Appendix VII

Drainage Impact Assessment

DRAINAGE IMPACT ASSESSMENT FOR PROPOSED RESIDENTIAL DEVELOPMENT AT LOT 1109 RP (PART) IN D.D. 253/8 KA SHUE ROAD, SAI KUNG, NEW TERRITORIES

DRAINAGE IMPACT ASSESSMENT

DECEMBER 16, 2024

CONFIDENTIAL

DRAINAGE IMPACT ASSESSMENT FOR Proposed Residential Development at Lot 1109 RP (Part) in D.D. 253/8 Ka Shue Road, Sai Kung, New Territories

CONFIDENTIAL

DRAINAGE IMPACT ASSESSMENT

DATE: DECEMBER 16, 2024

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QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	
Remarks				
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Signature				
Project number				
File reference				

SIGNATURES

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TABLES

FIGURES

APPENDICES

1 INTRODUCTION

1.1 BACKGROUND

1.1.1 The applicant proposes to redevelop the Application Site at Lot 1109 RP (Part) in D.D. 253,8 Ka Shue Road, Sai Kung, New Territories with minor relaxation of building height and site coverage restrictions. The Application Site falls within “Residential (Group C) 1” zone on the approved Tseng Lan Shue Outline Zoning Plan (OZP) No. S/SK-TLS/10.

1.1.2 The Applicants commissioned WSP (Asia) Limited (WSP) as the Consultant to carry out a Drainage Impact Assessment (DIA) for the proposed development under this planning application.

1.2 APPLICATION SITE AND ITS ENVIRONS

1.2.1 The Application Site covers an area of approximately 1,572m^2 and is situated in Sai Kung, New Territories. The proposed development site is bounded by Ka Shue Road.

1.2.2 The existing topography of the Project Site is predominantly flat, with a slight slope. The highest point is located in the middle of the site at +228.8mPD, gently sloping down to approximately +228.7mPD near Clear Water Bay Apartments Blocks F and E, and further descending to +220mPD at the northern edge of the site. The Application Site is surrounded by existing old buildings and areas of greenery. For the location of subject site, please refer to **Figure 1.**

1.3 PROJECT DESCRIPTION

1.3.1 The proposed development consists of two residential towers with soft landscape.

1.3.2 The proposed development's ground level will feature a combination of greenery and concrete paving. The ratio of paved to unpaved areas will remain largely consistent with the existing site layout.

1.3.3 The master layout plan is shown in **Appendix A.**

2 ASSESSMENT CRITERIA AND METHODOLOGY

2.1 GENERAL

2.1.1 The aim of this study is to assess the changes to runoff from the Application Site as a result of the proposed development and the potential impacts on the existing drainage system.

2.2 METHODOLOGY

Catchment Area

2.2.1 The catchment areas for the purpose of this DIA have been defined and details could be referred to Sections 3.

Storm Return Period

2.2.2 According to DSD's "*Stormwater Drainage Manual – Fifth Edition January 2018 (SDM)"*, the category of stormwater drainage system of the site is classified as "Urban Drainage Branch Systems", so 1 in 50-year storm return period was adopted in this assessment. Effect of rainfall increase and sea level rise due to climate change by end of 21st Century are taken into account by adding 16% and 12.1% to the surface runoff from the proposed development in accordance with the Table 28 and Table 31 SDM Corrigendum No. 1/2022, respectively.

Sea Tidal Effect

2.2.3 The proposed project site is not subject to sea tidal effect and therefore sea level is not considered in the DIA.

Basic Formulation of Rational Method

2.2.4 Rational method is used for calculation of the peak runoff. The formula is extracted from Section 7.5.2(a) of SDM which is to estimate the stormwater runoff as shown below:

$$Q_p = 0.278CiA$$

where Q_p = Peak runoff in m^3/s
C = Runoff coefficient (dimensionless)
i = Rainfall intensity in mm/hr
A = Catchment area in km^2

Time of Concentration

2.2.5 The time of concentration of urban area is assumed as 5 minutes as a conservative approach.

Runoff Intensity

2.2.6 The rainfall intensity is referenced from the Section 4.3.2 of SDM (Fifth Edition) and its Corrigendum 1/2024 which is to estimate the Intensity-Duration-Frequency (IDF) Relationship. The design storm return period is 50 years, the values of a, b and c are 505.5, 3.29 and 0.355, respectively.

$$i = \frac{a}{(t_d + b)^c}$$

where i = Extreme mean intensity in mm/hr

t_d = Duration in minutes ($t_d < 240$)
a, b, c = Storm constants given in SDM Table 3a.

- **Runoff Coefficient**

2.2.7 According to surface characteristics of the catchments, the runoff coefficient for paved area and unpaved area is 0.95 and 0.30 respectively.

-

2.2.8 Colebrook-White Equation is used in hydraulic design for pipe flow.

$$V = -\sqrt{32gRs}\, log\left(\frac{k_s}{14.8R} + \frac{1.255v}{R\sqrt{32gRs}}\right)$$

where
V = Mean velocity (m/s)
g = Gravitational acceleration (m/s^2)
R = Hydraulic radius (m)
D = Pipe diameter (m)
k_s = Equivalent sand roughness (m)
v = Kinematic viscosity of fluid (m^2/s)
s = Frictional slope (energy gradient due to frictional loss)

2.2.9 Manning's Equation is used in hydraulic design for open channel flow.

$$V = \frac{Ar^{1/6}(rs)^{1/2}}{n}$$

where
V = Mean velocity (m/s)
A = Cross sectional area of flow (m^2)
s = Frictional slope (Energy gradient due to frictional loss)
r = Hydraulic radius (m)
n = Manning coefficient of roughness

3 DRAINAGE IMPACT ASSESSMENT

3.1 BEFORE DEVELOPMENT

3.1.1 The Application Site is currently occupied by a residential building and characterized by a combination of concrete surfaces and greenery area.

3.1.2 The assessment area has been divided into Catchment A (including A1 to A3) and Catchment B (B1 to B4) based on their unique boundaries and topographical features. The characteristics of the Catchment A and Catchment B are shown in **Figure 2** and summarised in **Table 3-1**.

3.1.3 According to the site observations, the existing drainage system for the Application Site will be collected by the on-site U-channels and eventually discharge to two stepped channels as shown in **Figure 3**. The runoff from Catchment A would be discharged to the Stepped Channel 1, whereas the runoff from Catchment B will be discharged into Stepped Channel 2.

Table 3-1 Summary of Catchment Characteristics Before Development

Catchment	Sub-Catchment	Runoff coefficient (C)	Total Area (m^2)	Estimated Runoff [1] (m^3/s)	Receiving Stepped Channel
A	A1	0.95	317.9	0.049	Existing Stepped Channel 1
	A2	0.30	143.8		
	A3	0.95	302.7		
B	B1	0.95	642.41	0.054	Existing Stepped Channel 2
	B2	0.30	56.78		
	B3	0.30	221.88		
	B4	0.30	15.46		

Note[1] :The estimated runoff would be included 16% climate change factor as conservative.

3.2 AFTER DEVELOPMENT

3.2.1 After development, there is no major change on the landscape characteristic (i.e. combination of concrete surface and greenery area).

3.2.2 The catchment of the assessment area has been re-defined into Catchment P-A (including P-A1 to P-A6) and Catchment P-B (P-B1 to P-B9).The characteristics of the Catchment P-A and Catchment P-B are shown in **Figure 4** and summarised in **Table 3-2.**

3.2.3 The Application Site will follow the existing drainage system. The collected surface runoff would be discharged to the existing stepped channels as shown in **Figure 5**. The runoff from Catchment P-A would be discharged to the Stepped Channel 1, whereas the runoff from Catchment P-B will be discharged into Stepped Channel 2.

Table 3-2 Summary of Catchment Characteristics After Development

Catchment	Sub-Catchment	Runoff coefficient (C)	Total Area (m^2)	Estimated Runoff [1] (m^3/s)	Receiving Stepped-Channel
P-A1	P-A1	0.30	144.6	0.048	Existing Stepped Channel 1
	P-A2	0.30	74.1		
	P-A3	0.30	8.4		
	P-A4	0.95	264.9		
	P-A5	0.30	1.9		
	P-A6	0.95	314.8		
P-B1	P-B1	0.30	28.4	0.053	Existing Stepped Channel 2
	P-B2	0.30	42.9		
	P-B3	0.95	55.2		
	P-B4	0.30	24.9		
	P-B5	0.95	249.0		
	P-B6	0.30	131.3		
	P-B7	0.30	3.7		
	P-B8	0.95	343.7		
	P-B9	0.30	1.6		

Note[1] :The estimated runoff would be included 16% climate change factor as conservative.

3.3 ASSESSMENT FINDINGS

3.3.1 Base on the catchment area as mentioned in **Table 3-1** and **Table 3-2,** the runoff from the proposed development before and after development was estimated based on the return periods of 50 years as detailed in **Appendix B**.

3.3.2 **Table 3-3** presents a comparative analysis of the estimated peak runoff under existing and proposed development conditions. For Existing Stepped Channel 1, the peak runoff is projected to decrease marginally from 0.049m^3/s to 0.048m^3/s, while for Existing Stepped Channel 2, it is expected to reduce slightly from 0.054m^3/s to 0.053m^3/s. These calculations, based on a 50-year return period, demonstrate that the proposed development will not lead to an increase in peak runoff. Hence, no significant adverse impact is anticipated due to the proposed development on the existing drainage system.

Table 3-3 Estimated Peak Runoff of the Existing Condition and Propose Development

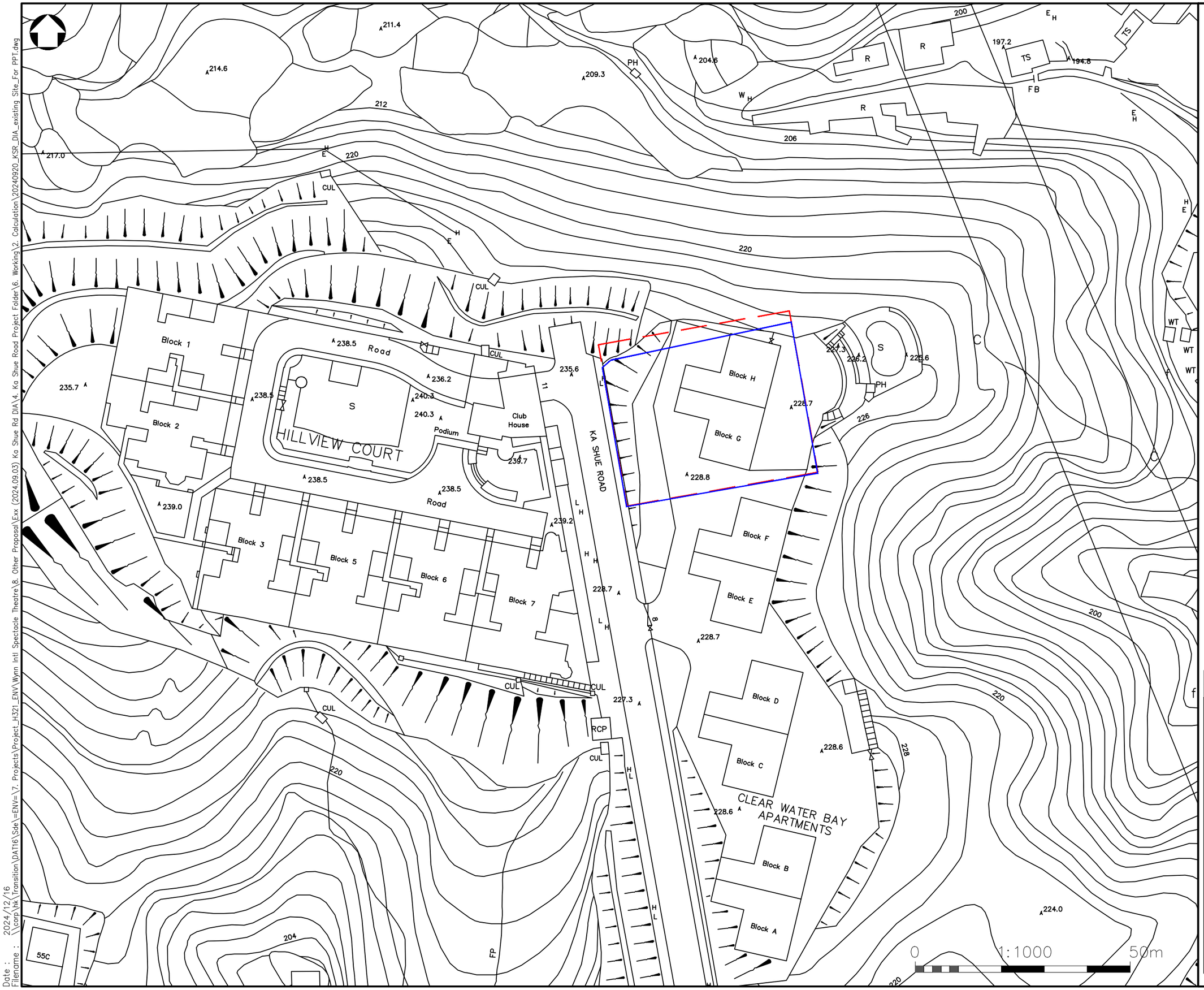
	Estimate Peak Runoff (m^3/s)		
	Existing Condition	After Development	Increasement ?
Existing Stepped Channel 1	0.049	0.048	No
Existing Stepped Channel 2	0.054	0.053	No

4 CONCLUSIONS

4.1.1 Based on the calculation, no additional runoff due to the proposed development is anticipated. The proposed development will follow the existing drainage system, and hence no adverse drainage impact from the Application Site is anticipated.

4.1.2 Routine inspection and desilting the drainage facilities within the proposed development and mitigation measures should be carried out during the operation periods to enhance drainage performance without blockage by debris or silting materials being washing down from the proposed development underground drainage system.

Figures



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Rev	Description	By	Date

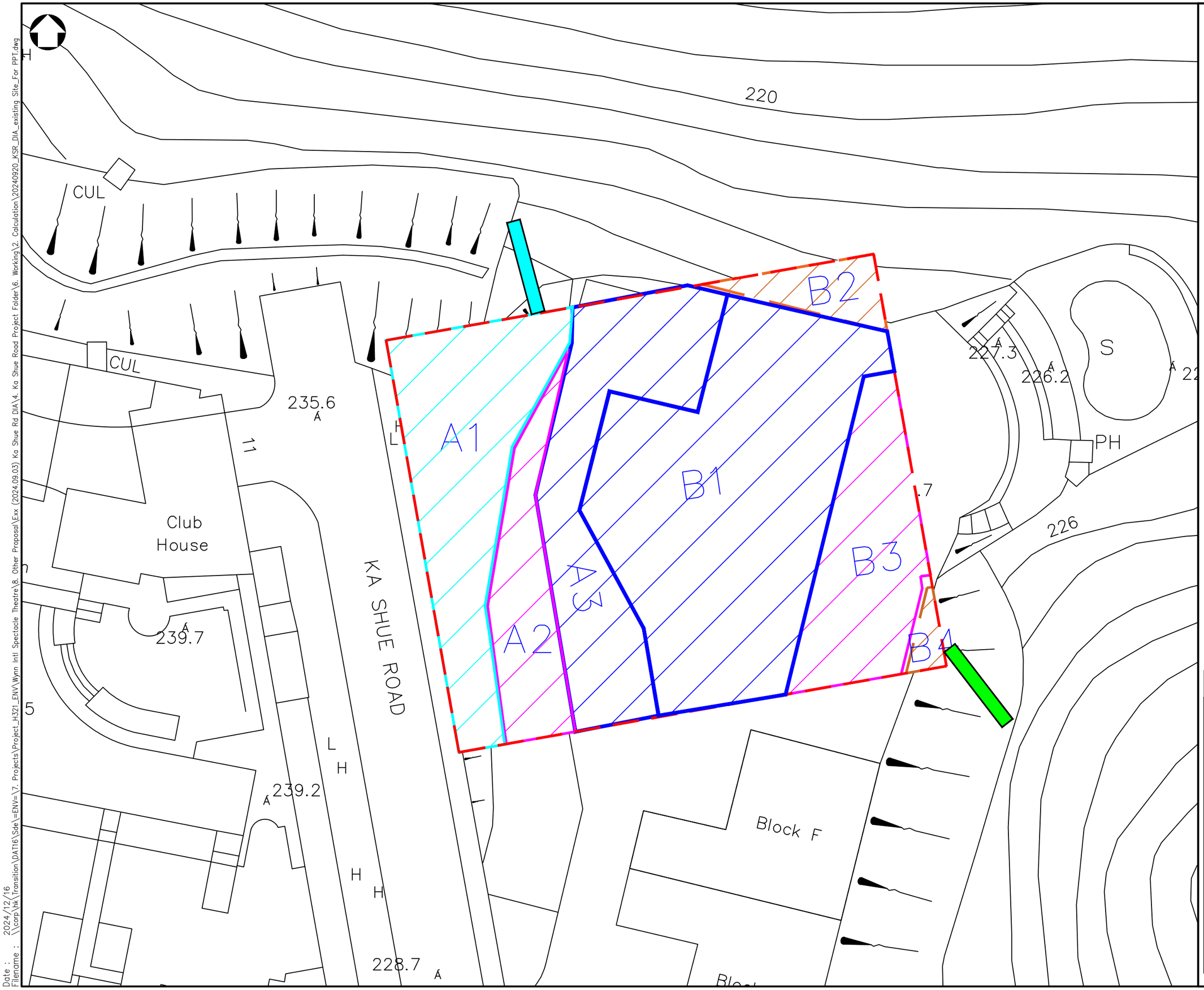
Consultant

wsp

Project title
Proposed Residential Development at Lot 1109 RP (Part) in D.D. 253/8 Ka Shue Road, Sai Kung, New Territories

Drawing title
LOCATION OF THE PROJECT

Drawing no.		Rev.
FIGURE 1		0
Drawn: SC	Date: AUG2024	Checked: AC	Approved: FN
Scale: 1:200@A3		Status: -	



Rev	Description	By	Date

Consultant

wsp

Project title
Proposed Residential Development at Lot 1109 RP (Part) in D.D. 253/8 Ka Shue Road, Sai Kung, New Territories

Drawing title
Existing Catchment at Subject Site Layout Plan

Drawing no.	Rev.
FIGURE 2	0

Drawn	Date	Checked	Approved
SC	AUG2024	AC	FN

Scale	Status
1:200@A3	-

Date : 2024/12/16
Filename : \\corp\hk\Transition\DAT16\Sde\=ENV=\7. Projects\Project_H321_ENV\Wynn Intl Spectacle Theatre\8. Other Proposal\Exx (2024.09.03) Ka Shue Rd DIA\4. Ka Shue Road Project Folder\6. Working\2. Calculation\20240920_KSR_DIA_existing Site_For PPT.dwg

Rev | Description | By | Date

Consultant

wsp

Project title
Proposed Residential Development at Lot 1109 RP (Part) in D.D. 253/8 Ka Shue Road, Sai Kung, New Territories

Drawing title
Locations of Existing Catchment Areas and Stepped Channel in Existing Condition

Drawing no.		Rev.
FIGURE 3		0
Drawn: SC	Date: AUG2024	Checked: AC	Approved: FN
Scale: 1:200@A3	Status: -	

Date : 2024/12/16
Filename : \\corp\hk\Transition\DAT16\Sde\=ENV=\7. Projects\Project_H321_ENV\Wynn Intl Spectacle Theatre\8. Other Proposal\Exx (2024.09.03) Ka Shue Rd DIA\4. Ka Shue Road Project Folder\6. Working\2. Calculation\20240920_KSR_DIA_existing Site_For PPT.dwg

LEGEND :

- ASSESSMENT SITE BOUNDARY
- LAWN
- PAVED AREA
- EXISTING STEPPED CHANNEL 1
- EXISTING STEPPED CHANNEL 2

220

CUL

CUL

235.6

11

Club House

239.7

239.2

KA SHUE ROAD

228.7

Block F

226

227.3

226.2

PH

S

P-A1

P-A2

P-A3

P-A4

P-A5

P-A6

P-B1

P-B2

P-B3

P-B4

P-B5

P-B6

P-B7

P-B8

P-B9

Rev	Description	By	Date

Consultant

wsp

Project title

Proposed Residential Development at Lot 1109 RP (Part) in D.D. 253/8 Ka Shue Road, Sai Kung, New Territories

Drawing title

Propose Catchment at Subject Site Layout Plan in Existing Condition

Drawing no.		Rev.
FIGURE 4		0
Drawn: SC	Date: AUG2024	Checked: AC	Approved: FN
Scale: 1:200@A3		Status: -	

Date : 2024/12/16
Filename : \\corp.hk\Transition\DAT16\Sde\=ENV=\7. Projects\Project_H321_ENV\Wynn Intl Spectacle Theatre\8. Other Proposal\Exx (2024.09.03) Ka Shue Rd DIA\4. Ka Shue Road Project Folder\6. Working\2. Calculation\20240920_KSR_DIA_existing Site_For PPT.dwg

LEGEND :

- ASSESSMENT SITE BOUNDARY
- ANTICIPATED STORMWATER AREA FLOW TO EXISTING STEP CHANNEL 1
- ANTICIPATED STORMWATER AREA FLOW TO EXISTING STEP CHANNEL 2
- EXISTING STEPPED CHANNEL 1
- EXISTING STEPPED CHANNEL 2

Rev	Description	By	Date

Consultant

wsp

Project title

Proposed Residential Development at Lot 1109 RP (Part) in D.D. 253/8 Ka Shue Road, Sai Kung, New Territories

Drawing title

Locations of Catchment Areas and Stepped Channel After Development

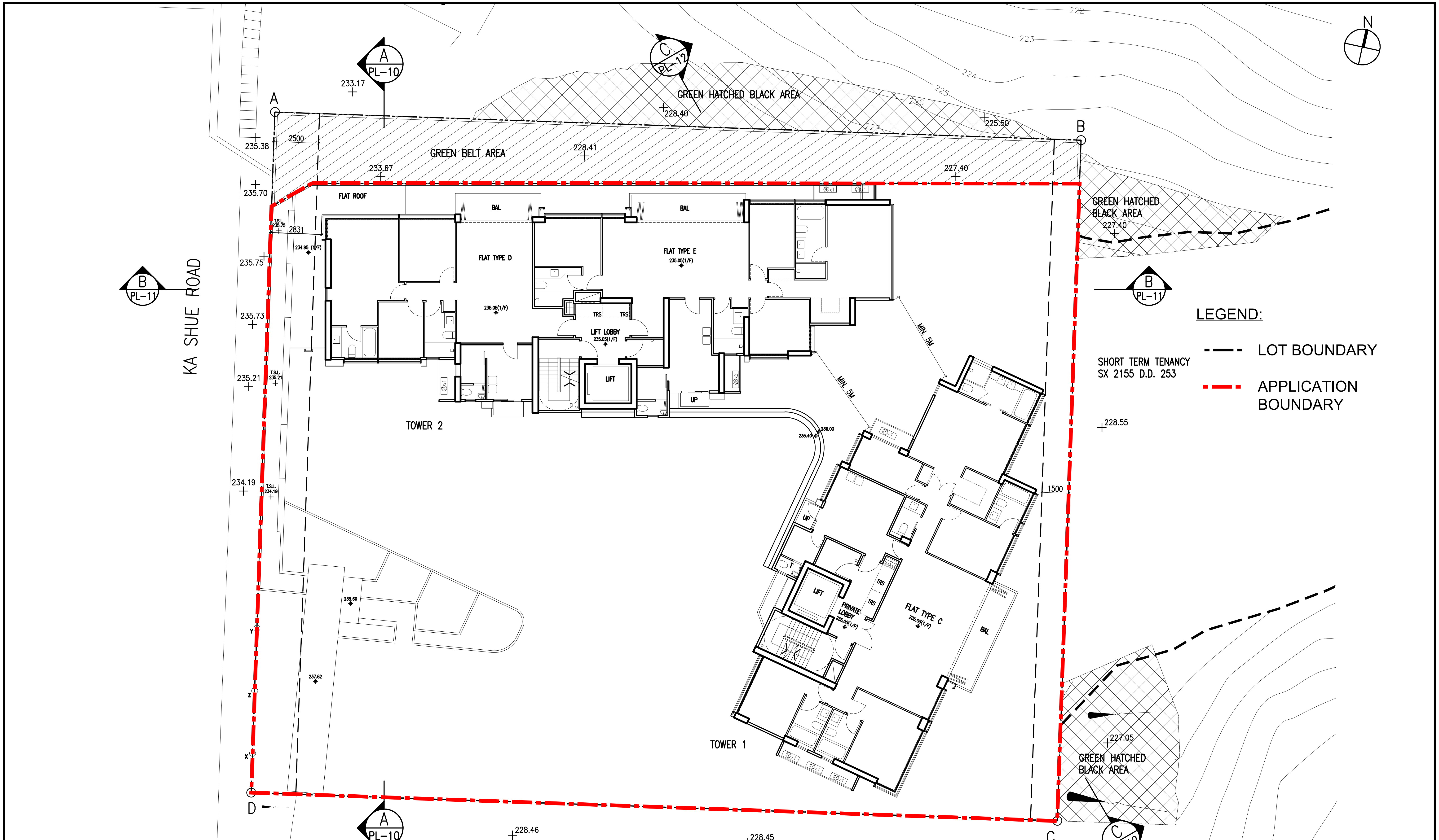
Drawing no.	Rev.
FIGURE 5	0

Drawn	Date	Checked	Approved
SC	AUG2024	AC	FN

Scale	Status
1:200@A3	-

Date : 2024/12/16
Filename : \\corp\hk\Transition\DA116\Sde\=ENV=\7. Projects\Project_H321_ENV\Wynn Intl Spectacle Theatre\8. Other Proposal\Ex (2024.09.03) Ka Shue Rd DIA\4. Ka Shue Road Project Folder\6. Working\2. Calculation\20240920_KSR_DIA_existing Site_For PPT.dwg

Appendix A Master Layout Plan of Proposed Development



TYPICAL FLOOR PLAN FOR 1/F TO 5/F (4/F OMITTED)

Figure 15a

C Y S Associates (H K) Ltd.
Architects & Urban Designers.
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PROJECT
Proposed Residential Development at Lot 1109 RP (Part) in D.D. 253, 8 Ka Shue Road, Sai Kung, New Territories

DRAWING TITLE
SECTION 16 APPLICATION
– TYPICAL FLOOR PLAN

NO.	DATE	REVISION	APP.

DESIGNED	DRAWN	PROJECT NO :	REV.
JC	LWH	23-546	
APPROVED	CHECKED	DRAWING NO : PL-04	
KC	JC		
DATE	SCALE	CAD REF : 546_GF-RF FOR PLAND_20241213	
AUG, 2024	1:200		

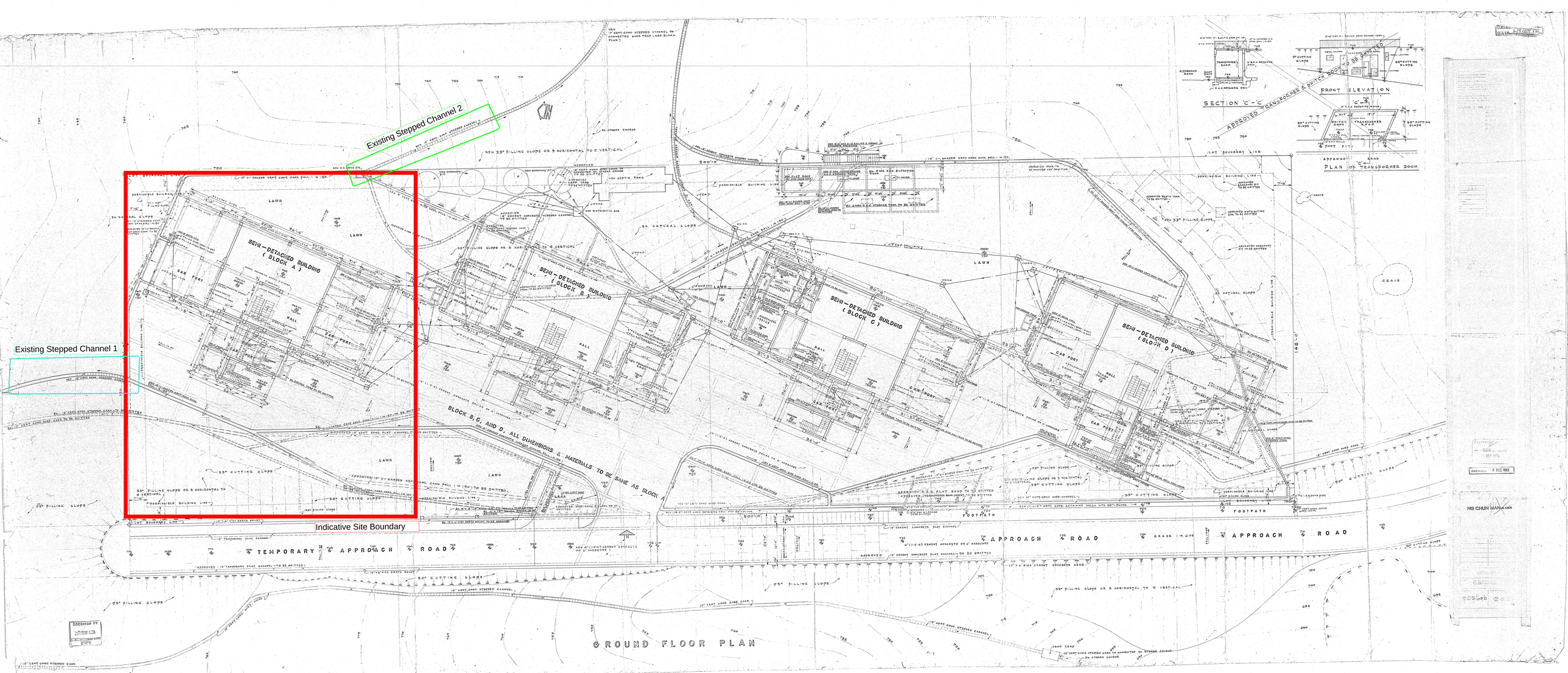
V:\CYSCAD\23-546 Ka Shue Road Sai Kung\BDA\Scheme for PlanD

Appendix B Drainage Impact Assessment Calculations

Appendix B - Drainage Impact Assessment Calculations

Scenario	Catchment Location	Catchment Area (A), m^2	Time of Concentration (mins)	Storm Constants			Runoff intensity (i), mm/hr	Runoff coefficient (C)	C x A	Climate Change Factor	Peak runoff, m^3/s
				a	b	c					
Exisitng - Catchment A	A1	317.9	5	505.5	3.29	0.355	238.6	0.95	302.0	16%	0.023
-	A2	143.8	5	505.5	3.29	0.355	238.6	0.30	43.2	16%	0.003
-	A3	302.7	5	505.5	3.29	0.355	238.6	0.95	287.6	16%	0.022
Total Runoff of Existing condition to Existing Stepped-Channel 1											**0.049**
Proposed - Catchment A	P-A1	144.6	5	505.5	3.29	0.355	238.6	0.30	43.4	16%	0.003
-	P-A2	74.1	5	505.5	3.29	0.355	238.6	0.30	22.2	16%	0.002
-	P-A3	8.4	5	505.5	3.29	0.355	238.6	0.30	2.5	16%	0.000
-	P-A4	264.9	5	505.5	3.29	0.355	238.6	0.95	251.7	16%	0.019
-	P-A5	1.9	5	505.5	3.29	0.355	238.6	0.30	0.6	16%	0.000
-	P-A6	314.8	5	505.5	3.29	0.355	238.6	0.95	299.0	16%	0.023
Total Runoff of After Development to Existing Stepped-Channel 1											**0.048**

Scenario	Catchment Location	Catchment Area (A), m^2	Time of Concentration (mins)	Storm Constants			Runoff intensity (i), mm/hr	Runoff coefficient (C)	C x A	Climate Change Factor	Peak runoff, m^3/s
				a	b	c					
Exisitng - Catchment B	B1	642.4	5	505.5	3.29	0.355	238.6	0.95	610.3	16%	0.047
-	B2	56.8	5	505.5	3.29	0.355	238.6	0.30	17.0	16%	0.001
-	B3	221.9	5	505.5	3.29	0.355	238.6	0.30	66.6	16%	0.005
-	B4	15.5	5	505.5	3.29	0.355	238.6	0.30	4.6	16%	0.000
Total Runoff of Existing condition to Existing Stepped-Channel 2											**0.054**
Proposed - Catchment B	P-B1	28.4	5	505.5	3.29	0.355	238.6	0.30	8.5	16%	0.001
-	P-B2	42.9	5	505.5	3.29	0.355	238.6	0.30	12.9	16%	0.001
-	P-B3	55.2	5	505.5	3.29	0.355	238.6	0.95	52.5	16%	0.004
-	P-B4	24.9	5	505.5	3.29	0.355	238.6	0.30	7.5	16%	0.001
-	P-B5	249.0	5	505.5	3.29	0.355	238.6	0.95	236.6	16%	0.018
-	P-B6	131.3	5	505.5	3.29	0.355	238.6	0.30	39.4	16%	0.003
-	P-B7	3.7	5	505.5	3.29	0.355	238.6	0.30	1.1	16%	0.000
-	P-B8	343.7	5	505.5	3.29	0.355	238.6	0.95	326.5	16%	0.025
-	P-B9	1.6	5	505.5	3.29	0.355	238.6	0.30	0.5	16%	0.000
Total Runoff of After Development to Stepped U-Channel 2											**0.053**


Existing Stepped Channel 2
Existing Stepped Channel 1
Indicative Site Boundary
SEMI-DETACHED BUILDING (BLOCK A)
SEMI-DETACHED BUILDING (BLOCK B)
SEMI-DETACHED BUILDING (BLOCK C)
SEMI-DETACHED BUILDING (BLOCK D)
BLOCK B, C, AND D, ALL DIMENSIONS & MATERIALS TO BE SAME AS BLOCK A
TEMPORARY APPROACH ROAD
APPROACH ROAD
GROUND FLOOR PLAN
SECTION 'C'-'C'
FRONT ELEVATION
PLAN OF TRANSFORMER ROOM
APPROVED TRANSFORMER & SWITCH ROOM TO BE OMITTED
LOT BOUNDARY LINE
PERMISSIBLE BUILDING LINE
FOOTPATH
GRAVE
NG CHUN MAN & ARCH