

Planning Department

**Term Consultancies for
Air Ventilation
Assessment Services**

Expert Evaluation on
Wong Nai Chung Area

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Air Ventilation
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Expert Evaluation on
Wong Nai Chung Area

December 2008

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Job number 25180

Job title	Term Consultancies for Air Ventilation Assessment Services	Job number	25180
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Document title	Expert Evaluation on Wong Nai Chung Area	File reference	
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Document ref

Revision	Date	Filename			
Draft 1	17/12/07	Description	First draft		
			Prepared by	Checked by	Approved by
		Name	Various	Rumin Yin	Raymond Yau
		Signature			
Draft 2	24/12/07	Filename	Wong Nai Chung Expert Evaluation_draft 2.doc		
		Description	Second Draft that incorporated the comments from the PlanD		
			Prepared by	Checked by	Approved by
		Name	Various	Rumin Yin	Raymond Yau
		Signature			
Issue 1	31/12/07	Filename	Wong Nai Chung Expert Evaluation_issue 1.doc		
		Description	Issued report version 1		
			Prepared by	Checked by	Approved by
		Name	Various	Rumin Yin	Raymond Yau
		Signature			
Issue 1 Revision 1	09/01/08	Filename	Wong Nai Chung Expert Evaluation_issue 1_revision 1.doc		
		Description	Incorporate the updated planning drawing		
			Prepared by	Checked by	Approved by
		Name	Various	Rumin Yin	Raymond Yau
		Signature			

Issue Document Verification with Document

Job title	Term Consultancies for Air Ventilation Assessment Services	Job number
		25180

Document title	Expert Evaluation on Wong Nai Chung Area	File reference
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Document ref

Revision	Date	Filename	Wong Nai Chung Expert Evaluation_with_amendment.doc		
Issue 2	16/12/08	Description	Comments for Amendment Plan		
			Prepared by	Checked by	Approved by
		Name	Various	Rumin Yin	Raymond Yau
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

Issue Document Verification with Document

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1 Introduction

Ove Arup and Partners Hong Kong Limited (Arup) was commissioned by Planning Department to provide an expert evaluation on the proposed building heights of the development sites within the Wong Nai Chung from air ventilation perspective. This consultancy study is based on the methodology of Air Ventilation Assessment as set out in Technical Circular No. 1/06 issued jointly by Housing, Planning and Lands Bureau and Environment, Transport and Works Bureau and its Annex A – Technical Guide for Air Ventilation Assessment for Development in Hong Kong.

2 Objective of the Study

The objective of this assignment is to assess the likely impact of the proposed building height and planning of the development sites within the study area on the pedestrian wind environment as compared to the existing condition.

3 Study Scope

The scope of work includes the tasks as follows.

- To identify any potential problem areas due to the proposed building heights;
- To provide recommendation on how the problems may be alleviated;
- To identify any key ventilation corridors to be preserved or reserved;
- To advise whether any more detailed study is required for focused areas and the scope of the detailed study required.

4 Study Area

4.1 Site Boundary

The study area is the Wong Nai Chung Area (The Area) in the central part of Hong Kong Island. This Area is bounded by Leighton Road in the north, Hong Kong Stadium and Tai Hang Road in the east, Wong Nai Chung Gap Road in the south and Stubbs Road in the west. It has been substantially developed and forms part of the existing urban areas of Hong Kong Island. (Figure 1)

The Area sits on basin of the valley. Owing to the hilly terrain, the street level of Wong Nai Chung Area ranges from +4mPD to +140mPD. The north-western part of the site is Happy Valley Racecourse with a relatively low elevation of approximately +7mPD. The built-up area is mainly concentrated in the south-eastern part of the Area. The whole site is surrounded by green belt except the connection to Causeway Bay Area.

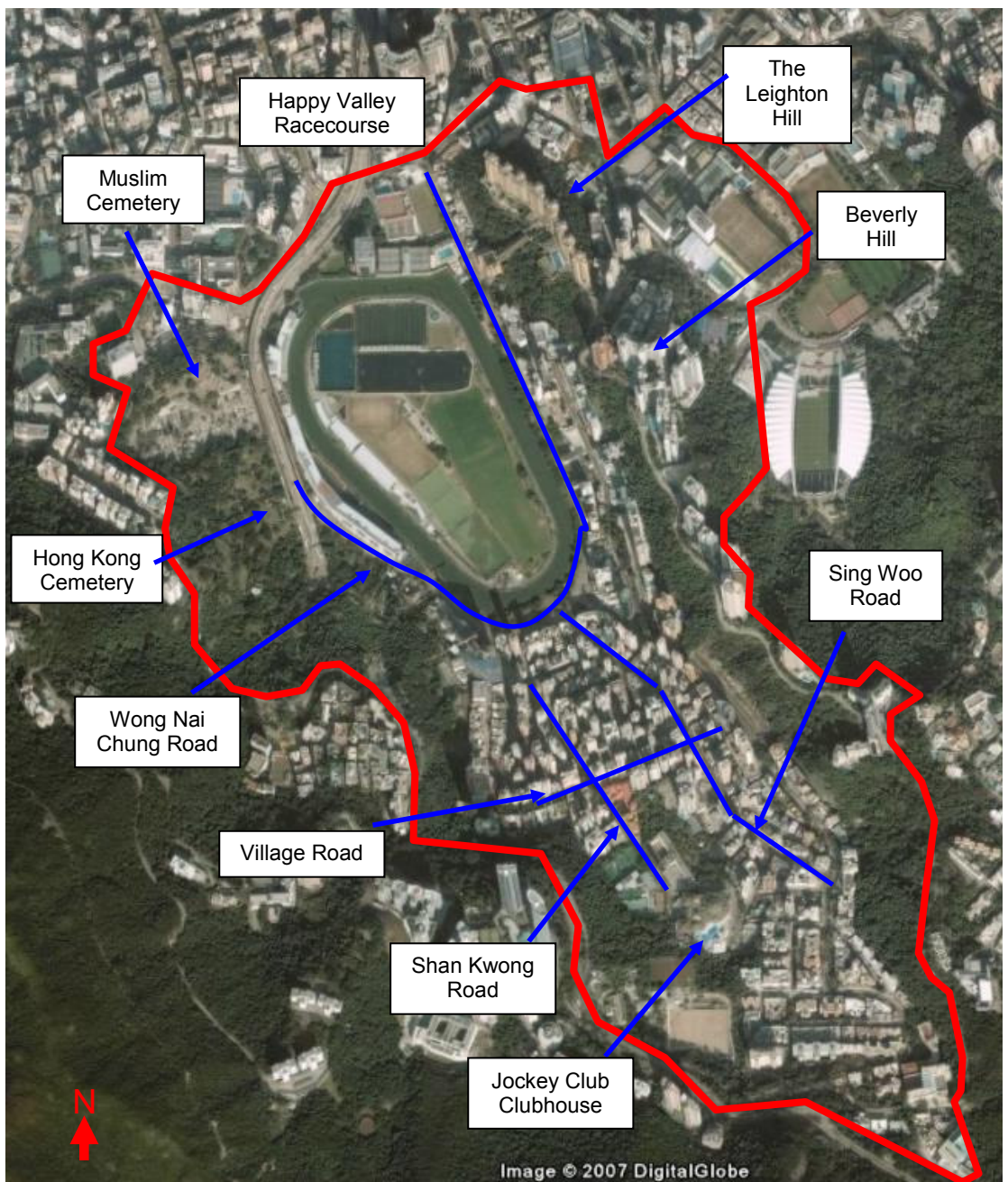


Figure 1 The Study Area (source from Google Earth)

4.2 Site Characteristic

The Area has been mostly developed. The development within the Area mainly encircles the valley floor stepping up to the higher grounds of the valley. The large and open Happy Valley Racecourse and Happy Valley Sports Ground in the centre of the valley plain are the predominant landscape features of the Area.



(a) Happy Valley Racecourse



(b) Broadwood Road and Wong Nai Chung Road



(c) The Leighton hill



(d) Wong Nai Chung Road to Shan Kwong Road



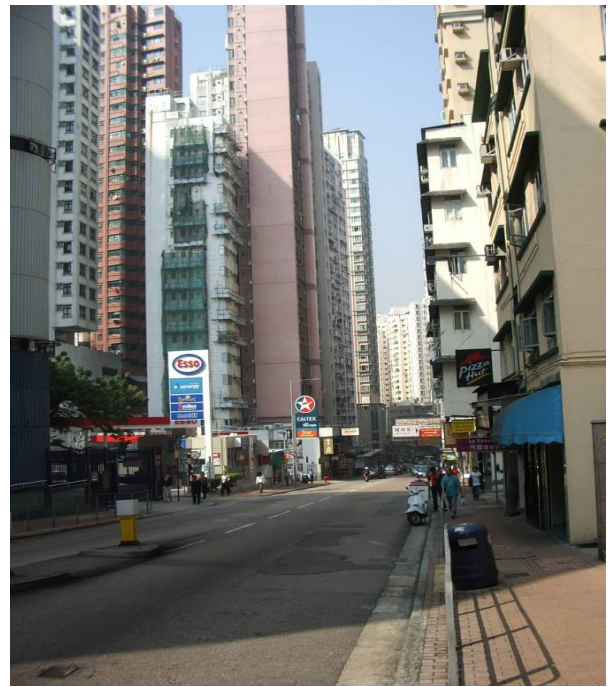
(e) View of Broadwood Road at Link road



(f) Caroline Hill road



(g) Blue Pool Road



(h) Sing Woo Road



(i) Wong Nai Chung Road



(j) Shan Kwong road



(k) Village Road

5 Wind Availability

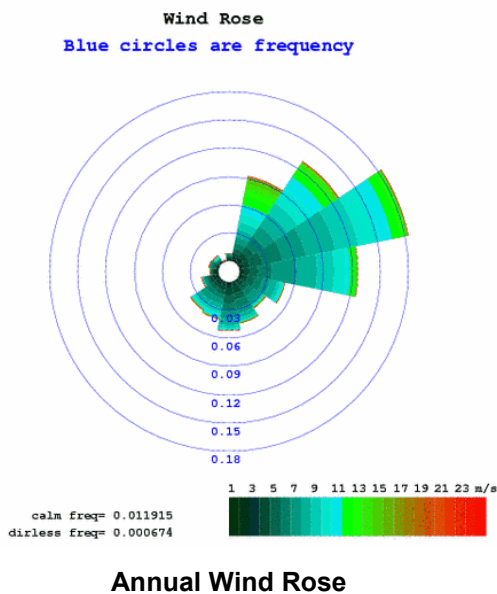
The wind availability of the site is an essential item to investigate the wind performance of the development. Since no Hong Kong weather station is located within the site, site wind availability data (V_{∞}) is achieved by mathematical models, which is provided by Planning Department.

5.1 Wind Data from MM5 Simulation Result

To facilitate AVA expert evaluation study, the wind data of MM5 simulation results at the height of 230 m above Ho Man Tin Area from HKUST¹ was provided by Planning Department and utilised in this study.

As the wind data below 200 m may be distorted by the highrise buildings and could not present the realistic wind characteristic of the site, the wind data at height of 230 m above the sea level were selected to demonstrate the wind characteristic of the site, with the consideration of surrounding topographical impact on the wind direction.

As shown in Figure 2, it can be concluded that Eastern (E) and North-Eastern (NE) winds dominate the annual wind frequency. While in summer period, the winds are mainly coming from South-western (SW) to Eastern (E) directions. Similar to the annual wind frequency characteristic, Eastern (E) and North-Eastern winds dominate in non-summer period.



¹ Acknowledgment: The MM5 wind data applied here was adopted from the Institute for the Environment (IENV), the Hong Kong University of Science and Technology (HKUST)

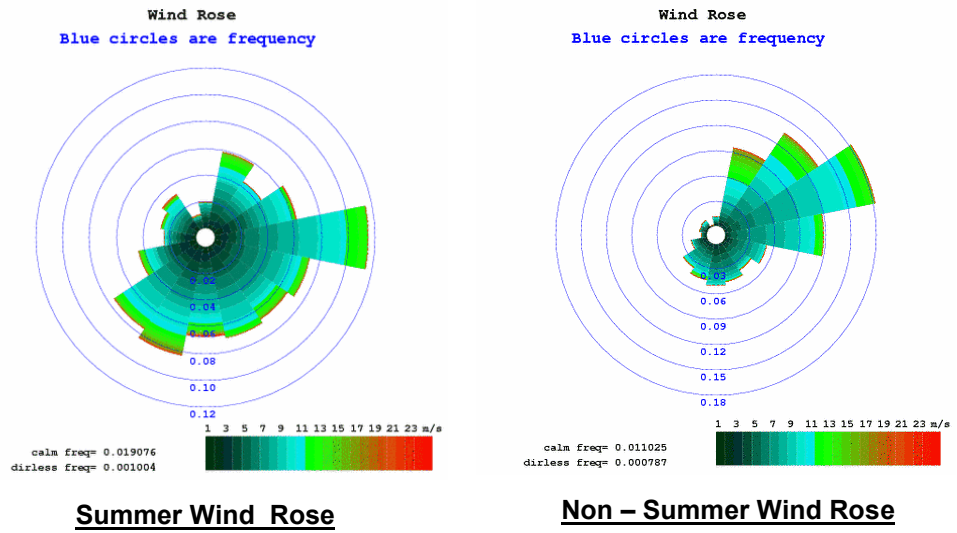


Figure 2 Annual and seasonal wind rose from MM5 data

6 Expert Evaluation on Existing condition and proposed OZP

6.1 Existing Condition

The existing building heights of the site area are shown in Figure 3.

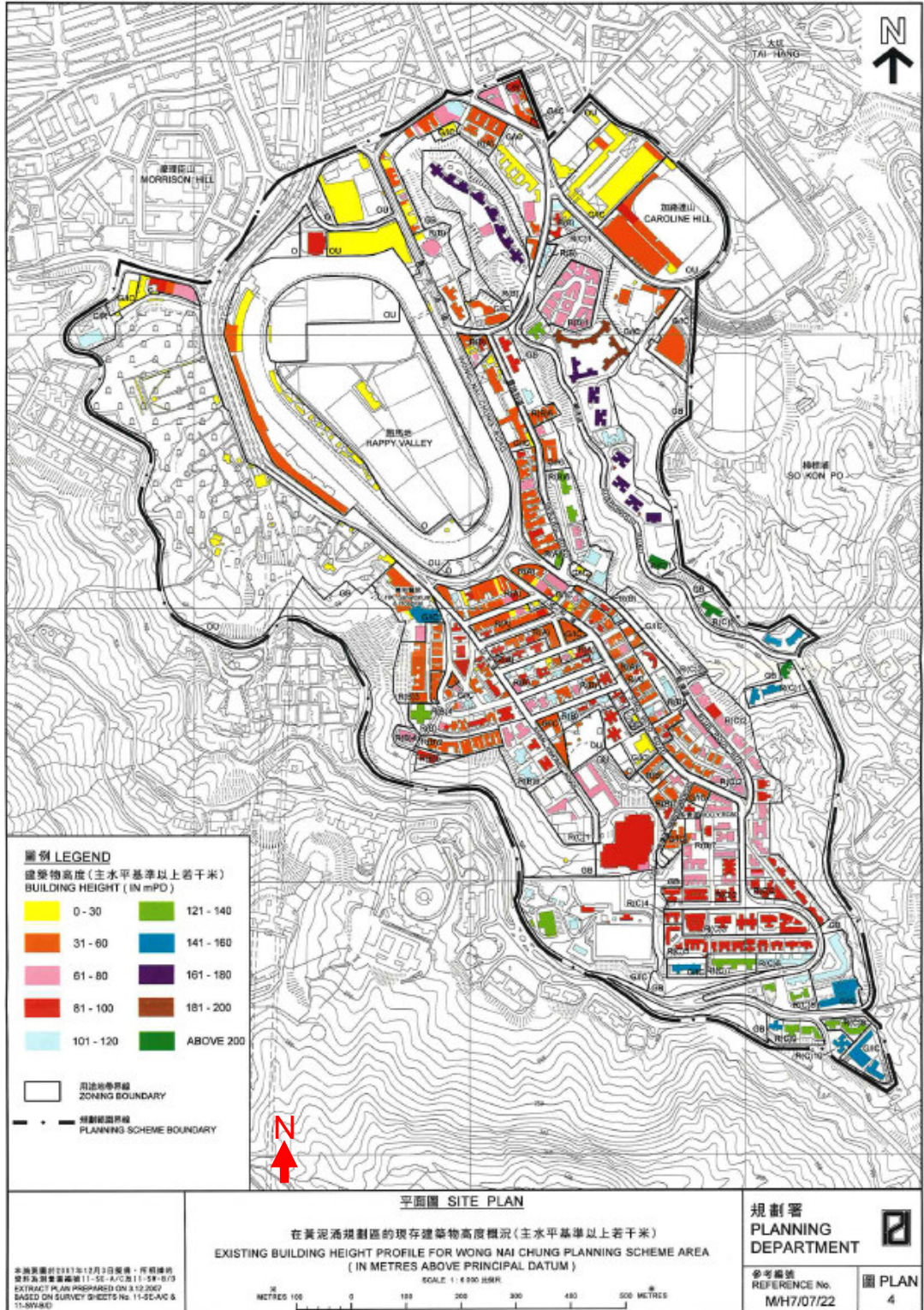


Figure 3 Building height of existing buildings

The wind environment characteristics of the existing area are summarised as follows.

- The whole site is mainly characterized by medium/high rise buildings with height variation from +30mPD to 250mPD. The building height is generally ramping up from north-western to the south-eastern part of the site
- The western part of the site is relatively open, which contains cemeteries and Happy Valley Racecourse. Hence, the ventilation environment there should be relatively good.
- The street patterns of main road at the southern area are relatively regular, roads are mainly laid from north-west to the south-east direction. However, the connectivity to the bystreets is not so satisfactory, such as Tsoi Tak Street, Yuen Yuen Street, Min Fat Street, Cheong Ming Street and Sing Ping Street. This may reduce air penetration along the streets.
- One of the important characteristic of Wong Nai Chung Area is the open areas at the north-western part. Such wide span open area allows more wind at high level wind going down to the pedestrian level. These areas may be treated as the main wind entrances of the Wong Nai Chung Area.
- Several major roads along NW to SE directions, such as Shan Kwong Road, Sing Woo Road and Blue Pool Road may serve as the major wind corridors of the Wong Nai Chung Area.
- The site with relative low-rise buildings located at the area near Happy View Terrace may be treated as one of the main wind entrances for NE wind.
- Shaded by Leighton Hill and its liner type high-rise buildings, the wind performance of area near the Leighton Road may not be good under summer SW wind condition.
- The southeast part of the Wong Nai Chung Area sits at the relatively high elevation of the valley. This topography characteristic with low-rise buildings acts as a wind entrance for summer SW wind.

6.1.1 Non-summer wind condition

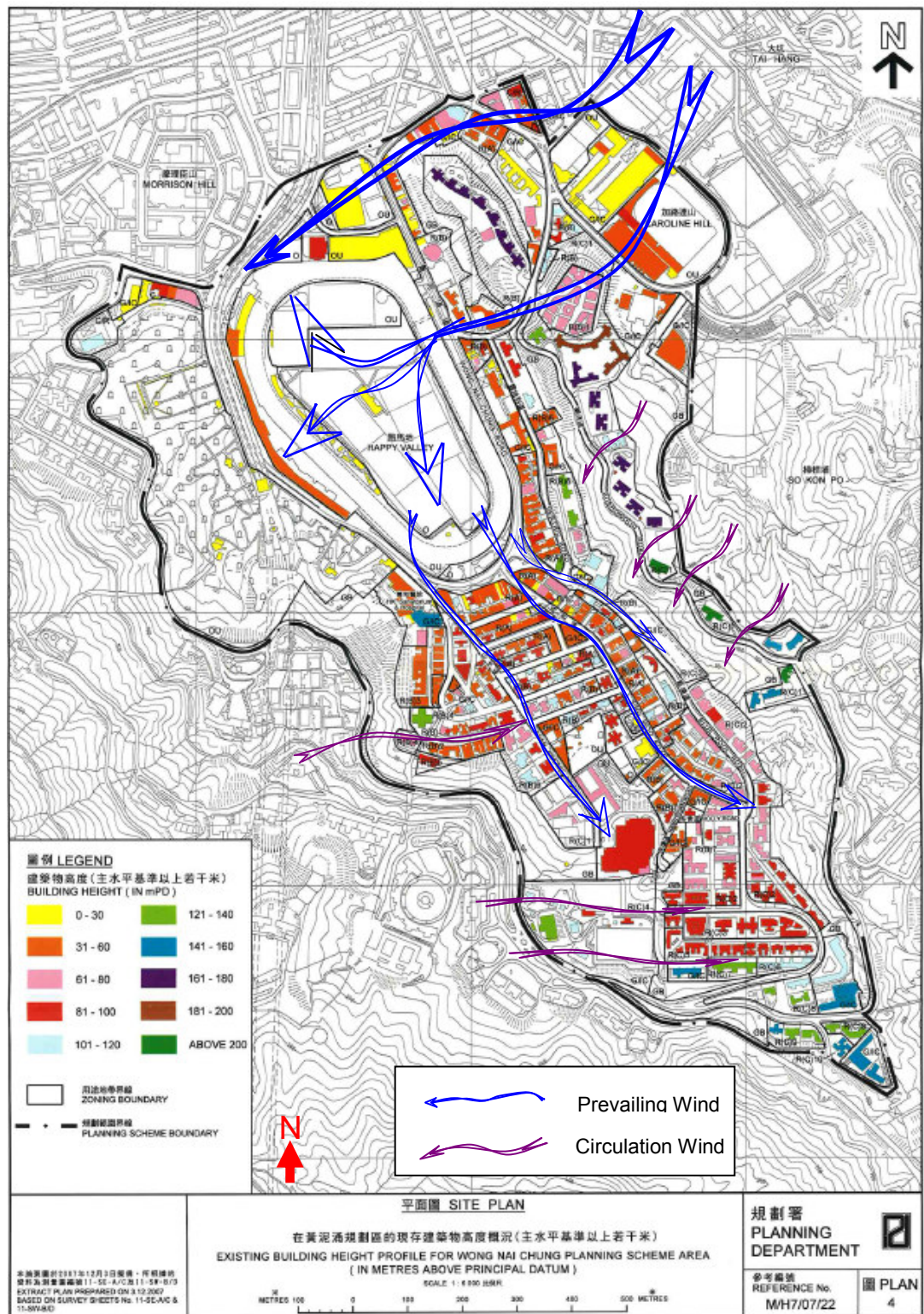
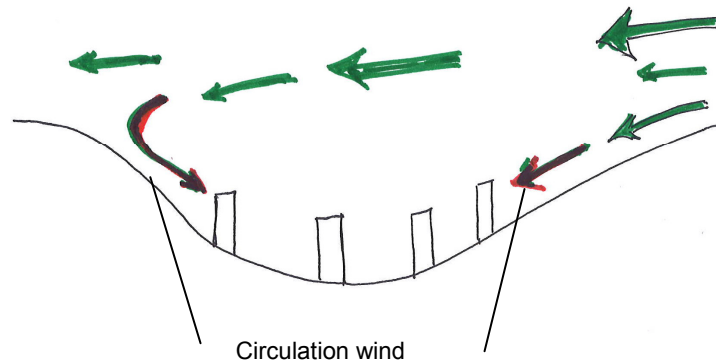


Figure 4 Wind performance in non-summer period

In non-summer period, the prevailing winds are from NE directions, as shown in Figure 4. The site wind performance can be summarized as following:

- Sitting on the basin of the valley and surrounded by the green belt, such special topographical feature may result in a unique wind environment of Wong Nai Chung Area. Circulation wind may run down the hill from the green area to built-up area along the slope.



- The buildings on the Leighton Hill is designed as a wall, diverts the north-eastern prevailing wind to the Morrison Hill area and then passes through the northern part of the site.
- The site with relative low-rise buildings located at the area near Happy View Terrace may be treated as one of the main wind entrances for NE wind.
- The incoming wind from the Happy View Terrace reaches the open area (Happy Valley Racecourse) and then redirects to the south-east direction due to the topographical effect.
- The wind then penetrates to the built-up area through Shan Kwong Road, Sing Woo Road and Blue Pool Road
- Shan Kwong Road, Sing Woo Road and Blue Pool Road may be treated as the main wind corridors for this built-up area, wind is delivered from these wind corridors to the bystreets.
- Existing building gaps at the area along Broadwood Road allows certain amount wind penetration.
- The street pattern of the southern part of Wong Nai Chung Area is irregular. Poor street connectivity may affect the wind penetration into the hinterland and result in relatively poor wind performance.

6.1.2 Summer wind condition

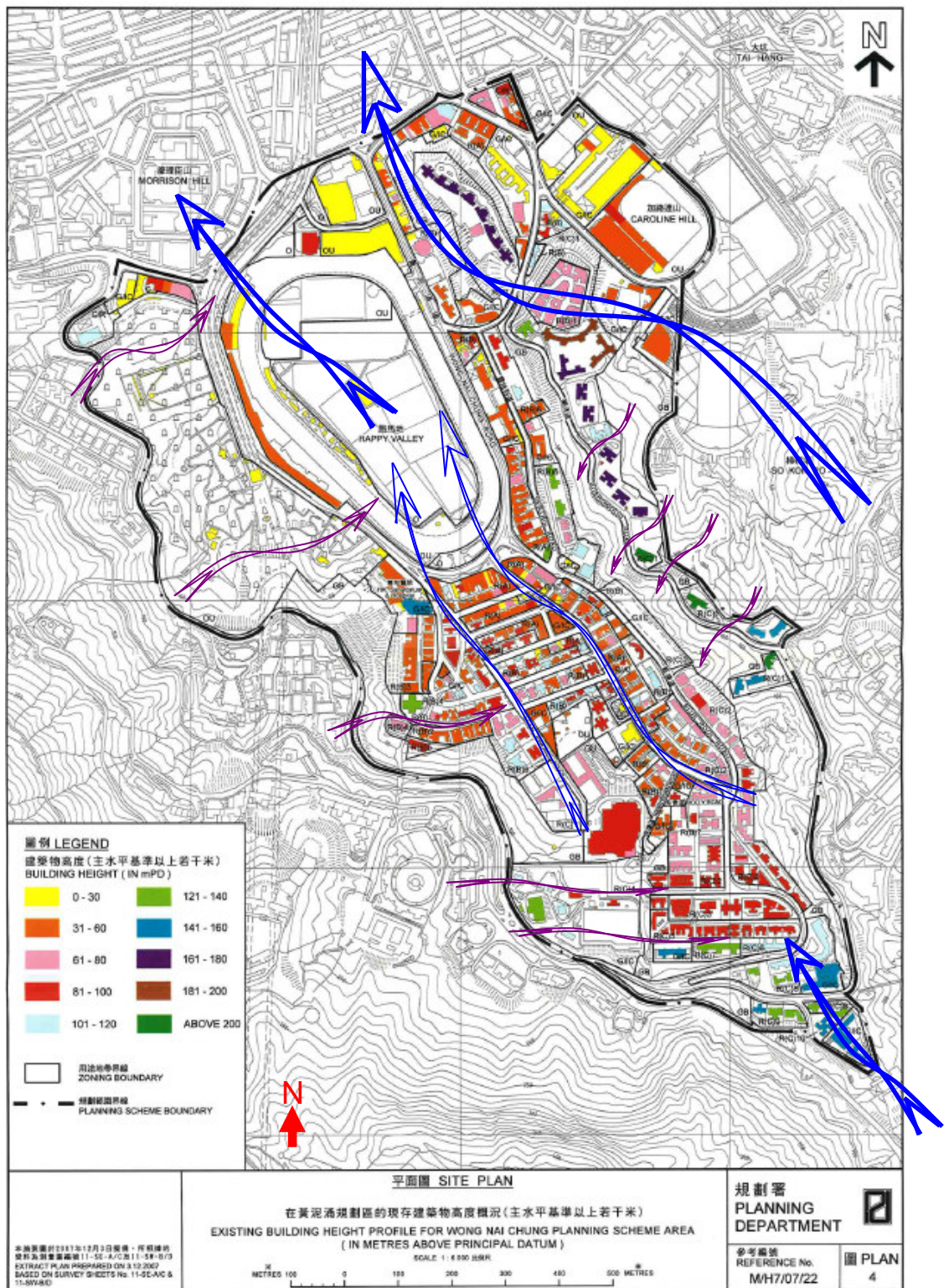


Figure 5 Wind performance in summer period

In summer period, the prevailing winds are from E to SW directions. However, due to the unique topographical feature of Wong Nai Chung Area, wind flow is confined by the valley and is channelled from SE to NW direction. Figure 5 shows the wind corridor under the prevailing wind condition. The wind performance of the study area is summarized as below.

- Shan Kwong Road and Sing Woo Road may still be treated as the main wind corridors for this built-up area, wind is delivered from these wind corridors to the bystreets.
- The southeast part of the Wong Nai Chung Area may also be the wind entrance under summer condition.
- Wind from Shan Kwong Road and Sing Woo Road reaches to the open area (Happy Valley Racecourse) at the low level.
- More wind at high level can also reaches to pedestrian level at the Happy Valley Racecourse area.
- Wind from Shan Kwong Road, Sing Woo Road is combined and further deliver to the Morrison Hill Area.
- The relative low-rise site located at the area near Happy View Terrace (between The Leighton Hill and Beverly Hill) may allow wind from So Kon Po hill penetrates to the Causeway Bay Area.
- Relatively direct connection between Village Road and Cheong Ming Street allows better cross ventilation between two sides of the valley
- The street pattern of the southern part of Wong Nai Chung Area is irregular. Poor street connectivity may affect the wind penetration into the hinterland and result in relative poor wind performance.
- Existing building gaps at the area along Broadwood Road allows certain amount of wind penetration.

6.2 Proposed Height Restriction

The air ventilation evaluation of Wong Nai Chung OZP under the proposed building height restriction during non-summer and summer period is evaluated in this section. Figure 6, Figure 7 and Figure 8 show the OZP proposed building height restrictions. Key ventilation corridors, wind performance and potential problem areas are also identified.

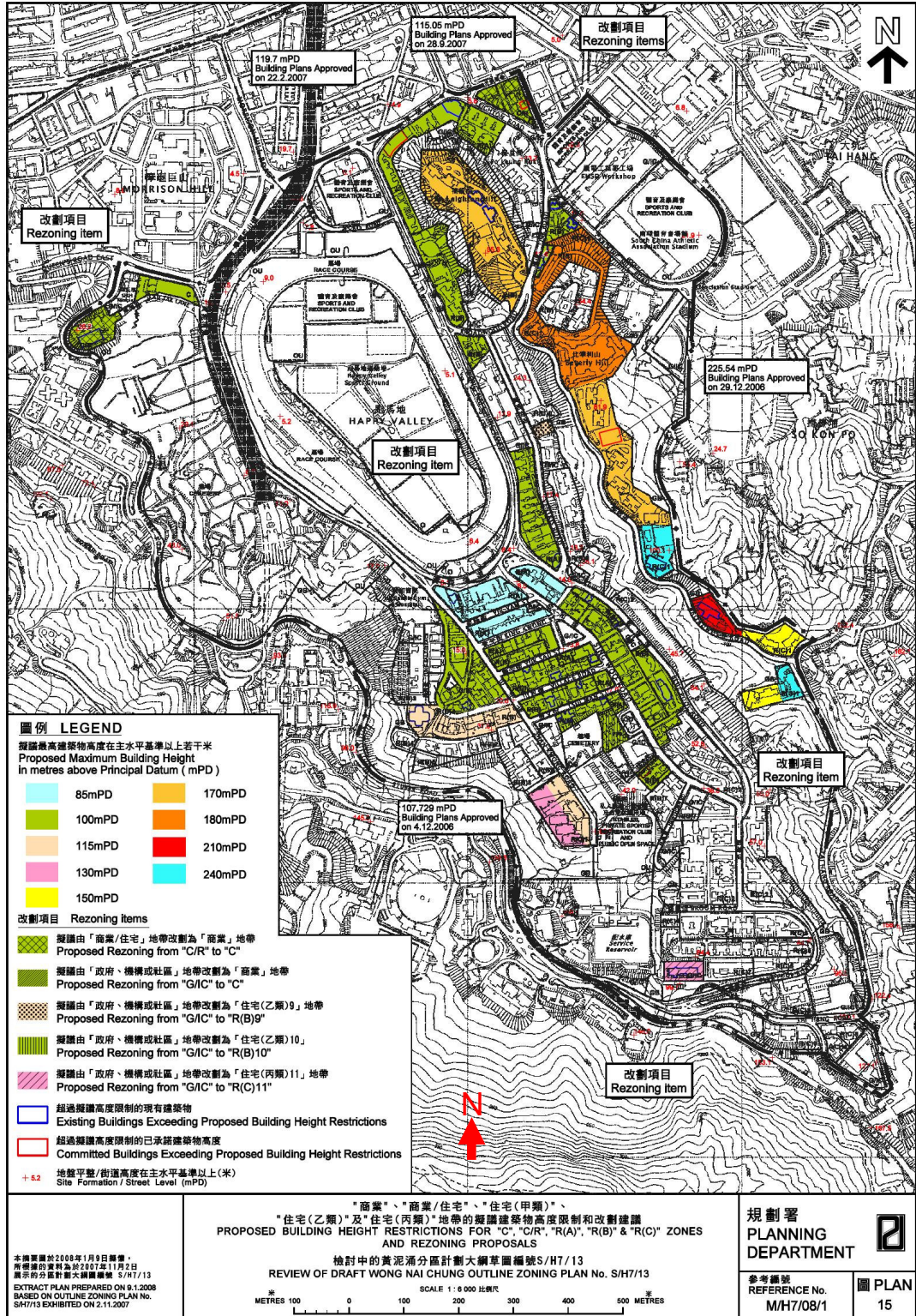


Figure 6 Proposed building height restrictions for Commercial and Residential zones on Wong Nai Chung OZP

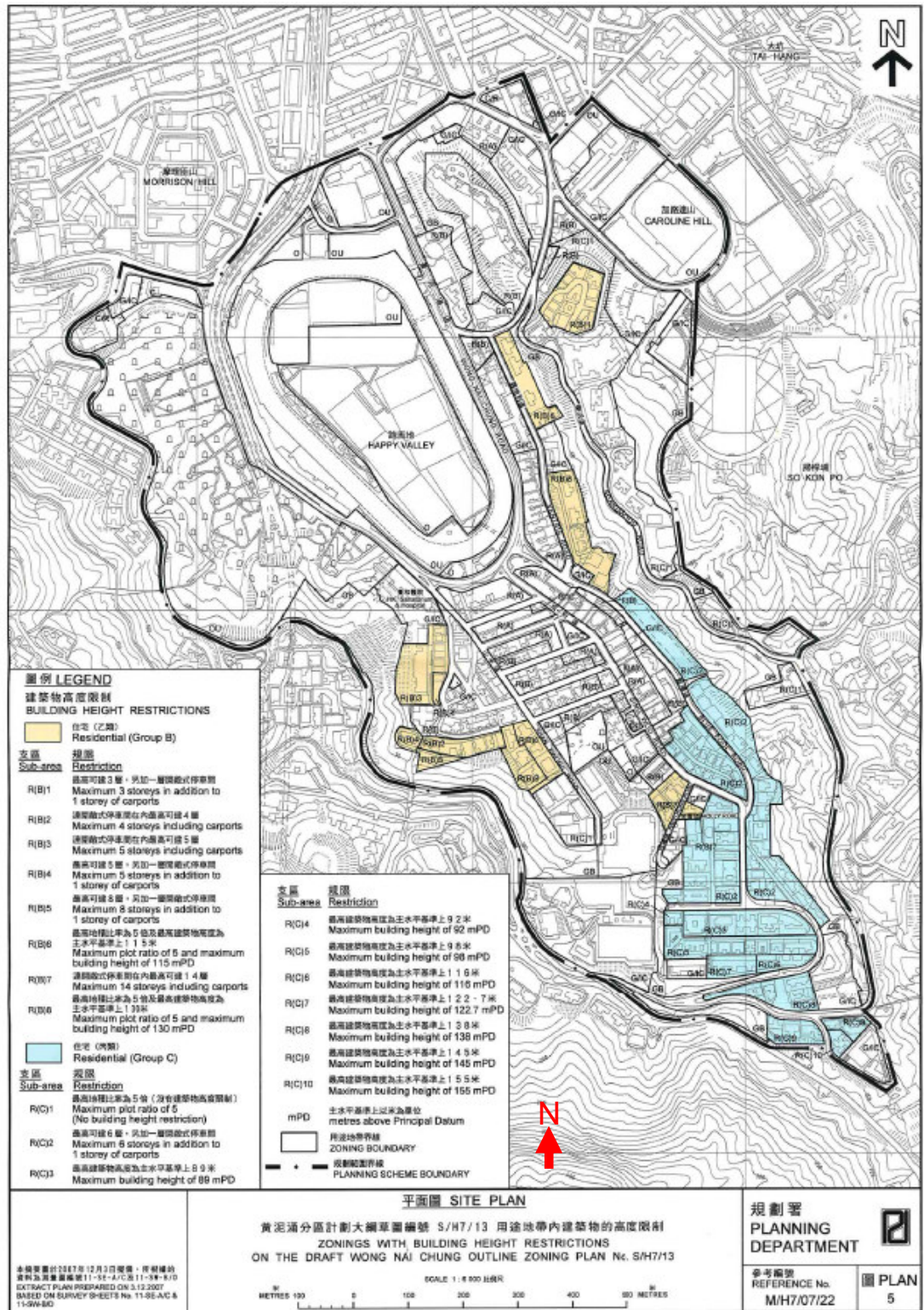


Figure 7 Existing building height restrictions for some R(B) and R(C) zones on Wong Nai Chung OZP

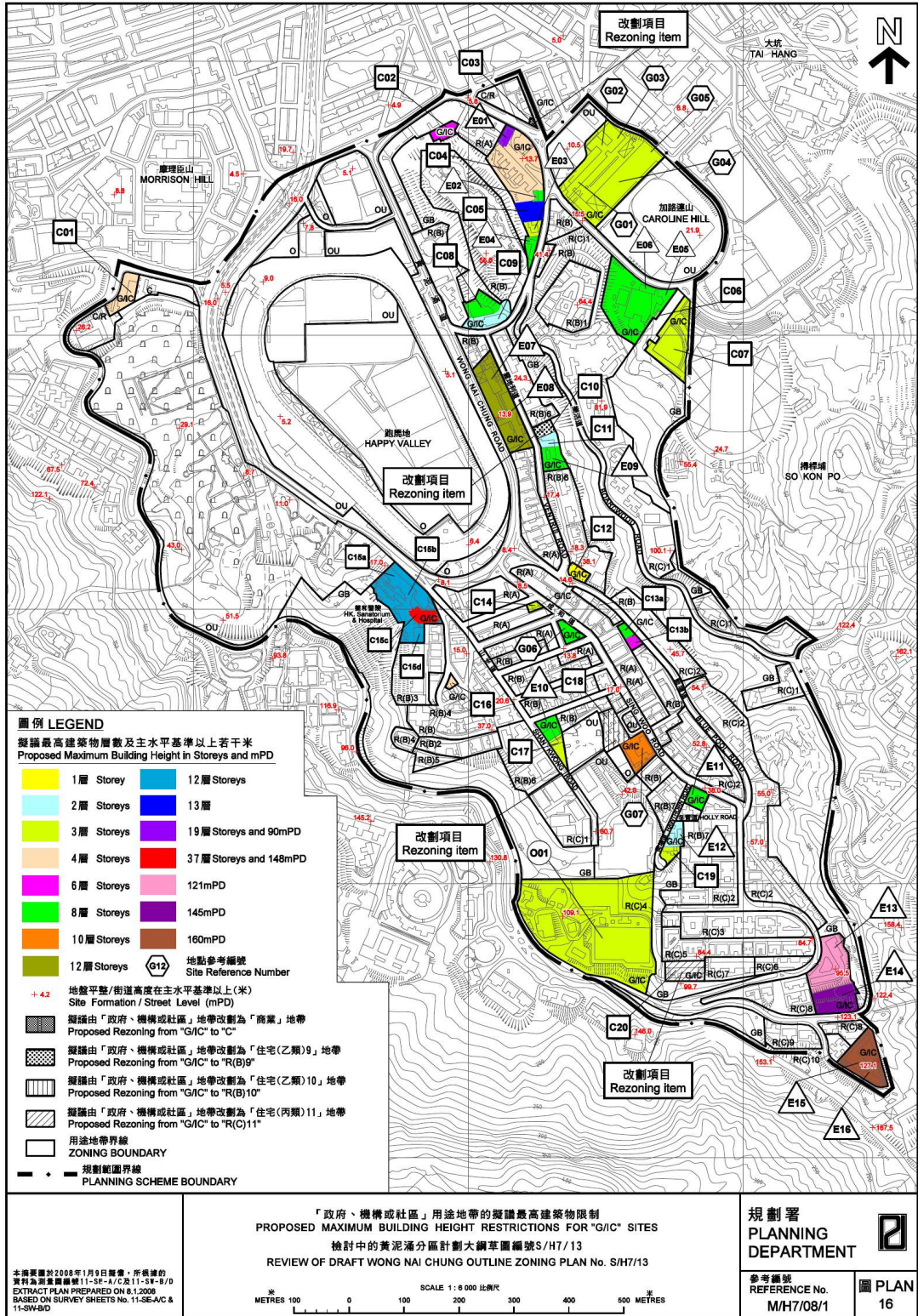


Figure 8 Proposed Building Height restrictions for "G/IC" sites on Wong Nai Chung OZP plan

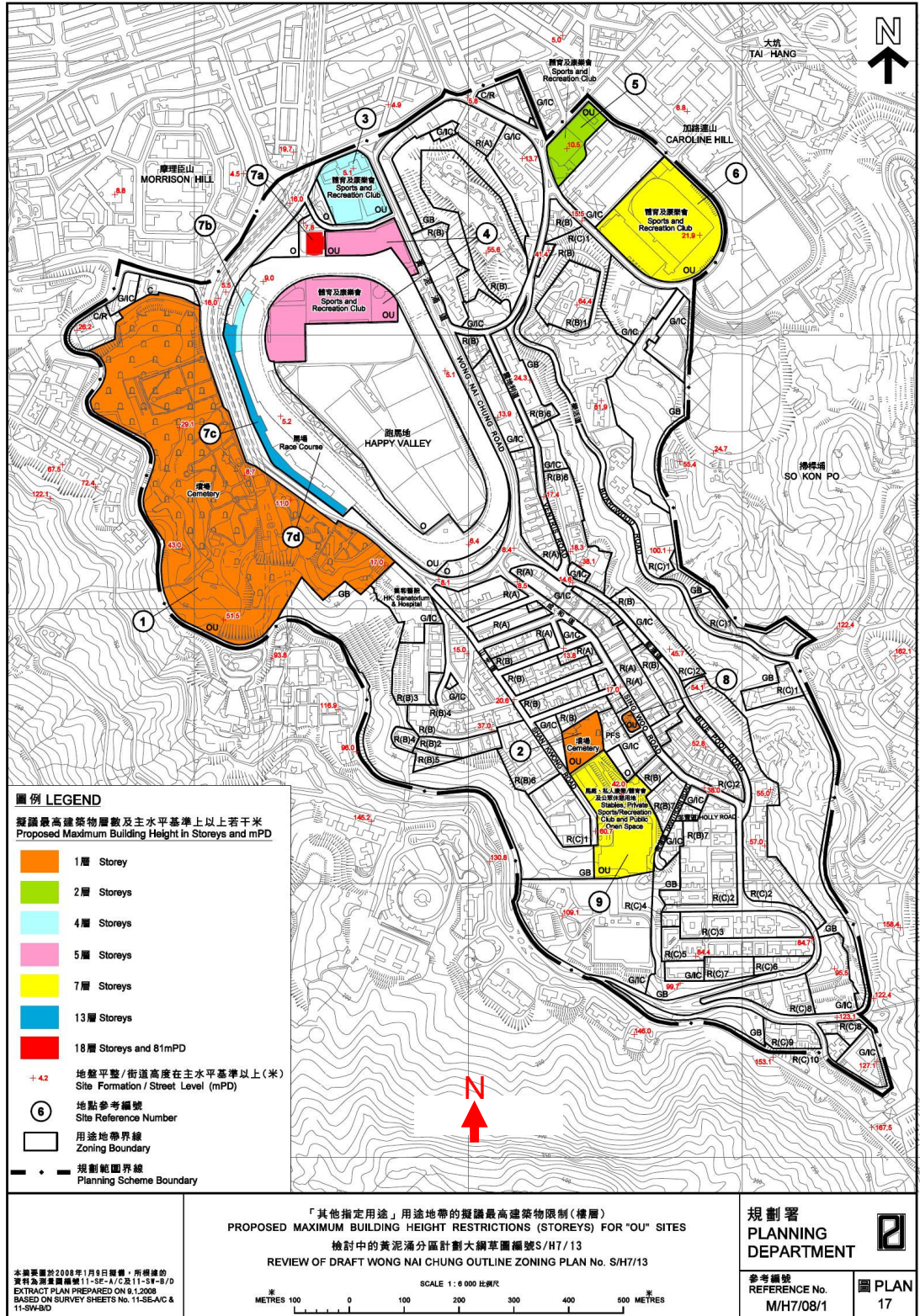


Figure 9 Proposed building height restrictions for “OU” zones on Wong Nai Chung OZP

The Area has been mainly planned for private residential and commercial zones. Most of the proposed building height restrictions in the Area range between +85mPD and +210mPD for “C”, “C/R”, “R(A)”, “R(B)” & “R(C)”. Since the street arrangement cannot be changed, the main wind corridors shall remain the same as the existing condition.

Compare with the existing condition, the following could be observed.

- The main wind entrance located at the area near the Happy View Terrace may be blocked. (Details will be discussed in Section 6.3.1)
- The site at the north-eastern part of Wong Nai Chung Area is linear type. Under current proposed OZP height restriction, if the gaps between buildings are not maintained while redeveloping, it may block the wind path to the Happy Valley Racecourse.
- The proposed building height at the junction of Wong Nai Chung Road and Shan Kwong Road may reduce the amount of air delivers to the wind corridors, i.e. Shan Kwong Road.

6.2.2 Summer wind condition

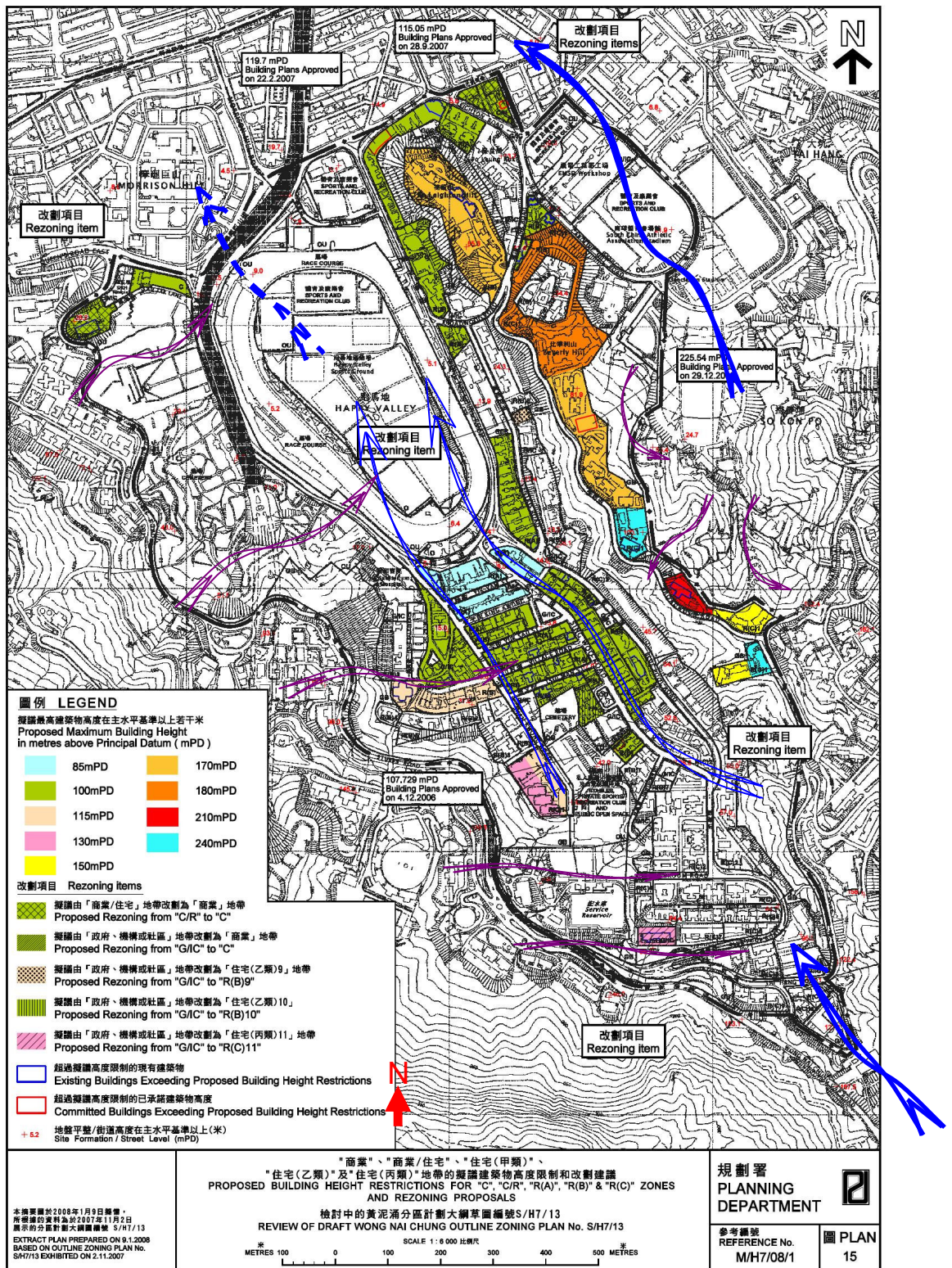


Figure 11 Summer wind condition

Under summer condition, similar to the existing case, wind flow is confined by valley and blowing from south-eastern to north-western direction. Shan Kwong Road and Sing Woo Road still perform as the main wind corridors of the site.

- Similar to non-summer condition, the liner building zone along the Broadwood Road may reduce the amount of the circulation wind running down to the basin of the valley.
- As the proposed building height at the area surrounded by Shan Kwong Road, King Kwong Road, Sing Woo Road and Wong Nai Chung Road is generally higher than existing condition, less wind may reach the Happy Valley Racecourse over the roof of proposed buildings.

6.3 Problematic areas and mitigation methods

The potential problem areas are identified with mitigation measures discussed in this section.

6.3.1 Area near Beverly Hill

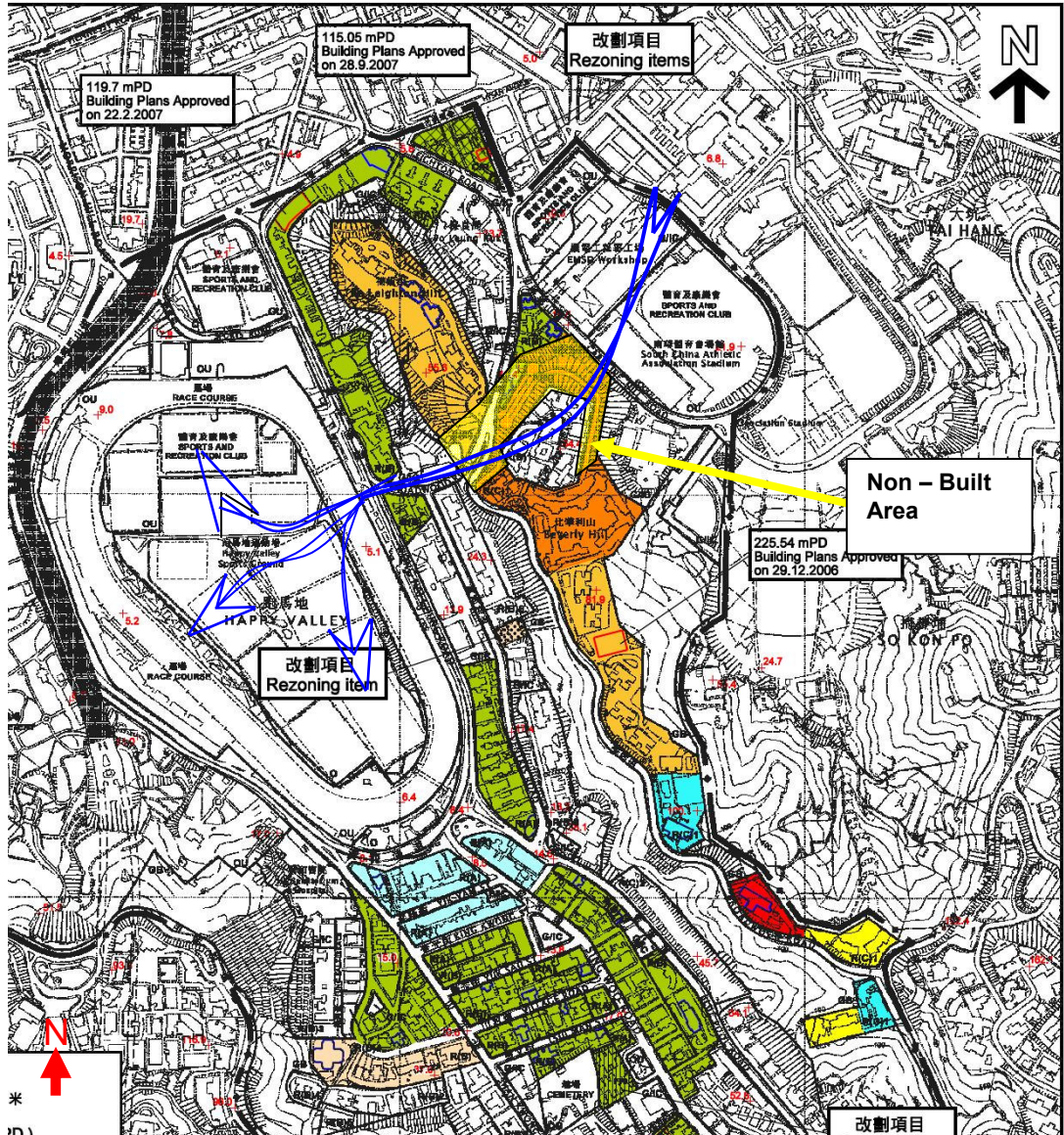


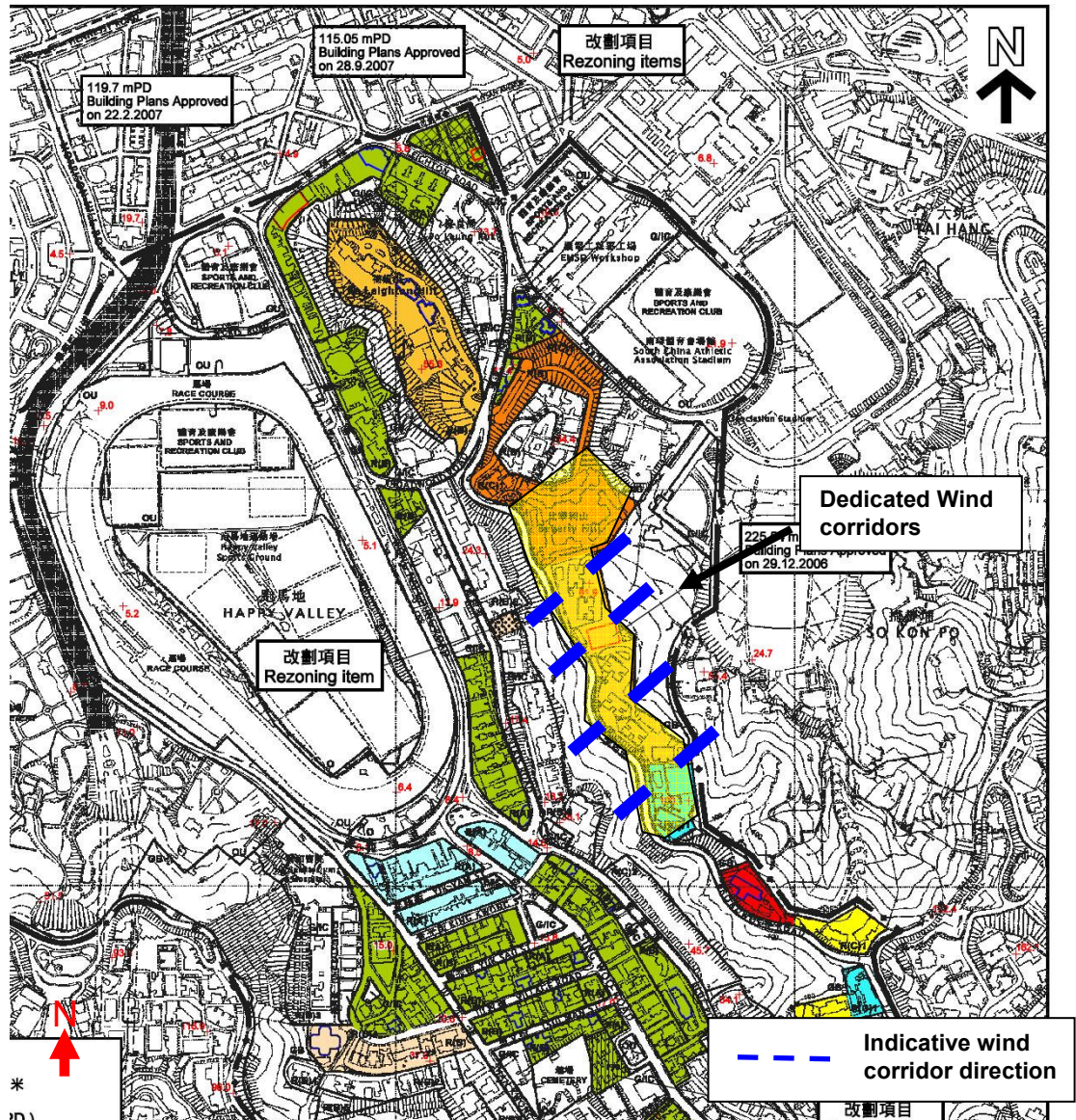
Figure 12 Area near Beverly Hill

Under existing condition, the area highlighted-yellow above is a vacant site, surrounded by the buildings around +190mPD. It is the wind corridor for NE and E winds. Under the planned scenario, a maximum building height of +180mPD is proposed. This may seriously block this wind corridor. Since this area is critical for the wind performance of the downstream area, it is suggested to

- Trim down the size of the development zone at Beverly Hill and designate the highlighted area as a non-built area, or
- Reduce the site coverage of the site as far as possible, and
- Set the proposed maximum building height as low as possible

so as to provide an effective wind corridor for wind penetration to the Happy Valley.

6.3.2 Area along Broadwood Road



6.3.3 South-East of Happy Valley Racecourse

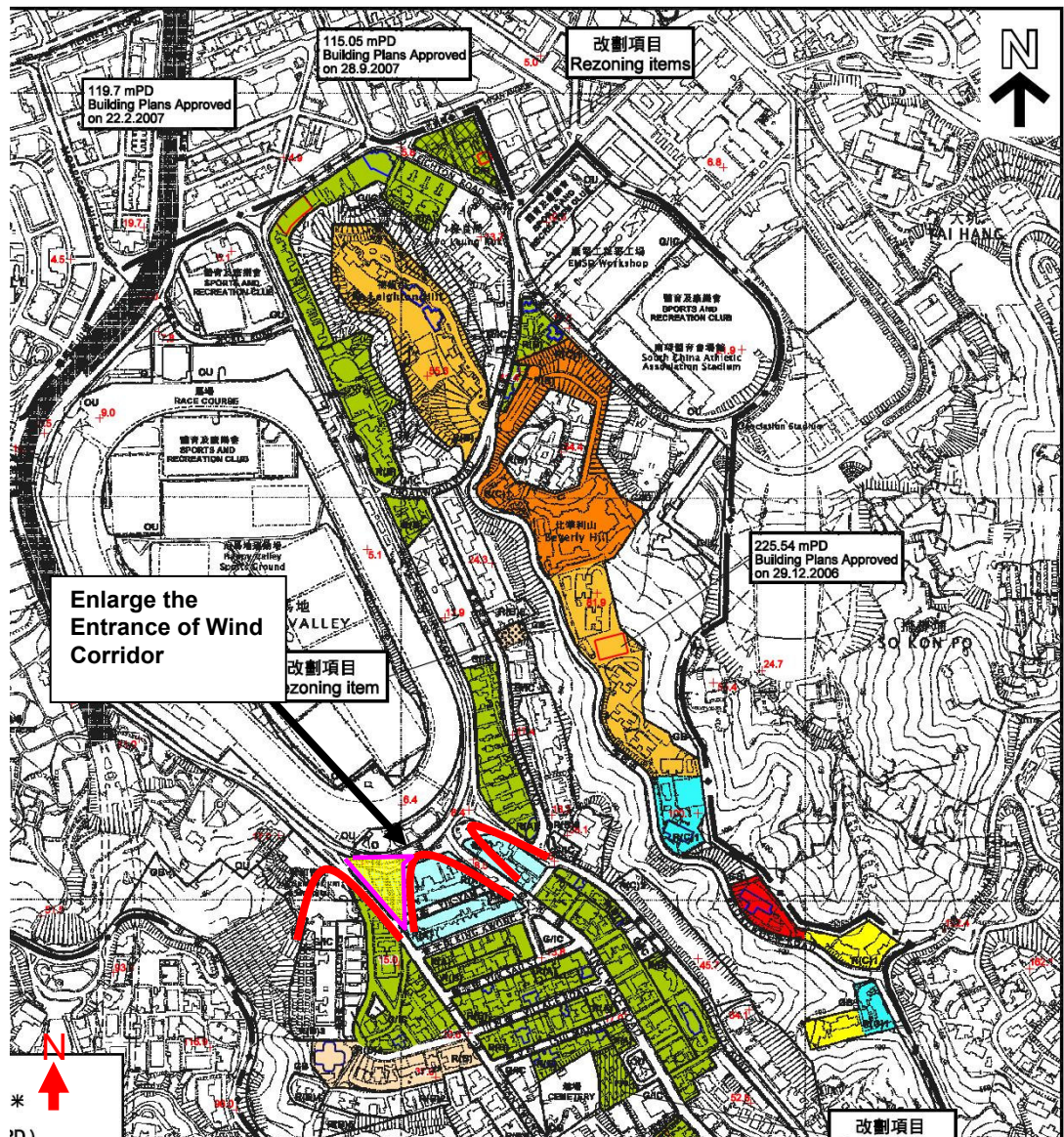


Figure 14 South-East of Happy Valley Racecourse

South-Eastern part of the Happy Valley Racecourse is the main wind entrance of Shan Kwong Road, Sing Woo Road and Blue Pool Road under the non-summer wind condition.

Currently, there is no special arrangement to enhance the wind performance of these corridors. In order to improve the wind delivery ability of these corridors, it is suggested to

- Designate dedicated wind corridors in the form of non-building areas in the highlighted zone to enlarge wind entrance to the Shan Kwong Road, Sing Woo Road and Blue Pool Road, and
- Encourage the more smooth buildings shape design to facilitate air penetration along these roads.

6.3.4 Shan Kwong Road and Sing Woo Road

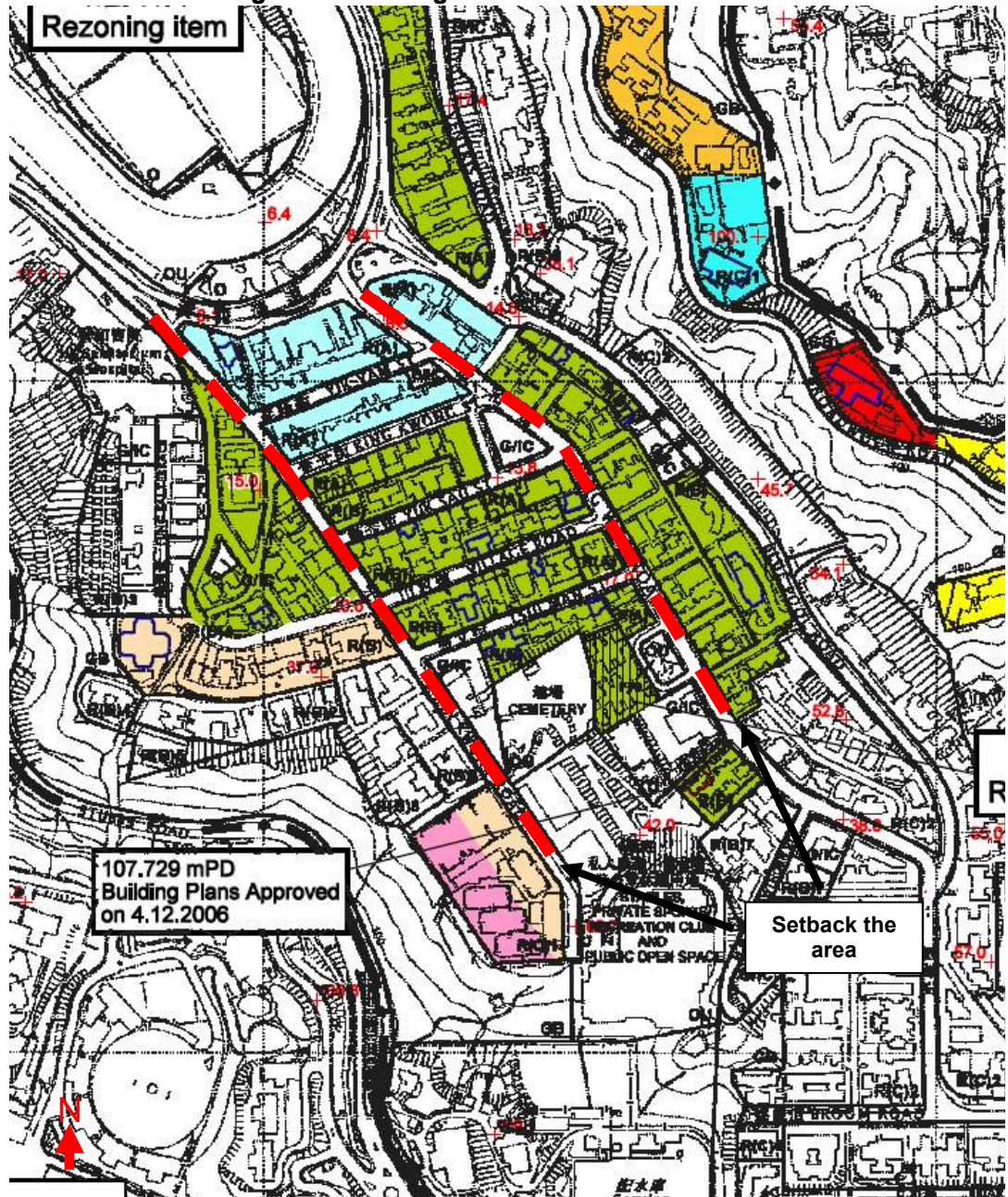
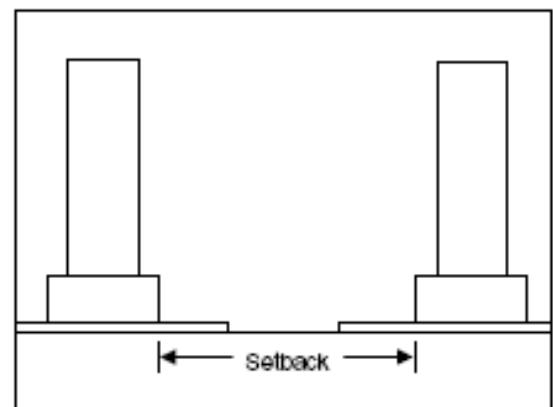


Figure 15 Shan Kwong Road and Shing Woo Road

Aforementioned, Shan Kwong Road and Sing Woo Road are treated as major wind corridors of the built-up area. The increased building height may decrease the wind delivery ability of these wind corridors.

It is suggested, if possible, to setback the buildings along these roads, so as to widen the wind corridors and allow better wind penetration.



6.3.5 Area along Village Road

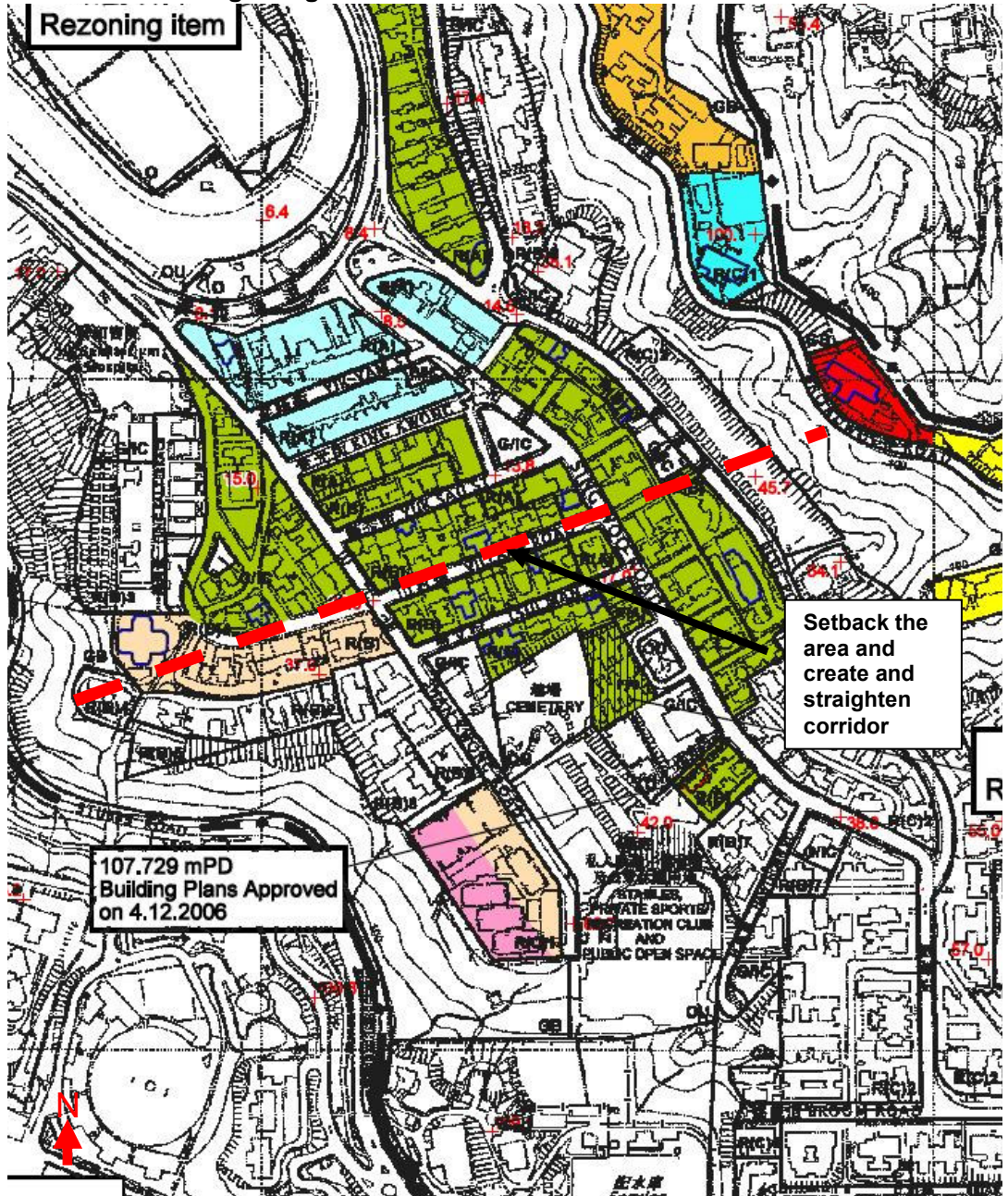


Figure 16 Area along Village Road

The Village Road is the wind corridor mainly for the circulation wind across two sides of valley. Under the planned scenario, there is no special arrangement on preserving such wind corridor, it is suggested to

- Setback the buildings along the Village Road to widen the wind corridor for better air ventilation, if possible

6.4 Recommendation for further study

Aforementioned, the areas near the Happy View Terrace, Shan Kwong Road, Sing Woo Road and Village Road serve as the main ventilation corridors of the Area. Wind is delivered from these ventilation corridors to the built-up area. Therefore, if the existing condition is altered afterward, a quantitatively AVA Initial Studies on these areas that discussed in Section 6.3.1 to 6.3.3. (i.e. Area near Beverly Hill, Area along Broadwood Road, South-East of Happy Valley Racecourse) are needed, so to assess the ability of wind after redevelopment.

7 Expert evaluation on Amended OZP

7.1 Background

Pursuant to section 6B(8) of the Town Planning Ordinance (the Ordinance), upon consideration of the representations to the draft Wong Nai Chung Outline Zoning Plan No. S/H/7/14 (the Plan) under section 6B(1), the Town Planning Board (the Board) has decided to propose amendments to the Plan. The exact locations of the areas affected by the proposed amendments are more specifically shown on the Amendment Plan No. R/S/H/7/14-A1 in the following drawing.

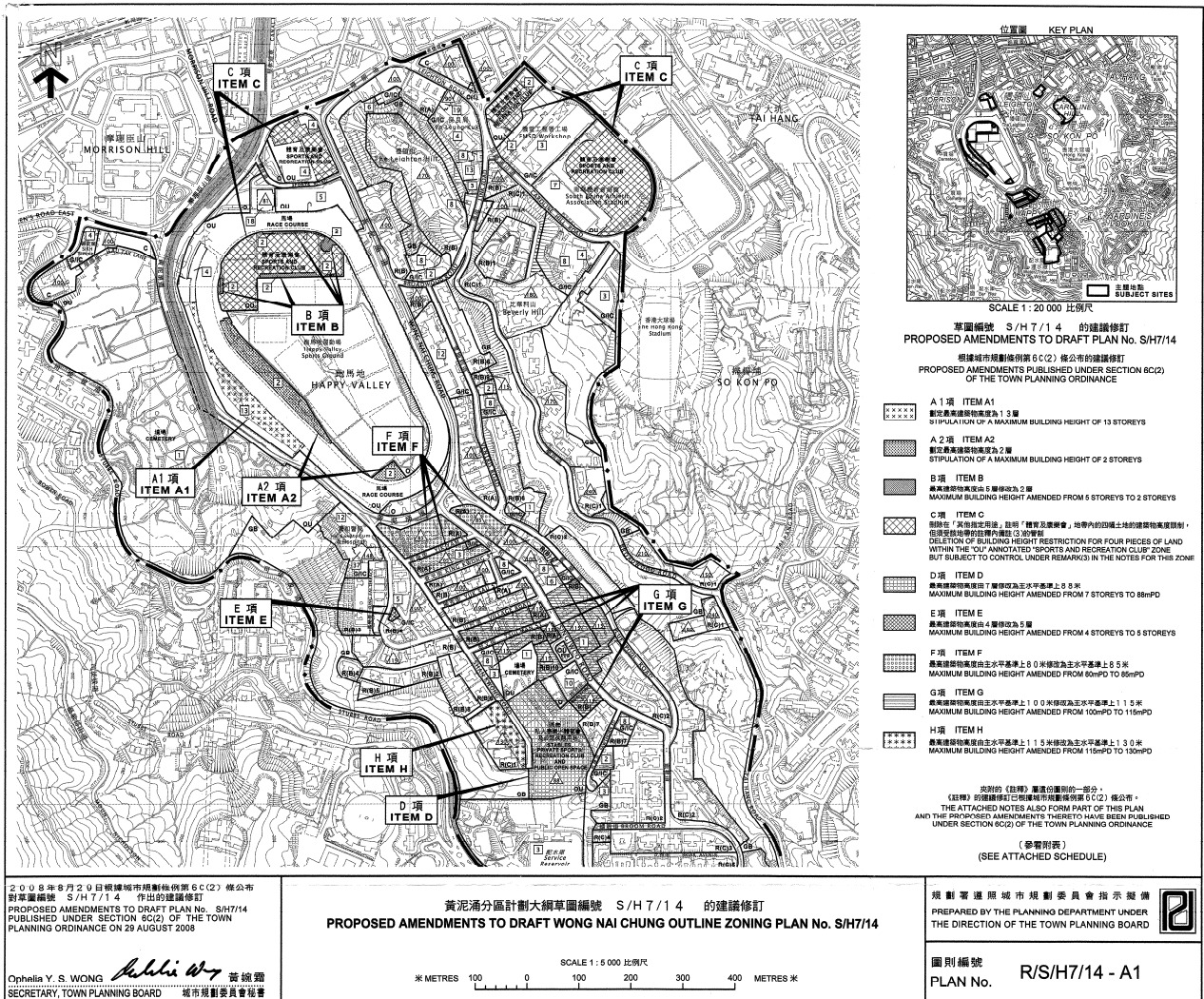


Figure 17 Amended Wong Nai Chung OZP

The amendments are summarized below:

Amendments to Matters shown on the Plan

- Item A1 – Extension of the 13-storey building height restriction for the “Other Specified Uses” annotated “Race Course” (“OU(Race Course)”) zone to cover the strip of land between the grandstands and race track of the Happy Valley Race Course.
- Item A2 – Stipulation of a maximum building height of 2 storeys for the two infield areas of the Happy Valley Race Course within the “OU(Race Course)” zone.
- Item B – Revision to the stipulated maximum building height for the stands, canteen and toilet at the sports fields of the Hong Kong Football Club within the “OU” annotated “Sports and Recreation Club” (“OU(SRC)”) zone from 5 storeys to 2 storeys.
- Item C – Deletion of the building height restrictions for four pieces of land in the “OU(SRC)” zone covering the Hong Kong Football Club, Craigengower Cricket Club, Post Office Recreation Club, PCCW Recreation Club and the South China Athletic Association but subject to the control under Remark (3) in the Notes for this zone.
- Item D – Revision to the stipulated maximum building height for the “OU” annotated “Stables, Private Sports/Recreation Club and Public Open Space” (“OU(SPCO)”) zone covering the Hong Kong Jockey Club (HKJC) Clubhouse and Central Store at 25 Shan Kwong Road from 7 storeys to 88 metres above Principal Datum (mPD).
- Item E – Revision to the stipulated maximum building height for the “Government, Institution or Community” zone covering the Man Lam Christian Church at 9 Village Road from 4 storeys to 5 storeys.
- Item F – Revision to the stipulated maximum building height for the “Residential (Group A)” (“R(A)”) sites bounded by Wong Nai Chung Road, Shan Kwong Road, King Kwong Street/Tsoi Tak Street and Blue Pool Road from 80mPD to 85mPD.
- Item G – Revision to the stipulated maximum building height for the “R(A)”, “Residential (Group B)” and “Residential (Group B)10” sites to the south of Village Road/Cheong Ming Street and to the east of Shan Kwong Road from 100mPD to 115mPD.
- Item H – Revision to the stipulated maximum building height for the eastern part of the “Residential (Group C)1” zone covering the HKJC Sports Complex at Shan Kwong Road from 115mPD to 130mPD.

Amendments to the Notes of the Plan

1. Revision to Remark (1) in the Notes for the “Residential (Group B)” zone to increase the stipulated maximum building height for the “Residential (Group B)10” sub-area from 100mPD to 115mPD.
2. Revision to Remark (3) in the Notes for the “OU(Race Course)” and “OU(SRC)” zones to specify that the planning permission requirement is only applicable to land where no building height restriction is stipulated on the Plan, and is not applicable to in-situ redevelopment of an existing building up to its existing building height.
3. Deletion of Remarks (2) and (3) in the Notes for the “OU(SPCO)” zone and addition of a new Remark requiring the provision of an at-grade public open space of not less than 5,000m².

7.2 Evaluation on Amended OZP

In general, the newly proposed building height restriction may not bring strong impact to the air ventilation as the building height to street ratio has been already high. Aforementioned, the more effective way, such as providing setback to the main wind channel, to enhance the wind environment has been suggested. The set back area zone should include Shan Kwong Road, Sing Woo Road and Village Road and these recommendations are still validated for amended OZP. The evaluations for the aforementioned items are listed as follow:

Item A1 - Extension of the 13-storey building height restriction for the “Other Specified Uses” annotated “Race Course” (“OU(Race Course)”) zone to cover the strip of land between the grandstands and race track of the Happy Valley Race Course.

Evaluation - This amendment would not have much impact to the wind environment

Item A2 - Stipulation of a maximum building height of 2 storeys for the two infield areas of the Happy Valley Race Course within the “OU(Race Course)” zone.

Evaluation - This amendment would not have much impact to the wind environment.

Item B - Revision to the stipulated maximum building height for the stands, canteen and toilet at the sports fields of the Hong Kong Football Club within the “OU” annotated “Sports and Recreation Club” (“OU(SRC)”) zone from 5 storeys to 2 storeys.

Evaluation - This amendment may enhance the wind environment, but limited to a small area.

Item C - Deletion of the building height restrictions for four pieces of land in the “OU(SRC)” zone covering the Hong Kong Football Club, Craigengower Cricket Club, Post Office Recreation Club, PCCW Recreation Club and the South China Athletic Association but subject to the control under Remark (3) in the Notes for this zone.

Evaluation - In stead of controlling building height, dedicated wind corridor should be provided for the site. An Initial AVA study is recommended for the captioned site to show the new development would not have great impact to the wind environment when seeking planning permission from the Town Planning Board.

Item D - Revision to the stipulated maximum building height for the “OU” annotated “Stables, Private Sports/Recreation Club and Public Open Space” (“OU(SPCO)”) zone covering the Hong Kong Jockey Club (HKJC) Clubhouse and Central Store at 25 Shan Kwong Road from 7 storeys to 88 metres above Principal Datum (mPD).

Evaluation - This amendment would not have much impact to the wind environment.

Item E - Revision to the stipulated maximum building height for the “Government, Institution or Community” zone covering the Man Lam Christian Church at 9 Village Road from 4 storeys to 5 storeys.

Evaluation - The proposed site area is relatively small and the amendment may not have much impact to the overall area of concern

Item F - Revision to the stipulated maximum building height for the “Residential (Group A)” (“R(A)”) sites bounded by Wong Nai Chung Road, Shan Kwong Road, King Kwong Street/Tsoi Tak Street and Blue Pool Road from 80mPD to 85mPD.

Evaluation - The newly proposed building height may not have much impact to the air ventilation as the building height to street ratio is already high. The setback of buildings along these streets is still strongly recommended to incorporate into the OZP.

Item G - Revision to the stipulated maximum building height for the "R(A)", "Residential (Group B)" and "Residential (Group B)10" sites to the south of Village Road/Cheong Ming Street and to the east of Shan Kwong Road from 100mPD to 115mPD.

Evaluation - The newly proposed building height may not have much impact to the air ventilation as the building height to street ratio is already high. The setback of buildings along these streets is still strongly recommended to incorporate into the OZP.

Item H - Revision to the stipulated maximum building height for the eastern part of the "Residential (Group C)" zone covering the HKJC Sports Complex at Shan Kwong Road from 115mPD to 130 mPD.

Evaluation - The newly proposed building height may not have much impact to the air ventilation as the building height to street ratio is already high. The setback of buildings along Shan Kwong Road is still strongly recommended to incorporate into the OZP.

8 Conclusion

This report provides the expert evaluation on the AVA of the proposed building heights for the study area. It is a qualitative assessment of wind performance of the site under existing condition and the scenario with proposed building heights. A preliminary assessment on site characteristic and wind availability is conducted. The expert evaluation indicates that:

For existing condition,

- Sitting on the basin of the valley and surrounded by the green belt, such special topographical feature may result in a unique wind environment of Wong Nai Chung Area. Circulation wind may run down from the green area to built-up area along the slope.
- The relative low-rise site located at the area near Happy View Terrace may be treated as one of the main wind entrances for NE wind.
- The incoming wind from the Happy View Terrace reaches to the open area (Happy Valley Racecourse) and then redirects to the south-east direction due to the topographical feature.
- The wind then penetrates to the built-up area through Shan Kwong Road, Sing Woo Road and Blue Pool Road
- Shan Kwong Road, Sing Woo Road and Blue Pool Road may be treated as the main wind corridors for this built-up, wind is delivered from these wind corridors to the bystreets.

For the planned scenario OZP,

- The wind entrance is located at the area near the Happy View Terrace. If built at the height of +150mpd in the planned OZP, such wind entrance may be blocked.
- There are several large gaps between existing buildings along the Broadwood Road. If such gaps can not be kept after redevelopment, it may block the wind to the Happy Valley Racecourse.
- Lesser wind may reduce the amount of air delivers to the wind corridors, i.e. Shan Kwong Road, Sing Woo Road and Blue Pool Road.

For the Amendment Plan (No. R/S/H7/14-A1),

The amendments may not pose a strong impact on overall ventilation as Planned scenario OZP in general, since the building height to street ration is already high for site of concern. However, deletion of building height restrictions on amendment **Item C** may affect the performance of wind corridor.

Some mitigation measures are recommended to enhance the ventilation performance of possible problem areas. However, the air ventilation performance at the pedestrian level is not merely determined by the building height. It is the combination effect of site characteristics and different design features, including the site location, building disposition and building height, surrounding building layout and building height, podium design, sky garden and podium garden design, site wind availability etc. Despite that the study area has been built up, opportunity should be explored in long term to enhance the wind performance through the following measures:

- Trim down the size of development zone at the area near Beverly Hill and designate it as a non-built area.
- Provides dedicated wind corridors at the area along Broadwood Road to allow more wind penetration.

- Reduce the buildable area of the sites abutting Wong Nai Chung Road to create larger wind entrances to the Shan Kwong Road, Sing Woo Road and Blue Pool Road.
- Setback the Shan Kwong Road, Sing Woo Road and Village Road to create a wider wind corridor for better wind penetration.

Because of the importance of the air circulation along the wind corridors, quantitative AVA Initial Studies, on the Area near Beverly Hill, Area along Broadwood Road and South-East of Happy Valley Racecourse are recommended. Also, for **area of Item C mentioned in amended OZP**, initial AVA study is also suggested to show the new development would not have great impact to the wind environment when seeking planning permission from the Town Planning Board.