



Planning Department

Air Ventilation Assessment For Hung Hom District Study FINAL REPORT



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August 2008

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1. INTRODUCTION

1.1 Background of the Study

- 1.1.1 In the Team Clean report published in August 2003, Government undertook to examine the practicality of stipulating air ventilation assessment (AVA) as one of the considerations for all major development or redevelopment proposals and in future plan making. In the “First Sustainable Development Strategy for Hong Kong” promulgated by the Office of the Chief Secretary for Administration in May 2005, a strategic objective to promote sustainable urban planning and design practices has been set out amongst other objectives with special regard to issues such as buildings affecting view corridors or restricting air flow.
- 1.1.2 A framework for applying AVA is developed on the basis of the “Feasibility Study on Establishment of Air Ventilation Assessment System” completed and endorsed by the Committee on Planning and Land Development on 7 June 2005. To ensure that air ventilation impacts are duly considered as one of the main criteria in the planning and design process, the Technical Circular on Air Ventilation Assessment was jointly promulgated in July 2006 by the former Housing, Planning and Lands Bureau and Environment, Transport and Works Bureau. It sets out the guidance and need to apply AVA to all major government projects, which may have major impacts on the macro wind environment.
- 1.1.3 Planning Department has commissioned CH2M HILL Hong Kong Limited to provide term consultancy services for undertaking air ventilation assessment in September 2006. As instructed by Planning Department in March 2007, an Expert Evaluation (EE) shall be conducted for the two development schemes to be formulated under the Hung Hom District Study. The EE was prepared in association with the CLP Power Wind/Wave Tunnel Facility (WWTF) at the Hong Kong University of Science and Technology (HKUST). No wind tunnel tests for the detailed air ventilation study are required.

1.2 Objectives of the Study

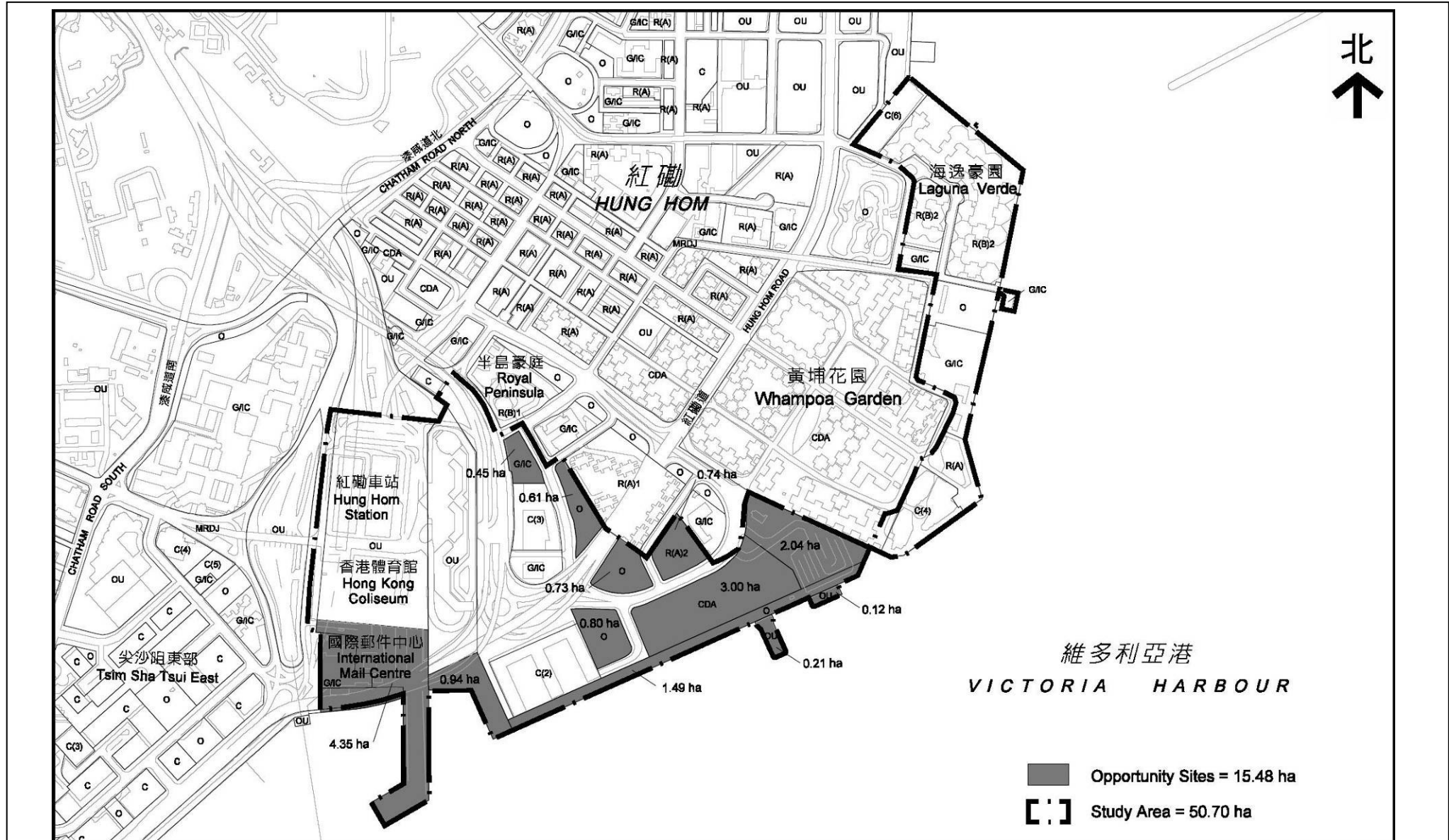
- 1.2.1 The objective of this study is to complete air ventilation assessment for two design schemes for the Hung Hom District Site and to facilitate the Government to decide an appropriate design scheme for better air ventilation.
- 1.2.2 Two design schemes, the Initial Scheme and the Revised Scheme, were assessed.

1.3 Project Site Characteristics

- 1.3.1 The Study Area for the Hung Hom District Study covers about 51 ha along the Hung Hom waterfront bordering the Victoria Harbour, as shown in Figure 1-1. Within this Study Area, 15.48 ha are initially considered as opportunity sites which are concentrated in the southern portion of the Study Area. In particular, there are three focus areas:
- MTRC Freight Yard and International Mail Centre Sites;
 - CDA and R(A)2 Sites; and
 - Tai Wan Shan Park
- 1.3.2 Victoria Harbour forms the southern boundary of the Study Area. The Study Area and its surrounding areas comprise a mixture of parks, roads and overpasses, medium-rise and high-rise buildings. A majority of those medium-rise and high-rise buildings in the eastern harbourfront area are newer buildings.
- 1.3.3 The Hong Kong Coliseum and Hung Hom Station are located immediately to the north of the MTRC Freight Yard and IMC Sites. The Metropolis (a commercial building) and Harbour Plaza Metropolis (a hotel) to the north-east and Harbourfront Horizon (a hotel) between the MTRC

Freight Yard and IMC Sites and CDA Site are existing buildings which will remain unchanged. The Hung Hom Station and the central part of Hung Hom is due north of the Study Area, with a significant number of medium- or high-rise residential buildings found in Whampoa Garden and Royal Peninsula close by, and Harbourfront Landmark and Laguna Verde further north.

- 1.3.4 Based on the existing building configurations and street alignments of Hung Hom, particularly those more recent high-rise developments along the eastern boundary of the Study Area, wind penetrations are expected to be mostly through available gaps and openings between existing buildings. The arterial roads, main roads and feeder roads and streets, particularly those that are aligned with and avoided blockage to the prevailing east or north wind directions, also facilitate wind penetrations into and enhance air ventilation within the Hung Hom District.



<p>Title: Study Area and Opportunity Sites – Hung Hom District Study</p>	<p>CH2M HILL HONG KONG LIMITED</p>
<p>Project: Air Ventilation Assessment Hung Hom District Study – Final Report</p>	<p>Figure: 1-1</p>

2. SITE WIND AVAILABILITY

2.1 Hong Kong Non-typhoon Wind Climate

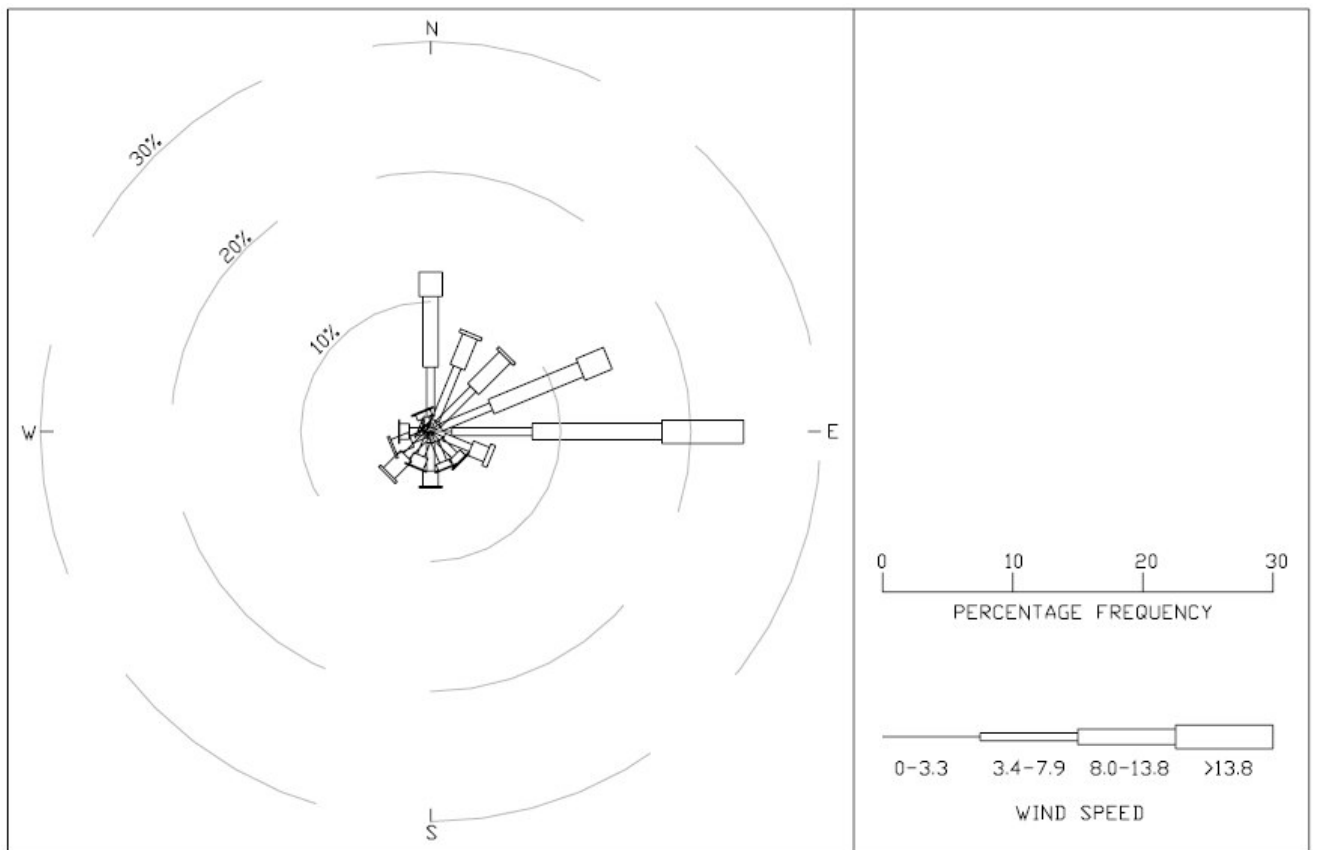
- 2.1.1 Waglan Island, located approximately 5 km southeast of Hong Kong Island, has been used by the Hong Kong Observatory (HKO) for the collection of long-term wind data since December 1952. Due to its small area, isolated location, relative lack of development and generally uninterrupted exposure to winds, data collected at Waglan Island is considered to be representative of winds approaching the Hong Kong region.
- 2.1.2 HKO data, measured at Waglan Island during the period of January 1953 to May 2000 inclusive, have been combined with wind tunnel measurements to determine a probabilistic model of mean speed and direction of non-typhoon winds affecting Hong Kong (Hitchcock et al. 2003). The wind rose representing annual, non-typhoon winds at Waglan Island, corrected to 500 m, is presented in Figure 2-1, which indicates that the prevailing non-typhoon winds affecting Hong Kong occur mainly from northerly, easterly and south to south-westerly directions.

2.2 Topographical Impact

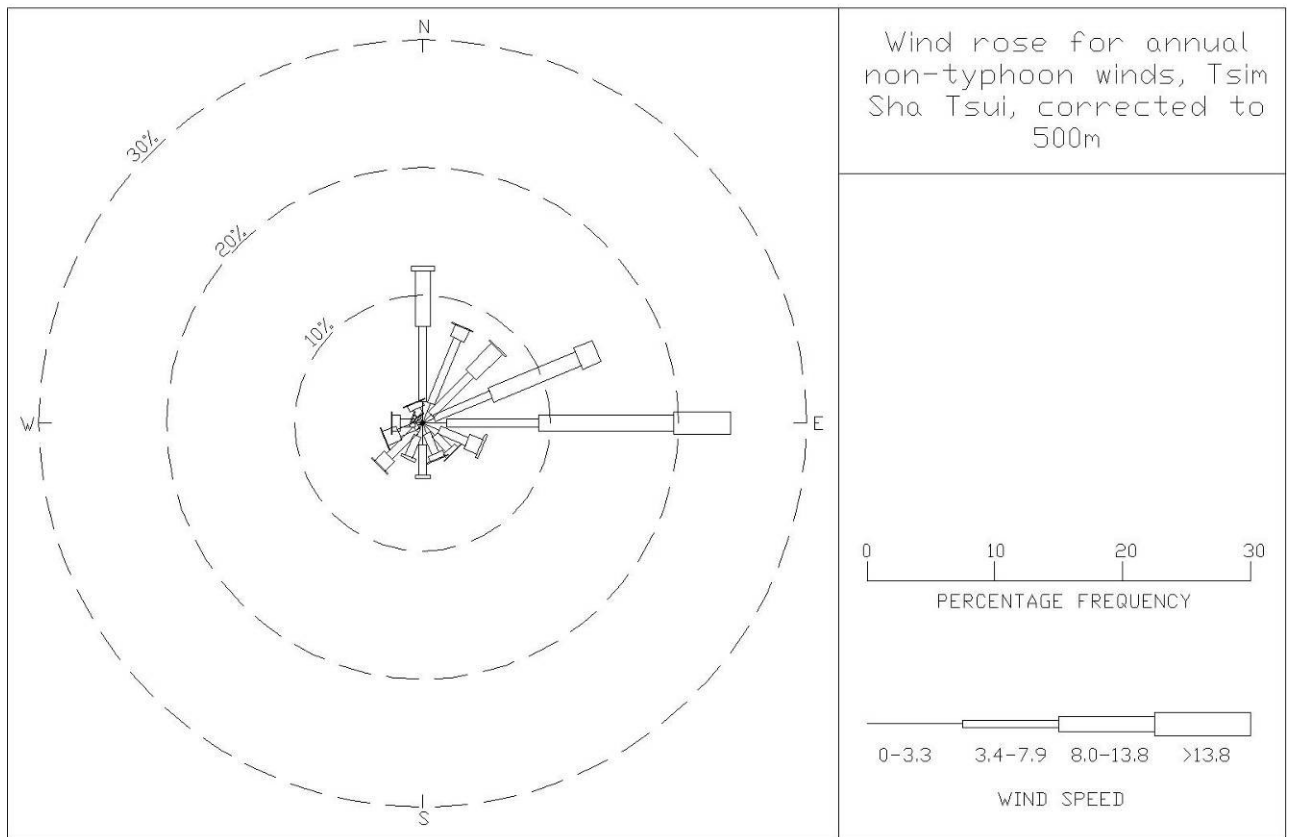
- 2.2.1 Topographies surrounding the Study Area are expected to modify the prevailing winds observed at Waglan Island. Distant hilly terrain and urban fabric north of the site provides some shielding effect and the downwind slope moderates the northerly winter monsoon. The hilly Hong Kong Island across Victoria Harbour also provides a shielding effect that is likely to moderate the southerly sea breezes. Victoria Harbour, with its narrow eastern Lei Yue Mun entrance, creates a channelling effect that is likely to enhance the easterly monsoon.
- 2.2.2 Overall, by considering the effects of the surrounding topography, the site wind availability for the Study Area is expected to be dominated by easterly winds with lesser contributions from northerly and southerly winds. For a more precise site wind climate, a site wind availability study that considers the directional characteristics of the local wind and its interaction with the local topography and built environment is recommended.

2.3 Site Wind Availability for Tsim Sha Tsui

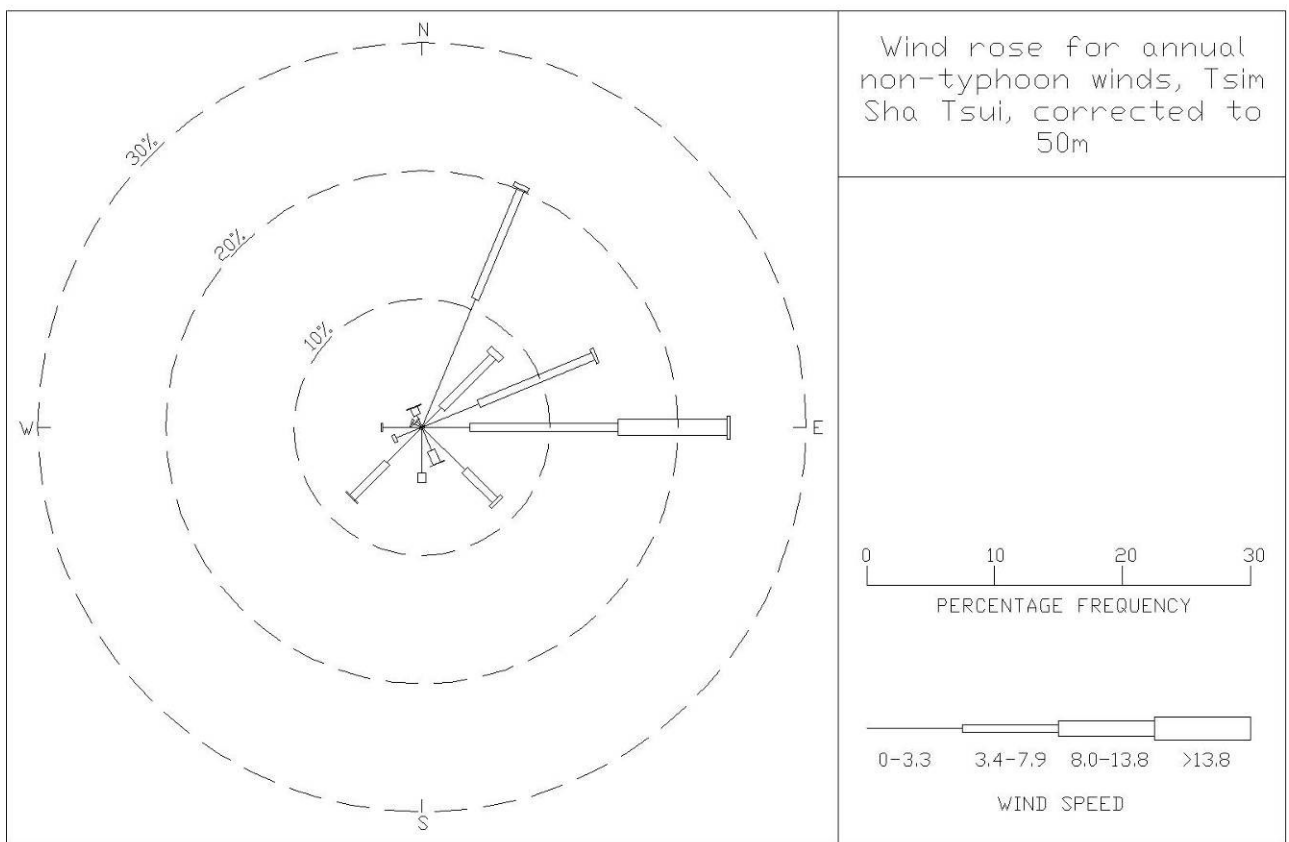
- 2.3.1 A site wind availability study for a site at Tsim Sha Tsui that is relatively close to the Study Area has previously been commissioned by the Planning Department. The test results of that study are shown in Figures 2-2 and 2-3 for a height of 500 m and 50 m respectively. At 500 m, the wind rose for Tsim Sha Tsui is similar to that for Waglan Island at the same height (Figure 2-1), with some minor differences attributable to the surrounding topography. The wind rose at 50 m is, as expected, markedly different to that at 500 m.
- 2.3.2 The site wind availability for the Study Area at the higher heights, say 500 m, is expected to be similar to that for Tsim Sha Tsui and Waglan Island. However, at lower heights, the wind availability is more sensitive to buildings and streetscapes upwind and hence becomes far more site-specific. Therefore, for a more precise site-specific wind climate, an appropriate site wind availability study is recommended.
- 2.3.3 Summarizing the above, it is generally expected that the prevailing winds for the Study Area would be dominated by easterlies with lesser contribution from northerly and southerly winds.



<p>Title: Wind Rose for Annual, Non-typhoon Winds at Waglan Island (corrected to 500m)</p>	<p>CH2M HILL Hong Kong Limited</p>
<p>Project: Air Ventilation Assessment Hung Hom District Study – Final Report</p>	<p>FIGURE: 2-1</p>



<p>Title: Wind Rose for Annual, Non-typhoon Winds at Tsim Sha Tsui (corrected to 500m)</p>	<p>CH2M HILL Hong Kong Limited</p>
<p>Project: Air Ventilation Assessment Hung Hom District Study – Final Report</p>	<p>FIGURE: 2-2</p>



<p>Title: Wind Rose for Annual, Non-typhoon Winds at Waglan Island (corrected to 50m)</p>	<p>CH2M HILL Hong Kong Limited</p>
<p>Project: Air Ventilation Assessment Hung Hom District Study – Final Report</p>	<p>FIGURE: 2-3</p>

3. DESIGN SCHEMES

3.1 General Design Considerations

- 3.1.1 The Study Area and surrounding areas comprise a mixture of parks, roads and overpasses, medium-rise and high-rise buildings. A majority of those medium-rise and high-rise buildings are newer buildings that occupy the eastern harbour front of the Study Area. Existing buildings in the remaining parts of Hung Hom are mostly medium-rise buildings.
- 3.1.2 Two design schemes have been developed and subject to expert evaluation:
- (a) Initial Scheme ((Figure 3-2 to 3-5)
 - (b) Revised Scheme (Figure 3-6 to 3-8)
- 3.1.3 In air ventilation term, the major variations among the two design schemes are the number of building blocks and the disposition and height of the residential and commercial towers within the subject development site. Their major design features are summarized in the following sections.

3.2 Initial Scheme

- 3.2.1 The major features of the Initial Scheme are:
- MTRC Freight Yard and International Mail Centre (IMC) Sites (Figure 3-2 and 3-3)
 - Low-rise retail developments are proposed around the perimeter of the Sites, in Areas A, E, and H. The proposed buildings are limited to 23m PD in height.
 - Low-rise waterfront kiosks, retail and dining outlets are proposed for Areas L and M around the waterfront part of the Sites. The proposed buildings are 11 m in height (15 mPD).
 - Areas C, I and P are open areas designated for use as public passageways and public areas.
 - Two medium-rise hotels are proposed for Areas B and D. The proposed hotels are well-separated and about 55 m above ground (75 mPD).
 - CDA and R(A)2 Sites (Figure 3-4 and 3-5)
 - A mixed development: a cluster of two-tier (40 mPD and 75 mPD) buildings comprising commercial office, retail and hotel, with a hotel block at the eastern end atop a podium (not exceeding 15 mPD) is proposed for the CDA Site. A public transport interchange (PTI) is proposed at the ground floor of the podium. A residential development with two towers (not exceeding 120 mPD) over a podium (not exceeding 15 mPD) is proposed for the R(A)2 site.
 - Areas A, C, E, H, I and J are open areas designated for use as public passageways and public areas.
 - A 60 m high (75 mPD) hotel over a 10 m high (15 mPD) podium is proposed for Area F.
 - A mixed commercial office, retail and hotel development is proposed for Area D. The proposed development is a cluster of two-tier buildings: the first row of buildings closer

to the harbour stand at 40 mPD and the second row at 75 mPD, with individual buildings separated by no less than 10 m.

- Two high-rise residential buildings are proposed for the R(A)2 Site. The two proposed buildings are nearly identical in section and height (not exceeding 120 mPD), both sitting on top of a 8 m podium that covers the entire R(A)2 Site.
- Tai Wan Shan Park
 - The spiral café proposed for Tai Wan Shan Park is a low-rise building approximately 4.8m in height above ground.

3.3 Revised Scheme

3.3.1 The major features of the Revised Scheme are:

- MTRC Freight Yard and IMC Sites (Figures 3-2 and 3-3)
 - No changes have been made to the Initial Scheme of the MTRC Freight Yard and IMC Sites.
- The CDA Site is split into Sites A and B (Figure 3-1):

Site A

- Office and retail development, D1 to D4, are proposed for Area D (Site A). A cluster of two-tier buildings, 40 mPD and 75 mPD, each atop a podium (not exceeding 15 mPD). The buildings are separated by no less than 10 m.

Site B

- A cluster of hotel buildings (buildings F1 to F3 at heights 40 mPD, 75 mPD and 60 mPD respectively) atop a podium (not exceeding 15 mPD) is proposed for Area F (Site B).
- A PTI at ground level of Site B is serviced by a pedestrian access (H) via the waterfront promenade and a vehicle ingress/egress (K) at the north corner of Site B.
- The disposition of the hotel blocks are different from the Initial Scheme.
- R(A)2 Site
 - The two high-rise residential buildings proposed for the R(A)2 Site are about 87 m in height (100 mPD) and they are comparable in height to surrounding buildings. The two buildings are separated by approximately 20 m.
 - Areas A, C, E, I and J are open areas designated for use as public passageways and public areas.
 - The main difference between the Initial Scheme and the Revised Scheme is the reduction in height of the residential towers.
- Tai Wan Shan Park
 - The spiral café at Tai Wan Shan Park has been removed and replaced by landscaping.

3.4 Expert Evaluation of the Two Design Schemes

3.4.1 Expert evaluation has been undertaken for each of the design schemes.

3.4.2 Taking into account the site wind characteristics, the expert evaluation identifies that the following major design features of the two schemes may have air ventilation impacts:

- MTRC Freight Yard and IMC Sites

- The proposed low-rise retail developments for Areas A, E and H are expected to create little wind blockage effects and are unlikely to adversely affect the pedestrian level wind conditions. Furthermore, these buildings are integrated into the terraced design of the Sites to capture the southerly winds to enhance wind penetrations.
 - The proposed low-rise waterfront kiosks, retail and dining outlets are unlikely to adversely affect the pedestrian level wind conditions around the Sites, or its general surroundings. In terms of local pedestrian level wind conditions, an improved local air ventilation effect may be achieved by providing more gaps and openings between buildings.
 - Areas C, I and P are generally spacious and relatively unobstructed by large or tall buildings, facilitating unhindered wind penetrations into the Study Area, Hung Hom and surrounding areas. Moreover, Areas C and I are integrated into the terraced design of the Sites to capture the southerly winds to enhance wind penetration.
 - The building layout for the two medium-rise hotels in Areas B and D is not expected to create significant wind blockage effects, compared with taller and/or more closely spaced buildings, and hence facilitates wind penetrations, particularly southerly winds which are enhanced by the terraced form of the buildings. Furthermore, the proposed hotels are quite exposed to winds from southerly directions and expected to generate beneficial downwashes to feed to pedestrian level around the bases of the hotels.
 - Some localised stagnant zones will occur in the lee of the proposed hotels, depending on the approaching wind direction and the resultant wind-structure interaction. However, such stagnant zones will change as the wind direction changes.
 - Overall, the proposed building layout is unlikely to adversely affect the pedestrian level wind conditions within the MTRC Freight Yard and IMC Sites, Study Area, Hung Hom and surrounding areas. Large portions of the Sites are designated open areas with gardens/parks, landscaping and trees. These open areas are beneficial to air ventilation by allowing unhindered wind penetrations into the Study Area, Hung Hom and surrounding areas. Furthermore, planned trees and other landscaping will help to mitigate local air pollution and enhance local air quality.
- CDA and R(A)2 Sites
- In both the Initial and Revised Schemes, Areas A, C, E, H, I and J are open areas designated for use as public passageways and public areas. These open areas are generally spacious and relatively unobstructed by large or tall buildings, facilitating unhindered wind penetrations into the Study Area, Hung Hom and surrounding areas, particularly for winds from southerly directions.

CDA – Site A

- In the Initial Scheme, the height, spacing and step effect of the building cluster in Area D is not expected to create significant wind blockage effects, thus facilitating wind penetrations for winds from both easterly and southerly directions. Furthermore, the proposed buildings are exposed to winds from southerly directions. Coupled with the step effect, this is expected to generate beneficial downwashes to feed to pedestrian level around the bases of the buildings. Some localised stagnant zones will occur in the lee of the proposed buildings, depending on the approaching wind direction and the resultant wind-structure interaction. However, such stagnant zones will change as the wind direction changes.
- In the Revised Scheme, the step effect captures stronger winds at higher levels as downwashes, particularly from the southerly winds, to feed to the pedestrian level

around the bases of the buildings. The height, spacing and step effect of the building cluster lessen wind blockage effects. The pedestrian level wind conditions around Site A are expected to be similar for both the Initial and Revised Schemes.

CDA –Site B

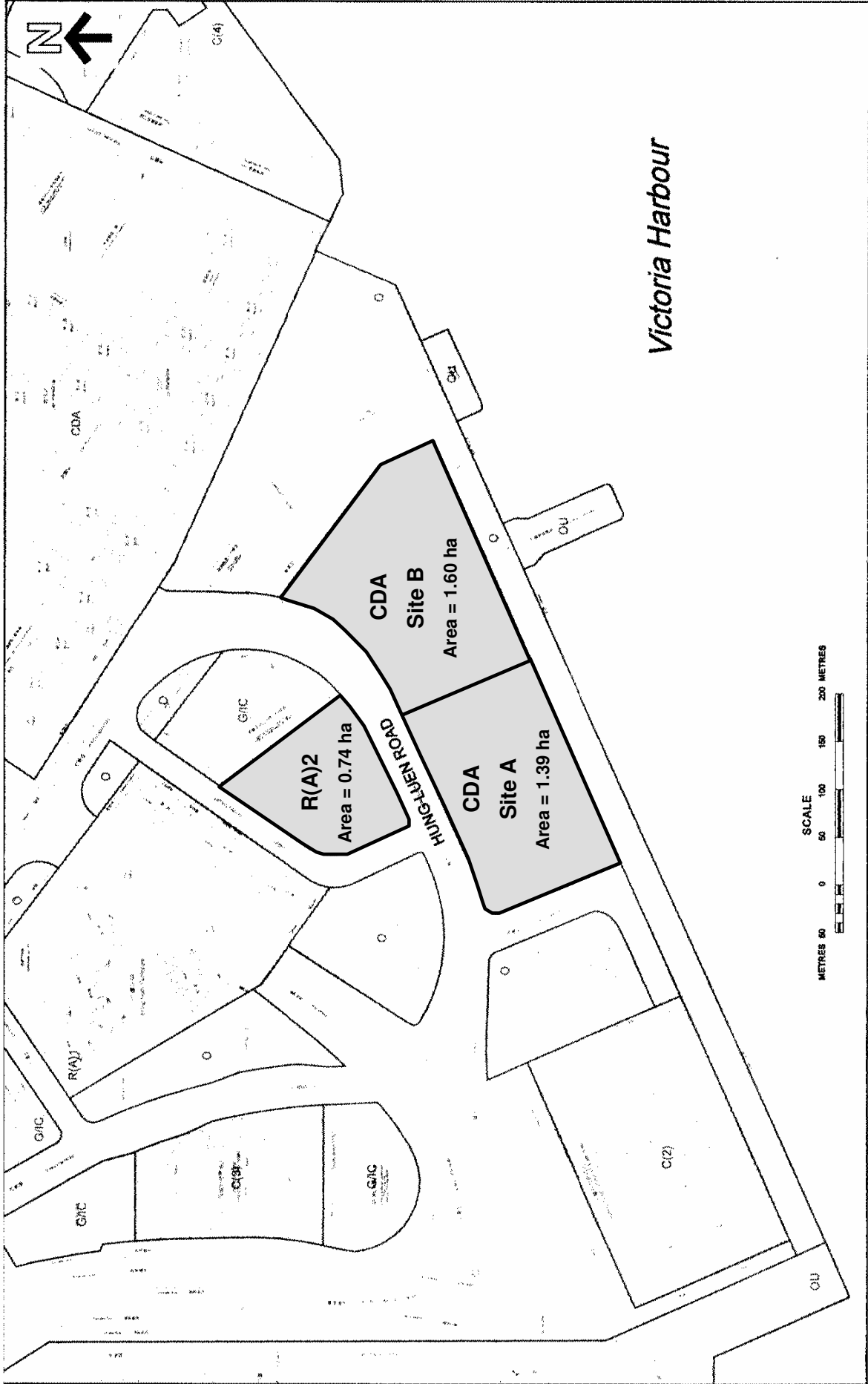
- In the Initial Scheme, considering the height and size of the proposed hotel in Area F and its positioning with respect to the expected prevailing winds for the site, the wind blockage effects are not expected to be severe. Some localised stagnant zones will occur in the lee of the proposed hotel and podium, depending on the approaching wind direction and the resultant wind-structure interaction. However, such stagnant zones will change as the wind direction changes. For winds from northerly and easterly directions, the proposed hotel is expected to generate some beneficial downwashes to feed to pedestrian level around the base of the hotel. However, for winds from southerly directions, the expected downwashes will mostly be trapped on the podium roof and their beneficial effects will not extend to the pedestrian level wind conditions.
- In the Revised Scheme, the cluster of hotel buildings are well spaced on the podium roof. The height, orientation, spacing and step effect of the buildings on the podium lessen wind blockage effects for winds from southerly and easterly directions. While most downwashes would be trapped onto the podium roof, some wind will pass through the building gaps and reach the pedestrian level beyond. In this respect, the pedestrian level wind conditions will likely be marginally better than that in the Initial Scheme.
- In both the Initial and Revised Schemes, a public transport interchange (PTI) at ground level of Site B is serviced by a pedestrian access (H) via the waterfront promenade and a vehicle ingress/egress (K) at the north corner of Site B. Both accesses provide some air ventilations through the PTI, though further improvements by employing mechanically forced ventilation could be considered. Creating more large openings around the perimeter of the PTI, such as reducing the number of retail outlets along the north-west and south-east sections of the PTI perimeter, will also facilitate better wind penetrations through the PTI and provide better air flow at pedestrian accessways/footpaths around the PTI perimeter.
- Overall, the Revised Scheme for Site B is likely to result in marginally better pedestrian level wind conditions within the Study Area and the surrounding areas than the Initial Scheme.

R(A)2 Sites

- In the Initial Scheme, the two high-rise residential buildings proposed for the R(A)2 Site are not expected to create significant wind blockage effects, thus allowing wind penetrations for winds from both easterly and southerly directions. Some localised stagnant zones will occur in the lee of the proposed buildings and podium, depending on the approaching wind direction and the resultant wind-structure interaction. However, such stagnant zones will change as the wind direction changes. Furthermore, the two proposed buildings protrude above the cluster of buildings (75 mPD and 40 mPD) in Area D to generate downwashes. However, the proposed 8 m high podium that covers the entire R(A)2 Site will hinder the downwashes from reaching pedestrian level. Positioning the two buildings closer to the podium alignment may allow more downwashes to reach pedestrian level. The position of the two buildings can also be arranged so as to maximise the spacing between the two buildings and other adjacent buildings to maximise wind penetrations, particularly by southerly and/or easterly winds.
- Comparing the Initial and Revised Schemes, the lower building height for the Revised Scheme (100 mPD) versus 120 mPD for the Initial Scheme will offer slightly improved upper level wind penetrations to the surrounding areas. The

height and spacing of the two buildings in the Revised Scheme are unlikely to create wind blockage effects, compared with taller and/or more closely spaced buildings.

- Both the Initial and Revised Schemes are unlikely to adversely affect the pedestrian level wind conditions within the CDA and R(A)2 Sites, Study Area, Hung Hom and surrounding areas.
- Tai Wan Shan Park
 - In the Initial Scheme, the spiral café proposed for Tai Wan Shan Park is unlikely to adversely affect the pedestrian level wind conditions in its immediate surrounding.
 - In the Revised Scheme, the spiral café at Tai Wan Shan Park has been removed and replaced by landscaping. This will be beneficial to the pedestrian level wind conditions in Tai Wan Shan Park and its immediate surrounding.



Title: Revised CDA and R(A)2 Sites	CH2M HILL HONG KONG LIMITED
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Legend:

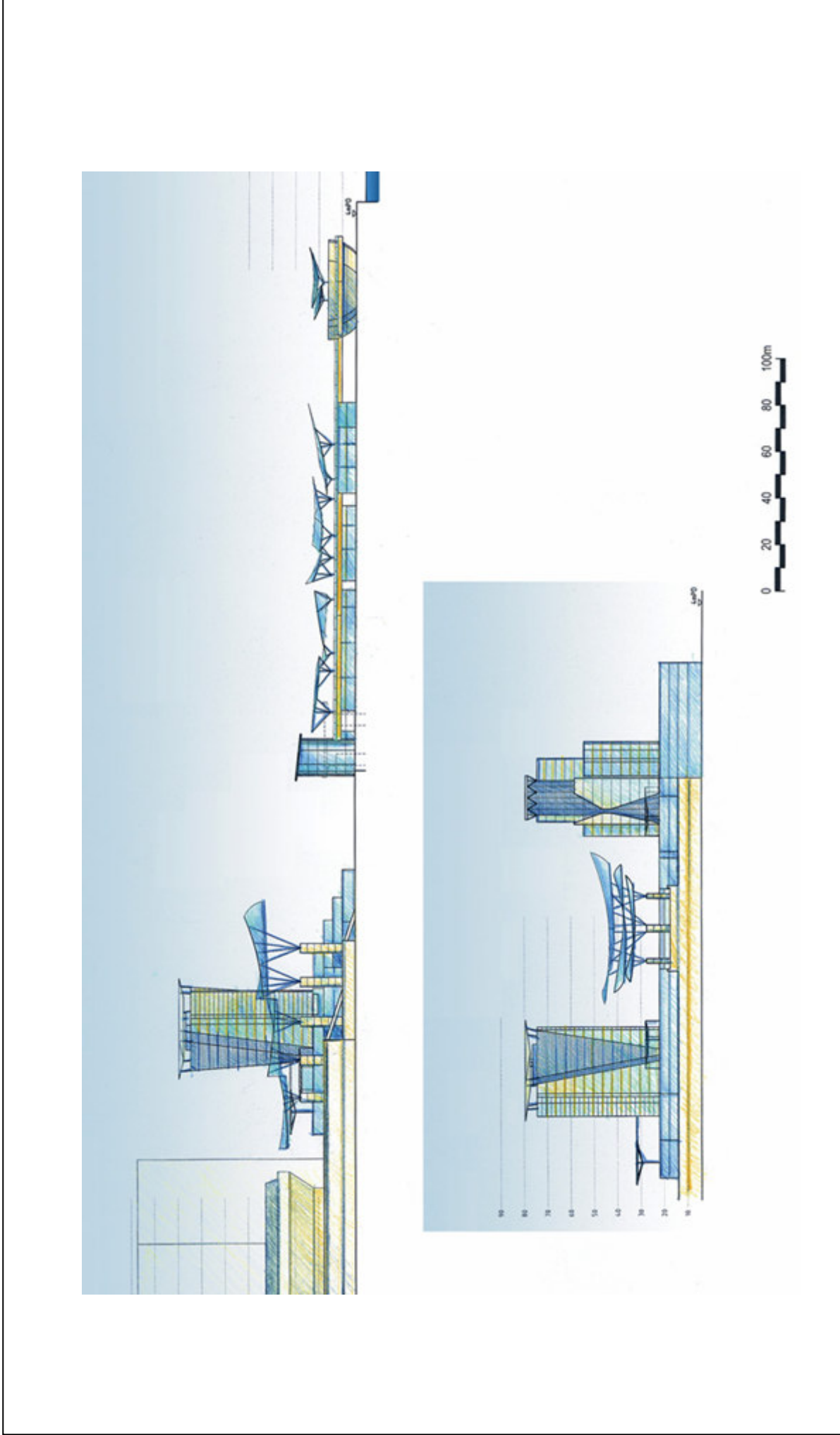
- A Proposed Low-Rise Retail Development
- B Proposed Medium-Rise Hotel / Service Apartments
- C Proposed Access/Egress Providing Connection to Grade at Waterfront
- D Proposed Medium-Rise Hotel / Service Apartments
- E Proposed Low-Rise Retail
- F Proposed Vehicular / Servicing Access (Deck Level)
- G Proposed Vehicular / Servicing Access (At Grade)
- H Retail Entrance Providing Access to Deck Level
- I Proposed Public Waterfront
- J At Grade SCL Alignment underneath Retail Podium
- K Approximate Location of SCL Ventilation Building (to be incorporated into development pending minor design modification)
- L Waterfront Kiosks and Harbour Cruise Departure Point
- M Retail / Dining Outlets
- N Proposed Service Access from Cheong Tung Road South (At Grade underneath Metropolis)
- O Proposed Demolition of Ramp at Either End of Existing Walkway and Introduction of Lifts and Stairs to Enable Enhancement Works and Access
- P Pedestrian Access under Hung Hom Bypass
- Q Existing Coach Park to be Reconfigured

Title: Proposed Building Layout for MTRC Freight Yard and IMC Sites: Plan

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Figure: 3-2



Title:	Proposed Building Layout for MTRC Freight Yard and IMC Sites: Section	CH2M HILL HONG KONG LIMITED
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Legend:

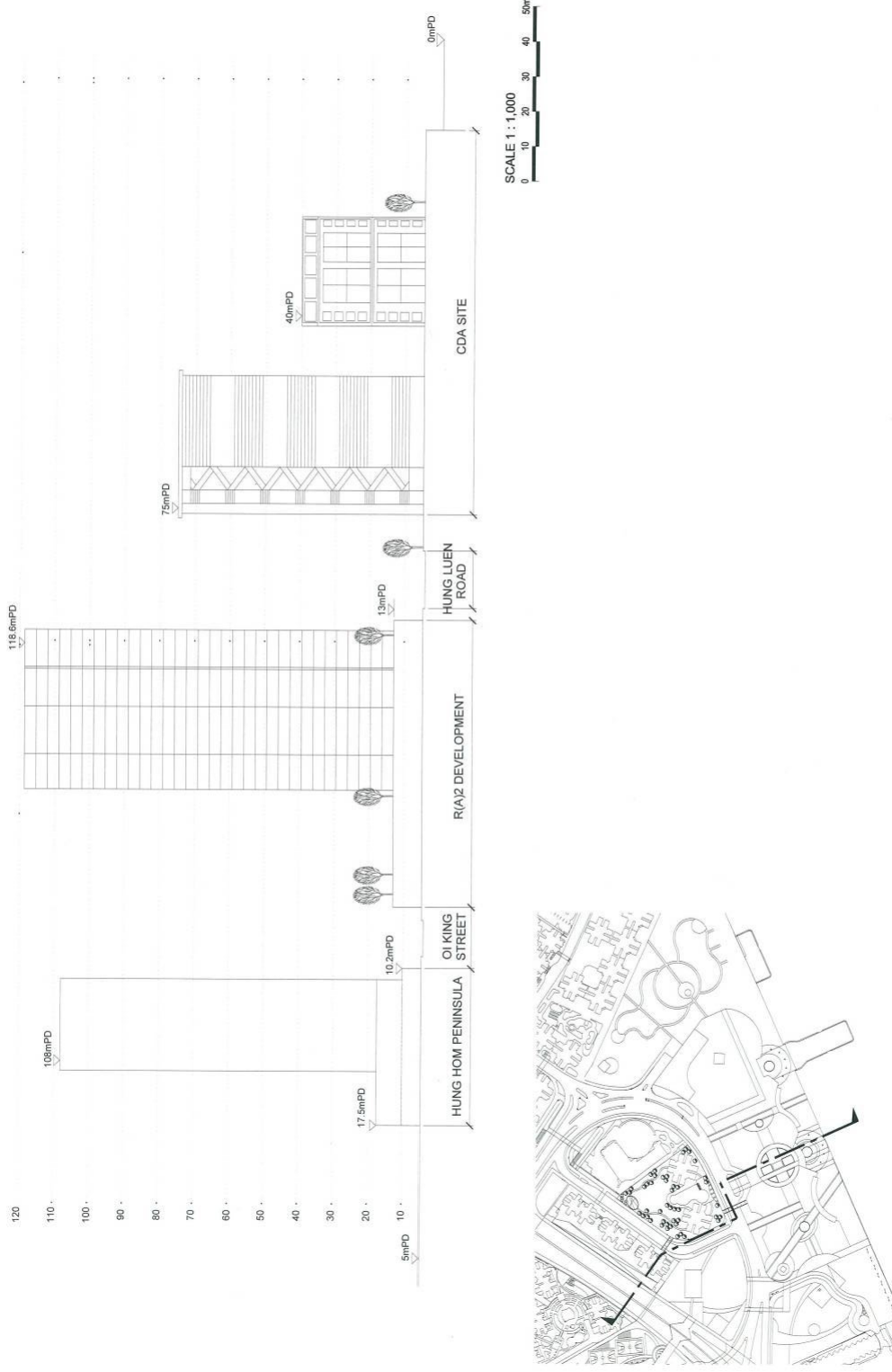
- A Realigned Access Road (Subject to Detailed Design) and Open Space
- B Proposed New Pedestrian Crossing
- C Open Space
- D1–D4 Office, Hotel and Retail within CDA
- E Waterfront Entrance to Retail and Hotel
- F Hotel Over Podium with PTI at Grade
- G Hotel Drop Off and Access to Basement Parking
- H Waterfront Entrance to PTI
- I Reprovisioned within CDA and Possible Connection to Upper Level Retail from 2nd Level of Ferry Pier
- J Waterfront Promenade
- K New Urban Park
- Access / Egress to Reprovisioned PTI

Title: Proposed Building Layout for CDA and R(A)2 Sites: Initial Scheme - Plan

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Figure: 3-4



Title: Proposed Building Layout for CDA and R(A)2 Sites: Initial Scheme - Section

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Figure : 3-5



LEGEND

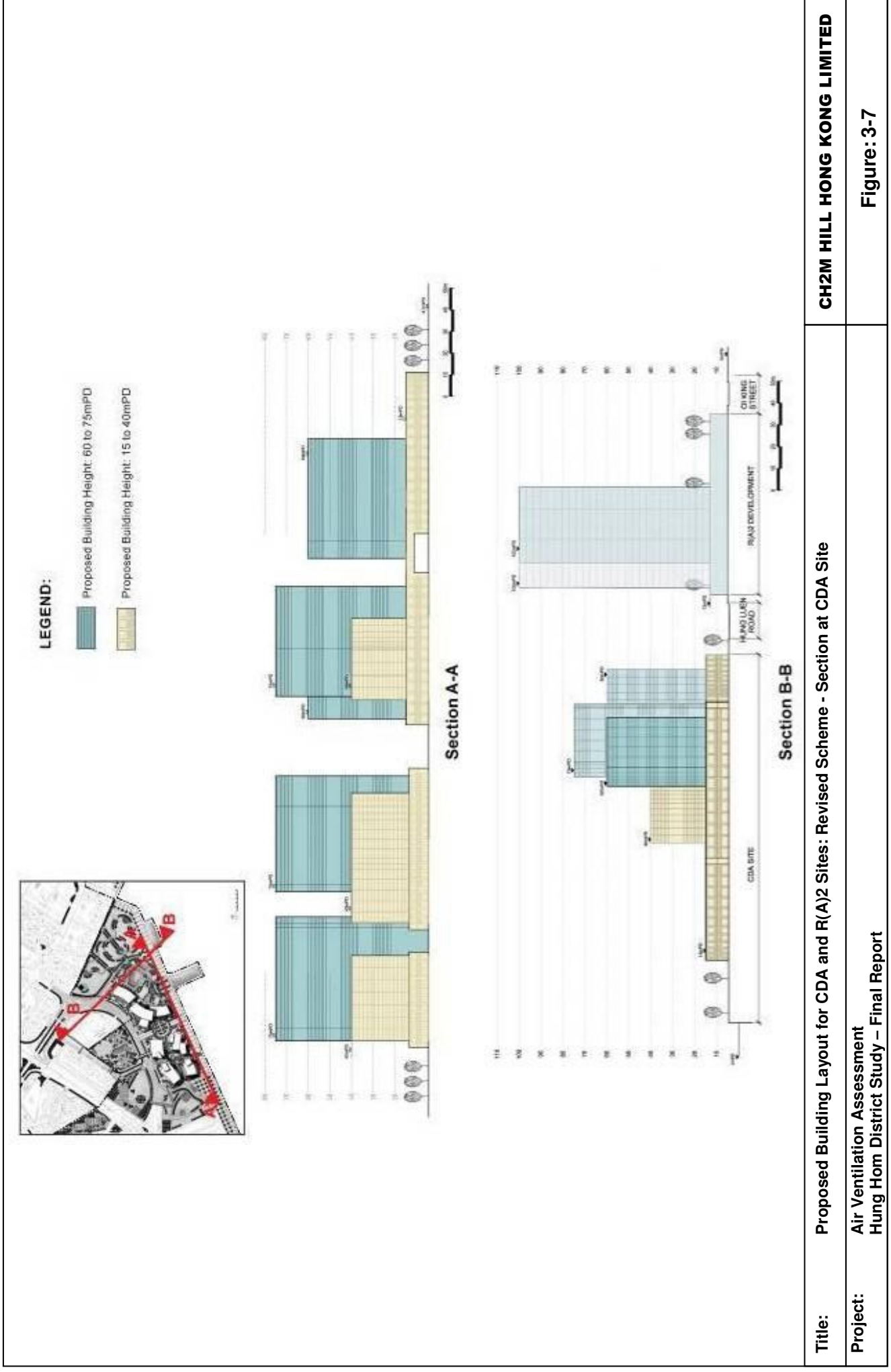
- A.** Realigned Access Road and Open Space
- B.** Proposed Improved Pedestrian Crossings at Grade
- C.** Open Space
- D1- D4.** Office Blocks with Retail on Ground/1st Floors
- E.** Central Open Space Corridor and Plaza
- F1-F3.** Hotel over Podium with Reprovisioned PTI and Retail on Ground / 1st Floors
- G.** Drop-off and Access to Basement Parking
- H.** Ferry Pier Arrival Plaza and Waterfront Entrance to Reprovisioned PTI within CDA
- I.** Waterfront Promenade
- J.** New Urban Park
- K.** Access / Egress to Reprovisioned PTI
- L.** Layby / Drop-off
- M.** Access to Basement Parking and Loading / Unloading Area

Title: Proposed Building Layout for CDA and R(A)2 Sites: Revised Scheme - Plan

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Figure : 3-6

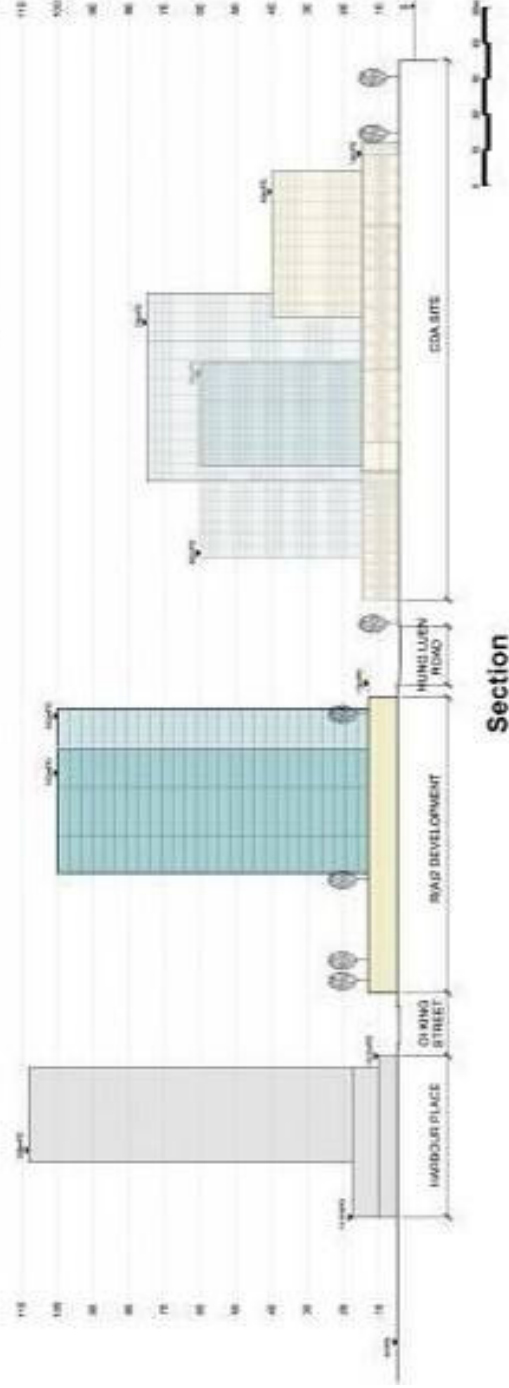
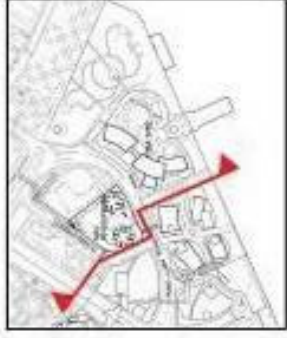


Title:	Proposed Building Layout for CDA and R(A)2 Sites: Revised Scheme - Section at CDA Site	CH2M HILL HONG KONG LIMITED
Project:	Air Ventilation Assessment Hung Hom District Study – Final Report	Figure : 3-7



LEGEND:

Proposed Building Height in mPD



Section

<p>Title: Proposed Building Layout for CDA and R(A)2 Sites: Revised Scheme - Section at R(A)2 Site</p>	<p>CH2M HILL HONG KONG LIMITED</p>
<p>Project: Air Ventilation Assessment Hung Hom District Study – Final Report</p>	<p>Figure: 3-8</p>

4. CONCLUSIONS

- 4.1.1 Based on the non-typhoon probabilistic wind model derived from long-term wind data collected at Waglan Island and the surrounding topography and buildings, the site wind availability for the Hung Hom District Study Area is expected to be dominated by easterly winds with lesser contributions from northerly and southerly winds.
- 4.1.2 The proposed layout and building forms of the proposed developments for the Study Area are generally consistent with basic wind-structure interaction principles that govern air ventilation at pedestrian level. The Study Area is also likely to benefit from its generally unobstructed harbour frontage and exposure to easterly and southerly winds. Any localised stagnant zones resulting from the blockage effect of tall buildings will change as the wind direction changes.
- 4.1.3 For the MTRC Freight Yard and IMC Sites, the proposed layout and building form is unlikely to adversely affect the pedestrian level wind conditions within the sites and the surrounding areas. The designated open areas could allow unhindered wind penetration and the planned trees and landscaping will help to enhance local air quality.
- 4.1.4 The Revised Scheme and the Initial Scheme for the CDA and R(A)2 Sites share similar design features in terms of building height, spacing, and step design. The Revised Scheme, with its revised building shape, orientation, and spacing for Buildings D1 to D4 and F1 to F3 on the CDA Site, is likely to result in a marginally better pedestrian level wind conditions within the Study Area and the surrounding areas than the Initial Scheme.
- 4.1.5 Air ventilation within the PTI on the ground floor of Site B of the CDA Site can be improved by employing mechanically forced ventilation and/or creating more large openings around the PTI perimeter to facilitate better wind penetrations.
- 4.1.6 Removing the spiral café at Tai Wan Shan Park and replacing it with landscaping is beneficial to the pedestrian level wind conditions in Tai Wan Shan Park and its immediate surrounding.
- 4.1.7 Overall, both the Initial Scheme and the Revised Schemes under the Hung Hom District Study are unlikely to adversely affect the pedestrian level wind conditions within the Study Area, Hung Hom and surrounding areas.