4. POSSIBLE IMPACT ON THE ENVIRONMENT AND PROPOSED ENVIRONMENTAL PROTECTION MEASURES

4.1 Air Quality Impact

4.1.1 Relevant Legislation and Assessment Criteria

4.1.1.1 The principal legislation against air pollution in Hong Kong is the *Air Pollution Control Ordinance* (APCO) (Cap. 311). Air Quality Objectives (AQOs), which specify the statutory concentration limits for various criteria pollutants and the maximum numbers of times allowed to exceed over a specified period of time are set for the whole territory. These AQOs are also referred to in the TM-EIA.

4.1.1.2 In addition to the AQOs, Annex 4 in the TM-EIA issued under the EIA Ordinance sets an hourly TSP limit of 500μg/m^3 for construction dust impact assessment.

Table 2 Relevant Hong Kong Air Quality Objectives

Pollutant	Concentration (μg/m^3) in average time:			
	1 Hour	8 Hours	24 Hours	1 Year
Respirable Suspended Particulates	-	-	180	55
Nitrogen Dioxide	300	-	150	80
Carbon Monoxide	30,000	10,000	-	-
Sulphur Dioxide	800	-	350	80
Total Suspended Particulates	N.A.	-	260	80

4.1.1.3 The *Air Pollution Control (Construction Dust) Regulation* came into effect since 16 June 1997. Stockpiling of dusty materials; loading, unloading or transfer of dusty materials; transfer of dusty materials using a conveyor belt system; use of vehicles; debris handling, excavation or earth moving, and site clearance, etc. are classified as "Regulatory Work" under the Regulation. A Schedule, which specifies dust control requirements for a variety of construction activities, is included in the Regulation. The contractor carrying out a Regulatory Work is required under the Regulation to ensure that the dust control measures required under the Regulation are implemented.

4.1.1.4 For the operational phase, the Project will be designed and implemented to a standard in compliance with the relevant criteria recommended in the Hong Kong Planning Standards and Guidelines (HKPSG), approval conditions, if any, specified for the planning application under the Town Planning Ordinance, the relevant TM-EIA and other applicable ordinances and regulations.

4.1.2 Construction Phase Impact

4.1.2.1 Fugitive dust impact due to the construction of the Project is anticipated while significant impacts of other air quality parameters are not expected.

4.1.2.2 Amongst the three stages of the construction work, excavations of the Site Formation stage of the Project is expected to cause most of the fugitive dust impacts. Excavation is expected to commence from early 2004 till the early 2nd quarter of 2005. According to the construction programme of KSL as advised by KCRC, there will possibly be a concurrent construction period of the Project (excavation) and KSL in the 4th quarter of 2004 and 1st quarter of 2005.

4.1.2.3 About 60,000m^3 of materials will need to be excavated during the construction of the Project. Based on a preliminary estimate, a maximum of about 1,600m^3 of materials will be excavated per day during Site Formation stage.

Background Air Quality

4.1.2.4 According to the "Guidelines on Assessing the 'TOTAL' Air Quality Impacts" published by EPD, the long-term (5-year) average of the monitored Total Suspended Particulate (TSP) concentration obtained by EPD's monitoring station at Central/ Western, which is of similar nature to the Tsim Sha Tsui district, is adopted as the background TSP concentration, which is 76μg/m^3.

Source Inventory

4.1.2.5 Dusty construction activities that would cause fugitive dust impact during bulk excavation are identified as:

- Excavation
- Loading of materials to trucks for disposal at public filling area
- Transportation of materials
- Wind erosion

4.1.2.6 Other construction activities including non-percussive piling, erection of structure and other superstructure works do not involve handling of significant amount of silt materials and are considered having less fugitive dust impact.

4.1.2.7 Fugitive dust emissions due to excavation, loading of materials, transportation of materials and wind erosion are derived based on Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources published by the U.S. Environmental Protection Agency (EPA).

Modelling Methodology and Meteorological Condition

4.1.2.8 Construction dust impacts arising from site formation works on the nearby existing ASRs were predicted using the air quality model "*Fugitive Dust Model"* (FDM). FDM was developed to model fugitive dust emissions and is well accepted by the Hong Kong EPD and the USEPA for this purpose. The model was developed based on the widely used Gaussian plume formulae for estimation of pollutant concentrations but has been adapted to incorporate a gradient-transfer deposition algorithm which accounts for the settling out of dust particles, and to include the wind dependent factor on dust emission rates. The model is designed to predict fugitive dust dispersion from point, line and area sources.

4.1.2.9 The following meteorological data of year 1998 relevant to the study have been obtained from Hong Kong Observatory and used in the modelling study of the dust emission impact assessment:

- Hourly wind direction and speed, air temperature together with atmospheric Pasquill stability class at the Hong Kong Observatory Headquarters in Tsim Sha Tsui;
- Daily morning and maximum mixing heights based on the radiosonde ascent at King's Park; and
- Hourly total sky cover, cloud amount and cloud based height of the 1st - 4th layers observed at the Hong Kong Observatory Headquarters in Tsim Sha Tsui.

Proposed Mitigation Measures Adopted

4.1.2.10 In line with the obligations of the future contractors who would exercise control of fugitive dust emissions in accordance with the requirements in the Air Pollution Control (Construction Dust) Regulation, this assessment has assumed some mitigated dust emission rates associated with dusty activities and facilities based on typical dust control measures listed below: -

- Site hoarding of at least 2.4m high to be erected along the boundaries of the Subject Site (particularly along the northern boundary adjacent to No. 1, Peking Road) except at the site entrance/ exit;
- Truck speed to be controlled within 8 km/hr. Dusty vehicle loads transported to and from the work location to be covered by tarpaulin sheets and not to be overloaded;
- Vehicle wheel washing facilities including high pressure water jets to be provided at designated vehicle exit points;
- Side enclosure and covering, by impervious sheeting where practicable, of any aggregate or other dusty material storage piles, placing of stockpiles in an area to be sheltered on the top and the three sides, and/or sprayed with water. Demolished items to be covered by impervious sheeting or placed in area sheltered on the top and the three sides within a day of demolition.
- All dusty material to be sprayed with water prior to loading, unloading or transfer so as to maintain the fill material wet.
- Frequent watering (at least 4 times per day) of the worksites with active dusty operations and watering of all dust emission sources when necessary. The frequency shall be increased when the weather is dry;
- Drop height of excavated materials to be controlled to a minimum to limit fugitive dust generation from unloading as far as practicable;

4.1.2.11 According to "Control Techniques for Particulate Emissions from Stationary Sources, Vol 2", wetting suppression is an effective measure to suppress dust emission. While wetting twice a day can effectively suppress dust emission by 50%, it is recommended that all dusty activities and facilities in the Subject Site should be wetted at least 4 times a day in order to achieve a control efficiency of 75%.

Predicted TSP Result

4.1.2.12 Representative sensitive uses in the neighbourhood of Subject Site were selected as the Representative Assessment Points (RAPs) for the assessment. The locations of the RAPs are shown in Figure 5. It is noted that the RAPs were selected at façades adjacent to the Site to represent the worst scenario.

4.1.2.13 As most of the air sensitive uses rely on mechanical system for ventilation with fresh air intake points located further away from the Site, should the predicted pollutant concentrations at the RAPs comply with relevant standard, it is expect that the air sensitive uses in the vicinity of the Subject Site would also be subject to acceptable impacts.

4.1.2.14 The predicted hourly and daily TSP concentrations at the RAPs with the background concentration included are summarized in Table 3 and Table 4 respectively. The maximum predicted hourly and daily TSP concentrations are 258 $\mu g/m^3$ and 114 $\mu g/m^3$ respectively, which are located at the commercial building at No. 1, Peking Road.

Table 3 Predicted Hourly TSP Concentrations due to the Project with Background Concentration with Mitigation

RAP	Predicted Hourly TSP Concentration (µg/m^3) with Background Concentration at Different Height above Ground					
	1.5m	5m	10m	15m	20m	25m
A01	173	148	101	90	84	81
A02	182	149	101	89	83	80
A03	185	145	100	89	83	80
A04	187	144	103	90	83	81
A05	170	125	101	91	85	83
A06	186	139	103	91	85	82
A07	185	130	103	91	85	82
A08	157	117	100	90	85	81
A09	173	125	100	90	84	81
A10	165	123	100	90	85	81
A11	169	124	100	90	85	81
A12	175	132	100	90	84	81
A13	176	131	102	90	84	81
A14	163	125	101	91	86	83
A15	174	258	102	90	84	81
A16	155	230	102	89	84	80
A17	171	170	104	89	84	81

Table 4 Predicted Daily TSP Concentrations due to the Project with Background Concentration with Mitigation

RAP	Predicted Daily TSP Concentration (µg/m^3) with Background Concentration at Different Height above Ground					
	1.5m	5m	10m	15m	20m	25m
A01	112	106	86	81	79	77
A02	114	104	86	80	78	77
A03	113	104	85	80	78	77
A04	111	102	86	81	78	77
A05	100	93	85	81	79	78
A06	110	101	85	80	78	77
A07	98	92	83	80	78	77
A08	87	85	81	80	78	78
A09	99	92	83	80	78	77
A10	104	95	85	81	78	77
A11	100	94	85	81	79	77
A12	103	96	84	80	78	77
A13	100	96	84	80	78	77
A14	92	89	85	81	79	78
A15	103	114	86	80	78	77
A16	101	114	85	80	78	77
A17	99	100	84	80	78	77

4.1.2.15 Appendix I-1 to Appendix I-3 showed the derivation of the background TSP concentration, emission factors for modelling of fugitive dust impact and the typical FDM modelling files respectively.

Cumulative TSP Impact

4.1.2.16 KCRC advised that the KSL tunnel section underneath the Subject Site would be excavated by means of a "drill and blast" process. All other sections of the tunnels in the vicinity of the Subject Site will be constructed using the "cut and cover" method.

4.1.2.17 There is a tentative proposal by KCRC to construct an access shaft next to Kowloon Park Drive within the Subject Site by pipelines for accessing to the section of the tunnels constructed by the "drill and blast" process. If this proposal is to go ahead, at peak periods of excavation, it is anticipated that there will be up to 40 trucks a day servicing the access shaft to remove an average of about 230 m^3 of excavated materials per day. On the other hand other sections of the KSL will be constructed using the conventional "cut-and-cover' method with temporary deck constructed to reinstate traffic before bulk excavation.

4.1.2.18 Based on the latest information provided by KCRC regarding the method of construction, mitigation measures proposed and the estimated emission rate in accordance with USEPA's AP-42, the cumulative fugitive dust impact was assessed. Fugitive dust emission information provided by KCRC has been included in Appendix I-4 for reference.

4.1.2.19 The predicted hourly and daily TSP concentrations at the RAPs due to the construction of KSL itself are shown below. The maximum predicted hourly and daily TSP concentrations due to the construction of KSL only are 264 $\mu g/m^3$ and 148$\mu g/m^3$ respectively, which are located at No. 1, Peking Road.

Table 5 Predicted Hourly TSP Concentrations due to KSL Construction with Background Concentration with Mitigation

RAP	Predicted Hourly TSP Concentration ($\mu g/m^3$) with Background Concentration at Different Height above Ground					
	1.5m	5m	10m	15m	20m	25m
A01	179	116	104	96	92	89
A02	145	113	103	96	92	89
A03	143	119	103	96	91	89
A04	149	121	102	95	91	88
A05	135	114	101	95	91	88
A06	175	124	101	94	90	88
A07	194	130	102	93	91	88
A08	183	126	102	94	91	89
A09	264	134	103	95	92	89
A10	135	112	99	96	93	90
A11	111	103	100	96	93	90
A12	103	104	101	97	93	90
A13	104	106	101	97	94	91
A14	107	108	103	98	95	91
A15	105	104	101	97	94	91
A16	121	112	103	95	92	89
A17	240	120	106	97	93	90

Table 6 Predicted Daily TSP Concentrations due to KSL Construction with Background Concentration with Mitigation

RAP	Predicted Daily TSP Concentration (μg/m^3) with Background Concentration at Different Height above Ground					
	1.5m	5m	10m	15m	20m	25m
A01	106	89	81	80	79	79
A02	89	85	83	81	80	79
A03	90	88	84	81	80	79
A04	92	90	85	81	80	79
A05	91	88	84	81	80	79
A06	107	96	86	82	80	79
A07	122	99	87	82	79	79
A08	121	98	86	81	79	79
A09	148	103	87	82	80	79
A10	98	89	84	81	80	79
A11	86	83	82	80	80	79
A12	83	82	81	80	80	79
A13	82	82	81	81	80	80
A14	84	82	81	81	80	80
A15	84	82	81	80	80	79
A16	92	84	80	80	80	79
A17	121	87	81	80	80	79

4.1.2.20 The cumulative fugitive dust impact has been assessed conservatively. All emission sources due to the construction of the entire KSL project are assumed to be concurrent with the construction of the Project. The maximum predicted hourly and daily TSP concentrations at the RAPs due to the concurrent construction of the Project and KSL is shown below. The maximum predicted hourly and daily TSP concentrations due to the construction of the Project and KSL are 268 μg/m^3 and 151 μg/m^3 respectively, which are again located at No. 1, Peking Road.

Table 7 Predicted Cumulative Hourly TSP Concentrations with Background Concentration with Mitigation

RAP	Predicted Hourly TSP Concentration (μg/m^3) with Background Concentration at Different Height above Ground					
	1.5m	5m	10m	15m	20m	25m
A01	200	169	114	99	92	89
A02	234	162	113	98	92	89
A03	237	176	111	97	91	89
A04	194	152	110	97	91	88
A05	177	133	109	97	91	88
A06	215	156	112	99	91	88
A07	198	143	113	99	92	88
A08	191	137	108	96	92	89
A09	264	134	108	97	92	89
A10	170	129	106	96	93	90
A11	190	131	107	96	93	90
A12	180	138	107	97	93	90
A13	182	137	107	97	94	91
A14	168	132	107	98	95	91
A15	179	268	109	97	94	91
A16	161	236	110	97	92	89
A17	240	192	114	98	93	90

Table 8 Predicted Cumulative Daily TSP Concentrations with Background Concentration with Mitigation

RAP	Predicted Daily TSP Concentration (µg/m^3) with Background Concentration at Different Height above Ground					
	1.5m	5m	10m	15m	20m	25m
A01	116	111	90	84	81	80
A02	124	110	90	83	81	79
A03	119	112	90	84	81	79
A04	114	105	88	82	80	79
A05	102	96	87	83	80	79
A06	115	105	89	83	80	79
A07	122	99	87	82	80	79
A08	121	98	86	82	80	79
A09	151	103	87	82	80	79
A10	106	96	86	82	80	79
A11	106	96	87	82	80	79
A12	105	97	86	81	80	79
A13	101	97	85	82	80	80
A14	94	92	86	82	80	80
A15	106	115	87	82	80	79
A16	102	115	87	82	80	79
A17	124	104	88	83	81	79

4.1.2.21 The cumulative hourly TSP concentration contour at the worst-hit level (5m aboveground) has been plotted as shown in Figure 6. No exceedance is found at all RAPs.

4.1.3 Operational Phase Impact

4.1.3.1 Air pollution sources identified that might affect the Project during its operational phase include vehicular emissions due to road traffics; emissions from chimneys as well as other industrial operations. During the construction of the KSL, the associated fugitive dust and other criteria air pollutants may also affect the Project.

4.1.3.2 Subject to detailed project design, the use of any boiler and chimney facilities at the Site is subject to licensing control and the capacity, if any, should be limited. No significant air pollution is considered likely due to operation of the Project.

Vehicular Emission from Road Traffic

4.1.3.3 The road carriageways that would affect the Project include:

- Canton Road (local distributor);
- Salisbury Road (primary distributor); and
- Kowloon Park Drive (primary distributor).

4.1.3.4 The Project, whichever it is retail/ hotel/ restaurant/ commercial development is planned to be mechanically ventilated with air conditioning facilities, which is typical of developments of the same type. Fresh air intake positions will be located at a higher elevation (+14.5 mPD) and remote from the roads (about +4 mPD) abutting the Subject Site so that the vehicular emission impact is considered minimal.

4.1.3.5 Also, the fresh air intake points will be located with a minimum buffer distance of 5m from Canton Road (local distributor), and 20m from Salisbury Road and Kowloon Park Drive (primary distributor) in accordance with Table 3.1 of HKPSG in order to avoid any unacceptable air quality impact due to vehicular emission.

4.1.3.6 Slightly positive pressure will be maintained for the facilities so that the chance of having polluted air getting into the buildings can be significantly reduced.

4.1.3.7 For the Grand Piazza, which will be designed as a passive recreational area, separation distance of 4m will be maintained from Canton Road and 6m from both Salisbury Road and Kowloon Park Drive respectively. The separation distance is considered sufficient in accordance with Table 3.1 of HKPSG so that no unacceptable air quality impact is envisaged during its operation.

4.1.3.8 In conclusion, no unacceptable vehicular emission impact is expected for the Project.

Emissions from Industrial Operations

4.1.3.9 There is no industrial area situated within 1km from the Subject Site. Moreover, the proposed Project is a low-rise development so that impacts due to emissions from the existing chimneys (e.g. boilers of hotels) in the area onto the Project is considered insignificant.

4.1.4 Construction and Operation of KSL

4.1.4.1 Cumulative construction dust impacts have been addressed. The result indicated that the cumulative TSP concentration at all identified sensitive uses would be within the acceptable level.

4.1.4.2 On the other hand, the Project Proponent of the KSL will ensure that no unacceptable air quality impact would impose on the existing and planned sensitive uses nearby i.e. including this Project during the construction and operation of KSL.

4.2 Noise Impact

4.2.1 Construction Phase Impact

Relevant Legislation and Assessment Criteria

4.2.1.1 Construction noise is controlled under the *Noise Control Ordinance (NCO)* which prohibits the use of powered mechanical equipment (PME) during the restricted hours (7 p.m. to 7 a.m. on normal weekdays and any time on a public holiday, including Sunday) without a valid Construction Noise Permit (CNP) granted by the Authority. The criteria and procedures for issuing such a permit are specified in Technical Memorandum on Noise From Construction Works other than Percussive Piling (TM-GW).

4.2.1.2 Noise impacts arising from general construction works during normal working hours (i.e. 0700 to 1900 hours on any day not being a Sunday or public holiday) at the openable windows of noise sensitive buildings are to be assessed as per the guidelines contained in Table 1B of the TM-EIA. The recommended noise standards are 75dB(A) for domestic premises, 70dB(A) for educational institutions and 65dB(A) during examinations.

4.2.1.3 With effect from 1 November 96, the use of specified powered mechanical equipment (SPME) for carrying out construction work other than percussive piling and/ or the carrying out of prescribed construction work (PCW) within a designated area are also brought under control. The relevant technical details are provided in the "Technical Memorandum on Noise from Construction Work in Designated Areas".

4.2.1.4 Potential ground-borne noise impact is not listed in the Annex of TM-EIA. Accordingly, the criteria for evaluating such noise impact shall be determined on a case-by-case basis as per the guidelines in the TM-EIA and has been further elaborated in subsequent sections of this Project Profile.

Source Inventory

4.2.1.5 This section addresses construction noise impact caused by the Project during the non-restricted hours (i.e. 0700-1900 hours from Monday to Saturday other than public holidays and Sundays). According to the tentative method of construction, a powered mechanical equipment (PME) list has been furnished and tabulated in Table 9. The plant inventory and utilisation rate adopted in the assessment are typical of similar applications and are considered practicable by the Project Engineer in achieving the preliminary construction programme.

4.2.1.6 While it is expected that the future appointed Contractor may propose a different PME inventory and different method of construction, the carrying out of a representative quantitative assessment at this planning stage will allow the potential noise problem be addressed at an early stage and that practicable and sufficient noise mitigation measures can be derived and planned beforehand.

4.2.1.7 In all circumstances, the Contractor will be required by the Project Proponent through specific contract specifications to provide and implement sufficient direct noise mitigation measures with reference to the recommendations in this Project Profile to achieve acceptable noise levels on nearby NSRs.

Table 9 Proposed Powered Mechanical Equipment List

Stage of Work		**Equipment**		**Qty**	**Utilisation**
Site Formation	Tree Retaining Wall Installation	Pile wall for tree protection and temporary platform - Diameter around 219 mm	Odex	4	50%-80%
			Down-the-hole hammer (Odex then Down-the-hole hammer in each hole)		
			Rigs for pile		
		Crawler Crane		3	70%-80%
		Welding set		4	100%
		Air Compressor		8	100%
	Retaining Wall Installation for Main Building	Pile wall surround the Main Building- Diameter around 550~750mm	Rigs	6	50%-80%
			Odex		
			Down-the-hole hammer (Odex then Down-the hole hammer in each hole)		
		Crawler Crane		5	70%-80%
		Welding set		6	100%
		Air Compressor		18	100%
		Generator		4	90%-100%
		Backhoes		4	80%-90%
		Dump Truck		2	50%-80%
	Open Cut Excavation	Backhoes (for soil)		4	80%-100%
		Backhoes with breaker (for rock)		4	80%-100%
		Crawler Crane		2	70%-80%
		Generator		1	100%
		Dump Truck		2	50%-80%
	Remaining Excavation	Drill hole diameter around 150mm	Drilling rigs	9	50%
			Odex		
			Down-the-hole hammer (Odex, then Down-the-hole hammer in each hole)		
		Backhoes		3	70%
		Backhoes with breaker		3	70%
		Crawler Crane		2	70%-80%
		Air Compressor		9	100%
		Generator		3	100%
		Dump Truck		12	80%
Foundation		Backhoes		4	100%
		Backhoe with breaker		4	100%
		Odex & Down-the-hole hammer		3	80%
		Air Compressor		3	100%
		Generator		3	100%
		Crawler Crane		3	80%
		Dump Truck		2	50%-80%
Superstructure		Tower Crane		1	80%-90%
		Material Hoist		3	80%-90%
		Concrete Pump		1	20%
		Vibratory Poker		6	20%-40%
		Air Compressor		1	100%
		Water Pumps		2	10%
		Welding Sets		2	100%
		Generator		2	100%
		Dump Truck		2	50%-80%

Method of Noise Prediction

4.2.1.8 For all construction works carried out during normal working hours (i.e. 0700 to 1900 hours on any day not being a public holiday or Sunday). The method of assessment is described as follows:

- Identify from "Technical Memorandum on Noise From Construction Works other than Percussive Piling" (TM-CW) the Sound Power Level (SWL) of each PME used in the construction works;
- Refer to BS5228, "Noise and vibration control on construction and open sites – Part 1. Code of practice for basic information and procedures for noise and vibration control" if the SWL of individual equipment cannot be found in TM-CW;
- Select representative NSRs in the vicinity of for the construction noise impact assessment as Representative Assessment Point (RAP). In this case, the NSRs that are identified to rely on opened window for ventilation are selected for the construction noise impact assessment;
- Identify the notional source position for each RAP in accordance with the procedures as described in TM-CW;
- Calculate the Predicted Noise Level (PNL) based on distance attenuation from notional source positions to the representative RAPs;
- With consideration of the effect of facade reflection at the RAPs, predict the Corrected Noise Level (CNL);
- Based on a comparison of the CNL with the noise assessment criteria, identify the required noise mitigation measures and predict the mitigated noise levels.

Predicted Results under Unmitigated Scenario

4.2.1.9 The selected representative assessment points (RAPs) are shown in Figure 7. Both N1 (Hankow Centre) and N2 (Bo Yip Building) represent domestic premises, which rely on openable window for ventilation. The applicable noise standard is 75dB(A). A conservative approach was adopted to determine the distance attenuation correction based on horizontal distance separation only instead of the slant distance.

4.2.1.10 Predicted noise level at different construction stages for the unmitigated scenario is summarized in Table 10. Calculation of the prediction noise level is included in Appendix II-2. The highest estimated utilisation rate was adopted to represent the worst-case scenario. The results showed that the predicted construction noise level at some representative assessment points at some stages would exceed the relevant criteria.

Table 10 Predicted Construction Noise Level (Unmitigated) at Different Stages

Construction Stage	**Predicted Noise Level, dB(A)**	
	N1	**N2**
Site Formation (Jan 2004 – Mar 2004) Tree Retaining Wall Installation; Retaining Wall Installation for Main Building; Open Cut Excavation	83	79
Site Formation (Apr 2004) Retaining Wall Installation for Main Building; Open Cut Excavation	83	78
Site Formation (May 2004 – Oct 2004) Retaining Wall Installation for Main Building	81	76
Site Formation (Nov 2004 – Mar 2005) Remaining Excavation	79	74
Foundation Work	79	74
Superstructure Work	77	73

Proposed Mitigation Measures

4.2.1.11 Predicted noise level for the unmitigated scenario showed that the RAPs are likely to be adversely affected due to the construction of the Project. The following mitigation measures are proposed to be adopted during the construction of the project to alleviate potential construction noise impact:

- Use of quiet PME with lower sound power level;
- Provide site hoarding of 4m to 6m high along the eastern boundary with sufficient surface density (10 to 15 kg/m^2) as noise barrier (please refer to Appendix II-1B);
- Use of noise enclosure and temporary noise barriers with sufficient surface density (10 to 15 kg/m^2) (vertical and cantilevered types) (please refer to Appendix II-1B);
- Making use of the topography by carrying out excavation from west to east so that the original platform can act as effective noise barrier (please refer to Appendix II-1B);
- Implementation of good site practice and noise management.

4.2.1.12 To be prudent in the construction noise management, the following additional noise management measures and good site practices are recommended for implementation:

- Contractor shall comply with and observe the Noise Control Ordinance (NCO) and its current subsidiary regulations;
- Before the commencement of any work, the Contractor shall submit to the Engineer for approval the method of working, equipment and sound-reducing measures intended to be used at the site;
- Only well-maintained plants should be operated on-site;
- Plants should be serviced regularly during the construction programme;
- Machines that may be in intermittent use should be shut down or throttled down to a minimum between work periods;
- Silencers and mufflers on construction equipment should be utilised and should be properly maintained during the construction programme;
- Noisy activities can be scheduled to minimise exposure of nearby NSRs to high levels of construction noise. For example, noisy activities can be scheduled for midday or at times coinciding with periods of high background noise (such as during peak traffic hours);
- Noisy equipment such as emergency generators shall always be sited as far away as possible from NSRs;
- Mobile plants should be sited as far away from NSRs as possible; and
- Material stockpiles and other structures should be effectively utilised as noise barrier, where practicable.

Predicted Result under Mitigated Scenario

4.2.1.13 Predicted noise levels at different construction stages for the mitigated scenario are summarized in the table overleaf. Calculation of the prediction noise level is included in Appendix II-2. The results showed that the predicted construction noise levels at both representative assessment points at all stages would comply with the relevant noise criteria after mitigation.

Table 11 Predicted Construction Noise Level (Mitigated) at Different Stage

Construction Stage	**Predicted Noise Level, dB(A)**	
	N1	**N2**
Site Formation (Jan 2004 – Mar 2004) Tree Retaining Wall Installation; Retaining Wall Installation for Main Building; Open Cut Excavation	74	69
Site Formation (Apr 2004) Retaining Wall Installation for Main Building; Open Cut Excavation	73	69
Site Formation (May 2004 – Oct 2004) Retaining Wall Installation for Main Building	71	67
Site Formation (Nov 2004 – Mar 2005) Remaining Excavation	70	66
Foundation Work	69	65
Superstructure Work	68	63

Cumulative Impact with KSL under the Mitigated Scenario

4.2.1.14 Based on the latest information provided by KCRC's consultant for the KSL, the predicted highest construction noise level generated by the construction of KSL alone on noise sensitive use at Hankow Centre at different period under the mitigated scenario is shown below.

Table 12 Predicted Construction Noise Level (Mitigated) at Different Stages due to KSL Construction Alone

Period	**Description**	**Predicted Noise Level, dB(A)**
Feb 05 to Apr 05	Piling & excavation for tunnel access shaft	72
May 05 to Feb 06	Mined tunnel underneath FMPHQ	69
Jun 06 to Aug 06	Backfilling for access shaft	62

4.2.1.15 The same construction noise level was assumed to be generated by KSL on both NSRs. Based on the tentative construction period, the cumulative noise impact with concurrent construction of KSL at different stages of construction of the Project can then be determined and tabulated below.

Table 13 Predicted Cumulative Construction Noise Level (Mitigated) at Different Stages

Construction Stage	**Predicted Noise Level, dB(A)**	
	N1	**N2**
Site Formation (Jan 2004 – Mar 2004) Tree Retaining Wall Installation; Retaining Wall Installation for Main Building; Open Cut Excavation	74	69
Site Formation (Apr 2004) Retaining Wall Installation for Main Building; Open Cut Excavation	73	69
Site Formation (May 2004 – Oct 2004) Retaining Wall Installation for Main Building	71	67
Site Formation (Nov 2004 – Mar 2005) Remaining Excavation	74	73
Foundation Work	72	70
Superstructure Work	71	70

4.2.1.16 The predicted cumulative construction noise impacts at all representative noise sensitive uses amongst all stages of construction of the project would be within the acceptable level. Appendix II-1 included a drawing showing the proposed non-percussive piling and rock excavation locations where relatively noisy activities were to be carried out.

4.2.1.17 The retaining wall would wrap around the Main Building on three sides and around the big trees to be reserved. Rock excavation area is close to the western side. In fact, as the identified noise sensitive uses are situated to the east of the Subject Site. Equipment for construction of the retaining wall should be shielded by the Main Building itself.

4.2.1.18 Moreover, the notional noise sources adopted for assessment were closer to the RAPs when compared with most of the locations for rock excavation and construction of retaining wall that were close to the western boundary of the site. It is therefore envisaged that the assessment already represented a more conservative scenario. No unacceptable construction noise impact is envisaged during the construction of the Project after mitigation.

4.2.1.19 For other potential noise sensitive uses including the Hong Kong Cultural Centre, the Hong Kong Space Museum, the YMCA of Hong Kong and the Marco Polo Hong Kong (Hotel), they have blank façades or are already fitted with fixed window with central air conditioning (i.e. they do not rely on opened window for ventilation), they are considered unaffected by construction noise impact.

Potential Ground-borne Noise Impact

Introduction

4.2.1.20 In contrast to the noise addressed in the foregoing sections which are airborne in nature, ground-borne noise is caused by transmission of construction induced vibrations through the ground towards the NSRs, where the structure in which the NSRs is situated is excited to radiate audible noise causing an impact to the noise sensitive activities inside that structure.

4.2.1.21 *BS5228 Part 4: Code of practice for noise and vibration control applicable to piling: 1992* describes the parameters to measure and ranges of sensitivity of apparatus to use for different subject areas (Table 2 of BS5228 Part 4:1992).

4.2.1.22 It indicates that vertical and horizontal vibration impact on people due to piling only concentrates on the frequency range of 2 to 80 Hz. The audible frequency is, on the other hand, in the range of 20 to 20,000 Hz. Given that noise of low frequency is relatively undetectable by humans, the ground-borne noise impact is unlikely to be significant if the magnitude of vibration is low.

4.2.1.23 With respect to the construction activities at the FMPHQ, the tentative method of construction and plant inventory employed were given in Section 2.1.3 and Table 9 of this Project Profile. For the construction of the FMPHQ, no percussive piling will be required. In fact, construction method and equipment are carefully selected in order not to generate excessive impact on the surrounding environment and the monuments within the Subject Site.

4.2.1.24 For example, percussive piling will not be employed to avoid excessive vibration impact on the monument buildings. The nature of construction activities at the FMPHQ includes excavation, foundation and superstructure works, which are typical of ordinary building construction and such activities should not bear any significance in the generation of ground-borne noise and vibration impact.

Construction Activities that would Cause Ground-borne Noise Impact

4.2.1.25 As revealed in previous site investigation results (please also refer to Appendix II-2a), the ground soil is mainly composed of soft fill materials and weathered rock of Grade IV to V (which are highly to completely decomposed), which can easily be broken. These rocks are loose and are unlikely to be structurally linked to the bedrock at +2 mPD.

4.2.1.26 Moreover, subject to the detailed design, soil excavation and reinforcement works using non-percussive pipe piling for reinforcement of a few tree and the signal tower will only be carried out down to a level of about +2 to +3 mPD before reaching the bedrock at +2 mPD to facilitate latter construction works.

4.2.1.27 Consequently, the likelihood of open cut excavations to cause ground-borne noise is low as the works will not go beyond the +4 mPD level and would only involve soft soil materials.

4.2.1.28 The vibrations caused by installation of retaining wall around some trees using pipe piles might need some quantification although it would not penetrate beyond +2mPD. The same would certainly apply to pipe piles that would penetrate to bedrock in front of the Main Building.

Likelihood of Cumulative Ground-borne Noise Impact

4.2.1.29 The best available information obtained from KCRC and their consultant team working on the KSL project indicated that the construction activities that would cause ground-borne noise impact would commence in November 2004 the earliest and there is chance of further slippage depending on the status of gazettal of the railway alignment. Also, full excavation for tunnel or bored tunnel may happen in the first quarter of 2005.

4.2.1.30 In the construction program of FMPHQ given in Table 1, the installation of retaining wall for the Main Building will be completed by October 2004, while the works for the selected trees will complete even earlier in March 2004. This program is a conservative one and is likely that there will be an early finish.

4.2.1.31 By comparing these two program for the activities, it is very likely that there will be a period of a month or two in which the activities that would cause vibrations at FMPHQ would have been ceased before similar works for the KSL could commence. In order words, cumulative ground-borne noise impact would not be anticipated.

Sensitive Receivers

4.2.1.32 Sensitive receivers for ground-borne noise are derived from those that can be classified as NSRs according to TM-EIA. These sensitive receivers should be affected by noise induced by transmitted ground vibrations as a result of the construction works at the FMPHQ.

4.2.1.33 A number of such uses in the neighbourhood of the FMPHQ are evaluated and the followings are selected for purpose of evaluating the possible impact: -

- YMCA of Hong Kong (5/F and above)
- Marco Polo Hong Kong Hotel (7/F and above)
- Residential units at Hankow Centre (5/F and above)
- Residential units at Bo Yip Building (3/F and above)
- The Hong Kong Cultural Centre (HKCC)
  - Concert Hall (1/F)
  - Grand Theatre (1/F)
  - Studio Theatre (4/F)
- The Hong Kong Space Museum (HKSM)
  - Sky Theatre (G/F)
  - Recording Studio (1/F)

Ground-borne Noise Assessment Criteria

4.2.1.34 Section 4.4.2 (c) of the TM-EIA is relevant in the assessment. That is, where specific methodologies are not listed in the annexes or where the methodologies for certain issues can only be established on a case-by-case basis, the proposed methodologies should be consistent with the methodologies adopted for Hong Kong projects having similar issues or with methodologies accepted by recognised national/international organisations. Annex 5 of the TM-EIA also specifies that for noise maters not fully listed in the annex, the criteria for evaluating such noise impacts shall be deteremined on a vase by case basis. The criteria for ground-borne noise impact assessment is not explicated in the TM-EIA and is therefore derived in this context.

Reference to Previously Approved EIA

4.2.1.35 Having reviewed all EIA reports approved under the EIA Ordinance, there was no previous case that has directly addressed the potential ground-borne noise impact. One designated project, which is similar in nature to this development at FMPHQ is the "Wanchai Development Phase IIA", which was approved on 31 Aug 2001. The project mainly comprises land formation; road construction and other associated works where particularly sensitive noise sensitive receivers such as Hong Kong Academy for Performing Arts (HKAPA) would be affected. In that EIA, only airborne noise impact due to construction was predicted and was addressed accordingly. The adopted construction noise criteria for normal daytime working hours is 70 dB(A) as quoted in Note (1), Table 4.11of the EIA report for Wanchai Development Phase IIA. The predicted airborne noise level ranges from 68 to 79 dB(A) (N2 in Table 4.11 of the EIA report). It is explained in the EIA report that central air-conditioning systems and noise insulation facilities have been provided at HKAPA. In addition, as it does not rely on openable windows for ventilation, no adverse noise impact is expected for its indoor environment.

Reference to International Noise Criteria

4.2.1.36 One well-accepted standard, the "Noise Criteria" (NC) curve developed in the USA, is worth discussed here. The NC rating provides a good guide for loudness and indicates the extent of interference with speech communication. Another rating system, "Noise Rating" (NR) curves developed in Europe, serves similar purpose. Recommended NC level exists for different types of use. Relevant details are summarised and tabulated below.

Table 14 Extracts of Recommended NC Levels for Various Environments[1]

Type of Uses	**NC**
Residences	25 – 35
Theatre	25 – 30
Concert Halls	20 – 25

4.2.1.37 The application of NC curve as assessment criteria requires the analysis and prediction of the frequency spectrum of noise generated inside the affected premises. In view of the complexity of the pathway for ground-borne noise propagation (excited by collision/vibration, propagation of vibration through different media/ strata and eventually generated from the structure due to vibration), there are difficulties to predict the ultimate frequency spectrum that enables the NC levels be computed and compared to determined the impact.

4.2.1.38 Also, the NC levels are more of design criteria for an indoor acoustic environment for normal operation and enjoyment in the uses rather than the appropriate criteria for construction induced ground-borne noise.

[1] Extracted from Woods Practical Guide to Noise Control, Ian Sharland

Reference to Measured Background Noise Levels

4.2.1.39 Other than this, *Woods Practical Guide to Noise Control* also refers to the report of the Wilson Committee on the problem of noise, which gives recommendations in terms of dB(A), not only for acceptable background noise, but also for assessing the effects of additional noise. Most of the recommendations are documented in BS4142 "Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas". If the rating level of the planned new noise is less than 5 dB(A) above the background, the situation is described as "marginal". In addition, if the noise contains either a distinguishable, discrete, continuous note or distinct impulses or is irregular enough to attract attention, the rating level correction of +5dB(A) should be applied as well. In other words, for a unit that would be affected by a new noise of different/noticeable nature, the situation is marginal if the noise level is equivalent to the background level According to available information obtained from KCRC on the KSL project, the recent measured background noise level inside HKCC and HKSM are tabulated as follows:

Table 15 Background Noise Level measured at Particularly Sensitive Uses

Sensitive Uses	**Background Noise Level adopted, dB(A)**
HKCC	29
HKSM	33

**under condition with air conditioning system in function*

4.2.1.40 The method described in BS4142 s applied for determining industrial noise affecting NSRs, which is permanent in nature whereas construction noise, on the contrary, is transient in nature. In addition, the standard describes acceptable noise level at the outside of a building instead of within the indoor environment. Again, these are not criteria appropriate for regulatory purpose.

Reference to the Noise Control Ordinance and the associated TM and TM-EIA

4.2.1.41 The following existing noise criteria have been considered:

1. Table 1B of TM-EIA tabulates the noise standards for daytime construction activities with respect to different types of noise sensitive receivers that rely on opened window for ventilation, viz., Leq (30 min) = 75 dB(A) for domestic premises, hotels and hostels, 70 dB(A) for educational institutions and 65 dB(A) for educational institutions during examination;
2. Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (TMFP) stipulates that for noise source located on or within the same or an adjoining building such that the noise is transmitted primarily through the structural elements of the building, or buildings, the appropriate acceptable noise level (ANL) should be 10 dB(A) less than the relevant ANL;

4.2.1.42 With reference to other EIAs conducted in Hong Kong having similar issues, the HKCC and the HKSM are at most considered as having the same sensitivity as school where unaided voice communication is required. As such, a construction noise limit of Leq (30 min) = 70 dB(A) at the façades can be adopted.

4.2.1.43 Point 1 above implied that a similar adjustment should be made to the relevant ANL (i.e. 10 dB(A) less than the adopted value) if the point of assessment is at an internal location of a building in which the NSR is located. Using the same approach under NCO, the daytime noise standard for ground borne construction noise will be 70 – 10 = 60 dB(A), Leq (30 min). Similarly, the corresponding standard for dwellings/ hotel will be 75-10 = 65 dB(A)

4.2.1.44 The approach in deriving the appropriate standards is considered pragmatic given the temporary nature of construction induced ground-borne noise and the difficulty in abating vibration transmission off-site as well as at-source mitigation.

4.2.1.45 In brief, the following ground-borne noise criteria are proposed below.

Table 16 Proposed Ground-Borne Noise Criteria for Construction

Potential Sensitive Uses		**Proposed Ground-borne Noise Criteria, dB(A)**
YMCA of Hong Kong	(Lowest residential floor = 5/F)	65
Marco Polo Hong Kong Hotel	(Lowest residential floor = 7/F)	65
Hankow Centre	(Lowest residential floor = 5/F)	65
Bo Yip Building	(Lowest residential floor = 3/F)	65
Hong Kong Cultural Centre	- Concert Hall (1/F)	60
	- Grand Theatre (1/F)	60
	- Studio Theatre (4/F)	60
Hong Kong Space Museum	- Sky Theatre (G/F)	60
	- Recording Studio (1/F)	60

4.2.1.46 As there are concerns from the HKCC and the HKSM that ground-borne noise could be a nuisance to the performance that would demand a more stringent noise criteria to ensure enjoyment of the audience. It would always be a target that the Project Proponent should make an effort to minimise the impact to as low as practicable.

Source Strength

4.2.1.47 As mentioned before, the Subject Site has mainly soft soil materials on ground. Piling work is generally carried out down to a minimum of +2 to +3 mPD without reaching the bedrock. In soft driving conditions, the intensity of vibrations transmitted to the environment is limited.

4.2.1.48 It is therefore anticipated that the only significant construction activity leading to possible ground-borne noise impact is the retaining wall installation for the Main Building during the penetration of the pipe pile to bedrock to a depth of about 1m. Retaining wall installation for the Main Building is estimated to be carried out up to October 2004. Moreover, it is estimated that the period with the pile penetrating into bedrock would account for about 5% of the total time only and is transient in nature.

4.2.1.49 With regard to retaining wall installation for trees/signal tower, which is estimated to be carried out up to March 2004, the vibration strength is considered less significant. Nevertheless, considering the fact that the piling location for tree/signal tower is closer to some sensitive uses such as Hong Kong Cultural Centre, it was attempted to quantify that noise level due to such piling works using conservative assumptions.

4.2.1.50 Table 3 and Table 4 of BS5228 Part 4:1992 summarises the case history data on vibration levels measured during bored piling/cast-in-place piling (using hammer). It is noted that the vibration impact due to bored piling/cast-in-place piling is anticipated higher or at least equivalent to that generated due to rock excavation and piling using down-the-hole hammer as they usually possess much higher blow energy.

4.2.1.51 The measured vibration in terms of peak particle velocity (p.p.v.) at a particular plan distance (boring – 0.8 mm/s at 10m and base ramming - 1.5 mm/s at 10m) for the case: 1982 Halifax (W. Yorks) in Table 3 was quoted for similar soil condition (involving boring and base ramming under condition of loose rock fill over weathered rock in connection with the bedrock) and pile diameter of 500 mm reaching a depth of 15 to 17m.

4.2.1.52 It is noted that the soil within the Subject Site is composed of mostly soft materials and the pipe piles would only touch the bedrock level in a few cases. Ramming on bedrock would likely happen near the end of the drilling process for piling around the Main Building only.

4.2.1.53 Accordingly, the p.p.v. of 0.8 mm/s at 10m has conservatively been adopted for piling near the Main Building and tree/ signal tower where the pile would not penetrate the bedrock. On the other hand, a p.p.v. of 1.5 mm/s at 10m has been adopted for piling near the Main Building to predict the scenario when the piles penetrate the bedrock level.

4.2.1.54 It should be noted that the retaining wall for tree/signal tower will be formed by pile of 200mm in diameter. The situation is similar to may site investigation boring works carried out before the tendering stage of this Project during which complaint against ground-borne noise had not been received. Therefore, the use of this quoted data for the assessment of ground-borne noise impact is considered conservative.

Assessment Approach and Results

4.2.1.55 The assessment approach is based on *HGTNVIA*[2]. The procedure is as follows.

(A) To determine the peak particle velocity (p.p.v.) adjusted for distance based on the reference p.p.v.

(B) To determine the root mean square (rms) vibration velocity based on the adjusted p.p.v.

(C) To determine the vibration level (VdB) based on the rms vibration velocity and to convert the vibration level (VdB) to noise level (dB(A))

(D) To apply other correction factor to adjust for the noise level due to coupling loss, amplification due to resonance of floors/walls/ceilings, and number of equipment

(A) To determine p.p.v. Adjusted for distance

4.2.1.56 According to Section 10.2.2 of HGTNVIA, the peak particle velocity adjusted for distance can be determined as: $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$ $\Leftrightarrow PPV_{equip} \propto (1/D)^{1.5}$

Where PPV_{equip} = p.p.v. of the equipment adjusted for distance
PPV_{ref} = reference vibration level at 25 feet
D = distance in feet

4.2.1.57 A buffer distance is maintained between the FMPHQ Site and the sensitive uses. For piling work near the Main Building on the northern part of the Subject Site, which is expected to have ground-borne noise impact due to hole drilling beyond the bedrock level, the location of the works are even further away. The location of the identified noise source is assumed and shown in Appendix II-2b.

4.2.1.58 Sensitive uses such as the HKCC is located to the south of the FMPHQ Site whereas the HKSM is located further away. The distance between the sensitive uses and ground-borne noise sources and the projected p.p.v. are tabulated below.

[2] High-speed Ground Transportation Noise and Vibration Impact Assessment – US Department of Transportation, Federal Railroad Administration, Office of Railroad Development – December 1998

Table 17 Separation Distance and Predicted Peak Particle Velocity

Noise Sensitive Use	**Main Building Piling Work**			**Tree/Signal Tower Piling Work**	
	Horizontal Distance, m	**p.p.v. (bedrock penetration) (m/s)**	**p.p.v. (no bedrock penetration) (m/s)**	**Horizontal Distance, m**	**p.p.v. (m/s)**
YMCA of Hong Kong	65 ~ 120	3.6×10^{-5} ~ 9.1×10^{-5}	1.9×10^{-5} ~ 4.8×10^{-5}	60 ~ 120	1.9×10^{-5} ~ 5.4×10^{-5}
Marco Polo Hong Kong Hotel	50 ~ 105	4.4×10^{-5} ~ 1.3×10^{-4}	2.4×10^{-5} ~ 7.2×10^{-5}	35 ~ 90	3.0×10^{-5} ~ 1.2×10^{-4}
Hankow Centre	65 ~ 110	4.1×10^{-5} ~ 9.1×10^{-5}	2.2×10^{-5} ~ 4.8×10^{-5}	75 ~ 140	1.5×10^{-5} ~ 3.9×10^{-5}
Bo Yip Building	85 ~ 140	2.9×10^{-5} ~ 6.1×10^{-5}	1.5×10^{-5} ~ 3.2×10^{-5}	140 ~ 200	8.9×10^{-6} ~ 1.5×10^{-5}
HKCC (Concert Hall)	135 ~ 185	1.9×10^{-5} ~ 3.0×10^{-5}	1.0×10^{-5} ~ 1.6×10^{-5}	65 ~ 125	1.8×10^{-5} ~ 4.8×10^{-5}
HKCC (Grand Theatre)	200 ~ 250	1.2×10^{-5} ~ 1.7×10^{-5}	6.4×10^{-6} ~ 8.9×10^{-6}	145 ~ 190	9.7×10^{-6} ~ 1.4×10^{-5}
HKCC (Studio Theatre)	110 ~ 155	2.5×10^{-5} ~ 4.1×10^{-5}	1.3×10^{-5} ~ 2.2×10^{-5}	65 ~ 100	2.5×10^{-5} ~ 4.8×10^{-5}
Hong Kong Space Museum (Recording Studio)	215 ~ 265	1.1×10^{-5} ~ 1.5×10^{-5}	5.9×10^{-6} ~ 8.0×10^{-6}	190 ~ 235	7.0×10^{-6} ~ 9.7×10^{-6}
Hong Kong Space Museum (Sky Theatre)	215 ~ 265	1.1×10^{-5} ~ 1.5×10^{-5}	5.9×10^{-6} ~ 8.0×10^{-6}	190 ~ 235	7.0×10^{-6} ~ 9.7×10^{-6}

(B) To determine RMS Vibration Velocity

4.2.1.59 According to Section 10.2.1 of HGTNVIA, p.p.v. is typically a factor of 2 to 6 times greater than root mean square (rms) vibration velocity; a factor of 4 is adopted to calculate the approximate rms vibration velocity levels. The projected p.p.v. can then be converted to ground-borne noise level according to the formula in Section 6.1.2 of HGTNVIA:

$L_v = 20 \times \log_{10}[\nu/\nu_{ref}]$

where L_v = vibration velocity level in decibels (VdB)

ν = RMS velocity amplitude

ν_{ref} = reference RMS velocity amplitude of 2.54×10^{-8} m/sec

(C) To determine Vibration Level and in turn the Noise Level

4.2.1.60 For low frequency (when vibration spectrum peak is near 30 Hz) and mid frequency (when vibration spectrum peak is near 60 Hz), the correction factors are respectively –40dB and –25dB. In this study, the ground-borne vibration level (VdB) is converted to air borne noise level (dB(A)) by a correction of –25 dB.

Table 18 Predicted Vibration and Noise Levels without Adjustment

Noise Sensitive Use	Main Building Piling Works (bedrock penetration)		Main Building Piling Works (no bedrock penetration)		Tree/ Signal Tower Piling Works	
	RMS Vibration Velocity Level, VdB	Noise Level, dB(A)	RMS Vibration Velocity Level, VdB	Noise Level, dB(A)	RMS Vibration Velocity Level, VdB	Noise Level, dB(A)
YMCA of Hong Kong	63.6	38.6	58.1	33.1	56.2	31.2
Marco Polo Hong Kong Hotel	66.4	41.4	61.0	36.0	63.1	38.1
Hankow Centre	64.3	39.3	58.8	33.8	53.8	28.8
Bo Yip Building	59.5	34.5	54.0	29.0	47.2	22.2
HKCC (Concert Hall)	55.6	30.6	50.1	25.1	55.9	30.9
HKCC (Grand Theatre)	50.9	25.9	45.5	20.5	47.5	22.5
HKCC (Studio Theatre)	58.2	33.2	52.7	27.7	57.9	32.9
Hong Kong Space Museum (Recording Studio)	50.3	25.3	44.8	19.8	44.4	19.4
Hong Kong Space Museum (Sky Theatre)	50.3	25.3	44.8	19.8	44.4	19.4

(D) To apply other Correction Factors

4.2.1.61 According to Table 8-2 of HGTNVIA, the following path/receiver factors are considered applicable and thus included in the calculation:

Table 19 Correction Factor adopted in this Study

Factor Type	Factor	Correction
Path Factor	Coupling to Building Foundation – Large Masonry on Piles	- 10 dB
Receiver Factor	Floor-to-floor attenuation (1 to 5 floors above grade)	- 2 dB/floor
	Floor-to-floor attenuation (5 to 10 floors above grade)	- 1 dB/floor
	Amplification due to Resonance of Floors, Walls and Ceiling	+ 6 dB

4.2.1.62 Finally, the overall noise level is adjusted for the utilisation (maximum of 80%). The following scenarios are assessed with results presented as follows: -

Scenario 1: Concurrent Construction of Retaining Wall for the Main Building and Tree/Signal Tower without Bedrock Penetration

4.2.1.63 According to the preliminary construction programme, there will be concurrent construction of retaining wall for Main Building and Tree/Signal Tower during the first three months of the construction period. Potential ground-borne noise impact within this period has been assessed by summing up effects of the source terms, i.e. the Main Building Piling Works (no bedrock penetration) and Tree/Signal Tower Piling Work. Detailed calculation is shown in Appendix II-2.

Table 20 Predicted Ground-borne Noise Level (Scenario 1)

Sensitive Uses	Predicted Ground-Borne Noise Level, dB(A)	Adopted Noise Criteria, dB(A)
YMCA of Hong Kong	20	65
Marco Polo Hong Kong Hotel	23	65
Hankow Centre	20	65
Bo Yip Building	19	65
HKCC (Concert Hall)	**25**	60
HKCC (Grand Theatre)	18	60
HKCC (Studio Theatre)	21	60
HKSM (Recording Studio)	16	60
HKSM (Sky Theatre)	**18**	60

4.2.1.64 The results are tabulated below and compared with the adopted noise criteria. As observed, the predicted ground-borne noise levels are within the acceptable criteria. For sensitive uses such as the HKCC and the HKSM, the maximum predicted noise levels are 25 dB(A) and 18 dB(A) respectively which are well below the adopted noise criteria and are comparable to the measured background level in Table 15.

Scenario 2: Concurrent Construction of Retaining Wall for the Main Building with Bedrock Penetration and Construction of Retaining Wall for the Tree/Signal Tower

4.2.1.65 Despite the fact that the period when the pipe piles penetrate the bedrock is estimated to account for only 5% of the time, the scenario with concurrent construction of the retaining wall near the Main Building with bedrock penetration and for tree/signal tower has been evaluated.

4.2.1.66 The predicted cumulative noise levels are determined by summing up effects of the source terms – the Main Building Piling Works (bedrock penetration) and Tree/ Signal Tower Piling Work and are tabulated below. Detailed calculation is shown in Appendix II-2.

Table 21 Predicted Ground-borne Noise Level (Scenario 2)

Sensitive Uses	Predicted Ground-Borne Noise Level, dB(A)	Adopted Noise Criteria, dB(A)
YMCA of Hong Kong	24	65
Marco Polo Hong Kong Hotel	26	65
Hankow Centre	25	65
Bo Yip Building	24	65
HKCC (Concert Hall)	**27***	60
HKCC (Grand Theatre)	21	60
HKCC (Studio Theatre)	23	60
HKSM (Recording Studio)	19	60
HKSM (Sky Theatre)	**21**	60

* Ground-borne noise level at the HKCC (Concert Hall) may desirably be attenuated.

4.2.1.67 As observed from the result, the predicted ground-borne noise levels are again within the acceptable criteria. For sensitive uses nearby including HKCC and HKSM, the maximum predicted noise levels are 27 dB(A) and 21 dB(A) respectively which are slightly higher than that in Scenario 1.

4.2.1.68 It is noted that the construction work of the FMPHQ is limited to daytime only. Therefore, it is reasonable to expect that the extent of impact on the residents of the hotel and residential development is less significant. On the other hand, considering the nature of the particularly sensitive uses, an attempt is made to further attenuate the noise impact by careful sequencing of construction work.

4.2.1.69 It is considered that retaining wall construction for tree/signal tower would only last for a very short period and it is practicable to adjust the construction programme to avoid such cumulative impact. To this, the project proponent would allow flexibility by imposing a condition in the future construction contract so that the Contractor responsible for the works should avoid concurrent construction of the retaining wall for tree/signal tower and that for the Main Building while the pipe piles penetrate the bedrock. By implementing this control measures, Scenario 2 and its cumulative impact could be avoided.

Scenario 3: Construction of Retaining Wall for Main Building involving Bedrock Penetration

4.2.1.70 According to the preliminary construction programme, Main Building retaining wall is to be constructed up to October 2004 and hence will last for about 10 months. Based on the control measures recommended above, piling works for the Main Building involving bedrock penetration would be carried out alone without any contribution from other construction works by staggering/sequencing of major noisy activities. The level of noise impact was predicted and is tabulated below and can be regarded as the mitigated noise level for Scenario 2. Detailed calculation is shown in Appendix II-2.

Table 22 Predicted Ground-borne Noise Level (Scenario 3 - Mitigated/Residual Level for Scenario 2)

Sensitive Uses	Predicted Ground-Borne Noise Level, dB(A)	Adopted Noise Criteria, dB(A)
YMCA of Hong Kong	24	65
Marco Polo Hong Kong Hotel	24	65
Hankow Centre	24	65
Bo Yip Building	24	65
HKCC (Concert Hall)	**24**	60
HKCC (Grand Theatre)	19	60
HKCC (Studio Theatre)	20	60
HKSM (Recording Studio)	18	60
HKSM (Sky Theatre)	**20**	60

4.2.1.71 According to the result, the predicted ground-borne noise levels are again within the acceptable criteria. For sensitive uses like the HKCC and HKSM, the maximum predicted noise levels are 24 dB(A) and 20 dB(A) respectively which are well below the adopted standard and are comparable to the measured background level in Table 15.

Discussions

4.2.1.72 Because of limited data available to quantity the source strength that is specific to pipe piles in the present case, the source terms adopted in Section 4.2.1.53 were based on large bored piles and would therefore imply over-estimation.

4.2.1.73 It is noted also that the predicted ground-borne noise under all 3 scenarios would meet the noise criteria derived in Table 16. These were based on the assumptions outlined in the foregoing sections. Yet the assessment methodology is empirical and is subject to uncertainties, in which the correction factor of –10 dB(A) used could be lower at –7 dB(A) (1-2 storey commercial) or more likely to be higher at –13 dB(A) (large masonry on spread footings) according to HGTNVIA. The general rule is that the heavier the building construction, the greater the

correction. The difference that could be reflected in the results can be around ± 3 dB(A), with a likelihood of a more correction applicable. However, it should be noted that the source term adopted for this assessment refers to a condition with weathered rock on bedrock so that the vibration propagation efficiency should be much higher than the normal propagation efficiency assumed in paragraph 4.2.1.56 and therefore the source strength is considered highly conservative. Therefore, even under the worst case with no correction for coupling with building foundations on rock and above normal vibration propagation efficiency in soil, the predicted ground borne noise levels should still be within the respective assessment criteria proposed.

4.2.1.74 Taking both into consideration, a pragmatic approach is to verify the construction induced ground-borne noise at the sensitive uses once the construction activities have been started, most notably at the Hong Kong Cultural Centre (Concert Hall/ Grand Theatre).

4.2.1.75 If predicted values match with the measured ones, there is no need to impose constraints to the concerned construction activities at the FMPHQ site. On the contrary, it shall be made a condition in the construction contract for the FMPHQ that the Contractor should maintain close liaison with the operators of the Hong Kong Cultural Centre and the Hong Kong Space Museum to stagger the hours of works involving the last phase of pipe piles penetrating into the bedrock. It is known that the available hours at the HKCC without performance are 0700 – 0900, 1300 – 1400 and 1800 – 1900.

4.2.1.76 Similarly, in the case of the Hong Kong Space Museum, the available hours without shows would be 0700 – 1300 Monday to Friday, 0700-1100 on Saturday and the whole of Tuesday. However, there may be irregular hours of recording in the making of shows, the Contractor will need to liaise closely with the operator to sort out the available hours, if necessary.

Conclusion

4.2.1.77 Construction noise impact (air-borne and ground-borne) has been addressed and identified no insurmountable issues.

4.2.1.78 With suitable noise mitigation measures, there will be no exceedance of acceptable air-borne noise criteria as presented.

4.2.1.79 Pragmatic noise criteria have been established for control of ground-borne noise caused by construction activities at the FMPHQ based on relevant existing legislations. Results under all 3 scenario can meet this criteria at Leq(30 min) = 60 for HKCC and HKSM and that at Leq(30 min) = 65 for dwellings and hotels.

4.2.1.80 Results of the predicted ground-borne noise indicate that amid the uncertainties in the calculations, it would be prudent to avoid concurrent pipe piles driving near the selected tress when the piles near the Main Building has reached the bedrock level. This would mean no exceedance of 25 dB(A) when it comes to Scenario 2.

4.2.1.81 The Project Proponent is committed to mitigate the ground-borne noise as far as practicable and will have the following measures built in the construction contract: -

- Avoid concurrent pipe piles driving near the tree ring and the Main Building when the pipes near the Main Building is about to penetrate the bedrock;
- Conduct on-site noise measurement at the HKCC and the HKSM when the works at the FMPH commences to verify the level of transmitted ground-borne noise;
- Establish a communication channel with HKCC and HKSM to stagger, if necessary, the ground-borne noise causing construction activities to avoid clashing with hours of performance at both venues.

4.2.1.82 Based on the nature of construction, location and works programme, it is considered that the proposed redevelopment at FMPHQ would not result in any significant cumulative ground-borne noise impact nor air–borne noise impact with the construction of the proposed KSL at nearby sensitive uses.

4.2.2 Operational Phase Impact

Relevant Legislation and Assessment Criteria

4.2.2.1 Under the NCO, the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (TM) specifies the noise standards required to be met at NSRs subject to impact from fixed noise sources.

4.2.2.2 For planning purpose, Table 1A in Annex 5 of the EIAO-TM specifies that the maximum noise level arising from fixed noise sources, measured in terms of Leq(30 min) at the NSRs shall be 5 dB(A) below the Acceptable Noise Level (ANL) for the NSRs surrounding the Subject Site or the prevailing background noise levels for quiet areas with level 5dB(A) below the ANL.

4.2.2.3 The Subject Site is located in an urban area and is bounded by primary and local distributors on three sides. The background noise level has been measured at a location to the south of the Main Building so that it is not directly affected by any fixed noise. The measured background noise level ranges from 53 dB(A) to 61 dB(A)

4.2.2.4 In determining the ANL, appropriate Area Sensitivity Rating (ASR) for NSRs have to be established first. Section 2.3.4 of the TM specifies that the Area Sensitivity Rating depends upon the characteristics of the area in which the NSRs are located. There are four types of areas described in the TM. An ASR "B" was assumed for the Project as it is situated in Urban Area. In other words, the ANLs for daytime and evening time (0700-2300) and night time (2300-0700) are Leq(30 min) 65 dB(A) and Leq(30 min) 55 dB(A) respectively. By comparing the ANL-5 and the background noise level, it is determined that the criteria of 5dB(A) below the ANL should be adopted in accordance with TM-EIA.

4.2.2.5 On the other hand, a Planning Application would need to be submitted under Section 16 of the Town Planning Ordinance (Cap.131) for the granting of permission in respect of the Project. Construction of the Project can only commence after the granting of this permission.

4.2.2.6 Chapter 9 "Environment" of the HKPSG provides guidance for including environmental considerations in the planning of both public and private developments. The same noise criteria would need to be met for the operation of the Project to ensure that its operation would not be adversely affected by potential fixed noise sources nearby.

4.2.2.7 In addition, both the TM-EIA and Chapter 9 "Environment" of the HKPSG explicate noise standards of L_{10}(1 hour) 70 dB(A) for road traffic noise.

4.2.2.8 All these standards are applicable to uses that rely on opened window for ventilation.

Proposed Mitigation Measures

4.2.2.9 The Project will be designed and planned to avoid the generation of any adverse noise impact on the surrounding NSRs by means of proper installation of acoustic barrier/enclosure for the noisy facilities to meet the TM-EIA. All E&M facilities would be shielded and housed in a manner to avoid any unacceptable impact on the surrounding noise sensitive uses such as Hankow Centre. By careful design of the master layout plan, all noisy facilities could either be fully enclosed if practicable or positioned near the western side of the Subject Site with proper at-source shielding especially on the east side. No significant noise impact is therefore anticipated due to operation of the Project.

4.2.2.10 The Project itself should be designed and implemented to such a standard in compliance with relevant criteria as stipulated in relevant technical memorandum under the Noise Control Ordinance and the HKPSG for planning application under the Town Planning Ordinance.

4.2.2.11 It is recommended that the development should be ventilated by air conditioning facilities with proper mitigation measures subject to approval under the Antiquities and Monument Ordinance. The Project will not rely on opened window for ventilation.

4.2.2.12 It is understood that a section of KSL is proposed to be aligned beneath the subject site. The construction and operation of KSL is under planning and will be designed in order to avoid any potential ground borne noise impact during the operation of the project.

4.3 Water Quality Impact

4.3.1 Construction Surface Runoff

Relevant Legislation and Assessment Criteria

4.3.1.1 The Water Pollution Control Ordinance (WPCO) (Cap. 358) enacted in 1980 is the principal legislation controlling water quality in Hong Kong. Under the WPCO, Hong Kong waters are classified into 10 Water Control Zones (WCZs). Statutory Water Quality Objectives (WQOs) are specified for each WCZs. The WQOs for any particular waters, as defined in the WPCO, shall be the quality, which should be achieved and maintained in order to promote conservation and best use of those waters in the public interest.

4.3.1.2 The Technical Memorandum on "Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters" issued under Section 21 of the WPCO defines acceptable discharge limits of effluent to different types of receiving waters. Under the Ordinance, any discharge into a WCZ requires licensing and must comply with the terms and conditions specified in the licence, except for domestic sewage discharged into public foul sewers, and unpolluted water into stormwater drains and river courses.

4.3.1.3 The guidelines for handling and disposal of construction site discharges as detailed in EPD's ProPECC Note PN1/94 "Construction Site Drainage" recommend measures for construction phase wastewater management.

Appraisal of Water Quality Impact

4.3.1.4 Water quality impacts may arise due to site effluent including site runoff and potential washouts, fuel contaminated fluids and improper site housekeeping, especially during the rainy season.

4.3.1.5 Runoff and any discharge will be collected by either existing drainage system or temporary drainage system where necessary. Facilities such as sand traps and oil interceptors may be provided.

4.3.1.6 In general, the Contractor will be required to note and comply with the Water Pollution Control Ordinance and its subsidiary regulations. The Contractor shall carry out the Works in such a manner as to minimise adverse impacts on the water quality during the execution of the Works and rearrange the working method to minimise water pollution within and outside the site area. Potential water quality impact during construction shall be controlled with the following as basic principles:

- Prevent or minimise the likelihood of the identified pollutants being in contact with rainfall or runoff; and
- Measures to abate pollutants in the stormwater runoff.

4.3.1.7 These principles shall be achieved through the implementation of adequately designed water quality control measures as Best Management Practices (BMPs). Relevant pollution control clauses are summarised below:

- The Contractor shall observe and comply with the Water Pollution Control Ordinance and its subsidiary regulation.
- The Contractor shall carry out the Works in such a manner as to minimise adverse impacts on water quality during execution of the works. In particular he shall arrange his method of working to minimise the effects on the water quality within and outside the Site, on the transport routes and at the loading, dredging and dumping areas.
- The Contractor shall follow the practices, and be responsible for the design, construction, operation and maintenance of all the mitigation measures as specified in the Professional Persons Environmental Consultative Committee Practice Note (ProPECC PN) 1/94 "Construction Site Drainage" issued by EPD. The design of the mitigation measures shall be submitted by the Contractor to the Project Engineer for approval.

- The Contractor shall contain within the Site all surface runoff generated from foundation works, dust control and vehicle washing, etc.
- The Contractor shall not discharge directly or indirectly or cause or permit or suffer to be discharged into any public sewer, stormwater drain, channel, stream-course or sea any trade effluent or foul or contaminated water or cooling or hot water without the prior written consent of the Project Engineer in consultation with the Director of Environmental Protection and Director of Water Supplies, who may as a condition of granting his consent require the Contractor to provide, operate and maintain at the Contractor's own expense to the satisfaction of the Project Engineer suitable works for the treatment and disposal of such trade effluent or foul or contaminated or cooling or hot water. The design of such treatment works shall be submitted to the Project Engineer for approval not less than one month before the commencement of the relevant works.
- If any office, site canteen or toilet facilities is erected, foul water effluent shall be directed to a foul sewer or to a sewage treatment and disposal facility either directly or indirectly by means of pumping or other means approved by the Project Engineer.

4.3.2 Operational Phase Impact

4.3.2.1 The sewage/wastewater generated from the Project will be discharged to the nearby public sewers to meet the requirement as stipulated in the Technical Memorandum on Water Pollution Control Ordinance.

4.3.2.2 No adverse water quality impact is anticipated due to the operation of the Project.

4.4 Hazard

Appraisal of Hazard Impact

4.4.1.1 No potential hazardous source is identified nearby which may impose risk impact on the Project. Also, no potential hazard impact is anticipated due to the operation of the Project.

4.5 Waste Management

4.5.1 Construction Phase Impact

Relevant Legislation and Assessment Criteria

4.5.1.1 The principle legislation governing waste management in Hong Kong is the *Waste Disposal Ordinance* (Cap. 354) (WDO), and its subsidiary regulations. The Ordinance, enacted in 1980, generally encompasses all stages of waste management, from place of arising to final disposal point of waste. The *Waste Disposal (Chemical Waste) (General) Regulation*, enacted under the WDO in 1992, provides controls on all aspects of chemical waste disposal, including storage, collection, transport, treatment and final disposal.

4.5.1.2 In addition to the WDO and its subsidiary regulation, the following legislation have some bearing on the handling, treatment and disposal of wastes in Hong Kong, viz.,:

- Dumping at Sea Ordinance (1995);
- Crown Land Ordinance (Cap. 28);
- Public Health and Municipal Services Ordinance (Cap. 132) Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws; and
- Dangerous Goods Ordinance.

Appraisal of Waste Generation

4.5.1.3 Construction of the Project will involve the following key activities:

- Site Formation - the site formation work will involve piling as protection work and excavation activities;
- Foundation Works - the foundation works will involve mini-piling, shallow foundation construction and some excavation activities; and
- Superstructure Construction – this will involve construction of two to three storeys retail building and furnishing of existing buildings.

4.5.1.4 The nature of these construction works is considered similar to other building construction works in the territory. The following waste categories are expected to be generated:

- Excavated Material - will form the major portion of materials generated;
- Construction and demolition waste - quantity is expected to be limited;
- Chemical waste - quantity is expected to be limited; and
- General refuse - quantity is expected to be insignificant.

4.5.1.5 The major source of C&D Material is expected to arise from the excavation activities. A preliminary estimate is 60,000m^3, mainly from excavation activities, which requires off-site disposal. Based on the preliminary construction programme, the maximum daily amount of excavation material to be handled is estimated to be about 1,600m^3/day. Considering the nature of the Project, it is noted that there is limited opportunity for reuse of the excavated materials on-site. It is estimated that approximately 16.7 truckload per hour is required to handle the daily quantity of excavated material for delivery to off-site public filling areas or other reclamation areas.

4.5.1.6 Two ingress and egress points are proposed at the southeast and eastern sides of the Subject Site at Salisbury Road and Kowloon Park Drive and will be separated from that of Kowloon Southern Link. Upon the excavation of the materials, they will be loaded to the trucks for removal. Only limited amount of C&D materials might possibly be stockpiled on-site in a temporary manner. The truck carrying C&D materials will leave the site from the egress at either Salisbury Road or Kowloon Park Drive and transport the materials for disposal at the public filling barging point at Sai Ying Pun for delivering to the Fill Bank at Tuen Mun Area 38 by barge. Fill materials stockpiled in the Fill Bank will be reused for other projects (e.g. reclamation). According to the preliminary estimate, most of trucks will travel along Kowloon Park Drive with only one-third of trucks leaving from Salisbury Road egress travelling along Salisbury Road.

4.5.1.7 Relevant regulations should be observed and followed in all circumstances. Wherever practicable, the production of construction waste should be minimised by the contractor through careful design, planning, good site management, and control of ordering procedures, segregation and reuse of materials. Arrangement could be made for private contractors to collect used formwork materials for reuse.

4.5.1.8 The amount of chemical waste that will be generated from the construction work will depend on the contractor's on-site maintenance intention, age and number of plant and vehicles used. Chemical wastes such as lubricating oil or solvent generated by workers are not expected to be in large quantity, given the nature of the construction activities involved and will be disposed of in strict accordance with the *Waste Disposal (Chemical Waste) (General) Regulation*.

4.5.1.9 Throughout the construction phase, the workforce on the construction site would generate a variety of general refuse requiring disposal. It is expected that these refuse will mainly consist on food wastes, aluminium cans, and waste paper, etc. A reliable waste collector shall be assigned by the Contractor to collect general refuse generated from the construction site on a daily basis to minimise the potential odour, pest and litter impacts.

4.5.2 Operational Phase Impact

4.5.2.1 The Project is expected to generate limited municipal wastes similar to other commercial and tourism facilities during its operational phase. The associated environmental impacts should not be significant. Nevertheless, requirements on proper waste management are to be identified for future implementation.

4.6 Landscape and Visual Impact

4.6.1 General

Relevant Legislation and Assessment Criteria

4.6.1.1 A Planning Application will be submitted under Section 16 of the Town Planning Ordinance (Cap.131) for the granting of permission in respect of the plan. The HKPSG provides guidelines and criteria for determining the scale, location and site requirements of various land uses and facilities and is applied in planning studies, preparation/revision of town plans and developments. The Landscape Master Plan will also be submitted for Town Planning Board's approval under the Town Planning Ordinance (Cap.131). Approval for both of these aspects should be obtained before the implementation of the Project

4.6.1.2 The lease condition concerning tree protection and landscaping issues requires that no tree on the lot shall be removed or interfered without prior written consent from Lands Department who may impose conditions concerning the transplanting of existing trees, compensatory planting and replanting. Moreover, the proponent is required to preserve the mature Banyan Tree situated at the junction of Salisbury Road and Canton Road. A Tree Survey Report, Tree Transplanting / Felling Application and detailed landscaping plan in accordance with the master landscape plan should be submitted to Lands Department for approval. The application will establish the baseline conditions (identify trees with a girth of 300mm or larger), identify the species, dimensions, and condition of each tree. It will then make recommendations for the retention, transplantation or felling of these existing trees to accommodate the scheme proposals to allow impact on the existing trees to be fully assessed. The application will also include details of the proposed compensatory planting proposals. The application will be vetted independently by the Architectural Services Department and Leisure and Cultural Services Department. These Departments will advise Lands Department as to whether the application should be approved. In addition, the proponent should carry out works for the preservation and maintenance of the historic site and for the preservation, restoration and renovation of the historic buildings in accordance with the Concept Plans, the Alteration and Utilities Plans and the Technical Schedule.

4.6.1.3 In addition any felling or planting of trees within the Declared Monument Boundary will require a separate application for a permit under Section 6 of the Antiquities and Monument Ordinance which must be obtained from the Secretary for Home Affairs.

4.6.1.4 Approvals for these applications must be in place prior to the commencement of any site works, which could potentially affect the existing trees.

Existing Condition and Proposed Scheme

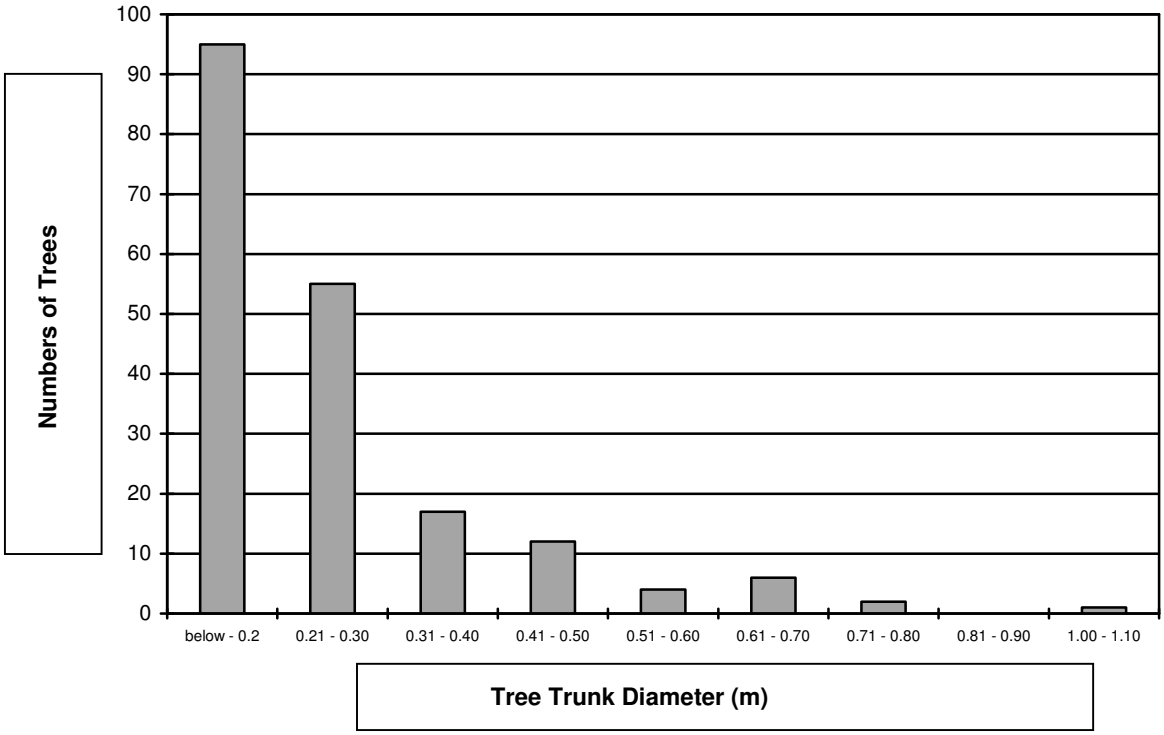
4.6.1.5 The existing landscape character and visual amenity is one characterised by the colonial buildings and the significant trees. However, this landscape character and hence visual amenity is degraded to an extent by the condition of the built structures and the extensive use of shotcrete to retain existing cut slopes.

4.6.1.6 The existing vegetation found onsite includes some 192 trees with some 80% of these being located on the steep cut slopes, which characterize the peripheral areas of the site. Appendix III-2 shows the location of the existing trees within the site with the main concentrations of trees being located on the cut slopes along Canton and Salisbury Roads and on the slopes to the north and west of the old Fire Station at Salisbury Road and Kowloon Park Drive. The site contains a wide variety of species, many of which are common species, both native and exotic, typically found in Hong Kong. Appendix III-1 lists the range of species found on site. No rare or protected species were identified.

4.6.1.7 The majority of trees on site are small with a diameter of less than 0.3 metres (approximately 50% less than 0.2 metres and a further approximately 29% less than 0.3 metres in diameter). The table below shows the size distribution of the trees found on site. This relatively small size profile also accounts for the 74 additional trees identified on site compared to the tree survey prepared as part of the *Study on Development Opportunities of the Former Marine Police*

Headquarters Site in Tsim Sha Tsui, which was provided by government as part of the tender documentation. The existing trees are generally from average to poor in condition with many exhibiting a average to poor form due largely to their growing conditions, i.e. grouped together on slopes competing for space and light, which has resulted in contorted and leaning trunks, unbalanced crowns and small size.

Table 23 Tree Size Distribution



4.6.1.8 The preliminary tree survey also identified six 'Very Important Trees' (VIT) under PWSCI (2003-04). Appendix III-3 provides the details of the VIT identified on site and their identification numbers related to the photographs contained in Appendix III-8. These VIT have a good to average form and largely high to medium amenity value although one has a low amenity value.

4.6.1.9 A Champion Tree, (recorded as tree number 248, *Phoenix dactylifera* in 'Champion Trees in Urban Hong Kong' published by the Provisional Urban Council in 1994) was found to be missing in the initial tree survey prepared for the Study on Development Opportunities of the Former Marine Police Headquarters Site in Tsim Sha Tsui undertaken by Planning Department in June 2001.

4.6.1.10 The successful Tender Scheme is characterised by three main elements: the heritage building, Grand Piazza and retail facilities. The Landscape Master Plan in Appendix III-5 shows the design of the landscape proposals and the artist impressions presented as Appendix III-6a-c provides preliminary views of the future appearance of the development. The proposed design seeks to retain the heritage character of the site while becoming more accessible to pedestrians and opening up views towards the main heritage buildings. The four main considerations from an urban design and landscape perspective were the permeability of the site, the utilisation of active frontages at street level, the creation of an important civic space and the implementation of a green corridor effect along Canton Road / Salisbury Road.

Permeability	The visual and physical permeability of the site are key to the design of the Tender Scheme. The most successful urban spaces are easily accessible to pedestrians and it is this quality, which the design seeks to emulate. This is important in terms of the sites accessibility at street level, particularly from Salisbury Road and Canton Road. Visual access to the site and its main heritage structures is also extremely important in that their appearance contributes to the urban character of the local area enhancing its sense of history. In addition pedestrians experience their journey through a city as a series of landmarks and opening the façade of the heritage building to views creates an important landmark between the Star Ferry and future piazza, and the attractions of Nathan Road and beyond. To achieve this sense of physical and visual permeability, it is important that access to the site and the main spaces is at street level and so the Tender Scheme incorporates pedestrian access directly from Salisbury and Canton Roads. This will involve the removal of the knoll to the south of the site. The physical form of the existing site will be recreated to an extent by the architectural design, which was the basis of the successful Tender Scheme.
Active Frontages	The existing street level around the periphery of the site is characterised by retaining walls and cut slopes which severely restrict the area available to pedestrians and create spaces which are not pedestrian friendly particularly at night. To overcome this, the successful Tender Scheme incorporated wider pavement areas along Canton Road and Salisbury Road, and created active frontages (retail facilities) at the pedestrian level, which increase the areas sense of vibrancy and create an inviting space in which pedestrians will want to dwell. This active frontage principle is also extended to the retail facilities, which enclose the Grand Piazza, and in both areas creates a safer environment for pedestrians during the hours of darkness.
Civic Open Space	The proposed Grand Piazza will also provide an important civic open space within the urban fabric of Tsim Sha Tsui. This open space will form part of the existing and future open space network with links to the existing space associated with the Hong Kong Cultural Centre and the future plaza to the north of the Star Ferry terminal. This space will form the setting for an al fresco dining and café experience in addition to forming a venue for future cultural functions and forums. The overall open space proposals for the site are presented as Appendix III-9.
Green Corridor Effect	The successful Tender Scheme seeks to create a green corridor effect along both Canton Road and Salisbury Road. This is achieved through the proposed planting of street trees and the widening of the existing pedestrian pavement providing a boulevard type character to the future streetscape. These trees will also a green continuum being visually linked with the retained VIT within the site when viewed from the pedestrian level. These proposals will enhance the existing streetscape character.

4.6.2 Evaluation of Construction Phase Impact and Proposed Mitigation Measures

4.6.2.1 The development at the FMPHQ will inevitably result in temporary adverse landscape and visual impacts during the construction phase due to the excavation works required to accommodate the proposals.

4.6.2.2 A decorative hoarding will be erected around the periphery of the site to screen the temporary construction works from the local low level visually sensitive receivers particularly pedestrians on Canton and Salisbury Roads, and Kowloon Park Drive. The proposed hoarding would provide a unified edge treatment and interface between the construction site and its landscape context.

4.6.2.3 The construction of the proposed development at the former MPHQ will inevitably affect the existing trees. Wherever possible the proposals have sought to retain the existing trees which contribute most to the landscape of the site in-situ and where this is not possible transplant trees to a new location. It is anticipated that some of the trees identified for transplantation with the best form, condition and amenity value can be relocated to the area immediately south of retained tree T96 on the western side of the site. The proposed treatment of the existing trees is determined by a number of factors including their growth condition (very few are in good condition), predicted survival rate after transplanting (based on the species, size and form (the majority of the species identified have a predicted medium to low survival rates)), amenity value (many trees exhibit a contorted form), the practicalities of redeveloping a spatially constrained site, the future architectural and landscape character of the design proposals (recreating the colonial splendour of the site and achieving an international standard of design) and opening of the site including the main colonial façade to views (this is important to both the recreation of the historic setting and improving our appreciation of the façade). In cases where transplantation is not considered viable due to the trees poor form, low amenity value and growth condition being located on the slopes then compensatory planting is proposed. A Tree Survey Report and Transplanting / Felling Application, will be prepared to identify trees to be preserved and provide justification for those identified for transplantation or felling, this form the basis of the application of the tree felling permit.

4.6.2.4 The successful tender scheme has been designed to accommodate and retain five of the six VIT identified on site. These trees with their large crowns contribute most to the landscape character of the site, its visual amenity and the setting of the main heritage buildings. However the implementation of the successful tender proposals will have an impact on the existing trees although those affected are largely made up of the small trees described above in paragraph 4.6.1.7 including the 74 additional trees identified. The impacts on the existing trees are described below with the site being zoned in three areas: the area affected by the widening of Canton Road, the area within the Declared Monument Boundary and the adjacent slopes affected by the proposals. Appendix III – 4 shows the extent of the three zones.

Area affected by the widening of Canton Road

4.6.2.5 The widening of Canton Road in isolation would lead to the removal of the existing access ramp along the western periphery of the site and the upgrading of the adjacent slope works and retaining wall to current safety standards. There are three alternative methods for the upgrading of the existing slope works and retaining wall either open cut, a cantilever structure or soldier piles, all of which will require extensive modification to the existing slope and hence impact on the existing trees. Generally the approximately 59 existing trees are small in size and exhibit poor form due to their age structure and their growth in close proximity to one another. However the significant Banyan trees numbers T66 and T67 located at the corner of Canton Road and Salisbury Road, and T96 located on the western periphery of the site will be retained as part of the overall landscape proposals (see photos in Appendix III-8). Given the requirement for these upgrading works including grouting and soil nailing approximately eight trees would require transplantation.

Area within the Declared Monument Boundary

4.6.2.6 Of the 58 trees within the Declared Monument Boundary (the area forming the basis of the Designated Project under Schedule 2 of the EIAO) 11 trees will be retained including the two existing VITs (VIT 10 and VIT 54) within the development proposals. The photographs in Appendix III-7 demonstrate the importance of these trees to the landscape setting and visual amenity of the site. However the development will require the transplantation of some 17 trees.

4.6.2.7 The photograph of T128 above demonstrates that a number of trees not identified as VITs have also been retained reflecting their contribution to the landscape character of the site and in forming the landscape setting for the historic structures.

Area at the adjacent slopes

4.6.2.8 The existing slopes to the north and west of the former Fire Station, to the north of Salisbury Road and on the existing cut slope to the north west of the site contain some 75 trees. Again the growth condition of these trees is demonstrated in their generally poor form and amenity value. Therefore with the implementation of the successful Tender Scheme some two trees would be transplanted. Five trees including three large trees, which are not VITs, have been identified for retention which make an important contribution to the landscape character of the site and that of Canton Road. These trees, T120, T121 and T122, are shown in the photographs in Appendix III-8.

4.6.2.9 The tree recommendations made as part of the successful Tender Scheme were based on the original government survey, however as has been described above this survey was preliminary in nature and was subject to a detailed site survey to ascertain the exact location of the trees. Therefore as a result some of the original tree recommendations have proven to be no longer practicable. These include for instance ten trees which were originally identified for retention or transplantation which cannot now be retained. The reasons for this include the inaccuracies in the original tree location information leading to conflicts with the successful Tender Scheme, the growth of trees on existing structures such as free standing walls which are required to be removed as part of the development of the site, safe access in terms of the preparation and lifting of existing trees identified for transplantation and the predicted survival rate of large trees given their growth on slopes and, current health and condition. The architectural conservation measures required for the southern façade of the main heritage building will also require the transplantation of eight trees originally identified for retention in-situ, however a planting bed will be re-established in this location following the completion of the construction works. The review of the recommendations for the existing trees has also identified two trees originally recommended for felling which can now be transplanted.

4.6.2.10 These figures for the treatment of the existing trees are subject to the findings of the approved detailed tree survey and felling application.

4.6.2.11 During the construction phase of the project the trees identified for retention within the project limit will be protected through the implementation of the following measures:

- Creation of a ‘precautionary area’ based on half the diameter of the canopy around the base of all trees identified for retention. The fencing shall be erected prior to the commencement of the construction phase operations and remain in place until the completion of this phase;
- Prohibition of the storage of materials including fuel, the movement of construction vehicles, and the refuelling and washing of equipment including concrete mixers within the precautionary area;

- Phased segmental root pruning for trees to be retained and transplanted over a three month period prior to lifting or site formation works, which affect the existing rootball of trees identified for retention. The extent of the pruning will be equal to half of the spread of the canopy although wherever possible the potential for extending the diameter of the proposed rootball will be explored during the detailed design stage of the project;
- Pruning of the branches of existing trees identified for transplantation and retention to be based on the principle of crown thinning maintaining their form and amenity value;
- The watering of existing vegetation particularly during periods of excavation when the water table beneath the existing vegetation is lowered;
- The rectification and repair of damaged vegetation following the construction phase to it's original condition prior to the commencement of the works or replacement using specimens of the same species, size and form where appropriate to the design intention of the area affected;
- All works affecting the trees identified for retention and transplantation will be carefully monitored. This includes the key stages in the preparation of the trees, the implementation of protection measures and health monitoring through out the construction period; and
- The tree transplanting and planting works should be implemented by approved Landscape Contractors and inspected and approved on site by a qualified Landscape Architect. A tree protection / transplanting specification would be included within the contract documents.

4.6.3 Evaluation of Operational Phase Impact and Proposed Mitigation Measures

4.6.3.1 The trees, which contribute most to the visual amenity of the site and form the landscape setting for the buildings were identified for retention early in the design of the Tender Scheme. These trees identified on the Landscape Master Plan (Appendix III-5 refers) largely conform to the VIT (Appendix III-3 refers) and the project proponent has designed the architectural layout to accommodate these large trees despite the tremendous technical challenges.

4.6.3.2 The VIT will be retained using a pipe pile wall method with a solid core containing the trees root ball extending to the bed rock below (Appendix III–7 refers). The core will be equal to approximately half of the existing trees canopy therefore for tree T54 located in the centre of the site the preserved rootball will be approximately 10m in diameter. However T10 will also require undercutting with horizontal piles to allow the creation of the proposed vehicular access from Kowloon Park Drive and the construction of the X,Y, Z.

4.6.3.3 The retention of the VIT includes the mature Banyan tree (numbers T66 / T67 which includes two trees considered as one due to their proximity and the nature of their root growth) located at the corner of Canton and Salisbury Roads. Of these the tree closest to the edge of the existing rock formation was identified for preservation in the general Conditions of Sale Preservation of Trees (18) (b). The retention of these trees will involve the preservation of the existing rock outcrop on which the trees are currently growing with the extent of the retained rock being dependent of the extent of the existing roots which will be determined during the initial site investigation.

4.6.3.4 This retention of a number of significant trees within a site which contribute most to the landscape and visual amenity of the site, and their sensitive incorporation within the architectural design proposals is relatively unique in Hong Kong and reflects the importance of these trees to the sites historical setting.

4.6.3.5 The overall predicted operational landscape and visual impacts are acceptable given the adoption of the following mitigation measures (refer to the proposed Landscape Master Plan, Appendix III-5):

- The restoration of the main buildings and the proposed creation of landscaped gardens will enhance the landscape character and quality of the area;

- The creation of the plaza to the south of the main colonial buildings will significantly increase public access to the site and open up views of the building façade;
- New street planting along Canton Road where conditions allow, from No. 1 Peking Road to the intersection with Salisbury Road, and along the Salisbury Road frontage. This planting will create a boulevard type landscape with a 3m clear footway, partially screen the development, and enhance the green edge effect that is a dominant feature of both the existing site and its urban context;
- At the street level, the new paving works that are required as a result of the development and the widening of Canton Road will lead to a significant improvement in the landscape and visual amenity of the streetscape within the study area; and
- Detailed landscape and tree preservation proposals will be submitted to the relevant government departments for approval under the lease conditions and in accordance with WBTC number 14/2002.

4.6.3.6 The implementation of the successful Tender Scheme will:

- **Rehabilitate the site** restoring the existing built structures;
- **Aesthetically upgrade the unsightly cut slopes** which characterise the existing site boundary;
- Provide an **enhanced architectural and landscape setting** for the historic structures;
- Allow **greater pedestrian access** from Salisbury Road and Canton Road; and
- **Enhance views** towards the decorative main building facade.

4.6.3.7 These measures will enhance the sites inherent urban landscape character and views of the site both at a pedestrian level from adjacent footpaths and in elevated views from the surrounding buildings.

4.6.3.8 It is a statutory requirement under Section 16 of the Town Planning Ordinance to adequately address the potential landscape and visual impact before the granting of the approval. All landscape and visual mitigation works will be funded, implemented managed and maintained by the project proponent. A qualified or registered landscape architect will be involved in the design, construction supervision and monitoring, and maintenance period to oversee the implementation of the recommended landscape and visual mitigation measures including the tree preservation and landscape works on site.

4.7 Cultural Heritage Impact

4.7.1 Relevant Legislation

4.7.1.1 All monuments within the site will be preserved to an extent given in the tender requirements. This, with respect to the monument building, includes preservation, maintenance, repair, restoration and renovation.

4.7.1.2 The Subject Site contains a Declared Monument Site in which the former Marine Police Headquarters (FMPHQ) Compound was gazetted under the Antiquities and Monuments Ordinance (Cap. 53) on December 14, 1994. The FMPHQ Compound includes an inventory of historic buildings, artefacts and landscape features:

(1) The Historic Buildings comprises:

(a) Main Building

(b) Stable Block

(c) Signal Tower

(d) Accommodation Block of the Former Fire Station and

(e) Main Building of the Former Fire Station

(2) The retaining wall along Canton Road constructed of Historic Granite Stonework Blocks and

(3) The historic Disused Tunnels and their Portals that lead to the underground areas of the site.

4.7.1.3 Under Section 6 of the same Ordinance, necessary permits need be granted from Secretary for Home Affairs (SHA) for any construction and maintenance work within the site of cultural heritage.

4.7.2 Main Principles of Preservation

The Historic Buildings

4.7.2.1 The Historic Buildings will be preserved in-situ, repaired, restored and maintained to the satisfaction of SHA or the Antiquities and Monuments Office (AMO) as he designated.

4.7.2.2 Detailed survey on the condition of the Historic Buildings including photographic and cartographic recordings will be conducted and submitted to the AMO for their approval before commencement of any works in the Historic Buildings.

4.7.2.3 Alteration or addition works to the Historic Buildings will be reversible except those considered to be minor by AMO.

4.7.2.4 The identified historic items within the interiors will be preserved and repaired to maintain the historic integrity of the Historic Buildings and to the satisfaction of the SHA or the AMO as he designated.

Retaining walls and Tunnels

4.7.2.5 The identified historic granite stonework blocks along Canton Road will be removed in whole upon demolition of the retaining wall and reused elsewhere on the Site or delivered to the Government as appropriate and to the satisfaction of SHA or AMO as he designated.

4.7.2.6 The Disused Tunnels will be excavated, exposed and part of the tunnel will be recorded in photographic and cartographic means. The recordings will be submitted to AMO for record purposes.

4.7.3 Impact Assessment

4.7.3.1 The historic integrity of the individual buildings and historic site are the identified receivers for impacts assessed. The impacts can be classified as Construction Phase and Operational Phase.

Construction Phase

4.7.3.2 The impact in the Construction Phase derives from the reversible alterations and additions within the Historic Buildings. The alterations shall include the removal of designated partitions and walls as delineated and specified in the Tender Document for the subject Site. Other alteration and additions are subject to SHA's approval and to be reversible to the original state as necessary.

4.7.3.3 The impact in the Construction Phase also derives from the site works associated with the development. The site works are considered a process of necessary transformation of the Site. The protection proposals for these works will be submitted to AMO for approval under the permit application mechanism.

Operational Impact

4.7.3.4 The impact in the operational phase derives from the daily operation of new uses within historic buildings and site as well as their natural ageing in time.

4.7.4 Mitigation Measures

Before and during Construction Phase

4.7.4.1 A detailed study report comprising the historic archives, measured drawings, photographic records and full bibliography in support of the historic evidence prepared by experts in cultural heritage will be submitted to AMO for their approval.

4.7.4.2 Before commencement of works, detailed descriptions, plans for building and mitigation works and implementation programme will be submitted to AMO for their approval and monitoring.

4.7.4.3 The Historic Buildings will be preserved to meet international standard. Relevant legislations, standards, Charters and planning guidelines will be observed.

4.7.4.4 Alteration or addition works to the Historic Buildings will be reversible except those considered to be minor by AMO.

4.7.4.5 All necessary precautions during construction and excavation work will be taken to prevent any damage to the Historic Buildings. Structural monitoring system will be designed and supervised by a Registered Structural Engineer during the whole of construction works on the site.

4.7.4.6 Principles contained in the Charter of Venice (ICOMOS) and the Burra Charter (ICOMOS Australia) would be observed.

4.7.4.7 The acceptability of the mitigation measures described above as well as other possible mitigation measures is governed under the Antiquities and Monuments Ordinance so that detailed assessment will be prepared and submitted for approval before commencement of work under the same Ordinance. As paragraph 1.2.1.3 mentioned, conditions which would be imposed through other applicable ordinances or regulations shall not normally be imposed in environmental permits issued under the Environmental Impact Assessment Ordinance.

Operational Phase

4.7.4.8 A comprehensive management plan including a heritage building maintenance guideline for the operation of FMPHQ would be prepared by conservation experts.

4.7.4.9 Periodic site inspection to heritage buildings on external areas, interior decoration and covered-up areas to ensure a constant monitoring of building condition is conducted.

4.7.4.10 The Permit on routine maintenance would be applied to AMO under the A & M Ordinance.

4.7.5 Conclusion

4.7.5.1 With the implementation of the mitigation measures as proposed and approved by AMO, the MPHQ can be properly preserved and transformed into beneficial uses. With the identified impacts being addressed, the Project Profile regarding the Development is considered to be acceptable in the view of heritage conservation.