Consultancy Agreement No. NEX/1023

West Island Line

Environmental Permit No. EP-313/2008
– Works Area B
Environmental Assessment Report

June 2009

	Name	Signature
Prepared & Checked:	Funny Wu	
Reviewed & Approved:	Josh Lam	

Version:	A	Date:	18 June 2009

AECOM Asia Co. Ltd. (Integrating the operation of ENSR Asia (HK) Ltd.)
11/F, Grand Central Plaza, Tower 2, 138 Shatin Rural Committee Road, Shatin, NT, Hong Kong
Tel: (852) 2893 1551 Fax: (852) 2891 0305
www.aecom.com

TABLE OF CONTENTS

Page

List of Tables

List of Figures

List of Appendices

1. INTRODUCTION

1.1. The “West Island Line” Project (hereinafter known as “the Project”) covers approximately 3km of underground railway from Sheung Wan via Sai Ying Pun and University of Hong Kong to Kennedy Town, three stations including Kennedy Town Station (KET Station), University Station (UNI station) and Sai Ying Pun Station (SYP Station), an overrun tunnel extended from KET Station to Ex-police Quarters site and ventilation shafts, cooling towers and chillers for stations and railway tunnel.

1.2. An Environmental Impact Assessment (EIA) study for the Project was submitted by the MTR Corporation (MTR) in October 2008 and was approved under Environmental Impact Assessment Ordinance (EIAO) on 23 December 2008. Following approval of the EIA Report (Register No.: AEIAR-126/2008), an Environmental Permit (EP) (EP-313/2009) was granted on 12 January 2009 for the construction and operation of the Project.

1.3. The nature and extent of environmental impacts, as well as potential hazard to life from the Project works were assessed in the EIA study. The approved EIA Report for the Project concluded that with the implementation of mitigation measures, the identified environmental impacts would not pose adverse environmental impacts on representative sensitive receivers.

1.4. With the proposed design changes of the Project during detailed design stage, the MTR (i.e. the Project Proponent) now documents minor site boundary and layout modification of the Works Area B as required under EP condition clause 3.1.1 (a). This site will be utilised as temporary site offices, material storage and rock crushing uses of which its nature of construction activities primarily remains the same as the approved EIA.

1.5. This Environmental Assessment Report has been prepared to assess the likely environmental issues pertinent to the proposed minor modification and to identify any additional requirements of environmental issues pertinent to the proposed modification, and to identify any additional requirements of environmental mitigation measures for compliance with environmental standards.

Proposed Minor Modification

1.6. Under the new proposal, there will be minor site boundary and layout modification of the Works Area B. The works boundary will be modified to align with curb line at northern end of Sai See Street. A portion of the northern site boundary will be slightly extended to the waterfront edge. The proposed works area and revised site layout plan are presented in **Figure 1.1 and 1.2** respectively.

Indicative Key Dates of Works Area B

1.7. **Table 1.1** below summaries the indicative key dates for the operation of Works Area B.

Table 1.1 Indicative Key Dates for Works Area B

Activity ID	Activity	Proposed Programme
-	Possession of Works Area B	10 July 2009
A1	Construction of site offices, rock crushing facility and barging point	July 2009 – April 2010
A2	Rock Crusher Operation	May 2010 – January 2013
A3	Reinstatement	July 2015 – August 2015
A4	Transport spoil to the barge	May 2010 – January 2013

1.8. The objectives of this Report are:

- to assess likely environmental issues, if any, pertinent to the proposed minor site boundary and layout modification of the Works Area B, and to identify any additional environmental mitigation if required; and
- to confirm that the minor modification would result in no adverse environmental impact; and
- to support the submission (under Clause 3.1.1 (a) of the EP condition).

Content of this Report

1.9. The remainder of the report is organized as follows:

- Section 2 presents an evaluation of potential impact on the environment due to the proposed minor modification, and proposes additional mitigation measures (if required) for compliance with the requirements in the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).
- Section 3 identifies any additional environmental monitoring and audit requirements.
- Section 4 presents the conclusions of this Environmental Assessment Report.

2. POSSIBLE IMPACT ON THE ENVIRONMENT DUE TO THE PROPOSED MODIFICATION AND REQUIRED MITIGATION MEASURES

2.1. Based on the latest site boundary and layout of Works Area B, potential major environmental impacts on airborne noise, construction dust and human health risk arising from rock crushing and barging activities have been evaluated and the mitigation measures have also been recommended appropriately in this section.

Airborne Noise

Review of Airborne Noise Impact Assessment of the Approved EIA Report

2.2. The associated potential noise impacts for Works Area B were assessed in the approved EIA Report. With the recommended mitigation measures in place, the predicted construction noise levels at the affected noise sensitive receivers near to Works Area B would comply with the EIAO-TM noise criteria.

Evaluation of Airborne Noise Impact Associated with the Proposed Modification

Noise Sensitive Receivers (NSRs)

2.3. Based on the review of the EIA Report, five NSRs, namely, KET10, KET11, KET12, KET13 and KET14 shown in Figure 3.2 in the approved EIA Report would be affected by the construction and operation of rock crushing and barging activities in Works Area B.

2.4. **Table 2.1** below summarizes the descriptions of the representative NSRs identified.

Table 2.1 Representative Noise Sensitive Receivers

NSR ID	Description	Land Use
KET 10	Lui Ming Cho Primary School	School
KET 11	Cayman Rise (Block 1)	Residential
KET 12	Cheong Kat Building	Residential
KET 13	The Merton (Block 2)	Residential
KET 14	Kennedy Town Jockey Club Clinic (A/C)	Clinic

Airborne Noise Impact Associated with the Proposed Modification

2.5. The potential source of noise impact from the construction tasks would be the use of powered mechanical equipment (PME). The construction works would involve construction of site offices, rock crusher and barging point, and operation of rock crusher, reinstatement and transportation of spoil to the barge. The plant inventory for construction of site offices, rock crusher and barging point and reinstatement recommended in the approved EIA Report would remain applicable.

Noise Mitigation Measures Recommended due to the Proposed Modification

2.6. **Appendix A** presents the mitigated plant lists and summarises the mitigated sound power levels of the proposed equipment for construction works mentioned above. The mitigated plant list is considered as practicable for completing the works within schedule.

2.7. The construction noise mitigation measures listed below are recommended to alleviate the construction noise impact:

- adoption of quieter plant; and

- use of noise enclosure/acoustic shed which would achieve a noise reduction of 15dB(A) for air compressor.

2.8. The predicted mitigated noise levels at the NSRs due to change of works layout with the use of the mitigated plant lists are presented in **Table 2.2** below:

Table 2.2 Predicted Mitigated Noise Levels

NSR ID	Predicted Mitigated Construction Noise Levels, dB(A)	EIAO-TM Criteria, dB(A)
KET 10	59 – 64	65/70(1)
KET 11	60 – 65	75
KET 12	41 – 74	75
KET 13	40 – 73	75
KET 14	62 – 65	75

Note: (1) EIAO-TM noise limits of $L_{eq(30\ min)}$ 70dB(A) for schools during normal hours (65 dB(A) during examination periods).

2.9. The construction noise mitigation measures recommended will be the same as those recommended in the approved EIA Report. There will be no change in the recommended mitigation measures. With these recommended mitigation measures in place, the predicted noise levels at most of the NSRs would comply with the EIAO-TM noise criteria.

Construction Dust

Review of Air Quality Impact Assessment of the Approved EIA Report

2.10. An air quality impact assessment was undertaken for Works Area B in the approved EIA Report. Dust suppression measures were proposed in the approved EIA Report to mitigate the dust impacts to within acceptable levels. With the implementation of construction dust mitigation measures stipulated in *Air Pollution Control (Construction Dust) Regulation*, the dust nuisance to the surrounding receivers can be minimized and emissions of excessive dust during construction and operation of rock crushing and barging activities in Works Area B are therefore not expected.

Air Quality Impact Associated with the Proposed Modification

Air Sensitive Receivers (ASR)

2.11. Representative air sensitive receivers (ASRs) which would be affected by the works in Works Area B are selected for air quality impact assessment. The selected representative ASRs are shown in Figures 11.1 and 11.2 in the approved EIA Report and listed in **Table 2.3**.

Table 2.3 Representative Air Sensitive Receivers considered in this Study

ID No.	Location	Use
K1	Kam Po Mansion	Residential
K2	Urban Council Smithfield Complex	GIC
K3	Luen Tak Apartments	Residential
K4	University Heights Tower 2	Residential
K5	Pokfield Garden	Residential

ID No.	Location	Use
K6	Smithfield Terrace Block D	Residential
K7	Kwun Lung Lau Block D	Residential
K8	Kennedy Town Playground	Open Space
K9	Sincere Western House	Residential
K10	Centenary House Block 2	Residential
K11	Cadogan Street Temporary Garden	Open Space
K12	The Merton Block 1	Residential
K13	Cayman Rise	Residential
K14	Victoria Road Workshop	Industrial
K15	Victoria Public Mortuary	GIC
K16	Kennedy Town Police Quarters Block B	Residential
K17	Kennedy Town Police Quarters Block B	Residential
K18	HKIVE (Tsing Yi) Kennedy Town Centre	Education Institute
U10	Belcher Bay Park	Open Space
U11	New Fortune House, Block A	Residential

Evaluation of Air Quality Impact Associated with the Proposed Modification

2.12. According to latest engineering design, there would be one single stage (secondary crushing) rock crusher with screening process, one emergency stockpile area and one barging point (Barging Point 1) at Works Area B. The rock materials from the Kennedy Town Station site would be transported to this rock crusher for processing. The rock crusher with screening processing and the receiving point (unloading of rocks/stones from trucks) of crushing facility would be situated inside an enclosure with one side opening for vehicular access. Water mist system would be provided inside the enclosure. The potential emission sources at this rock crushing facility would be the unloading activities (from trucks to receiving point of crushing facility) and dust emission during screening and crushing of the crusher.

2.13. After crushing/screening process, there would be an enclosed conveyor belt for transporting the crushed materials directly to the barge. No emission is expected during transportation process except the unloading point (continuous drop from conveyor to the barge). The unloading process is therefore considered as one of the potential dust emission sources. In order to prevent fugitive emission, flexible dust curtains would be provided at the unloading point.

2.14. As advised by the Project Proponent, an emergency stockpile area would be provided to store the rock materials when the rock crushing plant and barging point are not in operation during adverse weather condition, for example, Typhoon signal is hoisted that the barge is dangerous to approach the shore. The rock materials from Kennedy Town Station site would be transferred to the emergency stockpile area and fully covered with impervious sheets for temporary storage. The rock materials at the stockpile would be transported to the rock crusher by trucks once the operation of rock crushing plant and barging point resume. The inactive emergency stockpile area would be well covered with impervious sheets, while water spraying system would be applied to the active area. Since the size of the rock materials would be at least 100mm in diameter, with the implementation of the above measures, dusty emission from the material handling and wind erosion at the stockpile site would not be expected. The loading and unloading of rock materials at the stockpile areas would be the potential dust emission sources.

2.15. Haul roads would be provided within the Works Area B. Haul roads within the site would be paved and water spraying would be provided on the haul roads to keep in wet condition. Vehicles would be required to pass through designated wheel washing facilities before entering and leaving the rock crushing plant. At least 2.4m high hoarding would also be provided along the site boundary of the Works Area B.

Cumulative Dust Impact

2.16. Construction and operation of rock crushing and barging facilities would have potential cumulative dust impact with operation of Western District Public Cargo Working Area (Western PCWA), temporary magazine site and Kennedy Town Station site and therefore have been considered in this assessment.

Emission Inventory

2.17. Predicted dust emissions are based on emission factors from USEPA Compilation of Air Pollution Emission Factors (AP-42), 5th Edition. The major dusty construction activities to be considered in the modelling assessment for Kennedy Town Station Site, Temporary Magazine Site and Western PCWA would be the same as in approved EIA, while the activities to be considered for Kennedy Town Abattoir Site would include:

- Dust emission during the screening and crushing processes of the crusher;
- Unloading of rocks/stones from trucks to receiving point of crushing facility;
- Loading and unloading of rock materials at the emergency stockpile area;
- Transportation of the rock materials from Kennedy Town Station site to the receiving point of crushing facility by trucks on the paved haul road and from the emergency stockpile area to the receiving point of crushing facility; and
- Unloading point from enclosed conveyor to the barge (Barging Point 1).

2.18. Some of the dust control measures for the crushing plant, barging facilities and stockpile areas at the Works Area B as recommended in the approved EIA Report are still applied in the latest engineering design. These control measures have taken into account in this assessment and the details are presented in **Tables 2.4, 2.5** and **2.6**.

Table 2.4 Rock Crushing Plants – Dust Emission Design Control Measures

Process	Description	Dust Emission Design Control Measures
Unloading of raw materials	Unloading of stone/rock at the receiving hopper	The unloading process would be undertaken within enclosed rock crushing facility. Water mist system would be provided inside the enclosure.
Screening process	Screening the stone/rock	The stone/rock would be screened by the screening and sorting facility before moving to the crusher jaws. This process would be conducted inside the enclosure and water mist system would be provided.
Crushing of raw materials	Crushing the stone/rock with rock crusher.	The crushing process would be secondary crushing. The rock crushing plant would be enclosed and water mist system would be provided inside the enclosure.
Haul road to the rock crushing	Transportation of spoils to the rock crushing facility	The surface of the roads to/from the rock crushing facility would be paved and water spraying would be provided to keep the wet

Process	Description	Dust Emission Design Control Measures
facility		condition.

Table 2.5 Emergency Stockpiles Area – Dust Emission Design Control Measures

Process	Description	Dust Emission Design Control Measures
Unloading point	Unloading of stone/rock from trucks onto stockpile during adverse weather condition when the barging facility is not in operation	The stone/rock from the Kennedy Town Station Site would be transported to and stored at the emergency stockpile area during adverse weather condition when the barging facility is not in operation. Water spraying would be provided at the unloading point to suppress the dust impact.
Storage of materials	Active area for loading & unloading materials	As confirmed by the Project Proponent, any inactive area would be well covered with impervious sheeting. Water spraying system would be applied on the active area and watering with complete coverage of active area four times a day would be required.
Loading point	Loading of stone/rock from emergency stockpile to the trucks after the barging facility resumes work	The stone/rock stored at the emergency stockpile would be loaded onto the trucks to transport to rock crushing facility once the barging facility resumes works. Water spraying would be provided at the loading point to suppress the dust impact.
Trucks	Transportation of stone/rock to the crushing facility	Wheel wash facilities provided at the exit of stockpile area. The vehicles would be washed before leaving the stockpiles. The spoils would also be well covered before leaving the site in order to minimise generation of dusty materials. The haul roads within the site would be all paved and water spraying would be provided to keep the wet condition.

Table 2.6 Barging Facilities – Dust Emission Design Control Measures

Process	Description	Dust Emission Design Control Measures
Unloading of materials	Unloading of spoil materials	The crushed rock would be transported from the crushing facility through the enclosed conveyor for unloading to be barge. Flexible dust curtains would be provided at the discharge point for dust suppression.

2.19. The material handling rate, moisture content, silt content, number of trucks and truck speed are based on the latest engineering design for Works Area B. It is assumed that the emission rate of identified pollutant sources in Kennedy Town Station Site, temporary magazine site and Western

PCWA would remain the same as the one adopted in the approved EIA Report. Detailed calculations of the emission factors are given in **Appendix B**.

Table 2.7 Emission Factors for Dusty Construction Activities at Kennedy Town Abattoir Site

Emission Source	Activity	Emission Rate	Remarks
Rock Crushing Plant at Kennedy Town Abattoir Site	Unloading of rock/stone to the receiving hopper of rock crushing plant	E = 9.33333 x 10^{-5} g/s	Maximum handling rate: 200 Mg/hr, 12 operation hours per day. 90% reduction, unloading within enclosure with water mist system AP42, Section 11.19.2
	Secondary Crushing	E =0.0006 g/Mg =8.33333 x 10^{-4} g/s	Maximum screening rate: 200 Mg/hr, Maximum crushing rate: 50 Mg/hr, 12 operation hours per day. 90% reduction, within enclosed system and wet suppression AP42, Section 11.19.2
	Screening	E =0.0011 g/Mg =6.11111 x 10^{-3} g/s	
	Paved haul roads -Transport the rock materials to rock crushing plant	E = 1038 g/VKT =4.80338 x 10^{-4} g/m/s	E=k×(sL/2)^0.65×(W/3)^1.5 Particle size multiplier: 24g/VKT Silt content: 12g/m^2 Averaged truck weight: 17 tons No. of truck trips: 400 trucks trips/day (including return trip), 12 operation hours per day 95% reduction by water spraying to keep wet condition and hoarding erected along the haul road facing the ASRs. AP42, Section 13.2.1.
Emergency stockpile at Kennedy Town Abattoir Site	Loading/Unloading point between trucks and emergency stock pile	E = 3.23304 x 10^{-2} g/s	Maximum handling rate: 83Mg/hr, 12 operation hours per day. AP-42, S13.2.4, particle size < 30 um, 1/95 ed AP-42, Table 13.2.4-1, 1/95 ed 75% dust reduction with watering spraying provided at the loading/unloading point

Emission Source	Activity	Emission Rate	Remarks
	Paved haul roads -Transport the rock materials to and from stockpile area	E = 1038 g/VKT =4.80338 x 10^{-4} g/m/s	E=k×(sL/2)^0.65×(W/3)^1.5 Particle size multiplier: 24g/VKT Silt content: 12g/m^2 Averaged truck weight: 17 tons No. of truck trips: 200 trucks trips/day (including return trip), 12 operation hours per day 90% reduction by water spraying to keep wet condition AP42, Section 13.2.1.
Barging Point at Kennedy Town Abattoir Site	Unloading process to Barging Point 1	E = 7.79045 X 10^{-2} g/s	AP-42, S13.2.4, particle size < 30 um, 1/95 ed AP-42, Table 13.2.4-1, 1/95 ed Installation of flexible dust curtain at discharge point, 75% reduction of dust emission assumed.

<u>Prediction and Evaluation of Impacts</u>

2.20. It is assumed that the assumptions adopted for dispersion modeling and concentration calculation in the approved EIA Report would remain applicable and would be adopted in this assessment.

2.21. Based on the results indicated in **Table 2.8** and **2.9**, the predicted 1-hour and 24-hour average TSP at all the representative ASRs would comply with the criteria in EIAO-TM and AQO. It is noted that the worst affected levels would be at 1.5m above ground level. The contour plots of 1-hour and 24-hour average TSP concentrations at 1.5m above ground level are indicated in **Figure 2.1** to **2.6**. There are no ASRs found within the exceedance zone of the 1-hour and 24-hour average TSP criteria in the contour plots.

Table 2.8 Predicted Cumulative Hourly Average TSP Concentrations at Representative Air Sensitive Receivers

ASRs	Cumulative Hourly Average TSP Concentrations in $\mu g/m^3$				
	1.5m AGL	5m AGL	10m AGL	15m AGL	20m AGL
K1	369	215	140	114	101
K2	398	232	135	100	96
K3	282	218	138	100	96
K4	274	245	178	132	108
K5	362	263	166	123	102
K6	308	232	145	110	96
K7	408	270	164	118	96

ASRs	Cumulative Hourly Average TSP Concentrations in μg/m³				
	1.5m AGL	**5m AGL**	**10m AGL**	**15m AGL**	**20m AGL**
K8	385	293	181	130	104
K9	204	195	161	130	109
K10	143	141	130	118	107
K11	247	208	144	108	101
K12	290	240	159	116	99
K13	142	140	127	112	99
K14	191	164	132	119	107
K15	319	251	163	129	112
K16	354	211	124	106	101
K17	335	179	113	107	102
K18	293	210	122	104	99
U10	323	269	165	108	98
U11	259	241	188	140	107

Note: The background TSP level of 78 μg/m³, have been included in the above results.
The 1-hour average TSP EIAO-TM criterion: 500 μg/m³.

Table 2.9 Predicted Cumulative 24-Hour Average TSP Concentrations at Representative Air Sensitive Receivers

ASRs	Cumulative 24-Hour Average TSP Concentrations in μg/m³				
	1.5m AGL	**5m AGL**	**10m AGL**	**15m AGL**	**20m AGL**
K1	235	149	110	96	90
K2	250	158	107	90	87
K3	189	151	108	89	87
K4	186	167	130	106	93
K5	231	175	123	101	90
K6	203	158	112	94	87
K7	258	179	122	98	87
K8	247	192	131	104	91
K9	149	142	121	105	94
K10	114	113	106	99	93
K11	165	145	112	94	90
K12	186	161	120	98	89
K13	113	111	104	96	89

ASRs	Cumulative 24-Hour Average TSP Concentrations in μg/m³				
	1.5m AGL	**5m AGL**	**10m AGL**	**15m AGL**	**20m AGL**
K14	137	123	106	99	93
K15	200	166	121	104	95
K16	228	147	102	93	90
K17	216	130	96	93	90
K18	195	147	101	92	89
U10	202	175	123	93	88
U11	170	161	134	109	93

Note: The background TSP level of 78 $\mu g/m^3$, have been included in the above results.

The 24-hour average TSP AQO criterion: 260 $\mu g/m^3$.

Human Health Risk Assessment

Review of the Approved Human Health Risk Assessment

2.22. A review on the previous Human Health Risk Assessment (HHRA) (**Appendix C** refers) for the *"Demolition of Buildings and Structures in Proposed Kennedy Town Comprehensive Development Area Site – Environmental Report for VEP Application"* (KTCDA ER for VEP) has been conducted to evaluate the validity of the previous assessment and to determine whether additional mitigation measures will be required for the current variation.

Review on Toxicity Data and Other Parameters

2.23. Toxicity data from relevant authority databases, such as Integrated Risk Information System (IRIS) from USEPA, the Risk Assessment Information System, etc, have been reviewed. It is observed that there are no updates for the toxicity data for the 32 contaminants chosen for the previous assessment.

2.24. Other parameters from previous assessment, including the exposure parameters of the receptors, are found to be reasonable, and no adjustments are required.

Variation of the Project and Implication on the Previous HHRA

2.25. The major variation that might potentially affect the previous HHRA is the difference in the Site Office area ("Area A" of the previous HHRA). According to the previous report (**Appendix C**), Area A refers to the decommissioned Kennedy Town Abattoir (KTA) and the Kennedy Town Incinerator Plant (KTIP); while in the latest works boundary, the New Area A would consist of KTA, KTIP and the existing Highway Department (HyD) Depot. Both Previous Area A and New Area A are presented in **Figure 2.7**

2.26. As this new area, the HYD Depot, was not accounted in the previous assessment. The risk for this area should be evaluated and proper mitigation measures should be proposed.

2.27. There are no changes for other areas (Area B ~ D), and therefore assessment results for these areas from the previous assessment (**Appendix C**) are still application for the current Project.

Summary of Review

2.28. After reviewing the previous HHRA, it is concluded that the current variation would only affect the assessment for "Area A". The following scenarios (**Table 2.10**) from previous assessment will be re-evaluated based on the current variation and proper mitigation will be proposed.

Table 2.10 Assessment Scenarios

No.	Previous Assessment Area	New Assessment Area	Re - evaluation
1a	Area A: Decommissioned KTA and KTIP (paving thickness 300mm)	Area A: Decom KTA, KTIP and HYD Depot (paving thickness 300mm)	Yes
1b	Area A: Decommissioned KTA and KTIP (paving layer not intact)	Area A: Decom KTA, KTIP and HYD Depot (paving layer not intact)	Yes
2	Area B: New World First Bus Depot	No change	No
3	Area C: Public Car Park, Refuse Collection Point and Public Road	No change	No
4	Area D: Cadogan Street Temporary Garden	No change	No
5	Residential area east to the KTCDA site	No change	No
6	Residential area south to the KTCDA site	No change	No
7	Area A: Decommissioning of KTA and KTIP (paving layer not intact)	No change	No

2.29. Scenario 1a considered a 200mm thick paving layer on top of the existing paving layer. As a conservative approach, it is assumed that the Area A would be covered by a paving layer with a total thickness of 300mm.

2.30. Scenario 1b is similar to Scenario 1a, except the 300mm paving layer is assumed to be damaged due to the site operation (paving not interact).

2.31. Detailed descriptions for scenarios 2-7 can be found in **Appendix C**.

Evaluation of Human Health Risk Associated with the Proposed Modification

Acceptance Criteria of Human Health Risk Assessment

2.32. For consistency, acceptance criteria will be the same as the previous assessment. For carcinogenic risk, USEPA's lifetime excess risk of $1x10^{-6}$. For non-carcinogenic risk, hazard quotient of 1 was adopted.

Methodology and Assumption

2.33. The HHRA would be carried out in accordance with the assessment procedures outlined in the ASTM document E-2081 "Standard Guide for Risk-based Corrective Action". Software tool, the "RBCA Tool Kit for Chemical Release" (version 1.3b) developed by Groundwater Services Inc. was used for the risk calculation process. The RBCA Tool Kit for Chemical Release (RBCA Tool Kit) is designed to meet the requirements of the ASTM document E-2081, which is a comprehensive modelling and risk characterization package for RBCA evaluation for contaminated sites.

2.34. In general, the risk assessment is based on the "Source – Pathway – Receptor" concept – the receptor is exposed to health risk only when there is presence of contaminants source and completed transport pathway(s) for the contaminants to reach the receptor. Further discussion on source, pathway and receptor are presented below.

2.35. In the HHRA, the "Source", contaminants present in the soil and groundwater of the site needs to be characterized in terms of concentration and location. Since the contaminant concentration at the new area are not available, concentration of Area A from previous assessment would be adopted for a conservative approach. Other concentration of the contaminants would also be adopted from the previous assessment, tabulated as follow:

Table 2.11 Representative Contaminant Concentration in Assessment Area A

Contaminant	Conc. in Soil (mg/kg)	Conc. In Ground Water (mg/kg)
Heavy Metals		
Arsenic	9.0	5.4×10^{-2}
Barium	1.4×10^{2}	0.0
Cadmium	6.5×10^{-1}	9.8×10^{-2}
Chromium	1.0×10^{1}	7.8×10^{-2}
Copper	5.3×10^{1}	1.3
Molybdenum	2.0	0.0
Nickel	9.4	9.9×10^{-2}
Zinc	2.6×10^{2}	7.5
Mercury	6.8×10^{-1}	5.0×10^{-4}
Polyaromatic Hydrocarbons (PAHs) and Total Petroleum Hydrocarbons (TPH)		
Naphthalene	5.1×10^{-1}	5.0×10^{-3}
Phenanthrene	4.3×10^{-1}	8.0×10^{-3}
Anthracene	4.4×10^{-1}	6.0×10^{-3}
Fluoranthene	5.9×10^{-1}	2.0×10^{-2}
Pyrene	6.3×10^{-1}	7.7×10^{-2}
Benzo(a)Pyrene	6.2×10^{-1}	3.3×10^{-2}
TPH – Aliphatics >C06-C08	5.0×10^{-1}	5.0
TPH – Aliphatics >C08-C10	8.3×10^{-1}	8.3
TPH – Aliphatics >C10-C12	1.9×10^{1}	4.2×10^{1}
TPH – Aliphatics >C12-C16	1.7×10^{1}	3.8×10^{1}
TPH – Aliphatics >C16-C21	7.5×10^{1}	4.9×10^{2}
TPH – Aliphatics >C21-C34	2.3×10^{2}	1.4×10^{3}
TPH – Aromatics >C07-C08	5.0×10^{-1}	5.0
TPH – Aromatics >C08-C10	1.7×10^{-1}	1.7
TPH – Aromatics >C10-C12	6.0	1.3×10^{1}
TPH – Aromatics >C12-C16	7.9	1.7×10^{1}
TPH – Aromatics >C16-C21	4.0×10^{1}	2.6×10^{2}
TPH – Aromatics >C21-C35	1.5×10^{2}	9.0×10^{2}
BTEX[a]		
Benzene	2.0×10^{-1}	2.0×10^{-3}

Contaminant	Conc. in Soil (mg/kg)	Conc. In Ground Water (mg/kg)
Toluene	2.0×10^{-1}	8.0×10^{-3}
Ethylbenzene	2.0×10^{-1}	2.0×10^{-3}
m-Xylene	4.0×10^{-1}	4.0×10^{-3}
o-Xylene	2.0×10^{-1}	2.0×10^{-3}

Note a: Since all lab analysis results (except for toluene in groundwater) for BTEX were below limit of report (LOR), the value of LOR was used.

2.36. Exposure pathway and receptors are detailed in the previous assessment (**Appendix C**), a summary table is as follow:

Table 2.12 Exposure Pathway and Receptor for Assessment Area A

Scenario No.	Receptor			Exposure Pathway		
	Child	Adult / Worker	Construction Worker / Worker	Soil dermal contact / ingestion	Inhalation of vapour / particulate (outdoor)	Inhalation of vapour (indoor)
1a			✓		✓	✓
1b			✓	✓	✓	✓

Risk Assessment Results

2.37. The summary of the risk assessment result is presented in **Table 2.13**. Note that the re-evaluation result for the variation is the same as the previous assessment. This is because the additional land area has the same land use during the construction, while size of land area does not affect the model result, as the contaminants is modeled to have uniformed concentration. As the exposure parameters and the containment concentrations are the same for both previous and current study, it is reasonable that the assessment results for the previous and current study are identical.

2.38. It is observed that the carcinogenic risk and non-carcinogenic risk of inhalation of vapour in outdoor environment for both Scenario 1a and 1b are in compliance with the criterions.

2.39. However, the non-carcinogenic risk for inhalation of vapour in indoor environment for both Scenario 1a and 1b have exceed the compliance limit. This indicates that precautionary measures are required to reduce the risk.

2.40. For Scenario 1b, the carcinogenic risk for soil dermal contact and ingestion exceed the criterion. However, for scenario 1a, the soil dermal contact and ingestion pathway is blocked due to the presence of the paving layer. This indicates that the paving layer would serve as a physical barrier protecting the workers provided that the paving layer remains intact.

Table 2.13 Calculated Human Health Risk for Assessment Area A

Scenario No.	Receptor	Exposure Pathway	Carcinogenic Risk (Criterion: 1×10^{-6})	Non-carcinogenic Risk (Criterion: 1)
1a	Construction Worker	Inhalation of vapour in outdoor environment	3.4×10^{-7}	0.36
		Inhalation of vapour in indoor environment	3.4×10^{-8}	**9.4**

Scenario No.	Receptor	Exposure Pathway	Carcinogenic Risk (Criterion: 1 x 10^{-6})	Non-carcinogenic Risk (Criterion: 1)
1b	Construction Worker	Inhalation of vapour and particulate in outdoor environment	3.4 x 10^{-7}	0.36
		Inhalation of vapour in indoor environment	3.4 x 10^{-8}	**9.4**
		Soil dermal contact and ingestion	**1.1 x 10^{-6}**	0.018

Human Health Risk Mitigation Measures Recommended due to the Proposed Modification

2.41. The mitigation measures stipulated in EP Condition 3.2 would be applicable to Area A of this assessment (including additional area at HyD depot) and no additional mitigation measures would be required for mitigating the risk.

2.42. With the implementation of proposed mitigation measures in Area A, the human health risk imposed to construction workers at Area A would be acceptable, in compliance with the established criteria.

3. ENVIORNMENTAL MONITORING AND AUDIT REQUIREMENTS

Objectives and Requirements

3.1. Environmental monitoring and audit (EM&A) programme should be carried out for the WIL Project. The overall objectives of the EM&A programme are as follows:

- To monitor the project performance and the effectiveness of the mitigation measures
- To provide an easily indication if any of the environmental mitigation measures identified in this report and/or implemented by the Contractor fail to meet the established standards and guidelines;
- To take remedial action if unexpected problems or unacceptable impacts arise;
- To provide data to enable an environmental audit to be undertaken;
- To provide a database against which any short or long-term environmental effects; and
- To verify the environmental impacts predicted in the EIA study.

3.2. The EM&A requirements for the construction of the WIL have been summarised in Section 12 of the approved EIA Report and detailed in a separate EM&A Manual. These EM&A requirements, including requirements of those listed below, should remain applicable to the additional works.

- EM&A project team organization
- Baseline and impact air quality and noise monitoring and the corresponding event and action plan.
- Site environmental auditing
- Compliant investigation procedures
- EM&A reporting, including baseline monitoring report, monthly EM&A report.

Supplementary EM&A Requirements Associated with Proposed Modification

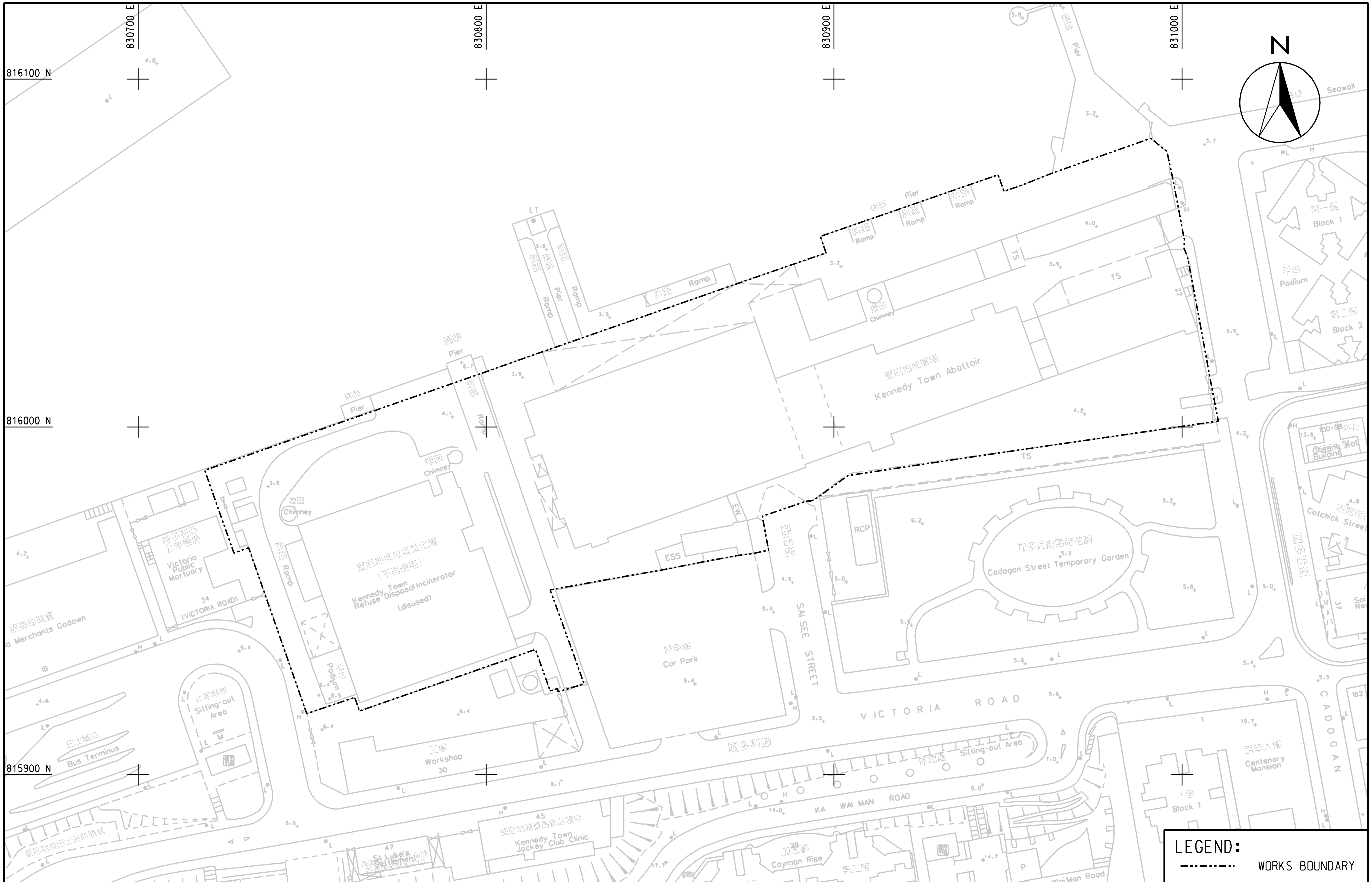
3.3. The EM&A requirements proposed in the approved EIA Report and KTCDA ER for VEP (**Appendix C refers**) would remain applicable to the proposed modification.

4. CONCLUSIONS

4.1. An environmental assessment has been conducted for the proposed modification of site boundary and layout at Works Area B. Likely environmental issues pertinent to the proposed modification were assessed and additional environmental mitigation requirements identified.

4.2. This Environmental Assessment Report concluded that the proposed modification would result in no adverse environmental impact with the implementation of the recommended mitigation measures, and therefore the proposed modification is considered to be environmental acceptable.

Figures



LEGEND:
-·-·-·- WORKS BOUNDARY

AECOM

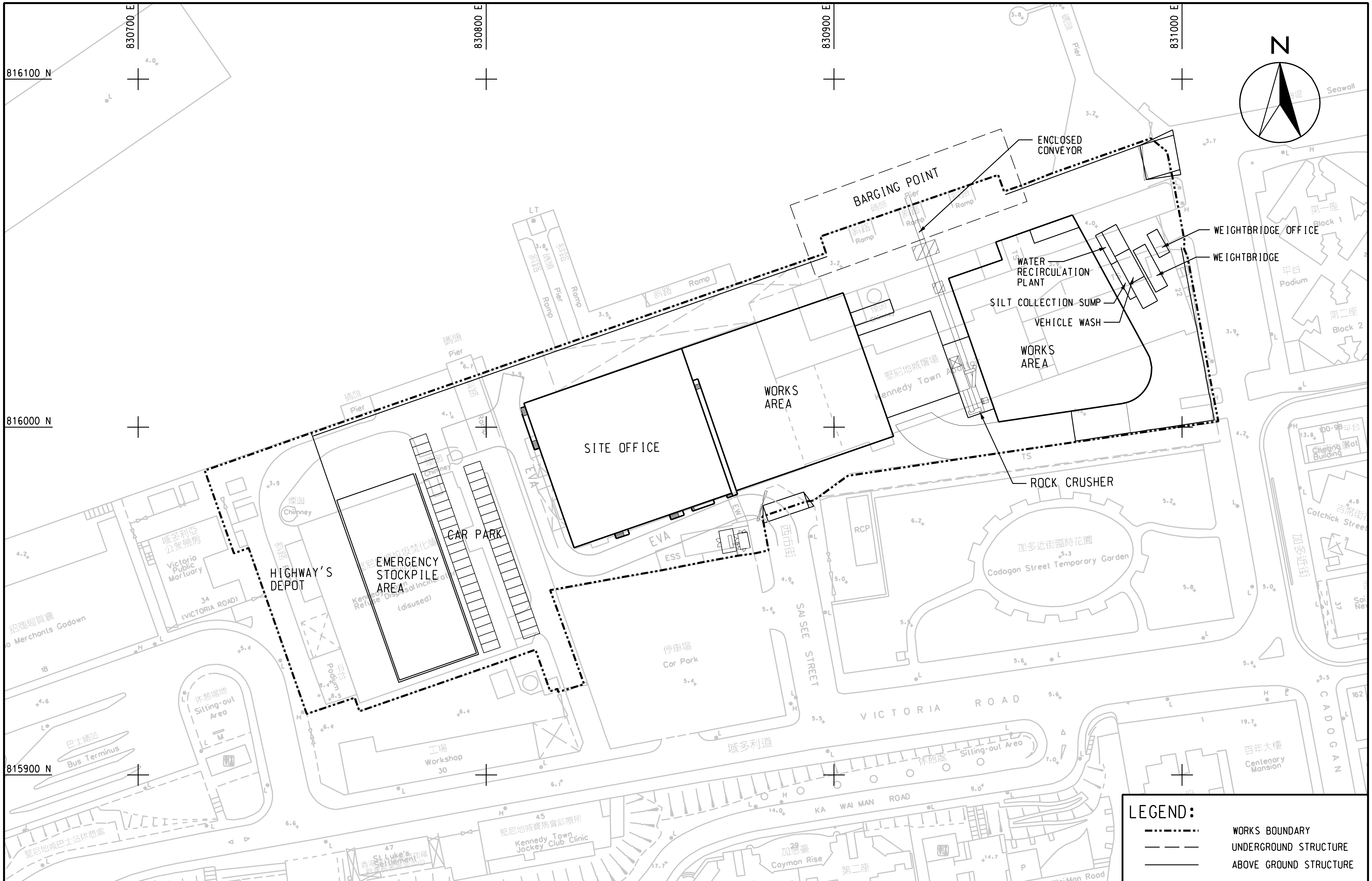
WEST ISLAND LINE ENVIRONMENTAL ASSESSMENT REPORT

WORKS AREA BOUNDARY

SCALE	A3 1:1000	DATE	JUN. 2009
CHECK	-	DRAWN	XCF
JOB No.	60017115	DRAWING No.	FIG 1.1
		REV	-

2009-6-11 19:26:49 XUCF

p:\projects\60017115\DRAWING\FIGURE\VARIATION\ENV\FIG 1.1.dgn



LEGEND:

-·-·-·	WORKS BOUNDARY
— — —	UNDERGROUND STRUCTURE
———	ABOVE GROUND STRUCTURE

AECOM

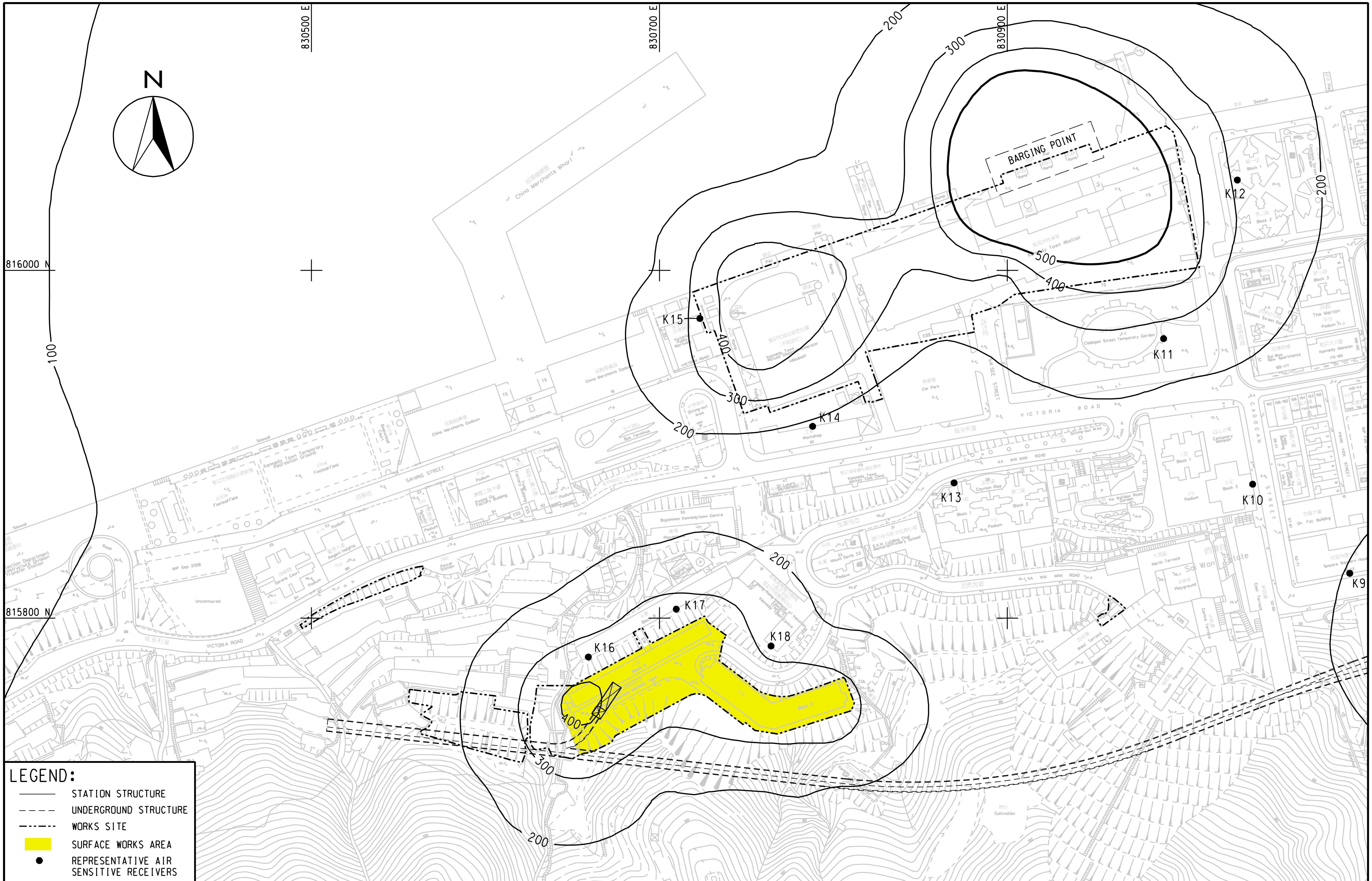
WEST ISLAND LINE ENVIRONMENTAL ASSESSMENT REPORT

LOCATIONS OF PLANT FACILITIES AT WORKS AREA B

SCALE	A3 1:1000	DATE	JUN. 2009
CHECK	-	DRAWN	XCF
JOB No.	60017115	DRAWING No.	FIG 1.2
REV	-		

2009-6-12 9:08:00 XUCF

P:\PROJECTS\60017115\DRAWING\FIGURE\VARIATION\ENV\FIG 1.2.dgn



LEGEND:

- STATION STRUCTURE
- UNDERGROUND STRUCTURE
- WORKS SITE
- SURFACE WORKS AREA
- REPRESENTATIVE AIR SENSITIVE RECEIVERS

AECOM

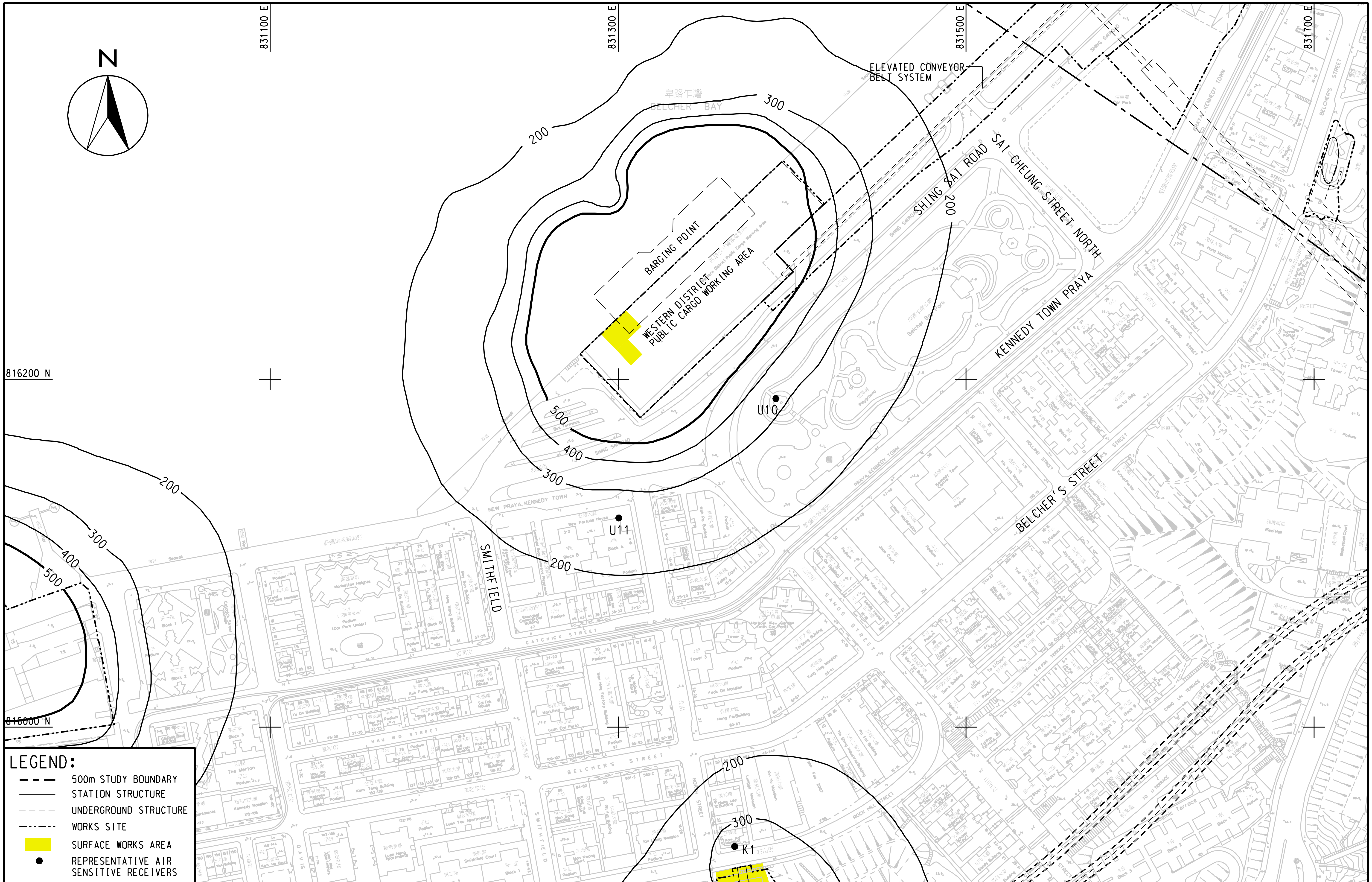
WEST ISLAND LINE ENVIRONMENTAL ASSESSMENT REPORT

CONTOURS OF CUMULATIVE MAXIMUM 1-HOUR TSP CONCENTRATION IN ug/m³ AT 1.5m ABOVE GROUND

SCALE	A3 1:2000	DATE	JUN. 2009
CHECK	-	DRAWN	LLJ
JOB No.	60017115	DRAWING No.	FIG 2.1
		REV	-

2009-6-10 15:47:06 XUCF

p:\projects\60017115\DRAWING\FIGURE\VARIATION\ENV\FIG 2.1.dgn



AECOM

WEST ISLAND LINE ENVIRONMENTAL ASSESSMENT REPORT

CONTOURS OF CUMULATIVE MAXIMUM 1-HOUR TSP CONCENTRATION IN ug/m^3 AT 1.5m ABOVE GROUND

SCALE	A3 1:2000	DATE	JUN. 2009
CHECK	-	DRAWN	HY
JOB No.	60017115	DRAWING No.	FIG 2.2
		REV	-

2009-6-11 20:50:56 XUCF

P:\PROJECTS\60017115\DRAWING\FIGURE\VARIATION\ENV\FIG 2.2.dgn

2009-6-10 15:54:41 XUCF

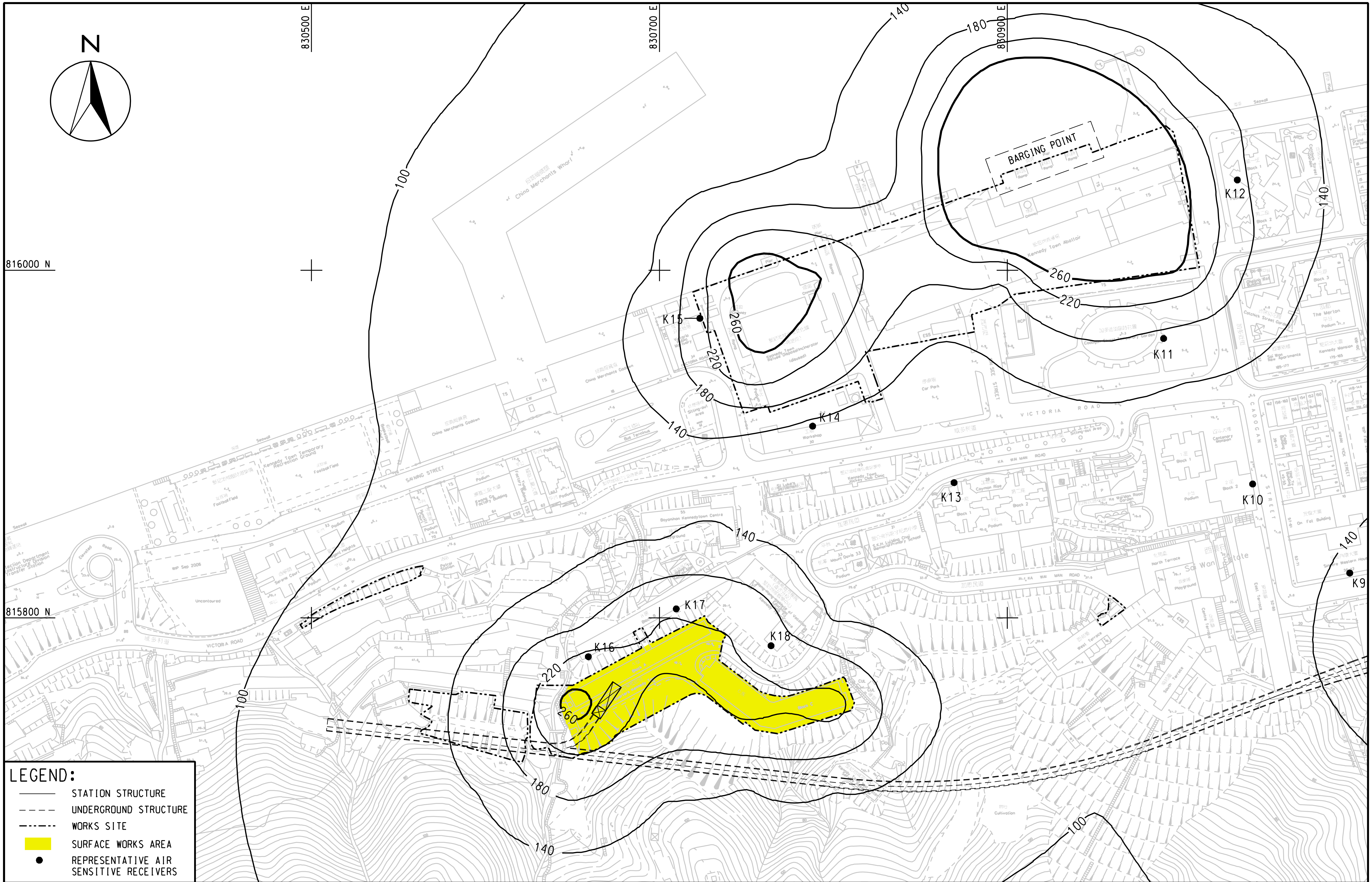
AECOM

WEST ISLAND LINE ENVIRONMENTAL ASSESSMENT REPORT

CONTOURS OF CUMULATIVE MAXIMUM 1-HOUR TSP CONCENTRATION IN ug/m^3 AT 1.5m ABOVE GROUND

SCALE	A3 1:2000	DATE	JUN. 2009
CHECK	-	DRAWN	HY
JOB No.	60017115	DRAWING No.	FIG 2.3
		REV	-

p:\projects\60017115\DRAWING\FIGURE\VARIATION\ENV\FIG 2.3.dgn



2009-6-10 15:59:54 XUCF

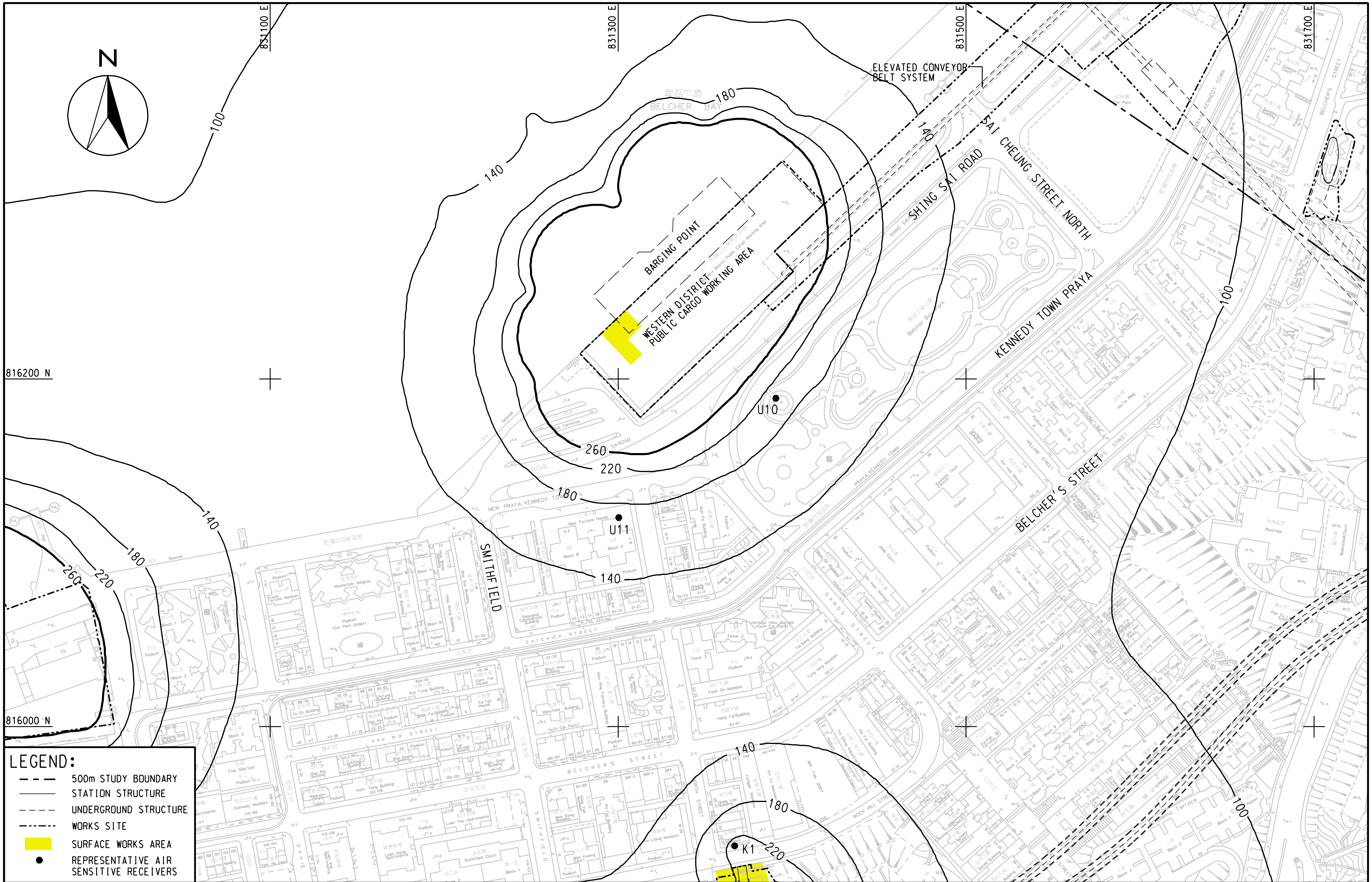
AECOM

WEST ISLAND LINE ENVIRONMENTAL ASSESSMENT REPORT

CONTOURS OF CUMULATIVE MAXIMUM 24-HOUR TSP CONCENTRATION IN ug/m³ AT 1.5m ABOVE GROUND

SCALE	A3 1:2000	DATE	JUN. 2009
CHECK	-	DRAWN	LLJ
JOB No.	60017115	DRAWING No.	FIG 2.4
		REV	-

p:\projects\60017115\DRAWING\FIGURE\VARIATION\ENV\FIG 2.4.dgn



2009-6-11 20:39:45 XUCF

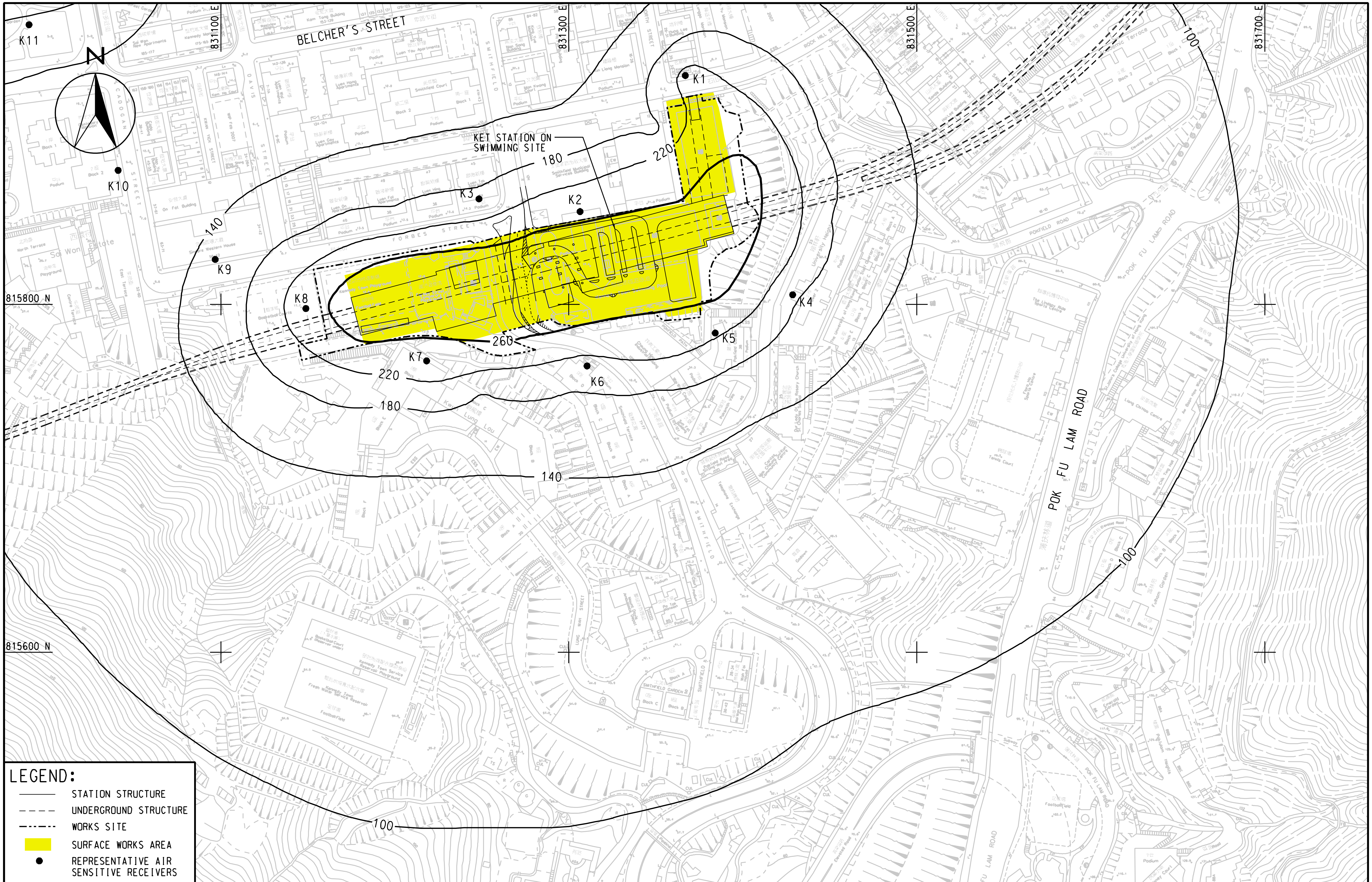
AECOM

WEST ISLAND LINE ENVIRONMENTAL ASSESSMENT REPORT

CONTOURS OF CUMULATIVE MAXIMUM 24-HOUR TSP CONCENTRATION IN ug/m³ AT 1.5m ABOVE GROUND

SCALE	A3 1:2000	DATE	JUN. 2009
CHECK	-	DRAWN	HY
JOB No.	60017115	DRAWING No.	FIG 2.5
		REV	-

P:\PROJECTS\60017115\DRAWING\FIGURE\VARIATION\ENV\FIG 2.5.dgn



AECOM

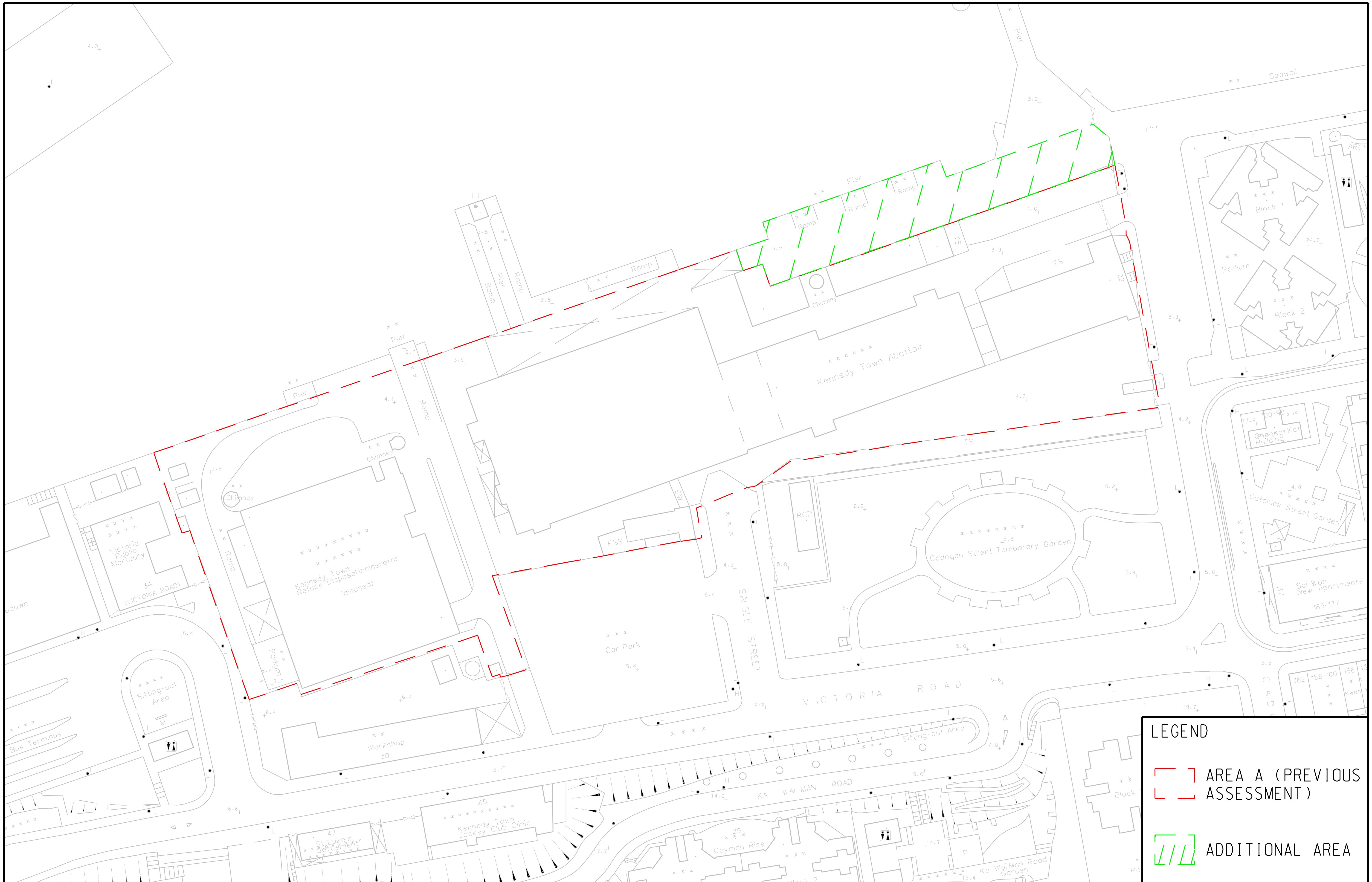
WEST ISLAND LINE ENVIRONMENTAL ASSESSMENT REPORT

CONTOURS OF CUMULATIVE MAXIMUM 24-HOUR TSP CONCENTRATION IN ug/m^3
AT 1.5m ABOVE GROUND

SCALE	A3 1:2000	DATE	JUN. 2009
CHECK	-	DRAWN	HY
JOB No.	60017115	DRAWING No.	FIG 2.6
		REV	-

2009-6-10 16:04:34 XUCF

p:\projects\60017115\DRAWING\FIGURE\VARIATION\ENV\FIG 2.6.dgn



AECOM

WEST ISLAND LINE
ENVIRONMENTAL ASSESSMENT REPORT

AREA A OF THE PREVIOUS AND CURRENT STUDY

SCALE	A3 1:1000	DATE	JUN 2009	
CHECK	BKAY	DRAWN	ALFA	
JOB No.	60017115	DRAWING No.	2.7	REV –

P:/60017115/2.1 ABATTOIR/RISK ASST/FIGURE.DGN

Appendix A

Construction Noise Impact Assessment – Mitigated Scenario

Appendix A

Powered Mechanical Equipment (PME) for Different Construction Tasks during Normal Daytime Working Hours (Mitigated Scenario)

Works Area B - Abattoir Site

Construct Site Offices + Crusher + Barging Point

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No. of Items	SWL/Item dB(A)	On-time %	Noise Mitigation Measure	Noise Barrier Reduction	Total SWL dB(A)
Generator	CNP103	2	95	100%			98
Mobile Crane	BS C7/114	2	101	30%			99
Truck	BS C9/39	2	103	65%			104
Poker	BS C6/40	2	98	30%			96
Compressor	CNP003	1	104	60%	Enclosure/Shed*	15	87
Concrete Mixer Truck	BS C6/23	2	100	50%			100
						Total	**107**

Rock Crusher Operation

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No. of Items	SWL/Item dB(A)	On-time %	Noise Mitigation Measure	Noise Barrier Reduction	Total SWL dB(A)	Total SWL dB(A)
Wheel Loader	BS C3/97	1	105	50%			102	
Truck	BS C9/39	2	103	65%			104	
Crusher	EIA Ref.	1	118	40%				114
Converyor	CNP041	4	90	70%				94
Water Recirculation Plant	CNP 283	1	85	75%			84	
						Total	**106**	**114**

Reinstatement

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No. of Items	SWL/Item dB(A)	On-time %	Noise Mitigation Measure	Noise Barrier Reduction	Total SWL dB(A)
Truck	BS C9/39	2	103	30%			101
Air Compressor	CNP002	2	102	100%	Enclosure/Shed*	15	90
Concrete Lorry Mixer	BS C6/23	2	100	50%			100
Poker, vibratory, hand-held	BS C6/40	4	98	30%			99
Crane	BS C7/114	1	101	20%			94
Breaker	BS C8/12	1	106	25%			100
						Total	**106**

Transport spoil to the barge

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No. of Items	SWL/Item dB(A)	On-time %	Noise Mitigation Measure	Noise Barrier Reduction	Total SWL dB(A)
Barge	CNP061	1	104	80%			103
						Total	**103**

Note:

EIA Ref. : The SWL of crusher was made reference to the approved EIA Report of Development at Anderson Road, 1998.

* With reference to paragraph 4.5 of EIAO Guidance Note No. 9/2004, movable noise barrier would achieve a noise reduction of 5dB(A) and 10 dB(A) for movable plant and stationary plant respectively, while the use of enclosure/shed would achieve 15 dB(A) noise reduction.

Appendix A - Calculation of Construction Noise Levels at Representative Noise Sensitive Receivers - Mitigated

NSR :KET 10- LMC Primary School

Act No.	Construction Element	SWL	Dist[2]	SPL	2009						2010											
					Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Works Area C - West of KET (Forbes Street Site)																						
1	Initial possession	100	-	0									0	0	0	0						
2	Utility Diversions	102	-	0												0	0	0	0	0	0	0
3	Piling/walling	109	-	0												0	0	0	0	0	0	
4	Bulk Excavation - soft	101	-	0																	0	0
5	Excavate rock and base	102	-	0																		
6	Commence KET Turnback Tunnel	100	-	0																		
7	Tunnel Lining for KET Turnback	101	-	0																		
8	Construct Station Box and Fitout ABWF	103	-	0																		
9	Reinstate Forbes Street and Smithfield	94	-	0																		
Works Area D - East of KET (Swimming Pool Site)																						
10	Demolish Pools and Grandstand	103	-	0																		
11	Piling/walling	108	-	0																		
12	Bulk Excavation - soft	101	-	0																		
13	Excavate rock and base	112	-	0																		
14	Commence KET to UNV Tunnel	101	-	0																		
15	Tunnel Lining for KET to UNV Tunnel	101	-	0																		
16	Construct Station Box and Fitout ABWF	103	-	0																		
17	Reinstate Site & Smithfield PTI Slab	99	-	0																		
Works Area A - Ex-Police Quarter																						
18	Utility Diversions	96	140	48									48	48	48	48						
19	Demolition	103	126	56													56	56	56	56	56	
20	Piling/walling	102	184	52																	52	
21	Excavation of Shaft (soft)	106	186	56																		56
22	Excavation of Shaft (rock)	100	188	50																		
23	Excavation of Tunnel / Adits (rock)	100	188	50																		
24	Lining	94	188	44																		
Works Area B - Abattoir Site																						
25	Construct Site Offices + Crusher + Transport spoil to the barge	107	125	60	60	60	60	60	60	60	60	60	60	60								
26	Rock Crusher Operation	114	201	63											63	63	63	63	63	63	63	63
27	Reinstatement	106	125	59																		
28	Barging Point	103	234	51											51	51	51	51	51	51	51	51
Works Area MA - Underground Magazine Site																						
29	Possession of Site	98	-	0	0	0																
30	Construction of Magazine	105	-	0		0	0	0	0	0	0	0	0	0	0	0	0					
31a	Operation of Magazine - Ventilation Fan	86	-	0														0	0	0	0	0
31b	Operation of Magazine - Truck	94	-	0														0	0	0	0	0
	Total SPL, dB(A)				60	60	60	60	60	60	60	60	60	60	63	63	64	64	64	64	64	64
	Exceedance				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Exceednace during Examination				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Act No.	2011												2012											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Works Area C - West of KET (Forbes Street Site)																								
1																								
2																								
3																								
4	0	0	0	0	0																			
5		0	0	0	0																			
6						0	0	0	0	0	0	0	0											
7									0	0	0	0	0	0	0	0	0							
8							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9																								
Works Area D - East of KET (Swimming Pool Site)																								
10			0	0	0																			
11						0	0	0	0	0	0													
12											0	0	0	0	0	0	0							
13														0	0	0	0							
14																	0	0	0					
15																		0	0					
16																		0	0	0	0	0	0	0
17																								
Works Area A - Ex-Police Quarter																								
18																								
19																								
20																								
21																								
22	50	50																						
23	50	50	50	50	50	50	50	50	50	50	50	50	50											
24									44	44	44	44	44	44	44	44	44							
Works Area B - Abattoir Site																								
25																								
26	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63
27																								
28	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51
Works Area MA - Underground Magazine Site																								
29																								
30																								
31a	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
31b	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total SPL, dB(A)	64	64	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63
Exceedance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exceednace during Examination	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Act No.	2013												2014									2015								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	55	56	57	58	59	60	61	62	63
Works Area C - West of KET (Forbes Street Site)																														
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9	0	0	0	0	0	0	0	0	0	0	0	0																		
Works Area D - East of KET (Swimming Pool Site)																														
10																														
11																														
12																														
13																														
14																														
15																														
16	0	0	0	0	0																									
17		0	0	0	0	0	0	0	0	0	0	0	0	0																
Works Area A - Ex-Police Quarter																														
18																														
19																														
20																														
21																														
22																														
23																														
24																														
Works Area B - Abattoir Site																														
25																														
26	63																													
27																												59	59	
28	51																													
Works Area MA - Underground Magazine Site																														
29																														
30																														
31a																														
31b																														
Total SPL, dB(A)	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	59	59	-
Exceedance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exceednace during Examination	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Remarks:

1. Noise sources at more than 300m from the sensitive receiver are not considered in cumulative noise assessment due to large distance attenuation effect.

2. Slant distance (m)

3. For the calculation of sound pressure levels (SPL), the PMEs are assumed to be placed at the notional source position according to the "Technical Memorandum on Noise from Construction Work other than Percussive Piling" by EPD.

* No PMEs used at surface

Noise Exceedance

The use of PME would not be visible when viewed from the assessment facade of NSR. The NSR is considered to be totally screened. According to GW-TM, a noise reduction of 10 dB(A) would be achieved.

Appendix A - Calculation of Construction Noise Levels at Representative Noise Sensitive Receivers - Mitigated

NSR :KET 11- Cayman Rise (Block 1)

Act No.	Construction Element	SWL	Dist^2	SPL	2009						2010												2011												2012												2013												2014									2015								
					Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	55	56	57	58	59	60	61	62	63
Works Area C - West of KET (Forbes Street Site)																																																																												
1	Initial possession	100	-	0									0	0	0	0																																																												
2	Utility Diversions	102	-	0												0	0	0	0	0	0	0																																																					
3	Piling/walling	109	-	0												0	0	0	0	0	0																																																					
4	Bulk Excavation - soft	101	-	0																	0	0	0	0	0	0	0																																															
5	Excavate rock and base	102	-	0																				0	0	0	0																																															
6	Commence KET Turnback Tunnel	100	-	0																								0	0	0	0	0	0	0	0																																									
7	Tunnel Lining for KET Turnback	101	-	0																											0	0	0	0	0	0	0	0	0																																						
8	Construct Station Box and Fitout ABWF	103	-	0																									0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																														
9	Reinstate Forbes Street and Smithfield	94	-	0																																							0	0	0	0	0	0	0	0	0	0	0	0																		
Works Area D - East of KET (Swimming Pool Site)																																																																													
10	Demolish Pools and Grandstand	103	-	0																					0	0	0																																																
11	Piling/walling	108	-	0																								0	0	0	0	0	0																																											
12	Bulk Excavation - soft	101	-	0																													0	0	0	0	0	0	0																																						
13	Excavate rock and base	112	-	0																																0	0	0	0																																						
14	Commence KET to UNV Tunnel	101	-	0																																			0	0	0																																			
15	Tunnel Lining for KET to UNV Tunnel	101	-	0																																				0	0																																			
16	Construct Station Box and Fitout ABWF	103	-	0																																				0	0	0	0	0	0	0	0	0	0	0	0																									
17	Reinstate Site & Smithfield PTI Slab	99	-	0																																												0	0	0	0	0	0	0	0	0	0	0	0	0																
Works Area A - Ex-Police Quarter																																																																													
18	Utility Diversions	96	186	46									46	46	46	46																																																										
19	Demolition	103	169	53													53	53	53	53	53																																																					
20	Piling/walling	102	229	50																	50																																																					
21	Excavation of Shaft (soft)	106	233	54																		54																																																				
22	Excavation of Shaft (rock)	100	233	48																			48	48																																																		
23	Excavation of Tunnel / Adits (rock)	100	233	48																			48	48	48	48	48	48	48	48	48	48	48	48	48																																									
24	Lining	94	233	42																											42	42	42	42	42	42	42	42	42																																						
Works Area B - Abattoir Site																																																																												
25	Construct Site Offices + Crusher + Transport spoil to the barge	107	115	61	61	61	61	61	61	61	61	61	61	61																																																												
26	Rock Crusher Operation	114	162	65											65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65																													
27	Reinstatement	106	115	60																																																																		60	60	
28	Barging Point	103	200	52											52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52																													
Works Area MA - Underground Magazine Site																																																																												
29	Possession of Site	98	-	0	0	0																																																																				
30	Construction of Magazine	105	-	0		0	0	0	0	0	0	0	0	0	0	0	0																																																							
31a	Operation of Magazine - Ventilation Fan	86	-	0														0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																															
31b	Operation of Magazine - Truck	94	-	0														0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																															
	Total SPL, dB(A), without round				61	61	61	61	61	61	61	61	61	61	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	60	-
	Total SPL, dB(A)				61	61	61	61	61	61	61	61	61	61	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	60	-
	Exceedance				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Remarks:

1. Noise sources at more than 300m from the sensitive receiver are not considered in cumulative noise assessment due to large distance attenuation effect.
2. Slant distance (m)
3. For the calculation of sound pressure levels (SPL), the PMEs are assumed to be placed at the notional source position according to the "Technical Memorandum on Noise from Construction Work other than Percussive Piling" by EPD.

* No PMEs used at surface

The use of PME would not be visible when viewed from the assessment facade of NSR. The NSR is considered to be totally screened. According to GW-TM, a noise reduction of 10 dB(A) would be achieved.

Appendix A - Calculation of Construction Noise Levels at Representative Noise Sensitive Receivers - Mitigated

NSR :KET 12- Cheong Kat Building

Act No.	Construction Element	SWL	Dist[2]	SPL	2009						2010											
					Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Works Area C - West of KET (Forbes Street Site)																						
1	Initial possession	100	260	47									47	47	47	47						
2	Utility Diversions	102	260	49												49	49	49	49	49	49	49
3	Piling/walling	109	260	56												56	56	56	56	56	56	
4	Bulk Excavation - soft	101	260	48																	48	48
5	Excavate rock and base	102	260	49																		
6	Commence KET Turnback Tunnel	100	240	47																		
7	Tunnel Lining for KET Turnback	101	240	48																		
8	Construct Station Box and Fitout ABWF	103	260	50																		
9	Reinstate Forbes Street and Smithfield	94	260	41																		
Works Area D - East of KET (Swimming Pool Site)																						
10	Demolish Pools and Grandstand	103	-	0																		
11	Piling/walling	108	-	0																		
12	Bulk Excavation - soft	101	-	0																		
13	Excavate rock and base	112	-	0																		
14	Commence KET to UNV Tunnel	101	-	0																		
15	Tunnel Lining for KET to UNV Tunnel	101	-	0																		
16	Construct Station Box and Fitout ABWF	103	-	0																		
17	Reinstate Site & Smithfield PTI Slab	99	-	0																		
Works Area A - Ex-Police Quarter																						
18	Utility Diversions	96	-	0									0	0	0	0						
19	Demolition	103	-	0													0	0	0	0	0	
20	Piling/walling	102	-	0																	0	
21	Excavation of Shaft (soft)	106	-	0																		0
22	Excavation of Shaft (rock)	100	-	0																		
23	Excavation of Tunnel / Adits (rock)	100	-	0																		
24	Lining	94	-	0																		
Works Area B - Abattoir Site																						
25	Construct Site Offices + Crusher + Transport spoil to the barge	107	107	61	61	61	61	61	61	61	61	61	61	61								
26	Rock Crusher Operation	114	57	74											74	74	74	74	74	74	74	74
27	Reinstatement	106	107	60																		
28	Barging Point	103	138	55											55	55	55	55	55	55	55	55
Works Area MA - Underground Magazine Site																						
29	Possession of Site	98	-	0	0	0																
30	Construction of Magazine	105	-	0		0	0	0	0	0	0	0	0	0	0	0	0					
31a	Operation of Magazine - Ventilation Fan	86	-	0														0	0	0	0	0
31b	Operation of Magazine - Truck	94	-	0														0	0	0	0	0
	Total SPL, dB(A), without round				61	61	61	61	61	61	61	61	62	62	74	74	74	74	74	74	74	74
	Total SPL, dB(A)				61	61	61	61	61	61	61	61	62	62	74	74	74	74	74	74	74	74
	Exceedance				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Act No.	Construction Element	2011												2012											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Works Area C - West of KET (Forbes Street Site)																									
1	Initial possession																								
2	Utility Diversions																								
3	Piling/walling																								
4	Bulk Excavation - soft	48	48	48	48	48																			
5	Excavate rock and base		49	49	49	49																			
6	Commence KET Turnback Tunnel						47	47	47	47	47	47	47	47											
7	Tunnel Lining for KET Turnback									48	48	48	48	48	48	48	48	48							
8	Construct Station Box and Fitout ABWF							50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
9	Reinstate Forbes Street and Smithfield																								
Works Area D - East of KET (Swimming Pool Site)																									
10	Demolish Pools and Grandstand			0	0	0																			
11	Piling/walling						0	0	0	0	0	0													
12	Bulk Excavation - soft											0	0	0	0	0	0	0							
13	Excavate rock and base														0	0	0	0							
14	Commence KET to UNV Tunnel																	0	0	0					
15	Tunnel Lining for KET to UNV Tunnel																		0	0					
16	Construct Station Box and Fitout ABWF																		0	0	0	0	0	0	0
17	Reinstate Site & Smithfield PTI Slab																								
Works Area A - Ex-Police Quarter																									
18	Utility Diversions																								
19	Demolition																								
20	Piling/walling																								
21	Excavation of Shaft (soft)																								
22	Excavation of Shaft (rock)	0	0																						
23	Excavation of Tunnel / Adits (rock)	0	0	0	0	0	0	0	0	0	0	0	0	0											
24	Lining									0	0	0	0	0	0	0	0	0							
Works Area B - Abattoir Site																									
25	Construct Site Offices + Crusher + Transport spoil to the barge																								
26	Rock Crusher Operation	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74
27	Reinstatement																								
28	Barging Point	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
Works Area MA - Underground Magazine Site																									
29	Possession of Site																								
30	Construction of Magazine																								
31a	Operation of Magazine - Ventilation Fan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
31b	Operation of Magazine - Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Total SPL, dB(A), without round	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74
	Total SPL, dB(A)	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74
	Exceedance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Act No.	Construction Element	2013												2014									2015								
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
		43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	55	56	57	58	59	60	61	62	63
Works Area C - West of KET (Forbes Street Site)																															
1	Initial possession																														
2	Utility Diversions																														
3	Piling/walling																														
4	Bulk Excavation - soft																														
5	Excavate rock and base																														
6	Commence KET Turnback Tunnel																														
7	Tunnel Lining for KET Turnback																														
8	Construct Station Box and Fitout ABWF																														
9	Reinstate Forbes Street and Smithfield	41	41	41	41	41	41	41	41	41	41	41	41																		
Works Area D - East of KET (Swimming Pool Site)																															
10	Demolish Pools and Grandstand																														
11	Piling/walling																														
12	Bulk Excavation - soft																														
13	Excavate rock and base																														
14	Commence KET to UNV Tunnel																														
15	Tunnel Lining for KET to UNV Tunnel																														
16	Construct Station Box and Fitout ABWF	0	0	0	0	0																									
17	Reinstate Site & Smithfield PTI Slab		0	0	0	0	0	0	0	0	0	0	0	0	0																
Works Area A - Ex-Police Quarter																															
18	Utility Diversions																														
19	Demolition																														
20	Piling/walling																														
21	Excavation of Shaft (soft)																														
22	Excavation of Shaft (rock)																														
23	Excavation of Tunnel / Adits (rock)																														
24	Lining																														
Works Area B - Abattoir Site																															
25	Construct Site Offices + Crusher + Transport spoil to the barge																														
26	Rock Crusher Operation	74																													
27	Reinstatement																												60	60	
28	Barging Point	55																													
Works Area MA - Underground Magazine Site																															
29	Possession of Site																														
30	Construction of Magazine																														
31a	Operation of Magazine - Ventilation Fan																														
31b	Operation of Magazine - Truck																														
	Total SPL, dB(A), without round	74	41	41	41	41	41	41	41	41	41	41	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	60	-
	Total SPL, dB(A)	74	41	41	41	41	41	41	41	41	41	41	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	60	-
	Exceedance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Remarks:

1. Noise sources at more than 300m from the sensitive receiver are not considered in cumulative noise assessment due to large distance attenuation effect.

2. Slant distance (m)

3. For the calculation of sound pressure levels (SPL), the PMEs are assumed to be placed at the notional source position according to the "Technical Memorandum on Noise from Construction Work other than Percussive Piling" by EPD.

* No PMEs used at surface

The use of PME would not be visible when viewed from the assessment facade of NSR. The NSR is considered to be totally screened. According to GW-TM, a noise reduction of 10 dB(A) would be achieved.

Appendix A - Calculation of Construction Noise Levels at Representative Noise Sensitive Receivers - Mitigated

NSR :KET 13- The Merton (Block 2)

Act No.	Construction Element	SWL	Dist²	SPL	2009						2010												2011												2012												2013												2014									2015								
					Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	55	56	57	58	59	60	61	62	63
Works Area C - West of KET (Forbes Street Site)																																																																											
1	Initial possession	100	274	46									46	46	46	46																																																										
2	Utility Diversions	102	274	48												48	48	48	48	48	48	48																																																		
3	Piling/walling	109	274	55												55	55	55	55	55	55																																																			
4	Bulk Excavation - soft	101	274	47																	47	47	47	47	47	47	47																																														
5	Excavate rock and base	102	274	48																				48	48	48	48																																															
6	Commence KET Turnback Tunnel	100	260	47																								47	47	47	47	47	47	47	47																																							
7	Tunnel Lining for KET Turnback	101	260	48																											48	48	48	48	48	48	48	48	48																																			
8	Construct Station Box and Fitout ABWF	103	274	49																									49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49																															
9	Reinstate Forbes Street and Smithfield	94	274	40																																							40	40	40	40	40	40	40	40	40	40	40	40																		
Works Area D - East of KET (Swimming Pool Site)																																																																											
10	Demolish Pools and Grandstand	103	-	0																				|0|0|0|																																																			
11	Piling/walling	108	-	0																								0	0	0	0	0	0																																												
12	Bulk Excavation - soft	101	-	0																													0	0	0	0	0	0	0																																								
13	Excavate rock and base	112	-	0																															0	0	0	0																																								
14	Commence KET to UNV Tunnel	101	-	0																																		0	0	0																																					
15	Tunnel Lining for KET to UNV Tunnel	101	-	0																																			0	0																																					
16	Construct Station Box and Fitout ABWF	103	-	0																																			0	0	0	0	0	0	0	0	0	0	0	0																										
17	Reinstate Site & Smithfield PTI Slab	99	-	0																																								0	0	0	0	0	0	0	0	0	0	0	0	0																	
Works Area A - Ex-Police Quarter																																																																											
18	Utility Diversions	96	-	0									0	0	0	0																																																											
19	Demolition	103	-	0													0	0	0	0	0																																																						
20	Piling/walling	102	-	0																	0																																																						
21	Excavation of Shaft (soft)	106	-	0																		0																																																					
22	Excavation of Shaft (rock)	100	-	0																			0	0																																																		
23	Excavation of Tunnel / Adits (rock)	100	-	0																			0	0	0	0	0	0	0	0	0	0	0	0	0																																												
24	Lining	94	-	0																											0	0	0	0	0	0	0	0	0																																			
Works Area B - Abattoir Site																																																																											
25	Construct Site Offices + Crusher + Transport spoil to the barge	107	105	62	62	62	62	62	62	62	62	62	62	62																																																																
26	Rock Crusher Operation	114	61	73											73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73																																			
27	Reinstatement	106	105	61																																																																					61	61	
28	Barging Point	103	120	56											56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56																																			
Works Area MA - Underground Magazine Site																																																																											
29	Possession of Site	98	-	0	0	0																																																																						
30	Construction of Magazine	105	-	0		0	0	0	0	0	0	0	0	0	0	0	0																																																									
31a	Operation of Magazine - Ventilation Fan	86	-	0														0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																																				
31b	Operation of Magazine - Truck	94	-	0														0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																																				
	Total SPL, dB(A), without round				62	62	62	62	62	62	62	62	62	62	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	40	40	40	40	40	40	40	40	40	40	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61	61	-
	Total SPL, dB(A)				62	62	62	62	62	62	62	62	62	62	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	40	40	40	40	40	40	40	40	40	40	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61	61	-
	Exceedance				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Remarks:

1. Noise sources at more than 300m from the sensitive receiver are not considered in cumulative noise assessment due to large distance attenuation effect.

2. Slant distance (m)

3. For the calculation of sound pressure levels (SPL), the PMEs are assumed to be placed at the notional source position according to the "Technical Memorandum on Noise from Construction Work other than Percussive Piling" by EPD.

* No PMEs used at surface

The use of PME would not be visible when viewed from the assessment facade of NSR. The NSR is considered to be totally screened. According to GW-TM, a noise reduction of 10 dB(A) would be achieved.

Sample Calculation of Construction Noise Levels at Representative Noise Sensitive Receivers - Mitigated

NSR :KET 14- Kennedy Town Jockey Club Clinic

Act No.	Construction Element	SWL	Dist[2]	SPL	2009						2010											
					Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Works Area C - West of KET (Forbes Street Site)																						
1	Initial possession	100	-	0									0	0	0	0						
2	Utility Diversions	102	-	0												0	0	0	0	0	0	0
3	Piling/walling	109	-	0												0	0	0	0	0	0	
4	Bulk Excavation - soft	101	-	0																	0	0
5	Excavate rock and base	102	-	0																		
6	Commence KET Turnback Tunnel	100	-	0																		
7	Tunnel Lining for KET Turnback	101	-	0																		
8	Construct Station Box and Fitout ABWF	103	-	0																		
9	Reinstate Forbes Street and Smithfield	94	-	0																		
Works Area D - East of KET (Swimming Pool Site)																						
10	Demolish Pools and Grandstand	103	-	0																		
11	Piling/walling	108	-	0																		
12	Bulk Excavation - soft	101	-	0																		
13	Excavate rock and base	112	-	0																		
14	Commence KET to UNV Tunnel	101	-	0																		
15	Tunnel Lining for KET to UNV Tunnel	101	-	0																		
16	Construct Station Box and Fitout ABWF	103	-	0																		
17	Reinstate Site & Smithfield PTI Slab	99	-	0																		
Works Area A - Ex-Police Quarter																						
18	Utility Diversions	96	158	47									47	47	47	47						
19	Demolition	103	160	54													54	54	54	54	54	
20	Piling/walling	102	190	51																	51	
21	Excavation of Shaft (soft)	106	192	55																		55
22	Excavation of Shaft (rock)	100	192	49																		
23	Excavation of Tunnel / Adits (rock)	100	192	49																		
24	Lining	94	192	43																		
Works Area B - Abattoir Site																						
25	Construct Site Offices + Crusher + Transport spoil to the barge	107	92	63	63	63	63	63	63	63	63	63	63	63								
26	Rock Crusher Operation	114	184	64											64	64	64	64	64	64	64	64
27	Reinstatement	106	92	62																		
28	Barging Point	103	208	52											52	52	52	52	52	52	52	52
Works Area MA - Underground Magazine Site																						
29	Possession of Site	98	-	0	0	0																
30	Construction of Magazine	105	-	0		0	0	0	0	0	0	0	0	0	0	0	0					
31a	Operation of Magazine - Ventilation Fan	86	-	0														0	0	0	0	0
31b	Operation of Magazine - Truck	94	-	0														0	0	0	0	0
	Total SPL, dB(A), without round				63	63	63	63	63	63	63	63	63	63	64	64	64	64	64	64	65	65
	Total SPL, dB(A)				63	63	63	63	63	63	63	63	63	63	64	64	64	64	64	64	65	65
	Exceedance				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Act No.	Construction Element	2011												2012											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Works Area C - West of KET (Forbes Street Site)																									
1	Initial possession																								
2	Utility Diversions																								
3	Piling/walling																								
4	Bulk Excavation - soft	0	0	0	0	0																			
5	Excavate rock and base		0	0	0	0																			
6	Commence KET Turnback Tunnel						0	0	0	0	0	0	0	0											
7	Tunnel Lining for KET Turnback									0	0	0	0	0	0	0	0	0							
8	Construct Station Box and Fitout ABWF							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Reinstate Forbes Street and Smithfield																								
Works Area D - East of KET (Swimming Pool Site)																									
10	Demolish Pools and Grandstand			0	0	0																			
11	Piling/walling						0	0	0	0	0	0													
12	Bulk Excavation - soft											0	0	0	0	0	0	0							
13	Excavate rock and base														0	0	0	0							
14	Commence KET to UNV Tunnel																	0	0	0					
15	Tunnel Lining for KET to UNV Tunnel																		0	0					
16	Construct Station Box and Fitout ABWF																		0	0	0	0	0	0	0
17	Reinstate Site & Smithfield PTI Slab																								
Works Area A - Ex-Police Quarter																									
18	Utility Diversions																								
19	Demolition																								
20	Piling/walling																								
21	Excavation of Shaft (soft)																								
22	Excavation of Shaft (rock)	49	49																						
23	Excavation of Tunnel / Adits (rock)	49	49	49	49	49	49	49	49	49	49	49	49	49											
24	Lining									43	43	43	43	43	43	43	43	43							
Works Area B - Abattoir Site																									
25	Construct Site Offices + Crusher + Transport spoil to the barge																								
26	Rock Crusher Operation	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64
27	Reinstatement																								
28	Barging Point	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52
Works Area MA - Underground Magazine Site																									
29	Possession of Site																								
30	Construction of Magazine																								
31a	Operation of Magazine - Ventilation Fan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
31b	Operation of Magazine - Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Total SPL, dB(A), without round	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64
	Total SPL, dB(A)	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64
	Exceedance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Act No.	Construction Element	2013												2014									2015								
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
		43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	55	56	57	58	59	60	61	62	63
Works Area C - West of KET (Forbes Street Site)																															
1	Initial possession																														
2	Utility Diversions																														
3	Piling/walling																														
4	Bulk Excavation - soft																														
5	Excavate rock and base																														
6	Commence KET Turnback Tunnel																														
7	Tunnel Lining for KET Turnback																														
8	Construct Station Box and Fitout ABWF																														
9	Reinstate Forbes Street and Smithfield	0	0	0	0	0	0	0	0	0	0	0	0																		
Works Area D - East of KET (Swimming Pool Site)																															
10	Demolish Pools and Grandstand																														
11	Piling/walling																														
12	Bulk Excavation - soft																														
13	Excavate rock and base																														
14	Commence KET to UNV Tunnel																														
15	Tunnel Lining for KET to UNV Tunnel																														
16	Construct Station Box and Fitout ABWF	0	0	0	0	0																									
17	Reinstate Site & Smithfield PTI Slab		0	0	0	0	0	0	0	0	0	0	0	0	0																
Works Area A - Ex-Police Quarter																															
18	Utility Diversions																														
19	Demolition																														
20	Piling/walling																														
21	Excavation of Shaft (soft)																														
22	Excavation of Shaft (rock)																														
23	Excavation of Tunnel / Adits (rock)																														
24	Lining																														
Works Area B - Abattoir Site																															
25	Construct Site Offices + Crusher + Transport spoil to the barge																														
26	Rock Crusher Operation	64																													
27	Reinstatement																												62	62	
28	Barging Point	52																													
Works Area MA - Underground Magazine Site																															
29	Possession of Site																														
30	Construction of Magazine																														
31a	Operation of Magazine - Ventilation Fan																														
31b	Operation of Magazine - Truck																														
	Total SPL, dB(A), without round	64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62	62	-
	Total SPL, dB(A)	64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62	62	-
	Exceedance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Remarks:

1. Noise sources at more than 300m from the sensitive receiver are not considered in cumulative noise assessment due to large distance attenuation effect.
2. Slant distance (m)
3. For the calculation of sound pressure levels (SPL), the PMEs are assumed to be placed at the notional source position according to the "Technical Memorandum on Noise from Construction Work other than Percussive Piling" by EPD.

* No PMEs used at surface

The use of PME would not be visible when viewed from the assessment facade of NSR. The NSR is considered to be totally screened. According to GW-TM, a noise reduction of 10 dB(A) would be achieved.

Appendix B

Calculations of Emission Rates

Appendix B Calculations of Emission Rates

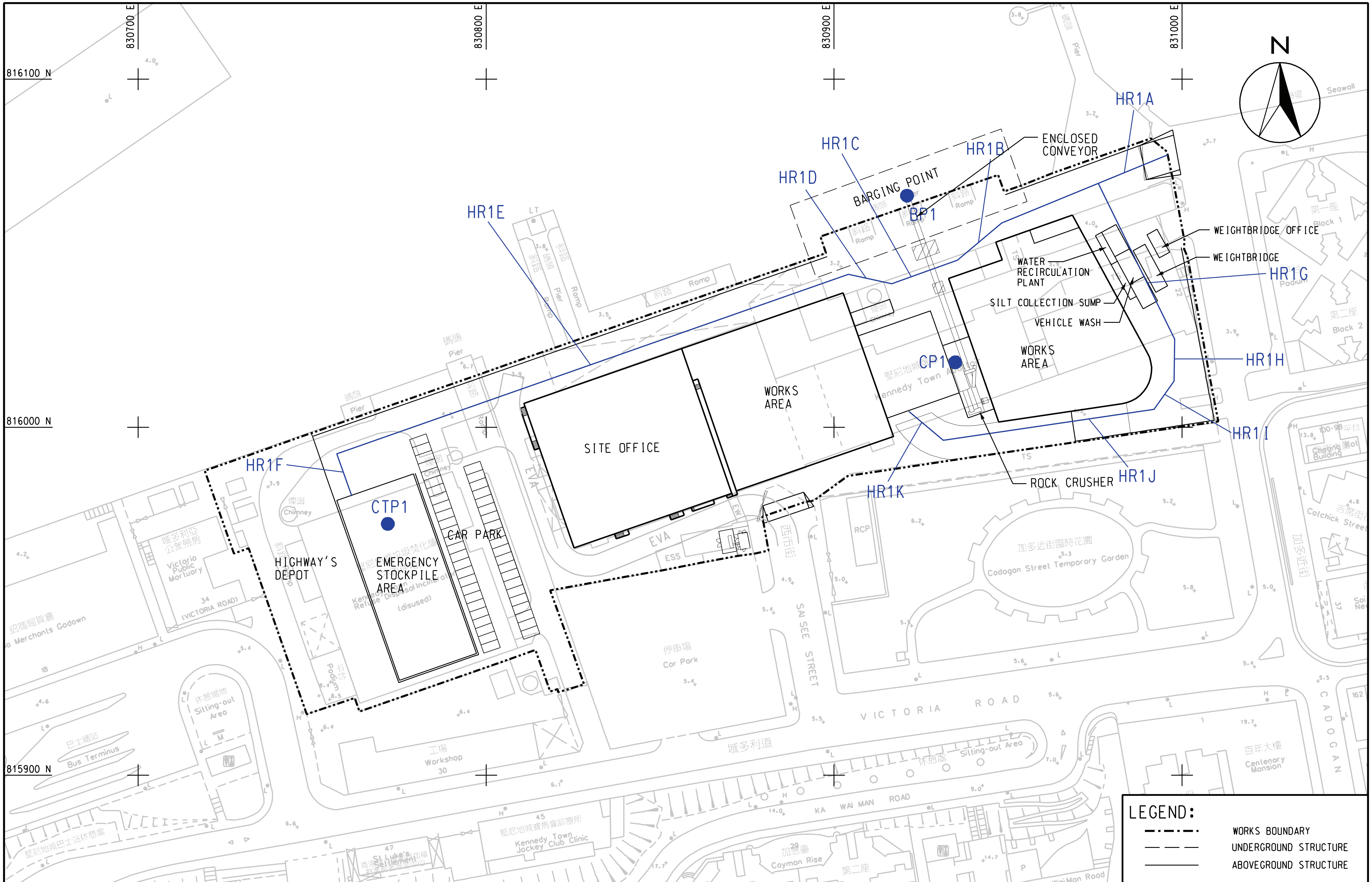
Location	Source	Emission Factors	Original	Mitigated	Parameters		Remarks
Kennedy Town	**Crushing Plant**	Crusher Loading Point	9.33333E-04	9.33333E-05			
Abattior Site		(g/s)			RSP emission factor (kg/Mg)	0.000008	*AP-42, Section 11.19.2, Table 11.19.2-1, 8/04 ed., Trunk Unloading - Fragmented Stone*
		Source ID: CP1			RSP to TSP factor	2.1	*AP-42, Section 11.19.2, Table 11.19.2-1, 1/95 ed.*
					Maximum handling rate (Mg/hr)	200	*from engineer*
					no. of operation hour (hr)	12	*from engineer (operation hours would be from 7:00 to 19:00)*
					Exhaust height (m)	5	
					Dust removal efficiency (%)	90	*operate within the enclosure with water mist system*
		Secondary Crushing	8.33333E-03	8.33333E-04			
		(g/s)			TSP emission factor (kg/Mg)	0.0006	*AP-42, Section 11.19, Table 11.19.2-1, 8/04 ed., Tertiary Crushing (Controlled)*
							No data is available for secondary crushing, thus, emission factor of Tertiary Crushing is adopted
		Source ID: CP1			Maximum crushing rate (Mg/hr)	50	*from engineer*
					no. of operation hour (hr)	12	*from engineer (operation hours would be from 7:00 to 19:00)*
					Exhaust height (m)	5	
					Dust removal efficiency (%)	90	*operate within the enclosure with water mist system*
		Screening	6.11111E-02	6.11111E-03			
		(g/s)			TSP emission factor (kg/Mg)	0.0011	*AP-42, Section 11.19, Table 11.19.2-1, 8/04 ed., Screening (Controlled)*
					Maximum handling rate (Mg/hr)	200	*from engineer*
		Source ID: CP1			no. of operation hour (hr)	12	*from engineer (operation hours would be from 7:00 to 19:00)*
					Exhaust height (m)	5	
					Dust removal efficiency (%)	90	*operate within the enclosure with water mist system*
		Haul Road - Transporting	9.606768E-03	4.803384E-04	TSP emission factor (g/VKT)	E=k × (sL/2)^0.65 × (W/3)^1.5	
		rocks to crushing plant					*AP-42, Section 13.2.1, 11/06 ed.*
		(g/m/s)			Particle size multiplier, k (g/VKT)	24	*AP-42, Section 13.2.1, Table 13.2.1-1, 11/06 ed.*
					Road silt loading (g/m2), sL	12	*AP-42, Section 13.2.1, Table 13.2.1-4, 11/06 ed.*
					Average truck weight (tons), W	17	*from engineer*
					E (g/VKT)	1038	*calculated*
		Source ID: HR1G-HR1K			No. of truck trips per day	400	*from engineer, round-trip included*
					no. of operation hour (hr)	12	*from engineer(7:00-19:00)*
					% of dust suppression	95	*95%, keeping haul road in wet condition and with hoarding along the haul road*
					Road width (m)	6	*from engineer*
					Emission height (m)	0.5	
	Stock Pile	Loading/Unloading Point	1.29322E-01	3.23304E-02	TSP emission factor (kg/Mg)	E = k × (0.0016) × [(U/2.2)^1.3 / (M/2)^1.4]	
		between trucks and stockpile					
		(g/s)			Particle size mutipler, k	0.74	*AP-42, S13.2.4, particle size < 30 um, 1/95 ed.*
					Material moisture content, M (%)	0.7	*AP-42, Table 13.2.4-1, 1/95 ed.*
		Source ID: CTP1			Average wind speed, U (m/s)	2.35	*from Hong Kong Observatory, Central Station(Yr2005)*
					E (kg/Mg)	5.61E-03	*calculated*
					Maximum handling capacity (Mg/hr)	83	*from engineer*
					no. of operation hour (hr)	12	*from engineer (operation hours would be from 7:00 to 19:00)*
					% of dust suppression	75	*water spray at discharge point*
					Emission height (m)	0.5	
		Haul Road - Transporting	4.803384E-03	4.803384E-04	TSP emission factor (g/VKT)	E=k × (sL/2)^0.65 × (W/3)^1.5	
		rocks to and from the					*AP-42, Section 13.2.1, 11/06 ed.*
		emergency stockpile			Particle size multiplier, k (g/VKT)	24	*AP-42, Section 13.2.1, Table 13.2.1-1, 11/06 ed.*
		(g/m/s)			Road silt loading (g/m2), sL	12	*AP-42, Section 13.2.1, Table 13.2.1-4, 11/06 ed.*
					Average truck weight (tons), W	17	*from engineer*
					E (g/VKT)	1038	*calculated*
		Source ID: HR1A-HR1F			No. of truck trips per day	200	*from engineer, round-trip included*
					no. of operation hour (hr)	12	*from engineer(7:00-19:00)*
					% of dust suppression	90	*90%, keeping haul road in wet condition*
					Road width (m)	6	*from engineer*
					Emission height (m)	0.5	
	Barging Point	Unloading of spoils	3.11618E-01	7.79045E-02	TSP emission factor (kg/Mg)	E = k × (0.0016) × [(U/2.2)^1.3 / (M/2)^1.4]	
		to barge					
		(g/s)			Particle size mutipler, k	0.74	*AP-42, S13.2.4, particle size < 30 um, 1/95 ed.*
					Material moisture content, M (%)	0.7	*AP-42, Table 13.2.4-1, 1/95 ed.*
		Source ID: BP1			Average wind speed, U (m/s)	2.35	*from Hong Kong Observatory, Central Station(Yr2005)*
					E (kg/Mg)	5.61E-03	*calculated*
					Maximum handling capacity (Mg/hr)	200	*from engineer*
					no. of operation hour (hr)	12	*from engineer (operation hours would be from 7:00 to 19:00)*
					% of dust suppression	75	*installation of flexible curtain at discharge point*
					Emission height (m)	0.5	

Appendix B Calculations of Emission Rates

Location	Source	Emission Factors	Original	Mitigated	Parameters		Remarks
Kennedy Town Station Construction Site	**Construction Site**	Heavy Construction					
		Area Source	1.03781E-04	2.59452E-05	TSP emission factor (Mg/hectare/month of activity)	2.69	*from AP-42, S13.2.3, 1/95 ed.*
		(g/m2/s)			Percentage area actively operating (%)	50	*from engineer*
		Source ID: A1-A20			% of dust suppression	75	*for watering four times a day*
					Emission height (m)	0	
		(Source ID and locations are			Area of emission source A1 (m^2)	583	*Area(m^2) = 27.0 x 21.6*
		the same as in approved EIA)			Area of emission source A2 (m^2)	558	*Area(m^2) = 27.2 x 20.5*
					Area of emission source A3 (m^2)	565	*Area(m^2) = 27.7 x 20.4*
					Area of emission source A4 (m^2)	662	*Area(m^2) = 27.8 x 23.8*
					Area of emission source A5 (m^2)	970	*Area(m^2) = 28.6 x 33.9*
					Area of emission source A6 (m^2)	1034	*Area(m^2) = 30.5 x 33.9*
					Area of emission source A7 (m^2)	1081	*Area(m^2) = 31.6 x 34.2*
					Area of emission source A8 (m^2)	829	*Area(m^2) = 28.7 x 28.9*
					Area of emission source A9 (m^2)	756	*Area(m^2) = 30.1 x 25.1*
					Area of emission source A10 (m^2)	777	*Area(m^2) = 31.2 x 24.9*
					Area of emission source A11 (m^2)	1373	*Area(m^2) = 26.0 x 52.8*
					Area of emission source A12 (m^2)	2004	*Area(m^2) = 36.3 x 55.2*
					Area of emission source A13 (m^2)	1823	*Area(m^2) = 42.2 x 43.2*
					Area of emission source A14 (m^2)	874	*Area(m^2) = 44.6 x 19.6*
					Area of emission source A15 (m^2)	223	*Area(m^2) = 8.4 x 26.6*
					Area of emission source A16 (m^2)	502	*Area(m^2) = 12.3 x 40.8*
					Area of emission source A17 (m^2)	1722	*Area(m^2) = 88.3 x 19.5*
					Area of emission source A18 (m^2)	1906	*Area(m^2) = 95.8 x 19.9*
					Area of emission source A19 (m^2)	58	*Area(m^2) = 7.3 x 8.0*
					Area of emission source A20 (m^2)	58	*Area(m^2) = 7.3 x 8.0*
		Wind erosion	2.69533E-06	1.34767E-06	TSP emission factor (Mg/hectare/yr)	0.85	*AP-42, 5th ed., Table 11.9.4*
		E (g/m2/s)			Percentage area actively operating (%)	50	*from engineer*
		Source ID: A1-A20			% of dust suppression	0	
					Emission height (m)	0	
		(For night-time only)			Area of emission source A1 (m^2)	583	*Area(m^2) = 27.0 x 21.6*
					Area of emission source A2 (m^2)	558	*Area(m^2) = 27.2 x 20.5*
					Area of emission source A3 (m^2)	565	*Area(m^2) = 27.7 x 20.4*
					Area of emission source A4 (m^2)	662	*Area(m^2) = 27.8 x 23.8*
					Area of emission source A5 (m^2)	970	*Area(m^2) = 28.6 x 33.9*
					Area of emission source A6 (m^2)	1034	*Area(m^2) = 30.5 x 33.9*
					Area of emission source A7 (m^2)	1081	*Area(m^2) = 31.6 x 34.2*
					Area of emission source A8 (m^2)	829	*Area(m^2) = 28.7 x 28.9*
					Area of emission source A9 (m^2)	756	*Area(m^2) = 30.1 x 25.1*
					Area of emission source A10 (m^2)	777	*Area(m^2) = 31.2 x 24.9*
					Area of emission source A11 (m^2)	1373	*Area(m^2) = 26.0 x 52.8*
					Area of emission source A12 (m^2)	2004	*Area(m^2) = 36.3 x 55.2*
					Area of emission source A13 (m^2)	1823	*Area(m^2) = 42.2 x 43.2*
					Area of emission source A14 (m^2)	874	*Area(m^2) = 44.6 x 19.6*
					Area of emission source A15 (m^2)	223	*Area(m^2) = 8.4 x 26.6*
					Area of emission source A16 (m^2)	502	*Area(m^2) = 12.3 x 40.8*
					Area of emission source A17 (m^2)	1722	*Area(m^2) = 88.3 x 19.5*
					Area of emission source A18 (m^2)	1906	*Area(m^2) = 95.8 x 19.9*
					Area of emission source A19 (m^2)	58	*Area(m^2) = 7.3 x 8.0*
					Area of emission source A20 (m^2)	58	*Area(m^2) = 7.3 x 8.0*
Magazine Site	Construction Site	Heavy Construction					
		Area Source	1.03781E-04	5.18904E-05	TSP emission factor (Mg/hectare/month of activity)	2.69	*from AP-42, S13.2.3, 1/95 ed.*
		(g/m2/s)			Percentage area actively operating (%)	50	*from engineer*
		Source ID: A21-A25			% of dust suppression	50	*for watering twice a day*
					Emission height (m)	0	
		(Source ID and locations are			Area of emission source A21 (m^2)	1238	*Area(m^2) = 32.4 x 38.2*
		the same as in approved EIA)			Area of emission source A22 (m^2)	1347	*Area(m^2) = 32.7 x 41.2*
					Area of emission source A23 (m^2)	153	*Area(m^2) = 11.5 x 13.3*
					Area of emission source A24 (m^2)	119	*Area(m^2) = 8.7 x 13.7*
					Area of emission source A25 (m^2)	90	*Area(m^2) = 9.0 x 10.0*
		Wind erosion	2.69533E-06	1.34767E-06	TSP emission factor (Mg/hectare/yr)	0.85	*AP-42, 5th ed., Table 11.9.4*
		E (g/m2/s)			Percentage area actively operating (%)	50	*from engineer*
		Source ID: A21-A25			% of dust suppression	0	
					Emission height (m)	0	
		(For night-time only)			Area of emission source A21 (m^2)	1238	*Area(m^2) = 32.4 x 38.2*
					Area of emission source A22 (m^2)	1347	*Area(m^2) = 32.7 x 41.2*
					Area of emission source A23 (m^2)	153	*Area(m^2) = 11.5 x 13.3*
					Area of emission source A24 (m^2)	119	*Area(m^2) = 8.7 x 13.7*
					Area of emission source A25 (m^2)	90	*Area(m^2) = 9.0 x 10.0*

Appendix B Calculations of Emission Rates

Location	Source	Emission Factors	Original	Mitigated	Parameters		Remarks
Western PCWA Site	Crushing Plant	Crusher Loading Point	5.09444E-04	1.27361E-04			
		(g/s)			RSP emission factor (kg/Mg)	0.000008	*AP-42, Section 11.19.2, Table 11.19.2-1, 8/04 ed., Trunk Unloading - Fragmented Stone*
		Source ID: CLP2			RSP to TSP factor	2.1	*AP-42, Section 11.19.2, Table 11.19.2-1, 1/95 ed.*
					Crushing rate (Mg/hr)	109	*from engineer (total crushing rate 1310Mg/day)*
		(Source ID and locations are			no. of operation hour (hr)	12	*from engineer (operation hours would be from 7:00 to 19:00)*
		the same as in approved EIA)			% of dust suppression	75	with water spray
					Emission height (m)	0.5	
		Overall Emission Rate (g/s)		**1.03102E-02**	Summation of emission factors of secondary crushing and screening		*Discharge Point of Dust Extraction and Collection System at Rock Crushing Facility*
		Source ID: CP2					
		(Source ID and locations are the same as in approved EIA)			Exhaust height (m)	15	
		Secondary Crushing	-	3.63889E-03			
		(g/s)			TSP emission factor (kg/Mg)	0.0006	*AP-42, Section 11.19, Table 11.19.2-1, 8/04 ed., Tertiary Crushing (Controlled)*
							No data is available for secondary crushing, thus, emission factor of Tertiary Crushing is adopted
					Crushing rate (Mg/hr)	109	*from engineer (total crushing rate 1310Mg/day)*
					no. of operation hour (hr)	12	*from engineer (operation hours would be from 7:00 to 19:00)*
					Dust removal efficiency (%)	80	
		Screening	-	6.67130E-03			
		(g/s)			TSP emission factor (kg/Mg)	0.0011	*AP-42, Section 11.19, Table 11.19.2-1, 8/04 ed., Screening (Controlled)*
					Crushing rate (Mg/hr)	109	*from engineer (total crushing rate 1310Mg/day)*
					no. of operation hour (hr)	12	*from engineer (operation hours would be from 7:00 to 19:00)*
					Dust removal efficiency (%)	80	
	Stock Pile	Loading Point (from crushing facility to stockpile)	1.70092E-01	1.70092E-02	TSP emission factor (kg/Mg)	E = k × (0.0016) × [(U/2.2)^1.3 / (M/2)^1.4]	
		(g/s)			Particle size mutipler, k	0.74	*AP-42, S13.2.4, particle size < 30 um, 1/95 ed.*
		Source ID: CTP2			Material moisture content, M (%)	0.7	*AP-42, Table 13.2.4-1, 1/95 ed.*
					Average wind speed, U (m/s)	2.35	*from Hong Kong Observatory, Central Station(Yr2005)*
		(Source ID and locations are			E (kg/Mg)	5.61E-03	*calculated*
		the same as in approved EIA)			Handling capacity (Mg/hr)	109	*from engineer*
					no. of operation hour (hr)	12	*from engineer (operation hours would be from 7:00 to 19:00)*
					% of dust suppression	90	*installation of flexible curtain and provision of water spray at discharge point*
					Emission height (m)	0.5	
		Material handling and storage piles	4.66571E-04	1.16643E-04	TSP emission factor (kg/Mg)	E = k × (0.0016) × [(U/2.2)^1.3 / (M/2)^1.4]	
		(g/m2/s)			Particle size mutipler, k	0.74	*AP-42, S13.2.4, particle size < 30 um, 1/95 ed.*
					Material moisture content, M (%)	0.7	*AP-42, Table 13.2.4-1, 1/95 ed.*
		Source ID: SP2, SP3			Average wind speed, U (m/s)	2.35	*from Hong Kong Observatory, Central Station(Yr2005)*
					E (kg/Mg)	5.61E-03	*calculated*
		(Source ID and locations are			Handling capacity (Mg/hr)	109	*from engineer*
		the same as in approved EIA)			no. of operation hour (hr)	12	*from engineer (operation hours would be from 7:00 to 19:00)*
					Area of stock pile (m^2)	364	*calculated*
					Active stock pile area (%)	100	*100% active site area for loading/unloading*
					Active stock pile area (m^2)	364	*calculated, Area (m^2) = 19.8 x 13.0 + 9.0 x 11.9*
					% of dust suppression	75	watering four times a day
					Emission height (m)	0	
		Wind erosion	2.69533E-06	2.69533E-06	TSP emission factor (Mg/hectare/yr)	0.85	*AP-42, 5th ed., Table 11.9.4*
		E (g/m2/s)			% of dust suppression	0	
		Source ID: SP2, SP3			Emission height (m)	0	
					Active stock pile area (m^2)	364	*calculated, Area (m^2) = 19.8 x 13.0 + 9.0 x 11.9*
		Haul Road - Transporting spoils to barging point	6.852893E-03	6.852893E-04	TSP emission factor (g/VKT)	E=k × (sL/2)^0.65 × (W/3)^1.5	
							AP-42, Section 13.2.1, 11/06 ed.
		(g/m/s)			Particle size multiplier, k (g/VKT)	24	*AP-42, Section 13.2.1, Table 13.2.1-1, 11/06 ed.*
					Road silt loading (g/m2), sL	12	*AP-42, Section 13.2.1, Table 13.2.1-4, 11/06 ed.*
		Source ID: HR2 to HR6			Average truck weight (tons), W	25	*from engineer*
					E (g/VKT)	1850	*calculated*
		(Source ID and locations are			Total no. of truck per day	160	*from engineer, round-trip included*
		the same as in approved EIA)			no. of operation hour (hr)	12	*from engineer(7:00-19:00)*
					% of dust suppression	90	*90%, keeping haul road in wet condition*
					Road width (m)	9	*from engineer*
					Emission height (m)	0.5	
	Barging Point 2	Unloading of spoils to barge	3.56089E-01	3.56089E-02	TSP emission factor (kg/Mg)	E = k × (0.0016) × [(U/2.2)^1.3 / (M/2)^1.4]	
		(g/s)			Particle size mutipler, k	0.74	*AP-42, S13.2.4, particle size < 30 um, 1/95 ed.*
					Material moisture content, M (%)	0.7	*AP-42, Table 13.2.4-1, 1/95 ed.*
		Source ID: BP2			Average wind speed, U (m/s)	2.35	*from Hong Kong Observatory, Central Station(Yr2005)*
					E (kg/Mg)	5.61E-03	*calculated*
		(Source ID and locations are			Total Handling capacity (Mg/day)	2743	*from engineer*
		the same as in approved EIA)			no. of operation hour (hr)	12	*from engineer (operation hours would be from 7:00 to 19:00)*
					% of dust suppression	90	*installation of flexible curtain and provision of water spray at discharge point*
					Emission height (m)	0.5	
	Barging Point 3	Truck unloading to conveyor leading to BP3	6.66701E-03	1.66675E-03	RSP emission factor (kg/Mg)	0.00005	*AP-42, Section 11.19.2, Table 11.19.2-1, 8/04 ed., Trunk Unloading - Conveyor, crushed stone*
		(g/s)			RSP to TSP factor	2.1	*AP-42, Section 11.19.2, Table 11.19.2-1, 1/95 ed.*
					Total Handling capacity (Mg/day)	2743	*from engineer*
		Source ID: BPP1			no. of operation hour (hr)	12	*from engineer (operation hours would be from 7:00 to 19:00)*
		(Source ID and locations are			% of dust suppression	75	with water spray
		the same as in approved EIA)			Emission height (m)	0.5	
		Unloading of spoils to barge	3.56089E-01	3.56089E-02	TSP emission factor (kg/Mg)	E = k × (0.0016) × [(U/2.2)^1.3 / (M/2)^1.4]	
		(g/s)			Particle size mutipler, k	0.74	*AP-42, S13.2.4, particle size < 30 um, 1/95 ed.*
					Material moisture content, M (%)	0.7	*AP-42, Table 13.2.4-1, 1/95 ed.*
		Source ID: BP3			Average wind speed, U (m/s)	2.35	*from Hong Kong Observatory, Central Station(Yr2005)*
					E (kg/Mg)	5.61E-03	*calculated*
		(Source ID and locations are			Total Handling capacity (Mg/day)	2743	*from engineer*
		the same as in approved EIA)			no. of operation hour (hr)	12	*from engineer (operation hours would be from 7:00 to 19:00)*
					% of dust suppression	90	*installation of flexible curtain and provision of water spray at discharge point*
					Emission height (m)	0.5	



LEGEND:

— · · —	WORKS BOUNDARY
— — —	UNDERGROUND STRUCTURE
———	ABOVEGROUND STRUCTURE

AECOM

WEST ISLAND LINE ENVIRONMENTAL ASSESSMENT REPORT

LOCATIONS OF POTENTIAL DUST EMISSION SOURCES

SCALE	A3 1:1000	DATE	JUN. 2009
CHECK	-	DRAWN	XCF
JOB No.	60017115	DRAWING No.	APPENDIX B
		REV	-

2009-6-10 14:36:12 DAIXL

p:\projects\60017115\DRAWING\FIGURE\VARIATION\ENV\APPENDIX B.dgn

Appendix C

Human Health Risk Assessment from KTCDA ER for VEP recorded at the surface rubble / ash located between the two KTIP chimney stacks, which were present above the hardstanding of the Site, but not in the soils below the hardstanding.

2.8 Remedial action was recommended in the approved EIA Report to clean up the rubble materials between the two KTIP chimneys prior to the demolition of any structures. As suggested in the approved EIA Report, the rubble materials must be removed by an appropriately qualified specialist contractor and must be collected, transported and deposited at landfill in accordance with criteria and conditions specified by EPD.

Ground Contamination

2.9 Thirty boreholes were drilled in the land contamination assessment for the approved EIA Report to analyze contaminant concentrations in soil and groundwater of the KTCDA site. Many borehole locations recorded soil contamination above the Dutch B criteria for heavy metals, total petroleum hydrocarbons (TPH) or polycyclic aromatic hydrocarbons (PAH). However, it was found that contamination was not present throughout all soil horizons and depths of the Site.

2.10 Groundwater was encountered in most boreholes, however there was insufficient groundwater accumulated in some boreholes to allow all contaminant parameters to be analyzed. TPH and PAH were recorded exceeding the Dutch B criterion in a number of boreholes. It was noted in the approved EIA Report that "Dutch B" criteria for groundwater were not generally applicable because groundwater would not be utilised as a potable resource in Hong Kong.

2.11 Remediation of the contaminated soil and groundwater was recommended in the approved EIA Report in order to comply with Government policy and allow unconstrained re-use of the Site following the completion of demolition.

Human Health Risk Assessment for Ground Contamination associated with Project Variations in Phase 1

Introduction

2.12 This human health risk assessment aims to assess the potential human health risk arising from the contaminated soil and groundwater at the KTCDA site, to populations located at and in the vicinity of the Site, during the period of occupation for temporary site offices and material storage uses.

2.13 It should be noted that the environmental impacts (including impacts to public health) during the demolition of the KTA and the KTIP (i.e. Activities E1 to E3 as indicated in **Table 1.1**, before the temporary use of the Site), as well as the impacts during the decontamination works (i.e. after the temporary use of the Site) had been assessed in the approved EIA Report and the existing environmental permit conditions still apply. Therefore, the human health risk during the period of demolition of the KTA and the KTIP as well as the period of decontamination works was not assessed further in this report.

Description of Proposed KTCDA site and Surrounding Environment

2.14 **Figure 2.1** shows the KTCDA site and representative receptors. For the purpose of the assessment, the KTCDA site was divided into four assessment areas, namely Area A – decommissioned KTA and KTIP Site, Area B – New World First Bus Depot, Area C – Public Car Park, Refuse Collection Point and Public Roads, and Area D – Cadogan Street Temporary Garden, based on the land uses.

Area A

2.15 It was assumed that after the demolition of the KTA and the KTIP, a temporary concrete paving layer would be constructed and therefore the entire Area A would be covered by concrete paving. Surface drainage would be constructed to ensure adequate drainage of the area. There would be no excavation of soil below the temporary concrete paving. This area will be temporarily occupied for site offices and material storage uses. The design of the temporary concrete paving is expected to be adequate for the use of the Site and would remain intact during the occupation of Area A.

2.16 Two scenarios concerning the paving layer in Area A were considered in the risk assessment:

- Scenario 1a: As described in Section 1.13 and 1.14, a concrete paving of about 200mm thick will be constructed in Area A on top of the existing paving layer. As a conservative approach, it was assumed that Area A would be covered by a paving layer with a total thickness of 300mm (the thickness of the existing hardstanding ranges from 150mm and 850mm, mostly around 300mm. It was assumed in this scenario that a concrete paving of 200mm is constructed on top of the existing paving layer of 100mm).

- Scenario 1b: This scenario is similar to Scenario 1a but assumed that the paving layer is insufficient to cater the use of the temporary site offices and material storage uses. In this scenario, the paving layer does not remain intact during the occupation of Area A.

Area B

2.17 New World First Bus depot is located in Area B. The depot is still in operation and there are two office buildings of about 5m tall in the area. Area B is paved and no major physical deterioration (e.g. cracks) of the paved surface was observed (considered as Scenario 2 in risk assessment).

Area C

2.18 Sai See Street, an open space car park, and a refuse collection point are located in Area C. The car park and the refuse collection point are in operation at present. The refuse collection point is a building structure of about 3m high. Area C is paved and no major physical deterioration of the paved surface was observed (considered as Scenario 3 in risk assessment).

Area D

2.19 Area D is the Cadogan Street Temporary Garden and currently is open to the public. Most part of the Area D is covered with soil without paving (considered as Scenario 4 in risk assessment).

Residential Population in the Vicinity of KTCDA site

2.20 There are residential buildings located south and east of the KTCDA site and the nearest representative residential areas were considered in the human health risk assessment (see **Figure 2.1**). The populations of the residential areas are off-site receptors of the contaminants present in the KTCDA site. The Merton is located at about 24m to the east of the KTCDA site (considered as Scenario 5 in risk assessment); Cayman Rise and Centenary Mansion are located at about 16m to the south of the KTCDA site (considered as Scenario 6 in risk assessment).

2.21 It has been assumed that the land uses of Areas B to D and the residential areas would remain unchanged during the period of temporary use of Area A.

2.22 The demolition works of the KTA and KTIP (Area A) may produce some damages to the existing paving layer and soil underneath could be exposed. In the worst case event that proper maintenance (i.e. filling out the cracks) of the existing paving layer and/or the additional concrete paving layer may not be conducted/constructed immediately after the demolition works, another scenario (Scenario 7) was considered to investigate the potential impact to surrounding population arising from Area A (without intact paving layer). Due to the close proximity to surrounding populations to Area A, the receptor of this scenario was assumed to be located within Area A, as a very conservative assessment approach.

2.23 **Table 2.1** presents a summary of land uses and conditions of the assessment areas and **Appendix 2.1** presents the photos showing current conditions of the assessment areas.

Table 2.1 Land Uses and Conditions of Assessment Areas

Scenario No.	Assessment Area	Land Use	Approximate Size (m^2)	Paved Surface?
1a	Area A: Decommissioned KTA and KTIP Site (paving thickness: 300mm)	Site offices and material storage	21,000	Yes
1b	Area A: Decommissioned KTA and KTIP Site (paving layer not intact)	Site offices and material storage	21,000	No
2	Area B: New World First Bus Depot	Bus depot	1,800	Yes
3	Area C: Public Car Park, Refuse Collection Point and Public Roads	Car park, refuse collection point and roads	3,600	Yes
4	Area D: Cadogan Street Temporary Garden	Garden	6,600	No
5	Residential area east to the KTCDA site	Residential building	33,000[a]	No[b]
6	Residential area south to the KTCDA site	Residential building		
7	Area A: Decommissioned KTA and KTIP Site (paving layer not intact)	Vacant land	21,000	No

Note:
[a] The residential areas are assumed to be affected by contaminants released from the entire KTCDA site, with size of 33,026m^2.
[b] For the purpose of the assessment, it is conservatively assumed that the whole KTCDA site is unpaved for calculation of risk to population at the residential areas.

Acceptance Criteria of Human Health Risk Assessment

Carcinogenic Risk

2.24 The lifetime excess risk of 1×10^{-6} for individual carcinogenic contaminant and exposure pathway was adopted to be the acceptance criterion for carcinogenic risk, in accordance with the adopted risk level by United States Environmental Protection Agency (USEPA) for deriving Soil Screening Levels.

Non-carcinogenic Risk

2.25 The hazard quotient of 1 for individual contaminant (causing non-carcinogenic effect) and exposure pathway was adopted to be the acceptance criterion for non-carcinogenic risk, in accordance with the adopted risk level by USEPA for deriving Soil Screening Levels.

Assessment Methodology

2.26 The human health risk assessment was carried out in accordance with the assessment procedures outlined in the ASTM[2] document E-2081 "Standard Guide for Risk-based Corrective Action". Software tool, the "RBCA Tool Kit for Chemical Release" (version 1.3b) developed by Groundwater Services Inc. was used for the risk calculation process. The RBCA Tool Kit for Chemical Release (RBCA Tool Kit) is designed to meet the requirements of

[2] The America Society for Testing and Materials.

the ASTM document E-2081, which is a comprehensive modelling and risk characterization package for RBCA evaluation for contaminated sites.

2.27 In general, the risk assessment is based on the "Source – Pathway – Receptor" concept – the receptor is exposed to health risk only when there is presence of contaminants source and completed transport pathway(s) for the contaminants to reach the receptor. Further discussion on source, pathway and receptor are presented below.

Source

2.28 In the human health risk assessment, the "Source", contaminants present in the soil and groundwater of the KTCDA site needs to be characterized in terms of concentration and location. In a previous study for the KTCDA site[3], representative soil and groundwater contaminant concentrations of each assessment area were derived for the human health risk assessment. The derived representative soil and groundwater contaminant concentrations in the previous study were adopted for the current human health risk assessment.

2.29 The representative soil contaminant concentrations were derived from the analysis data of soil samples collected in the site investigations conducted under the Agreement No. CE85/2001 (CE) and the approved EIA Report, whereas the representative groundwater contaminant concentrations were based on the analysis data of groundwater samples collected during the approved EIA study. The human health risk assessment in the previous study for the KTCDA site is attached in **Appendix 2.2** for reference.

2.30 According to the previous human health risk assessment, the representative soil contaminant concentrations were the 95% upper confidence limit[4] (UCL) on mean concentration, which is defined as:

$Y \pm t_{(\alpha/2,\ N-1)}\, s\ /\ (N)^{1/2}$, where

Y = geometric mean of contaminant concentrations of soil samples
s = geometric standard deviation of contaminant concentrations of soil samples
N = number of soil samples
α = the significance level = 95%
$t_{(\alpha/2,\ N-1)}$ = the upper critical value of the t distribution with N-1 degree of freedom

2.31 For groundwater contaminant concentrations, due to the relatively small size of groundwater samples collected, the maximum contaminant concentration of the groundwater samples was adopted to be the representative contaminant concentration.

2.32 **Table 2.2** and **Table 2.3** present the adopted representative soil contaminant concentrations (shown in Table 4.1 of the previous study) and representative groundwater contaminant concentrations (shown in Table 4.2 of the previous study) for each assessment area respectively, which were input into the RBCA Tool Kit for risk assessment.

Table 2.2 Representative Soil Contaminant Concentrations in Various Assessment Areas adopted for Risk Assessment

Contaminant	Area A	Area B	Area C	Area D	Whole KTCDA site[a]
Heavy Metals					
Arsenic	9.0	1.1×10^{1}	1.7×10^{1}	5.8	9.35
Barium	1.4×10^{2}	1.5×10^{2}	1.6×10^{2}	1.1×10^{2}	1.37×10^{2}
Cadmium	6.5×10^{-1}	1.1×10^{0}	8.8×10^{-1}	2.1×10^{-1}	6.12×10^{-1}
Chromium	1.0×10^{1}	1.8×10^{1}	1.1×10^{1}	6.1	9.77

[3] Demolition and Decontamination Works at the Kwai Chung Incineration Plant and at the Proposed Kennedy Town Comprehensive Development Area Site – Design and Construction. Design of Advance Works and Application for Further Environmental Permit – KTCDA site. Final Environmental Report for FEP Application. (Agreement No. CE85/2001 (CE)).

[4] The 95% UCL on mean concentration is the range of vales that will contain the true average (i.e. the average of the full statistical population of all possible data) 95% of the time.

Contaminant	Area A	Area B	Area C	Area D	Whole KTCDA site[a]
Copper	5.3×10^{1}	7.5×10^{1}	8.3×10^{1}	1.7×10^{1}	5.03×10^{1}
Molybdenum	2.0	4.4	2.3	8.8×10^{-1}	1.94
Nickel	9.4	8.6	9.3	4.2	8.31
Zinc	2.6×10^{2}	3.7×10^{2}	7.2×10^{2}	1.2×10^{2}	2.89×10^{2}
Mercury	6.8×10^{-1}	1.3	4.8	1.6	1.35
Polyaromatic Hydrocarbons (PAHs) and Total Petroleum Hydrocarbons (TPH)					
Naphthalene	5.1×10^{-1}	5.4×10^{-1}	5.0×10^{-1}	5.2×10^{-1}	5.13×10^{-1}
Phenanthrene	4.3×10^{-1}	7.8×10^{-1}	6.8×10^{-1}	5.8×10^{-1}	5.07×10^{-1}
Anthracene	4.4×10^{-1}	6.7×10^{-1}	6.7×10^{-1}	5.1×10^{-1}	4.92×10^{-1}
Fluoranthene	5.9×10^{-1}	1.3	9.0×10^{-1}	8.0×10^{-1}	7.05×10^{-1}
Pyrene	6.3×10^{-1}	1.3	9.8×10^{-1}	9.0×10^{-1}	7.59×10^{-1}
Benzo(a)Pyrene	6.2×10^{-1}	1.2	8.2×10^{-1}	4.6×10^{-1}	6.42×10^{-1}
TPH – Aliphatics >C06-C08	5.0×10^{-1}	5.0×10^{-1}	5.0×10^{-1}	5.0×10^{-1}	5.00×10^{-1}
TPH – Aliphatics >C08-C10	8.3×10^{-1}	8.3×10^{-1}	8.3×10^{-1}	8.3×10^{-1}	8.30×10^{-1}
TPH – Aliphatics >C10-C12	1.9×10^{1}	1.9×10^{1}	1.9×10^{1}	1.9×10^{1}	1.90×10^{1}
TPH – Aliphatics >C12-C16	1.7×10^{1}	1.7×10^{1}	1.7×10^{1}	1.7×10^{1}	1.70×10^{1}
TPH – Aliphatics >C16-C21	7.5×10^{1}	1.4×10^{2}	3.3×10^{1}	6.0×10^{1}	7.09×10^{1}
TPH – Aliphatics >C21-C34	2.3×10^{2}	2.3×10^{2}	9.8×10^{1}	1.6×10^{2}	2.02×10^{2}
TPH – Aromatics >C07-C08	5.0×10^{-1}	5.0×10^{-1}	5.0×10^{-1}	5.0×10^{-1}	5.00×10^{-1}
TPH – Aromatics >C08-C10	1.7×10^{-1}	1.7×10^{-1}	1.7×10^{-1}	1.7×10^{-1}	1.70×10^{-1}
TPH – Aromatics >C10-C12	6.0	6.0	6.0	6.0	6.0
TPH – Aromatics >C12-C16	7.9	7.9	7.9	7.9	7.9
TPH – Aromatics >C16-C21	4.0×10^{1}	7.4×10^{1}	1.7×10^{1}	3.2×10^{1}	3.77×10^{1}
TPH – Aromatics >C21-C35	1.5×10^{2}	1.6×10^{2}	6.5×10^{1}	1.1×10^{2}	1.33×10^{2}
BTEX[b]					
Benzene	2.0×10^{-1}	2.0×10^{-1}	2.0×10^{-1}	2.0×10^{-1}	2.0×10^{-1}
Toluene	2.0×10^{-1}	2.0×10^{-1}	2.0×10^{-1}	2.0×10^{-1}	2.0×10^{-1}
Ethylbenzene	2.0×10^{-1}	2.0×10^{-1}	2.0×10^{-1}	2.0×10^{-1}	2.0×10^{-1}
m-Xylene	4.0×10^{-1}	4.0×10^{-1}	4.0×10^{-1}	4.0×10^{-1}	4.0×10^{-1}
o-Xylene	2.0×10^{-1}	2.0×10^{-1}	2.0×10^{-1}	2.0×10^{-1}	2.0×10^{-1}

Note: All concentrations presented are in mg/kg.

[a] For the assessment of health risk impact from the whole KTCDA site on off-site receptors (Scenarios 5 and 6), the area weighted average of the soil concentrations presented in this table were adopted for the risk calculations. For example, for arsenic, the area weighted average soil concentration adopted is = (20997 x 9.0 + 1812 x 11 + 3642 x 17 + 6575 x 5.8) / (20997 + 1812 + 3642 + 6575) = 9.35mg/kg, where 20997, 1812, 3642 and 6575 are the areas of Areas A to D in m^2 respectively.

[b] Since all laboratory analysis results for BTEX were below the limit of report (LOR), the value of LORs was used.

Table 2.3 Representative Groundwater Contaminant Concentrations in Various Assessment Areas adopted for Risk Assessment

Contaminant	Area A	Area B	Area C[a]	Area D	Whole KTCDA site[b]
Heavy Metals					
Arsenic	5.4×10^{-2}	1.0×10^{-1}	1.0×10^{-1}	1.0×10^{-2}	1.0×10^{-1}
Barium	0.0	1.0×10^{-15}	1.0×10^{-15}	0.0	1.0×10^{-15}
Cadmium	9.8×10^{-2}	4.7×10^{-2}	4.7×10^{-2}	2.0×10^{-4}	9.8×10^{-2}
Chromium	7.8×10^{-2}	2.1×10^{-1}	2.1×10^{-1}	6.0×10^{-4}	2.1×10^{-1}

Contaminant	Area A	Area B	Area C[a]	Area D	Whole KTCDA site[b]
Copper	1.3	3.9	3.9	2.0×10^{-3}	3.9
Molybdenum	0.0	1.0×10^{-15}	1.0×10^{-15}	0.0	1.0×10^{-15}
Nickel	9.9×10^{-2}	2.0×10^{-1}	2.0×10^{-1}	3.0×10^{-3}	2.0×10^{-1}
Zinc	7.5^{0}	2.7×10^{1}	2.7×10^{1}	7.0×10^{-2}	2.7×10^{1}
Mercury	5.0×10^{-4}	5.0×10^{-4}	5.0×10^{-4}	5.0×10^{-4}	5.0×10^{-4}
Polyaromatic Hydrocarbons (PAHs) and Total Petroleum Hydrocarbons (TPH)					
Naphthalene	5.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	5.0×10^{-3}
Phenanthrene	8.0×10^{-3}	1.6×10^{-2}	1.6×10^{-2}	2.0×10^{-3}	1.6×10^{-2}
Anthracene	6.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	6.0×10^{-3}
Fluoranthene	2.0×10^{-2}	1.7×10^{-2}	1.7×10^{-2}	2.0×10^{-3}	2.0×10^{-2}
Pyrene	7.7×10^{-2}	1.3×10^{-2}	1.3×10^{-2}	2.0×10^{-3}	7.7×10^{-2}
Benzo(a)Pyrene	3.3×10^{-2}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	3.3×10^{-2}
TPH – Aliphatics >C06-C08	5.0	1.9×10^{-1}	1.9×10^{-1}	5.0×10^{-3}	5.0
TPH – Aliphatics >C08-C10	8.3	3.2×10^{-1}	3.2×10^{-1}	8.3×10^{-3}	8.3
TPH – Aliphatics >C10-C12	4.2×10^{1}	3.4×10^{-2}	3.4×10^{-2}	1.2×10^{-2}	4.2×10^{1}
TPH – Aliphatics >C12-C16	3.8×10^{1}	8.6×10^{-3}	8.6×10^{-3}	1.1×10^{-2}	3.8×10^{1}
TPH – Aliphatics >C16-C21	4.9×10^{2}	8.2×10^{-3}	8.2×10^{-3}	9.5×10^{-2}	4.9×10^{2}
TPH – Aliphatics >C21-C34	1.4×10^{3}	3.6×10^{-2}	3.6×10^{-2}	1.7×10^{-1}	1.4×10^{3}
TPH – Aromatics >C07-C08	5.0	1.9×10^{-1}	1.9×10^{-1}	5.0×10^{-3}	5.0
TPH – Aromatics >C08-C10	1.7	6.3×10^{-2}	6.3×10^{-2}	1.7×10^{-3}	1.7
TPH – Aromatics >C10-C12	1.3×10^{1}	2.9	2.9	3.7×10^{-3}	1.3×10^{1}
TPH – Aromatics >C12-C16	1.7×10^{1}	3.8	3.8	4.9×10^{-3}	1.7×10^{1}
TPH – Aromatics >C16-C21	2.6×10^{2}	6.5×10^{-1}	6.5×10^{-1}	5.0×10^{-2}	2.6×10^{2}
TPH – Aromatics >C21-C35	9.0×10^{2}	1.5×10^{-2}	1.5×10^{-2}	1.1×10^{-1}	9.0×10^{2}
BTEX					
Benzene[c]	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}
Toluene[c]	8.0×10^{-3}	3.0×10^{-3}	3.0×10^{-3}	2.0×10^{-3}	8.0×10^{-3}
Ethylbenzene[c]	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}
m-Xylene[c]	4.0×10^{-3}	4.0×10^{-3}	4.0×10^{-3}	4.0×10^{-3}	4.0×10^{-3}
o-Xylene[c]	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}

Note: All concentrations presented are in mg/kg.
[a] Since no groundwater sample was obtained within Area C, the groundwater results from the adjacent land use (i.e. Bus Depot) was adopted instead.
[b] For the assessment of health risk impact from the whole KTCDA site on off-site receptors (Scenarios 5 and 6), the maximum groundwater contaminant concentrations among of Areas A to D were adopted in the risk assessment.
[c] Except toluene was detected in groundwater sample collected in Areas A and B, the concentration of BTEX in groundwater samples were below limit of reporting (LOR), the value of LORs instead of maximum values was used.

Pathway

2.33 Contaminant transport mechanisms and pathways would include but not limited to transport between surface soil, subsurface soil, groundwater, soil gas and indoor/outdoor air. Transport pathways involving groundwater transport were not considered in this risk assessment because groundwater and surface water within and in vicinity of the Site were not for consumption or other uses such as swimming.

2.34 The applicable contaminant transport pathways for the KTCDA site and surrounding areas are discussed below:

Wind Erosion - Primary Transport Pathway

2.35 Contaminants in surface soil could be transported into the atmosphere by wind erosion in form of particulates. This contaminant transport pathway would only be applicable for assessment area without concrete paving (i.e. Scenario 1b, 4 to 7). In other scenarios, the concrete paving would act as a physical barrier and protects the soil underneath from wind erosion; therefore the contaminants in soil would not be released into air in form of particulates.

Volatilization - Primary Transport Pathway

2.36 Contaminants in surface soil, subsurface soil and groundwater could be volatilized and released into the atmosphere in form of vapour. This transport pathway would be considered applicable to all assessment areas because the concrete paving would not be able to avoid the release of contaminant vapour from underneath soil and groundwater into the atmosphere.

Air Dispersion - Secondary Transport Pathway

2.37 After the contaminants are released into atmosphere (in form of particulates or vapour), they would be transported by air dispersion. This transport pathway would bring the released contaminants to off-site locations, which would be the residential areas south and east to the KTCDA site considered in this risk assessment.

Enclosed Space Accumulation - Secondary Transport Pathway

2.38 Building structures located above the contaminated soil and groundwater would provide enclosed space for the released volatilized contaminant (in form of vapour) to accumulate. This pathway would be applicable to Scenarios 1a, 1b, 2 and 3, which would have existing/future building structures located inside the assessment area (**Table 2.1** refers).

Receptor

2.39 In order to characterize the receptor of various assessment areas, their exposure setting and exposure pathways would need to be determined.

Exposure Setting

2.40 The following parameters were characterized for children, adult, construction workers (for Area A) and workers (for Areas B and C) receptors:

- Exposure frequency and duration
- Soil ingestion rate
- Skin area and body weight
- Averaging time

2.41 **Table 2.4** summarizes the above parameters of various receptors.

Exposure Pathway

2.42 Receptors in the KTCDA site and surrounding residential areas could be exposed to contaminants through ingestion, inhalation and dermal (skin) absorption. The groundwater/surface water within and in vicinity of the KTCDA site would not be for consumption and the area would not be used for food production activities (e.g. agriculture activities). Therefore, contaminants exposure by consumption of food and water was not considered in the risk assessment. The valid exposure pathways are discussed as follows:

Direct Dermal Contact and Soil Ingestion

2.43 Contaminants in soil could be consumed if receptors directly contact (dermal) with or incidentally ingest the contaminated soil. As concrete paving above the contaminated soil (present in Scenarios 1a, 2 and 3) can acts as a physical barrier to prevent receptors from contacting or ingesting the soil, therefore this pathway is only applicable to receptors in Scenarios 1b and 4. It should be noted that this exposure pathway would not be applicable to Scenario 7 because Area A (after demolition of the KTA and the KTIP) would not be accessible to population in proximity.

Inhalation of Vapour/Particulates (in Outdoor Environment)

2.44 Receptors in outdoor environment could also intake the contaminants by inhaling contaminant-containing particulates/vapour in the atmosphere released from soil and groundwater. This exposure pathway would be valid for receptors at all assessment areas.

Inhalation of Vapour (in Indoor Environment)

2.45 As discussed above, contaminants in soil and groundwater could volatilize and release into the atmosphere. If there is building structure located above the contaminated soil and groundwater, the released contaminant vapour would accumulate in the indoor air of the building structure. Therefore, receptors in indoor environment could expose to contaminants by inhaling the indoor air containing contaminant vapour. This exposure pathway would be valid for Scenarios 1a, 1b, 2 and 3, where building structures would be located above the contaminated area.

2.46 **Figure 2.2** presents a "Source – Pathway – Receptor" flowchart showing how the considered receptors could expose to contaminants present in soil and groundwater. As a summary, the receptors and exposure pathways for various assessment areas are presented in **Table 2.5.**

Table 2.4 Exposure Parameters of Various Receptors

Parameters	Receptor				
	Residential Population / Users of Temporary Garden		Construction Worker at Area A, Workers at Areas B and C (Adult)	Receptor of Scenario 7	
	Child	Adult		Child	Adult
Averaging time for carcinogenic risk (yr)	70	70	70	70	70
Averaging time for non-carcinogenic risk (yr)[a]	6 / 16	30	10 / 30	5 / 5	5
Exposure duration (yr)[b]	6 / 16	30	10 / 30	5 / 5	5
Exposure frequency (day/yr)					
- Inhalation pathway (in outdoor and indoor environment)	350	350	300	350	350
- Soil dermal contact and ingestion pathway[c]	40	40	300 (for Scenario 1b only), this pathway is not applicable to Scenarios 1a, 2 and 3	This pathway is not applicable to Scenario 7 because surrounding populations would not be accessible to Area A	
Body weight (kg)[d]	15 / 35	70	70	15 / 35	70
Skin area (cm^2)[e]	4,500	5,800	5,800	Soil dermal contact and ingestion pathway is not applicable to Scenario 7	
Soil ingestion rate (mg/day)[f]	100	50	50 (for Scenario 1b only), soil ingestion pathway is not applicable to Scenarios 1a, 2 and 3		

Note:
[a] Averaging time for non-carcinogenic risk for child is divided into two categories: 6 years for age 0-6 and 16 years for age 0-16, as defaulted in RBCA Tool Kit. The occupation period of Area A (maximum possible exposure period of construction workers) is conservatively assumed to be 10 years to allow robustness of the assessment in case the occupation period is lengthened. The exposure period of workers in Areas B and C is assumed to be 30 years.
[b] The averaging time for non-carcinogenic risk is same to the exposure duration.
[c] As observed in the site visit, soil in the temporary garden is well covered by vegetation. Also, it was observed that temporary garden users mainly carried out activities on the paved trail and did not involve contact of soil. Therefore, an occurrence frequency of soil dermal contact and ingestion of 40 days/year was assumed for the temporary garden users to reflect the actual conditions; this frequency is in line with the recommended value (40 events per year) for the occurrence frequency of soil contact in "Dermal Exposure Assessment: Principles and Applications" (USEPA, 1992). It was assumed that construction workers in Area A could contact with soil on site every working day, if the paving layer on site is not intact.
[d] Body weight for child is divided into two categories: 15kg for age 0-6 and 35kg for age 0-16, as defaulted in RBCA Tool Kit. The adopted weight of 15kg for children of 0-6 years is based on the data in "Development of Statistical Distributions of Ranges of Standard Factors Used in Exposure Assessments" (USEPA, 1985), whereas the adopted weight of 35kg for children of 0-16 years can be reflected in the data in "Recommended Distributions for Exposure Factors Frequency used in Health Risk Assessment" (Finley *et al*, 1994).
[e] Adopted from USEPA (1997).
[f] Adopted from USEPA (1997). As the frequency for soil ingestion was assumed to be 40 days/year for temporary garden users, the soil ingestion rates input into the RBCA Tool Kit was adjusted to 11.4mg/day (=40x100/350) and 5.71mg/day (=40x50/350) for child and adult respectively in Scenario 4.

Table 2.5 Receptors and Exposure Pathways for Various Assessment Areas

Scenario No.	Assessment Area	Receptor			Exposure Pathway		
		Child	Adult / Worker	Construction Worker / Worker	Soil dermal contact and ingestion	Inhalation of vapour / particulate (outdoor environment)	Inhalation of vapour (indoor environment)
1a	Area A			✓		✓	✓
1b	Area A			✓	✓	✓	✓
2	Area B			✓		✓	✓
3	Area C			✓		✓	✓
4	Area D	✓	✓		✓	✓	
5	Residential Area East to KTCDA site	✓	✓			✓	
6	Residential Area South to KTCDA site	✓	✓			✓	
7	Area A	✓	✓			✓	

Risk Assessment Results

2.47 The software model RBCA Tool Kit for Chemical Releases (version 1.3b) was used to calculate the carcinogenic and non-carcinogenic risks to the receptors in the six assessment areas. In order to show how the software model was utilized, the screen captures of the model input and model output for the considered scenarios in the risk calculations are presented in **Appendix 2.3** of this report.

Acceptable Risk to Receptors at Residential Areas and Areas B to D

2.48 The carcinogenic and non-carcinogenic risks calculated by the software model for the considered scenarios are summarized in **Table 2.6**. As shown in **Table 2.6**, for Scenarios 2 to 6, the carcinogenic risk and non-carcinogenic risk imposed to receptors were found to be in compliance with the acceptance criteria, indicating that the human health risk arising from the contaminated soil and groundwater would be acceptable to these receptors.

Need of Installation of Gas-Resistant Membrane for Site Office in Area A

2.49 With reference to **Table 2.6**, the non-carcinogenic risk of the exposure pathway "inhalation of vapour in indoor environment" exceeds the acceptance criteria in Scenarios 1a and 1b. This shows that mitigation measure, which are (1) provision of clear void between the structure slab of the site office and the ground surface (i.e. the site office is a raised structure) and (2) incorporation of gas-resistant membranes into the raised floor of the site office, would be required for the future site office in Area A. This measure is a commonly adopted mitigation measure in the UK for housing development above the contaminated land and is suggested by the UK Environmental Agency to prevent gases in underneath soil from entering the building structure above. The same approach is also suggested by the Environmental Protection Department of Hong Kong SAR to prevent landfill gas from entering into building structures.

2.50 By implementing the abovementioned mitigation measures, the exposure pathway "inhalation of vapour in indoor environment" would be eliminated and hence the risk associated with this pathway would be eliminated. The recommended requirements of such mitigation measure are detailed below. Also, a monitoring programme of the indoor air quality of the site office is proposed, in order to ensure the mitigation measure is implemented in an effective manner. Details of the monitoring programme are discussed in Section 3 of this report.

Implication of Paving Design in Area A to Health Risk Level

2.51 From **Table 2.6**, it can be observed that the risk level associated with the exposure pathway "inhalation of vapour in outdoor environment" in Scenarios 1a and 1b would comply with the acceptance criteria and does not vary significantly.

2.52 For the exposure pathway "inhalation of vapour in indoor environment", the associated non-carcinogenic risk was found to exceed the acceptance criterion in Scenarios 1a and 1b, which indicated that the paving layer could not reduce the risk due to this exposure pathway to an acceptable level. As mentioned above, mitigation measures applied for the site office would eliminate this exposure pathway and its associated risk.

2.53 Scenario 1b examined the risk level of the case that the paving layer in Area A would not remain intact. As shown in **Table 2.6**, the carcinogenic risk of the exposure pathway "soil dermal contact and ingestion" exceeds the acceptance criterion. This indicated that the paving layer of the Area A would need to be designed such that the paving layer would be intact and able to serve as a physical barrier to eliminate the exposure pathway of "soil dermal contact and ingestion".

2.54 In summary, the thickness of the paving layer in Area A would not greatly influence the risk level to construction workers on-site, as long as the paving layer (in one layer or multiple layers) is designed for the proposed temporary uses in Area A and remains intact to act as an integral physical barrier to eliminate the exposure pathway of "soil dermal contact and ingestion". The risk associated with the exposure pathway "inhalation of vapour in indoor environment" would require appropriate mitigation measures for the site office as recommended.

Impact from Area A (without intact paving layer) to Populations in Proximity

2.55 As indicated in **Table 2.6**, the risk level from Area A without an intact paving layer to populations due to released contaminants in form of vapour and particulates, would comply with the acceptance criteria, assuming an exposure period of 5 years. The relatively low risk level is mainly due to the absence of the "soil dermal contact and ingestion" exposure pathway. The risk from Area A to the populations is expected to be lower because Area A is expected to be surrounded by site hoardings. The hoarding would reduce the amount of vapour and particulates exposed to the nearby populations.

2.56 The risk assessment results indicated that Area A without an intact paving layer would not impose unacceptable health risk to populations in the proximity. Nevertheless, in order to reduce the amount of contaminant-containing particulates released to the environment and eliminate the possibility of dermal contact and ingestion of contaminated soil by any personnel accessible to Area A, it is considered appropriate to fill out any cracks of the existing paving layer.

Potential Acute Health Effect

2.57 A review was also undertaken to examine the potential acute health effect associated with the ground contamination due to exposure through inhalation. The hourly average contaminant concentrations in air at the KTCDA site (assumed unpaved) predicted by the RBCA Tool Kit were compared with the corresponding acute reference exposure level (REL).

2.58 **Table 2.7** shows the comparison of the predicted contaminant concentration in air against the acute REL. No acute REL for total petroleum hydrocarbons was identified.

Table 2.6 Calculated Human Health Risk for various Assessment Areas

Scenario No.	Assessment Area	Receptor	Exposure Pathway	Carcinogenic Risk (Criterion: 1×10^{-6})	Non-carcinogenic Risk (Criterion: 1)
1a	Area A	Construction Worker	Inhalation of vapour in outdoor environment	3.4×10^{-7}	0.36
			Inhalation of vapour in indoor environment	3.4×10^{-8}	**9.4**
1b	Area A	Construction Worker	Inhalation of vapour and particulate in outdoor environment	3.4×10^{-7}	0.36
			Inhalation of vapour in indoor environment	3.4×10^{-8}	**9.4**
			Soil dermal contact and ingestion	**1.1×10^{-6}**	0.018
2	Area B	Workers	Inhalation of vapour in outdoor environment	8.9×10^{-8}	0.1
			Inhalation of vapour in indoor environment	5.0×10^{-7}	0.046
3	Area C	Workers	Inhalation of vapour in outdoor environment	1.1×10^{-7}	0.48
			Inhalation of vapour in indoor environment	8.3×10^{-7}	0.22
4	Area D	User of Temporary Garden	Soil dermal contact and ingestion	7.8×10^{-7}	0.0004
			Inhalation of vapour and particulate in outdoor environment	1.6×10^{-7}	0.23
5	Residential Area East to KTCDA site	Residence	Inhalation of vapour and particulate in outdoor environment	4.0×10^{-7}	0.48
6	Residential Area South to KTCDA site	Residence	Inhalation of vapour and particulate in outdoor environment	4.0×10^{-7}	0.48
7	Area A	Population in Proximity to Area A	Inhalation of vapour and particulate in outdoor environment	2.8×10^{-7}	0.60

Note: Risk level in bolded characters indicates exceedance of acceptance criterion.

Table 2.7 Comparison of Predicted Contaminant Concentration in Air Against Acute REL

Contaminant	Predicted Hourly Average Concentration by RBCA Tool Kit (μg/m³)	REL (μg/m³)
Arsenic[a]	3.6×10^{-7}	1.9×10^{-1}
Barium[b]	1.2×10^{-5}	1.5×10^{3}
Cadmium[b]	2.4×10^{-8}	3.0×10^{1}
Chromium[b]	8.9×10^{-7}	1.5×10^{3}
Copper[a]	4.6×10^{-6}	1.0×10^{2}
Molybdenum[b]	1.8×10^{-7}	3.0×10^{4}
Nickel[a]	3.2×10^{-7}	6.0
Zinc[b]	2.6×10^{-5}	3.0×10^{4}
Mercury[a]	1.5×10^{-1}	1.8
Naphthalene[b]	2.6×10^{-2}	7.5×10^{4}
Phenanthrene[b]	2.5×10^{-2}	1.0×10^{3}
Anthracene[b]	8.1×10^{-2}	4.0×10^{3}
Fluoranthene[b]	6.8×10^{-2}	1.0×10^{1}
Pyrene[b]	1.9×10^{-3}	7.5×10^{3}
Benzo(a)Pyrene[b]	1.5×10^{-4}	6.0×10^{2}
Benzene[a]	5.1×10^{-2}	1.3×10^{3}
Toluene[a]	1.2×10^{-1}	3.7×10^{4}
Ethylbenzene[b]	1.0×10^{-1}	5.0×10^{5}
m-Xylene[a]	8.0×10^{-2}	2.2×10^{4}
o-Xylene[a]	1.2×10^{-1}	2.2×10^{4}

Note:
[a] California EPA Acute RELs
[b] Temporary Emergency Exposure Limits (TEEL-1)

2.59 As shown in **Table 2.7**, the predicted contaminant concentration in air for all contaminants is well below the corresponding acute REL, which indicates that adverse acute health effect is not expected for exposure through inhalation of contaminants from the KTCDA site.

2.60 No REL for TPH is identified; also, with reference to ATSDR (1999), there are no regulations or advisories specific to TPH. Therefore, there is no established level for the direct assessment of potential acute health effect due to TPH. ATSDR (1999) stated that the workplace exposure limit for "petroleum distillates" is a federal government recommendation for TPH compounds.

2.61 Therefore, the Temporary Emergency Exposure Limits (TEEL-1) for "petroleum distillates" may be applicable for the purpose of assessing acute health effects of TPH. The TEEL-1 value of "petroleum distillates" is 350mg/m³, while the sum of the hourly average concentration of all TPH fractions predicted by RBCA Tool Kit is 148.9mg/m³. Based on this comparison, adverse acute health effect would not be expected for exposure of TPH through inhalation.

Supplementary Measures Recommended for Works in Phase 1

2.62 In order to mitigate the risk due to the exposure pathway of "inhalation of vapour in indoor environment" of construction workers working in the future site office at Area A, the following mitigation measures, which follows the building protection measures against landfill gas hazards recommended in *ProPECC Notes PN3/96 Landfill Gas Hazard Assessment for Developments Adjacent to Landfills*, should be provided for the future site office in order to prevent vapours from the soil and groundwater underneath from entering into the site office:

- Create a clear void between the structure slab of the site office and the ground surface (i.e. the site office is a raised structure), in order to allow ventilation by natural air movements to dilute the contaminant vapour released from the soil and groundwater

- Incorporate gas-resistant membranes into the raised floor of the site office to prevent contaminant vapour under the floor slab from entering the site office

2.63 **Figure 2.3** illustrates the general arrangement of the proposed mitigation measures.

2.64 Geomembranes such as high density polyethylene (HDPE) are commonly used in the application of preventing contaminant vapour and landfill gas from entering buildings/structures located at contaminated sites and landfills-adjacent area respectively. It is because HDPE has good resistance to chemical attack, good strength characteristics and low gas permeability. **Table 2.8** summarizes the recommended specifications of the gas-resistant membranes and installation requirements.

Table 2.8 Recommended Specifications of the Gas-Resistant Membranes and Installation Requirements

Function:	• To prevent contaminant vapour from underneath soil and groundwater from entering into the site office
Specification:	• The gas-resistant membrane should at least meet Geosynthetic Research Institute Test Method GM13 (GRI GM13) standard
Installation:	• Prior to installation, the surfaces where the gas-resistant membrane will come into contact should be properly cleaned and brushed to remove any dirt and deposits • The gas-resistant membranes should be installed in between the site office floor panels and the profile sheeting of the site office (which will be raised to provide clear void from the ground surface) • The gas-resistant membranes should cover the entire floor area. The membranes should extend at least 6 inches up the wall to provide protection for the edges and corners • Separate sections of gas-resistant membranes should be seamed/welded together with an overlapping of at least 12 inches • The gas-resistant membranes should be installed with minimal waviness to ensure a smooth configuration • Personnel installing the gas-resistant membranes should not smoke, wear hard-sole shoes or engage in activities which could damage the membranes
Condition to Cease Installation:	• All installation process should be ceased during precipitation, as well as when temperature is less than 0°C or above 75°C • Pre-heat the geomembrane if the temperature is less than 5°C (but above 0°C) before seaming process. (Abovementioned requirements are applicable if the membrane installation takes place in outdoor environment)
Testing during and after Installation:	• All testing should be carried out by appropriate personnel • Destructive tests will be conducted as the seaming progresses, not at the completion of seaming and installation contractor will not be informed in advance of the destructive tests location • Destructive tests samples and the location of samples collected should be marked and recorded. All holes created by the sample collection should be repaired • Non-destructive tests include vacuum box testing and visual examination • The testing should meet US ASTM D4337 specification

2.65 With the site office built as a raised structure to provide sub-floor ventilation and gas-resistant membranes are properly installed and maintained to prevent vapours from the soil and groundwater underneath from entering into the site office, the exposure pathway "inhalation of vapour in indoor environment" of construction workers at Area A can be eliminated. As a result, the human health risk imposed to construction workers at Area A would be acceptable, in compliance with the established criteria. A monitoring programme for the indoor air of the site office is recommended to be implemented to ensure the effectiveness of the abovementioned mitigation measures. Details of the monitoring requirements are presented in **Section 3** of this report.

Noise

Review of Noise Impact Assessment of the Approved EIA Report

2.66 Potential noise impacts from the demolition stage of the KTCDA site (including the chimneys of the KTIP and KTA) were assessed in the approved EIA Report. Noise impacts at sensitive receivers near the KTCDA site were assessed and the use of quieter powered mechanical equipment (PME) was proposed to mitigate the noise impact to within acceptable levels.

2.67 With reference to Section 5 of the approved EIA Report, potential noise impacts arising from the demolition of the KTCDA site would be the operation of demolition plant and vehicles. Major noise generating activities associated with the demolition works include mechanical demolition of the building structures including the chimneys and material transfer within the Site.

2.68 There would be no change in the originally assumed construction plant inventory for the demolition works, and the sequence of demolition activities would be same as that described in the approved EIA Report except the bus depot building, public car park, Cadogan Street Temporary Garden and the refuse collection point would not be demolished in Phase 1. Phase 1 demolition works would proceed in the order of demolition of structures and demolition of chimneys. It was assumed in the approved EIA Report that all the activities would not be carried out concurrently.

2.69 The conclusions as well as the mitigation measures recommended in the approved EIA Report would remain applicable to the Phase 1 demolition works of this Project. With the proposed mitigation measures in place, noise impacts arising from the Site could be reduced to acceptable levels and the predicted noise levels would comply with the construction noise criteria at all the NSRs during the Phase 1 demolition works.

Evaluation of Noise Impact Associated with the Proposed Variations

<u>Noise Sensitive Receivers</u>

2.70 Existing and future NSRs within 300m from the boundary of the project Site were identified in the approved EIA Report according to the criteria set out in the EIAO-TM. Based on the records of the site visit conducted on March 14, 2007, three recently completed residential developments were identified near the KTCDA site. These three developments were previously identified as planned NSRs in the approved EIA Report. The locations of the identified NSRs are shown in **Figure 2.4**. Descriptions of the representative NSRs and their horizontal distances from the notional noise source are presented in **Table 2.9** below.

Table 2.9 Representative Noise Sensitive Receivers

NSR	Description	Horizontal Distance from notional noise source (m)	Use
KT-N1	Cheong Kat Mansion	114	25-storey high residential block
KT-N2	Sai Wan New Mansion	162	13-storey high residential block
KT-N3	Centenary Mansion	146	27-storey high residential block above 4-storey high podium
KT-N4	Cayman Rise	98	31-storey high residential block above 5-storey high podium
KT-N5	Bayanihan Kennedy Town Centre	154	6-storey high Philippine overseas worker training school