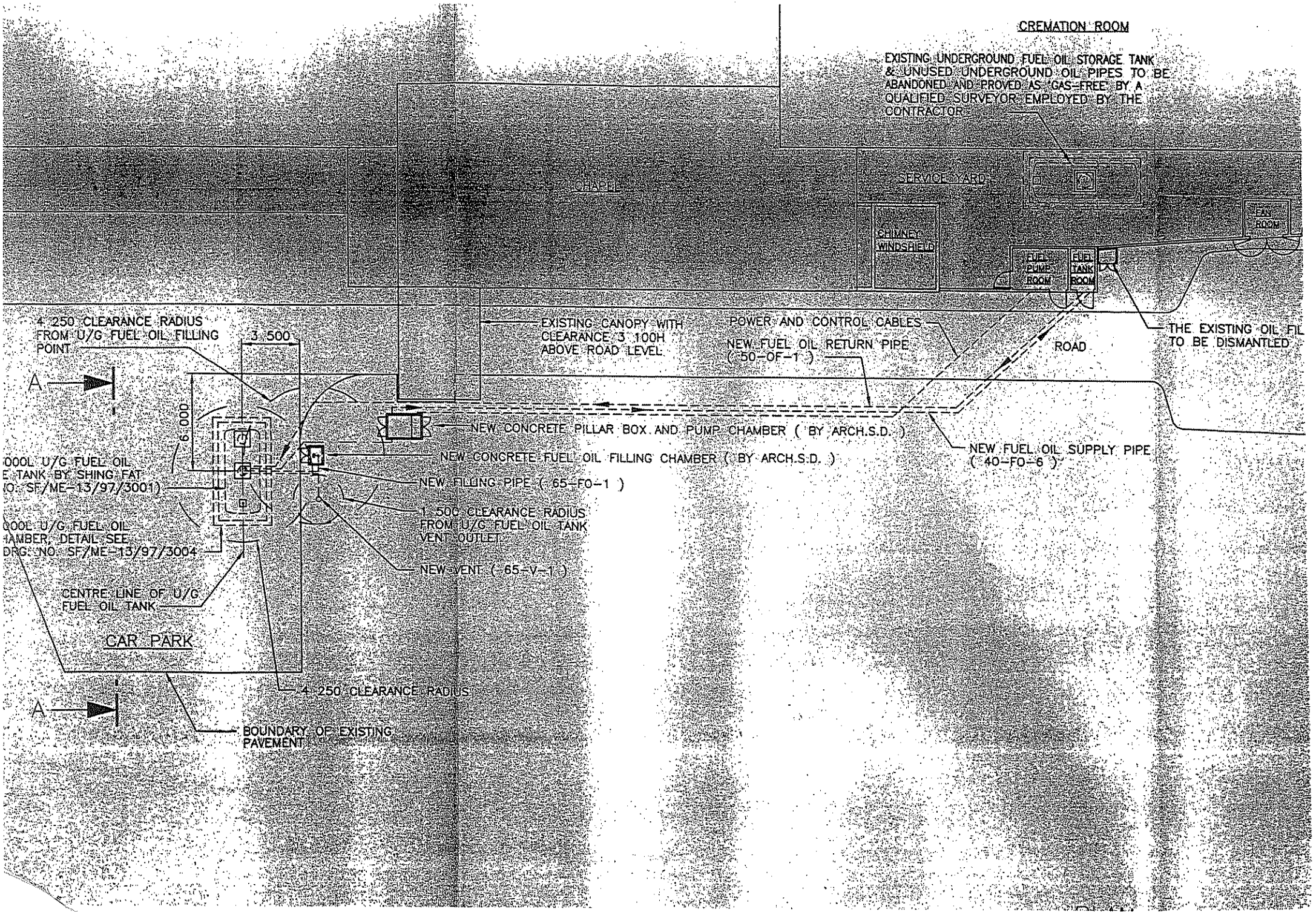
P:/60028568/1.01/CAD/Drawing/Report/CAR/DRAWING NO 5.DGN

Appendix A

Rationales of Selection for Site Inspection

Location	Site Observation	SI Proposed
Underground Storage Tank	• Fuel is pumped from the underground fuel tank to the aboveground storage tank via underground pipeline. Exact location of the pipeline was not clear. • Potential leakage from the tank via cracks to the ground is likely	Yes
Aboveground Storage Tank	• Tank room covered by intact concrete floor with no stain observed; • Fuel was pumped from the underground tank via underground pipeline; • Potential leakage from the pipe via cracks to the ground is likely	Yes
Cremation Room 1	• The floors were well covered by intact tiles with no stain observed; • The oil pipes ended behind the cremators where their connections were clad in metal plates; • Occasional leakage of fuel was suspected.	Yes
Cremation Room 2	• The floors were covered by intact tiles with no stain observed; • Occasional leakage of fuel was suspected.	Yes
East of Chimneys	• Some part of the ground was covered by intact concrete while the other area was landscaped with trees and shrubs; • Construction works may be conducted within these areas. As contaminants of stack emissions might deposit on the soil where the ground was unpaved, contamination of the soil is likely.	Yes
South of Chimneys	• As no works would be carried out at this area, contamination of soil is not anticipated.	No
West of Chimneys	• Construction works may be conducted within these areas. As contaminants of stack emissions might deposit on the soil where the ground was unpaved, contamination of the soil is likely.	Yes
North of Chimneys	• Some part of the ground was covered by intact concrete while some part of the area was landscaped with trees and shrubs; • As contaminants of stack emissions might deposit on the soil where the ground was unpaved, contamination of the soil is likely.	Yes

Appendix B


CREMATION ROOM
EXISTING UNDERGROUND FUEL OIL STORAGE TANK & UNUSED UNDERGROUND OIL PIPES TO BE ABANDONED AND PROVED AS GAS-FREE BY A QUALIFIED SURVEYOR EMPLOYED BY THE CONTRACTOR
CHAPEL
SERVICE YARD
CHIMNEY
WINDSHIELD
FAN ROOM
FUEL PUMP ROOM
FUEL TANK ROOM
4 250 CLEARANCE RADIUS FROM U/G FUEL OIL FILLING POINT
3 500
EXISTING CANOPY WITH CLEARANCE 3 100H ABOVE ROAD LEVEL
POWER AND CONTROL CABLES
NEW FUEL OIL RETURN PIPE (50-OF-1)
ROAD
THE EXISTING OIL FIL TO BE DISMANTLED
A
6 000
NEW CONCRETE PILLAR BOX AND PUMP CHAMBER (BY ARCH.S.D.)
NEW CONCRETE FUEL OIL FILLING CHAMBER (BY ARCH.S.D.)
NEW FUEL OIL SUPPLY PIPE (40-FO-6)
000L U/G FUEL OIL E TANK BY SHING FAT IO: SF/ME-13/97/3001)
NEW FILLING PIPE (65-FO-1)
000L U/G FUEL OIL HAMBER, DETAIL SEE DRG. NO. SF/ME-13/97/3004
1 500 CLEARANCE RADIUS FROM U/G FUEL OIL TANK VENT OUTLET
NEW VENT (65-V-1)
CENTRE LINE OF U/G FUEL OIL TANK
CAR PARK
4 250 CLEARANCE RADIUS
A
BOUNDARY OF EXISTING PAVEMENT

Appendix C

土木工程拓展署
CEDD Civil Engineering and Development Department

土力工程處
Geotechnical Engineering Office

Web site 網址 : http://www.cedd.gov.hk
E-mail 電子郵件 :
Telephone 電話 : (852) 2760 5753
Facsimile 傳真 : (852) 2712 6357
Our ref 本署檔號 : LPM/(GE/2006/04)/M10/300
Your ref 來函檔號 : 60028568/C/dwhl/8003191

香港九龍公主道 101 號
土木工程拓展署大樓
Civil Engineering and
Development Building,
101 Princess Margaret Road,
Kowloon, Hong Kong

27 March 2008

ENSR Asia (HK) Ltd.
11/F, Grand Central Plaza, Tower 2
138 Shatin Rural Committee Road
Shatin, N.T.

ENSR Asia (HK) Ltd.				
Received	8 APR 2008			
Reg. No.	804105			
File No.				
M Chan	AYK	FOCM		Sign Off
	TYUT	JLAM		
Env. Consultant	DCFL.			
Others				
Copied To				
Reply Date				

Attn: Mr. Derek Lam

Dear Sirs,

Contract No. GE/2006/04
10-Year Extended LPM Project, Phase 5, Package D - Landslip Preventive Works for Slopes in Hong Kong Island

Feature No. 11SE-D/C71, Cape Collinson Crematorium
Request for Temporary Site Access for Site Investigation

We refer to your above-referenced letter dated 19 March 2008 regarding the captioned subject.

After careful consideration, we regret that we are unable to accede to your request for temporary site access. Our problem is that the LPM works for feature 11SE-D/C71 is already suffering a delay of more than two months. Please be advised that the LPM works at this feature are at the terminal stage and that the Contractor would be mobilizing the plant and equipment off site and removing the hoarding by early May 2008. Before this time, it is not desirable for another party to occupy the toe area or any part thereof, for operational and safety reasons. As soon as the LPM works are completed, the concerned land will be handed back to Lands Department. Hence, it is more appropriate for you to carry out your investigation works after the land has been handed back to Lands Department. We have requested our Consultants to closely monitor the LPM works for this feature to ensure the works would be completed as soon as possible.

Yours faithfully,

(Elton K F Fok)
for Chief Geotechnical Engineer/LPM Division 3

c.c. Mott Connell Ltd (Mr. Chris Howley)

KYC/EKFF/ef

From: laiwk1@archsd.gov.hk [mailto:laiwk1@archsd.gov.hk]
Sent: Wednesday, April 16, 2008 4:02 PM
To: nlshum@fehd.gov.hk
Cc: Lam, Cheung Fai Derek; spm324@archsd.gov.hk; f.yu@alkf-arch.com; Simon Lee
Subject: Request for temporary site access for site investigation

Dear Mr. Shum

One trial pit is needed to be constructed on site for locating the fuel pipeline and collecting soil sample as per the requirement of Contamination Assessment Plan. In according to the latest information from EMSD, the fuel pipeline may be laid near the foot of the slope under CEDD possession for Landslip Preventive Measure project and slope stabilisation work in progress. In view of the tight time schedule for the EIA study, we have contacted the project geotechnical engineer to seek their approval for temporary site access and permission to carry out trial pit sampling within the concerned area. However, the project engineer is unable to accede to our request because of contractual problem and safety reason. He further advised that the tentative completion and handover date will be mid May 2008. While our environmental consultant strives to expedite the work in order to complete the EIA report by end May 2008, the lack of access for site investigation inevitably affects the progress. The consultant is reviewing the implication and will advise the time of delay once available. Regards.

WKLai
PM342
28673714

Appendix D

Soil boring log

ENSR

Job No.: 60028568	Completion Date : March, 18, 2008	Boring Log No. : BH1
Northing: 22.15.486	Location: Cape Collinson Crematorium	Logger : Leung Wing Hang
Easting: 114.13.779		Driller : Geotechnical Engineering

Time (hrs)	Soil Sample I.D.	Depth(m bcl)	Sample	Method	USCS Symbol	Description of Material	Well Diagram
18/3/2008					SP	Grey, silty sand with fine to medium gravel sized rock fragements (FILL)	
09:40	BH1- (0.5m)	0.5		Hand Digging	SP	Yellowish brown, silty fine to coarse sand with occasionally fine to medium sized rock fragements (FILL)	No Groundwater Encounterec No Well Installed
		1.0					
13:30	BH1 (1.50 - 1.95m)	1.5			SM	Extremely weak to weak, yellowish brown to brown, completely decoposed fine to coarse grained TUFF (fine sandy silt with ocassional rocks fragements)	
		2.0		Rotary Drilling			
		2.5					
		3.0					
		3.5					
		4.0					
		4.5					
		5.0					
16:00	BH1 (5.50 - 5.95m)	5.5				Moderately weak, graysih white, completely to highly decomposed TUFF with highly fractured, managese oxides stained joints	
		6.0					
						End of soil bore = 6 m bcl	

Remarks :

1) Concrete slab: 0.1m
2) Inspection pit from ground surface to 5.95 m bcl.
3) Soil Samples for BH1 at 0.5m, 1.5-1.95m and 5.50-5.95m were selected for laboratory analysis.

Boring Details

Soil bore Diameter : 0.75 m
Total Depth : 6.00 m bcl
Water First Noticed: NA

Well Installation Details

Well Diameter:
Total Depth:
Screen:
Sand Pack:
Bentonite Seal:
Grout:
Ground Completion :

Soil boring log

ENSR

Job No.: 60028568 Northing: 22.15.489 Easting: 114.13.799	Completion Date : March, 17, 2008 Location: Cape Collinson Creatorium	Boring Log No. : BH2 Logger : Leung Wing Hang Driller : Geotechnical Engineering

Time (hrs)	Soil Sample I.D.	Depth(m bcl)	Sample	Method	USCS Symbol	Description of Material	Well Diagram
17/3/2008				Hand Digging	SM	Browish grey, silty sand, medium to coarse gravel sized rock fragements (FILL)	No Groundwater Encounterec No Well Installed
12:00	BH2- (0.5m)	0.5					
		1.0					
		1.5					
18/3/2008				Rotary Drilling	ML	Extremely weak to very weak, yellowish brown, completely decomposed fine to medium grained TUFF (clayey, sandy silt)	
10:45	BH2 (2.00-2.45m)	2.0					
		2.5					
		3.0					
		3.5					
		4.0					
		4.5					
		5.0					
		5.5					
14:40	BH2 (5.80 - 6.25m)	6.0					
						End of soil bore = 6.30 m bcl	

Remarks :

1) Concrete slab: 0.1m
2) Inspection pit from ground surface to 1.5m bcl.
3) Soil sample for BH2 at 0.5m, 2.00-2.45m and 5.80-6.25m were selected for laboratory analysis.

Boring Details

Soil bore Diameter : 0.75 m
Total Depth : 6.30 m bcl
Water First Noticed: NA

Well Installation Details

Well Diameter:
Total Depth:
Screen:
Sand Pack:
Bentonite Seal:
Grout:
Ground Completion :

Soil boring log

ENSR

Job No.: 60028568	Completion Date : March, 15, 2008	Boring Log No. : BH3
Northing: 22.15.486	Location: Cape Collinson Crematorium	Logger : Leung Wing Hang
Easting: 114.13.785		Driller : Geotechnical Engineering

Time (hrs)	Soil Sample I.D.	Depth(m bcl)	Sample	Method	USCS Symbol	Description of Material	Well Diagram
14/3/2008					SP	Yellowish brown, silty fine to coarse SAND with ocassional fine gravel sized rock fragement (FILL)	
14:17	BH3- (0.5m)	0.5		Hand Digging			No Groundwater Encounterec
		1.0			ML	Extremely weak to weak, yellowish brown with spotted white, compietely decomposed fine to medium grained TUFF (clayey sandy silt)	No Well Installed
15/3/2008							
9:56	BH3 (1.50 - 1.95 m)	1.5					
		2.0					
		2.5					
		3.0			ML	Very weak to weak, yellowish brown, completely to highly decomposed TUFF (sandy silt)	
		3.5		Rotary Drilling			
		4.0					
		4.5					
		5.0					
12:47	BH3 (5.50 - 5.95 m)	5.5					
		6.0				End of soil bore = 6 m bcl	

Remarks :

1) Concrete slab: 0.1m
2) Inspection pit from ground surface to 1.5m bcl.
3) Soil sample for BH3 at 0.5m, 1.50-1.95m and 5.50-5.95m were selected for laboratory analysis.

Boring Details

Soil bore Diameter : 0.75 m
Total Depth : 6.00 m bcl
Water First Noticed: NA

Well Installation Details

Well Diameter:
Total Depth:
Screen:
Sand Pack:
Bentonite Seal:
Grout:
Ground Completion :

Soil boring log

ENSR

Job No.: 60028568	Completion Date : March, 20, 2008	Boring Log No. : BH4
Northing: 22.15.479	Location: Cape Collinson Crematorium	Logger : Leung Wing Hang
Easting: 114.13.795		Driller : Geotechnical Engineering

Time (hrs)	Soil Sample I.D.	Depth(m bcl)	Sample	Method	USCS Symbol	Description of Material	Well Diagram
17/3/2008				Hand Digging	SP	Browish grey, silty sand with fine to coarse sized rock fragement (FILL)	
13:50	BH4-0.5m	0.5					
						Moderately weak to moderately strong, yellowish grey spotted white, highly to moderately decomposed fine to medium grained TUFF, with highly fracture and managnese oxide stained joints	No Groundwater Encountered No Well Installed
		1.0					
		1.5					
						Moderately strong, yellowish grey with spotted white, moderately decomposed fine to medium grained TUFF, with closely to medium spaced, rough planar, manganese oxide stained joints, dipping at 10-30°	
		2.0					
		2.5					
		3.0					
		3.5		Rotary Drilling		Strong, grey spotted white, slightly decomposed fine to medium grained TUFF, with closely spaced, rough planar, limonite stained joints, dipping at 10-20° and 80-90° Moderately decomposed at 3.50 - 3.55m and 3.70 - 3.80m	
		4.0					
		4.5					
		5.0					
		5.5					
		6.0					
						End of soil bore = 6.25 m bcl	

Remarks :

1) Concrete slab: 0.1m
2) Inspection pit from ground surface to 0.6m bcl.
3) Soil samples for BH4 at 0.5m was selected for laboratory analysis.

Boring Details

Soil bore Diameter : 0.75 m
Total Depth : 6.25 m bcl
Water First Noticed: NA

Well Installation Details

Well Diameter:
Total Depth:
Screen:
Sand Pack:
Bentonite Seal:
Grout:
Ground Completion :

Appendix E

Criteria					VOCs mg/kg				TPH, mg/kg			Heavy Metal, mg/kg														Dioxin, ng/kg
					Benzene	Toluene	Ethylbenzene	Xylenes (Total)	C6-C8	C9-C16	C17-C35	Antimony	Arsenic	Barium	Cadmium	Chromium III	Chromium VI	Cobalt	Copper	Lead	Manganese	Mercury	Molybdnum	Nickel	Tin	Zince	Dioxins (I-TEQ)
Industrial					9.21	10000	8240	1230	10000	10000	10000	261	196	10000	653	10000	1960	10000	10000	2290	10000	38.4	3260	10000	10000	10000	5000
Soil Saturation Limit (Csat)					338	235	138	150	1000	3000	5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soil Sample Identification																										
Location	Depth (m)		Type	Sampling Date																						
	From	To																								
S1	0.10	NA	#	14/03/2008	NA	NA	NA	NA	NA	NA	NA	<0.50	6.1	26	0.10	6.6	<1.0	1.7	9.2	57	170	<0.05	2.3	3.6	13	54	8.32
S2	0.50	NA	#	14/03/2008	NA	NA	NA	NA	NA	NA	NA	<0.50	2.0	72	<0.10	1.8	<1.0	2.9	2.4	91	830	<0.05	<1.0	1.0	3.5	25	3.92
S3	0.10	NA	#	14/03/2008	NA	NA	NA	NA	NA	NA	NA	<0.50	4.7	17	<0.10	6.4	<1.0	1.0	5.8	67	140	<0.05	2.4	2.7	8.2	36	2.24
S4	0.10	NA	#	14/03/2008	NA	NA	NA	NA	NA	NA	NA	<0.50	4.1	19	<0.10	1.7	<1.0	6.2	1.9	150	520	<0.05	1.2	<1.0	1.3	22	2.71
S5	0.10	NA	#	18/03/2008	NA	NA	NA	NA	NA	NA	NA	<0.50	3.2	18	<0.10	2.5	<1.0	1.7	5.4	68	210	<0.05	1.5	1.6	3.0	34	8.58
BH-1	0.50	NA	#	17/03/2008	<0.20	<0.20	<0.20	<0.60	<5.0	<200	<500	NA	NA	NA	NA	NA	NA	NA	NA	59	NA	NA	NA	NA	NA	NA	NA
BH-1	1.50	1.95	^	17/03/2008	<0.20	<0.20	<0.20	<0.60	<5.0	<200	<500	NA	NA	NA	NA	NA	NA	NA	NA	180000	NA	NA	NA	NA	NA	NA	NA
BH-1	5.50	5.95	^	17/03/2008	<0.20	<0.20	<0.20	<0.60	<5.0	<200	<500	NA	NA	NA	NA	NA	NA	NA	NA	260	NA	NA	NA	NA	NA	NA	NA
BH-2	0.50	NA	#	17/03/2008	<0.20	<0.20	<0.20	<0.60	<5.0	<200	<500	NA	NA	NA	NA	NA	NA	NA	NA	37	NA	NA	NA	NA	NA	NA	NA
BH-2	2.00	2.45	^	18/03/2008	<0.20	<0.20	<0.20	<0.60	<5.0	<200	<500	NA	NA	NA	NA	NA	NA	NA	NA	72	NA	NA	NA	NA	NA	NA	NA
BH-2	5.80	6.25	^	18/03/2008	<0.20	<0.20	<0.20	<0.60	<5.0	<200	<500	NA	NA	NA	NA	NA	NA	NA	NA	48	NA	NA	NA	NA	NA	NA	NA
BH-3	0.50	NA	#	15/03/2008	<0.20	<0.20	<0.20	<0.60	<5.0	<200	<500	NA	NA	Na	NA	NA	NA	NA	NA	57	NA	NA	NA	NA	NA	NA	NA
BH-3	1.50	2.00	^	15/03/2008	<0.20	<0.20	<0.20	<0.60	<5.0	<200	<500	NA	NA	NA	NA	NA	NA	NA	NA	64	NA	NA	NA	NA	NA	NA	NA
BH-3	5.50	6.00	^	15/03/2008	<0.20	<0.20	<0.20	<0.60	<5.0	<200	<500	NA	NA	NA	NA	NA	NA	NA	NA	21	NA	NA	NA	NA	NA	NA	NA
BH-4	0.50	NA	#	17/03/2008	<0.20	<0.20	<0.20	<0.60	<5.0	<200	<500	NA	NA	NA	NA	NA	NA	NA	NA	64	NA	NA	NA	NA	NA	NA	NA

Notes:
- The most stringent criteria in RBRG Table, i.e. Industrial in this case, were used.
- Square in bolded line indicates exceedance of Industrial RBRG.
- Black square indicates exceedance of Industrial RBRG
- NA = no tested required.
- Full analytical results should be referred to laboratory report

#: Disturbed Samples
^: Undisturbed U76 Samples

Phased Reprovisioning of Cape Collinson Crematorium Environmental Impact Assessment Study - Contamination Assessment Report

Criteria		VOCs mg/kg				TPH, mg/kg			Heavy Metal, mg/kg														Dioxin, pg/L
		Benzene	Toluene	Ethylbenzene	Xylenes (Total)	C6-C8	C9-C16	C17-C35	Antimony	Arsenic	Barium	Cadmium	Chromium III	Chromium VI	Cobalt	Copper	Lead	Manganese	Mercury	Molybdnum	Nickel	Tin	Zince	Dioxins (I-TEQ)
Location	**Sampling Date**																							
Blank Anlaysis (in ug/L)																								
EQUIPMENT BLANK	18/03/2008	<1.0	<2.0	<2.0	<6.0	<20	<50	<50	<1.0	<10	<1.0	<1.0	<0.1	<0.1	<1.0	<1.0	<1.0	<1.0	<0.50	<1.0	<1.0	<1.0	<50	0.00
FIELD BLANK	18/03/2008	<1.0	<2.0	<2.0	<6.0	<20	<50	<50	<1.0	<10	<1.0	<1.0	<0.1	<0.1	<1.0	<1.0	<1.0	<1.0	<0.50	<1.0	<1.0	<1.0	<50	0.00
TRIP BLANK	18/03/2008	<1.0	<2.0	<2.0	<6.0	<20	<50	<50	<1.0	<10	<1.0	<1.0	<0.1	<0.1	<1.0	<1.0	<1.0	<1.0	<0.50	<1.0	<1.0	<1.0	<50	0.00