TERM CONSULTANCY FOR AIR VENTILATION ASSESSMENT SERVICES

Cat. A – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment (PLNQ 37/2007)

Final Report – Hung Hom

March 2008

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The Study Area

Expert Evaluation Report of HungHom

Executive summary

0.1 Wind Availability:

(a) The prevailing summer wind of the study area comes from the south. The prevailing annual wind of the study area comes from the east. In general, since the study area fronts the Victoria Habour to its east and south, wind coming to it is not obstructed.

(b) The prevailing winds arriving at the study area from the east and the south are from the Victoria Habour. Roughly speaking, wind of 2 to 3 m/s at the waterfront is possible at the pedestrian level given V infinity (site wind availability at 500m) of 8 to 10 m/s.

0.2 Existing conditions:

(a) Street Orientation: The north-south and east-west street orientation aligns well with the prevailing winds. The wider roads like Chatham Road North and Hung Hom South Road are useful air ways. Unfortunately, some of the east west orientated roads and streets are “blocked” by buildings on the waterfront.

(b) Building Volume Density (BVD): Building volume increases thermal capacity. The study area has “high” BVD around Hok Yuen Street East industrial areas; it has “medium” BVD around Whampoa Garden areas; and it has “low” BVD around Fat Kwong Street Garden.

(c) Ground Coverage Ratio (GCR): High ground coverage restricts the air circulation. The study area has “high” GCR around Hok Yuen Street East industrial areas; it has “medium” GCR around Whampoa Garden areas; and it has “low” GCR around Fat Kwong Street Garden.

(d) Building Heights: Tall buildings increase ground roughness and reduce air ventilation. On the whole, the study area has building heights in the range of 30 to 50 mPD, with some taller buildings. Unfortunately, there are taller buildings on the windward side of the study area. In order not to reduce air ventilation currently enjoyed, adding further tall buildings to the study area must be very carefully considered. Corresponding mitigation measures like creating and/or widening air paths, increasing permeability of the buildings, planning no building areas and open space, planting more trees, and so on, have to be implemented.

(e) Building Height to Street Width (H/W) Ratio: Tall buildings with narrow streets form street canyons which reduce air ventilation when the wind direction is perpendicular to the street. Most of the streets and roads in the study area have H/W ratio of 1.5:1 to 3:1. [Air ventilation can be better optimized for street canyons with H/W<2:1].

(f) Greeneries and Open Spaces: Greeneries and open spaces promote air circulation. The study area has a number of urban parks mostly at the fringes. Further greeneries and open spaces especially within the neighbourhood areas around Baker Street and Ma Tau Wai Road would improve the pedestrian wind environment and should be considered as far as practicable.

(g) Water Front: At the eastern boundary of the study area, from Hok Cheung Street to Wa Shun Street bus terminus, there are tall and closely packed buildings along the water front. Adding further tall buildings that length this line of blockage will further reduce the permeability to wind approaching from the east and hence NOT recommended.

(h) The area between Cheong Tung Road South and Hung Hom South Road has been separately studied. We opine:

(i) The Hung Hom South Road and Hung Lok Road are very useful air paths in bringing air flow from the waterfront to the inland areas. No building should be allowed on them.

(ii) The tall buildings (over 70 mPD) from Royal Peninsula to Hung Hom Peninsula is blocking the important summer south winds to the areas around Baker Street. This barrier must not be further lengthened with new development.

(iii) Extensive greenery and tree planting of the area in general is recommended.

0.3 <u>The Study Area's Strategic Importance</u>:
(a) To Kwa Wan (TKW) lies to the north of the study area. It may be useful that buildings of the study area bordering TKW are, as much as practically feasible, of reduced and of varying heights so that the extent of the wake areas is reduced and the summer prevailing wind approaching from the south could 'recover' when reaching TKW.

0.4 <u>The Study Area with Potential Re-development</u>:
(a) Many R(A) and OU(Business) sites will be re-developed with taller and bulkier buildings. Building heights will increase from 25 to 50, 100, 150 (in mPD), or taller. The air ventilation of the study area will inevitably worsen.

0.5 <u>The Study Area with Height Restrictions</u>:
(a) Given the plot ratio control under the current Hung Hom OZP, the buildings will be allowed to redevelop to their maximum development potential. To respect the development rights, potential high rise redevelopments will inevitably happen, " and hence the damage will inevitably be done". Building height control in itself is NOT an effective mechanism for better air ventilation. Scenarios "with" or "without" building height restrictions will not make a noticeable difference to air ventilation at pedestrian level. Fundamentally, it is impossible to ascertain the air ventilation performance based on only on height information of buildings. Careful considerations of other design

parameters are recommended for different areas in the study area in such a way that the air ventilation at pedestrian level may not be further deteriorated when redevelopments happen.

0.6 Further Recommendations:
(a) It is important to further carry out studies with a view to establishing guidelines and stipulating restrictions on the more effective design parameters like Open Space, Air Paths, Site Coverage and Non-building Area. Without these further measures, air ventilation of the study area and its contributions to its neighbours cannot be secured.

0.7 Further Studies:
(a) Further AVA studies comparing the “with” and “without” height restriction options may not be necessary or even beneficial as it is not possible to specify the more important parameters (e.g. building geometry and block disposition within each of the building sites) in the tests.

Expert Evaluation Report of Hung Hom

1.0 The Assignment

1.1 In order to provide better planning control on the building heights upon development/redevelopment, the approved Hung Hom Outline Zoning plan (OZP) No. S/K9/20 is being reviewed with a view to incorporating appropriate development restrictions in the Notes for various development zones of the OZP to guide future development/redevelopment. It is necessary to conduct an expert evaluation to assess the broad Air Ventilation (AV) impacts of the proposed building height restrictions.

1.2 This expert evaluation report is based on the materials given by Planning Department to the Consultant on 11 Feb 08 including:

-	the Hung Hom OZP
-	proposed building height (in mPD) for the Commercial (C), Comprehensive Development Area (CDA), Residential (Group A) (R(A) and Other Specified Uses (OU) annotated Business(OU(B)) zones
-	proposed building height (in number of storeys) for the Government, Institution or Community (G/IC) and other development zones on the OZP.
-	proposed building height for the CDA and R(A)2 sites near the Hung Hom waterfront

AND the following information forwarded to the Consultant on 12 Feb 08:

Podium Top in K9
No. of storey (podium) in K9
No. of storey in K9
Building Top in K9
Existing building height profile for Hung Hom planning scheme area
Building age profile for Hung Hom planning scheme area

1.3 The consultant has studied the above mentioned materials, and has conducted site inspection on 13 Feb 08. During the writing of the report, the consultant has working session with colleagues at Planning Department on 12 Feb 08.

2.0 Background

2.1 Planning Department study: "Feasibility Study for Establishment of Air Ventilation Assessment System" has recommended that it is important to allow adequate air ventilation through the built environment for thermal comfort.

2.2 Given Hong Kong's high density urban development, the study opined that: "more air ventilation, the better" is the useful design guideline.

2.3 The study summarises 10 qualitative guidelines for planners and designers. For the OZP level of consideration, breezeways/air paths, street grids and orientations, open spaces, non-building areas, waterfront sites, scales of podium, building heights, building dispositions, and greeneries are all important strategic considerations.

2.4 The study also suggests that Air Ventilation Assessment (AVA) be conducted in 3 stages: Expert Evaluation, Initial Studies, and Detail Studies. The suggestion have been adopted and incorporated into HPLB and ETWB Technical Circular no. 1/06. The key purposes of Expert Evaluation are to:

(a) Identify good design features.
(b) Identify obvious problem areas and propose some mitigation measures.
(c) Defines "focuses" and methodologies of the Initial and/or Detailed studies.
(d) Determine if further study should be staged into Initial Study and Detailed Study, or Detailed Study alone.

2.5 To conduct the Expert Evaluation systematically and methodologically, it is necessary to undertake the following information analyses:

(a) Analyse the wind data as the input boundary conditions of the wind environment of the study area.
(b) Analyse the topographical features of the study areas, as well as the surrounding areas.
(c) Analyse the greenery/landscape characteristics of the study areas, as well as the surrounding areas.
(d) Analyse the land use of the study areas, as well as the surrounding areas.

Based on the analyses:

(a) Estimate the characteristics of the input boundary conditions of the wind environments of the study area.
(b) Identify the wind paths and wind flow characteristics of the study area through slopes, open spaces, streets, gaps and non building areas between buildings, and low rise buildings; also identify stagnant/problem areas, if any.

Based on the analyses of the EXISTING urban conditions:

(a) Evaluate strategic role of the area in air ventilation term.
(b) Identify problematic areas which warrant attention.
(c) Identify existing "good features" that needs to be kept or strengthened.

Based on an understanding of the EXISTING urban conditions:

(a) Compare the prima facie impact, merits or demerits of the building height development restrictions as proposed by Planning Department on Air Ventilation.

(b) Highlight problem areas, if any. Recommend improvements and mitigation measures if possible.

(c) Identify focus areas or issues that may need further studies. Recommend appropriate technical methodologies for the study if needed.

3.0 The wind environment

3.1 Hong Kong Observatory (HKO) stations provide useful and reliable data of the wind environment in Hong Kong (Figure 3.1). There are some 46 stations operated by HKO in Hong Kong. Together, they allow a very good general understanding of the wind environment especially close to ground level.

3.2 The HKO station at Waglan Island (WGL) is normally regarded by wind engineers as the reference station for wind related studies (Figure 3.1). The station has a very long measuring record, and it is unaffected by Hong Kong's complex topography. Based on WGL wind data, studies are typically employed to estimate the site wind availability taking into account the topographical features around the site. Examining the annual wind rose of WGL, it is apparent that the annual prevailing wind in Hong Kong is from the East. There is also a major component of wind coming from the North-East; and there is a minor, but nonetheless observable component from the South-West.

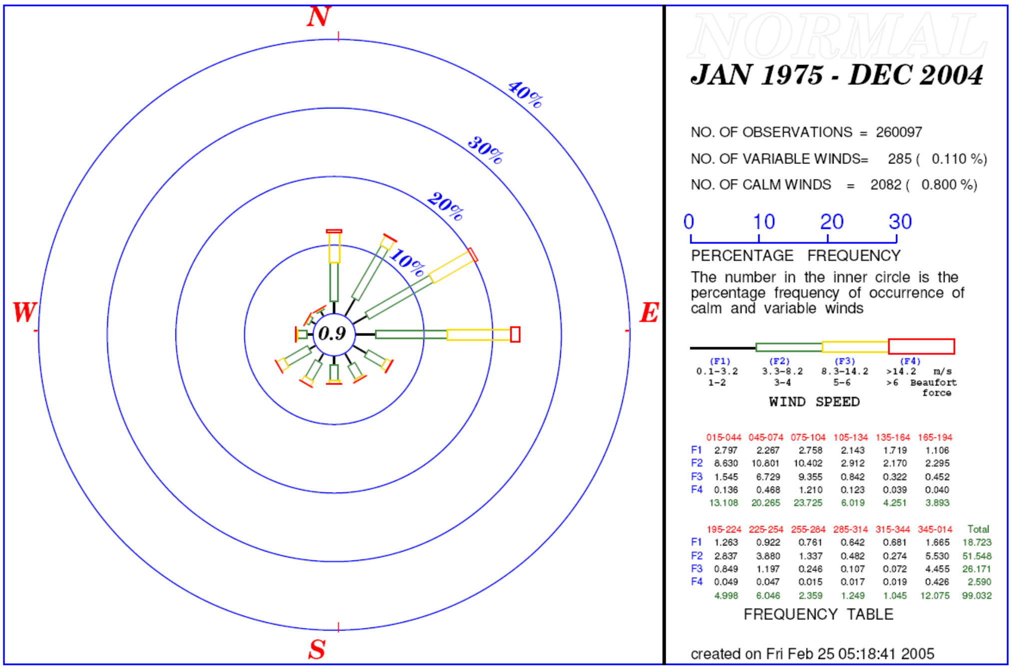


Figure 3.1 Wind rose of WGL 2006 (annual).

3.3 For the study, it is important to understand the wind environment both seasonally and monthly (Figures 3.2 and 3.3). In the winter months of Hong Kong, the prevailing wind comes from the North-East. In the summer months, they come from the South-West. As far as AVA is concerned, in Hong Kong, the summer wind is very important and beneficial to thermal comfort. Hence, based on WGL data, it is very important to plan our city, on the one hand, to optimize the ventilation potential based on the annual wind characteristics, and on the other hand, to maximize the penetration of the summer winds (mainly from the South-West) into the urban fabric.

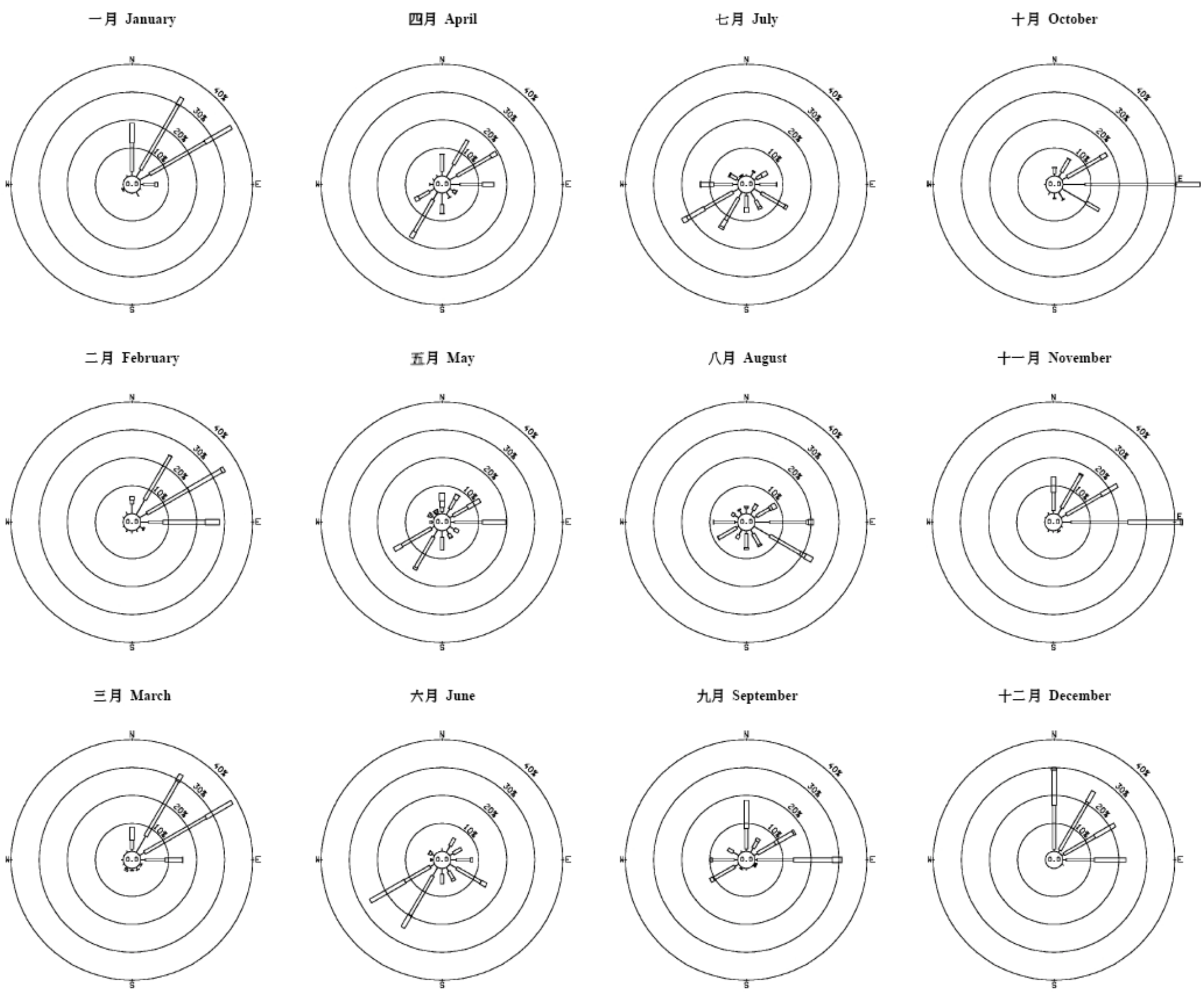


Figure 3.2 (as an example) monthly wind roses of WGL 2006.

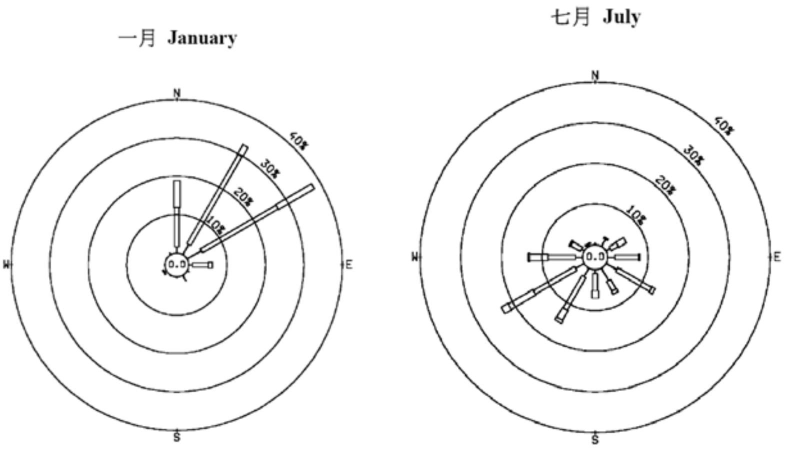
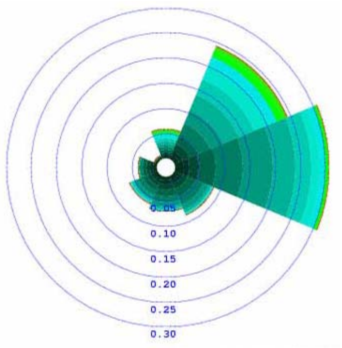


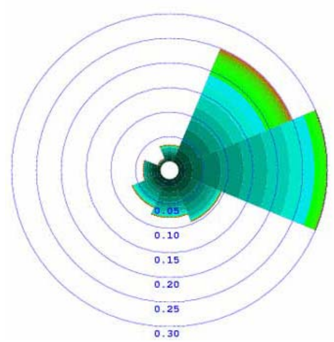
Figure 3.3 (as an example) Wind roses of WGL 2006 (Jan and July).

3.4 Researchers at Hong Kong University of Science and Technology (HKUST),) led by Prof Alexis Lau and Prof Jimmy Fung, have simulated the wind field above Hong Kong using MM5. The simulated period cover the whole year of 2004. Based on this dataset, 2 wind roses locations within the study area are extracted at 120m and 450m above ground (Figures 3.4, 3.5 and 3.6).

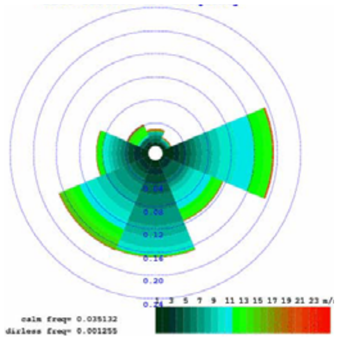
Figure 3.4 The two locations of MM5 extracted data.



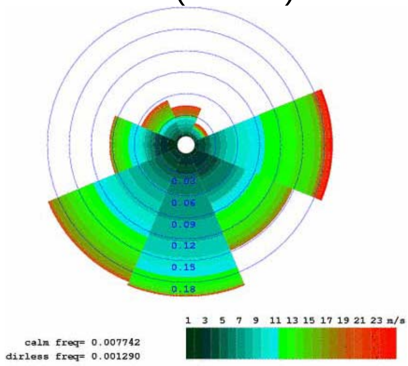
120m (Annual)



450m (Annual)

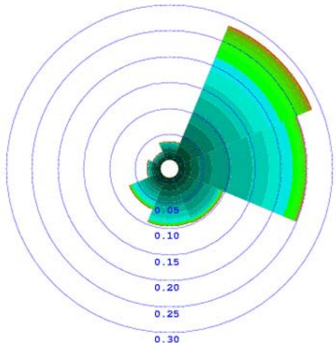


120m (Summer)

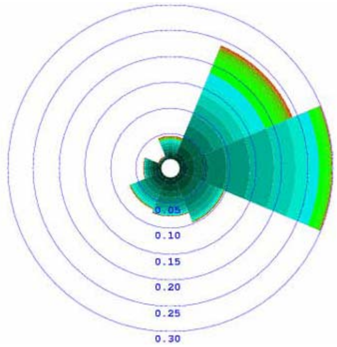


450m (Summer)

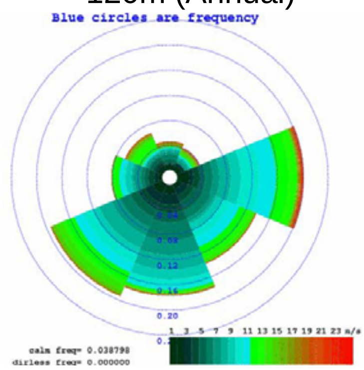
Figure 3.5 Wind roses in the study area at location A



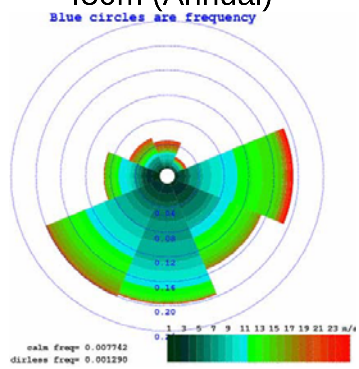
120m (Annual)



450m (Annual)



120m (Summer)



450m (Summer)

Figure 3.6 Wind roses in the study area at location B

3.5 Using the simulated MM5 data, the summer and the annual prevailing wind directions of the study area and the surroundings are presented in Figure 3.7, 3.8.

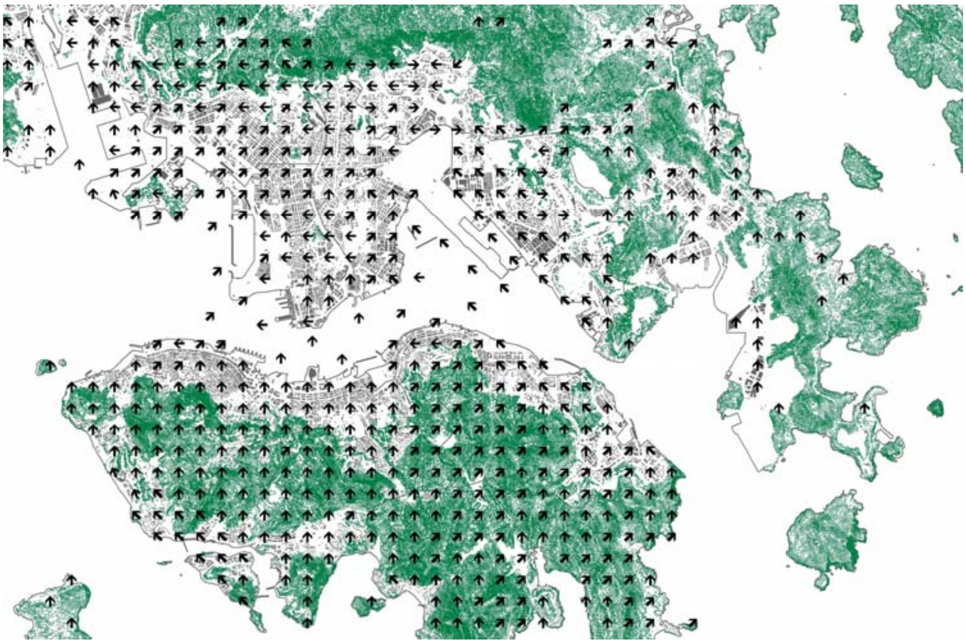


Figure 3.7 Prevailing wind directions of the summer months (Jun-Aug) based on MM5 (60m).

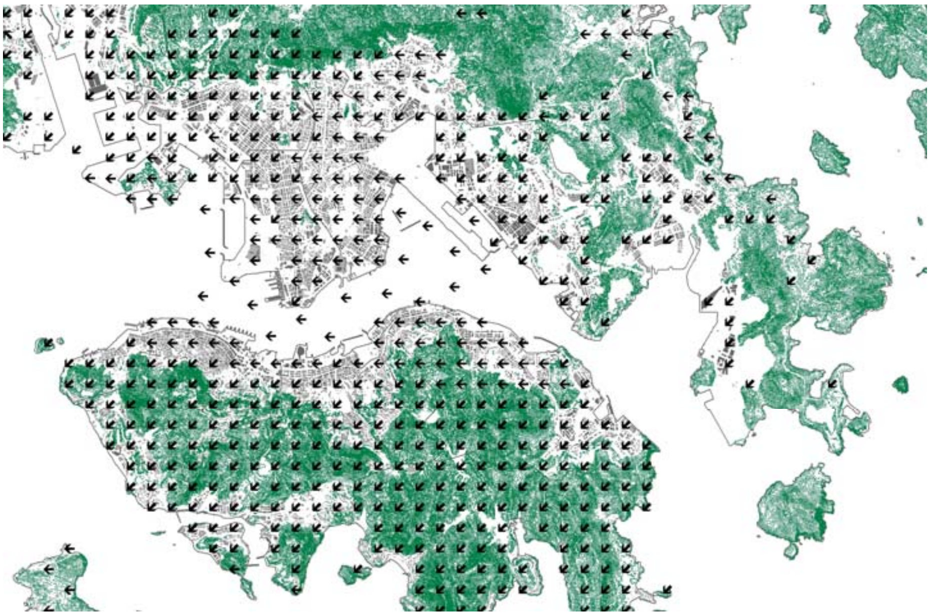


Figure 3.8 Prevailing wind directions (annual) based on MM5 (60m).

3.6 The MM5 data predicts that at 450m, the annual mean wind speed is about 8 m/s. The predicted mean wind speed in the summer at 450m is about 7 m/s.

3.7 In summary, based on the available wind data from the HKO and HKUST-MM5, one may conclude that <u>the annual wind of the study area is mainly from the East and North-East. The summer wind is mainly coming from the East, South and South-West</u> (Figure 3.9).

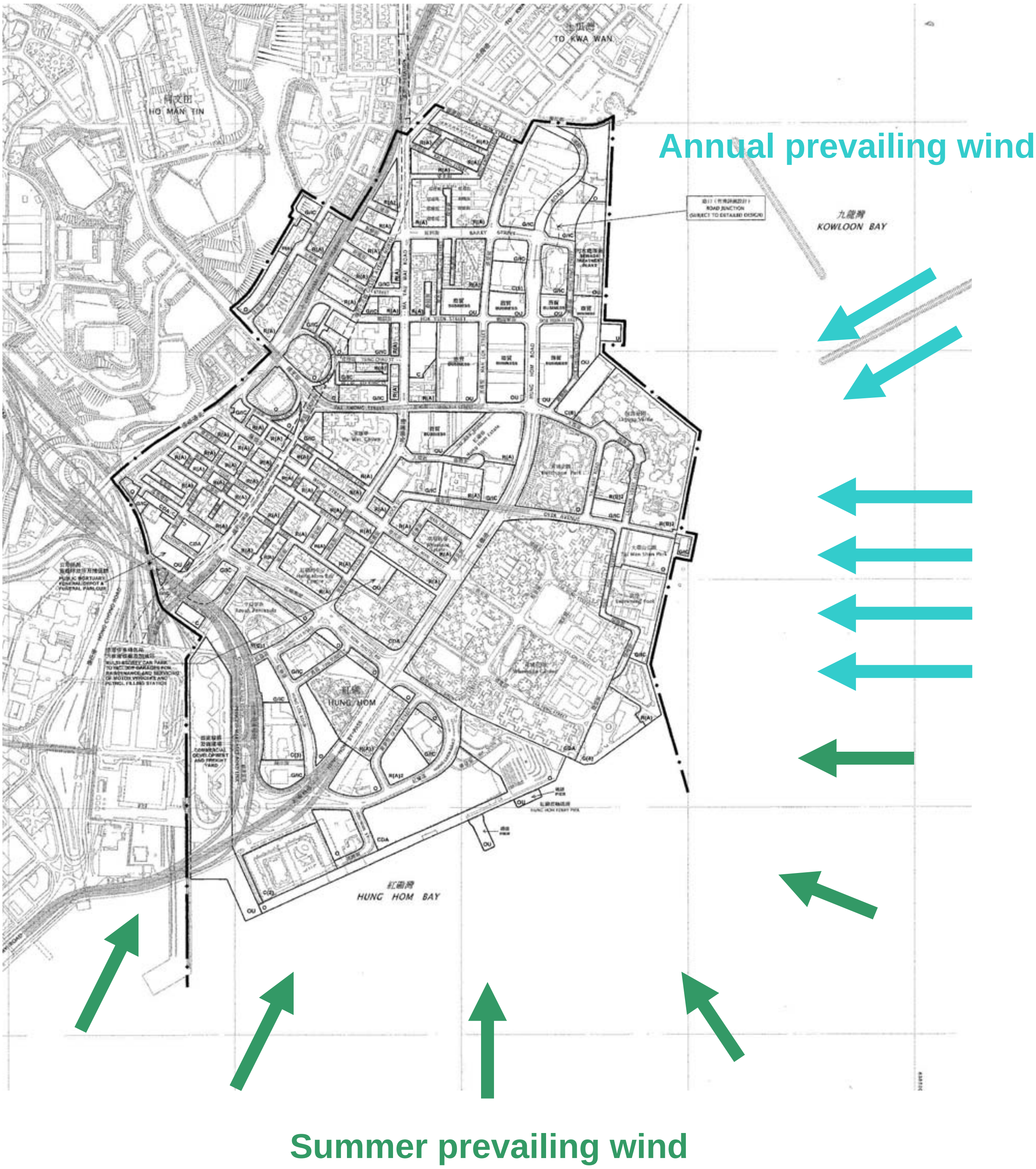


Figure 3.9 Annual and summer prevailing winds of the study area.

4.0 Existing Conditions – Street Layout and Orientation

4.1 The north-south and east-west street orientation aligns well with the prevailing wind directions (Figure 4.1).

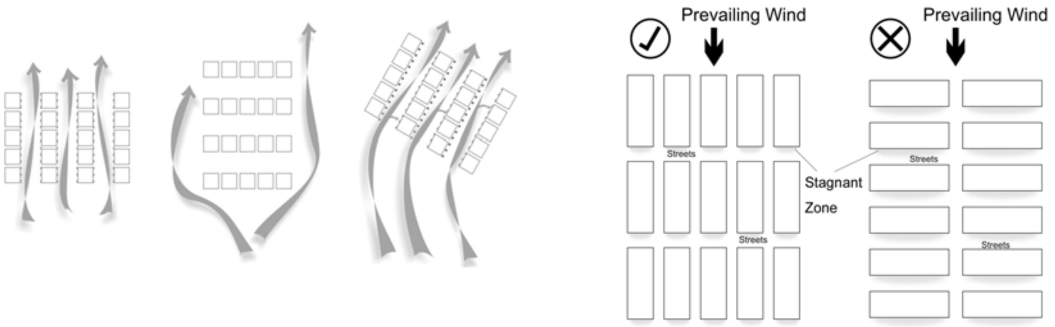


Figure 4.1 Streets parallel to the incoming wind are useful wind paths. VR in the order of 0.1 and better can be expected. Streets perpendicular to the incoming wind have stagnant zones within its canyons. VR in the order of 0.05 or less can be expected.

4.2 The wider roads like Chatham Road North and Hung Hom South Road are useful air paths for the southerly prevailing wind of the summer months. It is expected that air ventilation under the flyovers is reduced. The two roads don't go through the centre of the study area. Gilles Avenue South is not an effective air path due to the high roughness of the areas to its south. Hung Hom Road is not an efficient air path due to the build blockage to its south, Harbour Place and Hung Hom Peninsula.

4.3 The wider east-west orientated Man Yue Street terminates short of reaching the waterfront and is “blocked” by the buildings on the waterfront. As such its efficacy as east-west air paths is greatly reduced. In addition, it is expected that air ventilation under the flyovers is reduced.

4.4 The wider north-south orientated Ma Tau Wai Road is not an air path due to buildings of high ground coverage along it, as well as its southern end terminated by Wuhu Street.

4.5 In general, narrower streets are not efficient air paths due to the friction and roughness of buildings along them. At present, buildings along Baker Street/Tak Fung Street, Bulkeley Street, Wuhu Street/Tak On Street, Station Lane/Dyer Avenue, Hok Yuen Street and Bailey Street, and so on are not tall (around 30m to 50m). Given that the H/W ratio of these streets are is still lower than 2:1, they are useful under easterly prevailing wind directions.

4.6 The narrow streets like Whampoa Street, Po Loi Street and so on are unfortunately blocked by developments south of Hung Hom South Road. They are not useful air paths.

4.7 The north south orientated narrow streets like Man Lok Street are not useful air paths due to buildings with high ground coverage along them.

5.0 Existing Conditions – Building Volume Density

5.1 Building Volume Density (BVD): Building volume increases thermal capacity of the city. The study area has “high” BVD around Hok Yuen Street East industrial areas; it has “medium” BVD around Whampoa Garden areas; and it has “low” BVD around Fat Kwong Street Garden areas. (Figure 5.1)

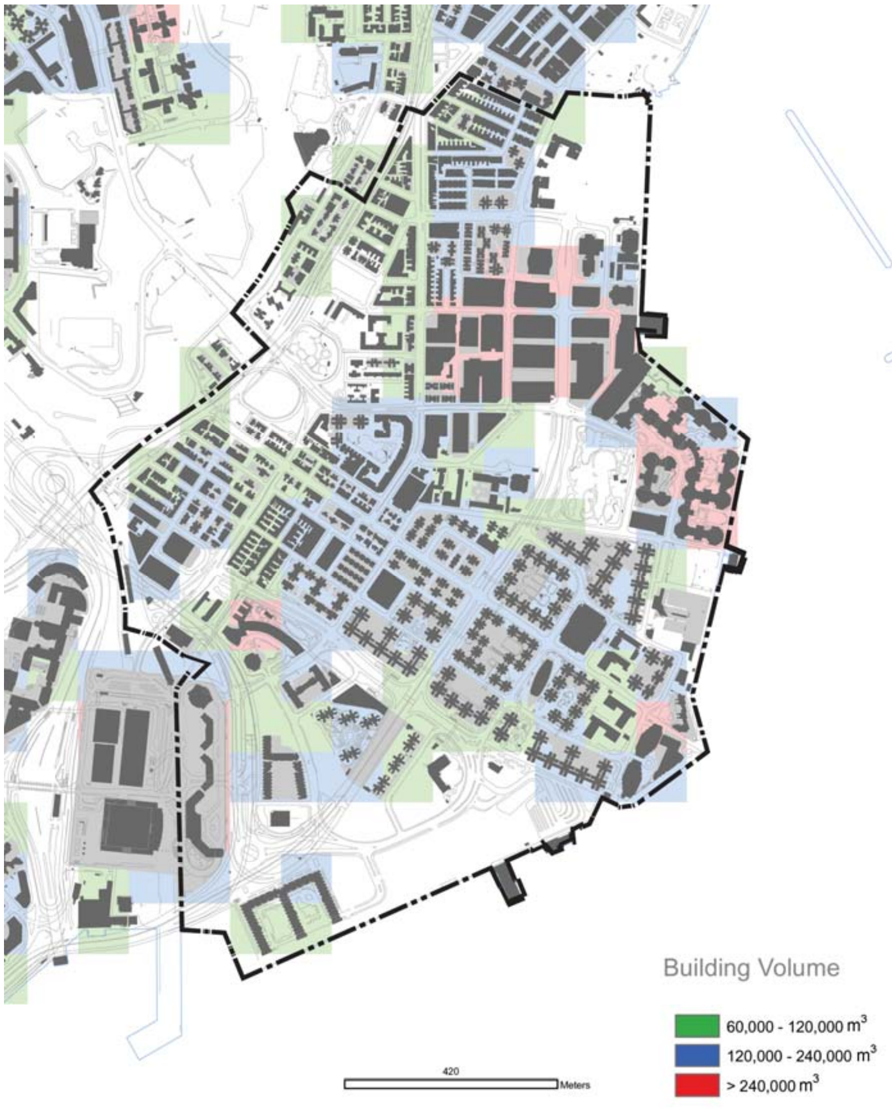


Figure 5.1 Building Volume Density of the study area

[Building Volume Density BVD = the amount of building volume in m^3 in the 100m x 100m grid of land. Building volume adds to the heat capacity of the built environment.]

5.2 Adding further building volume to the study area will add to the thermal capacity. Corresponding mitigation measures like creating and/or widening air paths, increase permeability of the buildings, planning no building areas and open space, planting more trees, and so on, have to be implemented.

6.0 Existing Conditions – Ground Coverage Ratio

6.1 High ground coverage restricts air ventilation. Based on previous research works of CUHK, higher ground coverage in a city means lower air ventilation permeability on the whole. The study area has “high” GCR around Hok Yuen Street East industrial areas; it has “medium” GCR around Whampoa Garden areas; and it has “low” GCR around Fat Kwong Street Garden areas. (Figure 6.1)

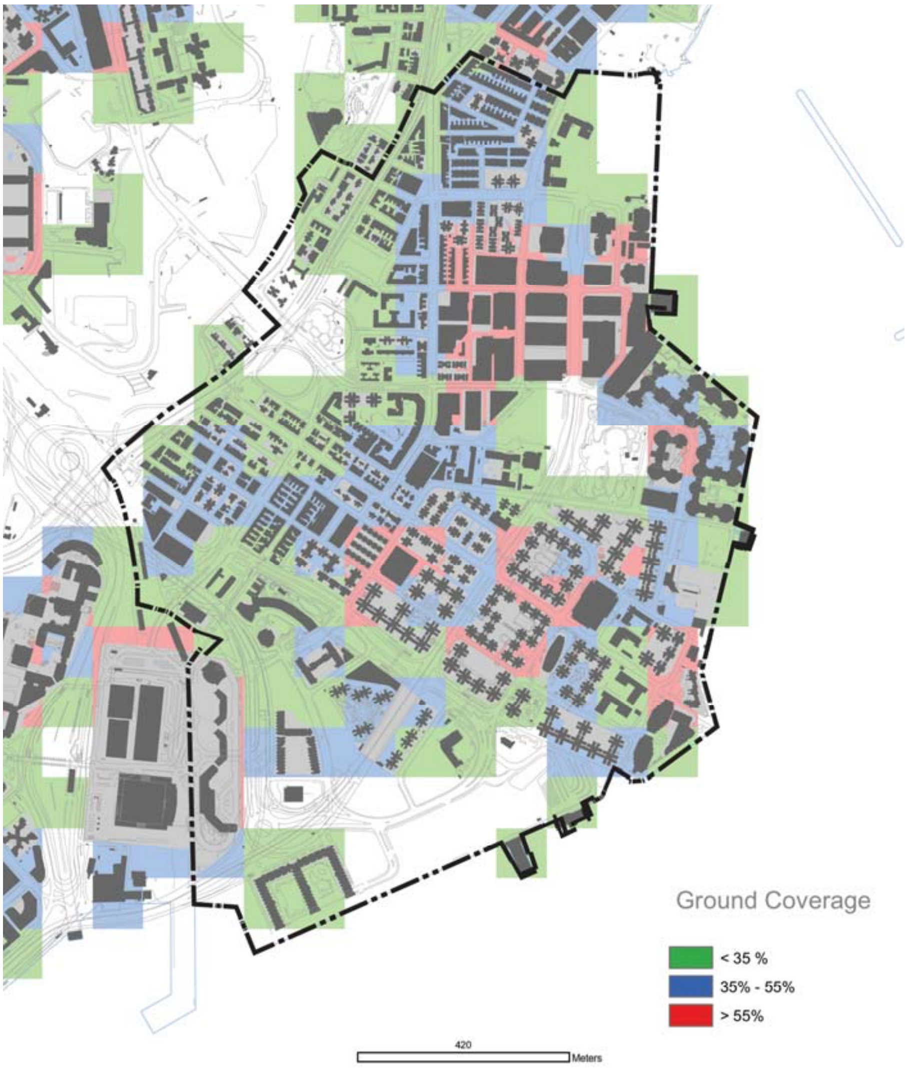


Figure 6.1 Ground Coverage Ratio of the study area. RED areas have higher ground coverage then GREEN areas. [GREY areas are podiums.]

6.2 Building podiums significantly add to ground coverage ratio, for large lots, air paths or non-building areas could help to provide permeability.

7.0 Existing Conditions – Building Heights

7.1 Tall buildings increase ground roughness and reduce air ventilation. On the whole, the study area has building heights in the range from 30 to 50m, with some taller buildings. Unfortunately, there are taller buildings on the windward side of the study area. In order not to reduce air ventilation currently enjoyed, adding further tall buildings to the study area must be very carefully considered. Corresponding mitigation measures like creating and/or widening air paths, increase permeability of the buildings, planning no building areas and open space, planting more trees, and so on, must be implemented.

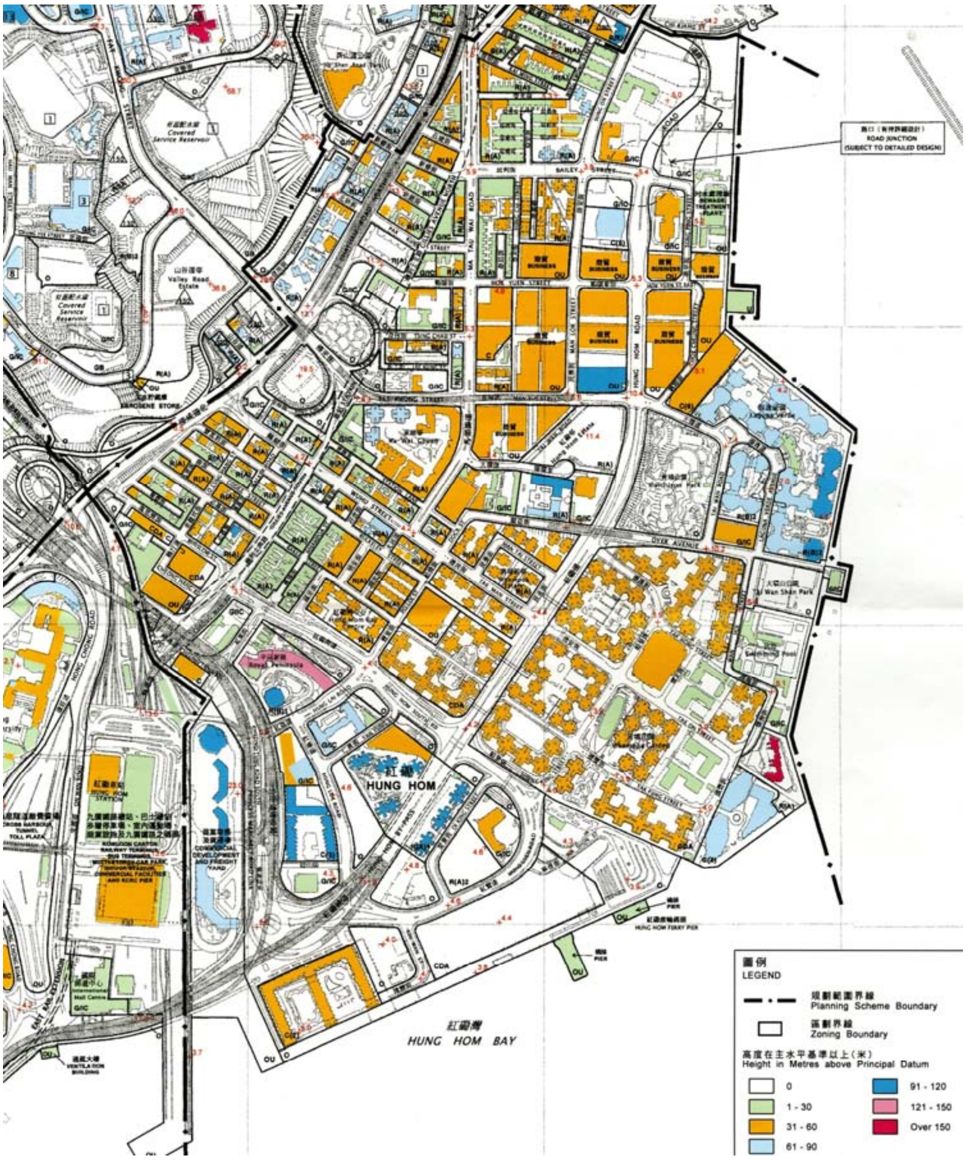


Figure 7.1 Existing building heights of the study area

8.0 Existing Conditions – Building Height to Street Width Ratio

8.1 Tall buildings with narrow streets form street canyons which reduce air ventilation when the wind direction is perpendicular to the street. Most of the streets and roads in the study area have Building Height to Street Width (H/W) ratio of 1.5:1 to 3:1. [Air ventilation can be better optimized for street canyons with H/W<2:1]. (Figure 8.1, 8.2, 8.3) The Figures illustrate the current urban morphology and thus the H/W ratios of selected streets of the study area.

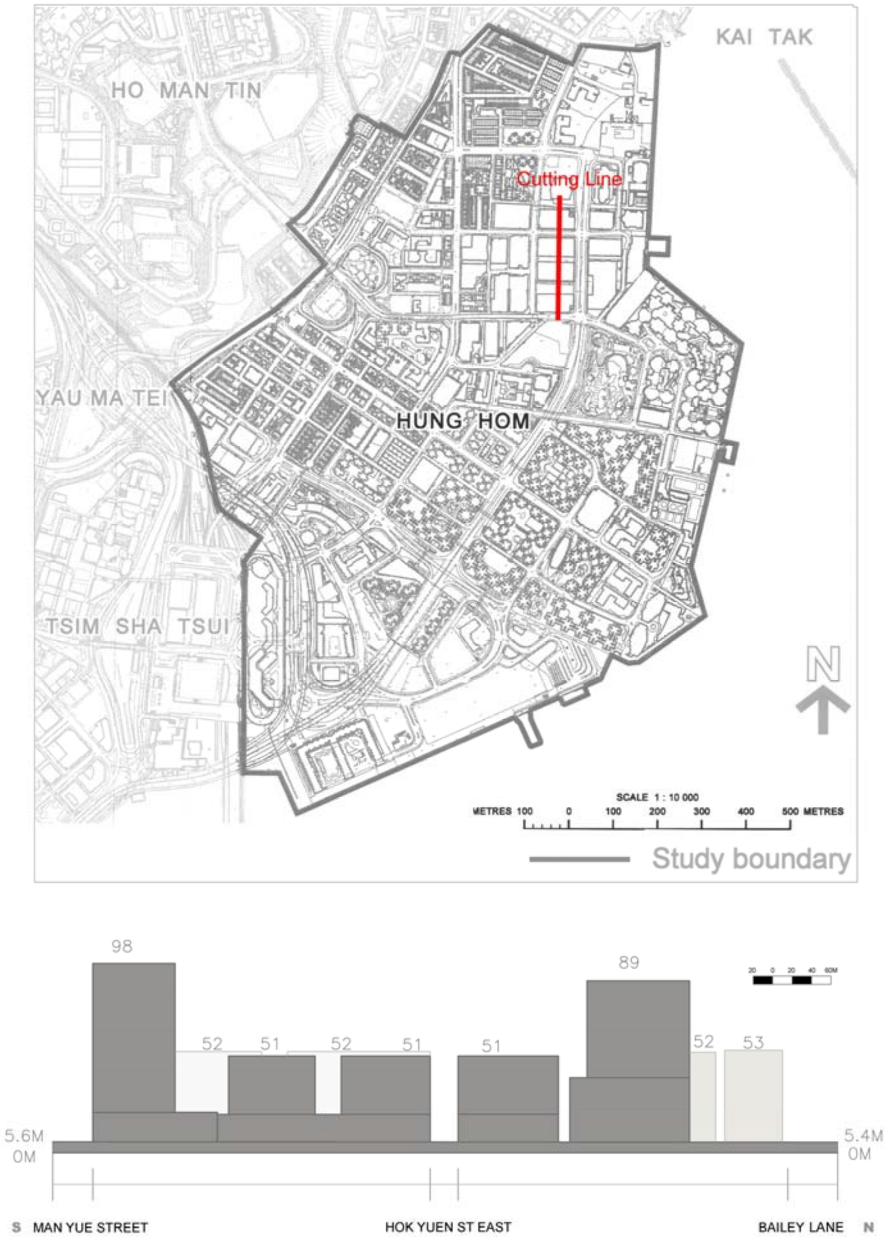


Figure 8.1 Section

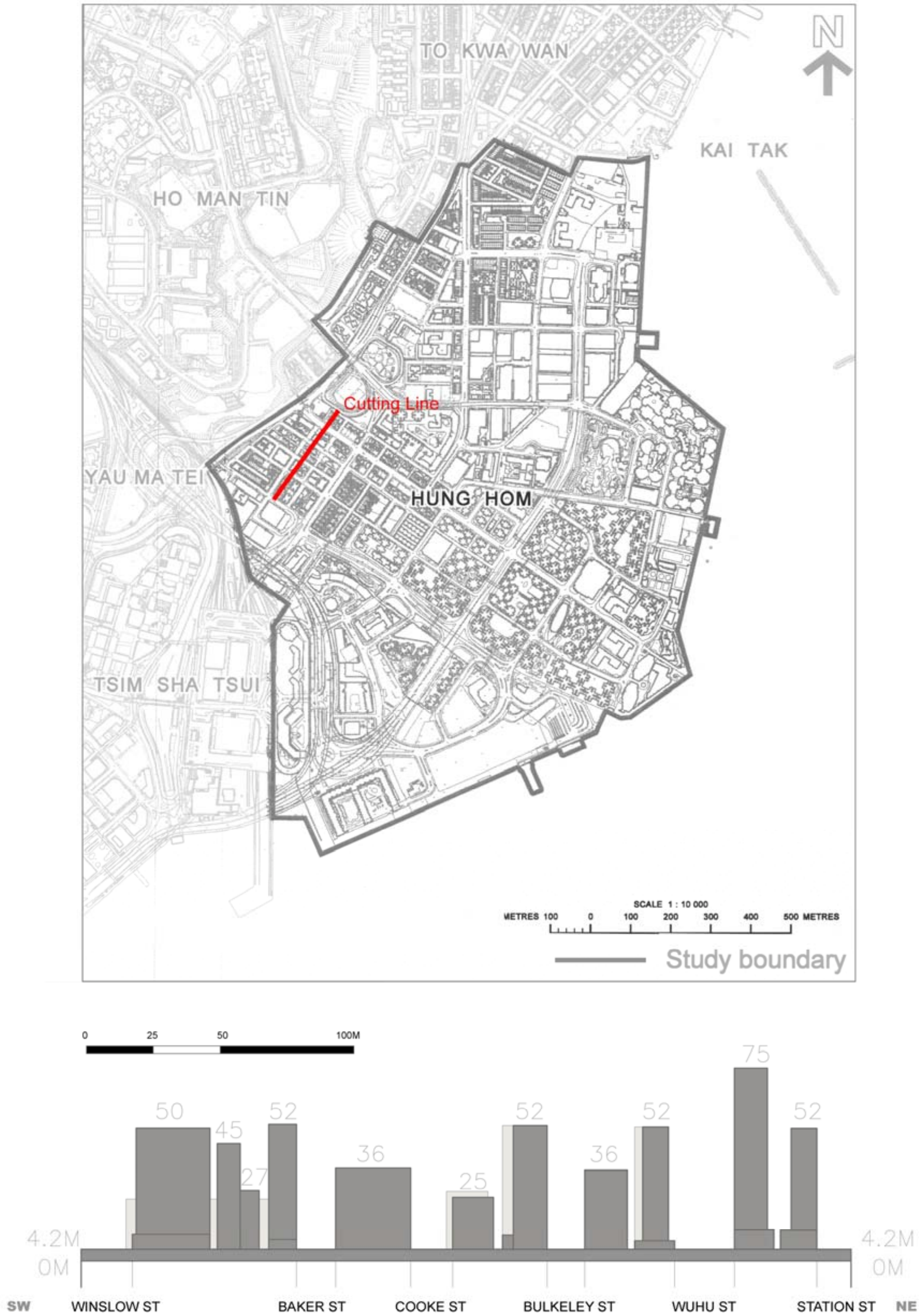


Figure 8.2 Section

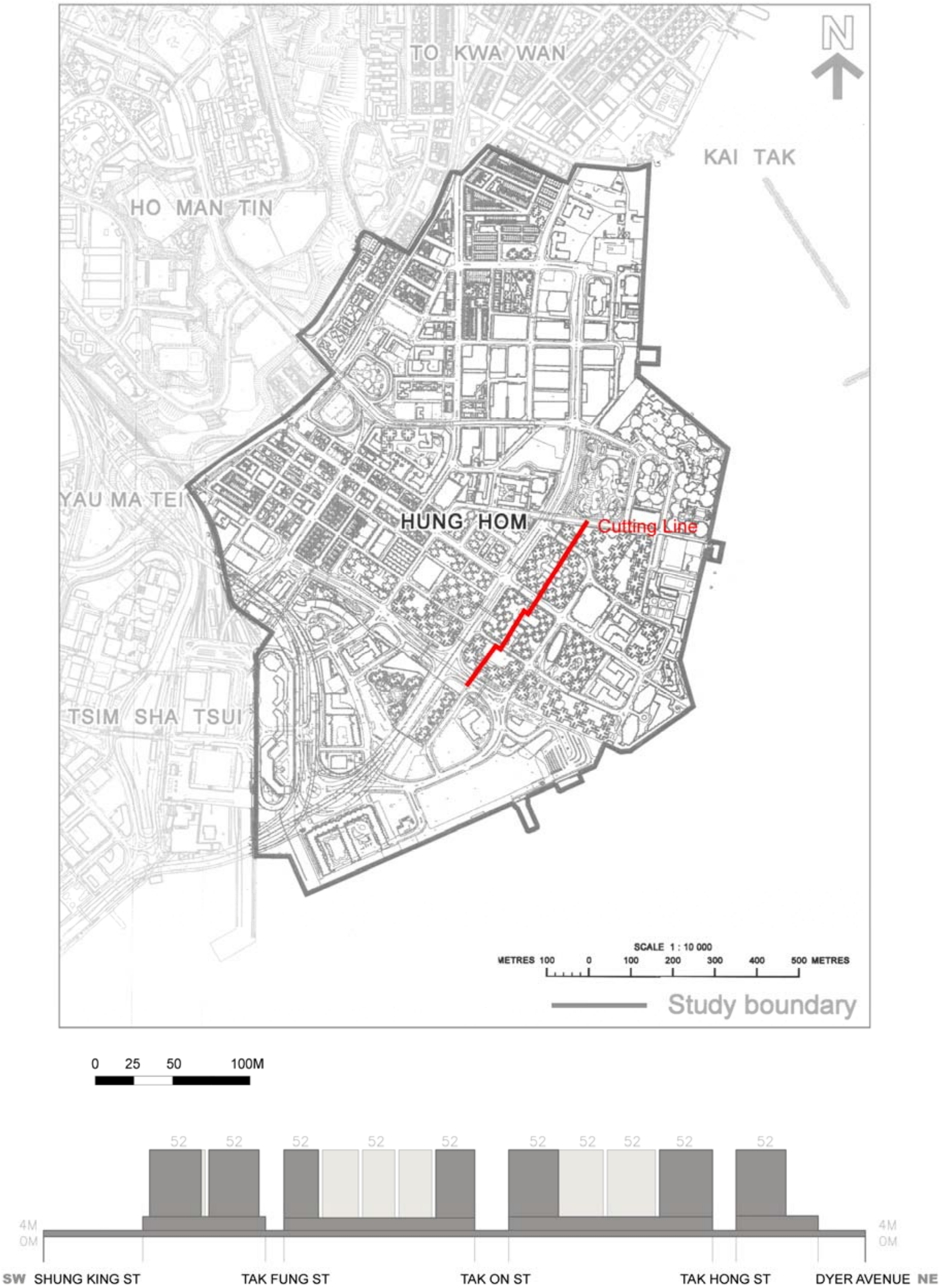


Figure 8.3 Section showing buildings with flyover and other minor structures omitted.

9.0 Existing Conditions – Greeneries and Open Spaces and WaterFront

9.1 Greeneries and open spaces promote air circulation. The study area has a number of urban parks mostly at the fringes. Whilst useful, since they are scattered, they do not assist too much the air ventilation of the study area.

9.2 Further greeneries and open spaces especially within the neighbourhood areas around Baker Street and Ma Tau Wai Road are would improve the pedestrian wind environment and should be considered as far as practicable.

9.3 At the eastern boundary of the study area, from Hok Cheung Street to Wa Shun Street bus terminus, there are tall and closely packed buildings along the water front. Adding further tall buildings that length this line of blockage will further reduce the permeability of wind approaching from the east and hence NOT recommended.

10.0 Existing Conditions – Area between Cheong Tung Road South and Hung Hom South Road

10.1 The area between Cheong Tung Road South and Hung Hom South Road has been separately studied. We opine:

(i) The Hung Hom South Road air path and Hung Lok Road air path are very useful in bringing air flow from the waterfront to the inland areas. No building should be allowed on them.

(ii) The tall buildings (over 70m) from Royal Peninsula to Hung Hom Peninsula is blocking the important summer south winds to the areas around Baker Street. This barrier must not be further lengthened with new development.

(iii) Extensive greenery and tree planting of the study area in general is recommended.

11.0 Strategic Importance of the Study Area

11.1 To Kwa Wan (TKW) lies to the north of the study area. It may be useful that buildings of the study area bordering TKW are, as much as practically feasible, of reduced and of varying heights so that the extent of the wake areas is reduced and the summer prevailing wind approaching from the south could ‘recover’ when reaching TKW.

12.0 The Study Area with Potential Re-development

12.1 It is anticipated that many of the R(A) and OU(Business) sites when re-developed will have taller and bulkier buildings with large podiums. Building Volume

Density, Ground Coverage Ratio and H/W ratios will all be greatly increased. Take H/W as an example, the current H/W ratio of 1.5:1 to 3:1 will likely to be increased to 6:1 or worse.

12.2 In terms of air ventilation, the scenario with most sites re-developed can be a pessimistic one. Allowing such a scenario to happen – and it will inevitably happen – without a mitigation plan is not recommended.

13.0 The Study Area with Height Restrictions

13.1 Before further reading, the text in section 12.1 and 12.2 of this report must be highlighted. The consultant's views in this section are written on the basis that "the re-development potentials of the study area have to be respected".

13.2 Based on the proposed height restrictions (Figure 12.1), the study area is largely divided into FIVE zones.

13.3 The GIC sites with their lower building heights and lesser building volumes increase the air space near ground level and provide useful potentials for air ventilation. The proposed height restrictions for GIC sites (Figure 12.2) seem to have already addressed this view. Furthermore, it is recommended that as far as possible the sewage treatment works along the waterfront should not be re-zoned to other development zoning. In case this site has to be redeveloped, careful disposition of the buildings, having a greening plan and a more detailed AVA are highly recommended.

13.4 Zone A including the Whampoa Garden and Laguna Verde areas at the waterfront are the major wind entrance to the Hung Hom Inland area under east prevailing wind direction. Adding taller buildings with full street frontage to maximize sea view will further reduce air ventilation under the prevailing east wind. To make sure the effectiveness of this important ventilation entrance, it is recommended that buildings in the area should be as low as possible. This helps the wind from the east to enter the Hung Hom inland area.

13.5 It is foreseeable that buildings on sites in zones B, C and D when re-developed will be a lot taller. The following table summarises a likely scenario:

Zone	Now in mPD (on average)	Foreseeable (with ht restriction in mPD)	Foreseeable (without restriction in mPD)
B	30	80	150
C	52	100-120	150
D	30	100	150

13.6 With height restrictions, the H/W ratio of the study area in zones B, C and D would be in the order of around 5:1. Without restriction, it is in the order of 6:1 or 7:1.

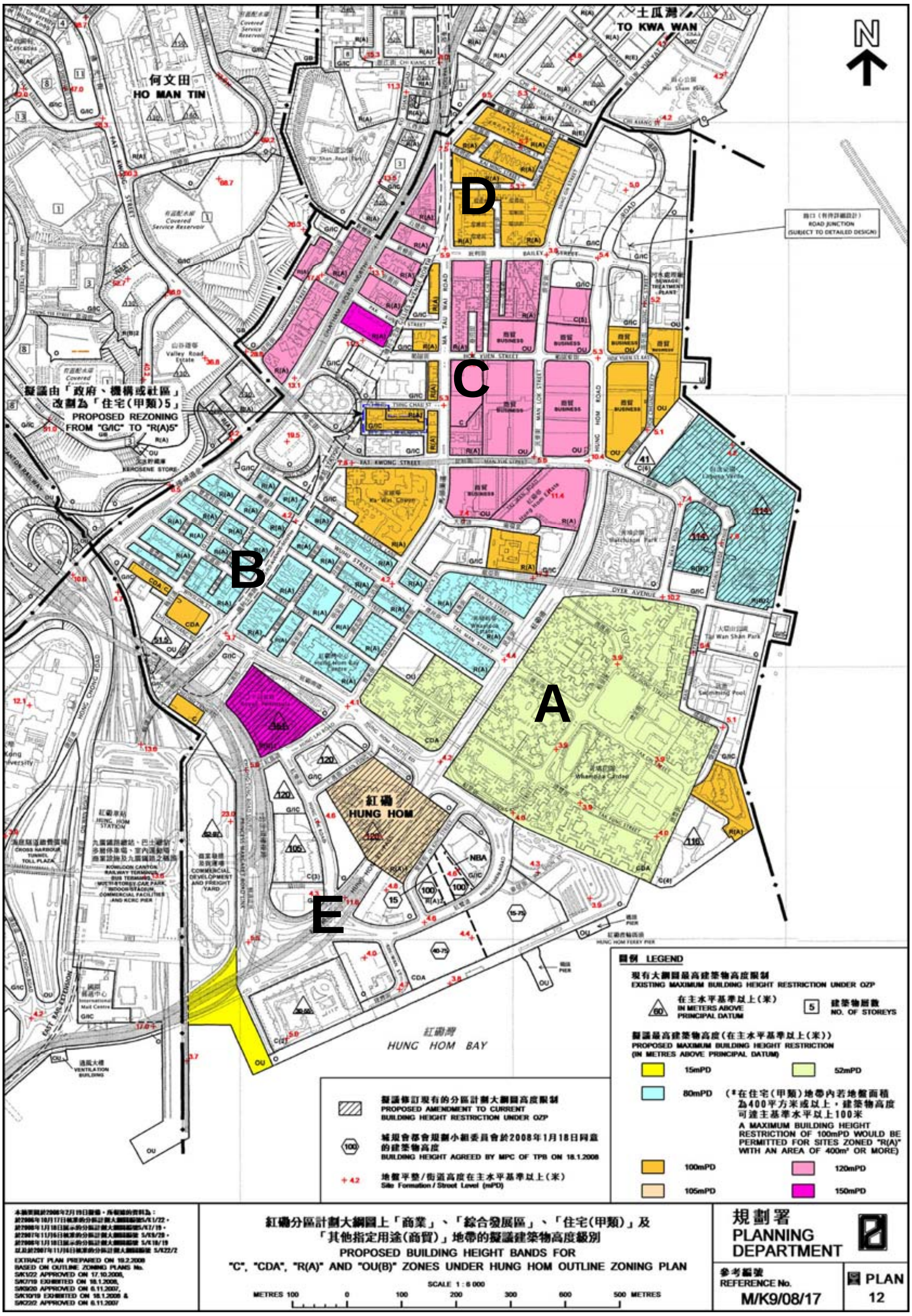


Figure 12.1 Proposed building height restrictions

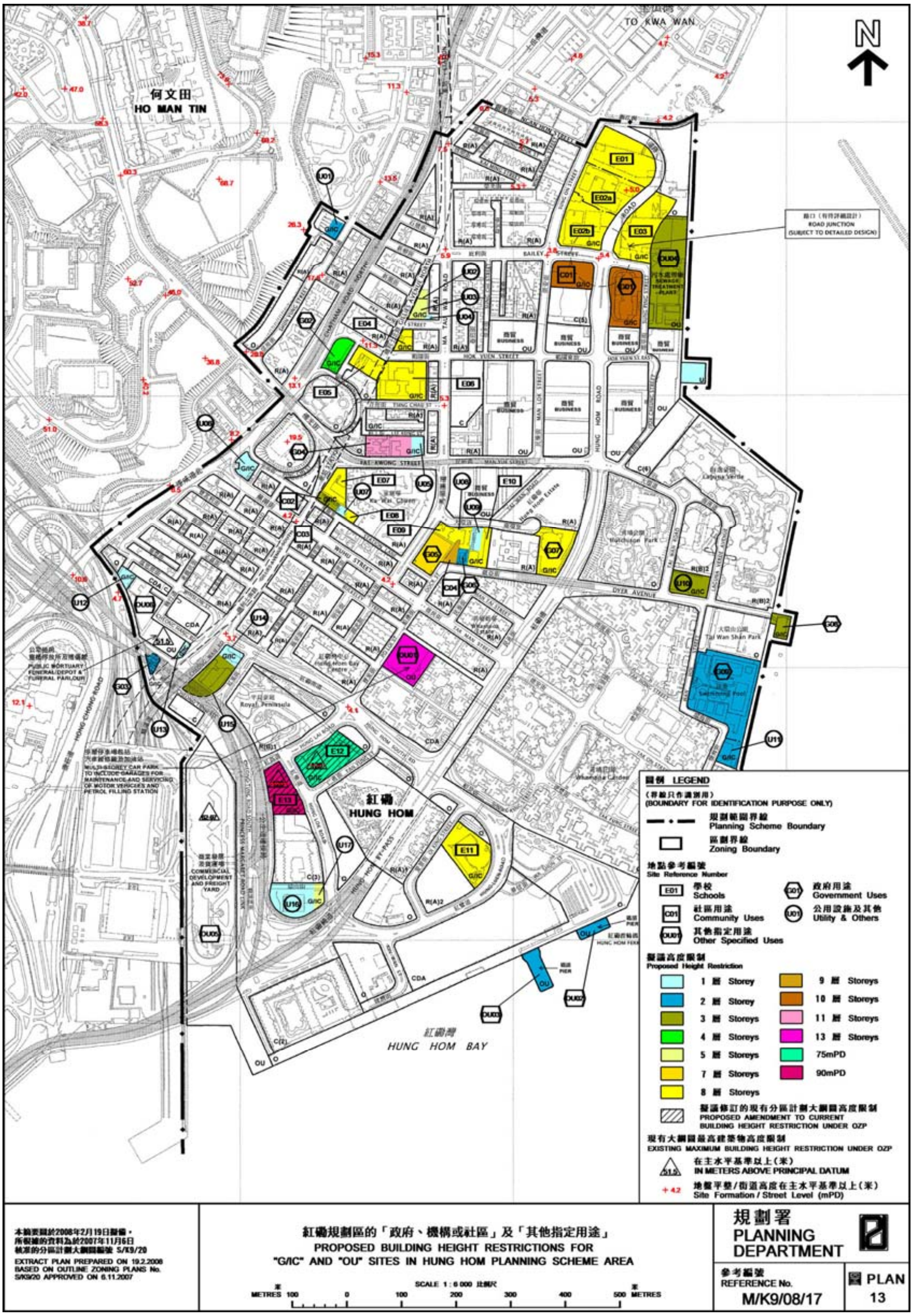


Figure 12.2 Proposed building height restrictions

13.7 The average existing building height of the residential developments in Zone B is about 50mPD. Significant increase in building height will decrease air ventilation. To moderate the adverse effect, it is suggested that buildings along all the main roads and streets in the zone should be set back to allow better air ventilation. Furthermore, provision of varying building height profile can help air mixing and air ventilation at street level.

13.8 The buildings at Zone C (“OU(Business)” on the Hung Hom OZP) are useful to the local wind environment of the inland area of Hung Hom. It is recommended that, if possible, buildable area in such areas should be reduced and the buildings along both side of Hok Yuen Street, Bailey Street and Fat Kwong Street be setback so as to widen the wind corridors and allow better air ventilation.

13.9 Zone D borders To Kwa Wan. It may be useful that buildings in this zone are of reduced and of varying heights so that the wake areas are reduced, and the south summer prevailing wind could ‘recover’ better when reaching TKW. In addition, north-south air paths and non-building areas through Zone D are useful.

13.10 The open areas along the Hung Hom South Road and the Hung Lok Road in Zone E are crucial for air circulation for Hung Hom. To maintain these 2 major wind corridors, it is recommended that the open space designations should be retained. No building should be allowed on them. Extensive greenery and tree planting along these wind paths is recommended. The proposed step height profile and the provision of view corridor for the “CDA” and “R(A)2” sites can maintain the wind penetrations for winds prevailing south-east direction.

13.11 Notwithstanding sections 13.3 to 13.10 above, given the inevitability of taller buildings and higher H/W ratio when sites are re-developed to maximise their development potentials, “damage to air ventilation will inevitably be done”, as such, building height is no longer the critical design parameter for better air ventilation. That is to say, height restrictions itself is not an effective measure to safeguard or improve the air ventilation of the study area. For example, all other parameters remain the same; a difference of building heights of 100 and 120m (~H/W=5:1 or 6:1) or 120m and 150m (~H/W=6:1 or 7:1) is NOT going to make a noticeable difference to ground level pedestrian wind environment.

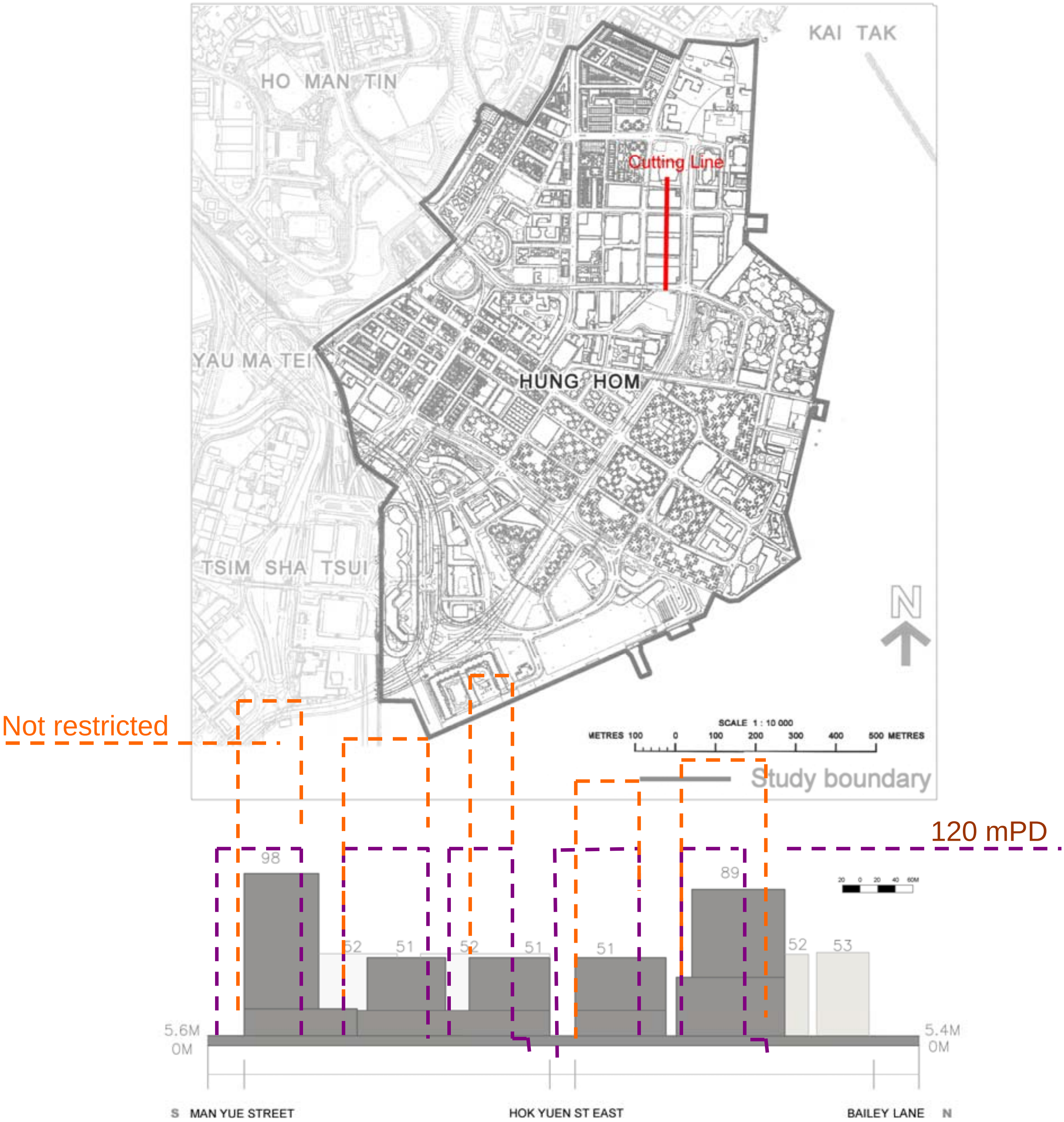


Figure 13.1 Section

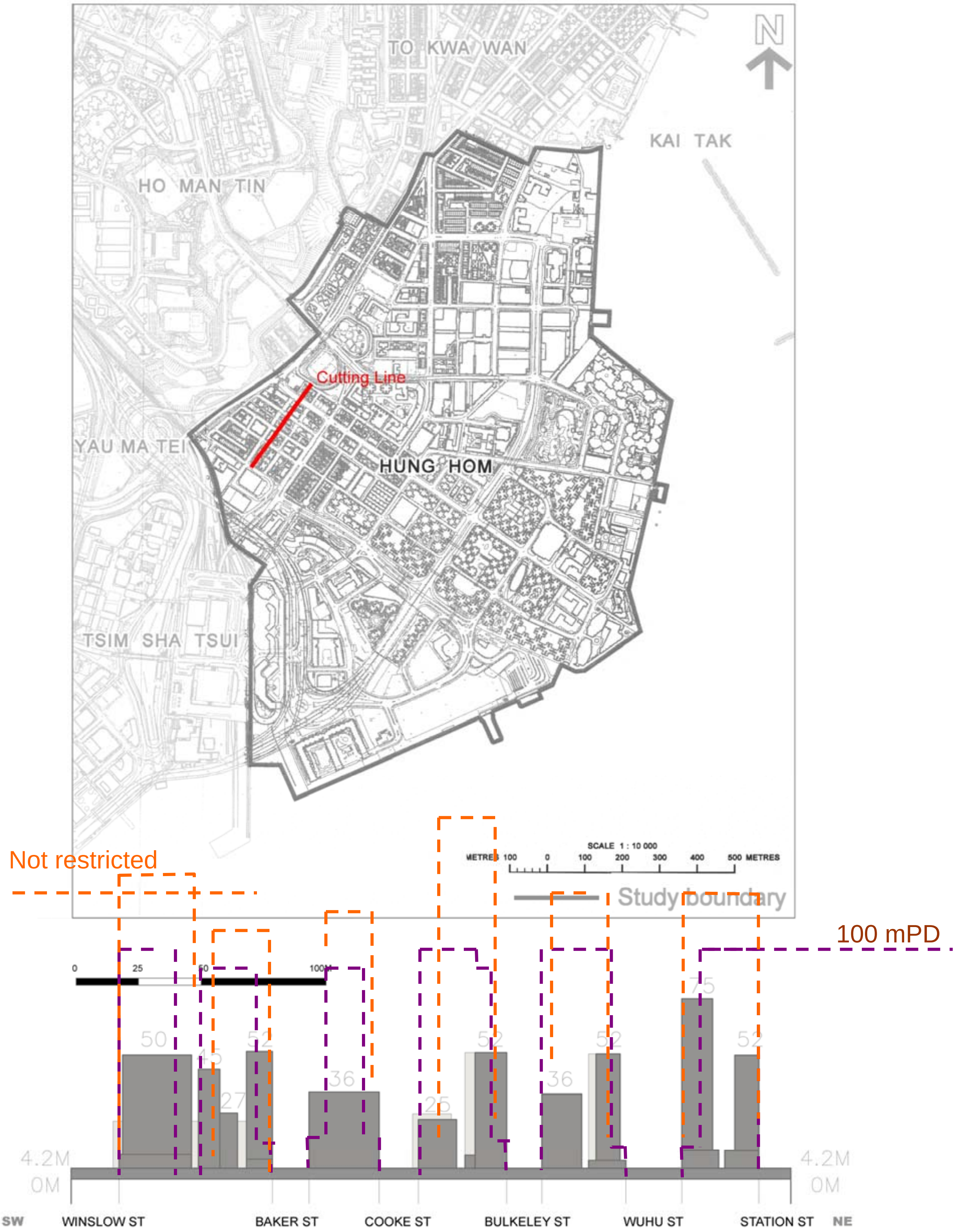


Figure 13.2 Section

13.12 Based on this "the damage will inevitably be done" basis, given the high H/W to be expected, it is unlikely that the proposed building height restrictions in itself would either improve or worsen the "to be" poor performance of air ventilation in the denser parts of the study area. (Figure 13.3) There are other more important design parameters, like air paths.

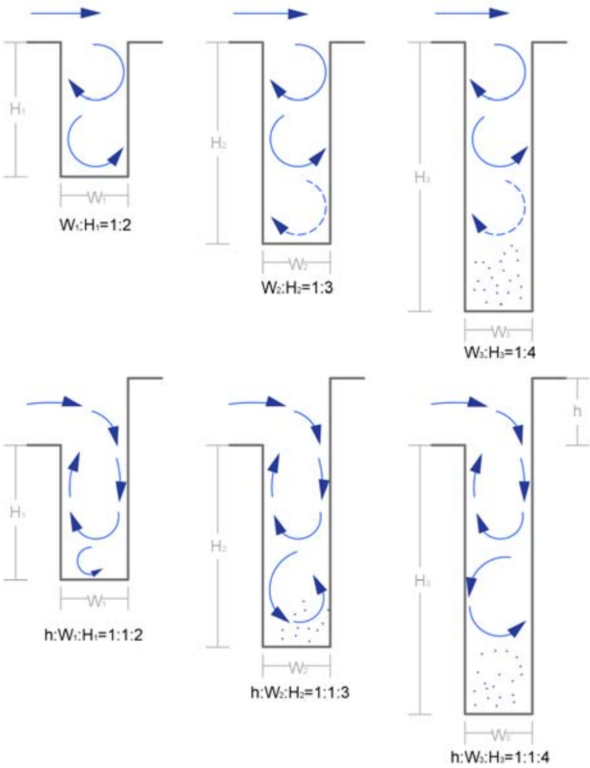


Figure 13.3 A generic understanding of wind regimes in canyons, and canyons with downwashes. Beyond a H/W ratio of 2:1, the ground level of canyons, even with the so call downwash effects, will have very weak air ventilation.

[Reference: 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 OFWIND TUNNEL EXPERIMENTS AND NUMERICAL SIMULATIONS, Water, Air, and Soil Pollution: Focus 2: 365–380, 2002, Kluwer Academic Publishers.]

13.13 As a further note, for "building height" as an understanding, in general, for air ventilation:

(a) A variation of building heights in close proximity is preferred than buildings with the same height. A range of building heights with a min/max of 1:2 is ideal. That is to say, for example, building heights can be in a range between 60m to 120m.

(b) Beyond a building height to street width ratio of 3:1, the ground level pedestrian air ventilation (AV) environment will be weak, and "the damage will inevitably be done". There is very little difference of the AV environment for H/W of say 5:1, 6:1 or 7:1.

13.14 In addition, given the same building bulk, in theory, an area with taller buildings of smaller footprints has more air space at the ground level for air ventilation. This is particularly useful if the alignment of the air spaces follows the prevailing wind direction. In practice however, project proponent would try to maximize the sea view and would develop with the major façade frontage facing the sea anyway, a reduction of footprint by decreasing the depth of the building is not going to assist air ventilation. Given the need to build tall buildings in Hong Kong, the disposition of buildings to allow air paths through the site is a far more important design consideration than building height.

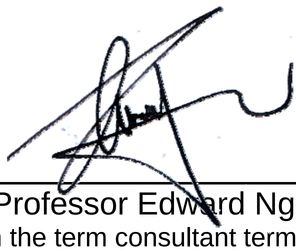
14.0 Further Recommendations

14.1 For air ventilation, the proposed building height restrictions might be considered, if at all, a “small” step towards the goal. It is important to further carry out studies with a view to establishing guidelines and stipulating restrictions on the more important design parameters like Open Space, Air Paths, Site Coverage and Non-building Area, and so on. Without these further measures and understanding, air ventilation of the study area cannot be secured, or assessed.

15.0 Focus Areas and Further Studies

15.1 Due to the consideration to allow development rights, potential high-rise re-developments will happen and hence the damage to air ventilation will inevitably be done, building height control in itself is NOT an effective mechanism for better air ventilation. The consultant opines that, given the magnitude of the building heights to be considered, there would unlikely to be a lot of difference between the “to be poorer” air ventilation performance under the “with” and “without” the proposed building height restrictions. Fundamentally, it is impossible to ascertain the air ventilation performance based on only on height information of buildings. Further AVA studies comparing the “with” and “without” options may not be necessary or even beneficial as it is not possible to specify the more important parameters (e.g. building geometry and block disposition within each of the building sites) in the tests; as such, no meaning result is possible.

15.2 A detailed AV assessment requires information beyond density, building heights and plot ratios. The information on building heights can provide the initial understanding to estimate the ground roughness. That is to say, high density city and tall buildings obviously will increase the roughness and reduce AV, but designing and positioning the buildings one way or another could either reduce the impact or worsen it – and the difference could be more significant. As such, building shapes, building disposition and position, air paths, gaps and permeability, are the more important design parameters to optimize the AV performance of the study area.



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