

Prepared by

Ramboll Hong Kong Limited

**PROPOSED SCHOOL AT VARIOUS LOTS IN D.D. 94, 98 & 100
AND ADJOINING GOVERNMENT LAND, KWU TUNG SOUTH,
NEW TERRITORIES**

DRAINAGE IMPACT ASSESSMENT

Date **October 2025**

Prepared by **Sunny Yeung / Kim Leung**
Assistant Engineer/ Senior Engineer



Signed7

Approved by **Tony Cheng**
Senior Manager

Signed

Project Reference **HENKTSISEI00**Document No. **R9864_v1.0 _250924.docx**

No part of this document may be reproduced or transmitted, in any form or by any means electronic, mechanical, photographic, recording or otherwise, or stored in a retrieval system of any nature without the written permission of Ramboll Hong Kong Ltd, application for which shall be made to Ramboll Hong Kong Ltd, 21/F, BEA Harbour View Centre, 56 Gloucester Road, Wan Chai, Hong Kong.

Disclaimer: This report is made on behalf of Ramboll Hong Kong Ltd. No individual is personally liable in connection with the preparation of this report. By receiving this report and acting on it, the client or any third party relying on it accepts that no individual is personally liable in contract, tort or breach of statutory duty (including negligence).

Ramboll Hong Kong Limited

21/F, BEA Harbour View Centre
56 Gloucester Road, Wan Chai, Hong Kong

Tel: (852) 3465 2888
Fax: (852) 3465 2899
Email: hkinfo@ramboll.com

Q:\Projects\HENKTSISEI00\04 Deliverables\05 DIA\R9864_v1.0 _250924.docx

CHAPTERS

	Page
1. INTRODUCTION.....	1-1
1.1 Project Background.....	1-1
2. EXISTING DRAINAGE NETWORK.....	2-1
2.1 The Application Site	2-1
2.2 Existing Catchment Drainage	2-1
2.3 Site Drainage and Sub-catchments	2-1
2.4 Ground Levels	2-1
3. METHODOLOGY AND DESIGN PARAMETERS.....	3-1
4. POTENTIAL DRAINAGE IMPACT OF PROPOSED DEVELOPMENT.....	4-4
4.2 Changes to Drainage Characteristics	4-4
4.3 Volume of Runoff and Peak Runoff Rate.....	4-4
5. PROPOSED DRAINAGE IMPACT MITIGATION MEASURES.....	5-5
6. MAINTENANCE AND CONSTRUCTION CONSIDERATIONS	6-7
6.1 Maintenance Considerations.....	6-7
6.2 Construction Considerations.....	6-7
7. CONCLUSION	7-9

FIGURES

Figure F1	Location Plan
Figure F2	Existing Catchment Area
Figure F3	Existing Drainage Systems
Figure F4	Proposed Drainage Systems

APPENDICES

Annex 1	Runoff Calculations
Annex 2	Design of Drainage System
Annex 3	Master Layout Plan

1. INTRODUCTION

1.1 Project Background

- 1.1.1 Ramboll Hong Kong Limited in associated with Binnies Hong Kong Limited (Binnies) has been commissioned to carry out drainage impact assessment (DIA) for the Proposed International School in Kwu Tung South. (Application Site).
- 1.1.2 The Application Site is divided into eastern and western parts by the River Beas, with a few local village houses. Access to the Application Site is provided via Hang Tau Road and village track roads (**Figure F1**).
- 1.1.3 The Application Site covers an area of approximately 127,000 m².
- 1.1.4 The Proposed Development consists of Kindergartens, primary schools, middle & high schools and ancillary facilities, with a total plot ratio of 1.35. The scheduled year of completion of 2036. A summary of key information of the Proposed Development is shown below in **Table 1-1**

Table 1-1 Development Schedule

Development Parameter	Proposed Development
<i>Site Area</i>	About 127,000 m ²
<i>Plot Ratio</i>	About 1.35
<i>Total Gross Floor Area (GFA)</i>	About 171,000 m ²
<i>Anticipated Population</i>	
<i>Kindergarten</i>	About 600
<i>Grades 1-5</i>	About 1,000
<i>Grades 6-12</i>	About 1,400

- 1.1.5 This DIA is prepared based on available information and requirement under Drainage Services Department (DSD) Advice Note No. 1 – Application to Drainage Impact Assessment Process to Private Sector Projects.

2. EXISTING DRAINAGE NETWORK

2.1 The Application Site

- 2.1.1 The Application Site is currently occupied by a number of temporary structures. The land use of the Application Site will be changed to approximately 70% paved after the Proposed Development.

2.2 Existing Catchment Drainage

- 2.2.1 The Application Site lies in the middle reach of River Beas. River Beas runs from the south to the north and discharges into River Indus, which further discharges into Shenzhen River to the north. Shenzhen River flows to the west and eventually discharges into Deep Bay.
- 2.2.2 River Beas locates within the Indus Basin forming one of the tributaries of River Indus and serves the southwest part of the Indus Basin.

2.3 Site Drainage and Sub-catchments

- 2.3.1 The identified relevant sub-catchments for and in vicinity of the Application Site are shown on **Figure F2**. The existing drainage system in vicinity of the Application Site is shown on **Figure F3**.
- 2.3.2 Runoff from all sub-catchments (Catchments 1 to 5) drains to the River Beas. Runoff from these area passes through the Application Site and discharge to the River Beas.

2.4 Ground Levels

- 2.4.1 The western part of the Application Site slopes downward from the south and west in general, and dipped gently towards River Beas.
- 2.4.2 The existing ground level of the western part falls gently from +16.0 mPD to +12 mPD (south to north). The existing ground level of the eastern part falls gently from +13.0 mPD to +10 mPD (north to south).

3. METHODOLOGY AND DESIGN PARAMETERS

- 3.1.1 The assessment criteria for the Application Site is based on the standards as set out in DSD's 5th edition of Stormwater Drainage Manual (SDM) published in January 2018 and the updates pursuant to Corrigendum No. 1/2022 and No.1/2024 promulgated. Table 10 of the SDM provides the recommended design return periods based on flood levels for the various drainage systems depending on the land use.
- 3.1.2 According to the SDM, 50-year design return period is recommended for the design of drainage system.
- 3.1.3 The Ration Method is adopted for evaluating the runoff for the drainage design.
- 3.1.4 According to the rainfall zone as shown in Figure 3 of SDM, the Application Site is located in an area that adopts rainfall statistics of North District Area. Hence, the design storm constants are adopted in accordance with Table 3a of the SDM corrigendum No.1/2024. The storm constants are shown in **Table 3.1** below.

Table 3-1 Storm Constants with 50-year Return Period

Parameter	Value
A	474.6
B	2.9
C	0.371

- 3.1.5 The runoff coefficient (C) values for the Rational Method were adopted in accordance with Clause 7.5.2 of the SDM. A table of runoff coefficient is shown in **Table 3.2** below.

Table 3-2 Runoff Coefficient

Land Use	Runoff Coefficient (C) Value
Unpaved (e.g. existing tree groups)	0.35
Paved (e.g. concrete)	0.95

- 3.1.6 The effects of climate change are considered in accordance with Clause 6.8, Table 28 and Table 29 of the SDM corrigendum No.1/2022. A summary of increased rainfall due to climate change is shown in **Table 3.3** below.

Table 3-3 Rainfall Increase due to Climate Change

Classification	Rainfall Increase (%)	Sea Level Rise (m)
End of 21 st Century (2081-2100)	16.0	0.47

- 3.1.7 Design allowance in the End-21st Century is considered in the calculation as well and summarized in **Table 3-4**.

Table 3-4 Design Allowance in End of 21st Century

Rainfall Increase	Sea Level Rise (m)
12.1%	0.23

- 3.1.8 The roughness values of pipes were adopted in accordance with Table 13 and 14 of the SDM. As a conservation approach, 10% (of flow area) sedimentation is adopted for the proposed drainage system in design checking. A summary of roughness coefficients is shown in **Table 3-5** below.

Table 3-5 Roughness Coefficient

Classification	Roughness Coefficient	Remarks
Poor Precast Concrete Pipes	Colebrook-White $k_s = 0.6\text{mm}$	Concrete Pipe
Rectangular Channel	Mannings'n = 0.015	Peripheral drains

4. POTENTIAL DRAINAGE IMPACT OF PROPOSED DEVELOPMENT

4.1.1 The Application Site will be developed into an international school. The Master Layout Plan of the Proposed Development is shown in **Annex 3**.

4.2 Changes to Drainage Characteristics

4.2.1 The Proposed Development will induce changes to the land use of the Application Site. The percentage of paved area comprising building blocks, concrete structures, roads and other paved facilities will be increased. As a result, there will be an increase in surface runoff generated from the Application Site.

4.3 Volume of Runoff and Peak Runoff Rate

4.3.1 The increase in the peak runoff rates due to the Proposed Development at the Application Site against various rainstorm return periods are shown in **Tables 4-1** below.

4.3.2 The relevant calculations are included in **Annex 1**.

Table 4-1 Estimated Peak Runoff Rate

Return Period	Peak Runoff Rate (m ³ /s)		
	Before Development (1)	After Development (2)	Increase in Runoff (2) – (1)
50 years	4.45	6.47	2.02
200 years	5.05	7.33	2.28

5. PROPOSED DRAINAGE IMPACT MITIGATION MEASURES

- 5.1.1 To intercept existing overland flow blocked by the Proposed Development, surface channels will be provided along the site boundaries of the Proposed Development. The catchment of the flow intercepted and the proposed drainage system are shown on **Figure F4**.
- 5.1.2 The flow will be discharged to River Beas through the proposed 1000 mm to 1650 mm diameter drains along the public road inside the Application Site.
- 5.1.3 Details of the hydraulic calculations and results of hydraulic check of the proposed drainage system along the public road inside the Application Site are contained in **Annex 2**.
- 5.1.4 The runoff from the Proposed Development and its adjacent catchment as shown in **Figure F4**.

6. MAINTENANCE AND CONSTRUCTION CONSIDERATIONS

6.1 Maintenance Considerations

- 6.1.1 The parties responsible for managing and maintaining the completed proposed drainage works are listed in **Table 6-1**.

Table 6-1 Preliminary Management and Maintenance Matrix

Description of Proposed Drainage Works	Management and Maintenance Party
Stormwater Storage facilities, box culverts, drainage pipes and associated manholes on public roads or outside boundaries	Drainage Services Department
U-channels and associated catchpits which received the surface water inside the Development sites	The Applicant
Stormwater drainage facilities exclusively used for public roads (I.e. carriageway and footpaths.)	Highways Department

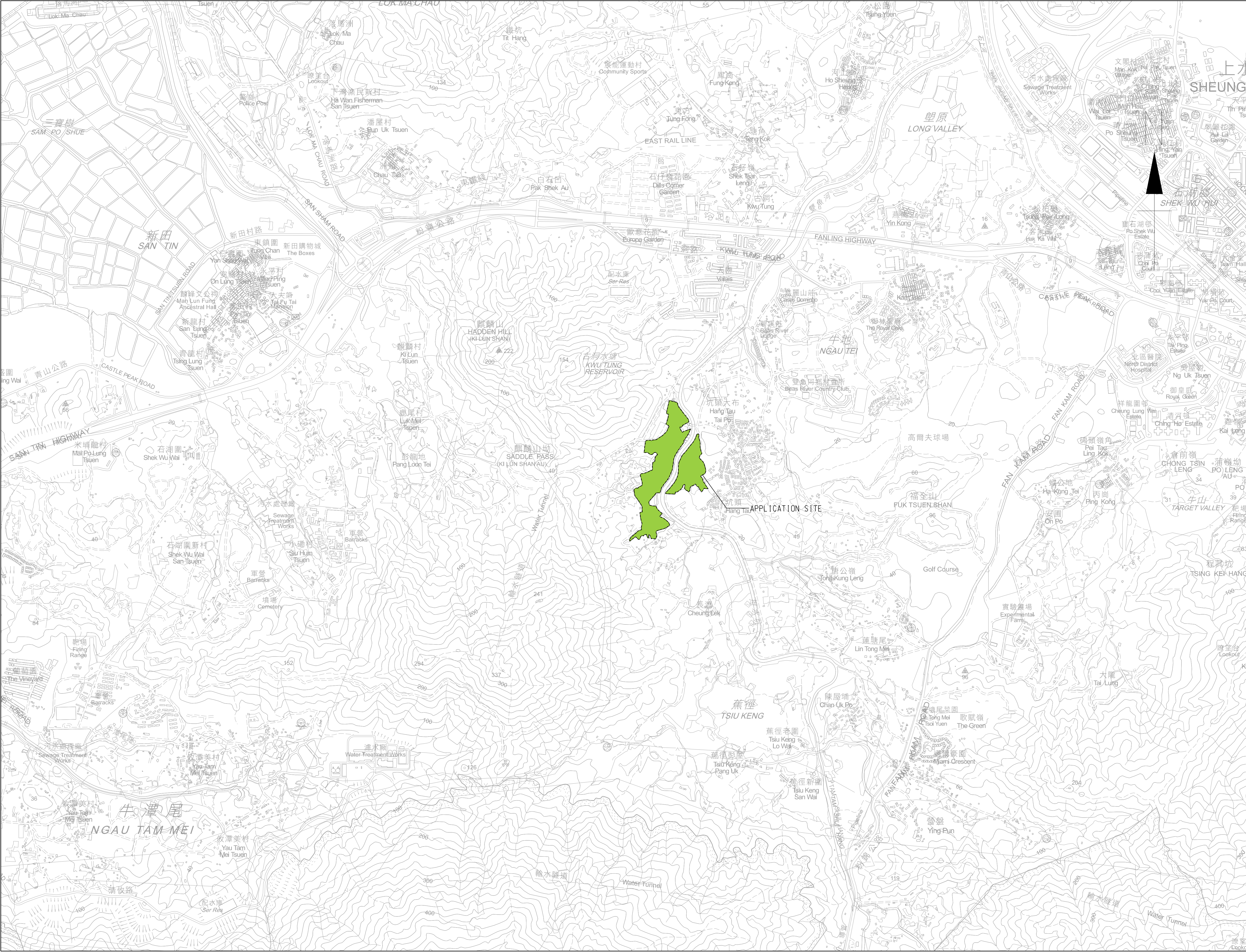
6.2 Construction Considerations

- 6.2.1 The contractor for the Proposed Development will be responsible for the maintenance of the existing drainage conditions in the vicinity of the Proposed Development during the construction stage. The contract documents will specify that the contractor must put in place appropriate temporary drainage measures to ensure that the flooding conditions during the construction period must not be worse than those under existing conditions.
- 6.2.2 The contractor's attention shall be drawn to the diversion of the existing U-channel along the boundary of the Proposed Development. Such measures must be submitted to the Authorised Person or his representative for approval before construction activities commence.
- 6.2.3 A settling basin will be installed to intercept runoff from the construction Application Site before discharge into the River Beas.

7. CONCLUSION

- 7.1.1 The runoff from the Proposed Development and from the adjacent catchment area of the Proposed Development will be diverted by the project proponent. The runoff will be conveyed by the proposed 1000 mm to 1800 mm diameter drains along public road inside Application Site.
- 7.1.2 The runoff generated from the Proposed Development and its adjacent catchment would only utilize about 84% of the proposed 1000 mm diameter drain, about 87% of the proposed 1500 mm diameter drain, about 52% of the proposed 1650 mm diameter drain and about 85% of the proposed 1800 mm diameter drain. The proposed drain in public road inside Application Site discharges into the upstream section of the River Beas.
- 7.1.3 Temporary drainage measures shall be implemented to ensure that the flooding conditions will not be worsened during construction. Periodic inspection by the Authorized Person or his representative will be carried out during construction.
- 7.1.4 With the implementation of the above proposed drainage measures and temporary drainage works, the Proposed Development at the Application Site is technically feasible from drainage impact point of view.

Figures

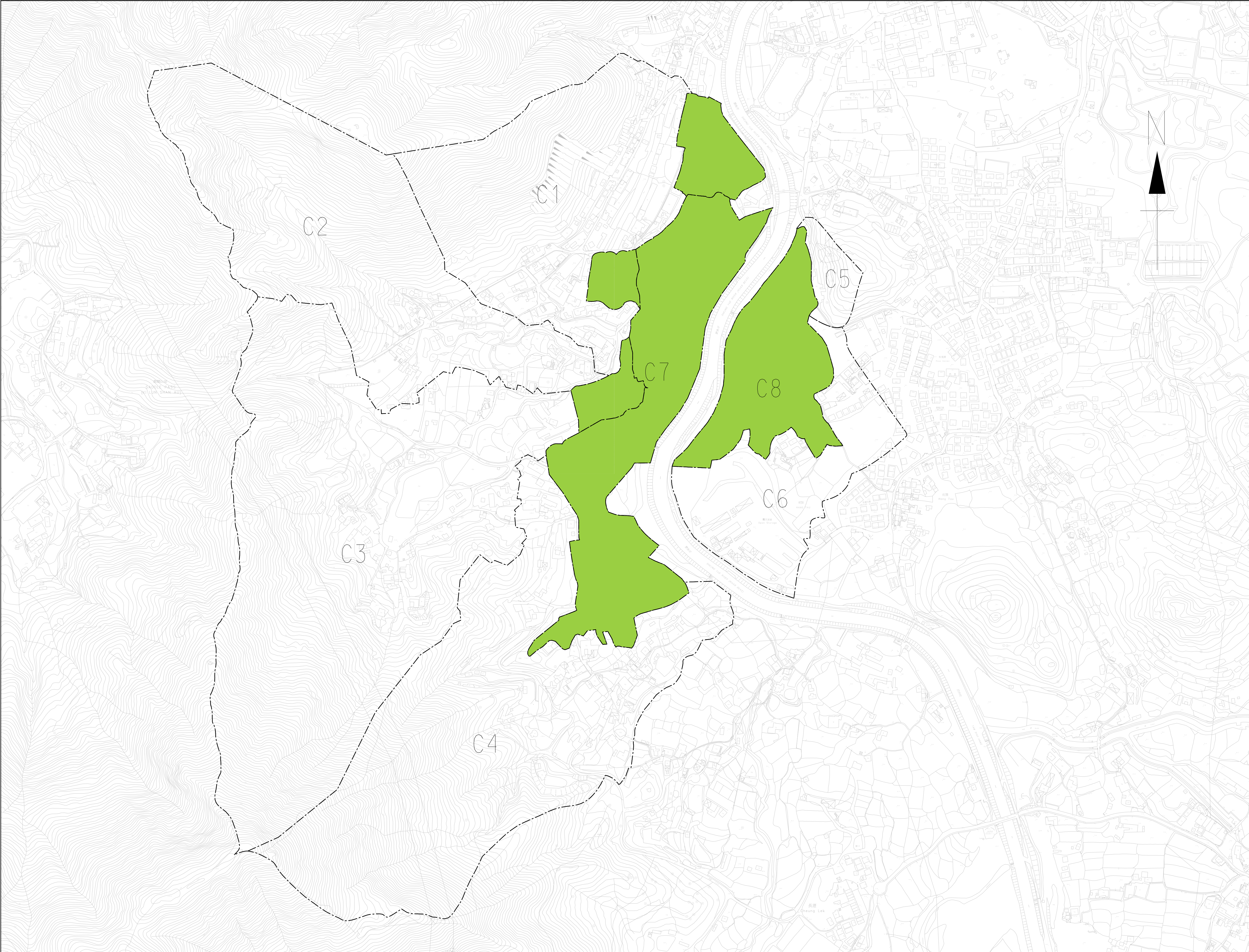


© Copyright by Binnies Hong Kong Limited

LEGEND:

THE APPLICATION SITE

Initial	Date	Checked	Date
Project			
S16 APPLICATION FOR PROPOSED INTERNATIONAL SCHOOL IN KWU TUNG SOUTH			
Title			
LOCATION PLAN			
Figure No. K1		Scale A3 1 : 20000	
 BINNIES HONG KONG LIMITED 賓尼斯工程顧問有限公司			



LEGEND:

THE APPLICATION SITE

CATCHMENT	AREA (m ²)
C1	99045
C2	122826
C3	211950
C4	164692
C5	7603
C6	46806
C7	91816
C8	35300

Initial	Date	Checked	Date
---------	------	---------	------

Project

S16 APPLICATION FOR PROPOSED
INTERNATIONAL SCHOOL IN KWU
TUNG SOUTH

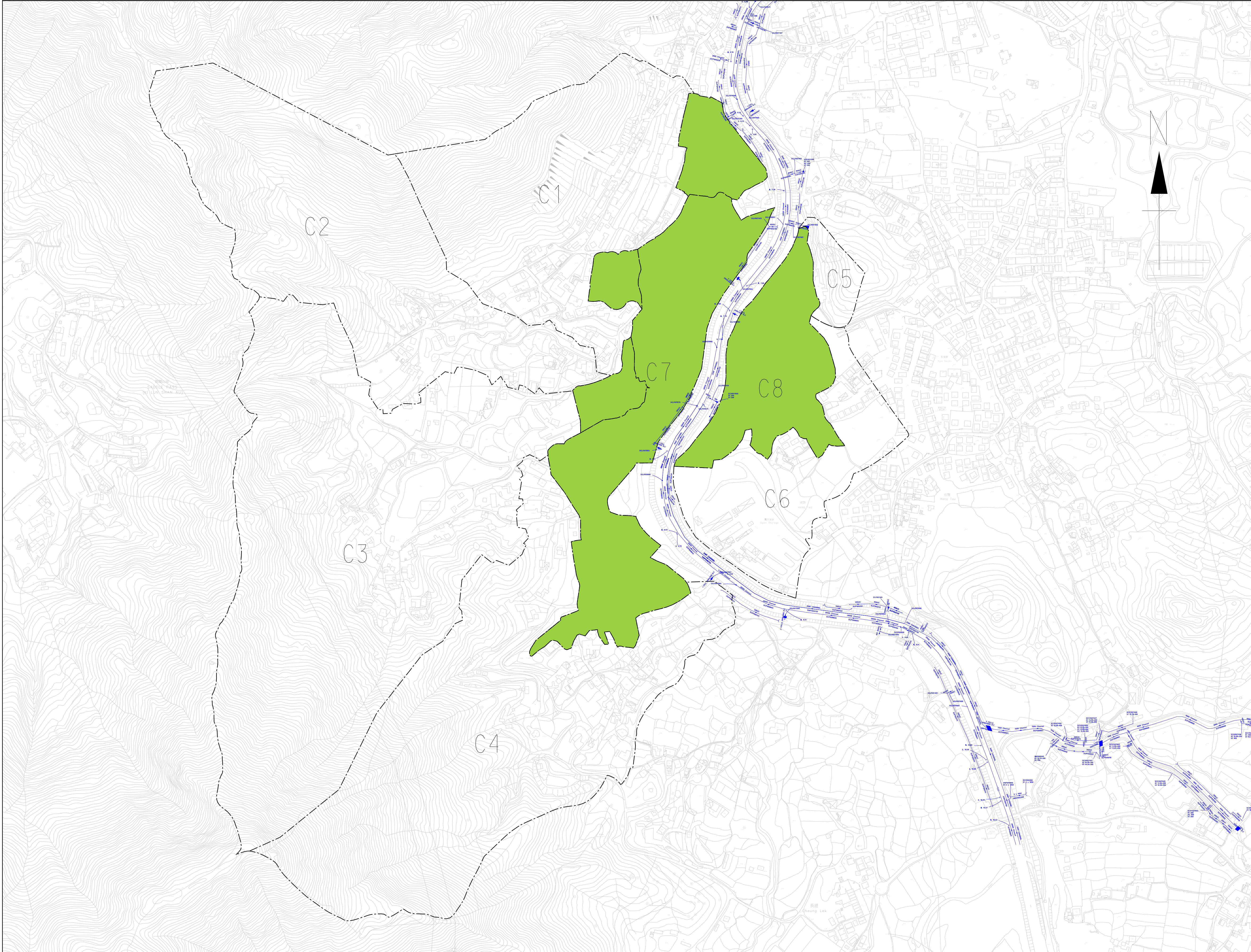
Title

EXISTING CATCHMENT AREA

Figure No. K2	Scale A3 1 : 5000
------------------	----------------------



BINNIES HONG KONG LIMITED
賓尼斯工程顧問有限公司



© Copyright by Binnies Hong Kong Limited

LEGEND:

- EXISTING CATCHPIT
- THE APPLICATION SITE
- EXISTING DRAINAGE PIPE/ CHANNEL

Initial	Date	Checked	Date
---------	------	---------	------

Project

S16 APPLICATION FOR PROPOSED
INTERNATIONAL SCHOOL IN KWU
TUNG SOUTH

Title

EXISTING DRAINAGE
SYSTEMS

Figure No.

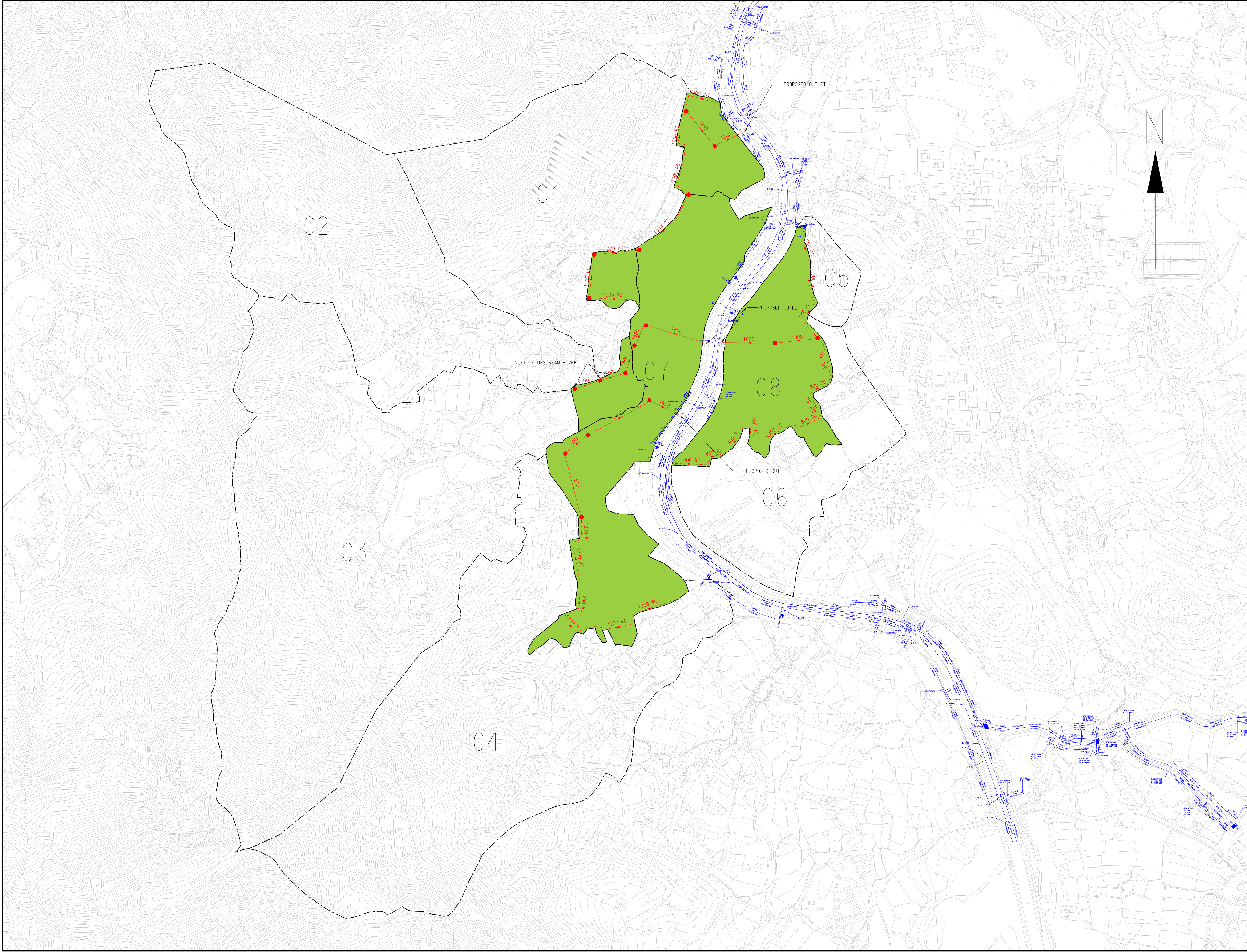
K3

Scale

A3 1 : 5000



BINNIES HONG KONG LIMITED
賓尼斯工程顧問有限公司



© Copyright by Binnies Hong Kong Limited

LEGEND:

EXISTING CATCHPIT

THE APPLICATION SITE

EXISTING DRAINAGE PIPE/ CHANNEL

PROPOSED CATCHPIT

PROPOSED MANHOLE

RC.
800

PROPOSED 800mm
RECTANGULAR CHANNEL

RC.
1000

PROPOSED 1000mm
RECTANGULAR CHANNEL

RC.
1200

PROPOSED 1200mm
RECTANGULAR CHANNEL

DIA.
1000

PROPOSED 1000mm DIAMETER
STORMWATER DRAIN

DIA.
1200

PROPOSED 1500mm DIAMETER
STORMWATER DRAIN

DIA.
1500

PROPOSED 1500mm DIAMETER
STORMWATER DRAIN

DIA.
1650

PROPOSED 1650mm DIAMETER
STORMWATER DRAIN

DIA.
1800

PROPOSED 1650mm DIAMETER
STORMWATER DRAIN

PROPOSED OUTLET

CATCHMENT	AREA (m ²)
C1	99045
C2	122826
C3	211950
C4	164692
C5	7603
C6	46806
C7	91816
C8	35300

Initial	Date	Checked	Date
Project			
S16 APPLICATION FOR PROPOSED INTERNATIONAL SCHOOL IN KWU TUNG SOUTH			
Title			
EXISTING DRAINAGE SYSTEMS			
Figure No. K4		Scale A3 1 : 5000	
 BINNIES HONG KONG LIMITED 賓尼斯工程顧問有限公司			

Plot Date = 2025/9/24

CAD Filename = C:\Daily Work\20250918G\K4.dgn

CAD FILE: C:\Daily Work\20250918G\K4.dgn

Annex 1

Runoff Calculations

Capacity Check:

Catchment C7 and C8 (Before development) (50 years)

Design Parameters

Design storm		50	year return period	
Storm constants	a	474.6		
	b	2.9		
	c	0.371		
Average Slope	H	0.30	m/100m	
Length of flow	L	110	m	
Inlet time $t_0=0.14465L/H^{0.2}A^{0.1}$	t_0	6.25	min	
Unpaved area	A_U	88900	m^2	
Runoff coef.	C_U	0.35		
Paved area	A_P	38100	m^2	
Runoff coef.	C_P	0.95		
Catchment area	A_{Total}	127,000	m^2	
Runoff coef.	$C_{average}$	0.53		
Surface roughness	k_s	0.6	mm	For Poor Precast Concrete Pipes
kinematic viscosity	ν	1.14	mm^2/s	
Frictional gradient	S_f	1 in 100		

Capacity Check:

Catchment C7 and C8 (Before development) (50 years)

Peak Runoff

Flow time	t_f	=	L_j / V_j		
		=	3.38	min	
Time of concentration	t_c	=	$t_0 + t_f$		
		=	9.63	min	
Intensity	i	=	$a / (t_c + b)^c$	x	1.281
		=	238.01	mm/hr	(Climate Change Factor)
Peak runoff	Q_p	=	$0.278 C i A$		(SDM Table 28)
		=	4.454	m^3/s	

Capacity Check:

Catchment C7 and C8 (After development) (50 years)

Design Parameters

Design storm		50	year return period	
Storm constants	a	474.6		
	b	2.9		
	c	0.371		
Average Slope	H	0.30	m/100m	
Length of flow	L	110	m	
Inlet time $t_0=0.14465L/H^{0.2}A^{0.1}$	t_0	6.25	min	
Unpaved area	A_U	38100	m^2	
Runoff coef.	C_U	0.35		
Paved area	A_P	88900	m^2	
Runoff coef.	C_P	0.95		
Catchment area	A_{Total}	127,000	m^2	
Runoff coef.	$C_{average}$	0.77		
Surface roughness	k_s	0.6	mm	For Poor Precast Concrete Pipes
kinematic viscosity	ν	1.14	mm^2/s	
Frictional gradient	S_f 1 in	100		

Capacity Check:

Catchment C7 and C8 (After development) (50 years)

Peak Runoff

Flow time	t_f	=	L_j / V_j		
		=	3.38	min	
Time of concentration	t_c	=	$t_0 + t_f$		
		=	9.63	min	
Intensity	i	=	$a / (t_c + b)^c$	x	1.281
		=	238.01	mm/hr	(SDM Table 28)
Peak runoff	Q_p	=	$0.278 C i A$		
		=	6.470	m^3/s	

Capacity Check:

Catchment C7 and C8 (Before development) (200 years)

Design Parameters

Design storm		200	year return period	
Storm constants	a	501.4		
	b	2.45		
	c	0.348		
Average Slope	H	0.30	m/100m	
Length of flow	L	110	m	
Inlet time $t_0=0.14465L/H^{0.2}A^{0.1}$	t_0	6.25	min	
Unpaved area	A_U	88900	m^2	
Runoff coef.	C_U	0.35		
Paved area	A_P	38100	m^2	
Runoff coef.	C_P	0.95		
Catchment area	A_{Total}	127,000	m^2	
Runoff coef.	$C_{average}$	0.53		
Surface roughness	k_s	0.6	mm	For Poor Precast Concrete Pipes
kinematic viscosity	ν	1.14	mm^2/s	
Frictional gradient	S_f 1 in	100		

Capacity Check:

Catchment C7 and C8 (Before development) (200 years)

Peak Runoff

Flow time	t_f	=	L_j / V_j		
		=	3.38	min	
Time of concentration	t_c	=	$t_0 + t_f$		
		=	9.63	min	
Intensity	i	=	$a / (t_c + b)^c$	x	1.281
		=	269.91	mm/hr	(Climate Change Factor)
Peak runoff	Q_p	=	$0.278 C i A$		(SDM Table 28)
		=	5.051	m ³ /s	

Capacity Check:

Catchment C7 and C8 (After development) (200 years)

Design Parameters

Design storm		200	year return period	
Storm constants	a	501.4		
	b	2.45		
	c	0.348		
Average Slope	H	0.30	m/100m	
Length of flow	L	110	m	
Inlet time $t_0=0.14465L/H^{0.2}A^{0.1}$	t_0	6.25	min	
Unpaved area	A_U	38100	m^2	
Runoff coef.	C_U	0.35		
Paved area	A_P	88900	m^2	
Runoff coef.	C_P	0.95		
Catchment area	A_{Total}	127,000	m^2	
Runoff coef.	$C_{average}$	0.77		
Surface roughness	k_s	0.6	mm	For Poor Precast Concrete Pipes
kinematic viscosity	ν	1.14	mm^2/s	
Frictional gradient	S_f 1 in	100		

Capacity Check:

Catchment C7 and C8 (After development) (200 years)

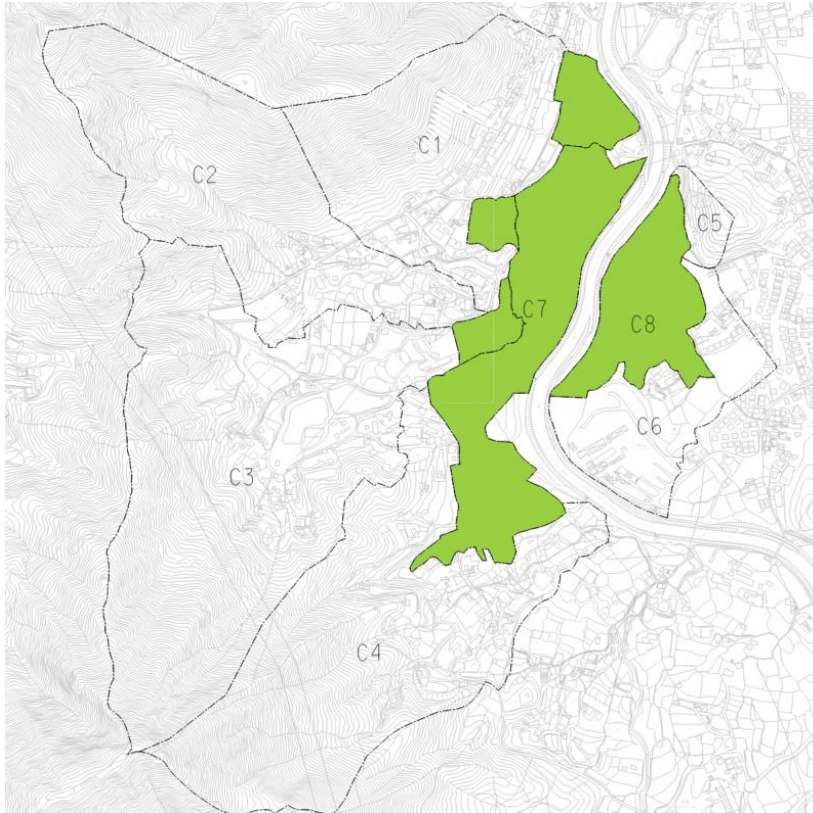
Peak Runoff

Flow time	t_f	=	L_j / V_j		
		=	3.38	min	
Time of concentration	t_c	=	$t_0 + t_f$		
		=	9.63	min	
Intensity	i	=	$a / (t_c + b)^c$	x	1.281
		=	269.91	mm/hr	(Climate Change Factor)
Peak runoff	Q_p	=	$0.278 C i A$		(SDM Table 28)
		=	7.338	m ³ /s	

Annex 2

Design of Drainage System

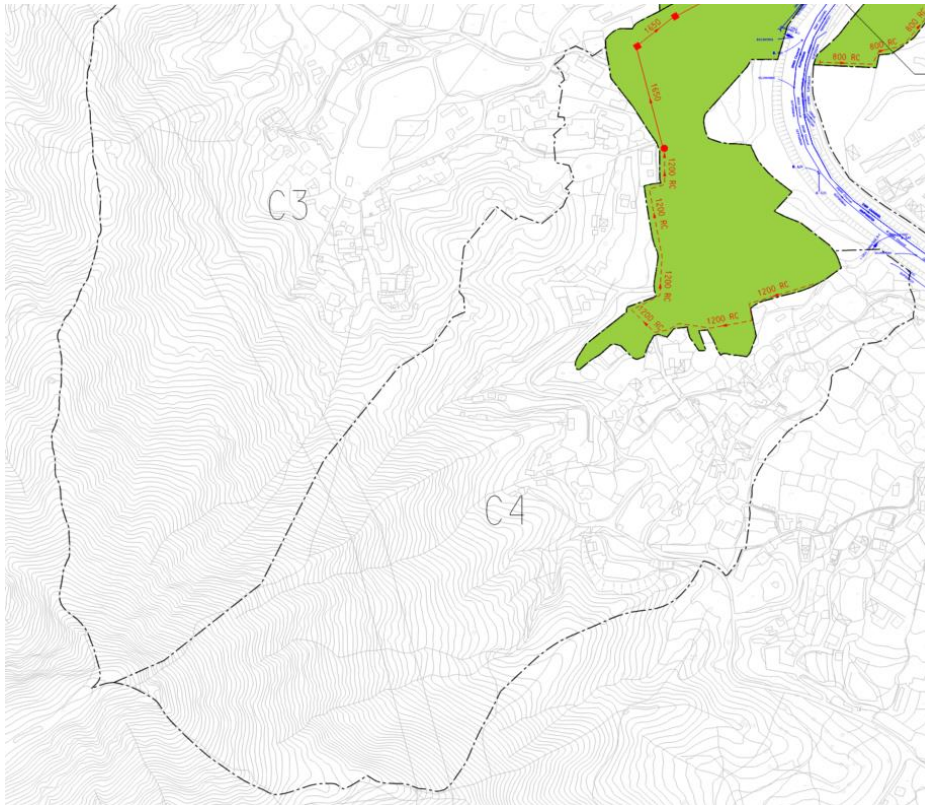
Summary of Catchment Characteristic



Cachment	Area (m ²)	Before Development		After Development		Runoff Coefficient	
		Paved Area (m ²)	Unpaved Area (m ²)	Paved Area (m ²)	Unpaved Area (m ²)	Paved	Unpaved
C1	99045	29,714	69,332	29,714	69,332	0.95	0.35
C2	122,826	36,848	85,978	36,848	85,978	0.95	0.35
C3	211,950	63,585	148,365	63,585	148,365	0.95	0.35
C4	164,692	49,408	115,284	49,408	115,284	0.95	0.35
C5	7,603	2,281	5,322	2,281	5,322	0.95	0.35
C6	46,806	14,042	32,764	14,042	32,764	0.95	0.35

Capacity Check:

Catchment C4



Design Parameters

Design storm		50	year return period
Storm constants	a	474.6	
	b	2.9	
	c	0.371	
Average Slope	H	28.00	m/100m
Length of flow	L	770	m
Inlet time $t_0=0.14465L/H^{0.2}A^{0.1}$	t_0	17.21	min
Unpaved area	A_U	115284	m^2
Runoff coef.	C_U	0.35	
Paved area	A_P	49408	m^2
Runoff coef.	C_P	0.95	
Catchment area	A_{Total}	164,692	m^2
Runoff coef.	$C_{average}$	0.53	
Surface roughness	k_s	0.6	mm
kinematic viscosity	ν	1.14	mm^2/s
Frictional gradient	S_f	1 in	100

For Poor Precast Concrete Pipes

Capacity Check:

Catchment C4

Peak Runoff

Flow time	t_f	=	L_j / V_j		
		=	3.38	min	
Time of concentration	t_c	=	$t_0 + t_f$		
		=	20.58	min	
Intensity	i	=	$a / (t_c + b)^c$	x	1.281
		=	188.51	mm/hr	(Climate Change Factor)
Peak runoff	Q_p	=	$0.278 C i A$		(SDM Table 28)
		=	4.574	m ³ /s	

Using Manning's Equation for Rectangular-Channel Geometry

Width	1200	mm	Input Parameter
Height	1200	mm	Input Parameter
Area	1.440	m ²	
Wetted Perimeter	3.600	m	
Hydraulic Radius	0.400	m	
Slope [Decimal]	0.01		Slope = tan θ
Manning's Roughness	0.015		for Fair concrete Pipe
Full Flow Velocity V_u	3.62	m/s	
Full Flow Discharge	5.21	m ³ /s	
	312701	l/min	

Assume the maximum water depth in the Rectangular-channel be 100% of the size

Water Depth	Area	Wetted Perimeter	Hydraulic Radius	Velocity	Discharge
[mm]	m ²	m	m	m/s	m ³ /s
1200	1.440	3.600	0.400	3.619	5.212

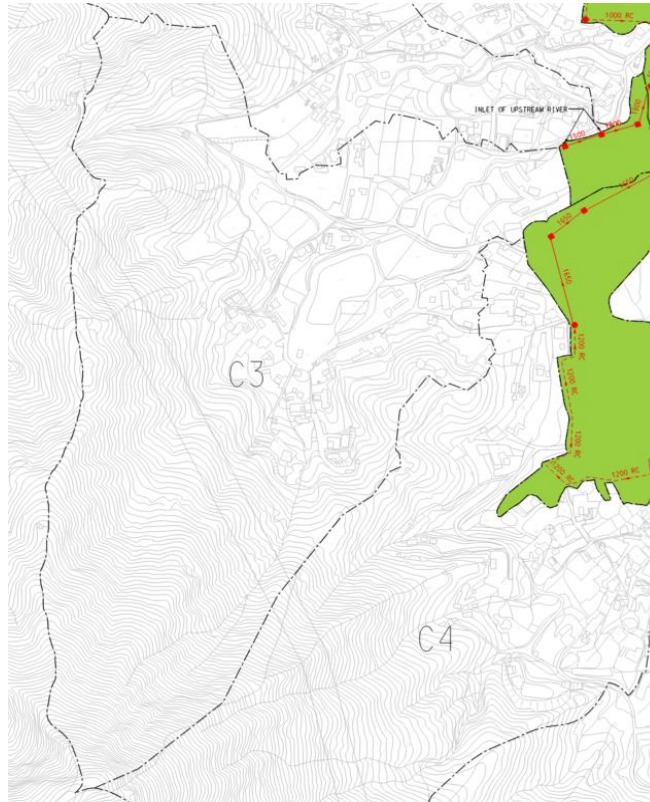
> Peak runoff Q_p

Surface roughness	k_s	0.6	mm	For Poor Precast Concrete Pipes
kinematic viscosity	ν	1.14	mm ² /s	
Frictional gradient	S_f 1 in	100		
Peak runoff from C3	=	4.57	m ³ /s	

Trial pipe size	D	=	1650	mm
Hydraulic radius	R = D/4	=	0.4125	m
Mean velocity (Colebrook-White)	$\bar{V}$	=	$-\sqrt{32gRS_f} \log \left[\frac{k_s}{148R} + \frac{1.255v}{R\sqrt{(32gRS_f)}} \right]$	
		=		
		=	4.55	m/s
Capacity provided	Q	=	V x Cross Section Area of Drain	
		=	9.72	m ³ /s
Allow 10% Area for Siltation	Q _{90%}	=	8.75	m ³ /s
		>	Peak runoff Q _p	
Utilization		=	Q _p /Q _{90%}	
		=	52%	

Capacity Check:

Catchment C3



Design Parameters

Design storm		50	year return period
Storm constants	a	474.6	
	b	2.9	
	c	0.371	
Average Slope	H	26.00	m/100m
Length of flow	L	770	m
Inlet time $t_0=0.14465L/H^{0.2}A^{0.1}$	t_0	17.03	min
Unpaved area	A_U	148365	m^2
Runoff coef.	C_U	0.35	
Paved area	A_P	63585	m^2
Runoff coef.	C_P	0.95	
Catchment area	A_{Total}	211,950	m^2
Runoff coef.	$C_{average}$	0.53	
Surface roughness	k_s	0.6	mm
kinematic viscosity	ν	1.14	mm^2/s
Frictional gradient	S_f	1 in	100

For Poor Precast Concrete Pipes

Capacity Check:

Catchment C3

Peak Runoff

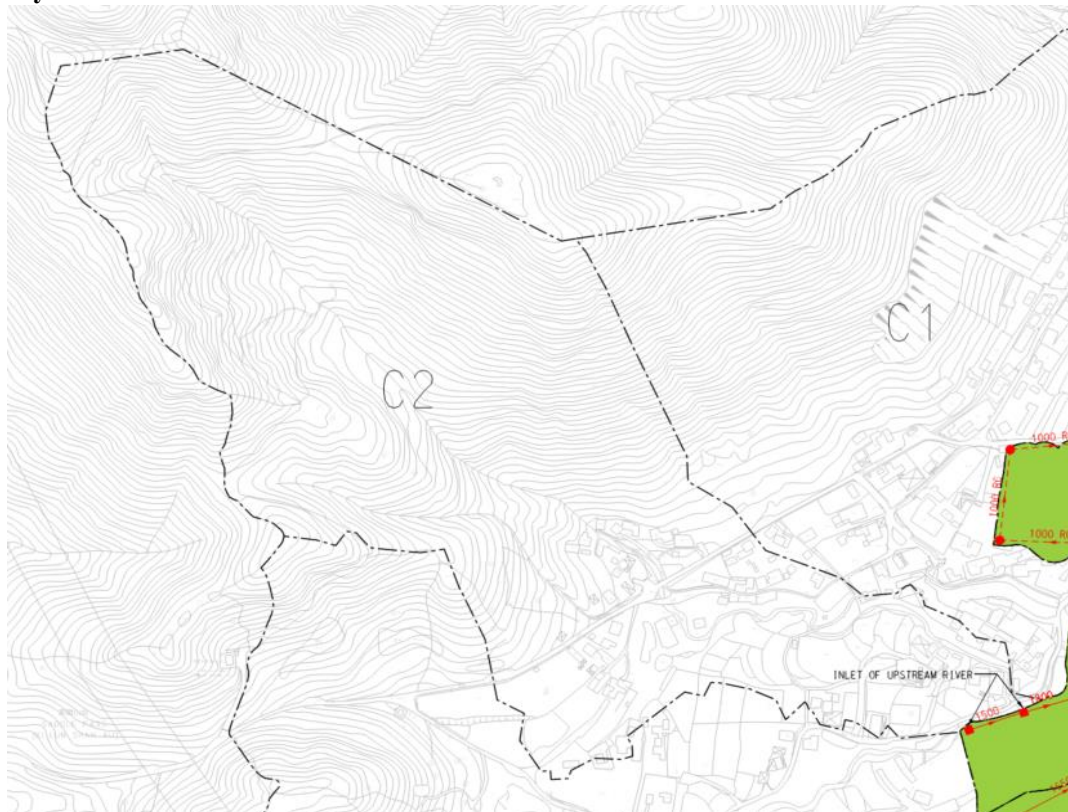
Flow time	t_f	=	L_j / V_j	
		=	3.20	min
Time of concentration	t_c	=	$t_0 + t_f$	
		=	20.23	min
Intensity	i	=	$a / (t_c + b)^c$	x 1.281 (Climate Change Factor)
		=	189.57	mm/hr (SDM Table 28)
Peak runoff	Q_p	=	$0.278 C i A$	
		=	5.920	m ³ /s

Capacity of Drain

Trial pipe size	D	=	1500	mm
Hydraulic radius	$R = D/4$	=	0.375	m
Mean velocity (Colebrook-White)	$\bar{V}$	=	$-\sqrt{32gRS_f} \log \left[\frac{k_s}{14.8R} + \frac{1.255v}{R\sqrt{(32gRS_f)}} \right]$	
		=	4.29	m/s
Capacity provided	Q	=	$\bar{V} \times \text{Cross Section Area of Drain}$	
		=	7.58	m ³ /s
Allow 10% Area for Siltation	$Q_{90\%}$	=	6.82	m ³ /s
		<	Peak runoff Q_p	
Utilization		=	$Q_p / Q_{90\%}$	
		=	87%	

Capacity Check:

Catchment C2



Design Parameters

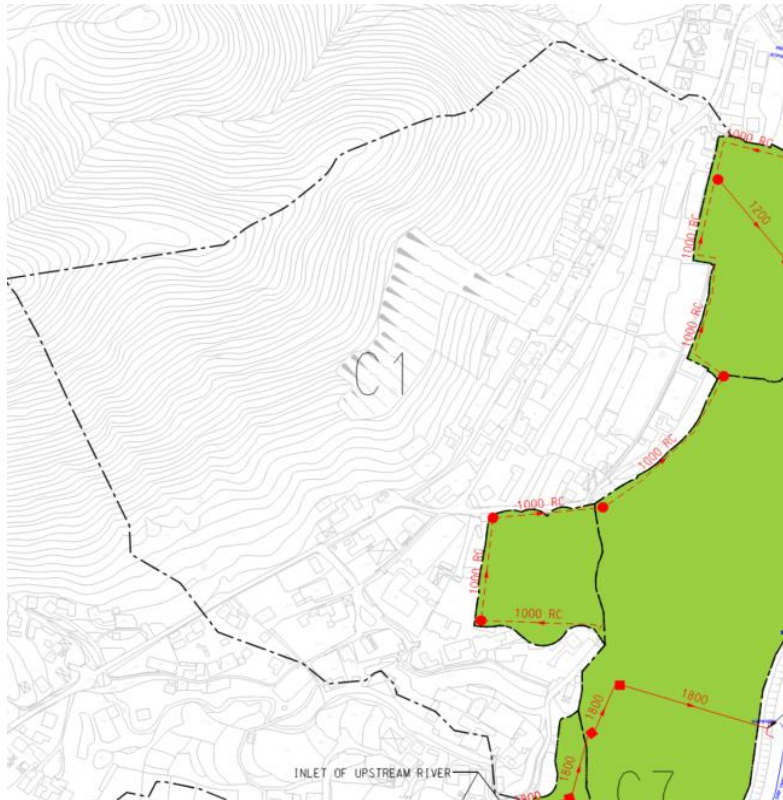
Design storm		50	year return period
Storm constants	a	474.6	
	b	2.9	
	c	0.371	
Average Slope	H	26.00	m/100m
Length of flow	L	770	m
Inlet time $t_0=0.14465L/H^{0.2}A^{0.1}$	t_0	17.98	min
Unpaved area	A_U	85978	m^2
Runoff coef.	C_U	0.35	
Paved area	A_P	36848	m^2
Runoff coef.	C_P	0.95	
Catchment area	A_{Total}	122,826	m^2
Runoff coef.	$C_{average}$	0.53	
Surface roughness	k_s	0.6	mm
kinematic viscosity	ν	1.14	mm^2/s
Frictional gradient	S_f	1 in	100

For Poor Precast Concrete Pipes

Capacity Check:		Catchment C2	
Peak Runoff			
Flow time	t _f	=	L _j / V _j
		=	3.20 min
Time of concentration	t _c	=	t ₀ + t _f
		=	21.18 min
Intensity	i	=	a / (t _c + b) ^c x 1.281 (Climate Change Factor)
		=	186.75 mm/hr (SDM Table 28)
Peak runoff	Q _p	=	0.278 C i A
		=	3.380 m ³ /s
Peak runoff from catchment 3		=	5.920 m ³ /s
Total runoff		=	9.300
Capacity of Drain			
Trial pipe size	D	=	1800 mm
Hydraulic radius	R = D/4	=	0.45 m
Mean velocity (Colebrook-White)	$\bar{V}$	=	$-\sqrt{32gRS_f} \log\left[\frac{k_s}{14.8R} + \frac{1.255v}{R\sqrt{(32gRS_f)}}\right]$
		=	
		=	4.79 m/s
Capacity provided	Q	=	V x Cross Section Area of Drain
		=	12.20 m ³ /s
Allow 10% Area for Siltation	Q _{90%}	=	10.98 m ³ /s
		<	Peak runoff Q _p
Utilization		=	Q _p /Q _{90%}
		=	85%

Capacity Check:

Catchment C1



Design Parameters

Design storm		50	year return period
Storm constants	a	474.6	
	b	2.9	
	c	0.371	
Average Slope	H	20.00	m/100m
Length of flow	L	770	m
Inlet time $t_0=0.14465L/H^{0.2}A^{0.1}$	t_0	19.37	min
Unpaved area	A_U	69332	m^2
Runoff coef.	C_U	0.35	
Paved area	A_P	29714	m^2
Runoff coef.	C_P	0.95	
Catchment area	A_{Total}	99,045	m^2
Runoff coef.	$C_{average}$	0.53	
Surface roughness	k_s	0.6	mm
kinematic viscosity	ν	1.14	mm^2/s
Frictional gradient	S_f	1 in	100

For Poor Precast Concrete Pipes

Capacity Check:

Catchment C1

Peak Runoff

Flow time	t_f	=	L_j / V_j		
		=	3.81	min	
Time of concentration	t_c	=	$t_0 + t_f$		
		=	23.18	min	
Intensity	i	=	$a / (t_c + b)^c$	x	1.281
		=	181.32	mm/hr	(Climate Change Factor)
Peak runoff	Q_p	=	$0.278 C i A$		(SDM Table 28)
		=	2.646	m ³ /s	

Using Manning's Equation for Rectangular-Channel Geometry

Width	1000	mm	Input Parameter
Height	1000	mm	Input Parameter
Area	1.000	m ²	
Wetted Perimeter	3.000	m	
Hydraulic Radius	0.333	m	
Slope [Decimal]	0.01		Slope = tan θ
Manning's Roughness	0.015		for Fair concrete Pipe
Full Flow Velocity Vu	3.20	m/s	
Full Flow Discharge	3.20	m ³ /s	
	192300	l/min	

Assume the maximum water depth in the Rectangular-channel be 100% of the size

Water Depth	Area	Wetted Perimeter	Hydraulic Radius	Velocity	Discharge
[mm]	m ²	m	m	m/s	m ³ /s
1000	1.000	3.000	0.333	3.205	3.205

> Peak runoff Q_p

Capacity Check: Proposed 1200mm Drain for Catchment C1



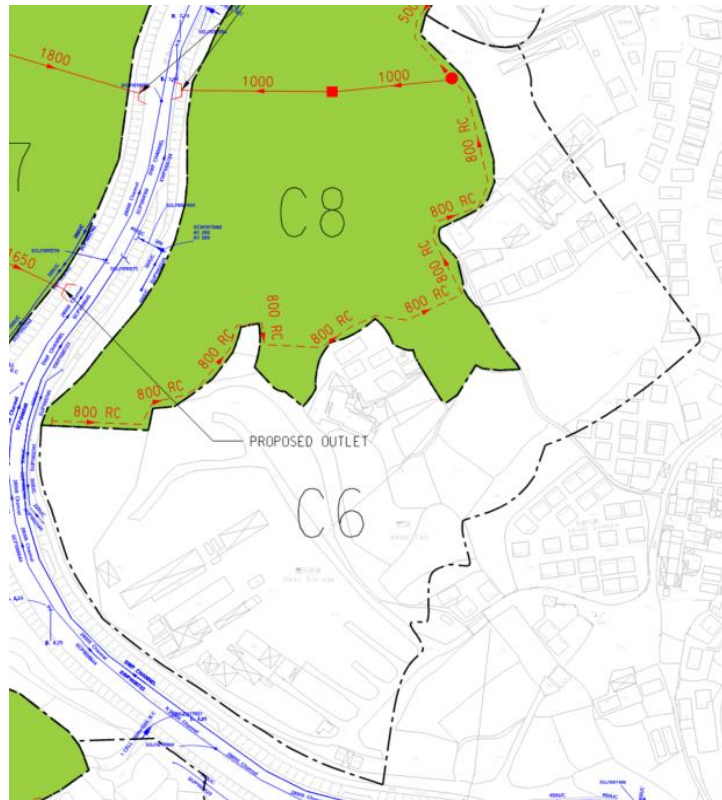
Design Parameters

Surface roughness	k_s	0.6	mm	For Poor Precast Concrete Pipes
kinematic viscosity	ν	1.14	mm^2/s	
Frictional gradient	S_f 1 in	100		
Peak runoff from C1	=	2.65	m^3/s	

Capacity of Drain

Trial pipe size	D	=	1200	mm
Hydraulic radius	$R = D/4$	=	0.3	m
Mean velocity (Colebrook-White)	$\bar{V}$	=	$-\sqrt{32gRS_f} \log \left[\frac{k_s}{14.8R} + \frac{1.255\nu}{R\sqrt{(32gRS_f)}} \right]$	
		=	3.74	m/s
Capacity provided	Q	=	$V \times \text{Cross Section Area of Drain}$	
		=	4.23	m^3/s
Allow 10% Area for Siltation	$Q_{90\%}$	=	3.81	m^3/s
		>	Peak runoff Q_p	
Utilization		=	$Q_p/Q_{90\%}$	
		=	70%	

Catchment C6



Design Parameters

Design storm		50	year return period
Storm constants	a	474.6	
	b	2.9	
	c	0.371	
Average Slope	H	0.30	m/100m
Length of flow	L	240	m
Inlet time $t_0=0.14465L/H^{0.2}A^{0.1}$	t_0	15.07	min
Unpaved area	A _U	23403	m ²
Runoff coef.	C _U	0.35	
Paved area	A _P	23403	m ²
Runoff coef.	C _P	0.95	
Catchment area	A _{Total}	46,806	m ²
Runoff coef.	C _{average}	0.65	
Surface roughness	k _s	0.6	mm
kinematic viscosity	ν	1.14	mm ² /s
Frictional gradient	S _f	1 in 100	

Capacity Check:

Catchment C6

Peak Runoff

Flow time	t_f	=	L_j / V_j		
		=	4.42	min	
Time of concentration	t_c	=	$t_0 + t_f$		
		=	19.49	min	
Intensity	i	=	$a / (t_c + b)^c$	x	1.281
		=	191.86	mm/hr	(Climate Change Factor)
Peak runoff	Q_p	=	$0.278 C i A$		(SDM Table 28)
		=	1.623	m ³ /s	

Using Manning's Equation for Rectangular-Channel Geometry

Width	800	mm	Input Parameter
Height	800	mm	Input Parameter
Area	0.640	m ²	
Wetted Perimeter	2.400	m	
Hydraulic Radius	0.267	m	
Slope [Decimal]	0.01		Slope = tan θ
Manning's Roughness	0.015		for Fair concrete Pipe
Full Flow Velocity V_u	2.76	m/s	
Full Flow Discharge	1.77	m ³ /s	
	106060	l/min	

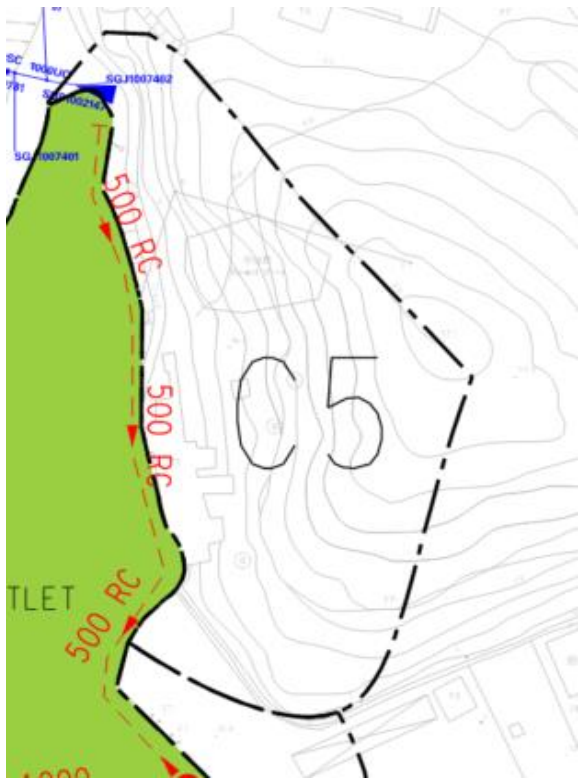
Assume the maximum water depth in the Rectangular-channel be 100% of the size

Water Depth	Area	Wetted Perimeter	Hydraulic Radius	Velocity	Discharge
[mm]	m ²	m	m	m/s	m ³ /s
800	0.640	2.400	0.267	2.762	1.768

> Peak runoff Q_p

Capacity Check:

Catchment C5



Design Parameters

Design storm		50	year return period
Storm constants	a	474.6	
	b	2.9	
	c	0.371	
Average Slope	H	3.00	m/100m
Length of flow	L	70	m
Inlet time $t_0=0.14465L/H^{0.2}A^{0.1}$	t_0	3.33	min
Unpaved area	A_U	3041	m^2
Runoff coef.	C_U	0.35	
Paved area	A_P	4562	m^2
Runoff coef.	C_P	0.95	
Catchment area	A_{Total}	7,603	m^2
Runoff coef.	$C_{average}$	0.71	
Surface roughness	k_s	0.6	mm
kinematic viscosity	ν	1.14	mm^2/s
Frictional gradient	S_f 1 in	100	

For Poor Precast Concrete Pipes

Capacity Check:

Catchment C5

Peak Runoff

Flow time	t_f	=	L_j / V_j		
		=	6.05	min	
Time of concentration	t_c	=	$t_0 + t_f$		
		=	9.38	min	
Intensity	i	=	$a / (t_c + b)^c$	x	1.281
		=	239.79	mm/hr	(Climate Change Factor)
Peak runoff	Q_p	=	$0.278 C i A$		(SDM Table 28)
		=	0.360	m^3/s	

Using Manning's Equation for Rectangular-Channel Geometry

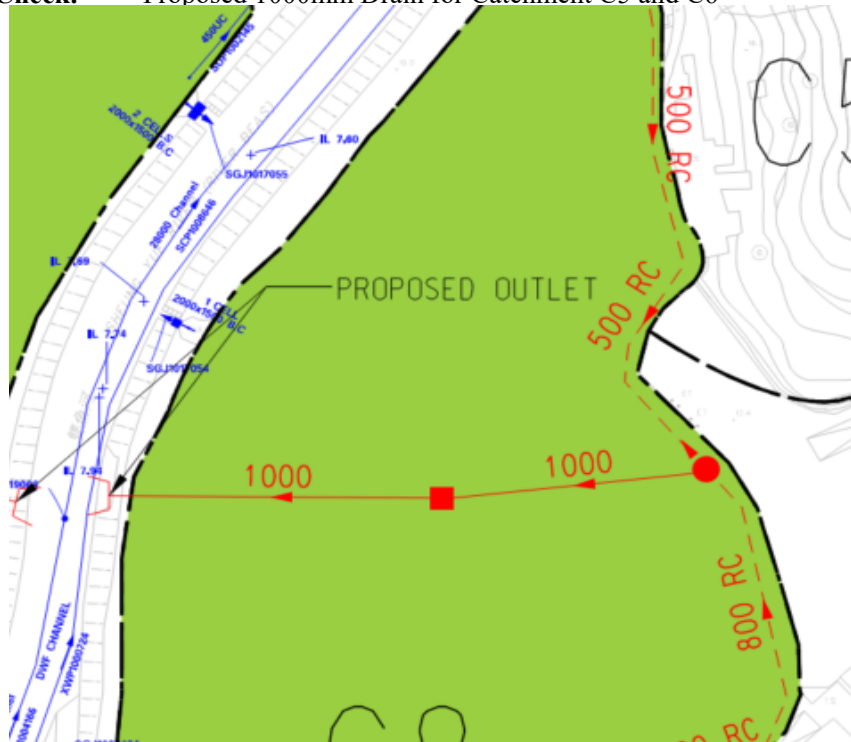
Width	500	mm	Input Parameter
Height	500	mm	Input Parameter
Area	0.250	m^2	
Wetted Perimeter	1.500	m	
Hydraulic Radius	0.167	m	
Slope [Decimal]	0.01		Slope = $\tan \theta$
Manning's Roughness	0.015		for Fair concrete Pipe
Full Flow Velocity V_u	2.02	m/s	
Full Flow Discharge	0.50	m^3/s	
	30285	l/min	

Assume the maximum water depth in the Rectangular-channel be 90% of the size

Water Depth	Area	Wetted Perimeter	Hydraulic Radius	Velocity	Discharge
[mm]	m^2	m	m	m/s	m^3/s
450	0.250	1.500	0.167	2.019	0.505

> Peak runoff Q_p

Capacity Check: Proposed 1000mm Drain for Catchment C5 and C6



Design Parameters

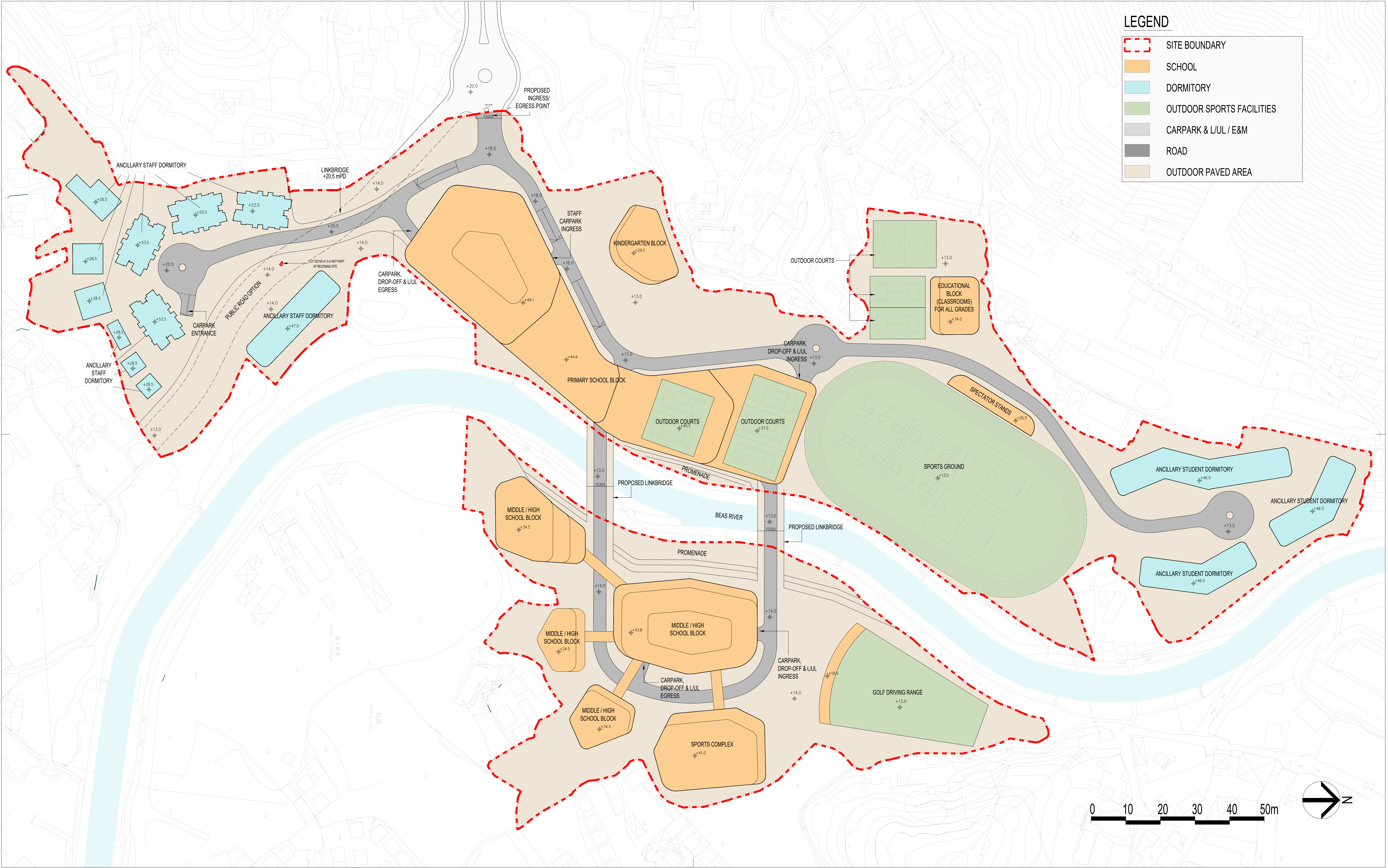
Surface roughness	k_s	0.6	mm	For Poor Precast Concrete Pipes
kinematic viscosity	ν	1.14	mm ² /s	
Frictional gradient	S_f 1 in	100		
Peak runoff from C5	=	0.36	m ³ /s	
Peak runoff from C6	=	1.62	m ³ /s	
Total runoff	=	1.98	m ³ /s	

Capacity of Drain

Trial pipe size	D	=	1000	mm
Hydraulic radius	$R = D/4$	=	0.25	m
Mean velocity (Colebrook-White)	$\bar{V}$	=	$-\sqrt{32gRS_f} \log \left[\frac{k_s}{14.8R} + \frac{1.255\nu}{R\sqrt{32gRS_f}} \right]$	
		=	3.34	m/s
Capacity provided	Q	=	V x Cross Section Area of Drain	
		=	2.63	m ³ /s
Allow 10% Area for Siltation	$Q_{90\%}$	=	2.36	m ³ /s
		>	Peak runoff Q_p	
Utilization		=	$Q_p/Q_{90\%}$	
		=	84%	

Annex 3

Master Layout Plan



Rev.	Description	Drawn	Checked	Approved	Date
—	I PLANNING SUBMISSION	I HKO	I JHK	I JHY	9-2025
A	I PLANNING SUBMISSION	I HKO	I JHK	I JHY	11-2025

Rev.	Description	Drawn	Checked	Approved	Date

Check all measurements on site.
Do not scale off drawings.

This drawing is to be read in conjunction with the specification and any discrepancies are to be immediately reported to the Architect.

This drawing remains the copyright property of the Architect and is not to be reproduced in whole or in part without permission of the Architect.

B.D. Ref.	—
F.S.D. Ref.	—
D.L.O. Ref.	—
Drawn	HKO
Date	11-2025
Checked	JHK
Date	11-2025
Approved	JHY
Date	11-2025
Cad File No.	P:\JHK\25018NT\planning submission\PILOT_BD\GBP_01_

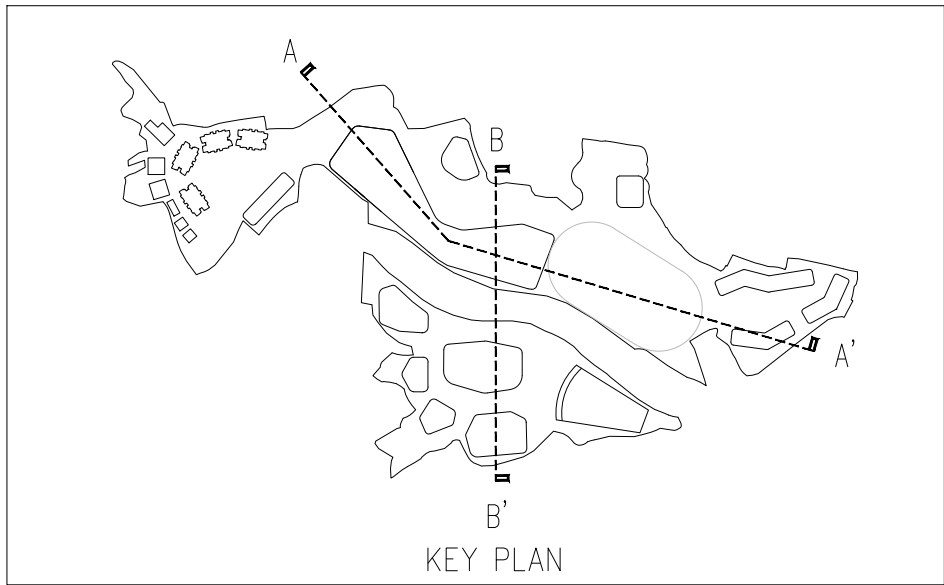


呂元祥建築師事務所

Project Title
PROPOSED INTERNATIONAL
SCHOOL DEVELOPMENT AT KWU
TUNG SOUTH

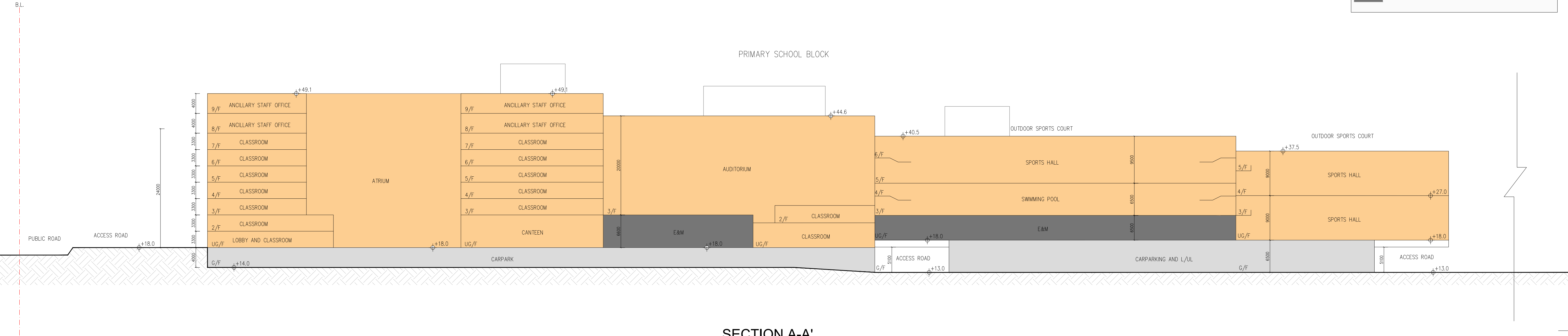
Drawing Title	FULL PHASE – MASTER LAYOUT PLAN
Project No.	25018NT
Scale	1:1000
Issue Date	NOV 2025
Drawing No.	A/GBP_01_

Drawing Purpose

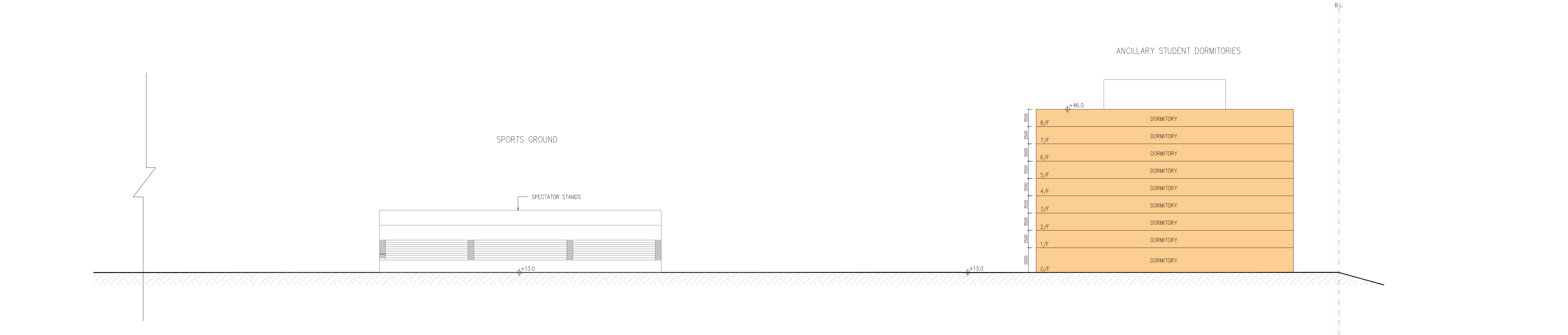


LEGEND

SITE BOUNDARY

SCHOOL

SECTION A-A'



SECTION A-A' (cont.)

Rev.	Description	Drawn	Checked	Approved	Date
—	I PLANNING SUBMISSION	I HKO	I JHK	I JHY	9-2025
A	I PLANNING SUBMISSION	I HKO	I JHK	I JHY	11-2025

Rev.	Description	Drawn	Checked	Approved	Date

Check all measurements on site.
Do not scale off drawings.

This drawing is to be read in conjunction with the specification and any discrepancies are to be immediately reported to the Architect.

This drawing remains the copyright property of the Architect and is not to be reproduced in whole or in part without permission of the Architect.

B.D. Ref.	—
F.S.D. Ref.	—
D.L.O. Ref.	—
Drawn	HKO
Checked	JHK
Approved	JHY
Cad File No.	P:\JHK\25018NT\planning submission\PL0T_BD\GBP_05



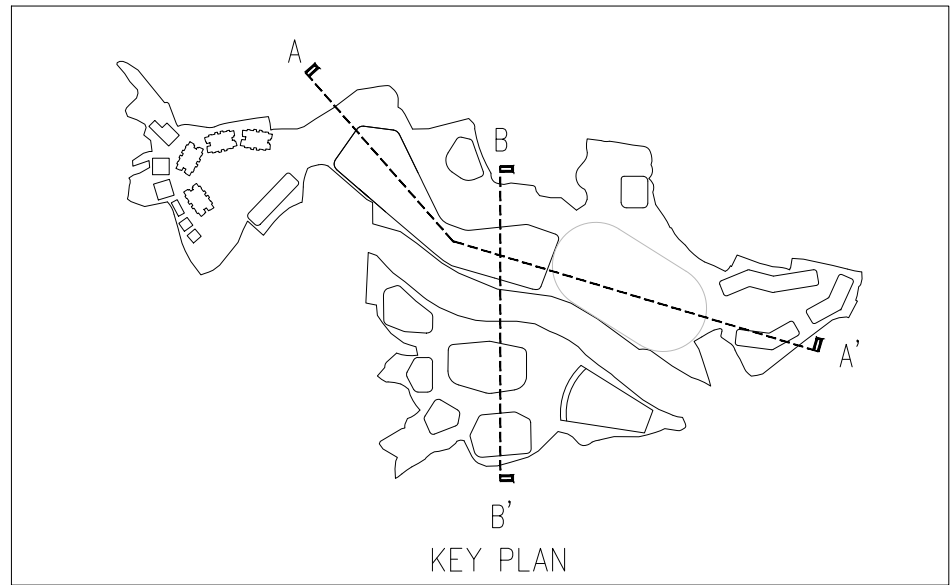
呂元祥建築師事務所

Project Title

Drawing Title
SECTION A-A

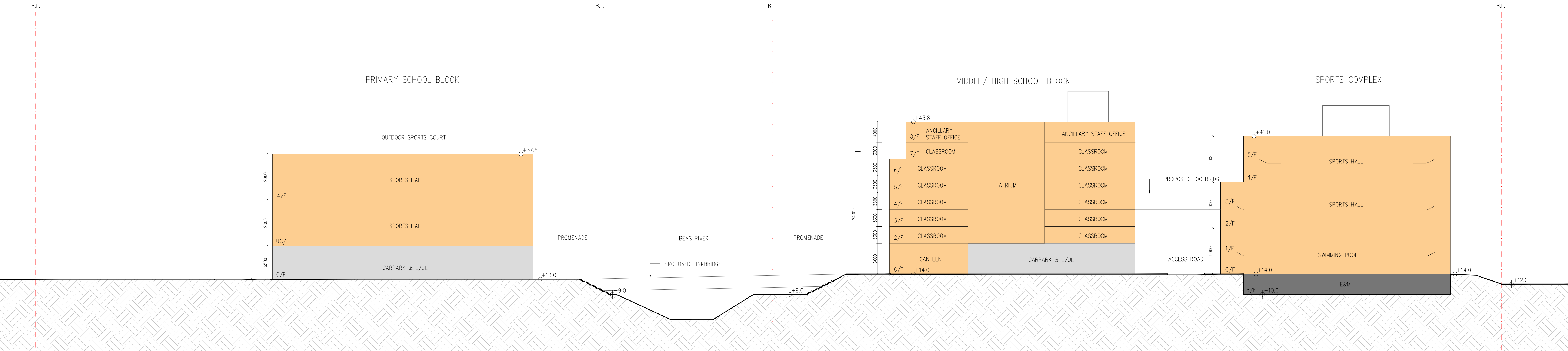
Drawing Purpose

Project No.	25018NT
Scale	1:400
Issue Date	NOV 2025
Drawing No.	A/GBP_05



LEGEND

SITE BOUNDARY

SCHOOL

SECTION B-B'

Rev.	Description	Drawn	Checked	Approved	Date
—	I PLANNING SUBMISSION	I HKO	I JHK	I JHY	I 9-2025
A	I PLANNING SUBMISSION	I HKO	I JHK	I JHY	I 11-2025

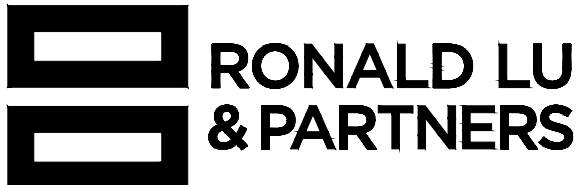
Rev.	Description	Drawn	Checked	Approved	Date

Check all measurements on site.
Do not scale off drawings.

This drawing is to be read in conjunction with the specification and any discrepancies are to be immediately reported to the Architect.

This drawing remains the copyright property of the Architect and is not to be reproduced in whole or in part without permission of the Architect.

B.D. Ref.	—
F.S.D. Ref.	—
D.L.O. Ref.	—
Drawn	HKO
Checked	JHK
Approved	JHY
Cad File No.	P:\JHK\25018NT\planning submission\LOT_BD\GBP_06



呂元祥建築師事務所

Project Title

Drawing Title
SECTION B-B

Project No.	25018NT
Scale	1:400
Issue Date	NOV 2025
Drawing No.	A/GBP_06

Drawing Purpose