Annex A

Revised Sensitivity Test for Proposed "R(B)14" Zone

S.12A APPLICATION FOR AMENDMENT OF PLAN
DRAFT TAI PO OUTLINE ZONING PLAN NO. S/TP/31

Proposed Residential Development(s) with Retail,
Public Vehicle Park and Social Welfare Facilities
Various Lots and Adjoining Government Land at Fung Yuen,
Tai Po, New Territories

SENSITIVITY TEST FOR THE PROPOSED "R(B)14" ZONE

March 2026

Applicant:
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TABLE OF CONTENT

List of Figures

List of Tables

List of Appendices

S.12A APPLICATION FOR AMENDMENT OF PLAN
DRAFT TAI PO OUTLINE ZONING PLAN NO. S/TP/31

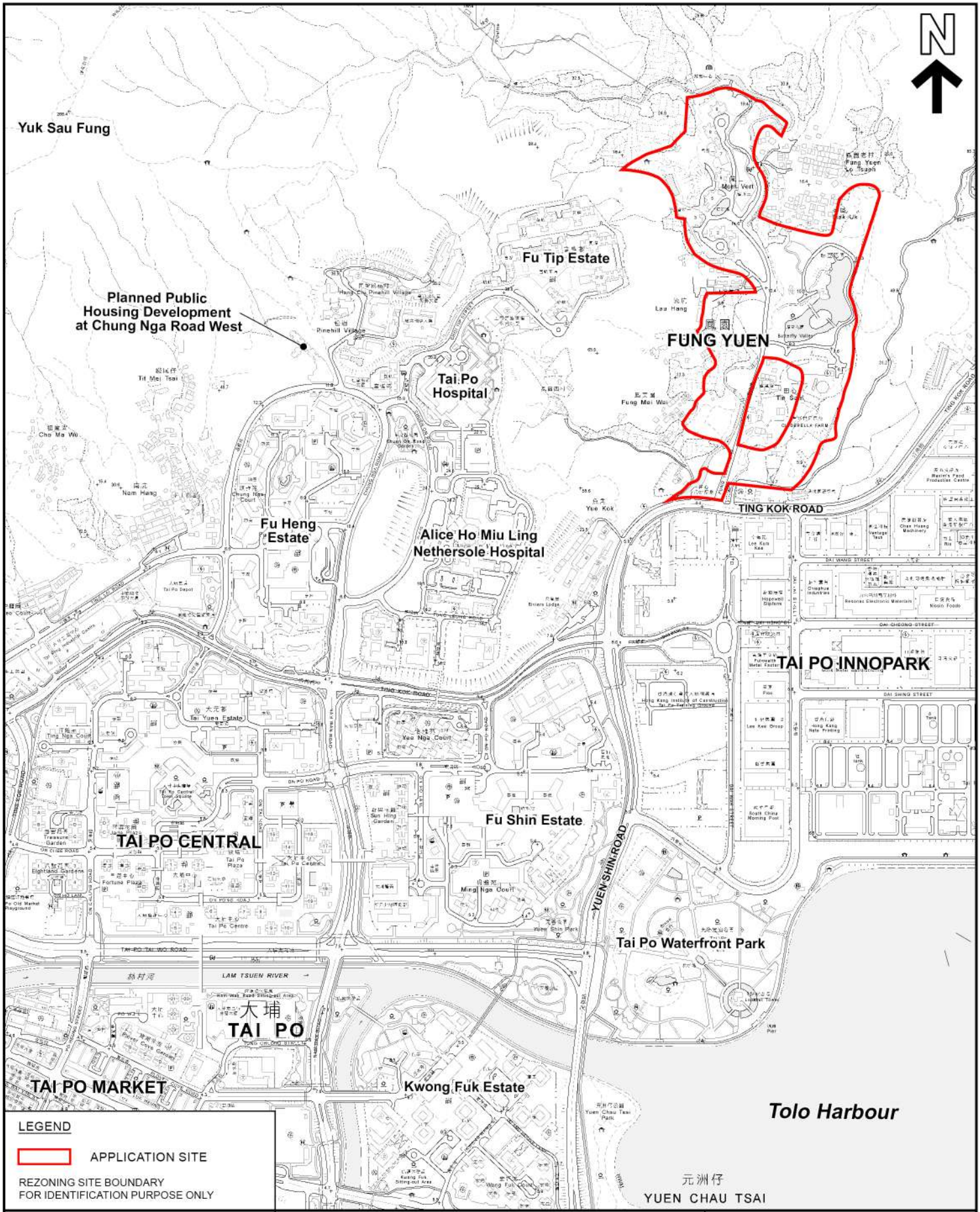
Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities
Various Lots in D.D. 11 and Adjoining Government Land, Fung Yuen, Tai Po, New Territories

Sensitivity Test for the Proposed "R(B)14" Zone

1 BACKGROUND

1.1 The northern portion of the Application Site under s12A Amendment of Plan Application No. Y/TP/40 ("the Application") is proposed to be rezoned from "Comprehensive Development Area (1)" to "Residential (Group B) 14" ("R(B)14") on the Draft Tai Po Outline Zoning Plan No. S/TP/31 ("the OZP") (**Figures 1 and 2** refer). The northern portion of the Application Site is mainly sat by an existing high-rise residential development, namely Mont Vert. Being the Phase 1 Development under Application No. A/TP/333, the residential development comprises 8 residential towers with a building height of not more than 102mPD. The domestic GFA of the development is about 87,356m^2. The construction of the development was completed with the Certificate of Compliance obtained in 2015 (**Figure 3** refers)

1.2 This Sensitivity Test is prepared and submitted on behalf of Fantastic State Limited ("the Applicant") to evaluate the infrastructural impact of potential developments of the third party lots within the "R(B)14" zone proposed under the Application.



LEGEND

APPLICATION SITE

REZONING SITE BOUNDARY
FOR IDENTIFICATION PURPOSE ONLY

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LOCATION PLAN

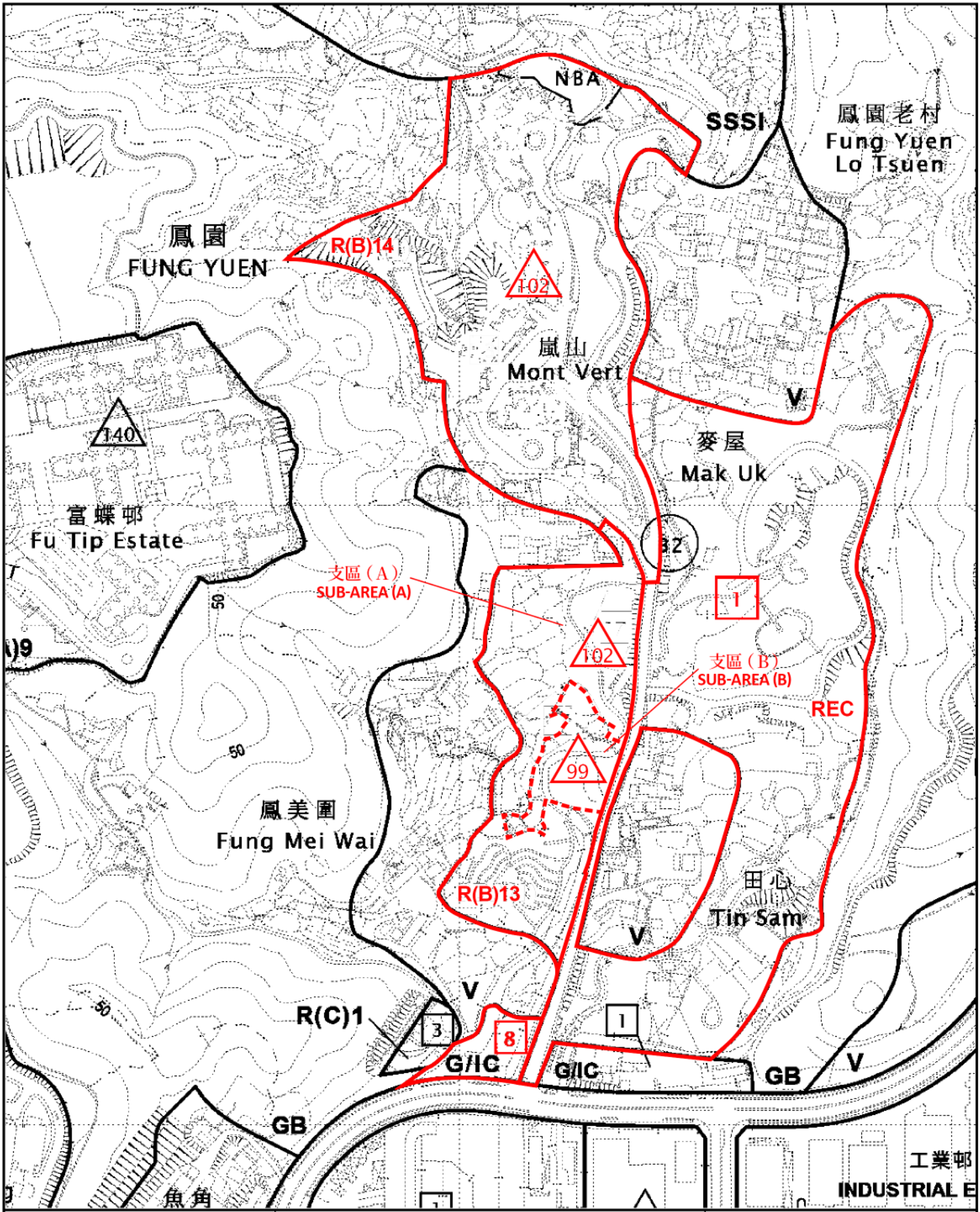
PROPOSED RESIDENTIAL DEVELOPMENT(S) WITH RETAIL, PUBLIC VEHICLE PARK AND SOCIAL WELFARE FACILITIES VARIOUS LOTS IN D.D. 11 AND ADJOINING GOVERNMENT LAND, FUNG YUEN, TAI PO, NEW TERRITORIES

SCALE 1 : 10 000

FIGURE 2

EXTRACT PLAN BASED ON SURVEY SHEET No. 3-SW-D & 7-NW-B

DATE: 25.9.2025



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PROPOSED AMENDMENTS TO THE OZP

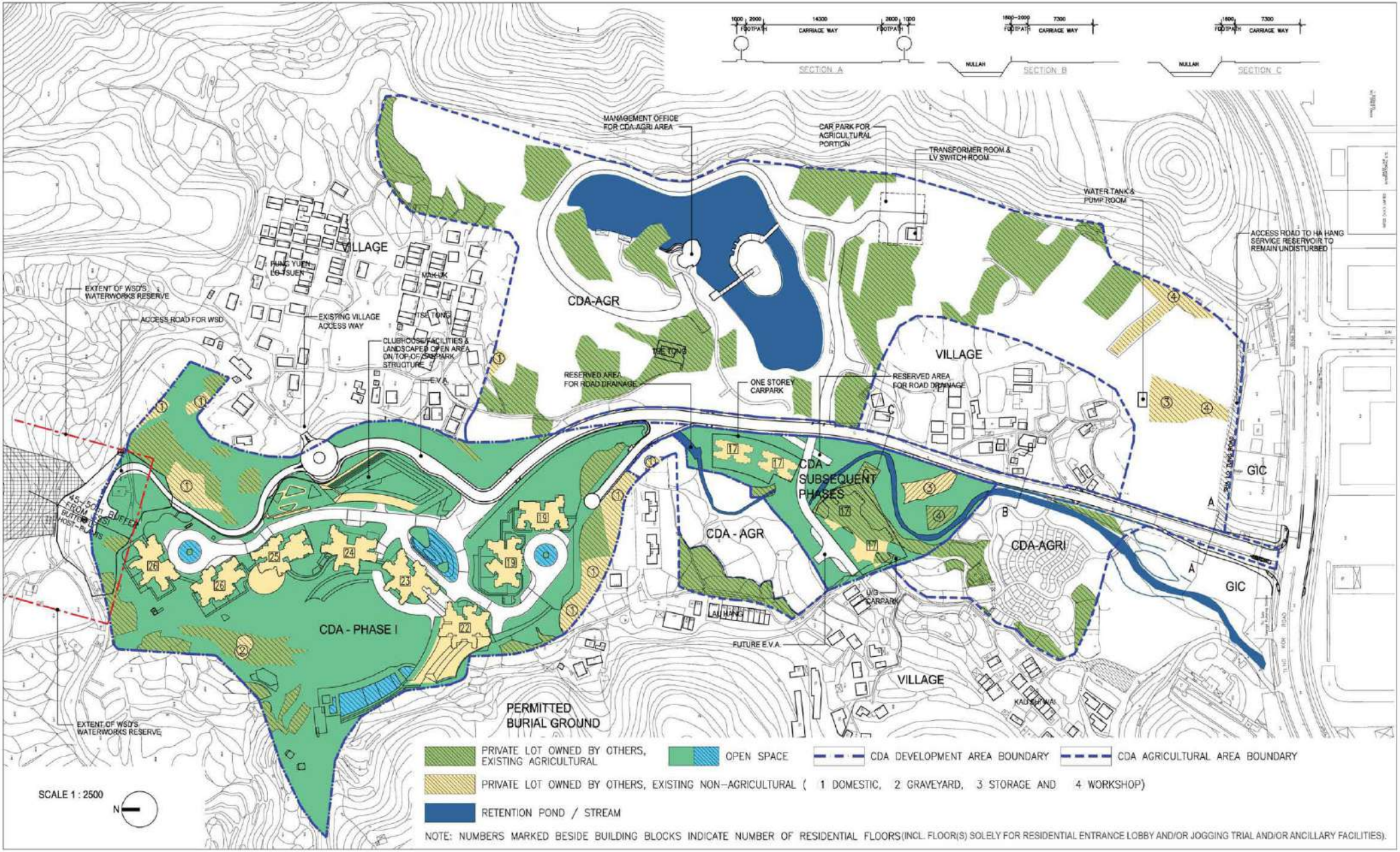
PROPOSED RESIDENTIAL DEVELOPMENT(S) WITH RETAIL, PUBLIC VEHICLE PARK AND SOCIAL WELFARE FACILITIES VARIOUS LOTS IN D.D. 11 AND ADJOINING GOVERNMENT LAND, FUNG YUEN, TAI PO, NEW TERRITORIES

SCALE 1 : 4 000

FIGURE 6.1

MODIFIED PLAN BASED ON OUTLINE ZONING PLANS No. S/TP/31 EXHIBITED ON 28.3.2025

DATE: 25.9.2025



PROPOSED DEVELOPMENT AT FUNG YUEN VALLEY, TAI PO - MASTER LAYOUT PLAN

December 2015

Figure 3 Approved Master Layout Plan under Application No. A/TP/333

2 LAND STATUS

2.1 The majority of the northern portion of the Application Site is private land owned or partly owned by the Applicant. The remaining are Government land (9%) and third party lots (11%).

Table 3.1 Breakdown of Land Ownership of Northern Portion

Land Ownership [a]	Northern Portion
Private land owned by the Applicant (m^2)	51,404 (80%)
Private land owned by others (m^2)	7,143 (11%)
Government land (m^2)	5,939 (9%)
Total (m^2)	64,486

[a] The areas are measured by using geographic information system software, and subject to detailed on-site survey.

2.2 The third party lots are scattered to northeast, northwest and south of Mont Vert. For the lots to the northeast, most of them are small in size and fragmented except Lot 400 in D.D. 11. There is a natural stream course meandering alongside the lots. Land suitable for potential development are limited. For the land to the northwest, most of the lots are sat on slope and/or occupied by graves and urns. For the land to the south, although most lots are third party lots and falling within village environ, they are already occupied by existing or committed development.

2.3 Therefore, only a few of the third party lots (about 3,000m^2) are available for potential developments. The location of the available land for potential developments is illustrated in **Figure 4**.

N

D.D. 11 Lot 400

NBA

3m buffer from watercourse

Proposed "R(B)14" Zone

Mont Vert

FUNG YUEN ROAD

Proposed "REC" Zone

Proposed "R(B)13" Zone

LEGEND

- REZONING SITE
- LAND OWNED BY PROJECT PROPONENT
- THIRD-PARTY LOTS
- GRAVES/URNS
- EXISTING/COMMITED DEVELOPMENT
- POTENTIAL SITES FOR NTEH (ABOUT 3,000m²)
- INDICATIVE NTEH LOCATION

APPLICATION PREMISES BOUNDARY
FOR IDENTIFICATION PURPOSE ONLY

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POTENTIAL SITES FOR NTEH DEVELOPMENT WITHIN THE PROPOSED "R(B)14" ZONE

PROPOSED RESIDENTIAL DEVELOPMENT(S) WITH RETAIL, PUBLIC VEHICLE PARK AND SOCIAL WELFARE FACILITIES
VARIOUS LOTS IN D.D. 11 AND ADJOINING GOVERNMENT LAND, FUNG YUEN, TAI PO, NEW TERRITORIES

SCALE 1 : 2 000

FIGURE 4

EXTRACT PLAN BASED ON
SURVEY SHEET No.
3-SW-25C & 25D, 7-NW-5A, 5B, 5C & 5D

DATE: 27.11.2025

3 POTENTIAL DEVELOPMENTS ASSUMPTION

3.1 Under the proposed amendment to the Statutory Notes of the OZP for "Residential (Group B)" Zone, *'On land designated "R(B)14", 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 domestic GFA of 87,356m^2, a maximum non-domestic GFA of 376m^2 and a maximum building height in terms above Principal Datum as stipulated on the Plan, or the GFA and height of the existing building, whichever is the greater.'* Considering that Mont Vert has used up all the permissible GFA of the proposed "R(B)14" zone, third party lots owners who wish to develop their land will be required to submit separate application(s) under section 16 of the Town Planning Ordinance to the Town Planning Board for minor relaxation of the GFA restriction, even the proposed uses are Column 1 uses[1]. Application(s) will be considered based on the individual merits of the development or redevelopment proposal.

3.2 While adverse infrastructural impact created by a single NTEH development shall not be anticipated, the cumulative impact arising from all the potential NTEH developments may need to be assessed. As such, a sensitivity test assuming all available third party lots for NTEH development has been carried out.

3.3 Adopting the standard land estimation of 250m^2 per NTEH for Small House s16 Planning Applications, with a total available third party lots of 3,000m^2 (para 2.3 refers). Ultimately, 12 NTEHs is assumed to be developed within the proposed "R(B)14" zone . The estimated population is 95 persons with the assumption of 3 units per NTEH.

3.4 By allocating the 12 NTEHs to the more intact third party lots, 8 potential NTEHs to the northeast, 1 NTEH to northwest and 3 NTEHs to the south are expected to be built ultimately. The location of the potential developments is illustrated in **Figure 4**.

[1] New Territories Exempted House ("NTEH")' subsumed under 'House' is proposed to be one of the Column 1 uses under the "R(B)14" zone and therefore no planning permission is required. Also, the development of NTEH is exempted from certain provisions of the Buildings Ordinance and its subsidiary regulations, including the need for obtaining prior approval and consent to the commencement of works from the Buildings Department.

4 INFRASTRUCTURE IMPACT

4.1 The infrastructural impact of the potential NTEH developments is assessed from traffic, drainage, sewerage and water supply points of view.

Traffic

4.2 It is anticipated that the trip generation of potential NTEHs developments is only 2 to 3 pcu/hr (one-way), the traffic impact by the NTEHs is negligible. Moreover, junction improvement schemes have been proposed subject to the Application to improve the junction performance of the studied critical junctions, all junctions will operate with ample junction capacity in the future year. It is confirmed that these junctions will have sufficient capacities to cater the additional minimal traffic trips of NTEHs. Please refer to ***Appendix 1*** for details.

Drainage

4.3 The potential sites for NTEHs development are grouped into two locations, which are Regions A to the south and Region B to the north. Region A is currently occupied by outdoor car parks and Region B consist of temporary structures and some vegetation under existing condition. Under existing condition, the runoff from Region A is discharged to the existing watercourse at the proposed "R(B)13" zone through overland flow, whilst the runoff from Region B is discharged to the existing watercourse next to the Mont Vert via overland flow.

4.4 Under the hypothetical scenario, the potential NTEHs will be developed within the available third party lots in the proposed "R(B)14" zone with the presence of the Development in the proposed "R(B)13" zone. The runoff from the potential NTEH developments in Region A will be collected by the proposed boundary channels of the Development in the proposed "R(B)13" zone. The drainage impact assessment of the Development in the proposed "R(B)13" zone has been accounted for collecting runoff from its vicinity via boundary channels, including the runoff from the catchments of the potential NTEH developments in Region A. For the runoff arising from the potential NTEH developments in Region B, it is anticipated to be discharged to the existing watercourse near Mont Vert.

4.5 As compared to existing condition, the weighted runoff coefficient taking into account the surface characteristics for the potential NTEH developments in Region A has been reduced under the hypothetical scenario, while that for Region B will be similar to the existing condition. Therefore, it is anticipated that the runoff generated from the potential NTEH development under the hypothetical scenario will be similar or less than that of the existing condition and there will be no adverse impacts arising from the potential NTEH development to the existing drainage system with the presence of the Development in "R(B)13" zone. Please refer to ***Appendix 2*** for details.

Sewerage

4.6 The Application Site is characterised by rural/suburban topography, with limited access to public sewerage infrastructure. Connection to the public system is deemed impractical due to challenges in maintenance, construction responsibilities, and site constraints, such as distance from terminal manholes and potential disruption to existing utilities. However, for conservative consideration, the sewerage sensitivity analysis incorporated the scenario that the total design sewage flow from all proposed NTEH's will be received by the public sewerage system.

4.7 The potential NTEH development in the "R(B)14" zone will not cause adverse sewerage impacts to the surroundings. Two schemes (Scheme 1 – Hypothetical Sewerage Tank / Sewerage Treatment Plant and Scheme 2 – Discharge to Public Sewerage) are proposed for the hypothetical development. NTEH owners might propose with private septic tanks or sewerage treatment plant, sewage will be fully managed on-site, complying with EPD/DSD standards and avoiding strain on public infrastructure. The low population density and rural setting further minimise risks. NTEH owners might propose constructing sewerage pipe(s) through others lot boundary and discharged to public sewerage system in Fung Yuen Road. The proposed sewerage pipe(s) should be carried by the owner at his own cost.

Water Supply

4.8 Based on the unit water demand and the estimated population, the mean daily fresh water and flushing water demands for the potential NTEH Developments in the proposed "R(B)14" zone are approximately 22m^3/day and 7m^3/day. As the existing DN150 salt water mains along Fung Yuen Road ends near the entrance of Mont Vert, salt water can only be supplied to the potential NTEH developments in Region A. For the potential NTEH development in Region B, it is assumed the flushing water will be provided by the existing DN200 fresh water main along Fung Yuen Road as there are no existing salt water mains at its adjacency.

4.9 Based on the hydraulic calculation, residual heads under hypothetical scenario, which included the potential NTEH development in "R(B)14" zone and the Development in the proposed "R(B)13" and "Government, Institution or Community" ("G/IC") zones, as well as the potential NTEH developments, are estimated. The residual heads for the fresh water supply system under hypothetical scenario range from 63.08m to 28.07m. For the salt water supply system, the residual heads under hypothetical scenario range from 72.26m to 31.12m. The residual heads under hypothetical scenario are well within residual head requirement of 20m and 15m for water supply system.

4.10 Based on the assessment findings, it is considered that there is no insurmountable impact due to the additional water demand from the potential NTEH developments in

"R(B)14" zone on the existing water supply system with the presence of the Development in the proposed "R(B)13" zone and "G/IC" zone.

5 CONCLUSION

5.1 By assessing the infrastructural capacity for potential NTEH developments on the available third part lots within the proposed “R(B)14” zone, the anticipated impact is minimal and significant adverse impact to the local infrastructure from traffic, drainage, sewerage and water supply points of view is not anticipated.

5.2 For potential developments of other nature on the third party lots within the proposed “R(B)14” zone following the approval of the s12A Application, their impact on the local infrastructure shall be discussed in separate planning application(s) submitted by the project proponent.

Appendix 1

Technical Note on Traffic Impact Assessment

Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots in D.D. 11 and Adjoining Government Land, Fung Yuen, Tai Po, New Territories

Technical Note on Traffic Impact by the Remaining Third Party Lots (February 2026)

1. Introduction

1.1 The planning application of the captioned subject was submitted to the government. Planning Department raised their concerns on the potential traffic impact by remaining third party lots within the proposed "R(B)14" zone

1.2 This technical note is prepared to demonstrate that the remaining third party lots will not anticipate adverse traffic impacts on the surroundings.

2. Development Parameters

2.1 As given by the KTA Planning Limited, all remaining third party lots within the proposed "R(B)14" zone are assumed to be developed into standard New Territories Exempted Houses (NTEHs). Assume 12 nos. of NTEHs (36 residential units) will be built. The locations of the NTEH developments within the proposed "R(B)14" zone are shown in **Figure Plan 1**.

3. Comparison between NTEH and Our Proposed Development

3.1 The comparison between the no. of units of NTEHs and our proposed developments in "R(B)14" Zone is shown in **Table 1** below.

Table 1 Comparison between the no. of units of NTEHs and Our Proposed Developments in "R(B)14" Zone

Use	No. of Residential Units
(A) NTEH	36
(B) Our Proposed Development	1,988
No. of Units of NTEHs / No. of Units of Our Proposed Development = (A) / (B)	**1.81%**

3.2 From **Tables 1**, it is revealed that the no. of unit of NTEHs is only 1.81% of our proposed development, which is minimal.

3.3 The roofed-over area of an NTEH is limited to not exceeding 65.03m^2 (about 700 square feet). Since there is no trip rate for NTEH in TPDM, trip rate of similar flat size has been reference. Upper limit of trip rate of for Private Housing: Low-Density / R(C) (70m^2) is adopted to estimate the trip generation by the NTEHs

Table 2 Estimated Trip for the NTEHs Development

Residential Use									
Use	No. of NTEH	Trips Rates (pcu/hr/flat)(1)				Trips (pcu/hr)			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Gen.	Att.	Gen.	Att.	Gen.	Att.	Gen.	Att.
NTEH	36	0.1117	0.0729	0.0454	0.0551	5	3	2	2

(1) Upper limit of trip rate of Private Housing: Low-Density / R(C) (70m^2) is adopted

3.4 The comparison of the estimated trip generations between NTEHs and proposed developments is shown in **Table 3** below.

Table 3 Trip for the NTEHs and Our Proposed Development

Use	Residential Use			
	Trips (pcu/hr)			
	AM Peak		PM Peak	
	Gen.	Att.	Gen.	Att.
(C) NTEH	5	3	2	2
(D) Our Proposed Development(1)	161	132	136	128
Trips of NTEHs / Trips of Our Proposed Development = (C) / (D)	**3.1%**	**2.3%**	**1.5%**	**1.6%**

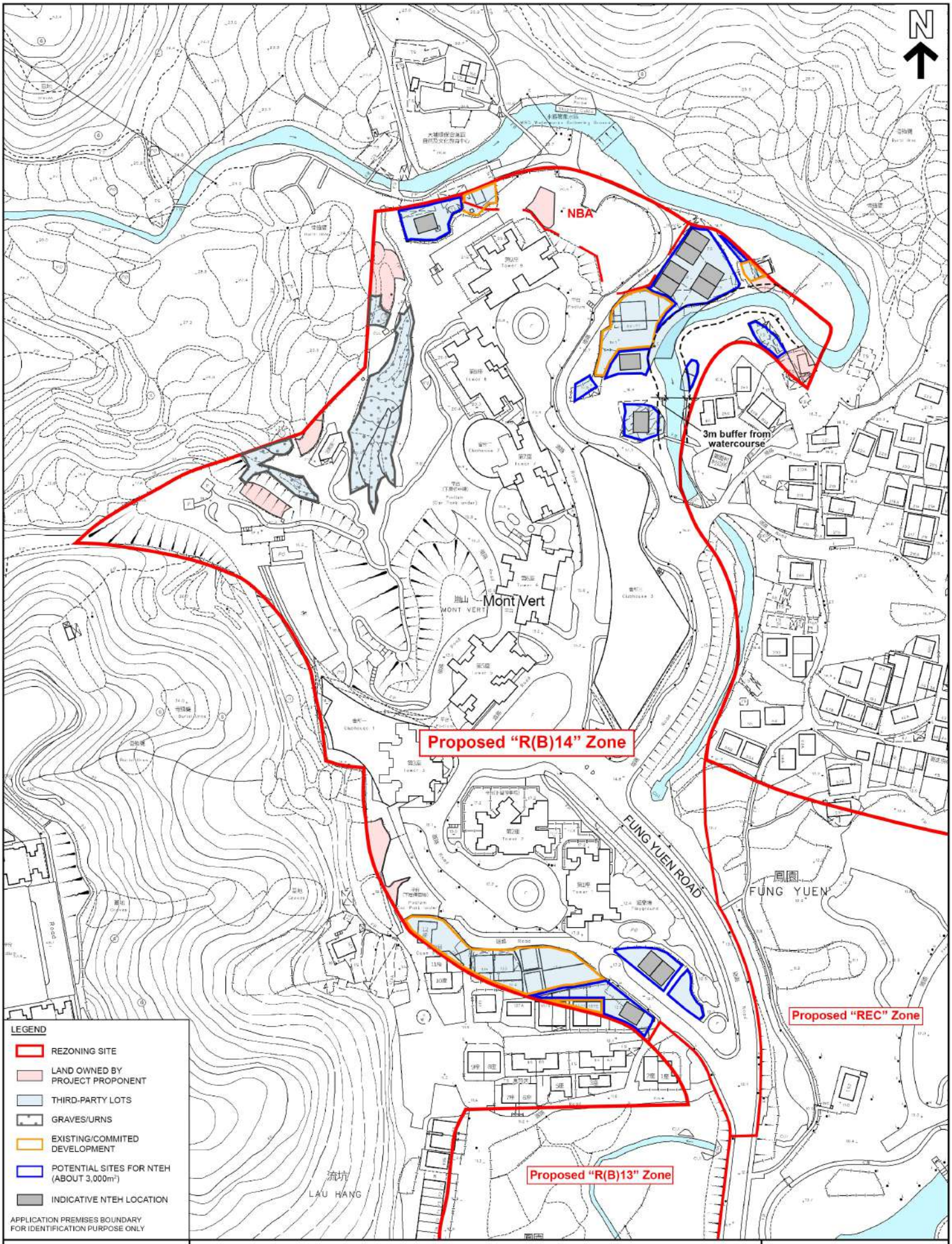
(1) Extracted from the TIA

3.5 From **Tables 2** and **3**, it is revealed that the trip generation by NTEHs is only 2 to 5 pcu/hr (one-way), which is only 1.5 to 3.1% of our proposed development. The traffic impact by the NTEHs is negligible.

3.6 Moreover, junction improvement schemes have been proposed to improve the junction performance of the studied critical junctions, all junctions will operate with ample junction capacity in the future year. These junctions have sufficient capacities to cater the additional minimal traffic trips of NTEHs.

4. Conclusion

4.1 This technical note shows that the trip generation of the NTEHs is small and negligible. Therefore, it would not anticipate adverse impact to the traffic network from traffic engineering point of view.



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POTENTIAL SITES FOR NTEH DEVELOPMENT WITHIN THE PROPOSED "R(B)14" ZONE

PROPOSED RESIDENTIAL DEVELOPMENT(S) WITH RETAIL, PUBLIC VEHICLE PARK AND SOCIAL WELFARE FACILITIES
VARIOUS LOTS IN D.D. 11 AND ADJOINING GOVERNMENT LAND, FUNG YUEN, TAI PO, NEW TERRITORIES

SCALE 1 : 2 000

PLAN 1

EXTRACT PLAN BASED ON SURVEY SHEET No.
3-SW-25C & 25D, 7-NW-5A, 5B, 5C & 5D

DATE: 27.11.2025

Appendix 2

Drainage Sensitivity Analysis

1 Sensitivity Analysis of Potential Development on Third Party Lots in R(B)14 Zone – Drainage

1.1 Background

1.1.1 As per the comments of Planning Department on the Planning Application of the proposed development at Fung Yuen, Tai Po (the Development), this sensitivity analysis aims to demonstrate that the existing drainage system is technical feasible to support the hypothetical scenario, which consists of both the potential New Territories Exempted Houses (NTEH) development on third party lots in the proposed R(B)14 zone with the presence of the Development in R(B)13 zone. The location of the R(B)13 and R(B)14 zones is shown in **Figure 1**.

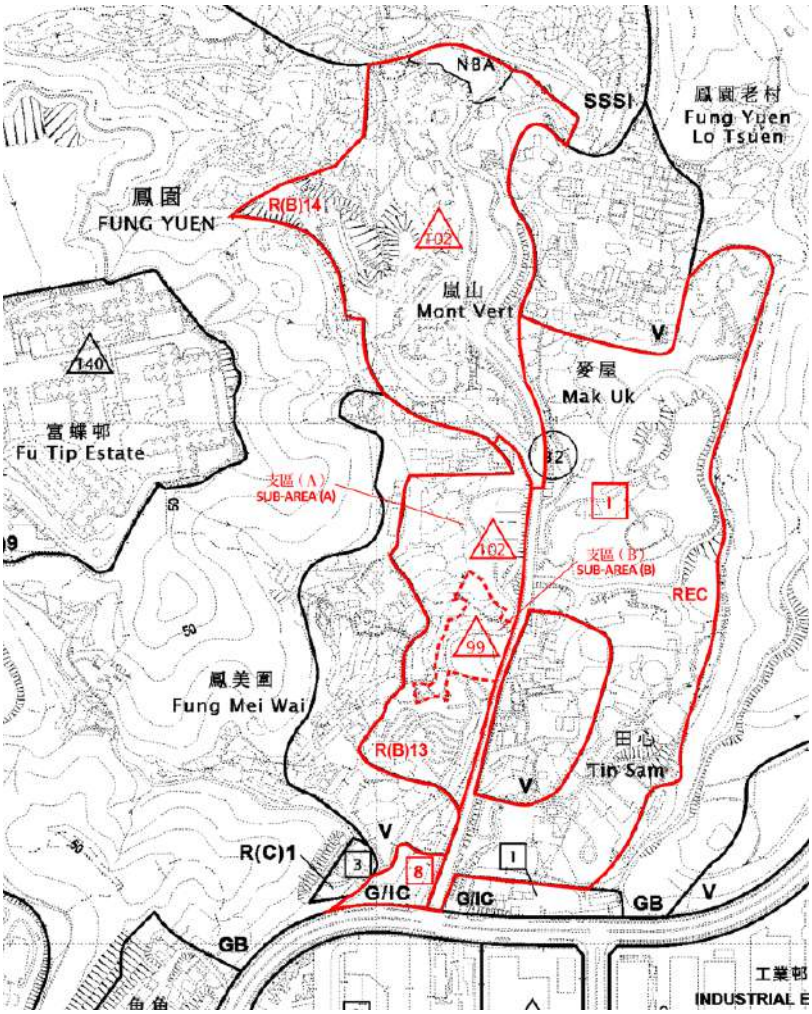

Figure 1 Location plan

1.2 The Remaining Potential Areas for the Potential NTEH Development in R(B)14 Zone

1.2.1 There are some remaining potential areas for the potential NTEH development in R(B)14 zone. It is estimated that the maximum no. of NTEH in that potential area is 12 houses which can be accommodated in five different third party lots. The estimated population is 95 persons with the assumption of 3 units per NTEH. The potential site for NTEH development within the proposed R(B)14 zone is enclosed in **Figure 2**.

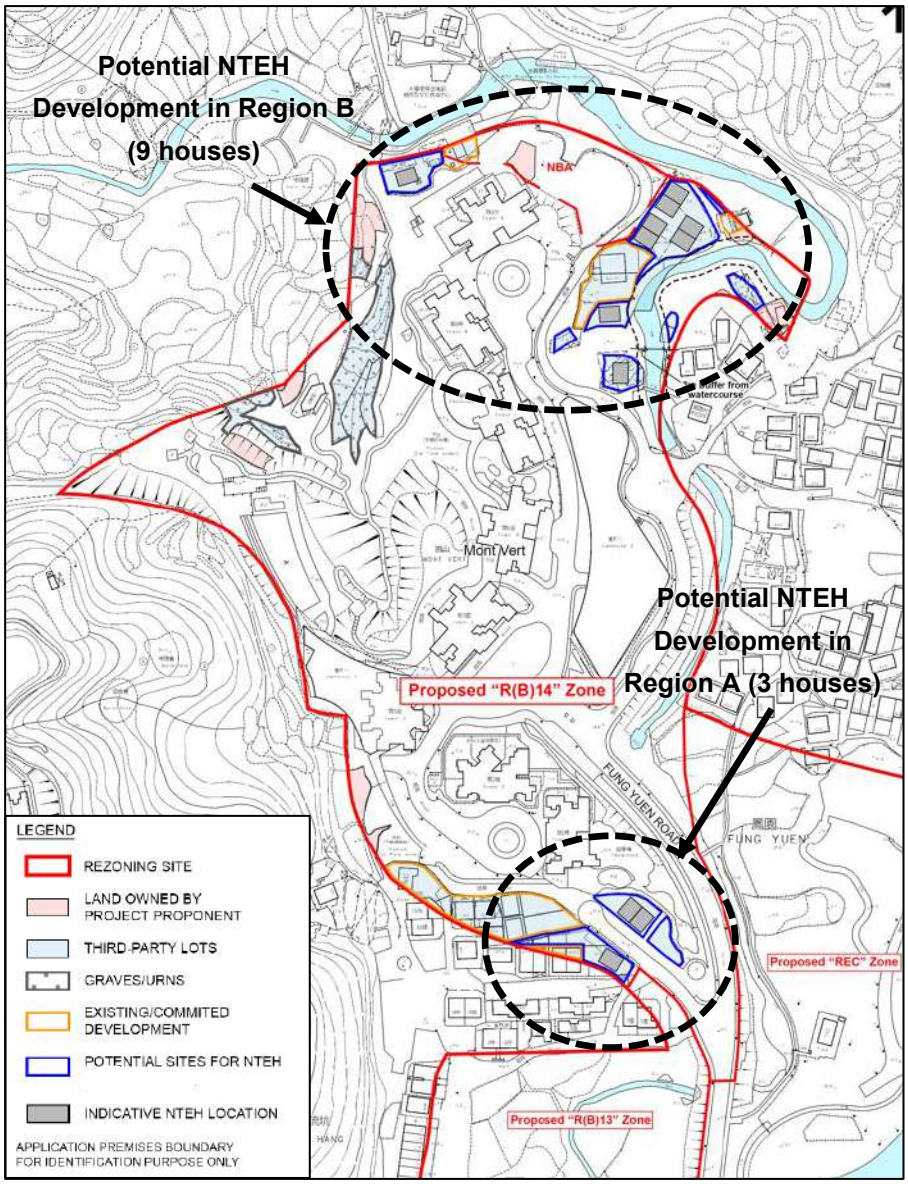

Figure 2 Potential site for NTEH development within the proposed R(B) 14 zone

1.3 Preliminary Drainage Assessment for the potential NTEH development in R(B)14 zone

Existing Surface Characteristics for the potential sites for NTEH development

1.3.1 As shown in **Figure 2**, the potential sites for NTEH development are grouped into two locations, which are Regions A and B. Region A is currently occupied by outdoor car parks and Region B consists of temporary structures and some vegetation under existing condition. Aerial photo showing the existing land use of the potential sites for NTEH is shown in **Figure 3**. Under existing condition, the runoff from Region A is discharged to the existing watercourse at the proposed R(B)13 zone through overland flow, whilst the runoff from Region B is discharged to the existing watercourse next to the Mont Vert via overland flow.

Figure 3 Aerial photo showing the potential site for NTEH

1.3.2 Under the condition with the Development of proposed R(B) 13 zone in place, the runoff from Region A will be collected by the proposed boundary channels of the Development for discharging into the existing watercourse at the R(B) 13 zone. For the runoff arising from the potential NTEH development in Region B, it is anticipated to be discharged to the existing watercourse near Mont Vert, as per the existing condition.

1.3.3 The existing surface characteristics for the potential sites for NTEH development in both Regions A and B are present in **Table 1.1**.

Table 1.1: Existing surface characteristics for the potential sites for NTEH development in Regions A and B

Location	Paved Area (m^2)	Unpaved Area (m^2)	Total Area (m^2)	Weighted Runoff Coefficient
Region A	532	0	532	0.95
Region B	1148	572	1720	0.72
Remark: (i) It is assumed that the runoff coefficient of paved area and unpaved area are 0.95 and 0.25 respectively.				

Surface Characteristics for the potential sites for NTEH development under hypothetical scenario

1.3.4 Under the hypothetical scenario, the potential NTEH will be developed within the potential sites for NTEH development in R(B)14 zone with the presence of the Development in R(B)13 zone. Since the development of NTENs is not part of the Proposed Development under this planning application, the third party lots owners who wish to develop their land shall determine its own design layout and submit separate planning application under S16 of the Town Planning Ordinance. This sensitivity test only demonstrates a possible option for the NTEHs under the hypothetical scenario.

1.3.5 It is assumed that, under the hypothetical scenario, excluding the plan area for the buildings (i.e. 65m^2 for each NTEH), 60% of the remaining areas of the potential sites will be paved by brick and 40 % of the remaining area will be unpaved. The surface characteristics for the potential sites for NTEH development in both Regions A and B under hypothetical scenario are present in **Table 1.2**.

Table 1.2: Surface characteristics for the potential sites for NTEH development in Regions A and B under hypothetical scenario

Location	Building Area (m^2)	Brick-paved Area (m^2)	Unpaved Area (m^2)	Total Area (m^2)	Weighted Runoff Coefficient
Region A	195	202	135	532	0.72
Region B	585	681	454	1720	0.71
Remark: (i) It is assumed that the runoff coefficient of buildings, brick-paved area and unpaved area are 0.95, 0.8 and 0.25 respectively. (ii) It is assumed that, excluding the plan area for the buildings (i.e. 65m^2 for each NTEH), 60% of the remaining areas of the potential sites will be paved by brick and 40 % of the remaining area will be unpaved.					

1.3.6 Same as the existing condition with the proposed Development, the runoff from the potential NTEH development in Region A will be collected by the proposed boundary channels of the Development in R(B)13 zone for discharging into the existing watercourse. The drainage impact assessment of the Development in R(B)13 zone has been accounted for collecting runoff from its vicinity via boundary channels, including the runoff from the catchments of the potential NTEH development in Region A. For the runoff arising from the potential NTEH development in Region B, it is anticipated to be discharged to the existing watercourse near Mont Vert. The discharge arrangement from the potential NTEH development to those boundary channels (for Region A) or existing watercourse (for Region B) are subject to the detailed design carried by the owners of the potential NTEH development.

Evaluation of Runoff Generated from NTEH under Existing and Hypothetical Scenarios

1.3.7 With reference to **Tables 1.1** and **1.2**, as compared to existing condition, the weighted runoff coefficient for the potential NTEH development in Region A has been reduced under the hypothetical scenario, while that for Region B, the weighted runoff coefficient is similar to existing condition. Based on **Table 1.3**, the runoffs generated from the NTEH development from Regions A and B under hypothetical scenario is similar or less than that in the existing scenario. Therefore, it is anticipated that the runoff generated from the potential NTEH development under the hypothetical scenario will be similar or less than that of the existing condition.

Table 1.3: Runoff Generated from NTEH under Existing and Hypothetical Scenarios

Location	Total Area (m^2) [A]	Weighted Runoff Coefficient [B]		Time of Concentration (Min) (iii),(iv)	200-year Extreme Mean Intensity with Climate Change Effect (mm/hr) (v) [C]	Peak Runoff (m^3/s) $[D] = \frac{[C] * [B] * [A]}{3600 * 1000}$		Change in Peak Runoff (m^3/s)
		Existing Scenario (i)	Hypothetical Scenario (i),(ii)			Existing Scenario	Hypothetical Scenario	
Region A	532	0.95	0.72	4.5	334.6	0.047	0.035	-0.012
Region B	1720	0.72	0.71	2.0	378.1	0.130	0.128	-0.002

Remark:

(i) It is assumed that the runoff coefficient of buildings, brick-paved area and unpaved area are 0.95, 0.8 and 0.25 respectively.

(ii) It is assumed that, excluding the plan area for the buildings (i.e. 65m^2 for each NTEH), 60% of the remaining areas of the potential sites will be paved by brick and 40 % of the remaining area will be unpaved.

(iii) Time of concentration is determined with Brandsby William's Equation, $t_o = \frac{0.14465L}{H^{0.2}A^{0.1}}$.
Region A: A= 532m^2, L= 82.8m, Hh= 13.19mPD, Hl= 8.24mPD. tc= 4.5min.
Region B: A=1720m^2, L=40.1m, Hh= 18.5mPD, Hl= 16.33mPD. tc= 2.0min.

(iv) It is assumed that there will be no change in site formation levels in the potential NTEH site as compared with the existing condition. Thus, the time of concentration for the development option will be same for both developed and existing condition.

(v) Extreme mean intensity is calculated with the time of concentration and storm constants given in Table 3a of Stormwater Drainage Manual (SDM) Corrigendum No. 1/2024 and adjusted with a factor of 1.281 for the climate change effect in the end of 21st century.

1.3.9 If the design layouts proposed by the third party lots owners in future deviate from the above assumption in **Table 1.2**, the third party lots owners shall carry out his/ her own assessment on the drainage impact caused by their developments and consider providing necessary mitigation measures, such as an on-site stormwater storage tank to temporarily store the additional runoff and discharge the stored runoff after the peak of the storm.

1.3.10 In view of the above, there will be no adverse impacts arising from the potential NTEH development to the existing drainage system with the presence of the Development in R(B)13 zone.

1.4 Conclusion

1.4.1 As per the comments of Planning Department, this sensitivity analysis aims to demonstrate that the existing drainage system is technical feasible to support the hypothetical scenario with the potential New Territories Exempted Houses (NTEH) development on third party lots in the proposed R(B)14 zone with the presence of the proposed development at Fung Yuen, Tai Po (the Development) in R(B)13 zone.

1.4.2 The potential sites for NTEH development are grouped into two locations, which are Regions A and B. Region A is currently occupied by outdoor car parks and Region B consists of temporary structures and some vegetation under existing condition. Under existing condition, the runoff from Region A is discharged to the existing watercourse at the proposed R(B)13 zone through overland flow, whilst the runoff from Region B is discharged to the existing watercourse next to the Mont Vert via overland flow.

1.4.3 Under the hypothetical scenario, the potential NTEH will be developed within the potential sites for NTEH development in R(B)14 zone with the presence of the Development in R(B)13 zone. The runoff from the potential NTEH development in Region A will be collected by the proposed boundary channels of the Development in R(B)13 zone. The drainage impact assessment of the Development in R(B)13 zone has been accounted for collecting runoff from its vicinity via boundary channels, including the runoff from the catchments of the potential NTEH development in Region A. For the runoff arising from the potential NTEH development in Region B, it is anticipated to be discharged to the existing watercourse near Mont Vert.

1.4.4 As compared to existing condition, the weighted runoff coefficient for the potential NTEH development in Region A has been reduced under the hypothetical scenario, while that for Region B will be similar to the existing condition. Therefore, it is anticipated that the runoff generated from the potential NTEH development under the hypothetical scenario will be similar or less than that of the existing condition and there will be no adverse impacts arising from the potential NTEH development to the existing drainage system with the presence of the Development in R(B)13 zone. If the design layouts proposed by the third party lots owners in future deviate from the assumption adopted in the sensitivity test, the third party lots owners shall consider providing necessary mitigation measures such as on-site storage tank in accordance with its own drainage impact assessment.

Appendix 3

Sewerage Sensitivity Analysis

PROJECT NO. P2319

SEWERAGE SENSITIVITY TEST FOR REMAINING AREAS OF "R(B)14" ZONE, TAI PO, NEW TERRITORIES

GREG WONG & ASSOCIATES LTD.

Prepared by:	Kelvin Au Yeung
Checked by:	Kevin Tang
Approved by:	Kevin Tang
Report No.:	2319G003
Revision:	3
Date:	March 2026

INDEX

Section

Appendices

1. Introduction

Greg Wong & Associates was commissioned to carry out a sewerage sensitivity test for Proposed Residential Development in Tai Po.

This Sensitivity Test Report assesses the potential sewerage impacts arising from the proposed development of New Territories Exempted Houses (NTEHs) in the remaining areas of the "R(B)14" zone under the latest rezoning application. The assessment focuses on demonstrating that the development will not cause adverse impacts to the surrounding environment, infrastructure, or public health. It evaluates sewage generation, treatment options.

The report is prepared in accordance with the Town Planning Board's (TPB) guidelines for rezoning applications, which require verification of infrastructure capacity, including sewerage, to ensure no overstrain on existing or planned systems. This sensitivity test simulates a conservative development scenario to confirm environmental acceptability.

The NTEH site location plan of the remaining areas of the proposed “R(B)14” zone are enclosed in **Appendix A**.

The rezoning application proposes the "R(B)14" zone for low-density residential development, primarily NTEHs, in a suburban area of Hong Kong's New Territories. The site is characterized by rural/suburban topography, with limited access to public sewerage infrastructure. Connection to the public system is deemed impractical due to challenges in maintenance, construction responsibilities, and site constraints, such as distance from terminal manholes and potential disruption to existing utilities.

For conservative consideration, the sewerage sensitivity analysis incorporated the scenario that the total design sewage flow from all proposed NTEH’s will be received by the public sewerage system.

2. Existing Sewerage Condition

2.1 Existing Sewerage

The sewerage record plans for the site have been retrieved from Drainage Services sewerage system is located underneath the Fung Yuen Road, which serves for the residents uphill and nearby. It is connected to the Tin Sam Sewage Pumping Station at the end of the Fung Yuen road. The sewerage record plans are enclosed in **Appendix B**.

			Fung Yuen Lo Tsuen A (A1)	***Fung Yuen Lo Tsuen B (A2)***	***Mak Uk (A3)***	***Tin Sam (C1)***	***Le Jardin (C2)***
No. of Flats			42	210	165	78	-
Occupant per Flats (2024 census)			2.6	2.6	2.6	2.6	-
Population	Residential		109	546	429	203	0
	Employee		0	0	0	0	10**
Unit Flow Factor (UFF)	Domestic	m^3/day/ person	0.150	0.150	0.270	0.270	-
	Commercial Employee	m^3/day/ employee	0.080	0.080	0.080	0.080	0.080
	Commercial Activities	m^3/day/ employee	0.200	0.200	0.200	0.200	0.200
Foul Water Flow (Q)	Domestic	m^3/s	0.000189	0.000948	0.001341	0.000634	-
	Commercial Employee	m^3/s	0.000000	0.000000	0.000000	0.000000	0.000009
	Commercial Activities*	m^3/s	0.000000	0.000000	0.000000	0.000000	0.000023
	Total	*m^3/s*	*0.000189*	*0.000948*	*0.001341*	*0.000634*	*0.000032*

Table 2.1 Assumed Populations and Average Foul Flow which catchment covers the existing developments within A1 + A2 + A3 + C1 + C2 to manhole FMH1005471

* J11 – Community, Social & Personal Services are assumed as commercial activities for existing residential A1 to C2 (refer to Table T-2 of "Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning")

**2000m^2/employee are assumed to manage Le Jardin

2.2 Capacity of Existing Sewerage System

The sewerage record plans for the site have been retrieved from Drainage Services. The sewerage record plans are enclosed in **Appendix B**.

From the DSD sewerage record plan, 200/225mm diameter pipe is located outside the NTEH development with a minimum 28m. It is anticipated that insufficient existing sewerage pipes are connecting from the NTEH development to public sewerage system. The hypothetical foul water flow from FMH1005858 to FMH1005427 are enclosed in **Appendix C**. The flowing capacity of pipe until Tin Sum Sewage Pumping Station is sufficient with hypothetical NTEH development.

2.3 Proposed Social Welfare Complex and Phase II Residential Tower

The Proposed Development in Social Welfare Complex and Phase II Residential Tower in application site is proposed to discharge to the public sewerage system. The proposed foul water flow is extracted from Sewerage Impact Assessment and enclosed in **Appendix C**.

The total foul water flow from Social Welfare Complex and Phase II Residential Tower are summarized as 0.000825m^3/s and 0.002226m^3/s.

3. Hypothetical Sewerage System

The proposed development in the remaining areas of "R(B)14" zone includes up to 12 NTEHs, in line with the attached plan. Each NTEH is assumed to accommodate up to three residential units, resulting in a total of 36 units. Based on standard occupancy rates for NTEHs (approximately 2.6 persons per unit), the anticipated population is 95 persons.

3.1 Scheme 1 – Hypothetical Sewerage Tank / Sewerage Treatment Plant

The site is located in a rural Hong Kong area, away from public sewerage networks managed by the DSD with a minimum 28m distance. It is not practical to construct the sewerage pipe through others lot boundary due to construction difficulties and maintenance responsibilities. NTEH developers are required to install private sewage disposal systems, such as septic tanks or package sewage treatment plants, to treat and dispose of effluent on-site or via licensed means, ensuring no direct discharge into public sewers or surrounding watercourses. The hypothetical sewerage works are shown in **Appendix C**.

3.2 Scheme 2 – Discharge to Public Sewerage

			New Territories Exempted Houses (NTEH)
No. of Flats			36
Occupant per Flats (2024 census)			2.6
Population	Residential		95
	Employee		0
Unit Flow Factor (UFF)	Domestic	m^3/day/ person	0.270
	Commercial Employee	m^3/day/ employee	0.080
	Commercial Activities	m^3/day/ employee	0.200
Foul Water Flow (Q)	Domestic	m^3/s	0.000297
	Commercial Employee	m^3/s	0.000000
	Commercial Activities*	m^3/s	0.000000
	Total	*m^3/s*	***0.000297***

Table 3.1 Assumed Populations and Average Foul Flow which catchment covers the existing developments within NTEH to manhole FMH1005471

	Catchment A (A1 + A2 + A3 + C1 + C2 + D + E + NTEH)
Calculated Total Average Flow (m3/s)	0.006493
Peaking Factor	6*
Total Peak Flow (m3/s)	0.038958

*Peaking Factor (including stormwater allowance) for facility with existing upstream sewerage is adopted

Table 2.2 Total Peak Flow Calculations from existing developments (Catchment A1 + A2 + A3 + C1 + C2 + D + E + NTEH) to manhole FMH1005471

The calculated peak sewerage flow from proposed development of NTEH is about 0.0017 m3/s. According to the sewerage record plan from DSD, there is no existing sewer for the proposed NTEH. It is recommended that an independently proposed sewerage system be provided to deliver flow to the existing sewerage system by the lot owner at his own cost and maintenance responsibilities. The hypothetical sewerage works and calculation are shown in **Appendix C**.

4. Conclusion

4.1 This sensitivity test demonstrates that the proposed 12 NTEHs in the "R(B)14" zone will not cause adverse sewerage impacts to the surroundings.

4.2 Two schemes are proposed for the hypothetical development.

4.3 NTEH owners might propose with private septic tanks or sewerage treatment plant, sewage will be fully managed on-site, complying with EPD/DSD standards and avoiding strain on public infrastructure. The low population density and rural setting further minimize risks.

4.4 NTEH owners might propose construction sewerage pipe through others lot boundary and discharged to public sewerage system in Fung Yuen Road. The proposed sewerage pipe should be carried by the owner at his own cost.

Appendix A

Potential NTEH Site Location Plan

Appendix B

Sewerage Record Plan (from DSD)

Appendix C

Hypothetical Sewerage Plan

Appendix A

Potential NTEH Site Location Plan

N

NBA

3m buffer from watercourse

Proposed "R(B)14" Zone

Mont Vert

FUNG YUEN ROAD

Proposed "REC" Zone

Proposed "R(B)13" Zone

LEGEND

- REZONING SITE
- LAND OWNED BY PROJECT PROPONENT
- THIRD-PARTY LOTS
- GRAVES/URNS
- EXISTING/COMMITED DEVELOPMENT
- POTENTIAL SITES FOR NTEH (ABOUT 3,000m²)
- INDICATIVE NTEH LOCATION

APPLICATION PREMISES BOUNDARY
FOR IDENTIFICATION PURPOSE ONLY

KTA PLANNING LIMITED
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POTENTIAL SITES FOR NTEH DEVELOPMENT WITHIN THE PROPOSED "R(B)14" ZONE

PROPOSED RESIDENTIAL DEVELOPMENT(S) WITH RETAIL, PUBLIC VEHICLE PARK AND SOCIAL WELFARE FACILITIES
VARIOUS LOTS IN D.D. 11 AND ADJOINING GOVERNMENT LAND, FUNG YUEN, TAI PO, NEW TERRITORIES

SCALE 1 : 2 000

PLAN 1

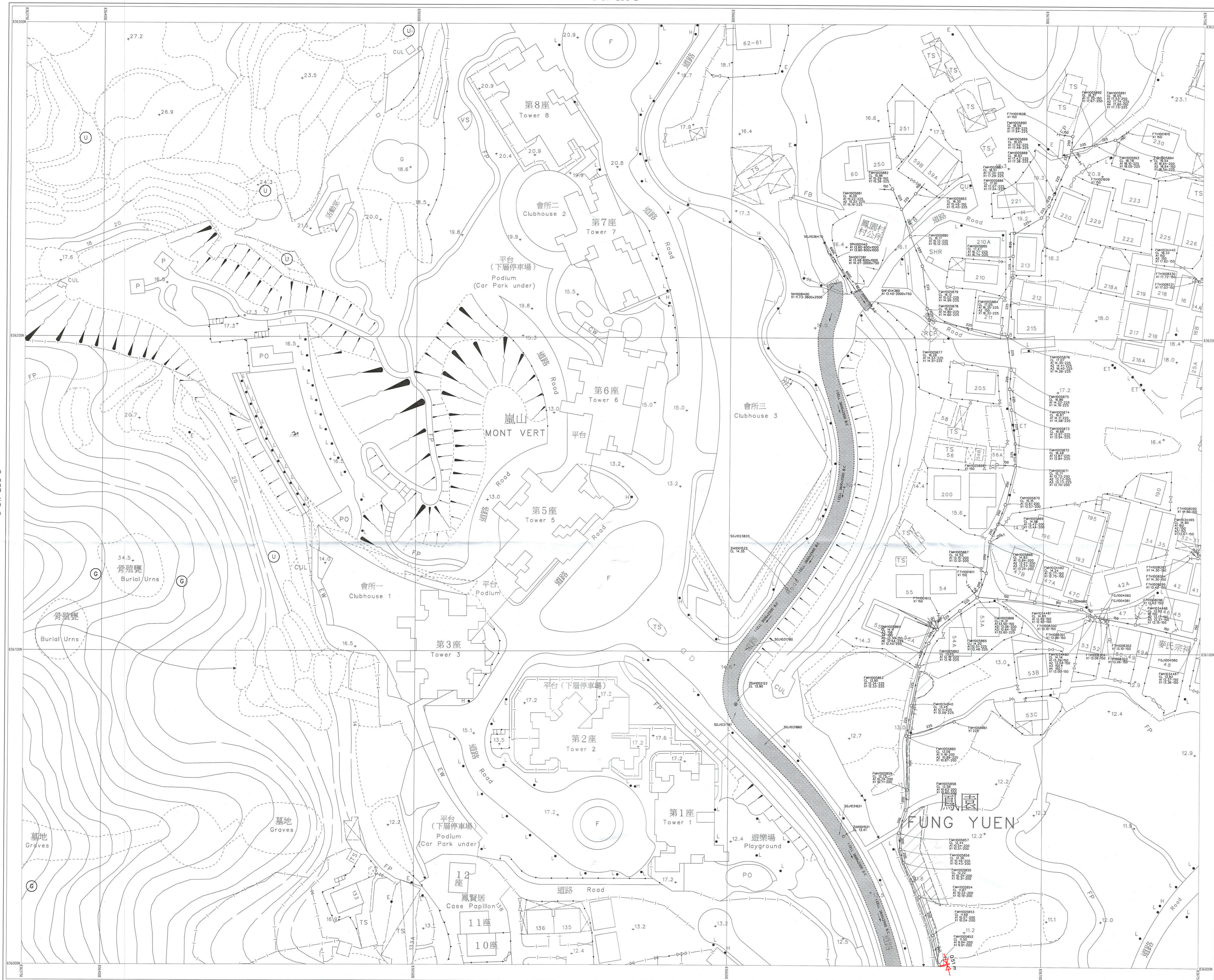
EXTRACT PLAN BASED ON
SURVEY SHEET No.
3-SW-25C & 25D, 7-NW-5A, 5B, 5C & 5D

DATE: 27.11.2025

Appendix B

Sewerage Record Plan (from DSD)

3-SW-25C-2



7-NW-5A-2

Please note that drainage information is now available in the GeoInfo Map services of the Lands Department (https://www.map.gov.hk/gm/?lg=en). Please refer to the Quick Reference Guide of the system for the operation.

For legend of drainage record plans, please refer to the following URL: (https://www.dsd.gov.hk/EN/Files/Legend_BW.pdf)

Metres | SCALE 1 : 500 | Metres

20 10 0 20 40 60 80 100

Mainland North Division
Drainage Services Department

Drainage Record Sheet Number

3-SW-25C-4

Last Updating : 1/4/2025

Map data renewed on January 2025

3 JUN 2025

流坑
LAU HANG

鳳園
FUNG YUEN

鳳美圍
FUNG MEI WAI

FUNG YUEN ROAD

田心
TIN SAM

金鳳台

9座 8座
7座 6座
5座
3座
2座 1座
鳳賢居
道路 Road
Ramp
Graves
Butte
28.19 m

7-NW-5A-1

7-NW-5B-1

Please note that drainage information is now available in the GeoInfo Map services of the Lands Department (https://www.map.gov.hk/gm/?lg=en). Please refer to the Quick Reference Guide of the system for the operation.

For legend of drainage record plans, please refer to the following URL: (https://www.dsd.gov.hk/EN/Files/Legend_BW.pdf)

7-NW-5A-4

Metres 20 10 0 40.08 m 20 40 60 80 100 Metres

SCALE 1 : 500

Mainland North Division
Drainage Services Department

Drainage Record Sheet Number

7-NW-5A-2

Last Updating : 1/4/2025

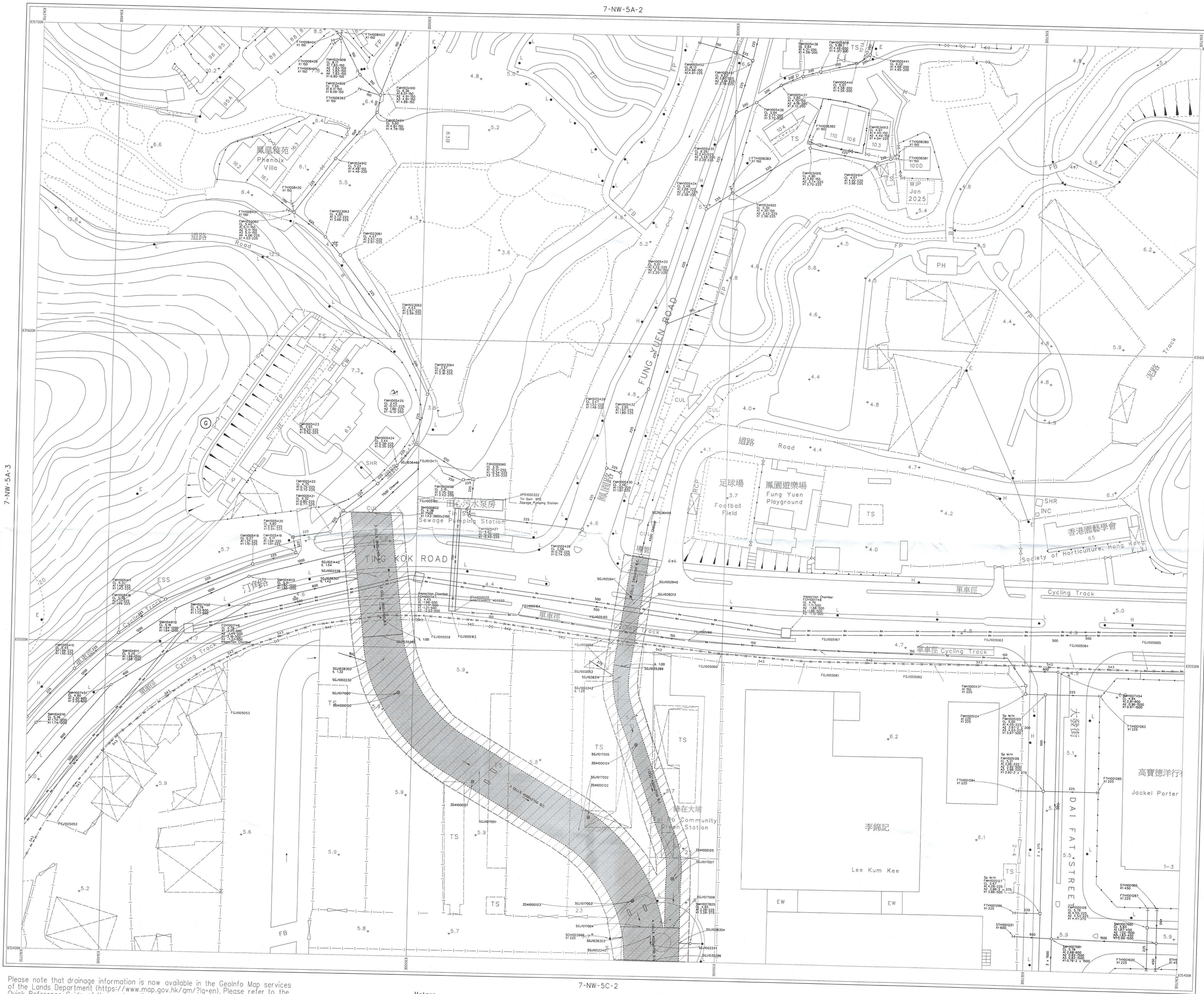
Map data renewed on January 2025

3 JUN 2025

7-NW-5A-2

7-NW-5A-3

7-NW-5B-3



Please note that drainage information is now available in the GeoInfo Map services of the Lands Department (https://www.map.gov.hk/gm/?lg=en). Please refer to the Quick Reference Guide of the system for the operation.

For legend of drainage record plans, please refer to the following URL: (https://www.dsd.gov.hk/EN/Files/Legend_BW.pdf)

7-NW-5C-2

Metres 20 10 0 20 40 60 80 Metres 100

SCALE 1 : 500

Mainland North Division
Drainage Services Department

Drainage Record Sheet Number

7-NW-5A-4

Last Updating : 1/4/2025

Map data renewed on January 2025

3 JUN 2025

Appendix C

Hypothetical Sewerage Plan

Foul Water Flow from Catchment D extracted from Sewerage Impact Assessment

discharge of the untreated raw sewage when there is plant failure before the storage capacity of the sewage treatment plant is exhausted during the maintenance period. It would be the same case for emergency situation such as power failure and plant breakdown. The lot owner will be responsible for the implementation and maintenance of the proposed STP.

3.2 G/IC zone

The proposed G/IC facilities has floor area of about 4,782 s.m. for the provision of a 150-place residential care home for the elderly cum a 30-place day care unit.

			Social Welfare Complex (D1)
No. of Flats			-
Occupant per Flats (2024 census)			-
Population	Residential		150
	Employee		110
Unit Flow Factor (UFF)	Domestic	m^3/day/ person	0.270
	Commercial Employee	m^3/day/ employee	0.080
	Commercial Activities	m^3/day/ employee	0.200
Foul Water Flow (Q)	Domestic	m^3/s	0.000469
	Commercial Employee	m^3/s	0.000102
	Commercial Activities	m^3/s	0.000255
	Total	*m^3/s*	*0.000825*
Peaking Factor (P)			6*
Peak Foul Water Flow (Qp)	*=Q x P*	m^3/s	*0.004951*

Table 3.6 Assumed Populations and Average Foul Flow which catchment covers the existing developments within D1 to manhole FMH1005429

**Peaking Factor (excluding stormwater allowance) for facility with new upstream sewerage is adopted*

The calculated peak sewerage flow from proposed development of Social Welfare Complex is about 0.0050 m3/s. According to the sewerage record plan from DSD, there is no existing sewer for the proposed Social Welfare Complex. It is recommended that an internal sewerage system be provided to deliver flow to the existing sewerage system at FMH1005429. The proposed sewerage works are shown in **Appendix F**. The calculation is attached in **Appendix G**.

The alignment of the proposed sewers connecting the proposed buildings and the proposed on-site treatment plant within the Development Site (Area (A) and (B)) are shown in **Appendix E** which will be subjected to detail design stage.

Foul Water Flow from Catchment E extracted from Sewerage Impact Assessment

3.3 Proposed Development in Area (A) Phase II

According to the Master Layout Plan in **Appendix B**, there will be 270 units in the proposed Phase II Residential Development while the estimated population is about 702. As it is a new upstream sewerage system in the proposed development, according to the Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning published by EPD, peaking factors (excluding stormwater allowance) has been used to assess and shown in the following table:

			Phase II Residential Tower (E)
No. of Flats			270
Occupant per Flats (2024 census)			2.6
Population	Residential		702
	Employee		10
Unit Flow Factor (UFF)	Domestic	m^3/day/ person	0.270
	Commercial Employee	m^3/day/ employee	0.080
	Commercial Activities	m^3/day/ employee	0.200
Foul Water Flow (Q)	Domestic	m^3/s	0.002194
	Commercial Employee	m^3/s	0.000009
	Commercial Activities	m^3/s	0.000023
	Total	*m^3/s*	0.002226
Peaking Factor (P)			6*
Peak Foul Water Flow (Qp)	*=Q x P*	m^3/s	*0.013357*

Table 3.7 Assumed Populations and Average Foul Flow which catchment covers the Area(A) Phase II residential developments to manhole FMH1005458

**Peaking Factor (excluding stormwater allowance) for facility with new upstream sewerage is adopted*

Assumptions:

1. Unit Flow Factor for Domestic Flows is taken as “Planning for Future Private R2”.
2. The population of employee is assumed to be 10 for each residential tower.

The calculated peak sewerage flow from the proposed Phase II residential tower is about 0.0134 m3/s. An existing sewerage system from nos. FTH1013660 to FWD1065306 are located within the Area(A) Phase II. The sewerage FTH1013660 to FWD1065306 will be demolished and an internal sewerage system will be proposed to deliver flow to the existing sewerage system at FMH1005458 during construction stage. The foul water flow will be discharge to the public sewerage system with no adverse impact. The abandoned pipe shall be removed or filled up to the satisfaction of DSD refer to DSD technical Circular No. 1/2022 – Handling of Abandoned Pipes under DSD’s Purview. The proposed sewerage works are shown in **Appendix F**. The calculation is attached in **Appendix G**. The alignment of the proposed sewers connecting the proposed buildings and the public sewerage system are shown in **Appendix E** which will be subjected to detail design stage.

Hypothetical Sewerage Plan
Scheme 1
(Sewerage Tank)

N

NBA

3m buffer from watercourse

Mont Vert

Proposed "R(B)14" Zone

Proposed "REC" Zone

Proposed "R(B)13" Zone

FUNG YUEN ROAD

鳳園 FUNG YUEN

LEGEND

- REZONING SITE
- LAND OWNED BY PROJECT PROPONENT
- THIRD-PARTY LOTS
- GRAVES/URNS
- EXISTING/COMMITED DEVELOPMENT
- POTENTIAL SITES FOR NTEH (ABOUT 3,000m²)
- INDICATIVE NTEH LOCATION
- EXISTING PUBLIC SEWERAGE ROUTE
- HYPOTHETICAL SEWERAGE TANK / SEWERAGE TREATMENT PLANT

APPLICATION PREMISES BOUNDARY
FOR IDENTIFICATION PURPOSE ONLY

KTA PLANNING LIMITED
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POTENTIAL SITES FOR NTEH DEVELOPMENT WITHIN THE PROPOSED "R(B)14" ZONE

PROPOSED RESIDENTIAL DEVELOPMENT(S) WITH RETAIL, PUBLIC VEHICLE PARK AND SOCIAL WELFARE FACILITIES
VARIOUS LOTS IN D.D. 11 AND ADJOINING GOVERNMENT LAND, FUNG YUEN, TAI PO, NEW TERRITORIES

SCALE 1 : 2 000

PLAN 1

EXTRACT PLAN BASED ON
SURVEY SHEET No.
3-SW-25C & 25D, 7-NW-5A, 5B, 5C & 5D

DATE: 3.9.2025

Hypothetical Sewerage Plan
Scheme 2
(To Public Sewerage)

Fung Yuen
Lo Tsuen A
(A1)

Fung Yuen
Lo Tsuen B
(A2)

Mak Uk
(A3)

Sewerage Discharge
From Upstream
Catchment Area A

FMH1005858
A1 10.63-200
X1 10.60-200

FMH1005857
A1 10.54-200
X1 10.51-200

FMH1005856
A1 10.46-200
X1 10.43-200

FMH1005855
A1 10.34-200
X1 10.31-200

FMH1005854
A1 10.22-200
X1 10.19-200

FMH1005853
A1 10.07-200
X1 10.04-200

FMH1005852
A1 9.94-200
X1 9.91-200

FMH1005471
A1 9.81-200
X1 9.78-200

Sewerage Discharge
To Downstream

FUNG YUEN LO TSUEN
鳳園老村
FUNG YUEN
鳳園
LE JARDIN
芊色花園
MAK UK
麥屋
FUNG YUEN ROAD
Clubhouse 3
會所三
Tower 1
第1座
Playground
遊樂場
Burial Urns
骨灰龕
Road
道路
PO
CUL
FP
TS
SHR
RCP
INC
CW
TSZ
WIP
May
2022

Hypothetical Sewerage Plan
Scheme 2
(To Public Sewerage)

Commercial Complex (B2)

Phase I Residential Towers (B1)

Phase II Residential Towers (E)

Swimming Pool (B3)

Social Welfare Complex (D)

Tin Sam (C1)

Le Jardin (C2)

Sewerage Discharge From Upstream

FMH1005471
A1 9.81-200
X1 9.78-200

FMH1005470
A1 9.70-200
X1 9.67-200

FMH1005469
A1 9.60-200
X1 9.57-200

FMH1005468
A1 9.46-200
X1 9.41-200

FMH1005467
A1 9.38-200
X1 9.35-200

FMH1005466
A1 9.22-200
X1 9.19-200

FMH1005465
A1 9.14-200
X1 9.11-200

FMH1005464
A1 8.81-200
X1 8.78-225

FMH1005463
A1 8.53-225
X1 8.50-225

FMH1005462
A1 8.24-225
X1 8.21-225

FMH1005461
A1 7.61-225
X1 7.58-225

FMH1005460

Sewerage Discharge From Catchment E

FMH1005458
A1 6.01-225
X1 5.98-225

FMH1005457

FMH1005456

FMH1005455
A1 5.09-225
X1 5.00-225

FMH1005454
A1 4.62-225
X1 4.57-225

FMH1005453
A1 4.34-225
X1 4.29-225

FMH1005452

FMH1005451
A1 3.81-225
X1 3.76-225

FMH1005450

Sewerage Discharge From Catchment C

FMH1005434
A1 2.68-225
X1 2.58-225

FMH1005433
A1 2.22-225
X1 2.20-225

FMH1005432
A1 1.93-225
X1 1.89-225

Sewerage Discharge From Catchment D

FMH1005429
A1 1.53-225
X1 1.48-225

FMH1005430
A1 1.65-225
X1 1.61-225

Sewerage Discharge To Tin Sam Sewage Pumping Station

FMH1005428
A1 0.79-225
X1 0.74-225

FMH1005427
A1 -0.35-225
X1 -0.40-225

鳳園 FUNG YUEN

鳳美園 FUNG MEI WAI

芊色花園 LE JARDIN

TING KOK ROAD

Fung Yuen Playground

Football Field

Society of Horticulture, Hong Kong

Cycling Track

P2319 Fung Yuen

Rev date: 3/3/2026

Sewerage Drainage Design

Hypotheical Sewerage Scheme

Catchment Label		*Proposed Area A Phase II (Area E)*	*Proposed Social Welfare Complex (Area D)*	*Fuen Yuen Lo Tsuen A + Fuen Yuen Lo Tsuen B + Mak Uk (Area A)*	*Tin Sum + Le Jardin (Area C)*	*Sewage Treatment Plant (Area B)*	*Hypothetical NTEH*								
Peak Foul Water Flow (m^3/s)		0.0134	0.0050	0.0149	0.0040	0.0455	0.0003								

From Sewerage Manual Part 1, Third Edition, May 2013:

Colebrook-White Equation for circular pipes flowing full.

Velocity, V = $-\sqrt{(8gDs)}\log\left(\frac{ks}{3.7D}+\frac{2.51v}{D\sqrt{(2gDs)}}\right)$

Capacity, Q = $V \times \pi \times D^2 / 4$

Assumptions:

Kinematic Viscosity of fluid, v =	0.00000114	m^2/s	(For Sewerage)
Hydraulic Pipeline Roughness, ks	3	mm	(for slimed sewers - clayware in poor condition; Table 5, Sewerage Manual Part 1, Third Edition, May 2013)
Kinematic Viscosity of fluid, v =	0.000001	m^2/s	(For Treated Sewerage)
Hydraulic Pipeline Roughness, ks	0.6	mm	(Concrete (Precast Concrete Pipes with 'O' Ring Joints in poor condition))

From Manhole	*To Manhole*	*Diameter, D (m)*	*Cross-section (m^2)*	*Wetted Perimeter (m)*	*Length (m)*	*Inlet Invert*	*Outlet Invert*	*Slope, s*	*Hydraulic Radius (m)*	*Viscosity, v (m^2/s)*	*Roughness, ks (m)*	*Velocity, V (m/s)*	*Capacity, Q (m^3/s)*	*Estimated FLow, F (m^3/s)*	*Ref. Area*	*% of Capacity*
Fuen Yuen Lo Tsuen A + Fuen Yuen Lo Tsuen B + Mak Uk + Tin Sum + Le Jardin + Hypothetical NTEH																
FMH1005858	FMH1005857	0.200	0.031	0.628	8	10.60	10.54	0.008	0.050	0.00000114	0.003	0.82	0.0257	0.0152	Area A + NTEH	59.0%
FMH1005857	FMH1005856	0.200	0.031	0.628	5.9	10.51	10.46	0.008	0.050	0.00000114	0.003	0.87	0.0273	0.0152	Area A + NTEH	55.5%
FMH1005856	FMH1005855	0.200	0.031	0.628	4.1	10.43	10.34	0.022	0.050	0.00000114	0.003	1.40	0.0440	0.0152	Area A + NTEH	34.4%
FMH1005855	FMH1005854	0.200	0.031	0.628	12.8	10.31	10.22	0.007	0.050	0.00000114	0.003	0.79	0.0249	0.0152	Area A + NTEH	61.0%
FMH1005854	FMH1005853	0.200	0.031	0.628	10.40	10.19	10.07	0.012	0.050	0.00000114	0.003	1.01	0.0319	0.0152	Area A + NTEH	47.6%
FMH1005853	FMH1005852	0.200	0.031	0.628	5.0	10.04	9.94	0.020	0.050	0.00000114	0.003	1.34	0.0420	0.0152	Area A + NTEH	36.1%
FMH1005852	FMH1005471	0.200	0.031	0.628	19.70	9.91	9.81	0.005	0.050	0.00000114	0.003	0.67	0.0211	0.0152	Area A + NTEH	71.8%
FMH1005471	FMH1005470	0.200	0.031	0.628	7.10	9.78	9.70	0.011	0.050	0.00000114	0.003	1.00	0.0315	0.0152	Area A + NTEH	48.1%
FMH1005470	FMH1005469	0.200	0.031	0.628	7.10	9.67	9.60	0.010	0.050	0.00000114	0.003	0.94	0.0295	0.0152	Area A + NTEH	51.5%
FMH1005469	FMH1005468	0.200	0.031	0.628	7.60	9.57	9.46	0.014	0.050	0.00000114	0.003	1.14	0.0357	0.0152	Area A + NTEH	42.4%
FMH1005468	FMH1005467	0.200	0.031	0.628	5.50	9.41	9.38	0.005	0.050	0.00000114	0.003	0.70	0.0219	0.0152	Area A + NTEH	69.3%
FMH1005467	FMH1005466	0.200	0.031	0.628	14.40	9.35	9.22	0.009	0.050	0.00000114	0.003	0.90	0.0282	0.0152	Area A + NTEH	53.8%
FMH1005466	FMH1005465	0.200	0.031	0.628	10.00	9.19	9.14	0.005	0.050	0.00000114	0.003	0.67	0.0210	0.0152	Area A + NTEH	72.4%
FMH1005465	FMH1005464	0.200	0.031	0.628	29.40	9.11	8.81	0.010	0.050	0.00000114	0.003	0.95	0.0300	0.0152	Area A + NTEH	50.6%
FMH1005464	FMH1005463	0.225	0.040	0.707	16.80	8.78	8.53	0.015	0.056	0.00000114	0.003	1.25	0.0497	0.0152	Area A + NTEH	30.5%
FMH1005463	FMH1005462	0.225	0.040	0.707	33.60	8.50	8.24	0.008	0.056	0.00000114	0.003	0.90	0.0358	0.0152	Area A + NTEH	42.4%
FMH1005462	FMH1005461	0.225	0.040	0.707	18.50	8.21	7.97	0.013	0.056	0.00000114	0.003	1.17	0.0464	0.0152	Area A + NTEH	32.7%
FMH1005461	FMH1005460	0.225	0.040	0.707	29.80	7.94	7.61	0.011	0.056	0.00000114	0.003	1.08	0.0428	0.0152	Area A + NTEH	35.4%
FMH1005460	FMH1005459	0.225	0.040	0.707	20.00	7.58	6.85	0.037	0.056	0.00000114	0.003	1.96	0.0779	0.0152	Area A + NTEH	19.5%
FMH1005459	FMH1005458	0.225	0.040	0.707	39.20	6.82	6.01	0.021	0.056	0.00000114	0.003	1.47	0.0586	0.0152	Area A + NTEH	25.9%
FMH1005458	FMH1005455	0.225	0.040	0.707	32.70	5.98	5.09	0.027	0.056	0.00000114	0.003	1.69	0.0672	0.0285	Area A + NTEH + Area E	42.4%
FMH1005455	FMH1005454	0.225	0.040	0.707	16.70	5.00	4.62	0.023	0.056	0.00000114	0.003	1.55	0.0615	0.0285	Area A + NTEH + Area E	46.4%
FMH1005454	FMH1005453	0.225	0.040	0.707	13.30	4.57	4.34	0.017	0.056	0.00000114	0.003	1.35	0.0536	0.0285	Area A + NTEH + Area E	53.2%
FMH1005453	FMH1005451	0.225	0.040	0.707	12.30	4.29	3.81	0.039	0.056	0.00000114	0.003	2.03	0.0805	0.0285	Area A + NTEH + Area E	35.4%
FMH1005451	FMH1005435	0.225	0.040	0.707	17.25	3.76	3.40	0.021	0.056	0.00000114	0.003	1.48	0.0589	0.0285	Area A + NTEH + Area E	48.5%
FMH1005435	FMH1005434	0.225	0.040	0.707	31.40	3.35	2.68	0.021	0.056	0.00000114	0.003	1.50	0.0595	0.0325	Area A + Area C + NTEH + Area E	54.6%
FMH1005434	FMH1005433	0.225	0.040	0.707	38.50	2.58	2.22	0.009	0.056	0.00000114	0.003	0.99	0.0394	0.0325	Area A + Area C + NTEH + Area E	82.6%
FMH1005433	FMH1005432	0.225	0.040	0.707	23.80	2.20	1.93	0.011	0.056	0.00000114	0.003	1.09	0.0434	0.0325	Area A + Area C + NTEH + Area E	75.0%
FMH1005432	FMH1005430	0.225	0.040	0.707	28.30	1.89	1.65	0.008	0.056	0.00000114	0.003	0.94	0.0375	0.0325	Area A + Area C + NTEH + Area E	86.8%
FMH1005430	FMH1005429	0.225	0.040	0.707	5.00	1.61	1.53	0.016	0.056	0.00000114	0.003	1.30	0.0515	0.0325	Area A + Area C + NTEH + Area E	63.1%
FMH1005429	FMH1005428	0.225	0.040	0.707	19.90	1.48	0.79	0.035	0.056	0.00000114	0.003	1.91	0.0759	0.0375	Area A + Area C + NTEH + Area D + Area E	49.4%
FMH1005428	FMH1005427	0.225	0.040	0.707	37.00	0.74	-0.35	0.029	0.056	0.00000114	0.003	1.76	0.0699	0.0375	Area A + Area C + NTEH + Area D + Area E	53.6%
Proposed Area A Phase II to Main																
Terminal manhole 3	FMH1005458	0.225	0.040	0.707	11	6.06	6.01	0.005	0.056	0.00000114	0.003	0.69	0.0274	0.0134	Area E	48.7%
Proposed Area D to Main																
Terminal manhole 2	FMH1005429	0.225	0.040	0.707	12	2.00	1.53	0.039	0.056	0.00000114	0.003	2.03	0.0807	0.0050	Area D	6.1%
STP to Streamcourse*																
Sewage Treatment Plant	Streamcourse	0.225	0.040	0.707	13	7.50	7.10	0.03	0.056	0.000001	0.0006	2.30	0.0916	0.0455	STP	49.6%

**Terminal manhole to public sewerage for the proposed development is indiciative

*Sewerage shall be treated by Sewage Treatment Plant to improve effluent quality before discharging to the streamcourse with no adverse impact

Appendix 4

Water Supply Sensitivity Analysis

1 Sensitivity Analysis of Potential Development on Third Party Lots in R(B)14 Zone – Water Supply

1.1 Background

1.1.1 As per the comments of Planning Department on the Planning Application of the proposed development at Fung Yuen, Tai Po (the Development), this sensitivity analysis aims to demonstrate that the existing water supply system is technical feasible to support the hypothetical scenario, which consists of both the potential New Territories Exempted Houses (NTEH) development on third party lots in the proposed R(B)14 zone with the presence of the Development in R(B)13 zone. The location of the R(B)13 and R(B)14 zones is shown in **Figure 1**.

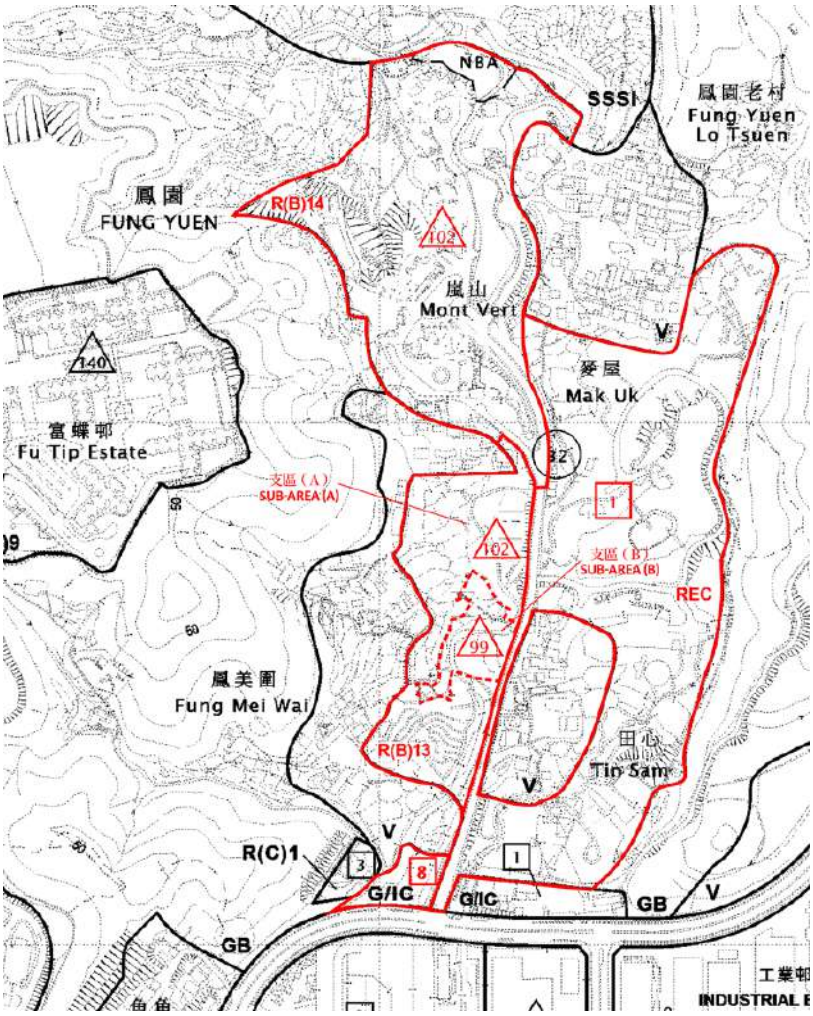


Figure 1 Location plan

1.2 Estimated Water Demand from the Development (R(B)13 and G/IC)

1.2.1 With reference to the WSIA, the Development in R(B)13 zone will include the residential development with supporting retail and public vehicle park facilities in sub-area (A) of proposed amendment to the OZP (named as Area (A) Phase I in WSIA); residential development in sub-area (B) (named as Area (A) Phase II in WSIA). The Development also consists of a Social Welfare Complex (SWC) in the G/IC site (named as Area (B) in WSIA). The water demands for the Development were estimated under the WSIA and the information is extracted and given in **Table 1.1** and **Table 1.2** below:-

Table 1.1: Water demand for the Development in R(B)13 zone

Development Type	Population (nos.)	Unit	Fresh Water Demand	Flushing Water Demand	Total Mean Fresh Water Demand (m^3/d)	Total Mean Flushing Water Demand (m^3/d)
Area (A) Phase I (sub-area (A) in proposed amendment of OZP)						
Residential Use (R2)	4,467	$m^3/h/d$	0.30	0.07	1,340.10	312.69
Service Trade (Residential)	4,467	$m^3/h/d$	0.05	-	223.35	-
Staff for Commerce (Service Trade – Type J4)	28	$m^3/h/d$	0.35	0.07	9.80	1.96
Landscaping	-	-	-	-	63.76	-
				Sub-Total =	1,637.01 (say 1,638)	314.65 (say 315)
Area (A) Phase II (sub-area (B) in proposed amendment of OZP)						
Residential Use (R2)	702	$m^3/h/d$	0.30	0.07	210.60	49.14
Service Trade (Residential)	702	$m^3/h/d$	0.05	-	35.10	-
Landscaping	-	-	-	-	12.69	-
				Sub-Total =	258.39 (say 259)	49.14 (say 50)
				Total =	1895.4	363.79

Table 1.2: Water demand estimation for the Social Welfare Complex in G/IC

Development Type	Population (nos.)	Unit	Fresh Water Demand	Flushing Water Demand	Total Mean Fresh Water Demand (m^3/d)	Total Mean Flushing Water Demand (m^3/d)
Area (B) (proposed amendment of G/IC in OZP)						
Residential Use (R2)	150	$m^3/h/d$	0.24	0.07	36.00	10.50
Staff (Service Trade – Type J11)	110	$m^3/h/d$	0.35	0.07	38.50	7.70
				Total =	74.50 (say 75)	18.20 (say 19)

1.3 Estimated Water Demand from the Potential NTEH Development on Third Party Lots in R(B) 14 Zone

1.3.1 There is about 3,000m^2 remaining potential area for the potential NTEH development in R(B)14 zone. It is estimated that the maximum no. of NTEH in that potential area is 12 houses and the estimated population is 95 persons with the assumption of 3 units per NTEH. The potential site for NTEH development within the proposed R(B)14 zone is enclosed in **Figure 2**.

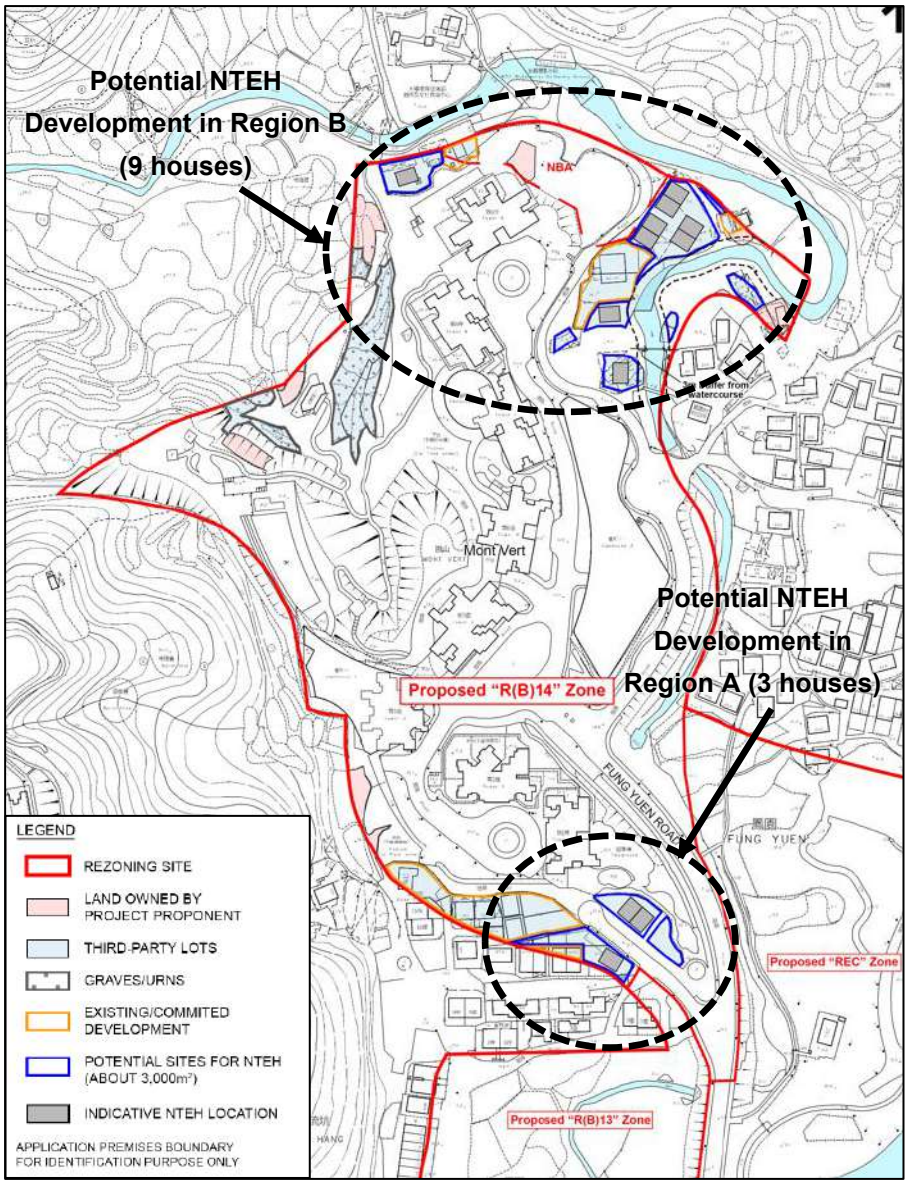


Figure 2 Potential site for NTEH development within the proposed R(B) 14 zone

1.3.2 The unit demands used in estimating the fresh water and flushing water consumption for the potential NTEH development in R(B)14 zone are presented in **Table 1.3**. The unit demands for village type development are based on unit water demand in Water Supplies Department Departmental Instruction (WSD DI) 1309.

Table 1.3: Unit demand for the potential NTEH development in remaining area in R(B)14 zone

Development Type	Unit	Fresh Water Demand	Flushing Water Demand
Village Type Development - Modern Type	$m^3/h/d$	0.23	0.07

Remarks:-

i. The unit water demand has been making reference to the domestic unit flow factor for Village Type Development - Redevelopment/ Modern Type under Table 1 of WSD's DI 1309.

1.3.3 Based on the unit water demand and the estimated population for the potential NTEH development in Region A and Region B, the total mean daily fresh water and flushing water demands for the potential NTEH development are approximately 22 m^3/day and 7 m^3/day. The details of the water demand estimation for the potential NTEH development are shown in **Table 1.4**.

Table 1.4: Water demand estimation for the Potential NTEH Development in R(B)14 zone

Development Type	Population (nos.)	Unit	Fresh Water Demand	Flushing Water Demand	Total Mean Fresh Water Demand (m^3/d)	Total Mean Flushing Water Demand (m^3/d)
Potential NTEH Development in Region A						
Village Type Development - Modern Type	24	m^3/head/d	0.23	0.07	5.52	1.68
Potential NTEH Development in Region B						
Village Type Development - Modern Type	71	m^3/head/d	0.23	0.07	16.33	4.97
				Total =	21.85 (Say 22)	6.65 (Say 7)

Remark:-

i. It is assumed 3 units per NTEH and the domestic household size is 2.6 according to latest statistics from Census and Statistics Department.
ii. There are 3 nos. and 9 nos. of house in Region A and B, thus, the population at Region A and B is 24 and 71.

1.3.4 As the existing DN150 salt water mains along Fung Yuen Road ends near the entrance of Mont Vert, salt water can only be supplied to the potential NTEH development in Region A. For the potential NTEH development in Region B, it is assumed the flushing water will be provided by the existing DN200 fresh water main along Fung Yuen Road as there are no existing salt water mains at its adjacency.

1.4 Water Supply Impact Assessment for Potential NTEH Development in R(B)14 Zone

Checking of Residual Pressures for Existing Fresh Water Supply Main

1.4.1 For assessing the impact to the existing DN600-DN200 fresh watermains, a few control points (namely Control Points A to F as shown in **Appendix A**), have been established for assessing the residual pressures of the fresh watermain with the potential NTEH development and the proposed Development. As a conservative approach, the fresh water demands for the potential NTEH development in Regions A and B and the flushing water demand for the potential NTEH development in Region B are assumed at the end points of the existing fresh water mains.

1.4.2 Based on the hydraulic calculation results shown in **Table 1.5**, with details given in **Appendix A**, the residual head under hypothetical scenario the is well within the requirement of 20 m according to Handbook on Plumbing Installation for Buildings. The residual heads under hypothetical scenario range from 63.09 m to 28.07 m. Thus, it is considered that there is no insurmountable impact arising from the potential NTEH development to the existing fresh water supply system with the presence of the Development.

Table 1.5: Summary of residual head of fresh water along the existing distribution main under hypothetical scenario

Control Point	Approx. Existing Ground Level (mPD)	Residual Head of the Existing Water Distribution Main under Proposed Condition (m)
Control Point A	4.76	63.08
Control Point B	4.57	61.45
Control Point C #	4.49	59.39
Control Point C1 *	5.43	56.16
Control Point C2 ^	7.57	52.20
Control Point D	14.38	40.76
Control Point E	16.65	36.08
Control Point F@	20.67	28.07

Remark:

(i) # The control point for the proposed fresh water supply connection point to the Social Welfare Complex

(ii) * The control point for the proposed fresh water supply connection point to the residential development of Area (A) Phase I

(iii) ^ The control point for the proposed fresh water supply connection point to the residential development of Area (A) Phase II

(iv) @ As a conservative approach, the water demands to the potential NTEH development in Region A and B are assumed at the end points of the existing fresh water mains.

Checking of Residual Pressures for Existing Salt Water for Flushing Water Supply System

1.4.3 Similar to fresh water supply system, for assessing the impact to the existing DN450-DN150 salt watermain, a few control points (namely Control Point 1 to 4 as shown in **Appendix A**) have been established for comparing the residual pressures of the salt water main with the potential NTEH development and the proposed Development. As a

conservative approach, the flushing water for the potential NTEH development in Region A is assumed at the end points of the existing salt water mains.

1.4.4 Based on the hydraulic calculation results summarised in **Table 1.6**, with details provided in **Appendix A**, the residual head is well within the requirement of 15 m according to Handbook on Plumbing Installation for Buildings. Thus, it is considered that there is no insurmountable impact arising from the Development to the existing salt water supply system.

Table 1.6: Summary of residual head of salt water along the existing distribution main under hypothetical scenario

Control Point	Approx. Existing Ground Level (mPD)	Residual Head of the Existing Water Distribution Main under Proposed Condition (m)
Control Point 1	4.35	72.26
Control Point 2	4.58	65.41
Control Point 2.1 #	4.59	61.80
Control Point 3 *	5.39	56.18
Control Point 3.1 ^	7.22	48.57
Control Point 4	13.41	31.20

Remark:

(i) # The control point for the proposed water supply connection point to the Social Welfare Complex

(ii) * The control point for the proposed water supply connection point to the residential development of Area (A) Phase I

(iii) ^ The control point for the proposed water supply connection point to the residential development of Area (A) Phase II

(iv) @ As a conservative approach, the flushing water for the potential NTEH development in Region A are assumed at the end points of the existing salt water mains.

1.5 Conclusion

1.5.1 As per the comments of Planning Department, this sensitivity analysis aims to demonstrate that the existing water supply system is technical feasible to support the hypothetical scenario with the potential New Territories Exempted Houses (NTEH) development on third party lots in the proposed R(B)14 zone with the presence of the proposed development at Fung Yuen, Tai Po (the Development) in R(B)13 zone.

1.5.2 Based on the unit water demand and the estimated population, the mean daily fresh water and flushing water demands for the Potential NTEH Development in R(B)14 zone are approximately 22 m^3/day and 7 m^3/day. As the existing DN150 salt water mains along Fung Yuen Road ends near the entrance of Mont Vert, salt water can only be supplied to the potential NTEH development in Region A. For the potential NTEH development in Region B, it is assumed the flushing water will be provided by the existing DN200 fresh water main along Fung Yuen Road as there are no existing salt water mains at its adjacency.

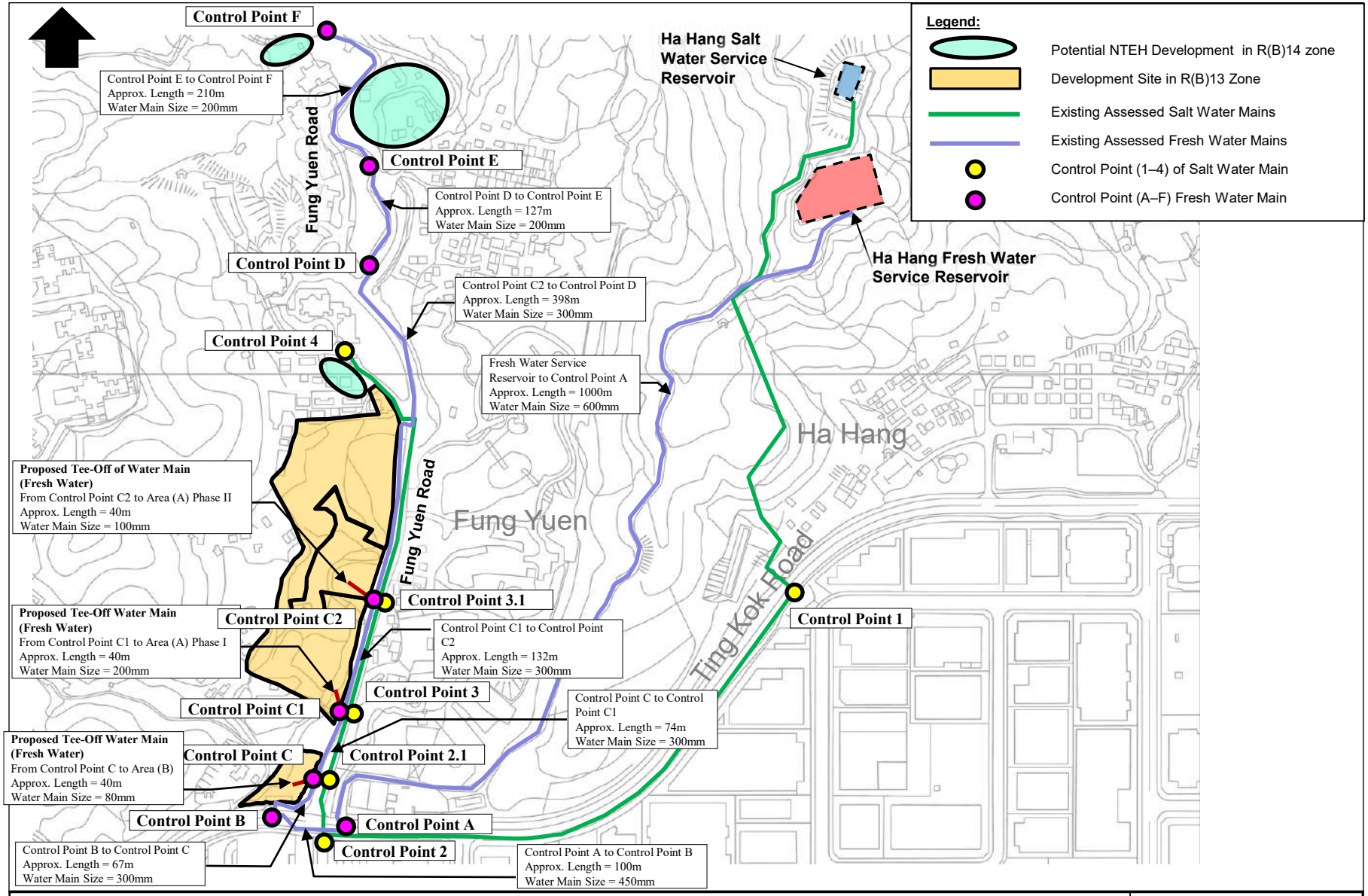
1.5.3 Based on the hydraulic calculation, residual heads under hypothetical scenario, which included the potential NTEH development in R(B)14 zone and the Development in R(B)13 zone and G/IC, as well as the potential NTEH development, are estimated. The residual heads for the fresh water supply system under hypothetical scenario range from 63.08 m to 28.07 m. For the salt water supply system, the residual heads under

hypothetical scenario range from 72.26 m to 31.12m. The residual heads under hypothetical scenario are well within residual head requirement of 20 m and 15 m for water supply system.

1.5.4 Based on the assessment findings, it is considered that there is no insurmountable impact from the additional water demand from the potential NTEH development in R(B)14 zone on the existing water supply system with the presence of the Development in R(B)13 zone and G/IC.

Appendix A

Residual Head Calculation for Fresh and Flushing Water Mains



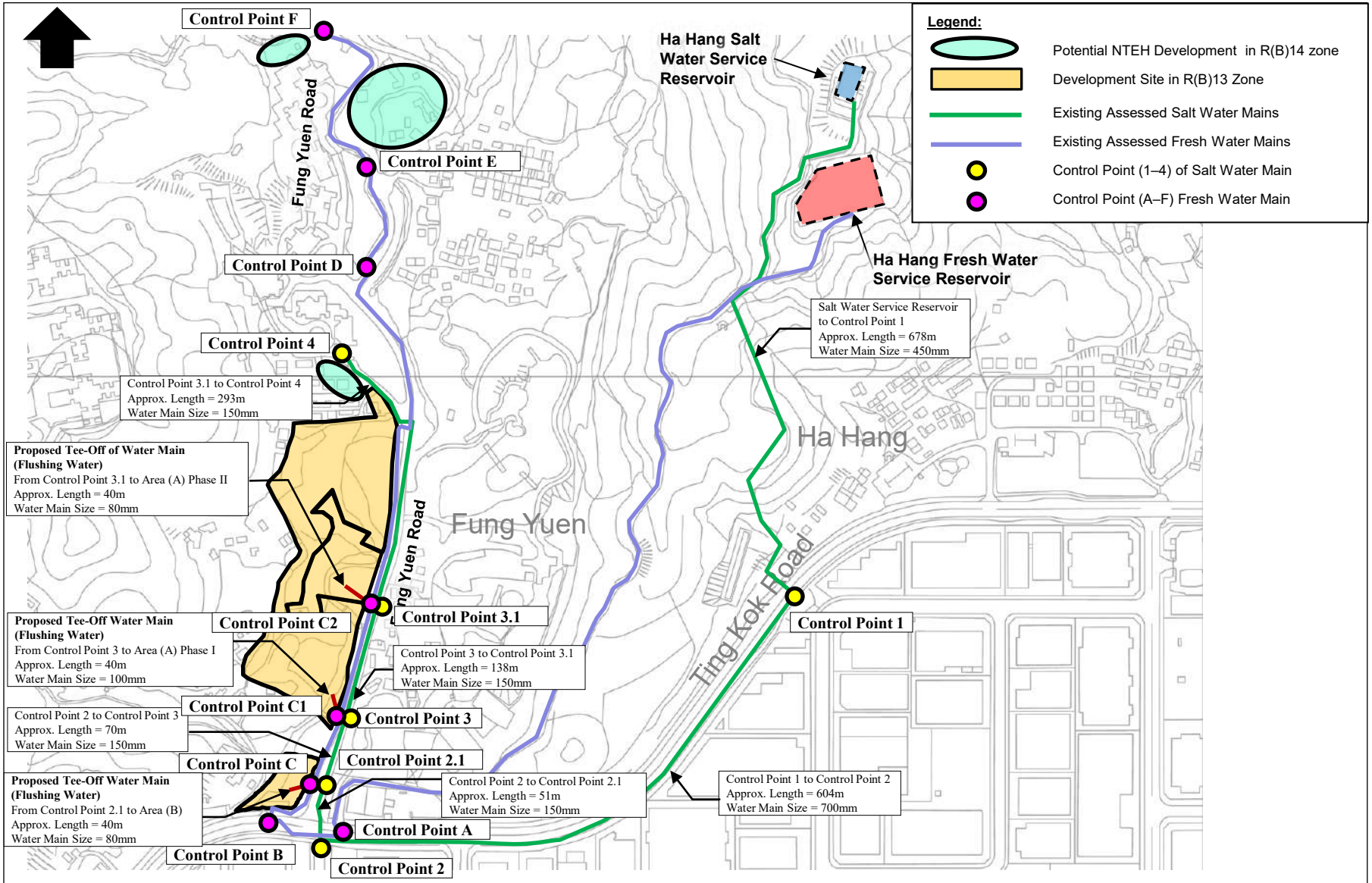
Project Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories

MOTT MACDONALD

Title Layout Plan for Hydraulic Calculation of Residual Head (Fresh Water Main)

Figure A

Date	Scale	File
Oct 2025	N.T.S.	



Project Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories

MOTT MACDONALD

Title Layout Plan for Hydraulic Calculation of Residual Head (Salt Water Mains)

Figure B

Date	Scale	File
Oct 2025	N.T.S.	

Summary table of the residual head at control points

Residual Head (m)			
Fresh Water		**Flushing Water**	
Control Point	**Hypothetical Scenario**	**Contraol Point**	**Hypothetical Scenario**
Control Point A	63.08	Control Point 1	72.26
Control Point B	61.45	Control Point 2	65.41
Control Point C #	59.39	Control Point 2.1 #	61.79
Control Point C 1 *	56.16	Control Point 3 *	56.15
Control Point C 2 ^	52.20	Control Point 3.1 ^	48.53
Control Point D	40.76	Control Point 4@	31.12
Control Point E	36.08		
Control Point F@	28.07		

Remark:
The control point for the proposed water supply connection point to the Social Welfare Complex in Area (B)
* The control point for the proposed water supply connection point to the residential development of Area (A) Phase I
^ The control point for the proposed water supply connection point to the residential development of Area (A) Phase II
@ As a conservative approach, water demand for the potential NTEH development in Region A & B are assumed at the end points of the existing fresh water and salt water mains.

Part 1 - Hydraulic Calculation for Fresh Water Supply System

Design Criteria and Assumption for Fresh Water Supply System

1. Basic Information

Existing Control Point along the Existing Fresh Water Mains from Ha Hang FWSR to DN200 FW Main

Control Point ID	Control Point A	Control Point B	Control Point C	Control Point C1	Control Point C2	Control Point D	Control Point E	Control Point F
Approx. Ground Level (mPD)	4.76	4.57	4.49	5.43	7.57	14.38	16.65	20.67

Note:

1. The locations of Control Point refer to **Figure A.**

Existing Pipe Segment along the Existing Fresh Water Mains from Ha Hang FWSR to DN200 FW Main

Segment Location	from Reservoir to Control Point A	from Control Point A to Control Point B	from Control Point B to Control Point C	from Control Point C to Control Point C1	from Control Point C1 to Control Point C2	from Control Point C2 to Control Point D	from Control Point D to Control Point E	from Control Point E to Control Point F
Approx. Segment Length (m)	1000	100	67	74	132	398	127	210
Size (mm)	600	450	300	300	300	300	200	200
Internal Pipe Diameter (mm)	586	424	282	282	282	282	189	189
Cross Section Area (m2)	0.2697	0.1412	0.0625	0.0625	0.0625	0.0625	0.0281	0.0281

Note:

1. The locations of pipe segment refer to **Figure A**.
2. The internal pipe diameter is from Table 1 of WSD's Guidelines for Hydraulic Modeling

2. Water Main Velocity Assumption

a. With referance to WSD's Guidelines for Hydraulic Modeling, the existing peak velocity along the existing water main is assumed as below;

Segment Location	from Reservoir to Control Point A	from Control Point A to Control Point B	from Control Point B to Control Point C	from Control Point C to Control Point C1	from Control Point C1 to Control Point C2	from Control Point C2 to Control Point D	from Control Point D to Control Point E	from Control Point E to Control Point F
Existing Peak Velocity (m/s)	2.5	2.0	1.5	1.5	1.5	1.5	1.5	1.5

3. Headloss Assumption

a. Hazen-Williams equation is adopted in the hydraulic calculation;
b. Hazen-Williams Coefficient, C, is adopted as 110 for water main size < 600mm and 120 for water main size >= 600mm according to WSD's Guidelines for Hydraulic Modeling;
c. Minor headloss is assumed to be eqaul to 10% of friction headloss.

4. Water Main Network Assumption

a. 1.5 m cover from the ground level is assumed for the water mains.

Approx. Soffit Level for Control Points

Control Point ID	Control Point A	Control Point B	Control Point C	Control Point C1	Control Point C2	Control Point D	Control Point E	Control Point F
Approx. Ground Level (mPD)	4.76	4.57	4.49	5.43	7.57	14.38	16.65	20.67
Approx. Soffit Level (mPD)	3.26	3.07	2.99	3.93	6.07	12.88	15.15	19.17

b. According to WSD comments, the invert level and top Water Head Level of Ha Hang Fresh water Service Reservoir are 76.200mPD and 82.075mPD.
Hence, it is assumed that in the design the water level at the service reservoir is at half full which will be (76.200 mPD + 82.075 mPD) / 2 = 79.138 mPD

Part 1. Residual Head of Fresh Water Main Under Hypothetical Scenario with Potential NTEH Development on Third Party Lots in R(B)14 Zone and the Proposed Development in R(B)13 Zone

(by using Hazen-Williams Equation)

1. Head Loss Equation (Hazen William Equation)

$$V = 0.3564 \times C \times D^{0.63} \times i^{0.54}$$

where
V = Velocity along the pipeline in m/s
C = Hazen-Williams Constant, 110 for D < 600mm, 120 for D >= 600mm
D = Internal diameter of the pipeline in meter
i = Hydraulic Gradient

2. Hydraulic Gradient Equation

$$\textit{Hydradulic Gradient} = \frac{\textit{Headloss}}{\textit{Pipe Length}}$$

3. Headloss and Residual Head Calculation

From Ha Hang Fresh Water Service Reservoir to Control Point A

Parameter	Unit	
Nonimal Pipe Diameter	mm	600
Internal Pipe Diameter, D	mm	586
Assumed Velocity under Peak Flow Condition, v	m/s	2.76
Hazen-William Constant	-	120
Hydraulic Gradient, i		0.01164
Travel Distance	m	1000
Estimated Major Headloss	m	11.64
Minor Headloss (Extra 10% of Estimated Major Headloss)	m	1.16
Top Water Level at Water Service Reservoir	mPD	79.14
Water Head Level at Control Point A	mPD	66.34
Approx. Ground Level at Control Point A	mPD	4.76
Approx. Soffit Level at Control Point A	mPD	3.26
Residual Head at Control Point A	m	63.08

From Control Point A to Control Point B

Parameter	Unit	
Nonimal Pipe Diameter	mm	450
Internal Pipe Diameter, D	mm	424
Assumed Velocity under Peak Flow Condition, v	m/s	2.49
Hazen-William Constant	-	110
Hydraulic Gradient, i		0.01653
Travel Distance	m	100
Estimated Major Headloss	m	1.65
Minor Headloss (Extra 10% of Estimated Major Headloss)	m	0.17
Water Head Level at Control Point A	mPD	66.34
Water Head Level at Control Point B	mPD	64.52
Approx. Ground Level at Control Point B	mPD	4.57
Approx. Soffit Level at Control Point B	mPD	3.07
Residual Head at Control Point B	m	61.45

From Control Point B to Control Point C

Parameter	Unit	
Nonimal Pipe Diameter	mm	300
Internal Pipe Diameter, D	mm	282
Assumed Velocity under Peak Flow Condition, v	m/s	2.61
Hazen-William Constant	-	110
Hydraulic Gradient, i		0.02900
Travel Distance	m	67
Estimated Major Headloss	m	1.94
Minor Headloss (Extra 10% of Estimated Major Headloss)	m	0.19
Water Head Level at Control Point B	mPD	64.52
Water Head Level at Control Point C	mPD	62.38
Approx. Ground Level at Control Point C	mPD	4.49
Approx. Soffit Level at Control Point C	mPD	2.99
Residual Head at Control Point C	m	59.39

From Control Point C to Control Point C1

Parameter	Unit	
Nonimal Pipe Diameter	mm	300
Internal Pipe Diameter, D	mm	282
Assumed Velocity under Peak Flow Condition, v	m/s	2.57
Hazen-William Constant	-	110
Hydraulic Gradient, i		0.02815
Travel Distance	m	74
Estimated Major Headloss	m	2.08
Minor Headloss (Extra 10% of Estimated Major Headloss)	m	0.21
Water Head Level at Control Point C	mPD	62.38
Water Head Level at Control Point C1	mPD	60.09
Approx. Ground Level at Control Point C1	mPD	5.43
Approx. Soffit Level at Control Point C1	mPD	3.93
Residual Head at Control Point C1	m	56.16

From Control Point C1 to Control Point C2

Parameter	Unit	
Nonimal Pipe Diameter	mm	300
Internal Pipe Diameter, D	mm	282
Assumed Velocity under Peak Flow Condition, v	m/s	1.66
Hazen-William Constant	-	110
Hydraulic Gradient, i		0.01252
Travel Distance	m	132
Estimated Major Headloss	m	1.65
Minor Headloss (Extra 10% of Estimated Major Headloss)	m	0.17
Water Head Level at Control Point C1	mPD	60.09
Water Head Level at Control Point C2	mPD	58.27
Approx. Ground Level at Control Point C2	mPD	7.57
Approx. Soffit Level at Control Point C2	mPD	6.07
Residual Head at Control Point C2	m	52.20

From Control Point C2 to Control Point D

Parameter	Unit	
Nonimal Pipe Diameter	mm	300
Internal Pipe Diameter, D	mm	282
Assumed Velocity under Peak Flow Condition, v	m/s	1.51
Hazen-William Constant	-	110
Hydraulic Gradient, i		0.01059
Travel Distance	m	398
Estimated Major Headloss	m	4.21
Minor Headloss (Extra 10% of Estimated Major Headloss)	m	0.42
Water Head Level at Control Point C2	mPD	58.27
Water Head Level at Control Point D	mPD	53.64
Approx. Ground Level at Control Point D	mPD	14.38
Approx. Soffit Level at Control Point D	mPD	12.88
Residual Head at Control Point D	m	40.76

From Control Point D to Control Point E

Parameter	Unit	
Nonimal Pipe Diameter	mm	200
Internal Pipe Diameter, D	mm	189
Assumed Velocity under Peak Flow Condition, v	m/s	1.53
Hazen-William Constant	-	110
Hydraulic Gradient, i		0.01727
Travel Distance	m	127
Estimated Major Headloss	m	2.19
Minor Headloss (Extra 10% of Estimated Major Headloss)	m	0.22
Water Head Level at Control Point D	mPD	53.64
Water Head Level at Control Point E	mPD	51.23
Approx. Ground Level at Control Point E	mPD	16.65
Approx. Soffit Level at Control Point E	mPD	15.15
Residual Head at Control Point E	m	36.08

From Control Point E to Control Point F

Parameter	Unit	
Nonimal Pipe Diameter	mm	200
Internal Pipe Diameter, D	mm	189
Assumed Velocity under Peak Flow Condition, v	m/s	1.53
Hazen-William Constant	-	110
Hydraulic Gradient, i		0.01727
Travel Distance	m	210
Estimated Major Headloss	m	3.63
Minor Headloss (Extra 10% of Estimated Major Headloss)	m	0.36
Water Head Level at Control Point E	mPD	51.23
Water Head Level at Control Point F	mPD	47.24
Approx. Ground Level at Control Point F	mPD	20.67
Approx. Soffit Level at Control Point F	mPD	19.17
Residual Head at Control Point F	m	28.07

Part 2 - Hydraulic Calculation for Salt Water Supply System (Flushing Water)

Design Criteria and Assumption for Salt Water Supply System

1. Basic Information

Existing Control Point along the Existing Salt Water Mains from Ha Hang SWSR to DN150 SW Main

Control Point ID	Control Point 1	Control Point 2	Control Point 2.1	Control Point 3	Control Point 3.1	Control Point 4
Approx. Ground Level (mPD)	4.35	4.58	4.59	5.39	7.22	13.41

Note:

1. The locations of Control Point refer to **Figure B**.

Existing Pipe Segment along the Existing Salt Water Mains from Ha Hang SWSR to DN150 SW Main

Segment Location	from Reservoir to Control Point 1	from Control Point 1 to Control Point 2	from Control Point 2 to Control Point 2.1	from Control Point 2.1 to Control Point 3	from Control Point 3 to Control Point 3.1	from Control Point 3.1 to Control Point 4
Approx. Segment Length (m)	678	604	51	70	138	293
Size (mm)	450	700	150	150	150	150
Internal Pipe Diameter	424	648	138	138	138	138
Cross Section Area (m2)	0.1412	0.3298	0.0150	0.0150	0.0150	0.0150

Note:

1. The locations of pipe segment refer to **Figure B**.
2. The internal pipe diameter is from Table 1 of WSD's Guidelines for Hydraulic Modeling

2. Water Main Velocity Assumption

a. The existing peak velocity along the existing water main is assumed as below;

Segment Location	from Reservoir to Control Point 1	from Control Point 1 to Control Point 2	from Control Point 2 to Control Point 2.1	from Control Point 2.1 to Control Point 3	from Control Point 3 to Control Point 3.1	from Control Point 3.1 to Control Point 4
Existing Peak Velocity (m/s)	1.5	2.0	1.5	1.5	1.5	1.5

3. Headloss Assumption

a. Hazen-Williams equation is adopted in the hydraulic calculation;

b. Hazen-Williams Coefficient, C, is adopted as 90 for salt water main according to WSD's Guidelines for Hydraulic Modeling;

c. Minor headloss is assumed to be eqaul to 10% of friction headloss.

4. Water Main Network Assumption

a. 1.5 m cover from the ground level is assumed for the water mains.

Approx. Soffit Level for Control Points

Control Point ID	Control Point 1	Control Point 2	Control Point 2.1	Control Point 3	Control Point 3.1	Control Point 4
Approx. Ground Level (mPD)	4.35	4.58	4.59	5.39	7.22	13.41
Approx. Soffit Level (mPD)	2.85	3.08	3.09	3.89	5.72	11.91

b. According to WSD comments, the invert level and top Water Head Level of Ha Hang Salt Water Service Reservoir are 80.3mPD and 85mPD. Hence, it is assumed that in the design the water level at the service reservoir is at half full which will be (80.30 mPD + 85.00 mPD) / 2 = 82.65 mPD

Part 2. Residual Head of Flushing Water Main under Hypothetical Scenario with Potential NTEH Development on Third Party Lots in R(B)14 Zone and the Proposed Development in R(B)13 Zone

(by using Hazen-Williams Equation)

1. Head Loss Equation (Hazen William Equation)

$$V = 0.3564 \times C \times D^{0.63} \times i^{0.54}$$

where
V = Velocity along the pipeline in m/s
C = Hazen-Williams Constant, 90
D = Internal diameter of the pipeline in meter
i = Hydraulic Gradient

2. Hydraulic Gradient Equation

$$\textit{Hydradulic Gradient} = \frac{\textit{Headloss}}{\textit{Pipe Length}}$$

3. Headloss and Residual Head Calculation

From Ha Hang Salt Water Service Reservoir to Control Point 1

Parameter	Unit	
Nonimal Pipe Diameter	mm	450
Internal Pipe Diameter, D	mm	424
Assumed Velocity under Peak Flow Condition, v	m/s	1.56
Hazen-William Constant	-	90
Hydraulic Gradient, i		0.01011
Travel Distance	m	678
Estimated Major Headloss	m	6.85
Minor Headloss (Extra 10% of Estimated Major Headloss)	m	0.69
Top Water Level at Water Service Reservoir	mPD	82.65
Water Head Level at Control Point 1	mPD	75.11
Approx. Ground Level at Control Point 1	mPD	4.35
Approx. Soffit Level at Control Point 1	mPD	2.85
Residual Head at Control Point 1	m	72.26

From Control Point 1 to Control Point 2

Parameter	Unit	
Nonimal Pipe Diameter	mm	700
Internal Pipe Diameter, D	mm	648
Assumed Velocity under Peak Flow Condition, v	m/s	2.03
Hazen-William Constant	-	90
Hydraulic Gradient, i		0.00997
Travel Distance	m	604
Estimated Major Headloss	m	6.02
Minor Headloss (Extra 10% of Estimated Major Headloss)	m	0.60
Water Head Level at Control Point 1	mPD	75.11
Water Head Level at Control Point 2	mPD	68.49
Approx. Ground Level at Control Point 2	mPD	4.58
Approx. Soffit Level at Control Point 2	mPD	3.08
Residual Head at Control Point 2	m	65.41

From Control Point 2 to Control Point 2.1

Parameter	Unit	
Nonimal Pipe Diameter	mm	150
Internal Pipe Diameter, D	mm	138
Assumed Velocity under Peak Flow Condition, v	m/s	2.09
Hazen-William Constant	-	90
Hydraulic Gradient, i		0.06435
Travel Distance	m	51
Estimated Major Headloss	m	3.28
Minor Headloss (Extra 10% of Estimated Major Headloss)	m	0.33
Water Head Level at Control Point 2	mPD	68.49
Water Head Level at Control Point 3	mPD	64.88
Approx. Ground Level at Control Point 3	mPD	4.59
Approx. Soffit Level at Control Point 3	mPD	3.09
Residual Head at Control Point 2.1	m	61.79

From Control Point 2.1 to Control Point 3

Parameter	Unit	
Nonimal Pipe Diameter	mm	150
Internal Pipe Diameter, D	mm	138
Assumed Velocity under Peak Flow Condition, v	m/s	2.07
Hazen-William Constant	-	90
Hydraulic Gradient, i		0.06276
Travel Distance	m	70
Estimated Major Headloss	m	4.39
Minor Headloss (Extra 10% of Estimated Major Headloss)	m	0.44
Water Head Level at Control Point 2.1	mPD	64.88
Water Head Level at Control Point 3	mPD	60.04
Approx. Ground Level at Control Point 3	mPD	5.39
Approx. Soffit Level at Control Point 3	mPD	3.89
Residual Head at Control Point 3	m	56.15

From Control Point 3 to Control Point 3.1

Parameter	Unit	
Nonimal Pipe Diameter	mm	150
Internal Pipe Diameter, D	mm	138
Assumed Velocity under Peak Flow Condition, v	m/s	1.58
Hazen-William Constant	-	90
Hydraulic Gradient, i		0.03815
Travel Distance	m	138
Estimated Major Headloss	m	5.26
Minor Headloss (Extra 10% of Estimated Major Headloss)	m	0.53
Water Head Level at Control Point 3	mPD	60.04
Water Head Level at Control Point 3.1	mPD	54.25
Approx. Ground Level at Control Point 3.1	mPD	7.22
Approx. Soffit Level at Control Point 3.1	mPD	5.72
Residual Head at Control Point 3.1	m	48.53

From Control Point 3.1 to Control Point 4

Parameter	Unit	
Nonimal Pipe Diameter	mm	150
Internal Pipe Diameter, D	mm	138
Assumed Velocity under Peak Flow Condition, v	m/s	1.50
Hazen-William Constant	-	90
Hydraulic Gradient, i		0.03481
Travel Distance	m	293
Estimated Major Headloss	m	10.20
Minor Headloss (Extra 10% of Estimated Major Headloss)	m	1.02
Water Head Level at Control Point 3.1	mPD	54.25
Water Head Level at Control Point 4	mPD	43.03
Approx. Ground Level at Control Point 4	mPD	13.41
Approx. Soffit Level at Control Point 4	mPD	11.91
Residual Head at Control Point 4	m	31.12