Hong Kong Housing Authority

Agreement No. CB20120293 Planning and Engineering Study for the Public Housing Site and Yuen Long Industrial Estate Extension at Wang Chau

Final Technical Report No.2 (TR-2) Option Generation, Evaluation and Preliminary Assessments

REP-008-01

September 2013

IMPORTANT – CONFIDENTIALITY

This project and study shall be kept confidential and any information contained in and/or related to the project/study shall not be disclosed to any person not involved in the project/study.

Job number 226464

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1 INTRODUCTION

1.1 Project Background

As stated in the Chief Executive's 2011-12 Policy Address, the Administration is committed to expanding the land resources and increasing housing land supply. To meet this policy objective, the Planning Department (PlanD) has carried out a comprehensive review of the areas zoned "Green Belt" (GB) on the Outline Zoning Plans (OZPs) focusing on sites which are no longer green or spoiled. A number of "GB" and "Open Storage" (OS) sites in Wang Chau, Yuen Long were identified as having potential for public housing (PH) development.

Subsequently, the Innovation and Technology Commission (ITC) and the Hong Kong Science and Technology Parks Corporation (HKSTP) advised of the need to expand the Yuen Long Industrial Estate (YLIE), in addition to the existing three Industrial Estates (IEs) at Tai Po, Tseung Kwan O and Yuen Long. It was requested to use a portion of the Wang Chau potential housing site for this purpose.

After due consideration, an agreement was reached between the Housing Department (HD) and ITC to share the 34.4 hectares (ha) site (the Site), tentatively with the northerly portion, around 16 ha in size, to be allocated for the YLIE extension (YLIEE), while the remaining 18.4 ha in the south would be developed for public housing use (**Figure 1.1.1**). It was further agreed that no Potential Hazardous Installations (PHIs) would be located at the YLIEE so as to minimize the potential adverse impact on the neighbouring PHD.

Ove Arup & Partners Hong Kong Limited (Arup) was commissioned by Hong Kong Housing Authority (HKHA) under entrustments from the Government of the Hong Kong Special Administrative Region (HKSAR) & Hong Kong Science and Technology Parks Corporation (HKSTP) to conduct the Planning and Engineering Study for Public Housing Site and YLIEE at Wang Chau (the Study), which will examine the feasibility on developing public housing and YLIEE at Wang Chau by conducting planning, engineering and environmental assessments to formulate proposal for the PH site and YLIEE, and the implementation strategies and programme for the PHD. The consultancy has commenced on 31 July 2012 and is scheduled for a period of 36 months.

1.2 Objectives of the Assignment

The overall objective of the Study is to examine the feasibility of PH and YLIEE sites at Wang Chau, taking into account the environmental, planning, urban design, traffic and transport, geotechnical, foundation, landscaping, sewerage, drainage, water supply and other engineering/infrastructure matters, air ventilation, socio-economic, financial, provision of Government/Institutional and Community (G/IC) facilities, open space, recreation and retail facilities; formulate and evaluate different development options as well as identify the preferred option; recommend optimal and practicable development schemes with parameters; propose necessary infrastructure upgrading works with schematic design; and prepare an implementation programme.

The Study will form the basis for implementation of the PH and YLIEE sites under the rezoning and Environmental Impact Assessment Ordinance (EIAO) (Cap. 499) processes.

Specifically, the objectives of the Study are set out as follows:

- identify opportunities, constraints and key issues confronting the public housing project and YLIEE, and highlight the problems that might affect their overall development;
- formulate development options and carry out preliminary feasibility assessments to derive practicable development parameters and schemes for the public housing project and YLIEE;
- formulate land use proposals and delineate development boundaries for the PHD, YLIEE and other associated infrastructures and facilities;
- evaluate the development options against a set of clearly defined principles, objectives and associated performance criteria as agreed with the Director's Representative;
- confirm the feasibility of the public housing project and YLIEE and associated infrastructures and facilities by undertaking a series of technical assessments including traffic and transport, sewerage, drainage, water supply, utilities, geotechnical, slope stability and site formation works, foundation, urban design, landscape and visual, air ventilation, natural terrain landslide hazard, hazard potential of industrial installation, land contamination, ecology and cultural heritage etc;
- confirm the environmental acceptability of the PH and YLIEE sites as well as the associated infrastructure works by conducting comprehensive environmental studies which shall include (i) Environmental Assessment Study (EAS) for confirming the environmental acceptability of the proposed developments, particularly the proposed housing development which is subject to environmental impact from the existing and planned developments and environment in the vicinity, (ii) Land Contamination and Remediation Assessment with carrying out the necessary site investigation (SI) and laboratory testing (LT) for the assessment; and (iii) Environmental Impact Assessment (EIA) for confirming the environmental acceptability of the impact arising from the proposed developments, particularly YLIEE on the existing developments and proposed developments, including the proposed housing development, in the vicinity; whereas the EIA shall include, inter alia, cultural heritage impact assessment and ecological impact assessment; the EIA shall be carried out for, but not limited to, the following designated projects:
  - this planning and engineering study for the Site under Schedule 3 of EIAO;
  - YLIEE under Schedule 2 of EIAO; and
  - any other facilities, works and projects identified in the Study for supporting the PH and/or YLIEE sites and falling within Schedule 2 or 3 of EIAO.
- formulate a strategy for public consultation/engagement and undertake the public consultation/engagement accordingly; explore good development concepts from the community, and gauge public feedback through the public consultation/engagement activities;

- recommend practicable and cost effective measures to mitigate the constraints and problems identified, including but not limited to environmental mitigation, geotechnical works, slope works, site formation works, natural terrain hazard mitigation works, road and infrastructural works required for the proposed PH and YLIEE sites, as well as innovative approaches to deal with the interface problem between public housing and YLIEE;
- provide recommendations on site formation works, natural terrain hazard mitigation works, slope works, road works and other infrastructure works, G/IC facilities as well as alternative mitigation measures to suit the proposed schemes with schematic design to be shown on plans and sections in enough details to demonstrate their feasibility to the satisfaction of the relevant departments and authorities;
- carry out preliminary design of the engineering works to cope with the development of the Site with preparation of schematic layout plans and preliminary engineering study to facilitate detailed design of these engineering works to proceed after this Study;
- carry out SI and LT where necessary and conduct preliminary engineering study, geotechnical assessment, natural terrain hazard study and the necessary mitigation measures for the proposed development and the required infrastructure so that the detailed design can be proceeded immediately after this Study;
- facilitate timely implementation of the sites and infrastructure developments by recommending a suitable implementation programme/framework including implementation packages, land requirement and rehousing;
- examine and advise the financial implications of the site developments, including land resumption and clearance costs, as well as infrastructure costs;
- facilitate rezoning of the sites for public housing use and IE use;
- provide support to fulfil the requirement of EIAO for implementation of the engineering feasibility study and designated projects under EIAO and to prepare all necessary reports, documents and materials for the EIAO process and associated public consultation and presentations.

1.3 The Study Area

The PH and YLIEE sites at Wang Chau are zoned GB and OS on the Ping Shan OZP No. S/YL-PS/14. It is currently occupied by OS, vehicle parks, farmland, fallow land, grassland, rural residential dwellings and temporary structures.

The Study Area is bounded by Shan Pui River to the east, Wang Tat Road and Long Tin Road to the south, covering Kai Shan in the west, and Ng Uk Tsuen in the north as indicated in **Figure 1.1.1**. The boundaries for feasibility assessments may not be confined to the Study Area and may need to extend to take account of the relevant conditions/impacts outside the Study Area for the satisfactory completion of the Study. The exact boundary and coverage of the sites for the PH development and YLIEE and the associated infrastructures/facilities for the developments (i.e. the Project site) will be reviewed, defined and refined in this technical report.

1.4 The Study Assignment

The Study is divided into two phases, namely Phase 1- Technical Feasibility Study Stage and Phase 2 - Public Consultation, Rezoning and EIAO Stage. Phase 2 Study will have two options, namely Phase 2A - Public Consultation, Rezoning and EIAO Stage for both PH site and YLIEE site and Phase 2B – Public Consultation, Rezoning and EIAO Stage for PH site only.

Phase 2A Study covers the services for the overall development option with both PH site and YLIEE site to proceed for further study after Phase 1 Study. Phase 2B Study is an alternative development option with only the PH site to proceed for further study after Phase 1 Study, i.e. YLIEE will not be further pursued.

The assignment of the Study will include the following main tasks at each phase:

Phase 1 -Technical Feasibility Study Stage

- Task 1 – prepare an inception report for the Study;
- Task 2 – establish a baseline profile of the Study Area and its relationship with the adjoining areas and conduct a review of the issues that affect the sites;
- Task 3 – establish guiding principles and formulate initial options for the public housing project and YLIEE with reference to the baseline profile under Task 2 above and target industry sectors;
- Task 4 – carry out preliminary feasibility assessments of various aspects to demonstrate the feasibility of the initial development options;
- Task 5 – evaluate the initial development options against the pre-determined criteria and derive a preferred development option for the public housing project and the YLIEE;
- Task 6 – update/undertake planning and technical assessments as well as EAS and EIA to confirm the feasibility of the preferred development option;
- Task 7 – conduct a financial assessment/appraisal of the development, comprising separately for the housing development and YLIEE; and to give a recommendation on whether each portion of the project is viable;
- Task 8 – prepare the Preliminary Outline Development Plan (PODP) together with the Preliminary Urban Design and Landscape Plan (PUDLP) and Preliminary Master Layout Plan (PMLP) for the proposed developments with recommended plot ratio, population, height restriction, block no. and storeys etc.;

Phase 2A or Phase 2B- Public Consultation, Rezoning and EIAO Stage

- Task 9 - conduct a public consultation/engagement on the PODP;
- Task 10 – refine relevant assessments conducted in Phase 1 in the light of the outcome of the public consultation/engagement giving rise to a revised development options and prepare the Recommended Outline Development Plan (RODP) together with the Recommended Urban Design and Landscape Plan (RUDLP) and Recommended Master Layout Plan (RMLP) for the proposed developments;
- Task 11 – examine the implementation mechanism, approaches and framework for the implementation of the proposed developments, provide details of land requirement to assess the broad cost and revenue for the

developments, associated infrastructure/facilities and land acquisition and prepare outline development programme;

- Task 12 – facilitate rezoning of the sites for public housing use, IE use and other associated uses (for Phase 2A or 2B Study where applicable);
- Task 13 – advise and assist the Employer to fulfil the requirement of EIAO for implementation of the engineering feasibility study and designated projects under EIAO;
- Provide the required technical input for Government to prepare the project definition statement(s) and technical feasibility statement(s) to create Category C and/or B items for individual associated/infrastructural projects for implementing the developments; conduct preliminary environmental review of non-designated projects;
- Task 14 – prepare a Final Report, Executive Summary for the Study.

1.5 Purpose of this Report

This Technical Report (TR-2) is to formulate the initial development options for the PH site and YLIEE site, carry out a preliminary feasibility assessment, evaluate the initial development options and recommend a preferred option for the PH site and YLIEE site. According to Clause 5.3 of the Brief, this report should comprise the following aspects:

- establish a set of guiding principles for formulating initial development options to address the key issues, make best use of development opportunities and take into account all aspects required to be addressed in the preliminary feasibility assessment;
- generation of not less than four development options (indicative layouts for the P&E study);
- undertake preliminary feasibility assessments of the initial options on such aspects as environment, traffic and transport, infrastructure, geotechnical, slope works, natural terrain hazard, site formation works, foundation works, land requirement, air ventilation, urban design, visual, landscape, sustainability and other aspects, etc to demonstrate the feasibility of the initial options and to compare/evaluate the relative strengths and weakness of the initial options. Such assessments shall be accompanied by recommendations on any necessary improvement works and mitigation measures, where appropriate;
- amend and refine the initial development options on the basis of the findings of the preliminary feasibility assessments;
- The development options shall be evaluated against the pre-determined criteria so that the relative performance of each element of the options could be compared and the overall options could be ranked for formulation of the preferred option.

1.6 Structure of this Report

The structure of this Technical Report is as follows:

Section 1 Introduces the project background, objectives and the main tasks of the Study, as well as the purpose of this report.

Section 2 Presents the site analysis, the key elements and the guiding principles considered in formulation of the initial development options, and criteria for evaluation of the different development options.

Section 3 Presents the preliminary assessment and evaluation of the initial development options with respect to planning, urban design, land matter and air ventilation aspects.

Section 4 Presents the preliminary assessment and evaluation of the initial development options with respect to engineering and infrastructure aspects.

Section 5 Presents the preliminary assessment and evaluation of the initial development options with respect to environmental impacts.

Section 6 Summarises the option evaluation and recommends the Preferred Option.

Section 7 Conclusion.

1.7 Nomenclature and Abbreviations

The following section lists out the abbreviated titles of Government bureaux, departments, offices, statutory bodies and public organizations mentioned in this report:

AFCD	Agriculture, Fisheries and Conservation Department
AMO	Antiquities and Monuments Office
CLP	China Light and Power
DSD	Drainage Services Department
EPD	Environmental Protection Department
GEO	Geotechnical Engineering Office
HD	Housing Department
HGC	Hutchison Global Communications
HKCG	Hong Kong and China Gas Company
HKHA	Hong Kong Housing Authority
HKSAR	Hong Kong Special Administration Region
HKSTP	Hong Kong Science and Technology Parks Corporation
HyD	Highways Department

IUCN	International Union for Conservation of Nature
ITC	Innovation and Technology Commission
MTRCL	Mass Transit Railway Corporation Limited
PRDEZ	Pearl River Delta Economic Zone
PlanD	Planning Department
USEPA	United States Environmental Protection Agency
WSD	Water Supplies Department

The following section lists out the meaning of abbreviation for expressions adopted in this report:

ADWF	Average Dry Water Flow
ANL	Acceptable Noise Level
API	Aerial Photograph Interpretation
AQO	Air Quality Objective
ASR	Air Sensitive Receiver
ATWTW	Au Tau Water Treatment Works
AVA	Air Ventilation Assessment
BOD	Biological Oxygen Demand
C&D	Construction and Demolition
CA	Conservation Area
CDA	Comprehensive Development Area
COD	Chemical Oxygen Demand
DFC	Design Flow to Capacity
DM	Declared Monuments
DO	Dissolved Oxygen
EAP	Emergency Access Point
EIA	Environmental Impact Assessment
EIAO	Environmental Impact Assessment Ordinance
ENTLI	Enhanced Natural Terrain Landslide Inventory
EP	Environmental Permit
EPS	Effluent Polishing Scheme
GB	Green Belt
GB	Graded Buildings [in Cultural Heritage Section]

GFA	Gross Floor Area
GI	Ground Investigation
G/IC	Government/Institution and Community
GLL	Government Land Licences
HKPSG	Hong Kong Planning Standards and Guidelines
HOS	Home Ownership Scheme
I/R	Industrial/Residential
LCA	Landscape Character Area
LR	Landscape Resources
LT	Laboratory Testing
L.V.	Low Voltage
mbgl	Metres Below Ground Level
MLD	Million Litres per Day
MM5	Fifth-Generation NCAR / Penn State Mesoscale Model
MTR	Mass Transit Railway
NAP	Assessment Point for Noise
NNG	New Grant Lot
NO_2	Nitrogen Dioxide
NSR	Noise Sensitive Receiver
NTHS	Natural Terrain Hazard Study
NTMFWPSR	Ngau Tam Mei Fresh Water Primary Service Reservoir
NTMWTW	Ngau Tam Mei Water Treatment Works
OS	Open Storage
OSL	Old Schedule Lots
OZP	Outline Zoning Plan
PATH	Pollutants in the Atmosphere and the Transport over Hong Kong
PHI	Potential Hazardous Installation
PME	Powered Mechanical Equipment
PMLP	Preliminary Master Layout Plan
PM2.5	Fine Suspended Particulates
PM10	Respirable Suspended Particulates

PODP	Preliminary Outline Development Plan
PRH	Public Rental Housing
PUDLP	Preliminary Urban Design and Landscape Plan
RBRGs	Risk-Based Remediation Goals
RC	Reserved Capacity
RMLP	Recommended Master Layout Plan
RODP	Recommended Outline Development Plan
RUDLP	Recommended Urban Design and Landscape Plan
SAB	Single Aspect Block
SI	Site Investigation
SO_2	Sulphur Dioxide
SP	Specified Processes
SS	Suspended Solid
SSSI	Sites of Special Scientific Interest
STT	Short Term Tenancies
TKTNFWSR	Tan Kwai Tsuen North Fresh Water Service Reservoir
TM-Places	Technical Memorandum on Noise from Places other than Domestic Premises, Public Places or Construction Sites
TM-EIAO	Technical Memorandum on Environmental Impact Assessment Process
VE	Village Environs
VSR	Visually Sensitive Receiver
WBA	Wetland Buffer Area
WCA	Wetland Conservation Area
WCFWSR	Wang Chau Fresh Water Service Reservoir
WQO	Water Quality Objective
WR	West Rail Line
YLIE	Yuen Long Industrial Estate
YLIEE	Yuen Long Industrial Estate Extension
YLSTW	Yuen Long Sewage Treatment Works

2 FORMULATION OF INITIAL DEVELOPMENT OPTIONS

This Section describes the initial development options, the key elements and the guiding principles considered in formulation of these options, as well as the criteria for evaluation of the different development options. **Section 2.1** - Site analysis provides a summary of the site contexts as presented in the Technical Report No.1 (TR1) Baseline Review. The analysis focuses on areas surrounding the Project Site, areas within the Project Site and key elements to be respected within the Project Site. It illustrates how the site contexts would affect the initial development options to be formulated. It also reviews and refines the boundary of the Project Site which would be used as a basis for the option formulation. **Sections 2.2** and **2.3** present a set of guiding principles and evaluation criteria to be used for the option generation and evaluation. **Section 2.4** describes the initial development options of the PH site and the YLIEE site. All the development options are evaluated in the subsequent **Sections 3** to **5**.

2.1 Site Analysis

2.1.1 Major Land Uses Surrounding the Project Site

As stated in TR1 Baseline Review Report, the surrounding areas of the Project Site are characterized by a mixture of various land use zoning (**Figure 2.1.1**) as well as different existing major land uses (**Figure 2.1.2**). The major land uses surrounding the Project Site are summarised as below.

High-rise Residential Development

Long Ping Estate is located to the immediate south of the PH site across Long Ping Road. The estate comprises 15 domestic blocks of 20 to 35 storeys. With a total of 8,483 flats, the estate has a total population of about 26,640.[1] The estate comprises a range of community facilities including shopping centre, public transport interchange, community hall and schools etc. Long Ping MTR Station is located right next to the estate connected by a footbridge.

Villages and Low-rise Residential Developments

There are basically three clusters of villages surrounding the Project Site. These dwellings, to the east of the Project site, include Yeung Uk Tsuen, Sai Tau Wai, Lam Uk Tsuen, Ting Fook Villas, Chung Sam Wai, Tung Tau Wai, Fuk Hing Tsuen and Tung Tau Wai San Tsuen. To the south of the Project site, there are Fung Chi Tsuen, Shui Tin Tsuen and Chun Hing San Tsuen. Tai Tseng Wai, Ng Uk Tsuen and Shing Uk Tsuen are located to the north of the Project site. Besides, some low-rise residential developments of about 3-storeys are found adjacent to the Project Site.

[1] Planning Brief of Long Ping Estate

Natural Landscapes

There are some natural landscapes surrounding the Project Site. To the immediate west of the Project Site lies Kai Shan, which is a "Conservation Area" ("CA") of approx. 50-110mPD in height. There are also some vegetated knolls zoned "CA" and "Green Belt" ("GB") in the west. They all serve as extensive greenery backdrop of the Project Site as well as its neighbouring areas. Chu Wong Ling (approx 40-50mPD), to the east of the Project Site, is another natural landscape zoned "GB" overlooking the Project Site.

Besides, there are some wetland areas in vicinity of the Study Area. To the east of the Study Area across Shan Pui River is Nam Sang Wai. It is an identified wetland area with high ecological value. To the north of the Study Area is the Inner Deep Bay Site of Special Scientific Interest (SSSI). They are being credited for the unique international and regional importance of the fish pond system particularly for ardeids. Further north, the Mai Po Inner Deep Bay Ramsar Site is recognized as wetland of international importance. To the northwest of the Study Area is the 61ha Hong Kong Wetland Park which comprises conservation, education and tourism facilities.

Burial Grounds and Graves

To the west of the Project site, large burial grounds with significant amount of graves can be found on Kai Shan and in areas to the south of the hill (**Figure 5.5.1c**). Parts of the burial grounds are very close to the Project Site with some even within the site boundary as originally proposed in the Project Brief. The most obvious one is in the middle portion of the PH site. Besides, there are some graves fall within the Project Site such as those in the middle and southern portions of the PH site (**Figure 5.5.1c**).

Industrial Uses

There are two major industrial areas next to the Project Site. One is the 67 ha Yuen Long Industrial Estate (YLIE) located to the east of the YLIEE site, separated by a nullah. Another one is to the south of the PH site zoned "Comprehensive Development Area" where temporary open storage, workshops as well as scattered and disordered residential dwellings are found (**Figure 2.1.1**).

Major Roads and Railway Tracks

There are two major roads abutting the Project Site, i.e. Long Ping Road and Fuk Hi Street (**Figure 2.1.2**). Long Ping Road serves as a major connecting road between YLIE, Long Ping Estate, Tin Shui Wai and Yuen Long Highway; while Fuk Hi Street is a key western access to YLIE. Numerous frontal vehicular accesses can be found along the street with frequent on-street loading/ unloading activities. To the southern tip of the PH site, the elevated West Rail (WR) is running along the site boundary.

2.1.2 Major Land Uses within the Project Site

As shown in **Figure 2.1.2**, the Project Site is irregular in shape. In terms of topography, it is mainly flat on its northern and central portions and has a slightly hilly terrain on the south strip. Generally speaking, there are no major natural topographical features within the Project Site. The major land uses within the Project Site are outlined below.

Open Storage/ Workshops

Based on our study, about 50% of the Project Site is currently occupied by open storages/ workshops which include vehicle parks and repair facilities, container storage areas, waste recycling workshops and open storage areas. Most of them are located within the YLIEE site and the northern part of the PH site.

Residential Dwellings

While there are no recognized villages within the Project Site, permanent and temporary houses are scattered within the PH site, especially in the southern part of the PH site.

Agricultural and Vegetated Land

Despite the domination of open storage/ workshops, patches of agricultural land and strips of wasteland are found in the northern and central portions of the Project Site. Secondary woodland and plantation are found mainly in the periphery of the YLIEE site and the southern portion of the PH site.

Nullah with footpaths and watercourses

A section of nullah with footpaths on each side runs along the eastern periphery of the YLIEE separating the site from the YLIE. On the other hand, there are several small watercourses entering the site from Kai Shan. These however have been heavily altered and channelised into irrigation ditches for agricultural uses. There is also a section of a watercourse flows through an area of agricultural land in the northern part of the Project site (**Figure 2.1.2**).

2.1.3 Key Elements to be Respected within the Project Site

In addition to the above major land uses, a number of key elements are found within the Project Site (**Figure 2.1.3**). Although the areal extents of these elements are less significant as compared with the major land uses, they are pivotal in defining the site boundary and in turn play determining roles in the formulation of initial development options. In this connection, due respect should be paid to these key elements in the option formulation process. These key elements include:

Burial Ground and Graves

As mentioned above, parts of the burial grounds to the west of the Project Site and a number of historical graves fall within the Project Site.

Village Environs

Being located adjacent to a number of villages, a tiny portion of two Village Environs (VE) fall into the boundary of the PH site. They are VE of Wing Ning Tsuen (D.D. 122) and VE of Fung Chi Tsuen and Shui Tin Tsuen (D.D 120 & 122).

Umah International Primary School

A private school, Umah International Primary School, is located in the southern end of the PH site. The school comprises a few single-storey buildings and a playground and the school is still in operation.

2.1.4 Proposed Refinements of Project Site Boundary

With consideration of the abovementioned key elements to be respected within the Project Site, the Project Site boundary was reviewed in an attempt to maximize the development potential of the Project Site and to make use of the site in an effective and sustainable manner.

As stated in the Brief, the original Project Site is about 34.4 ha in size, with about 18.4 ha for the PH site and 16 ha for the YLIEE site. After the review, it is proposed to realign the Project boundary such that about 18.69 ha will be allocated for the PH site; while for the YLIEE site, two scenarios are proposed with about 15.52 ha for Option A and 14.62 ha for Option B (referred to **Section 2.4.2**). The Project site thus has a total of 34.21 ha under YLIEE Option A or 33.31 ha under YLIEE Option B. Details of the proposed refinements of the project boundary are described in the sections below and the change of the Project Site area is summarised in **Table 2.1.1**.

Proposed Refinements of the Public Housing Site Boundary

The "J" shape of the PH Site with its original boundary as stated in the Brief sets to encroach on various existing developments and boundaries of some key important land uses. As shown in **Figure 2.1.4a**, the middle portion of the PH site overlaps with parts of the burial grounds which should be avoided. There are also numerous graves of significance both in terms of scale and quantity around the middle and southern tip of the PH Site in need of preservation. Besides, the VEs of Wing Ning Tsuen (D.D. 122) and Fung Chi Tsuen and Shui Tin Tsuen (D.D. 120 &122) should be retained from the PH site, while the site of Umah International Primary School should also be maintained. All these concerned elements and their boundary areas are therefore proposed to be excluded from the PH Site.

In parallel, a review has been conducted to identify if there is land within the Study Area that has development potentials for inclusion as part of the Project Site. Based on the review, 3 pockets of areas currently zoned "GB" and adjoining to the PH site have been identified and proposed for inclusion. These pockets of land are relatively flat in level and are considered suitable for residential development. Other sides of the PH site are constrained by various land uses or conflicts with some important elements, e.g. Fuk Hi Street, Long Ping Road, VEs, graves, CA zone, V zone, burial grounds, etc (**Figure 2.1.5**) and hence these lands are not recommended for inclusion.

Proposed Refinements of the YLIEE Boundary

The boundary of the YLIEE as stated in the Brief has fewer conflicts with the surrounding environment as compared with the PH site. However under the same attempt to maximize the development potential and to adopt effective land use, several refinements of the YLIEE boundary are proposed under the two scenarios - Option A as shown in **Figure 2.1.4a** and Option B as shown in **Figure 2.1.4b**.

The western boundary of the YLIEE site is immediately close to the burial grounds extended from Kai Shan, where a number of graves are found. In Option A (**Figure 2.1.4a**), it is proposed to adjust the YILEE site boundary slightly to exclude the graves, to distance the burial grounds and to further smoothen the site boundary. In Option B, the western side of the boundary is further refined to exclude the slope area at the western tip giving a regular cut at this end of the site

(**Figure 2.1.4b**). This aims to remove the requirements for an extensive bored pile wall adjacent to this slope for necessary site platform formation and the need for vehicle access to this area.

On the other hand, it is proposed to divert the existing 6m wide channel including the footpath immediately adjacent to the east boundary of the YLIEE to the proposed box culvert running along the future road within the YLIEE site. This aims not only to maximize the land usage of the YLIEE site, but also facilitate the integrity of YLIE and YLIEE. This proposed refinement applies to both Options A and B.

Proposed Refinements of the Boundary between the PH Site and the YLIEE Site

The northern part of the PH site is adjoining the YLIEE site. Although the YLIEE site would be restricted to non-hazardous activities and non-polluting industries, decent separation between the PH site and the YLIEE site is desirable. In view of this, a 50m wide buffer between the PH site and the YLIEE site is proposed.

To make this 50m buffer more desirable in terms of usage and management, it is proposed to realign the boundary between PH site and YLIEE site, and split the buffer into 2 pockets of land for benefits of both the PH and the YLIEE site. This refinement applies similarly to both YLIEE Option A and Option B as shown in **Figure 2.1.4a** and **2.1.4b**.

With the proposed refinements of the Project Site boundary, the PH site would be slightly increased to 18.69 ha from 18.4 ha. The YLIEE site would be reduced from 16 ha to 15.52 ha in Option A and to 14.62 ha in Option B. The total area of the Project Site would be changed from 34.4 ha as originally stated in the Brief to 34.21 ha for combination of PH site and YLIEE Option A, and 33.31 ha for combination of PH site and YLIEE Option B.

Table 2.1.1: Summary of changes of the site area for the proposed refinements of Project site boundary

	Area as stated in the Brief (ha)	Area for proposed refinements (ha)
PH site	18.4	18.69
YLIEE site	16	Option A: 15.52
		Option B: 14.62
Total	34.4	PH + Option A: 34.21
		PH + Option B: 33.31

2.2 Guiding Principles

With reference to the baseline conditions of the Project Site and reviews of relevant proposals/studies in TR1 Baseline Review Report, a set of guiding principles has been formulated. These principles will be used to facilitate the generation and evaluation of the initial development options for the PH site and YLIEE site. The guiding principles cover areas on Societal Needs, Community Facilities, Infrastructure, Environment and Urban Design.

2.2.1 Societal Needs

To maximise the development potential of the PH site for meeting public housing demand

In view of strong demand on public housing in the territory, the development potential of the PH site for maximising public housing supply in an optimum manner should be carefully explored. Given the irregular configuration of the PH site may hinder its development potential, opportunities such as taking advantage of its proximity with Long Ping Estate for shared uses of community facilities should be examined.

To maximise the development potential of the YLIEE site for meeting demand on industrial estate premises

According to the HKSTP Annual Report 2011/2012, the usage rates of the existing three industrial estates in Hong Kong are close to their full capacity with occupancy rates reaching 89-100% (the occupancy rate of the YLIE reached 95%). To accommodate the acute demand on industrial estate premises and promote economic activities, maximizing the development potential of the YLIEE for industrial uses should be fully examined.

2.2.2 Community Facilities

To provide sufficient community facilities

Since the proposed development will bring in additional population and employers to the vicinity, provision of sufficient community facilities for the proposed development should be ensured. Locations of the planned community facilities should be carefully considered so that they could provide convenient services to the future users and promote social interaction with the existing communities.

2.2.3 Infrastructures

To utilize the available/ potential transportation and infrastructural facilities for optimal development

Wang Chau is basically well served by various forms of infrastructure in terms of roads, railway, water supply, sewage treatment etc. These provisions should be capitalised upon and/ or enhanced to ensure that the proposed development is delivered in an efficient and timely manner. Should these infrastructures be at full capacity, new infrastructures to meet the development-induced demand should be planned properly.

To enhance connectivity to the surrounding developments and communities

The Project Site is adjacent to Long Ping Estate, YLIE, WR Long Ping Station, Public Transport Interchange (PTI) and a number of villages. Strategies should be explored to enhance the pedestrian accessibility and infrastructural facilities between these areas. Future residents of the PH site and future workers of the YLIEE should have access to more choices of activities, services and transportation facilities, and vice versa.

To design access to enhance connectivity to Kai Shan

Kai Shan is the major natural backdrop in the vicinity. It is also a prominent location where burial grounds and graves can be found. Pedestrian access and vehicular networks should be well planned to provide convenient access to and from Kai Shan.

2.2.4 Environment

To minimise the potential environmental problems due to the Industrial/ Residential (I/R) Interface

Chimney emission and fixed noise impacts arising from the YLIEE and YLIE are the key I/R interface issues that would have potential environmental constraints on the development layout options. Consideration should be given to avoid and minimise adverse environmental problems due to I/R interface as far as practicable, such as provision of buffer zone.

To minimise the major environmental impacts on the PH site

Apart from I/R interface issues, the eastern side of the PH site is potentially affected by the road traffic noise and vehicular emission impacts from Long Ping Road and Fuk Hi Street, and the southern end of the PH Site is affected by rail noise from MTRC West Rail (WR). Opportunities should be explored to pre-empt any adverse environmental impacts by means of urban planning and design. When developing the development layout options, consideration has been given to optimising the setback distance from roads, building disposition, orientation and block layouts to limit the view angles of the residential openable windows overlooking the roads, locating the planned schools and G/IC site at the southern portion of the site as far as practicable since these kinds of land uses would not operate during night-time and will not be subject to stringent night-time rail noise criterion.

To respect and preserve the habitats of conservation importance

The CA, "Wetland Buffer Area" (WBA) and "Wetland Conservation Area" (WCA), the ponds and surrounding wet habitats in the north and northwest of the Study Area ecologically linked to the Deep Bay area are areas or habitats of conservation importance within the Study Area. They should be well protected and preserved, avoiding any negative impacts arising from the proposed development.

To respect and preserve the cultural heritage resources

The Sheung Cheung Wai Site of Archaeological Interest and Mong Tseng Site of Archaeological Interest are located well outside the Study Area, but they serve as an indication of potential or archaeological deposits within the PH and YLIEE sites. Areas of archaeological potential were identified in the centre of the PH site and along the western and northwestern edge of the YLIEE site. An Archaeological Survey should be undertaken after land resumption to adequately assess the presence, and extent of the archaeological deposit. In addition, archaeological no-go areas were identified outside the PH and YLIEE sites, including northern historical villages (Ng Uk Tsuen, Tai Tseng Wai and Shing Uk Tsuen), historical villages to south of Long Ping Estate (Fung Chi Tsuen and Shui

Tin Tsuen), and historical villages of Chu Wong Ling (Fuk Hing Tsuen, Tung Tau Wai San Tsuen, Lam Uk Tsuen, Chung Sum Wai and Tung Tau Wai).

All historical clan graves and burial ground are excluded from the refined site boundary. There are also no Declared Monuments or Graded Historic Buildings within the Project site. However, a number of built heritage resources including Pak Kung Shrine, a well and a shrine are still found within the PH site. Given these cultural heritage resources might have significant cultural values and intangible values for the local communities, due respect should be paid to these resources with an aim to preserve their existences and enhance the local identity with their unique history.

To conserve and capitalise upon the natural landscapes surrounding the Project Site

Embracing the Project Site is a rich asset of natural landscape features - Kai Shan, Chu Wong Ling, Nam San Wai and Inner Deep Bay. They possess valuable landscape value which should be properly conserved. In particular, the adjacent Kai Shan is regarded as a significant natural asset for the neighbourhood areas. Visual corridors and physical access to this natural landscape should be provided/ enhanced to benefit the community.

2.2.5 Urban Design

To integrate with natural topography

Since the Project Site is sandwiched between Kai Shan to the west and Chu Wong Ling to the east, the proposed development would need to mediate between these two topographic features for a harmonious representation of the natural landscape.

Within the Project Site, the gradual increase of ground elevation towards the west of the site should also be taken into consideration for a sensible adoption of the natural conditions for the proposed development.

To maintain compatibility with surrounding built forms

Apart from the aforementioned natural topographic features, there are various developments surrounding the Project Site, including high-rise residential development at Long Ping Estate, mid-rise YLIE buildings and low-rise village clusters. These various built forms should be carefully examined and considered in the planning and design of the proposed development, so as to attain compatibility in between and achieve a balanced environment.

To preserve visual connection to Kai Shan

Kai Shan is a major natural backdrop of the Project Site. Certain level of visual connection between villages and Kai Shan should be preserved in order not to significantly affect the visual setting of the vicinity. Kai Shan should be capitalised on as the natural backdrop and recreational resources of the future community while future land-use layouts and height profiles within the Project Site should be carefully considered.

2.3 Evaluation Criteria

According to the Brief, the initial development options will be evaluated against a set of pre-determined criteria. With the evaluation, the relative performance of each element of the options could be compared and the overall performance of the options could also be ranked to come up with the preferred option. The evaluation of the initial development options will be conducted and presented with respect to three main areas: "Planning and Urban Design, Land Requirement and Air Ventilation" in **Section 3**, "Engineering and Infrastructure" in Section 4, and "Environmental Impacts" in Section 5 of this report.

The proposed evaluation criteria have been taken into account all different key issues identified in TR-1 Baseline Review that required to be addressed in the preliminary feasibility assessment, as well as the guiding principles as mentioned in **Section 2.2**. Burial grounds, graves, VE and Umah International Primary School have been excluded in the refined Project site boundary. Direct impacts on these elements are therefore avoided and the indirect impacts if any are considered to be the same for all development options. Hence these elements are not considered in the evaluation analysis. Besides, there are also no identified monuments and graded historical buildings within the Project site and potential helicopter noise and hazard-to-life impacts are not anticipated as identified in the TR-1 Baseline Review report. In this connection, these aspects/elements are also not included as evaluation criteria in this analysis.

On basis of the above consideration, the evaluation criteria for different aspects under "Planning and Urban Design, Land Requirement and Air Ventilation", "Engineering and Infrastructure", and "Environmental Impacts" are developed and described in **Tables 2.3.1** to **2.3.3**.

Table 2.3.1: Evaluation Principle and Criteria for Planning & Urban Design, Land Requirement and Air Ventilation

	Evaluation Principle	Evaluation Criterion
Planning and Urban Design	Meeting Societal Need	Meeting housing demand by maximizing flat production
		Meeting demand on industrial estate premises by maximizing developable area within statutory limits
	Enhancement of Community Facilities	Provision of sufficient G/IC facilities for the proposed development
		Provision of sufficient local open space for the proposed development
	Improvement in Linkage and Connectivity	Provision of sufficient pedestrian access to neighbouring community facilities and infrastructures
		Improvement in connectivity to Kai Shan
	Compatible Built Form	Integration of proposed development with surrounding natural topography
		Integration of proposed development with surrounding built form
	Visual Enhancement	Preservation of visual connection to Kai Shan
Land Requirement	Minimize land resumptions on private land lots	Extent of private land lots to be affected
	Minimize land requirements on existing accesses, road paths,	Extent of existing accesses of roads, cycle tracks, tracks, foot paths, bus stops/lay-bys, Railway

	Evaluation Principle	Evaluation Criterion
	railway operations, watercourses and nullahs etc	Protection Boundary, West Rail Emergency Access Point, watercourses and nullahs etc to be affected
Air Ventilation	Better Air Ventilation	Main streets aligned in parallel, or up to 30 degrees to the prevailing wind direction as far as practicable
		Building height variation across the district
		Adequately wide gaps between building blocks as far as practicable
		Angle between the axis of the building blocks and the prevailing wind direction should be within 30 degrees as far as practicable

Table 2.3.2: Evaluation Principle and Criteria for Engineering and Infrastructure

	Evaluation Principle	Evaluation Criterion
Traffic & Transport	Minimise impact on existing road network	Extent of road links and junctions to be affected.
	Provision of public transport facilities	Coverage of public transport facilities.
	Provision of pedestrian facilities	Connectivity between the proposed development and Yuen Long Town.
Building Foundation	Provision of foundations for residential towers	Foundations requirements for residential tower buildings for different options.
	Provision of foundation for non-residential buildings within the PH site	Foundations requirements for maximum 8 storey schools and other non-residential buildings for different options.
	Provision of foundation requirements for YLIEE buildings	Foundations requirements for industrial estate buildings for different options.
Site Formation	Maximise area of platform	Optimisation of site formation to ensure maximum area of development subject to other criteria detailed below.
	Optimisation of platform levels	Determination of suitable platform levels that are in keeping with the surrounding area, whilst meeting criteria for drainage, pedestrian and vehicle access.
	Minimise cut and fill quantities	Minimise cut and fill quantities in order to reduce total excavation and export of spoil, and import of fill.
	Minimise impact on existing natural slopes	Where possible, avoid steepening of slopes and use of retaining structures which negatively impact on aesthetics
	Minimise potential for ground settlement	Minimise fill works to reduce the likelihood of settlement induced from additional loading of the ground and any potential existing compressible soils.
Slope Works	Modification of existing slopes	Extent of slopes requiring modification, including upgrading works, to be kept to a minimum
Natural Terrain Hazard	Potential natural terrain hazards	Screening criteria as set out in GEO Report 138: proximity of facilities to slope and slope angle; identification of potential and past instability
	Minimise the natural terrain mitigation measures required	Extent of mitigation measures required to be kept to a minimum
	Minimise impact of mitigation measures on existing graves	Avoidance of impacts on graves and access to graves

	Evaluation Principle	Evaluation Criterion
Stormwater Drainage	Minimise the impacts on existing watercourses	Extent of impacts on existing watercourses within Project site
	Minimise the impacts on existing channel	Extent of impacts on existing Tai Tseng Wai Channel
	Minimise the impacts on surface runoff from outside Project site	Extent of impacts on surface runoff from Kai Shan
	Minimise the impacts on existing storm drains	Extent of impacts on existing storm drains along Long Ping Road
		Extent of impacts on existing storm drains along Fuk Hi Street
Sewerage	Minimise the impacts on existing Sewage Treatment Works	Extent of impacts on Yuen Long Sewage Treatment Works (YLSTW)
	Minimise the impacts on compliance with requirements	Compliance with requirements of "No net increase in pollution loads to Deep Bay"
	Minimise the impacts on existing foul sewers	Extent of impacts on existing foul sewers in YLIE
Water Supply	Minimise the impacts on planned salt water supply system	Extent of impacts on planned salt water supply system from Lok On Pai and Tan Kwai Tsuen
	Minimise the impacts on existing water supply system	Extent of impacts on fresh and flushing water supply systems within Project site
	Minimise the impacts on existing Water Treatment Works	Extent of impacts on operation of Au Tau Water Treatment Works (ATWTW) and Ngau Tam Mei Water Treatment Works (NTMWTW)
	Minimise the impacts on existing Fresh Water Service Reservoir	Extent of impacts on Wang Chau Fresh Water Service Reservoir (WCFWSR)
	Minimise the impacts on existing distribution mains	Extent of impacts on DN900 fresh water distribution mains along Fuk Hi Street
Other Utilities	Minimise the impacts on existing gas supply	Extent of impacts on existing medium pressure gas main within Project site
	Minimise the impacts on existing power supply	Extent of impacts on existing power cable within Project site
	Minimise the impacts on existing tele-communications	Extent of impacts on existing communication cables within Project site

Table 2.3.3: Evaluation Principle and Criteria for Environmental Impacts

	Evaluation Principle	Evaluation Criterion
Air Quality [1]	No adverse air quality impacts on the development options	Provision of sufficient separation distance between the YLIE and the residential development to ensure compliance with the new AQO
		Provision of sufficient separation distance between Long Ping Road & Fuk Hi Street and the residential development to ensure compliance with the new AQO
		Extent of further mitigation measures/building constraints (e.g. height restriction, further setback)
Noise [1]	No adverse road traffic impacts on the development options	Compliance with road traffic noise criteria
		Extent of on-site mitigation measures required such as fixed window, barrier, structural fin, acoustic window etc[5]
		Extent of off-site mitigation measures on existing

	Evaluation Principle	Evaluation Criterion
		roads required such as barriers, low noise surfacing, enclosure etc [4]
	No adverse rail noise impacts on the development options	Compliance with rail noise criteria
		Extent of on-site mitigation measures required such as fixed window, structural fin, non-sensitive use etc
		Extent of off-site mitigation measures on existing WR viaduct required such as barriers, enclosure[4]
	No adverse fixed noise impacts on the development options	Provision of sufficient separation distance from existing and planned fixed noise sources to ensure compliance with the noise criteria
		Extent of building mitigation measures required such as fixed windows etc
		Extent of at-source noise control measures required e.g. enclosure, barrier/cover, silencer etc
Ecology & Fisheries	Conservation of areas of ecological importance	Avoid/minimise impacts to the recognised sites of ecological concern with no significant residual impact (such as WCA, WBA, Deep Bay area, Kai Shan etc.)
		Preservation/enhancement of habitats of ecological importance (such as identified wetland habitats or secondary woodland with important ecological function, breeding/nursery grounds for species of conservation interest, potential areas which support species of conservation interest etc.)
	Conservation of areas of fisheries importance	Preservation/enhancement of active/inactive fishponds
		Avoid/minimise impacts to the abandoned fishponds
Cultural Heritage	Conservation of areas of archaeological potential or interest	Minimise the impacts on area of archaeological potential
	Respect to built heritage resources	Minimise the impacts on built heritage resources
Landscape and Visual	Protection and incorporation of high quality landscape resources.	Minimisation of tree or natural vegetation removal.
		Avoidance or minimisation of impacts on valuable landscape resources.
		Minimisation of encroachment on the western boundary shared with the Kai Shan range.
	Influence upon landscape character	Level of change and compatibility with the landscape character.
	Visual amenity and compatibility	Maintain visual connection between Kai Shan and Chu Wong Ling.
		Scale, appearance and compatibility of built form within the landscape setting for residential and industrial uses.
		Opportunities for incorporation of landscape elements.
Water Quality	Protection of important stream and hydrology regime	Extent of stream diversions and project footprint.
	Avoidance of water quality	"No net increase in pollution loads to Deep Bay

	Evaluation Principle	Evaluation Criterion
	impacts on Deep Bay	
Land Contamination	Optimise the land use to minimise risk due to land contamination	Potential level of risk on future landuses due to land contamination
Waste	Minimise amount of C&D materials/waste generation during construction stage	Amount of C&D materials/waste required for disposal during construction stage
	Minimise amount of waste generation during operational stage	Amount of domestic waste generated from PH site
		Amount of industrial waste generated by YLIEE site

Note:

[1] Construction dust and noise impacts will not be insurmountable given that suitable mitigation measures are adopted. Hence they would not impose any constraints on the development layouts and they are not considered in the evaluation analysis.

2.4 Land Use Proposals

Building upon the guiding principles on such aspects as societal needs, community facilities, infrastructures, environment and urban design, together with the proposed refinements of the Project Site boundary, two initial development options are generated for the PH site (i.e. Option 1 and 2) and YLIEE site (i.e. Option A and B). Their relevant development intentions, optimal development intensity, land use mix and land requirements are presented in **Sections 2.4.1** to **2.4.4**. Details of the key development parameters and land requirements for the proposed land use options of the PH site and the YLIEE site can also be found in **Appendix 2.4.1** and **Appendix 2.4.2**, respectively.

2.4.1 Land Use Proposal for PH site

2.4.1.1 Optimal Development Intensity and Land Use Mix

Optimal Development Intensity

As outlined in the guiding principles and in view of the upsurge needs for public housing in a territorial scale in Hong Kong, opportunities are explored to optimize the development intensity in the PH site.

The Yuen Long OZP No S/YL/21 generally allows a maximum domestic plot ratio of 5.0 or a maximum non-domestic plot ratio of 9.5 in "Comprehensive Development Area" zone and "Residential (A)" zone. To the immediate south of the PH site, Long Ping Estate has residential blocks in height ranging from 20 to 35 storeys. In order to achieve compatibility with the surrounding development as well as to optimize development intensity, plot ratios ranging from 5.5 to 6.0 with maximum height ranging from 26 to 41 storeys are proposed.

In regard to the average flat size, 50 m^2 is proposed which is in line with the average flat size of 45 m^2 in public rental housing (PRH) and 54 m^2 in Home Ownership Scheme (HOS)[2]. A Person-per-Flat (PPF) of 3.07 is assumed with reference to the PPF of 3.06 in PRH and 3.08 in HOS[3]. Based on these

[2] Reference parameters as advised by the Hong Kong Housing Authority.
[3] Ibid.

development parameters, the estimated population of the PH site would be 47,938 to 49,872.

Land Use Mix

Since public housing development represents the major land use in the PH site, compatible and complementary land uses with the residential use should therefore be developed for a well balanced community. For both Option 1 and Option 2, a number of major land uses is proposed including residential, local open space, underground or semi-below ground parking spaces, retail, school, integrated social welfare building, public transport interchange, roads, amenity greening and slope area.

(1) Residential with local open space and parking spaces

Residential use remains as the major land use in both of the options. About 14 ha of land is reserved for the public housing development. In accordance with the requirements set out by HKPSG, local open space of 1m² per person will be provided within the PH site. To cater for the potential demand from the future residents, basketball courts, mini-soccer pitch (7-a-side), children's playgrounds, table tennis tables and badminton courts will be provided. Underground or semi-below ground parking spaces will also be planned.

(2) Retail

By referring to the Housing Authority's development project at Shui Chuen O where retail Internal Floor Area (IFA) of 0.2m^2 per person is offered,[4] retail GFA of 15,023m^2 are proposed to serve the daily need of the proposed population.[5] The retail space will be provided in the form of 1-storey street-shops, which will mainly be found along the eastern side of the residential area adjacent to Fuk Hi Street, the proposed public transport interchange and Long Ping Road. By linking up these uses, the retail space would convenience the future users, facilitate social interactions with the neighbouring communities and also add vibrancy to the area.

(3) Schools

To cater for the needs arising from the proposed population, land for primary schools is reserved. Given the different number of population in the two options, the number of schools and land area reserved also vary accordingly. With a good aim to allow flexibility for future development, one of the school sites in each of the options is planned to accommodate the development of a secondary school.

In reference to the HKPSG, site area required by a 30-classroom primary school is 6,200 m^2 with a minimum width of 65m (95m x 65m), while a site of 6,950 m^2 is required to accommodate a 30-classroom secondary school with a minimum width of 65m.

(4) Integrated Social Welfare Building (ISWB)

As recommended by the Social Welfare Department (SWD), social welfare facilities including day activity centre, hostel for severely mentally handicapped

[4] Reference parameters as advised by the Hong Kong Housing Authority.

[5] The proposed GFA of 15,023m^2 is derived based on an assumed IFA to GFA ratio of 1: 1.5. The GFA is sufficient for the proposed population under both Options 1 and 2. The amount and layout of the retail provision are subject to review pending a retail study to be conducted separately in due course.

persons, hostel for moderately mentally handicapped persons, integrated vocational and rehabilitation services centre, care and attention home for severely disabled persons, special child care centre, early education and training centre, supported hostel for mentally handicapped persons, residential care home for the elderly and day care centre for the elderly should be provided in the PH site. It is also advised by SWD that a total Net Operational Floor Area (NOFA) of 5,908 m^2 would be required leading to a GFA of 8,862 m^2.[6] In order to respond to SWD's recommendations and to meet district needs for the concerned facilities, an ISWB is proposed in each of the options. A GIC site area of about 0.5 ha is thus allocated to accommodate the ISWB.

(5) Public Transport Interchange (PTI)

To provide sufficient transport facilities to the proposed population of the PH site and the employment population of the YLIEE, a PTI is proposed at the north-eastern corner of the PH site. In both options 1 and 2, land area of around 0.4 ha is reserved for this use.

(6) Roads, Amenity Greening and Slope

In addition to the above, roads and amenity greening are proposed within the PH site, occupying around 1.1 ha of land in both options. Due to the gradually hilly topography towards Kai Shan, an area of around 0.3 ha is also proposed for slope reservation.

2.4.1.2 Proposed Land Use Options

The PH site has a site area of 18.69 ha. Two options are proposed for the concerned development and their variation in terms of development intensity and land requirements (for residential and school uses) are elaborated as below.

Option 1

To better integrate with the existing communities and development in Yuen Long, residential development in Option 1 opts for a plot ratio (PR) of 5.5 with building height ranging from 26 to 36 storeys. In this land use option, a total of 15,615 flats will be provided and a total of 47,938 population can be accommodated (**Figure 2.4.1a**).

Approximately 14.44 ha of land is planned for the public housing development and 1.96 ha of land is reserved for 3 school sites.

Option 2

Built upon the development parameters of Option 1, this option intends to reach for the possibility to maximize housing supply in response to the territorial need for housing. A PR of 6.0 with building height ranging from 26 to 41 storeys is thus proposed, providing a total of 16,245 flats to cater for around 49,872 population (**Figure 2.4.1b**).

In terms of the land requirements, residential use in this option occupies around 13.75 ha and a total of 4 school sites would take up around 2.65 ha.

[6] Assuming a NOFA to GFA ratio of 1: 1.5.

2.4.2 Land Use Proposal for YLIEE site

2.4.2.1 Optimal Development Intensity and Land Use Mix

Optimal Development Intensity

The statutory Yuen Long OZP No S/YL/21 and the lease for the YLIE allow a maximum total GFA of 1,687,625m^2, plot ratio of 2.5 and a maximum building height of 8 storeys for the industrial development area in the YLIE. Since the YLIEE proposal is set as succession of the existing YLIE, it is considered reasonable to maintain the same development intensity for the benefits of compatibility and ease of integration. Thus, a plot ratio of 2.5 and maximum building height of 8 storeys are suggested for the industrial development within both options for the YLIEE site.

Land Use Mix

The YLIEE site is mainly for industrial uses where the land use proposal is sharply focused. In complementary to the industrial uses, various compatible uses such as local open space and car parking are also proposed to enhance the planning of the site and in accordance with the requirements set out in HKPSG. In both option A and option B, there is the same set of a total of proposed common land uses with slight variations in the relevant land area required due to the different site boundary and layout. The common land use components are:

(1) Industrial

Industrial uses occupy the majority of land area in the YLIEE site to facilitate the establishment of industrial operations adjacent to the existing YLIE. With slight variation in size, Option A and Option B possess around 12 ha of industrial lots and a maximum GFA of around 300,000m^2. Whereas the HKPSG recommends a worker density of 75 m^2 per worker, the proposed industrial lots would accommodate around 4,000 workers.

(2) Local Open Space

The HKPSG suggests a 0.5 m^2 local open space per worker, i.e. around 0.2 ha of land in total for the YLIEE site. To enhance the working environment of the YLIEE and to improve the surroundings of the industry focused zone, local open space of around 0.4 ha sufficiently in line with the HKPSG recommendation is proposed in each of the options.

(3) Car Parking Space

Car parking spaces are also provided within the YLIEE site for its smooth daily operation. Approximately 0.37 ha and 0.38 ha is reserved for Option A and Option B respectively taking reference from the existing parking demand in YLIE.

(4) Roads and amenity greening/pedestrian corridor

Internal roads and amenity greening/pedestrian corridor are also proposed in both of the options to facilitate vehicular and pedestrian movement. A total of less than 3 ha of land area is reserved for these uses with slight variation between the two options due to the difference in site boundary and layout.

2.4.2.2 Proposed Land Use Options

As illustrated in **Section 2.1.4**, the two options vary in their site boundaries resulting in Option A having a site area of 15.52 ha and Option B a site area of 14.62 ha. Their development focuses and variations are discussed as follows:

Option A

With an aim to maximize land area for development, Option A has taken up the slope area in the western part of the YLIEE site for development. The total land area of the YLIEE site would be 15.52 ha where 12.06 ha is reserved for industrial lots. A maximum GFA of 301,500 m^2 will be provided accommodating 4,020 workers (**Figure 2.4.1a-b**).

In order to provide a vehicular access to the industrial lot in the slope area, the internal road of the YLIEE site is branched out to the concerned lot. The internal road in total occupies about 2.18 ha of land.

Also, a 0.46 ha of land is reserved for amenity greening/pedestrian corridor taking into account of the slope area.

Option B

In this Option, the site boundary of the YLIEE is slightly smaller to exclude the slope area with an intention to optimize development and efficiency. Within the total site area of 14.62 ha, 11.55 ha is reserved for industrial use. A maximum GFA of 288,800 m^2 will be provided accommodating 3,851 workers (**Figure 2.4.1a-b**).

In terms of internal road, an approximate 1.86 ha is reserved. Another 0.43 ha is reserved for amenity greening/pedestrian corridor uses.

2.5 Overall Urban Design Proposals

The Project Site comprises primarily the GB and the OS zones. Village houses and a small number of industrial activities are found within the GB while the OS zone is filled with workshops and warehouses. However, upon the re-development of the Project Site, these uses are to be replaced and therefore will not form part of the environment of the future development.

Surrounding the Project Site within the Study Area include four major types of townscapes as shown in **Figure 2.1.2**. They are natural landscape, village-style residential clusters, industrial landscape and high-rise residential clusters. The natural landscape is mainly being found on the west side of the Project Site while the rest are found on the east side, and hence creates clear "urban front" and "natural back" for the site. On the urban front, the presence of the trucks driving to and from the industrial estate, together with the existing operation of workshops and open storages, has created a light industrial atmosphere in the vicinity of the Project Site.

Based on both options generated above-mentioned, the urban design frameworks for each of them are illustrated separately in the following sections.

2.5.1 Urban Design Framework for PH site

2.5.1.1 Urban Design Principles

The southern portion of the subject site has been allocated for residential uses. Being predominantly a public housing site, the following urban design aspects were considered in developing the two different design options in the housing area:

(1) Visual Connections

The annual prevailing wind direction of the PH site comes from east-northeast (ENE). In order to maximize the potential for natural ventilation, the development follows an east-to-west development pattern. The east-to-west corridors also contribute to providing visual connectivity to Kai Shan. Three connections occur in the northern portion of the housing area. To the south, when the site abuts the foothills of Kai Shan, a view corridor from the south toward the hilltop is also established (**Figure 2.5.1-3**).

In the northern portion of the housing site, a road running west to east follows the original direction of a stream. This stream generated a ridge that leads into Kai Shan. The road therefore maximizes this natural site condition, and develops a visual connection from the ground to the sky.

In order to avoid potential I/R Interface conflicts, a 50-metre wide buffer strip has been established between the PH site and the YLIEE site. This is also one of the major visual corridor from the existing villages on the eastern side towards Kai Shan(**Figure 2.5.15).**

There are two schools sites located within the residential clusters which also act as a visual buffer and allow a wider visual corridor from East to West.

(2) Stepped building height

The rationale behind of stepped building height is to develop a diversified building height profile and to avoid 'flat-headed' development. To showcase these height variations, about 5-storeys was utilized between the buildings of different building heights. Buildings would incrementally increase as they approach the foothills of Kai Shan. Buildings would decrease in height as they approach existing villages.

(3) Landscape

Connections into Kai Shan

Kai Shan is the most remarkable natural landmark within the study boundary. The development of housing has therefore taken Kai Shan into account. In the PH site, four pedestrian connections have been placed in order to get people to Kai Shan's foothills, which currently are utilized as burial grounds.

Interior Open Space Allocation

Local open space pockets have been placed throughout the PH site. Each pocket contains the possibility for a children's playground, and have been distributed evenly throughout the site.

(4) Connectivity

Establishing Connectivity Nodes and Minimizing Road Placements

Traffic has also been carefully considered in the development options. In order to minimize the quantity of necessary roads into the PH site, an exploration of different variations was explored. The resulting road network in the PH site can be defined by two separate roads: the northern road feeds the larger "plate" where the majority of population resides, whereas the southern road makes use of the land closest to the existing rail tracks.

Public Transport Interchange

The PTI has been strategically located as it could serve both the residents of the PH site and the employees of the YLIEE. The proposed location has also taken into account various traffic engineering considerations, such as separation from junctions, PTI layout design as well as tie-in with the proposed traffic management measures.

(5) Retails

In order to maximize the economic potential of the necessary retail activities in the PH site; all retail space has been consolidated to the eastern edge of the site. Streetfront retail has been established along Fuk Hi Street. The retail areas also benefit from the proximity to the proposed PTI. All retail space has been placed on ground level, in order to facilitate accessibility.

(6) Industrial/Residential (I/R) Interface

In order to avoid potential I/R Interface conflicts, a 50-metre wide buffer strip has been established between the PH site and the YLIEE site. The PTI and most of the outdoor core activities will be provided within this buffer strip.

(7) Other considerations

The development options have all taken into consideration noise as a potential limitation to development. In particular, the zone adjacent to the West Rail tracks requires a buffer of 180-200m and the narrow strip of land adjacent to Long Ping Road are areas with noise constraints. In order to maximize the use of land throughout the PH site, Single Aspect blocks (SAB) were utilized in some areas of the PH site to address the noise issues.

2.5.1.2 Proposed Layout

Taking into account of the above-mentioned urban design consideration, the general layout is drafted and as shown on **Figure 2.5.4-5.** In order to optimize the flat productions, most of the residential towers are placed on Plot A and B (**Figure 2.5.6**). It is intended to place two school sites within plot A to ensure a visual relief among the residential clusters. Some of the towers are also placed on the wings along Long Ping Road (named Plot C on **Figure 2.5.6)**.

At the southern end, residential site(s), school site and GIC site are being proposed. As mentioned, there is a minor difference between Option 1 and 2 at this corner regarding the land use for school site and residential site.

The general layouts are very similar in term of urban design for both options. Two options are proposed for the housing development and their variation is focused on the development intensity and land requirements (for residential and school uses). Regarding the development intensity and land use, details has been already elaborated in section **2.4.1.2.**

2.5.1.3 Comparison of Option 1 and 2

Plot Ratio (PR)

One of the key differences between the two options is Option 1 employs a domestic PR of 5.5 while Option 2 adopts a domestic PR of 6.0. The higher domestic PR in Option 2 is derived mainly by the increase of building height. The non-domestic PR for both options are the same of 0.1.

Provision of school sites

As mentioned in **Section 2.4**, the population threshold requires the allocation of one more school in Option 2 based on the HKPSG. As a result, land is provided for the secondary school in the southern portion of the housing site, and the building heights throughout the remainder of the building blocks are required to absorb the numbers of flats that the secondary school displaced.

Height Profile

The two items mentioned above result in the key difference between Option 1 and Option 2 in the term of the maximum building height limit of the towers. Thus, the maximum building height in Option 2 is 116m while the one in Option 1 is about 102m (**Figure 2.5.8**, **2.5.9-2.5.11**).

Table 2.5.1: Summary of Housing Parameters for Option 1 and Option 2

Housing Parameter	Option 1	Option 2
Maximum Height Limit (m)	102 m	116 m
Height of the tower (m)	75m / 88m / 102m	75m / 88m / 102m /116m
Number of residential storeys	25 / 30 / 35	25 / 30 / 35 /40
Total number of storeys (Ground floor included)	26 / 31 / 36	26 / 31 / 36 /41
Assumed no. of units/footprint	9-29 units	9-29 units
No. of towers	24	22

Widening of the View Corridor

Since one residential plot is used for school site in Option 2, which means that particular plot is used for lower building blocks of the school sites instead of residential towers. This help to widen the view corridor from existing Fung Chi Tsuen toward Kai Shan (**Figure 2.5.10**).

2.5.2 Urban Design Framework for YLIEE site

2.5.2.1 Urban Design Principles

Visual Connectivity

Appropriate building massing and siting should be taking into consideration with regards to the YLIEE site. In particular, the development of new industrial areas partitioned into plots of similar areas should be considered in order to maintain continuity with the existing YLIE. Building heights should also match the current maximum found in YLIE (8 storeys or 28-metres). This will contribute to the perception of being an extension of the current industrial site.

Visual connection to Kai Shan will be preserved in the YLIEE due to this lower building height. The lower building height will allow residents in the PH site to maximize northern views to the Deep Bay and Shenzhen (**Figures 2.5.13-2.5.15**).

Landscape

In order to minimize any I/R interface issues, a 50-metre buffer has been established between both areas. The YLIEE contributed 0.4 ha of area at the western portion of this open space strip. The buffer area within the YLIEE site not only serves as local open space for YLIEE, it also provides visual connectivity from the built area to the west and Kai Shan to the east.

Connectivity

Connection between the current YLIE and the YLIEE: Between lots 12 and 13 (**Figure 2.5.7**) in both options, pedestrian walkway has been included in order to further connect the users of this industrial site.

Proximity of the PTI to the YLIEE: The proposed PTI has been strategically placed at the buffer area between the PH site and the YLIEE site. In this manner, the PTI can serve both the employees of the YLIEE and the residents of the PH site.

2.5.2.2 Proposed Layout

The general layout for YLIEE site is similar for both options. The main road is designed to cut the piece of land into eastern and western sides (**Figure 2.5.3**). Industrial plots are placed along both sides of the road while sufficient connections are provided to link up the existing YLIE site and the proposed buffer area as well as the housing sites though the amenity strips.

As illustrated in Section **2.1.4**, the two options vary in their site boundaries result in the difference in the distribution of the industrial plots.

For Option A, in order to provide a vehicular access to the industrial lot 7, the internal road of the YLIEE site is branched out to that lot. In Option B, the site boundary of the YLIEE is slightly smaller to exclude the slope area with an intention to optimize development and efficiency. The division of the plots is revised to ensure a more even distribution in term of plot area **(Figure 2.5.12)**.

2.5.2.3 Comparison of Option A and B

Different treatment of the corner site

The YLIEE site is currently in a higher platform than the PH site, and as a result the two options generated take this factor into account. The main challenge with the northern portion of the YLIEE site is the current slope formation. Therefore, two different options are generated based on that. It can be seen that Option A makes better use of the available land for industrial purposes. The drawback is the necessity to create numerous slope platforms which will affect the continuity of role of the site as an extension to the YLIE, and also the need for an extensive bored pile wall adjacent to this slope. In Option B, avoiding using the corner site with higher site level **(Figure 2.5.7 and 2.5.12)**, on the other hand, this helps flatten the overall land area and thus improves the continuity between the YLIE and the YLIEE and removes the need for the extensive bored pile wall.

Development of Industrial Plots with a Variety of Sizes

One of the key principles established was to develop an industrial estate that would maximize the usable area, while simultaneously providing a diverse array of options for future tenants. It is necessary to develop a strategy that would allow provision of different lot sizes given the proposed road network and site formation strategies. As a result, the YLIEE site has the following distribution of lots, by options:

Table 2.5.2: Industrial Plot size

Industrial Plot size	Option A	Option B
1.10 ha -1.19 ha	0	1
1.00 ha - 1.09 ha	3	0
0.90 ha - 0.99 ha	0	0
0.80 ha - 0.89 ha	0	1
0.70 ha - 0.79 ha	9	7
0.60 ha - 0.69 ha	3	7
0.50 ha - 0.59 ha	1	0
Total number of lots	16	16

The distribution of areas showcases a fundamental difference between Options A and B. Most notably, Option A emphasizes on creating 0.7-0.79 ha lots, while Option B has a more even distribution between smaller and larger lots. The only outlying lot in Option B has 1.14 ha, which is significantly larger than the largest lot in Option A.

In terms of efficiency of land use, the comparison of options is given in **Table 2.5.3** below.

Table 2.5.3: Comparison of Land use efficiency for Option A and Option B

	Option A	Option B
Industrial Plot Areas	12.05	11.55
Developable Area	15.51	14.61
Efficiency	77.7%	79.1%

3 OPTION EVALUATION ON PLANNING AND URBAN DESIGN, LAND REQUIREMENT AND AIR VENTILATION

3.1 Urban Planning and Design

As mentioned in the previous sections, there are variations between Option 1 and 2 for the PH site and between Option A and B for the YLIEE site. The variations include development parameters, land requirements of various land uses and urban design frameworks etc. Because of these differences, the options will be evaluated against the evaluation principles and criteria as presented in **Section 2.3**. The relevant evaluation principles and criteria in respect of urban planning and design perspectives are reiterated in **Table 3.1.1** below:

Table 3.1.1: Evaluation principles and criteria under urban planning and design aspects

Evaluation Principle	Evaluation Criterion
Meeting Societal Need	Meeting housing demand by maximizing flat production
	Meeting demand on industrial estate premises by maximizing developable area within statutory limits
Enhancement of Community Facilities	Provision of sufficient G/IC facilities for the proposed development
	Provision of sufficient local open space for the proposed development
Improvement in Linkage and Connectivity	Provision of sufficient pedestrian access to neighbouring community facilities and infrastructures
	Improvement in connectivity to Kai Shan
Compatible Built Form	Integration of proposed development with surrounding natural topography
	Integration of proposed development with surrounding built form
Visual Enhancement	Preservation of visual connection to Kai Shan

3.1.1 Evaluation of the PH Options

Option 1 and Option 2 are evaluated and compared as summarised in **Table 3.1.2**. In terms of meeting housing demand by maximizing flat production, Option 2 performs better than Option 1 as Option 2 could provide 630 more flats than Option 1. Regarding the provision of G/IC facilities and local open space, both options perform equally well in meeting the requirements.

The overall layouts of both options are similar. The key difference is the widened view corridor from Fung Chi Tsuen toward Kai Shan. Since one residential plot is used for school site in Option 2, that means that particular plot is used for lower building blocks of the school sites instead of residential towers. This help to widen the view corridor from existing Fung Chi Tsuen toward Kai Shan.

The peak of Kai Shan is currently at 115mPD. If the tallest towers in Option 2 are 41 storeys (ground floor included) and the site formation is at +7 to +9 mPD for the residential site, the tallest towers in Option 2 would be higher than the peak of Kai Shan by about 8 metres. In Option 1, however, the towers still fall in-line with the peak of Kai Shan (refer to **Figure 2.5.15**).

Table 3.1.2: Comparison of the PH options under urban planning and design aspects

Evaluation Criterion	Option 1	Option 2
Meeting housing demand by maximizing flat production	• A total of 15,615 flats will be provided	• A total of 16,245 flats will be provided
Provision of sufficient G/IC facilities for the proposed development	• 1 Integrated Social Welfare Building will be provided • 3 primary schools (1 can be secondary school) will be provided, fulfilling the HKPSG requirement	• 1 Integrated Social Welfare Building will be provided • 4 primary schools (1 can be secondary school) will be provided, fulfilling the HKPSG requirement
Provision of sufficient local open space for the proposed development	• Local open space of 1m² per person including uses of basketball court, mini-soccer pitch (7-a-side) and children playground will be provided, fulfilling the HKPSG requirement	• Same as Option 1.
Provision of sufficient pedestrian access to neighbouring community facilities and infrastructures	• Sufficient pedestrian access is provided.	• Same as Option 1.
Improvement in connectivity to Kai Shan	• Sufficient linkage is provided.	• Same as Option 1.
Integration of proposed development with surrounding natural topography	• The surrounding natural landscape is being respected and sufficient buffer area is provided.	• Same as Option 1.
Integration of proposed development with surrounding built form	• The surrounding built form is being respected and integrated well with the proposed one.	• Same as Option 1.
Preservation of visual connection to Kai Shan	• View corridor to Kai Shan is preserved.	• View corridor to Kai Shan is preserved. The view corridor near Fung Chi Tsuen is wider than Option 1. • On the other hand, some towers (41 storeys) in Option 2 shall be slightly higher than the peak of Kai Shan.
Recommendation	-	**Preferred**

3.1.2 Evaluation of the YLIEE Options

Option A and Option B are evaluated and compared as summarised in **Table 3.1.3**. The divergent approaches dealing with the slope area at the southern tip of the YLIEE site contributes as a major differentiation between the two options. Because of this, 12.06 ha of land is reserved for industrial uses with a maximum GFA of 301,500 m^2 in Option A which is slightly higher than the 11.55 ha of land and 288,800 m^2 of GFA in Option B. In terms of local open space provision, both options are the same, providing 0.4 ha of local open space, well above the HKPSG requirements.

The overall layouts for both options are similar. The key difference is the northern portion of the YLIEE site due to the site formation treatment. It can be seen that Option A makes better use of the available land for industrial purposes. The drawback is the necessity to create numerous slope platforms which will affect the

continuity of role of the site as an extension to the YLIE. In Option B, avoiding using the corner site with higher site level, on the other hand, this help flattens the overall land area and thus improve the continuity between the YLIE and the YLIEE.

Table 3.1.3: Comparison of the YLIEE options under urban planning and design aspects

Evaluation Criterion	Option A	Option B
Meeting demand on industrial estate premises by maximizing developable area within statutory limits	• 12.06 ha of land is reserved for industrial uses with a maximum industrial GFA of 301,500 m^2.	• 11.55 ha of land is reserved for industrial uses with a maximum industrial GFA of 288,800 m^2.
Provision of sufficient local open space for the proposed development	• Local open space of around 0.40 ha is proposed meeting the requirement of HKPSG.	• Same as Option A.
Provision of sufficient pedestrian access to neighborhood community facilities and infrastructures	• Sufficient pedestrian access is provided.	• Same as Option A.
Improvement in connectivity to Kai Shan	• Sufficient linkage is provided.	• Same as Option A.
Integration of proposed development with surrounding natural topography	• Option A makes better use of the available land but the drawback is the necessity to create numerous slope platforms which affect the continuity with YLIE.	• Avoiding using the corner site with higher site level, this help flattens the overall land area and improve the continuity with YLIE.
Integration of proposed development with surrounding built form	• The surrounding built form is similar to the proposed one.	• Same as Option A.
Preservation of visual connection to Kai Shan	• View corridor to Kai Shan is preserved.	• Same as Option A.
Recommendation	-	**Preferred**

3.2 Land Requirement

The baseline condition of the current land status of the Project site has been established through desktop studies and presented in TR-1 Baseline Review Report. The detailed Land Requirement Plans will be prepared, as part of the TR-3 – Detailed Assessment on Preferred Option, to identify the affected lands and list out the land take required for the proposed development and the proposed infrastructures.

The preliminary feasibility assessments and evaluation of each initial development option in this report are undertaken with particular focus on the comparison of the extent of land take required i.e. the number and area of affected private land lots and affected leased Government land, as well as the extent of existing road accesses, watercourses and nullahs to be affected.

Since the burial grounds, graves (**Figure 3.2.1**), Umah International Primary School (**Figure 3.2.3**) have already been excluded from the refined Project site boundary, thus land take on these land uses are avoided. There are no existing public toilets, refuse collection points, government buildings, community centres, parks and playgrounds etc found within the Project site. Hence they are all not

considered in the evaluation of the initial options. The proposed evaluation criteria for land requirement are in **Table 3.2.1** below.

Table 3.2.1: Evaluation principle and criterion for land requirement aspect

Evaluation Principle	Evaluation Criterion
Minimize land resumptions on private land lots	Extent of private land lots to be affected
Minimize land requirements on existing accesses, road paths, railway operations, watercourses and nullahs etc	Extent of existing accesses of roads, cycle tracks, tracks, foot paths, bus stops/lay-bys, Railway Protection Boundary, West Rail Emergency Access Point, watercourses and nullahs etc to be affected

3.2.1 Evaluation of PH Options

Figure 3.2.2 illustrates the type of current land status within the Project site and in the surrounding areas. **Table 3.2.2** shows the number and area of potentially affected land lots by the proposed PH development site. Since the development area for the two PR options is the same (same project boundary), the extent of the affected land lots and extent of land take required is the same.

About 129,245 m^2 (~69%) of the area within the refined Project site boundary are private lands. A total of 332 private lots will be potentially affected by the proposed PH site. Amongst them, there are 9 Letter of Approval (LOA), 150 Modification of Tenancy (MOT), 2 Building Licence (BL), 12 Short Term Waiver (STW). A total of 24 Tso and Tong lots are identified and scattered within the PH site. These land lots are also OSL and they are owned by traditional family organisations and are held in common ownership for the benefit of the whole lineage. The remaining land within the Project site comprises mainly unleased Government land, as well as few leased Government land held under Short Term Tenancies (STT) on the northern portion of PH site and Government Land Licence (GLL) on the southern portion of PH site.

Notwithstanding the above, it should be noted that the number of affected lots presented in this report are still subject to change and final verification in the forthcoming Land Requirement Plan of the TR-3, based on the final project development boundary to be confirmed in next stage.

Table 3.2.2: Number and area of affected lots (same for both PR options)

		PH Site	
	Type of Land Records[1-9]	No. of Affected Lots	Approximate Area of Affected Lots (m^2)
Private Land Lot	OSL	331[10]	129,245[11]
	Tso and Tong Lots	24	-
	LOA (Licence)	9	-
	MOT (Licence)	150	-
	BL (Licence)	2	-
	STW (Licence)	12	-
	ONG	1	-
Government Land	STT (Licence)	3	1,773
	GLL (Licence)	6	232

Note:

(1) *Old Scheduled Lot [OSL] - 舊批約地段*

Land Parcels claimed during the Demarcation District (DD) Survey were called OSL as they were already in existence before the leasing of the New Territories (NT). They are land held under the Block

Crown Lease (BCL) granted by or on behalf of the Governor in 1905 pursuant to the New Territories (Land Court) Ordinance 1900 to the persons described in the Schedule to the lease.

(2) *Tso and Tong Lot - 祖堂地*

Tso and Tong are lineage trusts whereby village lands owned by traditional family organisations are held in common ownership for the benefit of the whole lineage. Under S.15 of the New Territories Ordinance (Cap. 97), whenever any land is held from the Government under lease or other grant, agreement or licence in the name of a clan (宗族), family (家族) or tong (堂), such clan, family and tong shall appoint a manager (司理) to represent it. The appointed manager shall be registered at the appropriate New Territories District Office of the Home Affairs Department. Consent of the District Officer is required for any transactions with the land.

(3) *Letter of Approval [LOA] - 批准書*

The approval given under the land grant condition (including BCL) of leasehold agricultural land to farmers who wishes to construct agricultural structures (e.g. greenhouses, livestock sheds, hatcheries, fish ponds, store rooms etc.)

(4) *Modification of Tenancy [MOT] - 租賃修訂*

Similar to LOA, but there is no limitation to agricultural uses. It is seldom issued nowadays and is superseded by the issue of Short Term Wavier (STW).

(5) *Building Licence [BL] - 建屋牌照*

A licence granted to any person by the Government under or by virtue of the lease permitting the erection on the land of a building or buildings, in relation to any land which is the subject of a Government grant.

(6) *Short Term Waiver [STW] - 短期豁免書*

It is issued to the land owner or occupier waiving the government right of re-entry for such a limited period, during which time the lessee may vary the use of the land with payment of prescribed fees.

(7) *New Grant Lot [NNG] - 新批地段*

Land parcels in the NT, or Crown land (i.e. land not claimed during the DD Survey), which were disposed of after 1905 either by way of public auction or by direct sale are known as the NNG. The land parcel granted before World War II are commonly known as Old New Grant Lot (ONG) while that granted after are commonly known as New New Grant Lot.

(8) *Short Term Tenancy [STT] - 短期租約*

A lease expressed to be granted for a term of not more than 7 years for specified use under conditions.

(9) *Government Land Licence [GLL] - 政府土地租用牌照*

A Licence confers a non-exclusive right of occupation of unleased government land. It mainly associates with habitation by people animal/poultry or cultivation/fishing/plantation. It may be issued under Cap. 28, but is rarely issued nowadays and is superseded by the issue of STT.

(10) Number of OSL which falls within the boundary of PH site. Any lot crossing over the common boundary of both PH and YLIEE has also been counted.

(11) Total area of OSL within the boundary of PH site.

Figure 3.2.3 illustrates the existing roads, cycle tracks, tracks, foot paths, Railway Protection Boundary, West Rail Emergency Access Point (EAP), watercourses and nullahs etc within the Project site and in the surrounding areas.

Several existing watercourses or drains are identified flowing across the PH site at the downstream of Kai Shan and will be affected by the proposed housing development. They will be diverted to the proposed new drainage system. Besides, a number of footpaths and tracks connecting to Kai Shan or the rural settlements and village houses within the PH site will also be potentially affected. It is recommended that footpaths and tracks connecting to Kai Shan should be reprovisioned in the development plan to allow public access to the existing graves and urns on Kai Shan. Accesses to those existing rural settlements and occupations which are outside the project limit and would be rendered land-

locked as a result of the proposed PH development should also be reprovided. Since the development area for the two PR options is the same (same project boundary), the extent of the impacts on existing watercourses, drains, footpaths and tracks is also the same.

To cater for the additional traffic due to the increase in population of the PH development, a section of Fuk Hi Street will be widened and minor improvement work on Long Ping Road is recommended (for the proposed new access road to the southern portion of the PH site and new bus stops/lay-bys). A very short section of an existing cycle track will need to be removed in order to provide connection of the new access road at the southern portion of the PH site to the junction of Long Ping Road and Fung Chi Road, but the signal-controlled crossing will be re-provided to maintain the linkage between this end of the cycle track and the one at the opposite side of the road. The proposed widening works at the junction of Long Ping Road and Fuk Hi Street, however, will not affect the existing cycle tracks as the works will only be carried out next to the PH site boundary without encroachment onto the other side of the road where the cycle track encircles Long Ping Estate. The extent of the proposed road improvement works would be the same for both options and hence the extent of the impacts on the existing cycle track is also the same.

Same for both options, the southern end of the PH site will encroach into the area within MTRC's Railway Protection Boundary held under Government land and GLLs while the West Rail EAP will not be affected. It should be noted that any proposals for new building, engineering works and developments (e.g. site formation/foundation works, ground investigation works, underground drainage works, demolition works etc.) to be carried out within the Railway Protection Boundary are subject to MTRCL's comment and special scrutiny of the Building Authority prior to giving approval to the plans and/or consent for commencing the construction works.

A comparison of the PH options in relation to land matter is provided in **Table 3.2.3** below.

Table 3.2.3: Comparison of land matter for different PH options

Evaluation Criteria	Option 1	Option 2
Extent of private land lots to be affected	• A total of about 129,245 m^2 private land lots will be affected.	• Same as Option 1.
Extent of existing accesses of roads, cycle tracks, tracks, foot paths, bus stops/lay-bys, Railway Protection Boundary, West Rail EAP, watercourses and nullahs etc to be affected	• Diversion of watercourses flowing across the Project site required. • Road improvement works including reprovision of bus stops/lay-bys on Fuk Hi Street and Long Ping Road to cater for PH development. • Existing accesses of tracks and footpaths connecting to graves on Kai Shan needs to be reprovisioned. • Accesses to those existing rural settlements and occupations which are outside the project limit and would be	• Same as Option 1.

Evaluation Criteria	Option 1	Option 2
	rendered land-locked as a result of the proposed PH development should also be reprovided. • Encroachment onto Railway Protection Boundary. Consent from the Building Authority before commencement of works required.	
Recommendation	No preference	No preference

3.2.2 Evaluation of YLIEE Options

Figure 3.2.2 illustrates the type of current land status within the Project site and in the surrounding areas. **Table 3.2.4** shows the number and area of potentially affected land lots by the proposed YLIEE site. The development area for the two YLIEE options is similar, except that the lot located at the western boundary is excluded in Option B. Hence, the extent of the affected land lots and extent of land take required for Option B will be slightly less than that of Option A. But the difference is considered insignificant.

About 74,476 m^2 (~48%) of the area within the refined Project site boundary for Option A and about 73,024 m^2 (~49%) for Option B are private land. A total of 222 private lots will be potentially affected by the proposed YLIEE site for Option A while 215 private lots will be potentially affected by Option B. Amongst them, there is only 1 STW. A total of 7 Tso and Tong lots are identified and scattered within the YLIEE site for both options. These land lots are also OSL and they are owned by traditional family organisations and are held in common ownership for the benefit of the whole lineage. 1 NNG and 1 LOA located in the northern portion of YLIEE site will also be potentially affected. The remaining land within the Project site comprises mainly unleased Government land, as well as few leased Government land held under Short Term Tenancies (STT) on the southern portion of YLIEE site.

Notwithstanding the above, it should be noted that the number of affected lots presented in this report are still subject to change and final verification in the forthcoming Land Requirement Plan of the TR-3, based on the final project development boundary to be confirmed in next stage.

Table 3.2.4: Number and area of affected lots for YLIEE options

		YLIEE Site			
		Option A		Option B	
	Type of Land Records[1-9]	No. of Affected Lots	Area of Affected Lots (m^2)	No. of Affected Lots	Area of Affected Lots (m^2)
Private Land Lot	OSL	221[10]	74,476[11]	214[10]	73,024[11]
	Tso and Tong Lots	7	-	7	-
	LOA (Licence)	0	-	0	-
	MOT (Licence)	0	-	0	-
	BL (Licence)	0	-	0	-
	STW (Licence)	1	-	1	-

	Type of Land Records[1-9]	YLIEE Site			
		Option A		Option B	
		No. of Affected Lots	Area of Affected Lots (m^2)	No. of Affected Lots	Area of Affected Lots (m^2)
	NNG	1	65 for building land and 339.7 for agricultural land	1	65 for building land and 339.7 for agricultural land
	LOA (Licence)	*1*	-	*1*	-
Government Land	STT (Licence)	6	1,695	6	1,695
	GLL (Licence)	0	-	0	-

Note:

[1] Old Scheduled Lot [OSL] - 舊批約地段

Land Parcels claimed during the Demarcation District (DD) Survey were called OSL as they were already in existence before the leasing of the New Territories (NT). They are land held under the Block Crown Lease (BCL) granted by or on behalf of the Governor in 1905 pursuant to the New Territories (Land Court) Ordinance 1900 to the persons described in the Schedule to the lease.

[2] Tso and Tong Lot - 祖堂地

Tso and Tong are lineage trusts whereby village lands owned by traditional family organisations are held in common ownership for the benefit of the whole lineage. Under S.15 of the New Territories Ordinance (Cap. 97), whenever any land is held from the Government under lease or other grant, agreement or licence in the name of a clan (宗族), family (家族) or tong (堂), such clan, family and tong shall appoint a manager (司理) to represent it. The appointed manager shall be registered at the appropriate New Territories District Office of the Home Affairs Department. Consent of the District Officer is required for any transactions with the land.

[3] Letter of Approval [LOA] - 批准書

The approval given under the land grant condition (including BCL) of leasehold agricultural land to farmers who wishes to construct agricultural structures (e.g. greenhouses, livestock sheds, hatcheries, fish ponds, store rooms etc.)

[4] Modification of Tenancy [MOT] - 租賃修訂

Similar to LOA, but there is no limitation to agricultural uses. It is seldom issued nowadays and is superseded by the issue of Short Term Wavier (STW).

[5] Building Licence [BL] - 建屋牌照

A licence granted to any person by the Government under or by virtue of the lease permitting the erection on the land of a building or buildings, in relation to any land which is the subject of a Government grant.

[6] Short Term Waiver [STW] - 短期豁免書

It is issued to the land owner or occupier waiving the government right of re-entry for such a limited period, during which time the lessee may vary the use of the land with payment of prescribed fees.

[7] New Grant Lot [NNG] - 新批地段

Land parcels in the NT, or Crown land (i.e. land not claimed during the DD Survey), which were disposed of after 1905 either by way of public auction or by direct sale are known as the NNG. The land parcel granted before World War II are commonly known as Old New Grant Lot (ONG) while that granted after are commonly known as New New Grant Lot.

[8] Short Term Tenancy [STT] - 短期租約

A lease expressed to be granted for a term of not more than 7 years for specified use under conditions.

[9] Government Land Licence [GLL] - 政府土地租用牌照

A Licence confers a non-exclusive right of occupation of unleased government land. It mainly associates with habitation by people animal/poultry or cultivation/fishing/plantation. It may be issued under Cap. 28, but is rarely issued nowadays and is superseded by the issue of STT.

[10] Number of OSL which falls within the boundary of YLIEE site. Any lot crossing over the common boundary of both PH and YLIEE has also been counted.

[11] Total area of OSL within the boundary of YLIEE site.

Figure 3.2.3 illustrates the existing roads, cycle tracks, tracks, foot paths, Railway Protection Boundary, West Rail EAP, watercourses and nullahs etc within the Project site and in the surrounding areas.

Several existing watercourses or drains are identified flowing across the YLIEE site at the downstream of Kai Shan. Tai Tseng Wai Nullah is also identified along the eastern boundary of YLIEE site adjacent to the existing YLIE. They will be demolished and diverted to the proposed new drainage system for both YLIEE options. Besides, a number of footpaths and tracks connecting to Kai Shan will also be potentially affected. It is recommended that footpaths and tracks connecting to Kai Shan should be reprovisioned in the development plan to allow public access to the existing graves and urns on Kai Shan. Accesses to those existing rural settlements and occupations which are outside the project limit and would be rendered land-locked as a result of the proposed YLIEE development should also be reprovided. Since the development area for the two YLIEE options is similar, the extent of the impacts on existing watercourses, drains, nullah, footpaths and tracks is also very similar.

A comparison of the YLIEE options in relation to land matter is provided in **Table 3.2.5** below.

Table 3.2.5: Comparison of the YLIEE options in relation to land matter

Evaluation Criteria	Option A	Option B
Extent of private land lots to be affected	• A total of about 74,476m^2 private land lots will be affected.	• A total of about 73,024m^2 private land lots will be affected. Extent of the affected land lots and land take required will be slightly less than that of Option A. But the difference is considered minor.
Extent of existing accesses of roads, cycle tracks, tracks, foot paths, bus stops/lay-bys, Railway Protection Boundary, West Rail EAP, watercourses and nullahs etc to be affected	• Diversion of watercourses flowing across the Project site and Tai Tseng Wai Nullah required. • Existing accesses of tracks and footpaths connecting to graves on Kai Shan needs to be reprovisioned. • Accesses to those existing rural settlements and occupations which are outside the project limit and would be rendered land-locked as a result of the proposed YLIEE development should also be reprovided.	• Same as Option A.
Recommendation	No preference	No preference

3.3 Air Ventilation

The proposed PH and YLIEE sites at Wang Chau are zoned as GB and OS on the existing Ping Shan OZP No. S/YL-PS/14. It is currently occupied by open spaces, vehicle parks, farmland, fallow land, grassland, rural residential dwellings and temporary structures. The existing site characteristics include the following:

Road pattern within the district: The Fuk Hi Street can facilitate the wind flowing from north to south, or vice versa. Whilst, Long Ping Road can facilitate the wind flowing from northeast to southwest, or vice versa. These two roads are considered as the major wind pathways in this district. In addition, several minor roads in the vicinity also act as potential air pathways.

Distribution of building height: The built area generally exhibits a low to medium height profile with 3-storey village houses to the north and east of the project site, and 8-storey industrial buildings in existing YLIE to the northeast of the project site. They are not expected to block the wind from northern and eastern directions. Long Ping Estate is the tallest development in the vicinity of the project site with Double H blocks of approx. 28 storeys, New Slab blocks of approx. 23 storeys, and Trident (i.e. Y-shape) blocks of approx. 35 storeys. This building group would have potential to impede the air flow.

Hilly Terrain: The Project Site is surrounded by both hilly terrain and flat areas. Kai Shan is located to the west side of the project with a ridgeline of 50mPD to the north, 110mPD in the central part and 50mPD to the south of the project site. Hence, Kai Shan may block the wind flow from western direction. Chu Wong Ling is located to the east side of the Project site with a ridgeline of 40-50mPD. Although it may block certain portion of wind, the wind can still penetrate into the site from the two sides of the hill.

The site wind availability data was determined using large scale topographical model (1:2000) tested in a boundary layer wind tunnel and the result was adopted in this option evaluation study. The experimental site wind availability study was undertaken in accordance with the current best international practice requirements stipulated in the Australasian Wind Engineering Society Quality Assurance Manual, AWES-QAM-1-2001 (2001) and the American Society of Civil Engineers Manual, Report on Engineering Practice No. 67 for Wind Tunnel Studies of Buildings and Structures (1999) and the Technical Guide for Air Ventilation Assessment for Developments in Hong Kong (2006).

A 1:4000 scale topographical study was constructed to determine the effects of local topography and the surrounding urban environment on the mean wind speed and turbulence intensity profiles of the study area. The physical model is shown in **Appendix 3.3.1**. The physical model covers the surrounding area up to a distance of not less than 10 km from the existing site boundary.

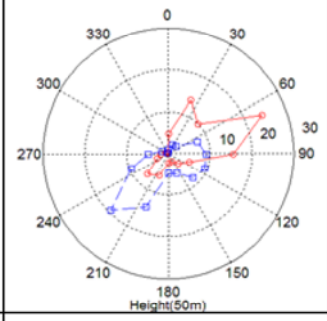
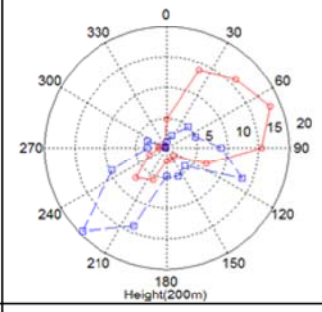
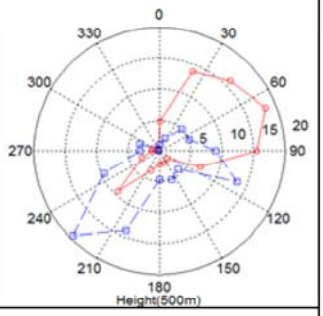
The measurement points for the site wind availability study were located at the centre of the subject development site. During the test, buildings within the Project site, which will be included in the 1:400 scale detailed model to be carried out in next detailed assessment stage, was removed. The topographical study was made reference to the wind data measured by Hong Kong Observatory at Waglan Island during the period between 1975 and 2001. Due to the relative lack of developments over the past 50 years and its generally uninterrupted exposure to wind, data collected at Waglan Island is considered to be representative of wind

approaching Hong Kong and are of the highest quality available for wind engineering purposes.

Appropriate combinations of roughness elements and fences was used to simulate the characteristics of wind approaching Hong Kong as represented by the mean wind speed and turbulence intensity profiles corresponding to wind flowing over open water.

Table 3.3.1 shows the wind rose results at 50m (approximate urban canopy layer height), 200m (medium level) and 500m (approximate wind boundary layer height) above the ground, which represent the wind availability of the study area.

Table 3.3.1: Summer and annual wind rose results based on wind tunnel simulation

	Wind Rose at 50m above the ground	**Wind Rose at 200m above the ground**	**Wind Rose at 500m above the ground**
Prevailing wind direction and annual probability			
Annual	ENE 24.3%	ENE 18.3%	ENE 18.3%
Summer	SW 7.0%	SW 7.0%	SW 9.3%

Note: red line – annual wind; blue line – summer wind

The wind roses indicate that the annual prevailing wind is from ENE direction and the summer wind is from SW direction. The wind pathways are shown in **Appendix 3.3.2**. The availability of SW wind is reduced at lower elevation (50m) probably due to topographical blockage effect by Kai Shan.

The annual frequency summary of the simulation result at 500m (approximate wind boundary layer height) is tabulated for 16 wind directions in **Table 3.3.2**.

Table 3.3.2: Summary of wind probability data (based on wind tunnel study) at 500m above the study area

Wind Direction	**Percentage of Occurrence (%)**	**Wind Direction**	**Percentage of Occurrence (%)**
N	4.8	S	2.1
NNE	13.9	SSW	3.5
NE	15.9	SW	9.3
ENE	18.3	WSW	3.0
E	15.4	W	1.3
ESE	7.0	WNW	1.2
SE	1.7	NW	0.2
SSE	2.1	NNW	0.3

In planning the proposed development layouts, the following issues shall be considered as far as possible:

- Wind pathways in the proposed developments should be aligned primarily along the prevailing wind direction (i.e. ENE and SW directions) as far as possible to allow effective air movements to remove heat, gases and particulates and to improve the microclimate.
- Main streets/wide main avenues between the proposed developments should be aligned in parallel, or up to 30 degrees to the prevailing wind direction (i.e. ENE and SW directions) as far as possible to maximise the penetration of prevailing wind through the district.
- Height variation across the proposed developments with decreasing heights towards the direction where the prevailing wind comes from (i.e. ENE and SW directions) should be allowed as far as possible for better air movements.
- Adequately wide gaps should be at a face perpendicular to the prevailing wind (i.e. ENE and SW directions) as far as possible to enhance air permeability.
- The angle between the axis of the building blocks and the prevailing wind direction (i.e. ENE and SW directions) should be within 30 degrees as far as possible to allow the building blocks to capture more wind for better indoor natural ventilation.

The proposed evaluation criteria for air ventilation are summarized in **Table 3.3.3** below.

Table 3.3.3: Evaluation principle and criterion for air ventilation aspect

Evaluation Principle	Evaluation Criterion
Better Air Ventilation	Main streets aligned in parallel, or up to 30 degrees to the prevailing wind direction as far as practicable
	Building height variation across the district
	Adequately wide gaps between building blocks as far as practicable
	Angle between the axis of the building blocks and the prevailing wind direction should be within 30 degrees as far as practicable

3.3.1 Evaluation of PH Options

The proposed PH site is of about 18.69ha consisting of an ISWB, schools, retail and public housing building blocks. The site platform level ranges from 5.5 to 13mPD. There are 24 housing blocks with 26, 31 and 36 storeys in Option 1 (**Figure 2.5.2**) and 22 housing blocks with 26, 31, 36 and 41 storeys in Option 2 (**Figure 2.5.2**).

There are two main access roads (M1 and M2) in the PH site. M1 is located in northern part of the site. It is 16m wide in total and is aligned in ENE direction. Under the annual prevailing wind direction in ENE direction, the wind is able to penetrate into the site and reach to the School Sites 1 and 2. M2 with a total width of 13m is located in southern part of the PH site. The major segment of M2 is also aligned parallel to the annual prevailing wind direction and is able to facilitate the penetration of wind from ENE direction.

The proposed housing blocks are mainly in "cruciform", 'Y' and 'T" shapes. For both options, the major axis of Blocks 8 to 14 in the central portion of the site is aligned in ENE direction; while the major axis of Blocks 15 to 19 on the southern strip of the land is aligned along Long Ping Road. Such arrangements can facilitate the air flow under prevailing annual wind condition (**Appendix 3.3.3**).

For both options, wide gaps are provided between building blocks to maximise the air permeability of the proposed development and to minimise the impacts on wind capturing potential of adjacent developments. Moreover, a 50m buffer is also provided between PH site and YLIEE. This buffer can also enhance the air permeability (**Appendix 3.3.3**).

In terms of the height profile, the building heights of the 24 public housing building blocks for Option 1 vary from 84mPD (with 26 storeys) to 110mPD (with 36 storeys). Blocks 1 to 14 are distributed in 2 groups and step down from 110mPD to 94mPD towards the annual prevailing wind direction from ENE. The stepped building height profile would help wind deflection and avoid air stagnation. For Option 2, the site consists of 22 public housing building blocks with heights varying from 84mPD (with 26 storeys) to 124mPD (with 41 storeys). Blocks 1 to 14 are distributed in 3 groups and step down from 124mPD to 94mPD towards the annual prevailing wind from ENE. The variation in building height profile is larger than that in Option 1, which would enhance air movements, allow wind deflection and avoid air stagnation.

Compared to the layout of Option 1, two residential Blocks 20 and 21 (26 storeys) in the southern tip of the site are replaced by a school (maximum of 8-storey) in Option 2. This would make Option 2 more favourable to facilitate wind flow passing through the buildings.

Overall, it is considered that the building layout arrangements in Option 2 are more preferable from perspective of air ventilation under annual condition.

In summer, the prevailing wind is from SW direction. The hilly terrain of Kai Shan at the western side of the PH site may block portion of wind from SW direction into the northern part of the PH site, but SW wind may still penetrate into the southern part of the PH site along Long Ping Road.

A comparison of the PH options in relation to air ventilation is provided in **Table 3.3.4** below.

Table 3.3.4: Comparison of the PH options in relation to air ventilation

Evaluation Criterion	Option 1	Option 2
Main streets aligned in parallel, or up to 30 degrees to the prevailing wind direction as far as practicable	• The main streets within the PH site are aligned approximately parallel to the annual prevailing wind direction.	• Same as Option 1.
Building height variation across the district	• Blocks 1 to 14 are distributed in 2 groups stepping down from 110mPD to 94mPD towards the annual prevailing wind direction from ENE.	• Blocks 1 to 14 are distributed in 3 groups stepping down from 124mPD to 94mPD towards the annual prevailing wind from ENE.
Adequately wide gaps between building blocks as far as practicable	• Adequate gaps (>10m) between buildings is allowed to maximize the air permeability. • A 50m buffer is provided between PH site and YLIEE site. This buffer can also enhance the air permeability.	• Same as Option 1. • In addition, two residential blocks (26 storeys) in the southern tip of the site are replaced by a school (maximum of 8-storey) in Option 2. This would make Option 2 more favourable to facilitate wind flow passing through the buildings.
Angle between the axis of the building blocks and the	• The major axis of Blocks 8 to 14 in the central portion of the site is	• Same as Option 1.

Evaluation Criterion	Option 1	Option 2
prevailing wind direction should be within 30 degrees as far as practicable	aligned in ENE direction.	
Recommendation	-	**Preferred**

3.3.2 Evaluation of YLIEE Options

The proposed YLIEE has an area of 15.52 ha for Option A and 14.62 ha for Option B. Both options will consist of 16 industrial lots with the same maximum building height of 32m. The site platform level ranges from 6.0 to 12mPD for Option A, and from 6.0 to 7.2mPD for Option B.

The main access road with a total width of 28m is planned running along the central part of the YLIEE site for both options. Under annual prevailing wind direction in ENE, the southern end of the road will channelize the wind into the site. Hence it is unlikely to cause regions of localized stagnant wind at pedestrian level.

In both option, the major axis of the buildings is approximately parallel to the annual prevailing wind direction in ENE (**Appendix 3.3.4**) and the building gap is at least 18m, which would facilitate the wind flow penetrating into the site.

In terms of the height profile, the site platform for Option A will change gradually from about 12mPD to 6.0mPD from west to east, thus the building height will decrease from 44mPD to 38.0mPD towards eastern direction. For Option B, the site platform will be more or less flat with a level of about 7.2mPD in the west to 6.0mPD in the east. The building height will decrease slightly from 39.2mPD to 38.0mPD towards the eastern direction. Although there is a minor difference in stepped building heights between Option A and B, it is considered that the impact on wind penetration due to such difference is not significant. Hence both options would perform similarly from air ventilation perspectives.

In summer, the prevailing wind is from SW direction. The hilly terrain of Kai Shan at the western side may block portion of wind from SW direction into the YLIEE site. Thus, it is expected that wind environment inside the development is likely to have relatively low wind speed regions in both Option A and B.

A comparison of the YLIEE options in relation to air ventilation is provided in **Table 3.3.5** below.

Table 3.3.5: Comparison of the YLIEE options in relation to air ventilation

Evaluation Criterion	Option A	Option B
Main streets aligned in parallel, or up to 30 degrees to the prevailing wind direction as far as practicable	• Under annual prevailing wind direction in ENE, the southern end of the road will channelize the wind into the site.	• Same as Option A.
Building height variation across the district	• The building height decreases from 44mPD to 38mPD towards eastern direction.	• The building height decreases from 39.2mPD to 38mPD towards eastern direction.
Adequately wide gaps between building blocks as far as practicable	• Adequate gaps (>18m) between buildings have been allowed to maximize the air permeability.	• Same as Option A.
Angle between the axis of the	• The major axis of the buildings is	• Same as Option A.

Evaluation Criterion	Option A	Option B
building blocks and the prevailing wind direction should be within 30 degrees as far as practicable	generally aligned parallel to the annual prevailing wind in ENE direction.	
Recommendation	No preference	No preference

4 OPTION EVALUATION ON ENGINEERING AND INFRASTRUCTURE

4.1 Traffic and Transport

The Study Area is relatively remote and is located to the north of Long Ping Road, to the west of Fuk Hi Street, and adjacent to the YLIE and Long Ping Estate. The proposed site occupies a strip of land starting from the elevated section of West Rail at Long Ping Road, follows Long Ping Road, then Fuk Hi Street and terminates at Tai Tseng Wai. The development site currently contains village houses clustered around Long Ping Road, and some cottage industries located on Fuk Hi Street.

Long Ping Road is of dual 2 carriageways configuration connecting Fuk Hi Street and Shui Pin Wai Interchange. At present, it carries medium to low level of traffic. It is generally observed that majority of traffic is east bounded, while lesser traffic is observed on the Long Ping Road. Traffic accessing the strategic highway will use Long Yip Street, Castle Peak Road and then Pok Oi Interchange to Route 3 which is perceived as a quicker and shorter route. Nonetheless, Long Ping Road offers an alternative, but direct connection to the strategic highway via Shui Pin Wai Interchange.

The proposed PH and YLIEE in the Study Area altogether would increase the traffic demand in Wang Chau area, in particular at Fuk Hi Street, Long Ping Road and Long Yip Street. Hence, the development potential of the Study Area partly hinges on the performance of the road network in the Wang Chau area.

In terms of public transport facility, two bus termini can be found within the Study Area. They are located at Wang Lee Street and Long Ping Estate respectively. At present Long Ping bus terminus provides service for 8 franchised bus routes, and 2 of which terminate at the terminus. Hence, the provision of additional public transport facility within the proposed PH and YLIEE site should be considered not only because it would improve the accessibility and the connectivity of the Study Area, it could also minimise the loading of the existing public transport facilities.

Lastly, from pedestrian point of view, the Project site is relatively remote and there are three ways to gain access to the Project site: 1) at-grade crossing at the junction of Fuk Hi Street and Long Ping Road; 2) at-grade crossing at the junction Long Ping Road and Fung Chi Road; and 3) at-grade crossing at Long Ping Road outside Yuk Ping House of Long Ping Estate. The access from the proposed PH and YLIEE sites to these crossings would be critical to ensure the connectivity between the Study Area, Yuen Long Town and West Rail Long Ping Station.

Amongst the proposed PH and YLIEE options as described in the earlier sections and the abovementioned key issues and constraints of the Study Area, a preliminary traffic impact assessment has been carried out to evaluate the impact for different PH and YLIEE options. The evaluation criteria are proposed in **Table 4.1.1** below.

Table 4.1.1: Evaluation principle and evaluation criterion for traffic and transport aspect

	Evaluation Principle	Evaluation Criterion
Traffic & Transport	Minimise impact on existing road network	Extent of junctions to be affected
	Provision of public transport facilities	Coverage of public transport facilities within the proposed developments
	Provision of pedestrian facilities	Connectivity between the proposed development and Yuen Long Town

4.1.1 Evaluation of PH Options

The initial assessment is to identify the likely amount of traffic generated and attracted by the PH options. The trip ends have been estimated based on traffic generation and attraction rates presented in Transport Planning and Design Manual Volume 1 Chapter 3. The trip rates and the corresponding trip ends are summarised in **Table 4.1.2**, **Table 4.1.3** and **Table 4.1.4** below:

Table 4.1.2: Traffic generation and attraction rates (PCU/HR/Flat for PH & PCU/HR/100sq.m for Retail Space)

Development Density / OZP Zoning	Average Flat Size (sq.m)	AM Generation	AM Attraction	PM Generation	PM Attraction
Subsidised Housing: Public Rental	40	0.0432	0.0326	0.0237	0.0301
Subsidised Housing: HOS / PSPS	50	0.0622	0.0426	0.0297	0.0401
Retail	-	0.2296	0.2434	0.3100	0.3563

Table 4.1.3: Estimated trips related to the proposed PH Option 1 (PCU/HR)

Development Density / OZP Zoning	No. of Flats / GFA[1]	AM Generation	AM Attraction	PM Generation	PM Attraction
Option 1 (PR5.5 with 15,615 flats, at this stage of the Study, it is assumed that 50% of the flats would be Public Rental and 50% would be HOS / PSPS)					
Subsidised Housing: Public Rental	7,808	338	255	186	236
Subsidised Housing: HOS / PSPS	7,808	486	333	232	314
Retail	14,382	34	36	45	52
Total		**858**	**624**	**463**	**602**

Note:
[1] A 10% allowance in terms of no. of flats will be included in the detailed assessment.

Table 4.1.4: Estimated trips related to the proposed PH Option 2 (PCU/HR)

Development Density / OZP Zoning	No. of Flats / GFA[1]	AM Generation	AM Attraction	PM Generation	PM Attraction
Option 2 (PR6.0 with 16,245 flats, at this stage of the Study, it is assumed that 50% of the flats would be Public Rental and 50% would be HOS / PSPS)					
Subsidised Housing: Public Rental	8,123	351	265	193	245
Subsidised Housing: HOS / PSPS	8,123	506	347	242	326
Retail	14,962	35	37	47	54
Total		**892**	**649**	**482**	**625**

Note:
[1] A 10% allowance in terms of no. of flats will be included in the detailed assessment.

Based on the above trip estimates, it is apparent that PH Option 2 would generate and attract more traffic compared with PH Option 1. Hence, Option 1 would have less impact on the road network in the Wang Chau area. To appreciate the future traffic condition, junction capacity analyses based on the Transport Planning and Design Manual (TPDM) were carried out at the key junctions using the peak hour preliminary forecast flows. A reserve capacity (RC) implies that a signal-controlled junction is operating at capacity while a negative RC% suggests that the junction is overloaded. For priority junctions, the performance indication is design flow ratio (DFC). A DFC ratio of 0.85 indicates a reasonable capacity provision which queuing would be prevented in the majority of cases. The assessment results comparing both PH options and the corresponding improvement measures are summarised in **Table 4.1.5** below.

It is worth to note that traffic accessing the strategic highway will use Long Yip Street, Castle Peak Road and then Pok Oi Interchange to Route 3 which is perceived as a quicker and shorter route. However, these road links and interchange are observed to be fairly congested during the peak hours. Hence, a traffic management measures has been devised to route the traffic, especially generated from the PH sites, to Route 3 via Long Ping Road and Shui Bin Wai Interchange. The proposed route from PH Sites to Route 3 would be via Fuk Hi Street, Long Ping Road and Shui Bin Wai Interchange compared with the existing route via Fuk Hi Street, Long Yip Street, Castle Peak Road and Pok Oi Interchange.

Table 4.1.5: 2031 junction performance for PH Option 1 and Option 2

Junction [1]	Junction Type[1]	PH Option 1		PH Option 2		Possible Mitigation Measures[2]
		AM	PM	AM	PM	
J1 – Fuk Hi Street / Long Ping Road	Signal	10%	>50%	5%	35%	Preliminary junction improvement has been considered and will be further refined in detailed assessment[2]
J2 – Fuk Hi Street / Wang Lok Street	Signal	3%	9%	**<0%**	1%	Lane marking to be further reviewed to improve the performance of the junction

Junction [1]	Junction Type[1]	PH Option 1		PH Option 2		Possible Mitigation Measures[2]
		AM	PM	AM	PM	
J3 – Long Ping Road / Fung Chi Road	Signal	22%	45%	15%	32%	Preliminary junction improvement has been considered and will be further refined in detailed assessment[2]
J4 – Fung Chi Road / Wang Tat Road / Ma Wang Road / Ping Wui Street	Signal	8%	13%	**<0%**	**<0%**	Junction to be further reviewed. However, the scope for junction improvement is limited due to the viaduct structures of West Rail
J5 – Wang Lok Street / Wang Tat Road / Long Yip Street / Yuen Long On Lok Road / Ma Wang Road	Signal	3%	6%	**<0%**	**<0%**	Junction to be further reviewed with the improvement proposal under Long Ping South Development
J6 – Po Yip Street / Long Yip Street / Yuen Long On Lok Road	Signal	2%	4%	**<0%**	**<0%**	Junction to be further reviewed with the improvement proposal under Yuen Long Pedestrian Study by Highways Department
J7 – Shui Bin Wai Interchange	Signal	4%	>50%	**<0%**	43%	Junction widening to be considered to improve the performance of the junction; Larger scale improvement measures such as dedicated slip roads should be explored to cater for the traffic demand in detailed assessment[2]

Note:
[1] The locations of junction refer to **Figure 4.1.1**.
[2] A 10% allowance in terms of no. of flats will be included in the detailed assessment.

With reference to the above preliminary junction assessments, it is observed that the overall road junctions performance for PH Option 1 would generally perform better than PH Option 2 due to the comparatively smaller traffic demand as shown in **Table 4.1.3** and **Table 4.1.4**. Despite Option 2 would generate and attract more traffic compared with Option 1, it is considered that there are no insurmountable impacts from traffic point of view for both options, given that suitable traffic improvement works are provided.

In terms of public transport facility, a public transport interchange has been proposed for both PH Options. Hence, both options perform equally from public transport point of view. Besides, as both PH Options share the same overall layout, the pedestrian accessibility within the site and connectivity to Yuen Long Town and West Rail would also be the same.

A comparison of the PH Options in relation the evaluation criterion are summarised in **Table 4.1.6** below:

Table 4.1.6: Comparison of traffic and transport aspects for different PH options

Evaluation Criterion	Option 1	Option 2
Extent of junctions to be affected	• No junction performs with RC below 0% or DFC above 0.85 for both AM or PM peaks.	• 5 junctions perform with RC below 0% or DFC above 0.85 for both AM or PM peaks.
Coverage of public transport facilities within the proposed developments	• A public transport interchange has been proposed between PH and YLIEE.	• Same as option 1.
Connectivity between the proposed development and Yuen Long Town	• A comprehensive pedestrian network has been developed to serve between the PH, Yuen Long Town and West Rail Long Ping Station.	• Same as option 1.
Recommendation	**Preferred**	-

4.1.2 Evaluation of YLIEE Options

The initial assessment is to identify the likely amount of traffic generated and attracted by the YLIEE options. The trip ends have been estimated based on the surveyed traffic generation and attraction rates of the existing YLIE. The trip rates and the corresponding trip ends are summarised in the **Table 4.1.7**, **Table 4.1.8** and **Table 4.1.9**. The existing traffic generation & attraction is 218 & 120 PCU/HR for the AM Peak and 121 & 227 PCU/HR for the PM Peak. It is worth to note that with the change of landuse from the existing open storage/parking to the proposed industrial estate, it is anticipated that the traffic generation and attraction would be reduced in the future.

Table 4.1.7: Traffic generation and attraction rates (PCU/HR/100 sqm land Area)

Trip Rate of Existing YLIE	AM Generation Rate	AM Attraction Rate	PM Generation Rate	PM Attraction Rate
Private Vehicle	0.0318	0.0365	0.0378	0.0194
Goods Vehicle	0.0226	0.0220	0.0238	0.0117

Table 4.1.8: Estimated trips related to the proposed YLIEE Option A (PCU/HR)

YLIEE	AM Generation	AM Attraction	PM Generation	PM Attraction
Private Vehicle	50	57	59	30
Goods Vehicle	35	35	37	19
Total	**85**	**92**	**96**	**49**

Table 4.1.9: Estimated trips related to the proposed YLIEE Option B (PCU/HR)

YLIEE	AM Generation	AM Attraction	PM Generation	PM Attraction
Private Vehicle	50	57	59	31
Goods Vehicle	36	35	38	19
Total	**86**	**92**	**97**	**50**

Based on the above trip estimates, it is clear that both YLIEE Options would generate and attract very much the same amount of traffic. Hence, the impact on the road network in the Wang Chau area is the same.

In terms of public transport facility, a public transport interchange has been proposed for both YLIEE Options. Hence, both options perform equally from public transport point of view. Besides, as both YLIEE Options share the same

overall layout, as a result, the pedestrian accessibility within the site and connectivity to Yuen Long Town and West Rail would also be the same.

A comparison of the YLIEE Options in relation to the remaining two evaluation criterion are summarised in **Table 4.1.10** below:

Table 4.1.10: Comparison of traffic and transport aspects for different YLIEE Options

Evaluation Criterion	Option A	Option B
Extent of junctions to be affected	• Base on the estimated trips ends shown in **Table 4.1.8** and **Table 4.1.9**, both YLIEE Options would have same magnitude of impact in Wang Chau area.	• Same as Option A.
Coverage of public transport facilities within the proposed developments	• A public transport interchange has been proposed between PH and YLIEE.	• Same as Option A.
Connectivity between the proposed development and Yuen Long Town	• A pedestrian corridor has been provided to serve between the YLIEE, Yuen Long Town and West Rail Long Ping Station.	• Same as Option A.
Recommendation	No preference	No preference

4.2 Geotechnics and Foundation Works

A key consideration for foundation design for this site is the potential complexity of the geology. The Site falls within Scheduled Area No. 2, recognised as an area of complex geology where karst features such as an uneven upper surface and dissolution cavities are known to occur within the marble (GEO, 1992). The site is also located within the influence zone of the northeast-trending Lo Wu-Tuen Mun fault and fold belt which contains a series of faults, folds and shear zones, including at least four major northeast-trending faults, namely the Lau Fau Shan Fault, Yuen Tau Shan Fault, Ma Tso Lung Fault and the San Tin Fault.

There is currently insufficient data to confirm the complexity of ground conditions below the site or to determine the variation in Grade III rockhead levels. Exploratory holes along the eastern boundary of the YLIEE site and PH site suggest rockhead may locally be in excess of 90mbGL. If marble is present, it may have been subject to dissolution, and resulting palaokarst conditions may pose significant problems for foundation design and construction. Such problems previously experienced in the Yuen Long area include an anomalously deep rockhead, with rock locally in excess of 150m below ground level. A steeply inclined and irregular rockhead profile makes the construction of conventional end-bearing piles very difficult. In addition, cavities formed within the marble may be infilled with weak and highly compressible material at considerable depth. The on-going dissolution and collapse of the marble rock mass results in thick superficial deposits comprising collapse material and weak cavity-fill. Such conditions are problematic for driven pile construction as piles have to penetrate very deep to pass through the cavities and weak material.

The faults which affect this area may also give rise to significant variations in rockhead level, which will impact on foundation design. The ground model will be further developed to identify variations in rockhead and potentially problematic

ground conditions once the project specific ground investigation has been completed.

The anticipated foundation requirements for the various structures being considered have been evaluated. The evaluation criteria for geotechnics and foundation works are proposed in **Table 4.2.1** below.

Table 4.2.1: Evaluation principle and criterion for geotechnics aspect

Evaluation Principle	Evaluation Criterion
Provision of foundations for residential towers within the PH site	Foundations requirements for residential tower buildings for different options.
Provision of foundation for non-residential buildings within the PH site	Foundations requirements for maximum 8 storey schools and other non-residential buildings for different options.
Provision of foundation requirements for YLIEE buildings	Foundations requirements for industrial estate buildings for different options.

The findings of this assessment are provided below, including a comparison of the development options.

4.2.1 Evaluation of PH Options

The PH site comprises both residential and non-residential buildings. The non-residential buildings e.g. schools and community buildings will be a maximum of 8 storeys for each option. The layout options for the PH differ in that two of the residential towers located within the southern portion of Option 1 of the PH site are replaced with an additional school. In addition to this, the footprint of the most westerly school located in the central portion of the PH site is increased in Option 2 compared to Option 1. Further to this, the only other significant change between the options is the number of storeys at each of the residential towers. The platform levels remain the same for both options, with the maximum number of stories (ground floor included) proposed is as follows:

Option 1: 36 storey residential towers

Option 2: 41 storey residential towers

Residential Towers

Taller towers with a higher number of storeys will exert a greater load through their foundations, therefore the number of piles will be greater for Option 2 than Option 1. Piled foundations are expected to be required for the residential towers for both options. The preferred piled option would be end bearing piles, socketed into competent rock (5 metres continuous Grade III or better with a minimum core recovery of 85%). Complex ground conditions in the Scheduled Area may result in areas of particularly deep weathering, where rockhead may be in excess of 150m below ground level (GEO 1992). Under such conditions, end bearing piles may not be feasible. Where particularly deep rockhead is encountered (i.e. greater than 100mbgl) three possible solutions include:

1. Relocation of the effected tower in order to avoid localised deep weathering;
2. An engineering solution such as friction piles;

3. Ground treatment to infill cavities

With these solutions there are potential restrictions and implications. If particularly deep rockhead is encountered, it may be feasible to exchange the location of an effected residential tower with one of the proposed low rise buildings. Where friction piles are required it is preferential to have a low to medium rise building at this location as the load exerted through the foundations will be lower. Small to medium rise buildings are preferable particularly on marble formation with cavities at which the increase in vertical effective stress is limited according to GEO Publication No.1/2006. Depending on the extent and/or number of areas identified where rockhead exceeds 100mbgl, moving towers may not always be feasible, and an alternative foundation solution for the residential towers may be sought.

Friction piles (including bored piles and barrettes) generally provide a lower bearing capacity compared to end bearing piles. The frictional capacity of these piles can be enhanced by post-construction grout (i.e. shaft-grouting), which is capable to provide greater pile capacity compared with a plain friction pile. Overall the cost of friction piles is likely to be higher compared with end bearing piles.

Where cavities have been identified ground improvement by infilling the cavities with cement grout could be a possible solution, however there can be inherent difficulties with identifying the extent of the cavities and possible leakage of grout through joints, therefore this option is considered to be a last resort.

There is potential for compressible soils (e.g. Alluvial and marine clays and silts) underlying the site. However, there is currently insufficient existing GI data to confirm the presence or absence and distribution both laterally and vertically of any such materials at the site. Although the consolidation of these compressible soils should have been completed due to their long formation history within the area, further consolidation may be triggered if there are additional surcharges due to site formation, building structures bearing on ground or possible groundwater drawdown around the area. If this was to happen, the consolidation of these significant thicknesses of compressible soils can cause negative skin friction on piles which will need to be considered for any pile design. Piles could be sleeved or designed to take the negative skin friction into account. Significant thicknesses of alluvial and marine deposits may also impact on the lateral displacement and capacity of the piles. This would result in additional cost of pile construction.

Non-Residential Buildings

For those buildings which are expected to be 8 storeys or less, the loading will be much lower than for the residential towers. For these buildings, pre-bored H-piles and mini-piles socketed into rock are considered to be most appropriate deep foundation solution. These types of foundation also provide more flexibility on the piling arrangement to suit the building layout. However, the practical construction limit for these piles is around 50 to 70m.

Similarly to the residential towers, if deep rockhead is encountered an alternative engineering solution may be sought. This may comprise friction piles rather than end bearing piles. Alternatively, if limits are imposed on vertical effective stress due to presence of marble or cavities (GEO Publication No.1/2006.) a buoyancy raft foundation may be a viable option. Similarly to the residential towers, ground improvement by infilling the cavities with cement grout is considered to be a final

option. As with the residential towers if the presence of compressible soils is confirmed, the possibility of negative skin friction on piles will need to be considered for any pile design.

It should be noted that options for foundation requirements shall be reviewed upon completion of the site specific ground investigation, and further refined with subsequent phases of ground investigation.

A comparison of the PH options in relation to foundation requirements is provided in **Table 4.2.2** below.

Table 4.2.2: Comparison of foundation requirements for different PH Options

Evaluation Criteria	Option 1	Option 2
Foundation requirements for residential tower buildings for different options.	• Piled foundations for 36 storey Residential Towers: end-bearing piles socketed into competent rock* Where rockhead is encountered deeper than 100mbgl, friction piles may be required.	• As Option 1, but an increase in the number of piles required per tower in order to take additional load of the 41 storey towers. However, two less towers as compared with Option 1, which are replaced by a school in Option 2.
Foundation requirements for maximum 8 storey schools and other non-residential buildings for different options.	• Pre-bored H-piles and mini-piles socketed into rock* Where deep rockhead is encountered friction piles may be a solution.	• Foundation requirements same as Option 1, but with one additional school building in place of two residential towers.
Recommendation	No preference	No preference

*Competent rock is taken to mean 5 metres continuous Grade III or better rock with a minimum core recovery of 85%, with the exception of marble. Where marble is encountered, competent rock is taken to mean 20m of continuous sound marble with no sign of significant dissolution, i.e. rock marble class I or II according to Chan (1994).

Under the proposed PH options, the number of piles required per tower is likely to be greatest for Option 2 because of the increased height of the towers. The cost of foundation construction per tower will therefore be greater for Option 2. However the increased cost of foundations for the residential towers should be approximately in proportion to the increase in the provision of residential floor area. Option 2 has higher towers, but two residential towers are replaced by a school which will require less piles. Thus there is no preference between the two options in relation to foundation requirements.

4.2.2 Evaluation of YLIEE Options

The options for the YLIEE site differ in terms of the platform level across the majority of the YLIEE site, the area along the western boundary of the site, and the number of lots along the southern boundary. In Option B the platform level across most of the site has been reduced by approximately 2 metres, the area of the western platform has been reduced, removing one of the proposed lots, however in Option B an additional lot has also been created along the southern boundary of the YLIEE site. A reduction in the total building footprint area of approximately 2,000m^2 is incurred with Option B.

Buildings within the proposed YLIEE are expected to be a maximum of 8 storeys for each option. Considering that these buildings will exert a relatively low loading, pre-bored H-piles and mini-piles socketed into rock are considered to be

most appropriate deep foundation solution. These types of foundation also provide more flexibility on piling arrangement to suit the building layout.

Similarly to the non-residential buildings of the PH site, if deep rockhead is encountered an alternative engineering solution may be sought. This may comprise friction piles rather than end bearing piles. Alternatively, if limits are imposed on vertical effective stress due to presence of marble or cavities (GEO Publication No.1/2006.) a buoyancy raft foundation may be a viable option which could partially balance the loading of the building with that of the excavated soil beneath. Ground improvement by infilling the cavities with cement grout is considered to be a final option. As with the PH site if the presence of compressible soils is confirmed, the possibility of negative skin friction on piles will need to be considered for any pile design.

A comparison of the YLIEE options in relation to foundation requirements is provided in **Table 4.2.3** below. Given that YLIEE Option 2 is proposed to have a lower platform level it can be assumed that the length of any piled foundations will be shorter by approximately 2 metres on average.

It should be noted that options for foundation requirements shall be reviewed upon completion of the site specific ground investigation, and further refined with subsequent phases of ground investigation.

Table 4.2.3: Comparison of foundation requirements for different YLIEE Options

Evaluation Criteria	YLIEE Option A	YLIEE Option B
Foundation requirements for industrial estate buildings for different options.	• Pre-bored H-piles and mini-piles socketed into rock. Friction piles if deep rockhead identified, and cannot be avoided.	• Same as Option A. However as Option B has a platform level approximately 2m lower than that for Option A; if piles are socketed into rock, it is expected that the pile length will be shorter due to the lower platform level.
Recommendation	-	**Preferred**

Under the proposed YLIEE options, assuming that the foundations are socketed into rock, the foundation designs will vary in terms their required depth, as the platform levels for Option A are generally 2 metres higher than the platform levels for Option B. In addition to this, the total footprint area of the buildings is less for Option B, and therefore fewer foundations will be required. However the number of foundations required is proportional to the usable space provided in each of the options, and therefore few or greater numbers of foundations does not reflect an overall additional cost or saving when considering the project as a whole. As a result of this from the perspective of foundations Option B is considered to be the preferred option as any piled foundations socketed into rock are likely to be 2m shorter. Option B is considered to be the preferred option.

4.3 Site Formation

The proposed site formation layout and levels (as shown in **Figures 4.3.1** and **4.3.2**) have been determined based on the following factors:

- Maximising the area of the platforms to ensure maximum area of development subject to other criteria detailed below.

- Optimising the platform levels so that they are in keeping with the surrounding area, whilst meeting criteria for drainage, pedestrian and vehicle access;
- Minimising cut and fill quantities in order to reduce total excavation and export of spoil, and import of fill;
- Minimising fill works to reduce the likelihood of settlement induced from additional loading of the ground and any potential existing compressible soils.

It should be noted that all site won material intended for use as fill will have to be tested to ensure compliance with Section 6 of General Specifications for Civil Engineering Works (2006 (updated 7 February 2013)). According to the specification, fill material shall have a particular particle size distributions within the ranges stated in Table 6.1 of the specification, and must not contain the following:

a) Material susceptible to volume change, including marine mud, soil with a liquid limit exceeding 65% or a plasticity index exceeding 35%, swelling clays and collapsible soils,

b) Peat, vegetation, timber, organic, soluble or perishable material,

c) Dangerous or toxic material or material susceptible to combustion, and

d) Metal, rubber, plastic or synthetic material.

Meta-sandstone and meta-siltstone recovered from excavation works and intended for use as fill will have to meet the criteria set out in Section 6 of General Specifications for Civil Engineering Works. It is anticipated that the site won meta-sedimentary rock will be suitable for general fill material. Given the current site use, there is potential for some contaminated material to be excavated during the site formation. If material is identified as being contaminated, this will also affect its suitability for re-use as fill material.

Soils susceptible to volume change such as alluvial and marine clay and silt have been identified in existing boreholes surrounding the site with thickness up to 5.5m, and 13.0m respectively. As a result, there is potential for compressible soils to be underlying the site. There is currently insufficient existing GI data to confirm the presence or absence and distribution both laterally and vertically of any such materials at the site. Where compressible soils exist there is the potential for high settlements upon loading such as placement of fill during site formation. If compressible soils are encountered, depending on their extent, surcharging of the ground may be required to induce settlement prior to construction, or these soils may need to be removed and replaced, or treated in-situ.

For the areas subject to excavation, the exact requirements for cut slope stabilisation or retaining walls will depend on the ground profile. At the western boundary of the site where the excavation of a number of cut slopes will be required, a combination of 30 degree soil slopes (with planting) and bored pile retaining walls has been assumed as a worst case scenario. Evidence from the site walkover suggests rockhead may be relatively high in this area. If this is the case steeper rock cut slopes may be possible, and bored pile walls may not be required, depending on the condition of the rock mass.

The evaluation criteria for site formation are proposed in **Table 4.3.1** below.

Table 4.3.1: Evaluation principle and criterion for site formation

Evaluation Principle	Evaluation Criterion
Maximise area of development	Optimisation of site formation to ensure maximum area of development subject to other criteria detailed below.
Optimisation of platform levels	Determination of suitable platform levels that are in keeping with the surrounding area, whilst meeting criteria for, drainage and vehicle access.
Minimise cut and fill quantities	Minimise cut and fill quantities in order to reduce total excavation and export of spoil, and import of fill
Minimise impact on existing natural slopes	Where possible, avoid steepening of slopes and use of retaining structures which negatively impact on aesthetics
Minimise potential for ground settlement	Minimise fill works to reduce the likelihood of settlement induced from additional loading of the ground and any potential existing compressible soils

4.3.1 Evaluation of PH Options

The options for the PH site differ in that two of the residential towers located in the southern portion of the PH site shown in Option 1, are replaced with an additional school. Further to this, the only other significant difference between the options is the number of storeys at each of the residential towers, whilst the platform levels, location and associated slopes and retaining structures will remain the same. As a result it is considered that the requirements for site formation will be the same for both options. The proposed site formation layout with locations and details of cut slopes and retaining walls is shown in **Figures 4.3.1 and 4.3.2.** As these figures illustrate, the PH site area consists of a series of platforms varying from +13mPD to +6mPD, with a small area at the eastern PH site boundary designated as a Public Transport Interchange (PTI) at +5.5mPD.

A comparison of the PH options in relation to site formation is provided in **Table 4.3.2** below.

Table 4.3.2: Comparison of site formation requirements for different PH Options

Evaluation Criteria	Option 1	Option 2
Optimisation of site formation to ensure maximum area of development subject to other criteria detailed below.	• The proposed PHD site comprises approximately 179,000m^2.	• Same as Option 1.
Determination of suitable platform levels that are in keeping with the surrounding area, whilst meeting criteria for drainage, pedestrian and vehicle access	• The proposed PH site comprises a large main platform sloping from +9mPD at its western boundary, sloping to the east to +6mPD. A section of the PH site then branches off to the south, where platform levels increase in elevation towards the south from +6mPD to +13mPD as shown in **Figure 4.3.1**.	• Same as Option 1, as shown in **Figure 4.3.2.**
Minimise cut and fill quantities in order to reduce total excavation and export of spoil, and import of fill	• Cut and fill volumes for the PH site are approximately 277,500m^3 and 142,500m^3 respectively.	• Same as Option 1.

Evaluation Criteria	Option 1	Option 2
Where possible, avoid steepening of slopes and use of retaining structures which negatively impact on aesthetics	• Where slopes are proposed adjacent to natural terrain, these are proposed to be 30° in order to allow more aesthetically pleasing vegetated slopes, and avoid the need for soil nails which would extend beyond the site boundary. In locations where a 30° slope would encroach onto the building or road footprints, the slopes will be combined with bored pile retaining walls. • Where retaining walls are proposed along the eastern site boundary, they can be designed to be stepped with planter boxes to provide a more aesthetically pleasing view.	• Same as Option 1.
Minimise fill works to reduce the likelihood of settlement induced from additional loading of the ground and any potential existing compressible soils	• Platform height has been designed to reduce from west to east across the PH site to minimize fill placement in likely to be underlain by compressible soils, taking into account other practical requirements such as drainage and access.	• Same as Option 1.
Recommendation	No preference	No preference

Site formation requirements for both options are the same; therefore there is no preference between options in relation to site formation.

4.3.2 Evaluation of YLIEE Options

The proposed site formation layout with locations and details of proposed cut slopes and retaining structures for the two YLIEE options are shown in **Figures 4.3.1** and **4.3.2** respectively.

For YLIEE Option A, the access road shall enter the site at the southeastern boundary from Fuk Hi Street at approximately +4.5mPD, and then rise to +9.0mPD towards the centre of the YLIEE in order to allow vehicular access to the +12.0mPD platform located at the western boundary. To ensure a maximum slope gradient of 1:200 across the development platform, the industrial estate lots to the east of the access road will slope downwards in an easterly direction from +9mPD to +8.5mPD only. A 4.0m high reinforced earth retaining wall will be required along the central section of eastern boundary of the site in order to accommodate the difference in ground level to the east of the site boundary, within the existing Yuen Long Industrial Estate. To the north and south of the +9.0mPD platform area the proposed ground level will slope in an easterly direction from +8.0mPD to +7.5mPD requiring a 3.5m high earth retaining wall along the northern and central-southern sections of the eastern boundary of the site.

Further to this, the platform located at the western edge of the YLIEE with a level of +12.0mPD extends westwards into an area bounded to the north, west, and

south by sloping natural terrain. In order to form this platform a 30° slope combined with a large bored pile wall (maximum of 10m in height) at the slope toe is required.

For YLIEE Option A, the estimated cut and fill volumes are: Cut 106,000m^3, Fill 297,000m^3. For both the PH site and YLIEE Option A, the estimated cut and fill volumes are: Cut 383,500m^3; Fill 439,500m^3.

The YLIEE Option B differs from Option A in that the lot located at the far western boundary is omitted (as shown in **Figures 4.3.1** and **4.3.2**). This removes the requirement for the associated platform level to be +12mPD, and removes the need for vehicle access to this area, which in turn means the central area of the main platform and road can be reduced. As a result, under Option B, the central area of the main platform of the YLIEE has been proposed at +6.7mPD; the requirement for extensive bored pile wall (up to 10m high) adjacent to this lot has been removed; and the difference in platform level and existing ground level at the eastern boundary of the site, and hence earth retaining wall height, has been reduced from 4.0m to 1.7m. As a result of reducing the main central platform area from +9.0mPD to +6.7mPD, to the volume of fill material required is significantly reduced.

For YLIEE Option B, the estimated cut and fill volumes are: Cut 113,000m^3, Fill 148,000m^3. For both PH site and YLIEE Option B, the estimated cut and fill volumes are: Cut 390,500m^3; Fill 290,500m^3.

A comparison of the Option A and Option B in relation to the site formation requirements is provided in **Table 4.3.2** below.

Table 4.3.3: Comparison of site formation requirements for YLIEE Options

Evaluation Criteria	Option A	Option B
Optimisation of site formation to ensure maximum area of development subject to other criteria detailed below.	• Option A comprises about 150,000m^2 of developable area.	• Option B comprises about 142,500m^2 of developable area.
Determination of suitable platform levels that are in keeping with the surrounding area, whilst meeting criteria for drainage, pedestrian and vehicle access	• The central area of the YLIEE site consists of a +9.0mPD platform, with a sloping road to +4.5mPD in the south east to allow vehicular access into the industrial estate. An approx. 20,000m^2 elevated platform at +12.0mPD is located at the most westerly portion of the YLIEE. The platform slopes gently from +9.0mPD from the central platform a gradient of 1:200 to the central area of the eastern boundary of the site to 8.5mPD, 4.0 metres above existing ground level immediately outside of the site.	• The central area of the YLEE site consists of a +6.7mPD platform, with a sloping road to +4.5mPD in the southeast to allow vehicular access. The platform slopes gently from +6.7mPD from the central platform a gradient of 1:200 to the central area of the eastern boundary of the site to +6.2mPD, 1.7 metres above existing ground level immediately outside of the site.
Minimise import of fill and export of spoil from site.	• Total Estimated Cut Volume for both YLIEE and PH site: 383,500m^3. • Estimated Fill Volume for both	• Estimated Cut Volume for both YLIEE and PH site: 390,500m^3. • Estimated Fill Volume for both YLIEE and PH site: 290,500m^3.

Evaluation Criteria	Option A	Option B
	YLIEE and PH site: 439,500m^3.	
Where possible, avoid steepening of slopes and use of retaining structures which negatively impact on aesthetics	• Raising the existing ground level of the main central platform from approximately +5.0mPD to a level of +9.0mPD and 8.5mPD at the eastern boundary, will result in the need for approximately 4m high earth retaining wall along the 550m length of the eastern boundary of the YLIEE. • The elevated platform located at the most westerly portion of the site with an elevation of +12.0mPD will require pile retaining walls up to 10m in height. • Where slopes are proposed adjacent to natural terrain, these are proposed to be 30° in order to allow more aesthetically pleasing vegetated slopes. In some areas will require bored piled walls at the slope toe. • Where reinforced earth retaining walls are proposed, they have been designed to be stepped with planter boxes to provide a more aesthetically pleasing view.	• Raising the existing ground level of the main central platform from approximately +5mPD to a level of +6.7mPD and 6.2mPD at the eastern boundary, will result in the need for approximately 1.7m high earth retaining wall along the 550m length of the eastern boundary of the YLIEE. • Reducing the size of the plot associated with the elevated platform located at the most westerly portion of the site will allow for a 30° cut slope option to be designed rather than a 10m high bored pile retaining wall. • Elsewhere, proposed slopes are as per Option A.
Minimise fill works to reduce the likelihood of settlement induced from additional loading of the ground and any potential existing compressible soils	• Approximately 3 to 4m in thickness of fill to be placed at the eastern side of the YLIEE site where alluvial and marine deposits are more likely to be encountered.	• Approximately 1.7m in thickness of fill to be placed at the eastern side of the YLIEE site where alluvial and marine deposits are more likely to be encountered.
Recommendation	-	**Preferred**

Option B, although resulting in a reduction of the overall site area of approximately 7500m^2, has several benefits in relation to site formation:

1. By reducing the size of the lot located at the western boundary, the site formation level for the associated platform can be kept in keeping with the adjacent main platform. This will remove the need for access from the main platform to the western platform and allow a reduction in platform levels across the site, thus reducing the thickness and volume of fill required.

2. The lower main YLIEE in Option B results in a reduction in the height of the earth retaining wall at the eastern boundary; reducing cost and visual impact, improving pedestrian access, and continuity with the adjacent YLIE.

3. Option B requires a reduced thickness of fill compared with Option A, resulting in lower loading on the potentially compressible soils which underly parts of the site, and the need for surcharging, removal and replacement or ground improvement.

4. By reducing the size of the lot located at the western boundary (as in Option B) the 8m bored piled wall in Option A can be replaced by a 30 degree spoil slope.

With the preferred YLIEE Option B, the cut and fill volume estimates suggest a surplus of spoil material. The re-use of this material on site will be considered in more detail as part of the Geotechnical and Site Formation Assessment once a preferred option has been identified.

4.4 Existing Registered Features

16 Nos. of registered manmade features have been identified within the site or immediately adjacent to the site boundary (**Figure 4.4.1** and **4.4.2**). Of these, 14 Nos. are cut slopes, 1 No. is a retaining wall, and 1 No. is a fill slope. All existing registered features have been assessed to determine whether they will be removed, modified or retained during site formation work. It should also be noted that a small number of unregistered slopes may exist within the site. The locations and condition of these will be further reviewed during the next stage of the study.

The proposed evaluation criterion is as follows:

Table 4.4.1: Evaluation principle and criterion for existing registered features

Evaluation Principle	Evaluation Criterion
Modification of existing slopes	Minimise modification of existing slopes

4.4.1 Evaluation of PH Options

Within the PH site 9 No. registered manmade features have been identified within the site or at the site boundary. It is anticipated that 4 No. of these features will need to be removed under both PH site options. A further 3 No. features will require modification as they are located partially within the site. According to the options currently being considered, the remaining 2 No. features are unlikely to require modification or removal. However, these slopes that are to be retained will require assessment to determine if they meet current Factor of Safety (FoS) requirements for residential development or if they require upgrading. Where existing features are located along the PH site boundary adjacent to Long Ping Road they will require cutting back in order to allow for construction of retaining walls.

Site formation works for both PH site options are the same; therefore the impact on existing features will be the same for both options. A comparison of the PH Options in relation to existing registered features is provided in **Table 4.4.2** below.

Table 4.4.2: Comparison of impact on existing registered features for PH Options

Evaluation Criteria	Option 1	Option 2
Minimise modification of existing slopes	• It is anticipated that 3 No. of slopes will require modification. 2 No. of slopes will require further assessment and may need upgrading.	• Same as Option 1
Recommendation	No preference	No preference

The impact on existing registered slopes is the same for both options; therefore there is no preference between options in relation to existing registered slopes.

4.4.2 Evaluation of YLIEE Options

7 No. registered manmade features have been identified within the YLIEE site or adjacent to the site boundary. For Option A it is anticipated that 3 No. of these features will be removed; 3 No. features will require modification as they are located partially within the site; and the remaining 1 No. feature located adjacent to the boundary of the site is not anticipated to require any modification. For Option B it is anticipated that 2 No. of these features will be removed; 3 No. features will require modification as they are located partially within the site; and the remaining 2 No. features are located adjacent to the boundary of the site, outside of the area to be developed and therefore will not require modification.

All slopes that are to be retained will require assessment to determine if they meet current FoS requirements for development or if they require upgrading. The only difference between anticipated slope works between the options is that 1 No. of the slopes that will be removed under Option A will be retained under Option B.

A comparison of the YLIEE options in relation to existing registered features is provided in **Table 4.4.3** below.

Table 4.4.3: Comparison of impact on existing registered features for YLIEE Options

Evaluation Criteria	Option A	Option B
Minimise modification of existing slopes	• It is anticipated that 3 slopes will require modification. 1 No. of slopes will require further assessment and may need upgrading.	• It is anticipated that 3 slopes will require modification. 2 No. of slopes will require further assessment and may need upgrading.
Recommendation	**Preferred**	-

Based on the above information the preferred option is Option A as less slopes require further assessment and possible upgrading works.

4.5 Natural Terrain Hazards

Areas of natural terrain with evidence of erosion, rock outcrop and boulders were identified from the aerial photographs and during the site walkover adjacent to the western boundary of the site. These slopes have potential for landslides, rock and boulder falls, which pose a risk to the development. Further site reconnaissance has been undertaken to take a closer look at the accessible areas of natural terrain. This confirmed the presence of several drainage lines which could result in channelisation, numerous boulders particularly adjacent to the YLIEE site, and anthropogenic modification of the natural terrain which may potentially cause future instability. Natural terrain hazards have been assessed by carrying out the following:

- Identification of catchments that are considered to pose a hazard to the development;
- A desk study to characterise the natural terrain and its landslide history;

- Aerial photograph interpretation (API) to clarify details gained from the desk study and to further identify any additional past instabilities or potential hazards;
- A site inspection to determine possible locations for mitigation measures.

Figures 4.5.1 and **4.5.2** show the areas requiring Natural Terrain Hazard Study (NTHS) according to the criteria set out in GEO Report 138.

For land use planning, adjusting facility layout can be an effective action for a large site development. It is sometimes possible to avoid or reduce the exposure to natural terrain hazards by siting the critical facilities (e.g. residential blocks) away from the hillside or exit of a potential hazardous drainage line. To avoid the potential impact of natural terrain hazards from the adjacent slopes, a buffer prohibiting construction within 50m of the site boundary adjacent to the natural slopes could be applied. However, given the need to maximise the platform area for development, it has not been possible to maintain a 50m buffer within the current options under consideration.

Based on an initial review of the likely natural terrain hazards and the current development options, it is likely that mitigation works would principally comprise the construction of flexible barriers outside the Project site along the footslopes of the natural terrain or along the crest of the cut slopes and retaining walls bounding the western edge of the site, with rigid barriers (check dams) located within the drainage lines upslope of the site. This is subject to confirmation once a preferred option has been selected and the NTHS has been completed.

Where flexible barriers are required on hill slopes with existing graves, the barriers can be strategically placed to avoid the graves. Design of the barriers will incorporate areas of overlap, where access routes and footpaths can be provided.

Where the construction of natural terrain mitigation measures is required, there will be the need for some vegetation clearance during construction, and for permanent access for maintenance.

The evaluation criteria for natural terrain hazards are proposed in **Table 4.5.1** below.

Table 4.5.1: Evaluation principle and criterion for natural terrain hazards

Evaluation Principle	Evaluation Criterion
Potential for natural terrain hazards	Screening criteria as set out in GEO Report 138: proximity of facilities to slope and slope angle; identification of potential and past instability
Minimise the natural terrain mitigation measures required	Extent of mitigation measures required to be kept to a minimum
Minimise impact of mitigation measures on existing graves	Avoidance of impacts on graves and access to graves

4.5.1 Evaluation of PH Options

The initial screening identified 8 No. catchments adjacent to the PH site which meet the alert criteria set out in GEO Report 138 (see **Figures 4.5.1** and **4.5.2**), and hence require natural terrain hazard assessment (NTHA).

Within the natural terrain catchments identified as meeting the alert critera adjacent to the PH site, 4 No. of relict landslides have been identified from the Enhanced Natural Terrain Landslide Inventory (ENTLI), which demonstrates these slopes have been subject to instability historically. API identified no boulders or outcrop within the natural terrain that could impact on the PH site.

It is anticipated that the possible natural terrain hazard mitigation measures are likely to comprise flexible barriers outside the Project site along the toe of those catchments meeting the alert criteria, as illustrated in **Figures 4.5.1** and **4.5.2**. Where flexible barriers are proposed they can be arranged so that they avoid graves, whilst areas of overlap in the flexible barriers can allow access routes. Requirements for natural terrain hazard measures for the preferred option will be confirmed once the NTHS has been complete.

A comparison of the PH options in relation to the natural terrain hazards is provided in **Table 4.5.2** below.

Table 4.5.2: Comparison of possible Natural Terrain Hazard Mitigations (NTHM) requirements for PH Options

Evaluation Criteria	Option 1	Option 2
Screening criteria as set out in GEO Report 138: proximity of facilities to slope and slope angle; identification of potential and past instability	• Potential for natural terrain hazards impacting on the PH site from 8 Nos. of catchments, with evidence of historical instability.	• Same as Option 1.
Extent of mitigation measures required to be kept to a minimum	• Flexible barriers outside the Project site are likely to be required along the footslopes of 8 No of catchments located around the mid portion of the western site boundary.	• Same as Option 1.
Avoidance of impacts on graves and access to graves	• Mitigation measures can be located to avoid contact with existing graves, whilst maintaining access routes.	• Same as Option 1.
Recommendation	No preference	No preference

The requirement for natural terrain hazard mitigation (NTHM) measures will be the same for both PH options; therefore there is no preference between options in relation to natural terrain hazards.

4.5.2 Evaluation of YLIEE Options

Initial screening has identified 11 Nos. catchments adjacent to the YLIEE which meet the alert criteria as set out in GEO Report 138 for Option A and 9 Nos. of catchments for Option B (see **Figures 4.5.1** and **4.5.2**), and hence require NTHA.

Within the natural terrain catchments meeting the alert criteria adjacent to the YLIEE, 15 Nos. relict landslides have been identified from the Enhanced Natural Terrain Landslide Inventory (ENTLI) for Option A, and 13 Nos. for Option B. 1 No. feature was identified from the Large Landslide Inventory. This demonstrates these slopes have been subject to instability historically. However of these landslides identified in the ENTLI only ENTLI No. 06NWB0097E could be

verified from the API. In addition to the landslide, the API identified several areas of boulders and rock outcrop that could potentially provide a source for boulder and rockfall.

It is anticipated that the possible natural terrain hazard mitigation measures are likely to comprise flexible barriers outside the Project site along the toe of those catchments meeting the alert criteria, which are less extensive for Option B than Option A, as illustrated in **Figures 4.5.1** and **4.5.2**. Rigid barriers (check dams) are also likely to be required within drainage lines in Catchments W and AD for Option A and Catchment AD for Option B. Where flexible barriers are proposed they can be arranged so that they avoid graves, whilst areas of overlap in the flexible barriers can allow access routes. Requirements for natural terrain hazard measures for the preferred option will be confirmed once the NTHS has been complete.

A comparison of the YLIEE options in relation to the natural terrain hazards is provided in **Table 4.5.3** below.

Table 4.5.3: Comparison of possible NTHM requirements for YLIEE Options

Evaluation Criteria	Option A	Option B
Identification of potential Natural Terrain Hazards	• Potential for natural terrain hazards impacting on the YLIEE from 11 No. of catchments, with evidence of historical instability and potential sources of boulder and rockfall.	• Potential for natural terrain hazards impacting on the YLIEE from 9 No. of catchments, with evidence of historical instability and potential sources of boulder and rockfall.
Mitigation Measures against natural terrain hazards	• Flexible barriers outside the Project site are likely to be required at the footslopes of 11 No.of the catchments located at the western boundary of the YLIEE site, with rigid barriers within two of the drainage lines (as indicated in **Figure 4.5.1**).	• Flexible barriers outside the Project site are likely to be required at the toe of 9 No. of the catchments identified at the western boundary of the YLIEE site, with rigid barriers within one of the drainage lines (as indicated in **Figure 4.5.2**).
Impact of mitigation measures on existing graves	• Mitigation measures can be located to avoid contact with existing graves, whilst maintaining access routes.	• Same as Option B.
Recommendation	-	**Preferred**

The YLIEE Option B results in the removal of the lot located at the western boundary, and so creates a buffer greater than 50m from the toe of catchments V and W, as shown in **Figure 4.5.2**. This buffer removes the need for NTHA and mitigation works for these catchments. The likely reduction in mitigation works makes the YLIEE Option B the preferred option.

4.6 Stormwater Drainage

The potential stormwater impacts on existing watercourse, channels and drains, and need of improvement works required are reviewed for different options. When assessing the impact on stormwater drainage, the site has been evaluated as a whole instead of separately for PH and YLIEE sites. The proposed evaluation criteria are given in **Table 4.6.1** below.

Table 4.6.1: Evaluation principle and criterion for stormwater drainage

Evaluation Principle	Evaluation Criterion
Minimise the impacts on existing watercourses	Extent of impacts on existing watercourses within Project site
Minimise the impacts on existing channel	Extent of impacts on existing Tai Tseng Wai Channel
Minimise the impacts on surface runoff from outside Project site	Extent of impacts on surface runoff from Kai Shan
Minimise the impacts on existing storm drains	Extent of impacts on existing storm drains along Long Ping Road
	Extent of impacts on existing storm drains along Fuk Hi Street

The Study Area locates at the catchment boundaries of Yuen Long Basin and Tin Shui Wai Basin. However, the Project site only falls within the catchment boundary of Yuen Long Basin. The general layout of Yuen Long Basin and Tin Shui Wai Basin are shown in **Figure 4.6.1**.

In order to maximize the land usage within the Project site, the existing watercourses across the Project site will be diverted to the proposed peripheral drains at the slope toe along site boundary and then collected to the proposed box culvert running along the future road within the site. Similarly, the existing 6m wide channel adjacent to the existing YLIE will be diverted to the proposed box culvert. Since the layouts of various development options are very similar, it is considered that the required diversion schemes for various development options are the same.

Peripheral drains alongside Project site boundary, on the other side, are required to protect the site from the surface runoff from Kai Shan. Since the requirements for the proposed peripheral drains are independent of the layouts within the Project site, it is considered that the requirements for peripheral drains for various development options are the same.

Due to the increase in paved area of the Project site, the peak surface runoff from the site to the existing downstream drainage system will be increased. Also, change of landuse from village (rural) areas to urban areas will increase the flood protection requirement from 1 in 10yr to 1 in 50yr. As a result, construction of new storm drains/upgrade of existing storm drains along Long Ping Road and Fuk Hi Street is expected to be required for all options. Nevertheless, the hydraulic impact on section of existing Tai Tseng Wai Channel downstream to the YLIEE should be minimal because most of the area within YLIEE are currently paved and the increase in paved area and hence the peak surface runoff after the proposed development are insignificant. Since the layouts of various development options are very similar, it is considered that the requirements for upgrade of existing storm drains for various options are the same. The existing and proposed stormwater drainage layout is shown in **Figure 4.6.2**. Feasibility checking calculation for the drainage improvement works is provided in **Appendix 4.6.1**.

A comparison of different options in relation to stormwater drainage impacts is provided in **Table 4.6.2** below.

Table 4.6.2: Comparison of stormwater drainage impacts for different options

Evaluation Criterion	Option 1 + Option A	Option 1 + Option B	Option 2 + Option A	Option 2 + Option B
Impacts on existing watercourses within	• Diversion of existing watercourses within Project site required. Same for all options.			

Evaluation Criterion	Option 1 + Option A	Option 1 + Option B	Option 2 + Option A	Option 2 + Option B
Project site				
Impacts on existing Tai Tseng Wai Channel	• Minimal hydraulic impacts on existing Tai Tseng Wai channel downstream to Project site due to insignificant increase in paved area. Same for all options.			
	• Diversion of section of existing Tai Tseng Wai Channel within Project site required. Same for all options.			
Impacts on surface runoff from Kai Shan	• Construction of peripheral drains alongside Project site boundary required. Same for all options.			
Impacts on existing storm drains along Long Ping Road	• Upgrading of existing storm drains along Long Ping Road might be required. Same for all options.			
Impacts on existing storm drains along Fuk Hi Street	• Upgrading of existing storm drains along Fuk Hi Street might be required. Same for all options.			
Recommendation	No preference	No preference	No preference	No preference

4.7 Sewerage

The potential impacts on existing sewerage system including the need of upgrading works on Yuen Long Sewage Treatment Works (YLSTW) and existing foul sewers are reviewed for different options. When assessing the impact on sewerage system, the site has been evaluated as a whole instead of separately for PH and YLIEE sites. The proposed evaluation criteria are given in **Table 4.7.1** below.

Table 4.7.1: Evaluation principle and criterion for sewerage system

Evaluation Principle	Evaluation Criterion
Minimise the impacts on existing Sewage Treatment Works	Extent of impacts on Yuen Long Sewage Treatment Works (YLSTW)
Minimise the impacts on compliance with requirements	Compliance with requirements of "No net increase in pollution loads to Deep Bay"
Minimise the impacts on existing foul sewers	Extent of impacts on existing foul sewers in YLIE

The Project site is located within Yuen Long Sewerage Catchment. The existing sewage flow within Yuen Long Sewerage Catchment is treated at the existing YLSTW. The general layout of Yuen Long Sewerage Catchment and location of YLSTW are shown in **Figure 4.7.1**. The existing treatment capacity of YLSTW is 70,000 m^3/day (ADWF). The proposed Effluent Polishing Scheme (EPS) at YLSTW is under planning with tentative commissioning date in September 2017. The scope of EPS at YLSTW will upgrade the effluent standards with design capacity decrease to 46,000m^3/day (ADWF) which is designed to cope with the planned sewage flow of 44,791m^3/d (ADWF) in year 2030. However, the proposed developments are not considered in EPS.

Based on the information from HKSTP on the Water Supply and Sewage Treatment Allocation for YLIE, it is revealed that HKSTP had already paid for a reserve of 36,000 m^3/day (ADWF) at YLSTW (refer to TR-2 Baseline Review Report) and currently only 4,000 m^3/day (ADWF) is used in YLIE but there is an internal allocation of 12,000 m^3/day to all grantees in YLIE. Therefore, the

YLSTW shall retain the reserved capacity to cater for flow up to 36,000 m^3/day (ADWF) including additional flow from future extension subject to further investigation and the upgraded capacity of YLSTW.

Further discussion with EPD and DSD regarding the need for upgrading of YLSTW capacity or any other discharge options has been made. It was agreed between EPD, DSD, HD and HKSTP in the meeting on 6 Nov 2012 that the sewage flows from the proposed Wang Chau developments shall be conveyed to YLSTW and the proposed EPS upgrading works at YLSTW would be designed to cater for the additional sewage flow from the proposed developments, given that the 36,000m^3/day entitlement is not exceeded.

The EPS Study for YLSTW to be carried out by DSD will review the design capacity requirement to take into account the additional sewage arising from this development site. As the YLSTW falls within Deep Bay Water Control Zone where the requirement of "No net increase in pollution loads to Deep Bay" shall be met, pollution load from the additional sewage from the proposed developments has to be offset by removing other existing pollution sources from the catchment. It is also understood that adoption of advanced sewage treatment technologies at YLSTW would also be investigated under the EPS Study.

Based on the planning parameters, the projected sewage flows for various development options are estimated as follows:

Table 4.7.2: Sewage flow projections for different options

Accommodation Type	Option 1 + Option A	Option 1 + Option B	Option 2 + Option A	Option 2 + Option B	Remarks
Residential - PRH & HOS					
Population	52,732	52,732	54,859	54,859	Include 10% Increment
Unit Flow Factor (m^3/person/day)	0.190	0.190	0.190	0.190	Table T-1, EPD's GESF
ADWF (m^3/day)	10,019	10,019	10,423	10,423	
Education - Primary Schools					
No. of Schools	3	3	4	4	
Students per School	765	765	765	765	Table 4, Chapter 3, HKPSG
No. of Students	2,295	2,295	3,060	3,060	
Unit Flow Factor (m^3/person/day)	0.040	0.040	0.040	0.040	Table T-2, EPD's GESF
ADWF (m^3/day)	92	92	122	122	

Accommodation Type	Option 1 + Option A	Option 1 + Option B	Option 2 + Option A	Option 2 + Option B	Remarks
Social Welfare Facilities					
Type of Facilities	Unknown	Unknown	Unknown	Unknown	
NOFA (m^2)	5,908	5,908	5,908	5,908	
NOFA per Person (m^2/employee)	5.70	5.70	5.70	5.70	Being conservative, taking Q_1 amongst various types of facilities in Table 3, Chapter 3, HKPSG
No. of Persons	1,036	1,036	1,036	1,036	
Unit Flow Factor (m^3/person/day)	0.080	0.080	0.080	0.080	Assuming the same as Commercial Employee, Table T-2, EPD's GESF
ADWF (m^3/day)	83	83	83	83	
Retail/Market					
IFA (m^2)	9,588	9,588	9,974	9,974	
IFA per Employment (m^2/employee)	26.15	26.15	26.15	26.15	Clause 2.1, Chapter 6, HKPSG
No. of Employee	367	367	381	381	
Unit Flow Factor (m^3/employee/day)	0.280	0.280	0.280	0.280	Table T-2, EPD's GESF
ADWF (m^3/day)	103	103	107	107	
Industrial					
GFA (m^2)	301,500	288,800	301,500	288,800	
GFA per Employment (m^2/employee)	75	75	75	75	Table 2, Chapter 5, HKPSG
No. of Employee	4,020	3,851	4,020	3,851	
Unit Flow Factor (m^3/employee/day)	2.000	2.000	2.000	2.000	Table T-3, EPD's GESF
ADWF (m^3/day)	8,040	7,701	8,040	7,701	

Accommodation Type	Option 1 + Option A	Option 1 + Option B	Option 2 + Option A	Option 2 + Option B	Remarks
Total ADWF (m^3/day)	18,337	17,998	18,775	18,436	
Contributing Population N (in thousands)	67.91	66.66	69.54	68.28	Clause 12.1, EPD's GESF
Peaking Factor	3.88	3.89	3.86	3.87	Table T-5, EPD's GESF
Peak Flow (m^3/day)	71,098	69,979	72,539	71,424	For Sewerage Design

From the above table, the projected sewage flow from the Project site under Option 2 for PH site and Option A for YLIEE site is the highest amongst all combination of the development options. With the internal allocation of 12,000m^3/d to all grantees in existing YLIE, the 36,000m^3/day entitlement will still not be exceeded. Therefore, there shall be no adverse impact on upgrading works at YLSTW for all development options.

Furthermore, EPD advised that they would identify some sites (i.e. existing unsewered villages) for offsetting the additional load from the proposed developments and review their calculation to meet the requirement of "No net increase in pollution loads to Deep Bay" given that the 36,000m^3/day entitlement is not exceeded. Therefore, there shall be no adverse impact on compliance with requirements of 'No net increase in pollution loads to Deep Bay' for all development options.

Since the existing foul sewers within YLIE are not designed for the proposed development, construction of new sewers/upgrade of existing sewerage network within YLIE is expected to be required to convey the sewage flows from the Project site to YLSTW by gravity regardless the selection of development options. No sewerage pumping station is expected to be required. Since the projected sewage flows under various development options are in the same order, it is considered that the scale of anticipated sewerage improvement works within YLIE for various development options are the same. The existing and proposed sewerage layout is shown in **Figure 4.7.2**.

A comparison of different options in relation to sewerage impacts is provided in **Table 4.7.3** below.

Table 4.7.3: Comparison of sewerage impacts for different options

Evaluation Criterion	Option 1 + Option A	Option 1 + Option B	Option 2 + Option A	Option 2 + Option B
Impacts on Yuen Long Sewage Treatment Works (YLSTW)	• No adverse impacts on existing YLSTW as the 36,000m^3/day entitlement was not exceeded. Same for all options.			
Impacts on compliance with requirements of "No	• Compliance with requirements of "No net increase in pollution loads to Deep Bay" as the 36,000m^3/day entitlement was not exceeded. Same for all options.			

Evaluation Criterion	Option 1 + Option A	Option 1 + Option B	Option 2 + Option A	Option 2 + Option B
net increase in pollution loads to Deep Bay"				
Impacts on existing foul sewers in YLIE	• Upgrading of existing foul sewers in YLIE might be required to cater for the additional sewage flow. Same for all options.			
Recommendation	No preference	No preference	No preference	No preference

4.8 Water Supply

The potential impacts on existing water supply system including the need of construction and upgrading works on flushing water supply system, Water Treatment Works, Water Service Reservoir, and fresh water distribution mains etc are reviewed for different options. When assessing the impact on water supply system, the site has been evaluated as a whole instead of separately for PH and YLIEE sites. The proposed evaluation criteria are given in **Table 4.8.1** below.

Table 4.8.1: Evaluation principle and criterion for water supply system

Evaluation Principle	Evaluation Criterion
Minimise the impacts on planned salt water supply system	Extent of impacts on planned salt water supply system from Lok On Pai and Tan Kwai Tsuen
Minimise the impacts on existing water supply system	Extent of impacts on fresh and flushing water supply systems within Project site
Minimise the impacts on existing Water Treatment Works	Extent of impacts on operation of Au Tau Water Treatment Works (ATWTW) and Ngau Tam Mei Water Treatment Works (NTMWTW)
Minimise the impacts on existing Fresh Water Service Reservoir	Extent of impacts on Wang Chau Fresh Water Service Reservoir (WCFWSR)
Minimise the impacts on existing distribution mains	Extent of impacts on DN900 fresh water distribution mains along Fuk Hi Street

Based on the planning parameters, the water demands from the Project site under different options were projected as follows:

Table 4.8.2: Water demand projections for different options

Accommodation Type	Option 1 + Option A	Option 1 + Option B	Option 2 + Option A	Option 2 + Option B	Remarks
Residential - PRH & HOS					
Population	52,732	52,732	54,859	54,859	Include 10% Increment
Fresh Water Unit Demand, including Service Trade (m^3/person/day)	0.225	0.225	0.225	0.225	Assumed 50% of PRH and 50% of HOS, Tables 1 & 2, DI No. 1309

Accommodation Type	Option 1 + Option A	Option 1 + Option B	Option 2 + Option A	Option 2 + Option B	Remarks
FWMDD (m^3/day)	11,865	11,865	12,343	12,343	Fresh Water Mean Daily Demand
Flushing Water Unit Demand (m^3/person/day)	0.070	0.070	0.070	0.070	Table 1, DI No. 1309
FLWMDD (m^3/day)	3,691	3,691	3,840	3,840	Flushing Water Mean Daily Demand
Education - Primary Schools Water Demand Included in Service Trade	-	-		-	Clause 3, DI No. 1309
Social Welfare Facilities Water Demand Included in Service Trade	-	-		-	Clause 3, DI No. 1309
Retail/Market Water Demand Included in Service Trade	-	-		-	Clause 3, DI No. 1309
Industrial					
Net Site Area	12.06	11.55	12.06	11.55	
Fresh Water Unit Demand (m^3/ha/day)	450	450	450	450	Table 1, DI No. 1309
FWMDD (m^3/day)	5,427	5,198	5,427	5,198	Fresh Water Mean Daily Demand
Flushing Water Unit Demand (m^3/person/day)	210	210	210	210	Table 1, DI No. 1309
FLWMDD (m^3/day)	2,533	2,426	2,533	2,426	Flushing Water Mean Daily Demand
Total FWMDD (m^3/day)	17,292	17,063	17,770	17,541	Total Fresh Water Mean Daily Demand
Peaking Factor for Distribution Mains	3	3	3	3	

Accommodation Type	Option 1 + Option A	Option 1 + Option B	Option 2 + Option A	Option 2 + Option B	Remarks
Fresh Water Peak Flow (m^3/day)	51,876	51,189	53,310	52,623	For FW Distribution Main Design
Total FLWMDD (m^3/day)	6,224	6,117	6,373	6,266	Total Flushing Water Mean Daily Demand
Peaking Factor for Distribution Mains	2	2	2	2	
Flushing Water Peak Flow (m^3/day)	12,448	12,234	12,746	12,532	For FLW Distribution Main Design
Total MDD (m^3/day)	23,516	23,180	24,143	23,807	Total Mean Daily Demand

Currently, there is no existing salt water supply system within and in the vicinity of the Project site for flushing. Although WSD showed their intention to have salt water supply to North West New Territories and Yuen Long under their Planning Report No. 10/2008 and the planned salt water supply system is now under construction, the proposed development had not been considered in WSD's study. Based on the information obtained from WSD (**Table 4.8.3** below), there shall be no spare capacity to cater for the proposed development regardless the selection of development options.

Table 4.8.3: Planned Daily Water Demand (m^3/d) within Tan Kwai Tsuen Salt Water Service Reservoir Supply Zone in Year 2012 and Later

	Year 2012	Later
Residential		
Tan Kwai Tsuen Salt Water Service Reservoir Supply Zone (PWP No. 9045WS)	43,851	43441
Tan Kwai Tsuen Salt Water Service Reservoir Extension Supply Zone (PWP No. 9048WS)	17,186	18045
Industrial, Commercial & Hospital Uses	6,000	6000
Total MDD	**67,037**	**67,486**
Salt Water Pumping Station at Lok On Pai (Required Capacity) (1)	80,444	80,983
Salt Water Pumping Station at Lok On Pai (Planned Capacity)	83,000	83,000
Tan Kwai Tsuen Salt Water Service Reservoir (Required Capacity) (2)	17,597	17,715
Tan Kwai Tsuen Salt Water Service Reservoir (Planned Capacity)	18,100	18,100

(1) Required Capacity of Salt Water Pumping Station = 1.2*MDD

(2) Required Capacity of Salt Water Service Reservoir = 0.25*MDD*1.05

Therefore, it is proposed to use Temporary Mains Water for Flushing (TMF) within the Project site. Nevertheless, separate fresh and flushing water supply

systems will be provided within the Project site to allow a flexibility of changing the source of flushing water supply from fresh water to others, i.e. salt water or treated sewage effluent in the future by WSD if required.

The Project site is located within the supply zone of Ngau Tam Mei Water Treatment Works (NTMWTW) and Au Tau Water Treatment Works (ATWTW). NTMWTW has an output capacity of 230 Million Litres per Day (MLD) and ATWTW has an output capacity of 330 MLD. Currently, both NTMWTW and ATWTW serve Wang Chau, Tin Shui Wai, Ngau Tam Mei, San Tin and Mai Po areas and they are alternatively used. Either one WTW can singly meet the existing water demands within the whole supply zone. However, according to the information received from WSD, it was found that NTMWTW nearly reached its capacity and it alone should have no spare capacity to cater for any additional water demand from the Project site.

Table 4.8.4: Existing daily water demand (m^3/d) at Water Treatment Works in Early Year 2012

Water Treatment Works (WTW)	Recorded Maximum Outputs in 11/Jun 12	Existing Capacity
NTMWTW	229,200	230,000
ATWTW	N.A.	330,000

It is proposed to operate ATWTW in parallel with NTMWTW in long term to supply fresh water within the supply zone regardless the selection of development options.

The Project site is located at the boundaries of supply zones between Wang Chau Fresh Water Service Reservoir (WCFWSR), Tan Kwai Tsuen North Fresh Water Service Reservoir (TKTNFWSR) and Ngau Tam Mei Fresh Water Primary Service Reservoir (NTMFWPSR). The key waterworks and fresh water service reservoir supply zones are shown in **Figure 4.8.1**. According to the information received from WSD (**Table 4.8.5** below), it was found that NTMFWPSR already reached its capacity and it should have no spare capacity to cater for any additional water demand from the Project site. Furthermore, there were other proposed developments at Yuen Long South which might have implications on TKTNFWSR. Therefore, it is proposed to supply water to the Project site solely from WCFWSR.

Table 4.8.5: Existing Daily Water Demand (m^3/d) at Fresh Water Service Reservoirs in Year 2012

Fresh Water Service Reservoirs (FWSR)	Maximum Monthly Consumption in Year 2012	Required Capacity (1)	Existing Capacity
Ngau Tam Mei(2)	127,090	95,318	40,000
Wang Chau	17,310	12,983	58,790
Tan Kwai Tsuen North	65,560	49,170	81,516

(1) Required Capacity of FWSR = 0.75*MDD

(2) Currently the function as Primary Service Reservoir is ignored

The projected water demand from the Project site under Option 2 for PH site and Option A for YLIEE site is the highest amongst all options. With the maximum monthly water consumption of $17,310m^3/d$ in year 2012 for all developments within WCFWSR supply zone, the projected total water consumption within WCFWSR supply zone will be $41,453m^3/day$ ($24,143m^3/day$ + $17,310m^3/day$).

The required capacity of WCFWSR is 31,090m^3/d (75% of 41,453m^3/day) which is still lower than the existing capacity of 58,790m^3/d. Therefore, WCFWSR should have enough capacity to cater for the additional water demand arising from the proposed developments regardless the selection of development options.

The existing DN900 MS fresh water distribution main running along Fuk Hi Street should have a capacity of 1.9m^3/s (assuming the peak flow velocity in the water main is 3m/s). Even if it is assumed that all the water consumption within WCFWSR supply zone after the proposed development (41,453m^3/day for Option 2 for PH site and Option A for YLIEE site) will pass through the concerned water main, the peak flow in the existing DN900 MS fresh water distribution main will be 1.4m^3/s (3 times of 41,453m^3/day) which is still lower than the existing capacity of 1.9m^3/s. Therefore, the existing DN900 MS fresh water distribution main running along Fuk Hi Street should have enough spare capacity to cater for the additional water demand from Project site regardless the selection of development options. Furthermore, in view of the short distance travelled from WCFWSR to Project site, the residual head at the proposed distribution mains within Project site should be enough regardless the selection of development options.

The existing and proposed water supply layout is shown in **Figure 4.8.2**.

A comparison of different options in relation to water supply is provided in **Table 4.8.6** below.

Table 4.8.6: Comparison of impacts on water supply system for different options

Evaluation Criterion	Option 1 + Option A	Option 1 + Option B	Option 2 + Option A	Option 2 + Option B
Impacts on planned salt water supply system from Lok On Pai and Tan Kwai Tsuen	• There is no spare capacity to cater for the flushing water demand from Project site. Same for all options.			
Impacts on fresh and flushing water supply systems within Project site	• Construction of new Temporary Mains Water for Flushing (TMF) within Project site proposed to provide a separate flushing water supply system. Same for all options.			
Impacts on operation of Au Tau Water Treatment Works (ATWTW) in parallel with Ngau Tam Mei Water Treatment Works (NTMWTW)	• Operation of ATWTW in parallel with NTMWTW would have adequate capacity to cater for the additional water demand and hence no adverse impacts. Same for all options.			
Impacts on Wang Chau Fresh Water Service Reservoir (WCFWSR)	• No adverse impacts on WCFWSR as it would have adequate capacity to cater for the additional water demand. Same for all options.			
Impacts on DN900 fresh water distribution mains along Fuk Hi Street	• No adverse impacts on DN900 fresh water distribution mains along Fuk Hi Street as it would have adequate capacity to cater for the additional water demand & adequate residual head at the proposed water mains. Same for all options.			
Recommendation	No preference	No preference	No preference	No preference

4.9 Other Utilities

The potential impacts on existing utilities including the need of improvement works and constraints are reviewed for different options. When assessing the impact on utilities, the site has been evaluated as a whole instead of separately for PH and YLIEE sites. The proposed evaluation criteria are given in **Table 4.9.1** below.

Table 4.9.1: Evaluation principle and criterion for other utilities

Evaluation Principle	Evaluation Criterion
Minimise the impacts on existing gas supply	Extent of impacts on existing medium pressure gas main within Project site
Minimise the impacts on existing power supply	Extent of impacts on existing power cable within Project site
Minimise the impacts on existing tele-communications	Extent of impacts on existing communication cables within Project site

On gas supply issue, the Hong Kong and China Gas Company (HKCG) has been consulted. Currently there is no existing gas main within the Project site. There is an existing 315mm diameter medium pressure underground gas pipe along Fuk Hi Street and an existing 300/355mm diameter medium pressure underground gas pipe along Long Ping Road. It is proposed to have new pipeline branched out into the Project site if the predicted future gas demands of the proposed developments do not exceed the spare capacity of the existing pipeline. Otherwise, a new gas pipeline would need to be installed along the existing roads. In view of the similar development scales of various development options, it is considered that the gas demands from Project site and hence the implications to the existing gas mains for various development options are the same. The existing and proposed gas supply layout is shown in **Figure 4.9.1**.

Information on the existing power supply network within and in the vicinity of the Project site has been obtained from China Light and Power (CLP). There are existing 132 kV and 11 kV cable circuits along Fuk Hi Street and Long Ping Road. There are also existing Low Voltage (L.V.) cables within the development site. Highways Department (HyD) has also been consulted about the existing street lightings. All public roads within and in the vicinity of the Project site are well served by street lightings. It is proposed to install new 11 kV cable circuits from the existing cable circuits along Fuk Hi Street and Long Ping Road to the Project site depending on the future demand. In view of the similar development scales of various development options, it is considered that the power demands from Project site and hence the implications to the existing power cables for various development options are the same. Furthermore, in order to maximize the land usage within the Project site, diversion of existing power cables running within Project site will be required regardless the selection of development options. The existing and proposed power supply layout is shown in **Figure 4.9.2**.

Telecommunication companies have been consulted to collate information on the existing and planned cable networks within and in the vicinity of the Project site. There are telecommunication services owned by PCCW, Hutchison Global Communications (HGC), Wharf T&T and Cable TV. These cables are mainly laid along Long Ping Road. HGC, Wharf T&T and PCCW also have cables laid along Fuk Hi Street. Telecommunication service for the Project site can be branched off from the existing communication cables along Fuk Hi Street and Long Ping Road

depending on the future demand. In view of the similar development scales of various development options, it is considered that the demands from Project site and hence the implications to the existing communication cables for various development options are the same. Furthermore, in order to maximize the land usage within the Project site, diversion of existing communication cables running within Project site will be required regardless the selection of development options. The existing and proposed telecommunication cable layout is shown in **Figure 4.9.3**.

A comparison of different options in relation to other utilities is provided in **Table 4.9.2** below.

Table 4.9.2: Comparison of impacts on other utilities for different options

Evaluation Criterion	Option 1 + Option A	Option 1 + Option B	Option 2 + Option A	Option 2 + Option B
Impacts on existing medium pressure gas main within Project site	• Construction of valve chambers on existing medium pressure gas main and tee-off new gas mains required. Same for all options.			
Impacts on existing power cable within Project site	• Construction of cable draw-pits on existing medium pressure power cable and tee-off new power cables required. Same for all options.			
	• Diversion of existing power cable required. Same for all options.			
Impacts on existing communication cables within Project site	• Construction of cable draw-pits on existing communication cables and tee-off new power cables required. Same for all options.			
	• Diversion of existing communication cable required. Same for all options.			
Recommendation	No preference	No preference	No preference	No preference

5 OPTION EVALUATION ON ENVIRONMENTAL IMPACTS

5.1 Air Quality

The baseline study has identified a number of existing air quality pollutant sources in the vicinity that would have certain bearing on the environmental acceptability of the Project during the operational phase. These pollutant sources include the industrial stacks within the existing YLIE adjoining the north-eastern site boundary, and the traffic on the neighbouring roads such as Long Ping Road and Fuk Hi Street.

Other than the existing air pollutant sources, the future YLIEE albeit for use of clean technology industries might also have some industrial stack emissions which would affect the existing Air Sensitive Receivers (ASRs) in the neighbourhood and planned ASR on PH site. Besides, in order to support the future population for PH and YLIEE site, some road improvement works on existing Fuk Hi Street and Long Ping Road are recommended in the current development proposals (refer to **Appendix 5.1.1**). It is anticipated that the associated increase in traffic would incur additional emission burden which may also impose potential constraints on the PH development along Fuk Hi Street and Long Ping Road.

During construction phase, activities such as site formation, road works, slope works, superstructure works, etc for the proposed development would generate fugitive dust and hence are sources of air pollution. However, fugitive dust can readily be controlled at-source by means of good site practices such as frequent watering. Hence it is not considered in the option selection exercise. The proposed evaluation criteria for air quality are therefore solely related to the operational air quality impacts of different development options and are summarized in **Table 5.1.1** below.

Table 5.1.1: Evaluation principle and criterion for air quality aspect

Evaluation Principle	Evaluation Criterion
No adverse air quality impacts on the development options	Provision of sufficient separation distance between the YLIE and the residential development to ensure compliance with the new AQO
	Provision of sufficient separation distance between Long Ping Road & Fuk Hi Street and the residential development to ensure compliance with the new AQO
	Extent of further mitigation measures/building constraints (e.g. height restriction, further setback)

A preliminary operational air quality assessment has been conducted to ascertain whether the evaluation criteria could be met for different development options. The assessment has evaluated the impacts arising from three classes of emission sources depending on their distance from the project site, including (1) Project induced contribution; (2) Pollutant-emitting activities in the immediate neighbourhood; (3) Other contributions from pollution not accounted for by (1) and (2).

All sources within 500m from the Project i.e. (1) and (2) are considered as near-field source impacts and are predicted using local-scale models. These sources include vehicular emission from open roads including proposed roads and all existing roads, as well as chimney emission from existing YLIE and planned YLIEE. Other far-field pollution source impacts (3) which are beyond 500m from the Project, i.e. background concentration, are predicted using a regional scale model - Pollutants in the Atmosphere and the Transport over Hong Kong, PATH. In PATH model, all major emission sources including public electricity generation, road transport, navigation, airport, industries, other fuel combustion and non-combustion sources covering both HKSAR and Pearl River Delta Economic Zone (PRDEZ) are considered. The PATH simulates wind field, pollutant emissions, transportation and chemical transformation and outputs pollutant concentrations over Hong Kong and the PRDEZ region at a fine grid size of 1.5km. The cumulative operational air quality is then a combination of the emission impacts contributed from the near-field and far-field sources.

For purpose of option evaluation, NO_2, PM_{10}, $PM_{2.5}$ and SO_2 are considered as the key pollutants in this preliminary air quality assessment. The toxic pollutants including ammonia, chloride, and lead which are currently emitted from an existing Specified Process (SP) in YLIE might impose potential development constraint on the PH site and hence are also assessed.

Representative ASRs including planned PH site and existing sensitive uses in vicinity of the planned YLIEE and proposed road works along Fuk Hi Street and Long Ping Road have been identified in this preliminary assessment. The assessment points are listed in **Table 5.1.2** and their locations are illustrated in **Figures 5.1.1** and **5.1.2** for PH Options 1 and 2, respectively. The impacts have been assessed for ASR heights at 1.5m, 5m, 7m, 9m, 10m, and afterward every 10m up to 150m above ground.

Table 5.1.2: Representative ASRs for preliminary assessment

ASR ID	Location	Uses[1]	No. of Storey
A001	Shing Uk Tsuen	R	1-3
A002 – A004	Tai Tseng Wai	R	1-3
A005	Fuk Hing Garden & Fuk Hing Tsuen	R	1-3
A006	Fuk Fai Garden & Meon Court	R	1-3
A007	Sai Tau Wai & Lam Uk Tsuen	R	1-3
A008 – A010	Long Ping Estate	R / E	6-34
A011	Shui Tin Tsuen	R	1-3
A012	Fung Chi Tsuen	R	1-3
A013	Residential Premises along Long Ping Road	R	1-3
A014	Chun Hing San Tsuen	R	1-3
A901 – A932	PH site (including residential blocks, schools, integrated social welfare building (ISWB), and retail)	R / E / G	5 – 41 [2]

Notes:
[1] R– Residential Premises; E – Educational Institutions; G – Government use
[2] No. of storey are different for the two options (including ground floor for residential towers).

The operational air quality assessment shall be conducted based on the highest emission strength from roads within the next 15 years upon commencement of operation of the proposed road. For the purpose of this preliminary assessment, the highest emission scenario for NO_x (the most critical parameter), given the

combination of emission factors and traffic flow has been determined from two years (i.e. the tentative commencement year at 2022 and after 15 years at 2037). The emissions are calculated by using the latest version of EmFAC-HK model available at that time of preparing this report and the results has identified Year 2022 as the worst assessment year and details are presented in **Section 5.1.1** below.

The assumptions and approach adopted in the preliminary air quality assessment are given in the **Table 5.1.3** below.

Table 5.1.3: Assessment assumptions and modeling approach adopted in the preliminary assessment

Emission sources	Assessment assumptions and approach
Roads	• NO_x, PM10, PM2.5 emissions from roads within 500m are predicted by EmFAC-HK using burden mode based on preliminary traffic forecast. There are three types of roads: 1) Primary Distributor (PD) at 70km/hr; 2) PD and District Distributor (DD) at 50km/hr; 3) Local Distributor (LD) and Rural Road (RR) at 50km/hr with cold start (**Appendix 5.1.1**). Temperature and humidity data are based on 2011 data from Wetland Park monitoring station (with >90% validity). • SO_2 emission factors are calculated based on vehicle fuel efficiency and fuel Sulphur (S) content (refer to **Appendix 5.1.2**). • **Appendix 5.1.3** summarises the calculated emission factors for NO_x, PM_{10}, $PM_{2.5}$ and SO_2. • **Appendix 5.1.4** summarises the composite emission factors for roads within 500m from the Project Boundary. • Dispersion is modeled by CALINE4 using MM5 data. Stability classes are estimated from PCRAMMET model. The mixing height is capped to 121m as per the real meteorological data. The surface roughness height is assumed to be 100m to represent the urbanized terrain in consideration of future high rise development site; while the wind standard deviation is estimated in accordance with the "Guideline on Air Quality Models (Revised), 1986. • Ozone Limiting Method (OLM) is adopted for conversion of NOx to NO_2, using the predicted O_3 and NO_2 levels from PATH model. Vehicular tailpipe NO_2 emission is assumed to be 7.5% of NOx.
Existing chimneys	• Emission inventory for chimneys is established based on the information provided by the operators or the latest SP license (details referred to TR-1 Baseline Review Report). **Appendix 5.1.5** summarises the locations and emission inventory of the industrial stacks within 500m from the Project boundary. • Dispersion is modeled by ISCST3 using MM5 data. Stability classes are estimated from PCRAMMET model. The mixing height is capped to 121m as per the real meteorological data. • OLM is adopted for conversion of NOx to NO_2, using the predicted O_3 and NO_2 levels from PATH model. The in-stack NO_2 emission is assumed to be 10% of NOx. • Emission rate for Ammonia, Chloride and Lead from SP in existing YLIE has been made reference to its respective SP Licence.
Planned chimneys within YLIEE	• Major pollution emitters such as SP are not expected at YLIEE. However, chimney operation cannot be ruled out. For purpose of assessments, it is assumed that there is one chimney at each industrial lot (positioned in the middle of the lot) for conservative analysis. • The configuration (i.e. stack height and diameter) of the planned chimney in future YLIEE and its emission characteristics (i.e. fuel consumption rate) are made reference to the existing chimney operation (excluding SP) within 500m of the Project site. An average fuel consumption rate of 220L/hr, average stack height of 22.7 mAG and average stack diameter of 1.0m has been assumed. A typical exit velocity of 6.0m/s and exit temperature of 100°C has been assumed. **Appendix 5.1.6** summarises the locations and assumed emission inventory of the planned industrial stacks in YLIEE.

Emission sources	Assessment assumptions and approach
	• Same modeling assumptions/approach as existing chimneys.
Background concentration	• For all pollutants except $PM_{2.5}$, the future ambient air quality predicted by PATH for Year 2020 are adopted to represent the background concentrations for Year 2022 for conservative assessment. The assessment area involves 4 grids in the PATH, including 17_38, 17_39, 18_38 & 18_39. • The background concentration of $PM_{2.5}$ is calculated according to EPD's "Guidelines on the Estimation of $PM_{2.5}$ for Air Quality Assessment in Hong Kong". The calculation of annual concentration of $PM_{2.5}$ is 71% of PM_{10}, while the daily concentration of $PM_{2.5}$ is 75% of PM_{10}. • The background concentration of Lead is taken from 5 years annual average data from the nearest EPD's monitoring station (i.e. Tsuen Wan Air Quality Monitoring Station) reported in Air Quality of Hong Kong. The background concentration is 47.6 ng/m^3. • For Ammonia and Chloride, there are no background monitoring data.

It should be noted that the information provided by the existing tenants of YLIEE including chimney data are confidential and can solely be used for this study. The privacy of the individual, public and private sector organisations is protected under the Personal Data (Privacy) Ordinance (Cap. 486). The Project Proponent is under obligation to protect the privacy of the YLIE companies and have committed that the private business operation information for individual company will be treated confidentially and will not be disclosed and published to the public. The information presented in this report are only provided to the government departments.

It should also be noted that the assessment presented in this report is preliminary only for purpose of option evaluation. Detailed air quality assessment will be carried out for the selected development option in next EIA stage, and during that time, the traffic data will be updated, the worst assessment year will be verified, and the detailed modeling approach and assessment assumptions will be reviewed and updated as appropriate.

5.1.1 Evaluation of PH site

The highest emission scenario is determined for NO_x using the latest version of EmFAC-HK model available at that time of preparing this report. **Table 5.1.4** summarises the total estimated amount of NOx from roads within 500m of the Project site for both Years 2022 and 2037, based on PH Option 1 as sensitivity scenario testing.

Table 5.1.4: Total NO_x emission from roads within 500m of the Project site for Option 1

Road Grouping	Total Emission (NO_x) (kg/day)	
	2022	2037
PD 70km/hr	27.2	9.6
PD and DD 50km/hr	66.5	26.5
LD and RR 50km/hr	39.9	14.4
Total	133.6	50.5

It can be seen from the above table that the total NO_x amount at Year 2022 would be much higher than that at Year 2037 for Option 1, and hence Year 2022 is considered as the worst assessment year for this preliminary air quality assessment. The difference in the pollutant emissions between the two PH

options is only due to the difference in the amount of traffic induced by the developments which is insignificant as compared to the total generated by all roads within 500m of the Project site. Therefore it is anticipated that the highest emission scenario would also occur in Year 2022 for Option 2. For this option evaluation analysis, the cumulative air quality impacts for both options at the same Year 2022 are thus assessed.

For comparison of the two PH options, the YLIEE Option B is assumed. Option B would have the assumed chimneys in the planned industrial lots at a closer distance to PH site and is therefore considered conservative. With the assumptions stated in **Table 5.1.4** above, the cumulative operational air quality impacts are predicted and the results for NO_2, $PM_{2.5}$, PM_{10} and SO_2 are compared against the new AQO in **Tables 5.1.5 – 5.1.8** below. Detailed results are provided in **Appendix 5.1.7** and **Appendix 5.1.8**. It is found that the worst hit level at PH site is at low ground level. This implies that the open road emission is the dominant source of air pollution.

Table 5.1.5: Results summary against new AQO for NO_2

ASR ID	Location	Max. 1-hr NO_2 Conc (µg/m³) [1,2]		Annual NO_2 Conc (µg/m³) [1,3]	
		Option 1	Option 2	Option 1	Option 2
A001	Shing Uk Tsuen	208.4 (1)	208.4 (1)	27.6 (0)	27.7 (0)
A002	Tai Tseng Wai	208.4 (1)	208.4 (1)	26.9 (0)	27 (0)
A003	Tai Tseng Wai	204.9 (1)	204.9 (1)	28.8 (0)	28.8 (0)
A004	Tai Tseng Wai	204.9 (1)	204.9 (1)	28.6 (0)	28.6 (0)
A005	Fuk Hing Garden & Fuk Hing Tsuen	206.4 (2)	206.6 (3)	34.2 (0)	34.4 (0)
A006	Fuk Fai Garden & Meon Court	204.5 (3)	205.2 (3)	34.7 (0)	34.9 (0)
A007	Sai Tau Wai & Lam Uk Tsuen	210 (5)	210.1 (5)	36.4 (0)	36.7 (0)
A008	Long Ping Estate	206.2 (1)	206.5 (1)	37.8 (0)	38.4 (0)
A009	Long Ping Estate	206.2 (1)	206.5 (1)	34.8 (0)	35.2 (0)
A010	Long Ping Estate	207.1 (1)	207.2 (1)	34.8 (0)	35.2 (0)
A011	Shui Tin Tsuen	206.1 (2)	206.6 (2)	38.7 (0)	39 (0)
A012	Fung Chi Tsuen	187.6 (0)	188.9 (0)	33.3 (0)	33.6 (0)
A013	Residential Premises along Long Ping Road	185.4 (0)	186.5 (0)	34.8 (0)	35.2 (0)
A014	Chun Hing San Tsuen	197 (0)	198.4 (0)	35.6 (0)	36 (0)
A901	PH site (Block 3)	193.2 (0)	193.8 (0)	34.4 (0)	34.5 (0)
A902	PH site (School 2)	194.1 (0)	194.7 (0)	33.3 (0)	33.5 (0)
A903	PH site (Block 4)	196 (0)	196.9 (0)	33.7 (0)	33.7 (0)

ASR ID	Location	Max. 1-hr NO_2 Conc ($\mu g/m^3$) [1,2]		Annual NO_2 Conc ($\mu g/m^3$) [1,3]	
		Option 1	Option 2	Option 1	Option 2
A904	PH site (Block 6)	206.1 (1)	207.7 (1)	34.3 (0)	34.5 (0)
A905	PH site (Block 6)	205.7 (1)	207.5 (1)	35.7 (0)	36.1 (0)
A906	PH site (Block 7)	210.4 (1)	210.5 (1)	35 (0)	35.2 (0)
A907	PH site (Block 7)	211.7 (1)	211.9 (2)	36.4 (0)	36.7 (0)
A908	PH site (Block 7)	210.3 (2)	210.4 (2)	36.4 (0)	36.8 (0)
A909	PH site (Block 11)	199.4 (0)	200.5 (1)	34.8 (0)	35.2 (0)
A910	PH site (Block 13)	206.4 (1)	207.7 (1)	35.7 (0)	36.1 (0)
A911	PH site (Block 13)	211.1 (2)	211.2 (2)	36.9 (0)	37.2 (0)
A912	PH site (Block 14)	211.2 (2)	211.4 (2)	38.1 (0)	38.6 (0)
A913	PH site (Block 14)	209.7 (2)	209.8 (2)	38.9 (0)	39.5 (0)
A914	PH site (Block 15)	206 (2)	207.9 (2)	37.9 (0)	38.6 (0)
A915	PH site (Block 16)	201.8 (1)	202.2 (1)	37.2 (0)	37.8 (0)
A916	PH site (Block 17)	200.2 (1)	200.5 (1)	35.1 (0)	34.9 (0)
A917	PH site (Block 18)	199.9 (0)	200.1 (1)	35.2 (0)	35 (0)
A918	PH site (Block 19)	207.5 (1)	208.6 (1)	35.6 (0)	36 (0)
A919	PH site (Option 1: Block 21; Option 2: School 4)	209.8 (1)	209.9 (1)	35.4 (0)	35.8 (0)
A920	PH site (Option 1: Block 20; Option 2: School 4)	200.1 (1)	200.7 (1)	34.2 (0)	34.4 (0)
A921	PH site (School 3)	175.6 (0)	175.7 (0)	30.1 (0)	30.3 (0)
A922	PH site (Option 1: Block 23; Option 2: Block 21)	175.2 (0)	175.2 (0)	29.4 (0)	29.5 (0)
A923	PH site (ISWB)	175 (0)	175.1 (0)	29.8 (0)	30 (0)
A924	PH site (ISWB)	177 (0)	177.5 (0)	31 (0)	31.2 (0)
A925	PH site (Retail)	201.3 (1)	202.5 (1)	38.3 (0)	39 (0)
A926	PH site (Retail)	212.9 (3)	213 (3)	**40.1** **(1)**	**40.2** **(1)**
A927	PH site (Retail)	214.9 (3)	215.2 (3)	**45.6** **(1)**	**46.2** **(1)**
A928	PH site (Retail)	214 (2)	214.3 (2)	**45.6** **(1)**	**46.3** **(1)**
A929	PH site (Retail)	211 (2)	211.3 (2)	**43.5** **(1)**	**44.3** **(1)**
A930	PH site (Retail)	211.6 (4)	211.9 (4)	**45.5** **(1)**	**46.4** **(1)**

ASR ID	Location	Max. 1-hr NO_2 Conc (μg/m³) [1,2]		Annual NO_2 Conc (μg/m³) [1,3]	
		Option 1	Option 2	Option 1	Option 2
A931	PH site (Retail)	212.2 (5)	217.9 (5)	**49.4 (1)**	**50.6 (1)**
A932	PH site (Retail)	212.1 (5)	212.4 (5)	**49.1 (1)**	**50.4 (1)**

Note:
[1] Value in bracket is the number of exceedance. Bold value denotes non-compliance with the new AQO.
[2] The limit for 1 hour NO_2 is 200μg/m³ and the number of exceedance allowance is 18.
[3] The limit for annual NO_2 is 40μg/m³.

Table 5.1.6: Results summary against new AQO for $PM_{2.5}$

ASR ID	Location	Max. 24-hrs $PM_{2.5}$ Conc (μg/m³) [1,2]		Annual $PM_{2.5}$ Conc (μg/m³) [1,3]	
		Option 1	Option 2	Option 1	Option 2
A001	Shing Uk Tsuen	94.8 (2)	94.8 (2)	30.7 (0)	30.7 (0)
A002	Tai Tseng Wai	94.7 (2)	94.7 (2)	30.7 (0)	30.7 (0)
A003	Tai Tseng Wai	93.4 (2)	93.4 (2)	30.8 (0)	30.8 (0)
A004	Tai Tseng Wai	93.5 (2)	93.5 (2)	30.9 (0)	30.9 (0)
A005	Fuk Hing Garden & Fuk Hing Tsuen	96.1 (3)	96.2 (3)	31.3 (0)	31.3 (0)
A006	Fuk Fai Garden & Meon Court	96.3 (3)	96.3 (3)	31.3 (0)	31.3 (0)
A007	Sai Tau Wai & Lam Uk Tsuen	96.3 (3)	96.3 (3)	31.3 (0)	31.3 (0)
A008	Long Ping Estate	96.1 (3)	96.1 (3)	31.4 (0)	31.4 (0)
A009	Long Ping Estate	96.1 (3)	96.1 (3)	31.3 (0)	31.3 (0)
A010	Long Ping Estate	96.1 (3)	96.1 (3)	31.3 (0)	31.3 (0)
A011	Shui Tin Tsuen	96.1 (3)	96.1 (3)	31.4 (0)	31.5 (0)
A012	Fung Chi Tsuen	94.4 (2)	94.4 (2)	30.8 (0)	30.8 (0)
A013	Residential Premises along Long Ping Road	94.4 (2)	94.4 (2)	30.8 (0)	30.9 (0)
A014	Chun Hing San Tsuen	94.7 (2)	94.7 (2)	30.9 (0)	30.9 (0)
A901	PH site (Block 3)	95.8 (3)	95.8 (3)	31.2 (0)	31.2 (0)
A902	PH site (School 2)	95.8 (3)	95.8 (3)	31.2 (0)	31.2 (0)
A903	PH site (Block 4)	95.8 (3)	95.8 (3)	31.2 (0)	31.2 (0)
A904	PH site (Block 6)	95.9 (3)	95.9 (3)	31.3 (0)	31.3 (0)
A905	PH site (Block 6)	96 (3)	96 (3)	31.4 (0)	31.4 (0)
A906	PH site (Block 7)	95.9 (3)	96 (3)	31.3 (0)	31.3 (0)

ASR ID	Location	Max. 24-hrs $PM_{2.5}$ Conc ($\mu g/m^3$) [1,2]		Annual $PM_{2.5}$ Conc ($\mu g/m^3$) [1,3]	
		Option 1	Option 2	Option 1	Option 2
A907	PH site (Block 7)	96 (3)	96 (3)	31.4 (0)	31.4 (0)
A908	PH site (Block 7)	96 (3)	96.1 (3)	31.4 (0)	31.4 (0)
A909	PH site (Block 11)	95.9 (3)	95.9 (3)	31.3 (0)	31.3 (0)
A910	PH site (Block 13)	96 (3)	96 (3)	31.4 (0)	31.4 (0)
A911	PH site (Block 13)	96 (3)	96 (3)	31.4 (0)	31.4 (0)
A912	PH site (Block 14)	96 (3)	96 (3)	31.4 (0)	31.5 (0)
A913	PH site (Block 14)	96 (3)	96 (3)	31.4 (0)	31.5 (0)
A914	PH site (Block 15)	95.9 (3)	95.9 (3)	31.4 (0)	31.4 (0)
A915	PH site (Block 16)	95.9 (3)	96 (3)	31.4 (0)	31.4 (0)
A916	PH site (Block 17)	95.9 (3)	95.9 (3)	31.3 (0)	31.3 (0)
A917	PH site (Block 18)	95.9 (3)	95.9 (3)	31.3 (0)	31.3 (0)
A918	PH site (Block 19)	96 (3)	96 (3)	31.3 (0)	31.3 (0)
A919	PH site (Option 1: Block 21; Option 2: School 4)	96 (3)	96 (3)	31.3 (0)	31.3 (0)
A920	PH site (Option 1: Block 20; Option 2: School 4)	95.9 (3)	95.9 (3)	31.2 (0)	31.3 (0)
A921	PH site (School 3)	94.2 (2)	94.2 (2)	30.6 (0)	30.6 (0)
A922	PH site (Option 1: Block 23; Option 2: Block 21)	94.1 (2)	94.2 (2)	30.6 (0)	30.6 (0)
A923	PH site (ISWB)	94.1 (2)	94.2 (2)	30.6 (0)	30.6 (0)
A924	PH site (ISWB)	94.2 (2)	94.2 (2)	30.7 (0)	30.7 (0)
A925	PH site (Retail)	96.2 (3)	96.2 (3)	31.5 (0)	31.6 (0)
A926	PH site (Retail)	96.1 (3)	96.1 (3)	31.6 (0)	31.6 (0)
A927	PH site (Retail)	96.2 (3)	96.2 (3)	32 (0)	32 (0)
A928	PH site (Retail)	96.2 (3)	96.2 (3)	31.9 (0)	31.9 (0)
A929	PH site (Retail)	96.2 (3)	96.3 (3)	31.6 (0)	31.7 (0)
A930	PH site (Retail)	96.1 (3)	96.1 (3)	31.7 (0)	31.7 (0)
A931	PH site (Retail)	96.2 (3)	96.2 (3)	31.8 (0)	31.9 (0)
A932	PH site (Retail)	96.2 (3)	96.2 (3)	31.8 (0)	31.9 (0)

Note:

[1] Value in bracket is the number of exceedance. Bold value denotes non-compliance with the new AQO.

[2] The limit for 24 hours $PM_{2.5}$ is 75μg/m³ and the number of exceedance allowance is 9.
[3] The limit for annual $PM_{2.5}$ is 35μg/m³.

Table 5.1.7: Results summary against new AQO for PM_{10}

ASR ID	Location	Max. 24-hrs PM_{10} Conc (μg/m³) [1,2]		Annual PM_{10} Conc (μg/m³) [1,3]	
		Option 1	Option 2	Option 1	Option 2
A001	Shing Uk Tsuen	126.4 (2)	126.4 (2)	43.2 (0)	43.2 (0)
A002	Tai Tseng Wai	126.4 (2)	126.4 (2)	43.2 (0)	43.2 (0)
A003	Tai Tseng Wai	124.7 (2)	124.7 (2)	43.4 (0)	43.4 (0)
A004	Tai Tseng Wai	124.7 (2)	124.8 (2)	43.5 (0)	43.5 (0)
A005	Fuk Hing Garden & Fuk Hing Tsuen	128.1 (3)	128.1 (3)	44 (0)	44 (0)
A006	Fuk Fai Garden & Meon Court	128.2 (3)	128.2 (3)	44 (0)	44 (0)
A007	Sai Tau Wai & Lam Uk Tsuen	128.2 (3)	128.3 (3)	44 (0)	44 (0)
A008	Long Ping Estate	128 (3)	128 (3)	44.1 (0)	44.1 (0)
A009	Long Ping Estate	128 (3)	128.1 (3)	44 (0)	44 (0)
A010	Long Ping Estate	128 (3)	128 (3)	44 (0)	44 (0)
A011	Shui Tin Tsuen	128 (3)	128 (3)	44.1 (0)	44.2 (0)
A012	Fung Chi Tsuen	125.7 (2)	125.7 (2)	43.2 (0)	43.3 (0)
A013	Residential Premises along Long Ping Road	125.8 (2)	125.8 (2)	43.3 (0)	43.3 (0)
A014	Chun Hing San Tsuen	126.1 (2)	126.1 (2)	43.4 (0)	43.4 (0)
A901	PH site (Block 3)	127.8 (3)	127.8 (3)	44 (0)	44 (0)
A902	PH site (School 2)	127.7 (3)	127.7 (3)	43.9 (0)	43.9 (0)
A903	PH site (Block 4)	127.7 (3)	127.7 (3)	44 (0)	44 (0)
A904	PH site (Block 6)	127.8 (3)	127.8 (3)	44 (0)	44 (0)
A905	PH site (Block 6)	127.9 (3)	127.9 (3)	44.1 (0)	44.1 (0)
A906	PH site (Block 7)	127.9 (3)	127.9 (3)	44 (0)	44 (0)
A907	PH site (Block 7)	127.9 (3)	128 (3)	44.1 (0)	44.1 (0)
A908	PH site (Block 7)	128 (3)	128 (3)	44.1 (0)	44.1 (0)
A909	PH site (Block 11)	127.8 (3)	127.8 (3)	44 (0)	44 (0)
A910	PH site (Block 13)	127.9 (3)	127.9 (3)	44.1 (0)	44.1 (0)
A911	PH site (Block 13)	127.9 (3)	127.9 (3)	44.1 (0)	44.1 (0)

ASR ID	Location	Max. 24-hrs PM_{10} Conc ($\mu g/m^3$) [1,2]		Annual PM_{10} Conc ($\mu g/m^3$) [1,3]	
		Option 1	Option 2	Option 1	Option 2
A912	PH site (Block 14)	127.9 (3)	128 (3)	44.2 (0)	44.2 (0)
A913	PH site (Block 14)	127.9 (3)	127.9 (3)	44.1 (0)	44.2 (0)
A914	PH site (Block 15)	127.8 (3)	127.9 (3)	44.1 (0)	44.1 (0)
A915	PH site (Block 16)	127.9 (3)	127.9 (3)	44.1 (0)	44.1 (0)
A916	PH site (Block 17)	127.8 (3)	127.8 (3)	43.9 (0)	44 (0)
A917	PH site (Block 18)	127.8 (3)	127.9 (3)	44 (0)	44 (0)
A918	PH site (Block 19)	127.9 (3)	127.9 (3)	44 (0)	44 (0)
A919	PH site (Option 1: Block 21; Option 2: School 4)	127.9 (3)	127.9 (3)	44 (0)	44 (0)
A920	PH site (Option 1: Block 20; Option 2: School 4)	127.8 (3)	127.8 (3)	43.9 (0)	44 (0)
A921	PH site (School 3)	125.5 (2)	125.5 (2)	43.1 (0)	43.1 (0)
A922	PH site (Option 1: Block 23; Option 2: Block 21)	125.5 (2)	125.5 (2)	43.1 (0)	43.1 (0)
A923	PH site (ISWB)	125.5 (2)	125.5 (2)	43.1 (0)	43.1 (0)
A924	PH site (ISWB)	125.6 (2)	125.6 (2)	43.1 (0)	43.1 (0)
A925	PH site (Retail)	128.1 (3)	128.2 (3)	44.3 (0)	44.3 (0)
A926	PH site (Retail)	128 (3)	128 (3)	44.3 (0)	44.3 (0)
A927	PH site (Retail)	128.2 (3)	128.2 (3)	44.7 (0)	44.7 (0)
A928	PH site (Retail)	128.2 (3)	128.2 (3)	44.7 (0)	44.7 (0)
A929	PH site (Retail)	128.2 (3)	128.2 (3)	44.4 (0)	44.4 (0)
A930	PH site (Retail)	128 (3)	128.1 (3)	44.4 (0)	44.4 (0)
A931	PH site (Retail)	128.1 (3)	128.1 (3)	44.6 (0)	44.6 (0)
A932	PH site (Retail)	128.1 (3)	128.1 (3)	44.6 (0)	44.6 (0)

Note:
[1] Value in bracket is the number of exceedance. Bold value denotes non-compliance with the new AQO.
[2] The limit for 24 hours PM_{10} is $100\mu g/m^3$ and the number of exceedance allowance is 9.
[3] The limit for annual PM_{10} is $50\mu g/m^3$.

Table 5.1.8: Results summary against new AQO for SO_2

ASR ID	Location	Max. 10-mins SO_2 Conc ($\mu g/m^3$) [1,2]		Max. 24-hrs SO_2 Conc ($\mu g/m^3$) [1,3]	
		Option 1	Option 2	Option 1	Option 2
A001	Shing Uk Tsuen	224.2 (0)	224.2 (0)	53.6 (0)	53.6 (0)

ASR ID	Location	Max. 10-mins SO_2 Conc ($\mu g/m^3$) [1,2]		Max. 24-hrs SO_2 Conc ($\mu g/m^3$) [1,3]	
		Option 1	Option 2	Option 1	Option 2
A002	Tai Tseng Wai	224.2 (0)	224.2 (0)	53.6 (0)	53.6 (0)
A003	Tai Tseng Wai	208.4 (0)	208.4 (0)	52 (0)	52 (0)
A004	Tai Tseng Wai	208.4 (0)	208.4 (0)	52.1 (0)	52.1 (0)
A005	Fuk Hing Garden & Fuk Hing Tsuen	213.3 (0)	213.3 (0)	50.5 (0)	50.5 (0)
A006	Fuk Fai Garden & Meon Court	213.5 (0)	213.5 (0)	50.5 (0)	50.5 (0)
A007	Sai Tau Wai & Lam Uk Tsuen	213.8 (0)	213.9 (0)	50.5 (0)	50.5 (0)
A008	Long Ping Estate	213.5 (0)	213.6 (0)	50.6 (0)	50.6 (0)
A009	Long Ping Estate	213.5 (0)	213.6 (0)	50.7 (0)	50.7 (0)
A010	Long Ping Estate	213.9 (0)	214 (0)	50.7 (0)	50.8 (0)
A011	Shui Tin Tsuen	214 (0)	214 (0)	50.8 (0)	50.8 (0)
A012	Fung Chi Tsuen	220.8 (0)	220.8 (0)	53.5 (0)	53.5 (0)
A013	Residential Premises along Long Ping Road	219.8 (0)	219.8 (0)	53.4 (0)	53.4 (0)
A014	Chun Hing San Tsuen	221.4 (0)	221.4 (0)	53.7 (0)	53.7 (0)
A901	PH site (Block 3)	213 (0)	213 (0)	51.7 (0)	51.7 (0)
A902	PH site (School 2)	213 (0)	213 (0)	50.7 (0)	50.7 (0)
A903	PH site (Block 4)	213 (0)	213 (0)	51.6 (0)	51.6 (0)
A904	PH site (Block 6)	213 (0)	213 (0)	50.7 (0)	50.7 (0)
A905	PH site (Block 6)	213 (0)	213 (0)	50.7 (0)	50.7 (0)
A906	PH site (Block 7)	213 (0)	213 (0)	50.6 (0)	50.6 (0)
A907	PH site (Block 7)	213 (0)	213 (0)	50.5 (0)	50.5 (0)
A908	PH site (Block 7)	213.1 (0)	213.1 (0)	50.5 (0)	50.5 (0)
A909	PH site (Block 11)	213.1 (0)	213.1 (0)	50.7 (0)	50.7 (0)
A910	PH site (Block 13)	213.3 (0)	213.4 (0)	50.5 (0)	50.5 (0)
A911	PH site (Block 13)	213.1 (0)	213.1 (0)	50.5 (0)	50.5 (0)
A912	PH site (Block 14)	213 (0)	213 (0)	50.5 (0)	50.5 (0)
A913	PH site (Block 14)	213 (0)	213 (0)	50.5 (0)	50.5 (0)
A914	PH site (Block 15)	213 (0)	213 (0)	50.6 (0)	50.6 (0)

ASR ID	Location	Max. 10-mins SO_2 Conc ($\mu g/m^3$) [1,2]		Max. 24-hrs SO_2 Conc ($\mu g/m^3$) [1,3]	
		Option 1	Option 2	Option 1	Option 2
A915	PH site (Block 16)	213 (0)	213 (0)	50.6 (0)	50.7 (0)
A916	PH site (Block 17)	213 (0)	213 (0)	50.6 (0)	50.6 (0)
A917	PH site (Block 18)	213.1 (0)	213.1 (0)	50.6 (0)	50.6 (0)
A918	PH site (Block 19)	213 (0)	213 (0)	50.6 (0)	50.7 (0)
A919	PH site (Option 1: Block 21; Option 2: School 4)	213 (0)	213 (0)	50.6 (0)	50.6 (0)
A920	PH site (Option 1: Block 20; Option 2: School 4)	213 (0)	213 (0)	50.6 (0)	50.6 (0)
A921	PH site (School 3)	219.8 (0)	219.8 (0)	53.3 (0)	53.3 (0)
A922	PH site (Option 1: Block 23; Option 2: Block 21)	219.8 (0)	219.8 (0)	53.3 (0)	53.3 (0)
A923	PH site (ISWB)	219.8 (0)	219.8 (0)	53.3 (0)	53.3 (0)
A924	PH site (ISWB)	219.8 (0)	219.8 (0)	53.3 (0)	53.3 (0)
A925	PH site (Retail)	213.8 (0)	213.8 (0)	50.7 (0)	50.7 (0)
A926	PH site (Retail)	213 (0)	213 (0)	50.5 (0)	50.5 (0)
A927	PH site (Retail)	213.1 (0)	213.1 (0)	50.6 (0)	50.7 (0)
A928	PH site (Retail)	213 (0)	213 (0)	50.6 (0)	50.6 (0)
A929	PH site (Retail)	213 (0)	213 (0)	50.5 (0)	50.5 (0)
A930	PH site (Retail)	213 (0)	213 (0)	50.6 (0)	50.6 (0)
A931	PH site (Retail)	213 (0)	213 (0)	50.8 (0)	50.8 (0)
A932	PH site (Retail)	213 (0)	213 (0)	50.8 (0)	50.8 (0)

Note:
[1] Value in bracket is the number of exceedance. Bold value denotes non-compliance with the new AQO.
[2] The limit for 10 mins SO_2 is 500$\mu g/m^3$ and the number of exceedance allowance is 3.
[3] The limit for 24 hours SO_2 is 125$\mu g/m^3$ and the number of exceedance allowance is 3.

PH site

The current development plans for both options have allowed a separation distance of at least 10m between residential blocks and the main road. It also raises the site platform near Long Ping Road by about 2-5m above ground. Together with the ground floor of at least 5.4m high, the first residential floor would be at a level of at least 7m above ground.

Based on the assessment results in the tables above, it can be found that air quality at the planned residential blocks, schools, and ISWB of the PH site for both options are able to meet the requirements of the new AQO for all pollutants. Although there are few number of exceedance for 1 hr NO_2, 24 hr $PM_{2.5}$ and 24 hr

PM_{10}, they are all within the allowance limits of the respective new AQOs. Therefore, no adverse air quality impacts on the residential blocks, schools, and ISWB of the PH site are anticipated for both options.

The planned retails in the PH site are street shops along Fuk Hi Street and Long Ping Road. Assuming there are window openings on facades facing the roads, it is found that the air quality at the retail shops for both options is generally able to meet the requirements of the new AQO except for annual NO_2. It is found that the maximum annual NO_2 is 49.4μg/m^3 and 50.6μg/m^3 for Options 1 and 2, respectively, exceeding the new AQO limit of 40μg/m^3. These exceedances are largely due to the close proximity of the retail shops to Long Ping Road and Fuk Hi Street (distance of 3-7m). Notwithstanding this, in consideration of the operational nature of the retail shops and the fact that the staff, owners and customers of the retails shops do not reside there, the annual NO_2 AQO would not be applied on retail shops, subject to agreement with EPD.

Apart from the AQO criteria pollutant, assessment results also indicate that the predicted concentrations of lead, ammonia and chloride on all ASRs for both PH options would not exceed the respective limits. Therefore, there are no constraints on the current development plans on the PH site due to the pollutant emission from the existing SP in YLIE.

Table 5.1.9: Results summary for Ammonia (results are same for both options)

ASR ID	Location	Max. 1-hr Ammonia Conc (μg/m^3) [1,2]	Annual Ammonia Conc (μg/m^3) [1,3]
A901	PH site (Block 3)	5.2 (0)	0.03 (0)
A902	PH site (School 2)	4.7 (0)	0.02 (0)
A903	PH site (Block 4)	5.3 (0)	0.03 (0)
A904	PH site (Block 6)	6.2 (0)	0.02 (0)
A905	PH site (Block 6)	5.8 (0)	0.02 (0)
A906	PH site (Block 7)	6.8 (0)	0.02 (0)
A907	PH site (Block 7)	6.3 (0)	0.02 (0)
A908	PH site (Block 7)	6.5 (0)	0.02 (0)
A909	PH site (Block 11)	5.0 (0)	0.02 (0)
A910	PH site (Block 13)	6.4 (0)	0.02 (0)
A911	PH site (Block 13)	5.9 (0)	0.02 (0)
A912	PH site (Block 14)	5.3 (0)	0.02 (0)

ASR ID	Location	Max. 1-hr Ammonia Conc (µg/m³) [1,2]	Annual Ammonia Conc (µg/m³) [1,3]
A913	PH site (Block 14)	5.6 (0)	0.02 (0)
A914	PH site (Block 15)	4.5 (0)	0.02 (0)
A915	PH site (Block 16)	4.1 (0)	0.01 (0)
A916	PH site (Block 17)	3.6 (0)	0.01 (0)
A917	PH site (Block 18)	3.4 (0)	0.01 (0)
A918	PH site (Block 19)	3.3 (0)	0.01 (0)
A919	PH site (Option 1: Block 21; Option 2: School 4)	3.2 (0)	0.01 (0)
A920	PH site (Option 1: Block 20; Option 2: School 4)	3.4 (0)	0.01 (0)
A921	PH site (School 3)	3.3 (0)	0.01 (0)
A922	PH site (Option 1: Block 23; Option 2: Block 21)	3.3 (0)	0.01 (0)
A923	PH site (ISWB)	3.2 (0)	0.01 (0)
A924	PH site (ISWB)	3.1 (0)	0.01 (0)
A925	PH site (Retail)	5.8 (0)	0.02 (0)
A926	PH site (Retail)	6.1 (0)	0.02 (0)
A927	PH site (Retail)	5.6 (0)	0.02 (0)
A928	PH site (Retail)	5.1 (0)	0.02 (0)
A929	PH site (Retail)	5.4 (0)	0.02 (0)
A930	PH site (Retail)	5.5 (0)	0.02 (0)
A931	PH site (Retail)	5.2 (0)	0.02 (0)
A932	PH site (Retail)	4.8 (0)	0.02 (0)

Note:

[1] Value in bracket is the number of exceedance. Bold value denotes non-compliance with the new AQO.

[2] The limit for 1 hour Ammonia is 3,200µg/m³. Reference to OEHHA, Acute RELs and toxicity summaries using the previous version of the Hot Spots Risk Assessment guidelines.

[3] The limit for annual Ammonia is 200µg/m³. Reference to Integrated Risk Information System, USEPA.

Table 5.1.10: Results summary against new AQO for Hydrogen Chloride (results are same for both options)

ASR ID	Location	Max. 1-hr Hydrogen Chloride Conc ($\mu g/m^3$) [1,2]	Annual Hydrogen Chloride Conc ($\mu g/m^3$) [1,3]
A901	PH site (Block 3)	8.7 (0)	0.05 (0)
A902	PH site (School 2)	7.8 (0)	0.04 (0)
A903	PH site (Block 4)	8.8 (0)	0.05 (0)
A904	PH site (Block 6)	10.2 (0)	0.04 (0)
A905	PH site (Block 6)	9.6 (0)	0.04 (0)
A906	PH site (Block 7)	11.3 (0)	0.04 (0)
A907	PH site (Block 7)	10.5 (0)	0.03 (0)
A908	PH site (Block 7)	10.8 (0)	0.03 (0)
A909	PH site (Block 11)	8.3 (0)	0.04 (0)
A910	PH site (Block 13)	10.6 (0)	0.03 (0)
A911	PH site (Block 13)	9.8 (0)	0.03 (0)
A912	PH site (Block 14)	8.9 (0)	0.03 (0)
A913	PH site (Block 14)	9.3 (0)	0.03 (0)
A914	PH site (Block 15)	7.5 (0)	0.02 (0)
A915	PH site (Block 16)	6.9 (0)	0.02 (0)
A916	PH site (Block 17)	6.0 (0)	0.02 (0)
A917	PH site (Block 18)	5.6 (0)	0.02 (0)
A918	PH site (Block 19)	5.6 (0)	0.02 (0)
A919	PH site (Option 1: Block 21; Option 2: School 4)	5.3 (0)	0.02 (0)
A920	PH site (Option 1: Block 20; Option 2: School 4)	5.6 (0)	0.02 (0)
A921	PH site (School 3)	5.4 (0)	0.02 (0)

ASR ID	Location	Max. 1-hr Hydrogen Chloride Conc ($\mu g/m^3$) [1,2]	Annual Hydrogen Chloride Conc ($\mu g/m^3$) [1,3]
A922	PH site (Option 1: Block 23; Option 2: Block 21)	5.5 (0)	0.02 (0)
A923	PH site (ISWB)	5.3 (0)	0.02 (0)
A924	PH site (ISWB)	5.1 (0)	0.02 (0)
A925	PH site (Retail)	9.7 (0)	0.03 (0)
A926	PH site (Retail)	10.2 (0)	0.03 (0)
A927	PH site (Retail)	9.2 (0)	0.03 (0)
A928	PH site (Retail)	8.4 (0)	0.03 (0)
A929	PH site (Retail)	9.0 (0)	0.03 (0)
A930	PH site (Retail)	9.1 (0)	0.03 (0)
A931	PH site (Retail)	8.7 (0)	0.03 (0)
A932	PH site (Retail)	8.0 (0)	0.03 (0)

Note:

[1] Value in bracket is the number of exceedance. Bold value denotes non-compliance with the new AQO.

[2] The limit for 1 hour Hydrogen Chloride is 2,100$\mu g/m^3$. Reference to OEHHA, Acute RELs and toxicity summaries using the previous version of the Hot Spots Risk Assessment guidelines.

[3] The limit for annual Hydrogen Chloride is 20$\mu g/m^3$. Reference to Integrated Risk Information System, USEPA.

Table 5.1.11: Results summary against new AQO for Lead (results are same for both options)

ASR ID	Location	Annual Lead Conc ($\mu g/m^3$) [1,2]
A901	PH site (Block 3)	0.00343 (0)
A902	PH site (School 2)	0.00255 (0)
A903	PH site (Block 4)	0.00305 (0)
A904	PH site (Block 6)	0.00263 (0)
A905	PH site (Block 6)	0.00244 (0)
A906	PH site (Block 7)	0.00246 (0)
A907	PH site (Block 7)	0.00231 (0)

ASR ID	Location	Annual Lead Conc (µg/m^3) [1,2]
A908	PH site (Block 7)	0.00230 (0)
A909	PH site (Block 11)	0.00234 (0)
A910	PH site (Block 13)	0.00224 (0)
A911	PH site (Block 13)	0.00210 (0)
A912	PH site (Block 14)	0.00184 (0)
A913	PH site (Block 14)	0.00183 (0)
A914	PH site (Block 15)	0.00165 (0)
A915	PH site (Block 16)	0.00156 (0)
A916	PH site (Block 17)	0.00150 (0)
A917	PH site (Block 18)	0.00144 (0)
A918	PH site (Block 19)	0.00138 (0)
A919	PH site (Option 1: Block 21; Option 2: School 4)	0.00133 (0)
A920	PH site (Option 1: Block 20; Option 2: School 4)	0.00143 (0)
A921	PH site (School 3)	0.00122 (0)
A922	PH site (Option 1: Block 23; Option 2: Block 21)	0.00129 (0)
A923	PH site (ISWB)	0.00125 (0)
A924	PH site (ISWB)	0.00111 (0)
A925	PH site (Retail)	0.00232 (0)
A926	PH site (Retail)	0.00230 (0)
A927	PH site (Retail)	0.00202 (0)
A928	PH site (Retail)	0.00182 (0)
A929	PH site (Retail)	0.00179 (0)

ASR ID	Location	Annual Lead Conc (µg/m³) [1,2]
A930	PH site (Retail)	0.00179 (0)
A931	PH site (Retail)	0.00173 (0)
A932	PH site (Retail)	0.00165 (0)

Note:
[1] Value in bracket is the number of exceedance. Bold value denotes non-compliance with the new AQO.
[2] The limit for annual Lead is 0.5µg/m³. Reference to Hong Kong New AQO Limits on Concentration of Pollutant.

Existing ASRs

It can be found from **Tables 5.1.4 – 5.1.7** that air quality at existing ASRs in the neighborhood could also comply with the new AQO for all pollutants for both options. Therefore, no adverse air quality impacts on the existing ASRs due to the Project are anticipated.

A comparison of the PH options in relation to air quality is provided in **Table 5.1.12** below.

Table 5.1.12: Comparison of air quality impacts for different PH options

Evaluation Criteria	Option 1	Option 2
Provision of sufficient separation distance between the YLIE and the residential development to ensure compliance with the new AQO	• Sufficient separation has been allowed between YLIE and PH development and assessment results show that the new AQO could be met.	• Same as Option 1.
Provision of sufficient separation distance between Long Ping Road & Fuk Hi Street and the residential development to ensure compliance with the new AQO	• Sufficient separation has been allowed between roads and PH development and assessment results show that the new AQO could be met.	• Same as Option 1.
Extent of further mitigation measures/building constraints (e.g. height restriction, further setback)	• No mitigation measures are required.	• Same as Option 1.
Recommendation	No preference	No preference

5.1.2 Evaluation of YLIEE site

There are only slight differences in the development layout plans for Options A and B for YLIEE site. Both comprise a total of 16 industrial lots, but the planned industrial lots for Option B would be a bit closer to PH site, thus considered as conservative in the preliminary assessment as presented in **S5.1.1**. Given the slight difference in the development layouts, it is anticipated that irrespective of the YLIEE development options, there are also no adverse air quality impacts on the planned and existing receivers.

A comparison of the YLIEE options in relation to air quality is provided in **Table 5.1.13** below.

Table 5.1.13: Comparison of air quality impacts for different YLIEE options

Evaluation Criteria	Option A	Option B
Provision of sufficient separation distance between the YLIE and the residential development to ensure compliance with the new AQO	• Sufficient separation has been allowed between YLIE and PH development and assessment results show that the new AQO could be met.	• Same as Option 1.
Provision of sufficient separation distance between Long Ping Road & Fuk Hi Street and the residential development to ensure compliance with the new AQO	• N/A	• N/A
Extent of further mitigation measures/building constraints (e.g. height restriction, further setback)	• Assume no major pollution emitters inside YLIEE (e.g. SPs) and the fuel consumptions shall be controlled in the lease condition.	• Same as Option 1.
Recommendation	No preference	No preference

5.2 Noise

The baseline study has identified a number of existing noise sources in the vicinity that would have certain bearing on the environmental acceptability of the Project during the operational phase. These sources include the following:

- Road traffic noise from roads in the vicinity of the Project Site including Fuk Hi Street, Long Ping Road, Long Tin Road, etc;
- West Rail Line running between Long Ping Station and Tin Shui Wai Station; and
- Fixed plant noise within existing YLIE, those scattered industrial workshops and other existing industrial noise sources in the vicinity of the Project Site.

Helicopter noise measurement was conducted at the rooftop of Yuet Ping House, Kam Ping House in Long Ping Estate, proposed YLIEE site, proposed PH site and rooftops of two buildings in YLIE. Based on site measurement, the helicopter noise levels were in the range of 60 – 77 L_{max} dB(A) which is well within the daytime noise criterion of 85 L_{max} dB(A). According to the information provided by Civil Aviation Department (CAD), there are no complaints against helicopter noise in recent Years 2011 and 2012 (up to end of November 2012). As presented in the TR-1 Baseline Review Report, it is considered that helicopter noise would not impose any development constraints on the Project Site.

Other than the existing noise sources, there are other planned noise sources due to the Project that need to be addressed. A PTI has been planned in the buffer zone between the PH and YLIEE site. In accordance with HKPSG, while specific noise level standards are not applicable for PTI, noise should be a major consideration in determining their locations and site layout. Efforts should be made to ensure

that the noise impact caused by this facility will be minimised. It is recommended that the PTI shall be designed to ensure no line-of-sight of the noise sources at the noise sensitive uses. Hence, it is considered that noise due to the operation of PTI would not impose any development constraints on the site.

In addition, the future YLIEE albeit for use of clean technology industries might also have some industrial operation and fixed sources which would affect the existing Noise Sensitive Receivers (NSRs) in the neighbourhood and planned NSRs on PH site. Besides, in order to support the future population for PH and YLIEE site, road improvement works on existing Fuk Hi street and Long Ping Road are recommended in the current development proposals. The associated traffic would induce the noise impacts that may also impose potential constraints on the development site.

During construction phase, activities such as site formation, road works, slope works, superstructure works, etc for the proposed development would involve the use of Powered Mechanical Equipment (PME) and hence would generate construction noise. However, construction noise could readily be controlled at-source by means of good site practices and mitigation controls such as the use of quieter plant, the use of temporary noise barriers / enclosures etc. Hence it is not considered in this option selection exercise. The proposed evaluation criteria for noise are therefore solely related to the operational noise impacts of different development options and are summarized in **Table 5.2.1** below.

Table 5.2.1: Evaluation principle and criterion of noise aspect

Evaluation Principle	Evaluation Criterion
No adverse road traffic noise impacts on the development options	Compliance with road traffic noise criteria
	Extent of on-site mitigation measures required such as fixed window, barrier, structural fin, acoustic window etc.
	Extent of off-site mitigation measures on existing roads required such as barriers, low noise surfacing, enclosure etc.
No adverse rail noise impacts on the development options	Compliance with rail noise criteria
	Extent of on-site mitigation measures required such as fixed window, structural fin, non-sensitive use etc.
	Extent of off-site mitigation measures on existing WR viaduct required such as barriers, enclosure
No adverse fixed noise impacts on the development options	Provision of sufficient separation distance from existing and planned fixed noise sources to ensure compliance with the noise criteria
	Extent of building mitigation measures required such as fixed windows etc
	Extent of at-source noise control measures required e.g. enclosure, barrier/cover, silencer etc

A preliminary operational noise assessment has been conducted to ascertain whether the evaluation criteria could be met for different development options. The assessment approach for different noise aspects is briefly described in the sections below. It should be noted that this assessment is preliminary only for purpose of option evaluation.

5.2.1.1 Road Traffic Noise

Road traffic noise assessment has been undertaken based on the method of UK Department of Transport "Calculation of Road Traffic Noise (CRTN)" using RoadNoise 2000 model. Calculations of future road traffic noise are based on the

maximum peak hour traffic forecast projected within a 15 years period upon commencement of operation. The preliminary traffic projection taking into account the induced traffic due to the proposed development and other concurrent projects has predicted that the maximum peak hour traffic flow between Year 2022 (commissioning year) and 2037 would occur in Year 2037. Hence, the assessment year for road traffic noise is taken at Year 2037.

Representative NSRs including those within planned PH site and those existing sensitive uses in vicinity of the proposed road works along Fuk Hei Street and Long Ping Road have been identified in this preliminary assessment. They are listed in **Table 5.2.2. Figures 5.2.1** and **5.2.2** show the location of the representative noise assessment points (NAPs) for PH Option 1 and Option 2, respectively.

Table 5.2.2: Representative NSRs for preliminary road traffic noise assessment

NSR[1]	Location	NAP	No. of Stories[2]	Uses[3]	Criterion, $L_{10\ 1\ hr}$ dB(A)[4]
Existing NSRs[8]					
N1	Tai Tseng Wai	R001	1-3	R	70
N9	Fuk Fai Garden & Meon Court	R162	1-3	R	70
N16	TWGH. Lo Kon Ting Memorial College, Long Ping Estate	R301	6	E	65
	Yuk Ping House, Long Ping Estate	R312	34	R	70
N19	Fung Chi Tsuen	R361	1-3	R	70
N24	Pak Fa Tsuen	R461	1-2	R	70
Planned NSRs (PH site)					
N27	Block 5	R1105A	36 / 41	R	70
	Block 6	R1106A-D	31 / 36	R	70
	Block 7	R1107A-K	31 / 31	R	70
	Block 8	R1108A	36 / 41	R	70
	Block 9	R1109A	36 / 41	R	70
	Block 11	R1111A-B	31 / 36	R	70
	Block 12	R1112A	31 / 36	R	70
	Block 13	R1113A-G	31 / 31	R	70
	Block 14	R1114A-G	31 / 31	R	70
	Block 15	R1115A-B	31 / 31	R	70
	Block 16	R1116A-B	36 / 36	R	70
	Block 17	R1117A-B	36 / 36	R	70
	Block 18	R1118A-B	36 / 36	R	70
	Block 19	R1119A-E	31 / 31	R	70
	Block 20	R1120A-G / R1122A-B [6]	26 / 26	R	70
	Block 21	R1121A / N/A[5,6]	26 / N/A[5]	R	70
	Block 22	R1122A-B / N/A[5,6]	26 / N/A[5]	R	70
	School 1	R1203A	8	E	65
	School 2	R1202A-B	8	E	65

NSR[1]	Location	NAP	No. of Stories[2]	Uses[3]	Criterion, $L_{10\ 1\ hr}$ dB(A)[4]
	School 3	R1201A-F	8	E	65
	School 4	R1204A-H / N/A[5,6]	N/A[5] / 8	E	65
	ISWB[7]	R1301A-C	5	G	70[6]

Notes:

[1] Some of the NSRs within the Study Area are located further away from the Project and hence not considered for this preliminary assessment. Thus, NSR IDs are not in sequential order.

[2] Number of storeys (ground floor included) for PH site are presented for the two options in [option 1] /[option 2].

[3] R– Residential Premises; E – Educational Institutions; G – Government use.

[4] Noise criterion according to Technical Memoranda on Environmental Impact Assessment Ordinance (TM-EIAO). The standards apply to uses that rely on opened windows for ventilation.

[5] N/A - "Not applicable" for the option.

[6] NAPs for the two options are different and are presented in [Option 1] / [Option 2]. .

[7] The Integrated Social Welfare Building (ISWB) comprises day centre, dare care centre for the elderly, special child care centre, early education and training centre, hostels, residential care home for the elderly, supported hostel for mentally handicapped persons, care and attention home for severely disabled persons, integrated vocational and rehabilitation services centre, hostel for moderately mentally handicapped persons, day activity centre, and hostel for severely mentally handicapped persons. They are for day care centre, training, and hostel uses and hence a criterion of 70dB(A) has been applied.

[8] The noise assessment point will include those New Territories exempt houses which may be built near the boundary of the "V" zone. A review will be conducted to account for the constraints from site entrance, pedestrian access and vehicular access roads etc in TR-3 submission. More existing NSRs (e.g. Shui Tin Tsuen and Chun Hing San Tsuen) will also be included in TR-3 if they are within 300m of the road improvement work or affected by the proposed works.

For preliminary assessment of the noise impacts on the existing NSRs due to the Project, according to EPD's Guidance Note 12/2010, the traffic noise impacts should be considered significant if the traffic noise level at the NSRs with the project is greater than that without the project by 1.0 dB(A) or more. The following two scenarios have therefore been conducted for the existing NSRs:

- Predicted overall noise levels with the project scenario at Year 2037
- Predicted overall noise levels without the project scenario at the same year (i.e. without modification in Year 2037).

5.2.1.2 Rail Noise

The West Rail Line (WRL) starts at Hung Hom Station and ends at Tuen Mun Station. The WRL is running close to the southern end of the proposed PH site in viaduct which is about 10m above ground level. Representative NSRs have been identified in this preliminary assessment (**Table 5.2.3**). **Figures 5.2.3** and **5.2.4** show the location of the representative NAPs for PH Option 1 and Option 2, respectively.

Noise impacts on residential uses within PH site would be considered for daytime, evening and night-time periods. For educational premises, only the daytime criterion is applicable. For the ISWB with multiple uses, relevant criteria shall be considered depending on the types of uses. The Day Centre, Day Care Centre for the Elderly, Special Child Care Centre, Early Education and Training Centre, Integrated Vocational and Rehabilitation Services Centre and Day Activity Centre

would not operate during evening and night-time periods, and hence only daytime noise criterion is applicable. However, for those residential uses, such as hostel, care home etc, all daytime, evening and night-time criteria shall be applied. Since detailed internal floor plan for ISWB is not available at planning stage, the assessment has been conducted and compared against the criteria for different periods to determine if there are any constraints on types of uses that need to be incorporated into the future floor plan.

Table 5.2.3: Representative NSRs for preliminary rail noise assessment

NSR	Location	NAP	No. of Stories[1]	Uses[2]	Daytime & Evening/ Night-time Criterion, $L_{eq\ 30\ min}$ dB(A)[3]	Criterion, L_{max} dB(A)[4]
N27	Block 19	R1119B,C	31 / 31	R	65 / 55	85
	Block 20	R1120B,H / R1122A,B[5]	26 / 26	R	65 / 55	
	Block 21	R1121B,C / R1123A,B[5]	26 / 26	R	65 / 55	
	Block 22	R1122A,B / R1124A,B[5]	26 / 26	R	65 / 55	
	Block 23	R1123A,B	26 / N/A[6]	R	65 / 55	
	Block 24	R1124A,B	26 / N/A[6]	R	65 / 55	
	School 3	R1201B	8 / 8	E	65/ N/A[6]	
	School 4	R1204B	N/A[6] / 8	E	65/ N/A[6]	
	ISWB (Day Centre, Day Care Centre for the Elderly, Special Child Care Centre, Early Education and Training Centre, Integrated Vocational and Rehabilitation Services Centre, Day Activity Centre)	R1301A-U	5 / 5	G	65/ N/A[6]	
	ISWB (Hostels, Residential Care Home for the Elderly, Supported Hostel for Mentally Handicapped Persons, Care and Attention Home for Severely Disabled Persons, Hostel for Moderately Mentally Handicapped Persons, Hostel for Severely Mentally Handicapped Persons)				65/55	

Notes:

[1] Number of storeys for PH site are presented for the two options in [option 1] /[option 2].

[2] R– Residential Premises; E – Educational Institutions; G – Government use

[3] The criteria are presented for [Daytime and evening time criterion / nighttime criterion]. Noise criterion is proposed according to Technical Memorandum for the Assessment of Noise from Places Other than Domestic Premises Public Places or Construction Sites.

[4] Noise criterion between 2300 – 0700 hours according to TM-EIAO.

[5] NAPs for the two options are different and are presented in [Option 1] / [Option 2].

[6] N/A – Not applicable for the option.

To establish the appropriate train noise source term for the preliminary rail noise assessments, reference has been made to the previous relevant EIA studies. The approved EIA Report for West Rail (i.e. "West Rail - Final Assessment Report West Kowloon to Tuen Mun Centre - Environmental Impact Assessment - Vol. 1, Technical Annexes, & Environmental Monitoring and Audit Manual" ref: EIA-149/BC) has adopted a train noise source term of L_{max} of 82.5 dB(A) at a distance of 25m and at a speed of 135km/h. According to recent approved EIA Report for Shatin to Central Link (i.e. "Shatin to Central Link – Tai Wai to Hung Hom Section" ref: EIA-200/2011), a more updated train noise source term of L_{max} 75.3 dB(A) (i.e. SEL 73.7 dB(A)) for 1 car at a distance of 25m and at a speed of 130 km/h on at-grade ballast track (model SP1900) has been adopted.

In addition, MTRCL has been approached to collate their latest operational information such as updated noise source term of WRL, speed profiles, headway during different time periods, trackform design, and the existing and committed noise mitigation measures in the vicinity of the proposed development. The information collected from MTRCL has been presented in TR-1 Baseline Review Report. According to MTRCL, the latest train noise source term in WRL EP conditions and the SCL EP conditions are still the latest available information in the public domain. However, the source terms adopted for WRL and SCL were measured on at-grade ballast track instead of viaduct. Hence, it would be advisable to conduct additional noise measurements to establish the in-situ noise source term of West Rail train units running on viaduct for the current study.

Two in-situ noise measurement events for West Rail train running on a viaduct have been conducted. The first set of measurement was conducted in October 2012 at Yuet Ping House of Long Ping Estate which aims to establish the train noise source term at different vertical directivities at higher level (i.e. from 2/F upwards). The second set of measurement was conducted in March 2013 at a vacant land near Umah International Primary School to establish the train noise source term at vertical directivities at lower level.

It should be noted that the original three locations (i.e. Leung Choy Building Phase 2, the vacant land near Shui Tin Tsuen and MTRCL's Yick Yuen EAP) proposed in the Inception Report were eventually not chosen for noise source measurement. Leung Choy Building Phase 2 and the vacant land near Shui Tin Tsuen were severely constrained by the high background noise and site accessibility. The MTRCL's Yick Yuen EAP was also not considered as it needs access grant from MTRCL and it was too far away from the PH site and may be less representative for the purpose of this assessment. In addition, all these three locations would require a tall crane to hold a series of microphones at different vertical levels during a long period in a day. This would inevitably cause adverse impacts on the use of the local roads / open space by the local communities. The potential safety issue in case of any unexpected events due to falling of the tall crane is also an important concern to MTRCL. Hence, all three measurement locations were not considered further.

After reviewing other locations, it is considered that the southern façade of Yuet Ping House, Long Ping Estate may be a more suitable measurement location as far as the PH site is concerned. Microphones were set up at 2/F, 3/F, 5/F, 7/F, 9/F, 11/F, 13/F, 15/F, 17/F and 19/F, facing the existing WR viaduct, at Yuet Ping House, Long Ping Estate to collect information at different vertical directivities. The measurements were conducted after 9pm and the train events were captured in between the periods when less traffic was observed or when traffic stopped at

the signalised junctions of Wang Tat Road and Ping Wui Street so as to minimize the background noise impact as much as practicable.

In order to collect the information for vertical directivities at lower level, another set of measurements was also conducted in March 2013 at a vacant land near Umah International Primary School. The measurement points were set up at a distance of 23m and 43m from the viaduct and at 1.2m and 4.7m above ground.

The measurement locations, the section drawing showing the vertical directivities, and the measurement results for WR trains running on viaduct are given in **Appendix 5.2.1**. Since the measurement locations at Yuet Ping House and near Umah International Primary School have different separation distance and train speeds, the measured train noise results at different vertical directivities have been corrected to the same reference conditions, at a distance of 25m and at a speed of 130 km/h, as in the SCL EIA. A summary of corrected train noise source terms at different vertical directivities are shown in **Table 5.2.4** below.

As shown in **Appendix 5.2.1**, at the highest vertical directivity (i.e. 19/F) representing the unscreened case, the corrected train noise source term is 76.1dB(A), which is within 1dB(A) as the source term adopted in SCL EIA after including the non-ballast track correction (i.e. 76.2 dB(A)). Hence, the corrected train noise source term on viaduct is considered appropriate.

Table 5.2.4: Corrected train noise source term with viaduct effect at different vertical directivities

Incident angle at measurement point, near track degree °	Train noise source term with viaduct effect SEL, dB(A)[1]	Incident angle for which the source term will be applied for calculation, degree °
-20	62.1	$\theta < -20$
-13	62.5	$-20 < \theta < -13$
-12	62.8	$-13 < \theta < -12$
-8	64.5	$-12 < \theta < -8$
-2	67.2	$-8 < \theta < -2$
-1	67.6	$-2 < \theta < -1$
9	68.9	$-1 < \theta < 9$
19	69.5	$9 < \theta < 16$
23	69.8	$16 < \theta < 23$
29	71.5	$23 < \theta < 29$
34	72.7	$29 < \theta < 34$
39	73.8	$34 < \theta < 39$
43	75.4	$39 < \theta < 43$
47	76.1[2]	$\theta > 43$

[1] The train noise source term with viaduct effect at reference condition of 1 car of 130 km/h and 25m setback on non-ballast track without facade correction.

[2] At this incident angle, screening effect from the viaduct is not anticipated. (See **Appendix 5.2.1** Section drawing)

The corrected train noise source term on viaduct for different vertical directivities have then been incorporated into Arup's train noise model (OveRail) to predict and assess the propagation of airborne train noise. The modelling methodology for propagation is based on the prediction procedures in Calculation of Railway Noise 1995 (CRN) and it has been validated against the examples listed in CRN

handbooks. **Appendix 5.2.2** summarises all the modeling parameters adopted, including the WR operational parameters and correction factors used for calculation.

A review of different rail noise assessment methodologies used in previous approved EIA reports in Hong Kong has been compared and listed below:

Application No.	Environmental Impact Assessment Report	Assessment Methodology
EIA-149/BC	West Rail – Final Assessment Report West Kowloon to Tuen Mun Centre – EIA – Vol. 1, Technical Annexes, & Environmental Monitoring and Audit Manual	Combination of Maekawa equation for barrier attenuation and dispersion model based on standard acoustic principle.
EIA-027/1999	East Rail Extensions - Tai Wai to Ma On Shan	
EIA-071/2001	Sheung Shui to Lok Ma Chau Spur Line	
EIA-169/2009	Hong Kong Section of Guangzhou - Shenzhen - Hong Kong Express Rail Link	US FRA High-Speed Ground Transportation Noise and Vibration Impact Assessment
EIA-200/2011	Shatin to Central Link - Tai Wai to Hung Hom Section	The Calculation of Railway Noise (CRN) by Department of Transport, UK
EIA-197/2011	Shatin to Central Link - Stabling Sidings at Hung Hom Freight Yard	
EIA-198/2011	Shatin to Central Link - Mong Kok East to Hung Hom Section	

The West Rail EIA was completed before the enactment of EIAO. The methodology assumes distance attenuation from each point source location within an array along the track alignment at 20m summation intervals and Maekawa equation as barrier attenuation. The MOS Rail and Spurline EIAs adopted the same methodology as West Rail EIA. The Express Rail Link adopts the methodology as stated in FRA High-Speed Ground Transportation Noise and Vibration Impact Assessment where the speed is about 200km/h.

The most recently approved EIAs involving air-borne train noise are the EIAs for SCL as summarized in the above table. All these three approved EIAs had adopted the CRN methodology which is one of the internationally recognized train noise prediction methodologies. Hence, it is proposed to adopt the same CRN methodology in line with the most recently approved EIA. In addition, a rail noise measurement will be conducted to validate the proposed assessment CRN methodology in the TR3/EIA submission.

5.2.1.3 Industrial Noise

The TR-1 baseline review study has identified a number of existing industrial noise sources within and in the vicinity of the Project site. The major sources include:

- Existing industrial premises within YLIE (including chiller plant, industrial process, louvers, loading / unloading activities etc).
- Existing rural industrial operations to the east of the Project site and in the northern and central parts of the Project site.

Appendix 5.2.4 shows the locations of these existing noise sources. Based on the site observation and information provided by operators, about 50% of the existing industrial companies in YLIE have night-time operation. On-site noise measurements have been undertaken at each industrial premise where access was permitted and the industrial noise emission inventory is established in **Appendix 5.2.4**. It should be noted that as requested by the existing tenants of YLIEE, the information collected from their premises including the established noise emission inventory are confidential and can solely be used for this study. The privacy of the individual, public and private sector organisations is protected under the Personal Data (Privacy) Ordinance (Cap. 486). The Project Proponent is under obligation to protect the privacy of the YLIE companies and have committed that the private business operation information for individual company will be treated confidentially and will not be disclosed and published to the public. The information presented in this report are therefore only provided to the government departments.

The YLIEE and PH sites will be developed concurrently and the existing industrial uses in YLIEE site will be removed and cleared before the population intake year of the PH site. Thus there is no I/R interface issue between the PH site and the existing industrial uses in the YLIEE site.

Other than the existing sources, the proposed YLIEE would also accommodate some industrial buildings where potential noise sources are expected such as chiller plant, loading and unloading activities etc, despite clean technology industries would be encouraged within YLIEE.

The PH site is targeted mainly for residential use. The retails are street-shops without provision of central air conditioning and mechanical ventilation. Industrial noise impacts due to small chillers and ventilation plant for the retails are therefore not anticipated. Nonetheless, these noise sources if really unavoidable are also considered of comparatively smaller scale and can be readily controlled by standard noise control measures. Hence, for the purpose of this option evaluation, the industrial noise sources within the PH site are not considered. Only the impacts due to the existing industrial noise sources and planned noise sources within YLIEE would be included in this preliminary assessment.

Appendix 5.2.4 provides details of the fixed noise assessment methodology and a summary is given below for easy reference.

- Identify and locate representative NSRs that may be affected by industrial noise sources;

- Determine the fixed noise criteria of the NSRs for daytime, evening and nighttime periods.
- Estimate the sound power levels (SWLs) of existing industrial noise sources by site measurement or from recognised sources of reference, where appropriate;
- Use standard acoustic principle to determine the corrections for attenuation, air absorption and screening;
- Evaluate the noise impacts on both existing NSRs and planned NSRs for the PH site; and
- Determine the maximum allowable SWLs of the planned fixed noise sources for the proposed industrial development in YLIEE and the at-source noise control measures required to ensure that the cumulative noise levels from the existing and planned fixed noise sources would achieve the respective noise criteria at existing and planned NSRs.

Representative NSRs have been identified in this preliminary assessment (**Table 5.2.5**) and the representative Noise Assessment Points (NAPs) are shown in **Figure 5.2.5** and **Figure 5.2.6**. Since the proposed development layouts for the northern portion of PH site are the same for both options, the same sets of NAPs are proposed and adopted in this assessment. The schools would be screened from the major industrial noise sources by the residential blocks and hence are not considered. Other than these planned NSRs, there are some existing low-rise village houses near the northern boundary of the YLIEE site that might be potentially affected by YLIEE. These existing NSRs would also be considered.

In order to determine the fixed noise criteria, prevailing noise levels have been measured in the vicinity of the Project site from September 2012 to January 2013. Details of the prevailing noise measurement results have been presented in the TR-1 Baseline Review Report. The fixed noise criteria established in TR-1 have been updated with respect to the development layouts which are shown in **Table 5.2.5** below. Details of NAPs and fixed noise criteria are given in **Appendix 5.2.3**.

Table 5.2.5: Representative NSRs and noise criteria for fixed noise assessment

NSR and NAPs	Uses [1]	ASR[3]	Time Period	ANL-5, dB(A) [A]	Prevailing Noise Level, dB(A) [B] [4]	Criteria, dB(A) [Minimum of [A] & [B]]	Ref. PNM[4]
Planned NSRs within the PH Site							
Block 1 R101A[2]	R	C[2]	Day	65	63	63	PNM12
			Evening	65	62	62	
			Night	55	56	55	
Block 3 R103A[2]	R	C[2]	Day	65	63	63	PNM12
			Evening	65	62	62	
			Night	55	56	55	
Block 5 R105A[2]	R	C[2]	Day	65	63	63	PNM12
			Evening	65	62	62	
			Night	55	56	55	
Block 7 R107A[2]	R	C[2]	Day	65	63	63	PNM12
			Evening	65	62	62	
			Night	55	56	55	
Block 14 R114B[2]	R	B	Day	60	71	60	PNM05
			Evening	60	62	60	

NSR and NAPs	Uses [1]	ASR[3]	Time Period	ANL-5, dB(A) [A]	Prevailing Noise Level, dB(A) [B] [4]	Criteria, dB(A) [Minimum of [A] & [B]]	Ref. PNM[4]
			Night	50	57	50	
Block 18 R118A[2]	R	B	Day	60	64	60	PNM02
			Evening	60	60	60	
			Night	50	52	50	
Existing NSRs (up to 3 storeys)							
Lux Court R004	R	C[2]	Day	65	54	54	PNM06
			Evening	65	47	47	
			Night	55	46	46	
Village House 51A R021	R	C[2]	Day	65	48	48	PNM07
			Evening	65	45	45	
			Night	55	44	44	

Notes:

[1] R – Residential Premises, E – Educational Institutions

[2] In accordance with TM-Places, NSR will be assigned an Area Sensitivity Rating of "C" if it is within 100m of YLIE/YLIEE zone, or an Area Sensitivity Rating of "B" if it is between 100 m and 250 m from such a zone. Based on the current programme as agreed between ITC, HKSTP, HD and PlanD, the YLIEE site and the PH site will be packaged in one rezoning exercise. Thus, the YLIEE site will be rezoned as industrial zone before the occupation of NSRs Block 1, 3, 5 and 7 and ASR "C" is assigned.

[3] ASR – Area Sensitivity Rating. Since the planned PH Site are not considered as Type (i) Rural area, including country parks or village type developments, Type (ii) Low density residential area consisting of low-rise or isolated high-rise developments or Type (iii) Urban area, Type (iv) Area other than those above is considered as appropriate type of area containing NSRs.

[4] PNM reference locations for representative prevailing noise levels. The minimum prevailing noise levels are adopted. Details are given in the TR-1 Baseline Review Report.

5.2.2 Evaluation for PH site

5.2.2.1 Road Traffic Noise

The predicted road traffic noise levels at each representative NAPs are presented in **Table 5.2.6**. Details are summarized in **Appendix 5.2.5**.

Table 5.2.6: Predicted road traffic noise levels for different PH options at Year 2037

NSR[1]	Location	NAP	Uses[2]	Criterion, $L_{10\ 1\ hr}$ dB(A)	Predicted $L_{10\ 1\ hr}$, dB(A)[3,4]		
					Without Project[4]	With Project	
						Option 1	Option 2
Existing NSRs							
N1	Tai Tseng Wai	R001	R	70	61 (0)	62 (0)	61 (0)
N9	Fuk Fai Garden & Meon Court	R162	R	70	74 (**4**)	75 (**5**)	76 (**6**)
N16	Yuk Ping House, Long Ping Estate	R312	R	70	77 (**7**)	79 (**9**)	79 (**9**)
	TWGH Lo Kon Ting Memorial College, Long Ping Estate	R301	E	65	72 (**7**)	74 (**9**)	75 (**10**)
N19	Fung Chi Tsuen	R361	R	70	75 (**5**)	77 (**7**)	77 (**7**)
N24	Pak Fa Tsuen	R461	R	70	75 (**5**)	75 (**5**)	75 (**5**)
Planned NSRs within PH site							

NSR[1]	Location	NAP	Uses[2]	Criterion, $L_{10\ 1\ hr}$ dB(A)	Predicted $L_{10\ 1\ hr}$, dB(A)[3,4]		
					Without Project[4]	With Project	
						Option 1	Option 2
N27	Block 5	R1105A	R	70	N/A	63 (0)	63 (0)
	Block 6	R1106A-B	R	70	N/A	71 (**1**)	71 (**1**)
	Block 7	R1107A-K	R	70	N/A	73 (**3**)	73(**3**)
	Block 8	R1108A	R	70	N/A	61 (0)	62 (0)
	Block 9	R1109A	R	70	N/A	62 (0)	62 (0)
	Block 11	R1111A-B	R	70	N/A	67 (0)	67 (0)
	Block 12	R1112A	R	70	N/A	68 (0)	68 (0)
	Block 13	R1113A-G	R	70	N/A	74 (**4**)	74 (**4**)
	Block 14	R1114A-G	R	70	N/A	73 (**3**)	73 (**3**)
	Block 15	R1115A-B	R	70	N/A	50 (0)	53 (0)
	Block 16	R1116A-B	R	70	N/A	64 (0)	64 (0)
	Block 17	R1117A-B	R	70	N/A	41 (0)	41 (0)
	Block 18	R1118A-B	R	70	N/A	52 (0)	53 (0)
	Block 19	R1119A-E	R	70	N/A	71 (**1**)	71 (**1**)
	Block 20	R1120A-G / R1122A-B [5]	R	70	N/A	73 (**3**)	66 (0)
	Block 21	R1121A / N/A[5]	R	70	N/A	67 (0)	N/A
	Block 22	R1122A-B / N/A[5]	R	70	N/A	66 (0)	N/A
	School 1	R1203A	E	65	N/A	53 (0)	59 (0)
	School 2	R1202A-B	E	65	N/A	64 (0)	64 (0)
	School 3	R1201A-F	E	65	N/A	67 (0)	67 (0)
	School 4	R1204A-H	E	65	N/A	N/A	76 (**11**)
	ISWB[6]	R1301A-C	G	70	N/A	70 (0)	70 (0)

Notes:

[1] Some of the NSRs within the Study Area are located further away from the Project and hence not considered for this preliminary assessment. Thus, NSR IDs are not in sequential order.

[2] R– Residential Premises; E – Educational Institutions; G – Government use.

[3] Noise levels presented are rounded to the nearest dB(A). Value in bracket is the number of exceedance. Bold value denotes non-compliance TM-EIAO's criteria.

[4] N/A – Not applicable for the option.

[5] NAPs for the two options are different and are presented in [Option 1] / [Option 2].

[6] The Integrated Social Welfare Building (ISWB) comprises day centre, dare care centre for the elderly, special child care centre, early education and training centre, hostels, residential care home for the elderly, supported hostel for mentally handicapped persons, care and attention home for severely disabled persons, integrated vocational and rehabilitation services centre, hostel for moderately mentally handicapped persons, day activity centre, and hostel for severely mentally handicapped persons. They are for day care centre, training, and hostel uses and hence a criterion of 70dB(A) has been applied.

Planned Residential Blocks at PH site

During process of building layout development, due consideration has already been given to avoiding adverse noise impacts arising from Long Ping Road and Fuk Hi Street as much as practicable. For example, in consideration of the narrow

strip of land on the southern portion of PH site where building setback is very limited, a SAB design has been adopted. Other residential blocks overlooking Fuk Hi Street are in cruciform shape with optimized setback and reduced view angle to the road as far as practicable.

However, as shown in **Table 5.2.6** above, some of the planned residential premises at PH site, including Blocks 6, 7, 13, 14, 19, and 20 would still be subject to noise levels in excess of the criterion. The exceedance is in the range of 1-4dB(A) for both options. Hence, mitigation measures are required.

Given the requirement of the prescribed windows, further setback distance from roads for mitigating the road traffic noise impacts is considered not feasible. Other types of mitigation measures have been investigated. They include the following:

Fixed window:	Fixed window design is an effective mitigation measures but is subject to air ventilation requirement. The current assessment has already assumed no openable window on the end wings facing Fuk Hi Street and the internal roads. The exceedance is found at the main window of the affected units, but use of fixed window will deprive of the primary air ventilation and hence is considered.
Structural fin:	Structural fins are effective to protect the flats if they are not directly overlooking the road. A number of factors including the possible reflection effect due to short separation distance of parallel fins, noise screening performance, aesthetic appearance need to be considered for testing of structural fin locations.
Barrier	Noise barrier or cantilevered noise barrier above the roof of retail shops could protect the flats at lower floors.
Acoustic window	Where the above mitigation measures are found ineffective, acoustic window will be considered to protect the remaining affected flats. According to the Final Report of Acoustic Design and Performance Evaluation of the Acoustic Window, the acoustic window with absorptive lining could achieve a noise attenuation of about 5-8 dB(A). However, the noise attenuation performance it is subject to EPD's agreement. For purpose of this preliminary assessment, a 5 dB(A) noise attenuation is assumed for conservative analysis.

Various mitigation measures have been tested for Option 1 and Option 2 and the proposed mitigation measures are shown in **Figures 5.2.7** and **5.2.8**, respectively.

At the northern portion of the PH site, the building layout plans have no difference for the two options except for the number of residential storeys. Thus the locations of the noise exceedance are more or less the same. Noise exceedance at the end unit of the eastern wing in Block 6 (i.e. R1106A) is due to the traffic on the northern internal road. It is found that provision of structural fins could be effective to mitigate the noise impacts on this flat by reducing the angle of view to the road. The width of the fins required is 1.5m for Option 1 and 1.8m for Option 2.

Exceedances on Block 7 (max of about 3 dB(A)) and Block 13 (max of about 4 dB(A)) are attributable to the road traffic on both Fuk Hi Street and the northern internal road. For both options, a 5.5m high barrier with 2.2m cantilever (absorptive) and a 5m high barrier with 3m cantilever (absorptive) on the roof of the retails on Block 7 and Block 13, respectively are found effective to protect all affected flats except at the end unit of the eastern wing in Block 13 facing the road junction i.e. R1113A. With the provision of this 5.5m high barrier with 2.2m cantilever (absorptive), the exceedance at R1106C of Block 6 under Option 2 could also be mitigated. For the remaining affected flat R1113A, structural fins of up to 2.1m has been tested but it is still found ineffective. Since the noise exceedance is only 4dB(A), it is considered that the use of acoustic window would be able to mitigate the noise impacts at R1113A to within the 70dB(A) criterion. Nonetheless, it is also considered that in place of the two extensive cantilevered barriers proposed on the retail roof along two sides of the internal road, decking over may be an alternative option. Subject to discussion with HKHA, further studies on its effectiveness and practicable could be conducted in the detailed assessment in next stage.

For exceedance found at Block 14 overlooking the junctions of Fuk Hi Street and Long Ping Road, a combination of a 5m noise barrier with 3m cantilever on rooftop of the retail and a structural fins at R1114G are found to be effective to mitigate all affected NSRs. The width of the fins required is 1.8m for Option 1 and 2.1m for Option 2.

Further to the southern portion of the site, the layout options differ in that two of the residential towers located in Option 1 (Block 20 and 21) are replaced with an additional school (School 4) in Option 2. This would bring about more traffic on the southern access road for Option 1. The noise exceedance at the western facades of Block 19 is about 1dB(A) and at lower floors only. A 2m high noise barrier along the access road is found adequate to mitigate the impacts. The approximate extent of barrier is about 7m for Option 1 and 52m for Option 2. For Option 1, the noise impacts on Block 20 are due to the road traffic from Long Ping Road, and the exceedance is up to 3dB(A). It is found that both barriers and structural fins of up to 2.1m are ineffective to mitigate the impacts to within the noise criterion. Thus, acoustic windows are proposed.

As a result of the above, the extent of mitigation measures required for the proposed residential blocks in PH site is likely to be larger for Option 1 than Option 2.

Planned Schools at PH site

There are three schools for Option 1 - two at the northern portion of the site (School 1 and School 2) and one at the southern portion of site (School 3); and four schools for Option 2 – two at the northern portion of the site (School 1 and School 2) and two at the southern portion of site (School 3 and School 4).

For both options, School 1 and School 2 at the northern portion of the site could comply with the respective noise criterion and hence no mitigation measures are required. At the southern portion of site, noise exceedances are predicted at School 3 (at south facade for Option 1 and Option 2) and School 4 (at all facades for Option 2). The assessment has already assumed provision of a 3m high boundary wall. Since further setback from Long Ping Road is not feasible, it is considered that the potential noise impacts shall be mitigated through the

provision of appropriate acoustic insulation in form of upgraded windows and air conditioning in accordance with HKPSG.

As a result of the above, the extent of mitigation measures required for the proposed schools in PH site is likely to be larger for Option 2 than Option 1.

Planned Integrated Social Welfare Building (ISWB) at PH site

For both options, the ISWB is planned at the southern end of the PH site. Given sufficient separation of about 75m from Long Ping Road has been provided, the ISWB could achieve a full compliance of the noise criterion.

Existing NSRs in vicinity of the Project Site

Other than the planned NSRs on PH site, the noise impacts due to the associated traffic induced by the Project on the existing NSRs in vicinity of Fuk Hi street and Long Ping Road has also been assessed. It is found from **Table 5.2.6** that except Tai Tseng Wai, all the selected existing NSRs (including Fuk Fai Garden & Meon Court, Yuk Ping House, TWGH. Lo Kon Ting Memorial College, Fung Chi Tsuen and Pak Fa Tsuen) would exceed the respective noise criteria. Even for the without Project scenario, a noise exceedance of 4-7 dB(A) is predicted. With the Project in place, the noise contribution for both options, i.e. "With Project" scenario – "Without Project" scenario would be greater than 1 dB(A) at all NSRs except N1 Tai Tseng Wai and N24 Pak Fa Tsuen, whereas the impacts for Option 2 is in general slightly higher than Option 1. This implies that the traffic noise impacts due to the Project are significant for both options. Hence, at source mitigation measures such as noise barrier, enclosure and low noise surfacing would be required to protect these existing receivers. Considering substantial roadside barriers or enclosures might be required which would be visually undesirable, use of low noise surfacing is considered as more practicable solution. However, such mitigation measures shall be subject to agreement with Highway Department. The practicability and effectiveness of the at-source mitigation measures, as well as its secondary impacts on air quality and visual impact will need to be further investigated in the detailed assessment in next stage of study. Notwithstanding this, if roadside barriers or enclosures are considered, it is anticipated that the extent of these structures required to protect the existing NSRs is likely larger for Option 2 than that of Option 1.

5.2.2.2 Railway Noise

The predicted railway noise levels at the representative NSRs for the two PH options are presented in **Table 5.2.7**. Since the daytime and nighttime peak headways are the same, the predicted railway noise levels are also the same for both periods. Details are provided in **Appendix 5.2.6**.

Table 5.2.7 Predicted railway noise impacts for different PH options

NSR	Location of NSR	NAP	Uses[1]	Criterion, $L_{eq\ 30\ min}$ dB(A)[2]	Max Predicted Noise Levels, $L_{eq\ 30\ min}$ dB(A)			
					Option 1 [3]	Exceedance [3.4]	Option 2 [3]	Exceedance [3.4]
N27	Block 19	R1119B	R	65/55	43	(0 / 0)	44	(0 / 0)
		R1119C	R	65/55	47	(0 / 0)	47	(0 / 0)
	Block 20	R1120B	R	65/55	50	(0 / 0)	N/A	N/A

NSR	Location of NSR	NAP	Uses[1]	Criterion, $L_{eq\ 30\ min}$ dB(A)[2]	Max Predicted Noise Levels, $L_{eq\ 30\ min}$ dB(A)			
					Option 1 [3]	Exceedance [3,4]	Option 2 [3]	Exceedance [3,4]
		R1120H	R	65/55	32	(0 / 0)	N/A	N/A
		R1122A	R	65/55	N/A	N/A	53	(0 / 0)
		R1122B	R	65/55	N/A	N/A	53	(0 / 0)
	Block 21	R1121B	R	65/55	49	(0 / 0)	N/A	N/A
		R1121C	R	65/55	33	(0 / 0)	N/A	N/A
		R1123A	R	65/55	N/A	N/A	44	(0 / 0)
		R1123B	R	65/55	N/A	N/A	50	(0 / 0)
	Block 22	R1122A	R	65/55	53	(0 / 0)	N/A	(0 / 0)
		R1122B	R	65/55	53	(0 / 0)	N/A	(0 / 0)
		R1124A	R	65/55	N/A	N/A	43	(0 / 0)
		R1124B	R	65/55	N/A	N/A	51	(0 / 0)
	Block 23	R1123A	R	65/55	44	(0 / 0)	N/A	N/A
		R1123B	R	65/55	50	(0 / 0)	N/A	N/A
	Block 24	R1124A	R	65/55	43	(0 / 0)	N/A	N/A
		R1124B	R	65/55	51	(0 / 0)	N/A	N/A
	School 3	R1201B	E[5]	65/ N/A	54	(0 / 0)	54	(0 / 0)
	School 4	R1204B	E[5]	65/ N/A	N/A	N/A	53	(0 / 0)
	ISWB [6]	R1301A	G[6]	65/55	64	(0 / **9**)	64	(0 / **9**)
		R1301B	G[6]	65/55	66	(0 / **11**)	66	(0 / **11**)
		R1301C	G[6]	65/55	61	(0 / **6**)	61	(0 / **6**)
		R1301D	G[6]	65/55	60	(0 / **5**)	60	(0 / **5**)
		R1301E	G[6]	65/55	59	(0 / **4**)	59	(0 / **4**)
		R1301F	G[6]	65/55	57	(0 / **2**)	57	(0 / **2**)
		R1301G	G[6]	65/55	57	(0 / **2**)	57	(0 / **2**)
		R1301H	G[6]	65/55	57	(0 / **2**)	57	(0 / **2**)
		R1301I	G[6]	65/55	55	(0 / 0)	55	(0 / 0)
		R1301J	G[6]	65/55	55	(0 / 0)	55	(0 / 0)
		R1301K	G[6]	65/55	54	(0 / 0)	54	(0 / 0)
		R1301L	G[6]	65/55	54	(0 / 0)	54	(0 / 0)
		R1301M	G[6]	65/55	54	(0 / 0)	54	(0 / 0)
		R1301N	G[6]	65/55	54	(0 / 0)	54	(0 / 0)
		R1301O	G[6]	65/55	54	(0 / 0)	54	(0 / 0)
		R1301P	G[6]	65/55	53	(0 / 0)	53	(0 / 0)
		R1301Q	G[6]	65/55	49	(0 / 0)	49	(0 / 0)
		R1301R	G[6]	65/55	58	(0 / **3**)	58	(0 / **3**)
		R1301S	G[6]	65/55	59	(0 / **4**)	59	(0 / **4**)
		R1301T	G[6]	65/55	60	(0 / **5**)	60	(0 / **5**)
		R1301U	G[6]	65/55	61	(0 / **6**)	61	(0 / **6**)

Notes:

[1] R – Residential Premises, E – Educational Institutions, G – Government use

[2] The noise criteria are presented for [daytime and evening time criterion / night-time criterion].

[3] N/A – Not applicable for the options

[4] The number of exceedance is presented for [daytime and evening / night-time] period. Bold value denotes non-compliance with TM-EIAO's criteria.

[5] No school activities during nighttime period, only daytime criterion has been assessed.
[6] There is no internal layout plan for ISWB at planning stage. Both daytime and nighttime noise criteria have been assessed to determine if there are any constraints on types of uses that need to be incorporated into the future floor plan.

Similar to traffic noise, opportunities have been given to pre-empt any adverse environmental impacts by means of urban planning and design during process of building layout development. In view of the potential adverse rail noise impacts, SAB design has been adopted (Block 21, 23 and 24 for Option 1 and Block 21 and 22 for Option 2) on the southern portion of the PH site as far as practicable. It can be seen from the above table that all residential blocks and schools could comply the respective noise criteria, and hence no mitigation measures are required. The predicted noise levels at all NAPs of the ISWB would comply with the daytime noise criterion and only some of these facades close to the WR viaduct (i.e. R1301A to R1301H and R1301R to R1301U as shown in **Figure 5.2.3** and **Figure 5.2.4**) would expose to a noise level in excess of the nighttime noise criterion.

The ISWB is planned for various facilities with different kinds of uses, some for daytime activities only and some for hostel and residential home uses. As potential adverse railway noise impacts are predicted at some facades of ISWB during night-time period, some constraints on the internal floor layout plan would need to be imposed (as shown in **Figures 5.2.9** and **5.2.10** for Option 1 and Option 2 respectively).

As shown in **Appendix 5.2.6**, assessment points R1301I to R1301Q would comply with both the daytime and nighttime criteria. All floors of assessment point R1301A - R1301E and R1301R - R1301U would exceed the nighttime noise criterion. For assessment points R1301F to R1301H, some of the floors could not meet the nighttime criterion. It is therefore recommended that on the south wing of the ISWB (i.e. R1301A to R1301H and R1301R to R1301U), it would generally be restricted to facilities/uses with daytime activities only, i.e. Day Care Centre for the Elderly, Special Child Care Centre, Early Education and Training Centre, Integrated Vocational and Rehabilitation Services Centre and Day Activity Centre. On the north wing of the ISWB (i.e. R1301I to R1301Q) where both daytime and nighttime criteria could be met, there would have no restriction on the uses and all types of facilities including hostels and residential care home could be planned.

In addition, the measured train noise source term is SEL 76.1 dB(A) and L_{max} 77.2 dB(A) at a distance of 25m with reference speed of 130 km/h. As the minimum separation distance between nearest NSRs (i.e. ISWB) and WR is about 25m, the TM-EIAO criterion of L_{max} 85 dB(A) could also be complied.

5.2.2.3 Industrial Noise

The existing industrial noise sources in YLIE are considered to be the major sources to the proposed residential development in the PH site. The planned sources in the industrial lots of YLIEE would also contribute some noise impacts to the PH site. The schools on the southern part within the PH site would be screened from these industrial noise sources by the residential blocks and hence are not considered in this industrial noise assessment. Apart from the existing

industrial noise sources in YLIE and the future industrial noise sources in YLIEE, the following existing noise sources are also included in this option assessment.

- Tung Tau Industrial Area; and
- Rural industrial activities in the vicinity to the east of the PH site

Tung Tau Industrial area is located at some 500m to the southeast of the PH site. The existing high rise residential buildings in Long Ping Estate and the low rise village houses in Yeung Uk Tsuen are closer to Tung Tau Industrial area than the planned residential NSRs in the PH site. These existing NSRs either provide a degree of screening and/or an additional buffer zone to the noise sources in Tung Tau Industrial area.

For both options for PH site, the design has proactively incorporated the following features to minimise the impacts due to industrial noise sources at the outset.

- A separation distance of 170-270 m between the first layer residential blocks (i.e. Blocks 1, 3, 4, 5, 6 & 7) to the existing industrial noise sources in YLIE.
- A separation distance of 65-80 m between the first layer residential blocks (i.e. Blocks 1, 3, 4, 5, 6 & 7) to the future industrial noise sources in YLIEE.
- A separation distance of about 50 m between the residential blocks (i.e. Blocks 7) to the existing rural industrial noise sources to the east of the PH site.

For the existing industrial noise sources within YLIE, the representative worst affected NSRs of the two PH options would include Blocks 1, 3, 5, 7 on the northern portion of the PH site overlooking YLIE and YLIEE. For conservative assessment, the YLIEE Option B is assumed as the planned industrial lots 1 - 4 are at a closer distance to PH site. Despite the two options have different plot ratios and different number of building storeys, the development layouts of the residential blocks on the northern portion are the same. It is therefore considered that the two options for PH site would perform equally in terms of industrial noise impacts.

It is anticipated that premises in YLIEE would generally have two main types of industrial noise sources, similar to the existing operation in YLIE. The first type would be the chiller units or processing plant which are typically installed on the roof top. The second main type of noise source would be the loading / unloading activities which would need to be conducted at ground level. Based on the measurements conducted at existing YLIE during the baseline review study, it is considered appropriate to adopt a notional SWL of 115 and 112 dB(A) for the chiller units or process plant on the roof of the industrial lots at daytime/evening and nighttime respectively. Similarly, for the loading / unloading activities at ground level, a SWL of 97dB(A) per each of the industrial lot is considered appropriate.

The current assessment has assumed 50% of the future companies in YLIEE (i.e. 8 industrial lots) would have night-time operation, i.e. same as existing YLIE. For conservative assessment of the impacts on the PH site, it is assumed that the nearest 8 industrial lots to the residential blocks would be operating during night-time. Besides, based on site observation at existing companies in YLIE, occasional loading/unloading activities were usually found during day time and would take less than 15 mins. Hence the assessment has assumed the operating time of 15 mins for loading/unloading activities. It has also assumed the

loading/unloading activities will be taken at all lots simultaneously which is considered to be very conservative. However, in order to avoid potential noise impacts on NSRs, it is recommended that all loading/unloading activities within YLIEE should be taken during daytime and evening time only, and they should be carried out at a designated location where could be screened by the industrial building itself. These assumptions are derived based on site observations within the existing YLIE, and hence are considered to provide good estimates for the purpose of this TR-2 Report. **Appendix 5.2.7** shows the locations for all these assumed noise sources in YLIEE adopted for the assessment for PH site.

The predicted noise impacts on the NAPs have been assessed based on the SWLs established for various existing sources. The predicted cumulative noise impacts on representative NAPs are summarized in **Table 5.2.8** below and the detailed calculations are given in **Appendix 5.2.7**.

Table 5.2.8: Predicted industrial noise impacts on PH Site

NSR and NAP	Uses [1]	ASR[3]	Period	Criteria, $L_{Aeq, 30 min.}$, dB(A)	Noise Levels from different sources, $L_{Aeq, 30 min}$		Compliance (Y/N)
					Existing noise sources[4]	Cumulative (i.e. Existing + planned noise sources) [4]	
Block 1 [R101A]	R	C[2]	Day	63	55	58	Y
			Evening	62	55	58	Y
			Night	55	50-51	51	Y
Block 3 [R103A]	R	C[2]	Day	63	56	58	Y
			Evening	62	56	58	Y
			Night	55	51-52	52	Y
Block 5 [R105A]	R	C[2]	Day	63	57	59	Y
			Evening	62	57	59	Y
			Night	55	52	52	Y
Block 7 [R107A]	R	C[2]	Day	63	58-59	60	Y
			Evening	62	58-59	60	Y
			Night	55	52	52	Y
Block 14 [R114B]	R	B[2]	Day	60	49	49	Y
			Evening	60	49	49	Y
			Night	50	44	44	Y
Block 18 [R118A]	R	B[2]	Day	60	44-46	44-46	Y
			Evening	60	44-46	44-46	Y
			Night	50	43-44	43-44	Y

Notes:

[1] R – Residential Premises, E – Educational Institutions

[2] In accordance with TM-Places, NSR will be assigned an Area Sensitivity Rating of "C" if it is within 100m of YLIE/YLIEE zone, or an Area Sensitivity Rating of "B" if it is between 100 m and 250 m from such a zone.

[3] ASR – Area Sensitivity Rating. Since the planned PH Site are not considered as Type (i) Rural area, including country parks or village type developments, Type (ii) Low density residential area consisting of low-rise or isolated high-rise developments or Type (iii) Urban area, Type (iv) Area other than those above is considered as appropriate type of area containing NSRs.

[4] Existing noise sources include the identified noise sources in YLIE, scattered workshops in the neighbourhood and Tung Tau Industrial Area. Noise from planned new sources in YLIEE would need to be controlled with maximum allowable SWLs to ensure overall noise compliance.

It can be seen from the above table that the existing industrial noise sources mainly contributed from YLIE would cause noise impacts of 44-59 dB(A) during daytime and evening periods, and 43-52 dB(A) during night-time period on the PH site. This implies that noise impacts from the planned sources within YLIEE would need to be properly controlled at-sources in order to ensure the cumulative noise impacts on PH site would comply with the noise criteria.

It is predicted that the dominant noise sources for the residential blocks on PH site would be the chillers / processing plant on the roof of the industrial lots. Calculations indicate that these noise sources shall be implemented with at-source noise control measures including acoustic enclosure and silencers in order to meet the noise criteria at the NSRs. It is also advisable to implement some good practice to reduce the noise impacts from industrial sources.

A summary of potential noise mitigation measures required at the industrial lots within YLIEE to protect the PH site is given below.

- No loading and unloading activities are allowed in during night-time period;
- Loading and unloading activities at any other time shall be carried out at designated location where should be blocked by the industrial building itself, or designed with a top cover to provide noise screening where necessary;
- The noise sources such as chillers / processing plant on the roof of the nearest industrial lots (i.e. lot 1-4) should be positioned away from the planned NSRs of PH site as far as possible;
- All new sources such as chillers / processing plant on the roof of all industrial lots in YLIEE could be provided with appropriate at-source noise control measures, including acoustic enclosure, silencer, low noise equipment design etc to achieve a noise reduction requirement of 30 dB(A).

With appropriate mitigation measures on YLIEE described above, results indicate that noise compliance on PH site would be achieved for both options as shown in **Table 5.2.8**. It is considered that the above mitigation measures could be readily controlled by implementing appropriate lease conditions or administrative control to limit the noise emission from YLIEE.

Overall, based on the preliminary assessment, the current separation distance of 170 m to the existing industrial noise sources in YLIE and 65m to the planned industrial noise sources in YLIEE would be required to control the cumulative noise impacts for the two PH options to within the relevant noise criteria. For both options, noise emission from YLIEE would need to be controlled by means of good practice and appropriate at-source noise control measures. It is therefore considered that Option 1 and Option 2 perform equally in meeting the requirements with regard to fixed noise impacts.

In summary, a comparison of the PH options in relation to road traffic noise, railway noise and fixed noise is provided in **Table 5.2.9** below. Despite Option 2 would require larger extent of mitigation measures to mitigate the road traffic noise impacts as compared to Option 1, both options are considered feasible from environmental noise point of view.

Table 5.2.9: Comparison of noise impacts for PH Options

Evaluation Criteria	Option 1	Option 2
Road traffic noise		
Compliance with road traffic noise criteria	• Compliance with the road traffic noise criteria could be achieved given appropriate mitigation measures are provided.	• Same as Option 1.
Extent of on-site mitigation measures required	• In order to comply with the noise criteria for the proposed residential blocks in PH site, mitigation measures including structural fin, barrier above retail roof, acoustic window are required. The layout in Option 1 differs from Option 2 in that there are two more residential towers located in the southern tip of the PH site while in Option 2, they are replaced with an additional school (School 4). This would bring about more traffic on the southern access road for Option 1. Extent of mitigation measures required for residential blocks for Option 1 is likely to be larger than Option 2, but both options are considered feasible. • School 3 (at south facade for Option 1) shall be provided with appropriate acoustic insulation in form of upgraded windows and air conditioning in accordance with HKPSG.	• Similar mitigation measures including structural fin, barrier above retail roof, acoustic window are required. • School 3 (at east facades) and School 4 (at all facades) shall be provided with appropriate acoustic insulation in form of upgraded windows and air conditioning in accordance with HKPSG. Extent of mitigation measures required for the proposed schools in PH site is likely to be larger for Option 2 than Option 1, but both options are considered feasible.
Extent of off-site mitigation measures on existing roads required	• At source mitigation measures such as noise barrier, enclosure and low noise surfacing would be required to protect the existing receivers.	• At source mitigation measures such as noise barrier, enclosure and low noise surfacing would be required to protect the existing receivers. • Extent of these structures required is likely larger for Option 2 than Option 1, but both options are considered feasible.
Rail noise		
Compliance with rail noise criteria	• Compliance with the rail noise criteria could be achieved given appropriate mitigation measures are provided.	• Same as Option 1.
Extent of on-site mitigation measures required	• No on-site mitigation measures are required for residential blocks and schools. • Some constraints on the internal floor layout plan of ISWB would need to be imposed in order to meet the night time criterion. On the south wing of the ISWB, it would generally be restricted to facilities/uses with daytime activities only while on the north wing of the	• Same as Option 1.

Evaluation Criteria	Option 1	Option 2
	ISWB, there would have no restriction on the uses.	
Extent of off-site mitigation measures on existing WR viaduct required	• No off-site mitigation measures are required.	• Same as Option 1.
Fixed noise		
Provision of sufficient separation distance from existing and planned fixed noise sources to ensure compliance with the noise criteria	• With assumption that the noise emission from YLIEE would be properly controlled, the current separation distance to the existing industrial noise sources in YLIE and planned sources in YLIEE would be required to control the fixed noise impacts in order to comply with the relevant noise criteria.	• Same as Option 1.
Extent of building mitigation measures required	• With assumption that the noise emission from YLIEE would be properly controlled, no mitigation measures on the residential buildings on PH site are required.	• Same as Option 1.
Extent of at-source noise control measures required e.g. enclosure, barrier/cover, silencer etc	• Noise emission from YLIEE needs to be controlled by means of good practice and appropriate at-source noise control measures including no loading and unloading activities during night-time period, loading and unloading only at designated location where should be blocked by the industrial building itself, or designed with a top cover where necessary, locating the noise sources such as chillers / processing plant on the roof of the nearest industrial lots (i.e. lot 1-4) away from PH site as far as possible, use of acoustic enclosure, silencer, low noise equipment design etc for all sources such as chillers / processing plant on the roof of all industrial lots in YLIEE to achieve a noise reduction of 30 dB(A).	• Same as Option 1.
Recommendation	**Preferred**	-

5.2.3 Evaluation of YLIEE site

5.2.3.1 Road Traffic Noise

The two options for the YLIEE site differ slightly in terms of the area at the western boundary of the site (exclusion of the slope area in Option B), the

platform level across the YLIEE site, and the sizes of industrial lots. The maximum GFA and the number of workers to be accommodated for both options are only different from each other slightly (301,500 m^2 GFA and 4,020 workers for Option A and 288,800m^2 GFA and 3,851 workers for Option B). In terms of the amount of traffic generated and attracted by the YLIEE, the difference is also very insignificant (referred to **S4.1.2**). Thus the difference on the road traffic impacts on existing and planned NSRs due to the difference in the two YLIEE options would not be anticipated.

5.2.3.2 Railway Noise

The railway noise impact has no relation with the YLIEE options.

5.2.3.3 Industrial Noise

The potential industrial noise impacts due to the YLIEE on the PH site have been assessed based on the conservative YLIEE Option B in **Section 5.2.2.3** above. It is found that it could comply with the respective noise criteria by use of appropriate noise mitigation controls.

Other than the planned NSRs within the PH site, there are some existing village houses (i.e. Lux Court and village house 51A) in Shing Uk Tsuen village, which would be closer to the planned industrial lots 8, 9 and 10 in the northern part of YLIEE. Unlike the planned NSRs in Blocks 1 to 7 of PH site, these village houses have a comparatively lower prevailing noise levels and hence more stringent noise criteria should be applied. However, the village houses are only up to 3 storeys high. Since the planned industrial buildings in YLIEE are 8 storeys high, the chillers / processing plant on the roof of the industrial lots would be screened by the building itself. Other industrial lots further away would contribute significantly less on the noise impacts due to the larger separation distance and more substantial screening effects by other building lots.

Despite the two YLIEE options have different lot sizes, the development layouts on the northern portion of the site would be similar with similar distances to the existing worst affected NSRs in Shing Uk Tsuen. It is therefore considered that the two YLIEE options do not make any significant difference in relation to fixed noise impacts.

As described in previous section, it is anticipated that premises in YLIEE would generally have two main types of industrial noise sources: chiller units or processing plants on the roof top and loading / unloading activities at ground level. Similar to PH site, the assessment has also assumed 50% of the future companies in YLIEE (i.e. 8 industrial lots) would have night-time operation, i.e. same as existing YLIE. For conservative assessment of the impacts due to YLIEE, it is assumed that the nearest 8 industrial lots to the existing NSRs would be operating during night-time. In order to avoid potential noise impacts on the NSRs, it is recommended that all loading/unloading activities within YLIEE should be taken during daytime and evening time only, and they should be carried out at a designated location where could be screened by the industrial building itself. **Appendix 5.2.7** shows the locations for all these assumed noise sources in YLIEE adopted for the assessment.

The predicted noise impacts on the existing NSRs have been assessed based on the SWLs established for various existing sources. The predicted cumulative noise impacts on representative NAPs are summarized in **Table 5.2.10** below and the detailed calculations are given in **Appendix 5.2.7**.

Table 5.2.10: Fixed noise impacts for the worst affected existing NSRs for different YLIEE options

NSR and NAP	Uses [1]	ASR[3]	Period	Criteria, $L_{Aeq, 30 min}$, dB(A)	Noise Levels from different sources, $L_{Aeq, 30 min}$		Compliance (Y/N)
					Existing noise sources[4]	Existing + planned noise sources [4]	
Lux Court [R004A]	R	C[2]	Day	54	47	47	Y
			Evening	47	47	47	Y
			Night	46	45	45	Y
Village House 51A [R021A]	R	C[2]	Day	48	45	45	Y
			Evening	45	45	45	Y
			Night	44	43	43	Y

Notes:
Notes:
[1] R – Residential Premises, 3-storeys
[2] In accordance with TM-Places, NSR will be assigned an Area Sensitivity Rating of "C" if it is within 100m of YLIE/YLIEE, or an Area Sensitivity Rating of "B" if it is between 100 m and 250 m from such a zone.
[3] ASR – Area Sensitivity Rating. Since the planned PH Site are not considered as Type (i) Rural area, including country parks or village type developments, Type (ii) Low density residential area consisting of low-rise or isolated high-rise developments or Type (iii) Urban area, Type (iv) Area other than those above is considered as appropriate type of area containing NSRs.
[4] Existing noise sources include the identified noise sources in YLIE, scattered workshops in the neighbourhood and Tung Tau Industrial Area. Noise from planned new sources in YLIEE would need to be controlled with maximum allowable SWLs to ensure overall noise compliance.

Based on the current preliminary assessment, the worst affected NSR is predicted to be at village house 51A (NAP R021) during night time period. It can be seen from the above table that the existing industrial noise sources mainly contributed from YLIE would cause noise impacts of 45 dB(A) during daytime and evening periods, and 43 dB(A) during night-time period at village house 51A. This implies that noise impacts from the planned sources within YLIEE would need to be properly controlled at-sources in order to ensure the cumulative noise impacts would comply with the noise criteria for both YLIEE options.

Calculations indicate that new chillers / processing plant on the roof of all industrial lots in YLIEE shall be implemented with at-source noise control measures including acoustic enclosure and silencers in order to meet the noise criteria at the NSRs. It is also advisable to implement some good practice to reduce the noise impacts from industrial sources.

A summary of potential noise mitigation measures required at the industrial lots within YLIEE to protect the existing receivers is given below.

- No loading and unloading activities are allowed during night-time period;
- Loading and unloading activities at any other time shall be carried out at designated location where should be blocked by the industrial building itself, or designed with a top cover to provide noise screening where necessary;

- The noise sources such as chillers / processing plant on the roof of the nearest industrial lots (i.e. lot 8 and 9) should be positioned away from the NSRs to the north of YLIEE site as far as possible;
- All new sources such as chillers / processing plant on the roof of all industrial lots in YLIEE should be provided with appropriate at-source noise control measures, including acoustic enclosure, silencer, low noise equipment design etc to achieve a noise reduction requirement of 30 dB(A).

With appropriate mitigation measures on YLIEE described above, results indicate that noise compliance on existing receivers would be achieved for both YLIEE options as shown in **Table 5.2.10**. It is considered that the above mitigation measures could be readily controlled by implementing appropriate lease conditions or administrative control to limit the noise emission from YLIEE.

For both YLIEE options, noise emission from planned industrial lots would need to be controlled by means of at-source noise mitigations of the same extent. It is therefore considered that Option A and Option B perform equally in meeting the requirements with regard to fixed noise impacts.

In summary, a comparison of the YLIEE options in relation to road traffic noise, railway noise and fixed noise is provided in **Table 5.2.11** below.

Table 5.2.11: Comparison of noise impacts for different YLIEE Options

Evaluation Criteria	Option A	Option B
Road traffic noise		
Compliance with road traffic noise criteria	• Difference in amount of traffic generated and attracted by the YLIEE options is very insignificant and hence the difference on the road traffic impacts on existing and planned NSRs. • Compliance shall be referred to "Evaluation of PH site".	• Same as Option B.
Extent of on-site mitigation measures required	• Extent of on-site mitigation measures required shall be referred to "Evaluation of PH site".	• Same as Option B.
Extent of off-site mitigation measures on existing roads required	• Extent of off-site mitigation measures required shall be referred to "Evaluation of PH site".	• Same as Option B.
Rail noise		
Compliance with rail noise criteria	• No relation with the YLIEE options.	• No relation with the YLIEE options.
Extent of on-site mitigation measures required	• No relation with the YLIEE options.	• No relation with the YLIEE options.
Extent of off-site mitigation measures on existing WR viaduct required	• No relation with the YLIEE options.	• No relation with the YLIEE options.
Fixed noise		

Evaluation Criteria	Option A	Option B
Provision of sufficient separation distance from existing and planned fixed noise sources to ensure compliance with the noise criteria	• With the current distance between YLIEE and existing receiver and assumption that the noise emission from YLIEE would be properly controlled, the relevant noise criteria could be met.	• Same as Option B.
Extent of building mitigation measures required	• With assumption that the noise emission from YLIEE would be properly controlled, no mitigation measures on existing NSRs are required.	• Same as Option B.
Extent of at-source noise control measures required e.g. enclosure, barrier/cover, silencer etc	• Noise emission from YLIEE needs to be controlled by means of good practice and appropriate at-source noise control measures including no loading and unloading activities during night-time period, loading and unloading only at designated location where should be blocked by the industrial building itself, or designed with a top cover where necessary, locating the noise sources such as chillers / processing plant on the roof of the nearest industrial lots (i.e. lot 8-9) away from PH site as far as possible, use of acoustic enclosure, silencer, low noise equipment design etc for all sources such as chillers / processing plant on the roof of all industrial lots in YLIEE to achieve a noise reduction of 30 dB(A).	• Same as Option B.
Recommendation	No preference	No preference

5.3 Ecology

A desktop baseline ecological study for the Project site, the Study Area and its vicinity has been conducted in the TR-1 Baseline Review Report. In addition, a 9-month ecological survey is being conducted and up to the time of preparing this report, five months ecological surveys on faunal groups (on mammals and birds from December 2012 through February 2013 and on all faunal groups from March to April 2013) and some habitat and floral surveys within the Study Area had been completed. A preliminary habitat map of the Study Area has been prepared based on the findings of these surveys and is shown in **Figure 5.3.1**. The following summarises the key findings based on the desktop study and ecological surveys of the Project Site and Study Area and its vicinity:

- The PH site was dominated by developed area. Agricultural land was found mainly in the northern part of the PH site and also scattered over the site. Wasteland was found in the northern part of the site and secondary woodland was identified mainly at the western fringe of the site. Orchards were found at the northern and southern parts of the site. Along the Long Ping Road, plantation was also found. There are few watercourses running through the site.
- The YLIEE site was mainly dominated by developed area, with the northern portion dominated by agricultural land and seasonally wet grassland. Secondary woodland and plantation were identified at the western fringe of the site boundary. There is a watercourse at the northern end of the site and a channelized watercourse at the western edge of the site boundary.
- Outside the Project site, the eastern part of the Study Area was mainly occupied by developed areas, whereas the western part was dominated by the grassland, orchard and secondary woodlands. Some wetland habitats (such as fishponds and marsh) were found at the northern and northwestern part of the Study Area. Secondary woodland was also found near Ng Uk Tsuen.
- The rare plant species *Sphenoclea zeylanica* was recorded in wet agricultural land in the northwestern part of the Study Area by CH2M Hill (2008)[7].
- A clump (about ten individuals) of young trees *Aquilaria sinensis* was found in the secondary woodland within the YLIEE site during the botanical survey conducted in May 2013 (**Figures 5.3.1 and 5.3.2**). This species is listed as Near Threatened (NT) and is under State protection (Category II) in China[8] and is classified as Vulnerable on the IUCN Red List of Threatened Species[9]. The wild population of this species is protected by the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) in Hong Kong. Seedlings and trees *Aquilaria sinensis* were also found in the secondary woodland and orchard within the Study Area, mainly located to the northeast of the Wing Ning Tsuen (**Figures 5.3.1 and 5.3.2**). A total of about 90 seedlings and about ten young trees were found within the Study Area.
- One group of shrub species *Rhododendron simsii* was recorded in the secondary woodland within the Study Area and to the west of Wang Chau Village during the botanical survey conducted in May 2013 (**Figures 5.3.1 and 5.3.2**). The wild population of all *Rhododendron* spp. (including this *R. simsii*) are protected by the Forests and Countryside Ordinance (Cap. 96) in Hong Kong. However, it is a common to very common shrub species found in shrubland on hillsides and along stream habitats[10].
- Three individuals of the small tree *Camellia oleifera* were recorded in the secondary woodland within the Study Area and to the west of Wang Chau Village during the botanical survey conducted in May 2013 (**Figures 5.3.1**

[7] CH2M HILL Hong Kong Limited, 2008. Environmental Impact Assessment of Proposed Development at Fung Lok Wai, Yuen Long Lot 1457 R.P. in D.D. 123.
[8] AFCD, Agriculture, Fisheries and Conservation Department, 2003.Hong Kong Herbarium. Available at http://www.hkherbarium.net/Herbarium/frame.html.
[9] IUCN (2013). The IUCN Red List of Threatened Species. Available at http://www.iucnredlist.org/. Accessed in May 2013.
[10] AFCD. Agriculture, Fisheries and Conservation Department, 2007. Flora of Hong Kong. Volume 1. Agriculture, Fisheries and Conservation Department. Hong Kong.

and 5.3.2). This species is protected by the Forests and Countryside Ordinance, Cap. 96 in Hong Kong and considered as "restricted"[11].

- A total of 13 bird species recorded in the Study Area during December 2012 to April 2013 were considered to be of conservation concern by Fellowes *et al.* (2002)[12]. Results of the bird surveys conducted during December 2012 to April 2013 are provided in **Table 2** of **Appendix 5.3.1** (see also **Figure 5.3.2**). Two of these bird species (Little Egret *Egretta garzetta* of Potential Regional Concern and Collared Crow *Corvus torquatus* of Local Concern) were recorded within the YLIEE site boundary.
- Most of the non-bird fauna recorded during a site visit conducted in September 2012 and the five-month ecological surveys were not of conservation significance. Results of the surveys on mammal, reptile, amphibian, butterfly, dragonfly and stream fauna are provided in **Tables 3 – 5 and 7 – 8** of **Appendix 5.3.1**. The species recorded that are considered to be of conservation significance by Fellowes *et al.* (2002)[6] include: one reptile species Common Rat Snake *Ptyas mucosus*, which is of Potential Regional Concern; one fish species Small Snakehead *Channa asiatica,* which is of Local Concern; one dragonfly Scarlet Basker *Urothemis signata,* which is of Local Concern; and one aquatic invertebrate *Nanhaipotamon hongkongense*, which is of Potential Global Concern. The Common Rat Snake was recorded in a watercourse within the PH site, whereas *Nanhaipotamon hongkongense* was recorded within the small drainage channel in Wang Chau Village. The aquatic invertebrate *Nanhaipotamon hongkongense* is endemic to Hong Kong. Uncommon fish species Small Snakehead *Channa asiatica* and Scarlet Basker were found on the upper section of a stream to the west of the YLIEE site during a site visit conducted in September 2012.
- There are a number of sites of conservation interest or areas of ecological importance found in the Study Area including WCA, WBA, CA, grassland at Kai Shan and secondary woodland at the toe of Kai Shan. Over 100 species of butterflies were recorded at Kai Shan by Chan *et al.* (2012)[13], including 15 species of Local Concern as considered in Fellowes *et al.* (2002)[6] (see **Table 6** in **Appendix 5.3.1**). Location of these sites/areas range from immediately adjacent to the Project Site to approximately 500m from it.

In view of the above issues, it is considered appropriate to adopt the following criteria for evaluation of the options for the aspect of ecology.

[11] Xing, F.W., Ng, S.C., Chau, L.K.C. 2000. Gymnosperms and angiosperms of Hong Kong. Memoirs of the Hong Kong Natural History Society 23: 21-136.

[12] Fellowes, J. R., Lau, M. W. N., Dudgeon, D., Reels, G. T., Ades, G. W. J., Carey, G. J., Chan, B. P. L., Kendrick, R. C., Lee, K. S., Leven, M. R., Wilson, K. D. P. and Yu, Y. T. 2002. Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong. *Memoirs of the Hong Kong Natural History Society* 25:123-159.

[13] Chan, H.S.R., Chau, W.K., Cheng, W.K., Chow, S.M., Ho, S.C.J., Kan, S.C.J., Lau, W.H.S. and Ng, K.L.E. 2012. *Encyclopedia of Hong Kong Butterflies - Search for Butterflies.* Hong Kong Lepidopterists' Society Limited.

Table 5.3.1: Summary of evaluation principle and criterion

Evaluation Principle	Evaluation Criterion
Conservation of areas of ecological importance	Avoid/minimise impacts to the recognised sites of ecological concern (such as CA, WCA, WBA, Deep Bay area, Kai Shan etc.) with no significant residual impact.
	Preservation/enhancement of habitats of ecological importance (such as identified wetland habitats or secondary woodland with important ecological function, breeding/nursery grounds for species of conservation interest, potential areas which support species of conservation interest etc.) and/or avoid/minimise any significant residual impacts to these areas.

5.3.1 Evaluation of PH Site

It should be noted that the ecological field survey is still on-going and more ecological data will be collected to establish the ecological baseline profile and to confirm whether any species of conservation concern are present and determine species diversity. The ecological value of the habitats was evaluated in this preliminary study based on the available ecological data during the time of preparing this report.

Habitat and vegetation within the PH site boundary

The PH site covers mostly the developed area, and also includes agricultural land, secondary woodland, orchard, plantation, wasteland and minor watercourses (**Figure 5.3.1 and Table 5.3.2**). All existing habitats within the PH site boundary will be destructed for developments under both options, thus the potential ecological impacts due to the habitat loss are considered to be the same. The habitat loss under the two options is summarized in **Table 5.3.2**.

Table 5.3.2: Habitat loss for both PH Options 1 and 2

Habitats	Length (m)/ Area (ha)
Minor Watercourse	Approx.. 745m
Agricultural Land	0.85
Secondary Woodland	0.98
Orchard	1.74
Plantation	0.36
Wasteland	1.04
Developed Area	13.72
Total	**18.69**

A few watercourses were found within the PH site, they were located within the Wang Chau village, at the western side of the site and to the east of Wing Ning Tsuen. The lower section of the watercourse within the Wang Chau village was concrete-lined with natural bottom, whereas the other sections had natural bank and bottom. Due to its vicinity of the developed area, this stream was under some degree of pollution. The other two watercourses identified were the lower section of the watercourses originated from Kai Shan. The vegetation species found in this habitat were limited to the bank of the stream, including herb species of *Alocasia macrorrhizos*, fern species of *Cyclosorus parasiticus*, fruit tree species of *Musa* x *paradisiaca* and tree species of *Ficus variegata* var. *chlorocarpa*.

There were patches of agricultural land within the PH site boundary, mainly in the northern part of the site. The others are small in size and found in the southwestern part of the site. The agricultural lands identified were mainly active and utilized by dryland crops. However, the nature of this habitat is very dynamic and can change from time to time. The diversity of vegetation species recorded in this habitat is generally low as this habitat is under regular management (i.e. subject to high level of human disturbance). Species such as climber species of *Ipomoea batatas* and *Benincasa hispida*, fruit tree species of *Musa* x *paradisiaca* and herb species of *Saccharum officinarum* are commonly planted in this habitat.

Native secondary woodlands were found at the western fringe of the site boundary. These woodlands are located at the southeastern fringe of Kai Shan. These woodlands are contiguous with woodland outside the site but within the Study Area and aere not fragmented. They were found to be of a young age and consist of a semi-closed canopy dominated by tree species *Celtis sinensis, Litsea glutinosa* and *Macaranga tanarius* var. *tomentosa*. The understory is dominated by the shrub (*Psychotria asiatica*) and the small tree/ shrub (*Litsea rotundifolia* var. *oblongifolia*).

There was an orchard found within the site and located to the north of The Green Hills. There was no sign of active or regular management of the orchard and the fruit trees were planted in abnormally high density (with approximately 0.5 - 1m spacing). The vegetation recorded in this habitat is mostly fruit tree species including *Clausena lansium, Dimocarpus longan* and *Litchi chinensis*.

The plantations found within the PH site were the road-side plantation along the Long Ping Road. These road-side plantations function as screen planting. The diversity of the vegetation species recorded is limited as this plantation area is usually under high level of management. These plantations are dominated by exotic tree species of *Acacia confusa, Chukrasia tabularia, Lophostemon confertus* and *Melaleuca cajuputi* subsp. *cumingiana*.

Wasteland was found at the northern side of the site. These areas have arisen as a result of human disturbance and invasion of weedy vegetation species on abandoned land. The vegetation in this habitat is usually composed of the common and exotic species. The dominant species found in this habitat type include the exotic herb species *Bidens alba, Conyza sumatrensis* and *Pennisetum purpureum,* and the native herb species *Microstegium ciliatum*.

Developed areas occupy most of the PH site. The developed areas mainly consist of open storage and village areas (including a small number of trees and small farmland areas found near the village houses). Vegetation recorded in this habitat type is usually common and widespread species such as the climber species *Ipomoea cairica*, fruit tree species *Dimocarpus longan* and *Carica papaya*, and herb species *Panicum maximum*.

Mammal species recorded within the PH site boundary

One single mammal species, Japanese Pipistrelle *Pipistrellus abramus*, was recorded within the PH site boundary during December 2012 to April 2013. Two individuals of this species were observed flying over wasteland during the night surveys. This species is common and widespread in Hong Kong[14].

Bird species recorded within the PH site boundary

A total of 33 bird species were recorded during the surveys conducted from December 2012 to April 2013. None of the species recorded were of conservation significance as considered by Fellowes *et al.* (2002)[6].

Reptile species recorded within the PH site boundary

Three reptile species were recorded within the PH site during March to April 2013. One of these species, Common Rat Snake *Ptyas mucosus*, is of Potential Regional Concern[6]. It was recorded in a watercourse within the site (**Figures 5.3.1 and 5.3.2**). Common Rat Snake is common and widespread in Hong Kong[15].

Amphibian species recorded within the PH site boundary

All of the eight amphibian species recorded are common and widespread in Hong Kong[16]. All of them were recorded during the night-time surveys conducted from March to April 2013. One exotic species, Greenhouse Frog *Eleutherodactylus planirostris* was also recorded in the developed area within the site.

Butterfly species recorded within the PH site boundary

A total of nine butterfly species were recorded during March to April 2013 and two additional species were recorded during the site visit conducted in September 2012. All of these 11 species are common or very common in Hong Kong[17].

Dragonfly species recorded within the PH site boundary

Five dragonfly species were recorded during March to April 2013 and one additional species was recorded during the site visit conducted in September 2012. These six species are all considered to be common or abundant in Hong Kong by Tam *et al.* (2011)[18].

Stream fauna species recorded within the PH site boundary

The fish species, Mosquito Fish *Gambusia affinis*, was recorded during the surveys conducted from March to April 2013. One additional fish species, Chinese Barb *Puntius semifasciolatus*, was recorded during the site visit conducted in September 2012.

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[14] Shek, C.T. 2006. *A Field Guide to the Terrestrial Mammals of Hong Kong*. Cosmos Books Ltd., Hong Kong.
[15] Karsen, S.J., Lau M.W.N. and Bogadek, A. 1998. *Hong Kong Amphibians and Reptiles*. Urban Council, Hong Kong.
[16] Chan, S.K.F., Cheung K.S., Ho, C.Y., Lam, F.N., Tang, W.S., Lau, M.W.N., Bogadek, A. 2005. *A Field Guide to the Amphibians of Hong Kong*. Cosmos Books Ltd., Hong Kong.
[17] Chan, A., Cheung, J., Sze, P., Wong, A., Wong, E. and Yau, E. 2011. A Review of the Local Restrictedness of Hong Kong Butterflies. *Hong Kong Biodiversity* 21: 1-12
[18] Tam, T.W., Leung, K.K., Kwan, B.S.P., Wu, K.Y., Tang, S.S.H. So, I.W.Y, Cheng, J.C.Y., Yuen, E.F.M., Tsang, Y., Hui, W. 2011. *The Dragonflies of Hong Kong*. Cosmos Books Ltd., Hong Kong.

Aquatic invertebrate species recorded include the snail *Pomacea spp*. and the crab *Nanhaipotamon hongkongense*. The crab species is considered to be of Potential Global Concern by Fellowes *et al.* (2002)[5]. This species is endemic to Hong Kong. This crab species was found in a ditch around a piece of agricultural land within the PH site.

It is currently proposed that all of the existing watercourses within the PH site would be realigned and piped. The underground pipes would connect to the u-channel to be constructed along the western site boundary. There is no regular record of the species of conservation significance in the watercourses and these species were also recorded in low numbers. Based on current survey findings, the watercourses within the PH site do not appear to be an important habitat for the species of conservation significance. However, as the surveys are on-going, more data will be included in the final assessment. For this reason, and since some stream sections within the site boundary are natural and semi-natural, it would be premature to assume that no streams within the site boundary are of ecological significance. Should any streams be evaluated as being of ecological significance, mitigation measures, such as ecologically friendly channelization measures, should be considered.

Breeding/nursery ground of species of conservation significance within the PH site boundary

No breeding/nursery ground of species of conservation significance was identified within the PH site during the desktop study and the five-month ecological surveys.

Impacts on the sites of conservation significance from the PH development

Kai Shan, which is located immediately to the west of the Project Site, is known for its diversity of butterfly species recorded. As Kai Shan is the tallest hill in the area, it attracts the butterflies which show the behavioural phenomenon of 'hill-topping'. The proposed PH development is located at the fringe of the secondary woodland/orchard, and in the vicinity to the existing Long Ping Estate. No fragmentation of the suitable habitats for the hill-topping will result from the PH development. The nectar/larval food plants of the butterfly species of conservation interest recorded within the PH site are all common or very common (see **Table 5.3.3**). Accordingly, no significant impacts on the potential feeding/breeding/nursery ground for the butterfly species of conservation significance recorded in the Study Area are expected, taking into account the presence of nectar/larval food plants.

Table 5.3.3: Butterfly species of conservation significance recorded within the Study Area and the nectar/larval food plants of these butterfly species recorded within the PH site boundary.

Common Name	Conservation Status[19]	Sources[20]	Nectar Plant/ Larval Food Plant[21]	Record in PH Site
Common Awl *Hasora badra*	LC[1] VR[2]	Chan *et al.* 2012; Present Study	*Blumea riparia, Derris alborubra, Derris laxiflora, Derris trifoliata, Derris uliginosa, Deutzia pulchra, Millettia nitida, Millettia pachycarpa, Lantana camara*	*Lantana camara* (very common)
Tamil Grass Dart *Taractrocera ceramas*	LC[1] R[2]	Chan *et al.* 2012	*Bambusa* spp., *Buddleja asiatica, Buddleja davidii, Lantana camara,* Several coarse grasses,	*Lantana camara* (very common)
Pale Palm Dart *Telicota colon*	LC[1] R[2]	Present Study	*Buddleja asiatica, Buddleja davidii, Lantana camara, Miscanthus sinensis, Pennisetum purpureum, Pentas lanceolata, Perilla frutescens, Setaria palmifolia*	*Lantana camara* (very common); *Pennisetum purpureum* (very common)
Spotted Angle *Caprona alida*	LC[1] VR[2]	Chan *et al.* 2012	*Deutzia pulchra, Helicteres angustifolia, Helicteres isora, Mikania cordata*	-
Plain Hedge Blue *Celastrina lavendularis*	LC[1] VR[2]	Chan *et al.* 2012	*Acer albopurpurascens, Desmodium sequax, Hiptage benghalensis, Severinia buxifolia, Viburnum*	-

[19] a. Fellowes, J. R., Lau, M. W. N., Dudgeon, D., Reels, G. T., Ades, G. W. J., Carey, G. J., Chan, B. P. L., Kendrick, R. C., Lee, K. S., Leven, M. R., Wilson, K. D. P. and Yu, Y. T. 2002. Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong. Memoirs of the Hong Kong Natural History Society 25:123-159.
b. Chan, A., Cheung, J., Sze, P., Wong, A., Wong, E. and Yau, E. 2011. A Review of the Local Restrictedness of Hong Kong Butterflies. Hong Kong Biodiversity 21: 1-12.

[20] Chan, H.S.R., Chau, W.K., Cheng, W.K., Chow, S.M., Ho, S.C.J., Kan, S.C.J., Lau, W.H.S. and Ng, K.L.E. 2012. *Encyclopedia of Hong Kong Butterflies - Search for Butterflies.* Hong Kong Lepidopterists' Society Limited.

[21] a. 林柏昌、林有義。2008。蝴蝶食草圖鑑。晨星出版集團。
b. 林春吉。2008。台灣蝴蝶食草與蜜源植物大圖鑑。天下文化。
c. 林春吉。2004。彩蝶生態全紀錄:臺灣蝴蝶食草與蜜源。綠世界出版社。
d. 張保信。1997。台灣的蝴蝶世界。渡假出版社。
e. 詹肇泰，邱榮光。2004。蝶鳥舞動-鳳園-具特殊科學價值地點。萬里機構 萬里書店 大埔環保協進會。
f. Young, J. J., Yiu, V., Yau, S. M. 2007. A Photographic Monograph on Hong Kong Butterflies (Volume 4). Best Tri Printing Company Limited. 161pp.
g. Young, J. J., Yiu, V., Yau, S. M., Choi, K. P., Au, W. K., Sae Sha, W. C. 2007. A Photographic Monograph on Hong Kong Butterflies (Volume 2). Best Tri Printing Company Limited. 325pp.
h. Young, J. J., Yiu, V., Yau, S. M., Pun, S. F., Wai C. Y. Law, Y. S., Choi K. P. 2008. A Photographic Monograph on Hong Kong Butterflies (Volume 4). Best Tri Printing Company Limited. 437pp.
i. Young, J. J., Law Y. S., Choi, K. P., Pun, S. F., Yau, S. M., Chor, H. K., Lam, W. 2011. A Photographic Monograph on Hong Kong Butterflies (Volume 4). Best Tri Printing Company Limited. 555pp.

Common Name	Conservation Status[19]	Sources[20]	Nectar Plant/ Larval Food Plant[21]	Record in PH Site
			odoratissimum, Vitex negundo	
Peacock Royal *Tajuria cippus*	LC[1] R[2]	Chan *et al.* 2012	*Loranthus parasiticus, Macrosolen cochinchinensis, Scurrula parasitica, Taxillus chinensis*	-
Spotted Royal *Tajuria maculata*	LC[1] VR[2]	Chan *et al.* 2012	*Loranthus spp., Macrosolen cochinchinensis, Scurrula parasitica*	-
Yellow Rajah *Charaxes marmax*	LC[1] UC[2]	Chan *et al.* 2012	*Blumea riparia, Croton tiglium, Lantana camara, Mikania cordata, Ruellia squarrosa*	-
Orange Staff Sergeant *Athyma cama*	LC[1] VR[2]	Chan *et al.* 2012	*Glochidion acuminatum, Glochidion lanceolatum, Glochidion philippicum, Glochidion rubrum , Glochidion zeylanicum, Syzygium levinei, Zanthoxylum avicennae*	-
Common Yeoman *Cirrochroa tyche*	LC[1] VR[2]	Chan *et al.* 2012	*Buddleja asiatica, Buddleja davidii, Lantana camara, Rhus chinensis, Schefflera octophylla, Syzygium levinei, Vitex negundo, Zanthoxylum avicennae,*	*Lantana camara* (very common)
Danaid Egg-fly *Hypolimnas misippus*	LC[1] UC[2]	Chan *et al.* 2012	*Abutillon spp., Hibiscus spp., Lantana camara, Plantago asiatica, Plantago major, Portulaca oleracea*	*Lantana camara* (very common); *Hibiscus tiliaceus* (common)
Vagrant *Vagrans egista*	LC[1] VR[2]	Chan *et al.* 2012	*Bougainvillea brasiliensis, Buddleja asiatica, Buddleja davidii, Clerodendrum trichotomum, Homalium cochinchinensis, Pentas lanceolata, Gomphrena globosa, Stachytarheta jamaicensis, Xylosma longifolium*	-
Painted Lady *Vanessa cardui*	LC[1] R[2]	Chan *et al.* 2012	*Artemisia spp., Blumea spp., Buddleja asiatica, Buddleja davidii, Carduus spp., Debregeasia bicolor , Gnaphalium affine, Gomphrena globosa, Malva verticillata , Pentas lanceolata, Urtica spp., Zornia diphylla*	-
Small Three-ring *Ypthima norma*	LC[1] VR[2]	Chan *et al.* 2012	-	-
Red-spot	LC[1]	Chan *et al.* 2012	-	-

Common Name	Conservation Status[19]	Sources[20]	Nectar Plant/ Larval Food Plant[21]	Record in PH Site
Sawtooth *Prioneris philonome*	VR[2]			
Spotted Sawtooth *Prioneris thestylis*	LC[1] R[2]	Chan *et al.* 2012	*Aralia decaisneana, Asclepias curassavica, Bidens pilosa var. radiate, Capparis spp., Clerodendrum trichotomum, Crateva religiosa, Crateva trifoliate, Cuphea articulate, Duranta repens, Euphorbia pulcherrima, Lantana camara, Pentas lanceolata, Premna serratifolia, Tetradium glabrifolium, Sambucus chinensis, Stachytarpheta jamaicensis, Turpinia formosana, Zanthoxylum ailanthoides*	*Lantana camara* (very common)

Note:
[1] Conservation status by Fellowes *et al.* (2002): LC = Local Concern
[2] Conservation status by Chan *et al.* (2011): VR = Very Rare; R = Rare; UC = Uncommon.

The nearest active egretry, Tung Shing Lane, is located over 2,000m from the Project Site; no major flight-line is expected to pass through the Project Site given that the contiguous fishponds at Nam Shang Wai, Lut Chau and/or the Deep Bay Area are located to the north of the egretry and egrets would consume less energy by reaching these foraging areas by heading north directly. Hence, the buildings proposed in the PH site (tallest height range from about 102m in the Option 1 to about 116m in the Option 2) are not a concern with respect to the ardeid breeding populations.

Significant adverse impacts on wetlands of conservation significance from the development of the PH site are not expected with implementation of good site practices during construction and compliance with the Water Pollution Control Ordinance during the construction and operation phases. As the WBA is currently under disturbance from different sources (such as the existing YLIE and open storage in the YLIEE site), additional disturbance from the PH site is not expected to be significant. No significant additional disturbance from the increased population and building height is predicted to the areas which are sensitive to disturbance (e.g. the fishponds within WCA and Deep Bay area). It is not anticipated that the residents from the PH site will make extensive use of these areas. Thus, the main potential source of impacts on fauna is due to noise and light (especially during night-time) from the residential development. However, the closest distance between the PH site and the fishponds in the WCA is approximately 900m and the view from the nearest fishponds in WCA and the Deep Bay area is mostly blocked by the elevated areas (such as Kai Shan and the small hill to the north of Ng Uk Tsuen). Thus, disturbance to the continuous and contiguous fishponds from the high-rise buildings in the PH site is not expected to be significant.

Summary of the PH options evaluation

A comparison of the PH options in relation to ecology is provided in **Table 5.3.4** below. In summary, since all habitats under the two PH options will be converted to developed area, the ecological impacts are considered to be the same. It should, however, be noted that more ecological data are required to be collected for detailed assessment of the ecological value of the habitats.

Table 5.3.3: Summary of Option Evaluation on Ecology for the PH options

Evaluation Criteria	Option 1	Option 2
Preservation/enhancement of habitats of ecological importance and/or avoid/minimise any significant residual impacts to these areas	• Secondary woodland (0.98ha) and orchard in the southern portion (0.80ha) are potentially of ecological value and a total of approximately 1.78ha of these habitats will be lost due to the development. • Natural streams may be evaluated as of ecological significance (pending completion of ecological field surveys). If assessed as of ecological significance, use of ecologically friendly channelization methods would be appropriate, if feasible. • No breeding/nursery ground of species of conservation significance was identified during the preparation of this report.	• Same as Option 1.
Avoid/minimise impacts to the recognised sites of ecological concern with no significant residual impact	• No direct impacts on the sites of ecological concern. • No significant additional disturbance to the sites of ecological concern.	• Same as Option 1.
Recommendation	No preference	No preference

Loss of the habitats which are evaluated to be of low to moderate ecological value or above will require compensation. It is recommended that compensation for the loss of orchard in the southern portion (0.80ha) and secondary woodland (0.98ha) within the PH development footprint is required for both options as a precautionary approach. The orchard in the southern portion was adjacent to the secondary woodland and may be ecologically linked to this habitat; however, it would require more ecological data and further investigation of the value of the habitats to confirm this. Hence, the area of the compensation for the loss of the habitats, which are of low to moderate ecological value or above, may be revised in the later stage of the ecological impact assessment. Provision of the native woodland compensatory plantings of adequate quantity and quality on-site is preferable. Where not practicable, the off-site compensation shall be considered. Suitable compensatory planting areas will be reviewed and details will be proposed in later submissions.

Consideration could also be given to plant nectar/larval food plants in the landscaped areas within the PH site to compensate the loss of nectar source/larval food plants if any due to the proposed development.

A crab species *Nanhaipotamon hongkongense* of conservation interest was recorded within the PH site. Translocation of this aquatic invertebrate species may be required before the site clearance/construction. The individuals of this species within the Project Site should be identified by qualified ecologists before the translocation. The identified individuals are recommended to be translocated to suitable microhabitats (e.g. suitable stream flow).

In addition, depending upon ecological survey findings, if the natural streams are evaluated as of ecological significance, measures to minimise impacts on natural or semi-natural streams by use of ecologically friendly channelization methods may be appropriate for both options.

Notwithstanding the above, the details of the mitigation measures will be proposed and confirmed in the detailed ecological impact assessment at the later stage of the study when more data are collected to assess the ecological value of the habitats.

5.3.2 Options Evaluation for Ecology for the YLIEE Site

Similar to PH site, it should be noted that the ecological field survey is still on-going and more ecological data will be collected to establish the ecological baseline profile and to confirm whether any species of conservation concern are present and determine species diversity. The ecological value of the habitats was evaluated in this preliminary study based on the available ecological data during the time of preparing this report.

Habitat and vegetation within the YLIEE site boundary

The development footprints of the two YLIEE options are similar except there is a non-development area at the western slope of the site in the Option B (**Figure 5.3.3**). The habitat loss under the two options is summarized in **Table 5.3.5**.

Table 5.3.4: Habitat loss for YLIEE Options A and B

Habitats	Length (m)/ Area (ha)	
	Option A	Option B
Minor Watercourses	Approx.. 637m	Approx. 637m
Channelised Watercourses	0.29	0.29
Agricultural Land	1.26	1.26
Seasonally Wet Grassland	0.73	0.73
Secondary Woodland	0.80	0.46
Orchard	0.07	0.07
Developed Area	12.37	12.11
Total	**15.52**	**14.92**

A channelised watercourse was found along the northeastern YLIEE boundary. This watercourse is connected to the tidal Shan Pui River located to the east of the Study Area. As this watercourse is concrete-lined with concrete bottom, the composition of the flora species recorded was very limited. Common plant species, including *Alternanthera philoxeroides, Melinis repens* and *Mikania micrantha*, were recorded on the banks.

Watercourses found within the YLIEE site were mainly irrigation ditches near the agricultural land. The flow has been modified and they are under high level of human disturbance because they are used for irrigation. Flora species including the common herb species of *Bidens alba*, *Microstegium ciliatum* and *Panicum repens*. were recorded on the bank of the watercourses.

Agricultural land was identified in the northern part of the YLIEE site. This agricultural land includes both active and inactive farmland; vegetation in the latter includes common invasive plant species. Most of the active agricultural land is occupied by dryland crops with a small area used for growing *Colocasia esculenta*. Crop species such as the climber species *Ipomoea batatas* and *Benincasa hispida*, fruit tree species *Musa* x *paradisiaca* and herb species *Allium fistulosum* and *Lactuca sativa* are commonly planted in this habitat.

Seasonally wet grassland was found within the northern part of the YLIEE site boundary. This has resulted from the invasion by wetland herb species of abandoned agricultural land which is flooded during the wet season. Dominant vegetation recorded in this habitat included the wetland plants such as the herb species *Hedychium coronarium, Microstegium ciliatum* and *Panicum repens*, and the fern species *Cyclosorus interruptus*.

Native secondary woodlands were found at the western fringe of the YLIEE site. These woodlands were part of the secondary woodland located to the east of Kai Shan. Due to the frequent disturbance from hill fire, the size of the woodland is limited and was found to be of a young age. Vegetation species recorded in the secondary woodland included climber *Sageretia thea*, ferns *Blechnum orientale* and *Lygodium japonicum*, shrubs *Psychotria asiatica* and *Rhus chinensis* and trees *Celtis sinensis* and *Cratoxylum cochinchinense*. Six individuals of the tree species of conservation concern, *Aquilaria sinensis*, were also recorded in the western part of the site.

Developed areas, which were mainly open storage sites, occupied most of the YLIEE site. The diversity of the vegetation recorded was limited and included the tree species *Macaranga tanarius* var. *tomentosa* and herb species *Bidens alba, Eleusine indica* and *Panicum maximum*.

Mammal species recorded within the YLIEE site boundary

No mammal species was recorded within the YLIEE site during the surveys conducted from December 2012 to April 2013.

Bird species recorded within the YLIEE site boundary

A total of 23 bird species were recorded during the surveys conducted from December 2012 to April 2013. Two out of these 23 species, Little Egret *Egretta garzetta* and Collared Crow *Corvus torquatus*, are considered to be of Potential Regional Concern and of Local Concern respectively by Fellowes *et al.* (2002)[6]; the latter is also Near Threatened[22] globally. The Little Egret was recorded within the channelized watercourse within the site, whereas the Collared Crow was flying over the secondary woodland/developed area along the western fringe of the site within the PH site during the surveys.

Reptile species recorded within the YLIEE site boundary

Only one reptile species, Bowring's Gecko *Hemidactylus bowringii*, was recorded in the developed area of the YLIEE site. This species is not of conservation significance.

Amphibian species recorded within the YLIEE site boundary

Eight amphibian species were recorded during the surveys conducted from March to April 2013. All of them are common and widespread in Hong Kong[9].

Butterfly species recorded within the YLIEE site boundary

A total of seven butterfly species were recorded within the YLIEE site boundary during March to April 2013 and one additional species was recorded during the site visit conducted in September 2012. Most of these eight species are common or very common in Hong Kong[16]. One suspected Common Yellow Swallowtail *Papilio machaon* was seen flying over a watercourse within the YLIEE site. This species is considered to be very rare in Hong Kong[16] and a vagrant species from the north of Hong Kong[23]. This species is not presented in **Figure 5.3.2** as it is not a confirmed record. Irrespective of this however, vagrant species are not normally considered to be of conservation significance[6].

Dragonfly species recorded within the YLIEE site boundary

A total of five dragonfly species were recorded during March to April 2013. All of these species are considered to be common or abundant in Hong Kong by Tam *et al.* (2011)[11].

Stream fauna species recorded within the YLIEE site boundary

No stream fauna species was recorded within the YLIEE site during the surveys conducted from December 2012 to April 2013.

It is currently proposed that all of the existing watercourses within the YLIEE site would be realigned and piped. The underground pipes would connect to the u-channel to be constructed along the western site boundary. There is no regular record of the species of conservation significance in the watercourses and these species were also recorded in low numbers. Based on current survey findings, the watercourses within the PH site do not appear to be an important habitat for the species of conservation significance. However, as the surveys are on-going, more data will be included in the final assessment. For this reason, and since some

[22] BirdLife International (2013). Taxonomy. Available at http://www.birdlife.org/datazone/info/taxonomy. Accessed in May 2013.
[23] Lo, P. Y. F. and Hui, W.L.. 2010. *Hong Kong Butterflies*. Cosmos Books Ltd., Hong Kong.

stream sections within the site boundary are natural and semi-natural, it would be premature to assume that no streams within the site boundary are of ecological significance. Should any streams be evaluated as being of ecological significance, mitigation measures, such as ecologically friendly channelization measures, should be considered.

Breeding/nursery ground of species of conservation significance within the YLIEE site boundary

No breeding/nursery ground of species of conservation significance was identified within the YLIEE site and the Study Area during the desktop study and the five-month ecological surveys.

Impacts on the sites of conservation significance from the YLIEE development

The proposed YLIEE site is located to the west of the existing YLIE. Additional disturbance to the surrounding areas (such as Kai Shan, WBA) are not anticipated to be significant. This is because the surrounding areas are currently disturbed by the existing YLIE and open storage within the YLIEE site. The proposed YLIEE development is located at the toe of Kai Shan; hence, no habitat fragmentation will be resulted to retard the utilization of Kai Shan by butterflies. The nectar/larval food plants of the butterfly species of conservation interest recorded within the YLIEE site are all common or very common (see **Table 5.3.6**); hence, significant impacts on the loss of potential feeding/ breeding/ nursery ground for butterflies are not expected, taking into account of the presence of nectar/larval food plant within the site boundary. Given that much of the industrial activities will be kept indoors within the proposed YLIEE, the disturbance level from the proposed YLIEE is not expected to be significantly higher than at present. As the nearest distance between the fishponds in the WCA and the YLIEE site is approximately 450m, the disturbance to the fauna in the WCA and Deep Bay area from the YLIEE is also expected to be low.

The potential sources of disturbance from the proposed YLIEE are water, noise and light (especially during night-time) pollution. The effluent and noise generated from the YLIEE during the construction and operation stages will be governed by the relevant ordinances (such as the Water Pollution Control Ordinance and Noise Control Ordinance) and they are predicted to be within ecologically acceptable levels with full compliance with the Ordinances. Light during night-time from the YLIEE is not expected to be of concern, as lit areas will not be close to the fishponds compared to the areas which are currently lit at night.

Table 5.3.6: Butterfly species of conservation significance recorded within the Study Area and the nectar/larval food plants of these butterfly species recorded within the YLIEE site boundary.

Common Name	Conservation Status[24]	Sources[25]	Nectar Plant/ Larval Food Plant[26]	Record in YLIEE Site
Common Awl *Hasora badra*	LC[1] VR[2]	Chan *et al.* 2012; Present Study	*Blumea riparia, Derris alborubra, Derris laxiflora, Derris trifoliata, Derris uliginosa, Deutzia pulchra, Millettia nitida, Millettia pachycarpa, Lantana camara*	*Lantana camara* (very common)
Tamil Grass Dart *Taractrocera ceramas*	LC[1] R[2]	Chan *et al.* 2012	*Bambusa* spp., *Buddleja asiatica, Buddleja davidii, Lantana camara,* Several coarse grasses,	*Lantana camara* (very common)
Pale Palm Dart *Telicota colon*	LC[1] R[2]	Present Study	*Buddleja asiatica, Buddleja davidii, Lantana camara, Miscanthus sinensis, Pennisetum purpureum, Pentas lanceolata, Perilla frutescens, Setaria palmifolia*	*Lantana camara* (very common);
Spotted Angle *Caprona alida*	LC[1] VR[2]	Chan *et al.* 2012	*Deutzia pulchra, Helicteres angustifolia, Helicteres isora, Mikania cordata*	-
Plain Hedge Blue *Celastrina lavendularis*	LC[1] VR[2]	Chan *et al.* 2012	*Acer albopurpurascens, Desmodium sequax, Hiptage benghalensis, Severinia buxifolia, Viburnum*	-

[24] a. Fellowes, J. R., Lau, M. W. N., Dudgeon, D., Reels, G. T., Ades, G. W. J., Carey, G. J., Chan, B. P. L., Kendrick, R. C., Lee, K. S., Leven, M. R., Wilson, K. D. P. and Yu, Y. T. 2002. Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong. Memoirs of the Hong Kong Natural History Society 25:123-159.
b. Chan, A., Cheung, J., Sze, P., Wong, A., Wong, E. and Yau, E. 2011. A Review of the Local Restrictedness of Hong Kong Butterflies. Hong Kong Biodiversity 21: 1-12.

[25] Chan, H.S.R., Chau, W.K., Cheng, W.K., Chow, S.M., Ho, S.C.J., Kan, S.C.J., Lau, W.H.S. and Ng, K.L.E. 2012. *Encyclopedia of Hong Kong Butterflies - Search for Butterflies.* Hong Kong Lepidopterists' Society Limited.

[26] a. 林柏昌、林有義。2008。蝴蝶食草圖鑑。晨星出版集團。
b. 林春吉。2008。台灣蝴蝶食草與蜜源植物大圖鑑。天下文化。
c. 林春吉。2004。彩蝶生態全紀錄:臺灣蝴蝶食草與蜜源。綠世界出版社。
d. 張保信。1997。台灣的蝴蝶世界。渡假出版社。
e. 詹肇泰，邱榮光。2004。蝶鳥舞動-鳳園-具特殊科學價值地點。萬里機構 萬里書店 大埔環保協進會。
f. Young, J. J., Yiu, V., Yau, S. M. 2007. A Photographic Monograph on Hong Kong Butterflies (Volume 4). Best Tri Printing Company Limited. 161pp.
g. Young, J. J., Yiu, V., Yau, S. M., Choi, K. P., Au, W. K., Sae Sha, W. C. 2007. A Photographic Monograph on Hong Kong Butterflies (Volume 2). Best Tri Printing Company Limited. 325pp.
h. Young, J. J., Yiu, V., Yau, S. M., Pun, S. F., Wai C. Y. Law, Y. S., Choi K. P. 2008. A Photographic Monograph on Hong Kong Butterflies (Volume 4). Best Tri Printing Company Limited. 437pp.
i. Young, J. J., Law Y. S., Choi, K. P., Pun, S. F., Yau, S. M., Chor, H. K., Lam, W. 2011. A Photographic Monograph on Hong Kong Butterflies (Volume 4). Best Tri Printing Company Limited. 555pp.

Common Name	Conservation Status[24]	Sources[25]	Nectar Plant/ Larval Food Plant[26]	Record in YLIEE Site
			odoratissimum, Vitex negundo	
Peacock Royal *Tajuria cippus*	LC[1] R[2]	Chan *et al.* 2012	*Loranthus parasiticus, Macrosolen cochinchinensis, Scurrula parasitica, Taxillus chinensis*	-
Spotted Royal *Tajuria maculata*	LC[1] VR[2]	Chan *et al.* 2012	*Loranthus spp., Macrosolen cochinchinensis, Scurrula parasitica*	-
Yellow Rajah *Charaxes marmax*	LC[1] UC[2]	Chan *et al.* 2012	*Blumea riparia, Croton tiglium, Lantana camara, Mikania cordata, Ruellia squarrosa*	-
Orange Staff Sergeant *Athyma cama*	LC[1] VR[2]	Chan *et al.* 2012	*Glochidion acuminatum, Glochidion lanceolatum, Glochidion philippicum, Glochidion rubrum , Glochidion zeylanicum, Syzygium levinei, Zanthoxylum avicennae*	*Zanthoxylum avicennae* (common)
Common Yeoman *Cirrochroa tyche*	LC[1] VR[2]	Chan *et al.* 2012	*Buddleja asiatica, Buddleja davidii, Lantana camara, Rhus chinensis, Schefflera octophylla, Syzygium levinei, Vitex negundo, Zanthoxylum avicennae,*	*Lantana camara* (very common); *Rhus chinensis* (common); *Zanthoxylum avicennae* (common)
Danaid Egg-fly *Hypolimnas misippus*	LC[1] UC[2]	Chan *et al.* 2012	*Abutillon spp., Hibiscus spp., Lantana camara, Plantago asiatica, Plantago major, Portulaca oleracea*	*Lantana camara* (very common); *Plantago* major (common)
Vagrant *Vagrans egista*	LC[1] VR[2]	Chan *et al.* 2012	*Bougainvillea brasiliensis, Buddleja asiatica, Buddleja davidii, Clerodendrum trichotomum, Homalium cochinchinensis, Pentas lanceolata, Gomphrena globosa, Stachytarheta jamaicensis, Xylosma longifolium*	-
Painted Lady *Vanessa cardui*	LC[1] R[2]	Chan *et al.* 2012	*Artemisia spp., Blumea spp., Buddleja asiatica, Buddleja davidii, Carduus spp., Debregeasia bicolor , Gnaphalium affine, Gomphrena globosa, Malva verticillata , Pentas lanceolata, Urtica spp., Zornia diphylla*	-
Small Three-ring	LC[1] VR[2]	Chan *et al.* 2012	-	-

Common Name	Conservation Status[24]	Sources[25]	Nectar Plant/ Larval Food Plant[26]	Record in YLIEE Site
Ypthima norma				
Red-spot Sawtooth *Prioneris philonome*	LC[1] VR[2]	Chan *et al.* 2012	-	-
Spotted Sawtooth *Prioneris thestylis*	LC[1] R[2]	Chan *et al.* 2012	*Aralia decaisneana, Asclepias curassavica, Bidens pilosa var. radiate, Capparis spp., Clerodendrum trichotomum, Crateva religiosa, Crateva trifoliate, Cuphea articulate, Duranta repens, Euphorbia pulcherrima, Lantana camara, Pentas lanceolata, Premna serratifolia, Tetradium glabrifolium, Sambucus chinensis, Stachytarpheta jamaicensis, Turpinia formosana, Zanthoxylum ailanthoides*	*Lantana camara* (very common)

Note:
[1] Conservation status by Fellowes *et al.* (2002): LC = Local Concern.
[2] Conservation status by Chan *et al.* (2011): VR = Very Rare; R = Rare; UC = Uncommon.

Summary of the YLIEE options evaluation

A comparison of the YLIEE options in relation to ecology is provided in **Table 5.3.7** below. The major difference between the two options is that the exclusion of the western slope area from the development plan in Option B would preserve a patch of the secondary woodland habitat of about 0.34ha compared to Option A. While the impacts on other types of habitats are similar for both options, it is considered that Option B is preferred option. It should however be noted that more ecological data are required to be collected for detailed assessment of the ecological value of the habitats.

Table 5.3.7: Summary of Option Evaluation on Ecology for the YLIEE site.

Evaluation Criteria	Option A	Option B
Preservation/enhancement of habitats of ecological importance and/or avoid/minimise any significant residual impacts to these areas	• Seasonally wet grassland is potentially of ecological value and a total of approximately 0.73 ha of this habitat will be lost. • Secondary woodland is potentially of ecological value and a total of approximately 0.80ha of this habitat will be lost. • Natural streams may be evaluated as of ecological significance (pending completion of ecological field surveys). If assessed as of ecological significance, use of ecologically friendly	• Seasonally wet grassland is potentially of ecological value and a total of approximately 0.73 ha of this habitat will be lost. • Secondary woodland is potentially of ecological value and a total of approximately 0.46ha of this habitat will be lost. • No breeding/nursery ground of species of conservation significance was identified during the preparation of this report.

Evaluation Criteria	Option A	Option B
	channelization methods would be appropriate, if feasible. • No breeding/nursery ground of species of conservation significance was identified during the preparation of this report.	
Avoid/minimise impacts to the recognised sites of ecological concern with no significant residual impact	• No direct impacts on the sites of ecological concern. • Significant additional disturbance to sites of ecological concern are not expected.	• No direct impacts on the sites of ecological concern. • Significant additional disturbance to sites of ecological concern are not expected.
Recommendation	-	**Preferred**

Loss of the habitats which are evaluated to be of low to moderate ecological value or above will require compensation. It is recommended that compensation for the loss of seasonally wet grassland (0.73ha for both options) and secondary woodland (0.8ha for Option A and 0.46ha for Option B) within the YLIEE development footprint is required as a precautionary approach. Seasonally wet grassland is potentially of higher ecological value; however, more ecological data are required to confirm if it supports significant number of the wetland dependent species or species of conservation significant. Hence, the area of the compensation for the loss of the habitats, which are of low to moderate ecological value or above, may be revised in the later stage of the ecological impact assessment. Provision of the wetland habitat of same size or function and native woodland compensatory plantings of adequate quantity and quality on-site is preferable. Where not practicable, the off-site compensation shall be considered. Suitable compensatory planting areas will be reviewed and details will be proposed in later submissions.

Six individuals of the tree species of conservation concern, *Aquilaria sinensis*, were recorded in the western part of the YLIEE site, and within the development footprint of Option A. It is recommended that detailed vegetation survey within the Project Site should be conducted before the site clearance/construction to identify and locate the species of conservation interest (such as *Aquilaris sinensis*). *In-situ* preservation should be considered as far as possible, and if direct impact is unavoidable, transplanting the affected plants if they are suitable.

Consideration could also be given to plant nectar/larval food plants in the landscaped areas within the YLIEE site to compensate the loss of nectar source/larval food plants if any due to the proposed development.

In addition, depending upon ecological survey findings, if the natural streams are evaluated as of ecological significance, measures to minimise impacts on natural or semi-natural streams by use of ecologically friendly channelization methods may be appropriate for both options.

Notwithstanding the above, the details of the mitigation measures will be proposed and confirmed in the detailed ecological impact assessment at the later stage of the study when more data are collected to assess the ecological value of the habitats.

5.4 Fisheries

The desktop baseline study on the fisheries conditions of the Project Site and Study Area has been carried out. All identified fishponds will be visited once during March-August 2013 and the pond status will be recorded. Some of the fishponds were visited in May 2013 and the other will be visited in June 2013 tentatively. Preliminary findings on the fishpond status are summarized in **Figure 5.4.1**. The following summarises the fisheries baseline conditions of the Project Site and Study Area based on the available information:

- No ponds were found within the Project Site, but an ornamental fish rearing premises [redacted] was identified at Tseng Tau Tsuen during a site visit made in May 2013. There was no occupant inside the premises during the site visit. However, as this is not pond fish culture, it is out of the scope of the fisheries impact assessment.
- There are ponds to the west of the Project Site and in the northern and northwestern part of the Study Area. The ponds identified at the northern and northwestern edge of the Study Area are at the southern fringe of the main area of continuous and contiguous fishponds in the northwest New Territories. According to AFCD (2013) [27], most fishponds in the northwest New Territories are used for polyculture (rearing of species such as carps, tilapia and/or grey mullet).
- Based on the habitat map presented by CH2M Hill (2008)[7], the ponds at the northern and northwestern edge of the Study Area were classified as "unmanaged ponds" in which there was no evidence of fish culture taking place.
- The ponds at the northern edge of the Study Area (i.e. to the west of the YLSTW) were visited in September 2012 and were found to be inactive, i.e. no active management was noted, but there were no significant physical constraints to resumption of commercial fisheries.
- The ponds at the northwestern edge of the Study Area were visited in May 2013. They were mostly abandoned and overgrown with vegetation.
- The ponds to the west of the Study Area were visited in May 2013. They were located at the valley of Kai Shan. Most of these were also overgrown with vegetation, which considered to be abandoned.
- Overall, a total of 5.07 ha of inactive fishpond and 1.21 ha of abandoned fishpond were found within the Study Area. However, it should be noted that the farming practice is flexible and can be changed from time to time.

In view of the above issues, it is considered appropriate to adopt the following criteria for evaluation of the options for the aspect of fisheries.

Table 5.4.1: Summary of evaluation principle and criterion

Evaluation Principle	Evaluation Criterion
Conservation of areas of fisheries importance	Preservation/enhancement of active/inactive fishponds and/or avoid/minimise any significant residual impacts to these fishponds.
	Avoid/minimise impacts to the abandoned fishponds.

[27] AFCD (2013). Marine fish culture, pond fish culture and oyster culture. Available at http://www.afcd.gov.hk/english/fisheries/fish_aqu/fish_aqu_mpo/fish_aqu_mpo.html. Accessed in May 2013.

5.4.1 Options Evaluation for Fisheries for PH Site

No ponds were found within the development footprint of the PH site for both options, but there is an ornamental fish rearing premises [redacted] within the Tseng Tau Tsuen. As this is not pond fish culture, it is out of the scope of the fisheries impact assessment.

Based on the desktop review study and preliminary site survey, there were no active fishponds identified within the Study Area. Hence indirect impacts on the fish culture are not anticipated unless fish culture is resumed in the inactive/abandoned fishponds. With good site practices and compliance with the Water Pollution Control Ordinance during the construction and operation stages, adverse impacts to the existing watercourses and water bodies will be avoided. Hence, indirect impacts to the existing inactive fishponds will be avoided and will not constrain resumption of the fish culture practice.

A comparison of the PH options in relation to fisheries is provided in **Table 5.4.2** below. It should be noted that a detailed fisheries impact assessment will be conducted in later stage of the study.

Table 5.4.2: Summary of Option Evaluation on Fisheries for the PH site

Evaluation Criteria	Option 1	Option 2
Preservation/ enhancement of active/ inactive fishponds and/or avoid/minimise any significant residual impacts to these fishponds	• No fishpond was identified within the development footprint. • No active fishpond was identified within the Study Area. • Inactive fishponds were identified in the Study Area and they are not going to be lost physically. Given that the relevant ordinances are followed, pollution to these inactive fishponds from the development will not occur and resumption of fish culture is practicable.	• Same as Option 1.
Avoid/minimise impacts to the abandoned fishponds	• Abandoned fishponds were identified in the Study Area and they are not going to be lost physically. Given that the relevant ordinances are followed, pollution to these inactive fishponds from the development will not occur and resumption of fish culture is practicable.	• Same as Option 1.
Recommendation	No preference	No preference

5.4.2 Options Evaluation for Fisheries for YLIEE Site

No ponds were found under the development footprint of the YLIEE site for both options, so there is no direct impact on fisheries. Based on the desktop review study and preliminary site survey, there were no active fishponds identified within the Study Area. Hence indirect impacts on the fish culture are not anticipated unless fish culture is resumed in the inactive/abandoned fishponds. With good site practices and compliance with the Water Pollution Control Ordinance during the construction and operation stages, adverse impacts to the existing watercourses and water bodies will be avoided. Hence, indirect impacts to the existing inactive

fishponds will be avoided and will not constrain resumption of the fish culture practice.

A comparison of the YLIEE options in relation to fisheries is provided in **Table 5.4.3** below. It should be noted that a detailed fisheries impact assessment will be conducted in later stage of the study.

Table 5.4.3: Summary of Option Evaluation on Fisheries for the YLIEE site

Evaluation Criteria	Option A	Option B
Preservation/ enhancement of active/ inactive fishponds and/or avoid/minimise any significant residual impacts to these fishponds	• No fishpond was identified within the development footprint. • No active fishpond was identified within the Study Area. • Inactive fishponds were identified in the Study Area and they are not going to be lost physically. Given that the relevant ordinances are followed, pollution to these inactive fishponds from the development will not occur and resumption of fish culture is practicable.	• Same as Option A.
Avoid/minimise impacts to the abandoned fishponds	• Abandoned fishponds were identified in the Study Area and they are not going to be lost physically. Given that the relevant ordinances are followed, pollution to these inactive fishponds from the development will not occur and resumption of fish culture is practicable.	• Same as Option A.
Recommendation	No preference	No preference

5.5 Cultural Heritage

A desktop study has been conducted as part of the baseline study to identify all the cultural heritage resources in the vicinity of the Project. They are summarized in **Table 5.5.1** below. Details have been presented in the Final TR-1 Baseline Review Report and Final Archaeological Desk-Based Review and Proposal for Archaeological Field Survey Report. **Figures 5.5.1 – 5.5.5** show the locations of all these cultural heritage resources.

Table 5.5.1: Summary of cultural heritage resources in the vicinity of the Project site

Type	Number	Description
Declared Monument (**Figure 5.5.1**)	1	I Shing Kung (DM-1)
Graded historic buildings (**Figure 5.5.1**)	12	Tin Hau Temple, Yu Yuen, Entrance Gate at Tai Tseng Ng Uk Tsuen, Nos. 4 & 7A and Lot WCL132 in DD123 at Sai Tau Wai, No. 83 Fung Chi Tsuen (Lung Wah Yuen), No. 39, 40,41,42,43 Shing Uk Tsuen, No. 40 & 41 Fuk Hing Tsuen
Historical villages (**Figure 5.5.2**)	11	Fuk Hing Tsuen, Tung Tau Wai, Chung Sam Wai, Yeung Uk Tsuen, Sai Tau Wai and Lam Uk Tsuen, Tai Tseng Wai, Ng Uk Tsuen, Shing Uk Tsuen, Fung Chi Tsuen and Shui Tin Tsuen
Historical clan graves (**Figure 5.5.1**)	10	Historical clan graves in Shui Tin Tsuen and Wang Chau (G1-G10)
Burial ground (**Figure 3.2.1**)	3 areas in	Traditional clan graves and burial grounds including

Type	Number	Description
	Kai Shan and 1 area in Chu Wong Ling	the Tang Clan at Kai Shan
Built heritage resources within the project site (**Figure 5.5.1c**)	2	Historical well in Wang Chau (to the West of Fuk Hi Street) and Pak Kung Shrine in Wang Chau (northwest of Fung Chi Tsuen)
Known Sites of Archaeological Interests near the PH and YLIEE (**Figure 5.5.3**)	2	Sheung Cheung Wai Site of Archaeological Interest and Mong Tseng Site of Archaeological Interest
Potential areas of archaeological potential within the project site (**Figure 5.5.4**)	1	An area of archaeological potential located in the centre of the PH site (Area A)
	1	A number of relatively undisturbed areas of archaeological potential located along the western and northwestern edge of the YLIEE site (Area B).
Potential areas of archaeological potential outside the PH and YLIEE sites but within the Study Area (**Figure 5.5.5**)	3	Archaeological no-go areas identified outside the PH and YLIEE sites, including northern historical villages (Ng Uk Tsuen, Tai Tseng Wai and Shing Uk Tsuen), historical villages to south of Long Ping Estate (Fung Chi Tsuen and Shui Tin Tsuen), and historical villages of Chu Wong Ling (Fuk Hing Tsuen, Tung Tau Wai San Tsuen, Lam Uk Tsuen, Chung Sum Wai and Tung Tau Wai)

The desk-based assessment identified two known sites of archaeological interest in the wider environmental setting of the Study Area. Both, Sheung Cheung Wai Site of Archaeological Interest and Mong Tseng Site of Archaeological Interest will not be impacted by the project, but serve as an indication for archaeological potential within the PH and YLIEE sites. Two areas of archaeological potential were identified for further investigation: Area in the centre of the proposed public housing site and series of smaller areas along the western and northwestern edge of the YLIEE site. An archaeological field investigation will have to be undertaken after land resumption in the areas identified. The results are required to minimize the impacts on archaeological deposits, if present.

The Project site would have avoided the Declared Monument and 12 Graded Historic Buildings which are located in and around the 11 historical villages. Hence, there would not be any direct impacts on both the Declared Monument athe Graded Historic Buildings. In addition, both the PH site and the YLIEE would not encroach into any of the 11 historical villages. The refined Project site boundary has already excluded the burial grounds and all graves, thus the direct impacts on these elements are also avoided. If construction works are to be conducted in the vicinity of the graves, mitigation in the form of condition survey might be required. Additional mitigation measures to be determined based on the findings of the condition survey may include buffer zone, protective covering, safe public access, vibration monitoring.

As there are no anticipated direct impacts on Declared Monument, Graded Historic Buildings, historical villages, burial grounds and graves, and their indirect impacts if any are considered to be the same for all development options, these elements are not considered as critical evaluation criteria in selection of the preferred option. The evaluation criteria for cultural heritage resources are proposed in **Table 5.5.2** below.

Table 5.5.2: Evaluation principle and criterion for cultural heritage aspect

Evaluation Principle	Evaluation Criterion
Conservation of areas of archaeological potential or interest	Minimise the impacts on area of archaeological potential
Respect to built heritage resources	Minimise the impacts on built heritage resources

5.5.1 Evaluation of PH Options

Although the Project site does not encroach onto any Declared Monument and Graded Historic Buildings, built heritage resources: historical well and a shrine to the West of Fuk Hi Street and Pak Kung shrine to northwest of Fung Chi Tsuen are within the boundary of the PH site (**Figure 5.5.1c**). Irrespective of the development options for the PH site, these two built heritage resources will be preserved in-situ and incorporated into the design of the new housing development. Appropriate mitigation measures during construction phase including a condition survey would be required. Additional mitigation measures such as the provision of structural support, protective covering, safe public access and vibration monitoring etc may also be required based on the findings of the condition survey. During the operational phase, the area around the historical well and the shrine will require appropriate landscaping as mitigation.

The PH site is located far away from the known sites of archaeological interest including Sheung Cheung Wai Site of Archaeological Interest and Mong Tseng Site of Archaeological Interest (**Figure 5.5.3**), and it would also not encroach onto the archaeological no-go areas identified in the Final Archaeological Desk-Based Review and Proposal for Archaeological Field Survey Report. However, there is an area of archaeological potential (Area A) found in the centre of the PH site (**Figure 5.5.4**). The extent of direct encroachment onto this area of archaeological potential is the same for the two PH option. Irrespective of the development options, a field survey investigation needs to be undertaken after land resumption to further understand the archaeological deposit, its extent and potential impact by the proposed PH site. Any mitigation measures including preservation in situ, watching brief or rescue excavation which may be required after the field survey will have to be agreed with AMO. The remaining parts of the PH site are deemed to have low, very low or no archaeological potential and hence are not considered in the evaluation analysis.

A comparison of the PH options in relation to cultural heritage resource is provided in **Table 5.5.3** below.

Table 5.5.3: Comparison of cultural heritage impacts for different PH options

	Option 1	Option 2
Conservation of Areas of Archaeological Potential or interest	• Encroach onto the area of archaeological potential in the centre of the PH site.	• Same extent of encroachment onto the area of archaeological potential in the centre of the PH site.
Respect to Built Heritage Resources	• Preservation of the Pak Kung Shrine and historical well and its shrine in-situ as part of the PH site.	• Same as Option 1.
Recommendation	No preference	No preference

5.5.2 Evaluation of YLIEE Options

There are no built heritage resources identified within the YLIEE site and hence both YLIEE options would have no impacts on built heritage resources.

The YLIEE site is located far away from the known sites of archaeological interest including Sheung Cheung Wai Site of Archaeological Interest and Mong Tseng Site of Archaeological Interest, and it would also not encroach onto the archaeological no-go areas identified in the Final Archaeological Desk-Based Review and Proposal for Archaeological Field Survey Report. However, there is an area of archaeological potential (Area B) found along the western and northwestern edge of the YLIEE site (**Figure 5.5.4**). The Option B differs from the Option A in that the lot located at the western boundary is excluded, where is identified as an area of archaeological potential. The extent of direct encroachment onto the area of archaeological potential for Option B is therefore less than Option A, thus the potential archaeological impacts. Notwithstanding, irrespective of the development options, a field survey investigation needs to be undertaken after land resumption to further understand the archaeological deposit, its extent and potential impact by the proposed YLIEE site. Any mitigation measures including preservation in situ, watching brief or rescue excavation which may be required after the field survey will have to be agreed with AMO. The remaining parts of the YLIEE site are deemed to have low, very low or no archaeological potential and hence are not considered in the evaluation analysis.

A comparison of the YLIEE options in relation to cultural heritage resource is provided in **Table 5.5.4** below.

Table 5.5.4: Comparison of cultural heritage impacts for different YLIEE options

	Option A	Option B
Conservation of Areas of Archaeological Potential or interest	• Encroach onto the area of archaeological potential along the western and northwestern edge of the YLIEE site.	• Encroach onto the area of archaeological potential along the northwestern edge of the YLIEE site, but not the lots at western boundary. Extent of potential archaeological impacts is less than that of Option A.
Respect to Built Heritage Resources	• No impact	• No impact
Recommendation	-	**Preferred**

5.6 Landscape and Visual

A baseline study to identify the extent and sensitivity of existing landscape and visual resources of the PH and YLIEE site has been completed in the TR-1 Baseline Review Report. The following tables extracted from the TR-1 report provide a summary of the sensitivity of landscape resources (LRs), landscape character areas (LCAs) and visually sensitive receivers (VSRs). **Figures 5.6.1** to **5.6.3** present LRs, LCAs and VSRs in relation to the PH and YLIEE sites.

Table 5.6.1: Sensitivity of Landscape Resources (LRs)

LR No.	Landscape Resources	Quality (High, Medium, Low)	Ability to Accommodate Change (Low, Medium, High)	Sensitivity (Low, Medium, High)
1	Industrial area	Low	High	Low
2	Villages	Medium	Medium	Medium
3	Agricultural Land	Medium	Medium	Medium
4	Open Storage	Low	High	Low
5	Mixed woodland, shrubs and grassland.	High	Low	High
6	Woodlands	High	Low	High
7	Residential area	Low/Medium	Medium	Low
8	Major transportation corridor	Low	High	Low
9	Roads and urban infrastructure	Low	High	Low
10	Streams	High	Low	High
11	Ponds	High	Low	High
12	Fishponds	High	Low	High
13	Artificial Channel	Low	High	Low
14	Urban area	Medium	Medium	Medium
15	Utilities	Low	High	Low

Table 5.6.2 below provides a summary of the sensitivity of landscape character areas. **Table 5.6.2**: Sensitivity of landscape character areas (LCAs)

LCA No.	Landscape Character Area	Quality (High, Medium, Low)	Ability to Accommodate Change (Low, Medium, High)	Sensitivity (Low, Medium, High)
1	Industrial urban landscape	Low	High	Low
2	Miscellaneous rural fringe landscape	Medium	Medium	Medium
3	Upland and hillside landscape	High	Low	High
4	Residential urban landscape	Medium	Medium	Medium
5	Transportation corridor landscape	Low	High	Low
6	Urban peripheral village landscape	Medium	Medium	Medium
7	Miscellaneous urban fringe landscape	Medium	Medium	Medium
8	'Hui' urban	Medium	Medium	Medium

LCA No.	Landscape Character Area	Quality (High, Medium, Low)	Ability to Accommodate Change (Low, Medium, High)	Sensitivity (Low, Medium, High)
	landscape			
9	Rural coastal plain landscape	High	Low	High

Table 5.6.3 below provides a summary of the sensitivity of visually sensitive receivers.

Table 5.6.3: Sensitivity of visually sensitive receivers (VSRs)

VSR no.	Visually Sensitive Receiver (VSR)	Type of VSRs (Residential/ Recreational/ Pedestrian/ Occupational/ Transportation/ Cultural)	Quality of Existing View (Good/Fair/Poor)	Sensitivity (Low, Medium, High)
1	Chun Hing New Village	Residential	Fair	Medium
2	Long Ping Road	Transportation/ Pedestrian	Fair	Low
3	Fung Chi Tsuen	Residential	Fair	Medium
4	Fung Chi Road Intersection	Transportation/ Pedestrian	Fair	Low
5	Roof Garden of Long Ping Estate Market	Residential	Fair	High
6	Wah Ping House	Residential	High	High
7	Fuk Hi Street Intersection	Transportation/ Pedestrian	Fair	Low
8	Ting Fook Villas	Residential / Transportation / Pedestrian	Poor	High
9	Chu Wong Ling	Recreational	Good	Medium
10	Fuk Hi Street adjacent China Inspection Co. Ltd	Occupational / Transportation / Pedestrian	Poor	Medium
11	Fuk Hang Street	Occupational/ Transportation / Pedestrian	Poor	Medium
12	Fuk Wang Street	Occupational/ Transportation	Poor	Medium
13	Fuk Shun Street Intersection	Occupational/ Transportation / Pedestrian	Poor	Medium
14	Tai Tseng Wai	Residential	Fair	High
15	Upland behind Wing Ning Tsuen	Residential	Fair	High
16	Foothills above	Cultural	Fair	Medium

VSR no.	Visually Sensitive Receiver (VSR)	Type of VSRs (Residential/ Recreational/ Pedestrian/ Occupational/ Transportation/ Cultural)	Quality of Existing View (Good/Fair/Poor)	Sensitivity (Low, Medium, High)
	Yeung Uk San Tsuen			
17	Uphill Open Grassland Kai Shan	Recreational	Good	Medium
18	Kai Shan Peak – facing east	Recreational	Good	Medium
19	High point above Shing Uk Tsuen	Recreational/Cultural	Good	Medium
20	Open area & car park, Ng Uk Tsuen	Residential / Transportation / Pedestrian	Fair	Medium
21	Open car park near Yeung Uk San Tsuen	Occupational/ Transportation	Poor	High

Whilst both locations have experienced varying degrees of landscape disturbance as a result of present land uses, such as open storage and construction of graves, several valuable landscape and visual resources remain. These include mature woodland and individual mature trees located within the southern section of the PH site, undulating natural terrain forming the lower slopes Kai Shan and small scale agricultural plots within the YLIEE site. These resources help to define the rural fringe character of the area.

The natural backdrop of Kai Shan and surrounding foothills provides important visual amenity, contains views locally and forms a key visual attractor. Currently views towards this resource are predominantly open and unobstructed as the height of intervening development is low.

In view of these points, it is considered appropriate to adopt the following evaluation criteria for landscape and visual issues.

Table 5.6.4: Evaluation Criteria for Landscape and Visual issues

Evaluation Principle	Evaluation Criterion
Protection and incorporation of high quality landscape resources.	Minimisation of tree or natural vegetation removal.
	Avoidance or minimisation of impacts on valuable landscape resources.
	Minimisation of encroachment on the western boundary shared with the Kai Shan range.
Influence upon landscape character	Level of change and compatibility with the landscape character.
Visual amenity and compatibility	Maintain visual connection between Kai Shan and Chu Wong Ling.
	Scale, appearance and compatibility of built form within the landscape setting for residential and industrial uses.
	Opportunities for incorporation of landscape elements.

5.6.1 Evaluation of PH Options

According to the current preliminary design, the associated development parameters for the two PH options that are relevant to landscape and visual concerns are summarised in the following table.

Table 5.6.5: Key development parameters for PH Site in relation to LVIA

	Option 1	Option 2
Gross Plot Ratio	5.5	6.0
Height Range (metres) above ground level.	75m – 102m	75m – 116m
Number of storeys (ground floor included)	26 / 31 / 36	26 / 31 / 36 / 41
Number of residential towers	24	22

Landscape Resources

The likely positive and negative landscape impacts for the PH site are common for both options as the required cut and fill works to achieve the development platforms would limit the potential to retain existing features such as natural terrain, tree and other vegetation cover in-situ. The provision of local open space within the site grows as the PR increases. In addition the configuration / quantity of buildings also changes, both these variables may also exert pressure on existing landscape resources or provide opportunities to retain existing landscape planting, establish view corridors or create valuable green space.

Several agricultural plots ((approximate 1.3ha combined) are located within the centre of the open storage land, these are relatively fragmented and surrounded by a mixture of tree and shrub planting and woodland pockets. These LRs would be replaced by the proposed development.

A number of small streams pass through the PH site originating from the upland landscape of Kai Shan. These resources have been altered as a result of the open storage and associated functions of the site. The proposed development layouts would require diversion of the existing watercourses and box culverting works in relation to these resources.

Both schemes propose the same sports court facilities within the development, some of these are located at the buffer zone and some above the street shops. This approach minimises the land take at-grade and allows greater opportunity for incorporation of landscape planting.

The proposed junction and road improvement works would require the removal of existing semi-mature avenue trees along Fuk Hi Street to provide the required geometry; these improvement works are the same for both development options.

As a result of the cut and fill operations required to form the development platforms for both options there is limited potential to retain the high quality landscape resources including mature woodland and individual mature trees located within the southern section of the site boundary, therefore it is predicted that this is likely to negative impacts prior to mitigation.

Landscape Character

The quality of the landscape character at the northern section of the PH site has experienced as a result of the un-managed open storage functions located off Fuk Hi Street and the encroachment into the hillside woodland of Kai Shan by grave

construction. In this case, the removal of open storage functions and replacement with a rationalised and more visually coherent urban and landscape design would promote a higher quality landscape character and sense of place. The core residential area would introduce a completely new typology of development within this predominantly level part of the site, providing a strong contrast to the existing site condition. The new development would be seen in the context of the Long Ping Estate which is of a similar scale and character.

The upland landscape to the west of the site, comprising Kai Shan is considered to be of high value in terms of landscape resources and character. The alignment of buildings along the western boundary and treatment of engineered slopes needs to respond sensitively to this interface.

It is predicted that the replacement of the low quality open storage areas with a more cohesive urban and landscape design could generate positive impacts on the landscape character. The proposed development would encroach into areas of higher quality such as the woodland and village areas to the south along Long Ping Road which would generate negative impacts. In balance the overall impact of the development on landscape character is likely to be negligible for both options.

Visual Amenity

The residential buildings within the PH site are likely to become more visible as the population density increases as built form will be taller; in this case Option 2 is likely to be more visually intrusive but still similar in terms of urban form.

The height profile of residential towers in Option 1 proposes 26, 31 and 36 storey buildings. In the northern section of the site, these buildings step down from 36 to 31 storeys, from the west to the east, as the development meets Fuk Hi Street. To the south, adjacent to Long Ping Road, the towers range from 26 to 36 storeys and heights vary as the built form follows the alignment of the road.

In Option 2, 41 storey buildings are introduced; these are concentrated in the northern sector of the site. A stepping effect in building height is retained from west to east as the development meets Fuk Hi Street. In addition, 8 no of the 36 storey towers are replaced with 41 storey building, this increased density allows the removal of 2 no towers adjacent to School 3 off Long Ping Road.

In both cases the stepped profile of the buildings will help to provide visual diversity across the urban form avoiding the creation of a 'wall' of development. This varied profile will also respond the undulating hillside terrain of Kai Shan to the west.

The population density of Option 1 generates the requirement for 3 no schools, school 1 and 2 are located at the end of the main access road in the northern sector of the site. Their height (8 storeys) and positioning would allow a visual corridor to be retained through the site towards Kai Shan. School 3 would be located off Long Ping Road to the south.

Option 2 would require the provision of 4 no schools, in this case a facility would be provided to the east of school 3 off Long Ping Road replacing 2 no tower blocks (both 26 storeys including ground floor). The removal of these towers would assist in breaking up the overall massing and visibility of tower blocks in

this area and retain a stronger visual connection to the vegetated knolls at the foot of Kai Shan.

The village areas to the east of Fuk Hi Street including Fuk Hing Tsuen, Chung Sam Wai, Sai Tau Wai and Yeung Uk Tsuen have a direct visual connection with the existing site and towards Kai Shan. Whilst the PH site is likely to provide tangible improvements in terms of public realm and visual amenity from this vicinity, particularly along Fuk Hi Street, some existing views from these villages towards Kai Shan will be obstructed.

The proposed layout and orientation of built form within the southern section of the site, running parallel to the Long Ping Road would maintain views through the site towards Kai Shan Hill from upper storeys within the Long Ping Estate.

Level differences between the site and upland terrain of Kai Shan would generate the requirement for engineered slopes and retaining walls in order to construct the required development platforms. It is considered that these structures would generate a negative impact where visible from Long Ping Estate and new residential and public area views within the site.

The road junction improvement works are likely to have a positive impact on visual amenity along Fuk Hi Street. This road is presently of low visual quality, mainly as a result of the interface with open storage functions. It is likely that a rationalised road scheme comprising landscape mitigation works, such as compensatory planting and uniform verge/paving treatments, would provide better visual amenity and enhancement of this development component.

A 50m landscape buffer has been provided between the PH and YLIEE sites to provide a visual 'break' between the industrial and residential landuses and to reduce the overall massing of built form. At lower levels this buffer will also provide additional screening and visual amenity.

Given the extensive alterations to the PH site and context of development to the north, east and south of the site, the development options are considered to be compatible within the receiving landscape.

Positive visual improvements are likely to be generated as a result of the removal of visually distracting open storage functions and low quality streetscape and replacement with a more coherent and visually appealing urban and landscape design with good compatibility with the adjacent Long Ping Estate. Negative impacts are likely to arise from large scale development encroaching into predominantly open rural fringe landscape. In this case, VSRs will experience a change in their view which could generate some minor impacts in relation to both options. However, Option 2 is likely to generate a lower level of visual impact as result of the reduced building heights. **Table 5.6.6** below provides a summary of the evaluation for the PH site options.

Table 5.6.6: Summary of evaluation for PH Site

	Option 1	Option 2
Protection and incorporation of high quality landscape resources.	• Cut and fill operations allow limited scope for retention of vegetation or natural land forms within the site boundary. • Space provided to allow positive landscape integration; provide high level of amenity and	• Cut and fill operations allow limited scope for retention of vegetation or natural land forms within the site boundary. • Space provided to allow positive landscape integration; provide high level of amenity and

	Option 1	Option 2
	compensatory landscape mitigation.	compensatory landscape mitigation.
Influence upon landscape character	• Removal of open storage functions would promote higher quality landscape character. • Loss of existing mature vegetation and natural land forms would have a negative impact. • PR of 5.5 would require an additional 2 no high rise buildings north of Long Ping Road.	• Removal of open storage functions would promote higher quality landscape character. • Loss of existing mature vegetation and natural land forms would have a negative impact. • Less residential towers are required however; 8 no 41 storey towers would be created.
Visual amenity and compatibility	• The PH Site will introduce tall and large scale built form which will be visible from numerous vantage points including residential areas. • Buildings heights will vary providing visual diversity responding to undulating hillside terrain in the background. • Views from points within neighbouring villages towards Kai Shan Hill will be obstructed. • Loss of high quality vegetation across the site as a result of cut and fill operations will have a negative influence on visual amenity in the short to medium term. • Engineered slopes and retaining walls on western boundary would likely generate adverse visual impacts. • Building height ranges are lower (26, 31 & 36 storeys).	• The PH Site will introduce tall and large scale built form which will be visible from numerous vantage points including residential areas. • Buildings heights will vary providing visual diversity responding to undulating hillside terrain in the background. • Views from points within neighbouring villages towards Kai Shan Hill will be obstructed. • Loss of high quality vegetation across the site as a result of cut and fill operations will have a negative influence on visual amenity in the short to medium term. • Engineered slopes and retaining walls on western boundary would likely generate adverse visual impacts. • Maximum building heights are slightly greater (26, 31, 36 & 41 storeys). • Less residential towers are required however; 8 no 41 storey towers would be created.
Recommendation	**Preferred**	-

5.6.2 Evaluation of YLIEE Options

The proposed YLIEE layout design is generally consistent between the two options however; the size of some of the lots varies due to the arrangement of the access road through the centre of the site and ground level is generally lower in Option B. In addition, Option B reduces the level of encroachment into the Kai Shan range by removal of one plot. In this case, the likely landscape and visual impacts will be similar for both options although the interface with the western boundary with Kai Shan varies.

Landscape Resources

In order to achieve the required development platforms within the YLIEE cut and fill works would require the removal of existing tree and shrub cover throughout the site. The northern section of the site comprises small agricultural plots (approximate 1.7ha) which would also be removed.

Several small watercourses pass through the development area, emanating from the uplands of Kai Shan. These have been significantly altered as a result of the open storage function of the site; in addition agricultural land uses have utilised these features and diverted the natural channels into a series of irrigation ditches. It is considered the proposed development layout would have limited impact on these resources due to their existing poor condition.

In the case of Option B, a key difference is the exclusion of a plot on the western boundary which sits within a low valley, and forms a spur of development towards Kai Shan. Whilst this zone has been developed previously, some woodland areas remain and would be protected by this scheme.

Amenity areas / pedestrian corridors are provided in both options however, the spaces in Option B are more substantial and the exclusion of the plot to the west of the site would allow the creation of additional green space with the potential to be designated at Green Belt. In addition, both options include an area of Local Open Space to act as a buffer between the YLIEE and PH site, this would provide important landscape amenity and potentially allow preservation of associated resources.

The majority of the YLIEE site is comprised of open storage functions which have heavily degraded the landscape resources within the site. It is likely that replacement with a more formalised industrial land use in these areas would not result in a discernible change in the quality of the landscape. To the north of the site lies a small area of agricultural land which would be replaced. In this case, given the sensitivity and rarity of the resource negative impacts are likely due to the resultant deterioration in the LR. In balance the overall level of impact on landscape resources is likely to be relatively small to medium for both options. The impacts associated with Option B will be lessened due to the reduced footprint and exclusion of the development plot to the west.

Landscape Character

The existing site has experienced varying levels of landscape degradation, mainly as a result of the open storage functions located off Fuk Hi Street. In this case the removal of this function and replacement with a formal and more visually coherent land use will assist in the promotion of a higher quality landscape character and identity.

The upland landscape to the west of the site, comprising Kai Shan and lower foothills is considered to be of high value in terms of landscape character. The encroachment of industrial land uses closer to Kai Shan is likely to have a negative influence on the distinctiveness of its character. The exclusion of the plot on the western boundary of Option B would partially reduce the extent of encroachment towards Kai Shan. Whilst this zone has been developed previously, some woodland areas remain and would be protected by this scheme.

In general the likely impacts on landscape character are similar for both options in that the overall extent of industrial landscape character would be increased and rural fringe landscape character area lost. As the majority of this site is currently of low landscape character value, this is likely limit the overall level of impact. The impacts associated with Option B are likely to be lessened by the reduced footprint and exclusion of the development plot to the west.

Visual Amenity

The proposed development will introduce large scale industrial built form into a site previously characterised by a mixture of open storage facilities and small scale agricultural plots. These structures would be seen as a continuation of the existing industrial estate to the east.

The principle visual receptors would be located within residential properties in the villages of Ng Uk Tsuen and Tai Tseng Wai to the north; the openness of views from these points would be reduced or partially obstructed.

In order to form the required development platforms, level differences between the site and upland terrain of Kai Shan would generate the requirement for engineered slopes and retaining walls. It is considered that these structures would generate a negative impact where implemented and certain mitigation measures such as slope planting and tree screening will be required.

The development platform levels differ between the two options with the proposed ground levels of Option B being lower by approximately 1-5 metres in places. The lower levels would help to reduce the overall visual obstruction caused by the proposed built form helping the development to 'sit' deeper into the landscape. In addition, retaining walls located along Fuk Hi Street would be slightly lower and less visually obtrusive.

The exclusion of the plot on the western boundary of Option B would significantly reduce the extent of earthworks in this area, avoiding further encroachment towards the natural hillside Kai Shan and appearance of engineered slopes and level platforms.

Due the large scale of the proposed development area, engineered slopes and visual association with the adjacent industrial area; it is likely that negative impacts will be experienced prior to mitigation in relation to both options. The impacts associated with Option B are likely to be lessened by the reduced footprint and exclusion of the development plot to the west. Visual improvements may be experienced by some VSRs, in particularly along Fuk Hi Street, as a result of the removal of views towards the open storage functions and upgrading of the streetscape. **Table 5.6.7** below provides a summary of the evaluation for the YLIEE options.

Table 5.6.7: Summary of evaluation for YLIEE Site

	Option A	Option B
Protection and incorporation of high quality landscape resources.	• Proposal will require full removal or alteration of existing landscape resources (watercourses, trees and shrubs). • Loss of agricultural land required. • Local open space provided.	• Proposal will require full removal or alteration of existing landscape resources (watercourses, trees and shrubs). • Loss of agricultural land required. • Local open space provided.

	Option A	Option B
		• Option B provides Green Belt land to the west of the site, below Kai Shan Hill peak.
Influence upon landscape character	• Industrial landscape character will encroach closer to Kai Shan Hill and overall area (including existing estate) will be increased. • Loss of agricultural landscape.	• Industrial landscape character will encroach closer to Kai Shan Hill and overall area (including existing estate) will be increased. • Loss of agricultural landscape. • Encroachment into Kai Shan Hill range reduced in Option B.
Visual amenity and compatibility	• Built form would be seen as a continuation of existing industrial area. • Views from villages to the north would be reduced or obstructed. • Overall visibility of industrial landscape (including existing estate) will be increased. • Engineered slopes and retaining walls on western boundary would have a negative impact.	• Built form would be seen as a continuation of existing industrial area. • Views from villages to the north would be reduced or obstructed. • Overall visibility of industrial landscape (including existing estate) will be increased. • Engineered slopes and retaining walls on western boundary would have a negative impact. • Overall footprint of development (including road access) reduced in option B. • Development platforms generally 1-5m lower. • Less intrusion into the Kai Shan area. • Retaining walls / features along Fuk Hi Street reduced in height.
Recommendation	-	**Preferred**

To address landscape and visual impacts for both PH and YLIEE sites due to the construction and operational stages, a number of landscape and visual mitigation measures are recommended as follows:

- Minimising topography change and providing visually interesting engineering slopes and earthwork which is compatible with surrounding landscape
- The construction sequence and works programme should be optimised to minimise the duration of impact.
- Decorative screen hoarding erected around the site to screen low level views of construction works.
- Substantial slope cutting should be avoided and vegetation should be planted where the slope gradient allow.
- Existing trees to be retained within the site should be carefully protected during construction, where retention is not possible transplantation should be considered.

- Compensatory tree planting for all felled trees should be provided to the satisfactory of relevant Government department.
- Tall screen/buffer trees and shrubs should be planted to screen proposed structures such as roads and buildings.
- Provision of roadside and amenity planting to compliment the urban design and enhance visual experience and character.

The form, textures, finishes and colours of the proposed building, engineered structure should aim to be compatible with the existing surroundings. The building design should be refined to reduce visual bulkiness. In addition light earthy tone colours should also be considered to enhance the compatibility of the development with the landscape setting.

5.7 Water Quality

The baseline review study has identified a number of existing water pollution sources in the vicinity of the Project site. These pollutant sources include agricultural lands, municipal and industrial discharges and road side runoffs. The discharges from these pollutant sources are currently collected by a number of streams running through the Project Site. All these streams will be diverted to the proposed peripheral drains at the slope toe along site boundary and connected to the proposed drainage system, and finally to Deep Bay.

The baseline review study has also identified that there are no available water quality monitoring data at the nullahs and streams within the Study Area. The nearest EPD's river monitoring stations are recorded at Yuen Long Creek next to Yuen Long On Ning Road (YL3 monitoring station) and Long Yip Street, upstream sections of Shan Pui River (YL4 monitoring station) and are not located within the same catchment of the Project Site. Hence, the monitored data would not be representative for the water quality baseline conditions within/near the Project Site. Therefore, additional baseline water monitoring covering both the dry and wet seasons has been proposed at 5 locations at streams within the Study Area, representing the overall picture of existing inland water quality, as shown in **Appendix 5.7.1**.

- Location A: Downstream of Tai Tseng Wai Nullah, collecting the majority of runoff from Wang Chau;
- Location B: Within Project Site, collecting runoff passing through agricultural land in eastern part;
- Location C: Within Project Site and next to current industrial area;
- Location D: In the south of Project Site, collecting domestic and industrial discharges within the site;
- Location E: In the west of Project Site and generally no water during dry season.

A summary of dry season monitoring results for the key parameters including 5-day Biochemical Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO) and pH are given in **Table 5.7.1** below. A summary of all monitoring data for dry season are presented in **Appendix 5.7.1**.

Table 5.7.1: Summary of key parameter monitoring results during dry season

Parameters	Criteria [1]	Monitoring Locations				
		A	B	C	D	E [2]
BOD_5 (mg/L)	<3	**8** (4-15)	**4** (3-5)	**3** (1-5)	**40** (12-61)	-
COD (mg/L)	<15	**27** (22-42)	**23** (14-36)	**22** (8-32)	**124** (58-221)	-
DO (mg/L)	>4.0	**3.7** (2.6-4.3)	**3.5** (2.2-5.0)	**1.6** (2.6-4.3)	**1.9** (1.1-3.0)	-
pH Value	6.5-8.5	7.8 (7.4-8.9)	7.0 (6.8-7.2)	6.9 (1.0-2.4)	**8.6** (7.7-9.2)	-

Note:
[1] WQO criteria in Deep Bay.
[2] There was no water during the monitoring period under normal weather condition at location E.
[3] The exceedances are shown under bold.

It can be noted from the above table that the water quality of the water bodies near the Project Site during dry season had high concentrations of BOD_5 and COD. The concentrations of DO for Monitoring Locations A – D were also below the criterion of 4mg/L. The exceedances of the WQO criteria are likely due to industrial and domestic activities nearby the streams. It is also found that the water quality was the poorest in Location D, since it is close to a direct discharge point of municipal sewage in the vicinity and it also collects industrial wastewater within the Project Site as well.

Other parameters such as suspended solids (SS), inorganic pollutants and heavy metals were also monitored during this sampling. The results are given in **Appendix 5.7.1**. High concentrations of heavy metals like copper, chromium, lead, and zinc in Location D were observed and they were about ten times higher than those annual concentrations monitored at YL3 and YL4 stations. It is anticipated that the industrial wastewater collected from the Project Site to Location D contained a very high levels of heavy metals.

Baseline water monitoring for wet season will be carried out in later stage, tentatively in July-August 2013. Once the wet season water quality monitoring is completed, the results would be consolidated with those collated during dry season to establish the water quality baseline conditions.

Other than the existing baseline conditions, the Water Sensitive Receivers (WSRs) in the vicinity of the Project site have also been identified. These WSRs include the uphill streams/seasonal streams, downstream Tai Tseng Wai Nullah, marsh and ponds. **Figure 5.7.1** shows the locations of the WSRs. It shall however be noted that the ecological surveys are still on-going and the list of WSRs would need to be revisited in the detailed assessment to be carried out in next stage.

During construction phase, construction activities such as site formation, road works, slope works, superstructure works, etc for the proposed development would generate site runoff and sewage from workforce, and hence are sources of water pollution. However, the impact can readily be controlled at-source by means of good site practices such as use of cofferdam during stream diversion. Thus, it is not considered in the option selection exercise.

The proposed development for PH site and YLIEE site would require land take of all existing premises within the Project Site, and hence would remove all existing water pollution sources within the Project Site. This would help alleviating the pollution loading to Deep Bay.

During the operational phase, the PH site would have additional sewage discharges from the future population. On the other hand, YLIEE Site would also generate sewage and industrial wastewater. The effluents will be connected to a sewerage system and pumped to YLSTW before final discharges to the water bodies. The potential impacts on existing sewerage system including the need of upgrading works on YLSTW and existing foul sewers, as well as the impact on compliance with requirements of "No net increase in pollution loads to Deep Bay" have already been reviewed in **Section 4.7** above. To summarize, the sewage flow projections in **Section 4.7** based on the forecasted population and future GFA has indicated that the 36,000m^3/day entitlement of YLSTW will not be exceeded for all development options. As the proposed EPS upgrading works at YLSTW would be designed to cater for the additional sewage flow from the proposed developments, there shall be no adverse impact on compliance with requirements of 'No net increase in pollution loads to Deep Bay'. As such, adverse water quality impacts due to the additional pollution loading from the proposed development are not anticipated.

After considering the above issues, the following evaluation criteria for water quality are proposed.

Table 5.7.2: Evaluation principle and criteria for water quality

Evaluation Principle	Evaluation Criterion
Protection of important stream and hydrology regime	Extent of stream diversions and project footprint.
Avoidance of water quality impacts on Deep Bay	"No net increase in pollution loads to Deep Bay

5.7.1 Evaluation of PH Options

Whilst Option 1 and Option 2 have different development parameters such as plot ratio, building height, GFA for retail areas etc, both options have the identical footprint. As discussed in previous section, all the existing pollution sources within the PH site would be removed during the site formation work and all streams within the Project footprint would be diverted and connected to new drainage system. According to the preliminary design at this stage, the scheme of the stream diversion would be identical for both options. Hence, both options would perform equally.

During operational phase, the PH development site would generate additional sewage that need to be connected to the sewerage system and pumped to YLSTW. According to the preliminary assessment, Option 1 will generate sewage flow of 9,386m^3/day ADWF; while Option 2 will generate 9,788m^3/day ADWF. The difference is about 4% and is not considered significant. As the proposed EPS upgrading works at YLSTW would be designed to cater for the additional sewage flow from the proposed developments, there shall not have additional pollution loading to the Deep Bay and the 'No net increase in pollution loads to Deep Bay' shall be achieved. It is therefore considered that both options would perform equally.

Table 5.7.3 below provides a summary of the evaluation for the PH options.

Table 5.7.3: Summary of evaluation for PH Site

	Option 1	Option 2
Extent of stream diversions and project footprint.	• All existing water pollution sources within the site would be removed and all streams within the Project footprint would be diverted to new drainage system.	• Same as Option 1. The drainage diversion scheme would be the same for both options.
"No net increase in pollution loads to Deep Bay	• No additional pollution loading to the Deep Bay.	• Same as Option 1.
Recommendation	No preference	No preference

5.7.2 Evaluation for YLIEE Options

Similar to PH site, all the existing water pollution sources within the YLIEE site would be removed during the site formation work and all streams within the Project footprint would be diverted and connected to new drainage system. According to the preliminary design at this stage, the scheme of the stream diversion would be identical for both options. Hence, both options would perform equally.

The operation of YLIEE would inevitably generate additional industrial wastewater and sewage during operation stage. According to the preliminary assessment, it is estimated that the future YLEE would generate wastewater (including both sewage and industrial wastewater) of 8,040m^3/day and 7,701m^3/day ADWF for Option A and Option B, respectively. The difference is only about 4 % and is not considered as significant. As the proposed EPS upgrading works at YLSTW would be designed to cater for the additional sewage flow from the proposed developments, there shall not have additional pollution loading to the Deep Bay and the 'No net increase in pollution loads to Deep Bay' shall be achieved. It is therefore considered that both options would perform equally.

Table 5.7.4 below provides a summary of the evaluation for the YLIEE options.

Table 5.7.4: Summary of evaluation for YLIEE site

	Option A	Option B
Extent of stream diversions and project footprint.	• All existing water pollution sources within the site would be removed and all streams within the Project footprint would be diverted to new drainage system.	• Same as Option A. The drainage diversion scheme would be the same for both options.
"No net increase in pollution loads to Deep Bay	• No additional pollution loading to the Deep Bay.	• Same as Option A.
Recommendation	No preference	No preference

5.8 Land Contamination

A desktop study and a series of site inspections have been conducted for the Project site (including both the PH site and the YLIEE site) to identify the

potential hot spots for land contamination. Based on the findings as presented in the TR-1 Baseline Review Report, the northern part of the Project site especially for the area within YLIEE, is currently occupied by various industrial activities such as vehicle/repair maintenance facilities, container storage areas, waste recycling workshops and open storage areas etc. These activities are classified as "Contaminated Land Types", according to EPD's *Practice Guide for Investigation and Remediation of Contaminated Land*.

On the other hand, the southern region of the Project site (i.e. southern part of PH site) is currently occupied by residential uses such as village houses, although there are some isolated industrial activities within this area. Hence, the southern part of the Project site is considered as having a much lower potential of land contamination. **Figure 5.8.1** illustrates the distribution of the industrial activities within the Project site.

It should be noted that environmental sampling for groundwater and soil samples are yet to be collected after land resumption and analysed to ascertain the presence and extent of any land contamination within the Project site. Once the contamination levels are ascertained, the need for any mitigation measures would be recommended according to the future land uses. According to EPD's *Guidance Manual for Use of Risk-Based Remediation Goals for Contaminated Land Management*, for the purposes of land contamination assessment, there are 4 types of land uses, including 1) Industrial; 2) Public Park; 3) Urban Residential and 4) Rural Residential. Type 1) Industrial uses would have the highest risk tolerance while Type 4) Rural Residential would have the lowest risk tolerance.

The future land use of the Project site comprises residential, education institution, social welfare facilities and PTI within the PH site; and industrial premises within the YLIEE site. These landuses are classified as Urban Residential and Industrial respectively in accordance with the EPD's *Guidance Manual for Use of RBRGs for Contaminated Land Management*.

After considering the above information, the following evaluation criterion is considered appropriate for land contamination.

Table 5.8.1: Evaluation principle and criterion for land contamination aspect

Evaluation Principle	Evaluation Criterion
Optimise the land use to minimise risk due to land contamination	Potential level of risk on future landuses due to land contamination

5.8.1 Evaluation of PH site

Both Option 1 and Option 2 for the PH site have the same landuse including residential, educational institution, social welfare facilities and PTI. The major difference in the development plans is that the two residential blocks near the southern access in Option 1 will be changed to a school site in Option 2.

It should be noted that the PH site is located in the southern part of the Project site where the potential for land contamination is relatively lower. The PH site as Urban Residential having a lower risk tolerance would therefore be more compatible to the existing landuses. Nevertheless, environmental sampling will be conducted after land resumption to ascertain the presence and extent of any land contamination within the PH site.

Although the exact extent of land contamination is yet to be ascertained, both options would have similar performance as far as land contamination is concerned. A summary of the PH options in relation to the land contamination is provided in **Table 5.8.2** below.

Table 5.8.2: Comparison of land contamination issues for different PH options

Evaluation Criterion	Option 1	Option 2
Potential level of risk on future landuses due to land contamination	• The future landuses planning (i.e. PH in southern region) is generally compatible with existing landuses for both options, so the same performance is proposed.	• Same as Option 1.
Recommendation	No preference	No preference

5.8.2 Evaluation of YLIEE site

YLIEE site is allocated in the northern part in which there are existing industrial premises such as waste recycling plants, vehicle and heavy equipment repairing workshops, metal workshops, container storage yards and warehouses etc. These facilities are considered of having a higher potential for land contamination.

The YLIEE is an industrial use which has a highest risk tolerance and hence is considered compatible with the existing industrial uses in the northern part. Both Option A and Option B will be mostly occupied by industrial lots, except for the slope area, green buffer and parking space at western side. The more stringent RBRG "Public Park" will be applied for these kinds of landuses as compared to that of "Industrial" for industrial uses. The area of slope area, green buffer and parking space of Option B is slightly larger than that of Option A. However, since the difference in these areas between Options A and B is insignificant (approximately 0.5ha only), the difference in extent of potential remediation works required (if contamination is confirmed after environmental sampling is conducted at a later stage) at these areas should not be significant.

A summary on the comparison of the YLIEE options in relation to the land contamination is provided in **Table 5.8.3** below.

Table 5.8.3: Comparison of land contamination issues for different YLIEE options

Evaluation Criterion	Option A	Option B
Minimise the risk due to land contamination	• The future landuses planning (i.e. industrial) is generally compatible with existing landuses.	• The future landuses planning (i.e. PH in southern region) is generally compatible with existing landuses. • Difference in area of slope area, green buffer and parking space between Options A and B is insignificant (approximately 0.5ha only), thus the difference in extent of potential remediation works required should not be significant. Same performance is proposed.
Recommendation	No preference	No preference

5.9 Waste

Both the construction and operational phases of the Project would inevitably generate wastes that need to be disposed / managed off-site. During the construction phase, the site formation work would require some slope-cutting, demolition etc at some areas and the inert spoil could be used for filling work in some other areas. One of the design objectives would be to target for a balanced cut-&-fill design for the site formation work which would minimize the need for import of fill material and export of spoil from site for final disposal. It would also help to demand less number of construction vehicles transporting C&D materials into or leaving the Project site, and thus minimize unnecessary secondary environmental impacts such as noise and vehicular emission from construction vehicles.

During the operational phase, the population in the PH would generate mainly domestic solid wastes that need to be eventually transported and disposed of. Besides, the operation in the YLIEE would generate various types of industrial wastes that also need to be transported and disposed of. According to the information on YLIE collated during the Baseline Review Stage, industrial waste that could be generated from YLIEE may include scrap metals, waste plastic and paper, waste wood pallets, sludge, and various chemical wastes such as spent lube oil, waste lubricant, organic solvent and waste battery etc.

In view of the above consideration, the proposed evaluation criteria for waste are related to the total estimated amounts of the C&D materials required for off-site disposal during construction stage and the total estimated amounts of wastes generated from PH and YLIEE sites during its operational stage. They are summarised as follows.

Table 5.9.1: Evaluation principle and criterion for waste aspect

Evaluation Principle	Evaluation Criterion
Minimise amount of C&D materials generation during construction stage	Amount of C&D materials required for off-site disposal during construction stage
Minimise amount of waste generation during operational stage	Amount of domestic waste generated from PH site
	Amount of industrial waste generated by YLIEE site

5.9.1 Evaluation for PH site

Amount of C&D materials

The preliminary design for the site formation work has been worked out for the current development plans (see **Section 4.3**). It has taken into account various considerations including impacts on natural slope, cut slope stabilization, development area, drainage, vehicular and pedestrian access requirements etc. Although the preliminary design would still yet to evolve further in the next stage of the study, it would serve as the basis for estimating the quantity of cut and fill for the two options for purpose of this option evaluation study.

The following table summarises the estimated quantities of cut and fill for the two PH options.

Table 5.9.2: Initial estimate of C&D materials for the two PH Options

		Option 1	Option 2
Quantity of Cut (m^3)		277,500	277500
Quantity of Fill (m^3)		142,500	142,500
Balance (m^3)	Import	--	--
	Export	135,000	135,000

Currently, the site formation levels for the two PH options are the same. Hence the cut-&-fill balances for the two options are also the same. The net amount of C&D materials that required to be exported is 135,000m^3. It is considered that they perform equally in this aspect.

Amount of Domestic Waste Generated by PH site

The amount of domestic waste generated by the PH site during operational stage would be related to the planned population of the two options. According to the latest published information from "EPD Monitoring of Solid Waste in Hong Kong – Waste Statistics for 2011", the per capita domestic waste disposal rate is 0.84 kg/person/day in 2011. Based on this figure, the estimation of domestic waste of the two options is summarized in **Table 5.9.3**.

Table 5.9.3: Estimated amount of domestic waste generation from PH site

	Option 1	Option 2
Plot Ratio	5.5	6.0
Population	47,938	49,872
Waste Generation Rate (kg/person/day) [1]	0.84	0.84
Amount of Domestic Waste (tonnes/year)	14,698	15,291

Note:

[1] The "Year 2011 Per Capita Domestic Waste Disposal Rate (0.84 kg/person/day)" extracted from "EPD Monitoring of Solid Waste in Hong Kong – Waste Statistics for 2011" is adopted.

Assuming the same provision of the solid waste recycling measures / strategies for both options, the amount of domestic wastes that requires final disposal for Option 2 would be slightly greater than that of Option 1 during operational stage. However, the difference is considered insignificant (approximately 4% only). Irrespective of the options, sustainable waste management strategy shall be considered and investigated during the operational stage, such as inorganic waste sorting (i.e. plastic, paper and aluminium cans) and food waste collection for subsequent composting etc, which will reduce the quantity of domestic waste required for final disposal.

A comparison of the PH options in relation to the waste is provided in **Table 5.9.4** below.

Table 5.9.4: Comparison of waste issues for different PH options

Evaluation Criterion	Option 1	Option 2
Amount of C&D materials required for disposal during construction stage	• Net amounts of C&D materials need to be exported is 135,000m^3	• Same as Option 1
Amount of domestic waste generated from PH site	• 14,698 tonnes per year	• 15,291 tonnes per year, the difference between the two options is insignificant.
Recommendation	No preference	No preference

5.9.2 Evaluation for YLIEE site

Amount of C&D materials

Despite the cut-&-fill balances of the two PH options are similar (i.e. refer to **Section 4.3.1**), the cut-&-fill balances of the two YLIEE options are different due to the different site platform level designs (i.e. refer to **Section 4.3.2**). The following table summarises the quantities of cut and fill for the two YLIEE options. However, when comparing the options, the overall cut and fill balances for the entire site shall be assessed.

Table 5.9.5: Initial Estimate of C&D materials of 2 YLIEE Options

		Option A	Option B
Quantity of Cut (m^3) for YLIEE		106,000	113,000
Quantity of Fill (m^3) for YLIEE		297,000	148,000
Total Estimated Cut Volume for both YLIEE and PH site (m^3)		383,500	390,500
Total Estimated Fill Volume for both YLIEE and PH site (m^3)		439,500	290,500
Balance (m^3)	Import	56,000	--
	Export	--	100,000

It can be seen from the above table that Option A is the preferable option as it could achieve a better overall cut-&-fill balance (i.e. net import of 56,000m^3) than Option B which would generate a surplus of spoil material (i.e. 100,000 m^3).

Should Option B be selected as the preferred option, the site formation level design needs to be revisited and the opportunities for re-use of the C&D material on site would be explored in more detail in order to minimize the amount of this material required for final disposal.

Amount of Industrial Waste Generated by YLIEE

The total GFA of YLIEE site is approximately 301,500m^2 and 288,800m^2 for Option A and Option B respectively. As advised by HKSTP, the YLIEE would target on 3 major categories of industries including:

- Machinery and equipment manufacturing;
- Biotechnology related production; and
- Pharmaceutical.

However, the mix between these 3 categories of industries is not known. For the purposes of this option evaluation, it is assumed that each category of these three industries would share the same proportion of occupancy at YLIEE in future (i.e. each shares one third of the GFA) for both options.

As part of the baseline review study, information on the amount of industrial waste generation from each of the tenancies in existing YLIE has been collated. The information on waste generation has been categorized according to their types of industries and the industrial waste generation rates for each type of existing industries have been derived.

Assuming that the waste generation rates for the 3 categories of industries in future YLIEE would be the same as those of similar types in existing YLIE, the amount of industrial waste generation for two YLIEE options has been estimated in **Table 5.9.6**.

Table 5.9.6: Summary of industrial waste generation of different YLIEE options

	Option A			Option B		
Total GFA (m^2)	301,500			288,800		
Industrial Types	Machinery & Equipment Manufacturing	Biotechnology Related Production [2]	Pharmaceutical	Machinery & Equipment Manufacturing	Biotechnology Related Production [2]	Pharmaceutical
GFA (m^2)	105,000	105,000	105,000	96,267	96,267	96,267
Waste Generation Rate (kg/day/m^2) [1]	4.91×10^{-3}	1.52×10^{-3}	1.52×10^{-3}	4.91×10^{-3}	1.52×10^{-3}	1.52×10^{-3}
Amount of Industrial Waste (tonnes/year)	188.2	58.3	58.3	172.5	53.4	53.4
Total Amount of Industrial Waste (tonnes/year)	304.8			279.3		

Note:

[1] The Waste Generation Rate is devised from the baseline information gathered from existing tenants of YLIE during the baseline review stage.

[2] No baseline information of "Biotechnology Related Production", so the waste generation rate of "Pharmaceutical" is adopted.

It can be seen from the above table that Option A would generate slightly more industrial waste than Options B. However, the difference is considered very insignificant (only 2%).

A comparison of the YLIEE options in relation to the waste is provided in **Table 5.9.7** below. Option A is the preferable option as it could achieve a better overall cut-&-fill balance. Should Option B be selected as the preferred option, the site formation level design needs to be revisited and the opportunities for re-use of the C&D material on site would be explored in more detail in order to minimize the amount of this material required for final disposal.

Table 5.9.7: Comparison of waste issues for different YLIEE options

Evaluation Criterion	Option A	Option B
Amount of C&D materials required for disposal during construction stage	• Together with the PH site, a 56,000m^3 cut-&-fill to be imported.	• Together with the PH site, a surplus of 100,000 m^3 spoil material to be exported.
Amount of industrial waste generated by YLIEE site	• 304 tonnes per year	• 279.3 tonnes per year, the difference between the two options is insignificant.
Recommendation	**Preferred**	-

6 PREFERRED DEVELOPMENT OPTION

6.1 Summary of Evaluation on PH Options

6.1.1 Planning and Urban Design, Land Requirement and Air Ventilation

Table 6.1.1 below summarises the comparison and evaluation of the PH options from planning and urban design, land requirement and air ventilation perspectives.

Table 6.1.1: Summary of the Evaluation for PH Options from planning and urban design, land requirement and air ventilation perspectives

Evaluation Criteria	Option 1	Option 2
Urban Planning and Design		
Meeting housing demand by maximizing flat production	• A total of 15,615 flats will be provided	• A total of 16,245 flats will be provided
Provision of sufficient G/IC facilities for the proposed development	• 1 Integrated Social Welfare Building will be provided • 3 primary schools (1 can be secondary school) will be provided, fulfilling the HKPSG requirement	• 1 Integrated Social Welfare Building will be provided • 4 primary schools (1 can be secondary school) will be provided, fulfilling the HKPSG requirement
Provision of sufficient local open space for the proposed development	• Local open space of 1m² per person including uses of basketball court, mini-soccer pitch (7-a-side) and children playground will be provided, fulfilling the HKPSG requirement	• Same as Option 1.
Provision of sufficient pedestrian access to neighbouring community facilities and infrastructures	• Sufficient pedestrian access is provided.	• Same as Option 1.
Improvement in connectivity to Kai Shan	• Sufficient linkage is provided.	• Same as Option 1.
Integration of proposed development with surrounding natural topography	• The surrounding natural landscape is being respected and sufficient buffer area is provided.	• Same as Option 1.
Integration of proposed development with surrounding built form	• The surrounding built form is being respected and integrated well with the proposed one.	• Same as Option 1.
Preservation of visual connection to Kai Shan	• View corridor to Kai Shan is preserved.	• View corridor to Kai Shan is preserved. The view corridor near Fung Chi Tsuen is wider than Option 1.
Recommendation	-	**Preferred**
Land Requirement		
Extent of private land lots to be affected	• A total of about 129,245 m² private land lots will be affected.	• Same as Option 1.

Evaluation Criteria	Option 1	Option 2
Extent of existing accesses of roads, cycle tracks, tracks, foot paths, bus stops/lay-bys, Railway Protection Boundary, West Rail EAP, watercourses and nullahs etc to be affected	• Diversion of watercourses flowing across the Project site required. • Road improvement works including reprovision of bus stops/lay-bys on Fuk Hi Street and Long Ping Road to cater for PH development. • Existing accesses of tracks and footpaths connecting to graves on Kai Shan needs to be reprovisioned. • Accesses to those existing rural settlements and occupations which are outside the project limit and would be rendered land-locked as a result of the proposed PH development should also be reprovided. • Encroachment onto Railway Protection Boundary. Consent from the Building Authority before commencement of works required.	• Same as Option 1.
Recommendation	No preference	No preference
Air Ventilation		
Main streets / wide main avenues should be aligned in parallel, or up to 30 degrees to the prevailing wind direction	• The main streets within the PH site are aligned approximately parallel to the annual prevailing wind direction.	• Same as Option 1.
Building height variation across the district with decreasing heights towards the direction where the prevailing wind comes from	• Blocks 1 to 14 are distributed in 2 groups stepping down from 111mPD to 94mPD towards the annual prevailing wind direction from ENE.	• Blocks 1 to 14 are distributed in 3 groups stepping down from 124mPD to 94mPD towards the annual prevailing wind from ENE.
Adequately wide gaps between building blocks	• Adequate gaps (>10m) between buildings is allowed to maximize the air permeability. • A 50m buffer is provided between PH site and YLIEE site. This buffer can also enhance the air permeability.	• Same as Option 1. • In addition, two residential blocks (26 storeys) in the southern tip of the site are replaced by a school (maximum of 8-storey) in Option 2. This would make Option 2 more favourable to facilitate wind flow passing through the buildings.
The angle between the axis of the building blocks and the prevailing wind direction should be within 30 degrees	• The major axis of Blocks 8 to 14 in the central portion of the site is aligned in ENE direction.	• Same as Option 1.
Recommendation	-	**Preferred**

Both Option 1 and 2 perform well in the sense that they could make use of the PH site and achieve optimal development intensity, provide sufficient GIC facilities,

local open space and other ancillary facilities e.g. retail space and PTI. Both options could also offer a pleasant environment with adoption of stepped building height profile, provisions of sufficient visual corridors and pedestrian access to Kai Shan. Besides, the proposed layouts of internal roads and retail space are efficient and well designed under both options. Single Aspect Buildings were proposed in some areas of the PH site to address the potential noise issues. A 50m buffer is also proposed between the PH site and the YLIEE site, which could enhance the environment of the vicinity.

On the other hand, there are some differences in land use proposal and urban design between Option 1 and 2. Option 1 adopts a domestic PR of 5.5 while Option 2 employs a domestic PR of 6. As a result of this, Option 2 would provide 630 more flats than Option 1 (15,615 flats in Option 1 and 16,245 flats in Option 2). Besides, building height ranges from 26 to 36 residential storeys in Option 1 and 26 to 41 residential storeys in Option 2. The layouts of the two options also vary with major differences stemming from the replacement of the two residential towers in Option 1 by one more school in Option 2. As a result, the view corridor from Fung Chi Tsuen (to the south of the PH site) towards Kai Shan is wider in Option 2 than that of Option 1.

Based on the above, it is considered that Option 2 is more preferable than Option 1 in terms of planning and urban design. Putting aside the common elements of the two options, Option 2 can provide 630 more flats, making more contribution to alleviating the strong public housing demand in the territory. Option 2 can also allow a wider view corridor from Fung Chi Tsuen to Kai Shan.

In terms of land requirement, since the development area for the two PR options is the same, the extent of the land take on the private lots and impacts on existing accesses of roads, cycle tracks, tracks, foot paths, bus stops/lay-bys, Railway Protection Boundary, West Rail EAP, watercourses and nullahs etc. to be affected will be the same.

Whereas from air ventilation point of view, the main access road and major axis of building blocks are aligned approximately parallel to the annual prevailing wind direction in ENE, and adequate gaps between buildings and a 50m buffer between PH and YLIEE sites are provided to maximize the air permeability for both options. The stepped building height profile would help wind deflection and avoid air stagnation. The major difference between the two options is that the two high-rise residential towers (26 storeys) in Option 1 are replaced by a school (maximum of 8-storey) in Option 2. This makes Option 2 more favourable to facilitate wind flow passing through the buildings. It is considered that the building layout arrangements in Option 2 are more preferable from perspective of air ventilation.

6.1.2 Engineering and Infrastructure

Table 6.1.2 below summarises the comparison and evaluation of the PH options from different engineering aspects and infrastructures perspectives.

Table 6.1.2: Summary of the Evaluation for PH Options from engineering and infrastructures perspectives

Evaluation Criterion	Option 1	Option 2
Traffic and transport		
Extent of junctions to be affected	• No junction performs with RC below 0% or DFC above 0.85 for	• 5 junctions perform with RC below 0% or DFC above 0.85

Evaluation Criterion	Option 1	Option 2
	both AM or PM peaks.	for both AM or PM peaks.
Coverage of public transport facilities within the proposed developments	• A public transport interchange has been proposed between PH and YLIEE.	• Same as option 1.
Connectivity between the proposed development and Yuen Long Town	• A comprehensive pedestrian. network has been developed to serve between the PH, Yuen Long Town and West Rail Long Ping Station.	• Same as option 1.
Recommendation	**Preferred**	-
Geotechnics and Foundation Works		
Foundation requirements for residential tower buildings for different options.	• Piled foundations for 36 storey Residential Towers: end-bearing piles socketed into competent rock (5 metres continuous Grade III or better with a minimum core recovery of 85%). Where rockhead is encountered deeper than 100mbgl, friction piles may be required.	• As Option 1, but an increase in the number of piles required per tower in order to take additional load of the 41 storey towers. However, two less towers as compared with Option 1, which are replaced by a school in Option 2.
Foundation requirements for maximum 8 storey schools and other non-residential buildings for different options.	• Pre-bored H-piles and mini-piles socketed into rock (5 metres continuous Grade III or better with a minimum core recovery of 85%). Where deep rockhead is encountered friction piles may be a solution.	• Foundation requirements same as Option 1, but with one additional school building in place of two residential towers.
Recommendation	No preference	No preference
Site formation		
Optimisation of site formation to ensure maximum area of development subject to other criteria detailed below.	• The proposed PHD site comprises approximately 179,000m^2.	• Same as Option 1.
Determination of suitable platform levels that are in keeping with the surrounding area, whilst meeting criteria for drainage, pedestrian and vehicle access	• The proposed PH site comprises a large main platform sloping from +9mPD at its western boundary, sloping to the east to +6mPD. A section of the PH site then branches off to the south, where platform levels increase in elevation towards the south from +6mPD to +13mPD as shown in **Figure 4.3.1**.	• Same as Option 1, as shown in **Figure 4.3.2.**
Minimise cut and fill quantities in order to reduce total excavation and export of spoil, and import of fill	• Cut and fill volumes for the PH site are approximately 277,500m^3 and 142,500m^3 respectively.	• Same as Option 1.
Where possible, avoid steepening of slopes and use of retaining structures	• Where slopes are proposed adjacent to natural terrain, these are proposed to be 30^o in order to	• Same as Option 1.

Evaluation Criterion	Option 1	Option 2
which negatively impact on aesthetics	allow more aesthetically pleasing vegetated slopes, and avoid the need for soil nails which would extend beyond the site boundary. In locations where a 30° slope would encroach onto the building or road footprints, the slopes will be combined with bored pile retaining walls. • Where retaining walls are proposed along the eastern site boundary, they can be designed to be stepped with planter boxes to provide a more aesthetically pleasing view.	
Minimise fill works to reduce the likelihood of settlement induced from additional loading of the ground and any potential existing compressible soils	• Platform height has been designed to reduce from west to east across the PH site to minimize fill placement in likely to be underlain by compressible soils, taking into account other practical requirements such as drainage and access.	• Same as Option 1.
Recommendation	No preference	No preference
Existing Registered Features		
Minimise modification of existing slopes	• It is anticipated that 3 No.of slopes will require modification. 2 No. of slopes will require further assessment and may need upgrading.	• Same as Option 1
Recommendation	No preference	No preference
Natural Terrain Hazards		
Screening criteria as set out in GEO Report 138: proximity of facilities to slope and slope angle; identification of potential and past instability	• Potential for natural terrain hazards impacting on the PH site from 8 Nos. of catchments, with evidence of historical instability.	• Same as Option 1.
Extent of mitigation measures required to be kept to a minimum	• Flexible barriers outside the Project site are likely to be required along the footslopes of 8 No of catchments located around the mid portion of the western site boundary.	• Same as Option 1.
Avoidance of impacts on graves and access to graves	• Mitigation measures can be located to avoid contact with existing graves, whilst maintaining access routes.	• Same as Option 1.
Recommendation	No preference	No preference
Stormwater Drainage		
Impacts on existing watercourses within Project site	• Diversion of existing watercourses within Project site required.	• Same as Option 1.
Impacts on existing Tai	• Minimal hydraulic impacts on	• Same as Option 1.

Evaluation Criterion	Option 1	Option 2
Tseng Wai Channel	existing Tai Tseng Wai channel downstream to Project site due to insignificant increase in paved area.	
	• Diversion of section of existing Tai Tseng Wai Channel within Project site required.	• Same as Option 1.
Impacts on surface runoff from Kai Shan	• Construction of peripheral drains alongside Project site boundary required.	• Same as Option 1.
Impacts on existing storm drains along Long Ping Road	• Upgrading of existing storm drains along Long Ping Road might be required.	• Same as Option 1.
Impacts on existing storm drains along Fuk Hi Street	• Upgrading of existing storm drains along Fuk Hi Street might be required.	• Same as Option 1.
Recommendation	No preference	No preference
Sewerage		
Impacts on Yuen Long Sewage Treatment Works (YLSTW)	• No adverse impacts on existing YLSTW as the 36,000m^3/day entitlement was not exceeded. Same for all options.	• Same as Option 1.
Impacts on compliance with requirements of "No net increase in pollution loads to Deep Bay"	• Compliance with requirements of "No net increase in pollution loads to Deep Bay" as the 36,000m^3/day entitlement was not exceeded. Same for all options.	• Same as Option 1.
Impacts on existing foul sewers in YLIE	• Upgrading of existing foul sewers in YLIE might be required to cater for the additional sewage flow. Same for all options.	• Same as Option 1.
Recommendation	No preference	No preference
Water Supply		
Impacts on planned salt water supply system from Lok On Pai and Tan Kwai Tsuen	• There is no spare capacity to cater for the flushing water demand from Project site.	• Same as Option 1.
Impacts on fresh and flushing water supply systems within Project site	• Construction of new Temporary Mains Water for Flushing (TMF) within Project site proposed to provide a separate flushing water supply system.	• Same as Option 1.
Impacts on operation of Au Tau Water Treatment Works (ATWTW) in parallel with Ngau Tam Mei Water Treatment Works (NTMWTW)	• Operation of ATWTW in parallel with NTMWTW would have adequate capacity to cater for the additional water demand and hence no adverse impacts.	• Same as Option 1.
Impacts on Wang Chau Fresh Water Service Reservoir (WCFWSR)	• No adverse impacts on WCFWSR as it would have adequate capacity to cater for the additional water demand.	• Same as Option 1.

Evaluation Criterion	Option 1	Option 2
Impacts on DN900 fresh water distribution mains along Fuk Hi Street	• No adverse impacts on DN900 fresh water distribution mains along Fuk Hi Street as it would have adequate capacity to cater for the additional water demand & adequate residual head at the proposed water mains.	• Same as Option 1.
Recommendation	No preference	No preference
Other Utilities		
Impacts on existing medium pressure gas main within Project site	• Construction of valve chambers on existing medium pressure gas main and tee-off new gas mains required.	• Same as Option 1.
Impacts on existing power cable within Project site	• Construction of cable draw-pits on existing medium pressure power cable and tee-off new power cables required.	• Same as Option 1.
	• Diversion of existing power cable required.	• Same as Option 1.
Impacts on existing communication cables within Project site	• Construction of cable draw-pits on existing communication cables and tee-off new power cables required.	• Same as Option 1.
	• Diversion of existing communication cable required.	• Same as Option 1.
Recommendation	No preference	No preference

Overall, the requirements for geotechnics and foundation works, site formation and natural terrain hazard mitigation measures, as well as the impacts on existing registered/slope features, stormwater drainage system, sewerage system, water supply system and other utilities are considered more or less the same for both PH options. There is in general no preference on the two PH options with respect to the engineering and infrastructure aspects, except for traffic.

Although the number of piles required per tower is likely to be greater for Option 2 because of the increased height of the towers, the increased cost of foundations for the residential towers should be approximately in proportion to the increase in the provision of residential floor area. Option 2 has higher towers, but two residential towers are replaced by a school which will require less piles. Thus there is no preference between the two options in relation to foundation requirements. Besides, since the extent of site formation work is the same for both options, the proposed site platform levels, cut slopes and retaining wall structures and thus the associated cut and fill quantities and the impact on the existing registered/slope features will be the same for both options.

Since the layouts of the two development options are very similar, the impact on existing watercourses/storm drains and the requirements for upgrading works on existing storm drains for both options are the same. Besides, the projected sewage flows under various development options are in the same order and the 36,000m^3/day entitlement will not be exceeded. The scale of anticipated sewerage improvement works required will also be the same for all options. For both options, it is proposed to operate ATWTW in parallel with NTMWTW in long

term to supply fresh water within the supply zone. It is also identified that the nearby WCFWSR and existing DN900 MS fresh water distribution main running along Fuk Hi Street would have enough capacity to cater for the additional water demand arising from the proposed developments regardless the development options. Requirements for the construction and diversion of gas main, power cables and communication cables are also the same for various development options. There is no preference between the two options in relation to these engineering and infrastructure aspects.

In terms of traffic and transport perspective, a public transport interchange will be proposed to serve the development for both options. As both PH Options share the same overall layout, the pedestrian accessibility within the site and connectivity to Yuen Long Town and West Rail would be the same. Despite Option 2 would generate and attract more traffic compared with Option 1, it is considered that there are no insurmountable impacts from traffic point of view for both options, given that suitable traffic improvement works are provided.

6.1.3 Environmental Impacts

Table 6.1.3 below summarises the comparison and evaluation of the PH options from environmental perspectives.

Table 6.1.3: Summary of the Evaluation for PH Options from environmental perspectives

Evaluation Criteria	Option 1	Option 2
Air Quality		
Provision of sufficient separation distance between the YLIE and the residential development to ensure compliance with the new AQO	• Sufficient separation has been allowed between YLIE and PH development and assessment results show that the new AQO could be met.	• Same as Option 1.
Provision of sufficient separation distance between Long Ping Road & Fuk Hi Street and the residential development to ensure compliance with the new AQO	• Sufficient separation has been allowed between roads and PH development and assessment results show that the new AQO could be met.	• Same as Option 1.
Extent of further mitigation measures/building constraints (e.g. height restriction, further setback)	• No mitigation measures are required.	• Same as Option 1.
Recommendation	No preference	No preference
Noise		
Road traffic noise		
Compliance with road traffic noise criteria	• Compliance with the road traffic noise criteria could be achieved given appropriate mitigation measures are provided.	• Same as Option 1.
Extent of on-site mitigation measures required	• In order to comply with the noise criteria for the proposed residential blocks in PH site, mitigation measures including structural fin, barrier above retail roof, acoustic window are	• Similar mitigation measures including structural fin, barrier above retail roof, acoustic window are required. • School 3 (at east facades) and School 4 (at all facades) shall

Evaluation Criteria	Option 1	Option 2
	required. The layout in Option 1 differs from Option 2 in that there are two more residential towers located in the southern tip of the PH site while in Option 2, they are replaced with an additional school (School 4). This would bring about more traffic on the southern access road for Option 1. Extent of mitigation measures required for residential blocks for Option 1 is likely to be larger than Option 2. • School 3 (at south facade for Option 1) shall be provided with appropriate acoustic insulation in form of upgraded windows and air conditioning in accordance with HKPSG.	be provided with appropriate acoustic insulation in form of upgraded windows and air conditioning in accordance with HKPSG. Extent of mitigation measures required for the proposed schools in PH site is likely to be larger for Option 2 than Option 1.
Extent of off-site mitigation measures on existing roads required	• At source mitigation measures such as roadside noise barrier, enclosure and low noise surfacing would be required to protect the existing receivers.	• At source mitigation measures such as roadside noise barrier, enclosure and low noise surfacing would be required to protect the existing receivers. • Extent of these structures required is likely larger for Option 2 than Option 1.
Rail noise		
Compliance with rail noise criteria	• Compliance with the rail noise criteria could be achieved given appropriate mitigation measures are provided.	• Same as Option 1.
Extent of on-site mitigation measures required	• No on-site mitigation measures are required for residential blocks and schools. • Some constraints on the internal floor layout plan of ISWB would need to be imposed in order to meet the night time criterion. On the south wing of the ISWB, it would generally be restricted to facilities/uses with daytime activities only while on the north wing of the ISWB, there would have no restriction on the uses.	• Same as Option 1.
Extent of off-site mitigation measures on existing WR viaduct required	• No off-site mitigation measures are required.	• Same as Option 1.
Fixed noise		
Provision of sufficient separation distance from	• With assumption that the noise emission from YLIEE would be	• Same as Option 1.

Evaluation Criteria	Option 1	Option 2
existing and planned fixed noise sources to ensure compliance with the noise criteria	properly controlled, the current separation distance to the existing industrial noise sources in YLIE and planned sources in YLIEE would be required to control the fixed noise impacts in order to comply with the relevant noise criteria.	
Extent of building mitigation measures required	• With assumption that the noise emission from YLIEE would be properly controlled, no mitigation measures on the residential buildings on PH site are required.	• Same as Option 1.
Extent of at-source noise control measures required e.g. enclosure, barrier/cover, silencer etc	• Noise emission from YLIEE needs to be controlled by means of good practice and appropriate at-source noise control measures including no loading and unloading activities during night-time period, loading and unloading only at designated location where should be blocked by the industrial building itself, or designed with a top cover where necessary, locating the noise sources such as chillers / processing plant on the roof of the nearest industrial lots (i.e. lot 1-4) away from PH site as far as possible, use of acoustic enclosure, silencer, low noise equipment design etc for all sources such as chillers / processing plant on the roof of all industrial lots in YLIEE to achieve a noise reduction of 30 dB(A).	• Same as Option 1.
Recommendation	**Preferred**	-
Ecology		
Preservation/ enhancement of habitats of ecological importance and/or avoid/minimise any significant residual impacts to these areas	• Secondary woodland (0.98ha) and orchard in the southern portion (0.80ha) are potentially of ecological value and a total of approximately 1.78ha of these habitats will be lost due to the development. • Natural streams may be evaluated as of ecological significance (pending completion of ecological field surveys). If assessed as of ecological significance, use of ecologically friendly channelization methods would be appropriate, if feasible. • No breeding/nursery ground of species of conservation significance was identified during	• Same as Option 1.

Evaluation Criteria	Option 1	Option 2
	the preparation of this report.	
Avoid/minimise impacts to the recognised sites of ecological concern with no significant residual impact	• No direct impacts on the sites of ecological concern. • No significant additional disturbance to the sites of ecological concern.	• Same as Option 1.
Recommendation	No preference	No preference
Fisheries		
Preservation/ enhancement of active/ inactive fishponds and/or avoid/minimise any significant residual impacts to these fishponds	• No fishpond was identified within the development footprint. • No active fishpond was identified within the Study Area. • Inactive fishponds were identified in the Study Area and they are not going to be lost physically. Given that the relevant ordinances are followed, pollution to these inactive fishponds from the development will not occur and resumption of fish culture is practicable.	• Same as Option 1.
Avoid/minimise impacts to the abandoned fishponds	• Abandoned fishponds were identified in the Study Area and they are not going to be lost physically. Given that the relevant ordinances are followed, pollution to these inactive fishponds from the development will not occur and resumption of fish culture is practicable.	• Same as Option 1.
Recommendation	No preference	No preference
Cultural Heritage		
Conservation of Areas of Archaeological Potential or interest	• Encroach onto the area of archaeological potential in the centre of the PH site.	• Same extent of encroachment onto the area of archaeological potential in the centre of the PH site.
Respect to Built Heritage Resources	• Preservation of the Pak Kung Shrine and historical well and its shrine in-situ as part of the PH site.	• Same as Option 1.
Recommendation	No preference	No preference
Landscape & Visual		
Protection and incorporation of high quality landscape resources.	• Cut and fill operations allow limited scope for retention of vegetation or natural land forms within the site boundary. • Space provided to allow positive landscape integration; provide high level of amenity and compensatory landscape mitigation.	• Cut and fill operations allow limited scope for retention of vegetation or natural land forms within the site boundary. • Space provided to allow positive landscape integration; provide high level of amenity and compensatory landscape mitigation.
Influence upon landscape character	• Removal of open storage functions would promote higher quality landscape character.	• Removal of open storage functions would promote higher quality landscape character.

Evaluation Criteria	Option 1	Option 2
	• Loss of existing mature vegetation and natural land forms would have a negative impact. • PR of 5.5 would require an additional 2 no high rise buildings north of Long Ping Road.	• Loss of existing mature vegetation and natural land forms would have a negative impact. • Less residential towers are required however; 8 no 41 storey towers would be created.
Visual amenity and compatibility	• The PH Site will introduce tall and large scale built form which will be visible from numerous vantage points including residential areas. • Buildings heights will vary providing visual diversity responding to undulating hillside terrain in the background. • Views from points within neighbouring villages towards Kai Shan Hill will be obstructed. • Loss of high quality vegetation across the site as a result of cut and fill operations will have a negative influence on visual amenity in the short to medium term. • Engineered slopes and retaining walls on western boundary would likely generate adverse visual impacts. • Building height ranges are lower (26, 31 & 36 storeys).	• The PH Site will introduce tall and large scale built form which will be visible from numerous vantage points including residential areas. • Buildings heights will vary providing visual diversity responding to undulating hillside terrain in the background. • Views from points within neighbouring villages towards Kai Shan Hill will be obstructed. • Loss of high quality vegetation across the site as a result of cut and fill operations will have a negative influence on visual amenity in the short to medium term. • Engineered slopes and retaining walls on western boundary would likely generate adverse visual impacts. • Maximum building heights are slightly greater (26, 31, 36 & 41 storeys). • Less residential towers are required however; 8 no 41 storey towers would be created.
Recommendation	**Preferred**	-
Water Quality		
Extent of stream diversions and project footprint.	• All existing water pollution sources within the site would be removed and all streams within the Project footprint would be diverted to new drainage system.	• Same as Option 1. The drainage diversion scheme would be the same for both options.
"No net increase in pollution loads to Deep Bay	• No additional pollution loading to the Deep Bay.	• Same as Option 1.
Recommendation	No preference	No preference
Land Contamination		
Potential level of risk on future landuses due to land contamination	• The future landuses planning (i.e. PH in southern region) is generally compatible with existing landuses for both options, so the same performance is proposed.	• Same as Option 1.
Recommendation	No preference	No preference
Waste		

Evaluation Criteria	Option 1	Option 2
Amount of C&D materials required for disposal during construction stage	• Net amounts of C&D materials need to be exported is 135,000m^3	• Same as Option 1
Amount of domestic waste generated from PH site	• 14,698 tonnes per year	• 15,291 tonnes per year, the difference between the two options is insignificant.
Recommendation	No preference	No preference

In general, the environmental performance in relation to air quality, rail noise, fixed noise, ecology, fisheries, cultural heritage, water quality, land contamination and waste will be more or less the same for the two PH options. Both options have similar development layouts, and they would be able to meet the statutory criteria for air quality, road traffic noise, rail noise, fixed noise and water quality given that appropriate mitigation measures are provided. As both options have the same development footprint, the extent of potential impact on habitats of ecological importance, area of archaeological potential and watercourses, as well as the extent of potential remediation works required would be the same. Since the site formation work is the same for both options, the volumes of cut and fill and the net amounts of C&D materials that need to be exported during construction stage are also the same. The amount of domestic wastes that requires final disposal for Option 2 would be slightly greater than that of Option 1 during operational stage. However, the difference is considered insignificant. Thus it is considered that they perform equally in this aspect.

Potential noise impacts on existing NSRs in vicinity of Fuk Hi Street and Long Ping Road due to the induced traffic by the Project are anticipated for both options. At source mitigation measures such as noise barrier, enclosure and low noise surfacing are required to protect the existing receivers. Since Option 2 with a higher population would attract and generate more traffic, it is anticipated that the extent of mitigation measures required is likely more than that of Option 1. Despite Option 2 would require larger extent of mitigation measures to mitigate the road traffic noise impacts as compared to Option 1, both options are considered feasible from environmental noise point of view.

On landscape and visual, the PH site will introduce tall and large scale built form with loss of existing mature vegetation and natural land forms yet promote higher quality landscape character by removal of open storage functions and provide high level of amenity and compensatory landscape mitigation. In general, building height ranges in Option 1 are lower (26, 31 & 36 storeys), whereas building heights in Option 2 are slightly greater (26, 31, 36 & 41 storeys). The residential buildings within the PH site are likely to become more visible as the built form will be taller. In this case, Option 2 is likely to be more visually intrusive while Option 1 is likely to generate a lower level of visual impact as result of the reduced building heights.

Overall, Option 1 is considered to be more preferable from environmental perspectives but Option 2 is still considered feasible given that suitable mitigation measures are provided.

6.1.4 Recommendation of Preferred PH Option

In terms of urban planning and design, Option 1 and 2 have many common elements such as provision of sufficient GIC facilities, local open space and other ancillary facilities. Both options could also provide a pleasant environment with adoption of stepped building height profile, provisions of sufficient visual corridors and pedestrian access to Kai Shan etc.

The major difference between the options is that Option 1 adopts a domestic PR of 5.5 while Option 2 employs a domestic PR of 6. As a result of this, Option 2 would provide 630 more flats than Option 1 (15,615 flats in Option 1 and 16,245 flats in Option 2). The layouts of the two options also vary with major differences stemming from the replacement of the two residential towers in Option 1 by one more school in Option 2. As a result, the view corridor from Fung Chi Tsuen (to the south of the PH site) towards Kai Shan is wider in Option 2 than that of Option 1.

In this regard, Option 2 performs better than Option 1 in terms of urban planning and design. Option 2 can provide 630 more flats, making more contribution in alleviating the strong public housing demand in the territory. Option 2 can also allow a wider view corridor from Fung Chi Tsuen to Kai Shan.

Option 2 also outperforms Option 1 in terms of air ventilation. One of the major differences between the two options is that the two high-rise residential towers (26 storeys) in Option 1 are replaced by a school (maximum of 8 storeys) in Option 2. This makes Option 2 more favourable to facilitate wind flow passing through the buildings and hence more preferable from perspective of air ventilation.

There is in general no preference on the two PH options with respect to the engineering and infrastructure aspects. In terms of traffic and transport perspective, despite Option 2 would generate and attract more traffic compared with Option 1, it is considered that there are no insurmountable impacts from traffic point of view for both options, given that suitable traffic improvement works are provided.

Option 1 also performs better than Option 2 in terms of environmental performance. Option 2 with more population would attract and generate more traffic, and hence the extent of mitigation measures required to mitigate the road traffic noise impacts is likely more than that of Option 1. Despite Option 2 would require larger extent of mitigation measures, both options are considered feasible from environmental noise point of view. On landscape and visual, Option 2 is likely to be more visually intrusive as the built form will be taller while Option 1 is likely to generate a lower level of visual impact as result of the reduced building heights.

In summary, Option 2 outperforms Option 1 in terms of urban planning and design and Option 2 can provide more flats to help alleviate strong public housing demand in the territory. On the other hand, the traffic and environmental concerns are not insurmountable and they could be addressed properly with appropriate traffic improvement works and environmental mitigation measures. In this connection, it is considered that Option 2 is the preferred option for the PH site.

6.2 Summary of Evaluation on YLIEE Options

6.2.1 Planning and Urban Design, Land Requirement and Air Ventilation

Table 6.1.4 below summarises the comparison and evaluation of the YLIEE options from planning and urban design, land requirement and air ventilation perspectives.

Table 6.1.4: Summary of the Evaluation for YLIEE Options from planning and urban design, land requirement and air ventilation perspectives

Evaluation Criteria	Option A	Option B
Urban Planning and Design		
Meeting demand on industrial estate premises by maximizing developable area within statutory limits	• 12.06 ha of land is reserved for industrial uses with a maximum industrial GFA of 301,500 m^2.	• 11.55 ha of land is reserved for industrial uses with a maximum industrial GFA of 288,800 m^2.
Provision of sufficient local open space for the proposed development	• Local open space of around 0.40 ha is proposed meeting the requirement of HKPSG.	• Same as Option A.
Provision of sufficient pedestrian access to neighborhood community facilities and infrastructures	• Sufficient pedestrian access is provided.	• Same as Option A.
Improvement in connectivity to Kai Shan	• Sufficient linkage is provided.	• Same as Option A.
Integration of proposed development with surrounding natural topography	• Option A makes better use of the available land but the drawback is the necessity to create numerous slope platforms which affect the continuity with YLIE.	• Avoiding using the corner site with higher site level, this help flattens the overall land area and improve the continuity with YLIE.
Integration of proposed development with surrounding built form	• The surrounding built form is similar to the proposed one.	• Same as Option A.
Preservation of visual connection to Kai Shan	• View corridor to Kai Shan is preserved.	• Same as Option A.
Recommendation	-	**Preferred**
Land Requirement		
Extent of private land lots to be affected	• A total of about 74,476m^2 private land lots will be affected.	• A total of about 73,024m^2 private land lots will be affected. Extent of the affected land lots and land take required will be slightly less than that of Option A. But the difference is considered minor.
Extent of existing accesses of roads, cycle tracks, tracks, foot paths, bus stops/lay-bys, Railway Protection Boundary, West Rail EAP, watercourses and nullahs etc to be affected	• Diversion of watercourses flowing across the Project site and Tai Tseng Wai Nullah required. • Existing accesses of tracks and footpaths connecting to graves on Kai Shan needs to	• Same as Option A.

Evaluation Criteria	Option A	Option B
	be reprovisioned. • Accesses to those existing rural settlements and occupations which are outside the project limit and would be rendered land-locked as a result of the proposed YLIEE development should also be reprovided.	
Recommendation	No preference	No preference
Air Ventilation		
Main streets / wide main avenues should be aligned in parallel, or up to 30 degrees to the prevailing wind direction	• Under annual prevailing wind direction in ENE, the southern end of the road will channelize the wind into the site.	• Same as Option A.
Building height variation across the district with decreasing heights towards the direction where the prevailing wind comes from	• The building height decreases from 44mPD to 39.5mPD towards eastern direction.	• The building height decreases from 39.2mPD to 38.2mPD towards eastern direction.
Adequately wide gaps between building blocks	• Adequate gaps (>18m) between buildings have been allowed to maximize the air permeability.	• Same as Option A.
The angle between the axis of the building blocks and the prevailing wind direction should be within 30 degrees	• The major axis of the buildings is generally aligned parallel to the annual prevailing wind in ENE direction.	• Same as Option A.
Recommendation	No preference	No preference

Options A and B have many common elements. Both Option A and B are proposing an optimum development density with PR 2.5 and building height of 8 storeys. Both options will provide sufficient local open space and parking spaces. Visual connections to YLIE and Kai Shan are retained and connectivity between YLIE and YLIEE by means of pedestrian walkways is well planned.

The major differences between Option A and B come from the slope area in the western part of the YLIEE site. Option A includes the slope area as part of the YLIEE site while Option B proposes exclusion of the area. Therefore, Option A provides 12.06 ha of industrial lots while Option B provides 11.55 ha. The distributions and sizes of industrial lots as well as road layouts also result in some variations between the options.

Although the total area of industrial lots in Option B is less than that of Option A, and the resulting GFA for industrial uses in Option B is less than Option A (the respective GFA in Option A and B is 301,500 m^2 and 288,800 m^2), the differences are relatively insignificant. When comparing the two options from an urban design perspective, Option B is more desirable than Option A. Option A has to create numerous slope platforms for the slope area. Option B, on the contrary, avoiding using the slope area with higher site level, helps flatten the overall land area and thus improves the continuity between the YLIE and the YLIEE site. In

this connection, it is considered that Option B's overall performance from planning and urban design aspects is better than Option A.

In terms of land requirement, since the western slope area will be excluded in Option B, the extent of the affected land lots and land take required will be slightly less than that of Option A. However, the difference is considered insignificant. The extent of the impacts on existing accesses of roads, tracks, foot paths, watercourses and nullahs etc. to be affected will be the same for both YLIEE options.

From air ventilation point of view, the arrangement of major buildings axis is approximately parallel to ENE annual prevailing wind direction and the building gap is at least 18m, which could facilitate the wind flow penetrating into the site for both options. Although there is a minor difference in stepped building heights between Option A and B due to the different platform levels, it is considered that the impact on wind penetration is not significant. Hence both options would perform similarly from air ventilation perspectives.

6.2.2 Engineering and Infrastructure

Table 6.1.5 below summarises the comparison and evaluation of the YLIEE options from different engineering aspects and infrastructures perspectives.

Table 6.1.5: Summary of the Evaluation for YLIEE Options from engineering and infrastructures perspectives

Evaluation Criterion	Option A	Option B
Traffic and transport		
Extent of junctions to be affected	• Both YLIEE Options would have same magnitude of impact in Wang Chau area.	• Same as Option A.
Coverage of public transport facilities within the proposed developments	• A public transport interchange has been proposed between PH and YLIEE.	• Same as Option A.
Connectivity between the proposed development and Yuen Long Town	• A pedestrian corridor has been provided to serve between the YLIEE, Yuen Long Town and West Rail Long Ping Station.	• Same as Option A.
Recommendation	No preference	No preference
Geotechnics and Foundation Works		
Foundation requirements for industrial estate buildings for different options.	• Pre-bored H-piles and mini-piles socketed into rock. Friction piles if deep rockhead identified, and cannot be avoided.	• Same as Option A. However as Option B has a platform level approximately 2m lower than that for Option A; if piles are socketed into rock, it is expected that the pile length will be shorter due to the lower platform level.
Recommendation	-	**Preferred**
Site formation		
Optimisation of site formation to ensure maximum area of development subject to other criteria	• Option A comprises about 150,000m^2 of developable area.	• Option B comprises about 142,500m^2 of developable area.

Evaluation Criterion	Option A	Option B
detailed below.		
Determination of suitable platform levels that are in keeping with the surrounding area, whilst meeting criteria for drainage, pedestrian and vehicle access	• The central area of the YLIEE site consists of a +9.0mPD platform, with a sloping road to +4.5mPD in the south east to allow vehicular access into the industrial estate. An approx. 20,000m^2 elevated platform at +12.0mPD is located at the most westerly portion of the YLIEE. The platform slopes gently from +9.0mPD from the central platform a gradient of 1:200 to the central area of the eastern boundary of the site to 8.5mPD, 4.0 metres above existing ground level immediately outside of the site.	• The central area of the YLEE site consists of a +6.7mPD platform, with a sloping road to +4.5mPD in the southeast to allow vehicular access. The platform slopes gently from +6.7mPD from the central platform a gradient of 1:200 to the central area of the eastern boundary of the site to +6.2mPD, 1.7 metres above existing ground level immediately outside of the site.
Minimise import of fill and export of spoil from site.	• Total Estimated Cut Volume for both YLIEE and PH site: 383,500m^3. • Estimated Fill Volume for both YLIEE and PH site: 439,500m^3.	• Estimated Cut Volume for both YLIEE and PH site: 390,500m^3. • Estimated Fill Volume for both YLIEE and PH site: 290,500m^3.
Where possible, avoid steepening of slopes and use of retaining structures which negatively impact on aesthetics	• Raising the existing ground level of the main central platform from approximately +5.0mPD to a level of +9.0mPD and 8.5mPD at the eastern boundary, will result in the need for approximately 4m high earth retaining wall along the 550m length of the eastern boundary of the YLIEE. • The elevated platform located at the most westerly portion of the site with an elevation of +12.0mPD will require pile retaining walls up to 10m in height. • Where slopes are proposed adjacent to natural terrain, these are proposed to be 30^o in order to allow more aesthetically pleasing vegetated slopes. In some areas will require bored piled walls at the slope toe. • Where reinforced earth retaining walls are proposed, they have been designed to be stepped with planter boxes to provide a more aesthetically pleasing view.	• Raising the existing ground level of the main central platform from approximately +5mPD to a level of +6.7mPD and 6.2mPD at the eastern boundary, will result in the need for approximately 1.7m high earth retaining wall along the 550m length of the eastern boundary of the YLIEE. • Reducing the size of the plot associated with the elevated platform located at the most westerly portion of the site will allow for a 30^o cut slope option to be designed rather than a 10m high bored pile retaining wall. • Elsewhere, proposed slopes are as per Option A.
Minimise fill works to reduce the likelihood of settlement induced from additional loading of the ground and any potential existing compressible soils	• Approximately 3 to 4m in thickness of fill to be placed at the eastern side of the YLIEE site where alluvial and marine deposits are more likely to be encountered.	• Approximately 1.7m in thickness of fill to be placed at the eastern side of the YLIEE site where alluvial and marine deposits are more likely to be encountered.
Recommendation	-	**Preferred**

Evaluation Criterion	Option A	Option B
Existing Registered Features		
Minimise modification of existing slopes	• It is anticipated that 3 slopes will require modification. 1 No. of slopes will require further assessment and may need upgrading.	• It is anticipated that 3 slopes will require modification. 2 No. of slopes will require further assessment and may need upgrading.
Recommendation	**Preferred**	-
Natural Terrain Hazards		
Identification of potential Natural Terrain Hazards	• Potential for natural terrain hazards impacting on the YLIEE from 11 No. of catchments, with evidence of historical instability and potential sources of boulder and rockfall.	• Potential for natural terrain hazards impacting on the YLIEE from 9 No. of catchments, with evidence of historical instability and potential sources of boulder and rockfall.
Mitigation Measures against natural terrain hazards	• Flexible barriers outside the Project site are likely to be required at the footslopes of 11 No.of the catchments located at the western boundary of the YLIEE site, with rigid barriers within two of the drainage lines.	• Flexible barriers are likely to be required at the toe of 9 No. of the catchments identified at the western boundary of the YLIEE site, with rigid barriers within one of the drainage lines.
Impact of mitigation measures on existing graves	• Mitigation measures can be located to avoid contact with existing graves, whilst maintaining access routes.	• Same as Option B.
Recommendation	-	**Preferred**
Stormwater Drainage		
Impacts on existing watercourses within Project site	• Diversion of existing watercourses within Project site required.	• Same as Option A.
Impacts on existing Tai Tseng Wai Channel	• Minimal hydraulic impacts on existing Tai Tseng Wai channel downstream to Project site due to insignificant increase in paved area.	• Same as Option A.
	• Diversion of section of existing Tai Tseng Wai Channel within Project site required.	• Same as Option A.
Impacts on surface runoff from Kai Shan	• Construction of peripheral drains alongside Project site boundary required.	• Same as Option A.
Impacts on existing storm drains along Long Ping Road	• Upgrade of existing storm drains along Long Ping Road might be required.	• Same as Option A.
Impacts on existing storm drains along Fuk Hi Street	• Upgrade of existing storm drains along Fuk Hi Street might be required.	• Same as Option A.
Recommendation	No preference	No preference
Sewerage		
Impacts on Yuen Long Sewage Treatment Works (YLSTW)	• No adverse impacts on existing YLSTW as the 36,000m^3/day entitlement was not exceeded. Same for all options.	• Same as Option A.

Evaluation Criterion	Option A	Option B
Impacts on compliance with requirements of "No net increase in pollution loads to Deep Bay"	• Compliance with requirements of "No net increase in pollution loads to Deep Bay" as the 36,000m³/day entitlement was not exceeded. Same for all options.	• Same as Option A.
Impacts on existing foul sewers in YLIE	• Upgrade of existing foul sewers in YLIE might be required to cater for the additional sewage flow. Same for all options.	• Same as Option A.
Recommendation	No preference	No preference
Water Supply		
Impacts on planned salt water supply system from Lok On Pai and Tan Kwai Tsuen	• There is no spare capacity to cater for the flushing water demand from Project site.	• Same as Option A.
Impacts on fresh and flushing water supply systems within Project site	• Construction of new Temporary Mains Water for Flushing (TMF) within Project site proposed to provide a separate flushing water supply system.	• Same as Option A.
Impacts on operation of Au Tau Water Treatment Works (ATWTW) in parallel with Ngau Tam Mei Water Treatment Works (NTMWTW)	• Operation of ATWTW in parallel with NTMWTW would have adequate capacity to cater for the additional water demand and hence no adverse impacts.	• Same as Option A.
Impacts on Wang Chau Fresh Water Service Reservoir (WCFWSR)	• No adverse impacts on WCFWSR as it would have adequate capacity to cater for the additional water demand.	• Same as Option A.
Impacts on DN900 fresh water distribution mains along Fuk Hi Street	• No adverse impacts on DN900 fresh water distribution mains along Fuk Hi Street as it would have adequate capacity to cater for the additional water demand & adequate residual head at the proposed water mains.	• Same as Option A.
Recommendation	No preference	No preference
Other Utilities		
Impacts on existing medium pressure gas main within Project site	• Construction of valve chambers on existing medium pressure gas main and tee-off new gas mains required.	• Same as Option A.
Impacts on existing power cable within Project site	• Construction of cable draw-pits on existing medium pressure power cable and tee-off new power cables required.	• Same as Option A.
	• Diversion of existing power cable required.	• Same as Option A.
Impacts on existing	• Construction of cable draw-pits on	• Same as Option A..

Evaluation Criterion	Option A	Option B
communication cables within Project site	existing communication cables and tee-off new power cables required.	
	• Diversion of existing communication cable required.	• Same as Option A.
Recommendation	No preference	No preference

Overall, the impacts on traffic and transport, stormwater drainage, sewerage, water supply and other utilities will be more or less the same for both YLIEE options. There is in general no preference on the two YLIEE options with respect to these engineering and infrastructure aspects.

Since the layouts of the two development options are very similar, trip generation and the associated impact on the road network are very much the same for both options. Similarly, the impact on existing watercourses/storm drains and the requirements for upgrading works on existing storm drains for both options are the same. Besides, the projected sewage flows under various development options are in the same order and the 36,000m^3/day entitlement will not be exceeded. The scale of anticipated sewerage improvement works required will also be the same for all options. For both options, it is proposed to operate ATWTW in parallel with NTMWTW in long term to supply fresh water within the supply zone. It is also identified that the nearby WCFWSR and existing DN900 MS fresh water distribution main running along Fuk Hi Street would have enough capacity to cater for the additional water demand arising from the proposed developments regardless the development options. Requirements for the construction and diversion of gas main, power cables and communication cables are also the same for various development options. There is no preference between the two options in relation to these engineering and infrastructure aspects.

The selection of preferred YLIEE options is mainly determined by geotechnical engineering factors. In terms of foundation requirement, Option B is considered to be the preferred option as any piled foundations socketed into rock are likely to be 2m shorter. Option B, although resulting in a reduction of the overall site area of approximately 7500m^2, has several benefits in relation to site formation. By reducing the size of the lot located at the western boundary, the site formation level for the associated platform can be kept closer to the adjacent main platform level. This will remove the need for access from the main platform to the western platform and allow a reduction in platform levels across the site, thus reducing the thickness and volume of fill required. The lower main YLIEE in Option B results in a reduction in the height of the earth retaining wall at the eastern boundary; reducing cost and visual impact, improving pedestrian access, and continuity with the adjacent YLIE. Option B also requires a reduced thickness of fill compared with Option A, resulting in lower loading on the potentially compressible soils which underlie parts of the site, and the need for surcharging, removal and replacement or ground improvement. Moreover, by reducing the size of the lot located at the western boundary, the 8m bored piled wall in Option A can be replaced by a 30 degree spoil slope in Option B. Option B is considered to be the preferred option. Although the cut and fill volume estimates suggest a surplus of spoil material, the re-use of this material on site will be considered in more detail as part of the Geotechnical and Site Formation Assessment once a preferred option has been identified.

In addition, Option B due to the exclusion of the lot located at the western boundary would create a buffer greater than 50m from the toe of catchments V and W. This buffer removes the need for NTHA and mitigation works for these catchments. The likely reduction in mitigation works also makes the YLIEE Option B the preferred option.

Although fewer slopes in Option A require further assessment and possible upgrading works, Option B is still considered to be the preferred option taking into consideration the overall performance in all aspects of the foundation, site formation and natural terrain hazard requirements.

6.2.3 Environmental Impacts

Table 6.1.6 below summarises the comparison and evaluation of the YLIEE options from environmental perspectives.

Table 6.1.6: Summary of the Evaluation for YLIEE Options from environmental perspectives

Evaluation Criteria	Option A	Option B
Air Quality		
Provision of sufficient separation distance between the YLIE and the residential development to ensure compliance with the new AQO	• Sufficient separation has been allowed between YLIE and PH development and assessment results show that the new AQO could be met.	• Same as Option 1.
Provision of sufficient separation distance between Long Ping Road & Fuk Hi Street and the residential development to ensure compliance with the new AQO	• N/A	• N/A
Extent of further mitigation measures/building constraints (e.g. height restriction, further setback)	• Assume no major pollution emitters inside YLIEE (e.g. SPs) and the fuel consumptions shall be controlled in the lease condition.	• Same as Option 1.
Recommendation	No preference	No preference
Noise		
Road traffic noise		
Compliance with road traffic noise criteria	• Difference in amount of traffic generated and attracted by the YLIEE options is very insignificant and hence the difference on the road traffic impacts on existing and planned NSRs. • Compliance shall be referred to "Evaluation of PH site".	• Same as Option B.
Extent of on-site mitigation measures required	• Extent of on-site mitigation measures required shall be referred to "Evaluation of PH site".	• Same as Option B.
Extent of off-site	• Extent of off-site mitigation	• Same as Option B.

Evaluation Criteria	Option A	Option B
mitigation measures on existing roads required	measures required shall be referred to "Evaluation of PH site".	
Rail noise		
Compliance with rail noise criteria	• No relation with the YLIEE options.	• No relation with the YLIEE options.
Extent of on-site mitigation measures required	• No relation with the YLIEE options.	• No relation with the YLIEE options.
Extent of off-site mitigation measures on existing WR viaduct required	• No relation with the YLIEE options.	• No relation with the YLIEE options.
Fixed noise		
Provision of sufficient separation distance from existing and planned fixed noise sources to ensure compliance with the noise criteria	• With the current distance between YLIEE and existing receiver and assumption that the noise emission from YLIEE would be properly controlled, the relevant noise criteria could be met.	• Same as Option B.
Extent of building mitigation measures required	• With assumption that the noise emission from YLIEE would be properly controlled, no mitigation measures on existing NSRs are required.	• Same as Option B.
Extent of at-source noise control measures required e.g. enclosure, barrier/cover, silencer etc	• Noise emission from YLIEE needs to be controlled by means of good practice and appropriate at-source noise control measures including no loading and unloading activities during night-time period, loading and unloading only at designated location where should be blocked by the industrial building itself, or designed with a top cover where necessary, locating the noise sources such as chillers / processing plant on the roof of the nearest industrial lots (i.e. lot 8-9) away from PH site as far as possible, use of acoustic enclosure, silencer, low noise equipment design etc for all sources such as chillers / processing plant on the roof of all industrial lots in YLIEE to achieve a noise reduction of 30 dB(A).	• Same as Option B.
Recommendation	No preference	No preference
Ecology		
Preservation/enhancement of habitats of ecological importance and/or avoid/minimise any significant	• Seasonally wet grassland is potentially of ecological value and a total of approximately 0.73 ha of this habitat will be lost. • Secondary woodland is potentially	• Seasonally wet grassland is potentially of ecological value and a total of approximately 0.73 ha of this habitat will be lost. • Secondary woodland is potentially

Evaluation Criteria	Option A	Option B
residual impacts to these areas	of ecological value and a total of approximately 0.80ha of this habitat will be lost. • Natural streams may be evaluated as of ecological significance (pending completion of ecological field surveys). If assessed as of ecological significance, use of ecologically friendly channelization methods would be appropriate, if feasible. • No breeding/nursery ground of species of conservation significance was identified during the preparation of this report.	of ecological value and a total of approximately 0.46ha of this habitat will be lost. • No breeding/nursery ground of species of conservation significance was identified during the preparation of this report.
Avoid/minimise impacts to the recognised sites of ecological concern with no significant residual impact	• No direct impacts on the sites of ecological concern. • Significant additional disturbance to sites of ecological concern are not expected.	• No direct impacts on the sites of ecological concern. • Significant additional disturbance to sites of ecological concern are not expected.
Recommendation	-	**Preferred**
Fisheries		
Preservation/ enhancement of active/ inactive fishponds and/or avoid/minimise any significant residual impacts to these fishponds	• No fishpond was identified within the development footprint. • No active fishpond was identified within the Study Area. • Inactive fishponds were identified in the Study Area and they are not going to be lost physically. Given that the relevant ordinances are followed, pollution to these inactive fishponds from the development will not occur and resumption of fish culture is practicable.	• Same as Option A.
Avoid/minimise impacts to the abandoned fishponds	• Abandoned fishponds were identified in the Study Area and they are not going to be lost physically. Given that the relevant ordinances are followed, pollution to these inactive fishponds from the development will not occur and resumption of fish culture is practicable.	• Same as Option A.
Recommendation	No preference	No preference
Cultural Heritage		
Conservation of Areas of Archaeological Potential or interest	• Encroach onto the area of archaeological potential along the western and northwestern edge of the YLIEE site.	• Encroach onto the area of archaeological potential along the northwestern edge of the YLIEE site, but not the lots at western boundary. Extent of potential archaeological impacts is less than that of Option A.
Respect to Built Heritage Resources	• No impact	• No impact

Evaluation Criteria	Option A	Option B
Recommendation	-	**Preferred**
Landscape & Visual		
Protection and incorporation of high quality landscape resources.	• Proposal will require full removal or alteration of existing landscape resources (watercourses, trees and shrubs). • Loss of agricultural land required. • Local open space provided.	• Proposal will require full removal or alteration of existing landscape resources (watercourses, trees and shrubs). • Loss of agricultural land required. • Local open space provided. • Option B provides Green Belt land to the west of the site, below Kai Shan Hill peak.
Influence upon landscape character	• Industrial landscape character will encroach closer to Kai Shan Hill and overall area (including existing estate) will be increased. • Loss of agricultural landscape.	• Industrial landscape character will encroach closer to Kai Shan Hill and overall area (including existing estate) will be increased. • Loss of agricultural landscape. • Encroachment into Kai Shan Hill range reduced in Option B.
Visual amenity and compatibility	• Built form would be seen as a continuation of existing industrial area. • Views from villages to the north would be reduced or obstructed. • Overall visibility of industrial landscape (including existing estate) will be increased. • Engineered slopes and retaining walls on western boundary would have a negative impact.	• Built form would be seen as a continuation of existing industrial area. • Views from villages to the north would be reduced or obstructed. • Overall visibility of industrial landscape (including existing estate) will be increased. • Engineered slopes and retaining walls on western boundary would have a negative impact. • Overall footprint of development (including road access) reduced in option B. • Development platforms generally 1-5m lower. • Less intrusion into the Kai Shan area. • Retaining walls / features along Fuk Hi Street reduced in height.
Recommendation	-	**Preferred**
Water Quality		
Extent of stream diversions and project footprint.	• All existing water pollution sources within the site would be removed and all streams within the Project footprint would be diverted to new drainage system.	• Same as Option A. The drainage diversion scheme would be the same for both options.
"No net increase in pollution loads to Deep Bay	• No additional pollution loading to the Deep Bay.	• Same as Option A.
Recommendation	No preference	No preference
Land Contamination		
Minimise the risk due to land contamination	• The future landuses planning (i.e. industrial) is generally compatible with existing landuses.	• The future landuses planning (i.e. PH in southern region) is generally compatible with existing landuses.

Evaluation Criteria	Option A	Option B
		• Difference in area of slope area, green buffer and parking space between Options A and B is insignificant (approximately 0.5ha only), thus the difference in extent of potential remediation works required should not be significant. Same performance is proposed.
Recommendation	No preference	No preference
Waste		
Amount of C&D materials required for disposal during construction stage	• Together with the PH site, a 56,000m^3 cut-&-fill to be imported.	• Together with the PH site, a surplus of 100,000 m^3 spoil material to be exported.
Amount of industrial waste generated by YLIEE site	• 304 tonnes per year	• 279.3 tonnes per year, the difference between the two options is insignificant.
Recommendation	**Preferred**	-

In general, the environmental performance in relation to air quality, road traffic noise, rail noise, fixed noise, water quality, and land contamination will be more or less the same for the two YLIEE options. Both options have similar development layouts, and they would be able to meet the statutory criteria for air quality, noise and water quality given that appropriate mitigation. The extent of watercourses to be affected and the extent of potential remediation works to be required for the two options are anticipated to be similar. The YLIEE is an industrial use which has a highest risk tolerance and hence is considered compatible with the existing industrial uses in the northern part.

There will be no direct impacts or significant disturbance on the sites of ecological concern and the extent of impact on all other habitats will be more or less the same for both options, except for secondary woodland. The major difference between the two options is that the exclusion of the western slope area from the development plan in Option B would preserve a patch of the secondary woodland habitat of about 0.34ha compared to Option A. While the impacts on other types of habitats are similar for both options, it is considered that Option B is the preferred option from ecological point of view. Besides, the exclusion of the western slope area would also avoid the direct encroachment onto the area of archaeological potential at the western edge of YLIEE for Option B. This so makes Option B more preferable from cultural heritage point of view.

Whereas the upland landscape to the west of the site comprises Kai Shan and lower foothills, which is considered to be of high value in terms of landscape character. The encroachment of industrial land uses closer to Kai Shan is likely to have a negative influence on the distinctiveness of its character. The exclusion of the industrial plot on the western boundary of Option B would reduce the extent of encroachment towards Kai Shan, which favours in the protection of the Kai Shan landscape and preservation of some woodland areas by this scheme. Besides, the exclusion of the plot would also allow the creation of additional green space with the potential to be designated at GB. In addition, both options include an area of Local Open Space to act as a buffer between the YLIEE and PH site, this would provide important landscape amenity and potentially allow preservation of associated resources.

The development platform levels differ between the two options with the proposed ground levels of Option B being lower by approximately 1-5 metres in places. The lower levels would help to reduce the overall visual obstruction caused by the proposed built form helping the development to 'sit' deeper into the landscape. The exclusion of the plot on the western boundary of Option B would significantly reduce the extent of earthworks in this area, avoiding further encroachment towards the natural hillside Kai Shan and appearance of engineered slopes and level platforms. In addition, retaining walls located along Fuk Hi Street would be slightly lower and less visually obtrusive.

On the other hand, Option A (combined with PH site) could achieve a better overall cut-&-fill balance (i.e. net import of 56,000m^3) than Option B (combined with PH site) which would generate a surplus of spoil material (i.e. 100,000 m^3). Option A would therefore perform better in this aspect.

Notwithstanding this, taking into consideration the aspects of ecology, cultural heritage, landscape and visual, Option B could achieve a better overall environmental performance than Option A and hence is considered to be the preferred option. It is recommended that, should Option B be selected as the preferred option, the site formation level design would need to be revisited and the opportunities for re-use of the C&D material on site would be explored in more detail in order to minimize the amount of this material required for final disposal.

6.2.4 Recommendation of Preferred YLIEE Option

It is apparent that Option B performs better than Option A in various aspects of planning, urban design, geotechnical engineering and environmental performance.

From an urban design perspective, Option B is more desirable than Option A as it avoids using the western slope area with higher site level which helps flatten the overall land area and thus improves the continuity between the YLIE and the YLIEE site. Option B is also considered to be the preferred option from engineering point of view, mainly because it could remove the need for a 8m bored piled wall at the western slope, reduce the thickness of fill required which thus result in lower loading on the potentially compressible soils, and the need for surcharging, removal and replacement or ground improvement. In addition, the exclusion of the western slope area in Option B would preserve a patch of the secondary woodland habitat of about 0.34ha, avoid the direct encroachment onto the area of archaeological potential at the western edge of YLIEE, reduce the extent of encroachment towards Kai Shan which favours in the protection of the Kai Shan landscape and preservation of some woodland areas by this scheme. The lower site formation levels would also help to reduce the overall visual obstruction caused by the proposed built form helping the development to 'sit' deeper into the landscape. This makes Option B more preferable from environmental point of view.

In summary, Option B is recommended to be the preferred option for YLIEE site.

7 CONCLUSION

This Technical Report (TR-2) is to formulate the initial development options for the PH site and YLIEE site, carry out a preliminary feasibility assessment, evaluate the initial development options and recommend a preferred option for the PH site and YLIEE site.

A site analysis has been carried out to identify all key elements within the Project Site that need to be respected and excluded from the Project site, including burial ground, graves, VE and Umah International Primary School. The analysis has also reviewed and refined the boundary of the Project site in an attempt to maximize the development potential of the site and to make use of the site in an effective and sustainable manner. Different initial development options for the PH site (Options 1 and 2) and YLIEE site (Options A and B) have been generated based on the guiding principles covering the areas on Societal Needs, Community Facilities, Infrastructure, Environment and Urban Design.

For PH site, Option 1 has proposed a PR of 5.5 with building height ranging from 26 to 36 storeys. It will provide a total of 15,615 flats to accommodate a total of 47,938 population. There are 24 housing blocks, 3 school sites and 1 GIC site. Option 2, on the other hand, has a PR of 6.0 with building height ranging from 26 to 41 storeys, providing a total of 16,245 flats to cater for around 49,872 population. There are 22 housing blocks, 4 school sites and 1 GIC site. The main difference in the development layout plans for the two options is that two residential towers (26 storeys) in the southern tip of the site in Option 1 are replaced by a school site (maximum of 8-storey) in Option 2.

For YLIEE site, Option A has taken up the slope area in the western part of the YLIEE site for development. The total land area of the YLIEE site would be 15.52 ha where 12.06 ha is reserved for industrial lots. A maximum GFA of 301,500 m^2 will be provided. In Option B, the slope area at the western edge site will be excluded from the boundary of the YLIEE site. The total land area will become 14.62 ha, and 11.55 ha is reserved for industrial use. A maximum GFA of 288,800 m^2 will be provided.

Preliminary assessments of the initial development options on different aspects including environment, traffic and transport, infrastructure, geotechnical, slope works, natural terrain hazard, site formation works, foundation works, land requirement, air ventilation, urban design, visual, landscape, etc have been undertaken. The development options have been evaluated against the pre-determined criteria.

Based on the overall findings of the option evaluation analysis, it is concluded that Option 2B is the preferred option for the Project site (**Figure 7.1.1**). This option can provide more flats in alleviating the strong public housing demand in the territory and allow a wider view corridor from Fung Chi Tsuen to Kai Shan. It can also improve the continuity between the YLIE and the YLIEE site. With exclusion of the western slope area, a patch of the secondary woodland habitat of about 0.34ha could be preserved and the extent of direct encroachment onto the area of archaeological potential at the western edge of YLIEE and the extent of encroachment towards Kai Shan could be reduced.