Annex 7

Revised Drainage Impact Assessment

Section 16 Planning Application for Proposed Comprehensive Development ('Flat', 'Social Welfare Facility (Residential Care Home for the Elderly)' and 'Shop and Services' Uses) with Minor Relaxation of Plot Ratio and Building Height Restrictions at Various Lots in D.D. 92 and 94 and the Adjoining Government Land, Hang Tau Tai Po, Kwu Tung South.

Drainage Impact Assessment

October 2026

Submitted to

Fonnie Holdings Limited

Prepared By

Meinhardt Infrastructure and Environment Ltd

Date	Revision	Prepared By	Checked By	Approved By
06 May 2025	0	Sylar TSUI	Adi LEE	Adi LEE
27 March 2026	1	Sylar TSUI	Adi LEE	Adi LEE
10 July 2026	2	Sylar TSUI	Adi LEE	Adi LEE
20 October 2026	3	Sylar TSUI	Adi LEE	TC LAM

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1 INTRODUCTION

1.1 Project Background

1.1.1.1 The Applicant, Fonnie Holdings Limited intends to develop the residential development cum Resident Care Home for the Elderly and Shop and Services (hereafter as "the proposed development") in D.D.94 and the adjoining Government land in Hang Tau Tai Po, Kwu Tung South (hereafter as "the Application Site").

1.1.1.2 This planning application is submitted under Section 16 of the Town Planning Ordinance ("the Ordinance") for the proposed development with minor relaxation of plot ratio and building height restrictions in the Approved Kwu Tung South Outline Zoning Plan No. S/NE-KTS/22.

1.1.1.3 Meinhardt Infrastructure and Environment Limited (MIEL) was commissioned by the Applicant to conduct an Drainage Impact Assessment (DIA) to support the Section 16 Planning Application of the proposed development, and to assess the environmental impact due to / upon the proposed development.

1.2 Objective of the Report

1.2.1.1 The objectives of this DIA are to assess the potential drainage impacts arising from the proposed development and recommend the mitigation measures, if necessary, to alleviate the impacts.

1.3 Report Structure

1.3.1.1 The remaining chapters of this report are shown below:

- Chapter 2 – Site Description
- Chapter 3 – Drainage Analysis
- Chapter 4 – Conclusion

2 SITE DESCRIPTION

2.1 Site Location and Its Environs

2.1.1.1 The proposed development will be located at the various lots in D.D.94 and the adjoining Government land in Hang Tau Tai Po, Kwu Tung South.

2.1.1.2 The Application Site is currently occupied by unused structures including a 2-story house, a pavilion, swimming pool and landscape garden. The proposed development is located in the "Comprehensive Development Area" Zone bounded by "Agriculture" (AGR) Zone, "Residential (Group D)" (R(D)) Zone and "Government Institution or Community" (G/IC) Zone according to the Draft Kwu Tung South Outline Zoning Plan (OZP) (OZP No.: S/NE-KTS/21). Existing land uses in the surroundings include low-rise village type development and temporary structures.

2.1.1.3 **Figure 2.1** shows the Application Site location and its environs.

2.2 Proposed Development

2.2.1.1 The proposed development consists of 4 nos. of residential towers, a clubhouse, a retail and a Residential Care Home for the Elderly (RCHE) with total site area of approximately 17,990.9 m^2. The development schedule of the proposed development is tabulated in **Table 2.1**. The layout plans of the proposed development are shown in **Appendix 2.1**.

Table 2.1 Development Schedule

Development Items	Design Parameter
No. of Tower	4
No. of Flat Unit	334
No. Clubhouse	1
No. of Swimming Pool	1
No. of RCHE	1
No. of Retail	1
Site Area	17,990.9m^2

2.2.1.2 According to the latest programme, the year of occupancy of the proposed development is expected to be Year 2031.

2.3 Existing Drainage Condition

2.3.1.1 The latest drainage record plans including 2-SE-15A, 2-SE-14B, 2-SE-9D, 2-SE-10C, 2-SE-10D, 2-SE-15B, 2-SE-14D, 2-SE-15C, 2-SE-15D, were obtained and reviewed to gather the background information on drainage infrastructure in the vicinity of the Application Site.

2.3.1.2 According to the drainage record plans, the Application Site is currently served by the public drainage facilities located along Hang Tau Road, to the east of the Application Site. Collected surface runoff is ultimately discharged to an existing open channel (KTS08) situated to the north. Relevant drainage parameters extracted from the drainage record plans are presented in **Figure 2.2** for reference.

2.3.1.3 One on-site catchments (Catchment A) and 9 off-site catchments (Catchments E to M) were identified based on the geographical characteristics of the Application Site and its nearby areas as shown in **Figure 2.2**.

2.3.1.4 Surface runoff from Catchment A discharges to the existing open channel (KTS08), located to the north of the Application Site, via public drainage pipes A1 to A7. Meanwhile, surface runoff from Catchments E to M also ultimately discharges to the same existing channel (KTS08). As such, Catchments A and E to M are included in the channel capacity assessment. The existing drainage system is shown in **Figure 2.2**.

2.3.1.5 Site photos of the existing channels (KTS08) and the box culverts, with aerial photos of the site, are shown in **Appendix 2.2**.

2.4 Paving Conditions

2.4.1.1 The Application Site is currently occupied by unused structures, it is generally unpaved with amount of 80% vegetation area of the Application Site, the paved area about 20% to the existing Site. The paving condition of the proposed development, 75% of the area would be paved with concrete and 25% of the area would be unpaved. Paving conditions is summarized in **Table 2.2**.

Table 2.2 Paving Conditions of the Catchment

Paving Conditions	Pre-development	Post-development
Paved Area	20%	75%
Unpaved Area	80%	25%

3 EVAULATION OF DRAINAGE IMPACT

3.1 Assessment Methodology and Assessment

3.1.1.1 The Rational Method has been adopted for runoff estimation in accordance with the Stormwater Drainage Manual (SDM) (DSD, 2018) and Corrigendum No. 1/2022:

$$Q_p = 0.278\, i \sum C_j A_j$$

where
Q_p *is peak runoff (m^3/s);*
i *is rainfall intensity (mm/hr);*
A_j *is the j^{th} catchment (km^2);*
C_j *is the runoff coefficient of the j^{th} catchment (dimensionless)*

3.1.1.2 The details of the Rational Method can be referred to the *Stormwater Drainage Manual* (SDM) (DSD, 2018).

3.1.1.3 Based on the required flood protection standard and the calculated time of concentration (t_c), the corresponding design rainfall intensities (i) are determined via linear interpolation of the relevant intensity-duration-frequency (IDF) tables.

3.2 Design Parameters

3.2.1.1 The paving conditions are discussed in **Section 2.4**. For hydraulic analysis, runoff coefficient of 0.95 was adopted to represent a concrete-paved area, and runoff coefficient

of 0.25 and 0.35 were adopted to represent flatted grassland (heavysoil) and steep grassland (heavysoil) respectively. The Manning's roughness coefficient of 0.015 (fair condition for concrete-lined circular pipes) and 0.016 (fair condition for U-channel) as stated in Table 13 of SDM were assumed for the capacity calculation as referred in the SDM.

3.2.1.2 The capacity of the existing channel has been estimated and compared with the total runoff generated from the identified catchments (i.e. Catchment A, E to M). The value of Manning's roughness coefficient used for estimating the channel capacity by using Manning's Equation was assumed to be 0.035 for the channel [fair condition for canals and ditches (canals with rough stony beds, weeds on earth banks)] and 0.016 for box culvert [fair condition for concrete-lined channels].

3.2.1.3 The proposed drainage design incorporates climate change adaptation and design allowances in accordance with DSD SDM Corrigendum No. 1/2022. A projected 16.0% rainfall increase due to climate change for the End of 21st Century (Table 28 of SDM), together with an additional 12.1% design allowance (Table 31 of SDM), has been adopted. Consequently, a cumulative total of 28.1% rainfall increase has been incorporated into the peak runoff calculations to evaluate hydraulic capacity.

3.2.1.4 The assumptions of this DIA are summarised below:

- Flood protection - Design return period for Main Rural Catchment Drainage Channels – 1 in 50 years
- Flood protection - Design return period for Embanked Channels – 1 in 200 years
- Runoff coefficient for concrete-paved area – 0.95
- Runoff coefficient for flatted grassland (heavysoil) – 0.25
- Runoff coefficient for steep grassland (heavysoil) – 0.35
- Manning's roughness coefficient for the existing / proposed circular pipe – 0.015
- Manning's roughness coefficient for the proposed U-channels – 0.016
- Manning's roughness coefficient for the channel – 0.035
- Manning's roughness coefficient for the box culvert in the channel – 0.016

3.3 Results for Existing Drainage Facilities

3.3.1.1 Relevant public drainage pipe capacities with existing drainage facilities as shown in **Figure 2.2** were calculated and detailed in **Appendix 3.1.** The relevant runoffs and capacities of the existing drainage pipes were estimated and tabulated in **Table 3.1**.

Table 3.1 Comparison of the Estimated Pipe Capacities and Runoffs after Proposed Development

Drainage Pipe Segment	Diameter, m	Slope	Catchment ID (Runoff, m^3/s)	Capacity Flow, m^3/s	% of Capacity Flow
50-Year Return Period					
C1-A2	0.300	0.022	A (0.40)	0.104	390%
A2-A3	0.300	0.074	A (0.40)	0.191	211%
A3-A4	0.300	0.017	A (0.40)	0.090	446%
A4-A5	0.450	0.024	A and E (0.44)	0.324	137%
A5-A6	0.450	0.018	A and E (0.44)	0.279	159%
A6-A7	0.450	0.024	A and E (0.44)	0.319	139%
Channel (Ch. 67)	Note [1]	0.003	A, E to K (24.66)	24.660	100%

Drainage Pipe Segment	Diameter, m	Slope	Catchment ID (Runoff, m^3/s)	Capacity Flow, m^3/s	% of Capacity Flow
Channel (Ch. 212)	Note [1]	0.008	A, E to M (28.59)	68.914	41%
Box Culvert	Note [1]	0.008	A, E to M (28.59)	46.755	61%
200-Year Return Period					
Channel (Ch. 67)	Note [1]	0.003	A, E to K (27.77)	24.660	113%
Channel (Ch. 212)	Note [1]	0.008	A, E to M (32.32)	70.044	46%
Box Culvert	Note [1]	0.008	A, E to M (32.32)	46.755	69%

Note:
*[1] Dimensions of the concerned Channel and Box Culvert have been presented in **Appendix 3.3**.*
[2] Exceedance of flow capacity is shown as underlined characters.

3.3.1.2 As demonstrated in the **Table 3.1**, the existing drainage system is inadequate under the 50-year return period scenarios for pipe segments (i.e. C1 to A7) and 200-year return period scenarios for the upstream of the channel (at Ch 67). Channel at Ch. 67 is heavily loaded, operating at 100% capacity under the 50-year return period and exceeding capacity at 113% under the 200-year return period. Consequently, directing additional site runoff into Channel at Ch. 67 is unfeasible.

3.4 Preliminary Proposed Drainage Facilities

3.4.1.1 To eliminate surcharging risks and ensure full compliance with the SDM guidelines, the following new drainage facilities are proposed.

3.4.1.2 To address these deficiencies without burdening upstream of the channel, a dedicated drainage bypass scheme is proposed via a new upgraded drainage system. Runoff from the catchment (i.e. Catchment A) is conveyed along proposed manholes PT1, P2, P3, P4, P5, and P6 utilizing 750mm pipe network. The proposed upgraded drainage line continues northwestward, making a direct outfall connection into downstream of the channel.

3.4.1.3 There is no change in the size and flow path of all concerned catchments between pre-development and post-development conditions, with the exception of Catchment A.

3.4.1.4 When the proposed drainage facilities are adopted, the existing redundant drainage facilities (catchpit SCH1023122 and pipe SWD1054900) will be abandoned.

3.4.1.5 The internal drainage arrangements within the Application Site will be further investigated and finalized at the detailed design stage of the project, with the detailed drainage proposal subject to future approval by the DSD.

3.5 Results for Proposed Drainage Facilities

3.5.1.1 The estimated drainage pipe capacities and runoffs following the proposed drainage facilities are summarized in **Table 3.2** and detailed in **Appendix 3.2**.

Table 3.2 Comparison of the Estimated Proposed Pipe Capacities and Runoffs after Proposed Development

Drainage Pipe Segment	Diameter, m	Slope	Catchment ID (Runoff, m^3/s)	Capacity Flow, m^3/s	% of Capacity Flow
50-Year Return Period					
PT1 – P2	0.750	0.020	A (0.80)	1.136	71%
P2 - P3	0.750	0.020	A (0.80)	1.138	70%
P3 - P4	0.750	0.021	A (0.80)	1.167	69%
P4 - P5	0.750	0.022	A (0.80)	1.189	67%
P5 - P6	0.750	0.021	A (0.80)	1.176	68%
P6 - P7	0.750	0.021	A (0.80)	1.161	69%
P6 - P7 (U-Channel)	0.750	0.024	A (0.80)	1.171	69%
Channel (Ch. 212)	Note [1]	0.008	A, E to M (28.99)	70.044	41%
Box Culvert	Note [1]	0.008	A, E to M (28.99)	46.755	62%
200-Year Return Period					
Channel (Ch. 212)	Note [1]	0.008	A, E to M (32.77)	70.044	47%
Box Culvert	Note [1]	0.008	A, E to M (32.77)	46.755	70%

Note:
*[1] Dimensions of the concerned Channel and Box Culvert have been presented in **Appendix 3.3**.*

3.5.1.2 The water levels and flow of the channel and the box culvert for 200-year return period are shown in **Table 3.3**. The calculated freeboards for both the channel and the box culvert remain satisfactory under the design flow conditions and no mitigation measure is required.

Table 3.3 Water Levels and Flow of Channel and Box Culvert

Parameter	Channel (CH 212)		The Box Culvert	
	Pre-development	Post-development	Pre-development	Post-development
Runoff, m^3/s	32.32	32.77	32.32	32.77
Cross Section Area, m^2	22.140		11.822	
Water Levels, m	1.55	1.57	1.08	1.09
Freeboard, m	0.90	0.88	0.92	0.91

3.5.1.3 Capacities of all the proposed pipes are sufficient to cater the peak storm water flow. Also, no flooding blackspot was identified within or near the site according to DSD flooding blackspots records. This indicates that the project is unlikely to contribute to flooding issues in the surrounding area. Therefore, adverse drainage impact arising from the proposed development is not anticipated.

3.6 Implementation, Management, and Maintenance Responsibilities

3.6.1.1 All proposed new drainage facilities will be implemented and constructed by the Applicant at their own cost and to the satisfaction of the DSD.

3.6.1.2 Regarding ongoing operation and stewardship, the management and maintenance of the drainage facilities located within the Application Site will be the responsibility of the Applicant, whereas the proposed drainage facilities situated within public areas will be maintained by DSD.

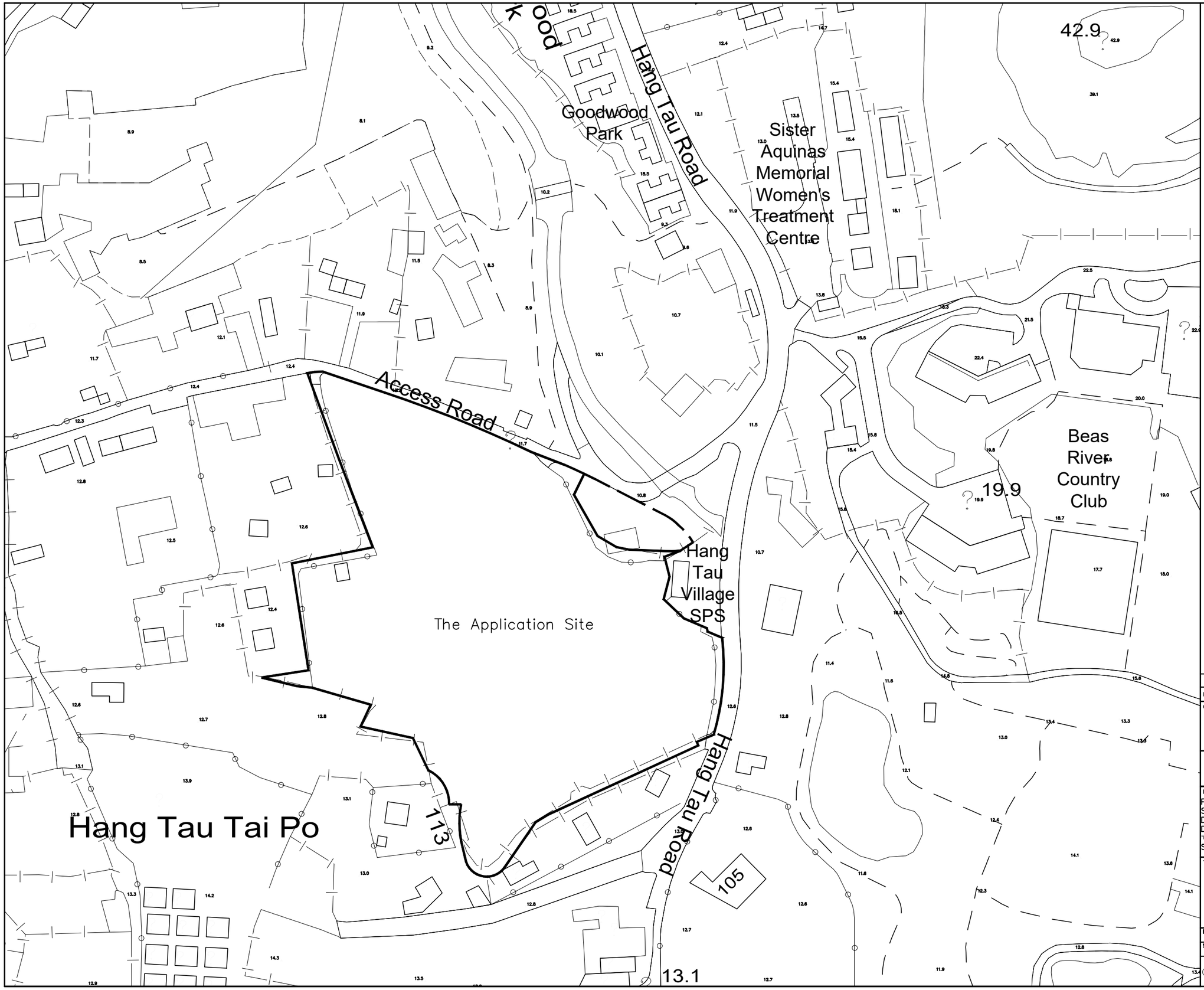
4 Conclusion

4.1.1.1 A Drainage Impact Assessment has been conducted for the proposed development. A new drainage facilities PT1 to P6, 750mm are proposed and direct discharge to the downstream of the channel.

4.1.1.2 The peak surface runoff was calculated based on a 50 and 200-year return period. The assessment findings have demonstrated and confirmed that the proposed drainage pipes are sufficient to cater with the estimated surface runoff from proposed development. No adverse drainage impact arising from the proposed development is anticipated.

4.1.1.3 The detailed arrangement of the proposed drainage system and the internal drainage arrangements within the Application Site will be further investigated at the detailed design stage of the project. The detailed drainage proposal shall be submitted to DSD for further approval.

Figures



LEGEND

The Application Site

CDA Zone Boundary

Rev	Amendment	By	Chk.	App.	Date

Client

MEINHARDT
Meinhardt Infrastructure and Environment Limited
邁進基建環保工程顧問有限公司

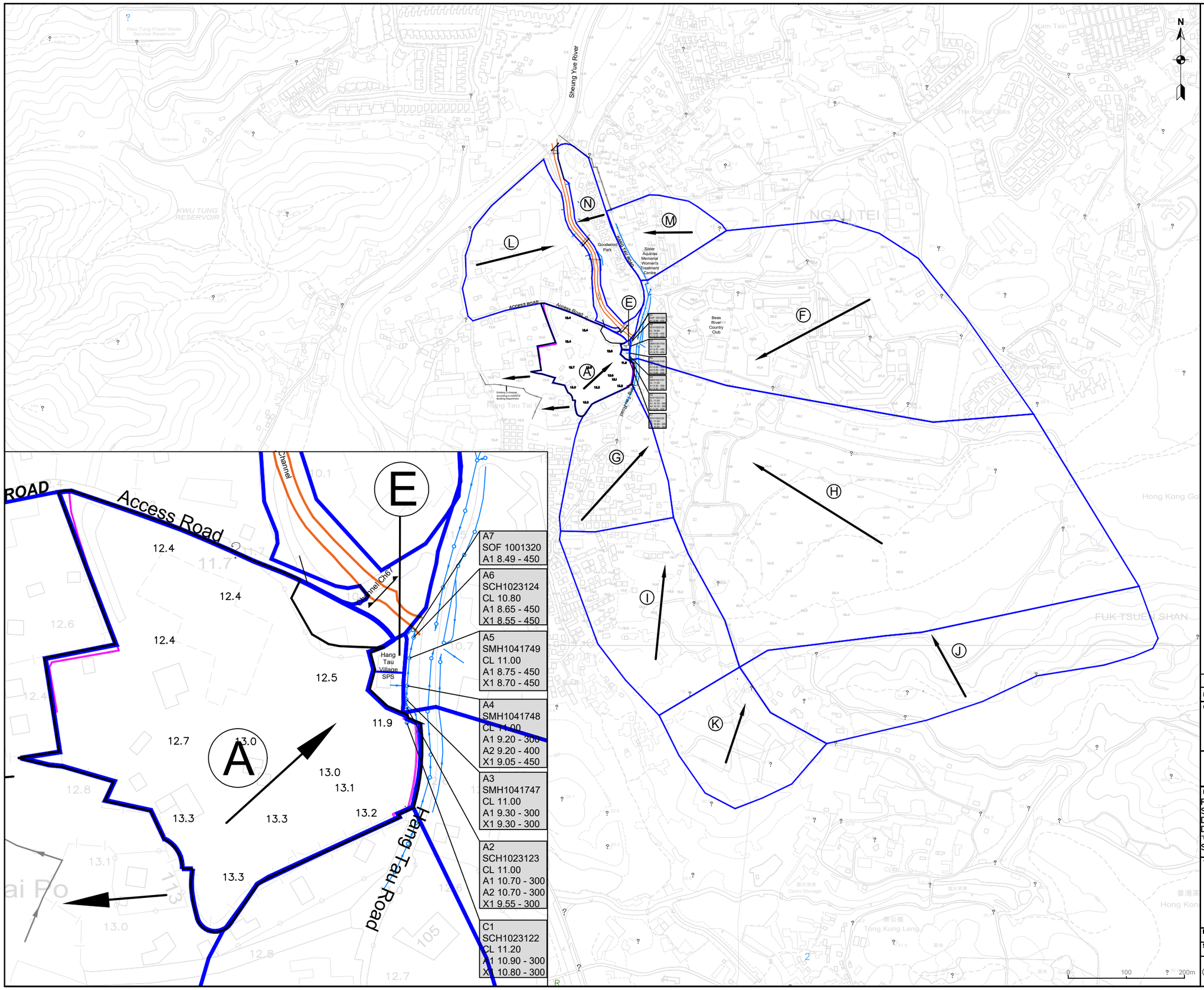
Project

Proposed Amendments to the Kwu Tung South Outline Zoning Plan for Residential Development at Various Lots in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" Zone, Hang Tau Tai Po, Kwu Tung South, New Territories

Title

Site Location and its Environs

Drawn	Checked	Approved
Scale	CAD File No. $FILEA$	First Issued
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LEGEND

- The Application Site
- Catchment Area
- Ⓐ Catchment ID
- Direction of Flow Path
- Involved Existing Drainage System
- Channel and Box Culvert
- Existing Boundary Wall

Rev	Amendment	By	Chk.	App.	Date

Client

MEINHARDT
Meinhardt Infrastructure and Environment Limited
迈进基础设施工程顾问有限公司

Project

Proposed Amendments to the Kwu Tung South Outline Zoning Plan for Residential Development at Various Lots in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" Zone, Hang Tau Tai Po, Kwu Tung South, New Territories

Title

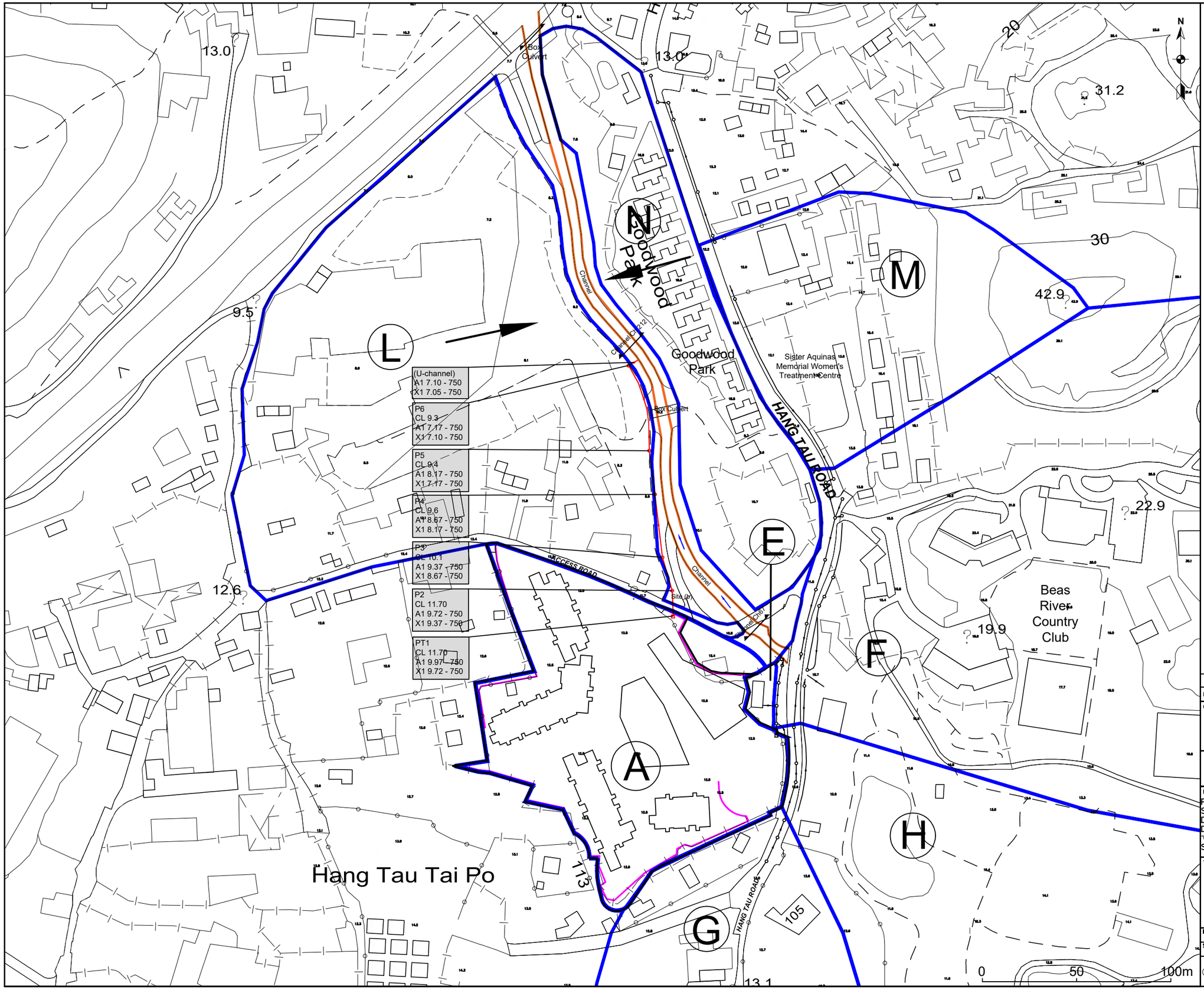
Catchment of the Existing Drainage System along Hang Tau Road

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Drawing No. Figure 2.2

Rev.



Rev	Amendment	By	Chk.	App.	Date

Client

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Project
Proposed Amendments to the Kwu Tung South Outline Zoning Plan for Residential Development at Various Lots in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" Zone, Hang Tau Tai Po, Kwu Tung South, New Territories

Title
Proposed Upgrading Drainage System along Hang Tau Road

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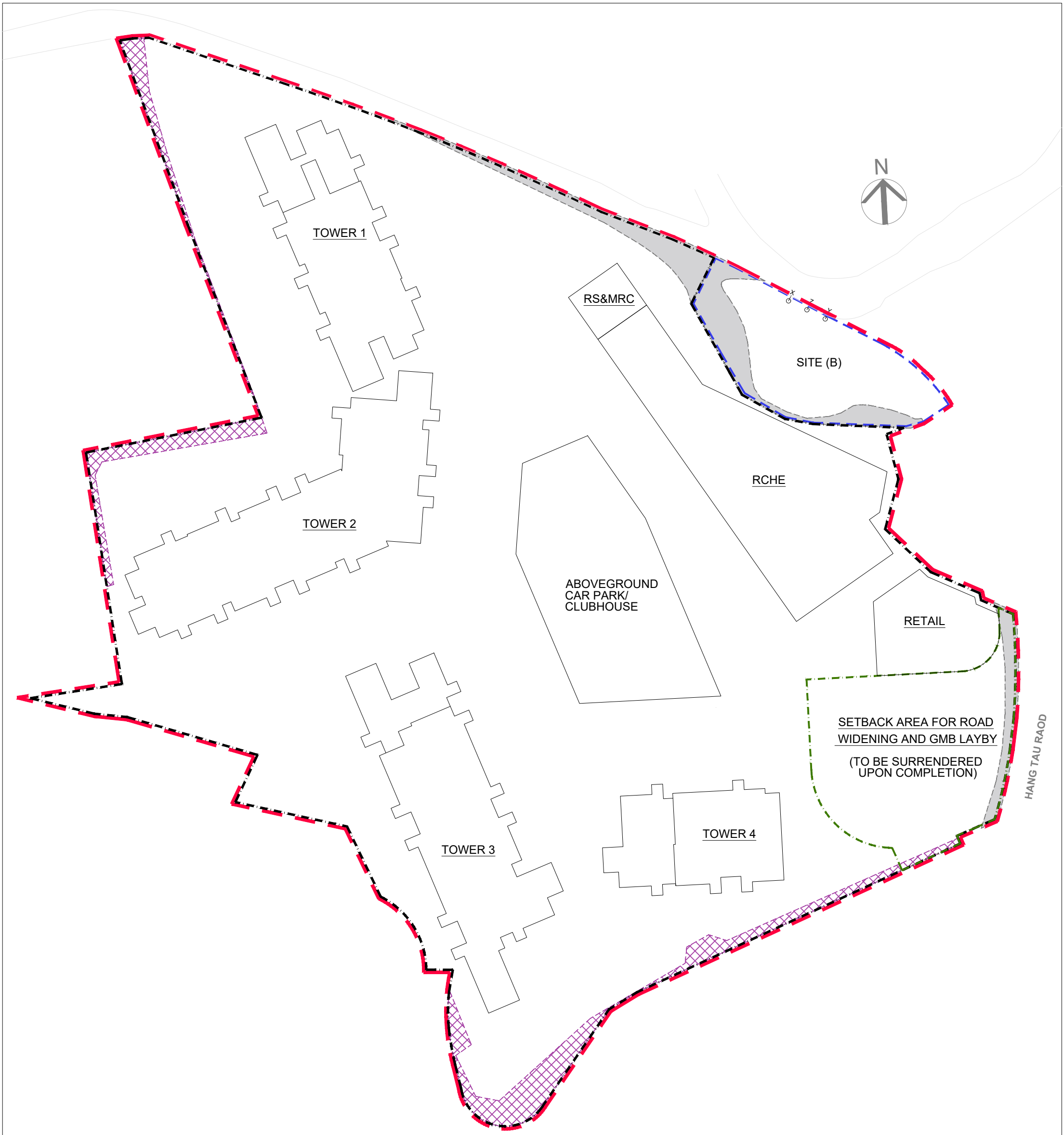
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Drawing No. Figure 3.1

Rev.

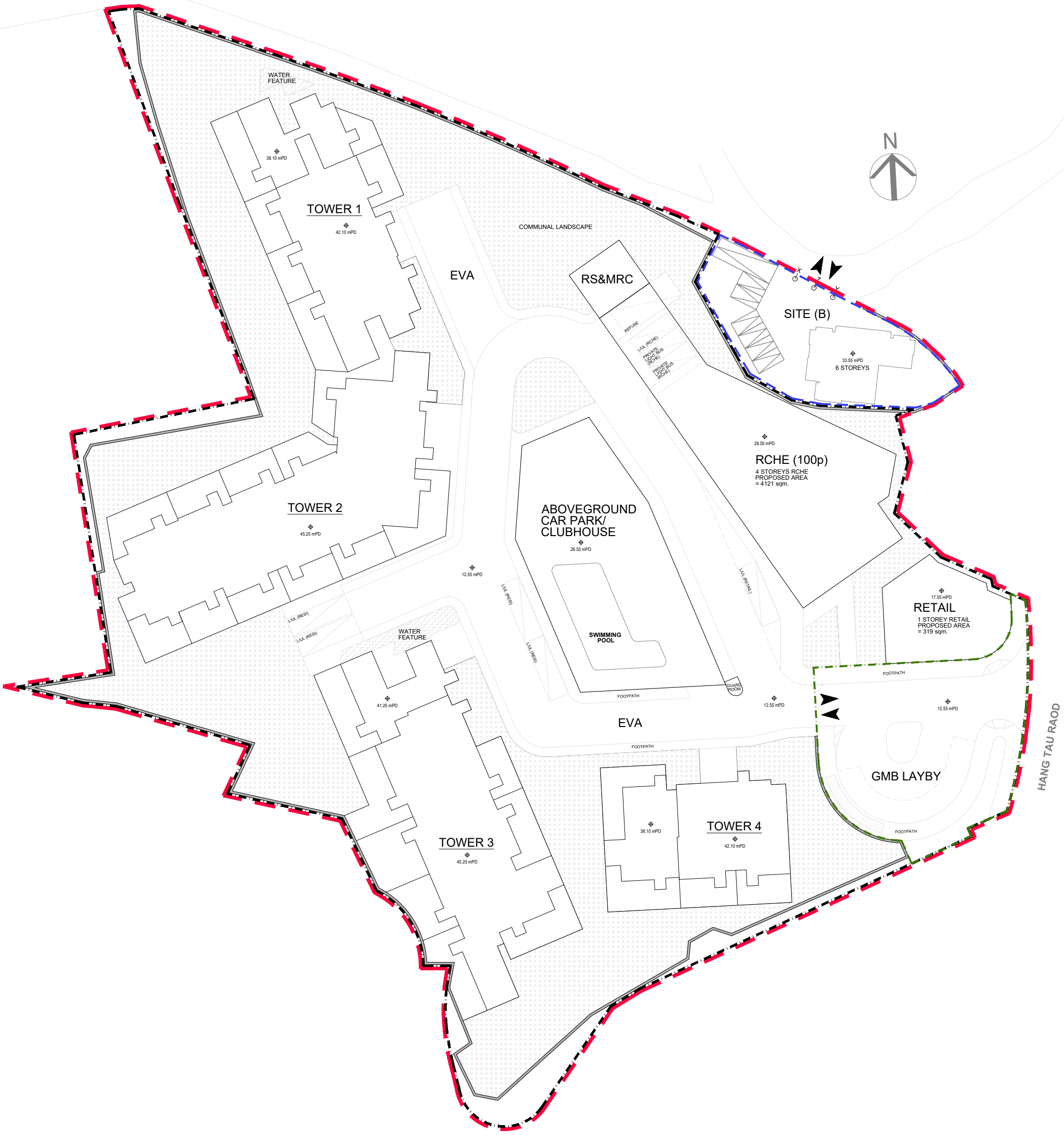
Appendix 2.1

Layout Plan of Proposed Development



LOT PLAN

Master Layout Plan for Residential Development at Various Lots
in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" zone
Hang Tau Tai Po, Kwu Tung South, New Territories

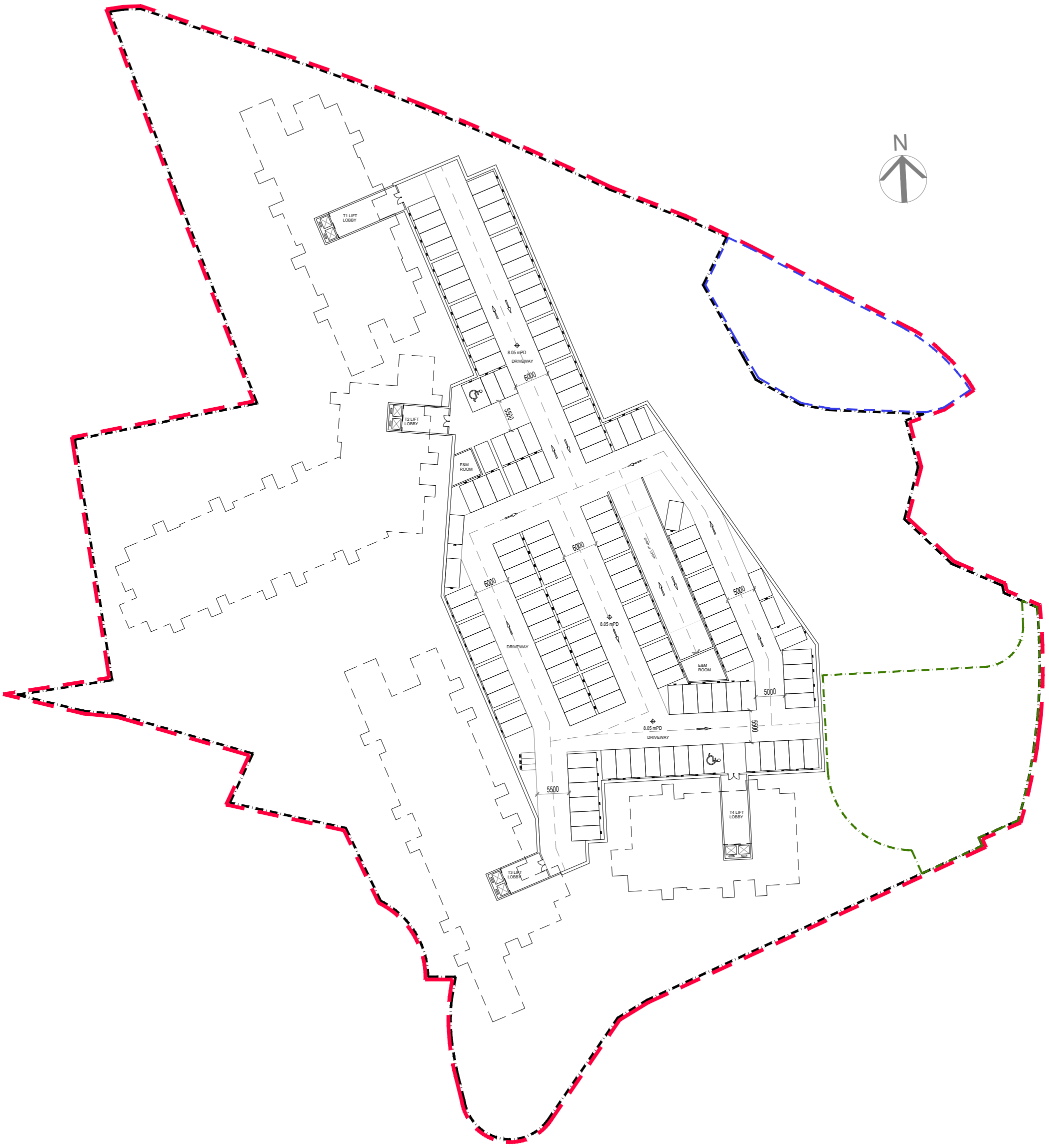


MASTER LAYOUT PLAN

LEGEND

- CDA Zone Boundary
- Application Site Boundary
- Site (B) Boundary
- Surrender Area

Master Layout Plan for Residential Development at Various Lots
in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" zone
Hang Tau Tai Po, Kwu Tung South, New Territories



B1/F FLOOR PLAN

LEGEND

- CDA Zone Boundary
- Application Site Boundary
- Site (B) Boundary
- Surrender Area

Master Layout Plan for Residential Development at Various Lots
in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" zone
Hang Tau Tai Po, Kwu Tung South, New Territories

LWK +PARTNERS



FIRST FLOOR PART PLAN

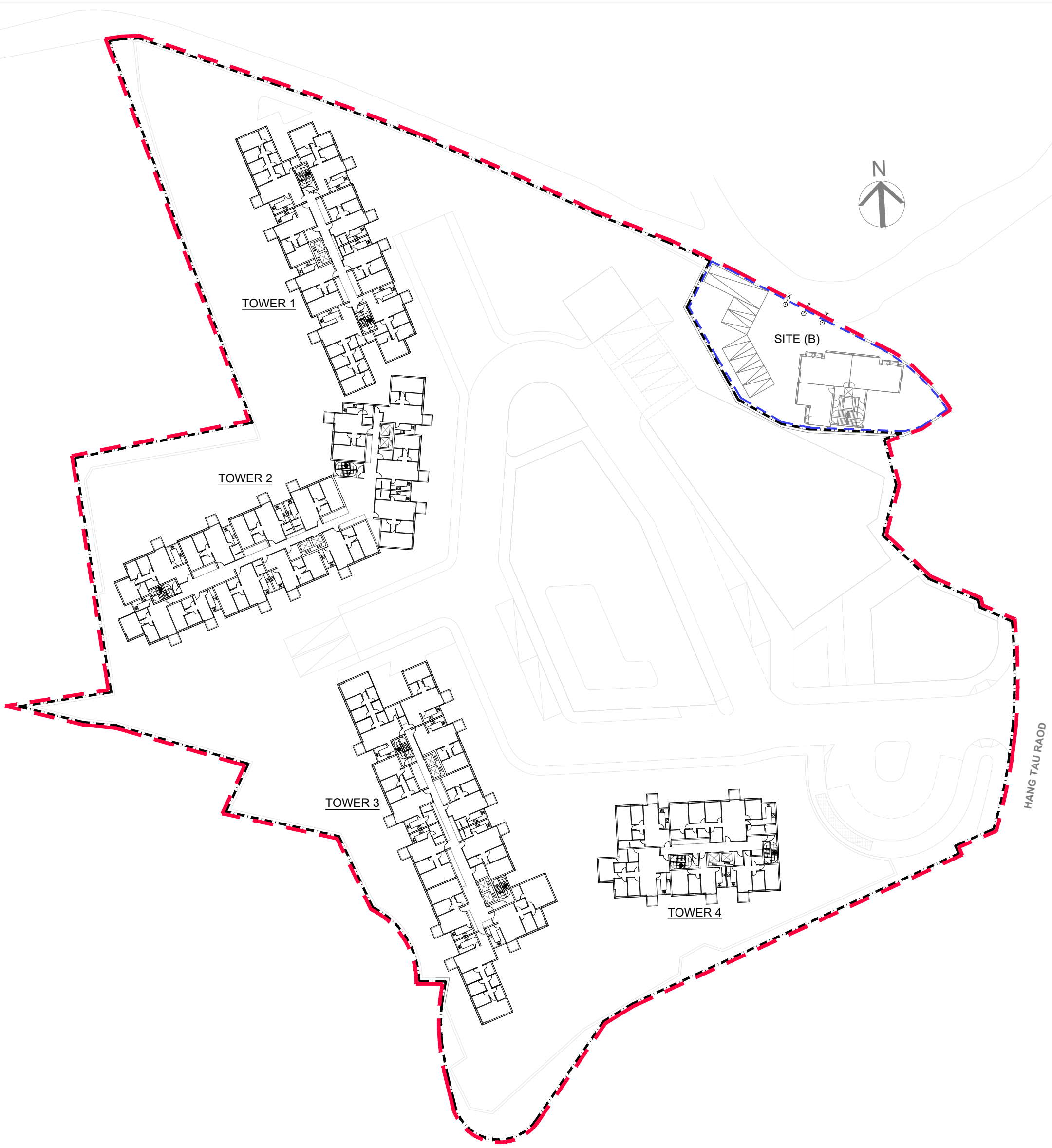
GROUND FLOOR PLAN

LEGEND

- CDA Zone Boundary
- Application Site Boundary
- Site (B) Boundary
- Surrender Area

Master Layout Plan for Residential Development at Various Lots
in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" zone
Hang Tau Tai Po, Kwu Tung South, New Territories

LWK + PARTNERS



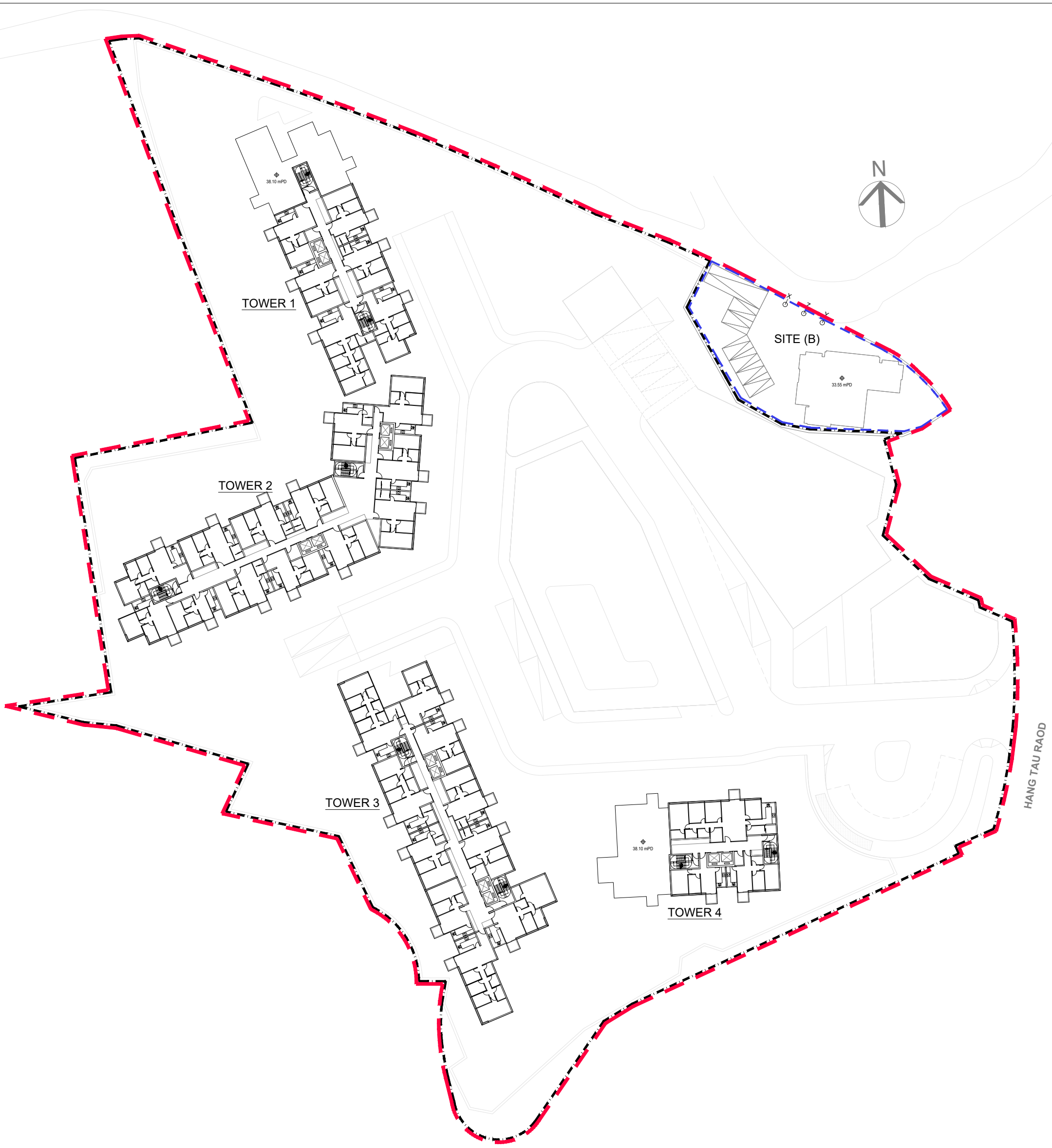
TYPICAL FLOOR PLAN (1/F to 7/F)

LEGEND

- CDA Zone Boundary
- Application Site Boundary
- Site (B) Boundary

Master Layout Plan for Residential Development at Various Lots
in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" zone
Hang Tau Tai Po, Kwu Tung South, New Territories

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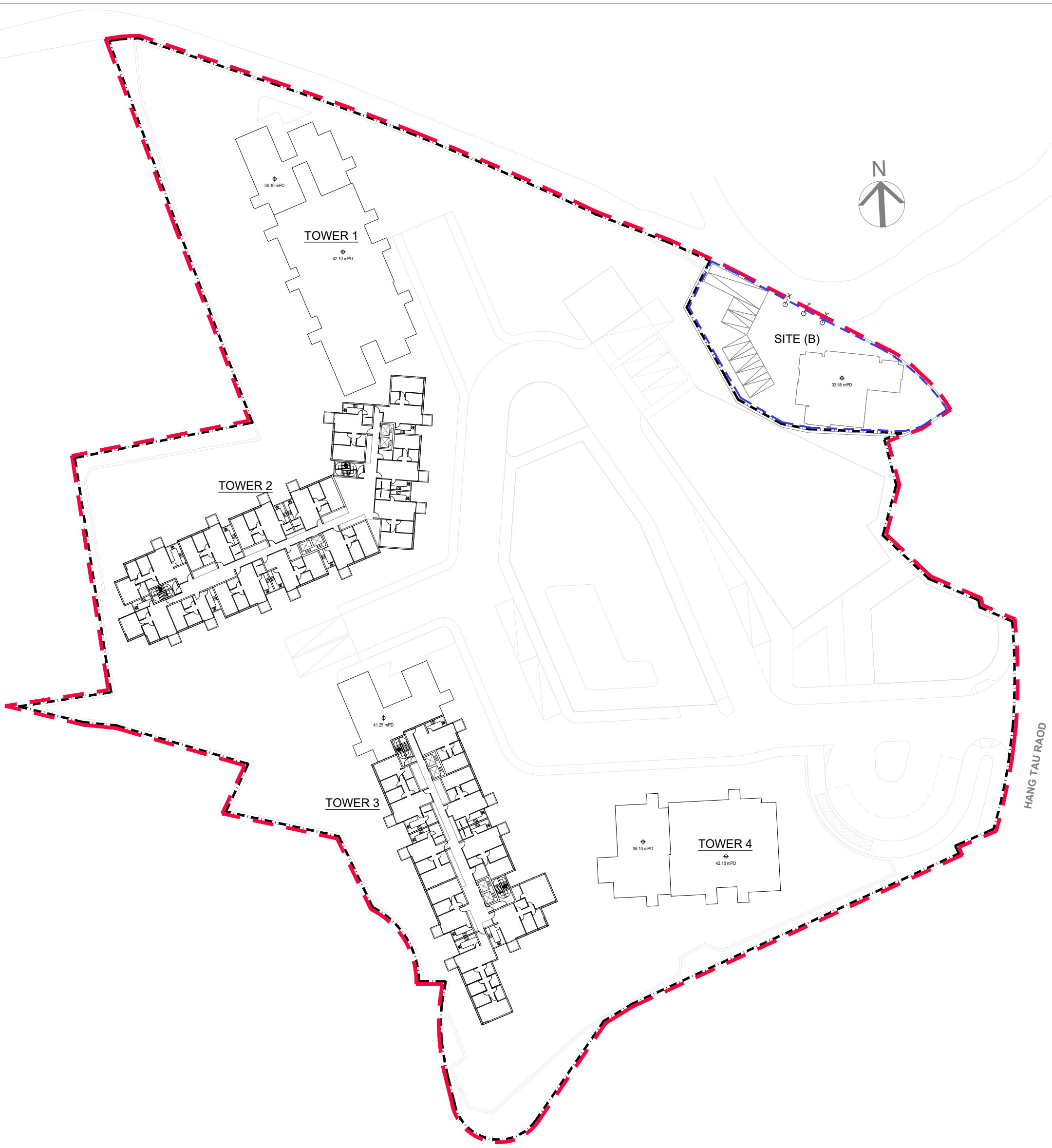
8/F FLOOR PLAN

LEGEND

- CDA Zone Boundary
- Application Site Boundary
- Site (B) Boundary

Master Layout Plan for Residential Development at Various Lots
in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" zone
Hang Tau Tai Po, Kwu Tung South, New Territories

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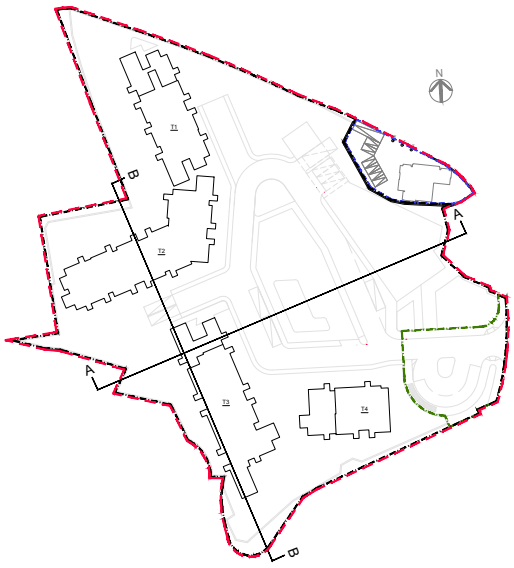
9/F FLOOR PLAN

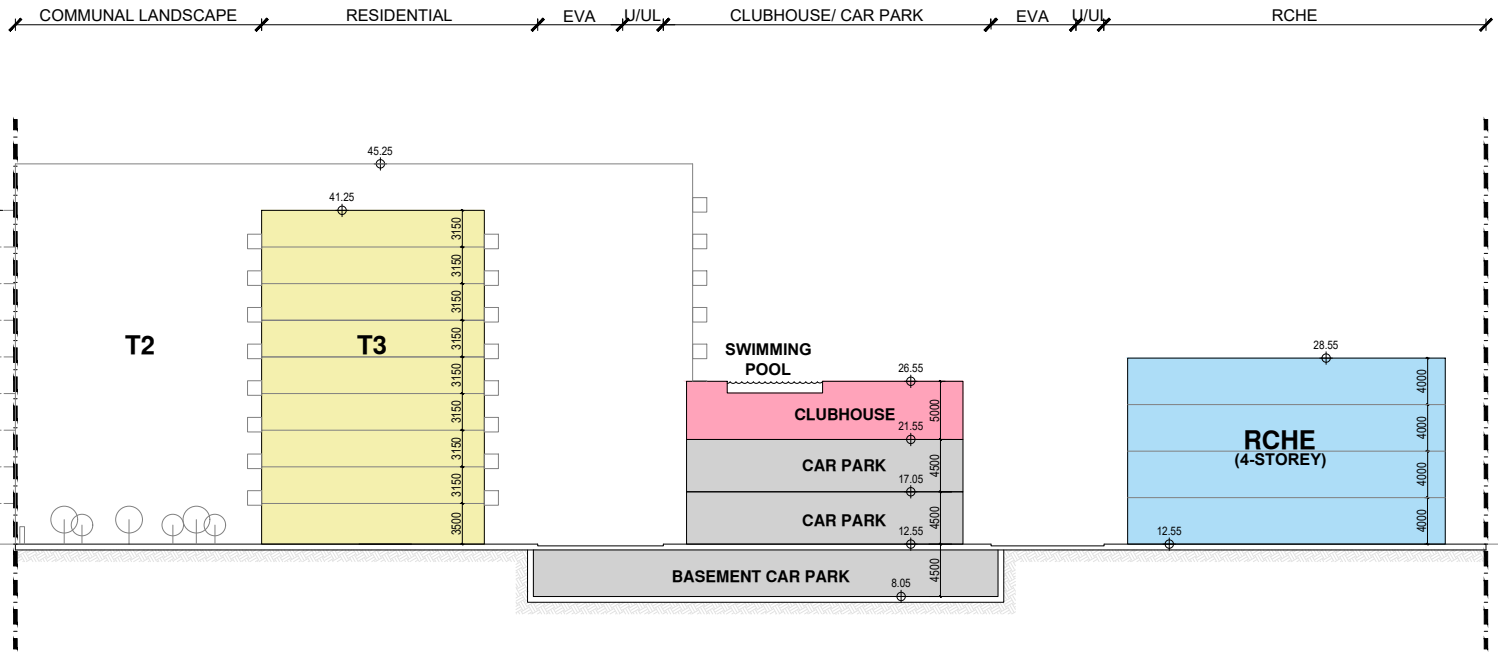
LEGEND

- CDA Zone Boundary
- Application Site Boundary
- Site (B) Boundary

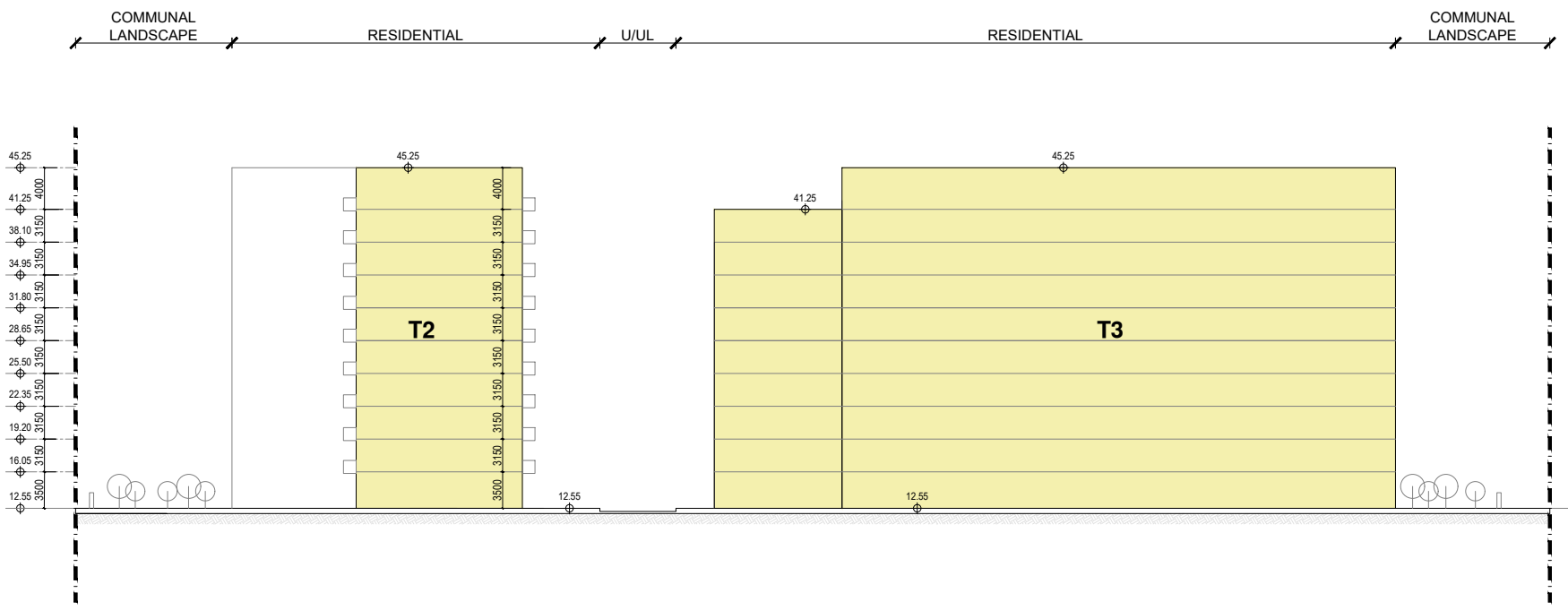
Master Layout Plan for Residential Development at Various Lots
in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" zone
Hang Tau Tai Po, Kwu Tung South, New Territories

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SCHEMATIC SECTION A



SCHEMATIC SECTION B

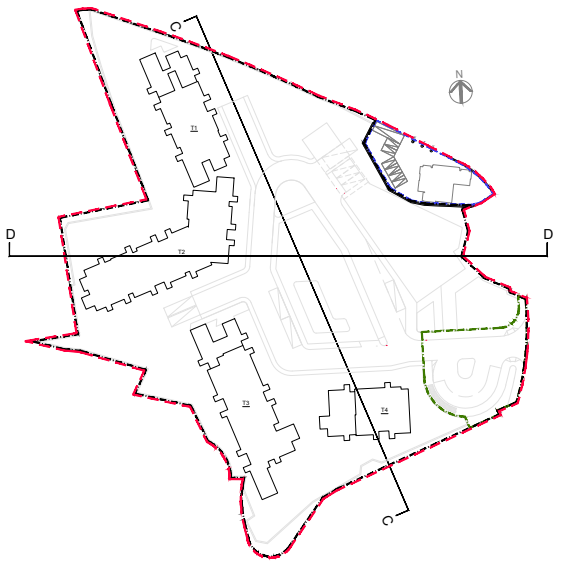
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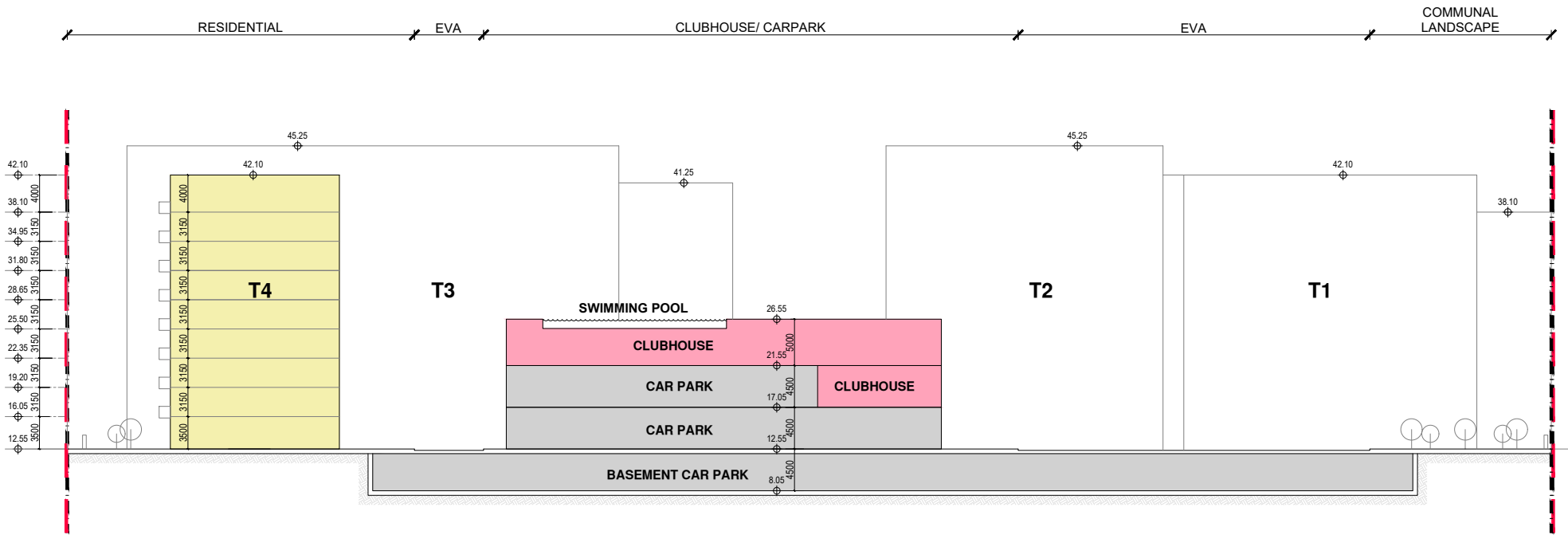
CDA Zone Boundary

Application Site Boundary

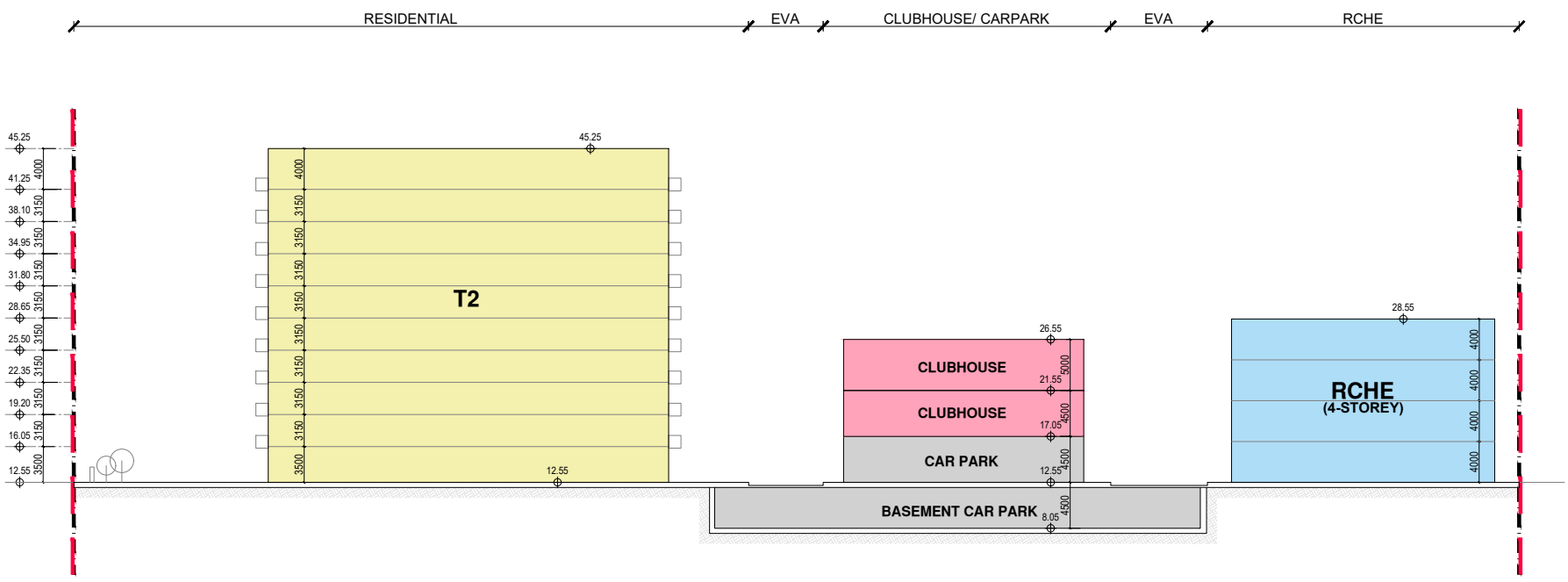
Master Layout Plan for Residential Development at Various Lots
in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" zone
Hang Tau Tai Po, Kwu Tung South, New Territories

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SCHEMATIC SECTION C



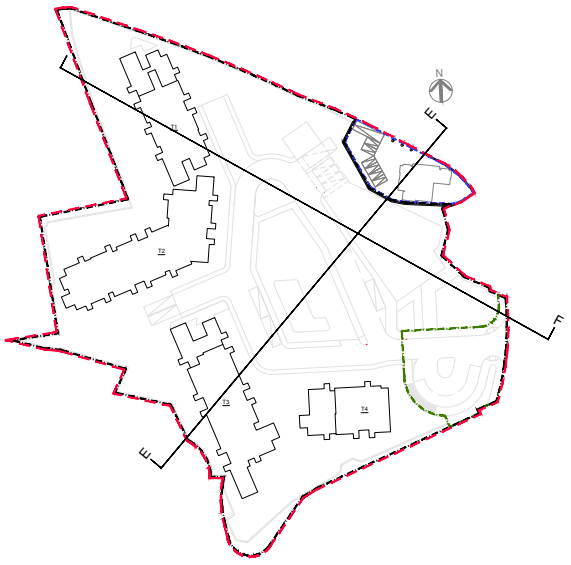
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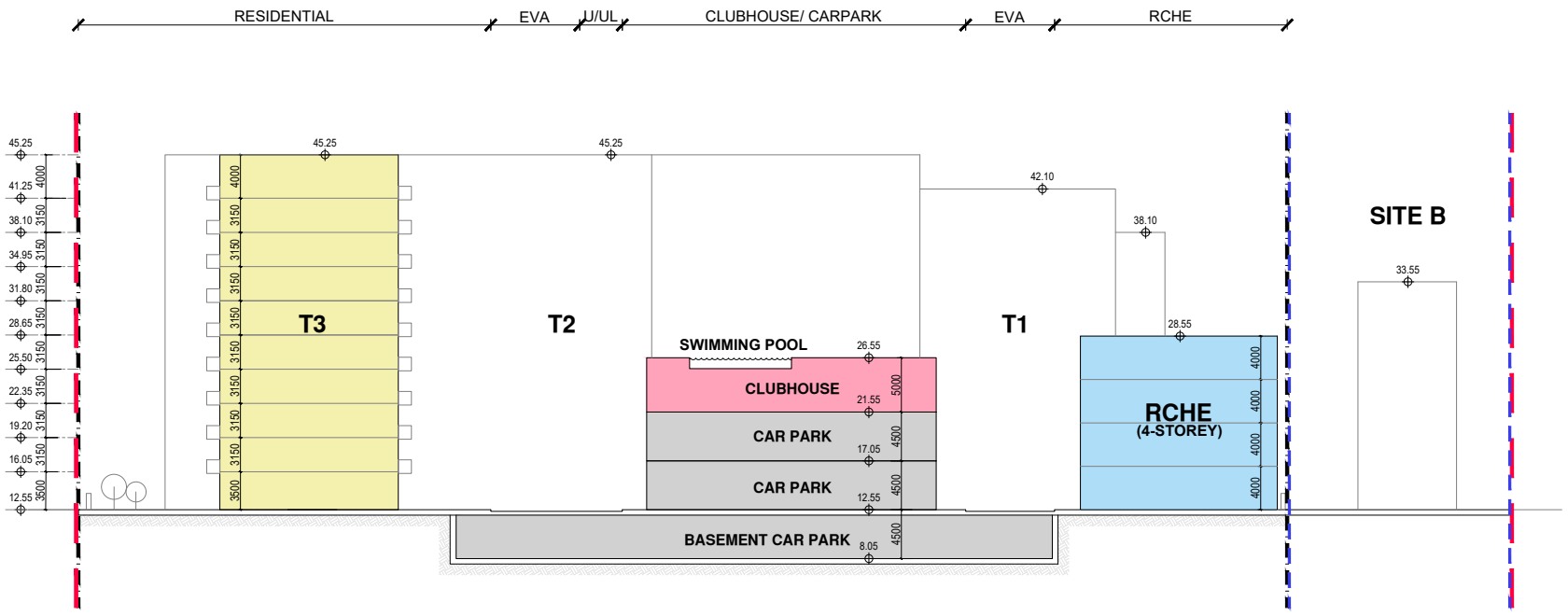
LEGEND

- CDA Zone Boundary
- Application Site Boundary

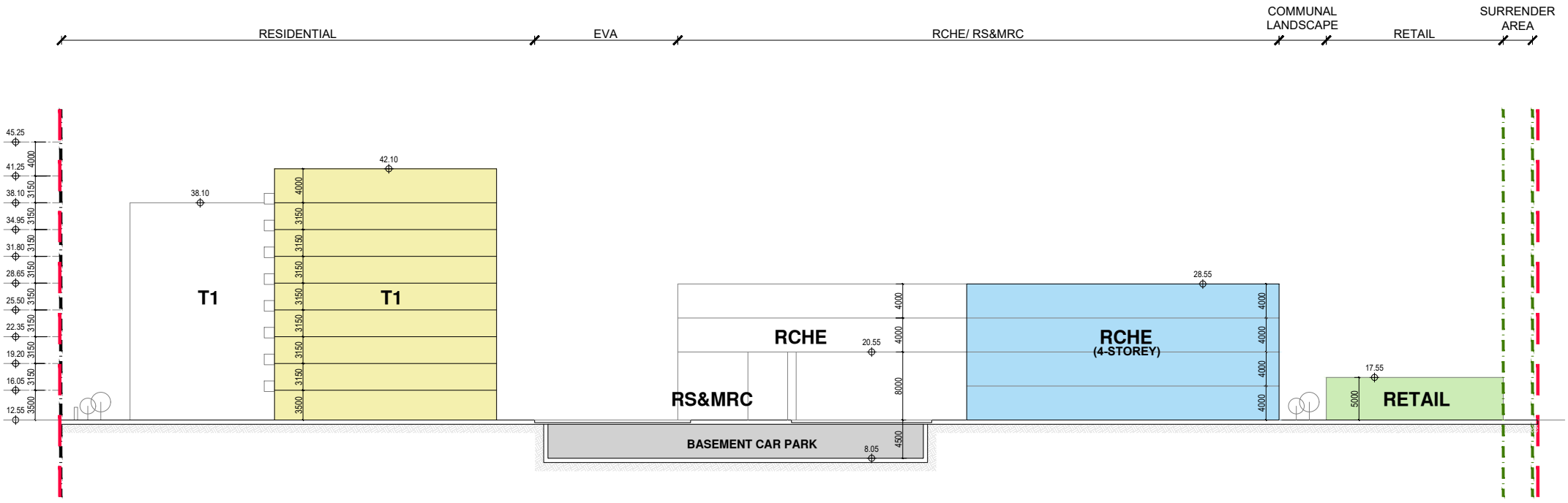
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Hang Tau Tai Po, Kwu Tung South, New Territories

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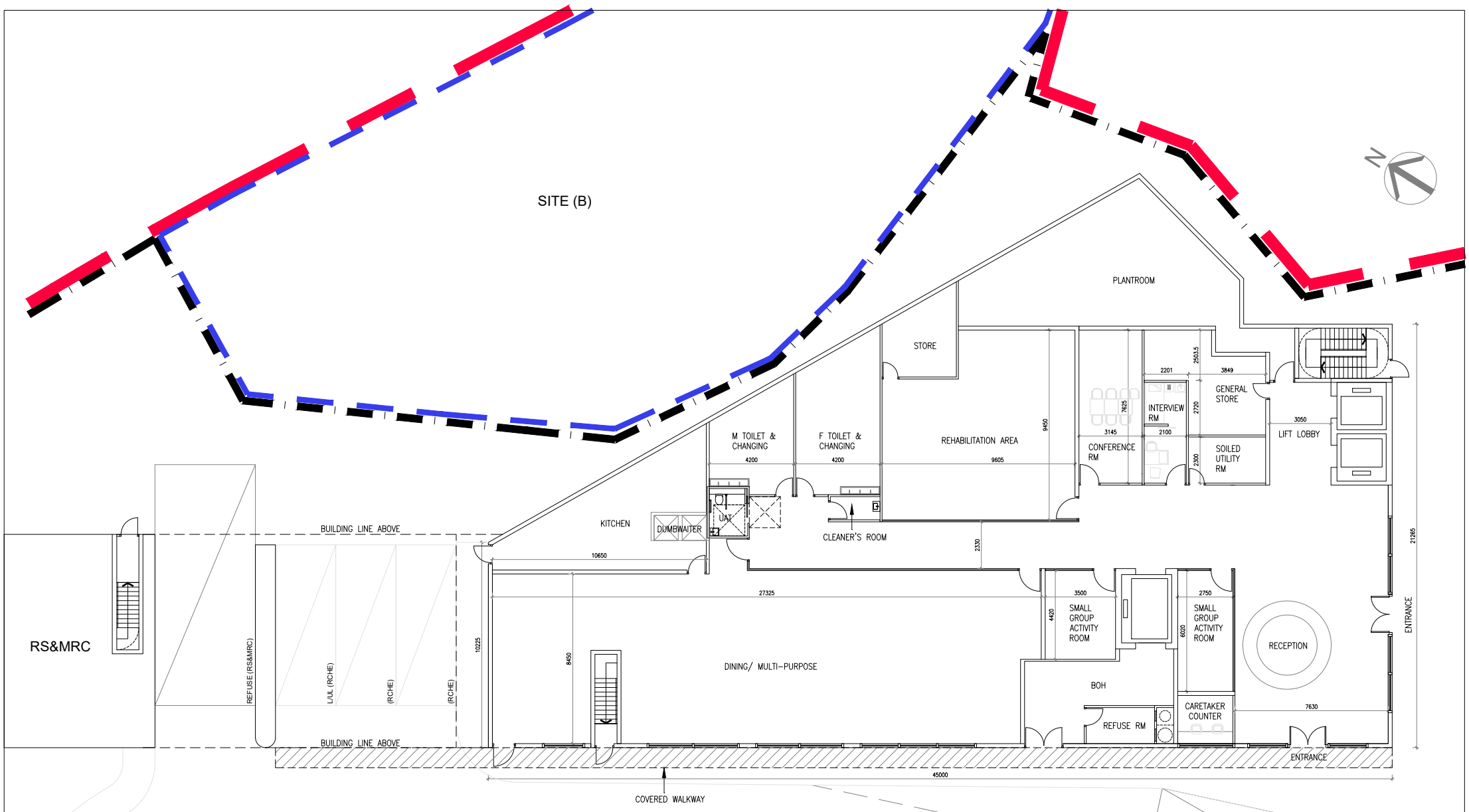
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LEGEND

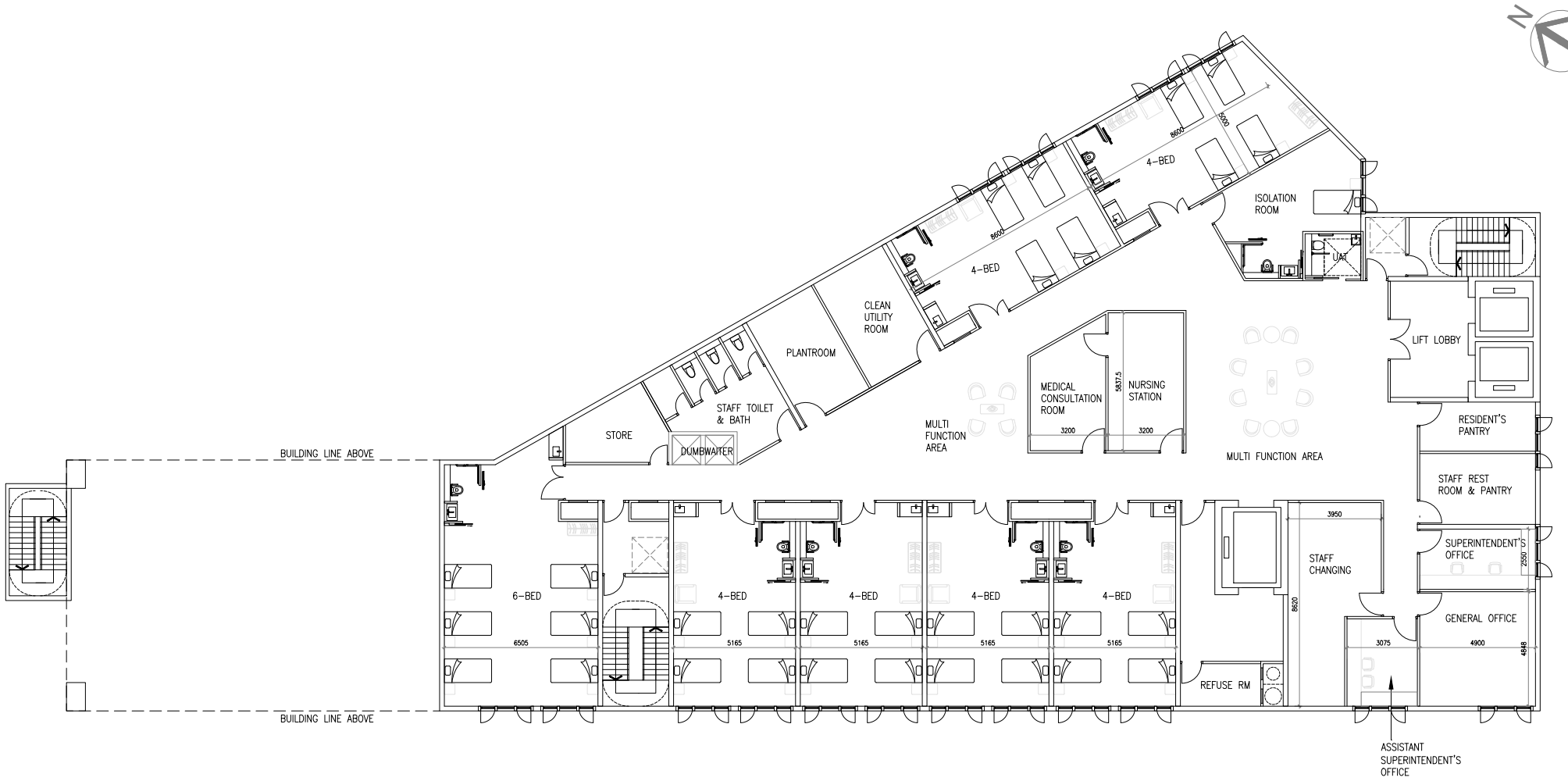
- CDA Zone Boundary
- Application Site Boundary
- Site (B) Boundary
- Surrender Area

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RCHE GROUND FLOOR PLAN



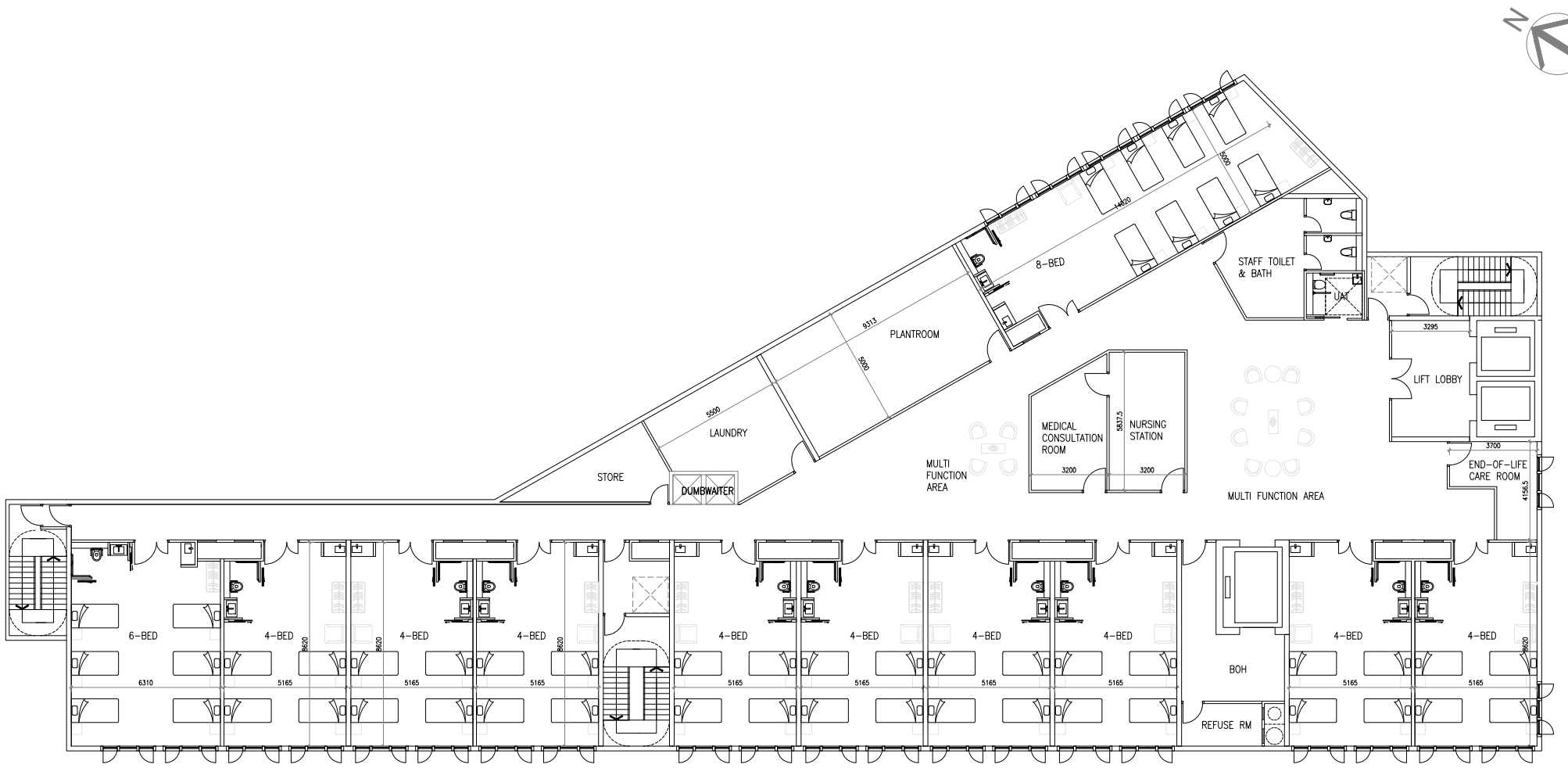
RCHE FIRST FLOOR PLAN

NUMBER OF BEDS: 30

REMARK: THE LAYOUT IS FOR INDICATION ONLY AND IS SUBJECT TO DETAILED DESIGN.

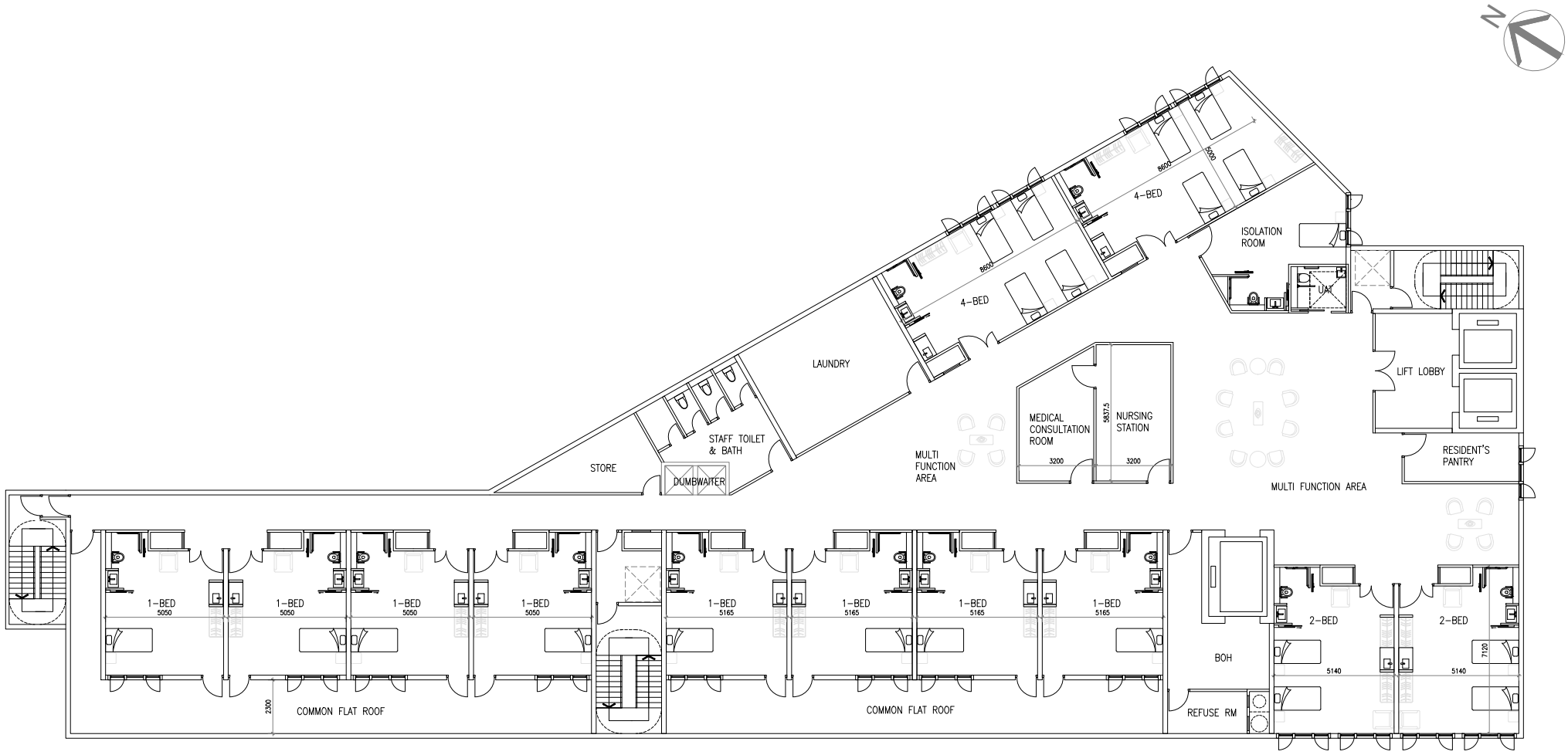
Master Layout Plan for Residential Development at Various Lots
in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" zone
Hang Tau Tai Po, Kwu Tung South, New Territories

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NUMBER OF BEDS: 50

RCHE SECOND FLOOR PLAN



NUMBER OF BEDS: 20

RCHE THIRD FLOOR PLAN

REMARK: THE LAYOUT IS FOR INDICATION ONLY AND IS SUBJECT TO DETAILED DESIGN.

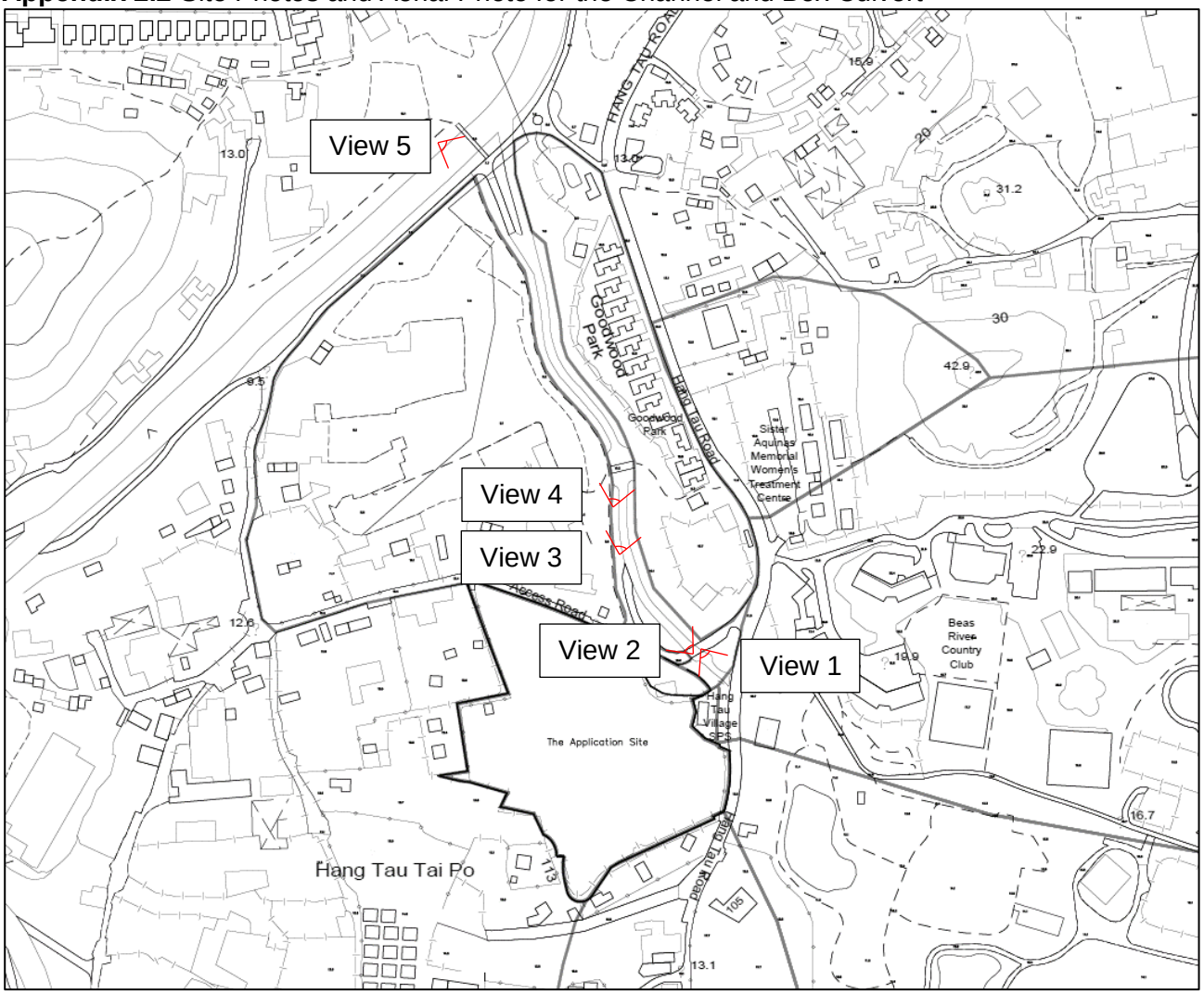
Master Layout Plan for Residential Development at Various Lots
in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" zone
Hang Tau Tai Po, Kwu Tung South, New Territories

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Appendix 2.2

Site Photos and Aerial Photo for the Channel and Box Culvert

Appendix 2.2 Site Photos and Aerial Photo for the Channel and Box Culvert

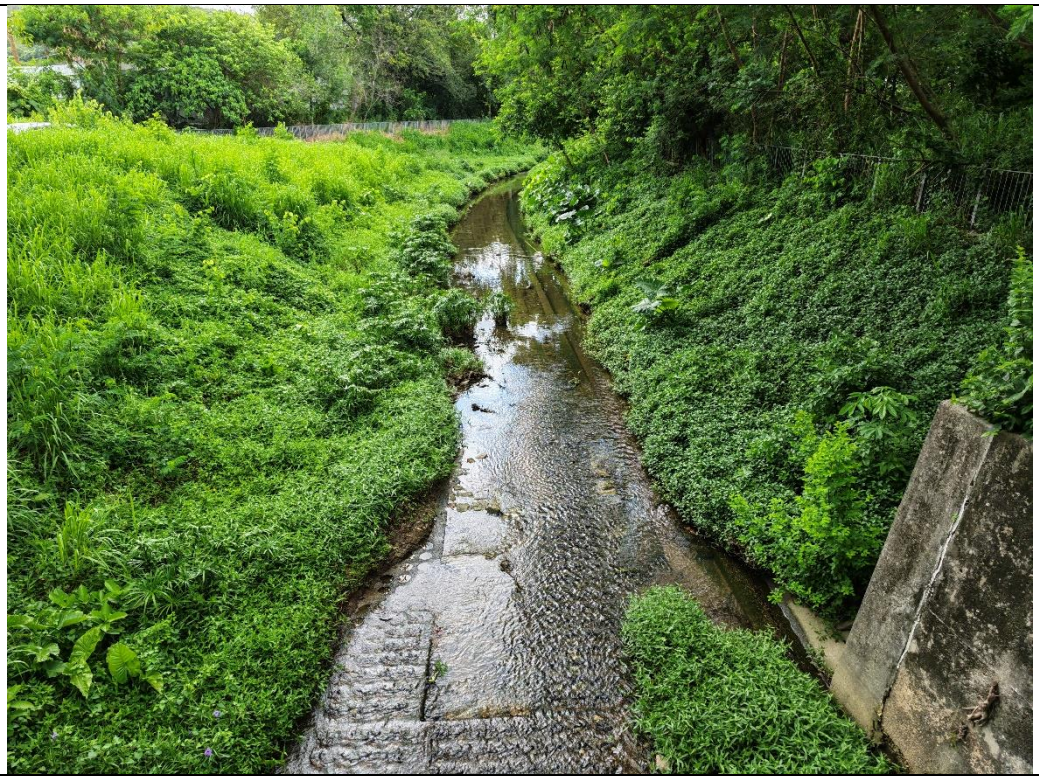


Appendix 2.2 Site Photos and Aerial Photo for the Channel and Box Culvert

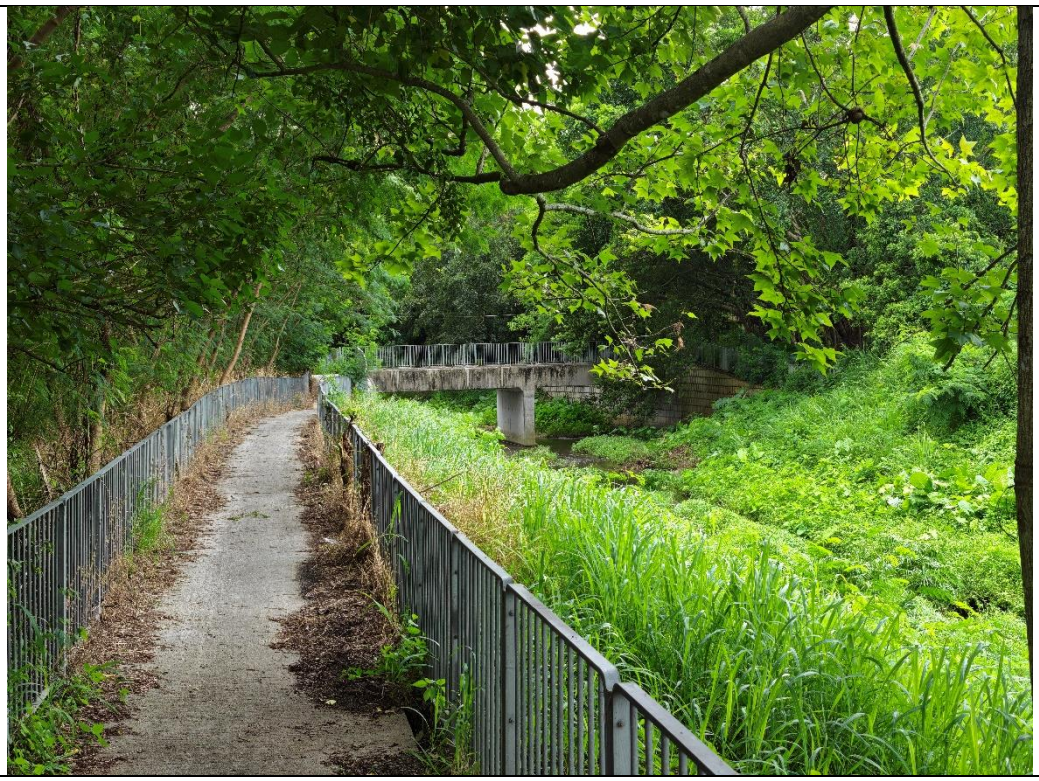
Site Photo:



View 1



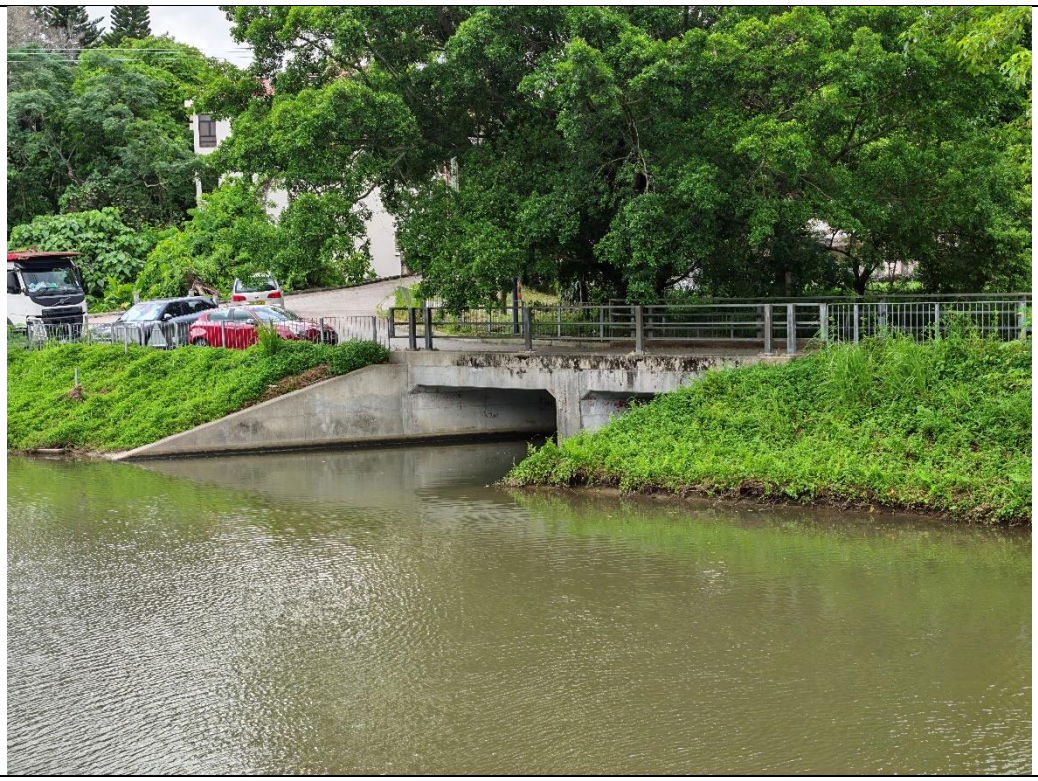
View 2



View 3



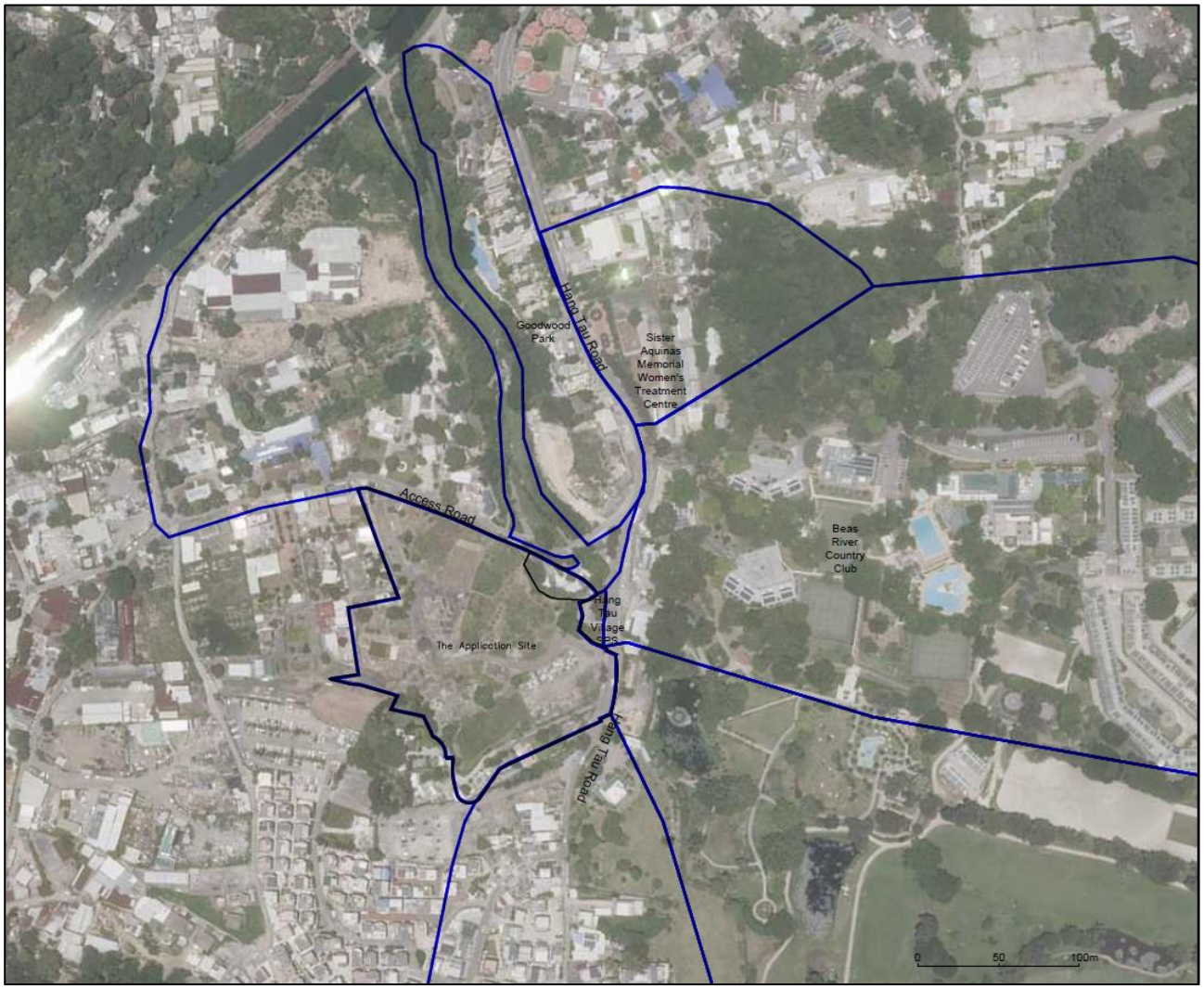
View 4



View 5

Appendix 2.2 Site Photos and Aerial Photo for the Channel and Box Culvert

Aerial Photo:



Appendix 3.1

Detailed Drainage Analysis for Per-development Scenario

A. Calculation of Runoff (50 years return period)

Catchment ID	Surface Type	Catchment Area (A), m^2	Catchment Area (A), km^2	Average slope (H), m/100m	Flow path length (L), m	Inlet time (t_0), min	Time of Concentration (t_c), min	Duration (t_d), min	a [1]	b [1]	c [1]	Rainfall Increase due to Climate Change & Design allowance [2]	Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s
Before Development																
A	80% Grassland (Heavy Soil), Flat + 20% concrete	18,724	0.0187	0.05	182.0	17.59	17.59	17.59	474.6	2.9	0.37	28.1%	199	0.39	0.0073	0.40
E	100% concrete	410	0.0004	3.72	14.2	0.86	0.86	0.86	474.6	2.9	0.37	28.1%	372	0.95	0.0004	0.04
F	10% Grassland (Heavy Soil), Steep + 90% concrete	157,117	0.1571	8.47	229.0	6.53	6.53	6.53	474.6	2.9	0.37	28.1%	265	0.89	0.1398	10.30
G	100% concrete	34,637	0.0346	0.94	115.1	5.92	5.92	5.92	474.6	2.9	0.37	28.1%	272	0.95	0.0329	2.49
H	96% Grassland (Heavy Soil), Flat + 4% concrete	276,309	0.2763	3.83	445.9	14.09	14.09	14.09	474.6	2.9	0.37	28.1%	213	0.28	0.0768	4.55
I	74% Grassland (Heavy Soil), Flat + 26% concrete	62,623	0.0626	5.11	172.1	5.95	5.95	5.95	474.6	2.9	0.37	28.1%	271	0.43	0.0271	2.04
J	89% Grassland (Heavy Soil), Steep + 11% concrete	94,014	0.0940	38.21	95.0	2.11	2.11	2.11	474.6	2.9	0.37	28.1%	335	0.42	0.0391	3.64
K	88% Grassland (Heavy Soil), Flat + 12% concrete	38,004	0.0380	20.09	118.1	3.27	3.27	3.27	474.6	2.9	0.37	28.1%	310	0.33	0.0127	1.09
L	60% Grassland (Heavy Soil), Flat + 40% concrete	40,988	0.0410	1.03	135.3	6.72	6.72	6.72	474.6	2.9	0.37	28.1%	263	0.53	0.0217	1.59
N	30% Grassland (Heavy Soil), Flat + 70% concrete	16,005	0.0160	1.75	34.3	1.69	1.69	1.69	474.6	2.9	0.37	28.1%	346	0.74	0.0118	1.14
M	26% Grassland (Heavy Soil), Steep + 74% concrete	18,118	0.0181	20.21	85.5	2.54	2.54	2.54	474.6	2.9	0.37	28.1%	325	0.79	0.0144	1.30

Note
Runoff is calculated in accordance with DSD's "*Stormwater Drainage Manual - Planning, Design and Managemen*t" (SDM), fifth edition, January 2018.
Rainfall Increase due to the climate change effects up to mid 21st Century has been adopted with reference to Table 28 of DSD's SDM, fifth edition, January 2018.
[1] Table 3d - Storm Constants for Different Return Periods of North District Area in the SDM Corrigendum No. 1/2024 (26 March 2024) has been adopted.
[2] Table 28 - Rainfall increase for mid of 21st Century in the SDM Corrigendum No. 1/2022 has been adopted, and Table 31 - Design allowance for rainfall increase in the SDM Corrigendum No. 1/2022 has been adopted.

Equations Used

$$t_0 = \frac{0.14465L}{H^{0.2}A^{0.1}} \qquad t_c = t_0 + t_f \qquad i = \frac{a}{(t_d + b)^c} \qquad Q_p = 0.278\,C\,i\,A$$

B. Estimated Pipe Capacity and Adequacy Check for the Proposed Upgrading Drainage System

Drainage Pipe	Diameter, m	Length, m	Level (out), mPD	Level (in), mPD	Slope	Manning's roughness coefficient	Cross Section Area, m^2 [5]	Wetted perimeter, m	Hydraulic radius, m	Mean velocity, m/s	Capacity flow, m^3/s	Catchments Served	Runoff, m^3/s	% of capacity flow	Sufficient Capacity? (Y/N)	Flow time (t_f), min
C1 - A2	**0.300**	6.9	10.80	10.65	0.022	0.015	0.064	0.942	0.07	1.63	0.104	A	0.40	**390%**	N	0.07
A2 - A3	**0.300**	3.4	9.55	9.30	0.074	0.015	0.064	0.942	0.07	3.01	0.191	A	0.40	**211%**	N	0.02
A3 - A4	**0.300**	6.0	9.30	9.20	0.017	0.015	0.064	0.942	0.07	1.42	0.090	A	0.40	**446%**	N	0.07
A4 - A5	**0.450**	12.3	9.05	8.75	0.024	0.015	0.143	1.414	0.10	2.27	0.324	A and E	0.44	**137%**	N	0.09
A5 - A6	**0.450**	9.4	8.75	8.58	0.018	0.015	0.143	1.414	0.10	1.95	0.279	A and E	0.44	**159%**	N	0.08
A6 - A7	**0.450**	3.4	8.58	8.50	0.024	0.015	0.143	1.414	0.10	2.23	0.319	A and E	0.44	**139%**	N	0.03

Stream	Width, m	Depth, m	Slope [4]	Manning's roughness coefficient	Cross Section Area, m^2 [5]	Wetted perimeter, m	Hydraulic radius, m	Mean velocity, m/s	Capacity flow, m^3/s	Catchments Served	Runoff, m^3/s	% of capacity flow	Sufficient Capacity? (Y/N)
Channel - CH. 67	Note [1]	Note [1]	0.003	0.035	14.030	11.486	1.22	1.76	24.660	A, E to K	24.56	100%	Y
Channel - Ch 212	Note [2]	Note [2]	0.008	0.035	22.140	16.470	1.34	3.11	68.914	A, E to M	28.59	41%	Y
Box Culvert	Note [3]	Note [3]	0.008	0.016	11.822	20.359	0.58	3.95	46.755	A, E to M	28.59	61%	Y

Note

[1] Dimension of Channel - CH.67 was adopted and referred to the As-built Drawing of the Channel in Appendix 3.2(Section B - AT CH.67 in Drawing No. MCL-118CD-P-KTS08-D111).

[2] Dimension of Channel - CH.212 was adopted and referred to the As-built Drawing of the Channel in Appendix 3.2(Section E - AT CH.212 in Drawing No. MCL-118CD-P-KTS08-D114).

[3] Dimension of Box Culvert was referred to the As-built Drawing of the Channel in Appendix 3.2 (Section B in Drawing No. MCL-118CD-P-KTS08-S407).

[4] Slope of Channel - CH.67 and Ch.212 and Box Culvert were referred to As-built Drawing of the Channel in Appendix 3.2 (Drawing No. MCL-118CD-P-KTS08-D101).

[5] A 5% reduction in flow area shall be applied if the gradient is greater than or equal to 1 in 25, and a 10% reduction in flow area shall be applied if the gradient is less than 1 in 25.

C. Calculation of Runoff (200 years return period)

Catchment ID	Surface Type	Catchment Area (A), m^2	Catchment Area (A), km^2	Average slope (H), m/100m	Flow path length (L), m	Inlet time (t_0), min	Time of Concentration (t_c), min	Duration (t_d), min	a [1]	b [1]	c [1]	Rainfall Increase due to Climate Change & Design allowance [2]	Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s
Before Development																
A	80% Grassland (Heavy Soil), Flat + 20% concrete	18,724	0.0187	0.05	182.0	17.59	17.59	17.59	501.4	2.45	0.348	28.1%	226	0.39	0.0073	0.46
E	100% concrete	410	0.0004	3.72	14.2	0.86	0.86	0.86	501.4	2.45	0.348	28.1%	423	0.95	0.0004	0.05
F	10% Grassland (Heavy Soil), Steep + 90% concrete	157,117	0.1571	8.47	229.0	6.53	6.53	6.53	501.4	2.45	0.348	28.1%	299	0.89	0.1398	11.63
G	100% concrete	34,637	0.0346	0.94	115.1	5.92	5.92	5.92	501.4	2.45	0.348	28.1%	307	0.95	0.0329	2.81
H	96% Grassland (Heavy Soil), Flat + 4% concrete	276,309	0.2763	3.83	445.9	14.09	14.09	14.09	501.4	2.45	0.348	28.1%	242	0.28	0.0768	5.17
I	74% Grassland (Heavy Soil), Flat + 26% concrete	62,623	0.0626	5.11	172.1	5.95	5.95	5.95	501.4	2.45	0.348	28.1%	306	0.43	0.0271	2.30
J	89% Grassland (Heavy Soil), Steep + 11% concrete	94,014	0.0940	38.21	95.0	2.11	2.11	2.11	501.4	2.45	0.348	28.1%	379	0.42	0.0391	4.12
K	88% Grassland (Heavy Soil), Flat + 12% concrete	38,004	0.0380	20.09	118.1	3.27	3.27	3.27	501.4	2.45	0.348	28.1%	350	0.33	0.0127	1.24
L	60% Grassland (Heavy Soil), Flat + 40% concrete	40,988	0.0410	1.03	135.3	6.72	6.72	6.72	501.4	2.45	0.348	28.1%	297	0.53	0.0217	1.79
N	30% Grassland (Heavy Soil), Flat + 70% concrete	16,005	0.0160	1.75	34.3	1.69	1.69	1.69	501.4	2.45	0.348	28.1%	392	0.74	0.0118	1.29
M	26% Grassland (Heavy Soil), Steep + 74% concrete	18,118	0.0181	20.21	85.5	2.54	2.54	2.54	501.4	2.45	0.348	28.1%	367	0.79	0.0144	1.47

Note
Runoff is calculated in accordance with DSD's "*Stormwater Drainage Manual - Planning, Design and Managemen*t" (SDM), fifth edition, January 2018.
Rainfall Increase due to the climate change effects up to mid 21st Century has been adopted with reference to Table 28 of DSD's SDM, fifth edition, January 2018.
[1] Table 3d - Storm Constants for Different Return Periods of North District Area in the SDM Corrigendum No. 1/2024 (26 March 2024) has been adopted.
[2] Table 28 - Rainfall increase for mid of 21st Century in the SDM Corrigendum No. 1/2022 has been adopted, and Table 31 - Design allowance for rainfall increase in the SDM Corrigendum No. 1/2022 has been adopted.

Equations Used

$$t_0 = \frac{0.14465L}{H^{0.2}A^{0.1}} \qquad t_c = t_0 + t_f \qquad i = \frac{a}{(t_d + b)^c} \qquad Q_p = 0.278\,C\,i\,A$$

D. Estimated Pipe Capacity and Adequacy Check for the Proposed Upgrading Drainage System

Drainage Pipe	Diameter, m	Length, m	Level (out), mPD	Level (in), mPD	Slope	Manning's roughness coefficient	Cross Section Area, m^2 [5]	Wetted perimeter, m	Hydraulic radius, m	Mean velocity, m/s	Capacity flow, m^3/s	Catchments Served	Runoff, m^3/s	% of capacity flow	Sufficient Capacity? (Y/N)	Flow time (t_f), min
C1 - A2	**0.300**	6.9	10.80	10.65	0.022	0.015	0.064	0.942	0.07	1.63	0.104	A	0.46	**444%**	N	0.07
A2 - A3	**0.300**	3.4	9.55	9.30	0.074	0.015	0.064	0.942	0.07	3.01	0.191	A	0.46	**240%**	N	0.02
A3 - A4	**0.300**	6.0	9.30	9.20	0.017	0.015	0.064	0.942	0.07	1.42	0.090	A	0.46	**508%**	N	0.07
A4 - A5	**0.450**	12.3	9.05	8.75	0.024	0.015	0.143	1.414	0.10	2.27	0.324	A and E	0.51	**156%**	N	0.09
A5 - A6	**0.450**	9.4	8.75	8.58	0.018	0.015	0.143	1.414	0.10	1.95	0.279	A and E	0.51	**181%**	N	0.08
A6 - A7	**0.450**	3.4	8.58	8.50	0.024	0.015	0.143	1.414	0.10	2.23	0.319	A and E	0.51	**159%**	N	0.03

Stream	Width, m	Depth, m	Slope [4]	Manning's roughness coefficient	Cross Section Area, m^2 [5]	Wetted perimeter, m	Hydraulic radius, m	Mean velocity, m/s	Capacity flow, m^3/s	Catchments Served	Runoff, m^3/s	% of capacity flow	Sufficient Capacity? (Y/N)
Channel - CH. 67	Note [1]	Note [1]	0.003	0.035	14.030	11.486	1.22	1.76	24.660	A, E to K	27.77	**113%**	N
Channel - Ch 212	Note [2]	Note [2]	0.008	0.035	22.140	16.470	1.34	3.16	70.044	A, E to M	32.32	46%	Y
Box Culvert	Note [3]	Note [3]	0.008	0.016	11.822	20.359	0.58	3.95	46.755	A, E to M	32.32	69%	Y

Note
[1] Dimension of Channel - CH.67 was adopted and referred to the As-built Drawing of the Channel in Appendix 3.2(Section B - AT CH.67 in Drawing No. MCL-118CD-P-KTS08-D111).
[2] Dimension of Channel - CH.212 was adopted and referred to the As-built Drawing of the Channel in Appendix 3.2(Section E - AT CH.212 in Drawing No. MCL-118CD-P-KTS08-D114).
[3] Dimension of Box Culvert was referred to the As-built Drawing of the Channel in Appendix 3.2 (Section B in Drawing No. MCL-118CD-P-KTS08-S407).
[4] Slope of Channel - CH.67 and Ch.212 and Box Culvert were referred to As-built Drawing of the Channel in Appendix 3.2 (Drawing No. MCL-118CD-P-KTS08-D101).
[5] A 5% reduction in flow area shall be applied if the gradient is greater than or equal to 1 in 25, and a 10% reduction in flow area shall be applied if the gradient is less than 1 in 25.

Appendix 3.2

Detailed Drainage Analysis for Post-development Scenario

A. Calculation of Runoff (50 years return period)

Catchment ID	Surface Type	Catchment Area (A), m^2	Catchment Area (A), km^2	Average slope (H), m/100m	Flow path length (L), m	Inlet time (t_0), min	Time of Concentration (t_c), min	Duration (t_d), min	a [1]	b [1]	c [1]	Rainfall Increase due to Climate Change & Design allowance [2]	Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s
After Development																
A	25% Grassland (Heavy Soil), Flat + 75% concrete	18,724	0.0187	0.05	182.0	17.59	17.59	17.59	474.6	2.9	0.37	28.1%	199	0.78	0.0145	0.80
E	100% concrete	410	0.0004	3.72	14.2	0.86	0.86	0.86	474.6	2.9	0.37	28.1%	372	0.95	0.0004	0.04
F	10% Grassland (Heavy Soil), Steep + 90% concrete	157,117	0.1571	8.47	229.0	6.53	6.53	6.53	474.6	2.9	0.37	28.1%	265	0.89	0.1398	10.30
G	100% concrete	34,637	0.0346	0.94	115.1	5.92	5.92	5.92	474.6	2.9	0.37	28.1%	272	0.95	0.0329	2.49
H	96% Grassland (Heavy Soil), Flat + 4% concrete	276,309	0.2763	3.83	445.9	14.09	14.09	14.09	474.6	2.9	0.37	28.1%	213	0.28	0.0768	4.55
I	74% Grassland (Heavy Soil), Flat + 26% concrete	62,623	0.0626	5.11	172.1	5.95	5.95	5.95	474.6	2.9	0.37	28.1%	271	0.43	0.0271	2.04
J	89% Grassland (Heavy Soil), Steep + 11% concrete	94,014	0.0940	38.21	95.0	2.11	2.11	2.11	474.6	2.9	0.37	28.1%	335	0.42	0.0391	3.64
K	88% Grassland (Heavy Soil), Flat + 12% concrete	38,004	0.0380	20.09	118.1	3.27	3.27	3.27	474.6	2.9	0.37	28.1%	310	0.33	0.0127	1.09
L	60% Grassland (Heavy Soil), Flat + 40% concrete	40,988	0.0410	1.03	135.3	6.72	6.72	6.72	474.6	2.9	0.37	28.1%	263	0.53	0.0217	1.59
N	30% Grassland (Heavy Soil), Flat + 70% concrete	16,005	0.0160	1.75	34.3	1.69	1.69	1.69	474.6	2.9	0.37	28.1%	346	0.74	0.0118	1.14
M	26% Grassland (Heavy Soil), Steep + 74% concrete	18,118	0.0181	20.21	85.5	2.54	2.54	2.54	474.6	2.9	0.37	28.1%	325	0.79	0.0144	1.30

Note

Runoff is calculated in accordance with DSD's "*Stormwater Drainage Manual - Planning, Design and Managemen*t" (SDM), fifth edition, January 2018.

Rainfall Increase due to the climate change effects up to mid 21st Century has been adopted with reference to Table 28 of DSD's SDM, fifth edition, January 2018.

[1] Table 3d - Storm Constants for Different Return Periods of North District Area in the SDM Corrigendum No. 1/2024 (26 March 2024) has been adopted.

[2] Table 28 - Rainfall increase for mid of 21st Century in the SDM Corrigendum No. 1/2022 has been adopted, and Table 31 - Design allowance for rainfall increase in the SDM Corrigendum No. 1/2022 has been adopted.

Equations Used

$$t_0 = \frac{0.14465L}{H^{0.2}A^{0.1}} \qquad t_c = t_0 + t_f \qquad i = \frac{a}{(t_d + b)^c} \qquad Q_p = 0.278\,C\,i\,A$$

B. Estimated Pipe Capacity and Adequacy Check for the Proposed Upgrading Drainage System (50 years return period)

Drainage Pipe	Diameter, m	Length, m	Level (out), mPD	Level (in), mPD	Slope	Manning's roughness coefficient	Cross Section Area, m^2 [5]	Wetted perimeter, m	Hydraulic radius, m	Mean velocity, m/s	Capacity flow, m^3/s [4]	Catchments Served	Runoff, m^3/s	% of capacity flow	Sufficient Capacity? (Y/N)	Flow time (t_f), min
PT1 - P2	**0.750**	12.7	9.80	9.55	0.020	0.015	0.398	2.356	0.17	2.86	1.136	A	0.80	71%	Y	0.07
P2 - P3	**0.750**	17.7	9.55	9.20	0.020	0.015	0.398	2.356	0.17	2.86	1.138	A	0.80	70%	Y	0.10
P3 - P4	**0.750**	33.7	9.20	8.50	0.021	0.015	0.398	2.356	0.17	2.93	1.167	A	0.80	69%	Y	0.19
P4 - P5	**0.750**	23.2	8.50	8.00	0.022	0.015	0.398	2.356	0.17	2.99	1.189	A	0.80	67%	Y	0.13
P5 - P6	**0.750**	47.3	8.00	7.00	0.021	0.015	0.398	2.356	0.17	2.96	1.176	A	0.80	68%	Y	0.27
P6 - P7	**0.750**	3.4	7.00	6.93	0.021	0.015	0.398	2.356	0.17	2.92	1.161	A	0.80	69%	Y	0.02
P6 - P7 (U-Channel)	**0.750**	2.1	6.93	6.88	0.024	0.016	0.398	2.356	0.17	2.94	1.171	A	0.80	69%	Y	0.01

Stream	Width, m	Depth, m	Slope [4]	Manning's roughness coefficient	Cross Section Area, m^2 [5]	Wetted perimeter, m	Hydraulic radius, m	Mean velocity, m/s	Capacity flow, m^3/s	Catchments Served	Runoff, m^3/s	% of capacity flow	Sufficient Capacity? (Y/N)
Channel - CH. 212	Note [2]	Note [2]	0.008	0.035	22.140	16.470	1.34	3.16	70.044	A, E to M	28.99	41%	Y
Box Culvert	Note [3]	Note [3]	0.008	0.016	11.822	20.359	0.58	3.95	46.755	A, E to M	28.99	62%	Y

Note
[2] Dimension of Channel - CH.212 was adopted and referred to the As-built Drawing of the Channel in Appendix 3.2(Section E - AT CH.212 in Drawing No. MCL-118CD-P-KTS08-D114).
[3] Dimension of Box Culvert was referred to the As-built Drawing of the Channel in Appendix 3.2 (Section B in Drawing No. MCL-118CD-P-KTS08-S407).
[4] Slope of Channel - CH.67 and Ch.212 and Box Culvert were referred to As-built Drawing of the Channel in Appendix 3.2 (Drawing No. MCL-118CD-P-KTS08-D101).
[5] A 5% reduction in flow area shall be applied if the gradient is greater than or equal to 1 in 25, and a 10% reduction in flow area shall be applied if the gradient is less than 1 in 25.

C. Calculation of Runoff (200 years return period)

Catchment ID	Surface Type	Catchment Area (A), m^2	Catchment Area (A), km^2	Average slope (H), m/100m	Flow path length (L), m	Inlet time (t_0), min	Time of Concentration (t_c), min	Duration (t_d), min	a [1]	b [1]	c [1]	Rainfall Increase due to Climate Change & Design allowance [2]	Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s
After Development																
A	25% Grassland (Heavy Soil), Flat + 75% concrete	18,724	0.0187	0.05	182.0	17.59	17.59	17.59	501.4	2.45	0.348	28.1%	226	0.78	0.0145	0.91
E	100% concrete	410	0.0004	3.72	14.2	0.86	0.86	0.86	501.4	2.45	0.348	28.1%	423	0.95	0.0004	0.05
F	10% Grassland (Heavy Soil), Steep + 90% concrete	157,117	0.1571	8.47	229.0	6.53	6.53	6.53	501.4	2.45	0.348	28.1%	299	0.89	0.1398	11.63
G	100% concrete	34,637	0.0346	0.94	115.1	5.92	5.92	5.92	501.4	2.45	0.348	28.1%	307	0.95	0.0329	2.81
H	96% Grassland (Heavy Soil), Flat + 4% concrete	276,309	0.2763	3.83	445.9	14.09	14.09	14.09	501.4	2.45	0.348	28.1%	242	0.28	0.0768	5.17
I	74% Grassland (Heavy Soil), Flat + 26% concrete	62,623	0.0626	5.11	172.1	5.95	5.95	5.95	501.4	2.45	0.348	28.1%	306	0.43	0.0271	2.30
J	89% Grassland (Heavy Soil), Steep + 11% concrete	94,014	0.0940	38.21	95.0	2.11	2.11	2.11	501.4	2.45	0.348	28.1%	379	0.42	0.0391	4.12
K	88% Grassland (Heavy Soil), Flat + 12% concrete	38,004	0.0380	20.09	118.1	3.27	3.27	3.27	501.4	2.45	0.348	28.1%	350	0.33	0.0127	1.24
L	60% Grassland (Heavy Soil), Flat + 40% concrete	40,988	0.0410	1.03	135.3	6.72	6.72	6.72	501.4	2.45	0.348	28.1%	297	0.53	0.0217	1.79
N	30% Grassland (Heavy Soil), Flat + 70% concrete	16,005	0.0160	1.75	34.3	1.69	1.69	1.69	501.4	2.45	0.348	28.1%	392	0.74	0.0118	1.29
M	26% Grassland (Heavy Soil), Steep + 74% concrete	18,118	0.0181	20.21	85.5	2.54	2.54	2.54	501.4	2.45	0.348	28.1%	367	0.79	0.0144	1.47

Note
Runoff is calculated in accordance with DSD's "*Stormwater Drainage Manual - Planning, Design and Managemen*t" (SDM), fifth edition, January 2018.
Rainfall Increase due to the climate change effects up to mid 21st Century has been adopted with reference to Table 28 of DSD's SDM, fifth edition, January 2018.
[1] Table 3d - Storm Constants for Different Return Periods of North District Area in the SDM Corrigendum No. 1/2024 (26 March 2024) has been adopted.
[2] Table 28 - Rainfall increase for mid of 21st Century in the SDM Corrigendum No. 1/2022 has been adopted, and Table 31 - Design allowance for rainfall increase in the SDM Corrigendum No. 1/2022 has been adopted.

Equations Used

$$t_0 = \frac{0.14465L}{H^{0.2}A^{0.1}} \qquad t_c = t_0 + t_f \qquad i = \frac{a}{(t_d + b)^c} \qquad Q_p = 0.278\,C\,i\,A$$

D. Estimated Pipe Capacity and Adequacy Check for the Proposed Upgrading Drainage System (200 years return period)

Drainage Pipe	Diameter, m	Length, m	Level (out), mPD	Level (in), mPD	Slope	Manning's roughness coefficient	Cross Section Area, m^2 [5]	Wetted perimeter, m	Hydraulic radius, m	Mean velocity, m/s	Capacity flow, m^3/s [4]	Catchments Served	Runoff, m^3/s	% of capacity flow	Sufficient Capacity? (Y/N)	Flow time (t_f), min
PT1 - P2	**0.750**	12.7	9.80	9.55	0.020	0.015	0.398	2.356	0.17	2.86	1.136	A	0.91	80%	Y	0.07
P2 - P3	**0.750**	17.7	9.55	9.20	0.020	0.015	0.398	2.356	0.17	2.86	1.138	A	0.91	80%	Y	0.10
P3 - P4	**0.750**	33.7	9.20	8.50	0.021	0.015	0.398	2.356	0.17	2.93	1.167	A	0.91	78%	Y	0.19
P4 - P5	**0.750**	23.2	8.50	8.00	0.022	0.015	0.398	2.356	0.17	2.99	1.189	A	0.91	77%	Y	0.13
P5 - P6	**0.750**	47.3	8.00	7.00	0.021	0.015	0.398	2.356	0.17	2.96	1.176	A	0.91	78%	Y	0.27
P6 - P7	**0.750**	3.4	7.00	6.93	0.021	0.015	0.398	2.356	0.17	2.92	1.161	A	0.91	79%	Y	0.02
P6 - P7 (U-Channel)	**0.750**	2.1	6.93	6.88	0.024	0.016	0.398	2.356	0.17	2.94	1.171	A	0.91	78%	Y	0.01

Stream	Width, m	Depth, m	Slope [4]	Manning's roughness coefficient	Cross Section Area, m^2 [5]	Wetted perimeter, m	Hydraulic radius, m	Mean velocity, m/s	Capacity flow, m^3/s	Catchments Served	Runoff, m^3/s	% of capacity flow	Sufficient Capacity? (Y/N)
Channel - CH. 212	Note [2]	Note [2]	0.008	0.035	22.140	16.470	1.34	3.16	70.044	A, E to M	32.77	47%	Y
Box Culvert	Note [3]	Note [3]	0.008	0.016	11.822	20.359	0.58	3.95	46.755	A, E to M	32.77	70%	Y

Note

[2] Dimension of Channel - CH.212 was adopted and referred to the As-built Drawing of the Channel in Appendix 3.2(Section E - AT CH.212 in Drawing No. MCL-118CD-P-KTS08-D114).

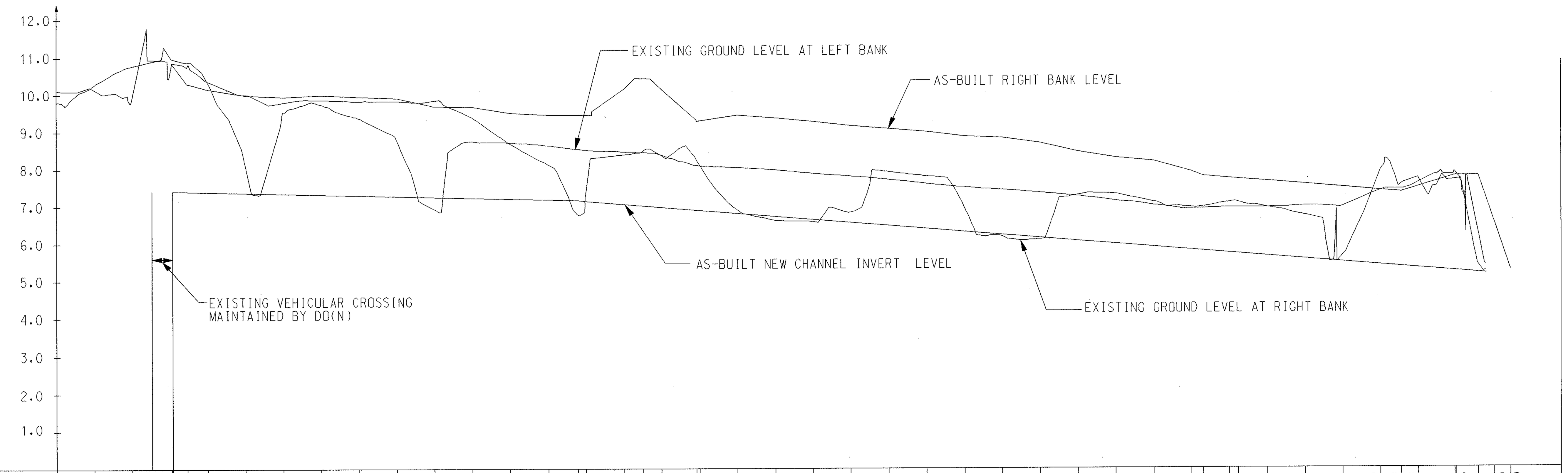
[3] Dimension of Box Culvert was referred to the As-built Drawing of the Channel in Appendix 3.2 (Section B in Drawing No. MCL-118CD-P-KTS08-S407).

[4] Slope of Channel - CH.67 and Ch.212 and Box Culvert were referred to As-built Drawing of the Channel in Appendix 3.2 (Drawing No. MCL-118CD-P-KTS08-D101).

[5] A 5% reduction in flow area shall be applied if the gradient is greater than or equal to 1 in 25, and a 10% reduction in flow area shall be applied if the gradient is less than 1 in 25.

Appendix 3.3

As-built Drawing of the Channel and Box Culvert



CHAINAGE (m)	0.00 10.00 20.00 25.20 30.48 30.70 34.61 40.00 50.00 60.00 70.00 80.00 90.00 100.00 110.00 120.00 130.00 137.79 140.00 150.00 157.00 160.00 169.21 170.00 180.00 190.00 200.00 210.00 200.00 230.00 240.00 250.00 260.00 270.00 280.00 290.00 300.00 303.00 310.00 312.43 320.00 330.00 340.00 350.00 355.50 360.00 369.64 370.00 375.91 380.00 384.30
AS-BUILT RIGHT BANKS LEVEL (mPD)	N.A. 10.857 10.290 10.156 9.992 9.939 9.986 9.944 9.900 9.686 9.663 9.507 9.450 9.441 9.431 (9.542) 10.144 10.420 10.417 10.144 9.309 (9.272) 9.283 9.431 9.350 9.252 9.142 9.055 8.973 8.853 8.808 8.669 8.441 8.272 8.181 7.898 7.775 7.716 7.696 7.633 7.550 7.465 7.380 7.330 7.468 7.765 7.765 7.765 6.536 5.244
AS-BUILT INVERT OF NEW CHANNEL (mPD)	7.56 N.A. 7.41 7.16 7.14 7.06 7.00 6.88 6.63 6.22 5.80 5.55 5.38
EXISTING GROUND LEVEL AT RIGHT BANK (mPD)	10.11 10.08 10.13 10.04 9.89 10.93 10.57 10.79 10.35 10.14 9.99 9.78 9.78 9.86 9.85 9.83 9.82 9.81 9.81 9.77 9.83 9.61 9.36 9.01 8.67 8.37 8.11 7.32 7.35 8.31 8.37 8.46 8.34 8.54 8.10 7.37 6.88 6.71 6.59 6.58 6.56 6.94 6.81 7.53 7.90 7.83 7.78 7.74 6.94 6.16 6.16 6.06 6.08 7.16 7.27 7.31 7.29 7.18 7.08 6.95 6.93 6.97 7.06 6.99 6.93 6.84 6.71 6.44 5.64 6.66 7.92 7.50 7.69 7.50 7.66 6.68
EXISTING GROUND LEVEL NEAR CENTRELINE OF CHANNEL (mPD)	8.22 7.67 7.53 7.51 7.82 7.54 8.01 7.51 8.61 9.37 9.51 9.65 10.02 9.98 10.05 10.06 9.80 9.76 9.68 9.53 9.14 8.51 7.56 6.74 8.37 8.36 8.36 8.40 8.38 8.36 8.36 8.38 8.22 8.33 8.29 8.25 8.19 8.14 8.25 8.20 8.06 7.97 7.88 7.80 7.73 7.66 7.61 7.57 7.54 7.49 7.40 7.38 7.29 7.31 7.28 7.20 7.13 7.03 6.95 6.89 6.89 6.90 6.92 6.93 6.95 6.92 6.88 6.73 6.70 6.97 6.99 6.94 8.25 5.65 5.19 5.47
GRADIENT OF NEW CHANNEL BASE	1 IN 345 / 1 IN 121 / 1 IN 121
BASE WIDTH	5m BASE TRAPEZOIDAL CHANNEL / 5m BASE TRAPEZOIDAL CHANNEL / 5m BASE RECTANGULAR CHANNEL

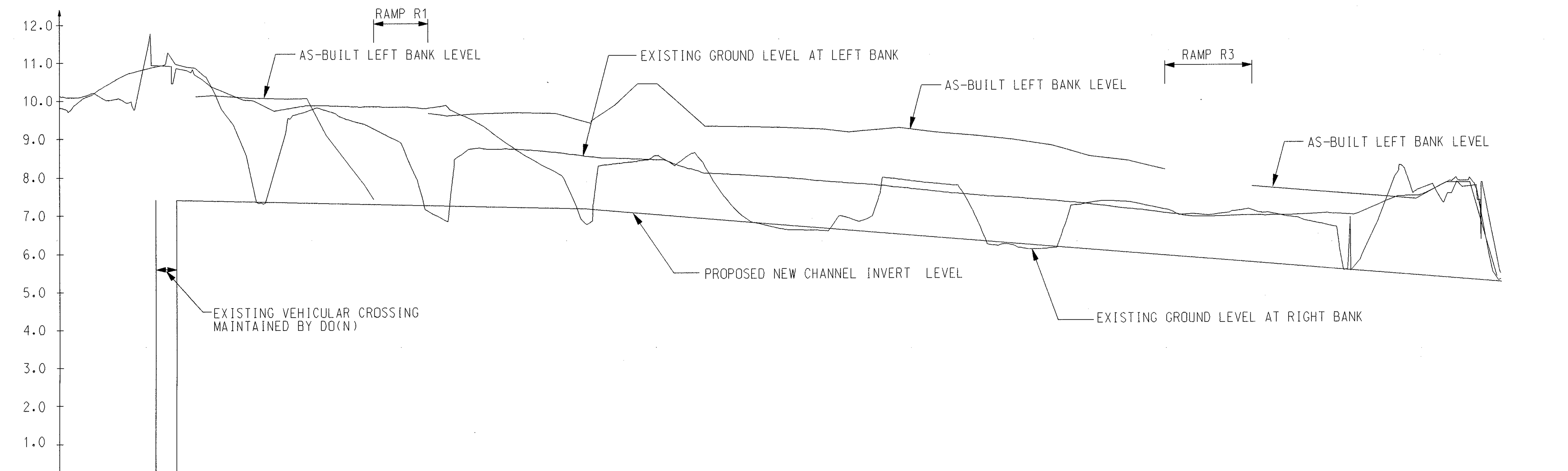
EXISTING RIVER BED AND DRAINAGE STRUCTURE TO BE MAINTAINED

TRANSITION STRUCTURE & AS-CONSTRUCTED BOX CULVERT

TRANSITION STRUCTURE AND AS-CONSTRUCTED BOX CULVERT

LONGITUDINAL PROFILE OF KTS08 (R.H.S.)

SCALE: HORIZONTAL 1 : 1000
VERTICAL 1 : 100



CHAINAGE (m)	0.00 10.00 20.00 25.20 20.00 30.70 35.71 40.00 50.00 60.00 64.90 70.00 80.00 82.42 90.00 96.69 100.00 110.00 110.00 120.00 130.00 137.79 145.51 150.00 151.44 156.71 162.31 169.20 170.00 180.00 190.00 200.00 206.94 210.00 200.00 230.00 240.00 250.00 260.00 270.00 280.00 289.75 290.00 300.00 310.00 310.00 320.00 330.00 340.00 350.00 355.50 360.00 363.36 369.63 370.00 376.68
AS-BUILT LEFT BANKS LEVEL (mPD)	N.A. 10.114 10.131 10.071 10.043 10.047 9.086 7.807 7.415 9.652 9.605 9.584 9.634 9.660 9.645 9.371 (9.441) 9.851 10.279 10.416 10.418 9.911 9.293 9.287 9.284 9.257 9.212 9.121 9.156 9.240 9.111 9.026 8.927 8.767 8.494 8.370 8.140 7.695 7.633 7.550 7.465 7.380 7.330 7.579 7.765 7.765 7.635 5.307
AS-BUILT INVERT OF NEW CHANNEL (mPD)	7.56 N.A. 7.41 7.16 7.14 7.06 7.00 6.88 6.63 6.22 5.80 5.55 5.38
EXISTING GROUND LEVEL AT RIGHT BANK (mPD)	10.11 10.08 10.13 10.04 9.89 10.93 10.57 10.79 10.35 10.14 9.99 9.78 9.78 9.86 9.85 9.83 9.82 9.81 9.81 9.77 9.83 9.61 9.36 9.01 8.67 8.37 8.11 7.32 7.35 8.31 8.37 8.46 8.34 8.54 8.10 7.37 6.88 6.71 6.59 6.58 6.56 6.94 6.81 7.53 7.90 7.83 7.78 7.74 6.94 6.16 6.16 6.06 6.08 7.16 7.27 7.31 7.29 7.18 7.08 6.95 6.93 6.97 7.06 6.99 6.93 6.84 6.71 6.44 5.64 6.66 7.92 7.50 7.69 7.50 7.66 6.68
EXISTING GROUND LEVEL NEAR CENTRELINE OF CHANNEL (mPD)	8.22 7.67 7.53 7.51 7.82 7.54 8.01 7.51 8.61 9.37 9.51 9.65 10.02 9.98 10.05 10.06 9.80 9.76 9.68 9.53 9.14 8.51 7.56 6.74 8.37 8.36 8.36 8.40 8.38 8.36 8.36 8.38 8.22 8.33 8.29 8.25 8.19 8.14 8.25 8.20 8.06 7.97 7.88 7.80 7.73 7.66 7.61 7.57 7.54 7.49 7.40 7.38 7.29 7.31 7.28 7.20 7.13 7.03 6.95 6.89 6.89 6.90 6.92 6.93 6.95 6.92 6.88 6.73 6.70 6.97 6.99 6.94 8.25 5.65 5.19 5.47
GRADIENT OF NEW CHANNEL BASE	1 IN 345 / 1 IN 121 / 1 IN 121
BASE WIDTH	5m BASE TRAPEZOIDAL CHANNEL / 5m BASE TRAPEZOIDAL CHANNEL / 5m BASE RECTANGULAR CHANNEL

EXISTING RIVER BED AND DRAINAGE STRUCTURE TO BE MAINTAINED

TRANSITION STRUCTURE & AS-CONSTRUCTED BOX CULVERT

TRANSITION STRUCTURE AND AS-CONSTRUCTED BOX CULVERT

LONGITUDINAL PROFILE OF KTS08 (L.H.S.)

SCALE: HORIZONTAL 1 : 1000
VERTICAL 1 : 100

Notes:

1. FOR GENERAL NOTES REFER TO CONSTRUCTION DRAWING Nos. MCL-118CD-P-PHASE2-GA000 & MCL-118CD-P-PHASE2-GA001.

Key to symbols

Rev	Date	Drawn	Description	Ch'k'd	App'd
AB	JAN 11	CYC	AS-CONSTRUCTED DRAWING	SSC	JBK
B	SEP 07	RL	DESIGN MODIFICATION FOR CONSTRUCTION		
A	JUL 06	CW	IDENTICAL TO TENDER DRAWING REVISION 01	TT	TMC

Client

DRAINAGE SERVICES DEPARTMENT
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Contract No. DC/2006/06

Contract

Drainage Improvement Works
in Kwu Tung South and Fu Tei Au, Sheung Shui

Drawing Title

CHANNEL KTS08 LONGITUDINAL PROFILE

Designed	AH		Eng.Chk.	TT	
Drawn	CW	CW	Approved	TMC	
Dwg.Chk.	GT		Scale	AS SHOWN@A1	

Project 204521

CAD file /DC_2006_06(PHASE 2)/As-built/KTS08/KTS08-D101-rev_AB.dgn

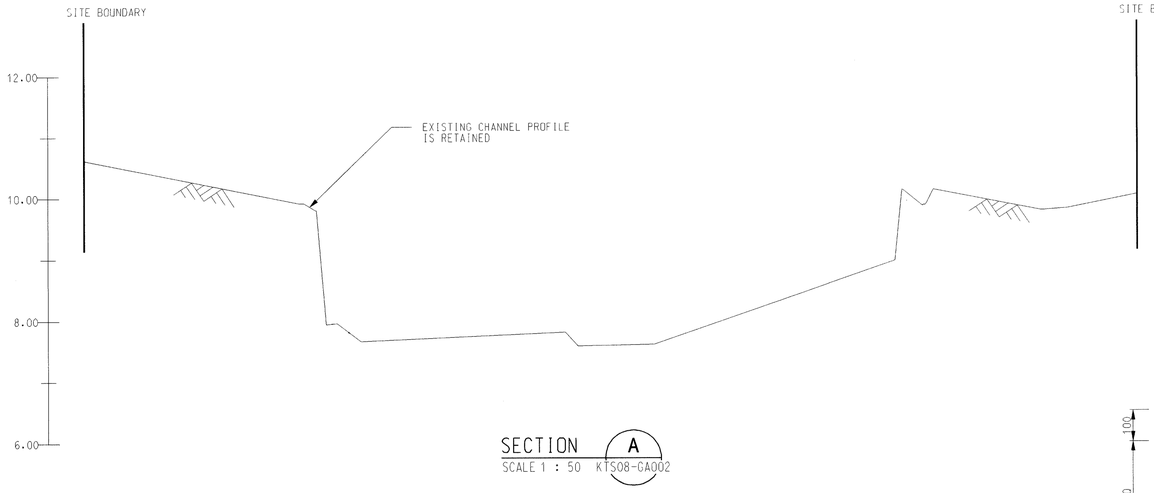
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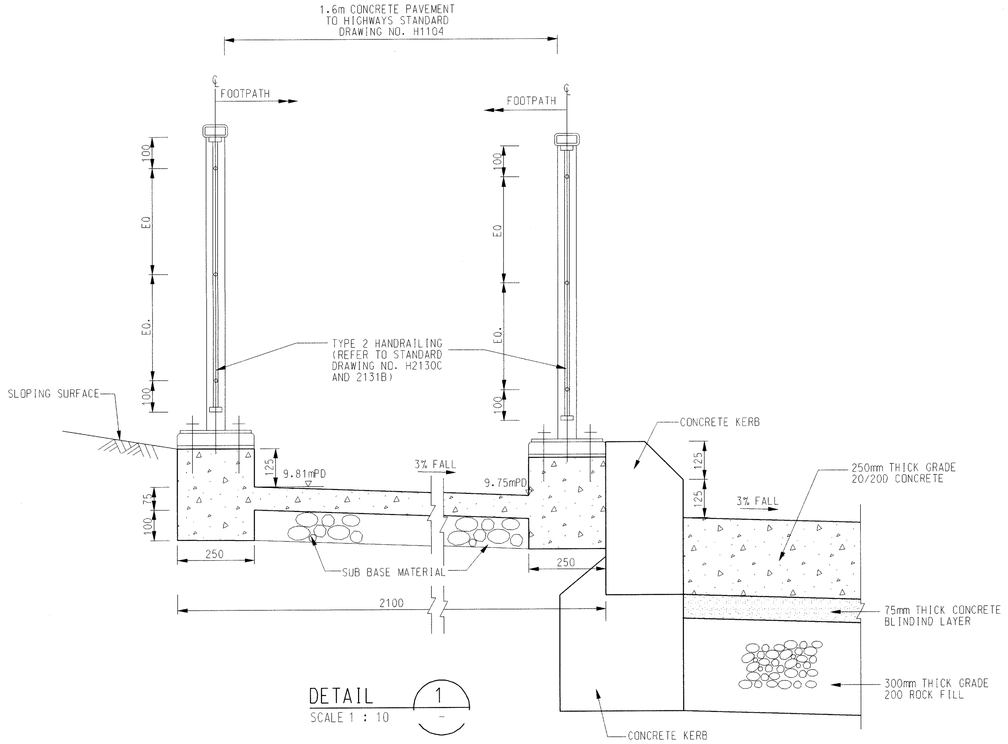
Rev AB

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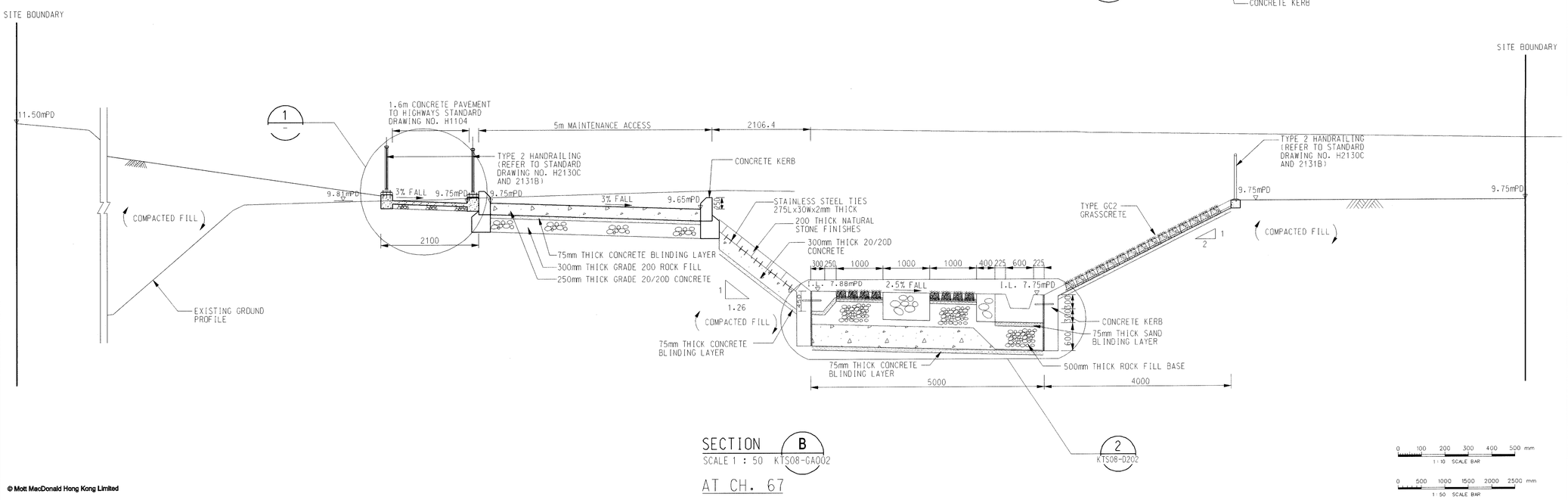
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SECTION A
SCALE 1 : 50 KTS08-GA002



DETAIL 1
SCALE 1 : 10



SECTION B
SCALE 1 : 50 KTS08-GA002

AT CH. 67

0 100 200 300 400 500 mm
1:10 SCALE BAR

0 500 1000 1500 2000 2500 mm
1:50 SCALE BAR

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Notes:

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2. FOR DETAILS OF CROSS SECTION REFER TO DRAWING No. MCL-118CD-P-KTS08-GA002.
3. FOR DETAILS OF FOOTPATH AND RAMP CONSTRUCTION REFER TO DRAWING No. MCL-118CD-P-KTS08-D201.

Key to symbols

Rev	Date	Drawn	Description	Ch'k'd	App'd
AB	JAN 11	CYC	AS-CONSTRUCTED DRAWING	SSC	JBK
A	JUL 06	CW	IDENTICAL TO TENDER DRAWING REVISION 01		

Client

DRAINAGE SERVICES DEPARTMENT
GOVERNMENT OF THE
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Contract No. DC/2006/06

Contract

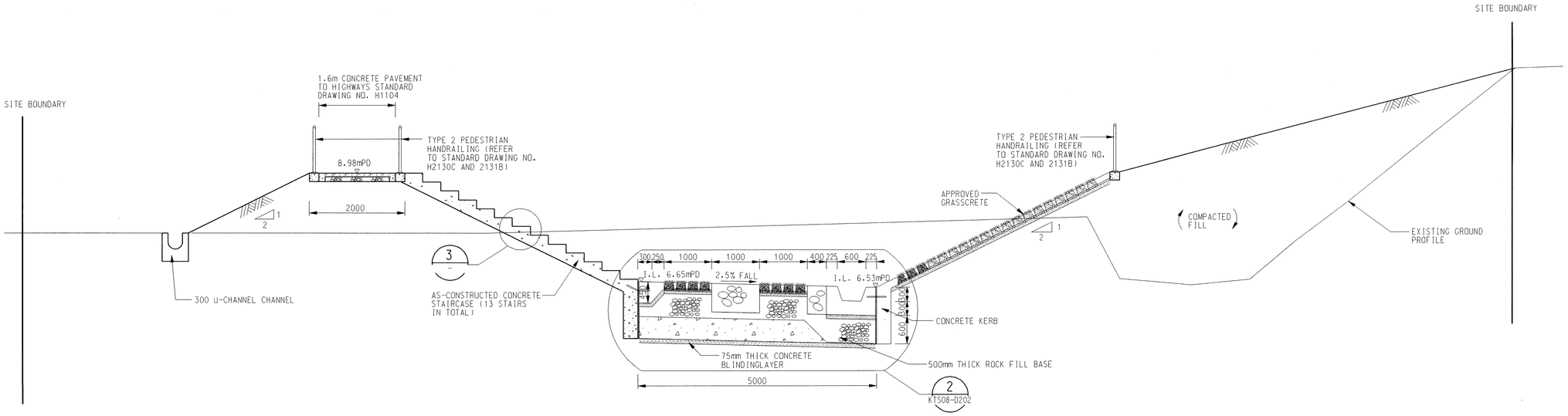
Drainage Improvement Works
in Kwu Tung South and Fu Tei Au, Sheung Shui

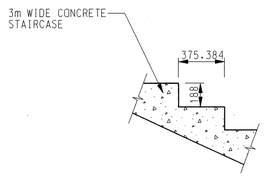
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CHANNEL KTS08
SECTIONS & DETAILS
(SHEET 1 OF 12)

Designed	AH		Eng.Chk.	TT	
Drawn	CW	CW	Approved	TMC	
Dwg.Chk.	TT		Scale	AS SHOWN@A1	

Project 204521
CAD file /DC_2006_06(PHASE 2)/As-built/KTS08/KTS08-D111-rev_AB.dgn
Status A
Drawing No. MCL-118CD-P-KTS08-D111
Rev AB





DETAIL 3 (-)
SCALE 1 : 25

SECTION E
SCALE 1 : 50 KTS08-GA003

AT CH. 212

0 500 1000 1500 2000 2500 mm
1:50 SCALE BAR

Notes:

1. FOR GENERAL NOTES REFER TO DRAWING No. MCL-118CD-P-PHASE2-GA000.
2. FOR DETAILS OF CROSS SECTION REFER TO DRAWING No. MCL-118CD-P-KTS08-GA003.

Key to symbols

Rev	Date	Drawn	Description	Ch'k'd	App'd
AB	JAN 11	CYC	AS-CONSTRUCTED DRAWING	SSC	JBK
A	JUL 06	CW	IDENTICAL TO TENDER DRAWING REVISION 01		

Client

DRAINAGE SERVICES DEPARTMENT
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Contract No. DC/2006/06

Contract

Drainage Improvement Works
in Kwu Tung South and Fu Tei Au, Sheung Shui

Drawing Title

CHANNEL KTS08
SECTIONS & DETAILS
(SHEET 4 OF 12)

Designed	AH		Eng.Chk.	TT	
Drawn	CW	CW	Approved	TMC	
Dwg.Chk.	GT		Scale	1:50@A1	

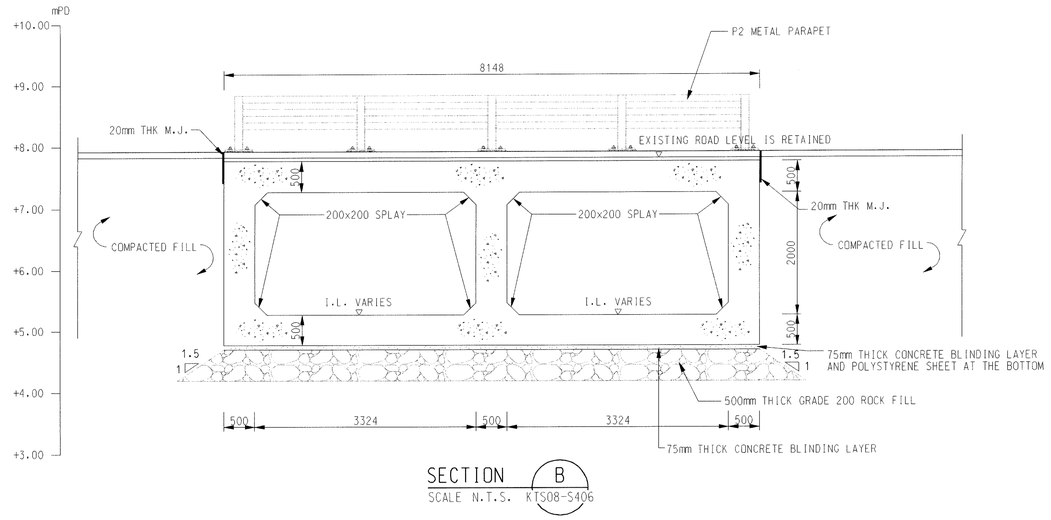
Project 204521 Status A

CAD file /DC_2006_06(PHASE 2)/As-built/KTS08/KTS08-D114-rev_AB.dgn

Drawing No. MCL-118CD-P-KTS08-D114 Rev AB

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SECTION B
SCALE N.T.S. KTS08-S406

Notes:

1. FOR GENERAL NOTES REFER TO DRAWING No. MCL-118CD-P-PHASE2-GA000.
2. FOR LOCATION OF CROSS SECTIONS REFER TO DRAWING No. MCL-118CD-P-KTS08-S406.

Key to symbols

SITE BOUNDARY

EXISTING GROUND PROFILE

Rev	Date	Drawn	Description	Ch'k'd	App'd
AB	JAN 11	CYC	AS-CONSTRUCTED DRAWING	SSC	JBK
B	MAR 07	RL	DESIGN MODIFICATION FOR CONSTRUCTION		
A	JUL 06	CW	IDENTICAL TO TENDER DRAWING REVISION 02	TT	TMC

Client

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Contract

Drainage Improvement Works
in Kwu Tung South and Fu Tei Au, Sheung Shui

Drawing Title

CHANNEL KTS08
GENERAL LAYOUT & DETAILS OF
AS-CONSTRUCTED BOX CULVERT No. 2
(SHEET 2 OF 3)

Designed	AH		Eng.Chk.	TT	
Drawn	CW	CW	Approved	TMC	
Dwg.Chk.	GT		Scale	1:50@A1	

Project 204521

Status A

CAD file /DC_2006_06(PHASE 2)/As-built/KTS08/KTS08-S407-Rev_AB.dgn

Drawing No. MCL-118CD-P-KTS08-S407

Rev AB

0 500 1000 1500 2000 2500 mm
1:50 SCALE BAR

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