土木工程拓展署
Civil Engineering and
Development Department

Agreement No. CE 32/2019 (CE)

Site Formation and Infrastructure Works for Proposed Public Housing Developments at Ying Fung Lane, Wong Tai Sin Community Centre and Ngau Chi Wan Village, Wong Tai Sin – Feasibility Study

Preliminary Air Ventilation Assessment in the form of Expert Evaluation (AVA-EE) (Ngau Chi Wan Village) (Ref: TR14a-08)

June 2022

Reviewed:	Anna Chung	21 June 2022
Approved for Issue:	David Ho	21 June 2022

AECOM ASIA COMPANY LIMITED

TABLE OF CONTENTS

Expression and Abbreviation

The following words and expressions shall have the meaning hereby assigned to them:-

a) "Site" means the site of Ngau Chi Wan Village proposed for housing developments as shown in **60625506/TR14a/FIGURE 1.2**. As compared to the original site boundary under the Brief, the existing Choi Hung Villa has been incorporated into the Ngau Chi Wan Village site to enhance the development potential and improve the development flexibility.

b) "Development" means the proposed public housing development(s) within the Site(s) and any government, institution or community facilities (G/IC), retail, welfare, open space and/or amenities necessary for supporting the proposed housing developments and the local community.

c) "Infrastructure Work" means the site formation works and the essential engineering infrastructure works within/outside the Site necessary for supporting the Development, including but not limited to the proposed site access, land decontamination works (if required), environmental mitigation measures, upgrading/reprovisioning of existing facilities, provision of proposed new landscape works, preservation and maintenance of existing trees and landscape areas affected by the Development, public transportation interchange/laybys, flyovers, footbridges, roadworks, stormwater drains, sewers, sewage pumping stations, waterworks, etc.

d) "Government" means the Government of the Hong Kong Special Administrative Region.

e) "Assignment" means the feasibility studies on the site formation and infrastructure works for supporting the housing developments.

f) "Project" means the project for proposed housing developments at the Site.

The following table lists the abbreviated titles of Government bureau, departments, offices, statutory bodies, public organizations, etc. which are used in this Assignment.

Abbreviation	Full Title
ACABAS	Advisory Committee on the Appearance of Bridges and Associated Structures
ACE	Advisory Council on the Environment
AFCD	Agriculture, Fisheries and Conservation Department
AMO	Antiquities and Monuments Office of Development Bureau
AOI	Area of Influence
ArchSD	Architectural Services Department
ASRs	Air Sensitive Receivers
AQOs	Air Quality Objectives
B/Ds	Bureaux/departments
BDTM	Base District Traffic Model
CBD	Central Business District
CEDD	Civil Engineering and Development Department
CDA	Comprehensive Development Area
CLP	CLP Power Hong Kong Limited
DC	District Council
DEVB	Development Bureau
DLC	District Land Conference

Abbreviation	**Full Title**
DLO	District Lands Office
DoH	Department of Health
DR	Director's Representative
DSD	Drainage Services Department
EDB	Education Bureau
EFS	Engineering Feasibility Study
EIAO	Environmental Impact Assessment Ordinance
EIAO-TM	Technical Memorandum on Environmental Impact Assessment Process
EKEO	Energizing Kowloon East Office
EMSD	Electrical and Mechanical Services Department
EPD	Environmental Protection Department
ExCo	Executive Council
FC	Finance Committee
FSD	Fire Services Department
GB	Green Belt
GEO	Geotechnical Engineering Office of CEDD
GLA	Government Land Allocation
GMB	Green Minibus
GSH	Green Form Subsidised Home Ownership Scheme
G/IC	Government, Institution or Community
ha	Hectare
HAD	Home Affairs Department
HATS	Harbour Area Treatment Scheme
HD	Housing Department
HKHS	Hong Kong Housing Society
HKPSG	Hong Kong Planning Standard and Guidelines
HyD	Highways Department
KTPTW	Kwun Tong Preliminary Treatment Works
LandsD	Lands Department
LCAs	Landscape Character Areas
LCSD	Leisure and Cultural Services Department
LegCo	Legislative Council
LRs	Landscape Resources
LTHS	Long Term Housing Strategy
NCWV	Ngau Chi Wan Village
NSRs	Noise Sensitive Receivers
O	Open Space

Abbreviation	**Full Title**
OU	Other Specified Uses
OVTs	Old and Valuable Trees
OZP	Outline Zoning Plan
PFC	Public Fill Committee of the CEDD
PlanD	Planning Department
PlanD/UD&L	Urban Design and Landscape Section of PlanD
PNAP	Practice Notes for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers
PR	Plot Ratio
PRH	Public Rental Housing
PTI	Public Transport Interchange
PTT	Public Transport Terminus
PWSC	Public Works Subcommittee
R(A)	Residential (Group A)
R(B)	Residential (Group B)
RC	Rural Committee
SCL	Shatin to Central Link
SIS	Slope Information System
SMO	Survey and Mapping Office of LandsD
SSF	Subsidised Sale Flats
SWD	Social Welfare Department
TD	Transport Department
TPB	Town Planning Board
TPEDM	The Territorial Population and Employment Data Matrix
TTIA	Traffic and Transport Impact Assessment
V	Village Type Development
VCAB	Vetting Committee on Aesthetic Design of Pumping Station Buildings
VRs	Visual Resources
WPCO	Water Pollution Control Ordinance
WSD	Water Supplies Department
WSRs	Water Sensitive Receivers
WTSCC	Wong Tai Sin Community Centre
WQO	Water Quality Objective
YFL	Ying Fung Lane

1 INTRODUCTION

1.1 Background

1.1.1 The Government is committed to facilitating steady and continued land supply, not only for providing people with a place to live and work, but also for the developments of Hong Kong's commerce, industry, innovation and technology and various emerging sectors. In the short to medium term, the Government will continue to optimize the use of built-up land and its surrounding areas to meet the community's pressing demand for land for housing and other purposes.

1.1.2 Three (3) potential individual sites, namely Ying Fung Lane, Wong Tai Sin Community Centre and Ngau Chi Wan Village, Wong Tai Sin, are identified for housing developments and supporting facilities. The respective locations of these sites are shown in **60625506/TR14a/FIGURE 1.1**. Boundaries of these sites would be subject to review throughout the course of this Assignment and subject to determination from the review findings of this Assignment.

1.1.3 An Engineering Feasibility Study (EFS) is required for each of the aforementioned individual sites (i.e. a total of three (3) EFSs are to be conducted under this Assignment) to determine the scope of the Infrastructure Works to make available the formed land for housing and associated developments, to assess the various impacts due to the provision of these infrastructures and housing developments and to recommend the mitigation measures to keep the potential impacts due to the Development within the acceptable level of the current standard/regulation. The EFSs shall take into account the cumulative demand/impact of other adjoining existing, planned, committed and possible developments to establish the recommended Infrastructure Works and the required mitigation measures, based on the notional development layout agreed with relevant Government departments. Under this Assignment, deliverables are to be produced to support the Planning Department (PlanD)'s re-zoning of the sites and hence outputs of this Assignment shall also satisfy the re-zoning requirements of the relevant departments, authorities and organizations.

1.1.4 According to 2020 Policy Address, the Government will invite HKHS to undertake the redevelopment of Ngau Chi Wan Village into high-density public housing in the view of the experience of the HKHS in housing production, rehousing of residents and integrated community planning.

1.1.5 This report focuses on the site at Ngau Chi Wan Village (the Project Site). The proposed development boundary of the Site is shown in **60625506/TR14a/FIGURE 1.2**. The two remaining sites will be presented in separate submissions.

1.2 Purpose of this Report

1.2.1 The Preliminary Air Ventilation Assessment – Expert Evaluation (AVA-EE) (hereafter as "the Report") is prepared to meet the requirement of the Clause 6.17 of the Brief. This Report aims to identify the existing wind environment at the vicinity of the Site and qualitatively analysis the probable wind impact induced by the scheme for the Development. This Report is also prepared according to the 'Technical Guide for Air Ventilation Assessment for Developments in Hong Kong' (Annex A of HPLB and ETWB TC No. 1/06).

1.3 Structure of this Report

1.3.1 This Report is organized into 7 sections including this introductory section:-

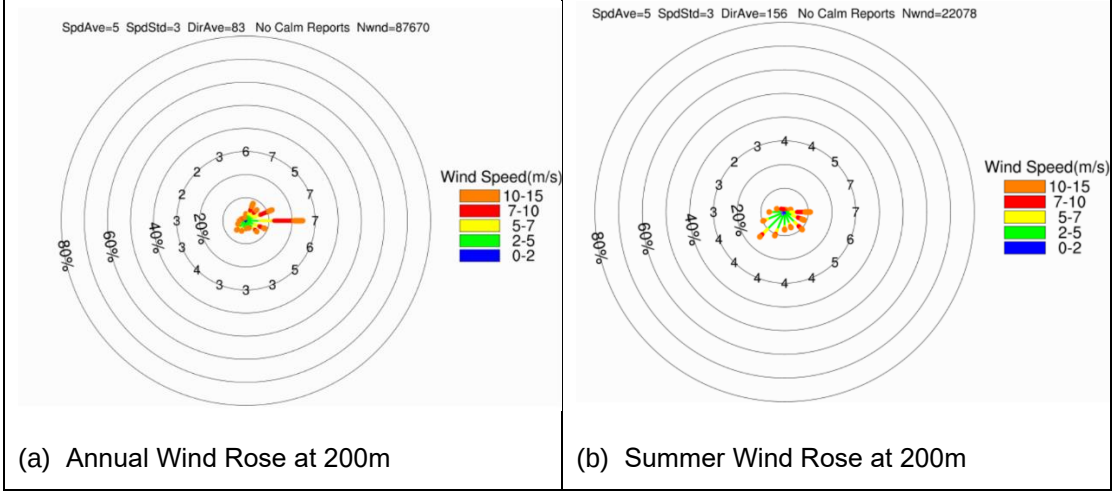
- **Section 2 –** Identification of wind availability at the Project Site;
- **Section 3 –** Identification of topography, land uses and urban morphology near the Project Site;
- **Section 4 –** Illustration of the Development Proposal;
- **Section 5 –** Evaluation of the existing wind environment and wind environment under the Development Proposal;
- **Section 6 –** Recommend merit air ventilation measures to the Development Proposal; and
- **Section 7 –** Summary and Conclusion.

2 WIND AVAILABILITY

2.1 Background

2.1.1 Identification of the annual and summer prevailing winds at NCWV is essential in determining the wind condition and air ventilation performance at the Site. As reference to the site wind availability data simulated via Regional Atmospheric Modelling System (RAMS) model released by PlanD, the Site is located at Grid (087, 046).

2.1.2 The prevailing winds from E, ENE and ESE directions would generally dominate the wind availability over a whole year, while in summer, the local wind environment would be determined by E, SE, SW and SSW wind. The wind roses and the location of extraction can be seen in **Figure 2.1** and **Figure 2.2** below. The prevailing wind directions are illustrated in **Figure 2.3** below.



(a) Annual Wind Rose at 200m

(b) Summer Wind Rose at 200m

Figure 2.1 Wind Roses Extracted from Grid (087, 046) of RAMS Model

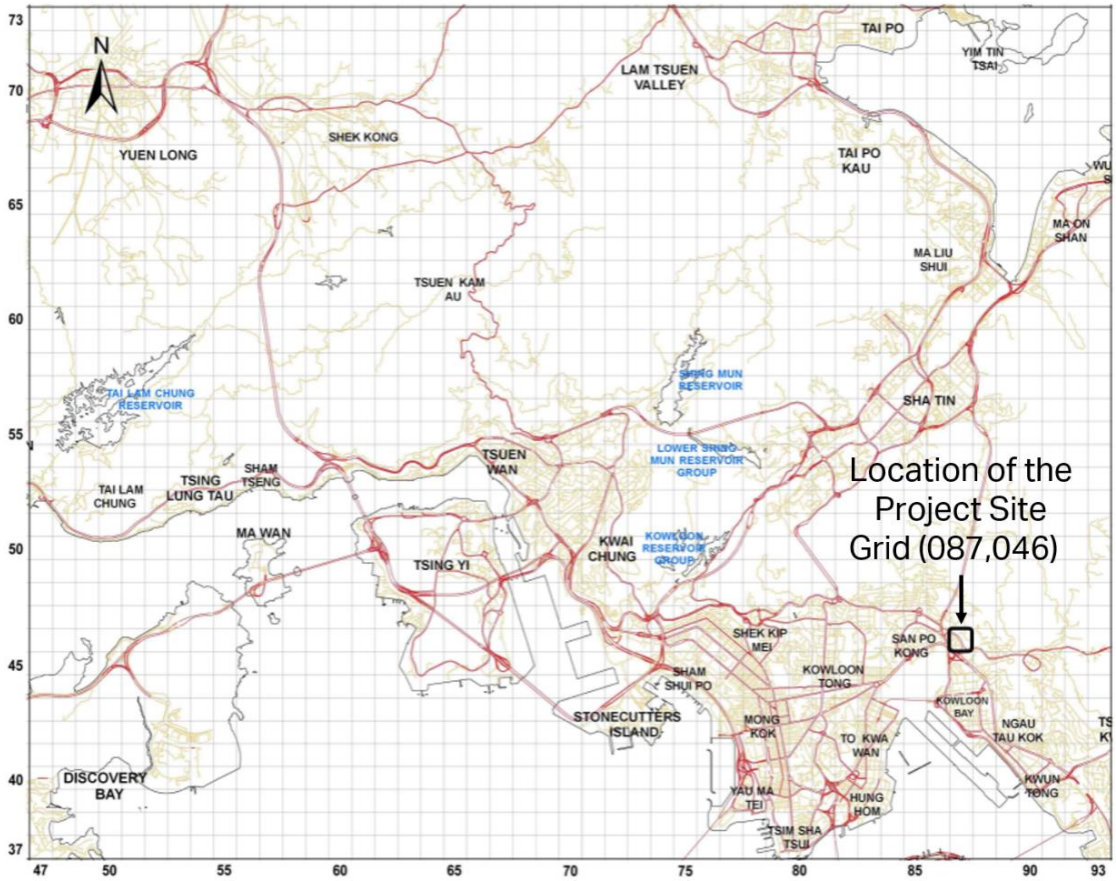


Figure 2.2 Illustration of Location for Wind Data Extraction at the Site

Table 2.1 Annual / Summer Wind Frequency Occurrence

Annual Winds	Occurrence frequency	Summer Winds	Occurrence frequency
N	3.1%	N	1.0%
NNE	8.3%	NNE	1.1%
NE	6.7%	NE	1.0%
ENE	12.3%	ENE	2.9%
E	24.8%	E	10.9%
ESE	9.1%	ESE	9.0%
SE	6.7%	SE	10.6%
SSE	3.5%	SSE	7.1%
S	3.4%	S	7.5%
SSW	4.8%	SSW	10.8%
SW	5.6%	SW	14.8%
WSW	3.8%	WSW	9.8%
W	2.9%	W	6.5%
WNW	2.1%	WNW	3.6%
NW	1.5%	NW	2.0%
NNW	1.4%	NNW	1.4%

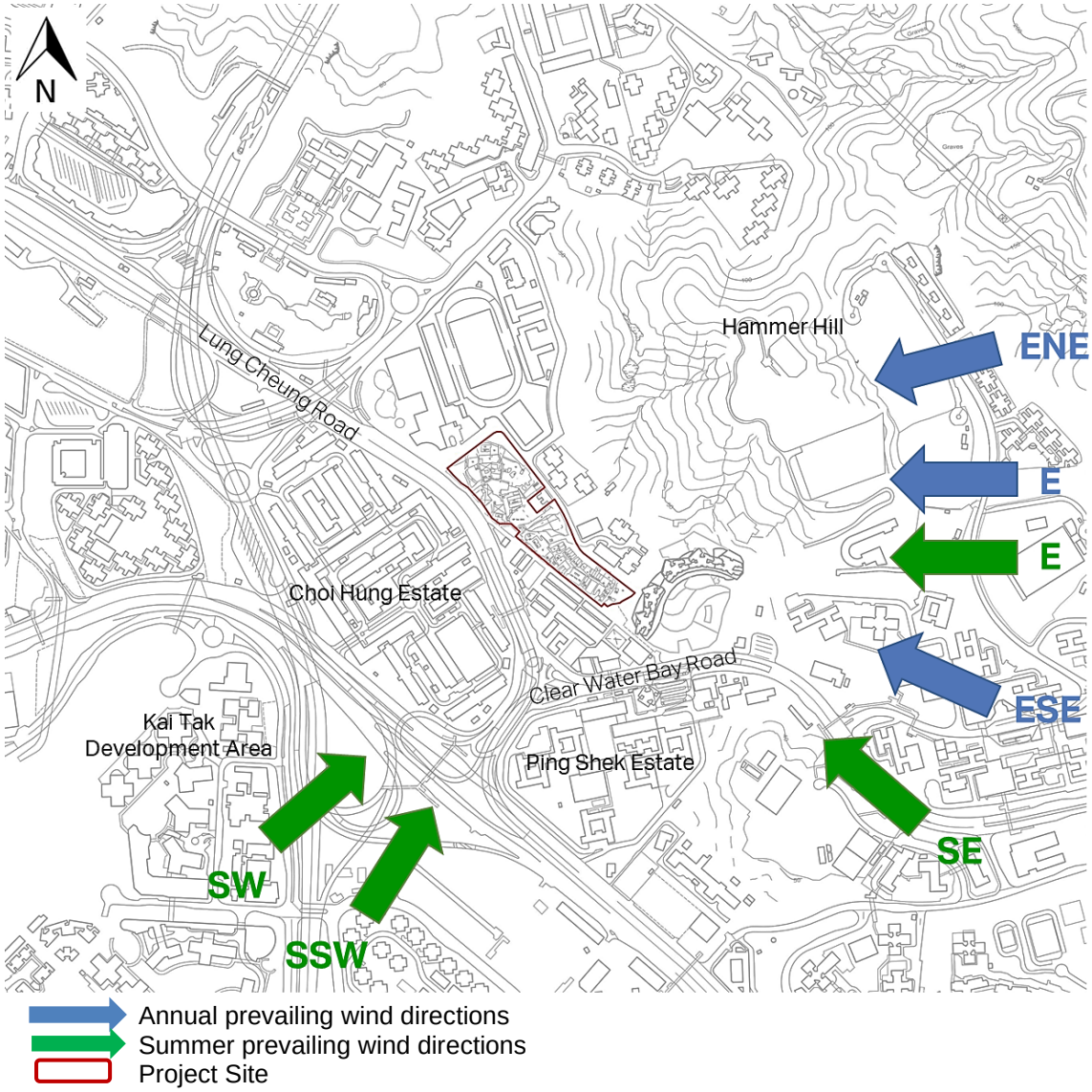


Figure 2.3 Illustration of Annual and Summer Prevailing Wind Directions towards the Site

3 SITE ENVIRONMENT

3.1 Local Topography

3.1.1 As revealed in **Figure 3.1**, the Site falls in the east Kowloon region, and located at the north of the Choi Hung MTR Station. The Site and its vicinity regions are sandwiched between the low land of Kai Tak to their southwest, and high-rise mountains of Ma On Shan Country Park to the northeast.

3.1.2 The terrain at the Site is relatively low in altitude, with a topographical height of around +10mPD. The area to the south, southwest and west are also flat and low rise in general. However, to the north, northeast and east of the Site, terrain rises steadily into the mountainous region with the nearest topography being the terrains of the Hammer Hill of approximately +100mPD in height. The vicinity highest point is around +400mPD in the region of Ma On Shan Country Park far northeast to the Site.

3.1.3 Furthermore, small knolls of Jordan Valley with height of around +150mPD also exist to the far southeast of the Site. Hence, it can be expected that the wind from northeast, east and southeast directions may be moderated by the hilly terrains, while the prevailing wind coming from south-westerly directions would approach the Site without significant terrain blockage.

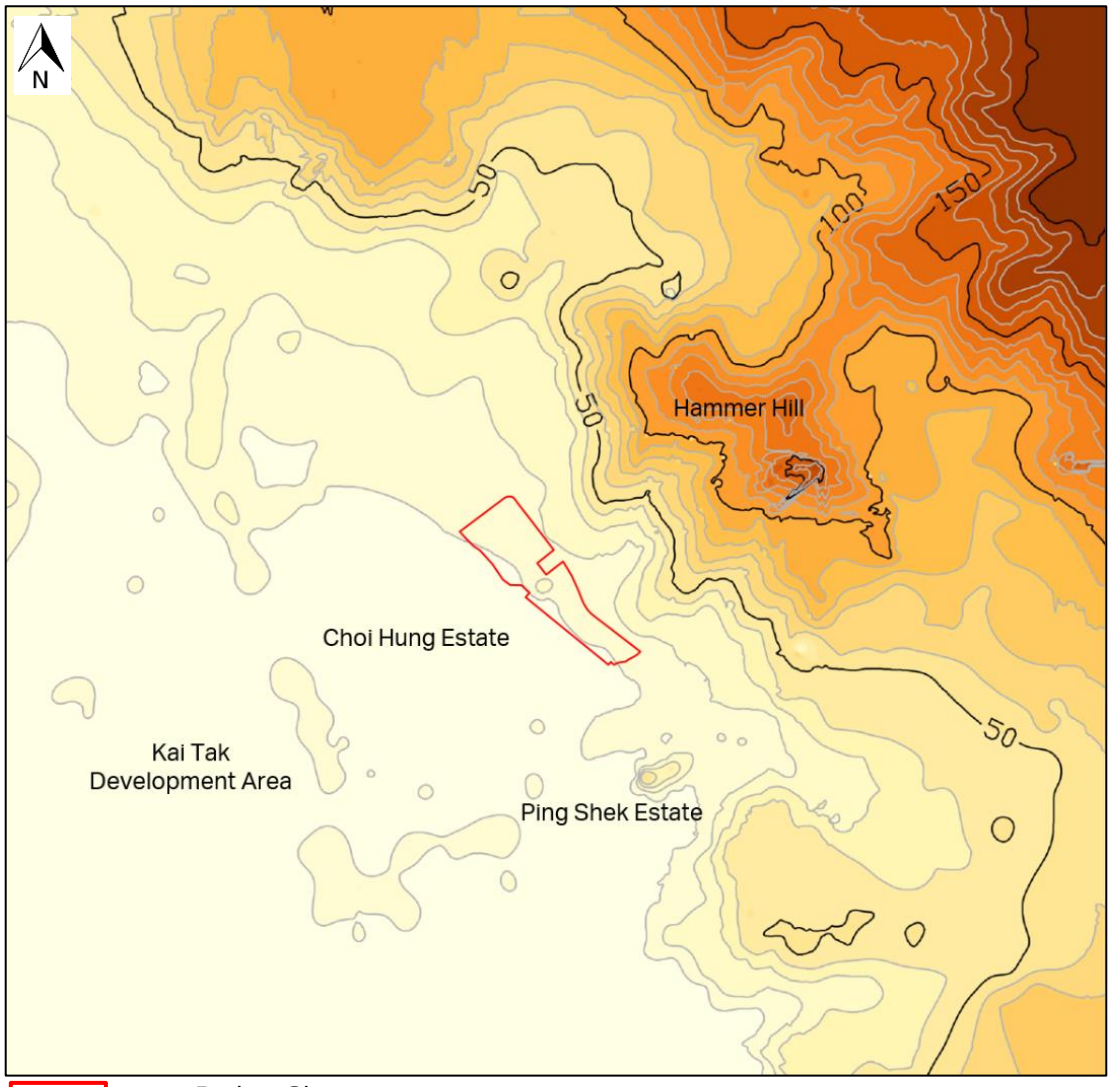


Figure 3.1 **Digital Topographical Map of Regions near the Site**

3.2 Land Uses

3.2.1 The land uses of the Site and the nearby regions are dictated by approved Ngau Chi Wan OZP No. S/K12/16. The land use types of the region are shown in **Figure 3.2**.

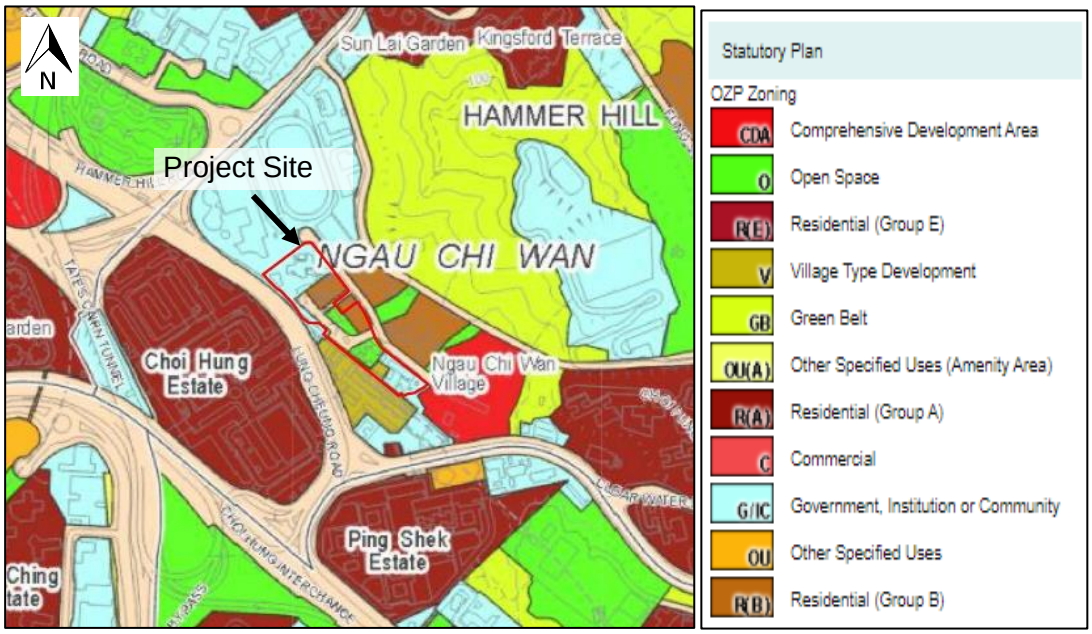


Figure 3.2 Land Uses at the Regions near the Site

3.2.2 The land uses within the Site itself is fragmented. The north and southern portion of the Site is currently zoned as G/IC, while the lands at the central portion of NCWV Site are separated into small parcels of R(B), O, V and Road.

3.2.3 To the immediate north side of the Site, the land uses are mainly G/IC, R(B), and O, deployed from west to east. The area to the further north and northeast is mainly covered by large piece of GB lands and a parcel of G/IC area.

3.2.4 The land uses for the area to the near east of the Project Site are mainly zoned as CDA, while the area to the near southeast and south of the Project Site are mainly G/IC and V. In addition, to the far south, southeast and east, the regions are mainly zoned as R(A), and OU, O and G/IC.

3.2.5 The region across the Lung Cheung Road to the southwest of the Site is currently zoned as R(A), the areas are mainly occupied by high-rise developments of Choi Hung Estate. In addition, small parcel of G/IC lands also appear to the west of the Site.

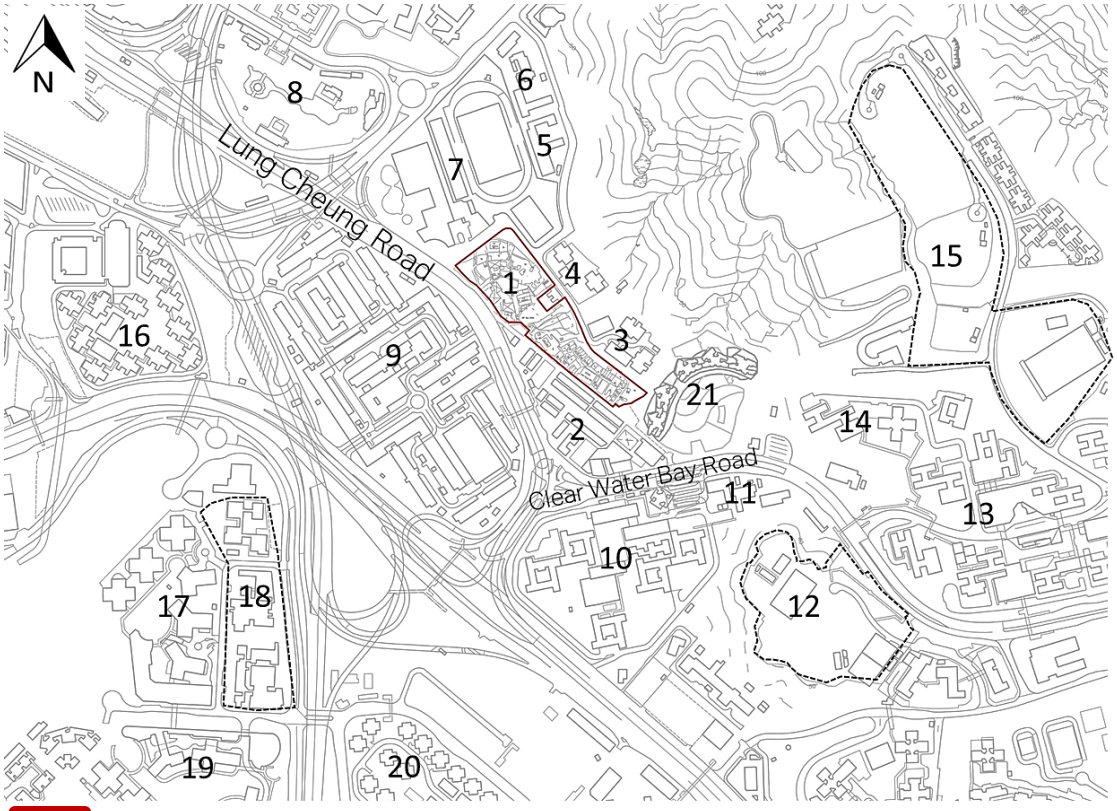
3.3 Existing Urban Morphology

3.3.1 The area of the Site is currently occupied by the low-rise building squatters / village houses. The vicinity areas of the Site currently have relative moderate morphology densities, as the regions nearby are mixed with buildings ranging from village houses, sportsground structures, single block quarters, small groups of mid to high-rise residential towers up to high-rise high-density public housing estates.

3.3.2 The area to the immediate north / northeast of the Site would have relatively low building density, as the development to the north is the Hammer Hill Road Playground / Swimming Pool (mostly open spaces) and Buddhist Hung Sean Chau Memorial College with mid-rise school building. Meanwhile, the area to the near northeast of the Site are Bayview Garden, Fortune Garden, Fire Services Department Wing Ting Road Fire Services Married Quarters and Wealth Garden, ranging from around 20 to 30 storeys in height.

3.3.3 The region locates at the immediate southwest of the Site belongs to the Ngau Chi Wan Village, the buildings in this region are mainly low-rise village type developments, while the mid-rise Ngau Chi Wan Municipal Service Building is located between the village houses and the Clear Water Bay Road. In addition, the region towards the further southeast locates the high-rise developments of Ping Shek Estate and Choi Fung Court / Choi Wan Estate, while mid-rise school buildings belonging to Ping Shek Estate Catholic Primary School, C&MA Sun Kei Primary School (Ping Shek) and Former S.K.H. St. John's Primary School are sandwiched between the high-profiled residential buildings.

3.3.4 There is a Ngau Chi Wan Comprehensive Development Area (CDA) located to the immediate east of the Site, in which 5 committed high-rise residential towers situated on a terraced podium are to be constructed. The region to the near southwest and west of the Site is also occupied by high-rise residential developments, which belongs to Choi Hung Estate. To the further southwest and west of the Site are the areas belonging to San Po Kong and Kai Tak Development Area, in where the buildings are mainly high-rise residential blocks, which are grouped into Rhythm Garden, Kai Ching Estate and Richland Garden. **Figure 3.3** illustrates the existing urban morphologies at the surroundings of the Site.



Project Site

Location / Buildings	Approximate building height (mPD) (1)	Location / Buildings	Approximate building height (mPD) (1)
1. Ngau Chi Wan Village Site (2)	130	2. NCWV, Ngau Chi Wan Municipal Building, Man Tak House	18, 45, 78
3. Fire Services Department Wing Ting Road Fire Services Married Quarters and Wealth Garden	110	4. Bay View Garden and Fortune Garden	115, 95

Location / Buildings	Approximate building height (mPD) (1)	Location / Buildings	Approximate building height (mPD) (1)
5. Buddhist Hung Sean Chau Memorial College	50.6	6. East Kowloon Psychiatric Centre, East Kowloon Polyclinic and East Kowloon Chest Clinic	38
7. Hammer Hill Road Sports Ground and Hammer Hill Road Swimming Pool	30	8. Nan Lian Garden	-
9. Choi Hung Estate	61	10. Ping Shek Estate, 8 Clear Water Bay Road	86 184
11. Ping Shek Estate Catholic Primary School, C&MA Sun Kei Primary School (Ping Shek) and Former S.K.H. St. John's Primary School	35	12. Ping Shek Playground	-
13. Choi Wan Estate	126	14. Choi Fung Court	150
15. Ngau Chi Wan Park	-	16. Rhythm Garden	80
17. Kai Ching Estate	120	18. Po Leung Kuk Stanley Ho Sau Nan Primary School, SKH Holy Cross Primary School and Cognitio College (Kowloon)	~40
19. Tak Long Estate	120	20. Richland Gardens	102
21. Committed Developments within the CDA Site	~230		

(1) The approximate building height are obtained from the building layout plan provided by HKHS and LiDAR Data in GIS model.

(2) Building height of NCWV development subject to HKHS's future design change.

Figure 3.3 Existing Urban Morphology near the Project Site

4 THE DEVELOPMENT PROPOSAL

4.1 General

4.1.1 The Site is planned to be developed into 3 residential Towers (namely Tower 1, 2 and 3 from hereafter, see **Figure 4.1**) as well as the associated podium of around +27mPD to +29mPD in height, and historic building (i.e., the Man Fat Nunnery). The three towers range from +115mPD to +130mPD in height, deployed from southeast to northwest along the Site.

Table 4.1 Major Proposed Developments in Development Proposal and the Corresponding Building Heights

Major Developments	Building Height
Tower 1	+130mPD
Tower 2	+115mPD
Tower 3	+115mPD
Podium under Tower 1	~+29mPD
Podium under Towers 2 and 3	~+27mPD

4.1.2 The proposed developments in the Site include several good design measures, including building separations, setbacks from Site boundaries and variation in building heights etc. Details are lists as follows (See **Figure 4.1a** to **4.1c**):

1. 15 meters building separation between Tower 1 and Fortune Garden;
2. Approximately 12 meters building separation between Towers 2 and Fortune Garden;
3. 15 meters building separation between Towers 2 and 3;
4. 20 meters setback of Tower 1 and approximately 12 meters setback of Tower 1 podium from Lung Cheung Road;
5. 7.5 meters setback of Tower 1 and podium underneath from the north west Project Site Boundary;
6. 7.5 meters setback of Towers 2/3 and podium underneath from Lung Chi Path.
7. Approximately 5 meters setback of Towers 1, 2, 3 and podiums underneath from the Wing Ting Road.
8. 7.5 meters setback of Tower 3 and podium underneath from the south east Project Site Boundary;
9. Empty Bay Design with two openings of 15m and 7.5m in width respectively above podium level at Tower 1.

4.1.3 These design measures would likely maintain the permeability through the Site and allow better wind penetration at grade. Detailed qualitative discussions about the wind performance of the Development Proposal are documented in **Section 6** below.

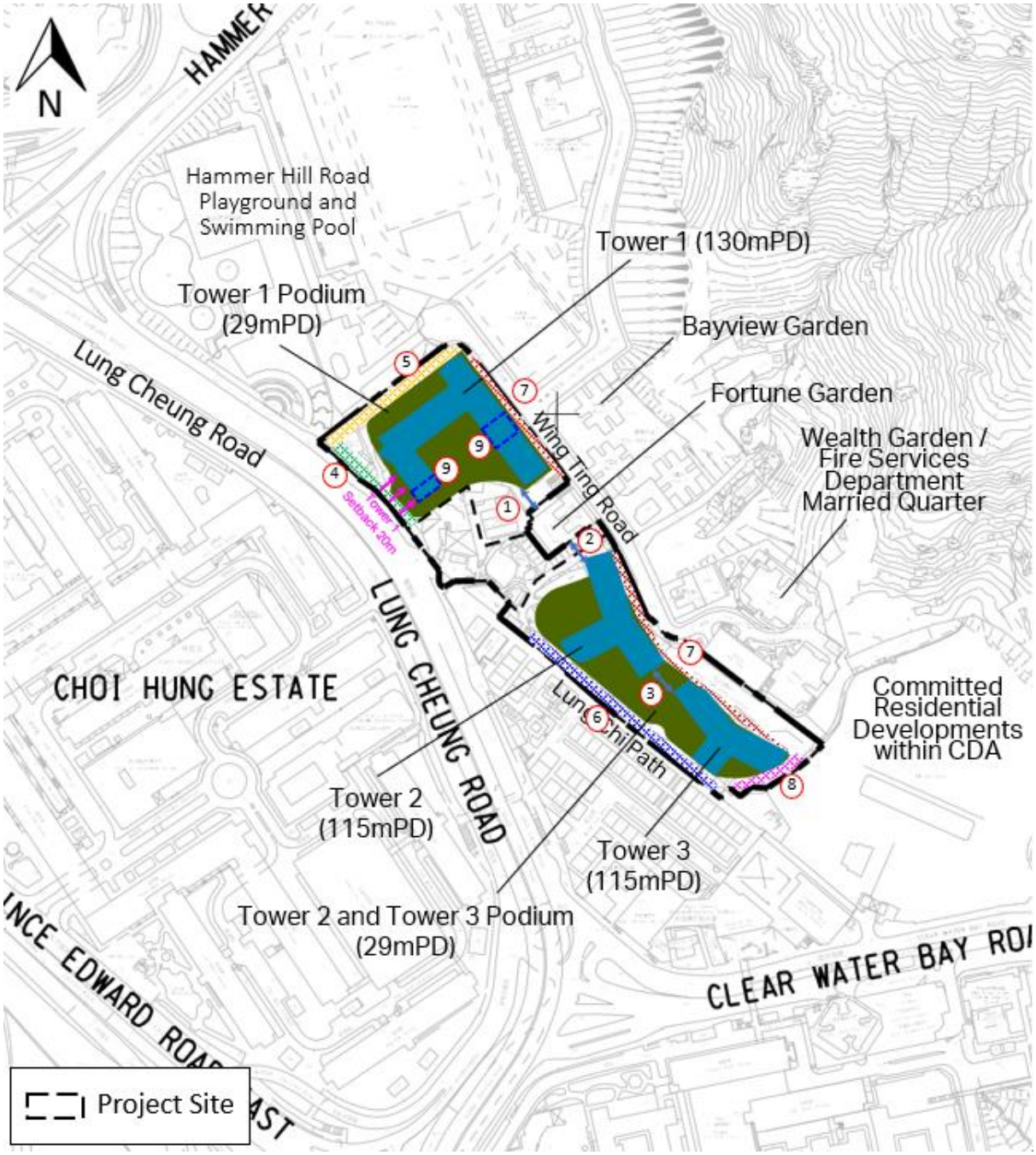


Figure 4.1a Development Proposal for the Site

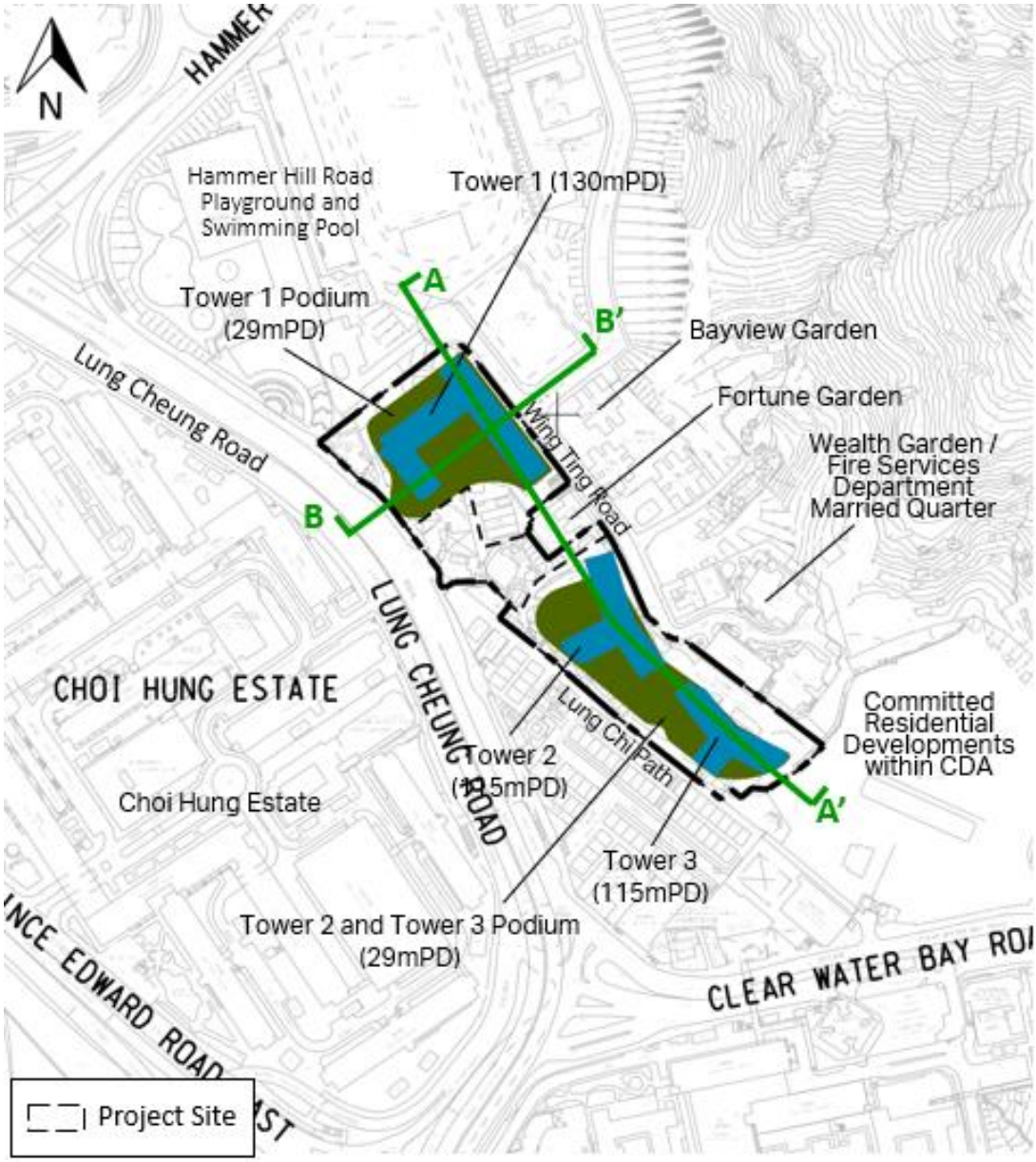
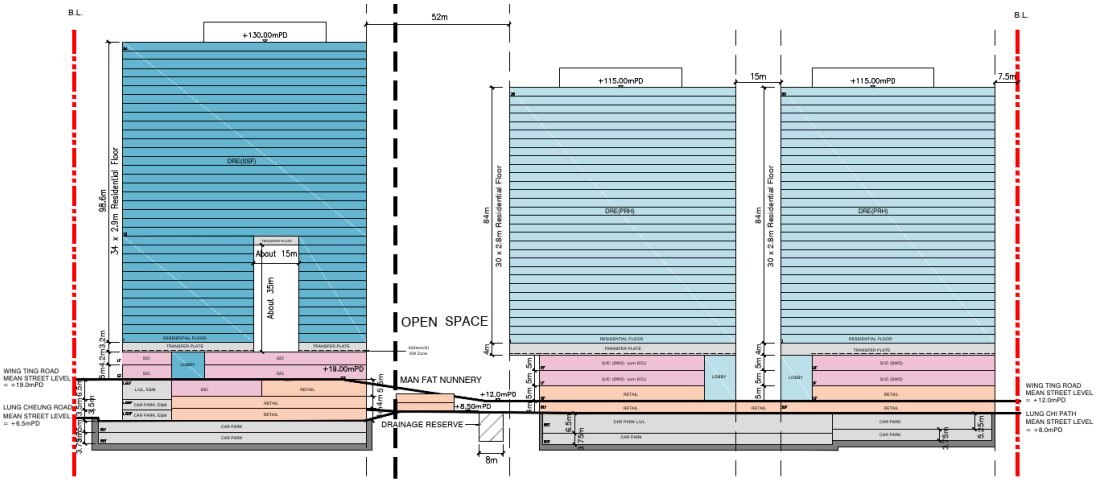
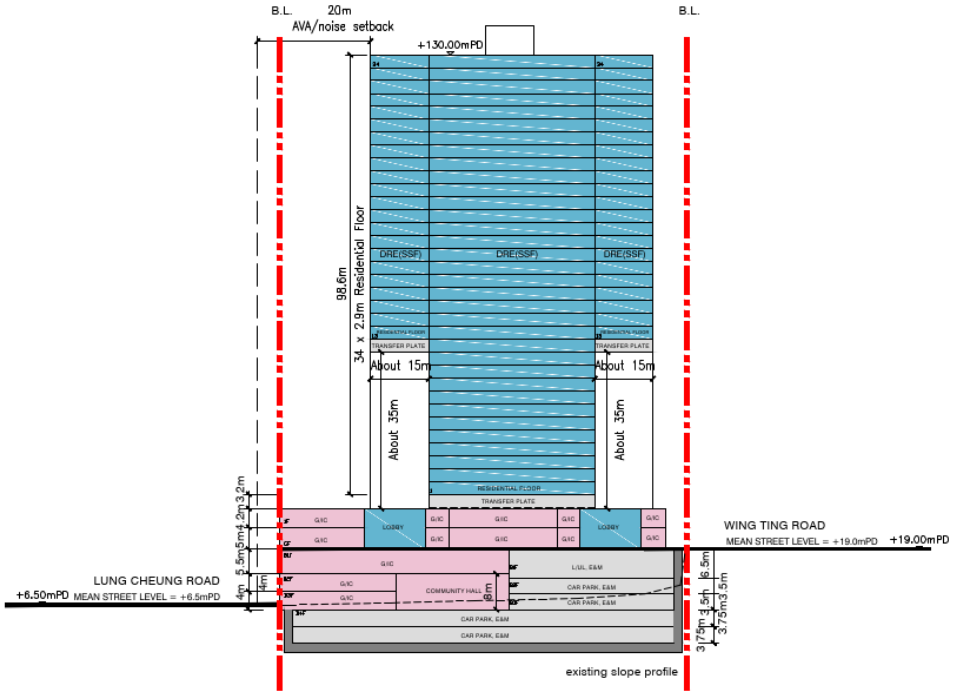


Figure 4.1b Development Proposal for the Site



Section AA'



Section BB'

Figure 4.1c Development Proposal for the Site

4.2 Committed High-rise Residential Development within the CDA near the Project Site

4.2.1 There is a Ngau Chi Wan CDA located to the immediate east of the Site, in which 5 committed high-rise residential towers situated on a seven-storey composite podium are to be constructed. The five residential towers all have building heights of approximately +230mPD, while the composite podium is of +60mPD in height for retail, carparking, residential care home for the elderly and kindergarten. **Figure 4.2** illustrates the design of the committed residential developments within the CDA.

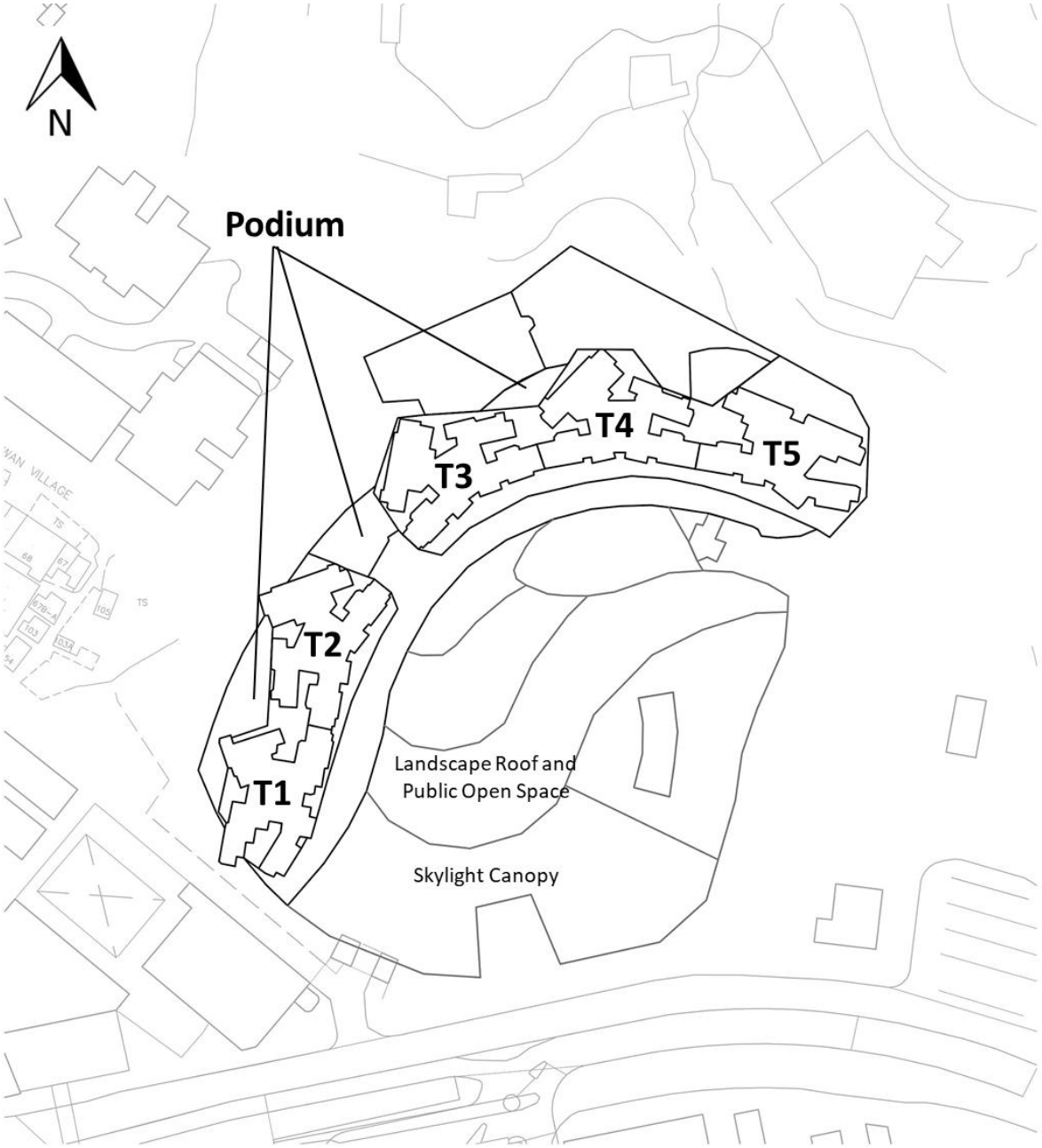


Figure 4.2 Building layout of the committed high rise residential towers within the CDA

5 EXPERT EVALUATION ON THE DEVELOPMENT PROPOSAL

5.1 General

5.1.1 Comparing to the current conditions of low-rise squatters at the Site, the construction of the Development Proposal of high-rise residential buildings with podiums would impose a certain magnitude of blockage in wind flow through the Site. The wind influence may be roughly estimated qualitatively by the extent of the wind influence area.

5.1.2 In regard to the Development Proposal of the Site, the +115mPD to +130mPD height buildings would generate wind wakes to the respective downstream side, complex air flows with eddies structures of varying size would occur within this region and result in wind impacts within the region. Qualitatively speaking, under the moderated incoming wind, the more permeability the developments can provide and more distance set-back from the impacted areas, the less impacts there would likely to be.

5.1.3 Detailed wind directional analysis and changes in potential wind flow pattern for the Proposed Scenario (i.e., with the proposed developments within the NCWV Site constructed) when compared to the Baseline Scenario (i.e., Low rise squatters within the NCWV Site) under the identified prevailing wind directions, with the probable wind influence and anticipated wind flow induced by the Development Proposal under different prevailing wind directions are discussed below.

5.2 Under the E Annual and Summer Prevailing Wind

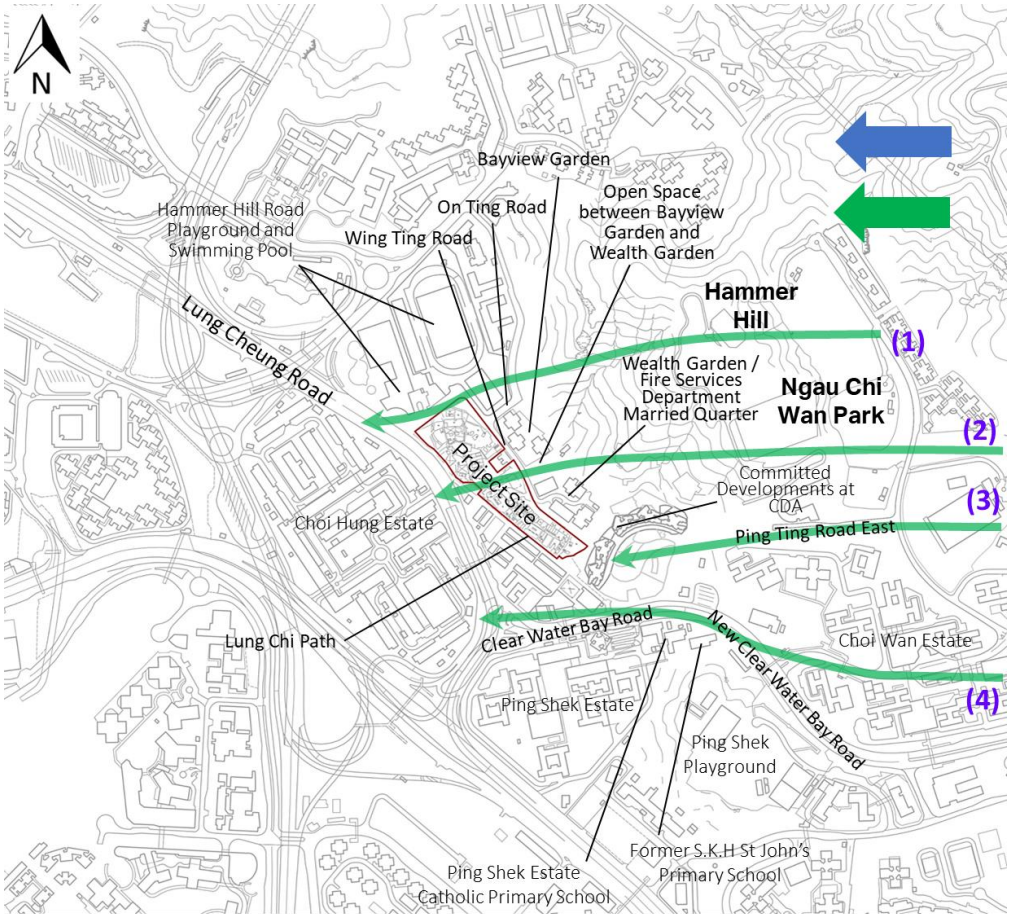
Baseline Scenario

5.2.1 A stream of E annual / summer wind originated from the northern section of the Ngau Chi Wan Park would flow via the football field of the Hammer Road Hill Playground, skim over the low-rise squatters within the Site and reach Lung Cheung Road (see Marker (1) in **Figure 5.1**).

5.2.2 Another stream of E annual / summer wind would flow past the Ngau Chi Wan Park to reach the area east of the Site. Although a portion of these wind may be moderated by the high-rise residential buildings of Bay View Garden, Fortune Garden, Wealth Garden and Fire Services Department Married Quarter, part of the wind flow would still be able to penetrate the open space located between Bay View Garden and Wealth Garden, eventually skim over the Project Site and reach the Choi Hung Estate across the Lung Cheung Road (see Marker (2) in **Figure 5.1**).

5.2.3 The wind flow from Ngau Chi Wan Park near Ping Ting Road East may be obstructed by the committed high-rise residential development within the CDA, located at the southeast side of the Fire Service Married Quarter (see Marker (3) in **Figure 5.1**). Moreover, the committed high-rise residential development within the CDA will generate wind wakes which would extend to the Project Site and affect the wind environment there under the easterly prevailing wind.

5.2.4 In addition to the east wind skimming over the Site, the wind originated from Choi Wan Estate may flow through the building separations between the clusters and skim into Clear Water Bay Road, and directed to flow towards the west, approaching the Choi Hung Estate and Ngau Chi Wan Village (see Marker (4) in **Figure 5.1**). **Figure 5.1** Illustrates the existing wind flows under E annual / summer prevailing wind.



Annual prevailing wind directions
Summer prevailing wind directions
Air flow
Project Site

Figure 5.1 Anticipated Wind Flows under the E Annual and Summer Prevailing Wind Direction for the Baseline Scenario

Proposed Scenario

5.2.5 Under the easterly annual and summer prevailing wind, the potential wind wake areas after the construction of the proposed development cover the Choi Hung Estate and several schools within the Estate, all located at the downwind of the Project Site.

5.2.6 The wind environment at the Ping Shek Estate, Ngau Chi Wan Municipal Building areas and Hammer Hill Road Sports Ground and Swimming Pool areas are not likely to be affected under the easterly prevailing wind after the proposed developments within the Site, as these areas are located at the sideways of the Site under this prevailing wind direction.

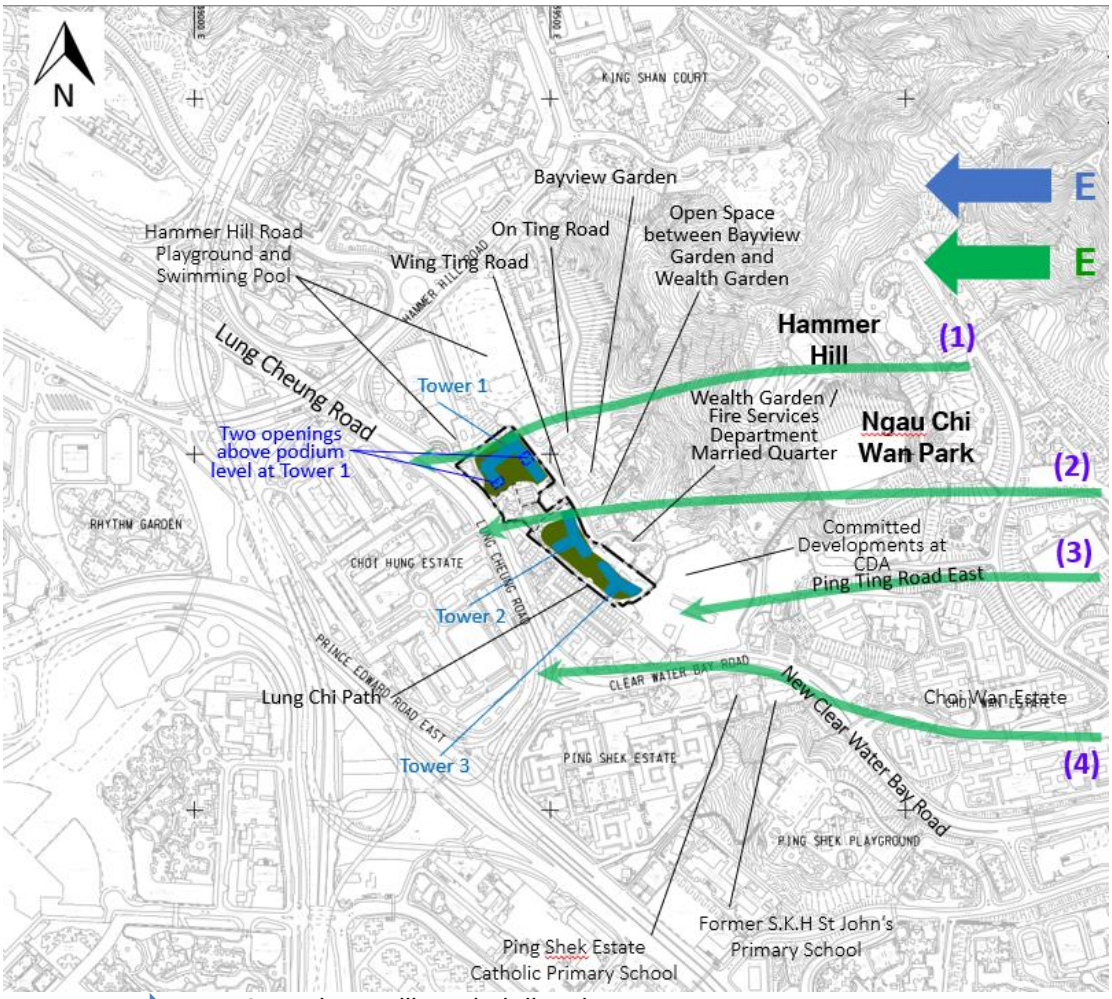
5.2.7 A portion of easterly wind coming from the Choi Wan Estate would flow along the Clear Water Bay Road in the east-west direction, and finally reaching the Choi Hung Estate, maintaining the wind environment there (see Marker (4) in **Figure 5.2**).

5.2.8 Easterly wind originated from the Ngau Chi Wan Park could reach the existing developments at Choi Hung Estate after skimming over the current low-rise squatters. After the construction of the proposed high-rise housing blocks within the Site, it is inevitable that the easterly wind reaching the Choi Hung Estate would be weakened. However, under the proposed development layout, with the building separations of approximately 12m maintained between proposed Tower 2 and the Fortune Garden, a portion of easterly wind from the Ngau Chi Wan Park, after flow via the open space between the Bayview Garden and the Wealth Garden, would

continue its path to the Choi Hung Estate and along Lung Cheung Road (see Marker (2) in **Figure 5.2**).

5.2.9 Similar to the Baseline Scenario, the wind flow from Ngau Chi Wan Park near Ping Ting Road East will be obstructed by the committed high-rise residential development within the CDA (see Marker (3) in **Figure 5.2**). It should be noted that the committed high-rise residential development within the CDA will generate wind wakes which would extend to the Site and affect the wind environment there under the easterly prevailing wind.

5.2.10 The placement of Tower 1 at Site C and its podium with 7.5m setback from the northwestern site boundary away from the Hammer Hill Road Playground and Hammer Road Swimming Pool building will widen the separation between Tower 1 at Site C and the Hammer Hill Road Swimming Pool building, which enhance the flow of the easterly wind to reach Lung Cheung Road via this separation in between (see Marker (1) in **Figure 5.2**). In addition, due to the relatively open nature of the lands near the Hammer Hill Road Playground and Hammer Hill Road Swimming Pool, the wind environment at the immediate northwest vicinity of the Site is anticipated not to be greatly affected under the easterly wind.



Annual prevailing wind directions
Summer prevailing wind directions
Air flow
Project Site

Figure 5.2 **Anticipated Wind Flows under the E Annual and Summer Prevailing Wind Direction for the Proposed Scenario**

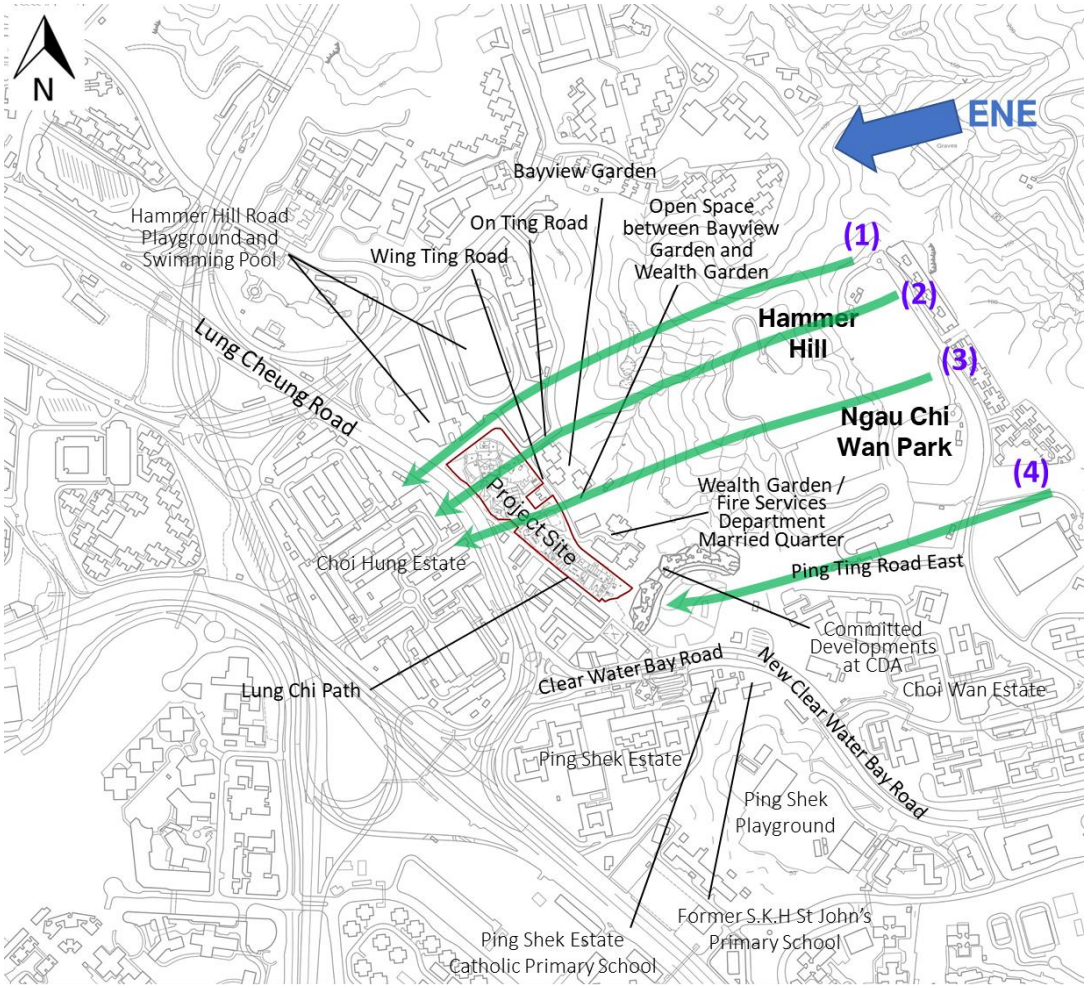
5.2.11 In addition, to the above, proposed block of Tower 1 is setback 20 meters and the podium underneath setback around 12 meters from Lung Cheung Road respectively, while proposed Towers 2 and 3 and their corresponding podiums are setback 7.5 meters from Lung Chi Path, these setbacks would help to alleviate the wind wakes on the Choi Hung Estate due to the Development Proposal within the Site.

5.2.12 In view of the above discussions, the easterly wind could still reach the Choi Hung Estate and flow along Lung Cheung Road under the easterly wind after the proposed developments are in place. It is unlikely to result in great declination of the wind environment after the construction of the Development Proposal within the Site.

5.3 Under the ENE Annual Prevailing Wind

Baseline Scenario

5.3.1 As illustrated in **Figure 5.3**, similar to the situation under the annual E wind, the ENE annual wind would flow via Ngau Chi Wan Park. Portions of ENE wind may be moderated by the high-rise residential buildings of Bay view Garden, Fortune Garden, Wealth Garden and Fire Services Department Married Quarter, eventually skim over the Project Site, and reach the Choi Hung Estate, while another stream would flow via the open space between Bayview Garden and Wealth Garden, skim over the low-rise squatter within the Site and reach the Choi Hing Estate (see Marker (3) in **Figure 5.3**).



Annual prevailing wind direction
Air flow
Project Site

Figure 5.3 **Anticipated Wind Flows under the ENE Annual Prevailing Wind Direction for the Baseline Scenario**

5.3.2 In addition, another portion of ENE wind would flow along the northern section of Ngau Chi Wan Park and skim down the hillslope of Hammer Hill. This wind flow would reach the Hammer Hill Road Playground and Hammer Hill Swimming Pool building and penetrate the region between the playground/swimming pool building and the Site, eventually reaching the Choi Hung Estate (see Marker (1) in **Figure 5.3**). The ENE wind along On Ting Road can also reach the Choi Hung Estate after skimming over the squatters within the Site under the Baseline Scenario (see Marker (2) in **Figure 5.3**).

5.3.3 The committed high-rise residential development within the CDA near the Site would inevitably generate wind wakes that affect its downwind areas of NCWV and Choi Hung Estate. The construction of the committed high-rise residential development within the CDA would prevent the ENE prevailing wind to reach the NCWV and Choi Hung Estate (see Marker (4) in **Figure 5.3**).

Proposed Scenario

5.3.4 Similar to the easterly prevailing wind, the potential wind wake areas after the construction of the proposed development covers areas of the NCWV and Choi Hung Estate and several schools within the Estate under the ENE prevailing wind. The wind environment at the Ping Shek Estate, Ngau Chi Wan Municipal Building areas and Hammer Hill Road Sports Ground and Swimming Pool areas are not likely to be affected under the east north easterly prevailing wind after the proposed developments within the Site, as these areas are located at the sideways of the Site.

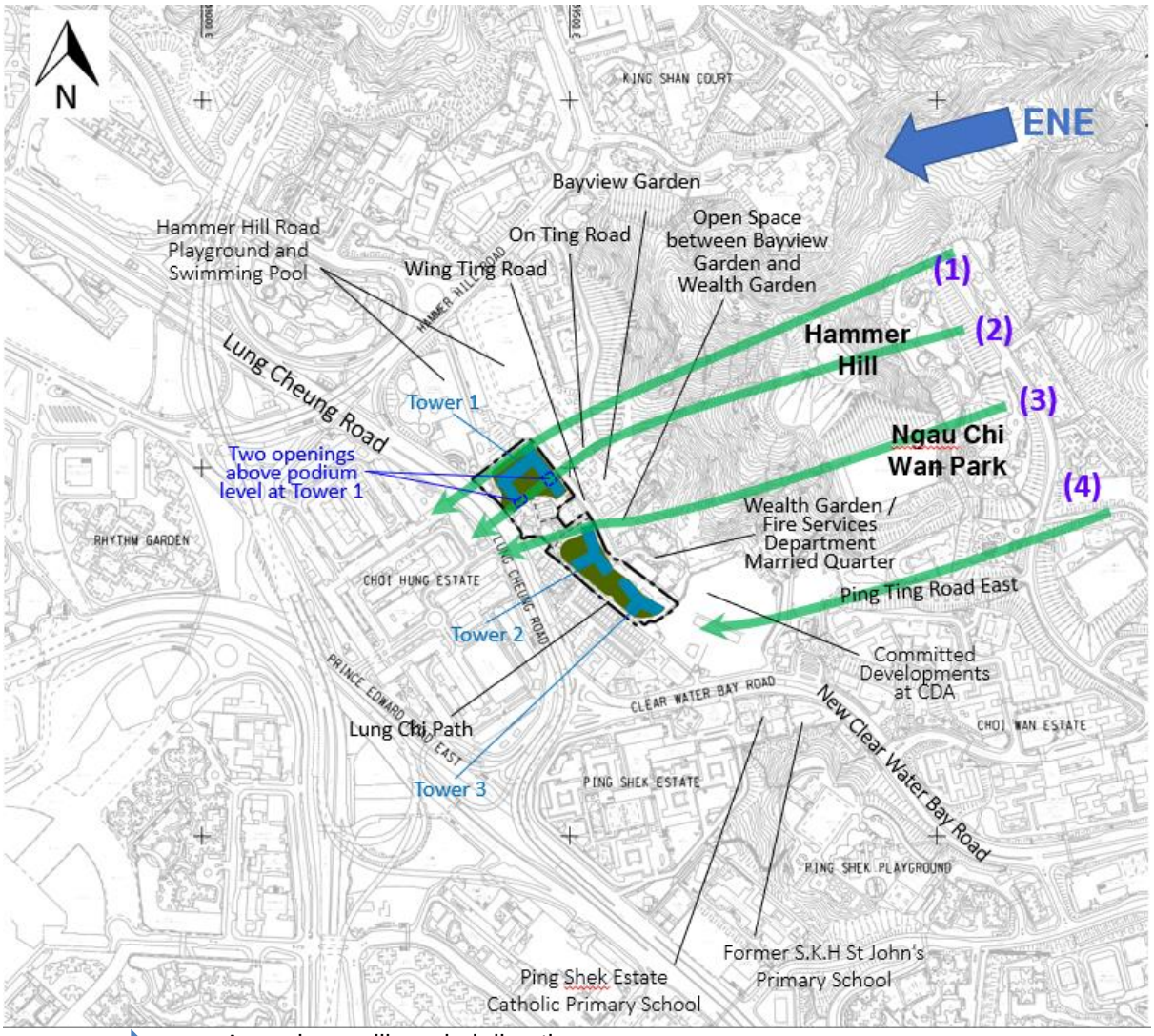
5.3.5 The proposed Tower 1 within the Site is bulky which would result in greater blockage of the ENE wind towards the western portion of the Choi Hung Estate as compared to the existing situation. However, the placement of proposed Tower 1 at Site C and the podium underneath with setback of 7.5 meters from the northwestern site boundary would widen the separation distance in between proposed Tower 1 at Site C and the Hammer Hill Road Playground/ Hammer Hill Swimming Pool block, which would facilitate the flow of ENE wind flow to penetrate through to reach Lung Cheung Road and Choi Hung Estate at the downwind side (see Marker (1) in **Figure 5.4**). In addition, due to the relatively open nature of the lands near the Hammer Hill Road Playground and Hammer Hill Road Swimming Pool, the wind environment at the immediate northwest vicinity of the Site can be maintained.

5.3.6 In addition, the two openings above podium level (**Figure 5.4**) at Tower 1 at Site C allow the portion of the ENE prevailing wind along On Ting Road to reattach to the pedestrian level, and provide some localised improvements to the surroundings near Choi Hung Estate. Furthermore, the approximate 12 meters building separation between Tower 2 at Site D1 and the Fortune Garden could still channel portion of the ENE wind to reach the Choi Hung Estate and the Lung Cheung Road after the construction of the proposed development within the Site.

5.3.7 The ENE wind originated from the Ngau Chi Wan Park and flowing from the open space between the Wealth Garden and Bayview Garden would be partly hindered by the north wing of the proposed Tower 2 under the current design layout to flow to the downstream regions. The blockage is anticipated to be more observable under the NE wind. However, the approximate 12 meters building separation between the proposed Tower 2 and the Fortune Garden could still channel portion of the ENE wind to reach the Choi Hung Estate and the Lung Cheung Road (see Marker (3) in **Figure 5.4**) after the construction of the Development Proposal within the Site. Nevertheless, further sustainable design features, such as incorporation of permeable elements on the building design at this location, if feasible, is encouraged to be explored in future building design optimization stages.

5.3.8 Similar to the Baseline Scenario, the wind flow from Ngau Chi Wan Park near Ping Ting Road East will be obstructed by the committed high-rise residential development within the CDA under the ENE prevailing wind (see Marker (4) in **Figure 5.4**). The committed high-rise residential development within the CDA will generate wind wakes which would extend to the Site and affect the wind environment there under the ENE prevailing wind.

5.3.9 Similar to that under the easterly wind, the setbacks of the proposed block of Tower 1, Tower 2 and Tower 3 and the podiums underneath from Lung Cheung Road with distance of at least 7.5 meters are useful in alleviation of the wind wakes on the Choi Hung Estate due to the Development Proposal within the Project Site under the ENE wind.



Annual prevailing wind directions
Air flow
Project Site

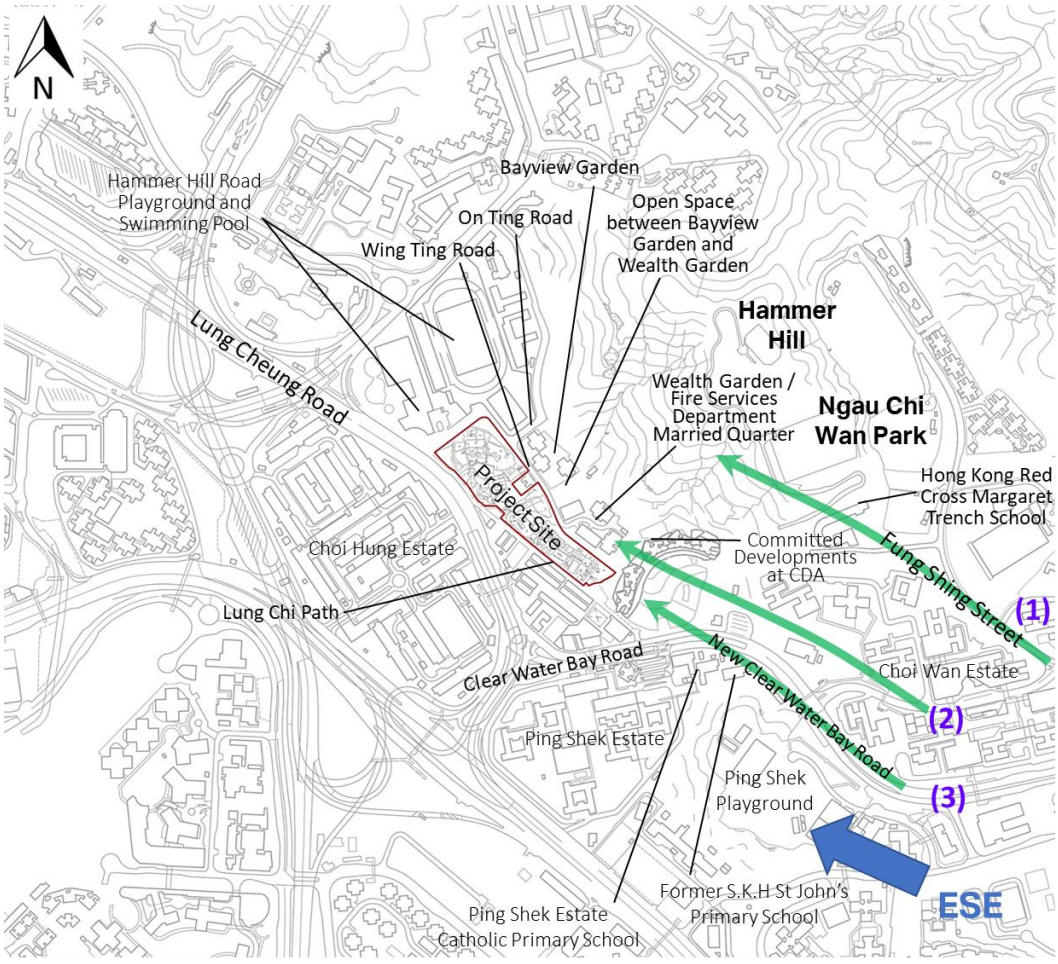
Figure 5.4 **Anticipated Wind Flows under the ENE Annual and Summer Prevailing Wind Direction for the Proposed Scenario**

5.4 Under the ESE Annual Prevailing Wind

Baseline Scenario

5.4.1 As shown in **Figure 5.5**, under the Baseline Scenario, a stream of ESE wind originated from the Choi Wan Estate that would flow via the building separations between the two clusters of the committed residential towers within the CDA and eventually being obstructed by the Wealth Garden and the Fire Services Department Married Quarter from flowing further downstream (see Marker (2) in **Figure 5.5**). The stream of ESE wind flow along the New Clear Water Bay Road will also be obstructed by the proposed towers within the CDA from flowing further (see Marker (3) in **Figure 5.5**).

5.4.2 Another path for the ESE wind is originated from the Fung Shing Street, in which a portion of ESE wind would be moderated by Choi Wan Estate and skim over the low-rise Hong Kong Red Cross Margaret Trench School, then towards the regions northeast to the Site (see Marker (1) in **Figure 5.5**) under the Baseline Scenario.



Annual prevailing wind direction
Air flow
Project Site

Figure 5.5 Anticipated Wind Flows under the ESE Annual Prevailing Wind Direction for the Baseline Scenario

Proposed Scenario

5.4.3 Under the ESE annual prevailing wind, the potential wind wake areas due to the proposed development within the Project Site would reach the Hammer Hill Road Swimming Pool, the Hammer Hill Road Sports Ground and the G/IC buildings nearby.

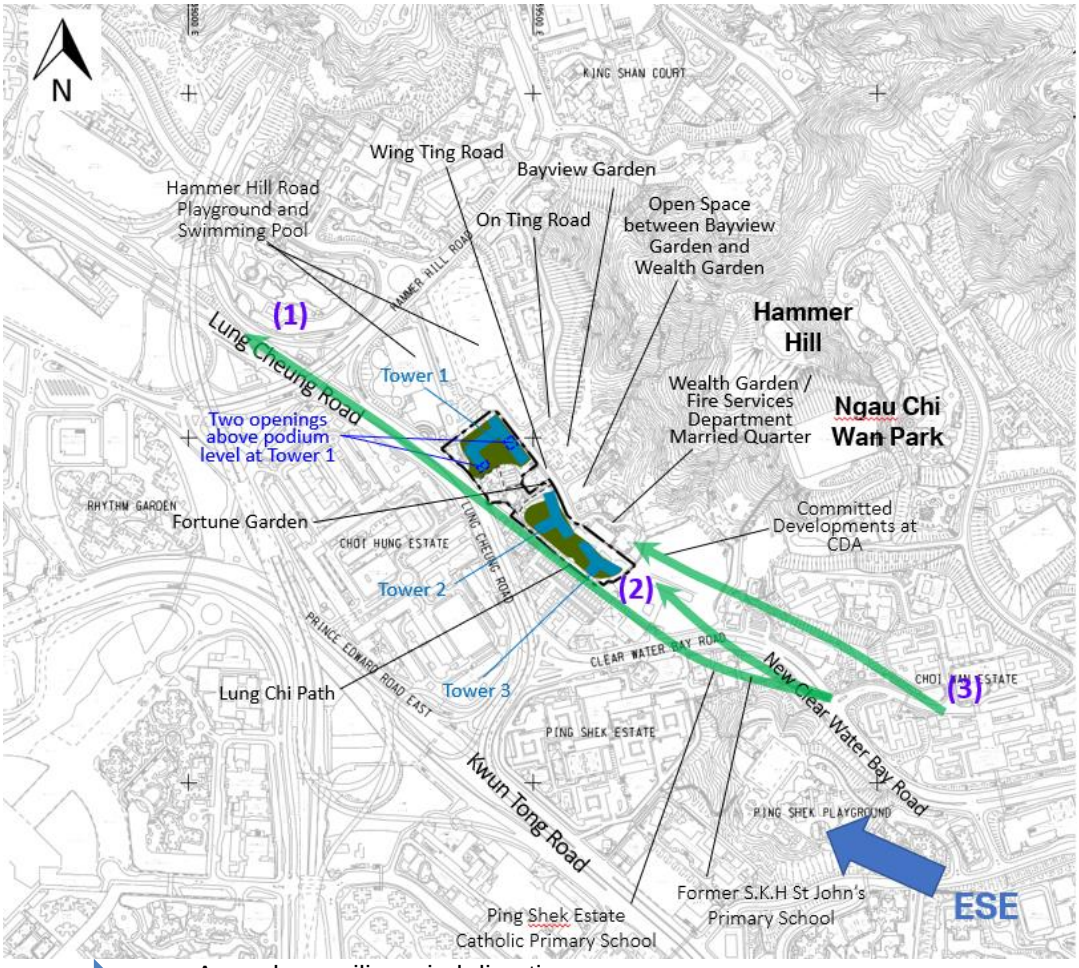
5.4.4 The Lung Cheung Road and Lung Chi Path aligning in approximately SE-NW direction as well as the Wing Ting Road aligning parallel to Lung Cheung Road could help maintain the wind environment in the immediate vicinity of the Site under the ESE prevailing wind.

5.4.5 A portion of ESE wind originated from the Ping Shek Playground and New Clear Water Bay Road to the east, after flowing via the gap between Ping Shek Estate and Former S.K.H St. John's Primary School, is anticipated to be diverted into Lung Chi Path or flow over the low-rise NCWV and merge into Lung Cheung Road (see Marker (1) in **Figure 5.6**). Tower 1 at Site C and the podium underneath have incorporated setbacks of 20 meters and approximately 12 meters from Lung Cheung Road respectively, while Towers 2 and 3 at Site D1 and their corresponding podia also have setbacks of about 7.5 meters from Lung Cheung Road, which would enhance the wind permeability and facilitate the flow of ESE wind along Lung Cheung Road.

5.4.6 The construction of the committed high-rise residential blocks within the CDA would limit the flow of ESE wind towards Wing Ting Road and reduce the magnitude of ESE wind flowing along this road (see Marker (2) in **Figure 5.6**). Setback of the proposed Towers (around 5m) within the Site from Wing Ting Road would mitigate the blockage of ESE wind by the proposed Towers and allow better flow of wind towards the Hammer Hill Road Sports Ground. Same as in the Baseline Scenario, the stream of ESE wind originated from the Choi Wan Estate that would flow via the building separations between the two clusters of the committed residential towers within the CDA and eventually being obstructed by the Wealth Garden and the Fire Services Department Married Quarter from flowing further downstream (see Marker (3) in **Figure 5.6**).

5.4.7 The committed high-rise residential blocks of maximum +230mPD within the CDA have already weaken the wind environment at its downwind under the ESE prevailing wind. After the proposed developments within the Site, comparing to the Baseline Scenario, the ESE wind channel from the Ping Shek Playground to the Hammer Hill Road Sports Ground would further be obstructed with the wind environment further weakened under the southeastern quadrant prevailing wind directions in the Proposed Scenario. However, the Development Proposal has optimized its placement and orientation by placing the shorter frontage of proposed buildings to face the ESE prevailing wind. All the towers and their podiums have imposed setbacks. The relatively bulky Tower 1 has paid the best effort in design to locate away from the Hammer Hill Road Swimming Pool, attempting to reduce the wind impacts at the downwind areas to a minimal.

5.4.8 Moreover, the proposed Towers within the Project Site have a variation in building heights of which Site C (+130mPD) is taller than Site D1 (+115mPD). Therefore, it is anticipated to have enhanced vertical air movement under the south eastern quadrant prevailing wind directions that would result in localized improvements in wind environment at regions surrounding the Site.



Annual prevailing wind direction
Air flow
Project Site

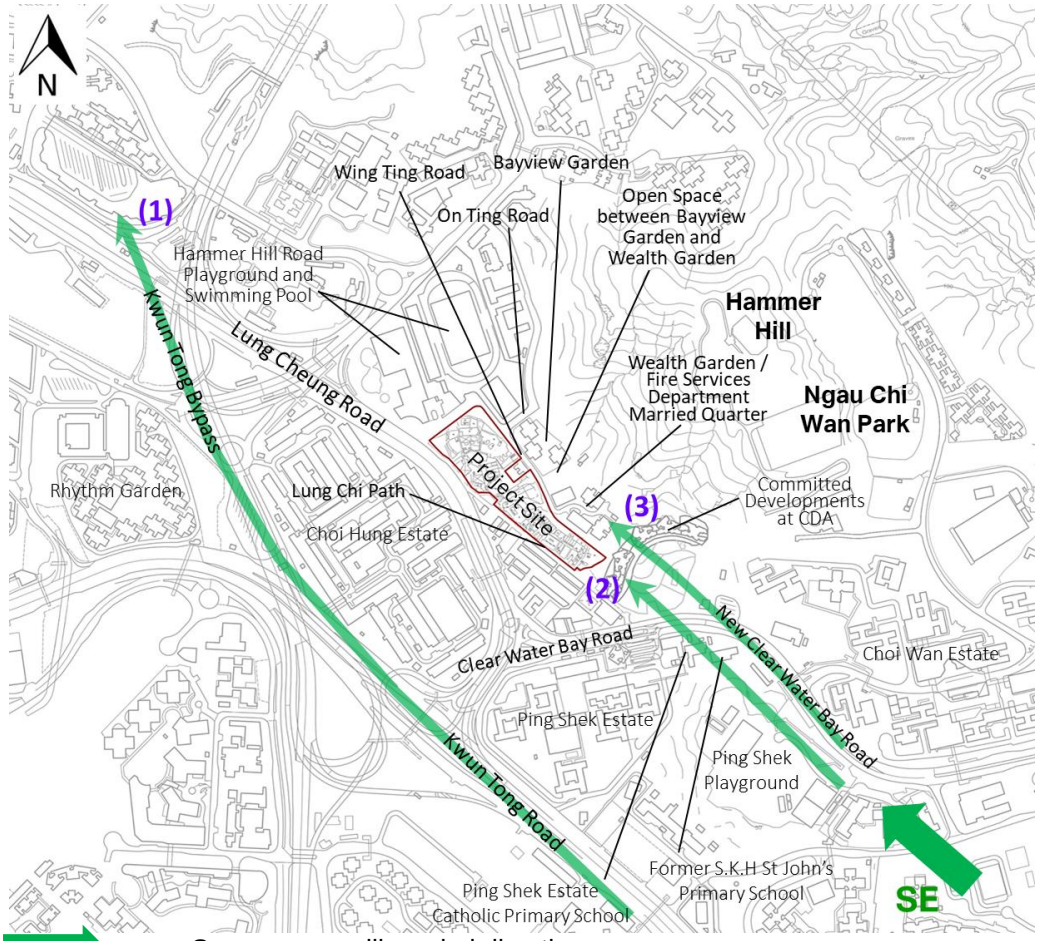
Figure 5.6 **Anticipated Wind Flows under the ESE Annual and Summer Prevailing Wind for the Proposed Scenario**

5.5 Under the SE Summer Prevailing Wind

Baseline Scenario

5.5.1 Under the Baseline Scenario, the prevailing SE wind entering from the Ping Shek Playground flow would be already obstructed by the committed high-rise residentials within the CDA after skimming over the Ping Shek Estate Catholic Primary School before reaching the Project Site (see Marker (2) in **Figure 5.7**). Meanwhile, similar to the ESE wind, the SE wind flowing along the New Clear Water Bay Road would flow via the building separations between the two clusters of the committed residential towers within the CDA and eventually being obstructed by the Wealth Garden and the Fire Services Department Married Quarter from flowing further downstream (see Marker (3) in **Figure 5.7**).

5.5.2 Another wind flow under SE wind would be the Kwun Tong Road - Kwun Tong Bypass, the wind maybe directed by this path to reach the region near Rhythm Garden and Choi Hung Estate and continue to flow towards north (see Marker (1) in **Figure 5.7**). The anticipated wind flows are illustrated in **Figure 5.7** below.



Summer prevailing wind direction
Air flow
Project Site

Figure 5.7 **Anticipated Wind Flows under the SE Summer Prevailing Wind Direction for the Baseline Scenario**

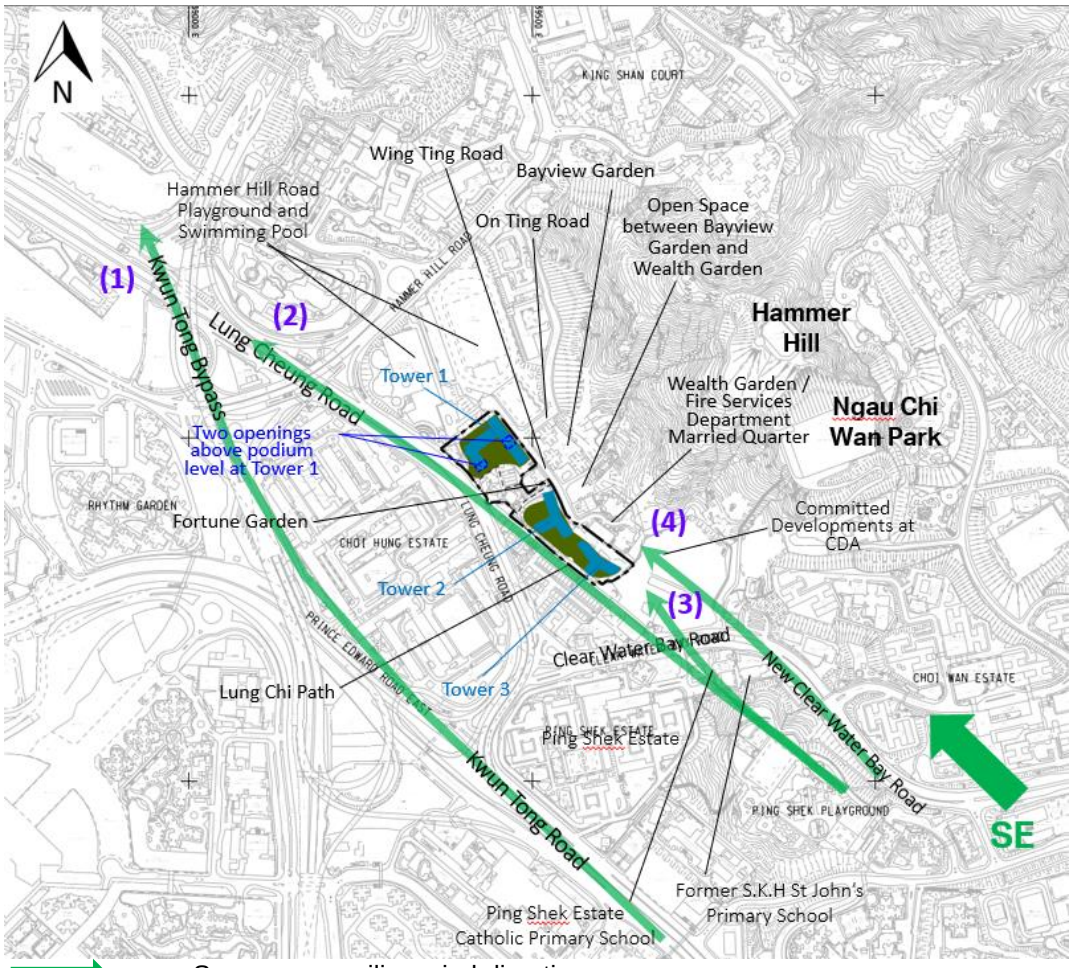
Proposed Scenario

5.5.3 Similar to the ESE prevailing wind, under the south-easterly summer prevailing wind, the potential wind wake areas due to the proposed development within the Site would reach the Hammer Hill Road Swimming Pool, the Hammer Hill Road Sports Ground and the GIC buildings nearby and might further extend to further downstream areas.

5.5.4 The south-easterly summer prevailing wind will be weakened by the existing Ping Shek Estate, skim over the low-rise buildings of NCWV and anticipated to be further sheltered by the proposed high-rise buildings within the Site before reaching the open areas of Hammer Hill Road Sports Ground and the Hammer Hill Swimming Pool. Same as in the Baseline Scenario, the SE wind flowing along the New Clear Water Bay Road would flow via the building separations between the two clusters of the committed residential towers within the CDA and eventually being obstructed by the Wealth Garden and the Fire Services Department Married Quarter from flowing further downstream in the Proposed Scenario (see Marker (4) in **Figure 5.8**).

5.5.5 Similar to that under the Baseline Scenario, portion of SE wind originated from the Ping Shek Playground, after flowing around the Ping Shek Estate would be obstructed by the committed high-rise buildings within the CDA under the Proposed Scenario (see Marker (3) in **Figure 5.8**), The SE wind availability along the Wing Ting Road and reaching the Hammer Hill Road Sports Ground is anticipated to be weakened. Lung Cheung Road allows south-easterly winds to flow which would promote air ventilation performance in the nearby areas of the Site (see Marker (2) in **Figure 5.8**). It should be pointed out that the proposed Towers under the Development

Proposal have incorporated setbacks both Lung Chi Path/Lung Cheung Road and Wing Ting Road, these good design features would enhance wind permeability and facilitate the flow of SE prevailing wind along these major wind corridors.



Summer prevailing wind direction
Air flow
Project Site

Figure 5.8 **Anticipated Wind Flows under the SE Annual and Summer Prevailing Wind Direction for the Proposed Scenario**

5.5.6 To alleviate the wind impacts under the south-easterly summer prevailing wind, the proposed development layout has optimized its placement and orientation by placing the shorter frontage of buildings facing the SE prevailing wind. Similar to that under the ESE wind, the relatively bulky Tower 1 at Site C has incorporated a setback of 20m from the Lung Cheung Road with less obstruction of the wind by the above podium tower. Apart from this, the proposed building is also placed 7.5 meters away from the Hammer Hill Road Swimming Pool, attempting to reduce the wind impacts at the downwind areas to minimal.

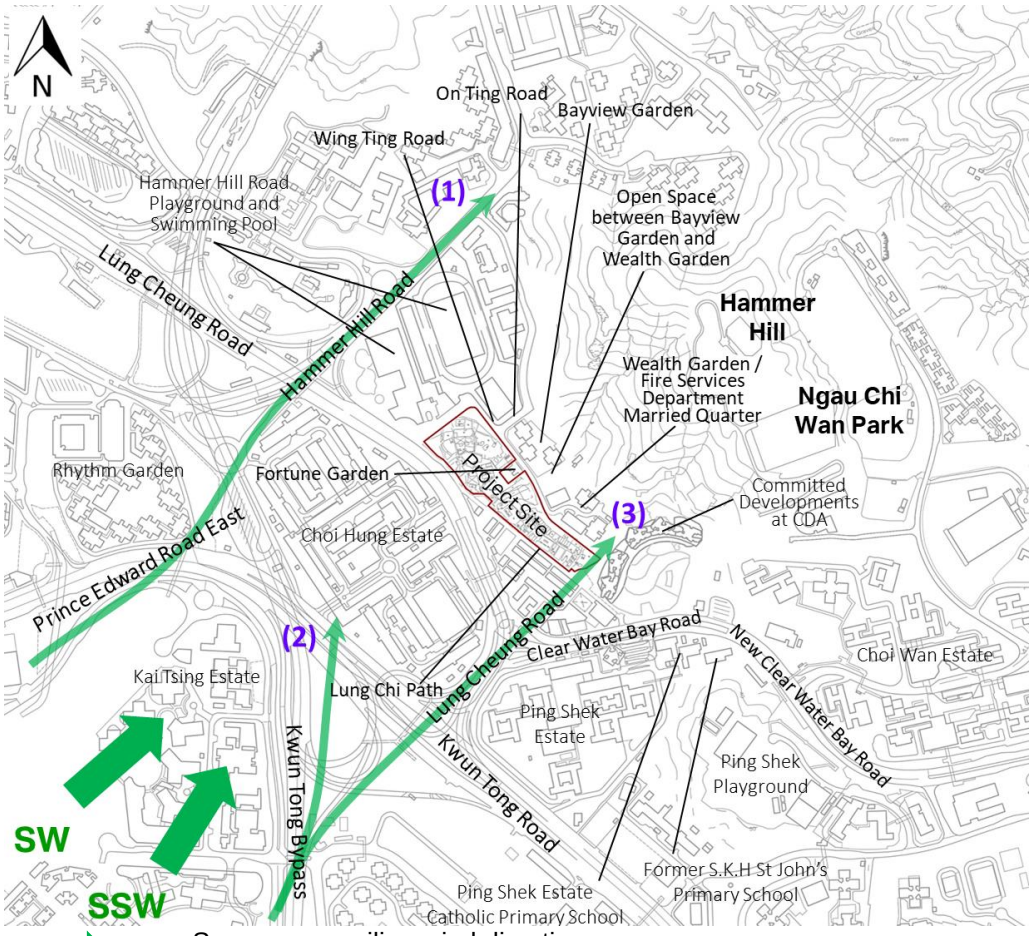
5.5.7 Wind flowing along Kwun Tong Road - Kwun Tong Bypass under the SE wind remains unobstructed under the Proposed Scenario. The SE wind would still be directed by this road to reach the region near Rhythm Garden and Choi Hung Estate and continue to flow towards the north (see Marker (1) in **Figure 5.8**). The anticipated wind flows are illustrated in **Figure 5.8**. Moreover, the proposed Towers within the Project Site have a variation in building heights of which Tower 1 (+130mPD) is taller than Tower 2 and Tower 3 (both +115mPD), downwash wind under the SE prevailing wind directions is anticipated, in which there would appear to have localized improvements in wind environment at regions in between Tower 1 and Tower 2 within the Site.

5.6 Under the SW/SSW Summer Prevailing Wind

Baseline Scenario

5.6.1 The SSW wind would enter from the Kai Tak region along the Kwun Tong Bypass. However, this directional wind will be partly moderated by Choi Hung Estate after flowing past the Kai Ching Estate. However, the weakened wind could still skim over the current squatters at the Project Site and reach the further downstream areas where the Bayview Garden and the Ngau Chi Wan Park are located. On the other hand, under the SW wind, the wind flow from Kwun Tong Bypass may flow along the Lung Cheung Road located at the south-eastern side of Choi Hung Estate and reach the south-eastern regions of the Site between the committed residential towers within the CDA and the Wealth Garden/Fire Services Department Married Quarter (see Marker (3) in **Figure 5.9**).

5.6.2 In addition, wind flow driven by SSW / SW wind would also approach the area north west to the Site. This portion of wind would channel through the Prince Edward Road East and flow to the northeast into the Hammer Hill Road. The potential existing wind flows under SSW and SW prevailing wind are illustrated in **Figure 5.9** below.



Summer prevailing wind directions
Air flow
Project Site

Figure 5.9 Anticipated Wind Flows under the SW and SSW Summer Prevailing Wind Directions for the Baseline Scenario

Proposed Scenario

5.6.3 Under the south-westerly quadrant summer prevailing wind, the potential wind wake areas due to the proposed development within the Site would reach the Bayview Garden, Wealth Garden and the Fire Services Department Married Quarters. To the further downwind side of the Site locates the Hammer Hill Areas with less frequent pedestrian access.

5.6.4 There are two major south-westerly wind passageways sandwiching the Choi Hung Estate in between that would promote the flow of south westerly wind and maintain the wind environment in the surroundings of the Site. One is the Prince Edward Road East extending to the Hammer Hill Road (see Marker (1) in **Figure 5.10**), the other is the portion of Lung Cheung Road intersecting the Clear Water Bay Road, then skim over the low-rise buildings of NCWV before flow around the southeastern edge of Tower 3 in the Site (see Marker (3) in **Figure 5.10**).

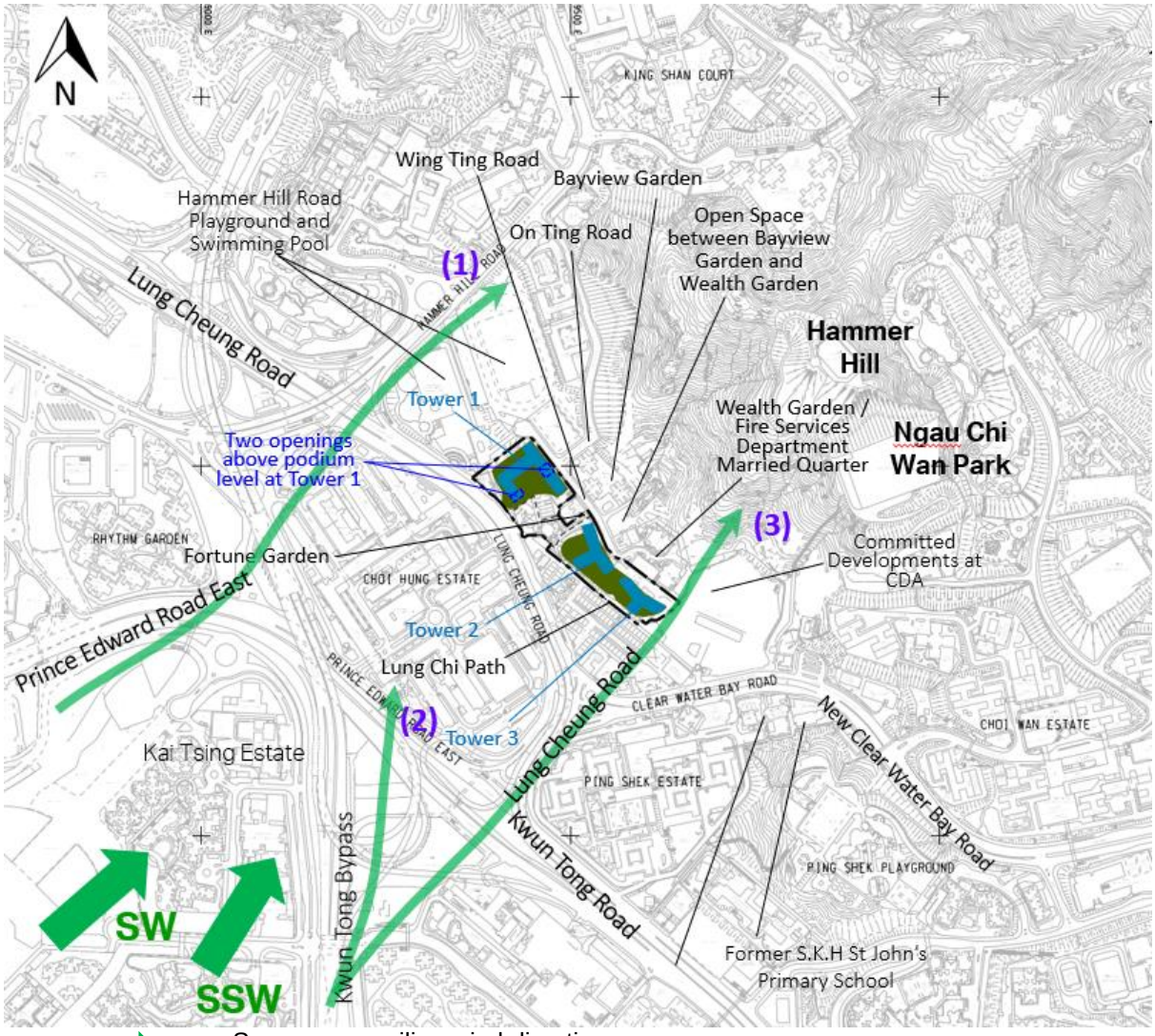


Figure 5.10 **Anticipated Wind Flows under the SW/SSW Summer Prevailing Wind Directions for the Proposed Scenario**

5.6.5 The SW/SSW wind will be moderated by the Choi Hung Estate before reaching the Site (see Marker (2) in **Figure 5.10**). Compared to the existing situation with low-rise squatters, the SW/SSW wind reaching the downwind Bayview Garden, Wealth Garden and the Fire Services Department Married Quarters would be further reduced after the construction of the Development Proposal within the Site. It is observed that the proposed buildings of the proposed development within the Site are taller than the buildings of Choi Hung Estate, which would induce downwash wind under the SW/SSW prevailing wind. As a result, it is anticipated that the wind environment along Lung Cheung Road can be maintained. Several air ventilation measures have been incorporated into the design of the proposed buildings of the proposed development. The three proposed building blocks have minor setbacks with distance of 5 meters away from the northeastern Site boundary along the Wing Ting Road, aim at reducing the wind impacts. Furthermore, there are building separation of about 15 meters between

proposed Towers 2 and 3 at Site D1 (see **Figure 4.1**), building separation of about 15 meters between Tower 1 at Site C and Fortune Garden, and building separation of around 12 meters between proposed Tower 2 at Site D1 and Fortune Garden respectively (see **Figure 4.1**). These good design measures all aim at increasing the wind permeability under the southwestern wind quadrant.

6 POTENTIAL STRATEGIES FOR FUTURE DESIGN OPTIMIZATION

6.1 Potential Strategies for Future Design Optimization

6.1.1 Based on the discussion in **Section 5** above, the proposed development would induce certain degree of wind influences under the annual / summer prevailing wind to its respective downstream regions. However, the proposed development has incorporated several good design measures including the building separations and setbacks from the Site boundaries, which would maintain the pedestrian wind flow and prevent significant deterioration in terms of wind environment. Furthermore, variation of building heights has been introduced between Tower 1 at Site C and Towers 2 and 3 at Site D1, which would enhance vertical air movement and improve the air ventilation performance at the local areas in between these proposed Towers. Subject to detailed design and analysis, empty bay designs with two openings of 15m and 7.5m in width respectively have also been incorporated above podium level at Site C, to facilitate the flow of ENE prevailing wind towards the Choi Hung Estate.

6.1.2 Given the fact that the Site is mainly deployed in NW-SE direction, the major residential regions nearby, which are Choi Hung Estate, NCWV, Bay View Garden and Wealth Garden, are identified as wind sensitive areas. To further minimize the wind impacts and facilitate wind flow to the aforementioned regions in a more effective and efficient way, enhancement measures such as provision of additional building permeability, are recommended to be further explored in the next stage of the Project.

6.1.3 Several typical general recommendations in the aspect of air ventilation performance are also suggested to be taken into consideration in further refinement and design stages, which are listed as follows:-

- Adopt further building permeability whenever possible and feasible with reference to PNAP APP-152;
- Incorporate greening measures, preferably through tree planting at-grade; and
- Avoid long continuous façades of building clusters.
- The recommendations of design measures from Sustainable Building Design Guidelines (SBDG) and Hong Kong Planning Standards and Guidelines (HKPSG) are suggested to be made for reference.

7 SUMMARY AND CONCLUSION

7.1.1 The Site is situated at the East Kowloon Area, north east to the Kai Tak Development Area. The annual prevailing wind towards the Site and vicinity areas are mainly from E, ENE and ESE directions. While in summer, the prevailing wind are composed by wind from E, SE, SW, and SSW directions.

7.1.2 The areas to the north, east and northeast of the Site are hilly terrains, which extends to Ma On Shan Country Park, while the terrain to the south and west in the vicinity of the Site are relatively low-rise and flat. Hence, prevailing wind coming from easterly and northerly directions may be moderated by the topographical features. In addition, the buildings near the Site ranges from low-rise village houses to high-rise public housing residential estates. The noticeable high-rise and high-density building clusters in the vicinity of the Project Site are the committed residential towers within the Comprehensive Development Area, Choi Hung Estate, Ping Shek Estate, and Choi Wan Estate.

7.1.3 The Development Proposal formulated for the future residential developments within the Site consists of 3 residential buildings with heights ranges from +115mPD to +130mPD. These buildings all sit on podium structures which are +27mPD to +29mPD in height. The proposed development is expected to induce wind shadow zones to the downstream areas, due to the constraint of the location and disposition of the Site and the buildings within. As a result, certain localized air ventilation impacts on the surrounding pedestrian wind environment is expected. The proposed development would shield a portion of E and ENE wind against the Choi Hung Estate and NCWV, while the Hammer Hill Road Playground and Bayview Garden / Wealth Garden would be under the wind influence of the proposed development under ESE / SE and SSW / SW wind respectively.

7.1.4 Regarding the potential air ventilation impacts, the proposed development has incorporated certain good air ventilation measures with reference to the Sustainable Building Design Guidelines and Hong Kong Planning Standards and Guidelines, such as maintaining building separations between the 3 towers, and setbacks from the Site boundaries, which allows certain degree of wind flows to reach key downstream areas and alleviate the possible wind influences. Variation of building heights between Tower 1 and Towers 2/3 has been adopted to enhance vertical air movement. Furthermore, empty bay designs with two openings of 15m and 7.5m in width respectively have been incorporated above podium level at Tower 1, to facilitate the flow of ENE prevailing wind towards the Choi Hung Estate. With incorporation of the above good design features, it is unlikely that the NCWV Development would induce any significant air ventilation impact to the surrounding areas. Further quantitative AVA Study is considered not necessary.

Figures

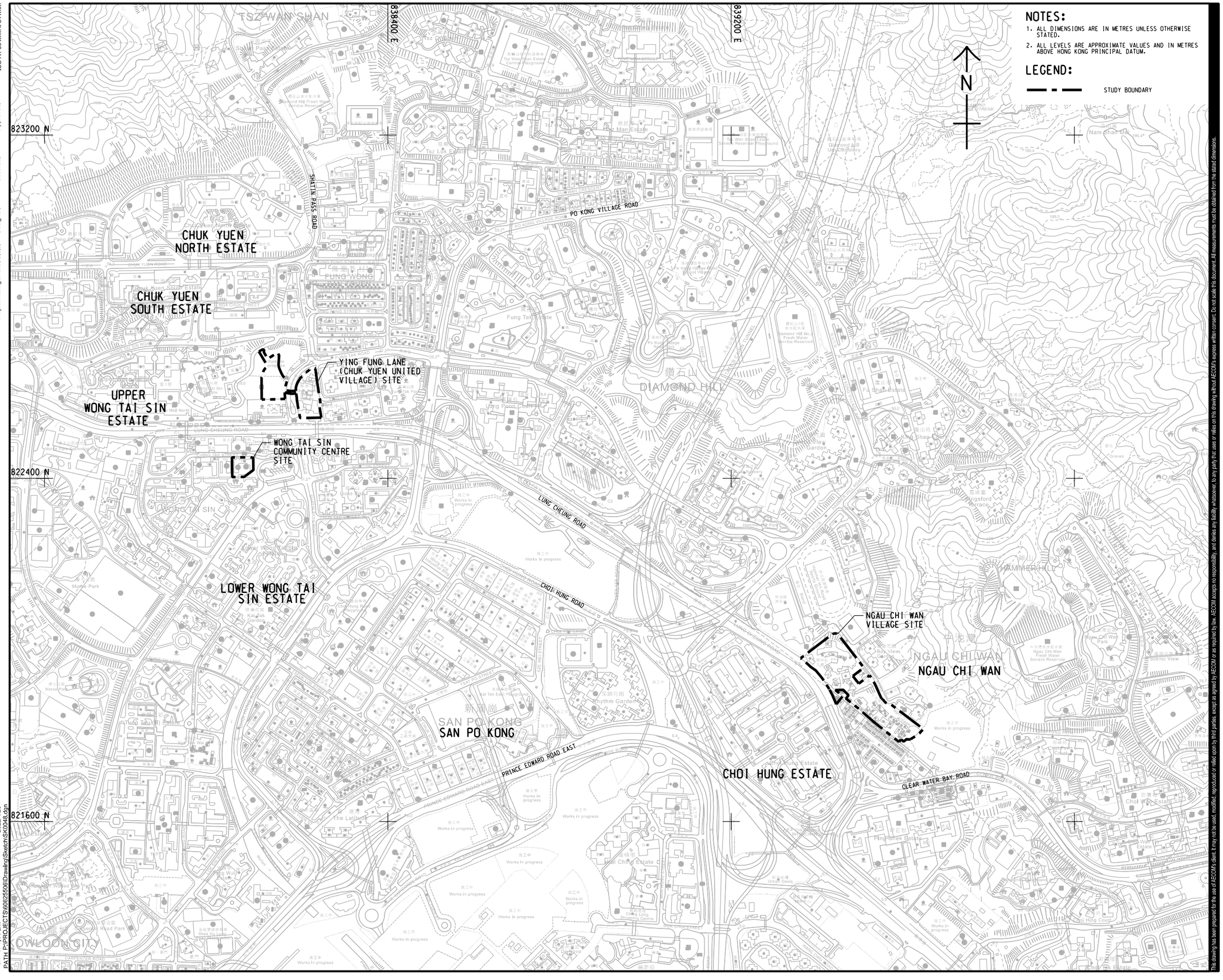
ISO A1 594mm x 841mm

Approved:

Checked:

Designer:

Project Management Initials:



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2022/4/20

AECOM

PROJECT
項目

SITE FORMATION AND INFRASTRUCTURE WORKS FOR PROPOSED PUBLIC HOUSING DEVELOPMENTS AT WONG TAI SIN - FEASIBILITY STUDY

CLIENT
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ISSUE/REVISION
修訂

I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 核核

STATUS
階段

SCALE 比例
A3 1 : 8000

DIMENSION UNIT 尺寸單位
METRES

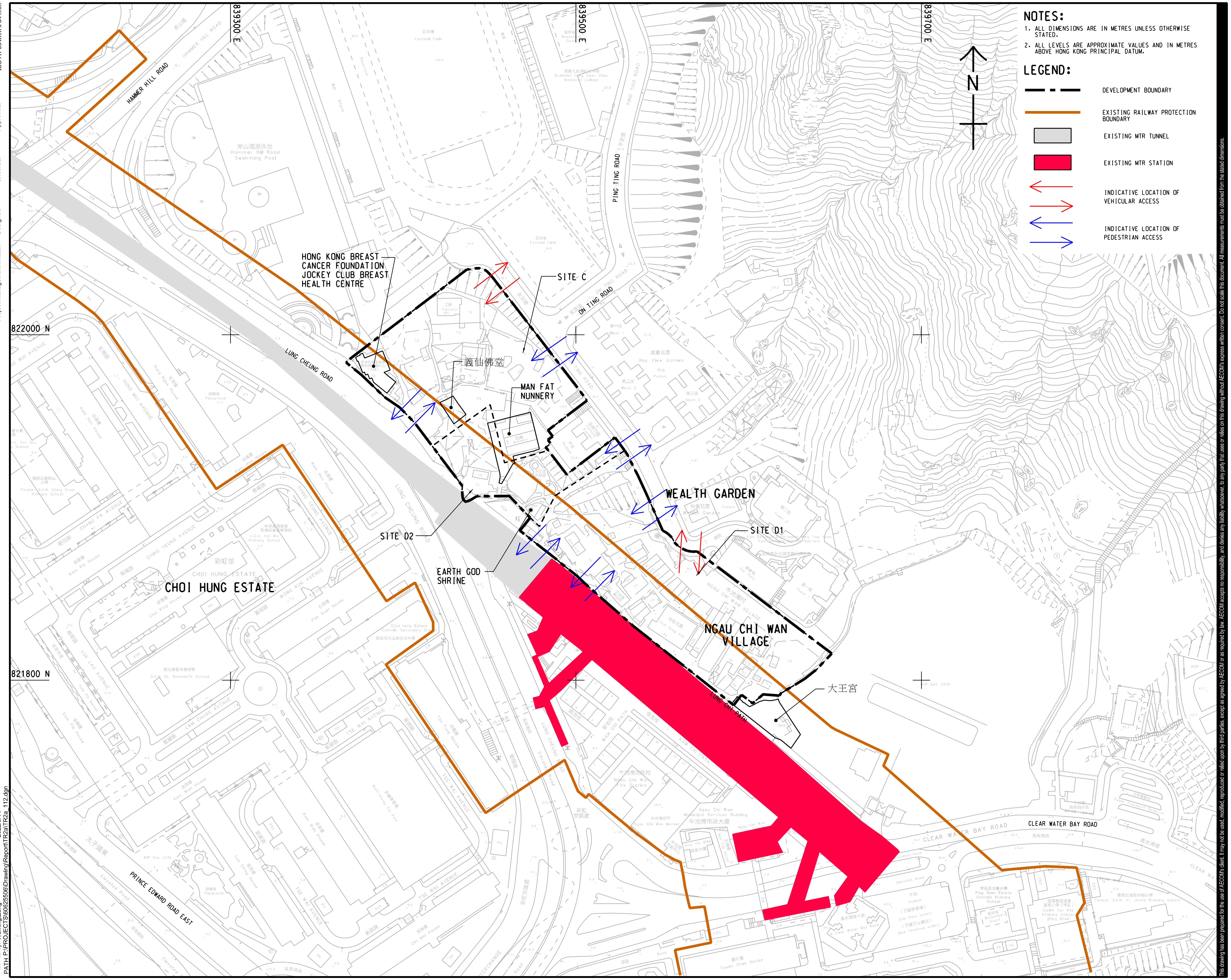
KEY PLAN
索引圖

PROJECT NO. 項目編號
60625506

AGREEMENT NO. 協議編號
CE 32/2019(CE)

SHEET TITLE
圖紙名稱
GENERAL LAYOUT PLAN

SHEET NUMBER
圖紙編號
60625506/TR14a/FIGURE 1.1



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PROJECT 項目

SITE FORMATION AND INFRASTRUCTURE WORKS FOR PROPOSED PUBLIC HOUSING DEVELOPMENTS AT WONG TAI SIN - FEASIBILITY STUDY

CLIENT 業主

CEDD 土木工程拓展署 Civil Engineering and Development Department

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ISSUE/REVISION 修訂

I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 複核

STATUS 階段

SCALE 比例: A3 1 : 2000

DIMENSION UNIT 尺寸單位: METRES

KEY PLAN 索引圖

PROJECT NO. 項目編號: 60625506

AGREEMENT NO. 協議編號: CE 32/2019(CE)

SHEET TITLE 圖紙名稱

LOCATION PLAN OF NGAU CHI WAN VILLAGE SITE

SHEET NUMBER 圖紙編號

60625506/TR14a/FIGURE 1.2