

**APPENDIX D  
AIR VENTILATION ASSESSMENT REPORT**

---



**Agreement No. CE 92/2017 (CE)**

**Site Formation and Infrastructure Works  
for Public Housing Development near Tan Kwai Tsuen,  
Yuen Long – Investigation, Design and Construction**

**FINAL AIR VENTILATION  
ASSESSMENT REPORT -  
EXPERT EVALUATION**

199086/BIN/104/Issue 1  
March 2023



土木工程拓展署  
Civil Engineering and  
Development Department







**Agreement No. CE 92/2017 (CE)**  
**Site Formation and Infrastructure Works  
for Public Housing Developments near Tan  
Kwai Tsuen, Yuen Long – Investigation,  
Design and Construction**




---

**Final Air Ventilation Assessment Report  
- Expert Evaluation**

---

*199086/BIN/104/Issue 1*

March 2023

	Name	Signature	Date
Prepared	Ramboll		Mar 2023
Reviewed	Esther Tong		Mar 2023
Authorized	Edwin Lo		Mar 2023



## **Table of Contents**

Page

### **1 INTRODUCTION 1**

1.1	Project Background .....	1
1.2	Objective of the Air Ventilation Assessment (Expert Evaluation) .....	1
1.3	Application Site and its Environs .....	1
1.4	Baseline Scheme .....	2
1.5	Proposed Scheme .....	2

### **2 SITE WIND AVAILABILITY 4**

2.1	Site Wind Availability Data .....	4
2.2	Topography and Building Morphology .....	4
2.3	Summary of Site Wind Availability under Existing Site Condition .....	6

### **3 EXPERT EVALUATION OF AIR VENTILATION PERFORMANCE OF THE PROPOSED DEVELOPMENT 8**

3.1	Assessment Methodology .....	8
3.2	Annual Prevailing Wind Flow from NNE, NE, E and ESE Directions .....	8
3.3	Summer Prevailing Wind Flow from SSE, S and SSW Directions .....	10
3.4	Summary of Air Ventilation Performance .....	11
3.5	Building Design Features .....	12

### **4 CONCLUSIONS 14**

## **List of Tables**

Table 2.1	Summary of RAMS Data under Annual and Summer Conditions.....	4
Table 2.2	Building Height of Existing and Neighbouring Development.....	6

## **List of Figures**

Figure 1.1	Location of the Application Site and its Environs
Figure 1.2	Master Layout Plans of Baseline Scheme and Proposed Scheme
Figure 2.1	Annual and Summer Wind Roses on RAMS (044, 065) & (044, 066) at 200m
Figure 3.1	Illustration of Wind Flow from North Northeast and Northeast Wind Directions
Figure 3.2	Illustration of Wind Flow from East and East Southeast Wind Directions
Figure 3.3	Illustration of Wind Flow from South and South Southeast Wind Directions
Figure 3.4	Illustration of Wind Flow from South Southwest Wind Direction
Figure 3.5	Proposed Mitigation Measures of Proposed Scheme

## **List of Appendices**

Appendix 1	Cross Sections of Proposed Scheme
------------	-----------------------------------

## **1 INTRODUCTION**

### **1.1 Project Background**

1.1.1 As a prevailing policy to increase land supply to meet the housing demand in the short, medium and long terms, the Government has identified sites in various districts with the potential to be developed for residential use. Amongst others, a site near Tan Kwai Tsuen (the Application Site), Yuen Long has been identified for public housing development. The location of the Application Site is indicated in **Figure 1.1**.

1.1.2 Binnies Hong Kong Limited was commissioned by the Civil Engineering and Development Department (CEDD) under Agreement No. CE 92/2017 (CE) Site Formation and Infrastructural Works for the Development near Tan Kwai Tsuen, Yuen Long – Investigation, Design and Construction for site formation and provision of essential infrastructures to support the housing development at the Application Site.

1.1.3 In accordance with the “Tong Yan San Tsuen Outline Zoning Plan No. S/YL-TYST/14”, the current land use zoning of the Application Site is “Residential (Group A)2” (“R(A)2”). Under the 'Remarks' column in the Notes for R(A) use, for R(A)2, no new development, or addition, alteration and/or modification to or redevelopment of an existing building shall result in a total development and/or redevelopment in excess of a maximum plot ratio of 6.5, and maximum building height of 205mPD, or the plot ratio and height of the existing building, whichever is the greater.

1.1.4 In view of the acute shortage of housing, the domestic PR of the Application Site is proposed to be intensified to 6.5 with an aim to increase flat production. The Application Site will provide a total of 7,420 public housing units with planned population intake from 2030 by phases. An “Application for Permission under Section 16 of the Town Planning Ordinance” is being prepared for the Proposed Development in order to obtain planning permission from the Town Planning Board for minor relaxation of the following restrictions:

- Maximum plot ratio:
  - Phase 1: from 6.5 to 7.0 (i.e. domestic PR of 6.5 and non-domestic PR of 0.5)
  - Phase 2: from 6.5 to 7.2 (i.e. domestic PR of 6.5 and non-domestic PR of 0.7)
  - Phase 3: from 6.5 to 7.3 (i.e. domestic PR of 6.5 and non-domestic PR of 0.8)
- Maximum building height:
  - Phase 1: from 205 mPD to 240 mPD
  - Phases 2 and 3: from 205 mPD to 235 mPD

### **1.2 Objective of the Air Ventilation Assessment (Expert Evaluation)**

1.2.1 The purpose of the AVA-EE is to qualitative assessment the air ventilation performance to the surrounding pedestrian wind environment due to the proposed increase in maximum plot ratio and building height of the proposed housing development (the Proposed Development).

### **1.3 Application Site and its Environs**

1.3.1 **Figure 1.1** shows the location of the Application Site and their environs.

1.3.2 The Application Site consists of public housing development with an area of around 48,765 m<sup>2</sup> which is located near Tan Kwai Tsuen of the Yuen Long District. It is located within “Residential (Group A)” (“R(A)2”) in the approved Outline Zoning Plan (OZP) No. S/YL-TYST/14 near Tan Kwai Tsuen, Yuen Long.

- 1.3.3 The Application Site in irregular shape is currently within rural areas with village houses and overlooked by natural hillside. To the west and northwest of the Application Site is Yuen Long Highway, village houses and some low-rise residential and industrial developments. To the north is the existing Tan Kwai Tsuen South Fresh Water Service Reservoir and the existing Tan Kwai Tsuen Salt Water Service Reservoir. The hilly terrains are on the east and southeast side of the Application Site and located over 500 m away from its boundary. As part of the infrastructure works proposed for the housing development, water supply facilities (proposed flushing water storage reservoir and proposed fresh water storage reservoir with formation level (roof level) at around +110 mPD (+115 mPD) and +115 mPD (+125 mPD) respectively) are planned to be built to the north of the Application Site and the associated access roads for supporting the proposed public housing development are proposed to cut through the Site in a “S” shaped alignment. Further to the south and southeast are Lam Tei Quarry and Tai Lam Country Park respectively.

#### **1.4 Baseline Scheme**

- 1.4.1 The Baseline Scheme is taken from the Air Ventilation Assessment – Expert Evaluation (AVA-EE) Report prepared under Agreement No. CE 31/2015 (CE)<sup>1</sup> to support the previous rezoning of the Application Site for housing development. The master layout plan of the Baseline Scheme is shown in **Figure 1.2**.
- 1.4.2 The Baseline Scheme consists of seven residential blocks with stepped platforms. Blocks 1 to 3 are situated on the lower platform at around +52 mPD; Blocks 4 and 5 are situated on the middle platform at level from +71 to +75 mPD and Blocks 6 and 7 are situated on the upper platform at around +84 mPD. The building height of the above residential blocks are at around +168 mPD for Blocks 1, 2 and 3; +191 mPD for Blocks 4 and 5; and +200 mPD for Blocks 6 and 7.
- 1.4.3 Two non-domestic blocks and a PTI with building height at around +67 mPD and +52 mPD respectively are proposed on the north-western part of the site in the Baseline Scheme.

#### **1.5 Proposed Scheme**

- 1.5.1 **Figure 1.2** illustrates the building layout of the Proposed Scheme and **Appendix 1** provides the cross sections of the Proposed Development.
- 1.5.2 The Proposed Scheme consists of seven residential blocks with an area of around 48,765 m<sup>2</sup> along with its necessary facilities. Around 7,420 public housing flats are planned to be built on stepped platforms at the Application Site. Blocks 1 to 3 in Phase 3 with 60 storeys including 7-storey podium for each block are situated on the lower platform at around +80 mPD at the north-western portion of the Application Site; Blocks 4 and 5 with 51 storeys including 5-storey podium for each block are situated on the middle platform at around +100 mPD to the middle portion of the Application Site; Blocks A and B with 50 storeys including 5-storey podium for each block are situated on the upper platform at around +110 mPD at the south-eastern portion of the Application Site. The building height of the above residential blocks are at around +235 mPD for Blocks 1 to 5; and +240 mPD for Blocks A and B. The podiums of Blocks 1 to 5 and A to B consist of welfare facilities and carparks. A 1- storey PTI at around +42 mPD is proposed underneath the podium of Phase 3; retails stores are provided in the podiums of Phase 2 and 3; and kindergartens are

---

<sup>1</sup> Black & Veatch (2017) Final Preliminary Air Ventilation Assessment Report in the Form of Expert Evaluation (TR13) under Agreement No. CE 31/2015 (CE) Site Formation and Infrastructural Works for the Development near Tan Kwai Tsuen, Yuen Long – Feasibility Study



proposed in the podiums of Phase 1 and 2. Furthermore, in the Proposed Scheme, two footbridges connecting Phase 1 to Phase 2 and Phase 2 to Phase 3 are proposed. The design information of these footbridges is not available at this early stage and the wind hinderance effect of the proposed footbridges is anticipated to be minor because the size of footbridge is expected to be small.

## 2 SITE WIND AVAILABILITY

### 2.1 Site Wind Availability Data

2.1.1 Considering this expert evaluation is not a detailed study for air ventilation performance, it is therefore considered acceptable to use the Regional Atmospheric Modelling System (RAMS) data for Site Wind Availability initially as a starting point. According to the location of the Application Site, the RAMS data of the grid (044, 065) and (044,066) extracted from the Site Wind Availability Data of Planning Department’s web site are used for the study.

2.1.2 **Figure 2.1** shows the relevant windrose diagrams representing the frequency and wind speed distribution at 200 m height of the district concerned during the annual condition and summer condition (Jun – Aug). Based on the wind rose with different heights (200 m, 300 m or 500 m) available, the 200 m site wind availability data represents wind data that takes into account the topographical effect around the Application Site. Therefore, a lower level of windrose at 200 m height is selected to study the prevailing wind condition as it represents the incoming wind to the Application Site and considers the influence on the prevailing winds by the surrounding topography.

2.1.3 According to the wind rose at 200 m altitude, the annual prevailing wind directions for the Application Site are NNE, NE, E and ESE; whereas the summer prevailing wind directions are SSE, S and SSW. The wind frequency data under the annual and summer conditions at 200 m altitude is shown in **Table 2.1** below.

**Table 2.1 Summary of RAMS Data under Annual and Summer Conditions**

Wind Direction	(044,065)		(044,066)	
	Probability for Annual Condition	Probability for Summer Condition	Probability for Annual Condition	Probability for Summer Condition
0° (N)	2.8%	0.9%	2.9%	0.9%
22.5° (NNE)	10.1%	1.3%	<b>10.9%</b>	1.2%
45° (NE)	<b>11.9%</b>	1.4%	<b>11.6%</b>	1.5%
67.5° (ENE)	8.9%	2.9%	8.8%	3.0%
90° (E)	<b>12.1%</b>	7.2%	<b>12.1%</b>	7.1%
112.5° (ESE)	<b>10.4%</b>	7.7%	9.7%	7.3%
135° (SE)	8.6%	9.4%	8.6%	9.8%
157.5° (SSE)	7.6%	<b>13.5%</b>	7.6%	<b>13.7%</b>
180° (S)	7.2%	<b>15.4%</b>	6.9%	<b>14.8%</b>
202.5° (SSW)	6.9%	<b>15.1%</b>	6.9%	<b>15.0%</b>
225° (SW)	5.0%	12.0%	5.1%	12.5%
247.5° (WSW)	2.2%	4.8%	2.2%	4.7%
270° (W)	2.3%	4.2%	2.3%	4.1%
292.5° (WNW)	1.4%	2.1%	1.5%	2.3%
315° (NW)	1.2%	1.2%	1.4%	1.2%
337.5° (NNW)	1.5%	0.9%	1.5%	0.9%

Note: Bold characters highlighted in grey represent the selected prevailing wind directions for evaluation.

## 2.2 Topography and Building Morphology

### Topography

2.2.1 There is an existing hilly terrain at around 500 m to the east and southeast side of the Application Site; whilst the existing topography of Tan Kwai Tsuen to the west of the Application Site is generally flat. On the east side of the Application Site, there are slopes with

their heights increasing from west to east. Further south to southeast is the hilly terrain of Lam Tei Quarry and Tai Lam Country Park, where the hilltop (around +328 mPD) may create a shelter, weakening the general southeast quadrant winds towards the Application Site.

- 2.2.2 On examining the annual and summer wind roses at 200 m, the existing hilly terrain on the east side of the Application Site, Lam Tei Quarry and Tai Lam Country Park would block the E, SSE, S and SSW prevailing winds reaching to the Application Site. However, as shown in **Figure 1.1**, given the large distance (around 750 m) between the Application Site and the hilly terrains, the sheltering effect on the easternly and southerly winds by the hills would not be significant. Therefore, the wind flow pattern at the Application Site would only be slightly influenced by the surrounding topography.
- 2.2.3 For annual NNE and NE wind directions, the wind availability would not be influenced by hilly terrains. For the annual winds under E and ESE directions, the wind availability towards the Application Site has been partially obstructed by the hilly terrain on the east side of the Application Site.
- 2.2.4 In the summertime, SSW, S, SSE prevailing winds towards the Application Site and its downstream areas are partially obstructed by the hilly terrain of Lam Tei Quarry and Tai Lam Country Park. Therefore, the wind flow pattern at the site would be slightly influenced by the surrounding topography.

### **Building Morphology**

- 2.2.5 **Figure 1.1** indicates the locations of the Application Site and the surrounding proposed and existing developments.
- 2.2.6 Regarding the existing building morphology, there are low-rise residential and industrial developments including Tan Kwai Tsuen, Casa Regalia, Domus, Meadowlands and Wo Ping San Tsuen, etc, identified on the west to northwest side of the Application Site, in which potential building blockages are considered low. Also, the existing North West N.T. Refuse Transfer Station located to the southwest of the Application Site is low-rise in nature while the existing Tan Kwai Tsuen North Fresh Water Service Reservoir, the existing Tan Kwai Tsuen South Fresh Water Service Reservoir and the existing Tan Kwai Tsuen Salt Water Service Reservoir are low-rise in nature which also provide a large area of open space near the north side of the Application Site. It is expected that the effect of blocking incoming wind to the Application Site is very limited.
- 2.2.7 The proposed water supply facilities (including the proposed flushing water and fresh water storage tanks) are on the immediate northeast side of the Application Site whilst the proposed primary school site is situated to the east of the Application Site. The proposed access road will cut through the middle of the Site in a “S” shaped alignment.
- 2.2.8 As most of the existing developments near the Application Site are low-rise developments, it is expected that they will not impose significant ventilation impact on the Application Site under the NE, NNE, E, ESE, SSE, S and SSW prevailing wind conditions. It is observed that there are several noise barriers (the tallest of these noise barriers is a cantilever noise barrier of 5.5 m high with a 2.5 m extension) constructed along Yuen Long Highway. It would slightly obstruct the incoming wind and could possibly induce small wind shadow regions at nearby residential development.
- 2.2.9 The building height of the existing developments and their locations from the Application Site are tabulated in the following **Table 2.2** and illustrated in **Figure 1.1**.

**Table 2.2 Building Height of Existing and Neighbouring Development**

Name of Development	Building Height	Location from Application Site
The Woodville	~+26.5 to +33.2 mPD	N
Treasure Court, Lai Hung Garden and Symphony Garden	~+30.8 to +48.6 mPD	N
Meadowlands	~+30 to ~+36 mPD	NW
Domus	~+40 mPD	NW
Casa. Regalia	~+40 mPD	NW
Osmanthus Garden	~+26 to ~+36 mPD	NW
Wo Ping San Tsuen	~+15 to +16 mPD	NW
The VERDANCY	~+19.9 to +23.7 mPD	NW
Jubilee Gardens and Trafalgar Gardens	~+29.4 to +33.8 mPD	NW
Bauhinia Garden	~+28.1 to +36.7 mPD	NW
Arnold Garden	~+29.3 to +31.3 mPD	NW
Chung Uk Tsuen	~+14 to +24 mPD	NW
Tan Kwai Tsuen	~+22 to ~+32 mPD	NW
Wo Ping San Tsuen	~+22 to ~+32 mPD	NW
Tan Kwai Tsuen North Fresh Water Service Reservoir	~+68 mPD	NE
Tan Kwai Tsuen South Fresh Water Service Reservoir	~+68 mPD	NE
Tan Kwai Tsuen Salt Water Service Reservoir	~+68 mPD	NE
North West N.T. Refuse Transfer Station	~+30 mPD	SW

### 2.3 Summary of Site Wind Availability under Existing Site Condition

2.3.1 RAMS wind data is recommended to be used for directional analysis.

#### **Annual Condition**

2.3.2 According to the RAMS wind availability data, the annual wind directions of the area are mainly NNE, NE, E and ESE. From **Table 2.1** above, the wind probability from the E direction is 12.1% at both grids (044, 065) and (044,066), which is considered to be the dominant wind direction for the Application Site. NNE (10.9% at grid (044,066)), NE (11.9% at grid (044,065) and 11.6% at grid (044,066)) as well as ESE (10.4% at grid (044,065)) winds are also dominant prevailing wind directions apart from the E wind.

2.3.3 Under the NNE wind condition, given that Yuen Long Highway is generally aligned in parallel to the NE - SW prevailing wind directions, it is expected that there is high wind availability of prevailing winds flowing along Yung Long Highway. Besides, the existing low-rise Tan Kwai Tsuen North Fresh Water Service Reservoir, the existing Tan Kwai Tsuen South Fresh Water Service Reservoir and the existing Tan Kwai Tsuen South Salt Water Service Reservoir renders large open space to the north side of the Application Site. It is expected that the NNE prevailing wind can flow atop the above existing water service reservoirs into the Application Site and further reach to its downstream areas.

2.3.4 Under the NE wind condition, the NE prevailing wind would also flow atop the existing three Water Service Reservoirs and further reach the Application Site and its surrounding (i.e. Tan Kwai Tsuen) and downstream areas (i.e. Wo Ping San Tsuen and the existing North West N.T.

Refuse Transfer Station). Therefore, the wind environment at the Application Site under NNE and NE directions is expected to be satisfactory.

- 2.3.5 Due to the high hilly terrain to the east of the Application Site, it is expected that the annual prevailing wind under E and ESE wind conditions would be partially obstructed by the topography, such that the E and ESE prevailing winds are expected to be weakened before reaching the Application Site. As a result, the wind performance of the Application Site would be slightly reduced under the annual E and ESE wind conditions.

#### **Summer Condition**

- 2.3.6 Under summer conditions, the prevailing winds are mainly coming from SSE (13.7%), S (14.8%) and SSW (15%) directions.
- 2.3.7 Under the SSE wind condition, the prevailing winds are still able to penetrate the Application Site and reach the downstream areas. Given that the natural topographic regions (Tai Lam Country Park) to the south to southeast is further away from the Application Site, it is expected that they will not impose significant air ventilation impact in summer SSE wind direction. The incoming SSE wind is expected to penetrate towards to the Tan Kwai Tsuen, Casa Regalia, Domus, Tan Kwai Garden, Meadowlands and Wo Ping San Tsuen etc. at downstream areas. The open space near the Application Site above the existing Tan Kwai Tsuen South Fresh Water Service Reservoir and the existing Tan Kwai Tsuen Salt Water Service Reservoir could possibly act as wind entrances for facilitating SSE wind flowing towards the downstream areas. Therefore, the existing wind environment at the Application Site under SSE direction is expected to be satisfactory.
- 2.3.8 Under the S and SSW wind directions, Yuen Long Highway could potentially act as a summer air path. A portion of incoming wind coming from the existing North West N.T. Refuse Transfer Station and the lower part of Kung Um Shan would flow relatively unobstructed to the Application Site and its downstream areas.
- 2.3.9 Considering the above, potential building blockage effect from the Application Site is considered low. Wind availability at pedestrian level under prevailing situation is considered good.

### **3 EXPERT EVALUATION OF AIR VENTILATION PERFORMANCE OF THE PROPOSED DEVELOPMENT**

#### **3.1 Assessment Methodology**

3.1.1 **Section 2** above describes the wind availability at the Application Site, and the dominant wind flow during annual and summer conditions. It is identified that the annual prevailing winds for the area are from NNE, NE, E and ESE directions whereas the summer prevailing winds are from SSE, S and SSW directions. The Proposed Development layout at the Application Site will be evaluated against the dominant wind directions identified, i.e. NNE and NE portions, E and ESE portions, SSE portion and S portions, and SSW portion.

#### **3.2 Annual Prevailing Wind Flow from NNE, NE, E and ESE Directions**

##### **NNE and NE Winds**

3.2.1 **Figure 3.1** illustrates the prevailing winds from NNE and NE wind directions under the Baseline Scheme and the Proposed Scheme.

3.2.2 Given that the existing Tan Kwai Tsuen South Fresh Water Service Reservoir and the existing Tan Kwai Tsuen South Salt Water Service Reservoir located to the northeast side of the Application Site are low-rise structures which form a large open area in the upwind area, the NNE and NE prevailing winds would flow atop these reservoirs towards the Application Site and its surrounding areas under both Baseline and Proposed Schemes.

3.2.3 Under the NNE and NE wind conditions, the proposed high-rise buildings at the Application Site under both Baseline Scheme and Proposed Scheme would obstruct a portion of the NNE and NE winds from penetrating into its downstream areas such as the existing North West N.T. Refuse Transfer Station and create a wind shadow in the immediate leeward regions, thus, reducing the wind availability. Compared to the Baseline Scheme, because of building blockage amplified by the increased building heights in the Proposed Scheme, the wake of the towers is larger in the Proposed Scheme and hence a decrease in wind flow from NNE and NE directions to the downstream of the Application Site is expected. However, its effect is considered to be minor because the area to the south of the Application Site have limited number of receivers. Furthermore, the taller towers at the Application Site in the Proposed Scheme would be able to capture high-level wind and create downwash to benefit air flow at pedestrian level of the Site and adjacent surrounding areas. Therefore, the impacts in terms of air ventilation performance under the NNE and NE winds to the existing users around the Application Site is minimal.

3.2.4 Under both schemes, various building separations, aligning in the NE-SW direction, are proposed between the building blocks at the Application Site to facilitate the NNE and NE winds to penetrate through the Application Site to the downstream areas such as the existing North West N.T. Refuse Transfer Station. Building separations of 15m in NE-SW direction have been allowed in the lower platform as well as between the middle and the upper platforms in both schemes. Despite the wind blockage caused by taller podiums in the Proposed Scheme with an increase in building height from the range of about 52mPD to 84mPD to about 80mPD to 110mPD, the podium coverage is minimized in the Proposed Scheme so that a building gap at the proposed access road between the lower platform and middle platform can be formed and enlarged from >30m in the Baseline Scheme to >40m in the Proposed Scheme to serve as an air path for NE and NNE winds to infiltrate into the Site. On the whole, NE and NNE winds flowing towards the Site and downstream areas such as Northwest N.T. Refuse Transfer Station are further aided by the comparable building separations of 15m in the lower platform and between the middle and the upper platforms,



coupled with the wider building separation of 40m at the proposed access road between the lower platform and middle platform in the Propose Scheme.

- 3.2.5 At the western portion of the Application Site, minor blockage to incoming NNE and NE winds at pedestrian level is expected due to the proposed low-rise structures at the Application Site under the Baseline Scheme, such as community hall/primary school/PTI/non-domestic blocks. While in the Proposed Scheme, since there is only a low-rise proposed primary school site to the north-west side of the Application Site, whose height shall be similar to that of a typical primary school with around 7 storeys, the NNE and NE winds can flow freely over open area along the western boundary of the Application Site and skim over the low-rise proposed school site towards its downstream areas including the existing Northwest N.T. Refuse Transfer Station and its surroundings. Hence, compared to the Baseline Scheme, the Proposed Scheme has improved air ventilation performance due to the provision of more open area along the western boundary of the Application Site. Also, as shown in **Figure 3.1**, under the Baseline Scheme, there are building setbacks of about 21 m to 53 m between Yuen Long Highway and the proposed building blocks along the western boundary of the Application Site, whilst under the Proposed Scheme, such building setback increases to about 84 m from Yuen Long Highway. The incoming NNE and NE winds would flow along Yuen Long Highway (a large wind corridor) and penetrate across the above setback areas and reach the downstream areas such as the existing Northwest N.T. Refuse Transfer Station. Therefore, the impact to the surrounding environment by the Proposed Development under NNE and NE prevailing winds is reduced.
- 3.2.6 Overall, it is anticipated that the air ventilation impact of the Proposed Scheme would be comparable to the Baseline Scheme under NNE and NE wind conditions.

#### **E & ESE winds**

- 3.2.7 **Figure 3.2** illustrates the prevailing wind flow from the E and ESE wind conditions under the Baseline Scheme and the Proposed Scheme.
- 3.2.8 Due to the high hilly terrain to the east of the Application Site, a portion of E and ESE winds would be shielded from the topography, such that the E and ESE prevailing winds are expected to be weakened before reaching the Application Site. However, since there is a large distance of about 750 m between the hilly mountain and the Application Site, the sheltering effect on E and ESE winds by the hills would not be significant.
- 3.2.9 As shown in **Figure 3.2**, the proposed high-rise residential building blocks at the Application Site would likely block the incoming E and ESE winds from flowing to the downstream areas such as Wo Ping San Tsuen, Tan Kwai Tsuen and their surroundings under both schemes. The Proposed Development would shelter the incoming wind and induce localised air ventilation impact. Compared to the Baseline Scheme, although the effect of the building blockage is amplified by the increased building heights in the Proposed Scheme, its effect is considered to be minor because wind flow diverted to the edge of the buildings have plenty of room to flow to downstream area given that the surrounding area is rather open with limited existing structures. Due to a large distance of around 114m across Yuen Long Highway between the Proposed Development and the nearest downstream region (i.e. Tan Kwai Tsuen), winds from E and ESE directions are able to replenish along Yuen Long Highway and settle further downstream at Tan Kwai Tsuen and its adjacent surrounding area. Also, the proposed high-rise towers at the Application Site could capture high-level wind and create downwash to benefit wind flow at pedestrian level of the Site and adjacent surrounding areas.
- 3.2.10 Compared to the Baseline Scheme, despite the wind blockage caused by taller podiums in the Proposed Scheme with an increase in building height from the range of about 52mPD to 84mPD to about 80mPD to 110mPD, the podium coverage is minimized in the Proposed

Scheme so that a building setback of 15m from the southern boundary at the upper platform could be provided. This setback, which is not in presence in the Baseline Scheme, would facilitate the penetration of E wind along the southern boundary of the Site. While at the northern part of the Site, the non-domestic buildings in the Baseline Scheme have been removed under the Proposed Scheme, thus providing more at-grade space for E and ESE winds to penetrate through the Site. The wind availability at downstream areas and the areas on the west side of the Application Site is expected to be slightly lower and comparable under both schemes.

3.2.11 Overall, it is anticipated that the overall air ventilation performance between Baseline and Proposed Schemes are comparable under E and ESE winds.

### **3.3 Summer Prevailing Wind Flow from SSE, S and SSW Directions**

#### **S and SSE winds**

3.3.1 **Figure 3.3** illustrates the wind flow from S and SSE directions under the Baseline Scheme and the Proposed Scheme.

3.3.2 The green belt, Lam Tei Quarry and Tai Lam Country Park are located at the upwind area of the Application Site under SSE prevailing wind. The Proposed Development at the Application Site would not have any adverse implications to the surrounding pedestrian areas at the windward side.

3.3.3 Referring to **Figure 3.3**, under the SSE wind condition, the proposed high-rise residential development is expected to impose wind blockage impacts on its downstream areas such as Domus, Casa Regalia, Meadowlands and Tan Kwai Tsuen. When the prevailing wind comes from the SSE wind direction, the proposed residential development would have some localised effects on air ventilation performance. Therefore, it is expected that wind availability of the above downstream areas would be reduced. Similar to E wind flow, Compared to the Baseline Scheme, although the effect of the building blockage is amplified by the increased building heights in the Proposed Scheme, its effect is considered to be minimal as the downstream area is separated by Yuen Long Highway, which acts as a major breezeway. S and SSE winds would be diverted around the edge of the Site near the proposed school site. Due to a large distance of around 114m across Yuen Long Highway between the Proposed Development and the nearest downstream region (i.e. Tan Kwai Tsuen), winds from S and SSE directions are able to replenish along Yuen Long Highway and settle further downstream at Tan Kwai Tsuen and its adjacent surrounding area. Also, the proposed high-rise towers at the Application Site could capture high-level wind and create downwash to benefit wind flow at pedestrian level of the Site and adjacent surrounding areas.

3.3.4 Therefore, the Proposed Scheme performs similarly to the Baseline Scheme under S and SSE wind conditions.

#### **SSW Wind**

3.3.5 **Figure 3.4** illustrates the wind flow from SSW direction under Baseline Scheme and Proposed Scheme.

3.3.6 As shown in **Figure 3.4**, considering that the residential building clusters such as Wo Ping San Tsuen, Tan Kwai Tsuen located to the west side of the Application Site are of low-rise buildings, the SSW prevailing wind would readily penetrate these building clusters and reach their surrounding areas. Also, Yuen Long Highway, which is located to the northwest of the Application Site aligned in the NE-SW direction, would act as a wind corridor to allow effective wind penetration under the summer SSW wind condition.

- 3.3.7 On the other hand, the proposed residential development at the Application Site would block some SSW prevailing winds towards the north side of the Application Site and the downstream areas of Tan Kwai Tsuen and Casa Regalia under both Baseline Scheme and Proposed Scheme. Compared to the Baseline Scheme, although the effects of the building blockage are amplified by the increased building heights in the Proposed Scheme, its effect is considered to be minimal since the area to the immediate north and northeast of the Application Site have limited number of receivers. Also, the proposed high-rise towers at the Application Site could capture more high-level wind and create downwash to benefit wind flow at podium level of the Site and adjacent surrounding areas.
- 3.3.8 Compared to the Baseline Scheme, despite the wind blockage caused by taller podiums in the Proposed Scheme with an increase in building height from the range of about 52mPD to 84mPD to about 80mPD to 110mPD, the podium coverage is minimized in the Proposed Scheme so that a building gap at the proposed access road between the lower platform and middle platform can be formed and enlarged from >30m in the Baseline Scheme to >40m in the Proposed Scheme to serve as an air path aligning in the NE-SW direction to facilitate the SSW wind to penetrate through the Application Site to the downstream areas such as the existing Tan Kwai Tsuen South Fresh Water Service Reservoir and existing Tan Kwai Tsuen Salt Water Service Reservoir.
- 3.3.9 At the western portion of the Application Site, various building setbacks are proposed between Yuen Long Highway and the Application Site. Under the Baseline Scheme, around 21 m to 53 m building setback distances are proposed between Yuen Long Highway and the proposed building blocks along the western boundary, whereas under the Proposed Scheme, such building setback increases to about 84 m from Yuen Long Highway, thus providing open area for free wind flow along the western portion of the Application Site. It is expected that SSW prevailing wind would penetrate through Yuen Long Highway and the building setback and reach the downstream areas further improving the wind availability there under the SSW wind condition.
- 3.3.10 Overall, it is anticipated that the air ventilation performance of the Proposed Scheme is expected to be comparable to the Baseline Scheme under SSW wind direction.

### **3.4 Summary of Air Ventilation Performance**

- 3.4.1 It is believed that the proposed high-rise development may obstruct some wind flow to downwind areas under the annual and summer prevailing wind directions. Compared to the Baseline Scheme, although the effect of the building blockage is amplified by the increased building heights in the Proposed Scheme, its effect is considered to be minimal because wind flow diverted to the edge of the buildings have plenty of room to flow to downstream area given that the surrounding area is rather open with limited existing structures. On the other hand, the proposed high-rise towers at the Application Site could capture high-level wind and create downwash to benefit wind flow at podium level of the Site and adjacent surrounding areas. In addition, despite the wind blockage caused by taller podiums in the Proposed Scheme with an increase in building height from the range of about 52mPD to 84mPD to about 80mPD to 110mPD, the podium coverage is minimized in the Proposed Scheme so that a building gap at the proposed access road between the lower platform and middle platform can be formed and enlarged from >30m in the Baseline Scheme to >40m in the Proposed Scheme to serve as an air path aligning in the NE-SW direction to facilitate the NNE, NE and SSW winds to penetrate through the Application Site to the downstream areas.
- 3.4.2 Under annual conditions, penetration of NNE, NE, E and ESE prevailing winds would be comparable under Baseline and Proposed Schemes with the aid of the removal of non-domestic buildings at the northern portion of the Site, enlarged building setback along Yuen

Long Highway and along the southern boundary of the upper platform, thus providing more open space for winds to penetrate through the western and southern boundary of the Site.

- 3.4.3 Under summer conditions, S and SSE wind penetration would be comparable between Baseline Scheme and Proposed Scheme. It is expected that S and SSE winds would be diverted around the edge of the Site near the proposed school site, replenish along Yuen Long Highway by making use of a wide distance of around 114m between the Proposed Development and the nearest downstream region (i.e. Tan Kwai Tsuen) and settle further downstream at Tan Kwai Tsuen under both schemes. Similar to NNE and NE winds, SSW wind penetration in the Proposed Scheme is expected to take the advantage of the larger open area provided along the western boundary and the enlarged building separation between the lower and middle platforms.
- 3.4.4 Mitigation measures such as the NE-SW aligned building separations at the lower platform and between the middle and upper platforms proposed in the Baseline Scheme are maintained in the Proposed Scheme to allow wind penetration. In addition, wider building separation at the proposed access road between the lower platform and middle platform as well as building setbacks along the western boundary at the lower platform and southern boundary of the upper platform are proposed in the Proposed Scheme which would enhance wind penetration further.
- 3.4.5 Overall, it can be concluded that the Proposed Scheme at the Application Site performs similarly to the Baseline Scheme under the prevailing annual and summer wind conditions after incorporating the above proposed mitigation measures.

### **3.5 Building Design Features**

- 3.5.1 The details of the proposed mitigation measures to be adopted in the Proposed Scheme for enhancing the air ventilation at the Application Site and the surrounding areas are summarised below and illustrated in **Figure 3.5**:
- A. Building separation of at least 15 m in width, aligning in approximately NE to SW directions, is proposed to be incorporated between Block 1 and Block 2 in the Application Site for facilitating wind penetration mainly from SW and NE quadrants to benefit its downstream areas.
  - B. Building separation of at least 15 m in width, aligning in approximately NE to SW directions, is proposed to be incorporated between Block 5 and Block A in the Application Site for facilitating wind penetration mainly from SW and NE quadrants to benefit its downstream areas.
  - C. Building separation of at least 40 m in width, aligning in approximately NE to SW directions, is proposed to be incorporated between Block 2 and Block 5 in the Application Site for facilitating wind penetration mainly from SW and NE quadrants to benefit its downstream areas.
  - D. Building separation of at least 15m for all building blocks to increase permeability of the Site.
  - E. Building setback of around 84m in width from the edge of Yuen Long Highway, aligning in approximately NE to SW directions, would facilitate wind penetration mainly from SW and NE quadrants to benefit its downstream areas.
  - F. Building setback of 15m in width from the edge of the southern boundary at the upper platform, aligning in approximately E to W direction, would facilitate wind penetration mainly from E quadrant to benefit its downstream areas.

- G. Open area along the western boundary of the Application Site could serve as a non-building area which would alleviate the potential air ventilation impacts of the proposed development and be successful in enhancing wind flow from NNE, NE, E, ESE and SSW directions towards its downstream areas.

#### **4 CONCLUSIONS**

- 4.1.1 A qualitative assessment of the wind performance of the proposed public housing development near Tai Kwai Tsuen has been carried out.
- 4.1.2 According to the findings of this AVA-EE, the annual prevailing wind comes from NNE, NE, E and ESE directions while the summer prevailing wind comes from SSE, S and SSW directions. After comparing the Baseline Scheme and the Proposed Scheme, it is concluded that the Proposed Scheme would overall perform similarly to the Baseline Scheme from the air ventilation perspective with design measures that can enhance wind penetration incorporated. It is considered that the Proposed Development would not have significant adverse impact to surrounding environment.
- 4.1.3 The Development shall not be limited to the proposed design and shall include other features as far as possible at the detailed design stage, including effective building separations and setbacks in alignment with the prevailing winds, to facilitate the penetration of wind across the Application Site. The followings are further recommendation design principles for further consideration at the detailed design stage to facilitate wind penetration:
- Building Permeability equivalent to 20% to 33.3% of total frontal area with reference to PNAP APP-152;
  - Minimisation of podium bulk with ground coverage of no more than 65%;
  - Building setback with reference to PNAP APP-152;
  - Greenery (preferably tree planting) of target 30% for sites larger than 2 ha, and 20% for sites below 2 ha at lower levels, preferably at grade;
  - Reference could also be made to recommendations of design measures in the Hong Kong Planning Standards and Guidelines.
- 4.1.4 It is recommended that a quantitative AVA shall be carried out for the Proposed Development at the detailed design stage to review the building design, quantify the potential air ventilation impact and assess the effectiveness of the proposed mitigation measures to optimise the building arrangement.

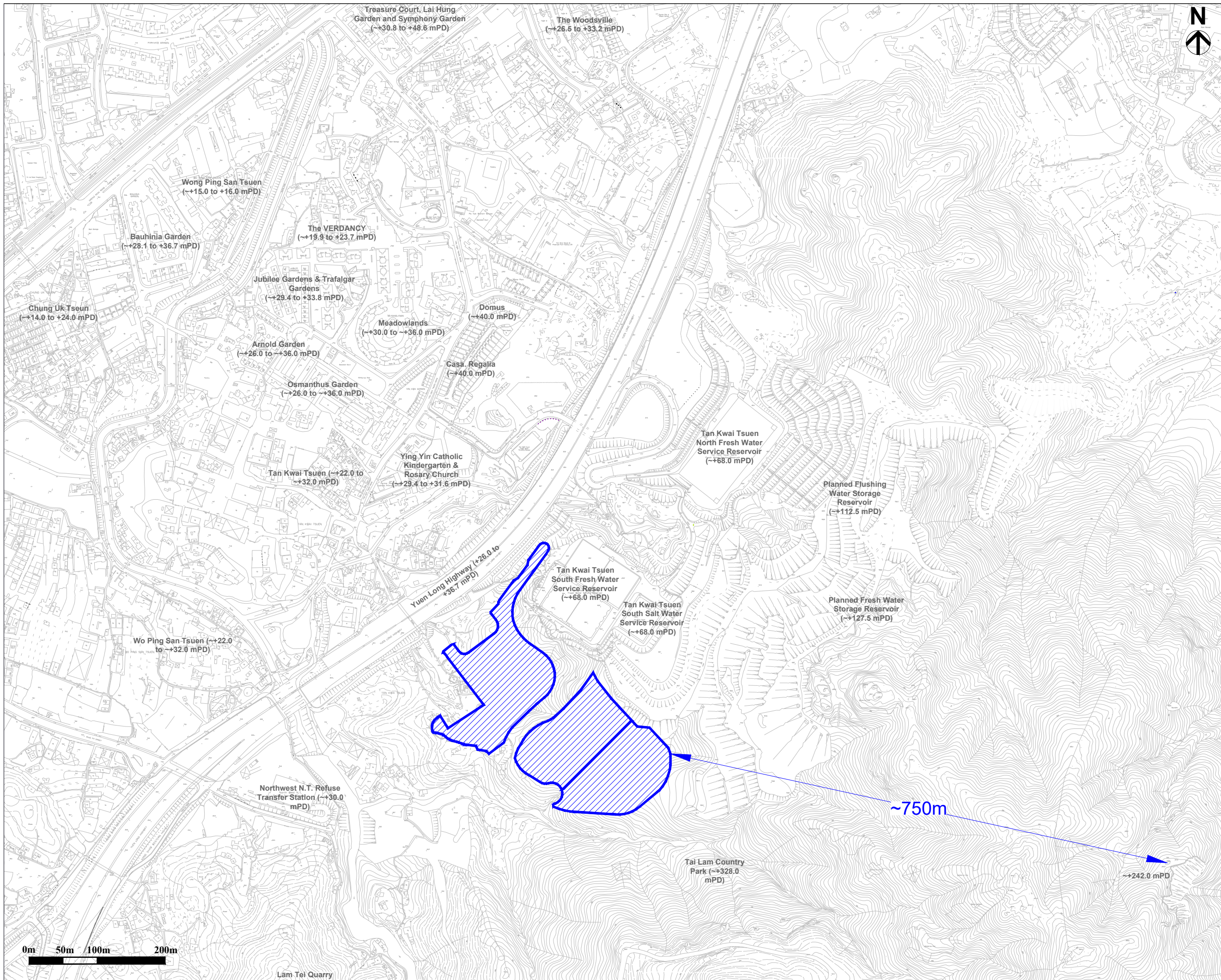
**END OF TEXT**



## **FIGURES**







LEGEND:  
 APPLICATION SITE

Revision	Date	Description			Initial
		Designed	Checked	Drawn	
Initial				YS	KY
Date				11/22	11/22

Approved

Agreement no. CE 92/2017 (CE)

Agreement title  
 SITE FORMATION AND INFRASTRUCTURE WORKS FOR PUBLIC HOUSING DEVELOPMENTS NEAR TAN KWAI TSUEN, YUEN LONG – INVESTIGATION, DESIGN AND CONSTRUCTION

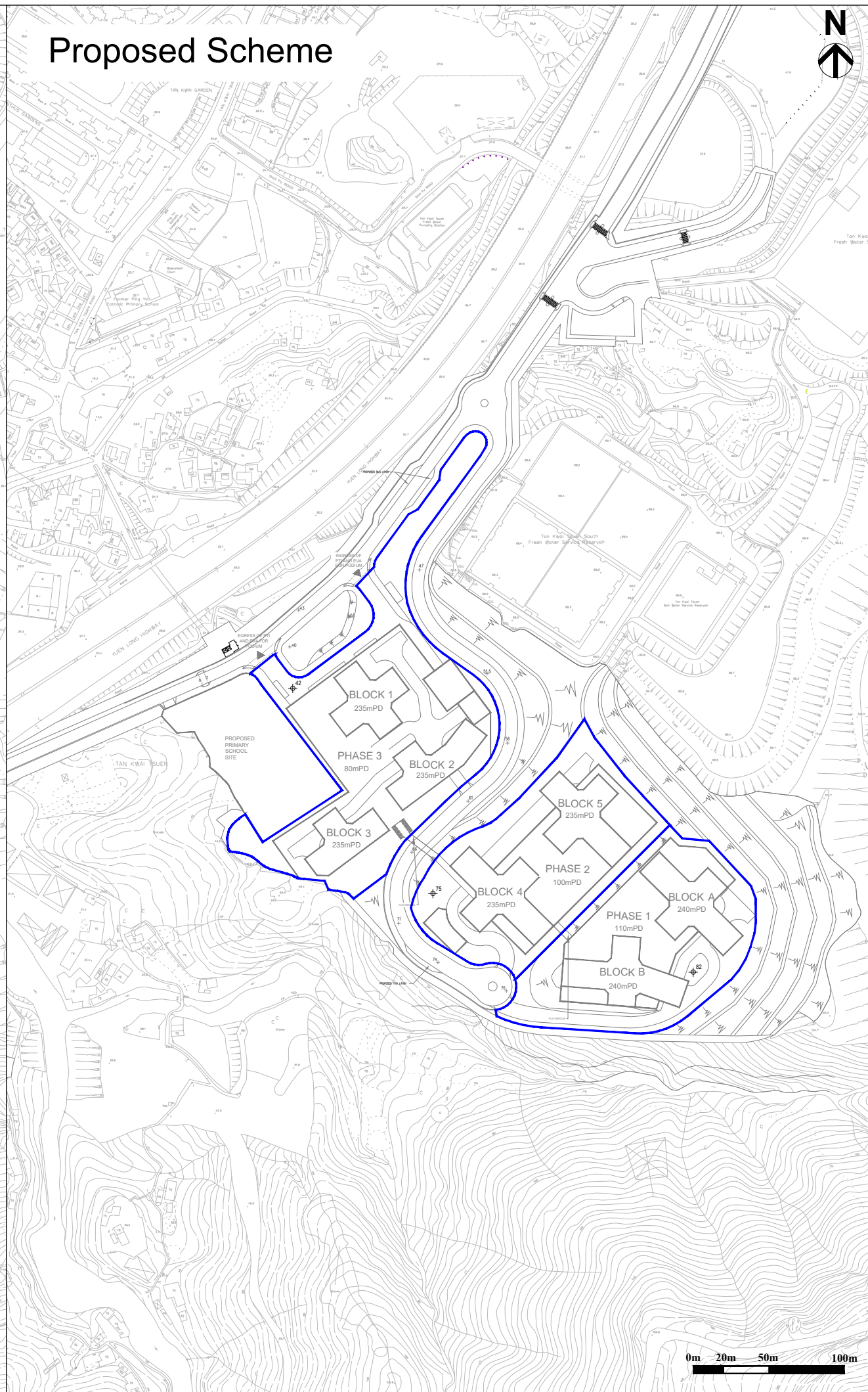
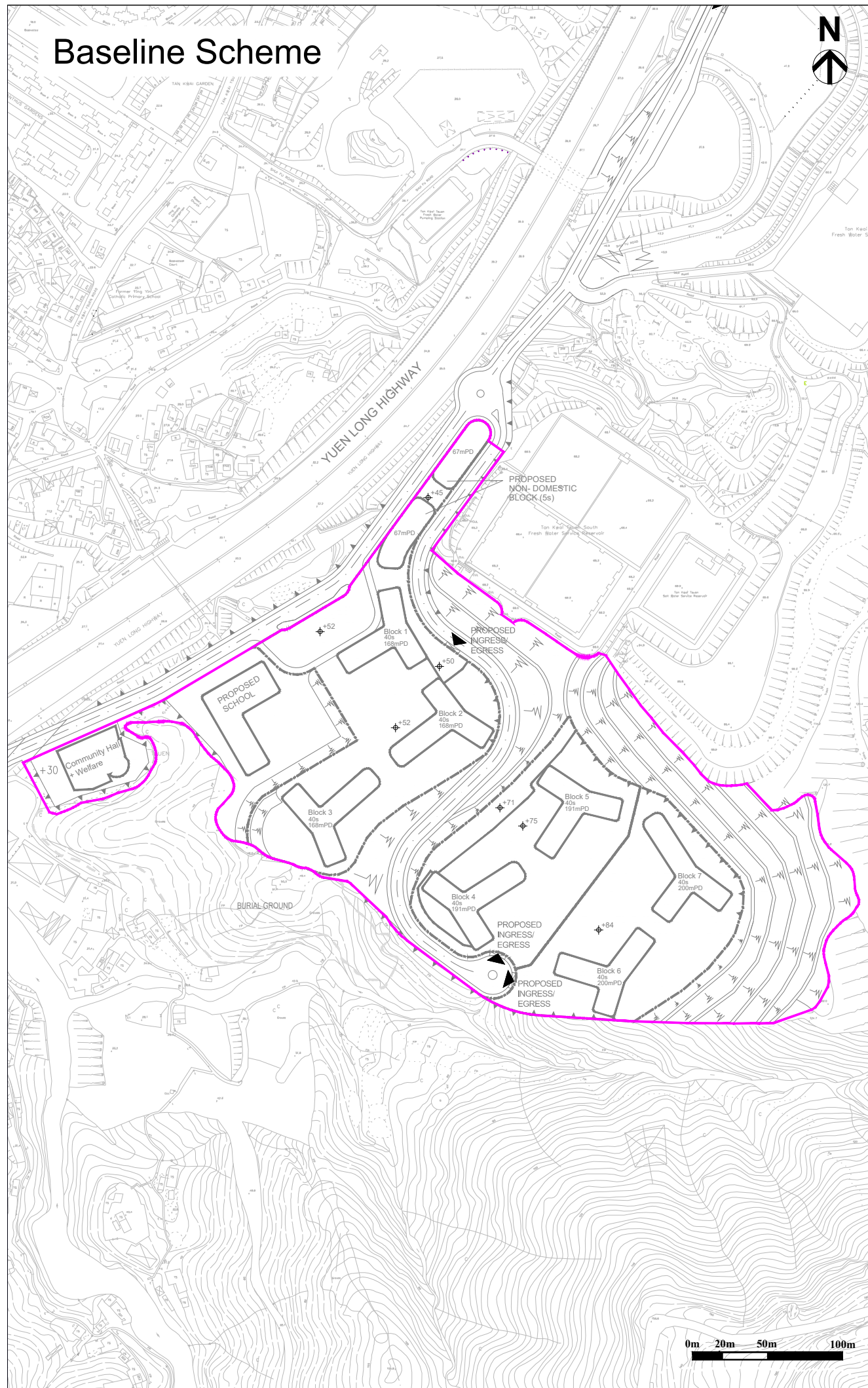
Drawing title  
 LOCATION OF THE APPLICATION SITE AND ITS ENVIRONS

Drawing No. Figure 1.1  
 Scale



# Baseline Scheme

# Proposed Scheme



© Copyright by Binnies Hong Kong Limited

LEGEND:

- SITE BOUNDARY OF BASELINE SCHEME
- SITE BOUNDARY OF PROPOSED SCHEME

Revision	Date	Description			Initial
		Designed	Checked	Drawn	
Initial				YS	KY
Date				11/22	11/22

Approved

Agreement no. CE 92/2017 (CE)

Agreement title  
SITE FORMATION AND INFRASTRUCTURE WORKS FOR PUBLIC HOUSING DEVELOPMENTS NEAR TAN KWAI TSUEN, YUEN LONG – INVESTIGATION, DESIGN AND CONSTRUCTION

Drawing title  
MASTER LAYOUT PLANS OF BASELINE SCHEME AND PROPOSED SCHEME

Drawing No. Figure 1.2

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

**binnies**  
BINNIES HONG KONG LIMITED  
賓尼士工程顧問有限公司

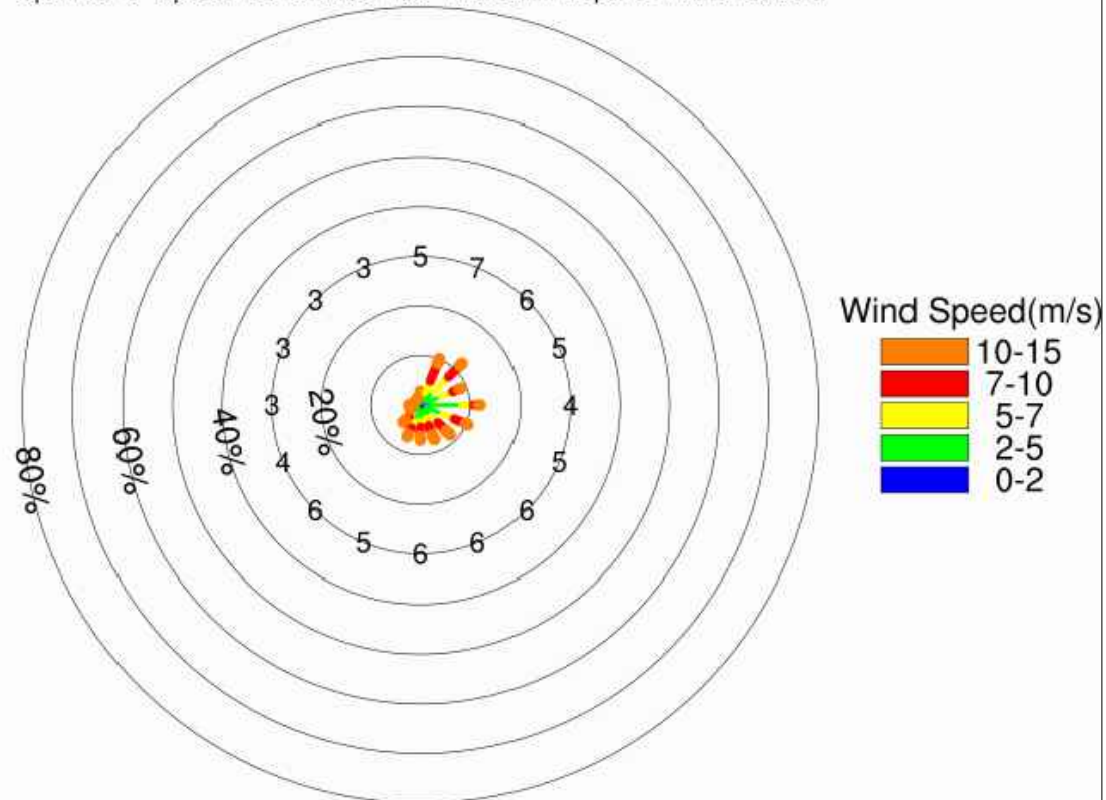


(044,065)

Annual

/disk/rdisk07/ramspj/nudge\_all/postproc/hkgplots/d\_00412\_lev200

SpdAve=5 SpdStd=3 DirAve=103 No Calm Reports Nwnd=87670

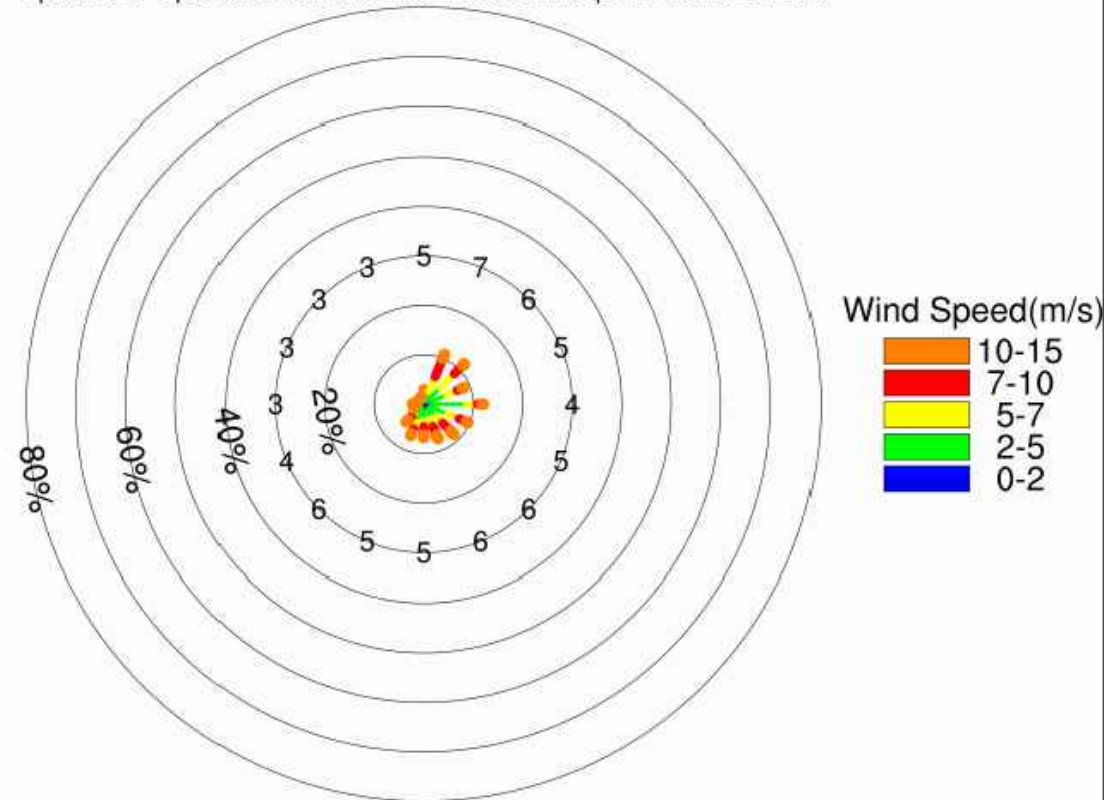


(044,066)

Annual

/disk/rdisk07/ramspj/nudge\_all/postproc/hkgplots/d\_00366\_lev200

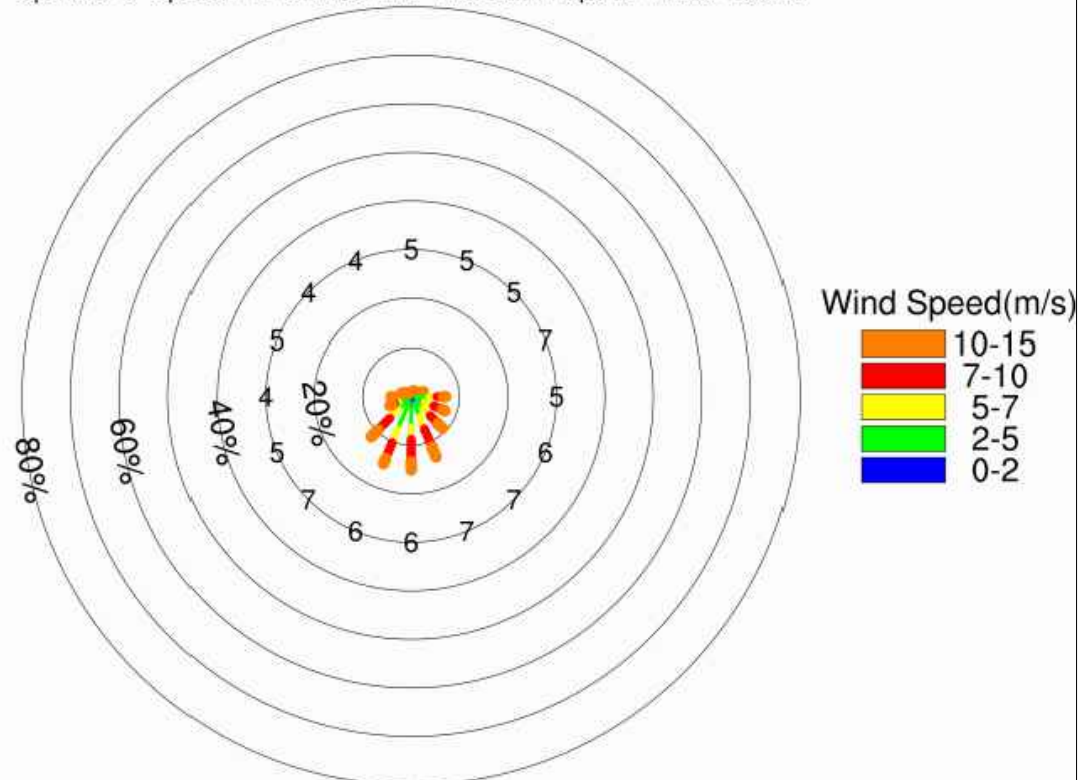
SpdAve=5 SpdStd=3 DirAve=100 No Calm Reports Nwnd=87670



Summer

/disk/rdisk07/ramspj/nudge\_all/postproc/hkgJJplots/d\_00412\_lev200

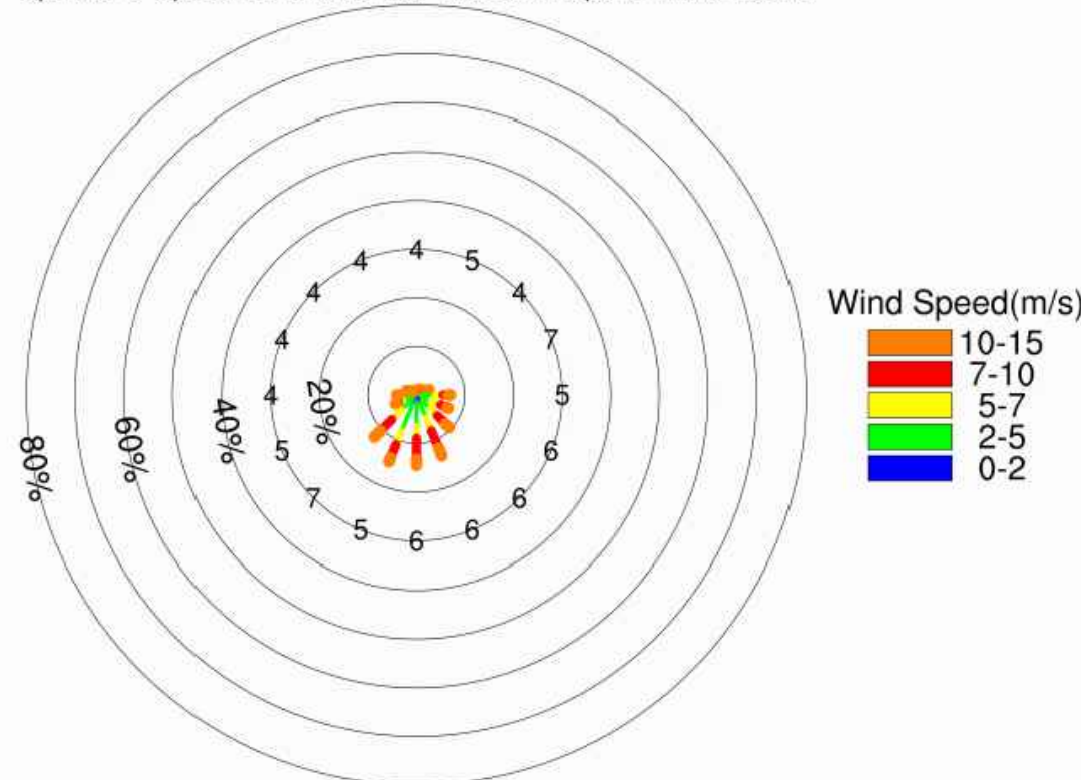
SpdAve=6 SpdStd=4 DirAve=173 No Calm Reports Nwnd=22078



Summer

/disk/rdisk07/ramspj/nudge\_all/postproc/hkgJJplots/d\_00366\_lev200

SpdAve=6 SpdStd=3 DirAve=173 No Calm Reports Nwnd=22078



Revision	Date	Description	Initial
	Designed	Checked	Drawn
Initial			VS KY
Date		03/23	03/23

Approved

Agreement no. CE 92/2017 (CE)

Agreement title  
SITE FORMATION AND INFRASTRUCTURE WORKS FOR PUBLIC HOUSING DEVELOPMENTS NEAR TAN KWAI TSUEN, YUEN LONG - INVESTIGATION, DESIGN AND CONSTRUCTION

Drawing title  
ANNUAL AND SUMMER WIND ROSES ON RAMS (044,065) & (044,066) AT 200m

Drawing No. Figure 2.1

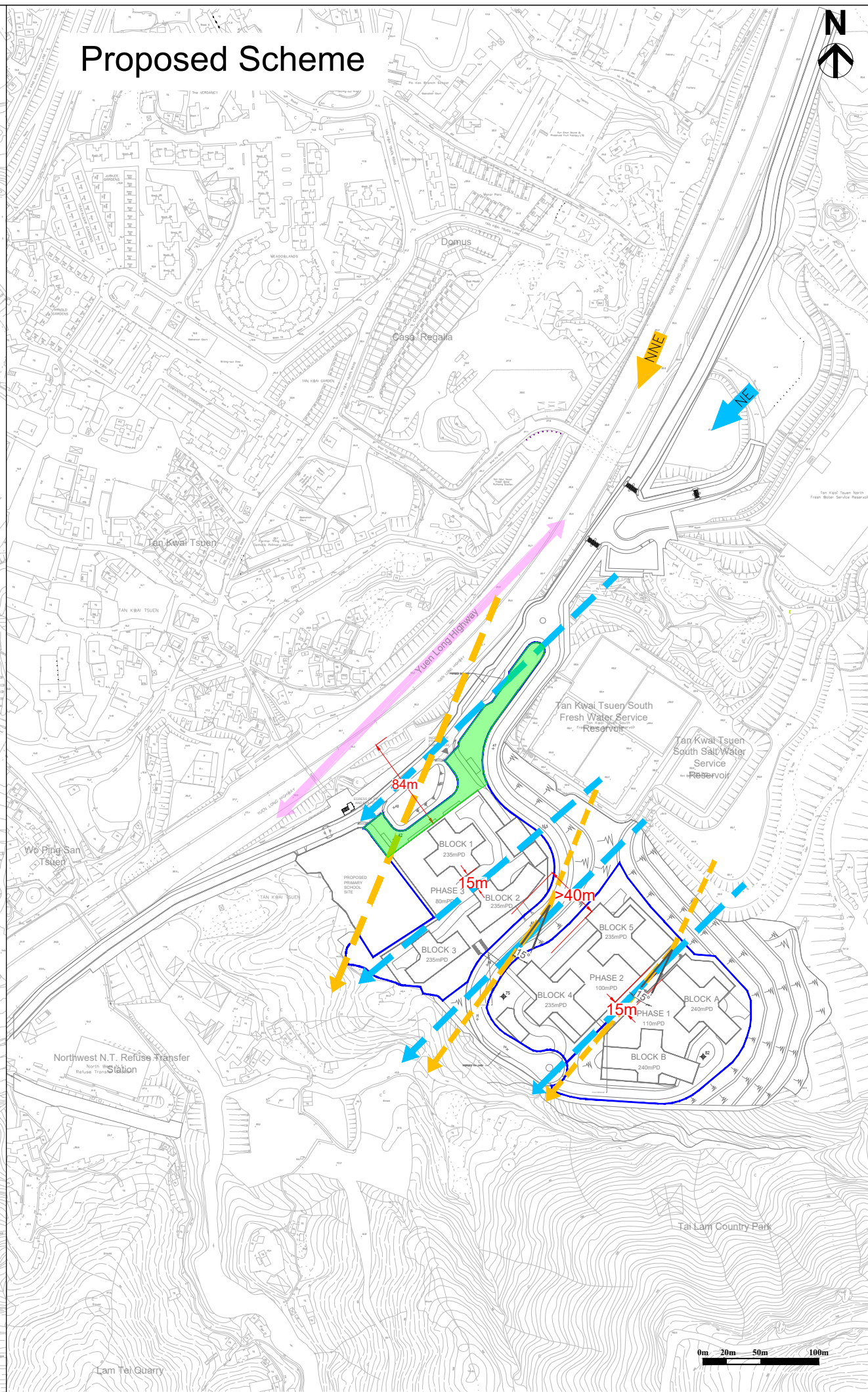
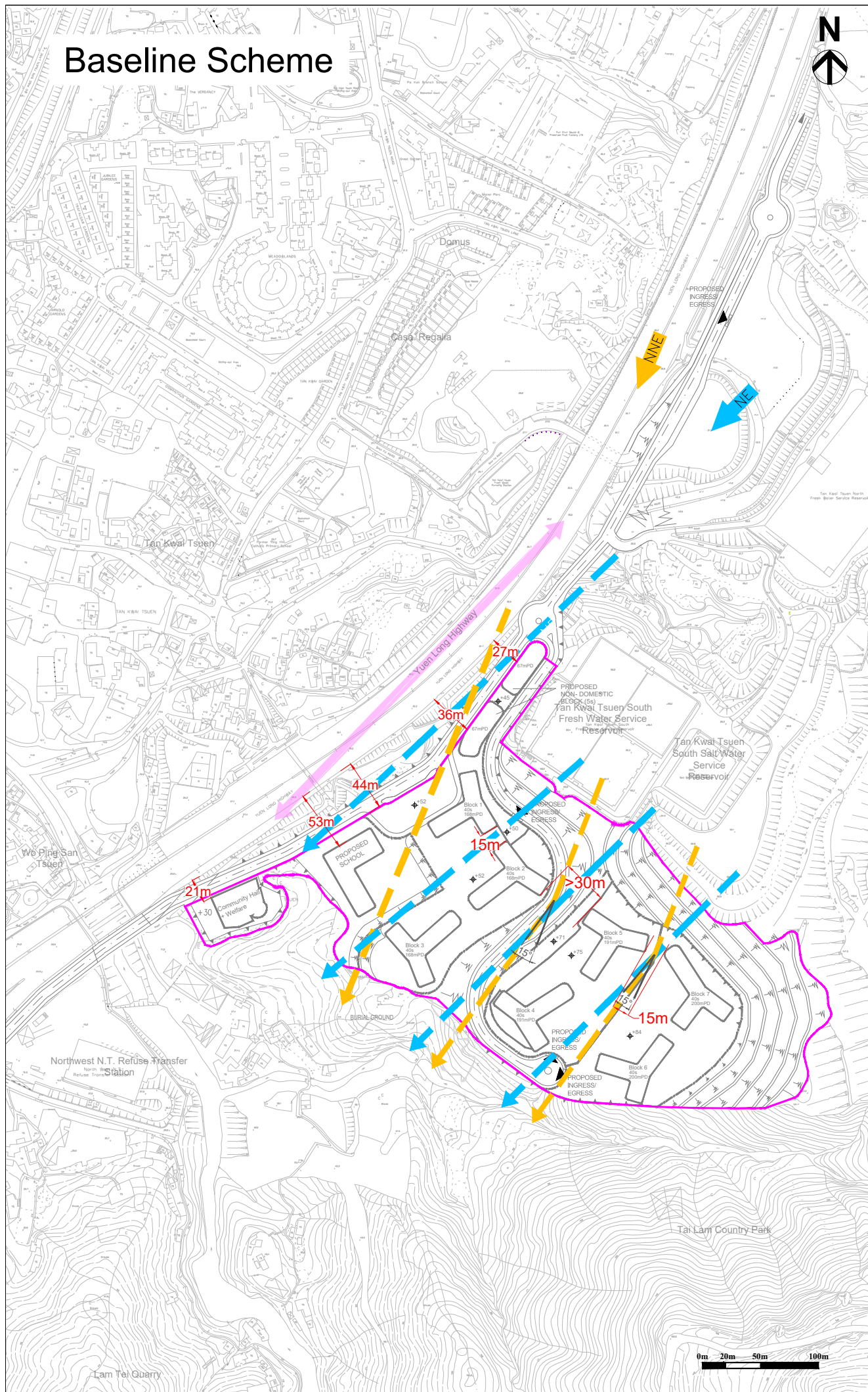
CEDD Civil Engineering and Development Department

binnes  
BINNIES HONG KONG LIMITED  
寶后新工程顧問有限公司



# Baseline Scheme

# Proposed Scheme



© Copyright by Binnies Hong Kong Limited

**LEGEND:**

- SITE BOUNDARY OF BASELINE SCHEME
- SITE BOUNDARY OF PROPOSED SCHEME
- EXPECTED NE WIND FLOW
- EXPECTED NNE WIND FLOW
- EXISTING BREEZEWAY
- BUILDING SEPARATIONS/ SETBACKS
- OPEN AREA

Revision	Date	Description	Initial
	Designed	Checked	Drawn
Initial			YS KY
Date		03/23	03/23

Approved

Agreement no. CE 92/2017 (CE)

Agreement title  
SITE FORMATION AND INFRASTRUCTURE WORKS FOR PUBLIC HOUSING DEVELOPMENTS NEAR TAN KWAI TSUEN, YUEN LONG – INVESTIGATION, DESIGN AND CONSTRUCTION

Drawing title  
ILLUSTRATION OF WIND FLOW FROM NORTH NORTHEAST AND NORTHEAST WIND DIRECTIONS

Drawing No. Figure 3.1

Scale

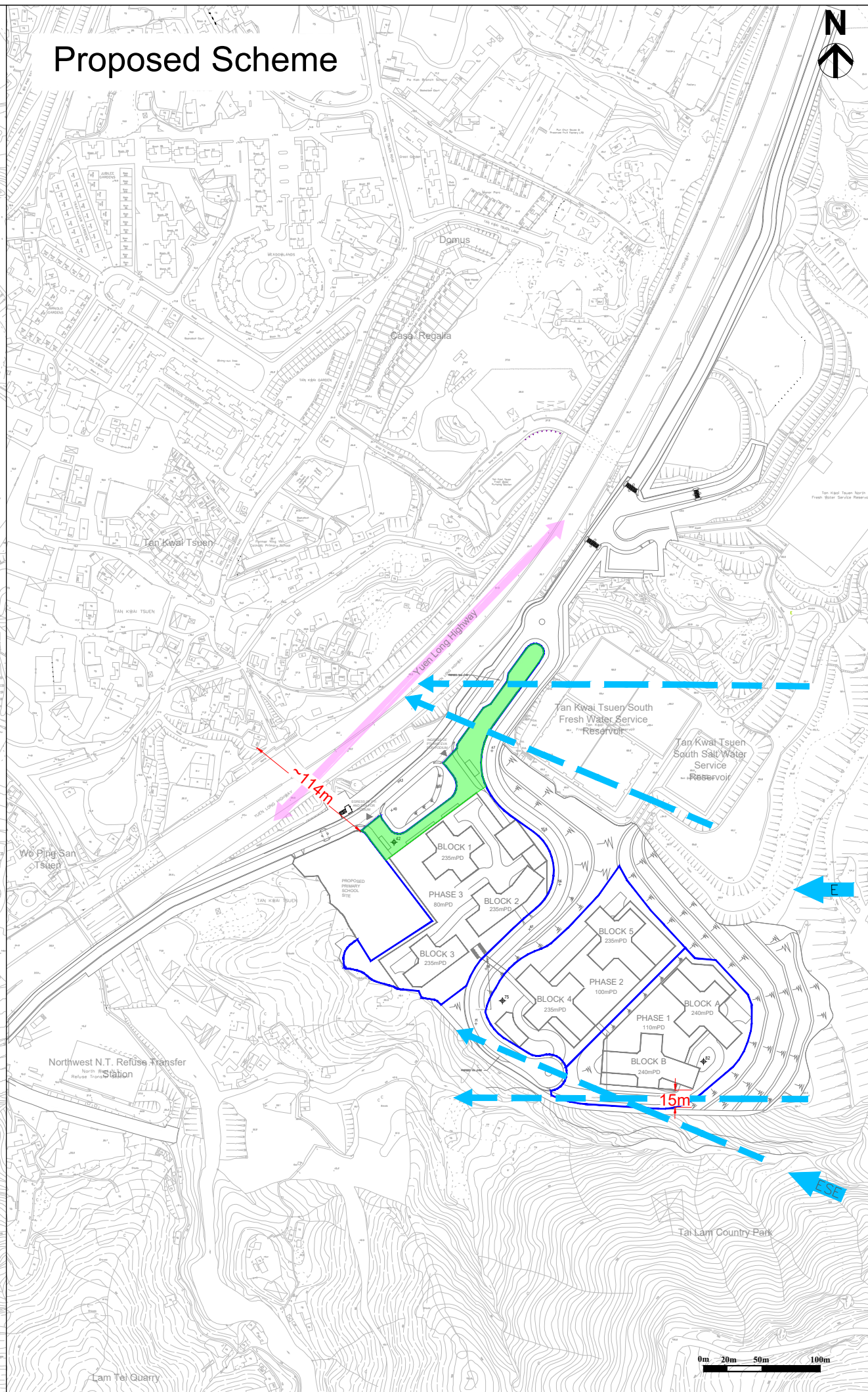
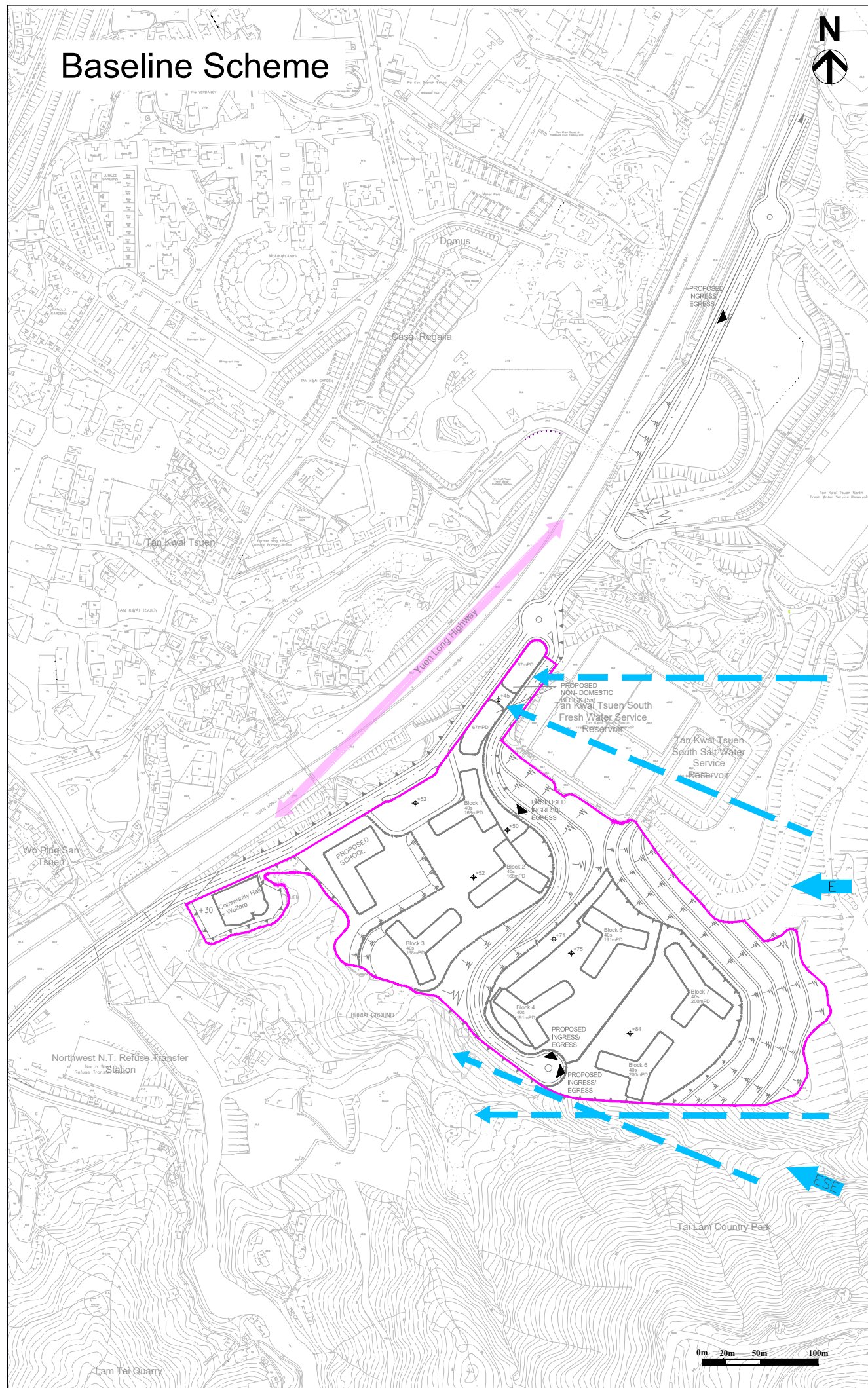
土木工程拓展署  
**CEDD** Civil Engineering and Development Department

**binnies**  
 BINNIES HONG KONG LIMITED  
 賓尼新工程顧問有限公司



# Baseline Scheme

# Proposed Scheme



© Copyright by Binnies Hong Kong Limited

### LEGEND:

- SITE BOUNDARY OF BASELINE SCHEME
- SITE BOUNDARY OF PROPOSED SCHEME
- EXPECTED E WIND FLOW
- EXPECTED ESE WIND FLOW
- ↔ EXISTING BREEZEWAY
- BUILDING SEPARATIONS/ SETBACKS
- OPEN AREA

Revision	Date	Description	Initial
Initial	Designed	Checked	Drawn
			YS
Date			03/23
			03/23

Approved

Agreement no. CE 92/2017 (CE)

Agreement title  
SITE FORMATION AND INFRASTRUCTURE WORKS FOR PUBLIC HOUSING DEVELOPMENTS NEAR TAN KWAI TSUEN, YUEN LONG – INVESTIGATION, DESIGN AND CONSTRUCTION

Drawing title  
ILLUSTRATION OF WIND FLOW FROM EAST AND EAST SOUTHEAST WIND DIRECTIONS

Drawing No. Figure 3.2

Scale

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

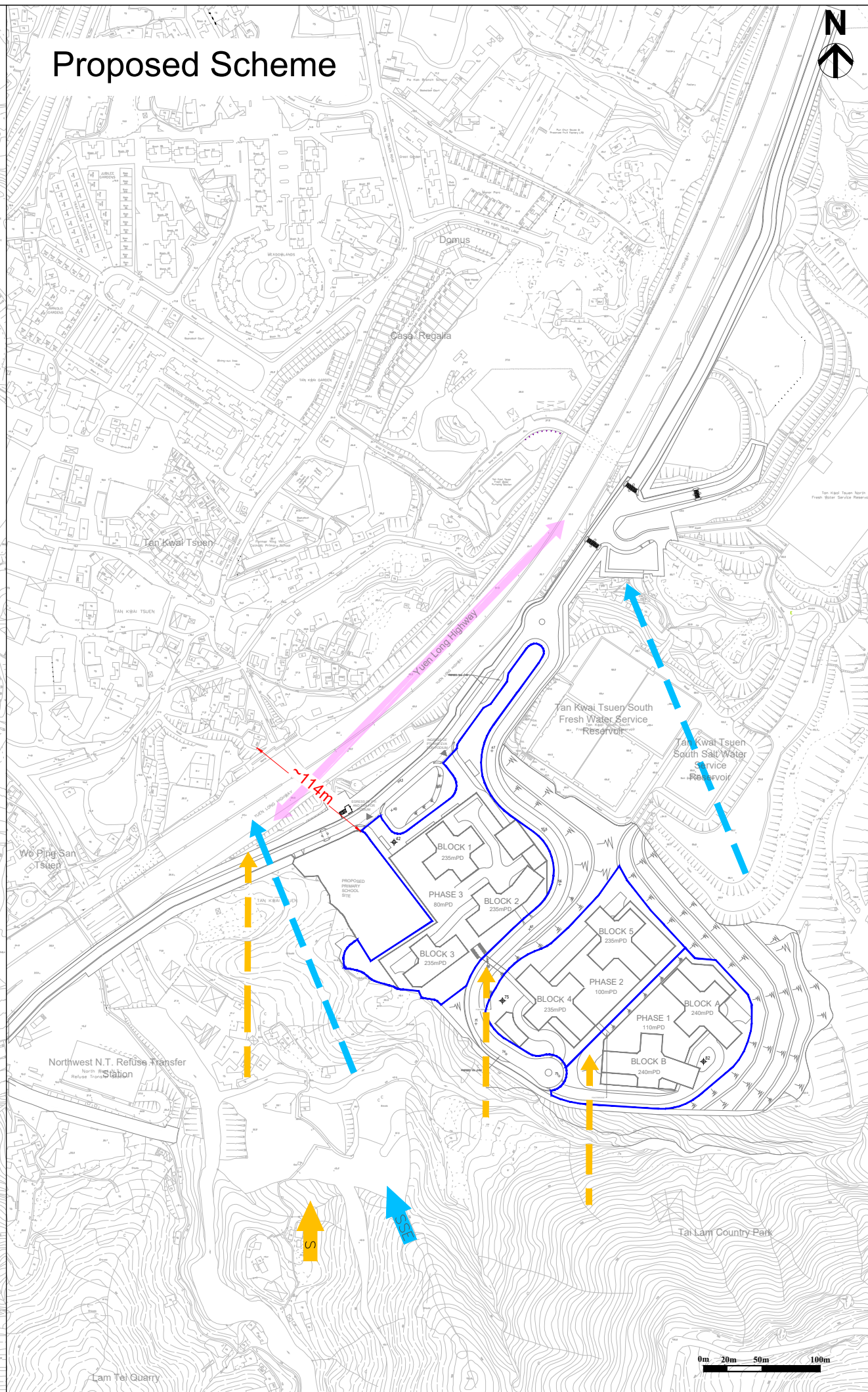
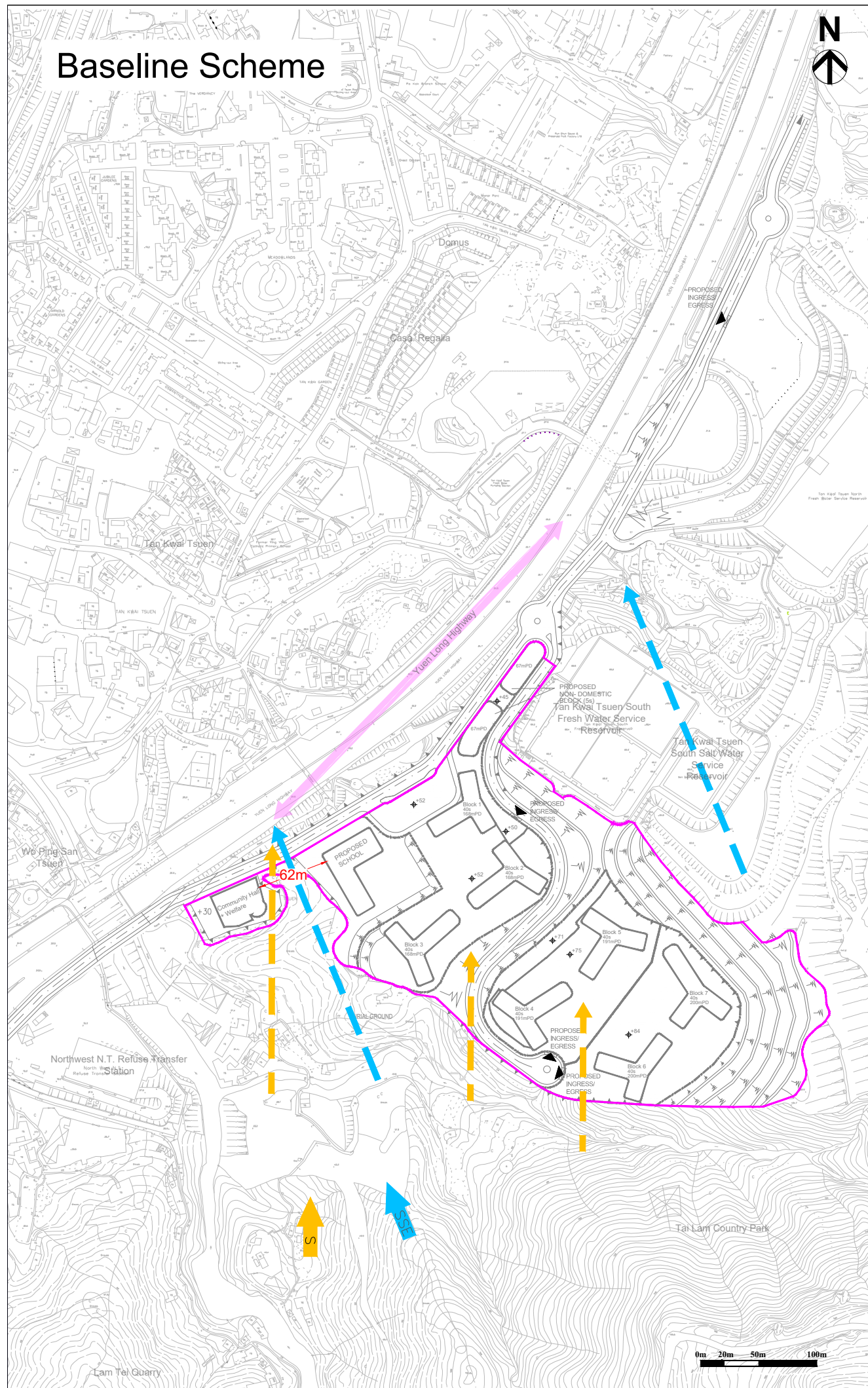
**binnies**

**BINNIES HONG KONG LIMITED**  
寶后新工程顧問有限公司



# Baseline Scheme

# Proposed Scheme



© Copyright by Binnies Hong Kong Limited

### LEGEND:

- SITE BOUNDARY OF BASELINE SCHEME
- SITE BOUNDARY OF PROPOSED SCHEME
- EXPECTED SSE WIND FLOW
- EXPECTED S WIND FLOW
- EXISTING BREEZEWAY
- BUILDING SEPARATIONS/SETBACKS

Revision	Date	Description			Initial
		Designed	Checked	Drawn	
Initial				YS	KY
Date				03/23	03/23

Approved

Agreement no. CE 92/2017 (CE)

Agreement title  
SITE FORMATION AND INFRASTRUCTURE WORKS FOR PUBLIC HOUSING DEVELOPMENTS NEAR TAN KWAI TSUEN, YUEN LONG – INVESTIGATION, DESIGN AND CONSTRUCTION

Drawing title  
ILLUSTRATION OF WIND FLOW FROM SOUTH AND SOUTH SOUTHEAST WIND DIRECTIONS

Drawing No. Figure 3.3

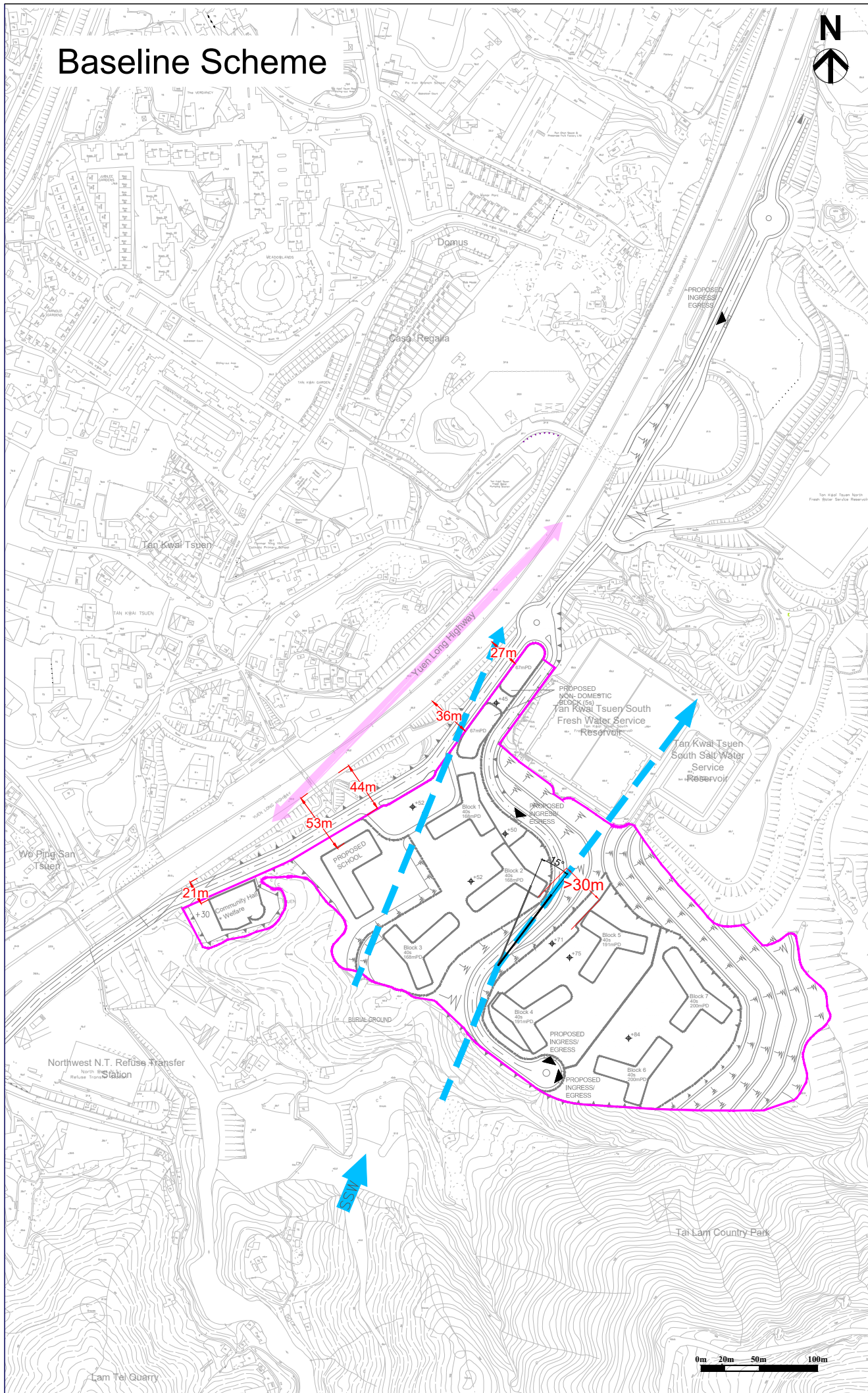
Scale

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

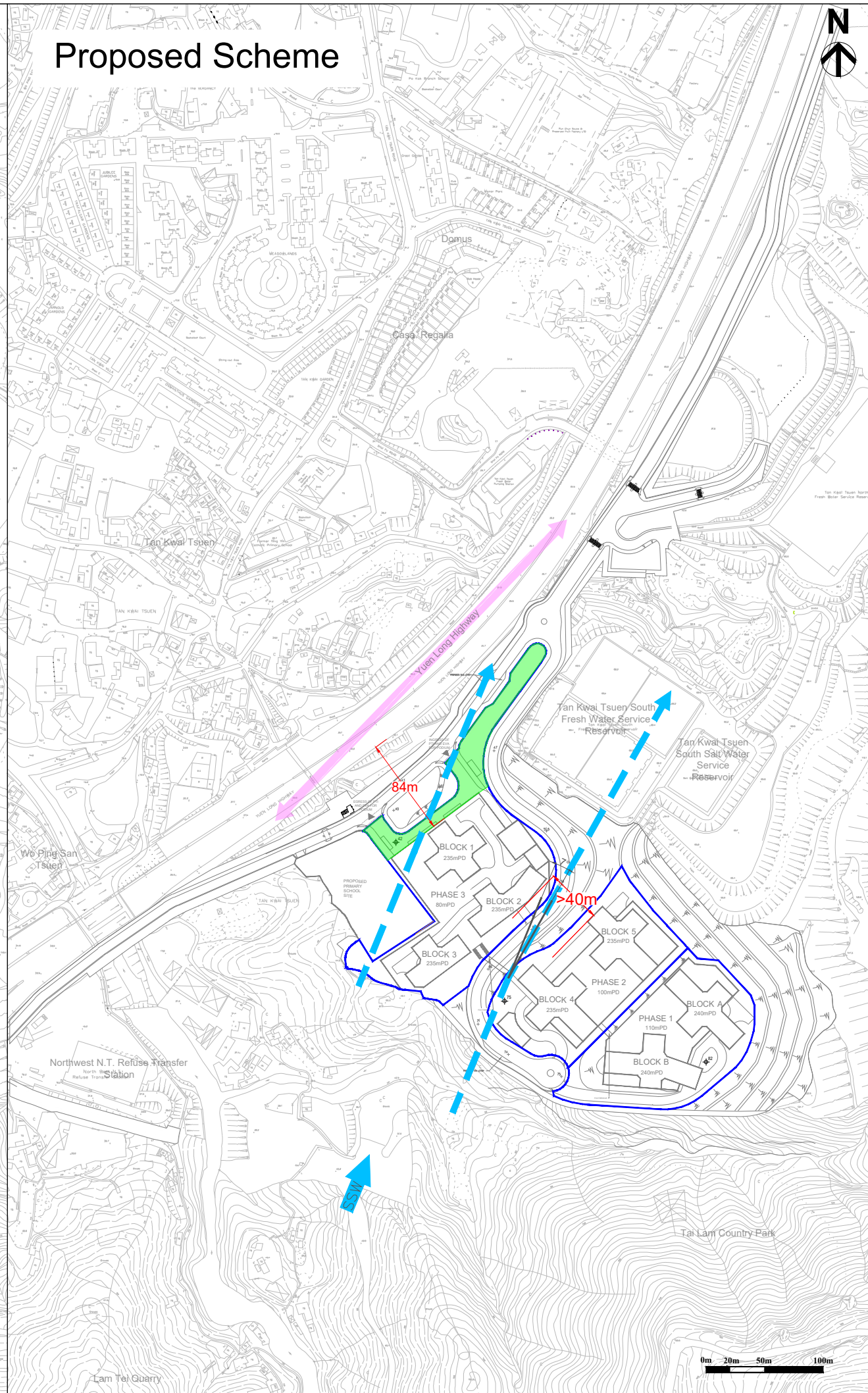
**binnies**  
BINNIES HONG KONG LIMITED  
賓尼新工程顧問有限公司



# Baseline Scheme



# Proposed Scheme



© Copyright by Binnies Hong Kong Limited

### LEGEND:

- SITE BOUNDARY OF BASELINE SCHEME
- SITE BOUNDARY OF PROPOSED SCHEME
- EXPECTED SSW WIND FLOW
- ↔ EXISTING BREEZEWAY
- BUILDING SEPARATIONS/ SETBACKS
- OPEN AREA

Revision	Date	Description	Initial
Initial	Designed	Checked	Drawn
			VS
Date		03/23	03/23

Approved

Agreement no. CE 92/2017 (CE)

Agreement title  
SITE FORMATION AND INFRASTRUCTURE WORKS FOR PUBLIC HOUSING DEVELOPMENTS NEAR TAN KWAI TSUEN, YUEN LONG – INVESTIGATION, DESIGN AND CONSTRUCTION

Drawing title  
ILLUSTRATION OF WIND FLOW FROM SOUTH SOUTHWEST WIND DIRECTION

Drawing No. Figure 3.4

Scale

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

**binnies**  
BINNIES HONG KONG LIMITED  
賓尼新工程顧問有限公司

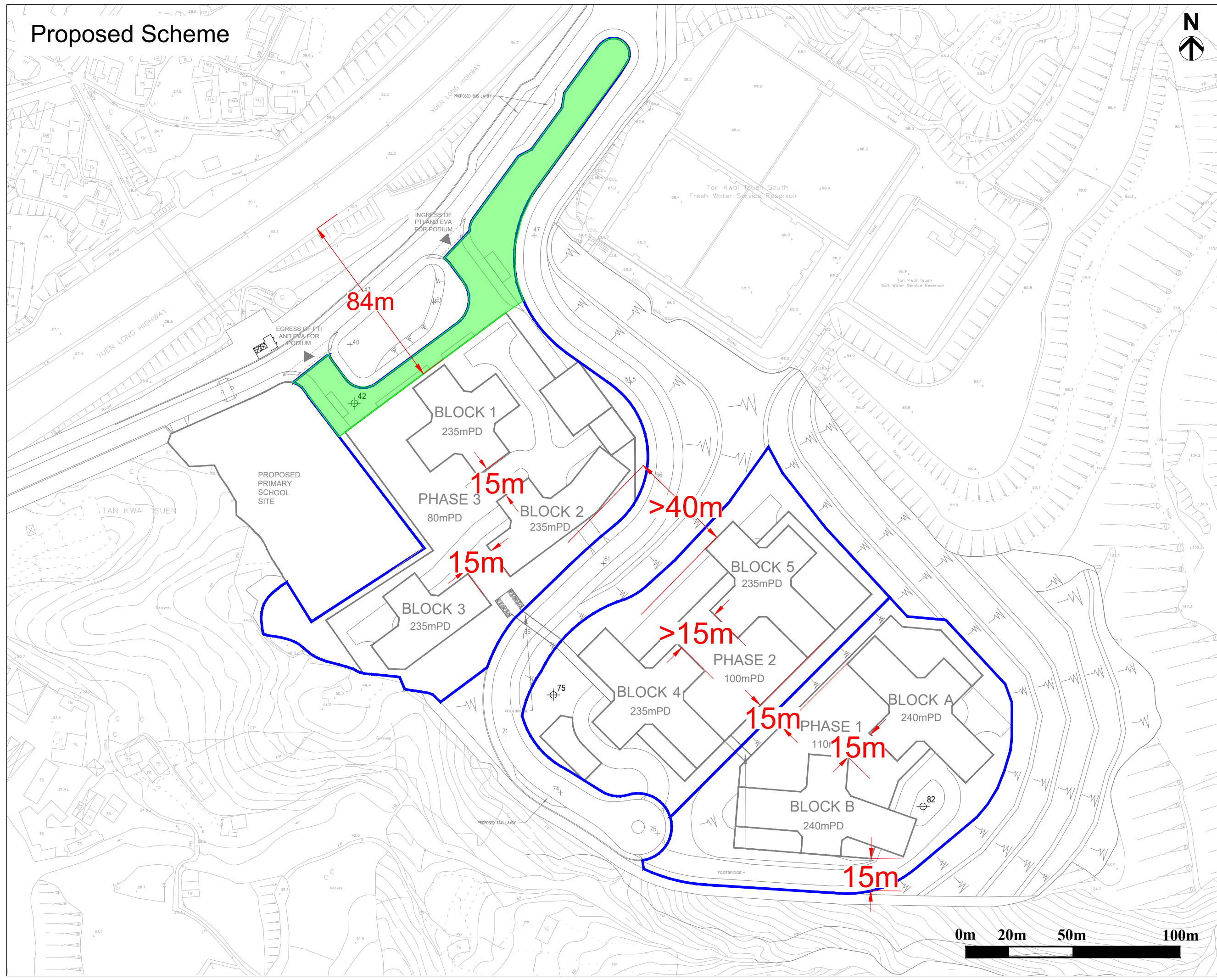


# Proposed Scheme



© Copyright by Binnies Hong Kong Limited

- LEGEND:
- SITE BOUNDARY OF PROPOSED SCHEME
  - BUILDING SEPARATIONS/ SETBACKS
  - OPEN AREA



Revision	Date	Description	Initial
	Designed	Checked	Drawn
			VS
	Date		03/23
			03/23

Approved

Agreement no. CE 92/2017 (CE)

Agreement title  
SITE FORMATION AND INFRASTRUCTURE WORKS FOR PUBLIC HOUSING DEVELOPMENTS NEAR TAN KWAI TSUEN, YUEN LONG - INVESTIGATION, DESIGN AND CONSTRUCTION

Drawing title  
PROPOSED MITIGATION MEASURES OF PROPOSED SCHEME

Drawing No. Figure 3.5

Scale



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

**binnies**  
BINNIES HONG KONG LIMITED  
賓尼新工程顧問有限公司

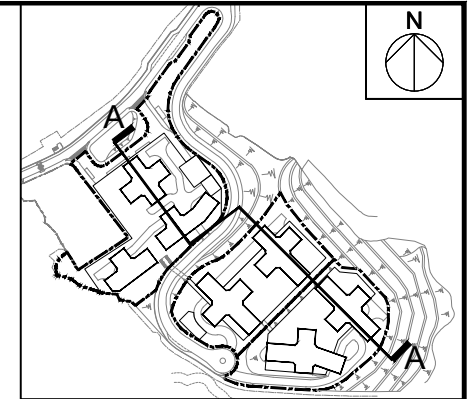
## **APPENDIX 1**

### **CROSS SECTIONS OF PROPOSED SCHEME**

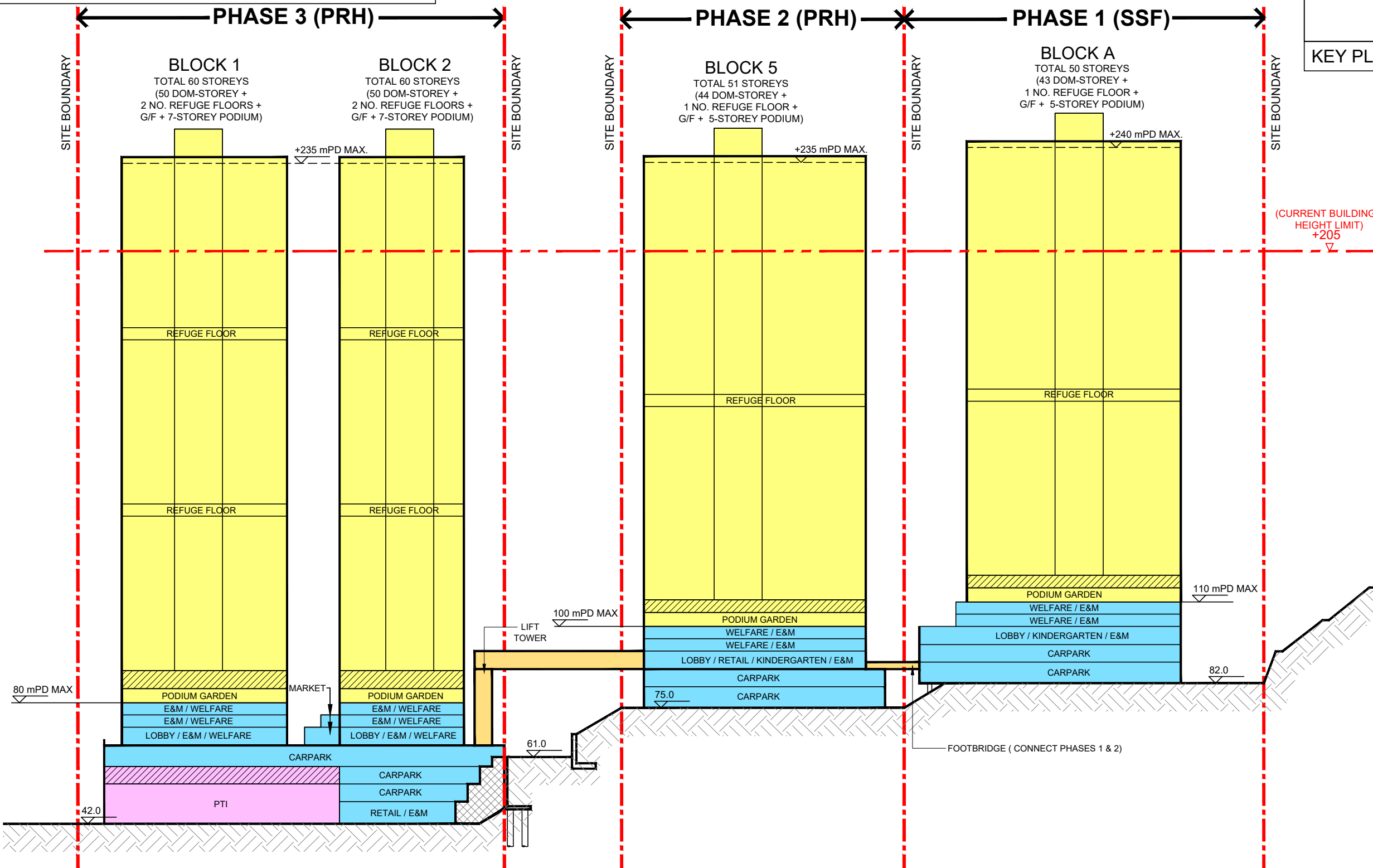


**LEGEND**

- - - SITE BOUNDARY
- DOMESTIC BLOCK
- COMMERCIAL / RETAIL / CARPARK / SOCIAL WELFARE FACILITIES
- PUBLIC TRANSPORT INTERCHANGE
- FOOTBRIDGE



KEY PLAN SCALE 1 : 8000

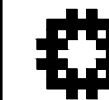


DRAFT

PROJECT TITLE  
**PUBLIC HOUSING DEVELOPMENT AT  
NEAR TAN KWAI TSUEN PHASES 1, 2 & 3**

DRAWING TITLE  
**SITE SECTION A - A**

SCALE 1:600 (A1) , 1:1200 (A3)



房屋署  
HOUSING DEPARTMENT

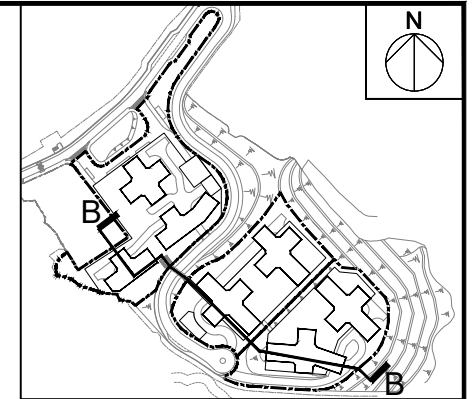
DRAWING NO.  
YL52/S16/A/LO-02

DATE:  
13/6/2022

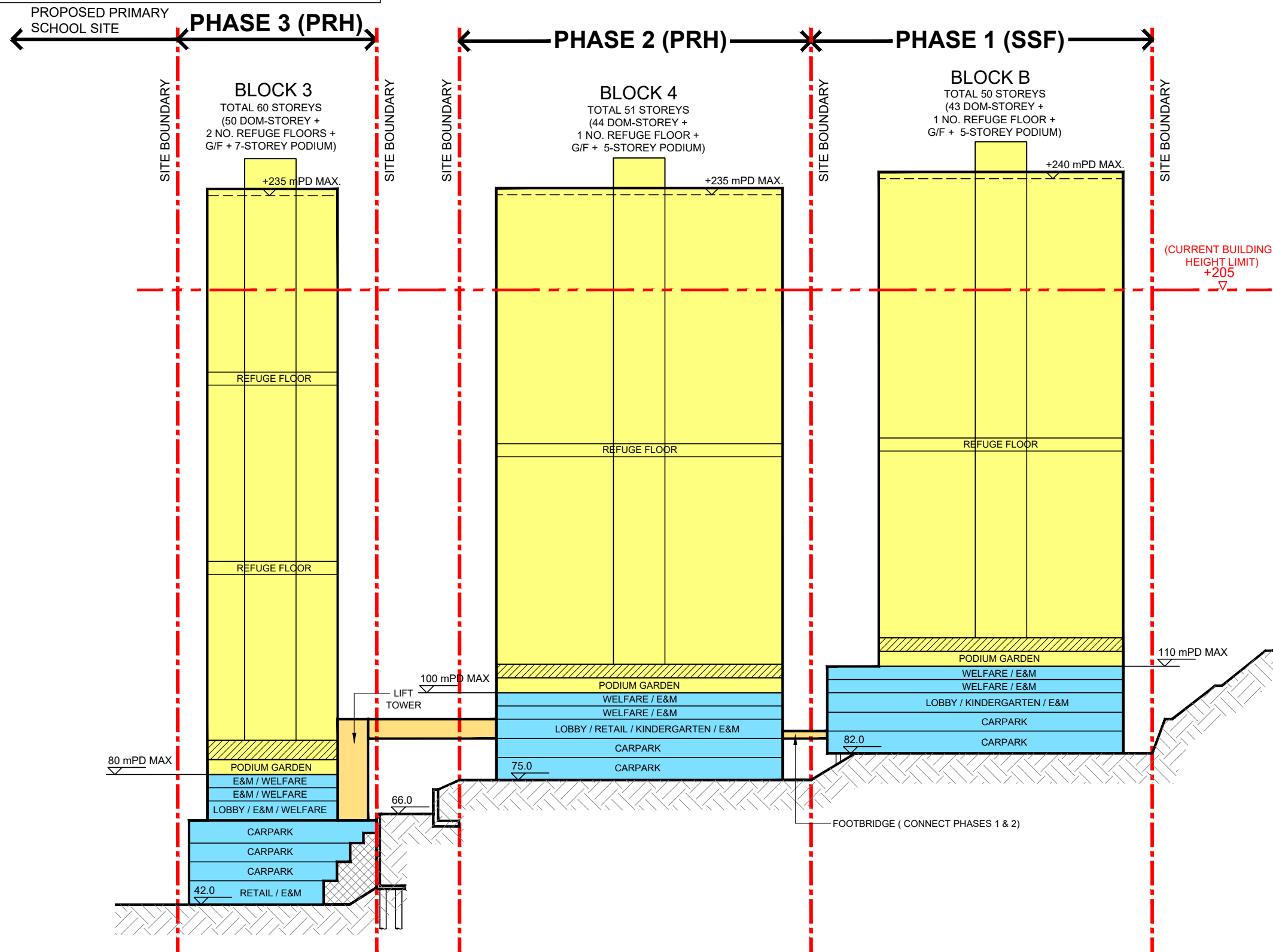


**LEGEND**

- SITE BOUNDARY
- DOMESTIC BLOCK
- COMMERCIAL / RETAIL / CARPARK / SOCIAL WELFARE FACILITIES
- FOOTBRIDGE



KEY PLAN SCALE 1 : 8000

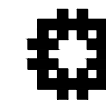


DRAFT

PROJECT TITLE  
**PUBLIC HOUSING DEVELOPMENT AT  
NEAR TAN KWAI TSUEN PHASES 1, 2 & 3**

DRAWING TITLE  
**SITE SECTION B - B**

SCALE 1:600 (A1) , 1:1200 (A3)



房屋署  
HOUSING DEPARTMENT

DRAWING NO.  
YL52/S16/A/LO-03

DATE:  
13/6/2022