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**AIR VENTILATION ASSESSMENT
FOR THE PUBLIC HOUSING
DEVELOPMENT PROJECT AT
EX-CHEUNG SHA WAN ESTATE**

EXPERT EVALUATION

Report Prepared by :
Allied Environmental Consultants Ltd.

COMMERCIAL-IN-CONFIDENCE

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EXECUTIVE SUMMARY

Hong Kong Housing Authority (HKHA) propose to develop the Ex-Cheung Sha Wan Estate site at Lai Chi Kok Road, Cheung Sha Wan (subject site). The development comprises of:

- 6 domestic blocks with 33- storey each, totalling approximate 2,300 flats
- Underground car-park

Allied Environmental Consultants Limited (AEC) was commissioned by HKHA to carry out an Expert Evaluation on Air Ventilation Assessment (AVA-EE) to qualitatively evaluate the potential air ventilation impacts due to the Project. The AVA-EE was carried out according to the air ventilation assessment framework as set out in *Technical Circular No. 1/06* and its *Annex A - Technical Guide for Air Ventilation Assessment for Development in Hong Kong* issued jointly by Housing, Planning and Lands Bureau and Environment, Transport and Work Bureau (Technical Guide).

The subject site is currently occupied by Asia Golf Club. The site is surrounded by medium to high-rise social service buildings and residential buildings to the west and east of the site respectively. Cheung Sha Wan Playground, a planned primary school and public rental housing (PRH) development at the Ex-Cheung Sha Wan Police Married Quarters are located in the north and the wholesale vegetable market in the south of the site respectively.

The existing buildings cause minor impediment to the oncoming land breezes and the prevailing wind from both annual eastern wind, and south-west wind in summer period. The major wind corridors, including Lai Chi Kok Road, Fat Tseung Street and Tonkin Street surrounding the project site provide adequate air ventilation corridors for the prevailing winds to penetrate into the subject site area.

Good design features were incorporated into the design scheme, which includes podium-free design to maximize open space area, adequate separation of buildings within the development to reduce screening effect on the prevailing wind, setback distance between the development and surrounding buildings to reduce the effect on the prevailing wind corridor, and building pattern aligned in parallel to the wind corridor to maximise the penetration of prevailing wind through the district.

However, some potential problems of the proposed design are also identified including possible eddy wind generated between subject buildings. Recommendations are suggested to ensure building permeability on the ground floor level in order to improve the air

ventilation.

An AVA Initial Study is not required as the project is qualitatively evaluated that the proposed development would not have any adverse impact on the existing wind environment in the surrounding area.

1. INTRODUCTION

Hong Kong Housing Authority (HKHA) propose to develop the Ex-Cheung Sha Wan Estate site at Lai Chi Kok Road, Cheung Sha Wan. The development comprises:

- 6 domestic blocks, each with 33-storey, totalling approximate 2,300 flats.
- Underground carpark

Allied Environmental Consultants Limited (AEC) was commissioned by HKHA to carry out an Expert Evaluation on Air Ventilation Assessment (AVA-EE) to qualitatively evaluate the potential air ventilation impacts due to the Project. The AVA-EE was carried out according to the air ventilation assessment framework as set out in *Technical Circular No. 1/06* and its *Annex A - Technical Guide for Air Ventilation Assessment for Development in Hong Kong* issued jointly by Housing, Planning and Lands Bureau and Environment, Transport and Work Bureau (Technical Guide).

2. OBJECTIVE

The objective of the AVA-EE is to qualitatively review and evaluate the potential air ventilation impact on the pedestrian wind environment within and in the vicinity of the subject site due to the Project by comparing that to the existing conditions, i.e. without the Project.

3. SCOPE OF STUDY

The scope of study includes as follows:

- Identify good design features;
- Identify obvious problem areas and propose some mitigation measures;
- Define “focuses” and methodologies of the Initial and/or Detailed studies; and
- Determine if further study should be staged into Initial Study and Detailed Study, or Detailed Study alone.

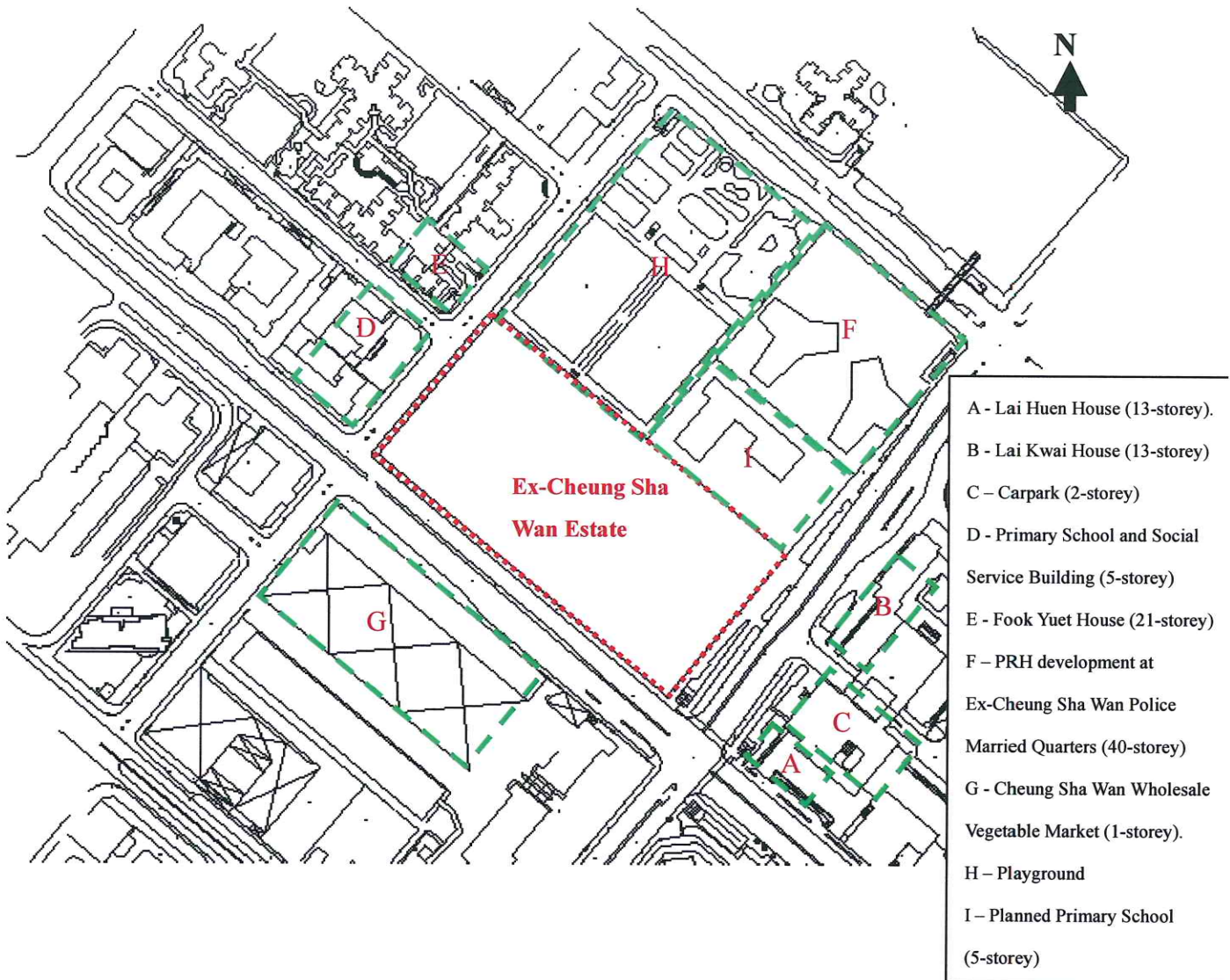
4. SITE CHARACTERISTICS

4.1. SITE LOCATION AND SURROUNDING ENVIRONMENT

The Project is located at Lai Chi Kok Road, Cheung Sha Wan, and is currently occupied by Asia Golf Club. The immediate surrounding environment as shown in *Figure 1* is analysed as follows:

- To the east across Tonkin Street is bounded by Lai Huen House (A) and Lai Kwai House (B), Lai Kok Estate. The medium rise residential buildings consist of 13-storey with a 2-storey carpark (C) located in between.
- To the west across Fat Tseung Street is bounded by a primary school Hoi Ping Chamber of Commerce Primary School and a social service building Immanuel Baptist Church Au Shue Hung Social Service Building (D). Both of them are of the same height with 5-storey.
- To the northwest across Fat Tseung Street is bounded by a high rise residential building Fook Yuet House (E), Fortune Esstate. It consists of 21-storey.
- Immediate to the north is Cheung Sha Wan playground (H), a planned primary school and the public rental housing (PRH) development at the Ex-Cheung Sha Wan Police Married Quarters site which is under construction. The school consists of 5-storey (I) and the PRH development of police married quarters consists of two blocks with 40-storey (F).
- To the south across Lai Chi Kok Road is bounded by Cheung Sha Wan Wholesale Vegetable Market with a single storey (G).

Figure 1 Site Location Map



5. WIND AVAILABILITY

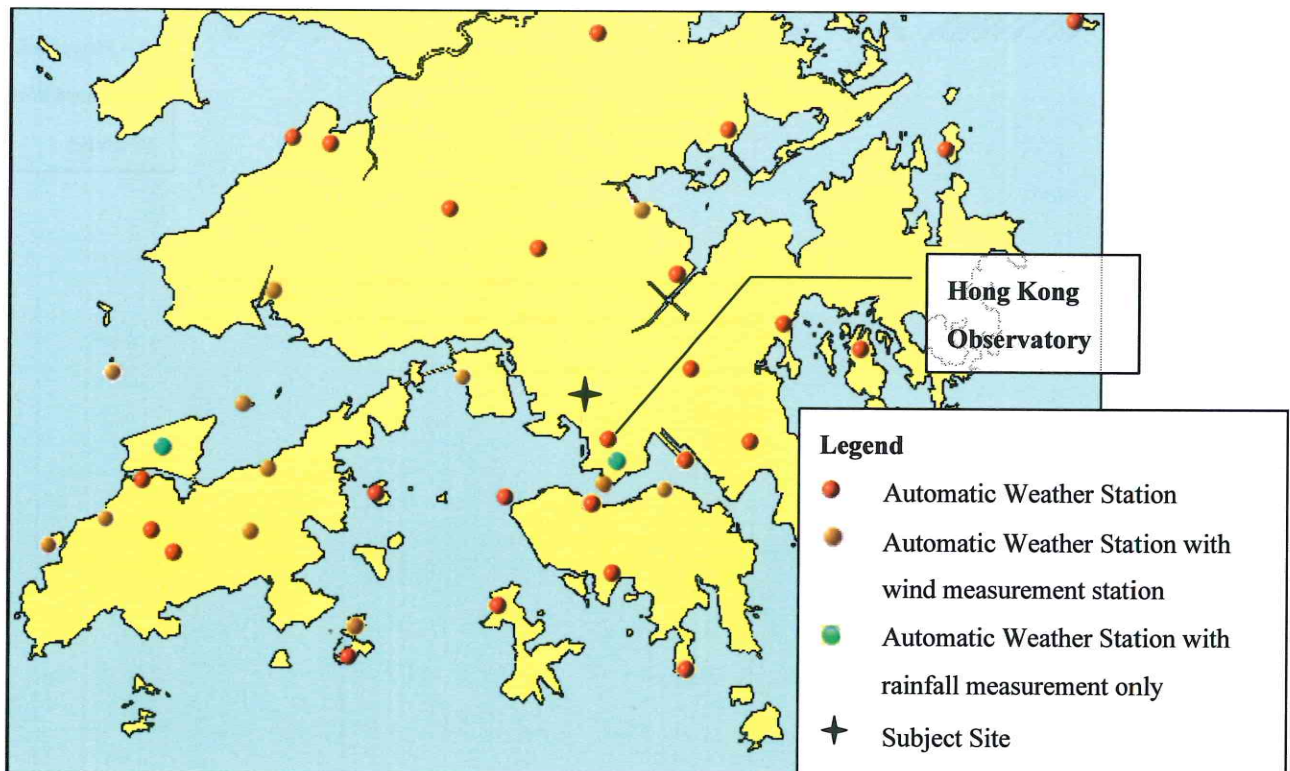
The wind data from the Hong Kong Observatory (HKO) and Mesoscale Model (MM5) published by PlanD were adopted in this AVA-EE. The HKO wind data represents the lower level wind availability where the wind direction is influenced by local topography in the surrounding environment while the MM5 wind data represents the wind availability at boundary layer (i.e. 596m above terrain).

The occurrences of winds from different directions are referred to MM5 wind data which is used to determine the prevailing wind for comparison and confirmation of HKO data. While the local wind conditions for summer and annual are referred to HKO wind data.

5.1. WIND DATA FROM HONG KONG OBSERVATORY

The Hong Kong Observatory weather station is the nearest wind weather station from the subject site. The station is approximately 4km in the south-east away from the subject site as shown in *Figure 2*. The wind data obtained from these automatic weather stations are used to identify annual and summer wind availabilities.

Figure 2 Locations of the Nearest Wind Weather Stations



5.1.1. Weather Station (Hong Kong Observatory Region)

Based on the wind rose of Hong Kong Observatory region as shown in **Figure 3**, it is found that the annual prevailing wind is eastern (E) wind. In the summer (July), besides the eastern wind (E), western (W) and south-western (SW) are also dominate in the period. The recorded annual mean wind speed measured at anemometer of automatic weather station is averaged 11.0km/h (3.06 m/s) from 1981-2010. The monthly means of prevailing wind direction and wind speed during year 1981-2010 are listed in **Table 1**.

Figure 3 Hong Kong Observatory Region Wind Rose (1981-2010)

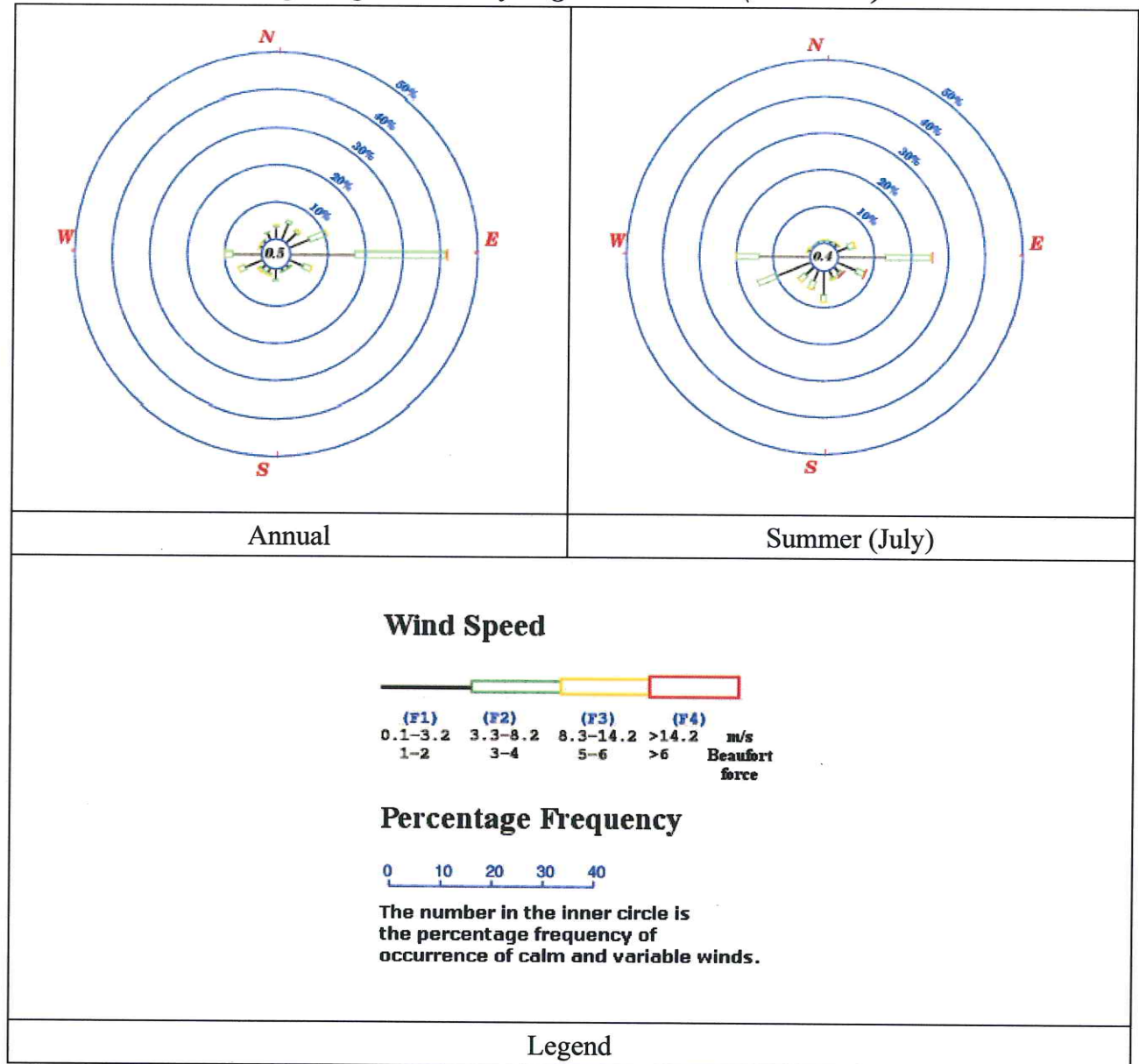


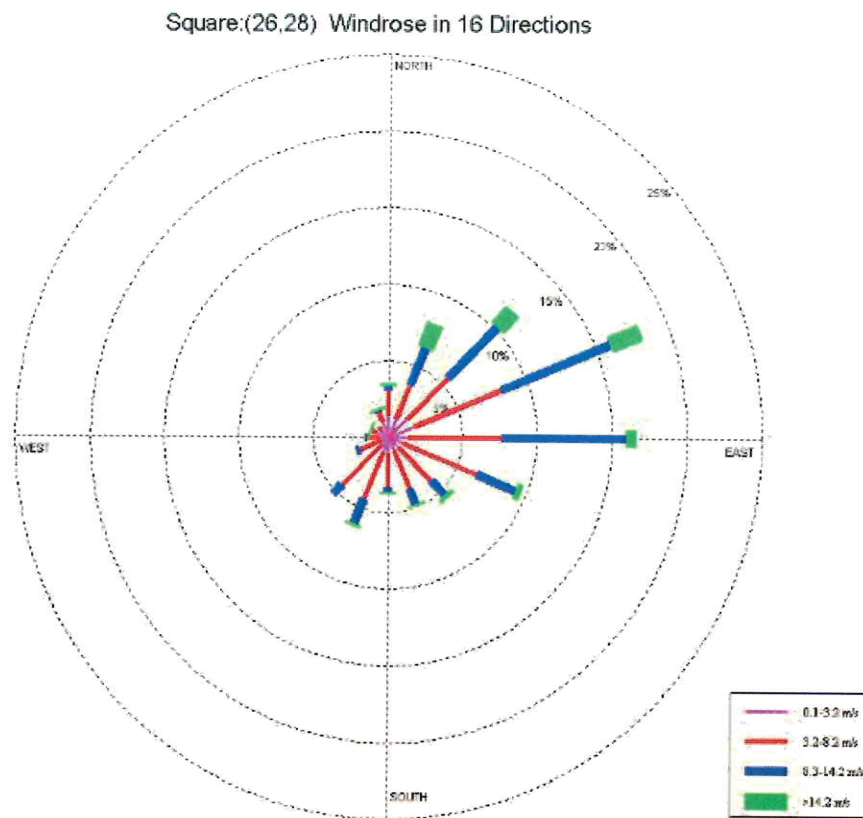
Table 1 *Wind Availability Data of Hong Kong Observatory, 1981-2010*

Month	Prevailing Wind Direction (degrees)	Wind Speed (km/h)
January	090	10.6
February	090	11.7
March	090	12.0
April	090	11.5
May	090	10.7
June	090	10.6
July	260	10.7
August	090	10.2
September	090	11.4
October	090	12.1
November	090	11.0
December	090	10.0
Year	090	11.0

5.2. WIND DATA FROM MM5

The wind availability to the subject site is evaluated with reference to the “Site Wind Availability Data” simulated by the Fifth-Generation NCAR/Penn State MM5 at the height of 596m above ground. The subject site is located within grid (26, 28) and its wind rose is shown in **Figure 4**. The mean wind velocity is 7.58m/s. It is found that east-northeast (ENE) winds dominate the annual wind frequency.

Figure 4 Wind Rose of Grid (26,28), MM5



5.3. FINDINGS OF WIND AVAILABILITY

Based on the wind data from HKO, east wind is dominant for annual wind direction. MM5 data shows that the dominant annual wind direction is ENE. The discrepancy between the two sets of data is caused by the locational differences of the data representation. HKO data is collected approximately 4km from subject site while MM5 data is localized at subject site. In addition to the two sets of wind data available, reference was made to the Expert Evaluation and Advisory Report for Proposed Amendments to Cheung Sha Wan Outline Zoning Plan (Project Ref.: AVR/G/55). From these sources, the annual prevailing wind is determined to come from the east, and the summer prevailing wind from the southwest.

6. EXPERT EVALUATION

This AVA-EE qualitatively evaluates the ventilation performance in the site environs with and without the Project. The study area of air ventilation assessment consists of subject site and the surrounding buildings. They are Lai Huen House, Lai Kwai House, Hoi Ping Chamber of Commerce Primary School, Immanuel Baptist Church Au Shue Hung Social Service Building, Fook Yuet House, a planned primary school, public rental housing (PRH) development at the Ex-Cheung Sha Wan Police Married Quarters and Cheung Sha Wan Wholesale Vegetable Market. The conditions under the annual prevailing wind and the summer wind are considered. Building heights, road/street orientation and patterns, and open spaces have also been taken into account for evaluating the characteristics of wind environment.

6.1. EXISTING CONDITIONS

The subject site is currently a flatted area as shown in *Figure 5*. The existing conditions of subject site (i.e. without the Project) are summarized as the follows.

- Building Heights

The existing land uses in the vicinity of the subject site are mainly residential. The heights of these residential buildings are not high, ranging from low to high are Cheung Sha Wan Wholesale Vegetable Market (1-storey), Hoi Ping Chamber of Commerce Primary School, Immanuel Baptist Church Au Shue Hung Social Service Building (5-storey), Lai Huen House, Lai Kwai House (13-storey), Fook Yuet House (21-storey), planned primary school (5-storey) and PRH development at the Ex-Cheung Sha Wan Police Married Quarters site (40-storey). Although the PRH development at the Police Married Quarters site is the highest, it is not located at a high building density area. Therefore, the buildings might not cause impediment to the oncoming land breezes and the prevailing wind to penetrate into the street level.

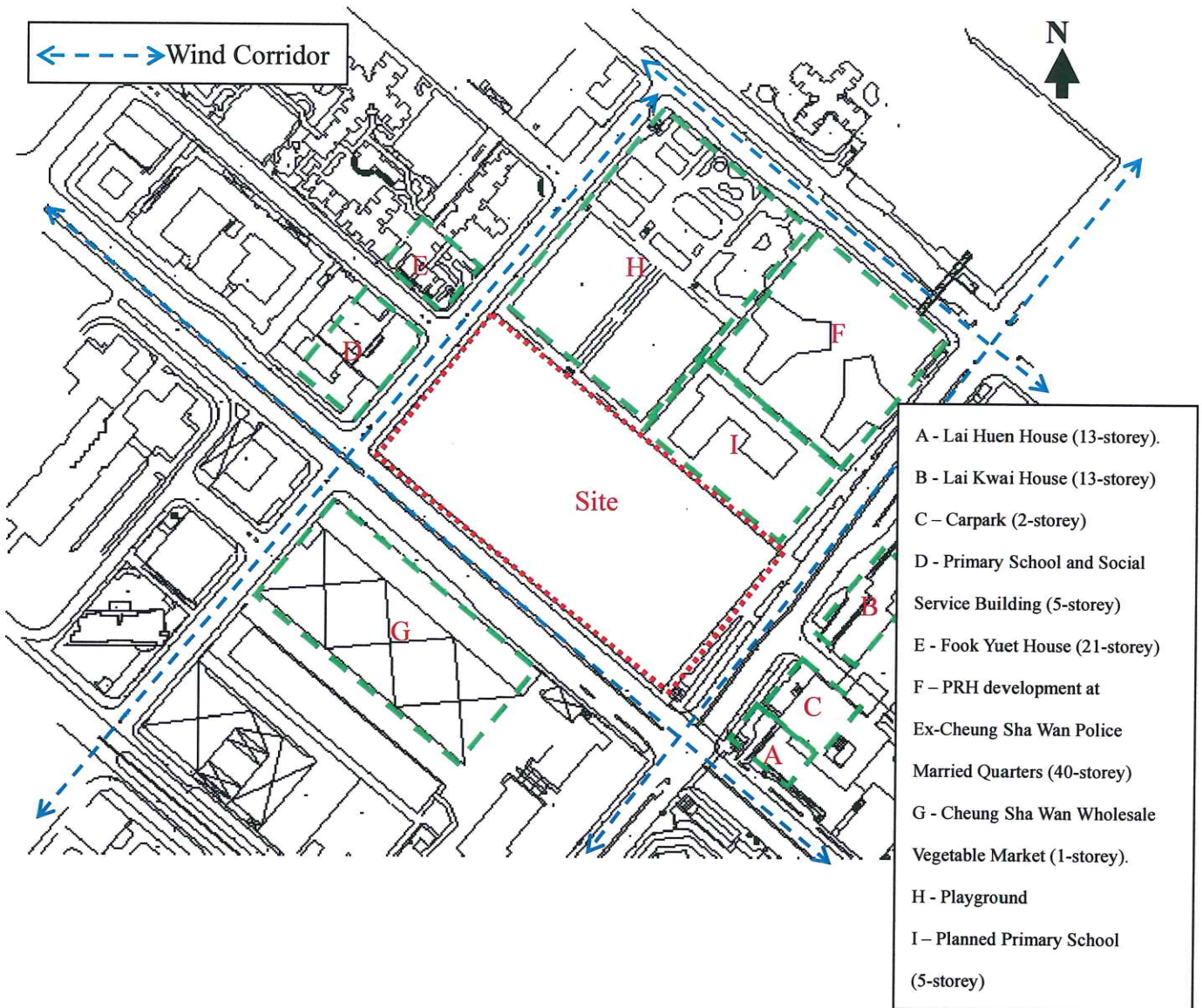
- Road/Street Pattern

Roads such as Cheung Sha Wan Road, Tonkin Street, Lai Chi Kok Road and Fat Tseung Street are considered as wind corridors within the study area for both annual and summer winds.

- Open Spaces

Open spaces (playground) are located at the immediate north of the project which promote air circulation at the pedestrian level and increase pedestrian comfort.

Figure 5 Site Environment and Wind Corridor

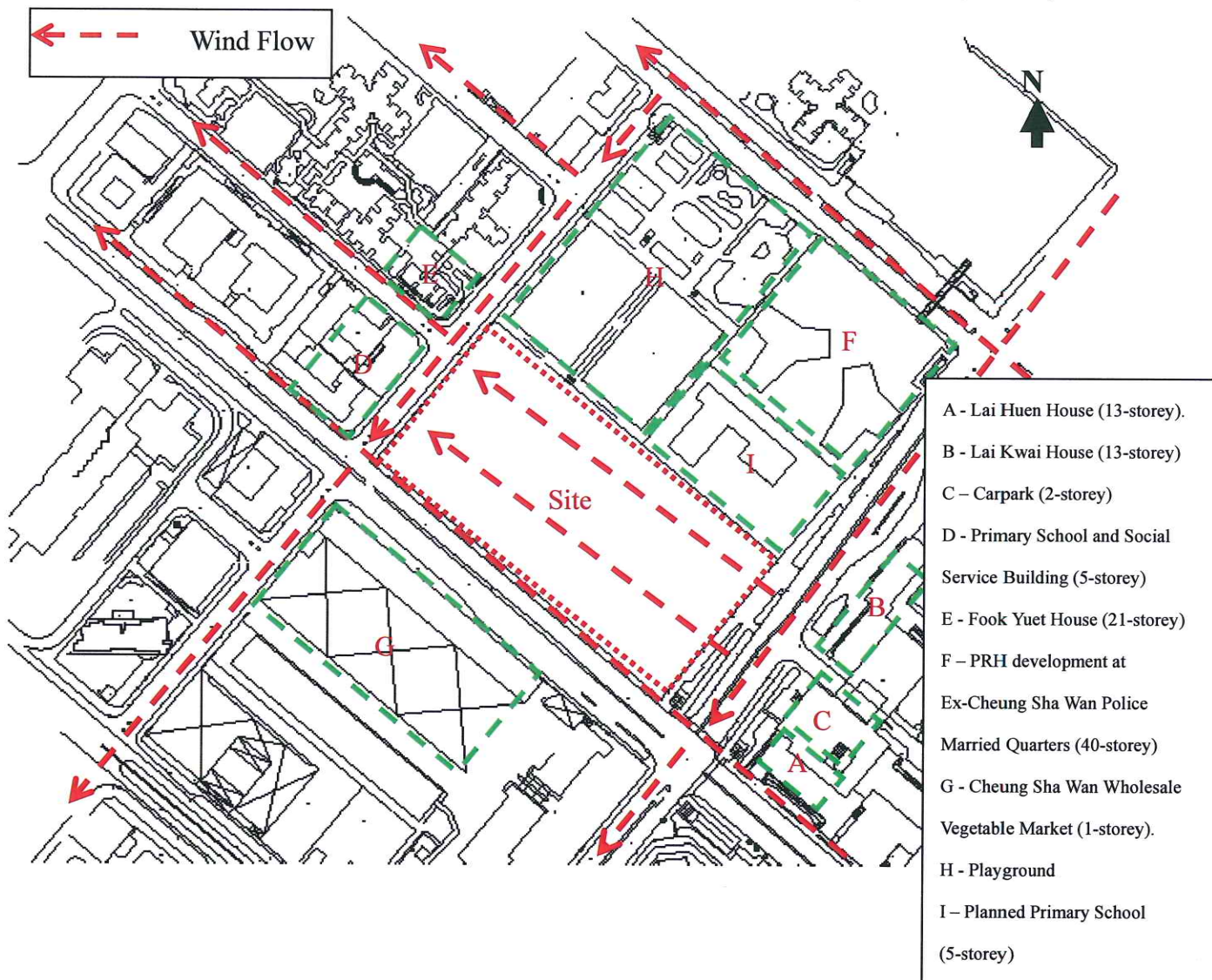


6.1.1. Annual prevailing wind (E) Condition

For the annual prevailing wind condition, it is expected that winds from E direction flow through the subject site.

As shown in *Figure 6*, the major wind corridors and the open space of playground are generally maintained at E prevailing wind condition. It is expected that the project site area together with the open space in the vicinity of the project will facilitate wind to pass through to the west direction. Moreover this wind corridor allows the prevailing winds to reach subject site, maintaining air ventilation at the pedestrian level.

Figure 6 Existing Annual Prevailing Wind Environment at Subject Site (E Wind)



6.1.2. Summer prevailing wind (SW) Condition

During the summer period, it is expected that the prevailing winds from SW directions flow through the subject site.

As shown in *Figure 7*, the major wind corridors are maintained. It is expected that the project site area together with playground will facilitate wind to pass through to the east direction. Moreover this wind corridor shall allow the prevailing winds to reach the subject site from the southwest and the air ventilation at the pedestrian level is generally maintained.

Figure 7 Existing Summer Wind Environment at Subject Site (South-West Wind)



6.2. PROPOSED DEVELOPMENT

The proposed development comprises of six domestic blocks each with 33-storeys, with a gross site area of approximately 23,000 square meters. The composition of the project is summarized in the *Figure 8 & Figure 9* and *Table 2*.

Figure 8 Layout Plan for the Project

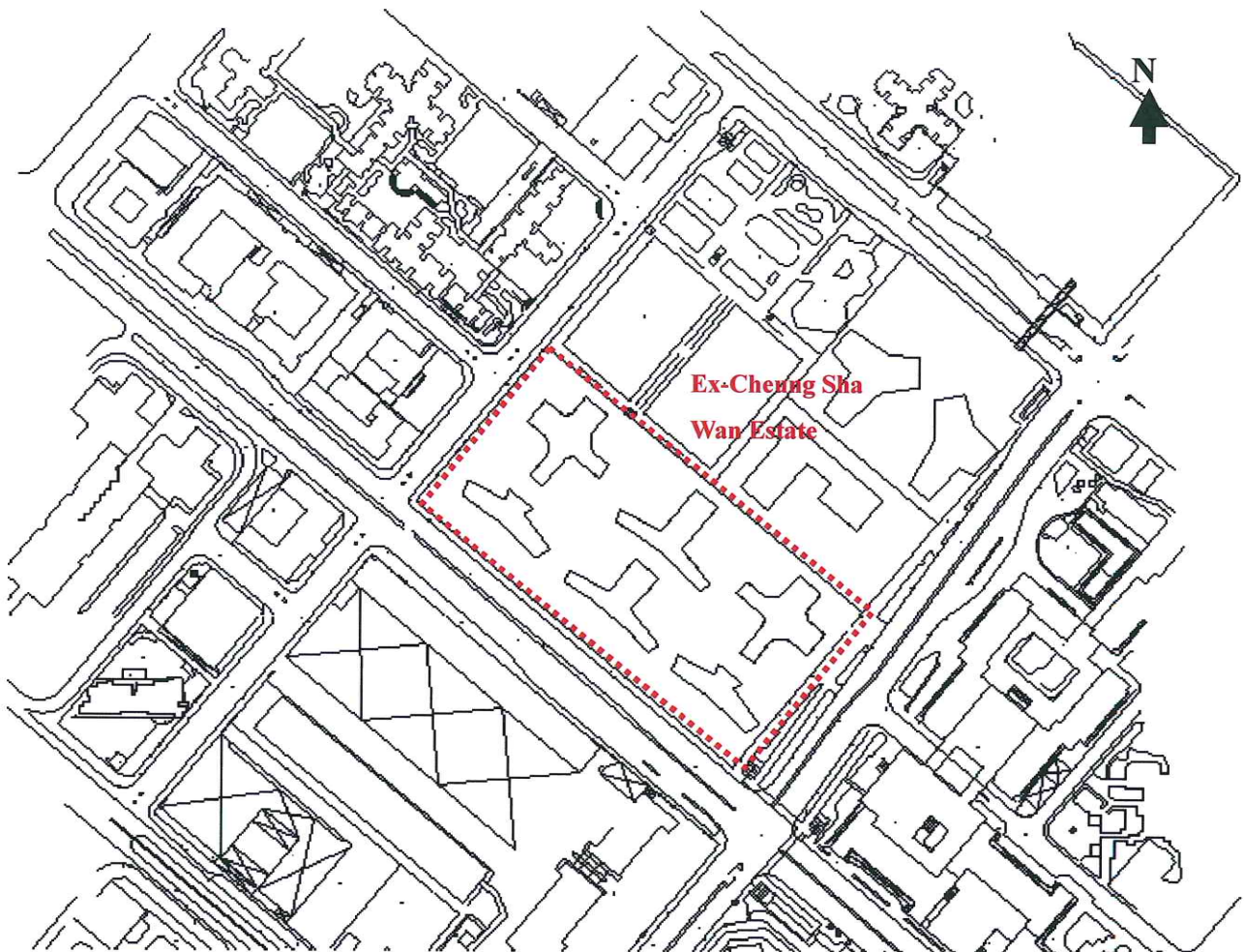
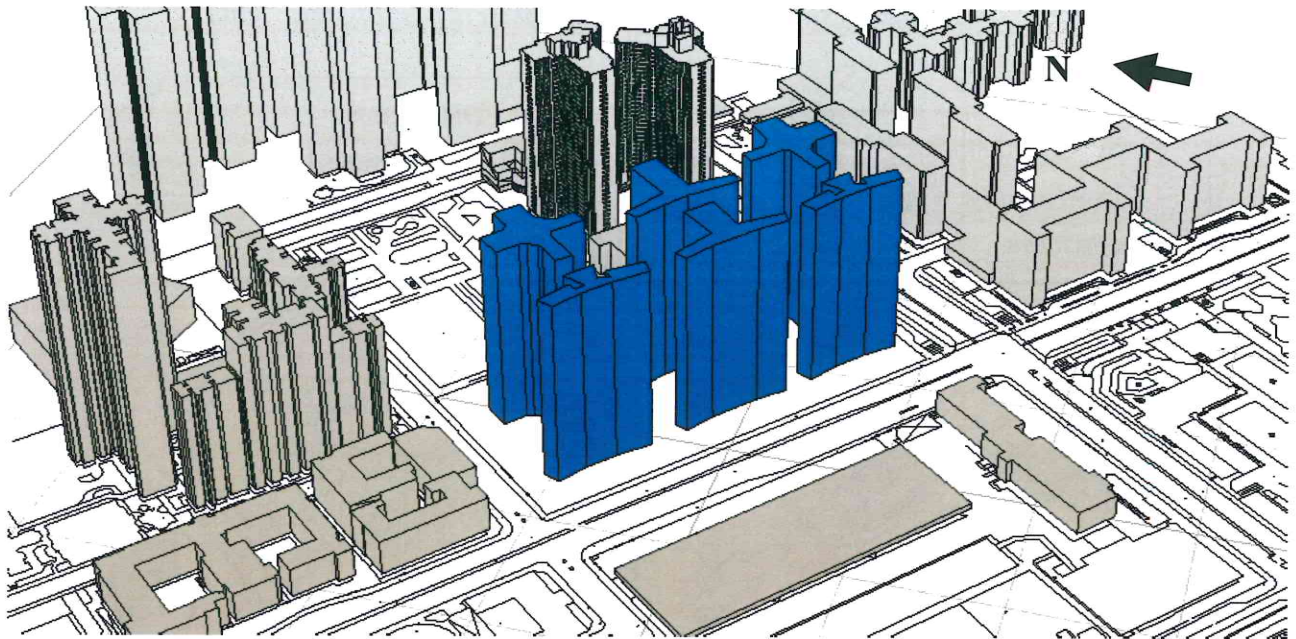


Figure 9 3-D layout for the project**Table 2** Development Details

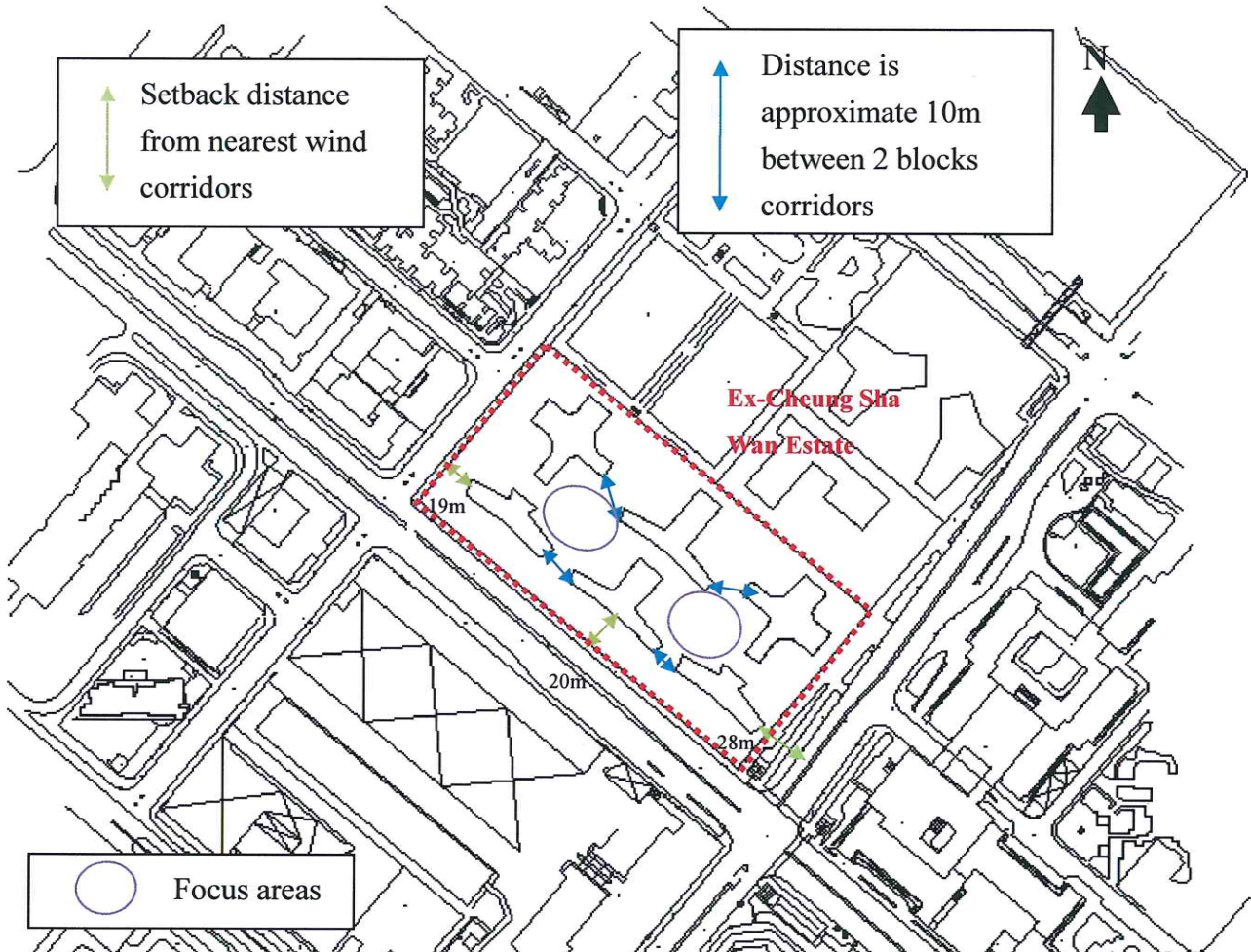
	Public Housing Development at Ex-Cheung Sha Wan Estate
Site Area	Around 23,000 square meters
No of Residential Blocks	6
No of Storeys	33 storey for each block
No of flats	Approximate 2,300
Podium	Podium free
Facility	Underground car park
Building Height	Restricted to +100mPD

6.2.1. Good Design Features

Good design features for improving air ventilation performance of the Project include:

- Podium free design in the proposed development which eliminates the impediment effect of the podium on the prevailing wind.
- A provision of 10 meters building separation between domestic blocks 1, 2, 3 and blocks 4, 5, 6. The setback distance of 28 meters from Tonkin Street, 20 meters from Lai Chi Kok Road and 19 meters from Fat Tseung Street help to preserve and funnel the air flow in the prevailing wind corridor as shown in *Figure 10*.
- Building pattern aligned in parallel to the wind corridor in order to maximise the penetration of prevailing wind through the district.

Figure 10 Provision of setback distance and focus areas for static wind



6.2.2. Problem

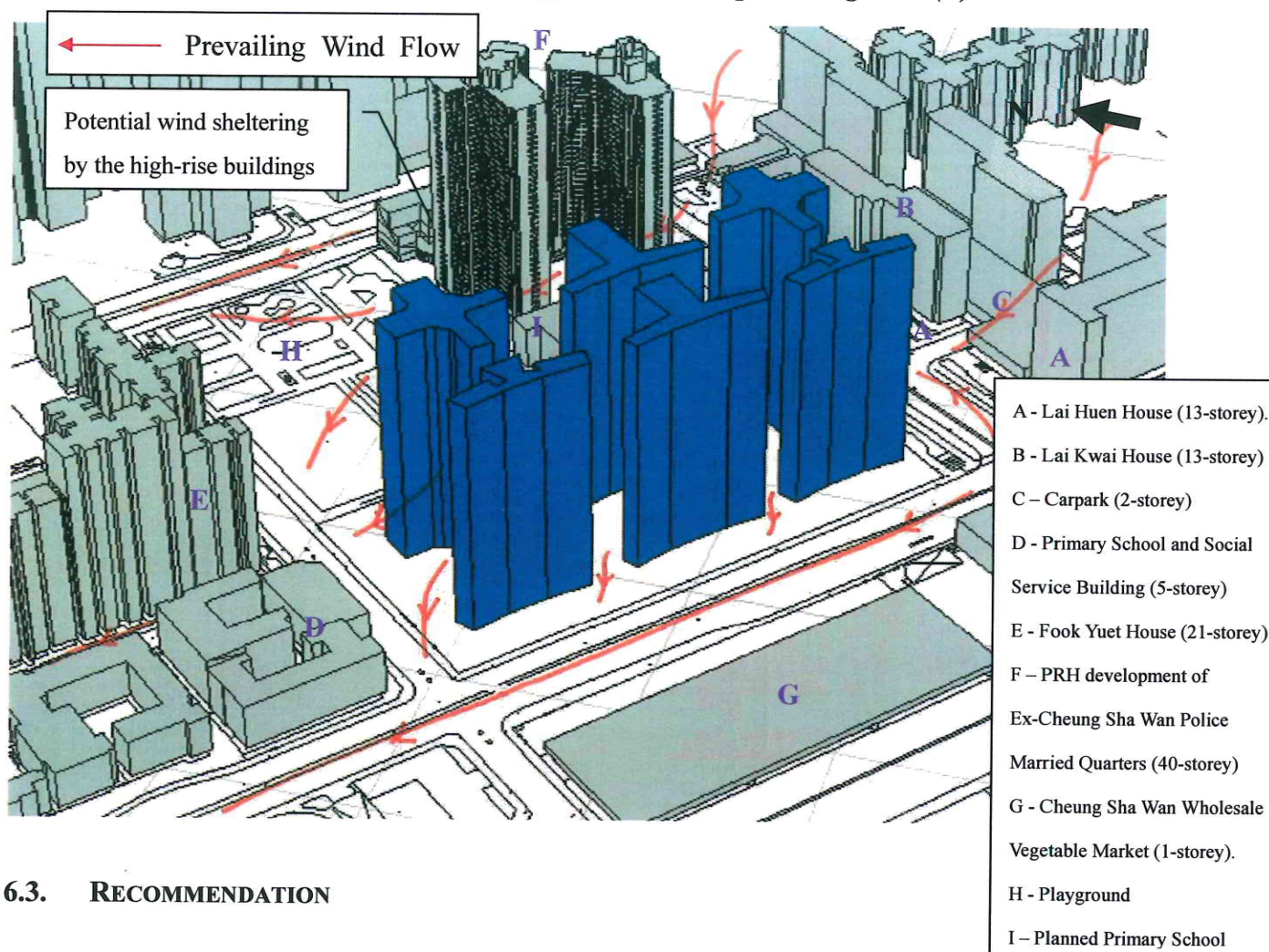
Nevertheless, some drawbacks are identified:

- Based on the proposed scheme, the height of the subject buildings are relatively high compared with the surrounding buildings. The buildings may pose potential wind sheltering as shown in **Figure 11**, and as a result affecting the wind availability to the nearby buildings such as Lai Huen House and the primary school for the annual prevailing wind, Lai Huen House and Lai Kwai House for the summer wind.
- The focus areas, as shown in **Figure 10**, are surrounded by the subject buildings. Therefore, low wind performance will be expected.

In view of these, the height of the subject buildings may affect air performance of the surrounding buildings such as Hoi Ping Chamber of Commerce Primary School in annual prevailing wind condition and Lai Huen House in the summer season. Nevertheless, the

good design of building separation can maximize the ventilation effect. In addition, increase the openings at the ground floor to enhance ventilation in the buildings is recommended.

Figure 11 Potential Wind Sheltering under annual prevailing wind (E)



6.3. RECOMMENDATION

To enhance the air ventilation performance of the Project, the following improvement measures are recommended for consideration:

- To enhance ventilation at ground floor and between the subject buildings
Size of the openings at ground floor should be enlarged. Hence, wind permeability of the buildings can be increased.

7. FUTURE STUDY

As the project design has adopted a range of good design features in consideration with the wind environment, the project development would not have any adverse impact on the existing wind environment in the surrounding areas. Therefore AVA Initial Study is not required.

8. CONCLUSION

This AVA-EE Study aims at providing qualitative evaluation of wind performance of the subject site under the existing condition and the proposed design option. The subject site is currently a flatted site where it is surrounded by medium to high-rise social service buildings and residential buildings. Under the good design features, the subject buildings can maintain the air ventilation at the pedestrian level within neighbourhood during annual prevailing wind condition and summer conditions.

The air ventilation performance of the proposed development, which consists of six domestic blocks with 33-storey has been evaluated. The following good design features has been incorporated in the Initial Scheme:

- Podium free design
- Adequate separation within the development to reduce screening effect on prevailing wind
- Setback distance between the development and surrounding buildings
- Buildings pattern aligned in parallel to the wind corridor in order to maximise the penetration of prevailing wind through the district

The following additional enhancement measure is recommended in the Expert Evaluation in order to improve the air ventilation performance:

- Increase the openings at the ground floor to enhance air ventilation.

An AVA Initial Study is not required as the project is qualitatively evaluated and determined not to have any adverse impact on the existing wind environment in the surrounding area.

