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For an Instructed Project for Kwai Chung Area

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Prepared by:

Calvin Chiu
Senior Manager

Approved by:

David Yeung
Managing Director

ENVIRON Hong Kong Limited
Room 2310, China Resources Building
26 Harbour Road, Wan Chai, Hong Kong
(852) 3743 0788

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Executive Summary

Study Area

The study area (see **Figure ES1**) is the area covered by Kwai Chung OZP on the northwest side of Kowloon Peninsula and to the east of Tsing Yi Island.

Wind Availability

According to MM5 simulated wind availability data, northeasterly wind is prevailing annually. Easterly wind is also important at relatively unobstructed locations (western side of Golden Hill Road and southern side of the study area, as well as the western side of the study area with long separation from hilly region on the eastern side). Southeasterly wind is also prevailing near the southeast side of the study area. On the other hand, southerly (including southeasterly and southwesterly wind) wind is dominant in summer (**Figure ES4**).

Topography and Urban Landscape

The study area is bounded by seawater to the southwest. Waterfront area in the south is mostly formed by reclamation for container terminal uses and is generally flat (around 4mPD). However, the ground elevation increases quickly towards inner region.

The eastern side of the study area is topographically higher (up to 360mPD). The northern side is also as high as 300mPD. The northeast boundary of the study area nearest to Golden Hill is as high as over 300mPD. The northern tip of the study area near to Shing Mun Reservoir is up to around 200mPD.

For the purpose of discussion, the study area is divided into 3 sub-areas: Kwai Chung sub-area, Chung Kwai Chung sub-area and Ha Kwai Chung sub-area (**Figure ES3**). The knoll within Ha Kwai Chung sub-area is the highest at about central part of the study area (service reservoir to the north of Wonderland Villas) and is as high as 258mPD. Another knoll of 166mPD is at Highland Park to the east of MTR Lai King Station.

The built area covers the lower ground area as well some other higher ground areas such as, Lai King (in Ha Kwai Chung sub-area), Kwai Shing (in Kwai Chung sub-area), Shek Lei/Shek Yam/Industrial and commercial area (in Chung Kwai Chung sub-area). The built area generally covers central and western portion of the study area. The eastern side is generally covered by vegetation. **Figure ES2** shows the distribution of green belt, open space and G/IC sites that usually allow wind distribution. As shown on the same figure, the northern to central portion of the area is more densely built.

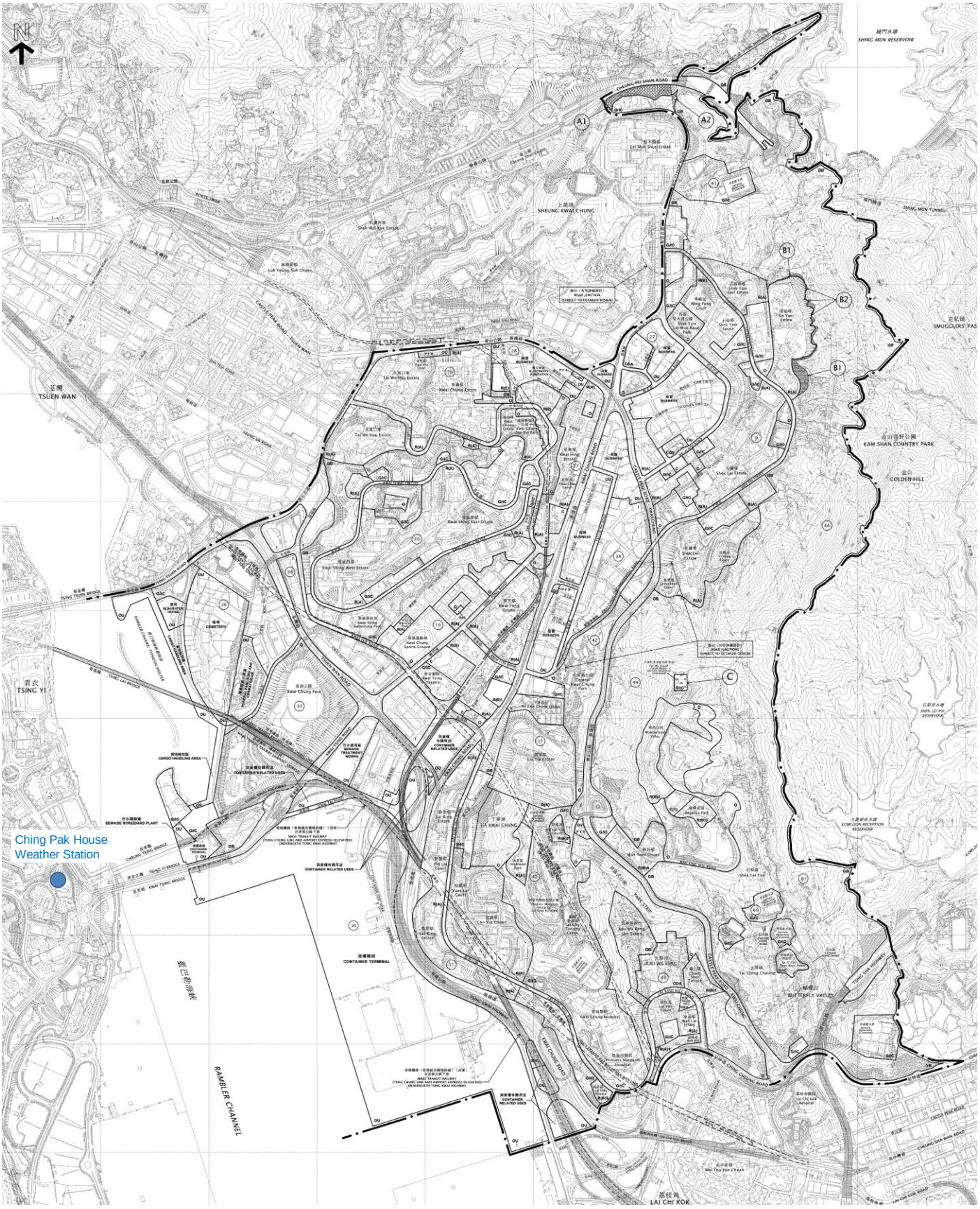


Figure ES1 Study Area – Kwai Chung OZP

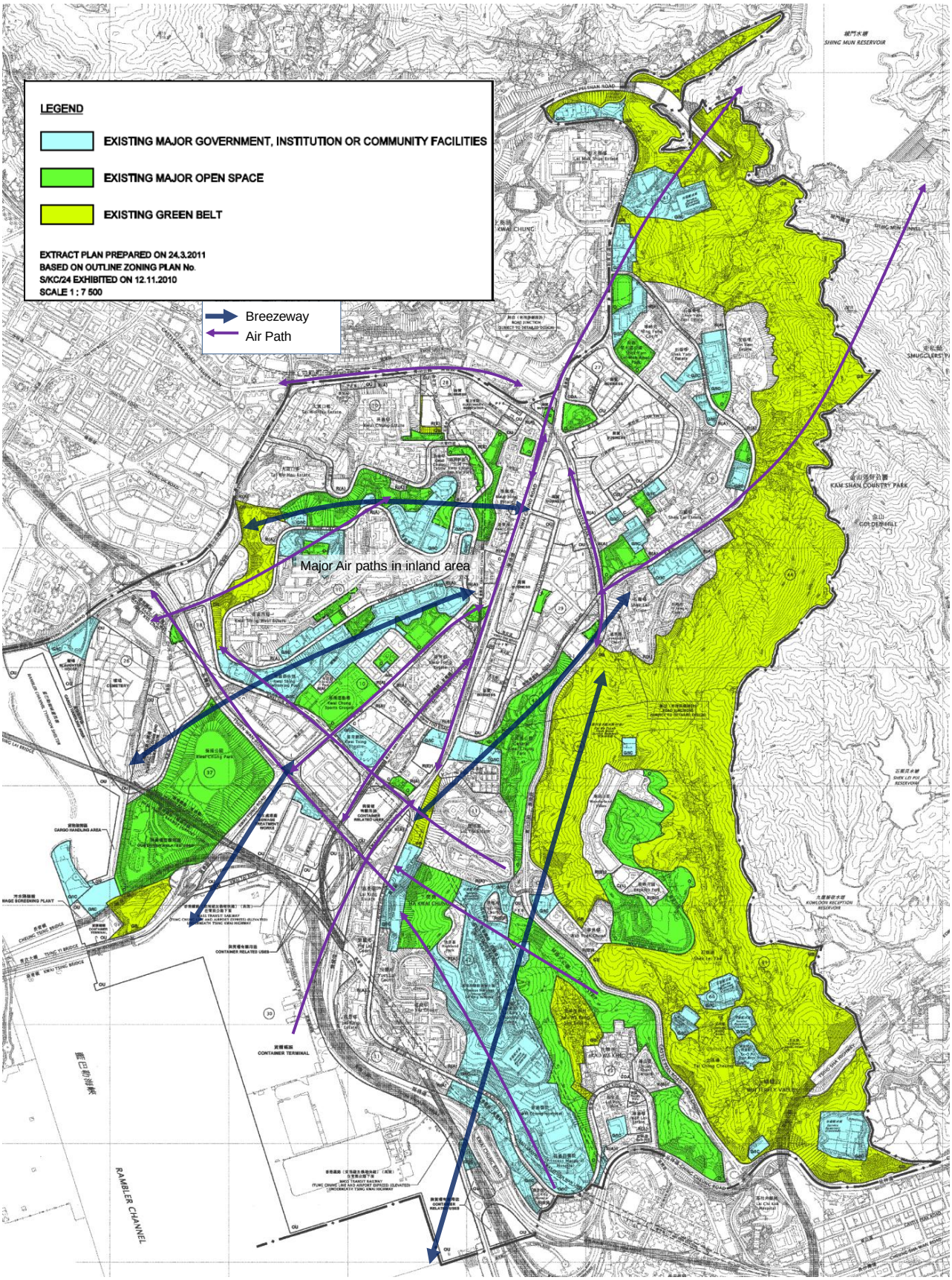


Figure ES2 Green Belt, Open Area, G/IC Site and Air Paths for Wind Distribution

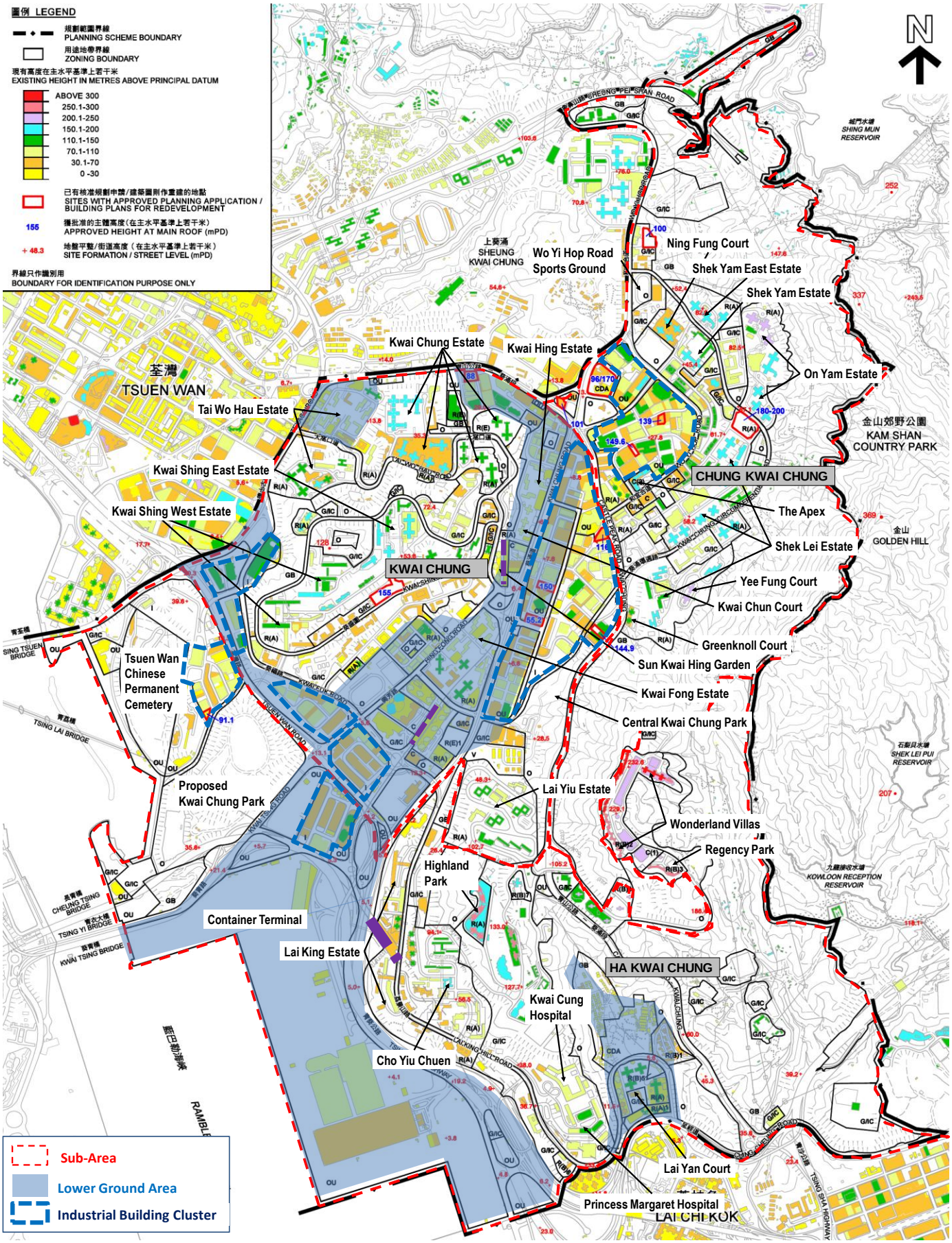


Figure ES3 Existing Building Height Profile and Division of Sub-Areas

Figure ES3 shows the existing building height profile. Lower ground can be found near shore, along Kwai Chung Road, Hing Fong Road, Tsuen Wan Road, etc. The waterfront area is occupied by container terminal. Industrial building clusters, residential development and some commercial development can be found at lower ground. At higher ground area, residential developments (incl. public housing development) are more common and industrial building cluster can be found along Wo Yi Hop Road.

Figure ES2 shows that open space and G/IC sites can be found within the built area, in particular along Hing Fong Road and on high ground along Kwai Shing Circuit. Major roads such as Kwai Chung Road, Tsuen Wan Road, Kwai Fuk Road, Castle Peak Road, etc. have effective width (building-to-building) of 50m or more. Air paths along these carriageways are shown.

For industrial building cluster, buildings usually have a large footprint and compacted together with little gap in between.

For residential and commercial developments, the extent of impact on air ventilation depends on disposition and alignment of the high-rise towers.

Evaluation of Existing Situation

Good Features

As shown in **Figure ES2**, there are a lot of inland open space, low-rise G/IC sites on the northwest side of Kwai Chung Road. Similarly, there exists Central Kwai Chung Park and other low-rise development areas (G/IC, V) on the eastern side of Kwai Chung Road for NE-SW wind flow. The G/IC areas to the west of On Yam Estate form another air path for NE wind flow to downwind area. There also exist open space and G/IC sites along carriageway which effects to widen the air path.

On the other hand, wider carriageways (e.g. Kwai Chung Road (over 40m), Tsuen Wan Road (over 50m), Kwai Fuk Road (around 50m), Castle Peak Road (around 50m), Kwai Tsing Road (over 50m)) and open area along them also form air path (**Figure ES4**). Other air paths with effective width more than 15m (usually a minimum width of corridor that can benefit wind penetration) can be found along MTR railway alignment (25m wide), Hing Fong Road (25m wide), etc. Cheung Wing Road and Shek Pai Street in Chung Kwai Chung sub-area facilitate NE wind flow to built area.

Most residential developments (e.g. On Yam Estate, Shek Lei Estate) have building gaps (no more than 2 towers aligned in continuous manner and have building gap of more than 15m in general and up to over 50m) to allow for wind penetration.

Problem Areas

Industrial building cluster along Kwai Chung Road and Tai Lin Pai Road are over congested, with two nearly continuous clusters of 420m and 520m long and some narrow corridor in-between. The existing E-W air path along Tai Lin Pai Road and Kwai On Street are blocked. E-W wind flow within built area is blocked.

Kwai Shing East Estate and Kwai Shing West Estate are situated at higher ground. The topography itself already makes it difficult for SE wind to pass through. The disposition of existing and recently completed buildings imposes some further impact against SE wind to penetrate to downwind area. The overall width of the buildings of these two estates is over 800m. As the permeability is lower under SE axis, the impact is considered significant.

The buildings within industrial building clusters and adjacent R(A) Sites bounded by Castle Peak Road and Wo Yi Hop Road are compacted together. There are no open space or through air path in between. The building cluster is generally impermeable.

Figure ES4 depicts the problem area.

Besides, there also exist some other minor problem areas where wind flow is possible but restricted in various degrees.

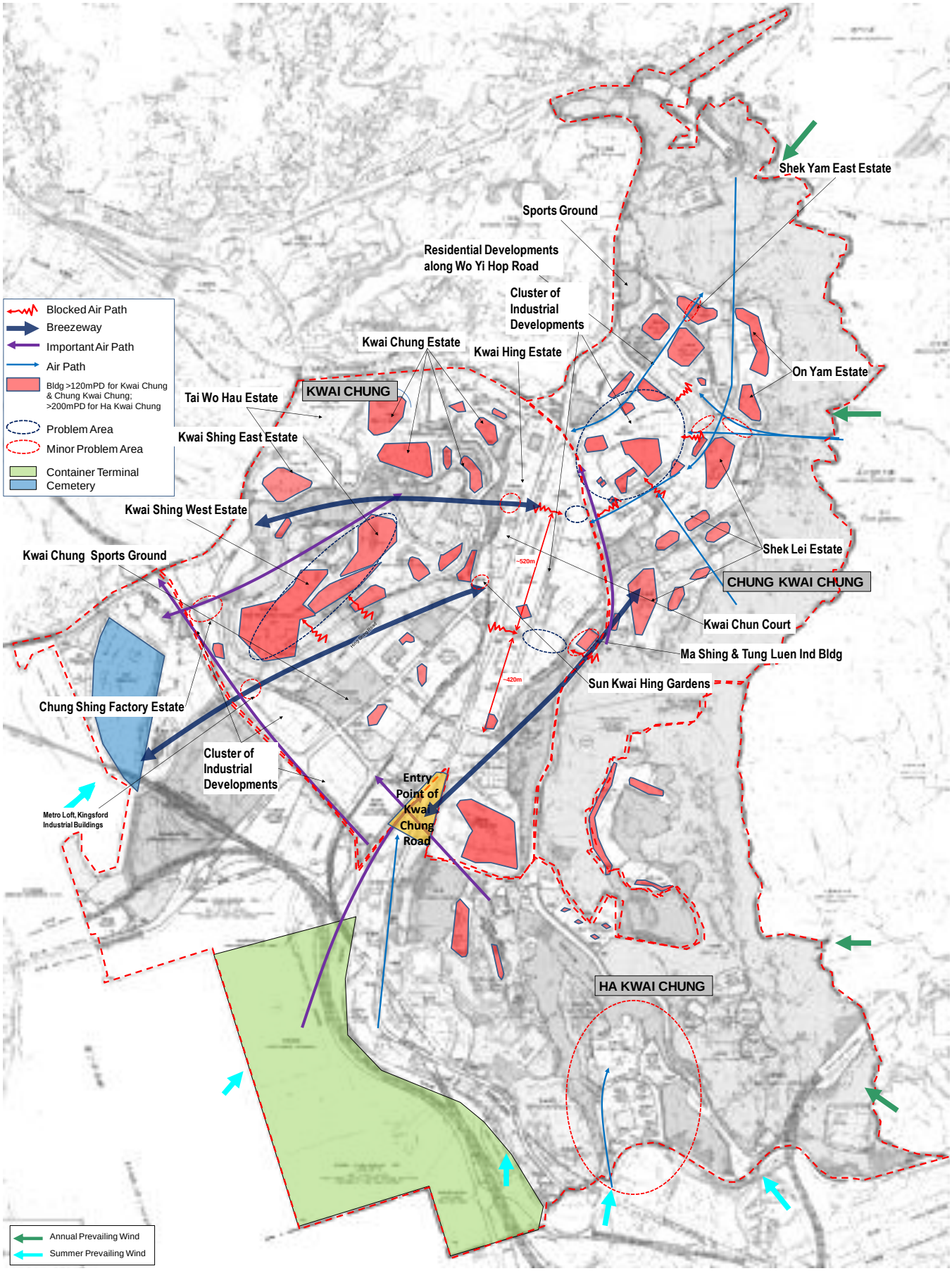


Figure ES4 Illustration of Air Flow and Problem Area

Initial Planned Scenario

Under the initial planned scenario (**Figure ES5**), the BH limit generally reflects the existing maximum building heights with respect to G/IC uses. For school developments, generally 8 storeys are allowed. For near shore area including Tsuen Wan Chinese Permanent Cemetery, container terminal area, the BH limit also reflects the existing situation.

For industrial buildings, the BH limits of industrial building cluster along Tsuen Wan Road range from 90mPD to 140mPD. The industrial building cluster bounded by Kwai Chung Road and Castle Peak Road would have BH limits ranging from 105mPD to 130mPD. The industrial building cluster bounded by Wo Yi Hop Road would have BH limit of 130mPD. OU(B) sites between Kin Chuen Street/Wo Tong Tsui Street and Castle Peak Road would have BH limit of 105mPD and 130mPD which is about 50m higher than existing BH.

Some of the sites would allow higher BH limit to take into account redevelopment potential (e.g. the northern portion of Cho Yiu Chuen, Lai King Estate, Lai Yiu Estate, southern portion of Kwai Shing West Estate, Tai Wo Hau Estate, and western portion of Shek Lei Estate).

A CDA site at Kau Wa Keng would have BH limit of 120mPD. The recently built Kwai Luen Estate and the committed development between Kwai Shing East Estate and Kwai Shing West Estate would have BH limit of 160mPD. The C site is occupied by a carpark building (currently 38mPD) to the south of MTR Kwai Fong Station and would have BH limit of 90mPD. The vacant R(E)1 site next to Kwai Chung Police Station would have BH limit of 90mPD. The mostly vacated industrial area to the north of Tsuen Wan Chinese Permanent Cemetery would have BH limit of 120mPD. The committed CDA development site along Cheung Wing Road would have BH limit of 120mPD. The R(A) site (under construction for public housing development) between Shek Li Estate and On Yam Estate has a BH limit of 180mD. The G/IC site under construction for Government quarters nearby Lei Muk Shue Police Station would have BH limit of 13 storeys.

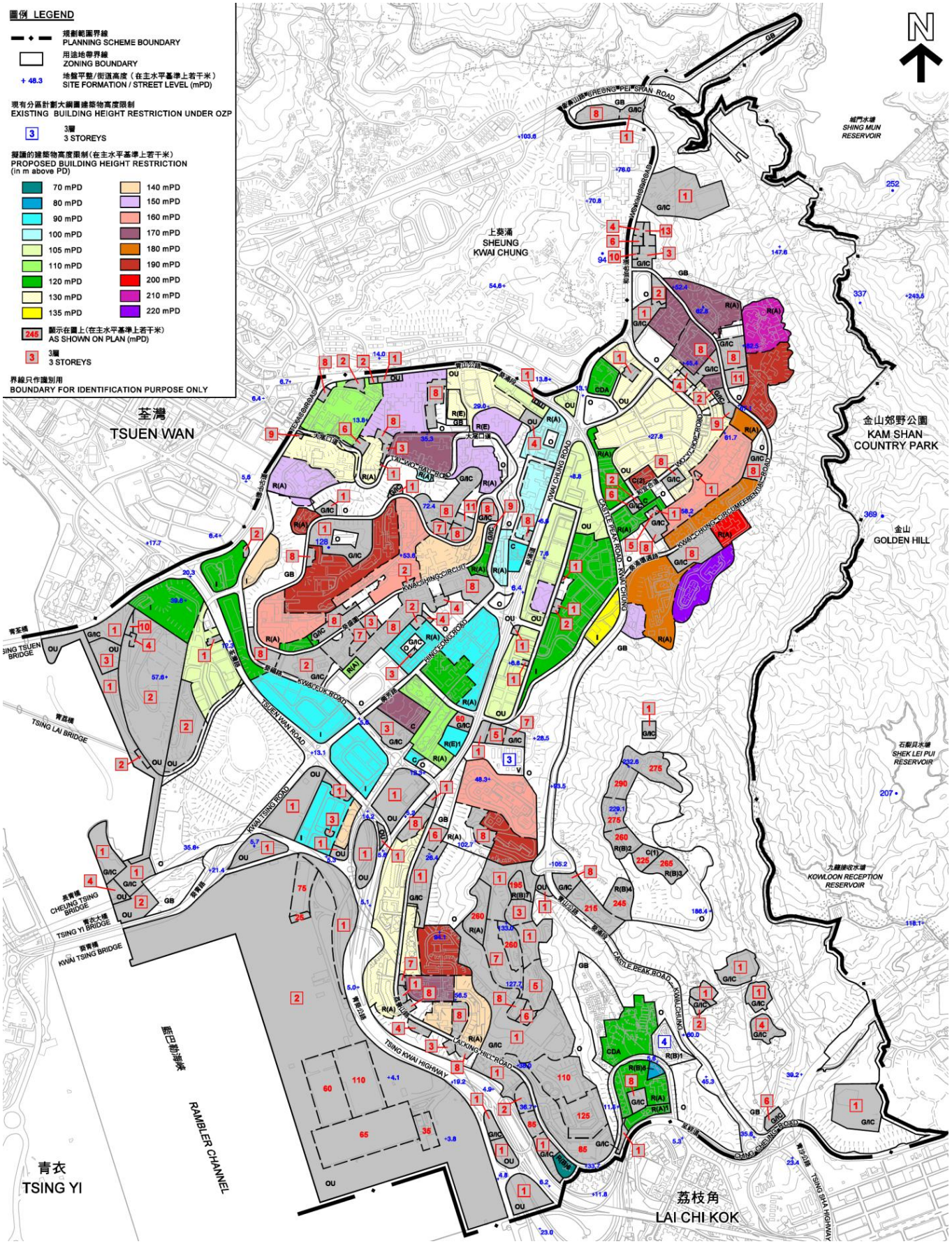


Figure ES5 Initial Planned Scenario

Under the initial planned scenario, there are following major problem areas (**Figure ES6**):

- Existing BH varies within a height band, where a few taller buildings reach the BH restriction and majority of the buildings are lower than the BH restriction. Under the initial planned scenario, these shorter buildings would be built to the BH limit upon redevelopment, resulting in taller buildings and thus increasing the H/W ratio. Higher H/W ratio along Tai Ling Pai Road is expected upon redevelopment (from 4:1 to 6:1);
- Buildings along Kwai Chung Road and Tai Lin Pai Road are over congested which would block air passage;
- Obstruction due to Kwai Shing East Estate and Kwai Shing West Estate, together with the newly built development at R(A) site at Kwai Luen Road;
- Increased H/W ratio along Castle Peak Road will intensify urban canyon effect;
- Impermeability of Tai Lin Pai Road industrial area and Wo Yip Hop Road industrial area.
- Western portion of the CDA site at Kau Wa Keng, if occupied, may block southerly wind from entering into this valley area.

Minor problem areas are also shown in **Figure ES6**.

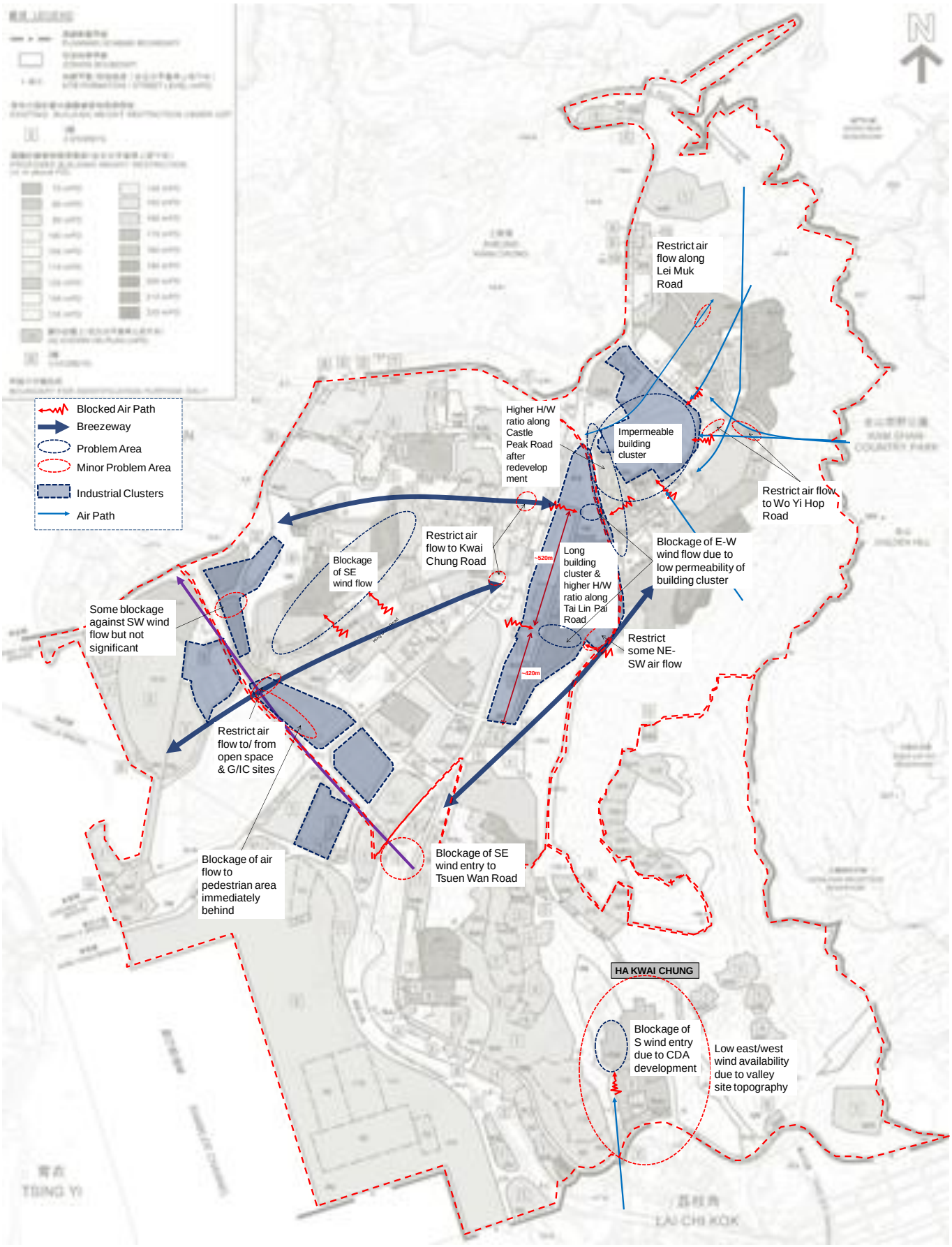


Figure ES6 Problem Area under Initial Planned Scenario

Recommendation and Further Study

Recommendations have been made to improve the initial planned scenario from air ventilation standpoint (**Figure ES7**). The recommended scenario adopts mitigations are in terms of building setback and NBA designation to address the issue for particular developments which bears importance on air ventilation.

- Setback from building lots or designation of NBA/building gap within the building lots among the industrial building cluster on both sides of Tai Lin Pai Road are recommended. Kwai Cheong Road is long enough so that wind entry to this carriageway should be maximized where practicable. An 15m-wide NBA between Kwai Cheong Road and Kwai Wing Road (setback 7m at grade from western boundary of existing Manhattan Centre to form the NBA with adjoining 8m-wide footpath) is therefore recommended to maximize air flow along it. This NBA will be of the same width as Kwai Cheong Road and Kwai Wing Road.

- Other air paths under concern are short and generally aligned along E-W axis. . For the four existing footpaths at grade between Kwai Chung Road and Tai Lin Pai Road/Ka Ting Road and the one between Castle Peak Road and Wah Sing Street, they are considered as good feature to allow wind penetration at pedestrian level and should be maintained. They are thus recommended to be designated as NBAs. As these footpaths, which act as air paths, are of 7m to 9m wide only and cannot serve very well as air corridors, additional measures should be incorporated. The building setback at grade required is:

  (1) 3m building setback from southern lot boundary of Millennium Trade Centre, northern lot boundary of Wing Cheung Industrial Building, southern lot boundary of Eastern Sea Industrial Building & northern lot boundary of Roxy Industrial Centre;

  (2) 4m building setback from southern lot boundary of Wing Cheung Industrial Building, northern lot boundary of Luen Tai Industrial Building, southern lot boundary of Roxy Industrial Centre & northern lot boundary of Kowloon Commerce Centre;

  (3) 11m building setback from southern lot boundary of Mai Wo Industrial Building;

  (4) 3.5m building setback from southern lot boundary of Yee Lim Industrial Building & northern lot boundary of Eastern Factory Building

- For areas between Tai Lin Pai Road and Castle Peak Road/Wing Yip Street which are with significant elevation difference, free of building structure at grade (measured from Tai Lin Pai Road) is not considered necessary. In this case, air corridors are recommended to be created by building setback at a particular elevation (not higher than ground level of Castle Peak Road/Wing Yip Street). They include: 7.5m building setback at above 25mPD from southern lot boundary of existing Hensey Industrial Building & northern lot boundary of Vanta Industrial

Centre to form a 15m-wide air corridor (which tally with existing width of east-west aligned Tai Lin Pai Road to the west); various building setback at grade along southern boundary of Vanta Industrial Centre to form a minimum 9.7m-wide air corridor connecting to Wah Sing Street; 15m-wide air corridor at above 18mPD created between Wing Yip Street and Kwai On Road (which tally with the existing width of Wing Yip Street).

- An NBA is assigned to cover the existing open space and slope between Castle Peak Road and Yip Shing Street (over 50m wide). It will straighten and maintain adequate width of the air path along Castle Peak Road. As discussed before, NBA without building structure at grade is normally recommended unless there is practical difficulty or benefit of the NBA is minimal. In this case, it is not anticipated that lot owner's development rights will be significantly impacted. NBA at grade is therefore proposed.

- The northwest end of one industrial building cluster where Metro Loft and Kingsford Industrial Buildings reside is currently occupied by temporary oil depot (low-rise) and open carpark so that southwesterly sea breeze can enter the inland area through it. An air corridor of 50m wide above 24mPD with the alignment projected from Kwai Hei Street and running in the NE-SW direction to connect Kwai Fuk Road and Tsuen Wan Road is recommended to maintain the entry for sea breeze from the southwest. The 24mPD is to align with the surface level of Kwai Fuk Road. The same breezeway in inland area along G/IC site and open space is over 100m wide. It is ideal to maintain the entry point with the same width as the breezeway in inland area. Nevertheless, a width of 50m is considered the minimum width that should be allowed for breezeway and is therefore recommended in this context.

- For the elongated industrial land sandwiched between Tsuen Wan Road and Kwai Hei Street with a total site width of about 300m facing the southwest, building gap should be provided or building permeability at lower levels should be enhanced to allow wind penetration to pedestrian areas immediately behind. Control can be exercised by imposing requirement to conduct quantitative AVA or designate NBA of not less than 15m wide aligned with existing road (Kwai Lok Street).

- To improve the permeability of the industrial building cluster , the building-to-building width of these streets is recommended to be increased. It is noted that there is a long-term road widening proposal to widen these roads to about 20.5m, which would result in a H/W ratio of about 5:1. This would significantly improve the air ventilation along these roads. As such, it is suggested to take advantage of the road widening proposal and designate a 4m-wide NBA from lot boundary aboutting Lam Tin Street and 3.5m-wide NBA from the lot boundary abutting Chun Pin Strret and Ta Chuen Ping Street to achieve a building-to-building width of 20.5m, so as to benfit both traffic and air ventilation conditions (photos 62, 63, 73, 74).

- Moreover, NBA is recommended at the existing non-through corridor between Kwai Hing Industrial Building, Kingswin Industrial Building, Vigor Industrial Building and Edwick Industrial Building. The NBA is further extended to the building footprint of Vigor Industrial Building and Hutchison Estate. It will form a through air path connecting Wo Yi Hop Road (from Lam Tin Street) to Castle Peak Road, which would help to ameliorate problem of Castle Peak Road due to increased H/W ratio and improve air ventilation within the industrial cluster as well. Despite that sections of air path on two sides of Chun Pin Street are not well aligned and there is bending between Lam Tin Street and the proposed NBA, it is considered that wind flow can be channelized through the proposed NBA to benefit pedestrian area. Preferably, the NBA should be of 15m wide and free of structure at grade (i.e. the elevation of pedestrian area). As a compromise to the development potential of individual lots, NBA of 9m wide (which is mostly similar to the existing scenario but with such area extended to Vigor Industrial Building and Hutchison Estate) is the minimum requirement. Normally, it is ideal to have a NBA at grade to directly benefit the pedestrian area. In this case, a flyover exists along Castle Peak Road (about 8m above ground near this NBA) and is perpendicular to this NBA. In order to benefit the pedestrian area along Castle Peak Road, the BH should be lower than the flyover. Otherwise, most wind flow channelized through the air path to Castle Peak Road can only reach the flyover level and above and only little wind can benefit the pedestrian area below the flyover. Therefore, NBA at grade is considered necessary.

- The northern side of Lai King Estate, if occupied, may block air flow to Tsuen Wan Road. Considering Housing department's concern on the redevelopment flexibility of Lai King Estate in future, two alternative options were considered, i.e. a lower BH limit assigned at the existing bus terminus, open carpark and slopes same as the level of Lai King Hill Road (about 24mPD) (option 1); or imposed a east-west aligned NBA for the strip of land to the immediate south of the school building of Lai King Catholic Secondary School excluding the bus terminus and open carpark (option 2) in order to allow flexibility for the redevelopment of Lai King Estate. After evaluation, option 1 will perform better than option 2 from air ventilation standpoint. Moreover, the existing air path connecting to Tsuen Wan Road can be preserved. Therefore, option 1 is preferred over option 2.

- The CDA site at Kau Wa Keng, if built, may block important southerly wind. Southerly wind is especially important because Kau Wa Keng is in the valley area with the southern side least obstructed. Therefore, NBA is designated along the western side of the CDA to minimize the potential blockage to southerly wind. The extent of NBA (maximum width of around 35m) is aligned with Lai King Hill Road (i.e. eastern side of the NBA aligned with eastern road side of Lai King Hill Road) to ensure that southerly wind after passing existing Lai Chi Kok Bay Garden would not be further blocked by new development within the CDA before reaching the ground level of the village. NBA should be at grade to avoid massive structure except that 2- to 3-storey houses which are not interconnected can be allowed. Alternatively, QAVA can be conducted to prove that the village would not have

inferior performance under southerly wind and in overall manner when compared with the existing scenario.

Further study to conduct quantitative AVA is recommended for redevelopment at a number of sites:

- Kwai Shing East Estate and Kwai Shing West Estate. The study should aim to allow adequate number and width of building gaps connecting to open space, slope and G/IC sites to improve SE wind penetration. In particular, SE wind entry to Yeung Uk Road (air path and pedestrian area in Tsuen Wan area) should be improved. In addition, existing NE-SW aligned air path partially along GB, G/IC sites should not be obstructed by providing adequate setback from northern side.
- Kwai Hing Estate and Kwai Chun Court. The study should aim to provide adequate building gap connecting to Kwai Chung Road and Tai Lin Pai Road so that E-W wind can pass through.
- Kwai Chung Estate. It should ensure that the air path along N-S axis connecting Castle Peak Road and open space in existing situation can be maintained.
- Tai Wo Hau Estate. To ensure that air ventilation performance along Texaco Road would not be deteriorated (e.g. by providing more setback from Texaco Road), SE wind penetration from along Tai Wo Hau Road and on the southern side via open space & G/IC sites can be maintained or further improved, SE wind entry to Sha Tsui Road can be improved to benefit Tsuen Wan area, and air path along N-S axis connecting Castle Peak Road and open space can be maintained.
- Shek Yam East Estate. To ensure that the air path is maintained (or even improved in scale) and aligned with Lei Muk Road.
- Shek Lei Estate. To ensure that the air path for southeast wind penetration is maintained (or even improved in scale) and aligned with Wai Kek Street.

Besides, development with low permeability should be avoided where practicable, especially for larger site which is supposed to have higher flexibility to determine the disposition and other features of the buildings. Therefore, for sites amalgamation to form larger sites for future development, quantitative AVA is also recommended for design improvement. In this case, recommendations for general direction for air ventilation improvement should be observed.

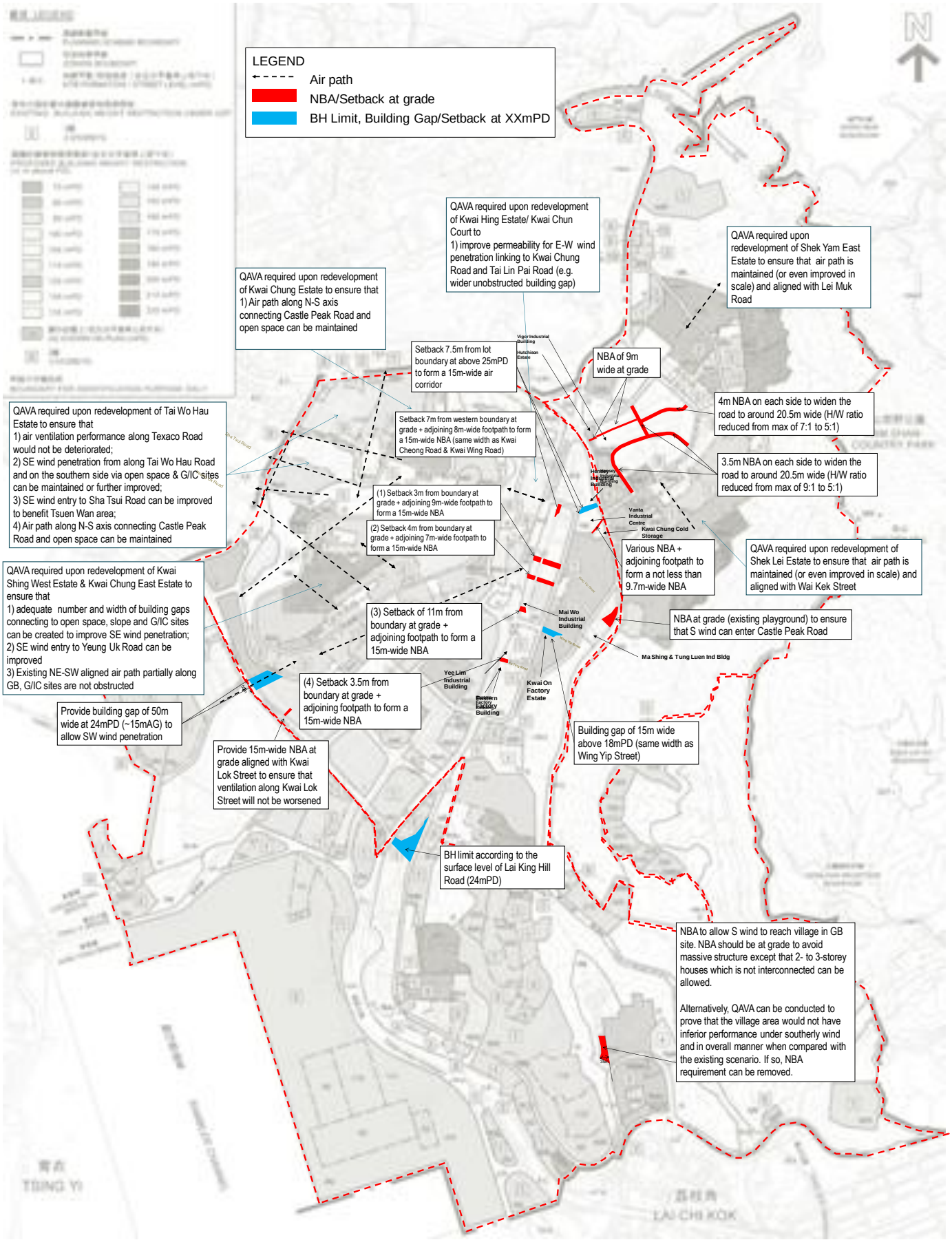


Figure ES7 Recommendation

1.0 Introduction

1.1 Assignment

1.1.1 This expert evaluation report for Kwai Chung Area was prepared based on materials provided by Planning Department in Nov 2010. Materials for Kwai Chung Area provided to the Consultant include but not limit to the followings:

- Kwai Chung OZP No. S/KC/24
- Wind Data
- Aerial Photos
- Existing Building Height Profile (Number of Storeys/mPD)
- Existing Spot Height
- Existing and Proposed Building Height Restrictions

1.2 Scope of Work

1.2.1 In this study, the Consultant is required to conduct a baseline analysis of the study area in Kwai Chung area and followed by an expert evaluation of the Initial Planned Scenario and Revised Scenario, if any.

1.3 Methodology

1.3.1 The methodology involves qualitative assessment to the existing situation and the proposed scenario(s) to identify problems and issues. In this assessment, the good features and problem areas with respect to air ventilation performance have been identified. Mitigation direction and measures are proposed with respect to the proposed scenario. Recommendations will be made to particular sites for further quantitative air ventilation assessments. This study involves review of information provided by Planning Department as well as verification of situations through site inspection.

2.0 Wind Availability

2.1.1 The study area is the area covered by Kwai Chung Outline Zoning Plan (OZP) on the northwest side of Kowloon Peninsula and to the west of Tsing Yi Island. **Figure 1** shows the study area.

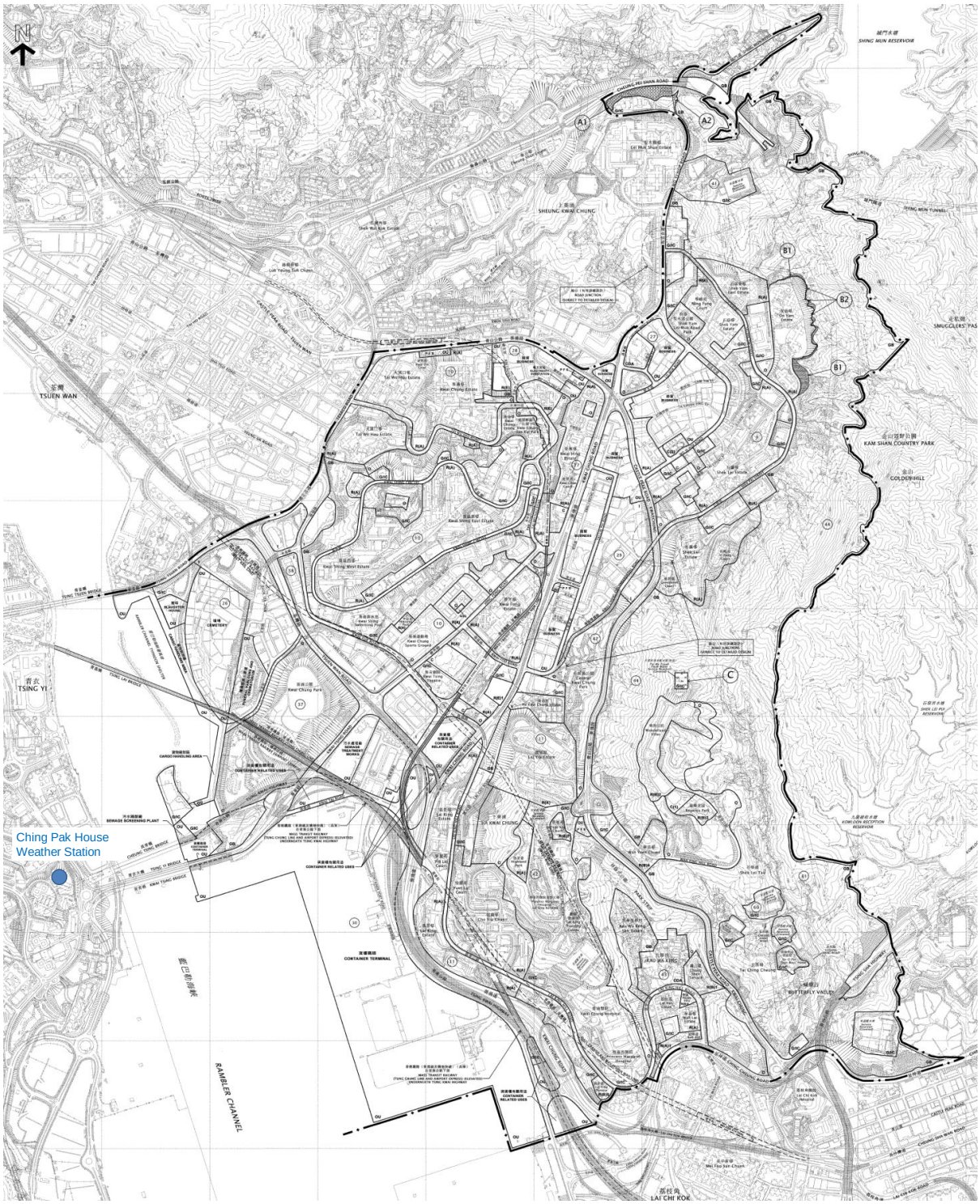


Figure 1 Study Area – Kwai Chung OZP

2.1.2 The wind availability analysis is based on both long term measurement data prepared by Hong Kong Observatory (HKO) and simulated wind availability data by Hong Kong University of Science and Technology (HKUST).

2.2 Measurement Data at Weather Station

2.2.1 HKO's weather monitoring stations scattered in Hong Kong provide reliable data of wind environment. The weather station nearest to the study area is at Ching Pak House of Cheung Ching Estate on Tsing Yi Island which is about 550m to the west of the study area. Ching Pak House Weather Station is elevated at 122mPD with anemometer height of 137mPD (see **Figure 1**).

2.2.2 Summer and Annual Wind Rose result at Ching Pak House weather station is presented in **Figure 2** and **Figure 3** for reference. Wind Rose has been prepared based on long term monitoring data (10-year long).

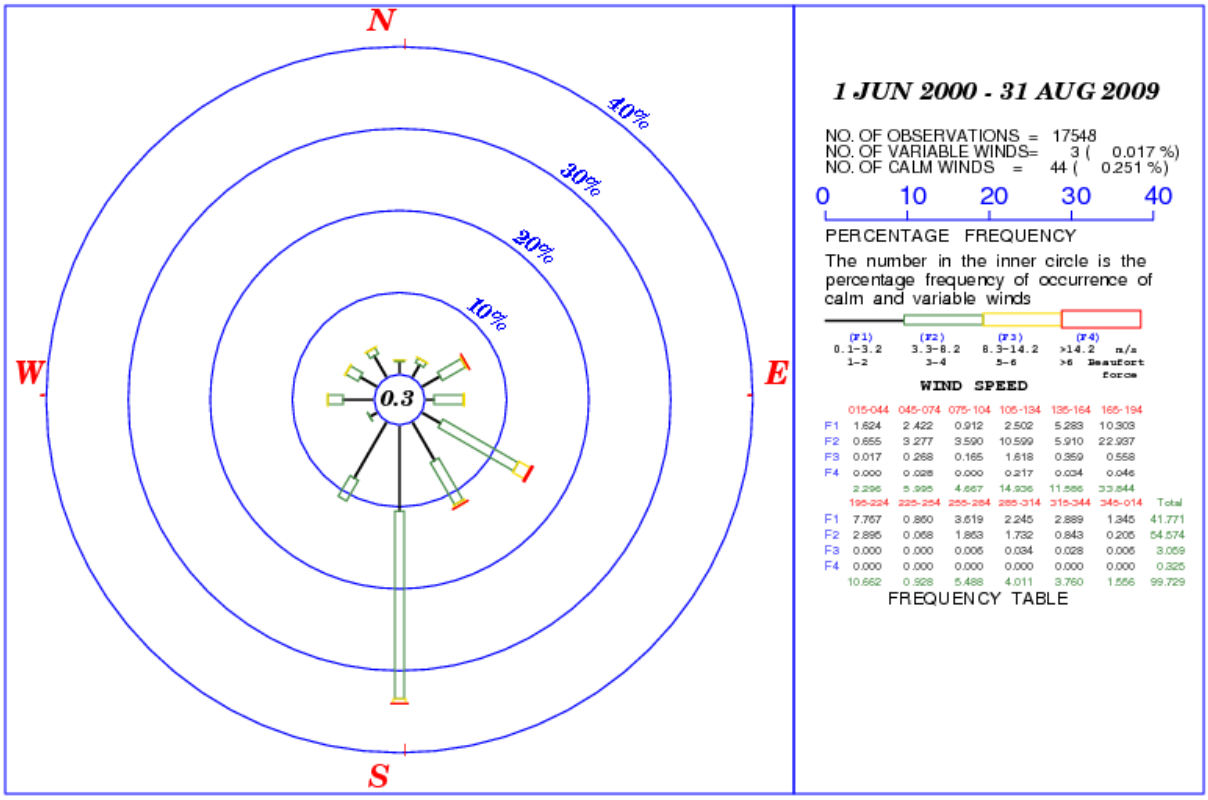


Figure 2 Summer Wind Rose Result at Ching Pak House Weather Station (Source: HKO)

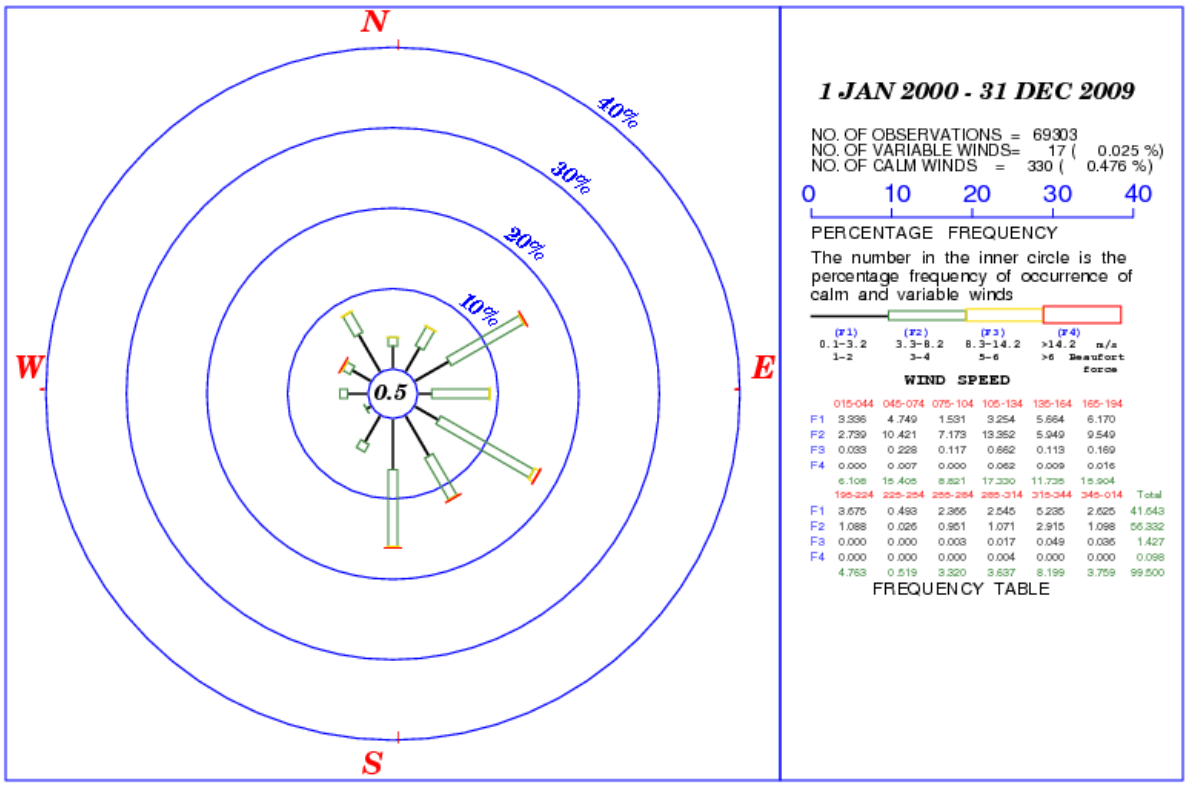


Figure 3 Annual Wind Rose Result at Ching Pak House Weather Station (Source: HKO)

2.2.3 Given the high anemometer height at Ching Pak House weather station, it is capable to represent the urban canopy elevation wind availability.

2.2.4 According to Wind Rose result (**Figure 2**), southerly wind is found prevailing in summer (Jun to Aug). Southeasterly wind is relatively more important than southwesterly wind.

2.2.5 Referring to the annual result (**Figure 3**), the importance of northeasterly to southeasterly wind increases whereas southerly wind is still important. Northeasterly and southeasterly wind is prevailing annually.

2.2.6 At Ching Pak House weather station, it is most affected by Tsing Yi Peak (334mPD) (**Figure 6**) to the southwest. Therefore, southwest wind availability as shown in the monitoring data is lower in general.

2.3 Simulated Wind Availability Data

2.3.1 HKUST have simulated a set of wind data using MM5. The data period covers the whole year of 2004. The simulated data allows to project to different elevations. The simulated data at 450m is representative of wind data above urban canopy and generally least affected by topography and building morphology.

2.3.2 **Figure 4** shows the MM5 Wind Rose result at 120m (approximate urban canopy layer height) and 450m (approximate wind boundary layer height) which are representative of the wind availability of Kwai Chung OZP area.

Height: 120m Height: 450m

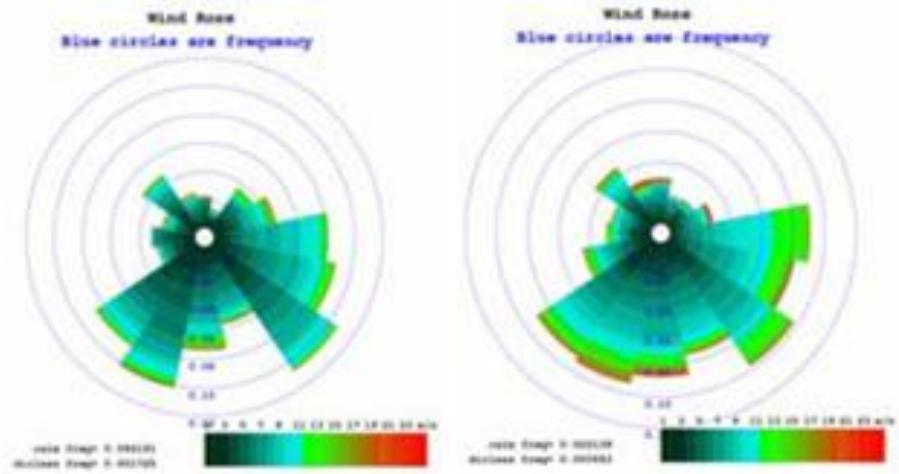


Figure 4 Summer Wind Rose Result based on MM5 Simulation (Source: HKUST)

Height: 120m Height: 450m

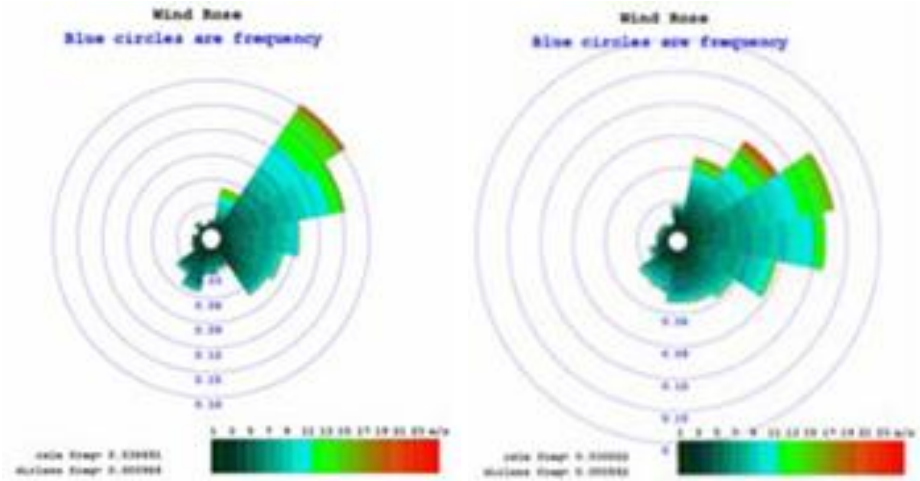


Figure 5 Annual Wind Rose Result based on MM5 Simulation (Source: HKUST)

2.3.3 Both summer Wind Rose result at 120m and 450m indicates that southwesterly and southeasterly (including E wind) wind is prevailing in summer. E & SSE wind availability is reduced at lower elevation (120m) probably due to topographical and building blockage effect by Golden Hill and built area of Kowloon Peninsula (which would reduce wind flow at elevation under or near the urban canopy) respectively.

2.3.4 The annual Wind Rose result at both 120m and 450m shows that northeasterly wind is dominant annually. At lower elevation (120m) when compared with the scenario at

450m, E & ENE wind availability is significantly reduced and is likely due to obstruction by topography (e.g. the area of Golden Hill adjacent to the study area is elevated up to around 360mPD so that wind below such elevation will be significantly blocked).

2.4 Topography and Building Morphology of the Surroundings

2.4.1 **Figure 6** shows the aerial photo of the study area and the surroundings.

2.4.2 The study area is surrounded by mountains such as Lin Fa Shan (579mPD) and Shek Lung Kung (474mPD) to the northwest, Tai Mo Shan (957mPD) to the further north, Needle Hill (532mPD) to the northeast and Grassy Hill (647mPD) to the further northeast, and Golden Hill (369mPD) & Eagle's Nest (305mPD) to the east. Tsing Yi Island (with Tsing Yi Peak up to 334mPD) is situated to the west and separated by Rambler Channel. In general, the built area of the study area is surrounded by high hill/mountain on three sides (northwest, northeast and east). In particular, Golden Hill is nearest to the study area so that wind availability from northeast and east direction is most significantly affected.

2.4.3 Southeast side of Tsing Yi Island is lower ground area (container terminal and oil depots) with least topographical and building blockage. Moreover, it is more distant from the study area when compared with the mountains on the north to east sides of the study area. Blockage impact against southwest to westerly wind is more likely. Some wind from southwest to west direction (especially in summer time) may be diverted to flow along southwest to south direction or along northwest direction. However, the impact is ameliorated due to long separation of hilly area of Tsing Yi Island from the study area.

2.4.4 According to the topography, annual prevailing northeasterly wind would be more likely to pass over Shing Mun Reservoir between Tai Mo Shan and Grassy Hill/Needle Hill/Golden Hill to the study area. The reservoir forms land of lower elevation when compared with the topography on northwest and southeast sides. Effectively, it forms a trough under such topographical condition and wind channelized through the trough (i.e. valley wind) would more easily reach downwind pedestrian area of lower elevations when compared with wind flowing over other higher ground.

2.4.5 E and N wind will be generally more obstructed by topography due to presence of Golden Hill and Tai Mo Shan respectively. It is expected that E wind frequency and mean speed will be reduced. E wind will be available at specific locations where there is least topographical obstruction. For example, E wind through another valley area along Golden Hill Road to the east of On Yam Estate is expected. Moreover, E wind should be more available at southern portion of the study area with least blockage by topography (e.g. south of Shek Lei Pui Reservoir).

2.4.6 Lai Chi Kok and Tsuen Wan are built-up area on the immediate southeast and north/northwest sides of the study area respectively. Northwesterly wind is usually the least occurred wind direction so that buildings within Tsuen Wan OZP do not significantly affect the study area. Nevertheless, it is observed that carriageways such as Tsuen Wan Road, Yeung Uk Road , Sha Tsui Road, etc. within Tsuen Wan district area aligned along NW-SE axis and can facilitate northwesterly wind penetration, if any.

2.4.7 The adjacent area in Lai Chi Kok is at around 5mPD only while most of southern portion of the study area adjacent to Lai Chi Kok is elevated much higher (except Lai Yan Court and Kau Wa Keng). Built area in Lai Chi Kok would have limited significance on wind availability on most of the study area on southern side at higher elevation. Nevertheless, it may effect to affect wind flow at pedestrian area of lower elevation at Lai Yan Court and Kau Wa Keng nearer to the southern side of study area.

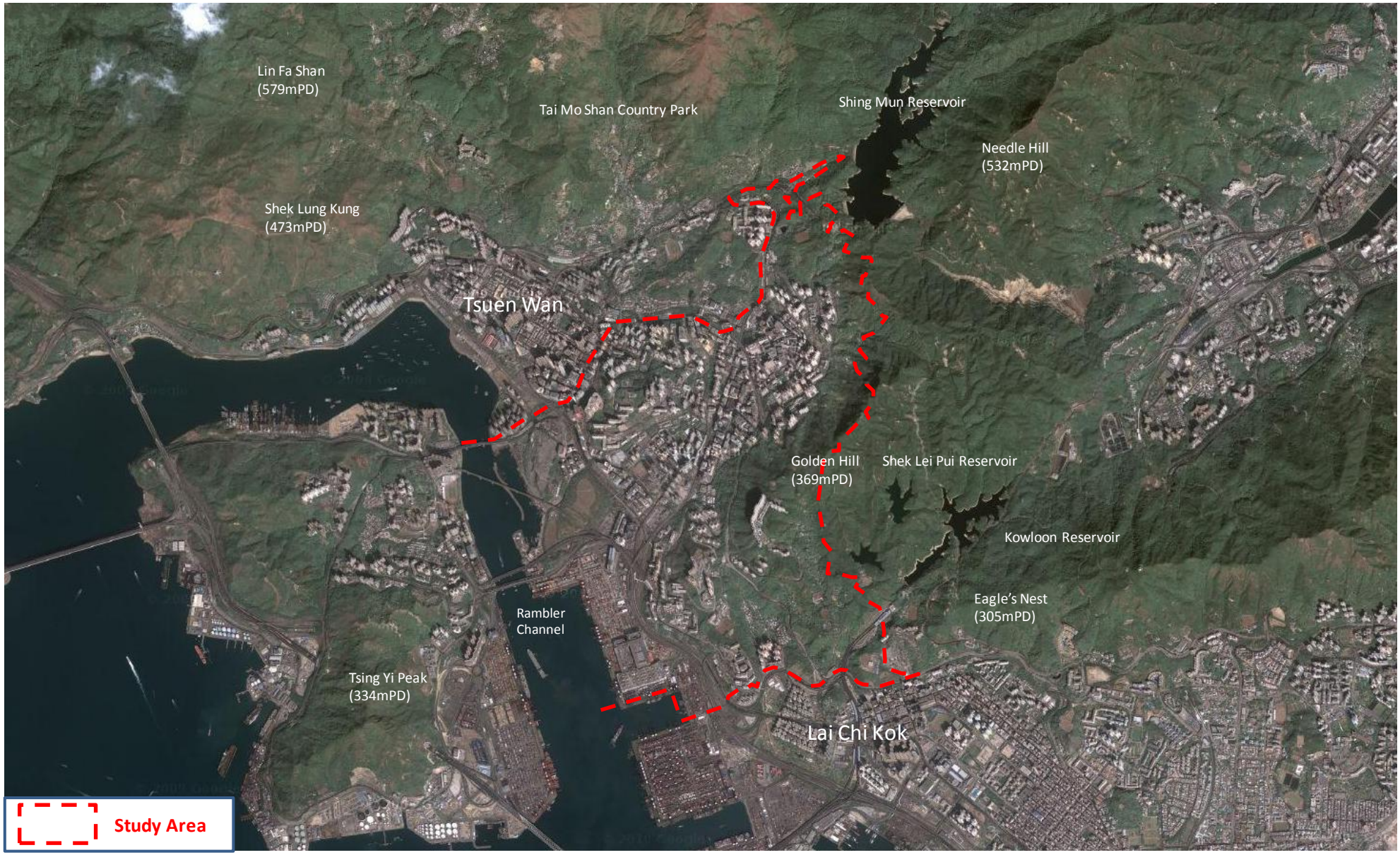


Figure 6Aerial Photo for the Study Area and Surroundings (Source: Google Map)

2.5 Summary of Wind Availability Data

2.5.1 As the weather station at Ching Pak House on Tsing Yi Island is close to waters and not significantly shielded by mountains, it can unlikely reflect potential blockage impact on the study area at Kwai Chung.

2.5.2 The MM5 data is considered more representative to depict the likely wind availability condition of the study area under concern.

Summer Wind Availability

2.5.3 MM5 data for Kwai Chung area indicates that southerly wind is prevailing. There is also least obstruction on the southern side. Building in Lai Chi Kok would not impose significant obstruction except for the low ground area along southern boundary of the study area.

2.5.4 Therefore, it is straightforward to conclude that southeasterly to southwesterly wind is prevailing in summer time for the study area. Southwest to west wind is slightly blocked by Tsing Yi Island so that it is less important than southeast to south wind.

Annual Wind Availability

2.5.5 MM5 data shows that northeasterly (including E wind) wind is dominant.

2.5.6 Northeasterly wind is considered prevailing taking into consideration the topography and building landscape. Especially, northeast valley wind from over Shing Mun Reservoir is considered important. The topography makes easterly wind less important. Nevertheless, Easterly wind is considered available at some locations which allow valley wind to pass through and western portion of the study area where there is adequate space for easterly wind passing over mountain to reach the downwind area. Near the southern side of the study area, southeasterly wind is also considered important due to diversion by topography.

2.5.7 **Figure 7** summarizes important wind directions for the study area. Taking into account the topography, building landscape and existence of breezeway linking in the surrounding area, the wind availability is depicted. The figure indicates likely scenario of how important wind direction approaches the study area.

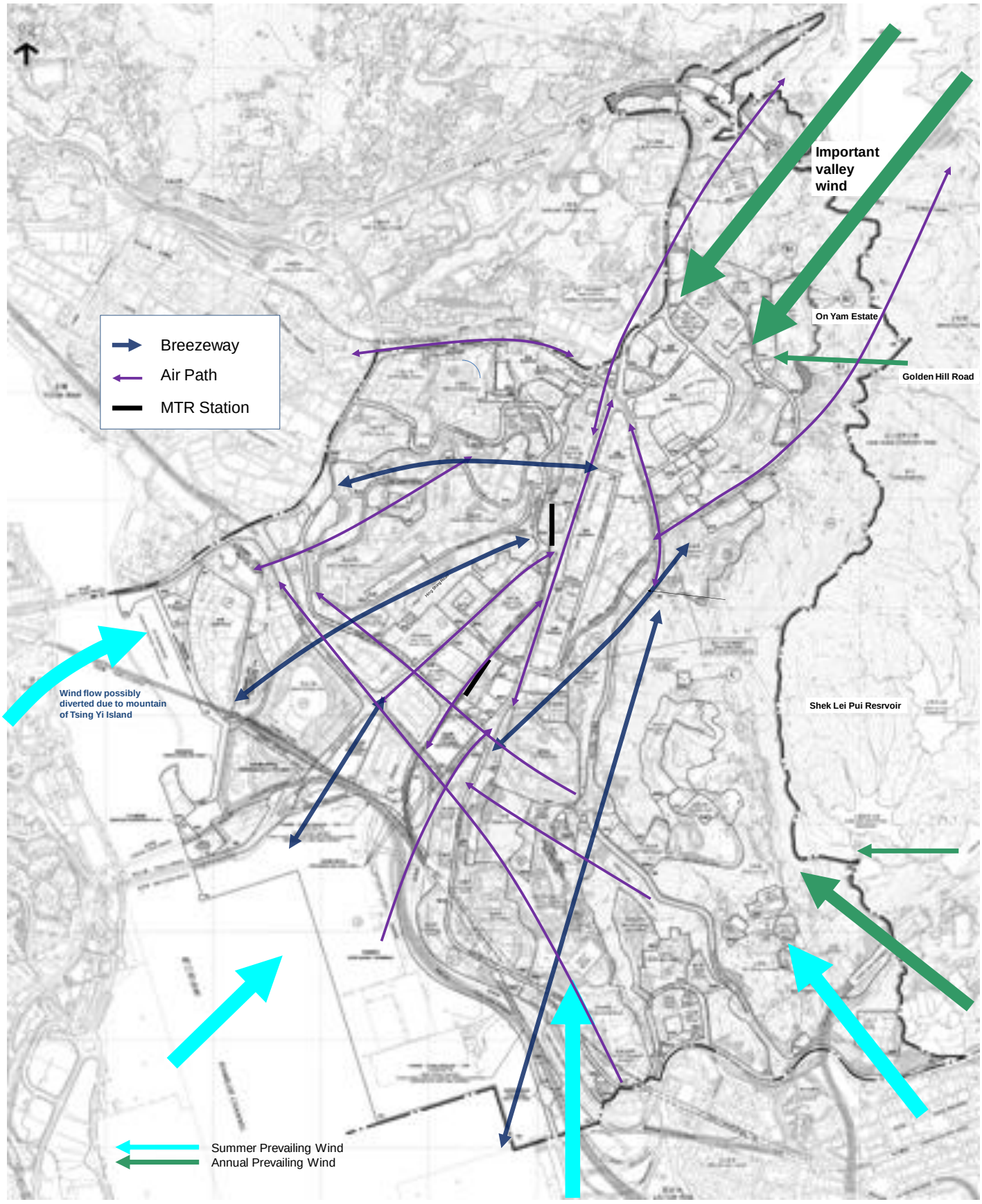


Figure 7 **Summary of Important Wind Directions for the Study Area**

3.0 Existing Condition of the Study Area

3.1 Location

3.1.1 The study area is located to the northwest of Kowloon Peninsula and to the east of Tsing Yi Island. The study area together with Tsuen Wan area is surrounded by hill/mountain on northwest, northeast and southeast sides. The study area is generally bounded by Texaco Road (building-to-building width over 30m) and Tsing Tsuen Road on the northwest, Castle Peak Road (about 30m) and Wo Yip Hop Road (over 30m) on the north, and Ching Cheung Road (over 50m) on the south. It is bounded by Rambler Channel on the south/southwest.

3.2 Topography

3.2.1 The elevation of major knolls within the study area and periphery is shown in **Figure 8**.

3.2.2 The study area is bounded by seawater on the southwest. The western side is generally of lower elevation except for Tsuen Wan Chinese Permanent Cemetery and the proposed Kwai Chung Park which are elevated up to 90mPD and 40mPD respectively. Other waterfront area which is mainly occupied by container terminals is mostly formed by reclamation and is generally flat (around 4mPD). However, the ground elevation increases quickly towards inner region. Especially, the elevation increases from around 5mPD along a section of Kwai Chung Road to up to over 166mPD at Lai King Headland Service Reservoir with equivalent slope of 1:2.5.

3.2.3 Apart from waterfront area, the elevation of central part of Kwai Chung along Kwai Tsing Road (over 50m wide), Kwai Chung Road (over 40m wide), Hing Fong Road (around 25m wide) and Tsuen Wan Road (over 50m wide) is relatively lower (around 5 to 15mPD).

3.2.4 Kam Shan (Golden Hill) Country Park, Shing Mun Country Park and Tai Mo Shan Country Park are located to the east and northeast and north of the study area respectively. All country parks are elevated higher generally and up to 369mPD, 532mPD and 957mPD respectively.

3.2.5 The eastern side of the study area is topographically higher as it approaches to the foothill of Golden Hill. The northeast boundary of the study area nearest to Golden Hill is as high as over 300mPD. The northern tip of the study area near to Shing Mun Reservoir is up to around 200mPD.

3.2.6 For the purpose of discussion, the study area is divided into 3 sub-areas: Kwai Chung sub-area, Chung Kwai Chung sub-area, and Ha Kwai Chung sub-area (**Figure 8**) generally according to the topography and different orientation of roads and building clusters. Kwai Chung sub-area is bounded by major carriageways

(Castle Peak Road, Tsuen Wan Road) comprising the flat urban core along Kwai Chung Road and the knoll at Kwai Shing area with major artery roads and connected open space/green belt/low-rise GIC strips running in northeast-southwest direction. Chung Kwai Chung sub-area is defined by its foothill setting where roads wind about and buildings juxtapose according to the contours. Ha Kwai Chung sub-area covers the southern portion of the study area comprising the low-lying waterfront area and the exposed terrain at the foothill of Golden Hill.

3.2.7 Lower ground areas are referred as area near water front and at comparable elevation, mostly developed and covered with buildings, roads, playground etc. Higher ground areas on the other hand refer to area at higher elevation and covered not only by buildings but also green belts and other open space. Most lower ground areas are lying within Kwai Chung sub-area and Ha Kwai Chung sub-area.

3.2.8 Kwai Chung sub-area is elevated up to around 120mPD at Peninsula High Level Salt Water Service Reservoir at Kwai Shing (**Figure 8**). The periphery of this knoll in the sub-area is bounded by Castle Peak Road (Kwai Chung Section), Texaco Road, Tsuen Wan Road, Hing Fong Road and Kwai Chung Road. Northerly wind is expected to be reduced due to blockage by Tai Mo Shan. The knoll itself within the sub-area would result in some wind obstruction under all wind directions. However, the significance of blockage is dictated by the overall terrain including building structure which will be discussed later.

3.2.9 Chung Kwai Chung sub-area is sloping upward towards east and north directions. The built area of Chung Kwai Chung sub-area is concentrated at the western portion adjacent to Kwai Chung sub-area at relatively lower elevation and ranges from around 12 to 85mPD when compared with the eastern side which is elevated up to 300mPD. Easterly wind will be significantly blocked due to high ground on the eastern side. Nevertheless, the east-west aligned Golden Hill Road within Kam Shan Country Park is elevated lower (around 150mPD) and would allow valley wind penetration along it. Also, Shing Mun Reservoir to the northeast is of relatively lower elevation than the adjacent vegetation area. Northeasterly wind would tend to flow from the reservoir to built area of Chung Kwai Chung sub-area.

3.2.10 Ha Kwai Chung sub-area covers both the seafront area on the western side which is dedicated for container terminals, cemetery and a proposed park, and higher ground area on the eastern side. It is bounded by Ching Cheung Road to the south and with varying elevation up to around 40mPD. The highest knoll area within Ha Kwai Chung sub-area is found at Tai Wo Tsuen Service Reservoir to the north of Wonderland Villas (258mPD). Another knoll of 166mPD at Highland Park is situated to the east of MTR Lai King Station. A low-lying area of Kau Wa Keng and Wah Lai Estate at around 4 to 5mPD is bounded by higher ground on east, north and west sides. The gradients on east/west sides are highest. Effectively, the low-lying area forms the trough of the valley. It is difficult for easterly and westerly wind to reach low ground of this “valley” area. Therefore, this area will rely on northerly valley wind and southerly wind more.

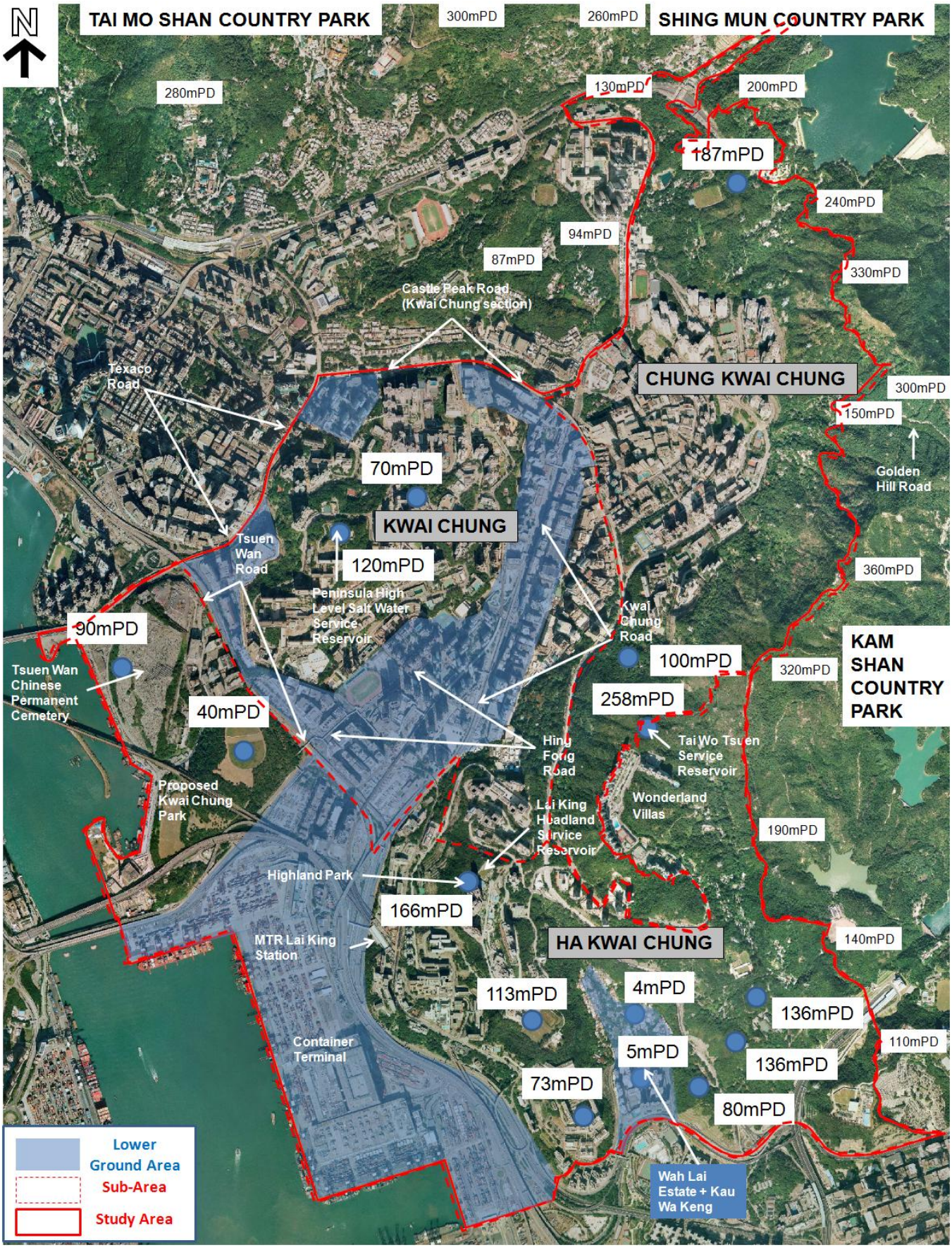


Figure 8 **Topography of the Study Area**

3.3 Existing Building Morphology and Wind Flow Regime

3.3.1 The existing building profile (with committed development) is shown in **Figure 9**. Figure 9 depicts the range of building height in mPD. In addition, the lower ground area and cluster of industrial area are also highlighted. **Appendix A** shows photos taken at built area. The eastern to southeastern side of the study area as well as central region of Kwai Chung sub-area at higher ground is generally covered by green belt and open space and allows wind penetration. The G/IC site (with low-rise buildings), open space and carriageways, on the other hand, dictate wind flow at lower ground area.

3.3.2 Major breezeways and air paths identified in this context (please also refer to **Figure 10**) include:

- Green belts and low-rise G/IC to the east of Cho Yiu Estate and Lai Yiu Estate;
- Low-rise G/IC areas between Kwai Shing Circuit and Hing Fong Road;
- Green belts, major open space and low-rise G/IC sandwiched between Tai Wo Hau Estate/ Kwai Chung Estate and Kwai Shing East Estate/Kwai Shing West Estate;
- Open space and green belts such as Central Kwai Chung Park;
- Kwai Tsing Road & Hing Fong Road for south to southwest wind penetration;
- Kwai Chung Road and Cheung Wing Road which welcome both southerly wind (important in summer) and northeasterly wind from Shing Mun Reservoir area;
- Segments of Castle Peak Road respectively for east/west and north/south wind penetration;
- Tsuen Wan Road and Kwai Fuk Road to welcome southeasterly wind;
- Shek Pai Street and adjacent slope area for northeasterly wind penetration;
- MTR alignment from Kwai Tai Road to Kwai On Road;
- Green belts, major open space and low-rise G/IC in connection with Wing Kei Road between Kerry Godown and Chun Sing Factory;
- G/IC (mostly slope) area between Cho Yiu Estate and developments such as Princess Margaret Hospital, Kwai Chung Hospital and Highland Park; and
- Existing open space and G/IC area (including slope area) between Lai Yiu Estate and Highland Park.

3.3.3 Open space, green belts and low-rise G/IC facilities, which are considered features important to air ventilation, should be preserved to maintain the air path network. On the other hand, major air corridors along carriageways (e.g. Kwai Chung Road, Castle Peak Road, and Tsuen Wan Road) should be maintained and not be narrowed.

3.3.4 The built area covers the lower ground area (**Figure 9**) as well as some other higher ground areas such as, Lai King (in Ha Kwai Chung sub-area) (see photos 1 to 3, 6 to 22 in **Appendix A**), Kwai Shing (in Kwai Chung sub-area) (photos 48 to 50), Shek Lei/Shek Yam/Industrial and Commercial area (in Chung Kwai Chung sub-area) (photos 62 to 72, 77, 78). Industrial building clusters are distributed within Kwai Chung sub-area (along Tsuen Wan Road and Kwai Chung Road) (photos 35, 37 to 46) and Chung Kwai Chung sub-area (bounded by Wo Yi Hop Road) (photos 62, 63, 71 to 74). Buildings in industrial building clusters are characterized by the fact that the building footprint almost occupies the entire site area. Identified commercial areas within the study area are of much lower scale (small site areas and fragmented) (photo 32) and can be found next to Kwai Fong and Kwai Hing MTR stations. Residential developments (including public rental housing) are distributed within all three sub-areas. In addition to green belts and open space, there are plenty of G/IC areas including hospitals all over three sub-areas as well which can facilitate wind distribution. **Figure 10** shows the green belt, open area and G/IC sites and air paths formed.

3.3.5 The eastern side of the study area is generally covered by vegetation (**Figure 8**). Other than vegetated slope of foothill of Golden Hill covering the eastern side of the study area, major open space, recreational areas and area with no or low-rise building structure only include Tsuen Wan Chinese Permanent Cemetery, the proposed Kwai Chung Park, Kwai Chung Sports Ground (photo 31), Hing Shing Road Playground & Hing Shing Playground, Central Kwai Chung Park, Wo Yi Hop Road Sports Ground, service reservoirs and other playgrounds/parks scattered within the built area. These areas provide breathing zone for urban environment. Moreover, there are many other slope areas covered with vegetation within Lai King and Kwai Shing districts (photos 1, 7, 9, 10, 11, 15, 16, 50, 54).

3.3.6 The lower ground area falls within Kwai Chung and Ha Kwai Chung sub-areas. It is already urbanized and covered with buildings, carriageways, G/IC facilities, container terminals, etc. (**Figure 8**). For densely built areas, the air path network usually relies on existing road carriageways and low-rise building area. For areas with lower building density, the air path network will depend more on open areas.

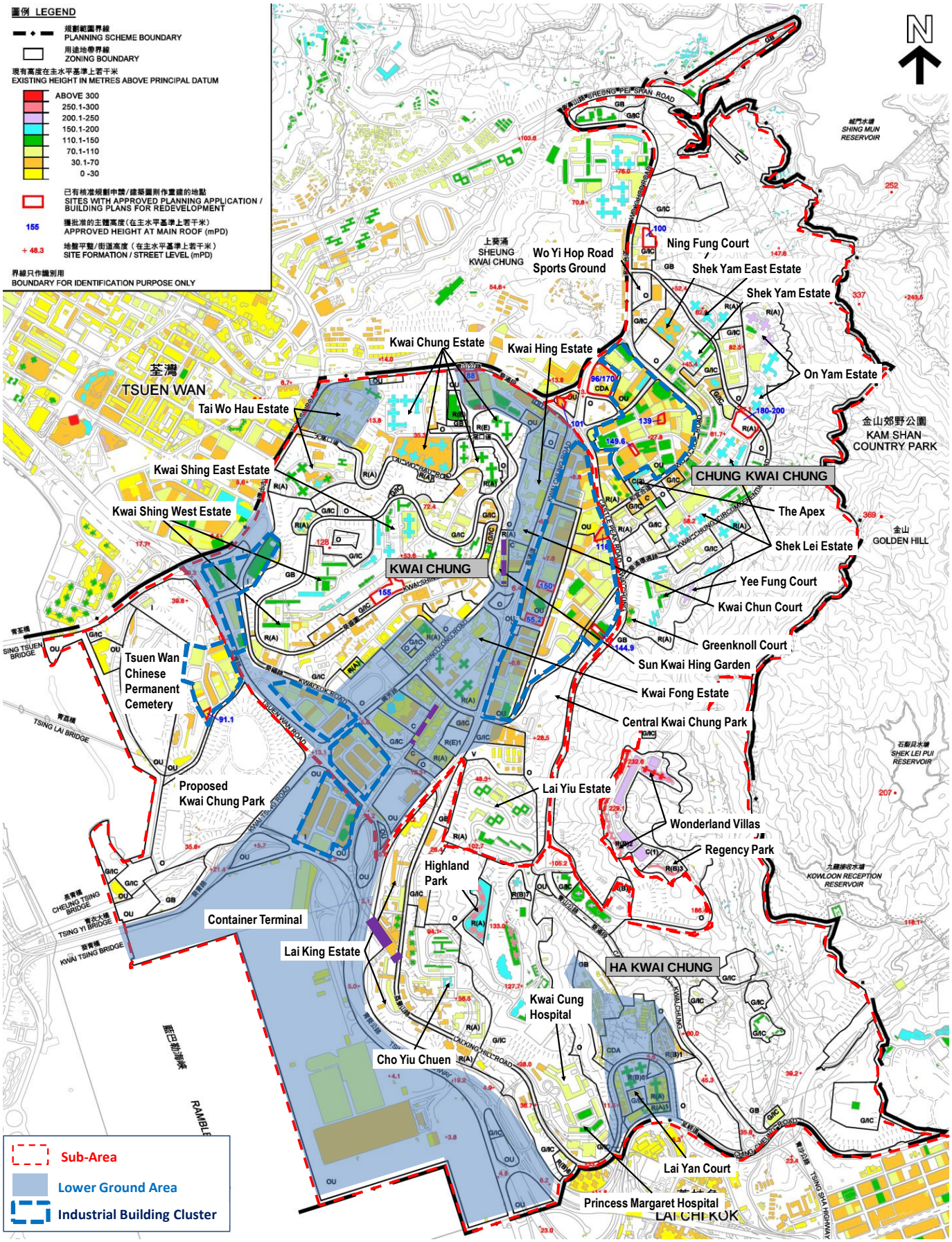


Figure 9 Existing Building Height Profile and Division of Sub-Areas

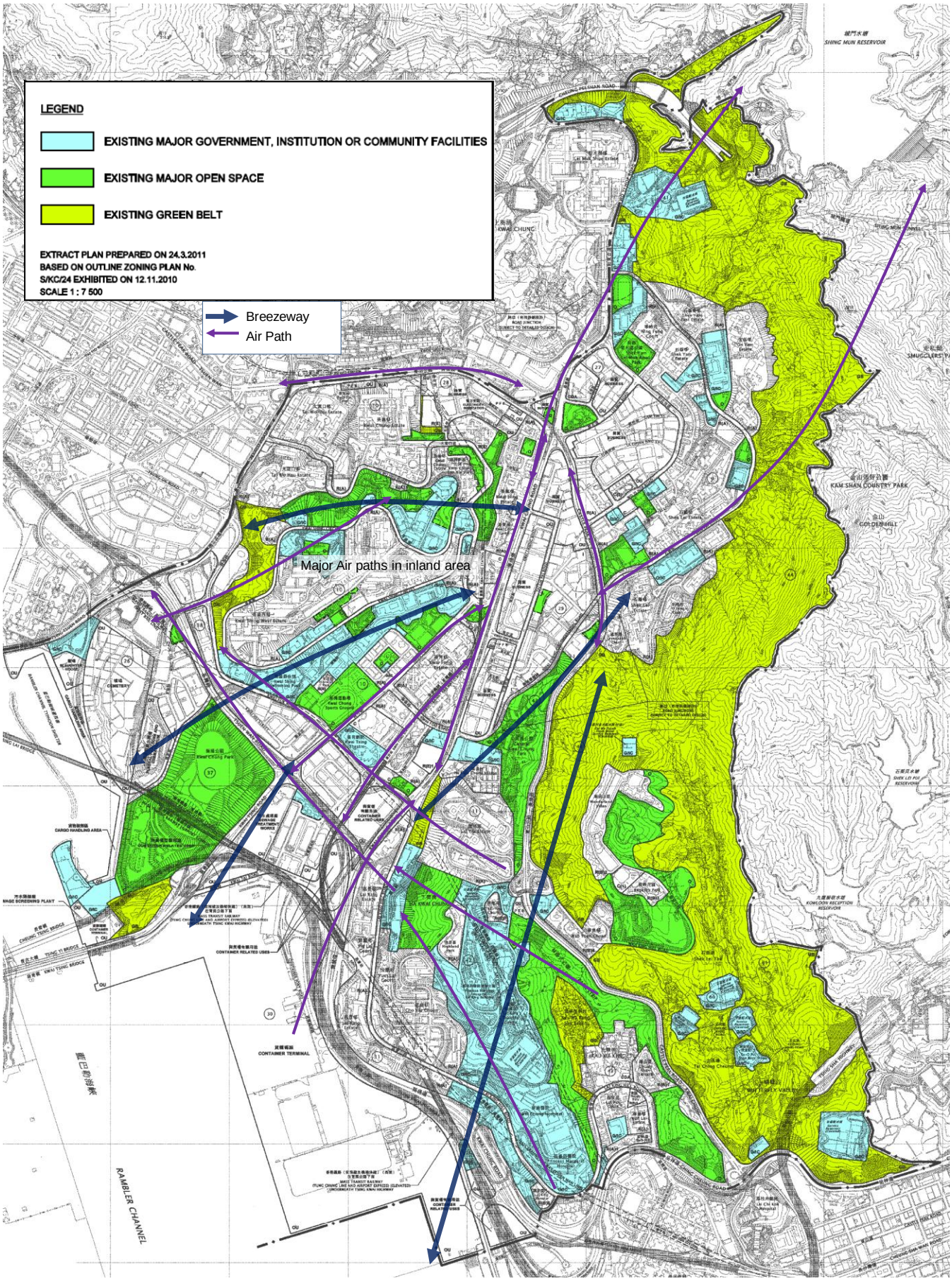


Figure 10 Green Belt, Open Area and G/IC Site for Wind Distribution

Kwai Chung Sub-Area

3.3.7 Kwai Chung sub-area is bounded by Texaco Road, Tsuen Wan Road and Castle Peak Road (Kwai Chung section).

3.3.8 Within lower ground area of Kwai Chung (which is generally along Tsuen Wan Road (over 50m wide), Kwai Chung Road (over 40m wide), Hing Fong Road (~25m wide), Castle Peak Road (over 30m wide)), except for some G/IC sites (e.g. Kwai Tsing Theatre, Kwai Chung Depot and container related uses sites), all other buildings are of mid- to high-rise (ranging from 7 to 43 storeys). Wind flow within lower ground area would rely more on road carriageways and open space. The higher ground is generally occupied by mid- to high-rise residential developments, G/IC use and open space. Carriageways are constructed around hill area and most of them are not straight and through roads. Wind flow at higher ground would more rely on G/IC sites and open space.

3.3.9 This sub-area mainly consists of industrial building clusters, residential developments and G/IC uses. Two major industrial building clusters are found between Tsuen Wan Road and Kwai Fuk Road, and between Castle Peak Road and Kwai Chung Road respectively. Residential developments are distributed along and on the western side of Kwai Chung Road (e.g. Kwai Fong Estate (photos 36, 47), Kwai Hing Estate (photo 46), New Kwai Fong Gardens (photo 32)), at higher ground areas bounded by Kwai Shing Circuit (e.g. Kwai Shing East Estate & Kwai Shing West Estate (photos 48 to 50)) & Castle Peak Road (Kwai Chung Estate (photo 51)), and at the southeast corner of the sub-area (i.e. Lai Yiu Estate (photo 12)). Low-rise GIC facilities and open spaces concentrate between Hing Fong Road and Kwai Shing Circuit and between Tai Wo Hau Estate/Kwai Chung Estate and Kwai Shing East Estate/Kwai Shing West Estate. Except Kwai Shing East Estate (up to 43 storeys) and Kwai Chung Estate (up to 41 storeys), most public housing estates are not more than 30 storeys high.

3.3.10 **Figure 11** shows the likely air flow and problem area within Kwai Chung sub-area. The ground elevation among building area ranges from 5 to 90mPD. Clusters with building height greater than 120mPD is highlighted for they would have dominant effect over topography. In principle, an air path should be of least obstruction by building structure and with adequate width. Air path is usually made up of roads/streets, interconnected open space, green belt and other vegetated area, park, low-rise building area, etc. For urban area with less open space and low-rise building area, the street pattern usually dictates the air flow.

Good Feature

3.3.11 There are a lot of slope areas, scattered playground and service reservoir on the northwest side of Kwai Chung Road. In addition, low-rise G/IC development (<10 storeys) provides additional opportunity for air flow.

3.3.12

3.3.13 **Figure 10** indicates the air path formed by green belt, open space and low-rise G/IC buildings. This is the good feature of this area, which allows wind penetration in various directions.

3.3.14 Similarly, there exists Central Kwai Chung Park and other low-rise development areas (G/IC, V) on the eastern side of Kwai Chung Road. Therefore, air flow under important wind directions (NE, SW, and SE) through these unobstructed areas are possible as depicted (**Figure 11**). The G/IC sites, open space, GB, etc. forms wide and unobstructed breezeway (with effective width of around 50 to 100m) for wind penetration from district to district.

3.3.15 On the other hand, wider carriageways (e.g. Kwai Chung Road (photo 46), Tsuen Wan Road (photos 20, 21), Kwai Fuk Road (photos 25 to 28), Castle Peak Road) together with open area and low-rise G/IC facilities along them also form important air path (with effective width of around 50m).

3.3.16 Other remaining air paths with minimum effective width of 15m can be found along MTR railway alignment (25m wide) (photos 32, 33, 36), Hing Fong Road (25m wide) (photo 47), etc.

3.3.17 For low lying areas, wind flow is usually governed by streetscape. Long unobstructed road carriageways such as Kwai Chung Road, Hing Fong Road, Tsuen Wan Road, Kwai Fuk Road (50m wide) and Texaco Road (over 30m wide) (photo 57) allows wind penetration along important wind directions. There is more concern on whether there is podium building along carriageways which limits the effective width of the carriageways than the building heights.

3.3.18 For area without through road as air path, building height would bear more significant impact on wind availability. Currently, most industrial buildings along Kwai Chung Road (40m to 50m wide) (which lacks of E-W aligned air path due to long building clusters (photo 46)) are not more than 20 storeys (less than 70m tall). The building height to street width ratio is not more than 2:1 and is considered acceptable for air ventilation at pedestrian level.

Problem Area

3.3.19 The high-rise developments include Kwai Chung Estate (mainly 38-41 storeys), Kwai Shing East Estate (20 to 43 storeys), Kwai Shing West Estate (7 to 25 storeys), Tai

Wo Hau Estate (13 to 39 storeys), High Prosperity Terrace (38 storeys), Lai Yiu Estate (13 to 24 storeys), Metroplaza (43 storeys), Kwai Fong Estate (20 to 41 storeys), Kwai Hong Court (38 storeys), Kowloon Commercial Centre (26 storeys), Wyler Centre (12 to 31 storeys), Man Shing Industrial Building (27 storeys), Tung Luen Industrial Building (25 storeys). Some of these developments are located near to identified air path or even blocks the air path (e.g. Man Shing and Tung Luen nearby Castle Peak Road, Cluster of buildings of Kwai Shing East Estate and Kwai Shing West Estate that would block SE air flow to Tsuen Wan district). Apart from high-rise buildings, long building clusters along Kwai Chung Road and Tai Lin Pai Road can be identified.

3.3.20 Given the existing condition, major problem areas (which would block air penetration or/and reaching pedestrian area) are identified below:

- Buildings along Kwai Chung Road and Tai Lin Pai Road are over congested (photos 37, 39 to 44). The building clusters are too long (two nearly continuous cluster of 420m and 520m long with some narrow corridor in-between). The gaps between buildings at-grade, if any, range from 6m to 10m wide (photo 42). For some of the existing buildings, there are setbacks above podium and the maximum width of gap above podium is about 21m. The existing E-W aligned carriageways (Tai Lin Pai Road and Kwai On Street) are blocked by buildings between Castle Peak Road and Tai Lin Pai Road (photos 39 to 44). Northeasterly to southeasterly wind flow is generally blocked (although easterly wind has been reduced due to topography, it is still regarded as important wind direction annually other than northeast wind. Moreover, there is already a separation of 900m to 1200m between the built area and mountain to the east. Easterly wind availability would be increased because there is adequate separation for wind at high level to reach lower pedestrian area).
- Kwai Shing East Estate and Kwai Shing West Estate are situated at higher ground (photos 48 & 49). The topography itself already makes it difficult for SE wind to reach Kwai Shing Circuit at downwind location of these estates. The disposition of buildings imposes some further impact against SE wind to penetrate to downwind area. While there is a gap between buildings of Kwai Shing East Estate and Kwai Shing West Estate with effective width of around 50m to allow SE wind penetration, one recently built Kwai Luen Estate and one committed development at R(A) site between Kwai Shing East Estate and Kwai Shing West Estate in Kwai Chung sub-area will block some southeast wind flow. The major façade of these two committed developments will be fronting to southeast as constrained by the elongated site area. As understood, the development block at Kwai Luen Road is fronting the 50m-wide building gap and will obstruct southeast wind flow.

3.3.21 Other than this, there are also minor problem areas (which would restrict the air flow in some extents instead of blocking air passage) identified and air flow is restricted:

- Chun Shing Factory Estate (photos 23 to 25) would restrict southwesterly air flow to Kwai Shing Circuit to its northeast side. However, as Kwai Shing Circuit is elevated higher (40mPD to 70mPD), the effective blockage impact due to Chun Shing Factory Estate has already been alleviated. Moreover, southwesterly wind can flow around Chun Shing Factory Estate on its northwest side to reach Kwai Shing Circuit. Therefore, while there is some blockage expected, the impact is not especially significant. Nevertheless, if blockage due to Chun Shing Factory Estate can be addressed, it is possible to improve the air path further to become a breezeway.
- Existing breezeway is identified along G/IC and open space along Hing Shing Road and Kwai Shing circuit. The entry of southwesterly wind to the existing breezeway must pass around existing industrial building cluster composed of Metro Loft, Kingsford Industrial Buildings, etc. (photo 27). The existing industrial building cluster partially blocks the path to the existing breezeway so that wind availability along it is restricted. Creation of open space or low-rise building area among the industrial building cluster can further improve wind availability. Similarly, the northeast end of the same breezeway can connect to Kwai Chung Road but slightly blocked by existing Sun Kwai Hing Garden. Given large G/IC sites and open space in the surrounding, a good connection can still be made between the breezeway and Kwai Chung Road. The impact is considered minor only. Improvement can be made by adjusting the block disposition upon redevelopment in future.
- Another breezeway is aligned along E-W axis via green belt and existing roads connecting Texaco Road and Kwai Chung Road. Near the eastern end situates Kwai Hing Estate and Kwai Chun Court. Wind flow needs to pass through a building gap of about 26m wide between Hing Lok House (Kwai Hing Estate) and Kai Fung House (Kwai Chun Court) and a carpark of 3 storeys high to reach Kwai Chung Road (photo 75). While wind penetration is allowed, the wind availability will be restricted. Improvement can be made by further increasing the building permeability.
- Man Shing Industrial Building and Tung Luen Industrial Building would affect the linkage of Central Kwai Chung Park and area to the further north. Fortunately, there exists green belt area on the eastern side so that wind can flow around these buildings.

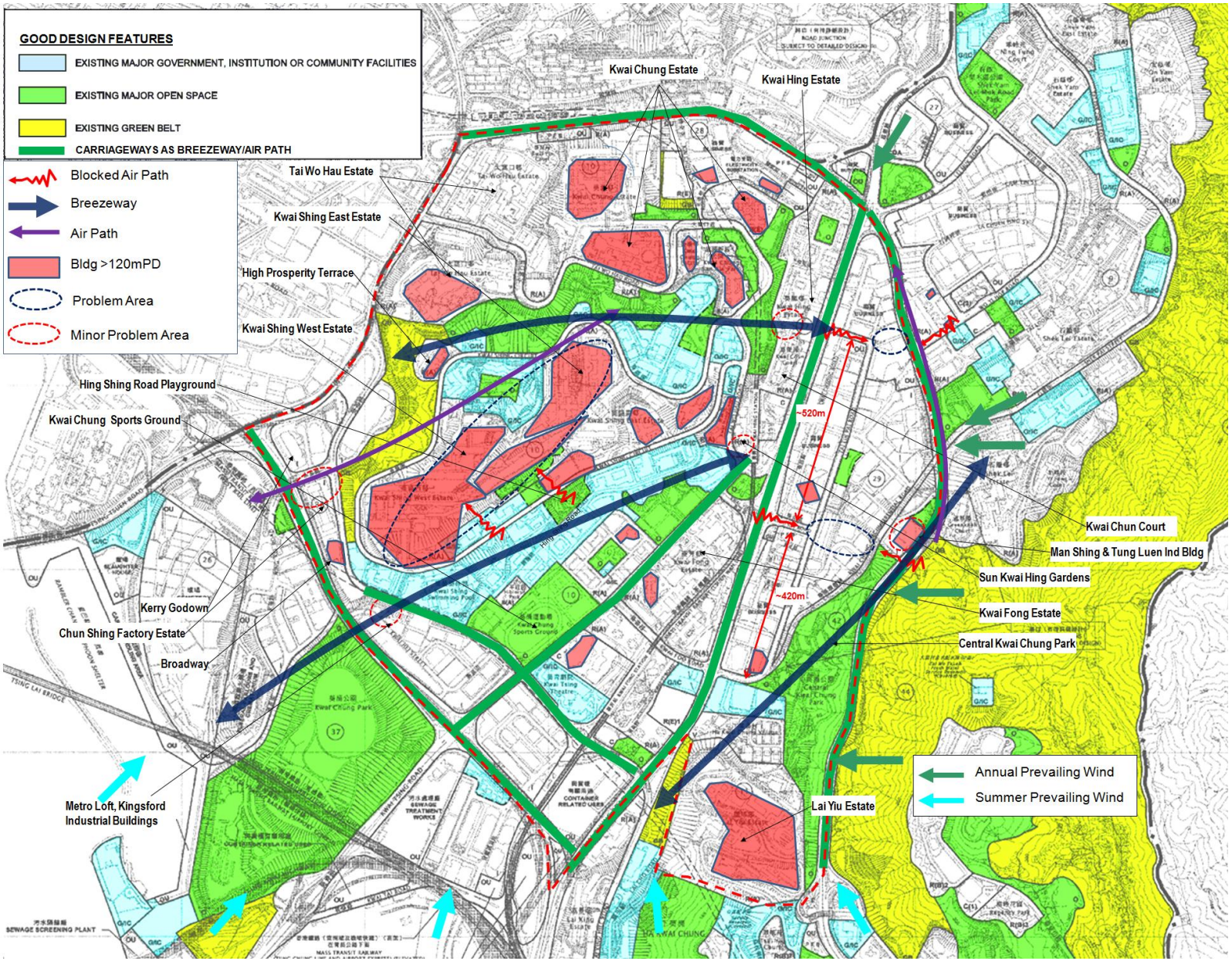


Figure 11 Illustration of Air Flow, Good Feature and Problem Area for Kwai Chung Sub-Area

Chung Kwai Chung Sub-Area

3.3.22 Chung Kwai Chung sub-area is bounded by Castle Peak Road, Cheung Wing Road, Wo Yi Hop Road to the west and Kam Shan Country Park to the east. Over half of Chung Kwai Chung sub-area is covered by green belt (GB). The built area of Chung Kwai Chung sub-area is concentrated among the central-western part and adjoining Kwai Chung sub-area.

3.3.23 **Figure 12** shows the likely air flow and problem area among Chung Kwai Chung sub-area. Similar to **Figure 11**, building over 120mPD is highlighted.

3.3.24 The industrial and commercial buildings are compacted together within the cluster bounded by Wo Yi Hop Road, Cheung Wing Road and Castle Peak Road (photos 72 to 78). Private residential developments are distributed on the eastern side of Wo Yi Hop Road. Public rental housing developments (e.g. Shek Yam Estate, On Yam Estate, On Yam East Estate, Shek Lei Estate and a housing block between On Yam Estate and Shek Lei Estate under construction) and Home Ownership Scheme (HOS) developments (e.g. Ning Fung Court and Yee Fung Court) are located to the further north, east and south of Wo Yi Hop Road. On Yam Estate and part of Shek Lei Estate are situated at higher platforms up to around 206mPD, while Yi Fung Court is located at the highest platform with a building height at about 224mPD. A hotel cum service apartment (The Apex) is also located within this area.

3.3.25 The buildings of The Apex are aligned in “L” shape in continuous manner. It will effectively form an integrated building structure which makes the entire site impermeable. Fortunately, the site is not located at any important air path or major breezeway. Nevertheless, such design with little gap in-between and in turn low permeability should not be adopted where practicable, especially for larger site area which should be of higher flexibility for disposition of buildings..

Good Feature

3.3.26 As mentioned before, valley wind from northeast side flowing over Shing Mun Reservoir to the built area is particularly important due to relatively higher topographical elevation on the east and north sides. In this regard, two air paths along Cheung Wing Road and Shek Pai Street, which align in same orientation as the valley wind, are identified important air path for northeasterly wind penetration. These two air paths including the adjacent low-rise building or open area have effective width over 40m and considered important air paths.

3.3.27 Wo Yi Hop Road Sports Ground and North Kwai Chung Jockey Club Public Swimming Pool are situated along Wo Yi Hop Road and effect to facilitate wind distribution to along Wo Yip Hop Road.

3.3.28 The G/IC areas to the west of On Yam Estate form another air path for northeast wind flow to downwind area.

3.3.29 Large building gap (over 50m) within On Yam Estate (photos 67 & 68) allows east wind penetration to G/IC sites and open space to the west.

3.3.30 There exists another SE-NW aligned air path along Wai Kek Street passing through the gap of Shek On House and Shek Wai House of Shek Lei Estate (photo 64) plus open space to reach Wo Yi Hop Road.

3.3.31 G/IC site nearby Shek Lei Estate and open space along Castle Peak Road enables east wind penetration to reach Castle Peak Road.

Problem Area

3.3.32 While there are large areas covered by green belt, open spaces and G/IC sites within this sub-area, they are mainly distributed among the periphery region. Within the built area, these open space and G/IC areas are not well connected as in Kwai Chung sub-area.

3.3.33 Given the existing condition, problem area is identified below:

- The buildings within industrial building clusters and adjacent R(A) sites are compacted together (photos 71 to 78). There is no open space in between. Existing Ping Lai Path (14m wide), Ping Fu Path (9m wide) and footbridge connection (8m wide) between Wai Yin Building and Ming Tak Building provides permeable space connecting Castle Peak Road and the pedestrian area within the industrial building cluster. The carriageways (e.g. Lam Tin Street, Ta Chuen Ping Street (photos 73 to 78)) in-between are not straight and through road. It is difficult for wind penetration through the industrial building cluster from important northeasterly, east and southwest directions. The building cluster is generally impermeable.

3.3.34 In addition, there are also some minor problem areas identified:

- Shek Yam East Estate is located on the north end of Lei Muk Road. The existing building gap of around 15m wide between Yam Yue House and Yam Hang House (photo 70) allows northeasterly wind from further penetrating downward and vice versa but may slightly restrict air flow.

- The low-rise G/IC sites to the west of On Yam Estate can act as breathing area for better air ventilation. Although there are continuous residential building lots along Wo Yi Hop Road (photo 71), northerly wind would rely on the open space area low-rise G/IC breathing area to penetrate to the downwind areas.

- The area between On Yam Estate (to the north) and Shek Lei Estate (to the south) will be occupied by a committed R(A) development (photo 66). According to the latest development plan of the R(A) development, the southeast half of the site will be occupied by building with longer aspect of the building facing southeast. It

will leave the N-S aligned air path (on the western side of the development site) least affected so that N wind from along G/IC sites can pass through. Moreover, the slope area along the northern boundary of the committed R(A) site is not expected to be occupied by high-rise building. Therefore, while wind availability will be reduced, the connection between G/IC uses to the west and open space to the east can still be maintained.

- The area of Golden Hill and Tai Mo Shan nearest to this sub-area is as high as up to 330mPD. On one hand, the high-rise buildings (e.g. On Yam Estate, Shek Lei Estate and Shek Yam Estate) would likely generate downwash effect to divert northeasterly and easterly wind flow downward and benefit adjacent areas. On the other hand, it would impose some blockage impact against easterly and northerly wind flow. Nevertheless, they are not found to form continuous impermeable structure (building gaps are generally available, no more than 2 towers are aligned close together (photos 65 & 69)) that would block important air path, the impact due to erection of these high-rise buildings is not considered significant.

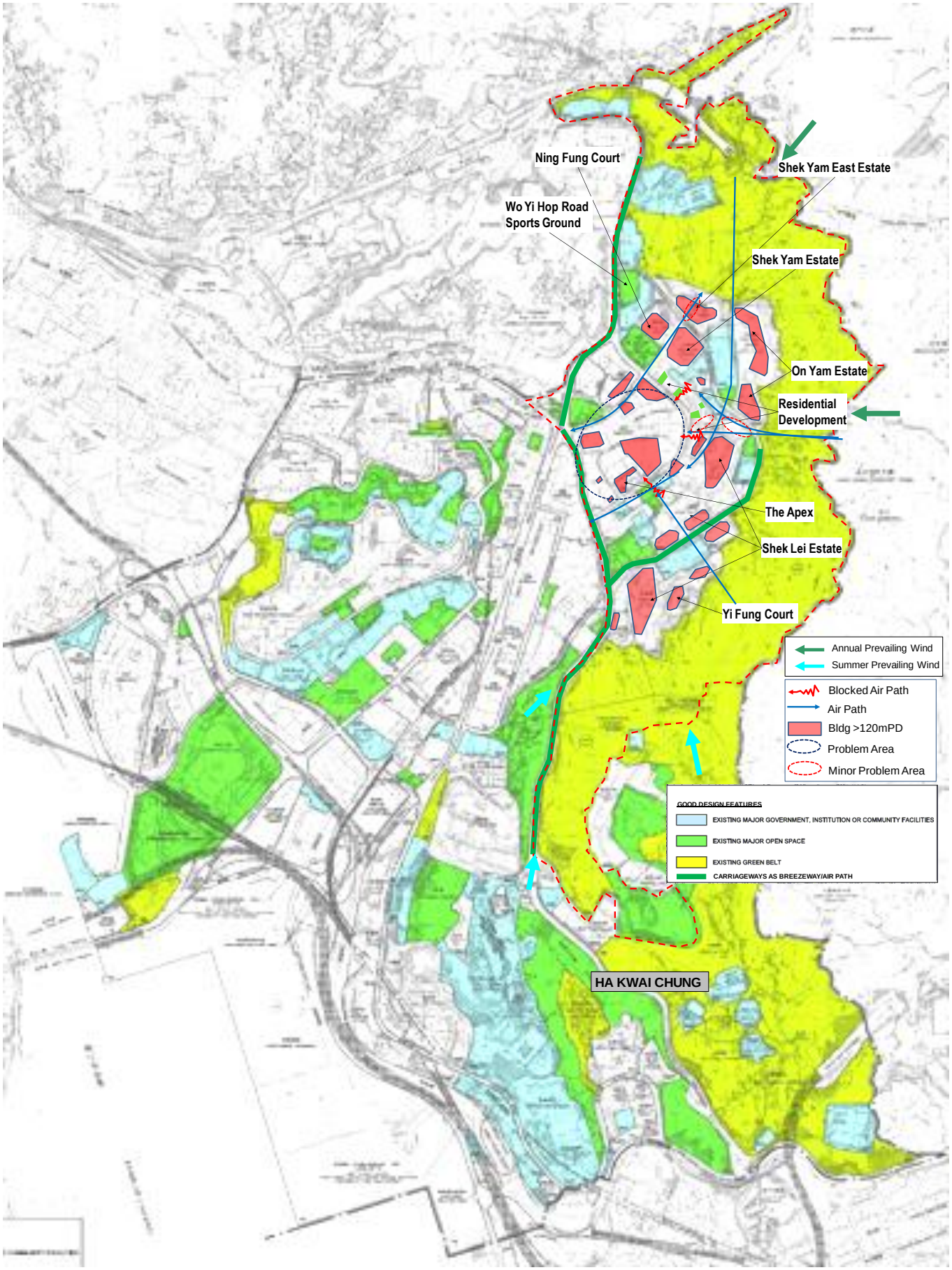


Figure 12 **Illustration of Air Flow, Good Feature and Problem Area for Chung Kwai Chung Sub-Area**

Ha Kwai Chung Sub-Area

3.3.35 Ha Kwai Chung sub-area includes western and southern parts of the study area and is mainly bounded by Tsuen Wan Road to the north. Developments within the sub-area consists of industrial building clusters along Tsuen Wan Road (photos 20 & 21), container terminal developments (Hutchison Logistics Centre, ATL Logistics Centre & Modern Terminal Limited) near seashore (photos 1, 4, 5), residential developments from nearby MTR Lai King station (e.g. Lai King Estate, Yin Lai Court, Cho Yiu Chuen, Highland Park (photos 2 & 3)) to higher ground area (e.g. Wah Yuen Chuen, Regency Park, Wonderland Villas) and along Ching Cheung Road (e.g. Wah Lai Estate, Lai Yan Court and Nob Hill), and G/IC uses (Princess Margaret Hospital and Kwai Chung Hospital). The highest elevated development is Wonderland Villas which is up to 339mPD (sited at knoll of over 230mPD).

3.3.36 Many developments are located nearby Lai King Hill Road elevated at higher ground (up to 40mPD). Generally, high-rise buildings are on one side of Lai King Hill Road only and these buildings would not significantly impede air movement along the road. While Lai King Hill Road is relatively exposed due to its high elevation, no wind channeling effect is present so that wind amplification and excessive wind problem is not considered a concern.

3.3.37 The eastern portion of the sub-area is mainly covered by vegetation. The waterfront area in the southwest is occupied by cemetery and container terminal. Other than topographical blockage (Golden Hill), wind from east and south east sides can reach the site without difficulty.

3.3.38 The stockpile of container near seashore would be less than 20m aboveground. No significant wind blockage impact is envisaged due to the stockpile of containers.

3.3.39 The existing ATL Logistics Centre and Hutchinson Logistics Centre buildings (9 to 15 storeys) (photos 1 & 4) are well separated from the entry point of Kwai Chung Road (Figure 13) and not excessively high when compared with Lai King Hill Road (20 to 65m higher). Wind entry to Kwai Chung Road would not be significantly blocked. Wind availability along Lai King Hill Road and around Lai King Estate as well as pedestrian areas at higher elevation (e.g. Cho Yiu Chuen) would not be significantly affected.

3.3.40 Wonderland Villa (photo 11) is located within the highest ground of the sub-area and aligned in a way which may impose blockage against easterly wind. Wind will tend to flow around the development and then reach the pedestrian area at lower ground. Given well adequate separation from important pedestrian area on the downwind side under easterly wind (e.g. Ha Kwai Chung Village and Lai Yiu Estate) and existence of unobstructed areas on north and south sides, impact is not envisaged to be significant.

3.3.41 **Figure 13** shows the likely air flow and problem area among Ha Kwai Chung sub-area. The ground elevation of this subarea is much higher. Building over 200mPD is considered of dominant effect to air flow over topography and is hightlighted.

Good Feature

3.3.42 Large area of Ha Kwai Chung sub-area, particular the eastern part, is covered with vegetation.

3.3.43 Buildings are generally scattered and not compacted together as in Chung Kwai Chung sub-area. Wind penetration under important wind directions (southerly, southwest, southeast, northeast) is possible.

3.3.44 The elevation increases rapidly from seashore to inland area to the east (photos 6, 7, 9, 11). Pedestrian area at inland area is least blocked by buildings fronting seashore under prevailing southwesterly wind in summer.

Problem Area

3.3.45 Given the existing condition, no major problem areas are identified. Minor problem areas are discussed below:

- As mentioned, the ground elevation increases rapidly to the east. Easterly wind may not be able to reach pedestrian level (e.g. Kwai Chung Road) easily.

- East and west wind availability at the valley area of Kau Wa Keng and Lai Yan Court is low. Fortunately, southerly wind is available from along the G/IC and open space of Lai Chi Kok Park in Mei Foo.

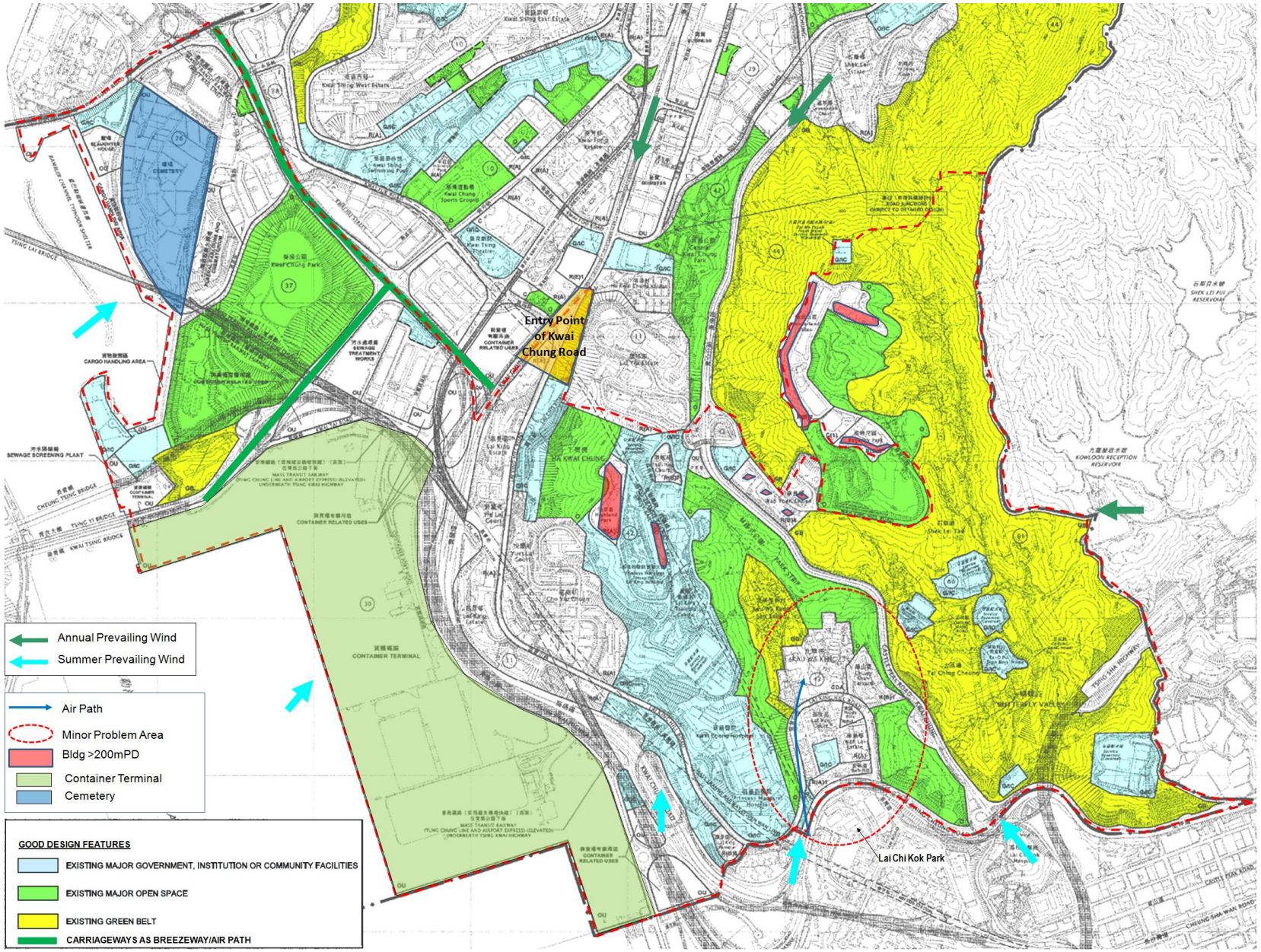


Figure 13 Illustration of Air Flow, Good Feature and Problem Area for Ha Kwai Chung Sub-Area

3.4 Summary of Major Features with Positive/Negative Effect on Air Ventilation

Good Features

3.4.1 Development density of the study area is not considered high when compared with other urban areas in Kowloon and Hong Kong Island. There are plenty of vegetated areas including mountains, slope, park, etc. which helps to reduce heat island effect.

3.4.2 There are some of interconnected open space, G/IC uses and green belts within the built area of Kwai Chung sub-area. They serve as breezeways or important air path to facilitate wind penetration under important wind directions identified in Chapter 2.

3.4.3 Within Ha Kwai Chung sub-area, the development density is even lower. Buildings are scattered and with spacious area in between for air ventilation. The ground elevation increases rapidly from seashore to inland area to the east. Southwesterly wind can reach pedestrian area of different elevations easier.

3.4.4 Carriageways of adequate width (mostly over 20m) such as Kwai Chung Road, Tsuen Wan Road, Hing Fong Road, Castle Peak Road, and aligned with important wind directions can be found in built area in both Kwai Chung and Chung Kwai Chung sub-areas. They can serve as air path and their existing widths should be maintained.

Problem Areas

3.4.5 On the other hand, features that restrict air ventilation performance and even possess negative impact are identified.

3.4.6 Firstly, the long industrial building cluster along Kwai Chung Road and Castle Peak Road would block easterly and westerly wind flow.

3.4.7 Building gaps among Kwai Shing East Estate and Kwai Shing West Estate together with the recently built and committed development is not adequately wide and would block southeasterly wind flow.

3.4.8 For Chung Kwai Chung sub-area, the open space, G/IC uses among the built area (industrial building cluster and R(A) sites) are not well connected. Compacted industrial building cluster bounded by Wo Yi Hop Road and nearby R(A) sites are impermeable and cannot allow wind penetration in between.

3.4.9 Apart from these, there are some minor problem areas. Building blockage against air path along important wind direction can be found at some locations. Chun Shing Factory Estate along Tsuen Wan Road would restrict southwest wind entry to downwind area; the industrial building cluster along Tsuen Wan Road would restrict SW wind entry to the open space and G/IC sites along Hing Shing Road; Sun Kwai

Hing Garden would restrict air flow from along the open space and G/IC sites to Kwai Chung Road; Kwai Hing Estate and Kwai Chun Court would restrict air flow from Texaco Road to Kwai Chung Road and vice versa; Man Shing and Tung Luen Industrial Buildings would restrict NE and SW air flow; Blocks of Shek Yam East Estate would restrict air flow along Lei Muk Road; continuous residential development along Wo Yi Hop Road would restrict NE air flow to downwind area; the committed R(A) development between On Yam Estate and Shek Lei Estate would restrict wind flow to Wo Yi Hop Road and G/IC sites on downwind side; valley area of Kau Wa Keng and Lai Yan Court would have low East/West wind availability; and easterly wind may not be able to reach pedestrian area on the western side of the study area due to steep ground gradient, etc.

3.4.10 All these features with negative impact should be addressed where practicable.

3.5 General Direction for Air Ventilation Improvement

3.5.1 The usual air ventilation problem of urban area is due to inadequate open space and building blockage. Urban canyon effect due to tall and compacted buildings prohibits wind flow to pedestrian area. There is a strong reliance on the urban landscape to provide necessary breezeway and air corridor for wind penetration. Existing carriageways and interconnected open space usually serve such purpose. Therefore, there is a genuine need to preserve the existing street grid pattern and identified air path. It should aim to explore opportunities for improvement by widening particular carriageways or air path identified of importance (e.g. along prevailing wind). Carriageway of 15m to 20m aligned with the prevailing wind direction is usually the minimum acceptable width which can facilitate wind penetration locally (i.e. not for wind distribution to downwind to areas farther away) in built environment and can be provided by means of building setback (see **Figure 14**). The orientation, building height on two sides, etc. would also affect the effectiveness of the air path. For regions with limited number of air paths, the width should be increased where practicable to compensate for the lack of air path. Moreover, through air path should be created where possible by removing existing/potential blockage.

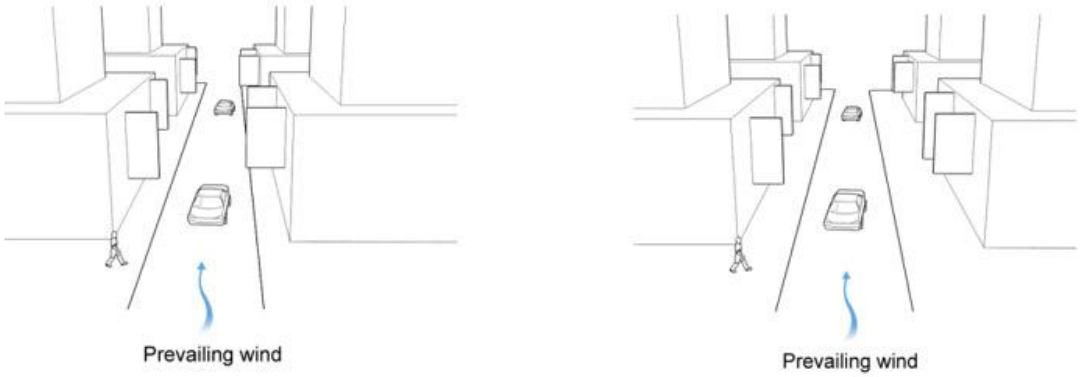
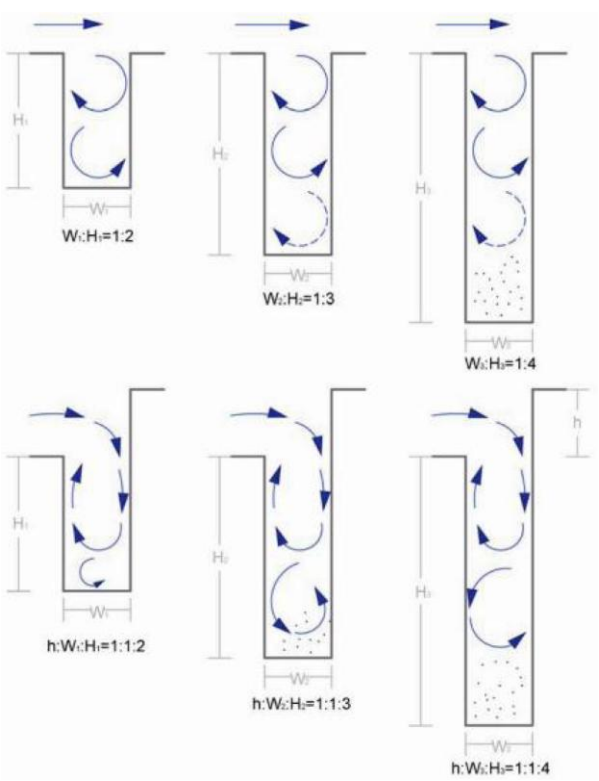


Figure 14 Widening of Potentially Important Air Path by Building Setback

3.5.2 In addition, open area within the urban area can provide linkage to allow wind distribution and even serve as breezeway for wind entry. Open space with greening can help to reduce urban heat island effect. All open space already dedicated should be preserved as well. Low-rise GIC facilities also serve as wind corridor and breathing space in the compact built environment and their low-rise profile should be maintained.

3.5.3 H/W (Height to width) ratio is a measure of the urban canyon effect and defined as building height to street width (building-to-building) ratio. Referring to **Figure 15**, it can be observed that with higher H/W ratio, air circulation near ground between buildings will be weakened. Ratio of 3:1 or higher is expected to have notably weaker air circulation realized at pedestrian level. A ratio of 2:1 or lower is ideal (while hard to achieve in urbanized area) because it can generate adequate air circulation between buildings in a way to remove pollutants near ground and provide good ventilation. Higher H/W ratio would, however, render the situation difficult for air circulation near ground. The higher H/W ratio would result in weaker air flow then. Even downwash effect (see **Figure 16**), which urban area usually relies heavily on would become ineffective if the H/W ratio is too high. Continuously high-rise buildings along carriageway causing high H/W ratio should be avoided. In other words, when H/W ratio cannot be lowered practicably, long and nearly continuous building structures (wall effect) must be avoided.



Hi : height of building
H : difference between heights of buildings on two sides
Wi : effective width of carriageway (building-to-building width)

(Source: A. KOVAR-PANSKUS, P. LOUKA, J.-F. SINI, E. SAVORY, M. CZECH, A. ABDELQARI, P. G. MESTAYER and N. TOY, INFLUENCE OF GEOMETRY ON THE MEAN FLOWWITHIN URBAN STREET CANYONS – A COMPARISON OF WIND TUNNEL EXPERIMENTS AND NUMERICAL SIMULATIONS, Water, Air, and Soil Pollution: Focus 2: 365–380, 2002, Kluwer Academic Publishers)

Figure 15 General Understanding of Urban Canyon Effect

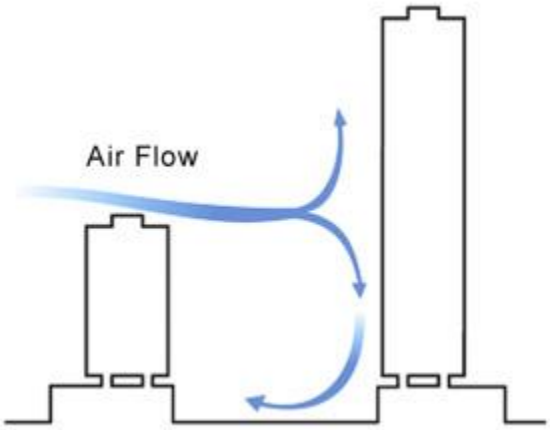


Figure 16 Illustration of Building Downwash Effect (Source: HKPSG)

3.5.4 In order to improve air ventilation in urbanized area at which taller building can hardly be avoided, the more important and preferred direction should be to retain, enhance and/or create breezeway/air path through designation of open space, non-building area, setback of buildings, building gap, etc.

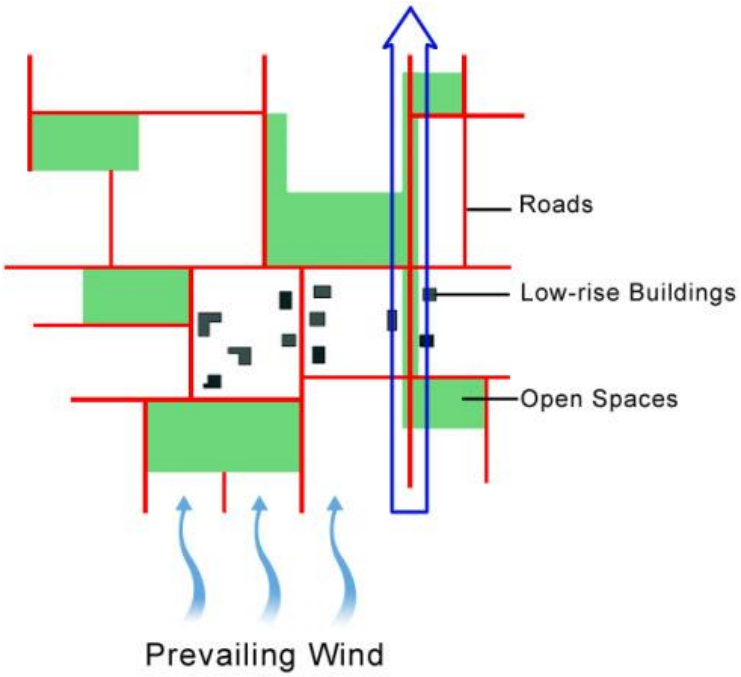


Figure 17 Linkage of Roads, Open Spaces and Low-rise Buildings to Form Air Paths/Breezeways (Source: HKPSG)

3.5.5 As a general rule, buildings nearer to seashore should have shorter building height (BH) and with increasing height in inner region to promote air flow to inner area by means of downwash (see **Figure 16**). Especially, breezeway leading sea breeze to

inner region is particularly important. Wall effect must be avoided near the shore (see **Figure 18**).

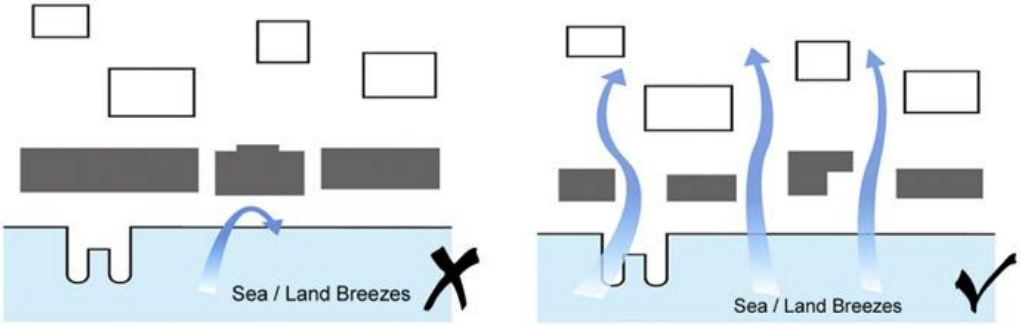


Figure 18 Avoidance of Blockage at Waterfront

3.5.6 A stepping building height profile would allow wind from seaside or prevailing wind direction to penetrate to inland or further downwind region easier. Even air paths exists, the building height profile should be followed where practicable.

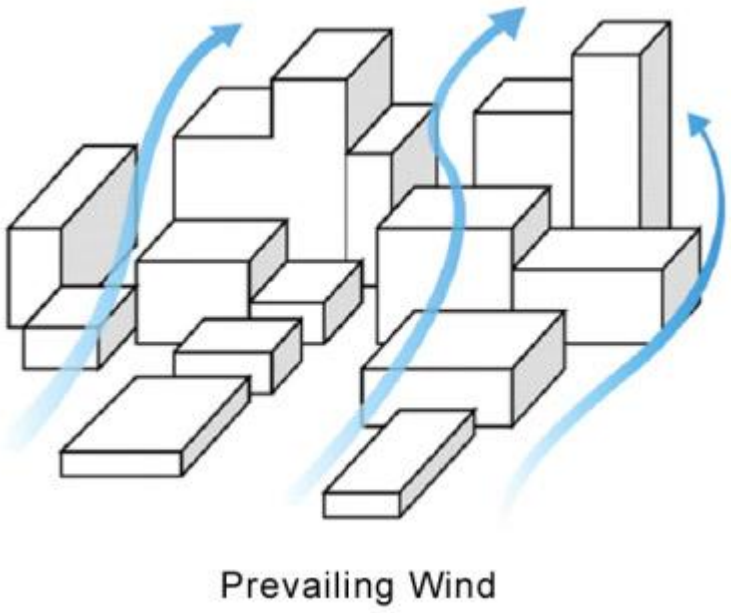


Figure 19 Good Building Height Profile

3.5.7 Building clusters with longer aspect perpendicular to prevailing wind direction should be avoided or significant wall effect would be resulted. Breaking of continuous building structures should be well considered.

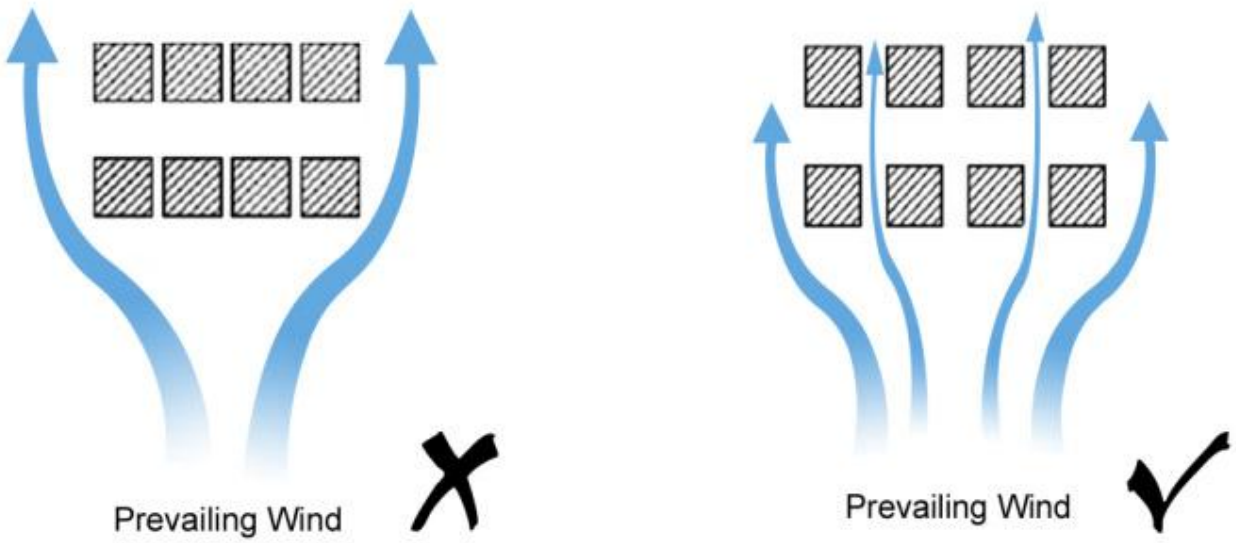


Figure 20 Avoidance of Long and Continuous Building Cluster perpendicular to Prevailing Wind Directions

3.5.8 Development with less site coverage of podium buildings would also help improve air ventilation in adjacent areas. Terraced podium design can allow wind flow over podium to reach pedestrian level easier. Designation of area with restriction on building height should be considered if such provision is effective to create air path and/or improve air ventilation.

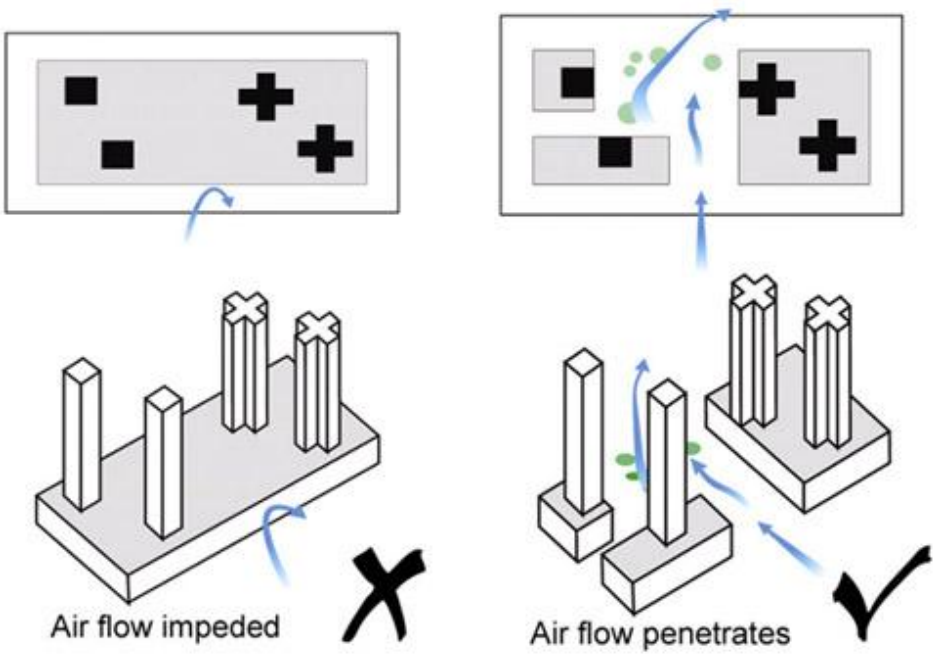


Figure 21 Avoidance of Massie Podium Structure wherever possible

3.5.9 To summarize, new development should be designed to incorporate the following good direction where practicable to improved air ventilation:

- Setback of building from road carriageways especially for carriageways that are narrow (with high H/W ratio) and those along prevailing wind direction to avoid encroaching to air path;
- adopt lower building height for areas on the upwind side of prevailing wind to create stepping height profile;
- avoid continuous building structure or building structure with major façade perpendicular to prevailing wind directions;
- avoid continuous podium buildings and adopt stepping podium design if any to facilitate wind penetration.

4.0 Evaluation of Initial Planned Scenario

4.1 Evaluation of Air Ventilation Performance

4.1.1 **Figure 22** shows the initial planned scenario.

4.1.2 According to the road network shown in the initial planned scenario, Tai Pak Tin Street/Path will extend to Wo Yi Hop Road to the west. Kwai Chung Circumferential Road (including existing Shek Pai Street) will extend to connect to Tai Lin Pai Road. Other major roads shown in the initial planned scenario resembles the existing situation. Other carriageways which are not shown in initial planned scenario are assumed to be existent in future. It means that road carriageways which usually act as air corridor (e.g. Kwai Chung Road, Tsuen Wan Road, Texaco Road) will not be affected under the initial planned scenario. On the other hand, the new Kwai Chung Circumferential Road will provide additional air path to connect to Kwai Chung Road to allow NE/SW wind penetration and will provide further improvement on air ventilation. It is also understood that there is a long-term road widening proposal for Lam Tin Street, Chun Pin Street and Ta Chuen Ping Street to widen these roads to 20.5m, which is considered beneficial to the air ventilation condition.

4.1.3 With respect to G/IC uses, the BH limit generally reflects the existing maximum building heights. For school developments, generally 8 storeys are allowed. In general, low-rise G/IC buildings function as breathing space/air corridors to the study area.

4.1.4 For near shore area including Tsuen Wan Chinese Permanent Cemetery, container terminal area, the BH limit also reflects the existing situation.

4.1.5 The BH limits of industrial building cluster along Tsuen Wan Road range from 90mPD to 140mPD generally generally reflecting existing building heights. The industrial building cluster bounded by Kwai Chung Road and Castle Peak Road would have BH limits ranging from 105mPD to 135mPD. The industrial building cluster bounded by Wo Yi Hop Road would have BH limit of 130mPD. OU(B) sites between Kin Chuen Street/Wo Tong Tsui Street and Castle Peak Road would have BH limit of 105mPD and 130mPD which is about 50m higher than existing BH.

4.1.6 While most of the BH restriction reflects existing situation, some of the development zones would allow higher BH restriction than existing heights to take into account redevelopment potential. For example, the northern portion of Cho Yiu Chuen would allow BH limit of 190mPD which is 50m higher than existing BH. Lai King Estate would allow BH limit of 130mPD which is over 30m higher than existing BH. The northern and southern portion of Lai Yiu Estate would allow BH limit of respectively 160mPD and 190mPD which is 30m and 40m higher than existing BH respectively. Southern portion of Kwai Shing West Estate would allow BH limit of 120/160mPD which is over 30m higher than existing BH. The northern and southern portion of Tai

Wo Hau Estate adjacent to Tai Wo Hau Road would allow BH limit of respectively 110mPD and 130mPD which is over 30m higher than existing BH. Portion of Shek Lei Estate (south of Shek Li Estate) would allow BH limit of 180mPD which is 20m higher than existing BH. The recently built Kwai Luen Estate and the committed development between Kwai Shing East Estate and Kwai Shing West Estate would have BH limit of 160mPD. The R(A) site between Shek Li Estate and On Yam Estate have BH limit of 180mD.

4.1.7 A CDA site at the valley location at Kau Wa Keng would have BH limit of 120mPD. The C site (currently 38mPD) to the south of MTR Kwai Fong Station would have BH limit of 90mPD. The vacant R(E)1 site next to Kwai Chung Police Station would have BH limit of 90mPD. The mostly vacated industrial area to the north of Tsuen Wan Chinese Permanent Cemetery would have BH limit of 120mPD. The committed CDA development site along Cheung Wing Road would have BH limit of 120mPD. The G/IC site under construction for Government quarters nearby Lei Muk Shue Police Station would have BH limit of 13 storeys.

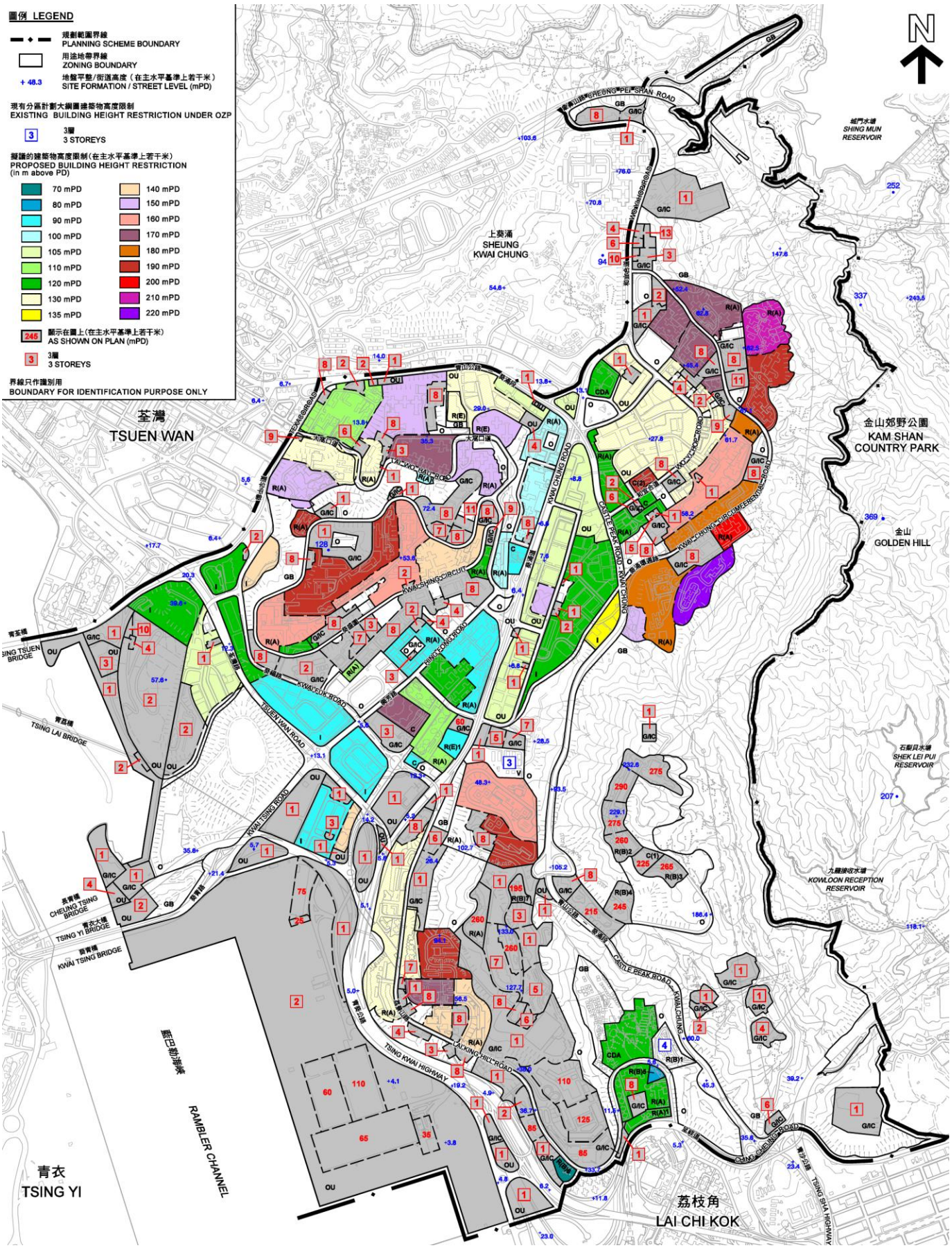


Figure 22 Initial Planned Scenario

Kwai Chung Sub-Area

4.1.8 Kwai Chung sub-area is dominated by I, OU, R(A) and R(E) developments. Residential development consists of public rental housing and some scattered private developments. The BH limit generally reflects the existing situation.

4.1.9 However, BH limit higher than existing building height is allowed for some of the developments including OU(B) sites at Yiu Wing Street/Kin Chuen Street/Wo Tong Tsui Street between Castle Peak Road and Kwai Chung Road (about 50m higher than existing BH) (photo 61), Lai Yiu Estate (about 30m to 40m higher than existing BH), Kwai Shing West Estate (over 30m higher than existing BH) and Tai Wo Hau Estate (over 30m higher than existing BH) (photos 55, 56). The "C" site to the south of MTR Kwai Fong Station would have BH limit of 90mPD.

4.1.10 Building height restriction higher than the existing heights of the buildings in these areas may result in adverse air ventilation impact in principle due to increase of H/W ratio. Carriageways corresponding to the developments with increasing building height in future include section of Castle Peak Road to the west of Kwai Chung Road (H/W ratio increase from 2:1 to 3:1), Lai Yiu Street & Wah Yiu Road (from 2:1 to 3:1), Kwai Shing Circuit, Kwai Luen Road, Kwai Hau Street and Tai Wo Hau Road. They may have higher H/W ratio resulted. Nevertheless, the effective road widths (building-to-building) of these carriageways are generally wide (over 40m) and some of the carriageways are lined with buildings on one side only (due to existence of slope area to the north of Castle Peak Road to the west of Kwai Chung Road, Kwai Shing Circuit, Kwai Hau Street & Tai Wo Hau Road, existence of slope and open space along Kwai Luen Road) so that the impact due to increased building height is less significant. Impact on Lai Yiu Street and Wah Yiu Road would depend on the disposition of future blocks upon redevelopment. It is assumed that urban design guidelines under HKPSG (also see Section 3.5 of this report) will be followed in future. Moreover, Lai Yiu Street and Wah Yiu Road are sited at high ground so that higher wind speed (especially south to southwesterly wind in summer) is experienced. The impact will be further ameliorated.

4.1.11 The "C" site (BH limit = 90mPD) to the south of MTR Kwai Fong Station (photo 32) is situated at a location nearby the air paths along Kwai Fuk Road and along MTR railway alignment. A single high-rise development would unlikely have significant impact provided that it is not a bottleneck area. Regarding the site environment, the opposite sides of this "C" site is either G/IC or OU sites with low buildings allowed. Therefore, future high-rise development would unlikely result in significant impact on air paths. However, the existing carpark at the site is blocking air flow to the covered PTI to the north. Upon redevelopment, consideration can be made to improve building permeability so that air ventilation within the covered PTI can be enhanced. As the problem is minor in nature and not necessarily related to general outdoor pedestrian area, no recommendation is made in this context.

4.1.12 There is a piece of elongated industrial land sandwiched between Tsuen Wan Road and Kwai Hei Street, with a total site width of about 300m facing the southwest and with a proposed BH restriction of 90mPD. If no building gap is allowed, the continuous building blockage effect would affect the pedestrian area immediately behind.

4.1.13 In addition, existing BH varies within a height band, where a few taller buildings reach the BH restriction and majority of the buildings are lower than the BH restriction. Under the initial planned scenario, these shorter buildings would be built to the BH limit upon redevelopment, resulting in more taller buildings and thus increasing the H/W ratio. Take Tai Lin Pai Road as an example, most buildings on two sides generally have BH lower than the BH limit. After development, Tai Lin Pai Road would have H/W increased from around 4:1 to 6:1 even the BH limit is comparable to the taller buildings in these clusters. In this case, either H/W ratio should be reduced or additional air path should be created/enhanced to allow easterly/westerly wind flow to reach Tai Lin Pai Road to attenuate the potential impact.

4.1.14 Many local roads are not explicitly shown on plan. It is assumed that these local roads will remain intact and would not be affected by the initial planned scenario. The air path along Kwai Chung Road includes part of the estate road of Kwai Hing Estate. The openness of this estate road should not be affected in redevelopment of the estate so as to maintain the air path.

4.1.15 As discussed above according to the initial planned scenario, the proposed BH limit for some areas may result in some but not significant air ventilation impact due to the fact that the carriageways adjacent to these areas are adequately wide or the carriageways are flanked with buildings on one side only. However, some other problems are still anticipated. The major problem areas are summarized below:

- Existing BH along Tai Lin Pai Road varies where majority of buildings are lower than the BH restriction. These shorter buildings can be built to the BH limit upon redevelopment under the initial planned scenario, resulting in more taller buildings thus increasing the H/W ratio (from 4:1 to 6:1);
- Buildings along Kwai Chung Road and Tai Lin Pai Road are over congested with some narrow corridors in between. The building clusters are too long (420m and 520m). The existing E-W aligned air paths along Tai Lin Pai Road and Kwai On Street are blocked by buildings between Castle Peak Road and Tai Lin Pai Road. Northeasterly (e.g. wind channelized along Wo Yi Hop Road), easterly to southeasterly wind flow is generally blocked (identified under existing condition); and
- Kwai Shing East Estate and Kwai Shing West Estate, together with Kwai Luen Estate obstruct southeast wind flow (identified under existing condition).

4.1.16 Minor problems identified before in Section 3.3.19 still exist under initial planned scenario. Moreover, the following minor problems according to the initial planned scenario should be addressed where practicable.

- The elongated industrial sites along Tsuen Wan Road may block pedestrian area immediately behind if continuous building is allowed. However, as these industrial sites are nearer to southwest waterfront and without blockage on windward side under southerly wind, the impact is considered localized and minor.

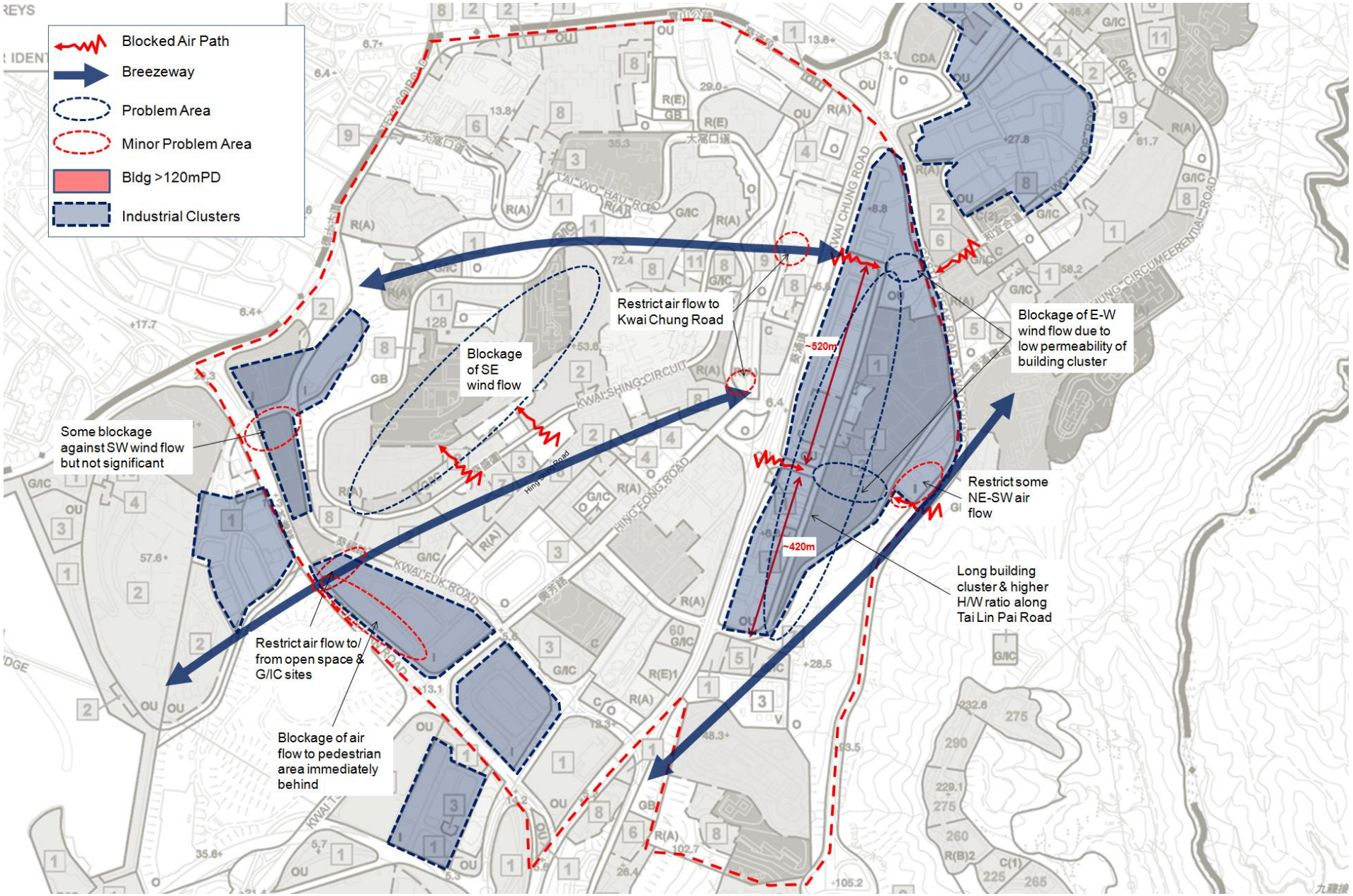


Figure 23 Problem Areas for Kwai Chung Sub-Area under Initial Planned Scenario

Chung Kwai Chung Sub-Area

4.1.17 In Chung Kwai Chung sub-area, the ground elevation ranges higher than Kwai Chung sub-area with the highest elevation of the major built area up to 114mPD (at Yi Fung Court). BH limit generally ranges from 120 to 220mPD.

4.1.18 G/IC sites are scattered within the major built area and northern part of this sub-area. The BH limit of G/IC sites generally reflects existing condition. A vacated G/IC site (under construction for government quarters) nearby Lei Muk Shue Police Station would have BH limit of 13 storeys. Considering that it is sited at higher ground, the actual building height is not significantly high. Moreover, it is isolated from other high-rise development built area. No significant impact is anticipated.

4.1.19 For most developments along Castle Peak Road (to the east of Kwai Chung Road), the existing building heights range from 33 to 110mPD (building height up to around 80m aboveground). Given that the building-to-building width of Castle Peak Road is about 30m, the existing H/W ratio is below 3:1. Under the proposed BH restrictions of 105mPD and 120mPD, the H/W ratio will be around 3:1 to 4:1 upon redevelopment. The urban canyon effect will be intensified. Either H/W ratio should be reduced or additional air path should be created to allow easterly to northeasterly wind flow to reach Castle Peak Road. The increased BH limit for western portion of Shek Lei Estate which is higher than existing BH would unlikely intensify urban canyon effect along the section of Castle Peak Road to the east of Kwai Chung Road because the existing slope will separate building area from Castle Peak Road.

4.1.20 A committed CDA development (120mPD) is sited along Cheung Wing Road. The opposite side of Cheung Wing Road is an industrial building. The building-to-building width is over 40m. Cheung Wing Road is identified as one of the important air path for northeasterly/ southwesterly wind penetration. While this air path may be slightly restricted after the CDA development, it is still considered sufficient to facilitate air flow. There is a site zoned “O” to the south of the CDA site as breathing area for wind distribution. This makes the CDA site less obstructive to air ventilation.

4.1.21 However, the previously identified problem areas have not been addressed. The problem areas are summarized below:

- Increased H/W ratio (from about 2:1 to around 3:1 to 4:1) along a section of Castle Peak Road to the east of Kwai Chung Road will intensify urban canyon effect (due to initial planned scenario); and

- The buildings within industrial building clusters are compacted together. The building cluster is generally impermeable. Wind flow at pedestrian level can only be channelized through existing carriageway in between. However, the carriageways (e.g. Lam Tin Street, Ta Chuen Ping Street) are not straight and through roads. It is difficult for wind penetration through the industrial building cluster from important northeasterly direction and any other possible direction (identified under existing condition).

4.1.22 Other minor problems identified before in Section 3.3.32 still exist under initial planned scenario.

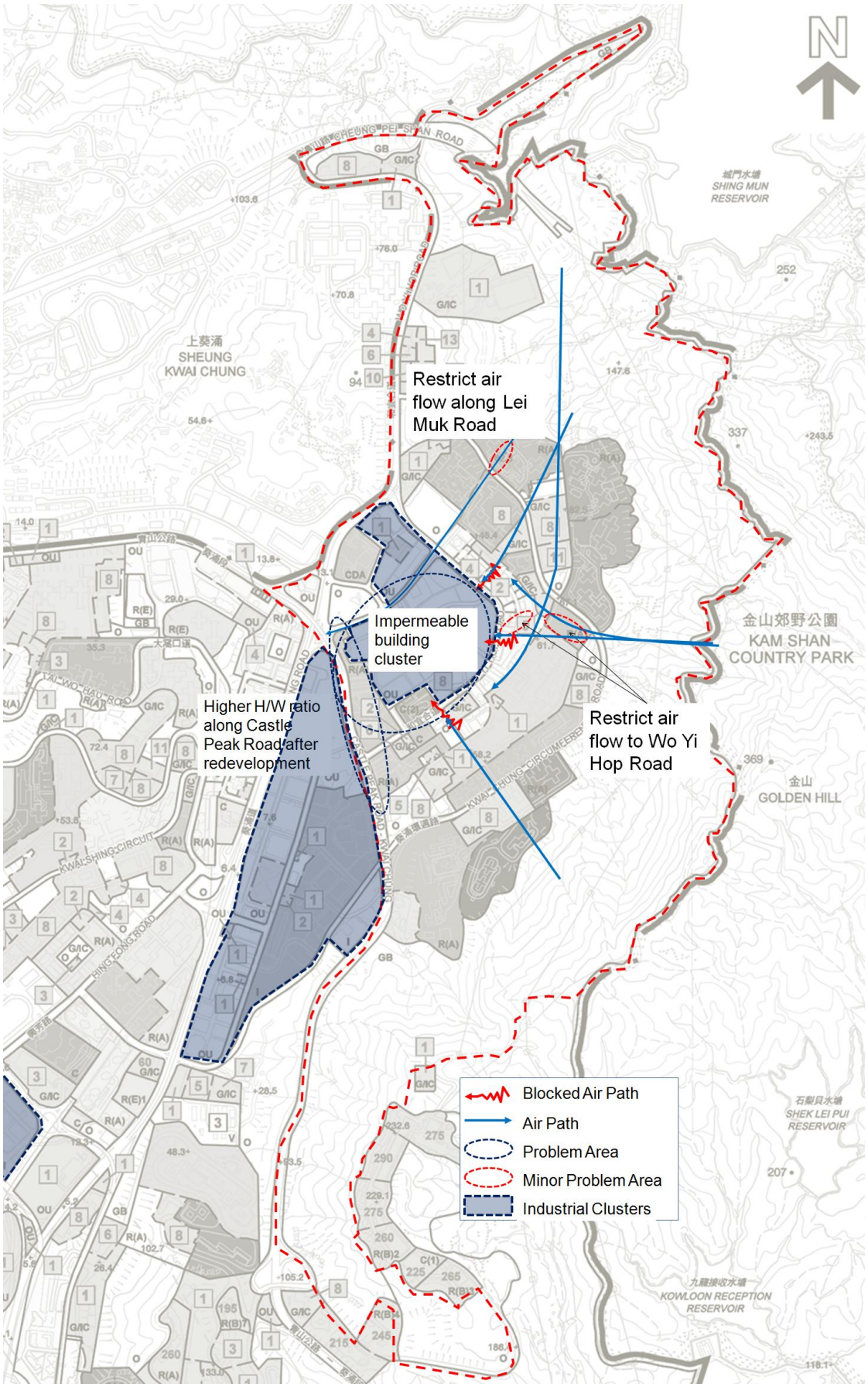


Figure 24 **Problem Area for Chung Kwai Chung Sub-Area under Initial Planned Scenario**

Ha Kwai Chung Sub-Area

4.1.23 There are generally fewer problem areas within Ha Kwai Chung sub-area because the area is not densely built and located near waterfront or a high elevation.

4.1.24 The piles of containers stored at the container terminal area would cause some blockage against wind from seaside. But as the terminal area is well separated from the inland built area or the inland built area is elevated higher (e.g. about 450m away from Tsuen Wan Road and about 250m away from Lai King Estate which is elevated over 30m higher), the impact is not envisaged significant.

4.1.25 Although the BH limit of Lai King Estate along Lai King Hill Road is higher than the existing BH, there is no high-rise building situated on the opposite side in close proximity to the road (photos 6 & 7). Therefore urban canyon effect is not considered significant even after redevelopment.

4.1.26 On the other hand, the site of Lai King Estate is N-S aligned along Lai King Hill Road. It may therefore impose blockage impact on easterly and westerly wind flow if there is no building gap in-between. Especially, if the northern portion of Lai King Estate is erected with continuous high-rise building in future, it may block some east wind flow from entering Tsuen Wan Road (photos 17 & 20). Currently, the northern portion of Lai King Estate along Lai King Hill Road is occupied by bus terminus, open carpark and slope. East wind can reach pedestrian area near the foothill (i.e. pedestrian area of industrial building clusters such as Kwai Shun Street and Kwai Fung Crescent on two sides of Tsuen Wan Road) without being blocked. This feature should be preserved wherever practicable. Nevertheless, the low-rise school sites and the open MTR emergency access point to their immediate north will allow east wind flow over it without any problem. Therefore, even high-rise buildings are erected at remaining area of Lai King Estate upon redevelopment in future, southeasterly wind can pass around Lai King Estate site via area on the northern side. Moreover, as Tsuen Wan Road is aligned near the shore area. Wind from periphery area can enter Tsuen Wan Road from southern side easier and the impact due to possible blockage at Lai King Estate site is further ameliorated. However, as a matter of the importance of Tsuen Wan Road as air path for the summer prevailing southeasterly wind, measures should be considered to facilitate wind entry to it where practicable.

4.1.27 The vacated area to the north of Tsuen Wan Chinese Permanent Cemetery is industrial zone and will allow BH limit of 120mPD in future. This area is close to the two identified air paths along Texaco Road and along GB and G/IC area to the northeast. The northwest side of this vacated industrial zone is slope area. It is anticipated that future blocks should not be sited on the slope area so that the air path along Texaco Road to the north would not be significantly affected. Important pedestrian area benefited by another air path along GB and G/IC area (e.g. Kwai Shing Circuit) is elevated at about 80mPD or higher. The blockage impact due to future building within this vacated industrial site is less significant. Nevertheless,

good practice should be adopted to leave sufficient building gap in order to minimize the impact to this important air path.

4.1.28 The existing industrial area to the immediate south of the industrial zone mentioned above has buildings of around 22 to 95mPD along Tsuen Wan Road. The H/W ratio ranges from less than 1:1 to 2:1. Based on BH limit of 105mPD, the ultimate H/W ratio will be around 2:1 and is considered acceptable.

4.1.29 The western portion of the CDA site at Kau Wa Keng, if occupied, may block some southerly wind from entering into this valley area and affect air ventilation of the existing low-rise development to the north within the GB area.

4.1.30 The problem area is summarized below:

- The western portion of the CDA site at Kau Wa Keng, if occupied, may block southerly wind from entering into this valley area (due to initial planned scenario).

4.1.31 Minor problem areas identified under existing situation in Section 3.3.43 remain under initial planned scenario. Other minor problem area is summarized below:

- The northern portion of Lai King Estate, if erected with high-rise building in future, may block some southeasterly wind flow from entering Tsuen Wan Road (due to initial planned scenario).

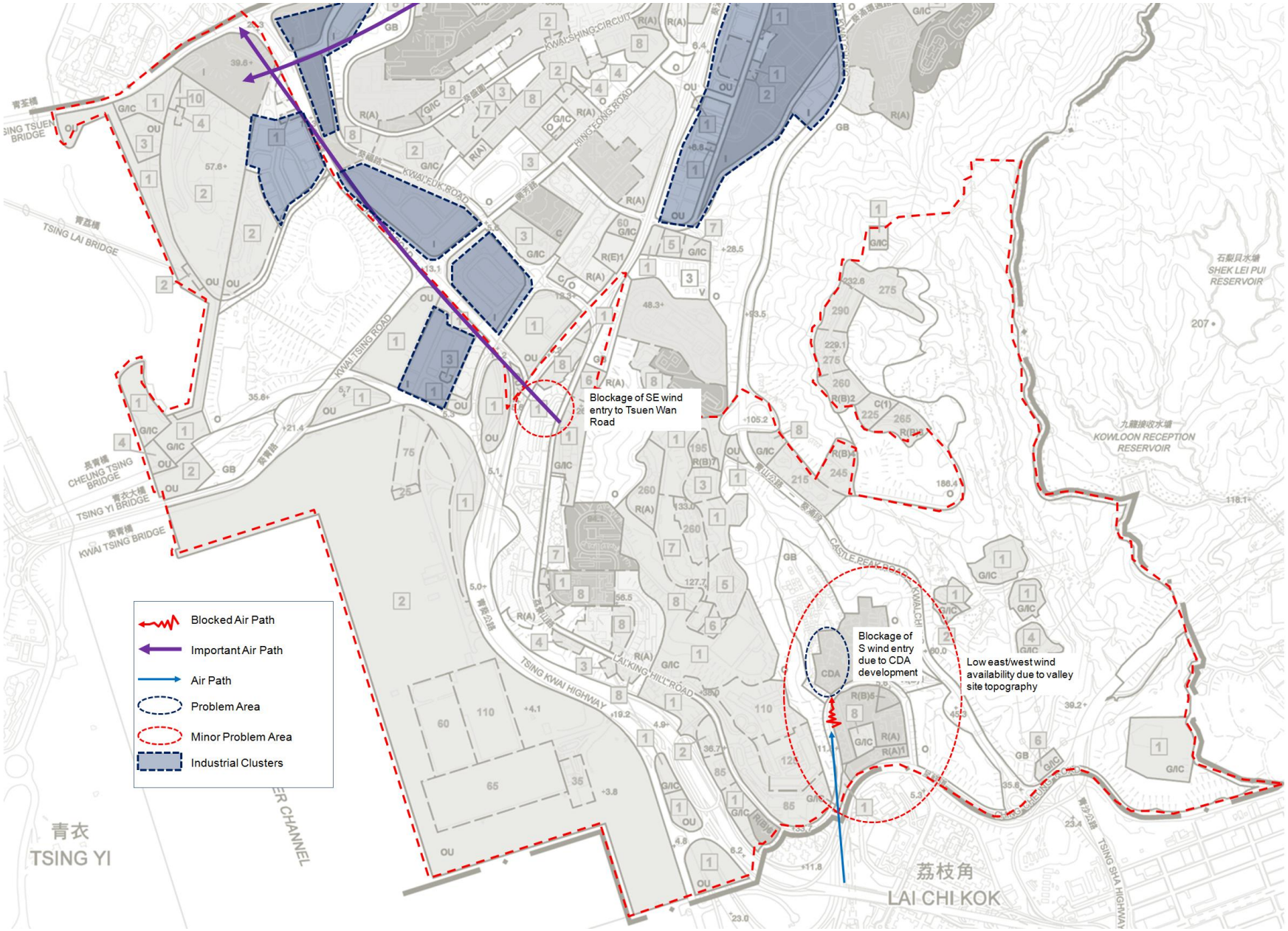


Figure 25 **Problem Area for Ha Kwai Chung Sub-Area under Initial Planned Scenario**

4.2 Recommendations

4.2.1 Breezeways and air paths are shown on **Figure 7** and **Figure 10**. Air paths for individual sub-areas are shown in **Figure 11** to **Figure 13** whereas problem areas with respect to initial planned scenario is identified and depicted in **Figure 23** to **Figure 25**.

4.2.2 Accordingly, recommendations are given to address the problem area where practicable. On the other hand, some of the air paths rely on the disposition of the buildings to provide adequate setback and building gap. Upon redevelopment, the change of the layout may impact on the air path as well. Therefore, mechanism should be provided to ensure that such air paths would not be impacted upon redevelopment.

Kwai Chung Sub-Area

4.2.3 **Figure 26** shows the recommended scheme for Kwai Chung sub-area based on evaluation of the initial planned scheme and identification of problem area under existing situation.

4.2.4 Problem areas within this sub-area are addressed by means of recommending further study (using quantitative AVA), designating NBA and provision of setback.

- Setback from building lots or designation of NBA/building gap within the building lots among the industrial building cluster on both sides of Tai Lin Pai Road are recommended (**Figure 26**). They will effect to improve the permeability of the building cluster for wind penetration (especially for E-W wind) (photos 35, 37 to 46). It will ameliorate impact due to increased H/W ratio along Tai Lin Pai Road. In principle, air corridor should be as wide as possible. A width of 15m is considered the minimum width required. On the other hand, the rule of thumb is to avoid bottleneck at the created air corridor where possible if this is aligned with other existing road/street. It means that the width of the air corridor should not be less than the existing road/street. Normally, building gap which is free of any structure at grade (i.e. NBA) is most preferred unless there is practical difficulty or the benefit of having no building structure at grade is minimal.

- Kwai Cheong Road is long enough so that wind entry to this carriageway should be maximized where practicable. An 15m-wide NBA between Kwai Cheong Road and Kwai Wing Road (setback 7m at grade from western boundary of existing Manhattan Centre to form the NBA with adjoining 8m-wide footpath) is therefore recommended to maximize air flow along it. This NBA will be of the same width as Kwai Cheong Road and Kwai Wing Road.

- Other air paths under concern are short and generally aligned along E-W axis. . For the four existing footpaths at grade between Kwai Chung Road and Tai Lin Pai Road/Ka Ting Road and the one between Castle Peak Road and Wah Sing

Street, they are considered as good features to allow wind penetration at pedestrian level and should be maintained. Especially, the footpaths connected to Kung Yip Street/ Wah Sing Street and existing Tai Lin Pai Road Playground are considered more important due to its better connection to other carriageways and open space. They are thus recommended to be designated as NBAs. As these footpaths, which act as air paths, are of 7m to 9m wide only and cannot serve very well as air corridors, additional measures (e.g. widening of the NBA) should be incorporated. The existing footpath between Kwai Shing Industrial Building/Hoover Industrial Building and Eastern Sea Industrial Building/ Kwai Cheong Centre is considered of lower importance as it is not aligned with existing carriage and open space or low-rise GIC facilities and is recommended to be preserved without further widening.

- With multiple air paths at the same orientation, there is lower priority to require to widen it from grade. Nevertheless, it is understood that the designation of building setback at grade for lots adjoining to the air path would not significantly affect the development potential upon redevelopment considering that the required building setback is not extensive. Therefore, building setback is recommended at grade to create the air corridor (with adjoining footpaths) for area between Kwai Chung Road and Tai Lin Pai Road/Ka Ting Road. Accordingly, the initial proposal is to have: (1) 18m-wide air corridor created between existing Millennium Trade Centre & Wing Cheung Industrial Building and between Eastern Sea Industrial Building & Roxy Industrial Centre by means of 4.5m building setback on both sides of 9m-wide footpath (which tally with existing width of Kung Yip Street to the east); (2) 15m-wide air corridor created between existing Wing Cheung Industrial Building & Luen Tai Industrial Building and between Roxy Industrial Centre & Kowloon Commerce Centre by means of 4m building setback on both sides of 7m-wide footpath; (3) 15m-wide air corridor created on the southern side of existing Mai Wo Industrial Building by means of 11m building setback from southern lot boundary (which tally with the existing width of east-west aligned Kwai Cheong Road to the east); (4) 16m-wide air corridor created between Yee Lim Industrial Building & Eastern Factory Building by means of 4m building setback on both sides of 8m-wide footpath (which tally with the existing width of Ka Ting Road to the east). An alternative proposal from Planning Department to keep all the above NBAs to 15m wide (i.e. minimum required width of air path) was also examined. As discussed, there is lower priority to require NBA with multiple air paths at the same orientation. It is agreed that to standardize all air corridors to 15m wide would not significantly impact the air ventilation performance. However, further reduction of the width of the air corridor to less than 15m would likely deteriorate the performance and is not recommended. As a result, the air corridors (1) & (4) mentioned above is revised to 15m wide. The building setback at grade required is:

  (1) 3m building setback from southern lot boundary of Millennium Trade Centre, northern lot boundary of Wing Cheung Industrial Building, southern lot boundary of Eastern Sea Industrial Building & northern lot boundary of Roxy Industrial Centre;

(2) 4m building setback from southern lot boundary of Wing Cheung Industrial Building, northern lot boundary of Luen Tai Industrial Building, southern lot boundary of Roxy Industrial Centre & northern lot boundary of Kowloon Commerce Centre;
(3) 11m building setback from southern lot boundary of Mai Wo Industrial Building;
(4) 3.5m building setback from southern lot boundary of Yee Lim Industrial Building & northern lot boundary of Eastern Factory Building

- For areas between Tai Lin Pai Road and Castle Peak Road/Wing Yip Street which are with significant elevation difference, free of building structure at grade (measured from Tai Lin Pai Road) is not considered absolutely necessary. In this case, air corridors are recommended to be created by building setback at a particular elevation (at least not higher than ground level of Castle Peak Road/Wing Yip Street). They include: 7.5m building setback at above 25mPD from southern lot boundary of existing Hensey Industrial Building & northern lot boundary of Vanta Industrial Centre to form a 15m-wide air corridor (the existing width of east-west aligned Tai Lin Pai Road to the west is 18m and therefore a 18m-wide air corridor is most preferred whereas 15m is the minimum acceptable width of the air corridor); various building setback at grade and along southern boundary of Vanta Industrial Centre to form a minimum 9.7m-wide air corridor connecting to Wah Sing Street (as understood, there is practical difficulty to create an uniform 15m-wide air path due to the irregularity of the footpath); 15m-wide air corridor at above 18mPD created between Wing Yip Street and Kwai On Road (which tally with the existing width of Wing Yip Street).

- Quantitative AVA is recommended upon redevelopment of Kwai Shing East Estate and Kwai Shing West Estate. As the two committed developments (one recently built) between two estates are not massive, and the situation cannot be altered in near future, it is more practical and effective to better design the redevelopment of Kwai Shing East Estate and Kwai Shing West Estate to resolve wind blockage problem. The study should aim to allow adequate number and width of building gaps connecting to open space, slope and G/IC sites to improve SE wind penetration. In particular, SE wind entry to Yeung Uk Road (an important air path and pedestrian area in Tsuen Wan area) should be improved. In addition, existing NE-SW aligned air path partially along GB, G/IC and O sites to the northwest should be preserved by providing adequate setback from northern side.

4.2.5 For areas that are considered with relatively minor air ventilation impact, on the other hand, designation of NBA and further study is recommended to maintain or further improve the air paths.

- An NBA is assigned to cover the existing Yip Shing Street Playground between Castle Peak Road and Yip Shing Street (over 50m wide). It will straighten the air path along Castle Peak Road. Otherwise, the effective width of the air corridor along Castle Peak Road will be reduced to around 30m (measured from NBA to Greenknoll Court). As discussed before, NBA without building structure at grade is normally recommended unless there is practical difficulty or benefit of the NBA is

minimal. In this case, it is not anticipated that lot owner's development rights will be significantly impacted. NBA at grade is therefore proposed. On the other hand, it is not anticipated that the adjacent slope area will be developed in future.

- The northwest end of an industrial building cluster where Metro Loft and Kingsford Industrial Buildings reside is currently occupied by temporary oil depot (low-rise) and open carpark so that southwesterly sea breeze can enter the inland area through it. An air corridor of 50m wide above 24mPD with the alignment projected from Kwai Hei Street and running in the NE-SW direction to connect Kwai Fuk Road and Tsuen Wan Road is recommended to maintain the entry for sea breeze from the southwest. The 24mPD elevation is to align with the surface level of Kwai Fuk Road. The same breezeway in inland area along G/IC site and open space is over 100m wide, a recommended width of 50m is a compromise in order not to seriously impact the development potential of the affected areas and is therefore recommended in this context.

- For the elongated sites along Tsuen Wan Road planned for industrial use with a total site width of about 300m facing the southwest, building gap should be provided to allow wind penetration to pedestrian areas immediately behind. Control can be exercised by designating NBA of not less than 15m wide aligned with existing road (Kwai Lok Street), which is the existing road width and also considered the minimum width of a corridor appropriatefor wind penetration purpose.
- Quantitative AVA is recommended upon redevelopment of Kwai Chung Estate to ensure that the air path along N-S axis connecting Castle Peak Road and open space in existing situation can be maintained.

- Quantitative AVA is recommended upon redevelopment of Tai Wo Hau Estate to ensure that air ventilation performance along Texaco Road would not be deteriorated (e.g. providing similar or more setback from Texaco Road), SE wind penetration from along Tai Wo Hau Road (photo 55) and on the southern side via open space & G/IC sites should be maintained or further improved, SE wind entry to Sha Tsui Road can be improved to benefit Tsuen Wan area, and air path along N-S axis connecting Castle Peak Road slope area and open space can be maintained.

- Quantitative AVA is recommended upon redevelopment of Kwai Hing Estate and Kwai Chun Court. The study should aim to provide adequate building gap connecting to Kwai Chung Road and Tai Lin Pai Road so that E-W wind can pass through.

- Blockage problem at the southern side of Sun Kwai Hing Gardens is considered minor due to large open space area around to connect Kwai Chung Road and the identified breezeway along the low-rise G/IC facilities. No recommendation is therefore made.

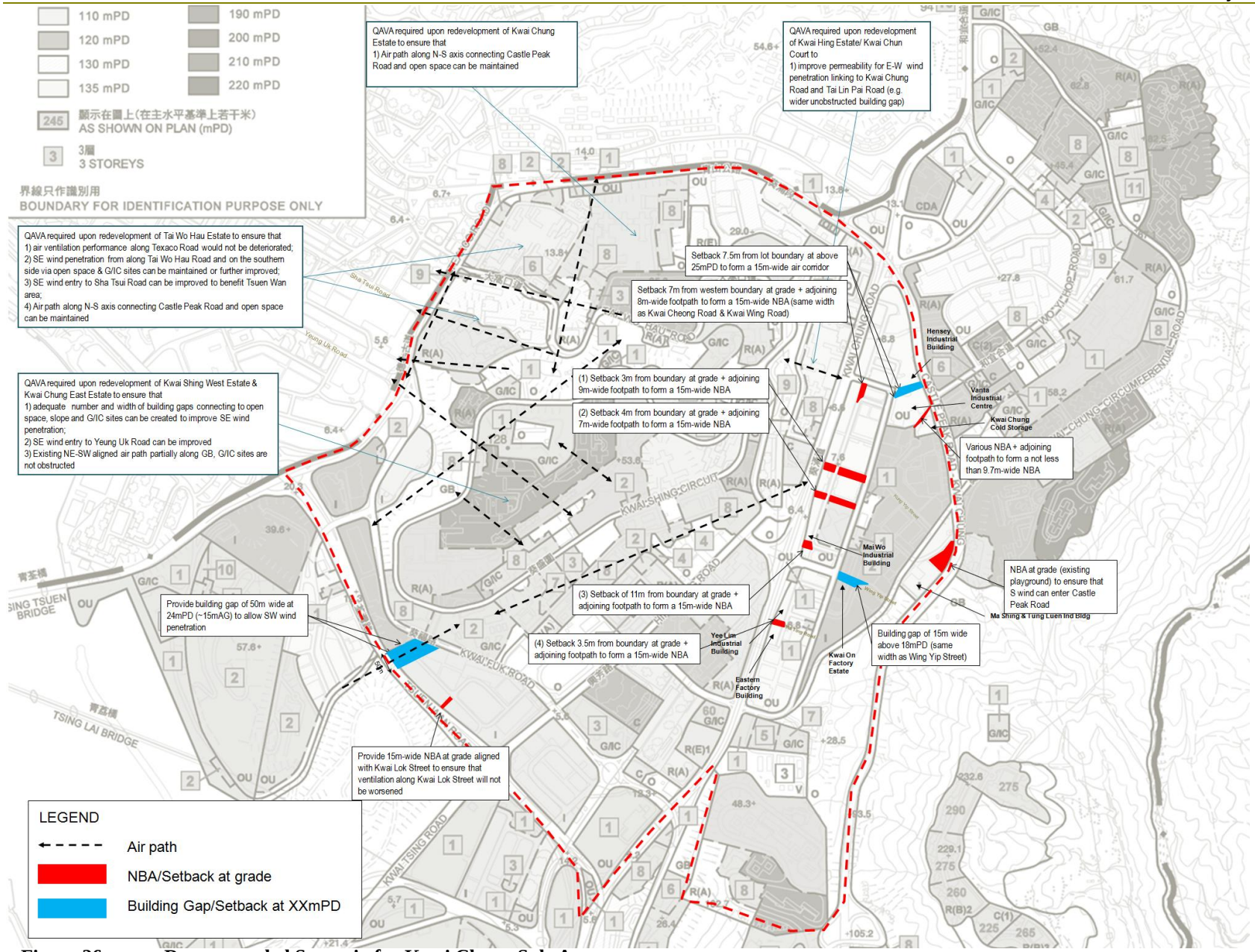


Figure 26 Recommended Scenario for Kwai Chung Sub-Area

Chung Kwai Chung Sub-Area

4.2.6 **Figure 27** shows the recommended scheme for Chung Kwai Chung sub-area based on evaluation of the initial planned scheme and identification of problem area under existing situation.

4.2.7 Problem areas within this sub-area have been addressed by means of designating NBA and provision of setback.

- The ground elevation of existing carriageways (Lam Tin Street, Chun Pin Street, Ta Chuen Ping Street) in this area ranges from +23 to +40mPD. The existing building-to-building width along these streets ranges around 14 to 18m. The BH limits are 120mPD, 130mPD or 190mPD under the Initial Planned Scenario. The building height to building-to-building width (H/W) ratios would have maximum of around 7:1 (and up to 9:1 for a section of Ta Chuen Ping Street aside The Apex) based on the Initial Planned Scenario. To improve the permeability of the industrial building cluster, the building-to-building width of these streets is recommended to be increased. It is noted that there is a long-term road widening proposal to widen these roads to about 20.5m, which would result in a H/W ratio of about 5:1. This would significantly improve the air ventilation along these roads. As such, it is suggested to take advantage of the road widening proposal and designate a 4m-wide NBA from lot boundary aboutting Lam Tin Street and 3.5m-wide NBA from the lot boundary abutting Chun Pin Strret and Ta Chuen Ping Street to achieve a building-to-building width of 20.5m, so as to benfit both traffic and air ventilation conditions (photos 62, 63, 73, 74).

- Moreover, NBA is recommended at the existing non-through corridor between Kwai Hing Industrial Building, Kingswin Industrial Building, Vigor Industrial Building and Edwick Industrial Building. The NBA is further extended to the building footprint of Vigor Industrial Building and Hutchison Estate. It will form a through air path aligned with Lam Tin Street connecting Wo Yi Hop Road (via Lam Tin Street) to Castle Peak Road, which would help to ameliorate problem of Castle Peak Road due to increased H/W ratio and improve air ventilation within the industrial cluster as well. Despite that sections of air path on two sides of Chun Pin Street are not well aligned and there is bending between Lam Tin Street and the proposed NBA, it is considered that wind flow can be channelized through the proposed NBA to benefit pedestrian area. Preferably, the NBA should be of 15m wide and free of structure at grade (i.e. the elevation of pedestrian area). As a compromise to the development potential of individual lots, NBA of 9m wide (which is mostly similar to the existing scenario but with such area extended to Vigor Industrial Building and Hutchison Estate) is the minimum requirement. Normally, it is ideal to have a NBA at grade to directly benefit the pedestrian area. In this case, a flyover exists along Castle Peak Road (about 8m above ground near this NBA) and is perpendicular to this NBA. In order to benefit the pedestrian area along Castle Peak Road, the BH should be lower than the flyover. Otherwise, most wind flow channelized through the air path to Castle Peak Road can only

reach the flyover level and above and only little wind can benefit the pedestrian area below the flyover (see illustration in **Figure 27**). Therefore, NBA at grade is considered necessary.

- Minor problem area is identified that there are continuous residential building lots along Wo Yi Hop Road restricting northerly wind from G/IC sites further penetrating to downwind area. However, given the small lot size, it is not possible to create adequate air path among the lots to remedy the situation without significant impact on their redevelopment potential. Given that there are already four existing open spaces along Shek Yam Road, i.e. Shek Yam Road Rest Garden and Shek Yam Road Rest Garden Nos. 2 to 4 to allow wind penetration, no further recommendation is made on this minor problem area.

- Another minor problem area is due to the committed R(A) development at Tai Pak Tin Street. As the R(A) development is already under construction, and the residual impact is considered minor, the situation cannot be altered until redevelopment and there is no urgency to remedy the situation. No further recommendation is made.

4.2.8 For site lying along air paths and with a prospect to provide alternative solutions to air ventilation improvement through disposition of building blocks upon development/ redevelopment, a further AVA is recommended to improve the air ventilation performance. Recommendations are given below.

- Quantitative AVA is recommended upon redevelopment of Shek Yam East Estate to ensure that the air path is maintained (or even improved in scale) and aligned with Lei Muk Road (Photo 70).

- Quantitative AVA is recommended upon redevelopment of Shek Lei Estate to ensure that the air path is maintained (or even improved in scale) and aligned with Wai Kek Street (Photo 64).

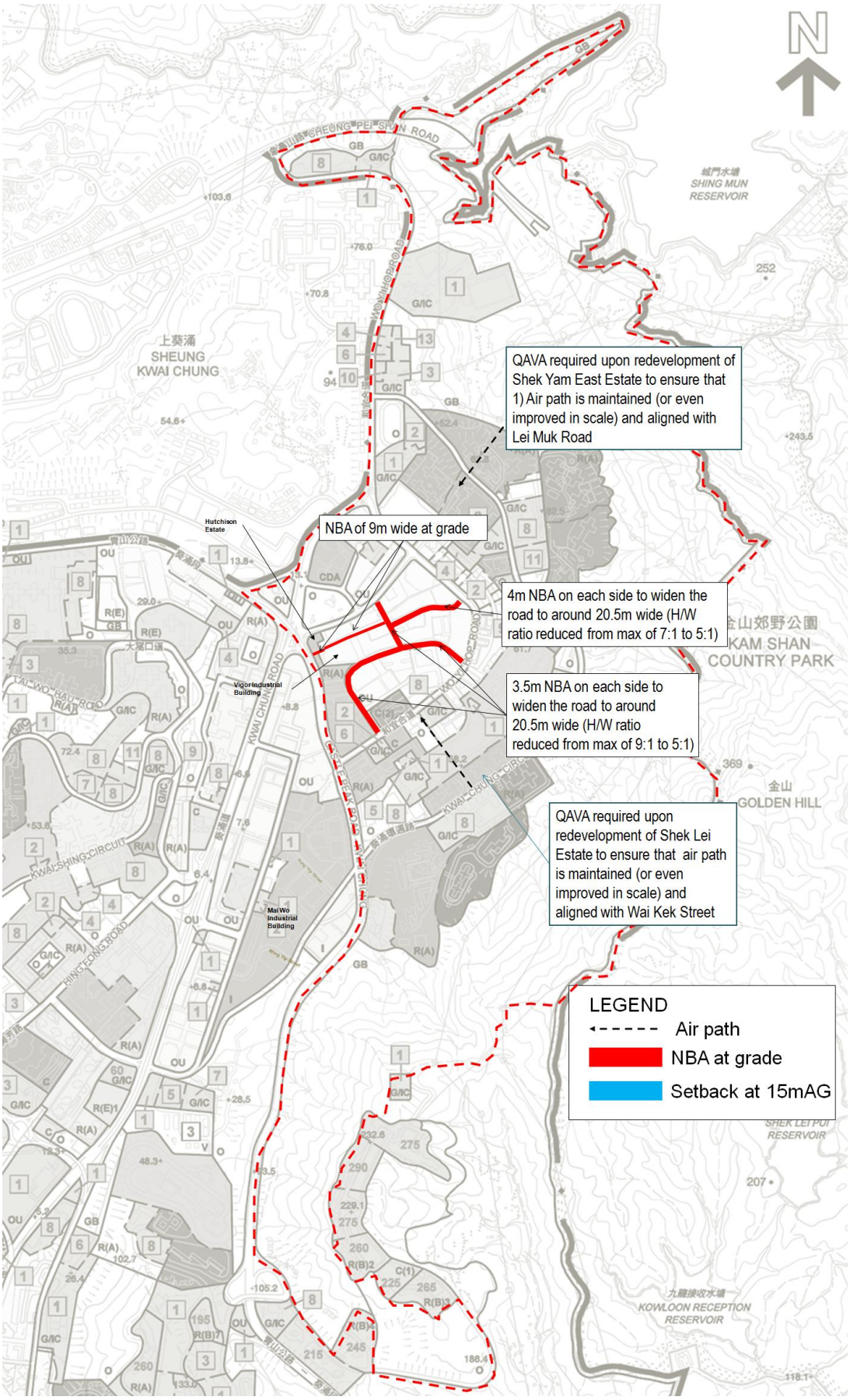


Figure 27 Recommended Scenario for Chung Kwai Chung Sub-Area

Ha Kwai Chung Sub-Area

4.2.9 **Figure 28** shows the recommended scheme for Ha Kwai Chung sub-area based on evaluation of the initial planned scheme and identification of problem area under existing situation.

4.2.10 Problem areas within this sub-area have been addressed by means of designating NBA or BH limit.

- The northern side of Lai King Estate, if occupied with high-rise development, may block air flow to Tsuen Wan Road and the pedestrian area on two sides of Tsuen Wan Road nearby the industrial building cluster may be impacted. Ideally speaking, NBA at grade is recommended which covers the existing bus terminus, open carpark and slope to the immediate north of housing blocks to preserve the air path. Considering Housing department's concern on the redevelopment flexibility of Lai King Estate in future, two alternative options were considered, i.e. a lower BH limit assigned at the existing bus terminus, open carpark and slopes same as the level of Lai King Hill Road (about 24mPD) (option 1); or imposed a east-west aligned NBA for the strip of land to the immediate south of the school building of Lai King Catholic Secondary School excluding the bus terminus and open carpark (option 2) in order to allow flexibility for the redevelopment of Lai King Estate. For option 1, the designation of lower BH limit (24mPD will maintain the air path not adversely impacted (photo 18). Wind entry to Tsuen Wan Road will unlikely be affected. Moreover, the immediate downwind location of this area under easterly wind is not considered an important pedestrian area. Impact due to low-rise building in option 1 among this area is negligible. For option 2, such narrower NBA would imply that mid- to high-rise building may be disposited at the existing bus terminus area so that wind entry to Tsuen Wan Road will still be slightly blocked. Option 1 will perform better than option 2 from air ventilation standpoint. Moreover, the air path connecting to Tsuen Wan Road can be preserved. Therefore, option 1 is preferred over option 2.

- The CDA at Kau Wa Keng may block important southerly wind. Southerly wind is especially important because Kau Wa Keng is in the valley area with the southern side least obstructed. Therefore, NBA is designated along the western side of the CDA to minimize the potential blockage to southerly wind. The extent of NBA (maximum width of around 35m) is aligned with Lai King Hill Road (i.e. eastern side of the NBA aligned with eastern road side of Lai King Hill Road) to ensure that southerly wind after passing existing Lai Chi Kok Bay Garden would not be further blocked by new development within the CDA before reaching the ground level of the village. NBA should be at grade to avoid massive structure except that 2- to 3-storey houses which are not interconnected can be allowed. Alternatively, QAVA can be conducted to prove that the village would not have inferior performance under southerly wind and in overall manner when compared with the existing scenario.

Topographical Constraints and Other Minor Problem for Three Sub-Areas

4.2.11 For all three sub-areas, problem areas due to topographical constraints (e.g. steep gradient which makes difficult for wind to reach lower ground after passing higher ground area) cannot be altered and addressed in this study. For example, high ground (e.g. Lin Fa Shan, Shek Lung Kung, Tai Mo Shan, Needle Hill, Grassy Hill, Golden Hill) on the northern to eastern sides of the study area will reduce wind availability especially for area near to the foothill of these high ground areas. In Ha Kwai Chung sub-area, the elevation increases rapidly when approaching inland area so that easterly wind has difficulty to reach the pedestrian area (e.g. Lai King Hill Road and Kwai Chung Road). The knoll of up to 120mPD exists in the middle of Kwai Chung Sub-area and would impose some blockage at immediate leeward area near foothill. However, the gradient of this knoll is much lower than that at Ha Kwai Chung area and problem is less significant. Although problems due to topographic constraints and some minor problems cannot be addressed, they are minor in nature. For example, in Ha Kwai Chung Sub-area, while easterly wind may not be able to reach pedestrian level due to blockage by Golden Hill, the developments in this sub-area are less dense and generally scattered, and summer wind (southeasterly and southwesterly wind) is available.

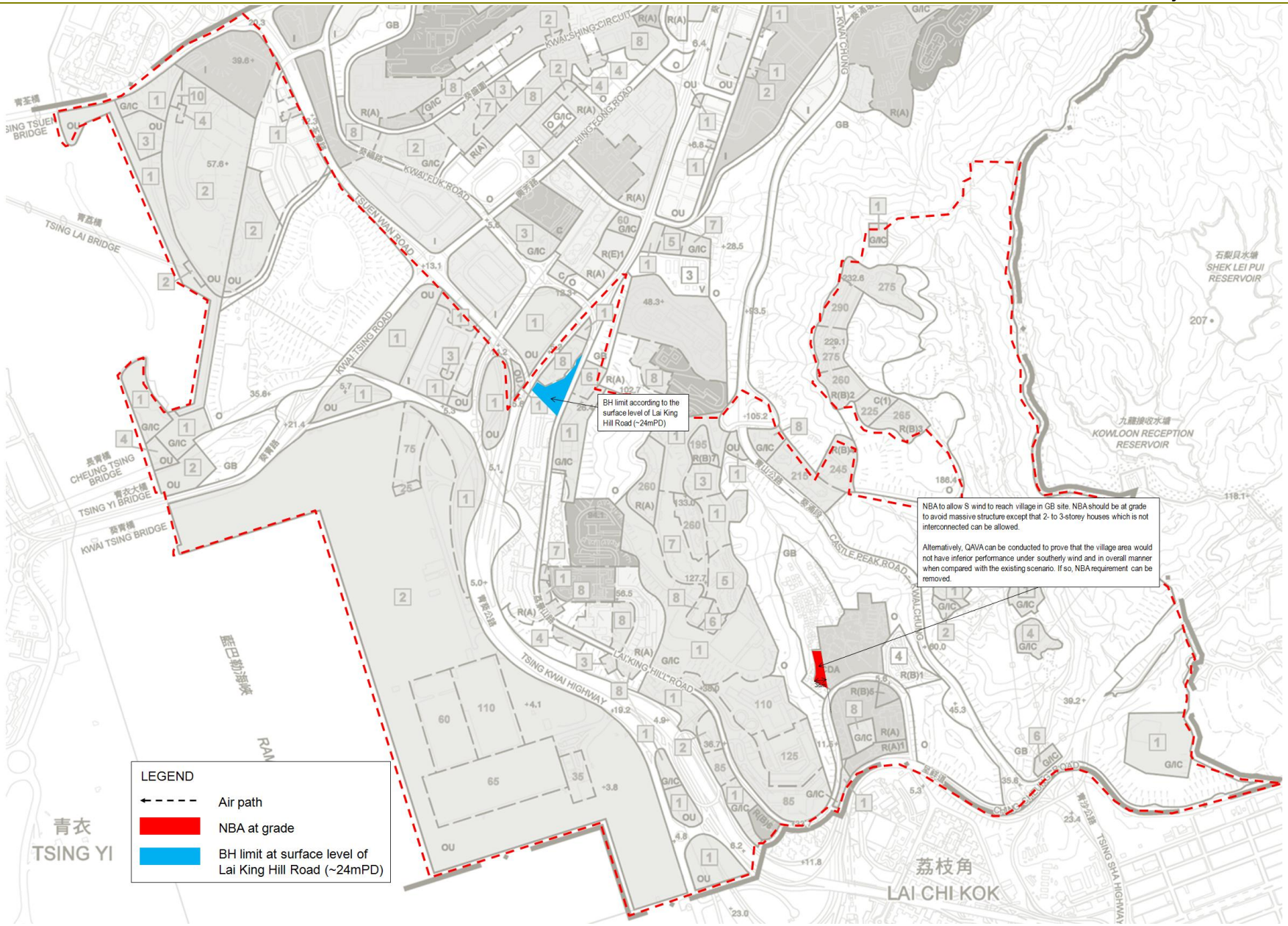


Figure 28 Recommended Scenario for Ha Kwai Chung Sub-Area

5.0 Conclusion and Further Recommendations

5.1 Conclusion

5.1.1 The initial planned scenario has been evaluated qualitatively taking into consideration the site wind availability, topography, existing and committed building morphology and potential development sites.

5.1.2 The study area has been divided into three sub-areas (Kwai Chung, Chung Kwai Chung, Ha Kwai Chung) for analysis purpose.

5.1.3 Major and minor problem areas have been identified for existing situation and under initial planned scenario. Recommendations have been provided to address possible problem with consideration of influence on the development potential of individual lots.

5.1.4 Major problem areas are those with building structures arranged in a manner which significantly block air passage. They occur at the industrial building cluster along Tai Lin Pai Road in Kwai Chung Sub-Area; another industrial building cluster cum R(A) sites bounded by Wo Yi Hop Road and Castle Peak Road in Chung Kwai Chung Sub-Area; and Kwai Shing East Estate and Kwai Shing West Estate erected at high ground in Kwai Chung Sub-Area. Blockage to air ventilation is envisaged due to compacted building with only small gap in between.

5.1.5 Minor problems are found at areas where wind penetration is allowed but restricted due to less than ideal building configuration (e.g. partial building blockage in front of the air path that result in bottleneck).

5.1.6 For major problem areas, recommendations in terms of building setback, building gap and designation of NBA to improve/create air path are suggested based on the existing configuration with least impact on development potential of the concerned building lots at the same time. Building setback and NBA are recommended among the industrial building cluster in Kwai Chung Sub-Area and the industrial building cluster cum R(A) sites in Chung Kwai Chung Sub-Area. For Kwai Shing East Estate and Kwai Shing West Estate with nearly continuous building structures which block existing SE wind flow, building gap can be created at various different locations to address the problem. To optimize the solution, quantitative AVA is suggested for these estates upon redevelopment.

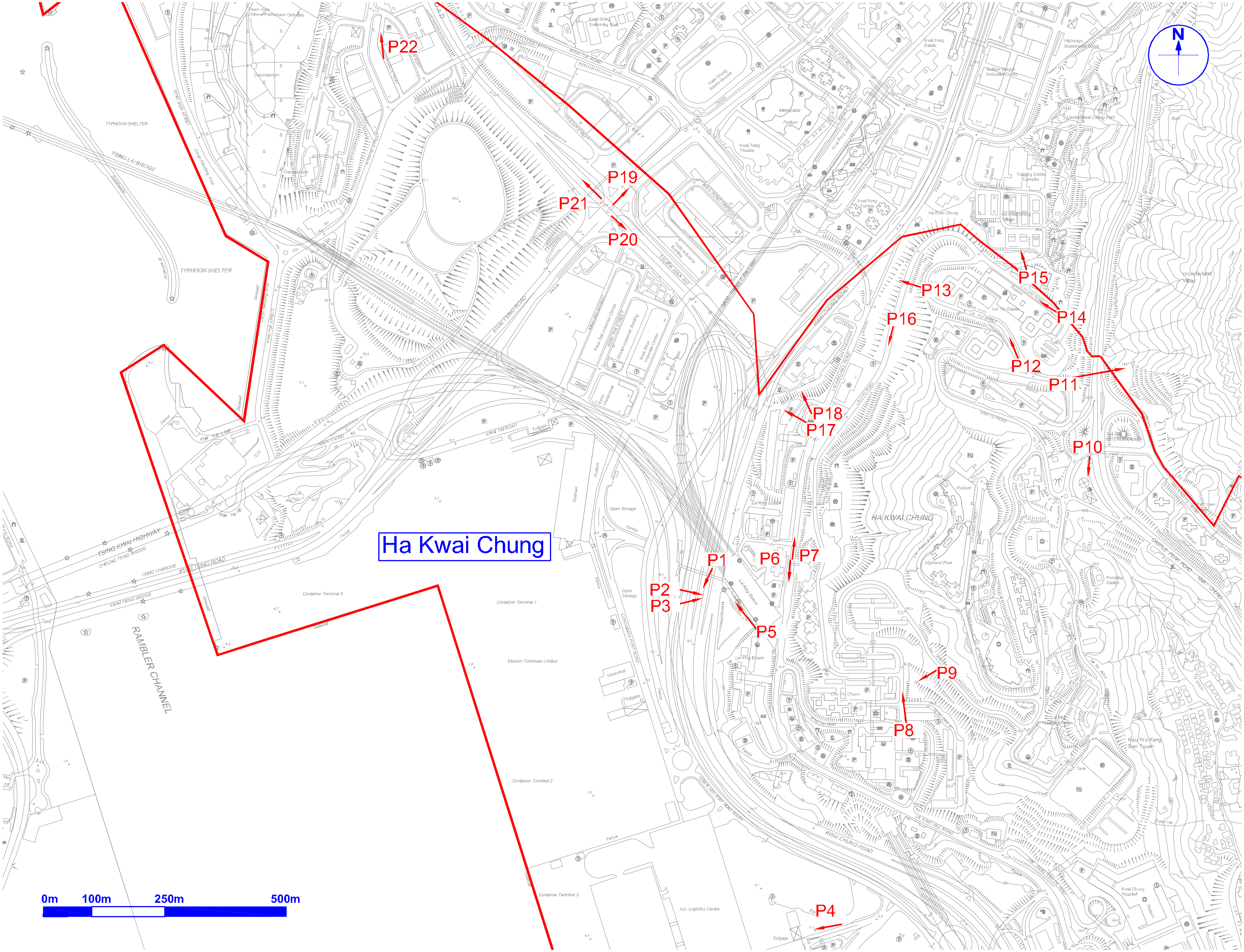
5.1.7 Besides, other recommendations in terms of NBA designation are provided to address other minor problem areas as well as to maintain the air paths.

5.1.8 Further study is also recommended upon redevelopment of various developments (Kwai Chung Estate, Tai Wo Hau Estate, Kwai Hing Estate & Kwai Chun Court, Shek

Yam East Estate, Shek Lei Estate) to maintain air path and further improve air ventilation.

5.1.9 It was discussed that development with low permeability should be avoided where practicable, especially for larger site which is supposed to have higher flexibility to determine the disposition and other features of the buildings. Therefore, for sites amalgamation to form larger sites for future development, quantitative AVA is also recommended for design improvement. In this case, recommendations for general direction for air ventilation improvement should be observed.

Appendix A
Photos of Street View of the Study Area



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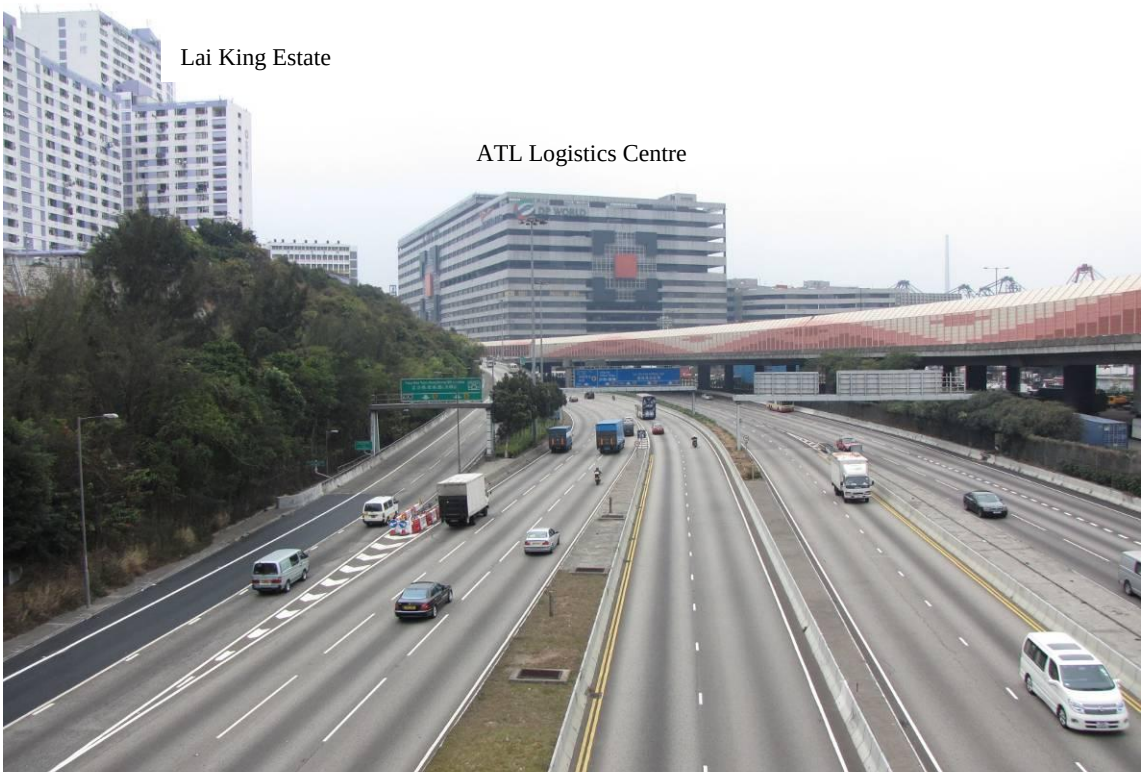
TSING KWAI HIGHWAY
KWAI CHUNG ROAD
KWAI TSING ROAD
TSING LAI BRIDGE
TYPHOON SHELTER
Container Terminal 1
Container Terminal 2
Container Terminal 3
Container Terminal 5



Location No.: 1 **Location: Kwai Chung Road**

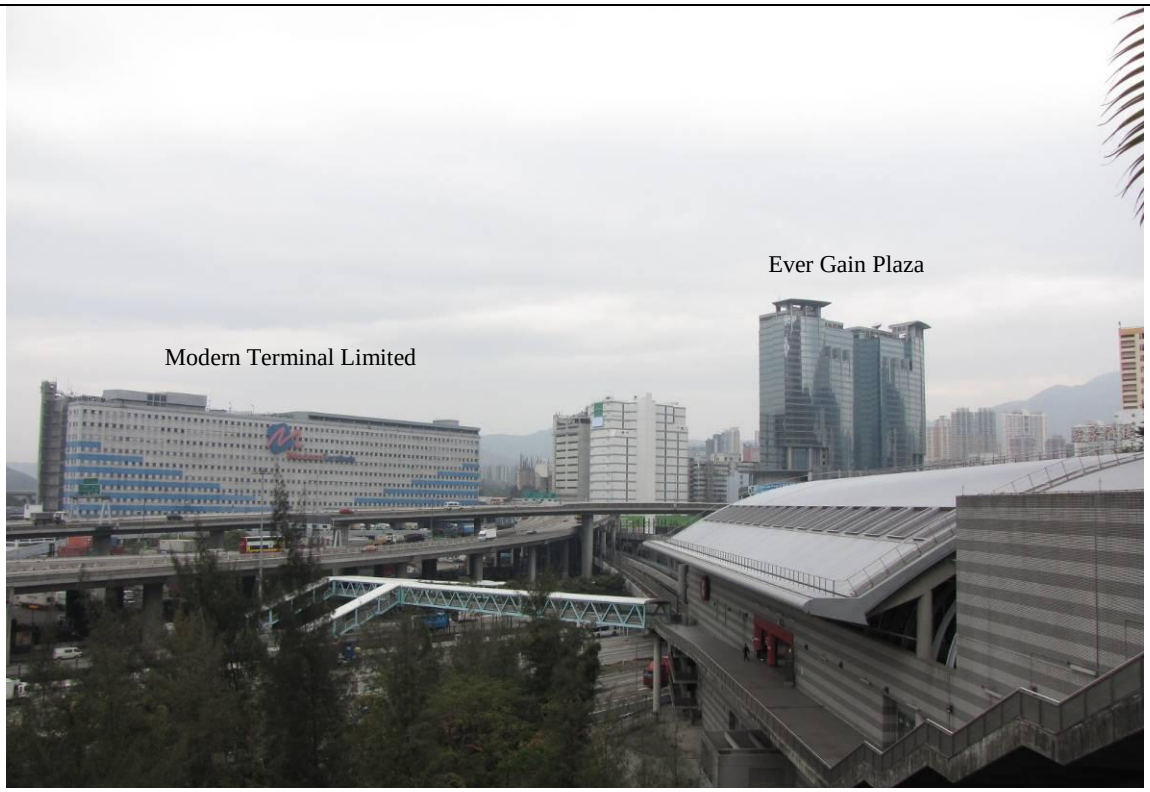
Location No.: 2 **Location: Tsing Kwai Highway**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON

Location No.: 3 **Location: Tsing Kwai Highway**

Location No.: 4 **Location: Container Port Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON

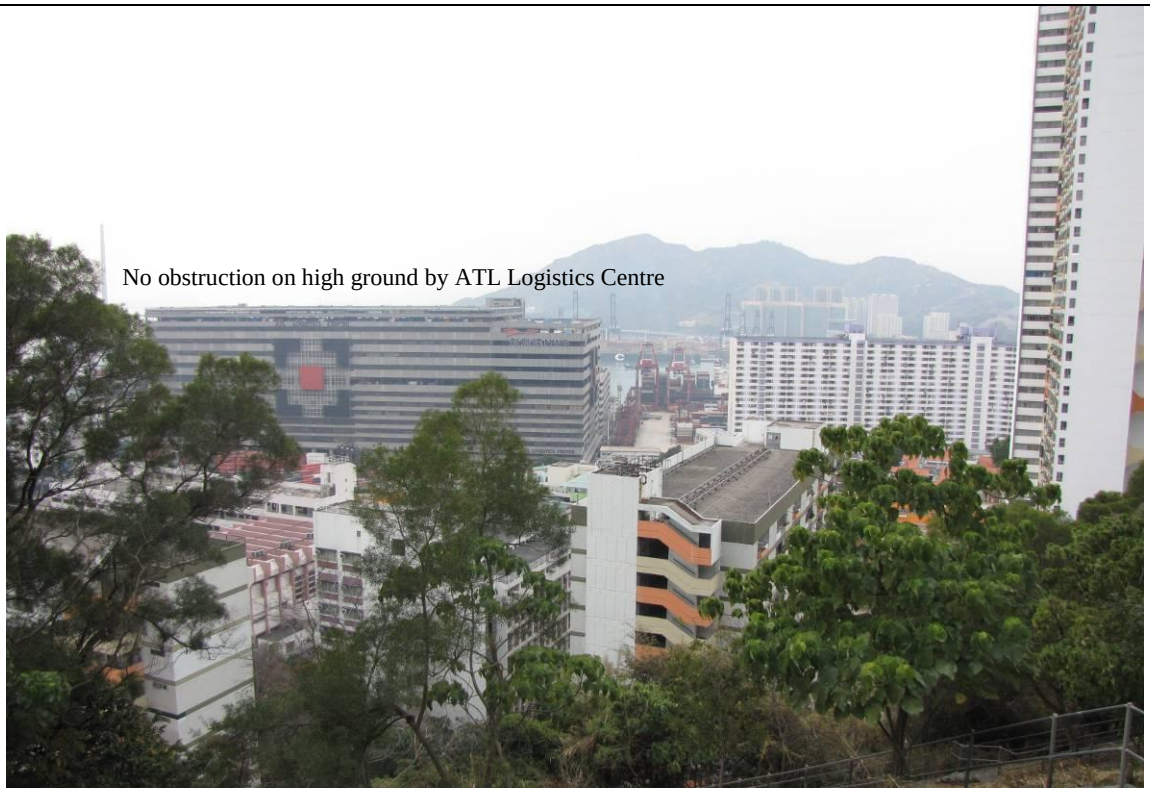


Location No.: 5 **Location: Tsing Kwai Highway**

Location No.: 6 **Location: Lai King Hill Road**

Location No.: 7 **Location: Lai King Hill Road**

Location No.: 8 **Location: Lim Cho Street**

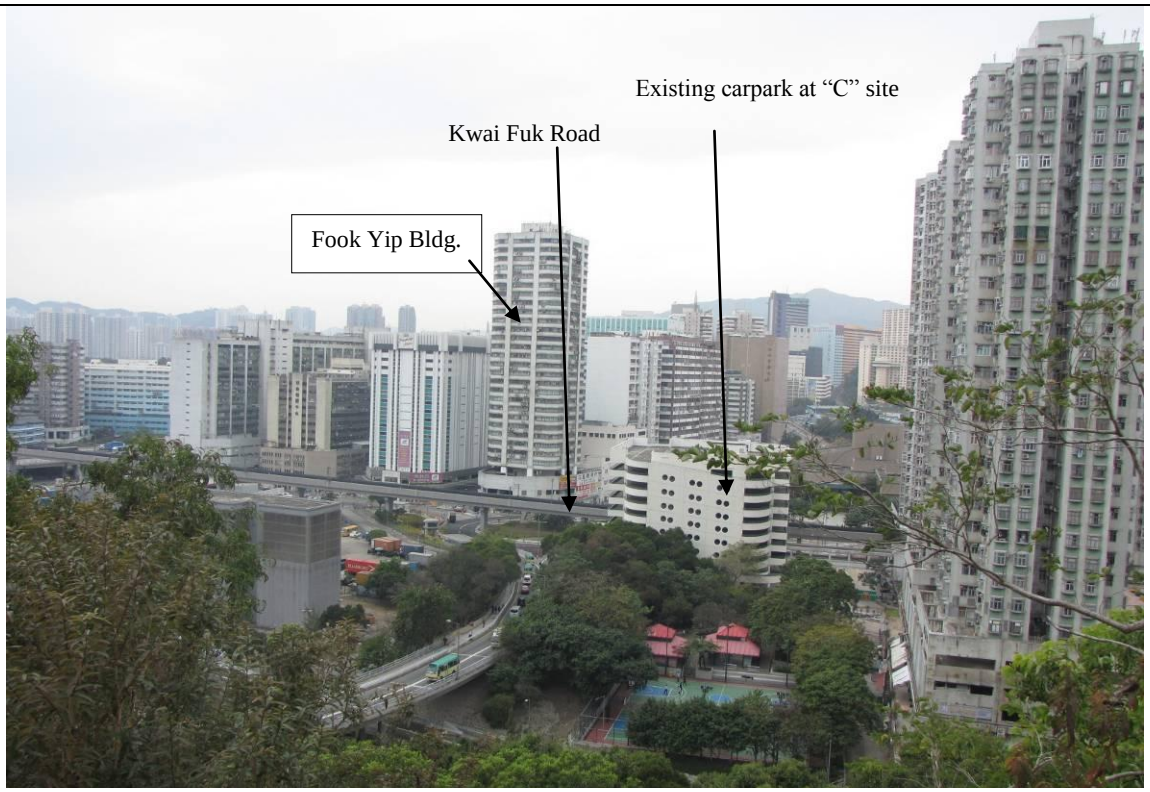


Location No.: 9 **Location: Lim Cho Street**

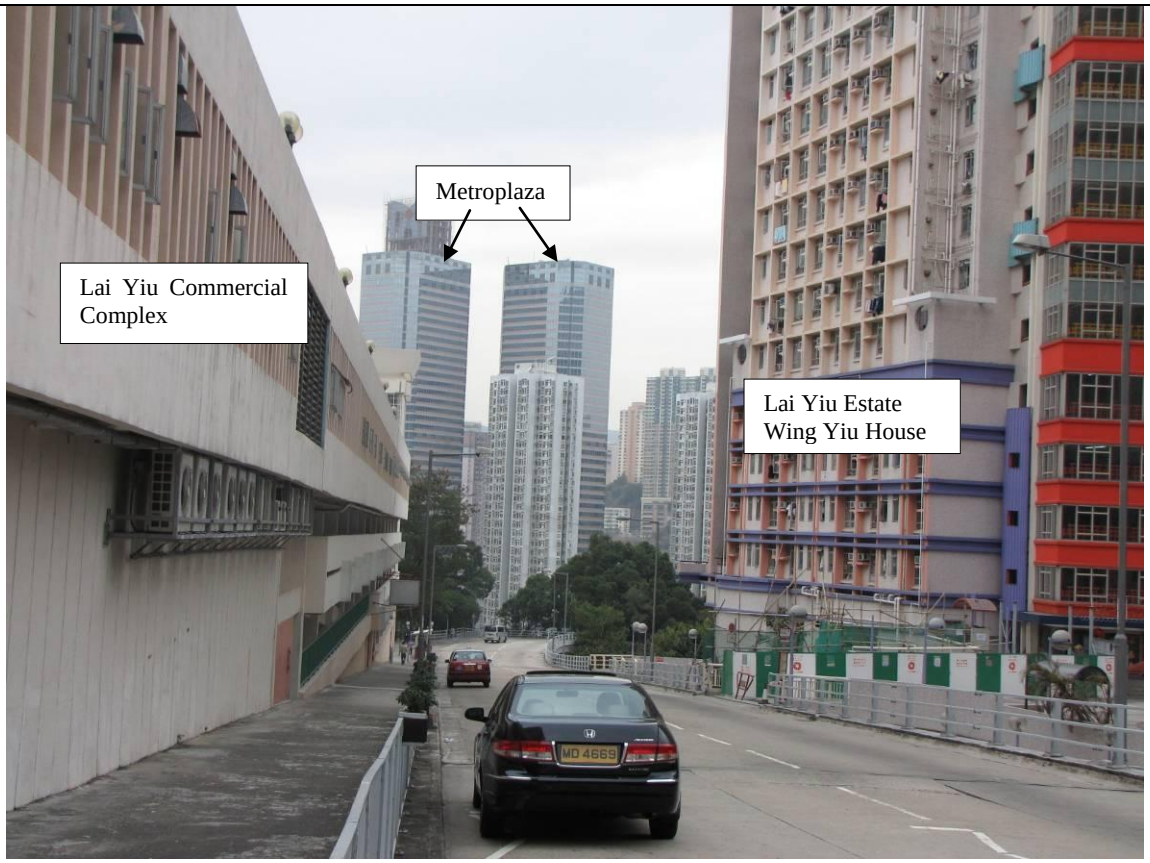
Location No.: 10 **Location: Castle Peak Road (Kwai Chung)**

Location No.: 11 **Location: Wah Yiu Road**

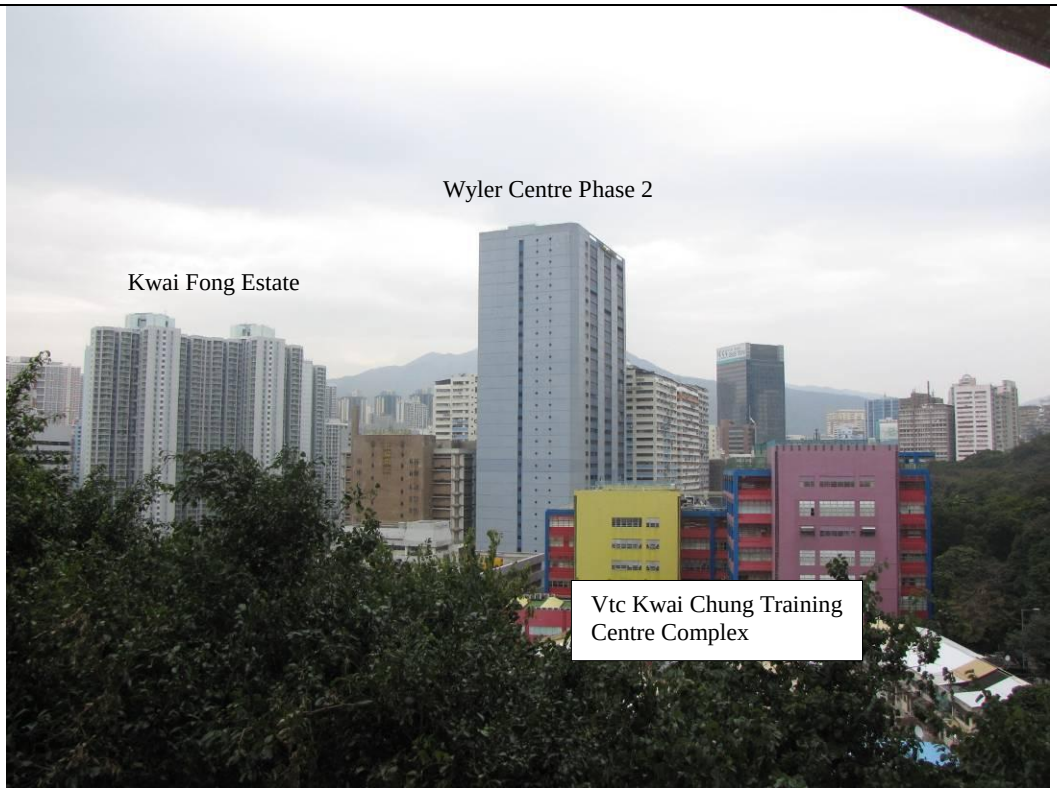
Location No.: 12 **Location: Lai Yiu Road**



Location No.: 13 **Location: Lai Yiu Road**



Location No.: 14 **Location: Lai Cho Road**



Location No.: 15 **Location: Lai Cho Road**

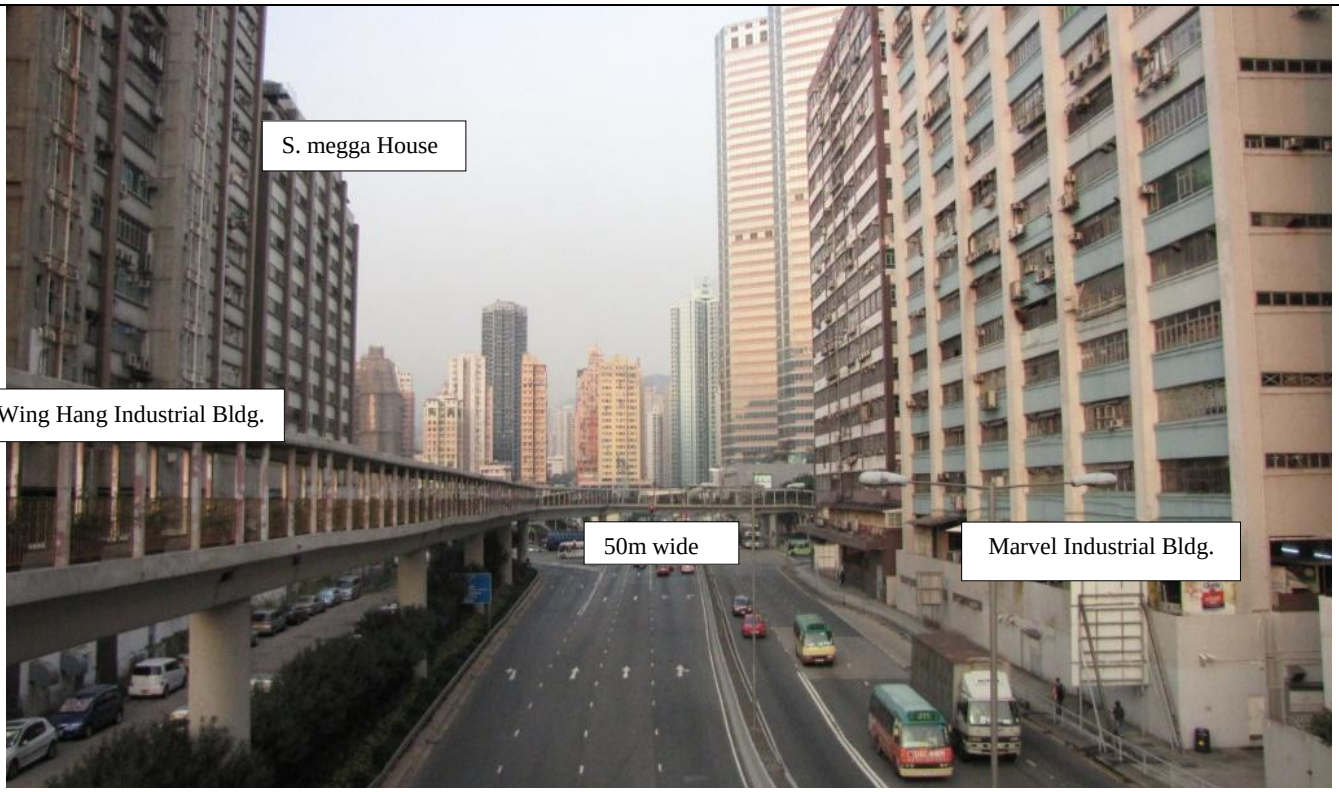
Location No.: 16 **Location: Lai Cho Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON

Location No.: 17 **Location: Lai King Hill Road**

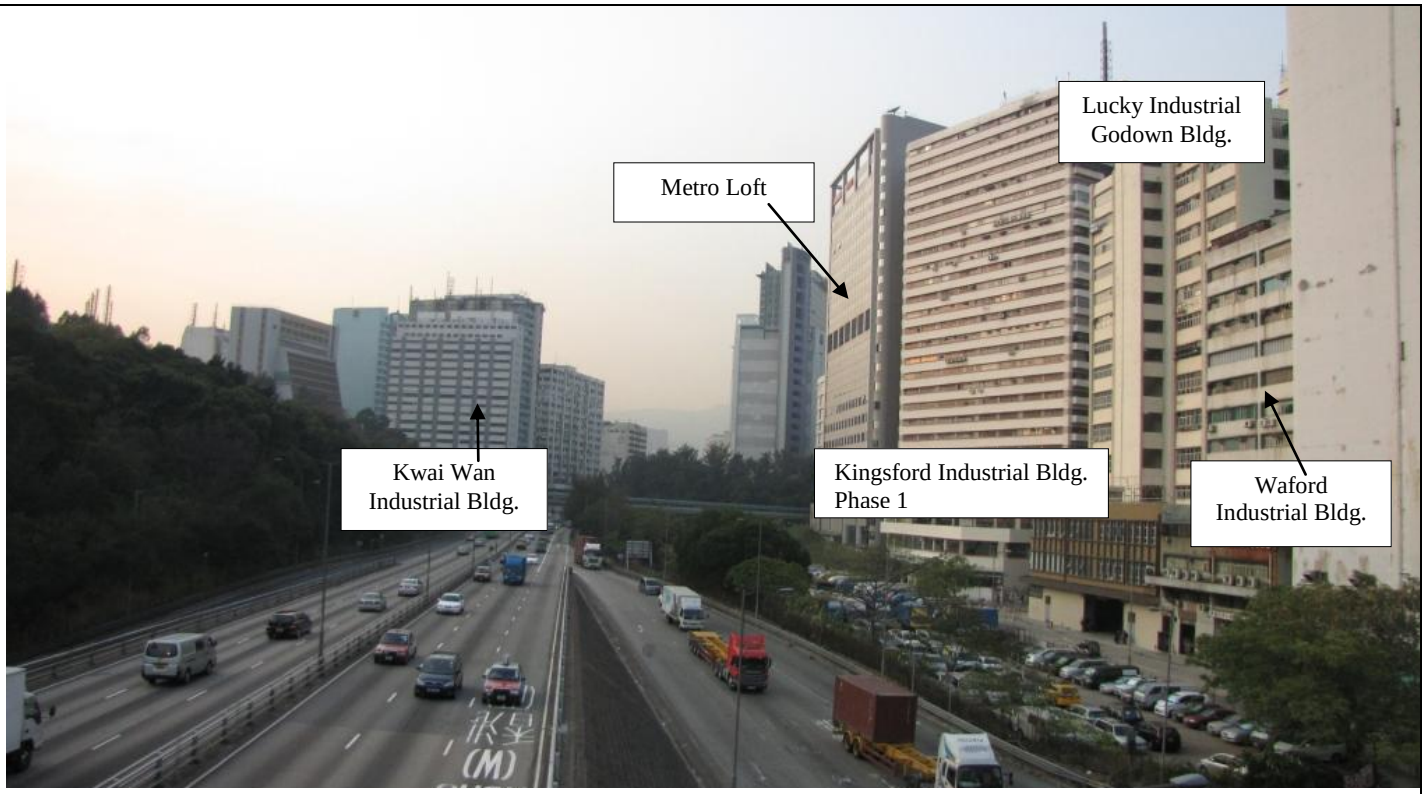
Location No.: 18 **Location: Lai King Hill Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON

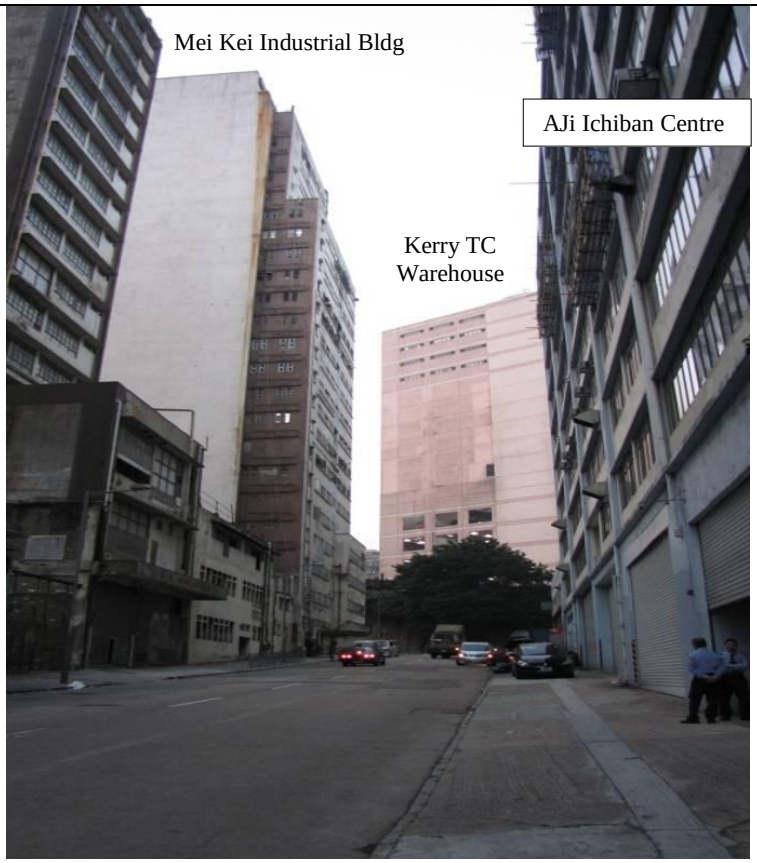


Location No.: 19 **Location: Hing Fong Road**

Location No.: 20 **Location: Tsuen Wan Road**

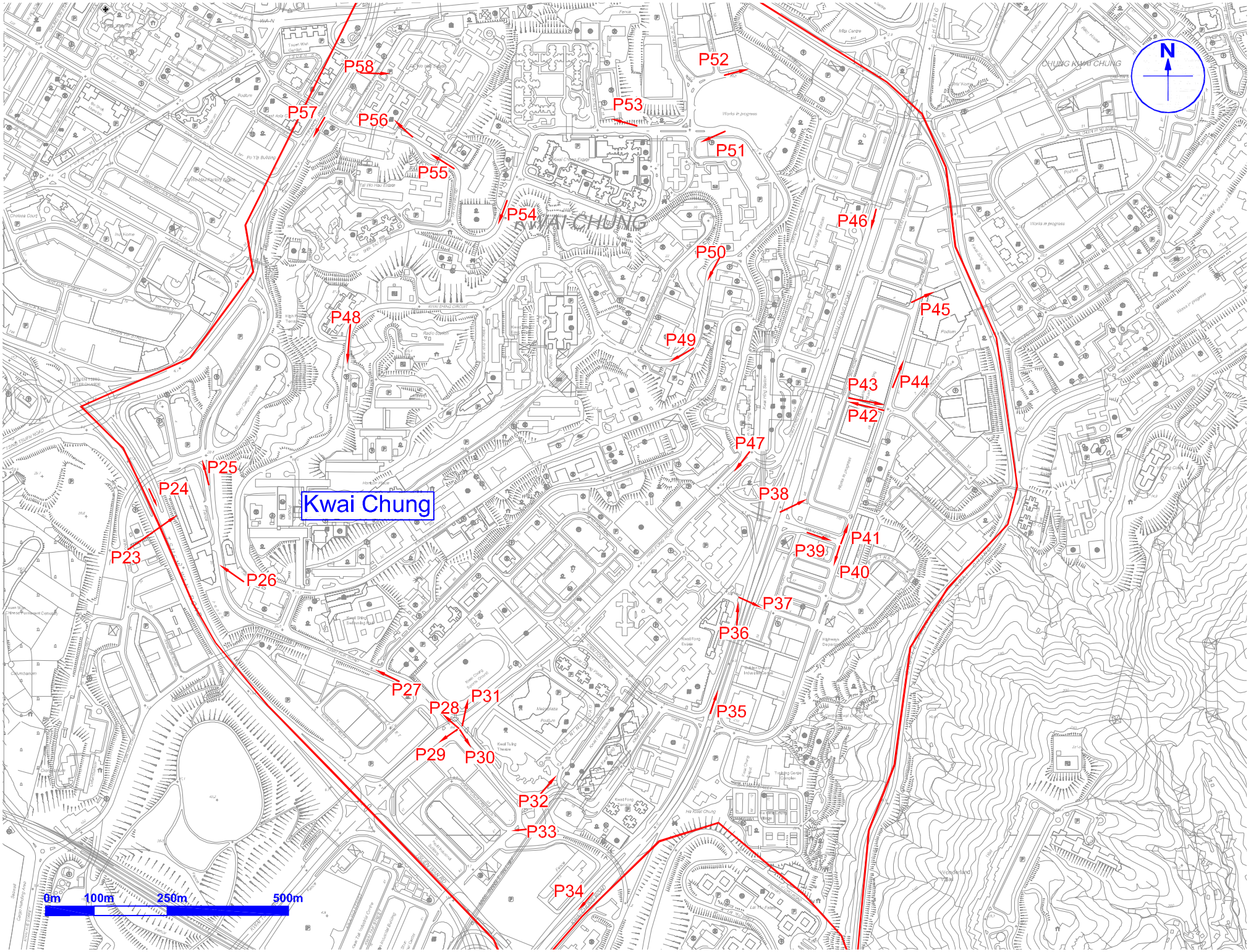


Location No.: 21 **Location: Tsuen Wan Road**



Location No.: 22 **Location: Wing Kei Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON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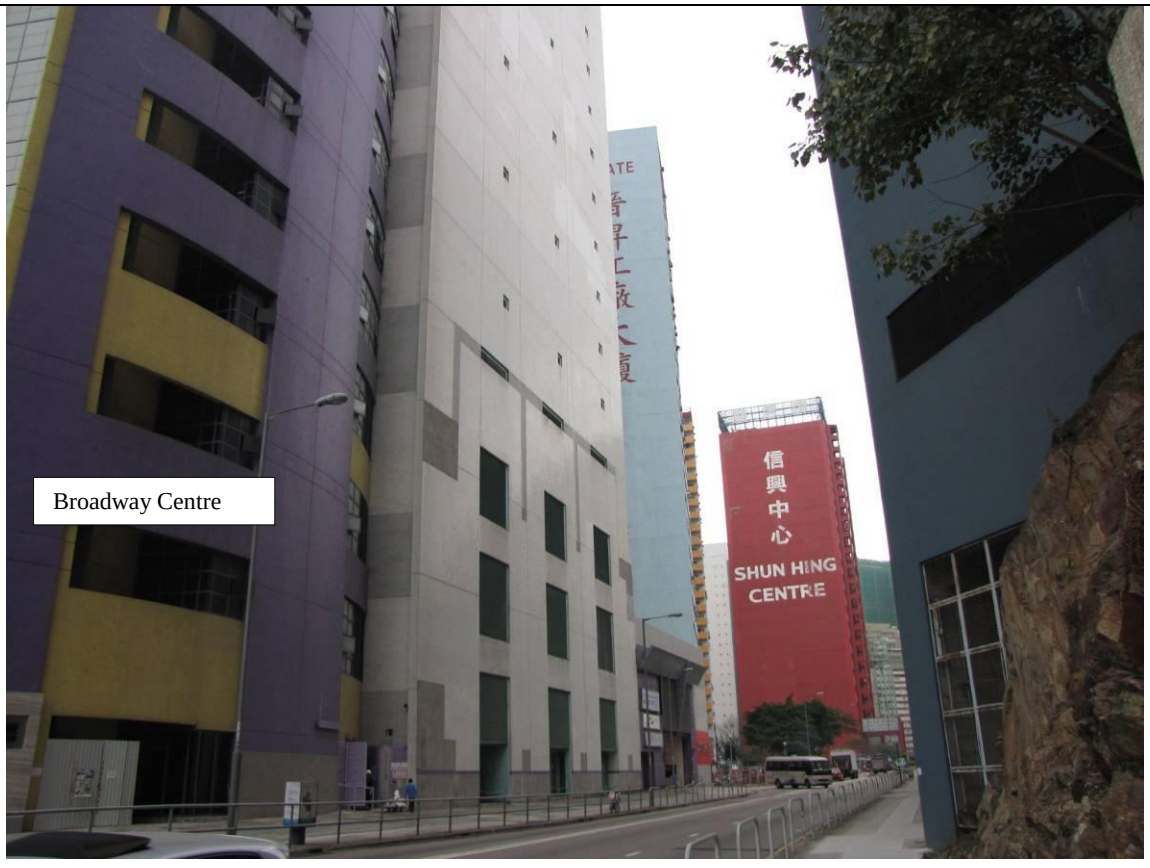
Location No.: 23 **Location: Wing Kei Road**

Location No.: 24 **Location: Tsuen Wan Road**

Location No.: 25 **Location: Kwai Fuk Road**



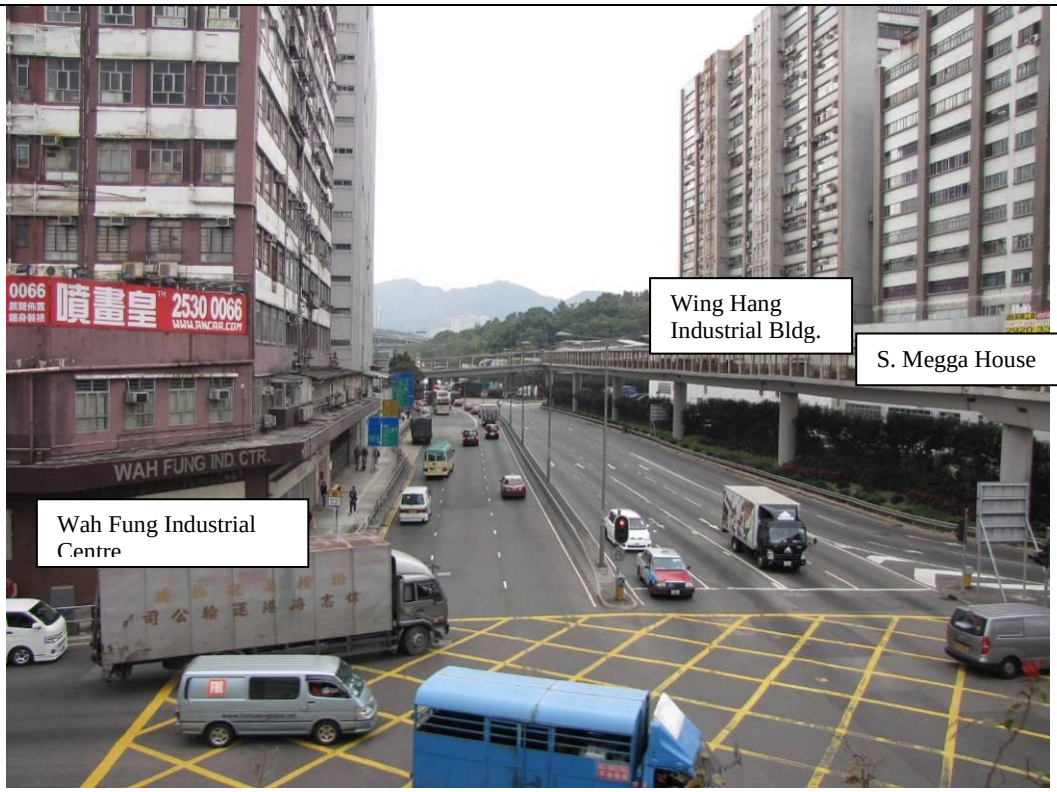
Location No.:26 **Location: Kwai Fuk Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON

Location No.: 27 **Location: Kwai Fuk Road**

Location No.: 28 **Location: Kwai Fuk Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON



Location No.: 29 **Location: Hing Fong Road**

Location No.: 30 **Location: Kwai Fuk Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON

Location No.: 31 **Location: Hing Fong Road**

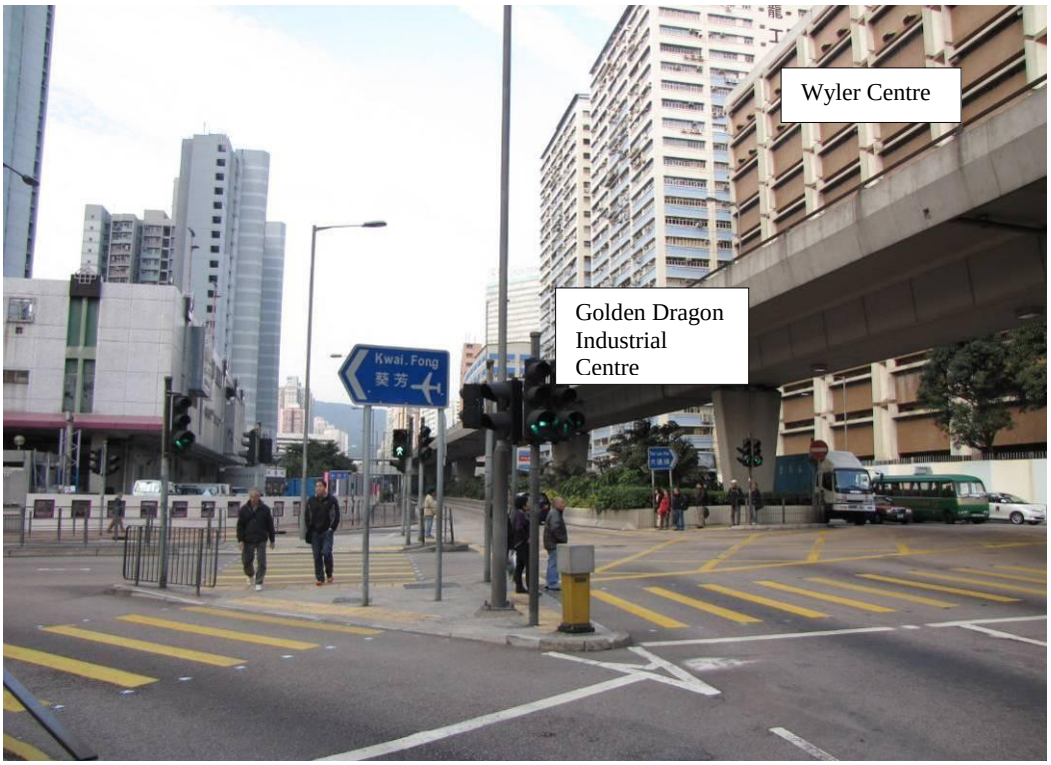
Location No.: 32 **Location: Kwai Fuk Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON

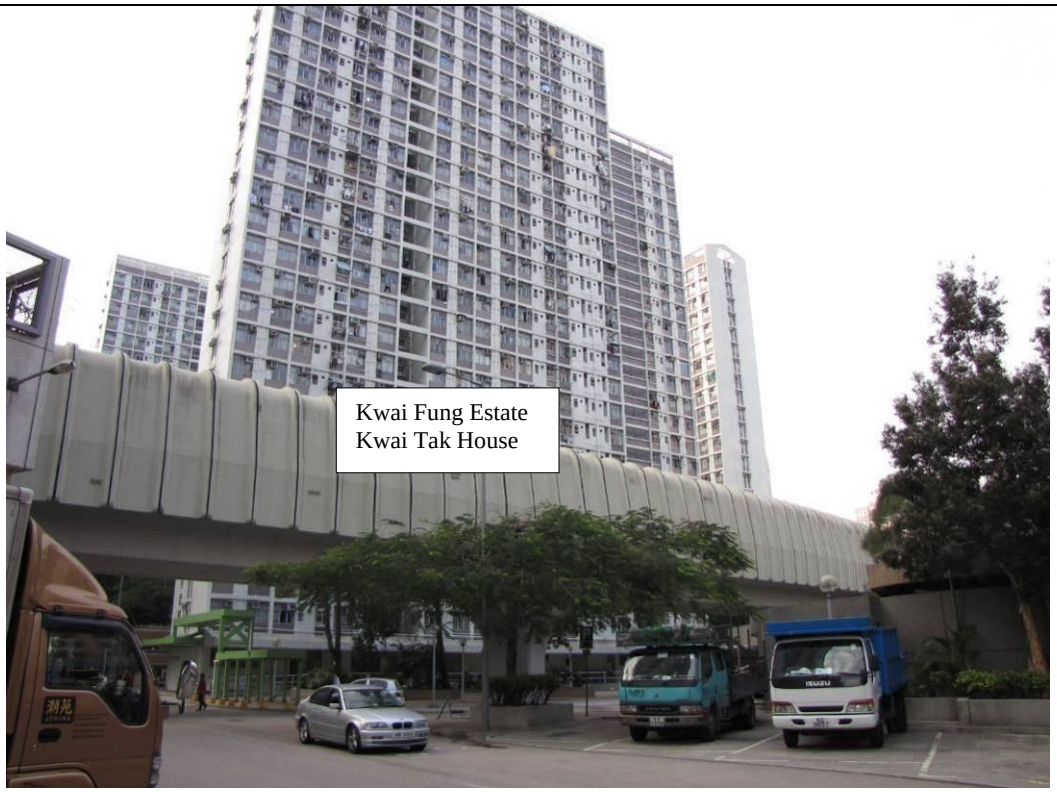
Location No.: 33 **Location: Kwai Fuk Road**

Location No.: 34 **Location: Kwai Chung Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON



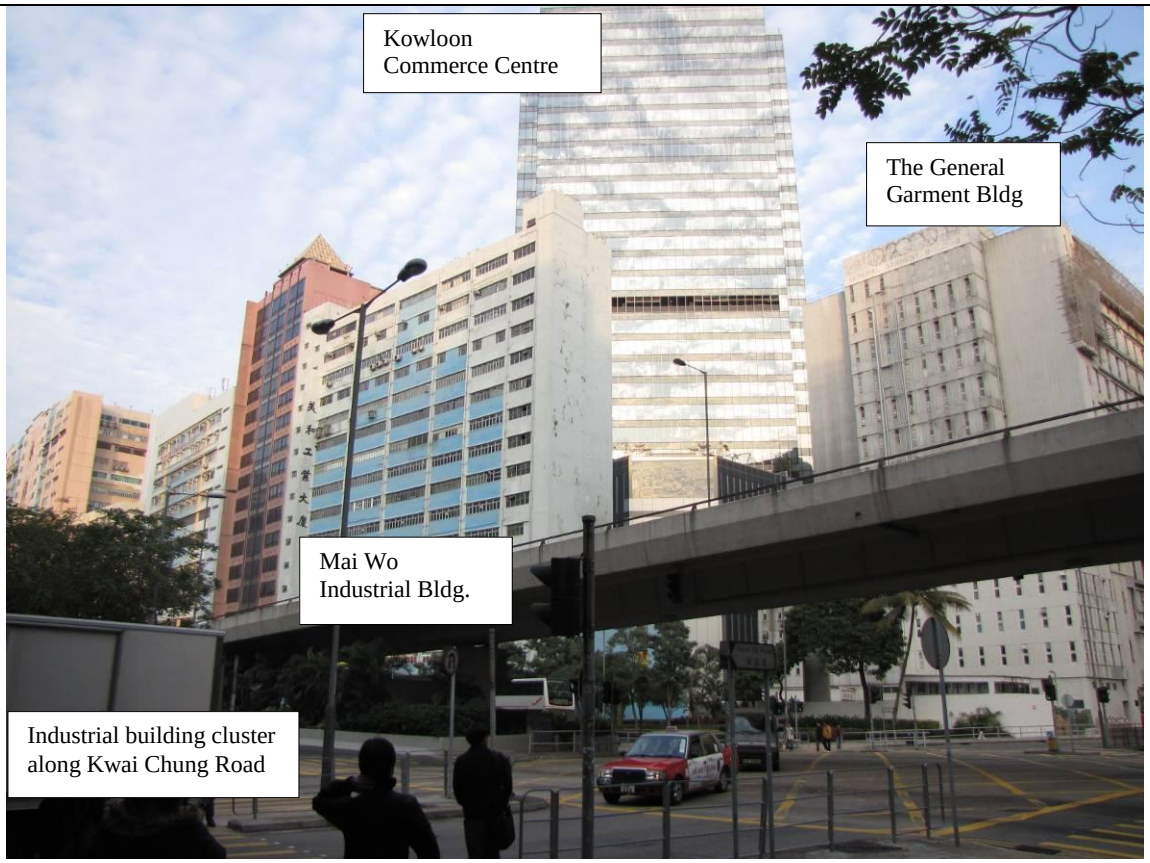
Location No.: 35 **Location: Kwai Chung Road**



Location No.: 36 **Location: Kwai Chung Road**

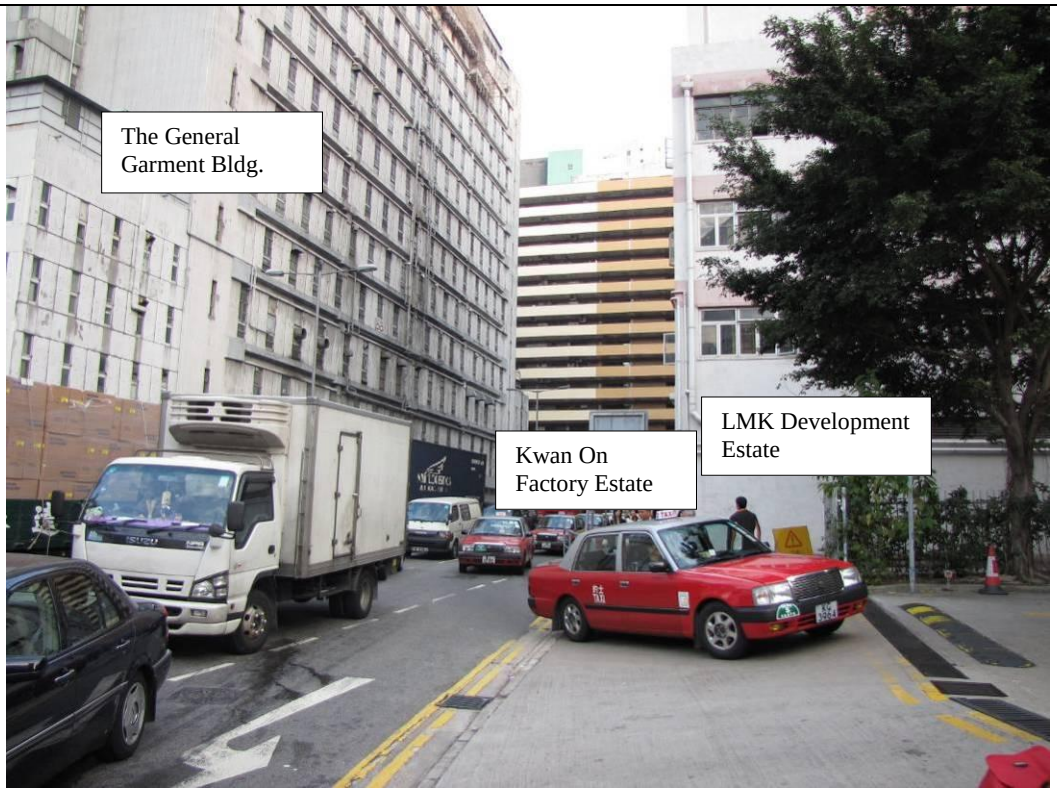
Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON

Location No.: 37 **Location: Kwai Chung Road**



Location No.: 38 **Location: Kwai Chung Road**

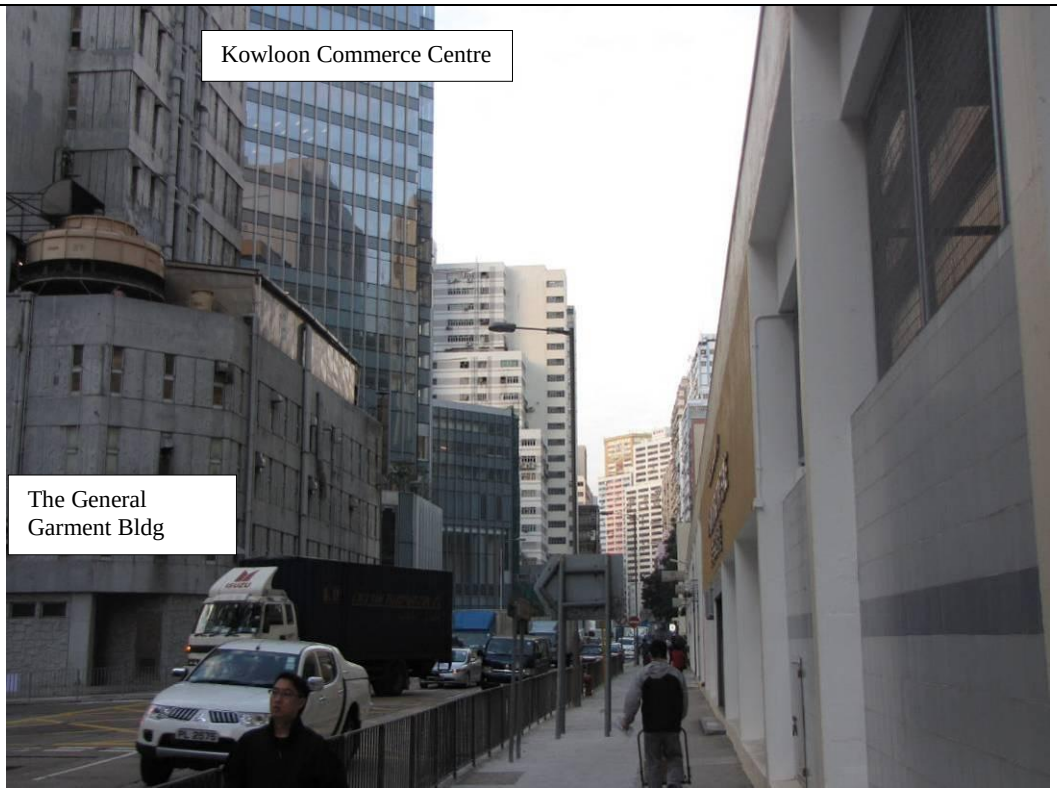
Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON



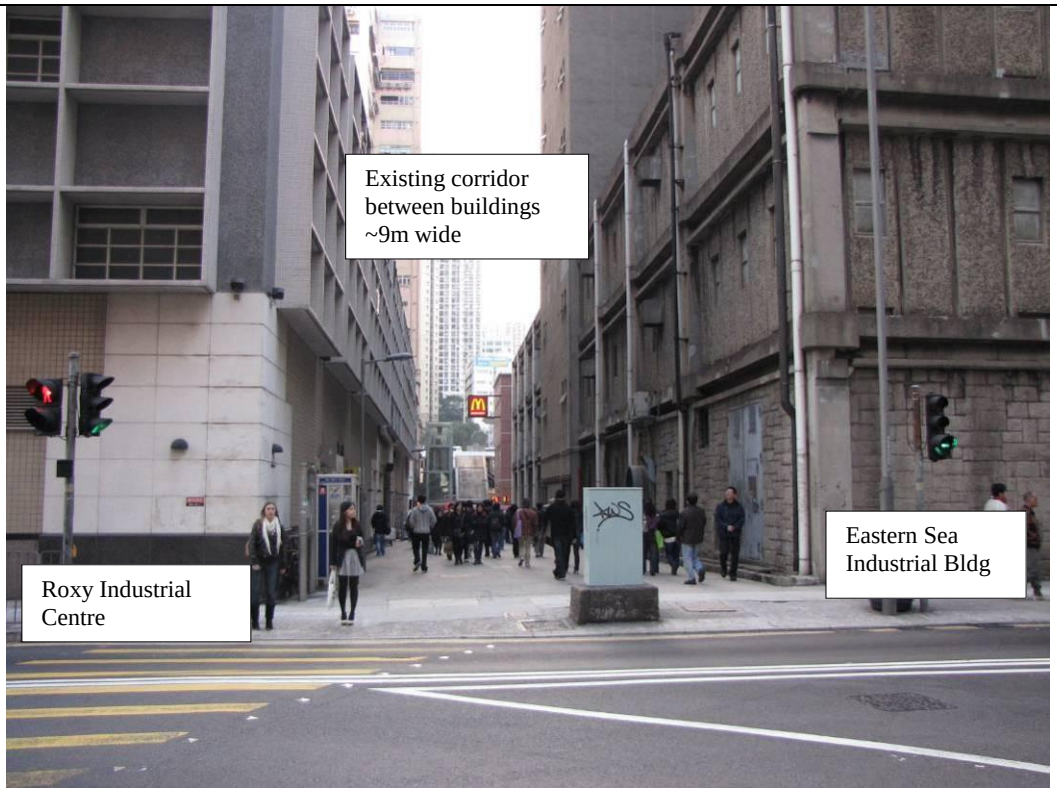
Location No.: 39 **Location: Kwai On Road**

Location No.: 40 **Location: Tai Lin Pai Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON



Location No.: 41 **Location: Tai Lin Pai Road**



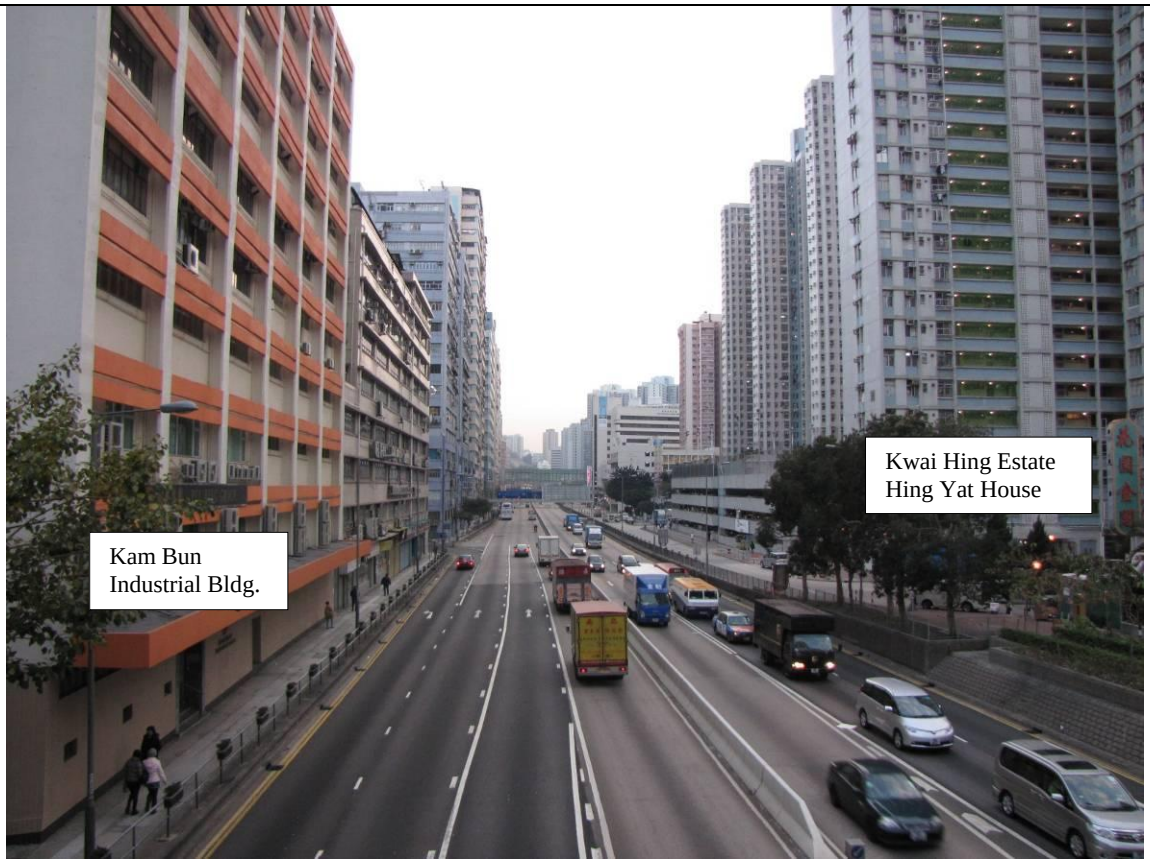
Location No.: 42 **Location: Tai Lin Pai Road**

Location No.: 43 **Location: Tai Lin Pai Road**

Location No.: 44 **Location: Tai Lin Pai Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON

Location No.: 45 **Location: Tai Lin Pai Road**



Location No.: 46 **Location: Kwai Chung Road**

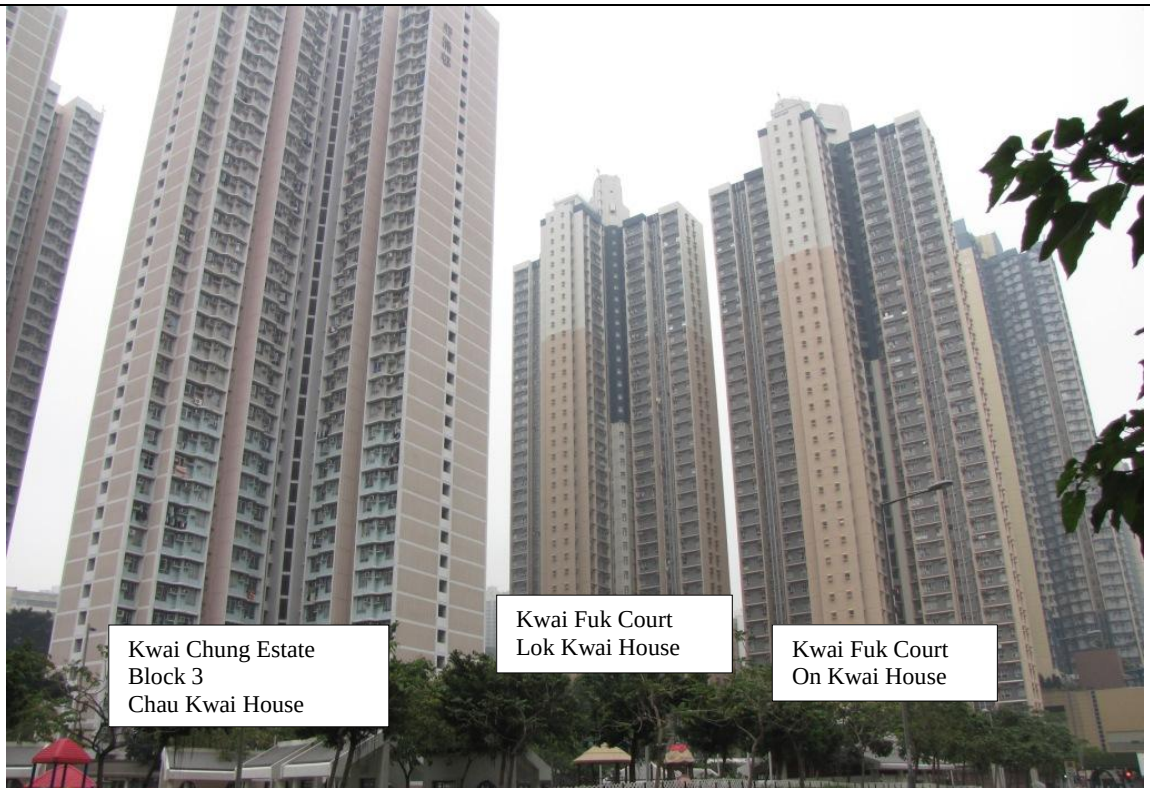
Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON

Location No.: 47 **Location: Hing Fong Road**

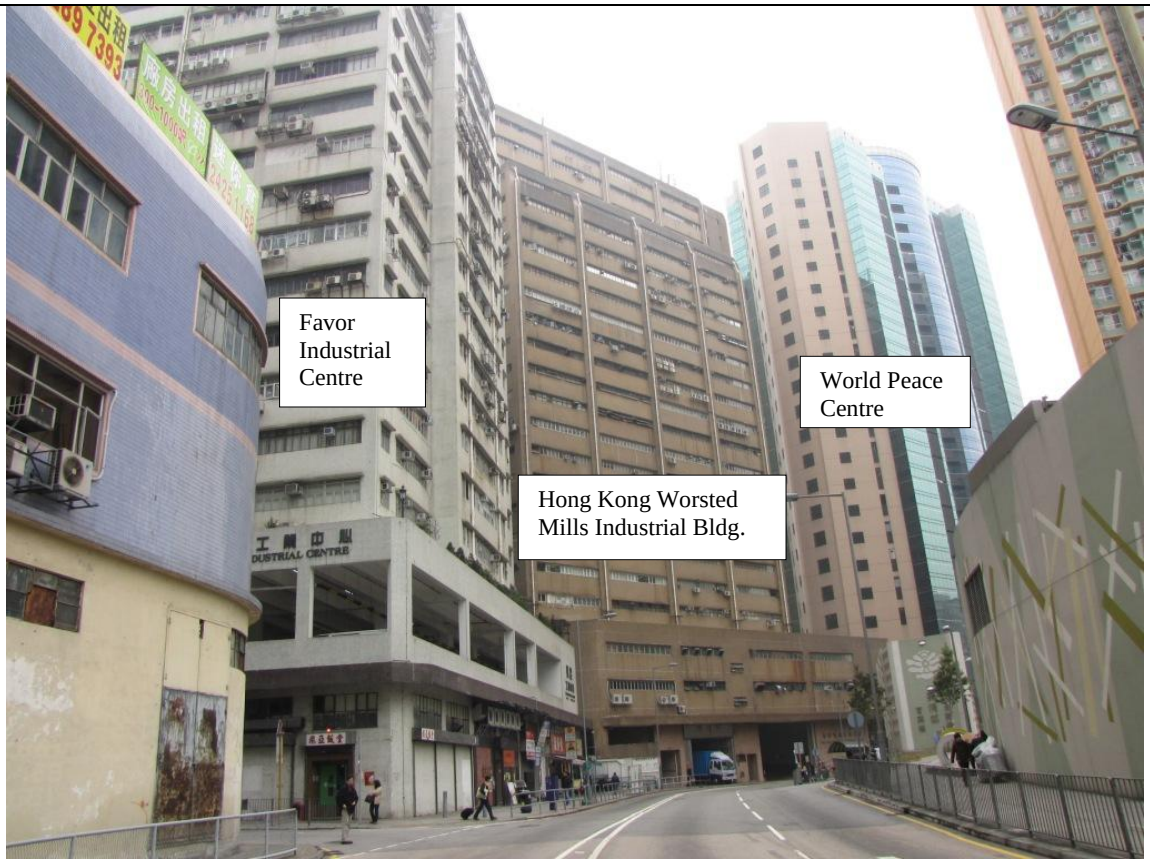
Location No.: 48 **Location: Kwai Shing Circuit**

Location No.: 49 **Location: Kwai Shing Circuit**

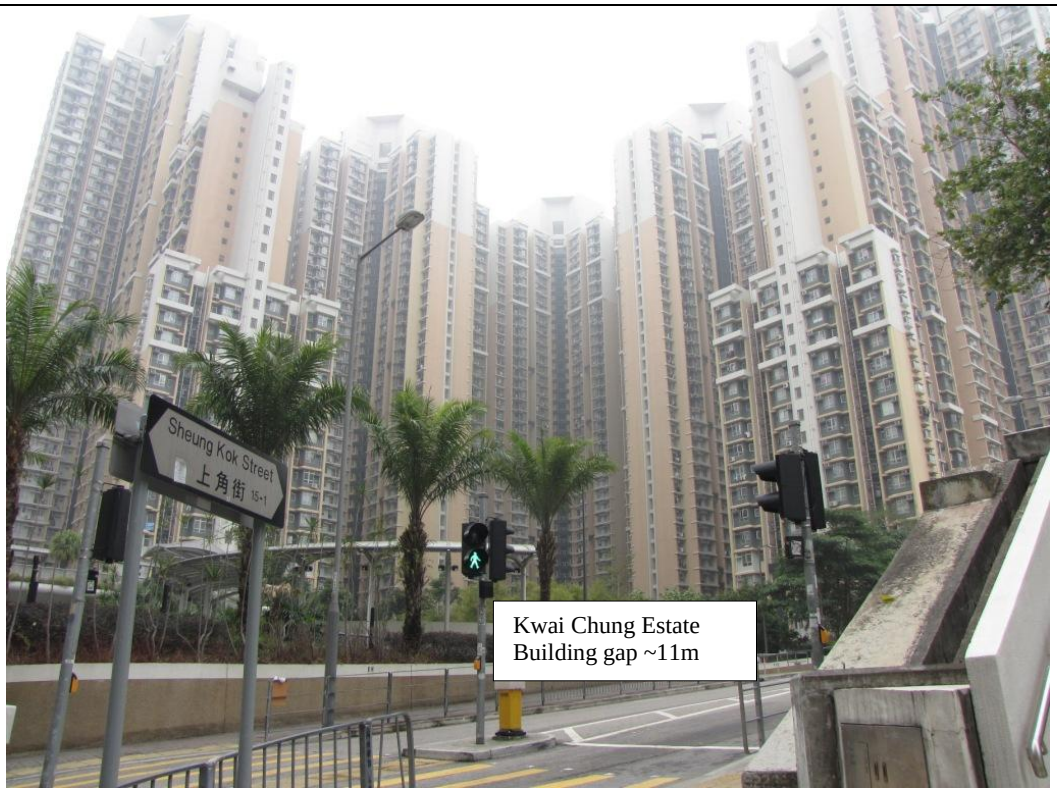
Location No.: 50 **Location: Kwai Shing Circuit**



Location No.: 51 **Location: Tai Wo Hau Road**



Location No.: 52 **Location: Wo Tong Tsui Street**

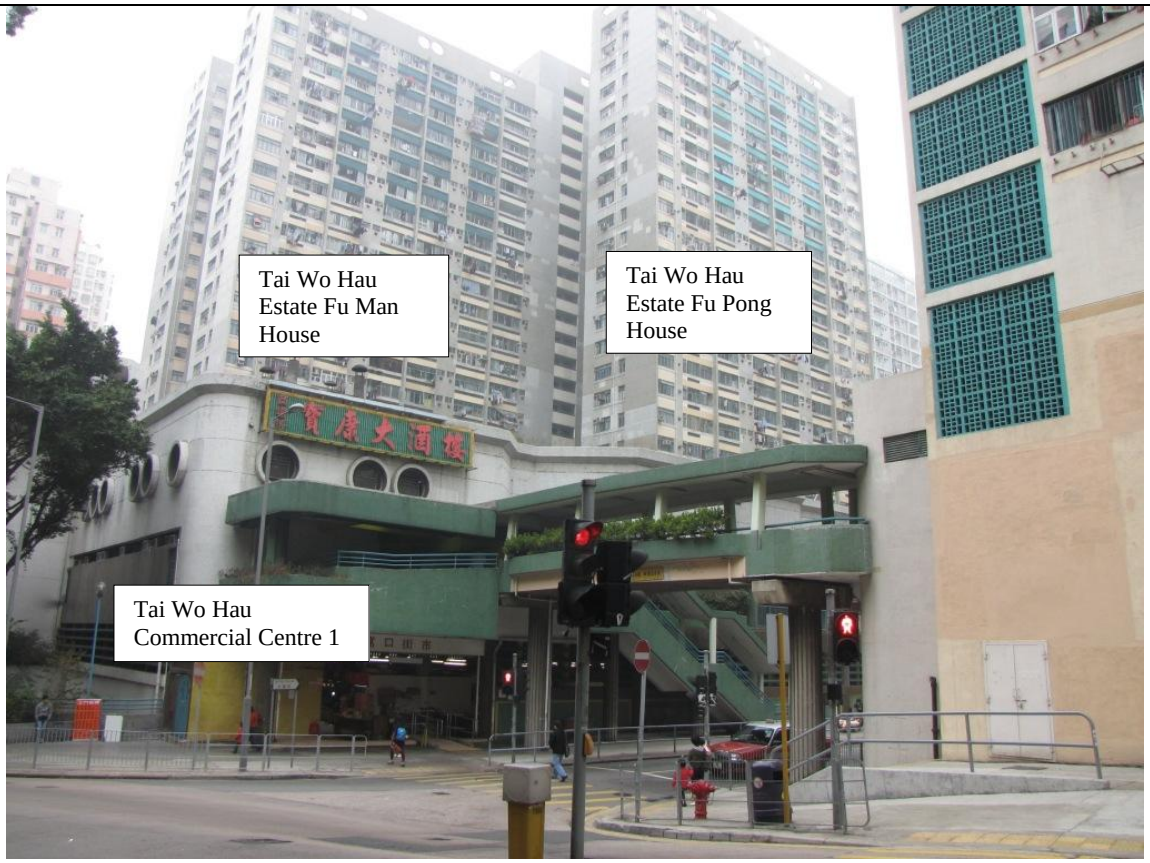


Location No.: 53 **Location: Sheung Kok Street**

Location No.: 54 **Location: Tai Wo Hau Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON

Location No.: 55 **Location: Tai Wo Hau Road**

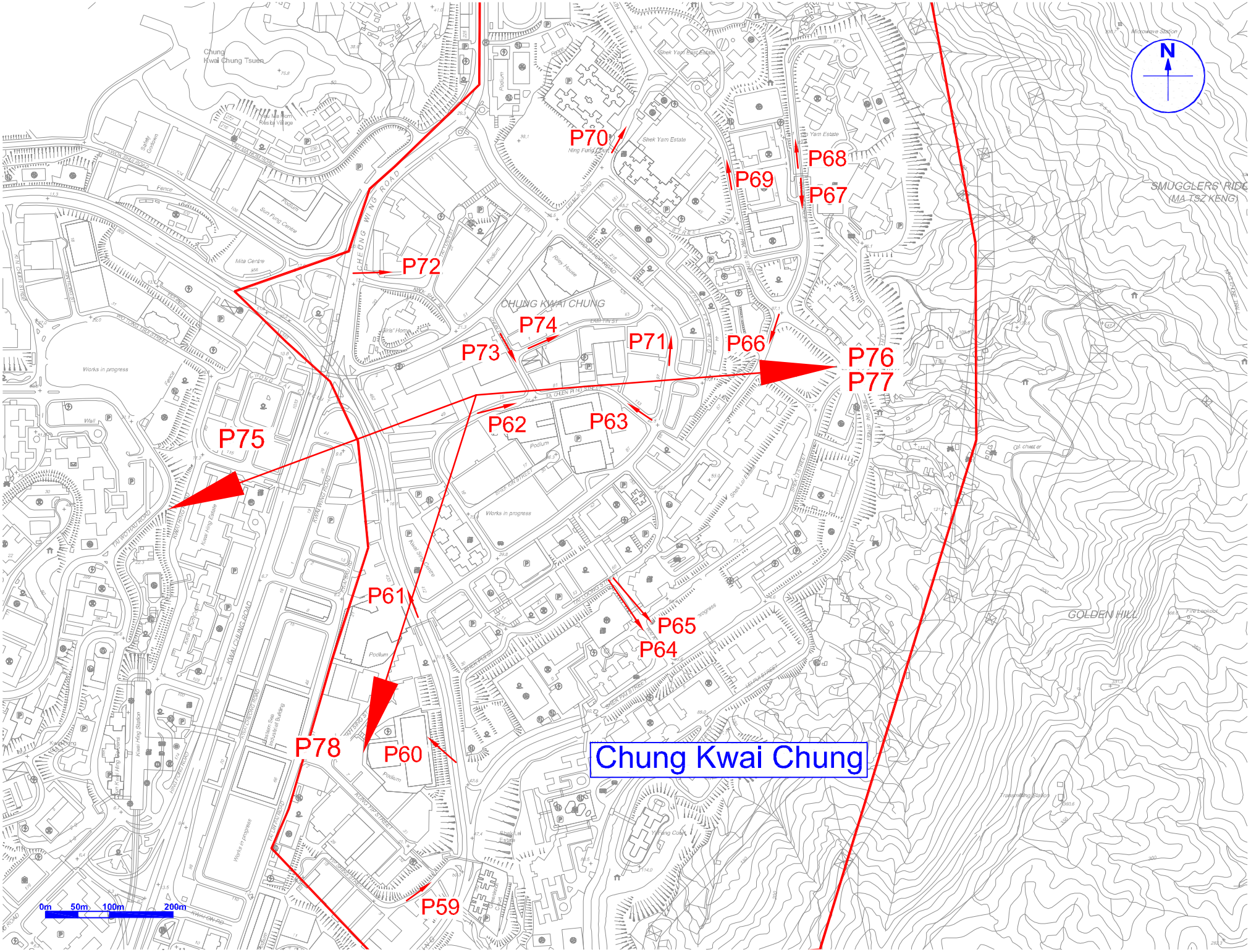


Location No.: 56 **Location: Tai Wo Hau Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Kwai Chung Area	ENVIRON

Location No.: 57 **Location: Texaco Road**

Location No.: 58 **Location: Tai Ha Street**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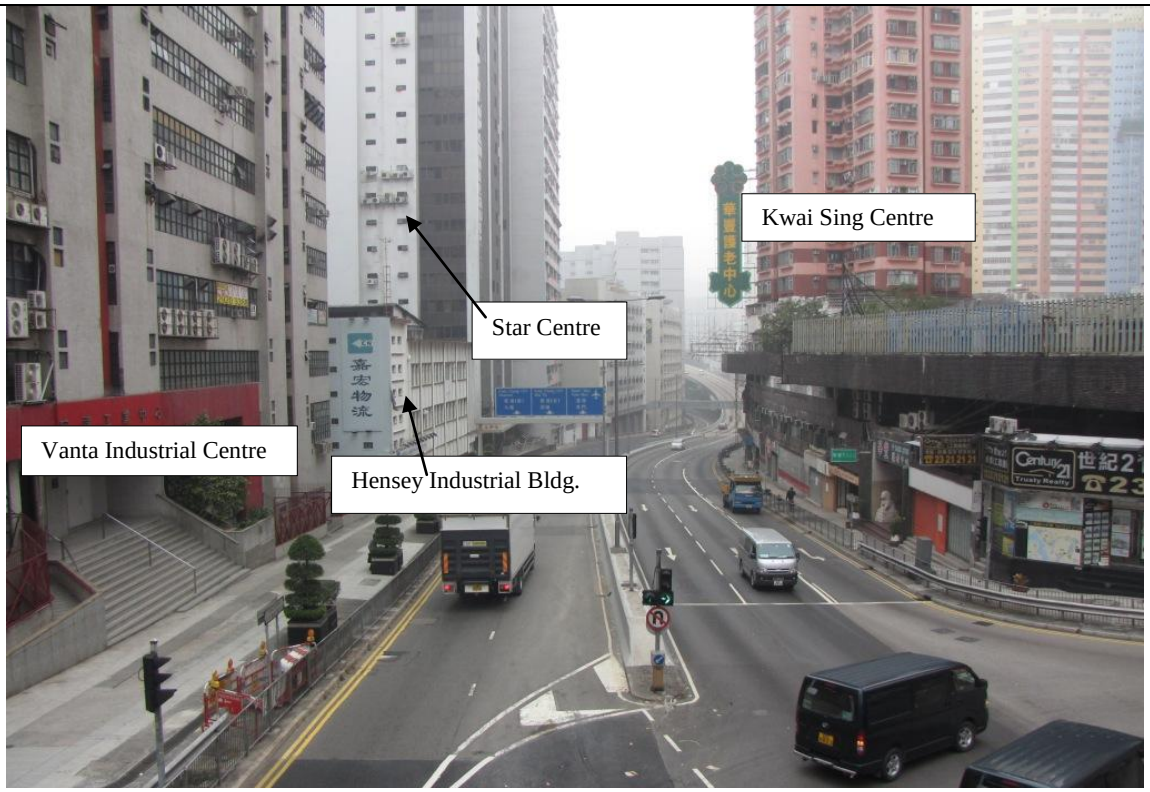
Location No.: 59 **Location: Yip Shing Street**

Location No.: 60 **Location: Castle Peak Road(Kwai Chung)**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Chung Kwai Chung Area	ENVIRON



Location No.: 61 **Location: Castle Peak Road(Kwai Chung)**

Location No.: 62 **Location: Ta Chuen Ping Street**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Chung Kwai Chung Area	ENVIRON

Location No.: 63 **Location: Ta Chuen Ping Street**

Location No.: 64 **Location: Tai Loong Street**

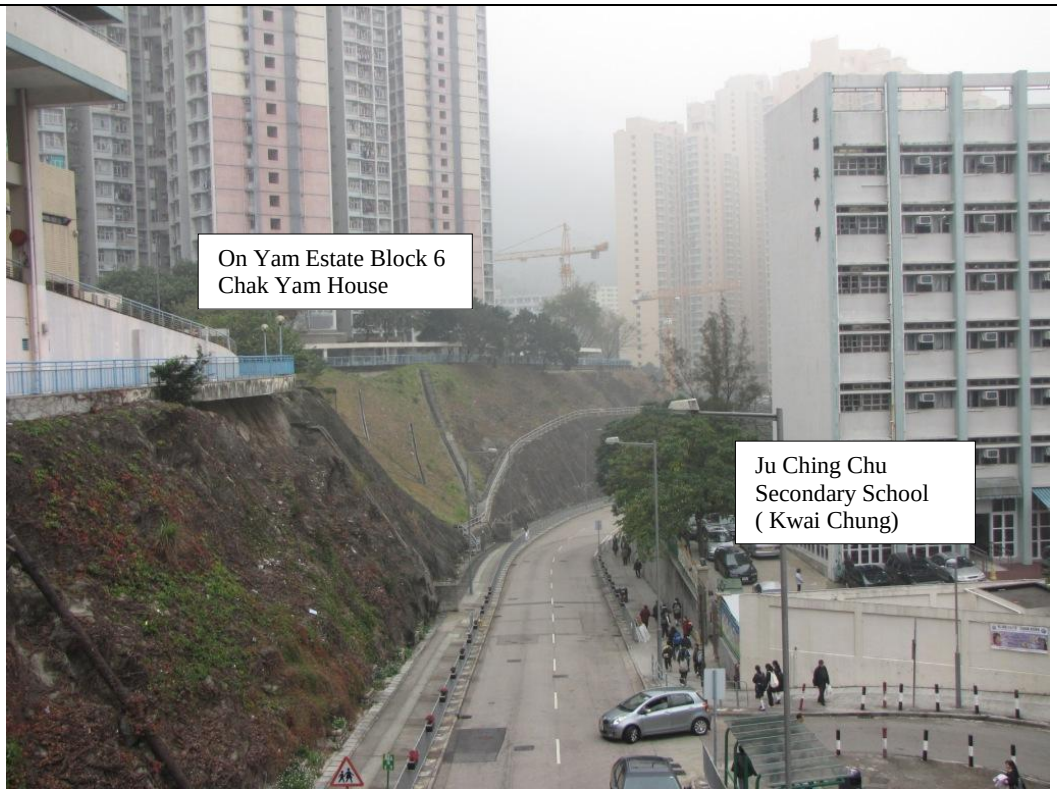
Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Chung Kwai Chung Area	ENVIRON

Location No.: 65 **Location: Tai Loong Street**

Location No.: 66 **Location: Tai Pak Tin Street**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Chung Kwai Chung Area	ENVIRON

Location No.: 67 **Location: On Chit Street**



Location No.: 68 **Location: On Chit Street**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Chung Kwai Chung Area	ENVIRON

Location No.: 69 **Location: Tai Pak Tin Street**

Location No.: 70 **Location: Lei Muk Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Chung Kwai Chung Area	ENVIRON

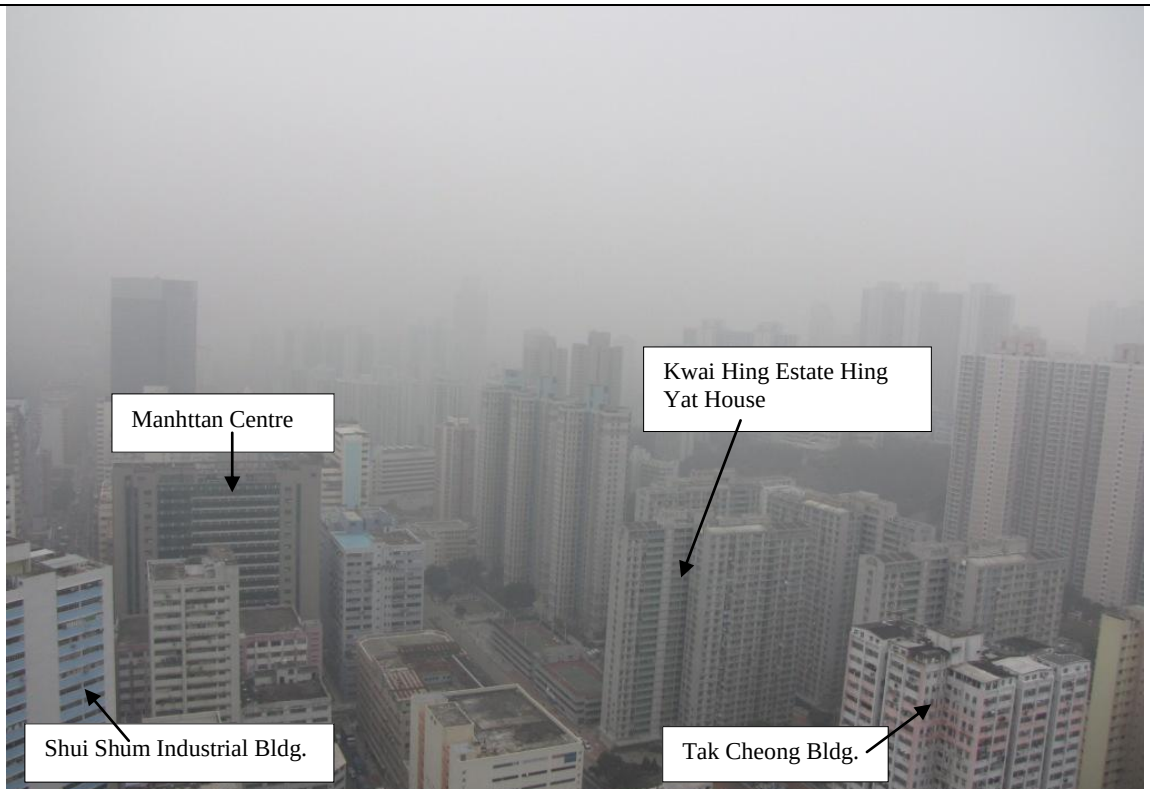
Location No.: 71 **Location: Wo Yi Hop Road**

Location No.: 72 **Location: Cheung Wing Road**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Chung Kwai Chung Area	ENVIRON

Location No.: 73 **Location: Chun Pin Road**

Location No.: 74 **Location: Lam Tin Street**

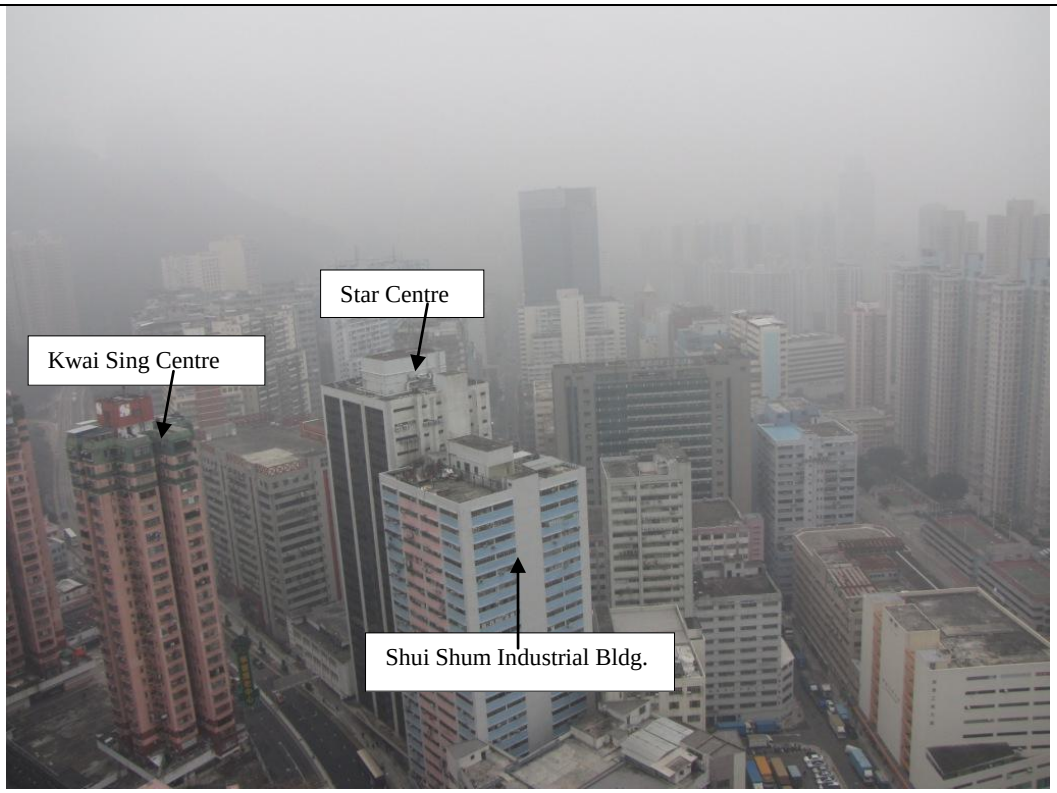


Location No.: 75 **Location: Ta Chuen Ping Street**

Location No.: 76 **Location: Ta Chuen Ping Street**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Chung Kwai Chung Area	ENVIRON

Location No.: 77 **Location: Ta Chuen Ping Street**



Location No.: 78 **Location: Ta Chuen Ping Street**