Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment Services under Agreement No. PLNQ 35/2009

Expert Evaluation and Advisory Report for

Proposed Amendments to

Cheung Sha Wan Outline Zoning Plan

FINAL

September 2010



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EXECUTIVE SUMMARY

CO₂nnsulting was commissioned by the Planning Department of HKSARG under the Term Consultancy for Expert Evaluation on Air Ventilation Assessment Services to assess the air ventilation impacts of the building height restrictions incorporated in the approved Cheung Sha Wan Outline Zoning Plan No. S/K5/31 and recommend mitigation measures to alleviate the impacts. Whilst it is understood that the current heights of older buildings are generally below 60mPD due to the former Kai Tak Airport Height restrictions, and owners are entitled to redevelop their sites in accordance with the development PR/GFA restrictions under the current OZP, the purpose of the expert evaluation is to provide a technical evaluation of the air ventilation impacts of the development as illustrated in the planned scenario as compared to the existing scenario.

The methodology adopted here follows that for an expert evaluation in the "Technical Guide for Air Ventilation Assessment for Developments in Hong Kong" as well as those requirements in the Project Brief.

The data from The Hong Kong Observatory and those from The Institute of Environment of The Hong Kong University of Science and Technology have been reviewed. Examination of the data indicates that the annual prevailing winds are: north-easterlies, easterlies, and south-westerlies; and the summer prevailing winds are easterlies, southerlies and south-westerlies.

Recommendations on Existing Scenario

The terrain of Cheung Sha Wan is mostly flat except for hilly regions such as the Piper's Hills and Eagle's Nest. Cheung Sha Wan has an unique feature and that is that street grids are mostly rectilinear. The streets are usually through-streets, and are mostly aligned with the prevailing winds except for the easterlies and southerlies.

Existing non-building areas either in the form of open space, or G/IC sites such as Shan Shui Po Park and Sham Shui Po Swimming Pool, Tung Chau Street Park, Asia Golf Club (temporary golf driving range), Cheung Sha Wan Playground, Sham Shui Po Sports Ground, Han Garden, Lei Cheng Uk Estate Garden, Tung Chau Street Park are essential wind corridors to the Project Area. Open spaces e.g. Nam Cheong Park and G/IC sites are also

found just south of the Project Area. It is essential that the low-rise nature and openness of these open space and G/IC sites shall be maintained.

It is important to maintain this sparse distribution of residential developments in region 1; and the low-rise G/IC facilities along Kwong Lee Road and Fat Tseung Street, green belt and open space in region 2, to allow sufficient wind breeze to permeate to the other regions of Cheung Sha Wan. Courtyards of various sizes are found in many developments such as the existing So Uk Estate, Lei Cheng Uk Estate, Han Garden. The integration of courtyards in these developments helps to reduce heat island effect and serves as ventilation pockets. Po on Road Playground and the school site at Cheung Fat Street will play an even more vital role in air ventilation when the redevelopment of So Uk Estate is complete. The low-rise nature of the school and the openness of the playground will help to mitigate the negative air ventilation impact of the proposed So Uk Estate redevelopment. It is essential that these two pockets are maintained for better air ventilation.

Numerous sites are committed just south of region 4, outside the Project Area. The existing and committed developments will have a significant adverse air ventilation impact in Cheung Sha Wan. The most significant are Fu Cheong Estate (119mPD, 41 storeys); the proposed Sai Chuen Road Estate (118mPD, 41 storeys); Nam Cheong Station Development (181.7mPD, 52 storeys); and CDA Site 6 for proposed public rental housing development (100mPD to 110mPD). In order to enhance air ventilation of the district, the open spaces along Hing Wah Street West, Ying Wa Street and Yen Chow Street West will act as breathing spaces within the built-up urban environment, whilst the G/IC sites at Lai Hong Street, Tung Chau Street, Yen Chow Street West are recommended for low-rise developments. The OU sites annotated wholesale market phase I and II at the waterfront are to be maintained as low-rise developments, as these lie in the gateway of southerlies and south-westerlies to the Project Area.

Region 5 is shielded by high-rise developments of Banyan Garden, Liberte, The Pacifica and Aqua Marina just south of the Project Area, and Manhattan Hill west of the Project Area. These developments form a substantial obstacle to onshore summer winds, developments of such scale and disposition should be avoided in the future to minimise the adverse impact of air ventilation, as region 5 is the gateway to breeze for the south-westerlies in the Cheung Sha Wan Area.

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Recommendations on Planned Scenario

It is observed in the proposed plan that it is possible to have podia which have 100% site coverage and up to three storeys. Large-scaled podia on narrow streets impede wind from reaching pedestrian level. It is recommended to provide setback from the site boundary, or to recess the lower floors from these streets to widen the streets, or to align the podia edge with the building edge, and to make the podia more permeable.

The proposed five bands of height for So Uk Estate Redevelopment are acceptable, however, it is preferred to have the incremental height increases with the ascending sea level from air ventilation point of view. As the site is generously large, there is design freedom for a permeable arrangement of building blocks, and to avoid slab type buildings which close off ventilation corridors as in the current situation.

The proposed maximum building height to 100 mPD and 120 mPD will worsen the skimming flow, and thus the air ventilation in region 3a compared to the existing medium-rise nature. A maximum height of 120 mPD with significant variation in height distribution is recommended to improve mixing of the windflow to improve air ventilation. An alternative recommendation to the reduced band height is to cap the maximum building height at 120mPD and have the buildings setback from the streets such that the minimum road spacing (measured from building face-to-building face) on Tonkin Street, Cheung Wah Street, Hing Wah Street are 37m, 20m and 30m respectively.

A maximum height of 110 mPD with significant variation in height distribution is recommended to improve mixing of the wind flow to improve air ventilation in region 3b. Alternative recommendations of maximum building height and minimum road spacing in the area (measured from building face-to-building face) are up to 120 mPD and 37 m respectively.

The proposed Urban Renewal Authority's development scheme at Lai Chi Kok Road/ Kweilin Street and Yee Kuk Street also includes a public open space created by setting back from the site boundary and thereby widening Kweilin Street. This kind of strategy and design which is beneficial for the air ventilation should be encouraged.

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It is also recommended that the non-building areas to be provided at Lai On Estate and Lai Kok Estate, such that the breeze can permeate to the centre of Cheung Sha Wan area via the Sham Shui Po Park and the future redevelopment of the housing estates.

The existing Temporary Wholesale Vegetable Market and Temporary Poultry Market fall within a "R(A)" zone with a proposed maximum height of 100 mPD. These large sites are located at the gateway of summer breeze into Cheung Sha Wan, therefore caution must be exercised to ensure that building blocks do not obstruct the ventilation gems: Asia Golf Club (temporary golf driving range) and Cheung Sha Wan Playground.

The proposed maximum building height of 120 mPD to 130 mPD compared to the existing building height mainly ranged from 40 mPD to 60 mPD, in the streets in region 5 will have a negative impact on air ventilation, when the major air paths are narrow. Recommendations on building height and road width are provided in this study report. It is recommended to maintain the O and G/IC sites along Lai Chi Kok Road to provide better air ventilation.

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1. INTRODUCTION

CO₂nnsulting was commissioned by the Planning Department of HKSARG under Category A Service of the Term Consultancies for Air Ventilation Assessment Services (AVAs). The objective is to assess the air ventilation impacts of the building height restrictions under the Outline Zoning Plan (OZP) for the Cheung Sha Wan Area and recommend mitigation measures to alleviate the impacts.

The main tasks are to provide the followings:

- Site inspection and analysis of the wind data and environment of the Project Area;
- A qualitative evaluation of the air ventilation impacts of the development as illustrated under the planned scenario as compared to the existing scenario;
- Recommendations of mitigation and improvement measures.

Figure 1 shows the boundary of the Project Area. Figures 2 shows satellite images of the Project Area. Figure 3 shows various views within the Project Area. The methodology adopted here follows that for an expert evaluation in the "Technical Guide for Air Ventilation Assessment for Developments in Hong Kong" as well as those requirements in the Project Brief.

2. SITE INFORMATION

The Project Area covers Cheung Sha Wan area of West Kowloon, with an area of approximately 328 hectares (according to S/K5/31). It is bounded by Eagle's Nest and Piper's Hill in the North, Tai Po Road and Berwick Street in the east, Boundary Street and Tung Chau Street Park in the south, West Kowloon Corridor and Lai Chi Kok Road in the south-west and Butterfly Valley Road in the west (See Figure 1). To its north is Eagle's Nest. To its north-east are the medium-rise residential development of Chak On Estate and the Shek Kip Mei Service Reservoir Playground. To its east are the service reservoir and the residential development of Shek Kip Mei Estate and Pak Tin Estate. To its south is Nam Cheong Park, piers and the harbour. To its south-west are high-rise residential developments of The Pacifica, Liberte and Banyan Garden, Aqua Marine and Manhattan Hill.

For the purpose of expert evaluation, the total Project Area is dissected into the following sub areas following similar topography and land use, as shown in Figure 1 in this study report. Figure 2 shows the key landmarks of the Project Area, in terms of air ventilation assessments.

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| Sub areas | Location | Descriptions | Terrain |
|-----------|------------------------------------|--|---------------|
| Region 1 | North of Ching Cheung Road, hill | Majority of the land use is Green | Hilly, 37.9 |
| | slopes of Eagle's Nest and Piper's | Belt (GB), with a number of low to | mPD to 236.2 |
| | Hill. | medium-rise residential and | mPD |
| | | low-rise G/IC uses such as St. | |
| | | Raphael's Catholic Cemetery and | |
| | | temples. | |
| Region 2 | Bounded by Ching Cheung Road, | Majority are residential | Flat, 6.2 mPD |
| | Tai Po Road, Po On Road, Wing | developments (R(A)) (mainly public | to 59.7 mPD |
| | Hong Street, Yu Chau West | housing estates) and G/IC (i.e. | |
| | Street and wing wing Street. | nospitals, schools and churches | |
| | | and open space (O) | |
| Dogion 20 | Dounded by Do On Dood Tonkin | And open space (O). | Flat 10 mpD |
| Region Sa | Street Up Chau Street and | developments with a commercial | to 11 mPD |
| | Cheung Sha Wan Road Kwong | site and O sites | |
| | Cheung Street and Tsap Fai | site and o sites. | |
| | Street | | |
| Region 3b | Bounded by Wai Wai Road, Tai | Majority of the developments are | Flat, 4.7 mPD |
| - 5 | Po Road, Berwick Street, Cheung | residential in small private lots and | to 10 mPD |
| | Sha Wan Road, and Tonkin Street | G/IC (i.e. hospitals, school, etc.) | |
| | | sites | |
| Region 3c | Bounded by Cheung Sha Wan | Majority of the developments are | Flat, 3.7 mPD |
| | Road, Boundary Street, Tung | residential in small private lots with | to 5.3 mPD |
| | Chau Street, Tonkin Street, Lai | some O and G/IC (i.e. schools, etc). | |
| | Chi Kok Road and Yen Chow | | |
| | Street | | |
| Region 4 | Bounded by Cheung Sha Wan | Mixture of residential (mainly public | Flat, 3.9 mPD |
| | Road, Tonkin Street, Yen Chow | housing estates/ Home Ownership | to 6.5 mPD |
| | Street, Lai Chi Kok Road, Tung | Scheme (HOS)), open space areas | |
| | Chau Street and Cheung Sha | and G/IC (I.e. schools, police | |
| | | | |
| Region 5 | Bounded by Ching Cheung Road | Majority of the developments are | Flat 3.9 mPD |
| | Wing Ming Street Yu Chau West | husiness/industrial developments | to 13.6 mPD |
| | Street, Wing Hong Street Tsan | with some G/IC and a commercial | 10 10.0 mil D |
| | Fai Street, Castle Peak Road. | site. | |
| | Kwong Cheung Street, Cheuna | | |
| | Sha Wan Road, Cheung Sha Wan | | |
| | Path, Lai Chi Kok Road and | | |
| | Butterfly Valley Road. | | |
| Region 6 | Bounded by Tung Chau Street, | Majority are Nam Cheong Estate | Flat, 3.6 mPD |
| | Chui Yu Road, Sham Mong Road, | and Tung Chau Street Park. | to 5.9 mPD |
| | Yen Chow Street West. | | |

Table 1 Characteristics of Sub-Regions within Project Area



Figure 1 The Project Area of Cheung Sha Wan

(Image source: Survey & Mapping Office, Lands Department, The Government of HKSAR)



(b) Region 2

Figure 2 Satellite Images of the Project Area (Image source: Survey & Mapping Office, Lands Department, The Government of HKSAR)



(c) Region 3a

Figure 2 Satellite Images of the Project Area (continued) (Image source: Survey & Mapping Office, Lands Department, The Government of HKSAR)



(Image source: Survey & Mapping Office, Lands Department, The Government of HKSAR)



Figure 2 Satellite Images of the Project Area (continued) (Image source: Survey & Mapping Office, Lands Department, The Government of HKSAR)





West Kowloon Corridor

(h) Region 6

Figure 2 Satellite Images of the Project Area (continued) (Image source: Survey & Mapping Office, Lands Department, The Government of HKSAR)



Figure 3a View of High-rise Development of Liberte and The Pacifica (44 to more than 50 storeys)

(Image source: CO₂nnsulting Ltd.)



Figure 3b Views of Existing So Uk Estate (to be redeveloped)

(Image source: CO2nnsulting Ltd.)



Figure 3c Views of Lei Cheng Uk Estate

(Image source: CO2nnsulting Ltd.)



Figure 3d Views of Tonkin Street Looking Northeast showing Lai Kok Estate (right)

(Image source: CO2nnsulting Ltd.)





Figure 3e Views of Lai Chi Kok Road Looking Southeast (a key air path)

(Image source: CO₂nnsulting Ltd.)



Figure 3f Views of Cheung Sha Wan Temporary Wholesale Poultry Market and large-scaled The Pacifica outside of the Project Area (an obstruction to breeze)

(Image source: CO₂nnsulting Ltd.)



Figure 3g View of Sham Shui Po Sports Ground

(Image source: CO2nnsulting Ltd.)



Figure 3h Open air paths provided by Asia Golf Club (temporary golf driving range) and Cheung Sha Wan Playground on Fat Tseung Street (Image source: CO₂nnsulting Ltd.)

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Figure 3i Cheung Sha Wan has numerous large-scaled committed developments such as Un Chau Estate Phase 5 at the junction of Tonkin Street and Cheung Sha Wan Road

(Image source: CO₂nnsulting Ltd.)



Figure 3j Sham Shui Po Park and Swimming Pool

(Image source: CO₂nnsulting Ltd.)





Figure 3k Views of Yen Chow Street Looking Southwest (a key air path)

(Image source: CO₂nnsulting Ltd.)



Figure 3I Views of Nam Cheong Street Looking Southwest (a key air path)

(Image source: CO₂nnsulting Ltd.)



Figure 3m Maple Street Playground on Cheung Sha Wan Road

(Image source: CO2nnsulting Ltd.)

3. WIND ENVIRONMENT

Two sets of wind data have been reviewed. Figure 4 shows the data from The Hong Kong Observatory. Figure 5 shows the wind data at various heights from The Institute of Environment of The Hong Kong University of Science and Technology. The wind roses at 120m and 450m show that the wind data at 120m are subject to more urban roughness, compared to the data at 450m, which is closer to the edge of the atmospheric boundary layer. Examination of the data of all four sets indicates that the annual prevailing winds are: north-easterlies, easterlies, and south-westerlies; the summer prevailing winds are easterlies, southerlies and south-westerlies.



Figure 4a Annual Wind Rose for Cheung Sha Wan (Hong Kong Observatory)



Wind Rose of CSW, Cheung Sha Wan (Running 60-minute wind)

Figure 4b Summer Wind Rose for Cheung Sha Wan (Hong Kong Observatory)





4. EXISTING SCENARIO

4.1 Topography and Existing Building Height Profile

Cheung Sha Wan has a unique feature and that is that street grids are mostly rectilinear. The streets are usually through-streets, and are mostly aligned with the prevailing winds except for the easterlies and southerlies. The current heights of older buildings are generally below 60mPD, due to the former Kai Tak Airport Height restrictions. The following observations of the characteristics of the Project Area are noted:

- The terrain of Cheung Sha Wan is mostly flat (3.6mPD to 13.6mPD) except for hilly regions such as the Piper's Hills (135.9mpD to 84.3mPD) and Eagle's Nest (236.1mPD to 109.1mPD). Region 1 sits on the hill slopes and consists of mainly green belts, open space areas and G/IC areas such as St. Raphael's Catholic Cemetery and temples, some low to medium-rise residential developments with maximum height from around 90mPD to 180mPD, such as Caldecott Hill and The Caldecott.
- Region 2, at the foot of Piper's Hills, mainly consists of public housing estates such as So Uk Esate and Lei Cheng Uk Estate with height from approximately 30mPD to 90mPD, as well as some G/IC, green belts and open space areas. The Caritas Medical Centre is also found in Region 2.
- Region 3a is at the centre of Cheung Sha Wan, and consists of a mixture of older low-rise and medium-rise residential developments on small private lots. The developments are mainly of height from approximately 20mPD to 90mPD, with some newly redeveloped high-rise residential developments above 120mPD. Albeit its central position within the Project Area, it benefits from open areas such as the Sham Shui Po Sports Ground, Cheung Sha Wan Playground and Asia Golf Club (temporary golf driving range) in the adjacent region 4.
- Region 3b consists of low-rise and medium-rise older residential developments mostly with small private lots of 40mPD to 60mPD in height. Region 3b includes a linear open space park along Tai Po Road (i.e. Sheung Li Uk Garden) and is adjacent to the service reservoir in Shek Kip Mei outside the Project Area.

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- Region 3c consists of older low and medium-rise residential developments mostly with small private lots mainly with height from 20mPD to 40mPD, with a large open space area i.e. Sham Shui Po Park. Region 3c is adjacent to the high-rise Fu Cheong Estate outside the Project Area.
- Region 4 mainly consists of public housing estates / HOS developments with height up to 120mPD and a few newly redeveloped taller buildings. It includes a large proportion of open space areas: Sham Shui Po Sports Ground, Cheung Sha Wan Playground and Asia Golf Club (temporary golf driving range). The sites with low-rise Cheung Sha Wan Temporary Wholesale Poultry Market, and Temporary Vegetable Market (to be redeveloped into residential use) are found at the southern boundary of the region. To the south, a number of sites are planned to be redeveloped outside the Project Area. These committed developments include the proposed Sai Chuen Road Estate (118 mPD, 41 storeys); Fu Cheong Estate (119 mPD, 41 storeys); Nam Cheong Station Development (181.7 mPD, 52 storeys); and CDA Site 6's proposed public rental housing development (100mPD to 110mPD), as shown in Figure 6. Considerations shall be given to maintain continuous air paths connecting major streets such as Tokin Street West, Fat Tseung Street West and Hing Wah Street during the development of these waterfront sites.
- Region 5 mainly consists of older medium-rise business/industrial buildings with height up to 60mPD with a few G/IC developments. Some newly redeveloped high-rises business/industrial buildings with height up to 145mPD are scattered in the region. High-rise residential developments such as Banyan Garden, Liberte, The Pacifica, Aqua Marine and Manhattan Hill are found outside the southern boundary of region 5.
- Region 6 mainly consists of Nam Cheong Estate below 60mPD, and Tung Chau Street Park. Region 6 is adjacent to the Nam Cheong Park, outside of the Project Area.



Figure 6 Committed Development Outside the Project Area with a Negative Impact on Air Ventilation to Cheung Sha Wan

The wind flow in the Project Area is impacted not only by the disposition, massing, site coverage and height of buildings, but also the harbour nearby, and the surrounding adjacent hills. Existing non-building areas either in the form of open space, or G/IC sites

such as Sham Shui Po Park and Swimming Pool, Tung Chau Street Park, Asia Golf Club (temporary golf driving range), Cheung Sha Wan Playground, Sham Shui Po Sports Ground, Han Garden, Lei Cheng Uk Estate Garden, Nam Cheong Park (outside of Project Area) are essential wind corridors to the Project Area. These regions are encouraged to be maintained to allow penetration of wind inland.

The Project Area now benefits from the occupation of older low to medium-rise developments not yet redeveloped with a lot of open space and green belts. Another advantage of the Project Area is the proximity of the vegetated hills (Piper's Hills and Eagle's Nest). As the south-westerlies meet the hill, it creates a high-pressure zone of increased velocity on the windward side of the hill, and a low-pressure region of on the leeward side of the hill. The velocity is increased as the wind sweeps around the sides and over the top of the hill as shown in Figure 7. Even on a calm day, upward air movement can be created as the sun warms the hills slopes, and creates a thermal gradient between the top of the hill and its base. The air movement cycle reverses when the air cools in the evening; it descends the hills and brings cooler wind to the base of the hills. The green belt provided by Piper's Hills and Eagle's Nest area good examples. Winds descend the faces of these green slopes and bring coolth to the base of the hill.



Figure 7 Influence of Terrain on Wind Flow

4.2 Existing Summer and Annual Scenarios

Section 3 has identified the summer prevailing winds are easterlies, southerlies and south-westerlies; and annual prevailing winds are north-easterlies, easterlies, and south-westerlies. The information on the existing scenario, as provided by the Planning Department, presents the existing building profile including the approved and committed developments. It is used as a basis for appreciating the existing wind environment and understanding the effects of development restrictions. Figure 8 shows the prevailing winds for the existing scenario, the major air paths are marked by arrows. Whilst it is understood that the current heights of older buildings are generally below 60mPD due to the former Kai Tak Airport Height restrictions, and owners are entitled to redevelop their sites in accordance with the development PR/GFA restrictions under the current OZP, the purpose of the expert evaluation is to provide a technical evaluation of the air ventilation impacts of the development as illustrated in the planned scenario as compared to the existing scenario. Table 2 summarise the major air paths.

| North-east wind | South-west wind | |
|-------------------|----------------------------|--|
| Cheung Fat Street | Castle Peak Road | |
| Tonkin Street | Cheung Sha Wan Road | |
| Camp Street | Hing Wah Street/ Sham Shui | |
| Yen Chow Street | Po Sports Ground | |
| Nam Cheong Street | Tonkin Street | |
| | Yen Chow Street | |
| | Nam Cheong Street | |

Table 2 Major air paths in Cheung Sha Wan



Figure 8 Existing Scenario showing Existing Air Paths

4.2.1 Region 1

Region 1 of the Project Area is hilly, with the majority of land use being green belts and natural slopes (See Figure 9). St. Raphael's Catholic Cemetery occupies the west part of region. These green belts (GB) and plots of lands for OU and G/IC uses allow the north-easterlies and the descending wind from the hills to permeate to regions 2 and 5. The low to medium-rise residential developments, i.e. Caldecott Hill, The Caldecott, Bamboo Villa, Pine Hill, Villa Carlton and Monte Carlton with maximum height up to 180mPD, would enjoy wind breeze, and benefit from any transpiration cooling effect from the vegetated hillside. It is important to maintain this sparse distribution to allow sufficient wind breeze going through region 1 to the other regions of Cheung Sha Wan.



Figure 9 Existing Scenario in the Region 1 of Cheung Sha Wan

4.2.2 Region 2

Region 2 benefits from easterlies and downhill wind. The area mainly consists of public housing estates, i.e. So Uk Estate and Lei Cheng Uk Estate, G/IC facilities and open space. The housing estates are mainly below 60mPD. As region 2 is located in the north-east of the Project Area, it is the gateway to breeze for the downhill wind and the easterlies in the Cheung Sha Wan Area. It is therefore essential to maintain the low-rise G/IC facilities along Kwong Lee Road and Fat Tseung Street, green belt and open space in this region.

The current disposition of the building blocks of So Uk Estate is not favourable to ventilation, as Orchid House, Marigold House, Peony House and Carnation House, Lotus House form a barrier to the wind movement, as shown in Figure 10. The current adverse air ventilation impact from So Uk Estate is not severe because the maximum building height is only up to 88 mPD; the development consists of ample courtyard spaces; and the area is not densely constructed at present.

Courtyards of various sizes are found in many developments such as the existing So Uk Estate, Lei Cheung Uk Estate, Han Garden. The integration of courtyards in these developments helps to reduce heat island effect and serves as ventilation pockets.



Figure 10 Existing So Uk Estate

Figure 11 shows the committed redevelopment plan of So Uk Estate with five bands of maximum height: 80 mPD, 100 mPD, 105mPD, 115mPD and 135mPD. This large site area with the maximum height allowance increased to 135 mPD suggests scope of having larger courtyards among the buildings. Developments such as Villa Carlton and Monte Carlton should be avoided as the building-to-building gap is small, and they form a wall to the ascending and descending winds.

The building disposition of Wai Oi Block (currently about 86mPD) of Caritas Medical Centre is not favourable for the downhill wind to permeate, as it serves like a wall with length of frontage 88m (Figure 11).



Figure 11 Existing / Committed Scenario in the Region 2 of Cheung Sha Wan

4.2.3 Region 3a

Region 3a is at the centre of Cheung Sha Wan, the majority of the current older residential developments are below 60 mPD (See Figure 12). This area enjoys north-easterlies and downhill wind through Cheung Fat Street and Tonkin Street. Hing Wah Street could have been a better air path if not for So UK Estate. It is important to re-iterate here that the disposition of buildings within the to-be-redeveloped estate should be considered carefully in terms of air ventilation. Po on Road Playground and the school site at Cheung Fat Street will play an even more vital role in air ventilation when the redevelopment of So UK Estate is complete. The low-rise nature of the school and the openness of the playground will help to mitigate the negative air ventilation impact of the proposed So UK Estate redevelopment. It is essential that these two pockets are maintained for better air ventilation.



Figure 12 Existing / Committed Scenario in the Region 3a of Cheung Sha Wan

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4.2.4 Region 3b

Region 3b is populated by current older residential developments mainly below 60 mPD, with a handful of newly redeveloped high-rise developments, the tallest one up to about 176 mPD. The rectilinear and orderly street alignments are favorable to allow north-easterlies and south-westerlies to permeate through the region. The current wind environment is pleasant.

4.2.5 Region 3c

Region 3c is at the south-east part of the Project Area with building density and maximum height similar to that seen in Region 3b. The air ventilation gem in region 3c is the Sham Shui Po Park and Sham Shui Po Swimming Pool area. These large plots of open space and G/IC areas play key roles to ventilate the heart of Cheung Sha Wan in the summertime. Boundary Street is the only key air path for the easterlies. It is essential to reiterate here that the combination of current low building height, density and abundant open spaces compensate the shortcoming that Boundary Street is the only key corridor for easterlies.



Figure 13 Existing / Committed Scenario in the Region 3b and 3c of Cheung Sha Wan

4.2.6 Region 4

Region 4 is a relatively sparsely built regions in Cheung Sha Wan. It benefits from abundant open spaces: Sham Shui Po Sports Ground, Asia Golf Club (temporary golf driving range), Cheung Sha Wan Playground, as well as current low-rise G/IC buildings about 20 mPD to 40mPD in height, such as the vocational school along Lai Chi Kok Road, Sham Shui Po Police Station at the junction of Yen Chow Street and Lai Chi Kok Road and the school along Hang Cheung Street and the existing Temporary Wholesale Vegetable Market and the Temporary Wholesale Poultry Market which will be redeveloped into residential use. These

are essential air paths to the heart of Cheung Sha Wan. Open carparks and the large open space at the Cheung Sha Wan Sewage Pumping Station are found just south of the Project Area. A number of sites are planned to be redeveloped outside the Project Area. These committed developments will have a significant adverse air ventilation impact on Cheung Sha Wan. The most significant are the proposed Sai Chuen Road Estate (118 mPD, 41 storeys); Fu Cheong Estate (119 mPD, 41 storeys); Nam Cheong Station Development (181.7 mPD, 52 storeys); and CDA Site 6 proposed public rental housing development (100mPD to 110 mPD), as shown in Figure 6. In order to enhance air ventilation of the district, the open spaces along Hing Wah Street West, Ying Wa Street and Yen Chow Street West will act as breathing spaces within the built-up urban environment, whilst the G/IC sites at Lai Hong Street, Tung Chau Street, Yen Chow Street West are recommended for low-rise developments. The OU sites annotated wholesale market phase I and II near the waterfront should also be maintained as low-rise developments, as these lie in the gateway of southerlies and south-westerlies to the Project Area. It is essential that the openness shall be maintained (See Figure 14).



Figure 14 Existing / Committed Scenario in the Region 4 of Cheung Sha Wan

4.2.7 Region 5

Region 5 is shielded by high-rise developments of Banyan Garden, Liberte, The Pacifica and Aqua Marina just south of the Project Area, and Manhattan Hill west of the Project Area. These developments form a substantial obstacle to onshore summer winds, developments of such scale and disposition should be avoided in the future to minimise the adverse impact of air ventilation, as region 5 is the gateway to breeze for the south-westerlies in the Cheung Sha Wan Area. The adverse impact on air ventilation in region 5 is not severe at the present, as descending wind from Eagle's Nest can still reach the area. Some summer breeze can travel along Cheung Sha Wan Road and Castle Peak Road to ventilate the area.



Figure 15 Existing / Committed Scenario in the Region 5 of Cheung Sha Wan

4.2.8 Region 6

Region 6 is the other relatively sparsely developed area with Nam Cheong Estate and Tung Chau Street Park. The existing wind regime benefits from the openness and the nearby Nam Cheong Park outside the Project Area.



Figure 16 Existing / Committed Scenario in the Region 6 of Cheung Sha Wan



Figure 17 Planned Scenario (Indicative)

5.2 Area of Concern

Figure 17 shows the indicative redevelopment of some sites assuming redevelopment up to the proposed maximum development restrictions on the OZP, in addition to the existing and approved / committed ones. The design, disposition and height of new development shown in this figure are hypothetical.

5.2.1 General

It is observed in the proposed plan that it is possible to have podia which have 100% site coverage and up to three storeys. Figure 18 shows the potential redevelopments with podia. Large-scaled podia on narrow streets impede wind from reaching pedestrian level. It is recommended to provide setback from the site boundary, or to recess the lower floors from these streets to widen the streets, or to align the podia edge with the building edge, and to make the podia more permeable as shown in Figure 19.



Figure 18 Potential Redevelopments

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Figure 19 Recommendations for Podia

5.2.2 Region 1

There are no changes in the proposed outline plan. The sparsely populated region will continue to serve as a ventilation gateway to Cheung Sha Wan.

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5.2.3 Region 2

The proposed So Uk Estate redevelopment consists of five bands of height, and these are 80mPD, 105mPD, 115mPD, 135mPD and 100mPD. The maximum height increase to 135mPD is acceptable, but it is preferred to have the incremental height increases with the ascending sea level from air ventilation point of view. It is reiterated here that the disposition of the building shall not repeat the arrangement in the existing So Uk Estate, shown in Figure 20a. Figure 20b shows the planned disposition. As the site is in the form of a diamond, with its width increases towards the north, it is recommended to incorporate air paths and introduce a large courtyard/open space within the site as shown in Figure 20c. As the site is generously large, there is design freedom for a permeable arrangement of building blocks, and to avoid slab type buildings which close off ventilation corridors as in the current situation, demonstrated in Figure 20a and 20b. Figure 20c shows the recommendation. Quantitative AVA studies for So Uk Estate are recommended.

The remaining areas in region 2 with 122mPD and 120mPD and 92mPD are acceptable, and will not cause deterioration to the Cheung Sha Wan Area if the disposition does not follow the existing arrangement in Figure 20a, but rather, in line with the principle demonstrated in Figure 20c. With the potential redevelopment with greater building height, open spaces such as the Po On Playground, Han Garden and Lei Cheung Uk Estate Sports Ground will play an even more vital role in ventilation than before, and must be maintained.



Figure 20 Disposition for So Uk Estate

5.2.4 Region 3a

The existing region 3a consists of mainly older buildings which are 40mPD and 60mPD in height, with twenty or more newly redeveloped buildings above 100mPD. Compared to the existing building height, the proposed maximum building height restriction of 100 mPD and 120mPD depending on the site area will worsen the skimming flow and thus have an adverse impact on air ventilation, that is, there will be little south-westerlies and northerlies reaching the street level, as shown in Figure 21. The mitigation measures such as those demonstrated in Figure 22 are recommended.



The wind skims over the brows of buildings.

Figure 21 Skimming Flow Worsened by Building Height Increase for Shun Ning Road, Castle Peak Road and Un Chau Street



Figure 22 Recommendations on Maximum Building Heights for Region 3a

If the recommendations in Figure 22 are not feasible, the maximum building height can be 120mPD with road width up to 37m. As the southerlies and northerlies will skim over the rows of buildings, Cheung Wah Street, Hing Wah Street, Tonkin Street will be key wind corridors. The road width (measured from building face-to-building face) on Tonkin Street, Cheung Wah Street, Hing Wah Street (See Figure 22) should preferably be approximately 37m, 20m and 30m respectively, as shown in Figure 23, if a maximum height of 120mPD is allowed.



Figure 23 Planned Maximum Building Height with Recommended Road Width for Tonkin Road

5.2.5 Region 3b

The existing region 3b consists of mainly older residential building of 40 mPD and 60mPD. The proposed maximum building height is 90mPD and 110mPD depending on the site area. The skimming flow will be worsened with little air reaching the pedestrian level with this increased height. It is recommended that region 3b to adopt similar recommendation provided for region 3a and demonstrated in Figure 24.





Figure 24 Recommendations on Maximum Building Heights for Region 3b

If the recommendations in Figure 24 are not feasible, the maximum building height can be 120mPD with road width up to 37m. With the increased building height in region 3b, air paths such as Tonkin Road, Yen Chow Street, Kweilin Street, Pei Ho Street, Nam Cheong Street, Wong Chuk Street play an even more important role. These permissible building heights and recommended road spacing are summarised in Table 3.

| Road / Street | Recommended Minimum Road Width (building face-to-building face) (m) | Planned Maximum Building Height (mPD) | Illustration |
|----------------------|---|---|-----------------------------|
| Tonkin Road | 37 | 120 | H=120mPD S~37 W~100m |
| Yen Chow Street | 30 | 110 | H=110mPD S~30 W ~ 100m |
| Kweilin Street | 20 | 90/110 | |
| Pei Ho Street | 20 | 90/110 | H=90mPD |
| Wong Chuk Street | 20 | 90/110 | S~22.5m W ~ 90 to 100m |
| Nam Cheong Street | 36 | 90/110 | H=90mPD S~36m to 100m |

Table 3 Planned Maximum Building Height and Recommended Minimum Building-to-BuildingFace Road Widths for Region 3b.

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5.2.6 Region 3c

The existing older buildings in region 3c are typically 40mPD. The proposed maximum building heights are 80mPD to 100mPD respectively. The recommendations here are similar to those in Table 3. The potential developments at Hai Tan Street, Kweilin Street and Pei Ho Street have integrated public and private open spaces. The public open space created by setting back from Pei Ho Street will help to ventilate the area. The proposed URA development scheme at Lai Chi Kok Road/ Kweilin Street and Yee Kuk Street also includes a public open space created by setting back from the site boundary and thereby widening Kweilin Street. This kind of strategy and design which is beneficial for the air ventilation should be encouraged. It is important to reiterate here that large-scale impermeable podia are not recommended on narrow streets, as shown in Figure 19. The real gem in region 3c in terms of air ventilation is the Sham Shui Po Park and Sham Shui Po Swimming Pool which serve as the gateway for summer breeze into region 4.

5.2.7 Region 4

Region 4 benefits from the vast open space it offers, as well as the Sham Shui Po Park and Sham Shui Po Swimming Pool south of the Project Area. The existing building height is 20mPD to 60mPD at Lai On Estate and Lai Kok Estate, the proposed maximum building height in region 4 is increased to 120mPD. This significant increase in building height will give rise to significant adverse impact to air ventilation. However, as the site is large, there is a great opportunity to provide more open spaces at the ground level for a given plot ratio. The disposition of the building blocks should follow the concept provided in Figure 19 to provide wind corridors through the site. It is also recommended that the non-building areas to be provided as shown in Figure 25 at Lai On Estate and Lai Kok Estate, such that the breeze can permeate to the centre of Cheung Sha Wan area via the Sham Shui Po Park and the future redevelopment of the two housing estates. Quantitative AVA studies for these sites are therefore recommended.



Figure 25 Recommended Non-building Areas in Lai Kok Estate

The existing Temporary Wholesale Vegetable Market and Temporary Wholesale Poultry Market are currently zoned "R(A)" and the maximum proposed building height is 100mPD. These sites are located at the gateway of summer breeze into Cheung Sha Wan, therefore caution must be exercised to ensure that building blocks do not obstruct the ventilation gems: Asia Golf Club (temporary golf driving range) and Cheung Sha Wan Playground. These sites are large, and the impact of poorly arranged building blocks could negatively impact the wind environment in Cheung Sha Wan. It is important to incorporate air paths within these sites as shown in Figure 26. Again, podia structure should be made smaller or permeable at these sites, as illustrated in Figure 19. Quantitative AVA studies for these sites are therefore recommended.



Figure 26 Recommendations on Future Residential Developments at the Temporary Market Sites

5.2.8 Region 5

Castle Peak Road and Cheung Sha Wan Road are major air paths in this region; whilst Cheung Shun Street and Cheung Yee Street are air paths in this region. The proposed maximum building height of 120mPD to 130mPD in these streets will have a negative impact on air ventilation, compared to the existing medium-rise nature when the major air paths are narrow. Table 4 describes the planned maximum building height and recommended minimum road width (building face-to-building face). If developments along Cheung Yee Street and Cheung Shun Street cannot be capped at 60mPD, the adverse air ventilation can be reduced by widening the road spacing (building face-to-building face) as shown in Table 4. The air ventilation can also be improved if the podia is to be made permeable, and in the longer term upon redevelopment, to implement a building gap as shown in Figure 27. However, Lee Hang Industrial Building at 10 Cheung Yue Street and Billion Plaza at 8 Cheung Yue Street are constructed and committed respectively, these mitigation suggestions may not be practical. It is recommended to maintain the O and G/IC sites at Lai Chi Kok Road to provide better air ventilation.

| Road / Street | Recommended Minimum Road Width (building face-to-building face) (m) | Recommended Maximum Building Height (mPD) | Illustration |
|------------------------|---|--|-----------------------------|
| Castle Peak Road | 22.5 | 100 | H=100mPD S~22.5m W ~ 80m |
| Cheung Sha Wan Road | 40 | 120 | H=120mPD S~40m W~80m |
| Cheung Shun Street | 17 | 60 | |
| Cheung Yee Street | 17 | 60 | H=60mPD S~17m W~45m |

Table 4 Recommended Maximum Building Height and Minimum Building-to-Building FaceRoad Widths for Region 5.



Figure 27 Building Gap on Cheung Yue Street

5.2.9 Region 6

There is no major concern with the proposed plan in this region. This area will continue to enjoy breezes. Tung Chau Street Park will continue to allow the wind to permeate into region 3c via Nam Cheong Street. Care should be taken with the building block disposition within Nam Cheong Estate.

5.3 Further Study

Given the consideration of development right which will lead to high-rise buildings, control of building height in itself is not an effective means for better air ventilation. This study only provides an overview of the existing wind environment and recommends broad measures to minimise negative impacts and where appropriate, improvement to the existing conditions.

For specific sites where large-scale redevelopment may be possible with a significant increase in maximum building height, caution should be taken with the building disposition. Podia on narrow streets should be avoided where possible, as shown in Figure 19. Further AVA studies are recommended for these large development/redevelopment sites in Figure 28. These sites are in the vicinity of alternative wind corridors.



Figure 28 Further Study Areas

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6. CONCLUSIONS

Existing non-building areas either in the form of open space, or G/IC sites such as Sham Shui Po Park and Sham Shui Po Swimming Pool, Tung Chau Street Park, Asia Golf Club (temporary golf driving range), Cheung Sha Wan Playground, Sham Shui Po Sports Ground, Han Garden, Lei Cheng Uk Estate Garden, Tung Chau Street Park are essential wind corridors to the Project Area. Open spaces e.g. Nam Cheong Park and G/IC sites are also found just south of the Project Area. It is essential that the low-rise nature and openness of these open space and G/IC sites shall be maintained.

It is important to maintain this sparse distribution of residential developments in region 1; and the low-rise G/IC facilities along Kwong Lee Road and Fat Tseung Street, green belt and open space in region 2, to allow sufficient wind breeze to permeate to the other regions of Cheung Sha Wan. Courtyards of various sizes are found in many developments such as the existing So Uk Estate, Lei Cheng Uk Estate, Han Garden. The integration of courtyards in these developments helps to reduce heat island effect and serves as ventilation pockets. Po on Road Playground and the school site at Cheung Fat Street will play an even more vital role in air ventilation when the redevelopment of So Uk Estate is complete. The low-rise nature of the school and the openness of the playground will help to mitigate the negative air ventilation impact of the proposed So Uk Estate redevelopment. It is essential that these two pockets are maintained for better air ventilation.

A number of sites are planned for development/redevelopment just south of region 4, outside the Project Area. The existing and committed developments will have a significant adverse air ventilation impact in Cheung Sha Wan. The most significant are Fu Cheong Estate (119mPD, 41 storeys); the proposed Sai Chuen Road Estate (118mPD, 41 storeys); Nam Cheong Station Development (181.7 mPD, 52 storeys); and CDA Site 6's proposed public rental housing development (100mPD to 110mPD). In order to enhance air ventilation of the district, the open spaces along Hing Wah Street West, Ying Wa Street and Yen Chow Street West will act as breathing spaces within the built-up urban environment, whilst the G/IC sites at Lai Hong Street, Tung Chau Street, Yen Chow Street West are recommended for low-rise developments. The OU sites annotated wholesale market phase I and II at the waterfront are to be maintained as low-rise developments, as these lie in the gateway of southerlies and south-westerlies to the Project Area.

Region 5 is shielded by high-rise developments of Banyan Garden, Liberte, The Pacifica and Aqua Marina just south of the Project Area, and Manhattan Hill west of the Project Area. These developments form a substantial obstacle to onshore summer winds, developments of such scale and disposition should be avoided in the future to minimise the adverse impact of air ventilation, as region 5 is the gateway to breeze for the south-westerlies in the Cheung Sha Wan Area.

It is observed in the proposed plan that it is possible to have podia which have 100% site coverage and up to three storeys. Large-scale podia on narrow streets impede wind from reaching pedestrian level. It is recommended to provide setback from the site boundary, or to recess the lower floors from these streets to widen the streets, or to align the podia edge with the building edge, and to make the podia more permeable.

The proposed five bands of height for So Uk Estate Redevelopment are acceptable, however, it is preferred to have the incremental height increases with the ascending sea level from air ventilation point of view. As the site is generously large, there is design freedom for a permeable arrangement of building blocks, and to avoid slab type buildings which close off ventilation corridors as in the current situation.

The proposed maximum building height to 100mPD and 120mPD will worsen the skimming flow, and thus the air ventilation in region 3a compared to the existing medium-rise nature. A maximum height of 120mPD with significant variation in height distribution is recommended to improve mixing of the windflow to improve air ventilation. An alternative recommendation to the reduced band height is to cap the maximum building height at 120mPD and have the buildings setback from the streets such that the minimum road spacing (measured from building-face to building-face) on Tonkin Street, Cheung Wah Street, Hing Wah Street are 37m, 20m and 30m respectively.

A maximum height of 110mPD with significant variation in height distribution is recommended to improve mixing of the windflow to improve air ventilation in region 3b Alternative recommendations of maximum building height and minimum road spacing (measured from building-face to building-face) are up to 100mPD and 40m respectively.

The proposed URA development scheme at Lai Chi Kok Road/ Kweilin Street and Yee Kuk Street also includes a public open space created by setting back from the site boundary and

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thereby widening Kweilin Street. This kind of strategy and design which is beneficial for the air ventilation should be encouraged.

It is also recommended that the non-building areas to be provided at Lai On Estate and Lai Kok Estate, such that the breeze can permeate to the centre of Cheung Sha Wan area via the Sham Shui Po Park and the future redevelopment of the housing estates.

The existing Temporary Wholesale Vegetable Markets and Temporary Poultry Market fall within a "R(A)" zone with a proposed maximum height of 100mPD. These large sites are located at the gateway of summer breeze into Cheung Sha Wan, therefore caution must be exercised to ensure that building blocks do not obstruct the ventilation gems: Asia Golf Club (temporary golf driving range) and Cheung Sha Wan Playground.

The proposed maximum building height of 120mPD to 130mPD compared to the existing building height mainly ranged from 40mPD to 60mPD, in the streets in region 5 will have a negative impact on air ventilation, compared to the existing medium-rise nature when the major air paths are narrow. Recommendations on building height and road width are provided in this study report. It is recommended to maintain the O and G/IC sites at Lai Chi Kok Road to provide better air ventilation.



Figure 29 Summary of Recommendations to Minimise the Impact