

MTR Corporation Limited

HONG KONG SECTION OF GUANGZHOU –
SHENZHEN – HONG KONG EXPRESS RAIL LINK
(No. EP-349/2009)

Revised Contamination Assessment Plan
for Mei Lai Road Works Area (Revision B)

Verified by:	
Position:	Independent Environmental Checker
Date:	2 July 2010

MTR Corporation Limited

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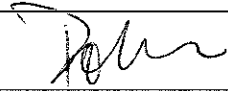
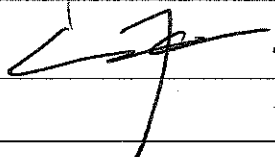
Glenn Frommes
Environmental Team Leader
30 JUN 2010

MTR Corporation Limited

**Hong Kong Section of
Guangzhou-Shenzhen-Hong Kong
Express Rail Link**

**Revised Contamination Assessment Plan for
Mei Lai Road Works Area (Site T)**

June 2010

	Name	Signature
Prepared & Checked:	Catherine Po	
Reviewed & Approved:	Lawrence Tsui	

Version: B

Date:

30 June 2010

The information contained in this report is, to the best of our knowledge, correct at the time of printing. The interpretation and recommendations in the report are based on our experience, using reasonable professional skill and judgment, and based upon the information that was available to us. These interpretations and recommendations are not necessarily relevant to any aspect outside the restricted requirements of our brief. This report has been prepared for the sole and specific use of our client and AECOM Environment accepts no responsibility for its use by others.

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1. INTRODUCTION

- 1.1 The Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL) will be a 26-km long underground rail line on a dedicated track that runs from the terminus located in West Kowloon to the boundary at Huanggang. The project is a designated project under Items A.2, A.4, A.7 and Q.1 of Part 1, Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO).
- 1.2 In accordance with the EIAO, an Environmental Impact Assessment (EIA) for the Hong Kong Section of XRL was conducted and approved on 28 September 2009 (Register No. AEIAR-143/2009) and an Environmental Permit (EP) No. EP-349/2009 was granted by the Director of Environmental Protection (DEP) on 16 October 2009.
- 1.3 During the time of EIA Study, Site T located at Mei Lai Road Works Area (MLW) was identified as an area with potential land contamination concern which required further assessment as the consent for site investigation was not granted. The location of Site T and the general site layout plan are shown in **Figure C8016/C/XRL/ENS/M57/002**. Pursuant to EP Condition 2.21, a revised Contamination Assessment Plan (CAP) with updated sampling and testing schedule according to site condition of Site T should be submitted to EPD for approval. A supplementary Contamination Assessment Report (CAR) and if contamination is found, a supplementary Remediation Action Plan (RAP) should be submitted to Environmental Protection Department (EPD) for endorsement prior to the commencement of works at Site T.
- 1.4 AECOM Asia Co. Ltd. (AECOM) was commissioned by MTR Corporation Limited (MTR) to undertake the supplementary land contamination assessment at Site T and this revised Contamination Assessment Plan is prepared to report the updated findings of further site appraisal at the site in accordance with the recommendation in the approved CAP.

2. ENVIRONMENTAL LEGISLATION, STANDARDS AND GUIDELINES

- 2.1 Assessment of land contamination sources shall be conducted in accordance with the approved EIA report, environmental standards and non-statutory guidelines recommended in the approved CAP viz. in general accordance with the requirement stipulated in “*Guidance Note for Contaminated Land Assessment Remediation*” (Guidance Note 1) and “*Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards and Car Repair / Dismantling Workshop*” (Guidance Note 2) issued by Environmental Protection Department (EPD). In addition, the Risk Based Remediation Goals (RBRGs) stipulated in the “*Guidance Manual for Use of Risk-based Remediation Goals for Contamination Management*” (The Guidance Manual) issued by EPD shall also be adopted as the criteria for assessing soil and groundwater contamination.

3. FURTHER SITE INSPECTION AND OSBERVATION

- 3.1 Site T covering an area of approximately 4,000m² is located at Mei Foo, with Po Leung Kuk Tong Nai Kan College located to the north, Mei Lai Road to the west, Castle Peak Road to the east and Mei Foo Sun Cheun Substation to the south. Site T is mainly surrounded by residential properties.
- 3.2 As described in Appendix A of the approved CAP (Figures NOL/ERL/300/C/XRL/ENS/M56/033, 036-037, 039-041 referred), Site T has been utilized as a car park for approximately ten years, however the main land contamination concern results from historical operation of Site T as an oil depot 30 years ago. In order to update the site condition of Site T and identify potential sources of contamination and potential hotspots resulting from current site operations, a site inspection was carried out on 1 April 2010, in accordance with the recommendation in the approved CAP. The general site layout and photographic records taken during site inspection are shown in **Figure C8016/C/XRL/ENS/M57/002**.

- 3.3 No site representative was available for interview during the site visit however based on observation, Site T is currently used as a car park. In general the ground was asphalt paved and small areas of oil staining were observed during the site visit. No significant difference in the layout of Site T was found between recent observation and findings of the approved EIA. Given that there have been no official records of dangerous goods licensing; no records of chemical spillage/leakage based on the approved CAP of XRL EIA (Appendix F and G of approved CAP referred); and the oil stains observed on the paved surface were small, penetration of potential contaminants from the stains on the paved surface to the soil underneath is considered unlikely. Land contamination impact due to current site operation is therefore not expected. However, as Site T was occupied by an oil depot 30 years ago, the potential for land contamination cannot be eliminated and a site investigation is still proposed within Site T.

4. SAMPLING AND TESTING PLAN FOR SITE INVESTIGATION

- 4.1 Based on the findings of further site inspection and information acquired from the approved CAP, a total of 8 sampling locations are proposed within Site T to assess the potential land contamination concern associated with the historical operation of the site. Given no hotspots are identified during the latest site inspection, sampling locations are proposed in a grid arrangement as recommended in the approved CAP and with reference to the Guidance Note 2. The proposed sampling locations are illustrated in **Figure C8016/C/XRL/ENS/M57/002**. The selection of potential chemicals of concern (COCs) for laboratory analysis at each proposed sampling location has made reference to the nature of historical land use of the site, the Guidance Note 1 and 2, Guidance Manual and the approved CAP. The sampling and testing plan, together with rationales for selecting the sampling locations, are summarized in **Table 4.1**.
- 4.2 The exact sampling locations of the site investigation (SI) shall be determined on site and will be subject to fine adjustment due to site specific conditions (e.g. locations, presence of foundations, underground utilities, delivery pipes and services).

Table 4.1 Sampling and Testing Plan for Site T

Proposed Sampling Location ¹	Sampling Method	Sample Matrix ^{2,3,5}		Parameters to be Tested ⁴			Rationale
				Petroleum Carbon Ranges	BTEX	Heavy Metals	
T01-T08	Borehole to 6m	Soil	0.5m BBC	X	X	Pb	To assess potential land contamination impacts which may have resulted from historic land use as an oil depot 30 years ago
		Soil	1.5m BBC	X	X	Pb	
		Soil	3.0m BBC	X	X	Pb	
		Soil	4.5m BBC	X	X	Pb	
		Soil	6.0m BBC	X	X	Pb	
		GW	If present [^]	X	X	-	

Remarks:

1. Locations are shown in **Figure C8016/C/XRL/ENS/M57/002**.

2. BBC= below base of concrete slab; GW=groundwater

3. Exact sampling depth shall be determined on site and subject to fine adjustment due to site specific conditions (e.g. hard rocks or groundwater encountered (if any)).

4. X = testing proposed

5. The number of samples may subject to change

[^] Samples will only be collected if groundwater is encountered during SI works.

Soil Sampling Method and Depth of Sampling

- 4.3 All soil boring / excavation and sampling should be supervised by a land contamination specialist.
- 4.4 The drilling of boreholes should be undertaken by means of dry rotary drilling method, i.e. without the use of flushing medium, to prevent cross-contamination during sampling. For safety reasons, an inspection pit should be excavated down to 2.0m below ground to inspect for underground utilities at the proposed borehole location. The site appraisal in the approved CAP identified historical operation of Site T as an oil depot which required further investigation. Soil boring is proposed undertaken down to a depth of approximately 6m below base of concrete (BBC) in order to

investigate the condition of soils from approximately 2 times of the depth of the foundation level of typical underground storage tanks and given hard rocks would likely be encountered at the depth of 6m with reference to the soil boring record of drillhole constructed within Site T and attached in **Appendix A**. The location of the as-built drillhole has also been illustrated in **Figure C8016/C/XRL/ENS/M57/002**.

- 4.5 Disturbed soil samples should be collected at depths of 0.5m and 1.5m BBC. Soil boring using drill rigs should then be performed from a depth of 2.0m to the maximum boring depth. Undisturbed samples should be collected at 3m, 4.5m and 6m BBC, to investigate the presence of contaminated soil. A groundwater sample should be collected if encountered in any of the soil boreholes. It should be noted that where there are visual or odorous signs of contamination, additional samples at that depth should be taken for laboratory analysis.
- 4.6 At each sampling location/depth, a sufficient quantity of soil sample (as specified by the laboratory) should be recovered. All soil samples should be uniquely labelled. Backup samples should be retained and stored at 0 - 4 °C in laboratory.

Strata Logging

- 4.7 Strata logging for boreholes should be undertaken during the course of drilling/digging and sampling by a qualified geologist. The logs should include the general stratigraphic description, depth of soil sampling, sample notation and level of groundwater (if encountered). The presence of rocks/boulders/cobbles and foreign materials such as metals, wood and plastics should also be recorded.

Free Product and Groundwater Level Measurement

- 4.8 When groundwater is encountered the thickness of free product (if present) and the ground water elevation should be measured with an interface probe. Should free product be encountered in sufficient volume it should be collected for laboratory analysis to determine the composition.

Groundwater Sampling

- 4.9 It is proposed to collect groundwater samples if groundwater is encountered at the sampling locations.
- 4.10 For each proposed borehole location, a groundwater well should be installed into the borehole if groundwater is encountered or as agreed by the land contamination specialist. A typical design of a groundwater monitoring well is shown in **Figure C8016/C/XRL/ENS/M57/001**. Well development (approximately five well volumes) should be carried out to remove silt residues from the wells. The wells should then be allowed to stand for a day to permit groundwater conditions to equilibrate. The groundwater elevation and thickness of free product layer, if present, should then be measured at each well. It should be noted that the depth to the water table at all monitoring wells should be measured at the same time with an interface probe in order to allow estimation of the groundwater table contours present at the site.
- 4.11 Prior to groundwater sampling, monitoring wells should be purged (at least three well volumes) to remove stagnant groundwater and to provide representative groundwater samples.
- 4.12 After purging, one groundwater sample should then be collected at each well using Teflon bailer and decanted into appropriate sample vials or bottles in a manner that minimizes agitation and volatilization of VOCs from the samples. All samples should be uniquely labelled.
- 4.13 Immediately after collection, groundwater samples should be transferred to new, clean, laboratory-supplied glass jars for sample storage/transport. The sampling jars should be the "amber glass" type. Groundwater samples should be placed in the glass jars with zero headspace and promptly sealed with a septum-lined cap. Immediately following collection, samples should be placed in ice chests, cooled and maintained at a temperature of about 4°C until delivered to the analytical laboratory.

Sample Size and Decontamination Procedures

- 4.14 All equipment in contact with the ground should be thoroughly decontaminated between each excavation, drilling and sampling event to minimise the potential for cross contamination. The equipment (including drilling pit, digging tools and soil/groundwater samplers) should be decontaminated by steam cleaning or high-pressure hot water jet, then washed by phosphate-free detergent and finally rinsed by distilled / deionised water.
- 4.15 Prior to sampling, the laboratory responsible for analysis should be consulted on the particular sample size and preservation procedures that are necessary for each chemical analysis.
- 4.16 The sample containers should be laboratory cleaned, sealable, water-tight, made of glass or other suitable materials with aluminium or Teflon-lined lids, so that the container surface will not react with the sample or adsorb contaminants. No headspace should be allowed in the containers which contain samples to be analysed for VOCs, Petroleum Carbons Range or other volatile chemicals.
- 4.17 The containers should be marked with the sampling location codes and the depths at which the samples were taken. If the contents are hazardous, this should be clearly marked on the container and precautions taken during transport. Samples should be stored at between 0-4 °C but never frozen. Samples should be delivered to laboratory within 24 hours of the samples being collected and analysed within the respective retention period but should not more than 10 days.

QA/QC Procedures

- 4.18 QA/QC samples should be collected in the following frequency during the SI. Chain of Custody protocol should be adopted.
- 1 duplicate sample per 20 samples for full suite analysis as shown in **Table 4.1**;
 - 1 equipment blank per 20 samples for full suite analysis as shown in **Table 4.1**;
 - 1 field blank per 20 samples for full suite analysis as shown in **Table 4.1**; and
 - 1 trip blank per trip for the analysis of Petroleum Carbon Ranges C₆-C₈ and BTEX (Benzene, Toluene, Ethylbenzene and Xylene).
- 4.19 Based on the sampling and testing plan as outlined in **Table 4.1**, there would be roughly (8 sampling location X 5 samples per location) 40 soil samples and 8 groundwater samples. The total number of duplicate, equipment blank and field blank would be 3 each (2 sets for soil samples and 1 set for groundwater samples). One trip blank should be collected for every transport of samples from the site to the laboratory.

Health and Safety

- 4.20 The specific safety measures to be taken depend on the nature and content of contamination, the site conditions and the regulations related to site safety requirements. Workmen Compensation Insurance and third party insurance must be provided for the SI.
- 4.21 Extreme care should be exercised if toxic gases or other hazardous materials are encountered. Any abnormal conditions found shall be reported immediately to the safety officer and the land contamination specialist.
- 4.22 The SI contractor shall establish and maintain a Health and Safety Plan before commencement of the SI that will include the following:
- (a) Instruction of works on work procedures, safe practices, emergency duties, and applicable regulations;

- (b) Regularly scheduled meetings of the workers in which the possible hazards, problems of the job, and related safe practices are emphasized and discussed;
- (c) Good housekeeping practices; and
- (d) Availability of and instruction in the location, use and maintenance of personal protective equipment.

4.23 The SI Contractor shall maintain equipment and supplies reasonably required in an emergency, including lifesaving, evacuation, rescue and medical equipment in good working order and condition at all times. The SI Contractor shall use all reasonable means to control and prevent fires and explosions, injury to personnel and damage to equipment of property. Without limiting the foregoing, the SI Contractor shall:

- (a) Maintain proper safety devices, barriers to minimize hazards during performance of the work;
- (b) Prohibit smoking and open flames and the carrying of matches and lighters;
- (c) Develop and maintain a written emergency plan applicable to the Work and Site;
- (d) Maintain equipment in good operating condition and have emergency and first aid equipment ready for immediate use, where applicable;
- (e) Conduct equipment tests to ensure that equipment is properly stored and in good operating condition, and that workers are able to respond to emergency situations;
- (f) Require all workers employed or retained by the Contractor, or a subcontractor, to at all time wear clothing suitable for all potential work, weather and environmental conditions; and
- (g) The personnel are required to wear respirator and gloves for vapour exposure protection, if necessary. Safety helmet and protective boots should be worn.

5. LABORATORY ANALYSIS

5.1 Laboratory analysis is proposed in order to screen the presence of potential contaminants that are of concern at the Site. **Table 5.1** summarizes the parameters, the minimum requirement of the reporting limits and reference methods for the laboratory analyses of soil and groundwater samples for this land contamination study.

Table 5.1 Parameters, Detection Limits and Reference Methods for Laboratory Analyses

Item	Parameter	Soil		Groundwater	
		Detection limits (mg/kg) or otherwise stated	Testing Method	Detection limits (µg/L) or otherwise stated	Testing Method
BTEX					
1	Benzene	0.2	USEPA 8260B or equivalent HOKLAS accredited method	5	USEPA 8260B or equivalent HOKLAS accredited method
2	Ethylbenzene	0.5		5	
3	Toluene	0.5		5	
4	Xylenes (Total)	1.5		15	
Metals					

Item	Parameter	Soil		Groundwater	
		Detection limits (mg/kg) or otherwise stated	Testing Method	Detection limits (µg/L) or otherwise stated	Testing Method
5	Lead	1	USEPA 6020 or equivalent HOKLAS accredited method	NA	USEPA 6020 or equivalent HOKLAS accredited method
Petroleum Carbon Ranges					
6	C6 - C8	5	USEPA 8260B/8015C or equivalent HOKLAS accredited method	20	USEPA 8260B/8015C or equivalent HOKLAS accredited method
7	C9 - C16	200		500	
8	C17 - C35	500		500	

Notes:

NA = Not Applicable

- 5.2 For sampling and laboratory analyses, chain of custody procedure should be included as QA/QC procedure.
- 5.3 All laboratory analyses for soil and groundwater samples should be conducted by a Hong Kong Laboratory Accreditation Scheme (HOKLAS) accredited laboratory. All laboratory test methods should be accredited by the HOKLAS or one of its Mutual Recognition Arrangement partners.
- 5.4 Extra soil samples shall be stored at 0-4 °C and tested for Toxicity Characteristics Leaching Procedure (TCLP) before submission of Remediation Action Plan (RAP) if excavation and landfill disposal is identified as the last resort. According to Guidance Note 2, the maximum storage time for mercury in soil samples is 8 days while the storage time for the rest of the parameters in soil samples is up to 6 months. Soil samples if stored beyond the allowable storage time may not be considered representative of the actual site conditions.
- 5.5 The criteria are set primarily in terms of TCLP limits shown in **Table 5.2**.

Table 5.2 Laboratory Testing Requirements for TCLP Analysis

Parameter	Test Methods*	Detection limit (mg/L)	Landfill Disposal Criteria TCLP Limit (ppm)
TCLP Leachate Preparation allowed by analysis for:			
Antimony (Sb)	USEPA 1311 and 6020A	2	150
Arsenic (As)		2	50
Barium (Ba)		2	1,000
Beryllium (Be)		1	10
Cadmium (Cd)		1	10
Chromium (Cr)		1	50
Copper (Cu)		2	250
Lead (Pb)		3	50
Nickel (Ni)		1.5	250
Selenium (Se)		0.2	1
Silver (Ag)		2	50
Thallium (Tl)		1	50
Tin (Sn)		2.5	250
Vanadium (V)		4	250
Zinc (Zn)		10	250

Parameter	Test Methods*	Detection limit (mg/L)	Landfill Disposal Criteria TCLP Limit (ppm)
Mercury (Hg)		0.2	1

* Equivalent internationally recognized standard methods could also be used.

6. INTERPRETATION OF RESULTS

- 6.1 With reference to the *Guidance Note for Contaminated Land Assessment and Remediation*, interpretation of results shall be based on the comparison with the Risk-based Remediation Goals (RBRGs) as stipulated in Table 2.1 and Table 2.2 of the Guidance Manual.
- 6.2 The RBRGs are developed based on a risk assessment approach to suit the local environmental conditions and community needs in Hong Kong. Decisions on contaminated soil and groundwater remediation are based on the nature and extent of the potential risks that are posed to human receptors as a result of exposure to chemicals in the soil and/or groundwater. Four types of land use scenarios are set under RBRGs to reflect the typical physical settings in Hong Kong under which people could be exposed to contaminated soil and groundwater. A description of each land use is as follows:
- Urban residential – Sites located in an urban area where main activities involve habitation by individuals. The typical physical setting is a high rise residential building situated in a housing estate that has amenity facilities such as landscaped yards and children's playgrounds. The receptors are residents who stay indoors most of the time except for a short period each day, during which they are outdoors and have the chance of being in direct contact with soil at landscaping or play areas within the estate.
 - Rural residential – Sites located in a rural area where the main activities involve habitation by individuals. These sites typically have village-type houses or low rise residential blocks surrounded by open space. The receptors are rural residents who stay at home and spend some time each day outdoors on activities such as gardening or light sports. The degree of contact with the soil under the rural setting is more than that under the urban setting both in terms of the intensity and frequency of contact.
 - Industrial – Any site where activities involve manufacturing, chemical or petrochemical processing, storage of raw materials, transport operations, energy production or transmission, etc. Receptors include those at sites where part of the operation is carried out directly on land and the workers are more likely to be exposed to soil than those working in multi-storey factory buildings.
 - Public parks – Receptors include individuals and families who frequent parks and play areas where there is contact with soil present in lawns, walkways, gardens and play areas. Parks are considered to be predominantly hard covered with limited areas of predominantly landscaped soil. Furthermore, public parks are not considered to have buildings present on them.
- 6.3 In addition to the RBRGs, screening criteria (soil saturation limits, C_{sat}, developed for Non-aqueous Phase Liquid [NAPL] in soil and water solubility limits for NAPL in groundwater) for the more mobile organic chemicals must be considered to determine whether a site requires further action.
- 6.4 According to the Guidance Manual, the land contamination data should be compared with the relevant RBRGs in accordance with the future land use of the site. Given the site would be occupied for railway development, the corresponding RBRG land uses category is proposed to be industrial. Relevant soil and groundwater RBRGs for this land contamination study including the soil saturation limit and solubility limit are presented in the following table. Should the future land uses of Site T be changed, re-testing and, if necessary, remediation works, should be conducted in accordance to relevant RBRG.

Table 6.1 Relevant RBRGs for Soil and Groundwater – Industrial

Chemical	Soil (mg/kg)		Groundwater (µg/L)	
	RBRGs for Industrial	Soil Saturation Limits	RBRGs for Industrial	Solubility Limits
BTEX				
Benzene	9.21	336	54,000	1,750,000
Ethylbenzene	8,240	138	10,000,000	169,000
Toluene	10,000	235	10,000,000	526,000
Xylenes (Total)	1,230	150	1,570,000	175,000
Metals				
Lead	2,290	NA	NA	NA
Petroleum Carbon Ranges				
C6 - C8	10,000	1000	1,150,000	5,230
C9 - C16	10,000	3000	9,980,000	2,800
C17 - C35	10,000	5000	178,000	2,800

Note: NA - Not Available

7. REPORTING

- 7.1 After completion of the site investigation, a supplementary CAR which reports the detailed methodology of site investigation, assessment criteria, on-site observations and the analytical results from the site investigation works, will be submitted to EPD for endorsement.
- 7.2 If land contamination is confirmed within the works areas, a supplementary Remediation Action Plan (RAP) which formulates remedial measures should be submitted to EPD for endorsement. The contaminated area should be remediated according to the approved supplementary RAP and construction works should not be conducted at identified contaminated site until the approval of a Remediation Report (RR) which demonstrates the completion of remedial actions and no further land contamination on the site.

Figures

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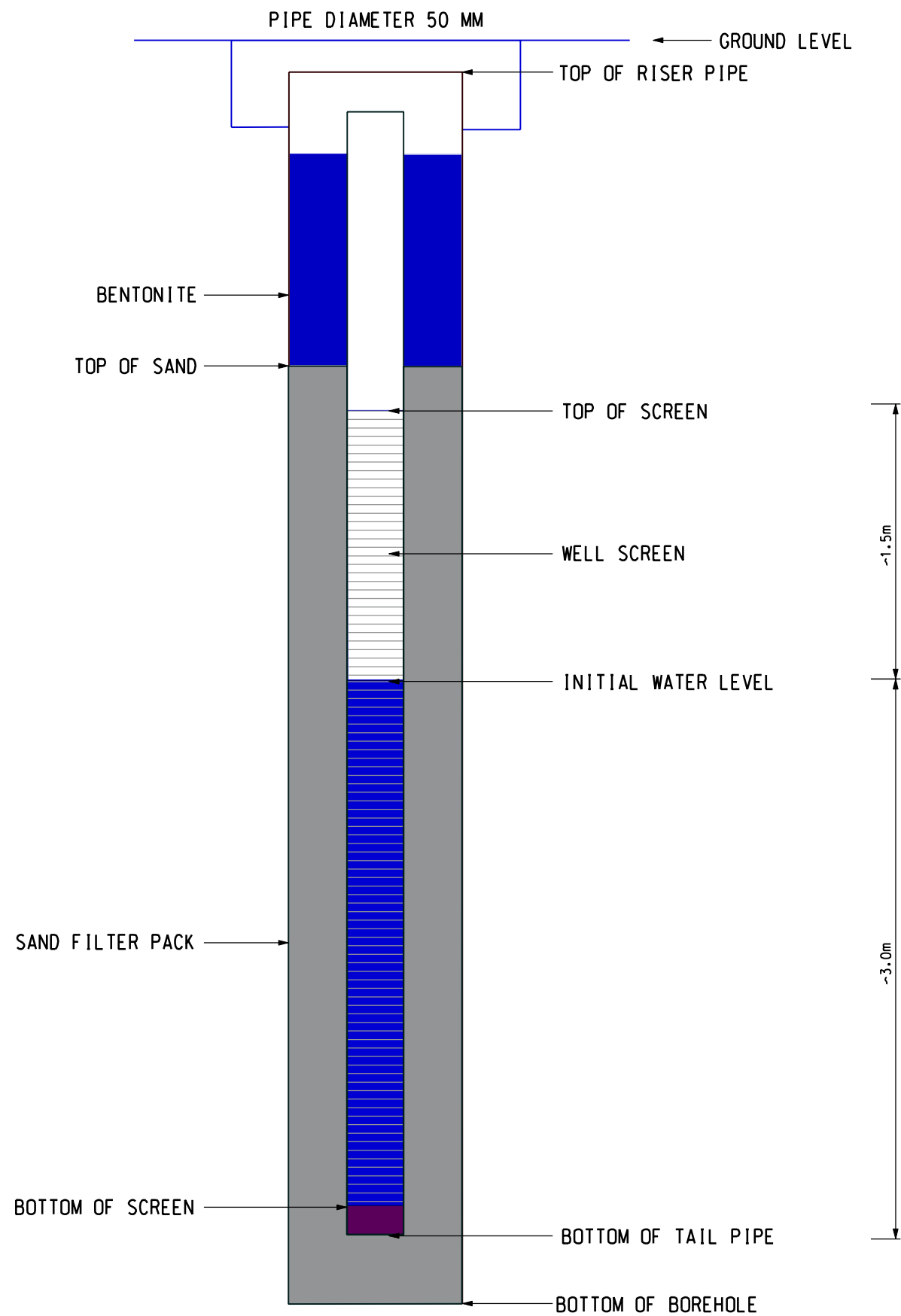
LOCATION	SITE ID	POTENTIAL CONTAMINATIVE LAND USES IDENTIFIED	HOTSPOTS OBSERVED	APPROXIMATE AREA OF THE SITE	APPROXIMATE AREA OF CONTAMINATIVE ACTIVITIES	TOTAL NUMBER OF SAMPLING POINT(S) PROPOSED WITHIN THE SITE
MLW	T	FORMER OIL DEPOT	NA	4000m ²	NA*	8**

NOTE:
SITE LAYOUT IS INDICATIVE ONLY.
* CURRENT LAND USE AS A CAR PARK WAS NOT CONSIDERED TO BE LAND CONTAMINATIVE. TO ASSESS THE POTENTIAL LAND CONTAMINATION IMPACTS DUE TO HISTORICAL LAND USES AS AN OIL DEPOT, SITE INVESTIGATION IS STILL PROPOSED.
** SAMPLING LOCATIONS ARE PROPOSED IN GRID ARRANGEMENT.

REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED

DRAWN DESIGNED CHECKED APPROVED DATE 16/APR/2010	YJP TWF KCC PL	 EXPRESS RAIL LINK 	TITLE C8016 ENVIRONMENTAL TERM CONSULTANCY FOR XRL SITE LAYOUT AND PROPOSED SI LOCATIONS		
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CADD REF. C8016_C_XRL_ENS_M57_002A.dgn			SCALE 1 : 1000 (A3)	FIGURE NO. C8016/C/XRL/ENS/M57/002	REV. A

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										DRAWN YJP DESIGNED TWF CHECKED KCC APPROVED PL DATE 16/APR/2010 DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE. © MTR CORPORATION LIMITED 2008. COPYRIGHT IN RESPECT OF THIS DRAWING / DOCUMENT IS OWNED BY THE MTR CORPORATION LIMITED OF HONG KONG. NO REPRODUCTION OF THE DRAWING / DOCUMENT OR ANY PART BY WHATEVER MEANS IS PERMITTED WITHOUT THE PRIOR WRITTEN CONSENT OF THE MTR CORPORATION LIMITED.					MTR EXPRESS RAIL LINK AECOM CADD REF. C8016_C_XRL_ENS_M57_001A.dgn					TITLE C8016 ENVIRONMENTAL TERM CONSULTANCY FOR XRL TYPICAL DESIGN OF GROUNDWATER SAMPLING WELL				
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																N.T.S.	C8016/C/XRL/ENS/M57/001	A						

Appendix A

Reference Soil Boring Log



GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO.
2108/XRL/D311

SHEET 1 OF 7

DRILLHOLE RECORD

CONTRACT NO. NEX/2108

PROJECT Contract NEX/2108 Ground Investigation Works for Express Rail Link

METHOD Rotary Cored

CO-ORDINATES

WORKS ORDER NO. GCE/2008/001/SI/R

MACHINE & NO. DR84

E 832567.55

DATE FROM 04/11/2008 TO 14/11/2008

N 822156.02

FLUSHING MEDIUM Water

ORIENTATION Vertical

GROUND LEVEL +6.40 mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
04/11/2008	SX	08:00						1	+6.40	0.00			Dark brown mottled yellowish brown, silty fine to coarse SAND with some angular to subangular fine gravel sized quartz fragments and some fine to medium and occasional coarse gravel sized moderately decomposed granite fragments. Contains occasional plastic sheets. (FILL)
								2		0.50			
								3	+4.90	1.50			
20/11/2008		Dry at 18:00						4	+4.40	2.00			Yellowish brown spotted pink, light grey and locally red, silty fine to coarse SAND with some angular to subangular fine gravel sized quartz fragments and some fine to medium gravel sized moderately decomposed granite fragments. Contains occasional fine to medium gravel sized concrete fragments. (FILL)
05/11/2008		Dry at 08:00	95					5					
								6	+3.30	3.10			Yellowish brown spotted light grey, white and locally red, clayey/silty fine to coarse SAND with some angular to subangular fine gravel sized quartz fragments and occasional fine to medium gravel sized highly decomposed and moderately decomposed granite fragments. (FILL)
								7		3.55			
	SX 4.00						1.1 2.2,2.2 N=8	8					
	PX							9	+2.40	4.00			Loose, greenish grey mottled yellowish brown, clayey/silty fine to coarse SAND with some angular to subangular fine gravel sized quartz fragments and occasional fine to medium gravel sized moderately decomposed granite fragments. (ALLUVIUM)
								10		5.10			
05/11/2008		2.01m at 18:00					1.2 2.2,2.2 N=8	11		5.55			Firm, yellowish brown mottled brownish grey and locally greenish grey, sandy clayey SILT with occasional angular to subangular fine gravel sized quartz fragments. (ALLUVIUM)
06/11/2008		08:00	100	100	100	5.0		12	+0.70	5.70			From 5.00m to 5.10m : With some fine to coarse gravel sized moderately decomposed granite fragments.
			92	61	49	NI				6.00		II	
						1.5						IV	Strong, pink spotted dark greenish grey and white, spotted and mottled light grey, mottled yellowish brown, slightly decomposed, coarse grained GRANITE. (CORESTONE)
												III	Joints are closely to medium spaced, locally very closely and widely spaced, rough stepped and rough undulating, extremely narrow to very narrow, iron and manganese oxide stained, dipping at 40° to 50° and 80° to 90°, locally 30° to 40°.
			72	65	35	NR			-0.70	7.10		II	From 5.70m to 5.73m, 6.05m to 6.10m, 6.33m to 6.44m, 6.68m to 7.06m, 7.20m to 7.23m, 7.50m to 7.63m, 7.80m to 7.84m, 8.42m to 8.45m, 8.83m to 8.88m and 9.11m to 9.93m : Moderately strong, moderately decomposed.
			53	63	63	3.1			-1.23	7.63		II	From 5.70m to 6.71m : Fine grained granite.
									-1.40	7.80		V	From 6.10m to 6.33m and 7.06m to 7.10m : Very weak to weak, highly decomposed.
		4.00m at 18:00				NR			-2.05	8.45		V	From 7.10m to 7.20m, 7.63m to 7.80m and 8.45m to 8.83m : No core recovered, assumed to be completely decomposed granite.
06/11/2008		3.01m at 08:00	94	69	69	3.2				8.83		II	From 9.51m to 10.74m : With an 80° to 90° joint
07/11/2008	PX 9.51												
	HX		80	80	72	2.8				9.51		III	

- SMALL DISTURBED SAMPLE
- ↑ LARGE DISTURBED SAMPLE
- SPT LINER SAMPLE
- ▨ U76 UNDISTURBED SAMPLE
- ▩ U100 UNDISTURBED SAMPLE
- ▧ MAZIER SAMPLE
- ▦ PISTON SAMPLE
- △ WATER SAMPLE
- ▲ PIEZOMETER TIP
- ⊥ STANDPIPE
- ⊥ STANDARD PENETRATION TEST
- ⊥ PERMEABILITY TEST
- ⊥ IMPRESSION PACKER TEST
- ⊥ IN-SITU VANE SHEAR TEST
- ⊥ PACKER TEST

LOGGED D.Y. Yip

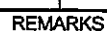
DATE 15/11/2008

CHECKED James Lu

DATE 17/11/2008

REMARKS

1. Constant head permeability test was carried out from the depths of 4.00m to 5.50m.
2. Acoustic televiewer survey was carried out from the depths of 13.50m to 37.50m.
3. Packer tests were carried out from the depths of 13.50m to 19.50m, 19.50m to 25.50m, 25.50m to 31.50m and 31.50m to 37.50m.
4. Standpipe was installed at a depth of 13.00m.
5. Piezometer tip was installed at a depth of 5.00m.





GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO.
2108/XRL/D311

SHEET **3** OF **7**

DRILLHOLE RECORD

CONTRACT NO. NEX/2108

PROJECT **Contract NEX/2108 Ground Investigation Works for Express Rail Link**

METHOD **Rotary Cored**

CO-ORDINATES

WORKS ORDER NO. **GCE/2008/001/SI/R**

MACHINE & NO. **DR84**

E 832567.55

DATE FROM **04/11/2008** TO **14/11/2008**

N 822156.02

FLUSHING MEDIUM **Water**

ORIENTATION **Vertical**

GROUND LEVEL **+6.40 mPD**

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
20			100	95	95			T2101		20.00	+		
21			100	95	95			T2101		20.32	+		
22			100	98	94	7.8		T2101		21.65	+		From 21.40m to 21.97m : Fine grained granite.
23			100	100	95	1.2		T2101		23.16	+		From 22.25m to 23.59m : Fine grained granite.
24			100	100	95	4.3		T2101		24.63	+		
25			100	97	94	3.7		T2101		26.15	+		
26			100	97	92	10.7		T2101		27.68	+		From 26.32m to 27.21m : With an 80° to 90° joint.
27		3.34m at 18:00	100	100	100	0.7		T2101		29.18	+		From 28.93m to 28.98m : Pegmatite vein dipping at 10° to 20°.
28		4.09m at 08:00	100	100	100			T2101			+		
29			100	100	100			T2101			+		
30			100	100	100			T2101			+		

- SMALL DISTURBED SAMPLE
- ⬆ LARGE DISTURBED SAMPLE
- ▨ SPT LINER SAMPLE
- ▨ U78 UNDISTURBED SAMPLE
- ▨ U100 UNDISTURBED SAMPLE
- ▨ MAZIER SAMPLE
- ▨ PISTON SAMPLE
- △ WATER SAMPLE
- ▲ PIEZOMETER TIP
- △ STANDPIPE
- ⬇ STANDARD PENETRATION TEST
- ⊥ PERMEABILITY TEST
- ⊥ IMPRESSION PACKER TEST
- ∇ IN-SITU VANE SHEAR TEST
- ⊥ PACKER TEST

LOGGED **D.Y. Yip**
DATE **15/11/2008**
CHECKED **James Lu**
DATE **17/11/2008**

REMARKS



GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO.
2108/XRL/D311

SHEET **4** OF **7**

DRILLHOLE RECORD

CONTRACT NO. NEX/2108

PROJECT **Contract NEX/2108 Ground Investigation Works for Express Rail Link**

METHOD **Rotary Cored**

CO-ORDINATES

WORKS ORDER NO. **GCE/2008/001/SI/R**

MACHINE & NO. **DR84**

E 832567.55

DATE FROM **04/11/2008** TO **14/11/2008**

N 822156.02

FLUSHING MEDIUM **Water**

ORIENTATION **Vertical**

GROUND LEVEL **+6.40 mPD**

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
30										30.03			
			100	46	40	2.5		T2101		30.69			From 30.34m to 31.03m : Pegmatite vein dipping at 50° to 60°.
31								T2101					From 31.03m to 31.21m and 31.45m to 31.56m : Fine grained granite.
32			100	100	97			T2101		31.92			
33						10.3		T2101					
			100	91	73			T2101		33.32			From 33.25m to 33.32m : Fine grained granite dipping at 50° to 60°.
34						>20 2.7		T2101					
			100	100	94			T2101		34.61			
35						>20		T2101					
			100	86	69			T2101		35.38			
36						5.5		T2101					
		3.32m at 18:00				1.0		T2101					
11/11/2008 12/11/2008		4.11m at 08:00	100	100	100			T2101		36.86			
37						5.4		T2101					
			100	95	95			T2101		37.62			
38						>20 0.6		T2101					
			100	100	100			T2101		38.93			At 38.99m and 39.08m : With fine grained granite veins of maximum thickness 13mm and 20mm dipping at 50° to 60°.
39													From 39.34m to 39.46m and 39.58m to 39.78m : Fine grained granite dipping at 30° to 40° and
40													

- SMALL DISTURBED SAMPLE
- ↑ LARGE DISTURBED SAMPLE
- SPT LINER SAMPLE
- U76 UNDISTURBED SAMPLE
- U100 UNDISTURBED SAMPLE
- MAZER SAMPLE
- PISTON SAMPLE
- △ WATER SAMPLE
- ▲ PIEZOMETER TIP
- STANDPIPE
- STANDARD PENETRATION TEST
- PERMEABILITY TEST
- IMPRESSION PACKER TEST
- IN-SITU VANE SHEAR TEST
- PACKER TEST

LOGGED **D.Y. Yip**
DATE **15/11/2008**
CHECKED **James Lu**
DATE **17/11/2008**

REMARKS



GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO.
2108/XRL/D311

SHEET **5** OF **7**

DRILLHOLE RECORD

CONTRACT NO. NEX/2108

PROJECT Contract NEX/2108 Ground Investigation Works for Express Rail Link

METHOD **Rotary Cored**

CO-ORDINATES

WORKS ORDER NO. GCE/2008/001/SI/R

MACHINE & NO. **DR84**

E 832567.55

DATE FROM **04/11/2008** TO **14/11/2008**

N 822156.02

FLUSHING MEDIUM **Water**

ORIENTATION **Vertical**

GROUND LEVEL **+6.40 mPD**

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
40			100	100	100			T2101		40.00	+		
			100	100	100			T2101		40.17	+		60° to 70° respectively.
41			100	100	100			T2101		40.71	+		
			100	100	100			T2101		41.82	+		
42			100	100	100			T2101		43.22	+		From 43.00m to 44.49m : With 80° to 90° joints.
43			100	74	74	4.9		T2101		44.45	+		
44			100	96	96	0.9		T2101		45.98	+		
45			100	93	92			T2101		47.18	+		
46			100	55	54			T2101		48.28	+		From 47.74m to 49.05m : With 80° to 90° joints where incipient from 51.22m to 52.00m, 52.28 to 52.59m and 52.77m to 53.08m.
47			100	72	68	>20		T2101		49.89	+		
48		3.31m at 18:00	100	81	81	5.1		T2101			+		
49		4.12m at 08:00	100			0.9		T2101			+		
50			100					T2101			+		

- SMALL DISTURBED SAMPLE
- ⬆ LARGE DISTURBED SAMPLE
- SPT LINER SAMPLE
- ▨ U78 UNDISTURBED SAMPLE
- ▩ U100 UNDISTURBED SAMPLE
- ▨ MAZIER SAMPLE
- ▩ PISTON SAMPLE
- △ WATER SAMPLE
- ▲ PIEZOMETER TIP
- ⊥ STANDPIPE
- ⊥ STANDARD PENETRATION TEST
- ⊥ PERMEABILITY TEST
- ⊥ IMPRESSION PACKER TEST
- ∨ IN-SITU VANE SHEAR TEST
- ⊥ PACKER TEST

LOGGED D.Y. Yip
DATE 15/11/2008
CHECKED James Lu
DATE 17/11/2008

REMARKS



GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO.
2108/XRL/D311

SHEET **6** OF **7**

DRILLHOLE RECORD

CONTRACT NO. NEX/2108

PROJECT **Contract NEX/2108 Ground Investigation Works for Express Rail Link**

METHOD **Rotary Cored**

CO-ORDINATES

WORKS ORDER NO. **GCE/2008/001/SI/R**

MACHINE & NO. **DR84**

E 832567.55

DATE FROM **04/11/2008** TO **14/11/2008**

N 822156.02

FLUSHING MEDIUM **Water**

ORIENTATION **Vertical**

GROUND LEVEL **+6.40 mPD**

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
50										50.00			
						>20		T2101					
51			100	91	91	1.2				51.22			
52			100	96	96			T2101		52.28			
53			100	100	100			T2101		53.69			
54			100	100	100			T2101		54.76			From 53.90m to 54.43m : with an 80° to 90° joint.
55			100	100	100			T2101		56.29			
56			100	73	65			T2101		57.25			
57		4.17m at 18:00	100	78	71			T2101		58.08			From 56.42m to 60.55m : With 80° to 90° joints where incipient from 58.17m to 58.27m and 60.00m to 60.45m.
58		4.19m at 08:00	100	100	100	2.6		T2101		59.24			From 57.04m to 57.18m : With a fine grained granite vein dipping at 40° to 50°.
59			100	90	86			T2101					From 57.49m to 57.55m and 57.58m to 57.65m : Fine grained granite veins dipping at 20° to 30°.
60													At 59.82m : With a fine grained granite vein of

- SMALL DISTURBED SAMPLE
- △ WATER SAMPLE
- ↑ LARGE DISTURBED SAMPLE
- ▲ PIEZOMETER TIP
- SPT LINER SAMPLE
- △ STANDPIPE
- ▨ U76 UNDISTURBED SAMPLE
- ↓ STANDARD PENETRATION TEST
- U100 UNDISTURBED SAMPLE
- ⊥ PERMEABILITY TEST
- ▨ MAZIER SAMPLE
- ⊥ IMPRESSION PACKER TEST
- ▨ PISTON SAMPLE
- ∇ IN-SITU VANE SHEAR TEST
- ⊥ PACKER TEST

LOGGED **D.Y. Yip**
DATE **15/11/2008**
CHECKED **James Lu**
DATE **17/11/2008**

REMARKS



GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO.
2108/XRL/D311

SHEET **7** OF **7**

DRILLHOLE RECORD

CONTRACT NO. **NEX/2108**

PROJECT **Contract NEX/2108 Ground Investigation Works for Express Rail Link**

METHOD **Rotary Cored**

CO-ORDINATES

WORKS ORDER NO. **GCE/2008/001/SI/R**

MACHINE & NO. **DR84**

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DATE FROM **04/11/2008** TO **14/11/2008**

N 822156.02

FLUSHING MEDIUM **Water**

ORIENTATION **Vertical**

GROUND LEVEL **+6.40 mPD**

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
60										60.00			
										60.59			
61										61.41			
14/11/2008		18:00											
62													
63													
64													
65													
66													
67													
68													
69													
70													

- SMALL DISTURBED SAMPLE
- ◄ LARGE DISTURBED SAMPLE
- SPT LINER SAMPLE
- ▨ U76 UNDISTURBED SAMPLE
- U100 UNDISTURBED SAMPLE
- ▨ MAZIER SAMPLE
- ▨ PISTON SAMPLE
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- ⊥ PACKER TEST

LOGGED **D.Y. Yip**
DATE **15/11/2008**
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DATE **17/11/2008**

REMARKS

maximum thickness 20mm dipping at 30° to 40°.

Hole completed at 61.41m.