Appendix H

Drainage Impact Assessment

Section 12A Planning Application for Proposed Amendments to the Sha Tin Outline Zoning Plan to Rezone "Open Space" Zone to "Other Specified Use" annotated "Hotel Development" Zone in Support of Proposed Hotel Development at Various Lots in D.D. 184 and Adjoining Government Land, Sha Tin, New Territories

Drainage Impact Assessment

June 2026

Delivering a better world

Prepared by:

AECOM Asia Company Limited
[redacted]

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1. Introduction

1.1 Background

1.1.1 AECOM Asia Company Limited (AECOM) has been commissioned by the Applicant to conduct a Drainage Impact Assessment (DIA) in support of a Section 12A Application under the Town Planning Ordinance (Cap. 131), to rezone the Application Site from “Open Space” (“O”) to “Other Specified Use” annotated "Hotel Development" Zone on the draft Sha Tin Outline Zoning Plan (OZP) No. S/ST/39.

1.1.2 The Application Site is bounded by Shing Mun River (SMR) to the north, Tai Chung Kiu Road to the south and Lion Rock Tunnel Road to the west. The location of the Application Site is indicated in **Figure 1**.

1.1.3 The subject planning application aims to make better use of the valuable land resources of the Application Site to facilitate a proposed hotel development (the Proposed Development) with an active public realm that contains retail/F&B, recreational elements and the preserved Main Building of Ng Yuen.

1.2 Objective of this Submission

1.2.1 This report outlines the assessment results of the potential drainage impact caused by the Proposed Development at the Application Site. The main objectives of this assessment include the followings:

(i) Review the existing stormwater drainage condition.

(ii) Outline the methodology adopted in this assessment.

(iii) Outline changes to the drainage characteristics and potential drainage impacts which may arise from the Application Site.

(iv) Propose drainage mitigation measures where appropriate to mitigate the potential drainage impact.

(v) Discuss the responsibility of the construction and maintenance aspects of the proposed drainage system.

1.3 Nomenclature

1.3.1 The following abbreviations and shortened expressions in **Table 1** are adopted in this report.

AECOM	AECOM Asia Company Limited
DSD	Drainage Services Department
GFA	Gross Floor Area
HKO	Hong Kong Observatory
mPD	Metres above Principal Datum
PlanD	Planning Department
SDM	Stormwater Drainage Manual (5th edition, DSD)
DIA	Drainage Impact Assessment

Table 1 – Nomenclature

2. Development Proposal

2.1 The Indicative Development Proposal

2.1.1 The Application Site has an area of approximately 4,561.5m^2 with a total Gross Floor Area (GFA) of about 18,246m^2.

2.1.2 The Indicative Block Plan of the Application Site is shown in **Figure 2**. The development schedule is summarized in **Table 2** below.

Development Parameters	Proposed Development
Application Site Area (m^2) (about)	4,561.5 (1)
Total Non-domestic GFA (m^2) (about)	18,246 (2)
• Hotel	17,446
• Commercial Use (3)	800
Total Non-domestic Plot Ratio	About 4.0
Maximum Building Height (to the main roof)	Not more than 68mPD
No. of Storeys	14
Site Coverage	
• Height not exceeding 15m	Not more than 100%
• Height Over 15m	Not more than 62.5%
No. of Hotel Rooms	443
No. of Blocks	2

Table 2 – Key Development Parameters

Remarks:
(1) Subject to detailed land survey at subsequent detailed design and land grant stage.
(2) Excluding GFA to be exempted under Building (Planning) Regulation such as back-of-house area to support the hotel, E/M plant rooms, car parking area, sky garden, etc.
(3) Includes 'Shop and Services', 'Eating Place', 'Place of Entertainment' and 'Place of Recreation, Sports or Culture' uses at the commercial portion.

3. Assessment Methodology

3.1 Overview of Methodology

3.1.1 This assessment is carried out to assess the drainage impact arising from the Proposed Development on the drainage system.

3.1.2 The assessment is carried out in accordance with the requirements stated in *"Advice Note No.1 – Application of the Drainage Impact Assessment Process to Private Sector Projects"* issued by the Drainage Services Department (DSD). The design parameters adopted are referenced from the design guidelines published by the DSD as follows:

- Stormwater Drainage Manual (SDM).
- Stormwater Drainage Manual - Corrigendum No. 1/2022.
- Stormwater Drainage Manual - Corrigendum No. 1/2024.
- Stormwater Drainage Manual - Corrigendum No. 2/2024.

3.2 Methodology and Assumptions

3.2.1 Rational Method is used for estimation of surface runoff from the Application Site. The design parameters are summarized in **Table 3**.

Design Storm Return Period	50 years
Rainfall Intensity	$i = \frac{a}{(t_d + b)^c}$
Rainfall Zone	HKO Headquarters
Design Storm Constants	a = 505.5; b = 3.29; c = 0.355
Runoff Coefficients, C	0.95 (Paved Area) 0.35 (Unpaved Area)
Rainfall Increases due to Climate Change	16%
Design Allowance	12.1%

Table 3 – Design Parameters for Runoff Estimation

3.2.2 Colebrook-White Equation and Manning's Equation is used for estimation of hydraulic checking of existing and proposed drainage system. The design parameters are summarized in **Table 4**.

Colebrook-White Roughness Value, ks	0.15 (Precast concrete pipes)
Manning's Coefficient, n	0.014 (Concrete-lined channels)
Pipe Sediment	10% reduction in flow capacity
Viscosity of Water, ν	1 x 10^{-6} m^2/s

Table 4 – Design Parameters for Hydraulic Analysis

3.3 Climate Change and Design Allowance

3.3.1 Design consideration on rainfall due to climate change has been incorporated into the design in accordance with the latest design guidelines and Corrigendums published by the DSD, as listed in **Section 3.1.2**.

SDM Corrigendum No. 1/2022

3.3.2 According to item (e), drainage provision in new development areas should consider the climate change effects up to the end of 21st century plus design allowance. With reference to items (k) and (n), a 16% increase in rainfall intensity and a 12.1% design allowance have been considered for this assessment.

SDM Corrigendums No. 1/2024 and No. 2/2024

3.3.3 The latest storm constants have been considered for this assessment to reflect the latest rainfall data and climate projections.

4. Runoff Estimations

4.1 Site Condition

4.1.1 The existing vegetated and paved areas are observed on the aerial photo in **Annex 1**. Based on the aerial photo, it is estimated that approximately 30% of the Application Site is paved under the existing conditions.

4.1.2 Not less than 10% of unpaved area will be provided within the Application Site.

4.2 Runoff Estimation

4.2.1 Rational Method is adopted for estimation of the runoff from the pre-development and post-development scenarios.

4.2.2 The pre-development and post-development surface runoff have been estimated. An increase of approximately 0.152 m^3/s in surface runoff is expected at the Application Site due to the change in land use. A summary of the surface runoff calculations is shown in **Table 5** below. For detailed runoff estimation, please refer to **Annex 2**.

	Area (m^2)		Design Rainfall Intensity (with Climate Change) (mm/hr)	Total Surface Runoff (m^3/s)
	Paved	Unpaved		
Pre-Development	1,368.45	3,193.05	306	0.192
Post-Development	4,105.35	456.15	306	0.344
			Net Increase	**0.152**

Table 5 – Summary of Surface Runoff

5. Potential Drainage Impacts and Mitigation Measures

5.1 Review on Existing Drainage System

5.1.1 The Application Site is bounded by Lion Rock Tunnel Road and Tai Chung Kiu Road. A main drainage channel, SMR is situated at the north of the Application Site. Ng Yuen is located within the Application Site, which is situated on low-lying ground with existing levels down to +3.0mPD.

5.1.2 According to record plans obtained from the DSD, existing drainage network is available in the vicinity of the Application Site. A 225 mm diameter outlet pipe is located immediately northeast of the Application Site, and a 600 mm diameter pipe is located to the southeast. Both pipes ultimately discharge stormwater to SMR via a 4 × 900 mm diameter outlet pipes. The outlet pipes are equipped with flap valves to prevent backwater flow during tidal events. The existing drainage record is shown in **Figure 3**.

5.1.3 According to drainage record plans from DSD, there is an existing catchpit (SCH4005212) located at the southeast of the Application Site. Stormwater received will be conveyed by an

existing 600mm diameter pipe (SWD4056374) and its downstream system towards SMR outfall. It is observed that there are existing channels capturing surface runoff from external catchment areas located to the south and east of the Application Site, which connect to this catchpit (SCH4005212). The existing channels are indicated in **Figure 3** for reference.

5.2 Proposed Drainage Arrangement

External Catchment Area

5.2.1 One external catchment area located to the north of the Application Site have been identified and is shown in **Figure 4**, named External Catchment Area 1. Since the Application Site obstructs the existing flow path, peripheral drains are proposed along the site boundary to intercept and divert the runoff from External Catchment Area 1. The collected runoff will be conveyed to terminal manhole TMH1 for discharge to public drainage system.

5.2.2 Another external catchment area located to the south and east of the Application Site has an existing drainage system as mentioned in **Section 5.1.3**. The proposed open area will make use of existing drainage system, some modification may be required to suit the layout, subject to the actual levels on site. To prevent site runoff from entering external catchment area, peripheral drains are proposed along the southern to southeastern boundaries of the Application Site.

Catchment Areas within the Application Site

5.2.3 The Development proposed to raise the site formation level to +6.00mPD.

5.2.4 Surface runoff generated within the Application Site will be collected by an internal drainage system and conveyed to TMH1 for discharge. The size and detailed arrangement of the internal drainage system will be further reviewed during the detailed design stage.

5.2.5 Part of the public drainage systems (i.e. manhole no. SMH4052743 and pipe segment from SMH4052743 to SMH4050182) are proposed to be modified to facilitate the connection from TMH1. The pipe segment from SMH4052743 to SMH4050182 will be upgraded from 225 mm diameter to 600mm diameter, **Figure 4** refers.

5.2.6 The proposed drainage pipes and peripheral drains will be designed with adequate capacity to cater for effects of climate change. The terminal manhole TMH1 will ultimately discharge site runoff to SMR via the existing 4 × 900 mm diameter outlet pipes. The proposed drainage layout is shown in **Figure 4**. Hydraulic calculation refers to **Annex 3**.

5.2.7 With the implementation of the proposed drainage arrangement, no insurmountable drainage impacts are anticipated.

6. Maintenance Responsibility

6.1.1 The general operation and maintenance requirements will be referenced to Practice Note No. 1/2024 "Design Checklists on Operation & Maintenance Requirements".

6.1.2 The Proposed Development will be responsible for constructing all necessary drainage systems within the Application Site, carrying out connection works to the public drainage system, and undertaking modification works to the existing public drainage networks.

6.1.3 The Proposed Development is responsible for the maintenance of terminal manhole and all upstream drainage system within the site.

6.1.4 The drainage systems outside the site boundary are proposed to be handed over to relevant government department for future maintenance.

7. Conclusion

7.1.1 This DIA report serves as a supporting document for rezoning the Application Site from “Open Space” to “Other Specified Use” annotated "Hotel Development" Zone to facilitate a proposed hotel development. The DIA has been carried out to assess the potential drainage impact due to the Proposed Development.

7.1.2 The pre-development and post-development surface runoff have been estimated. An increase of approximately 0.152 m^3/s in surface runoff is expected at the Application Site due to the change in land use.

7.1.3 The pipe segment from SMH4052743 to SMH4050182 will be upgraded from 225 mm diameter to 600mm diameter.

7.1.4 Proper internal and peripheral drainage system will be provided within the Application Site to collect and convey runoff from the external catchments and the Application Site. The collected runoff will ultimately be discharged to SMR via the existing 4 × 900 mm diameter outlet pipes.

7.1.5 The proposed drainage layout is shown in **Figure 4.** With the implementation of the proposed drainage arrangement, no insurmountable drainage impacts are anticipated.

End of Report

Figures

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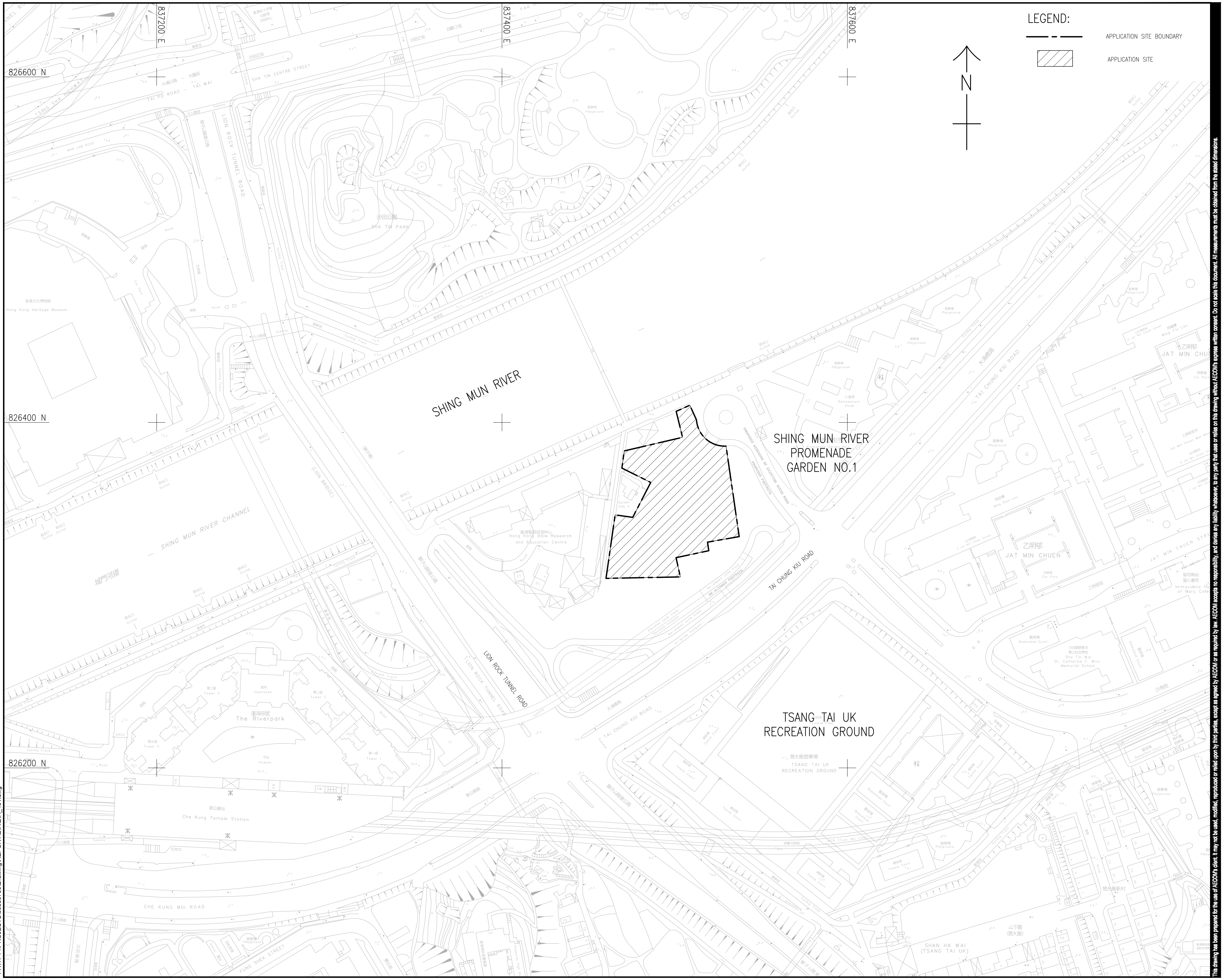

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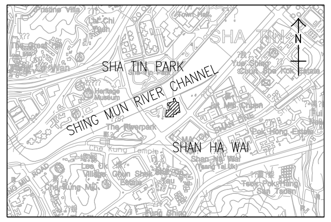

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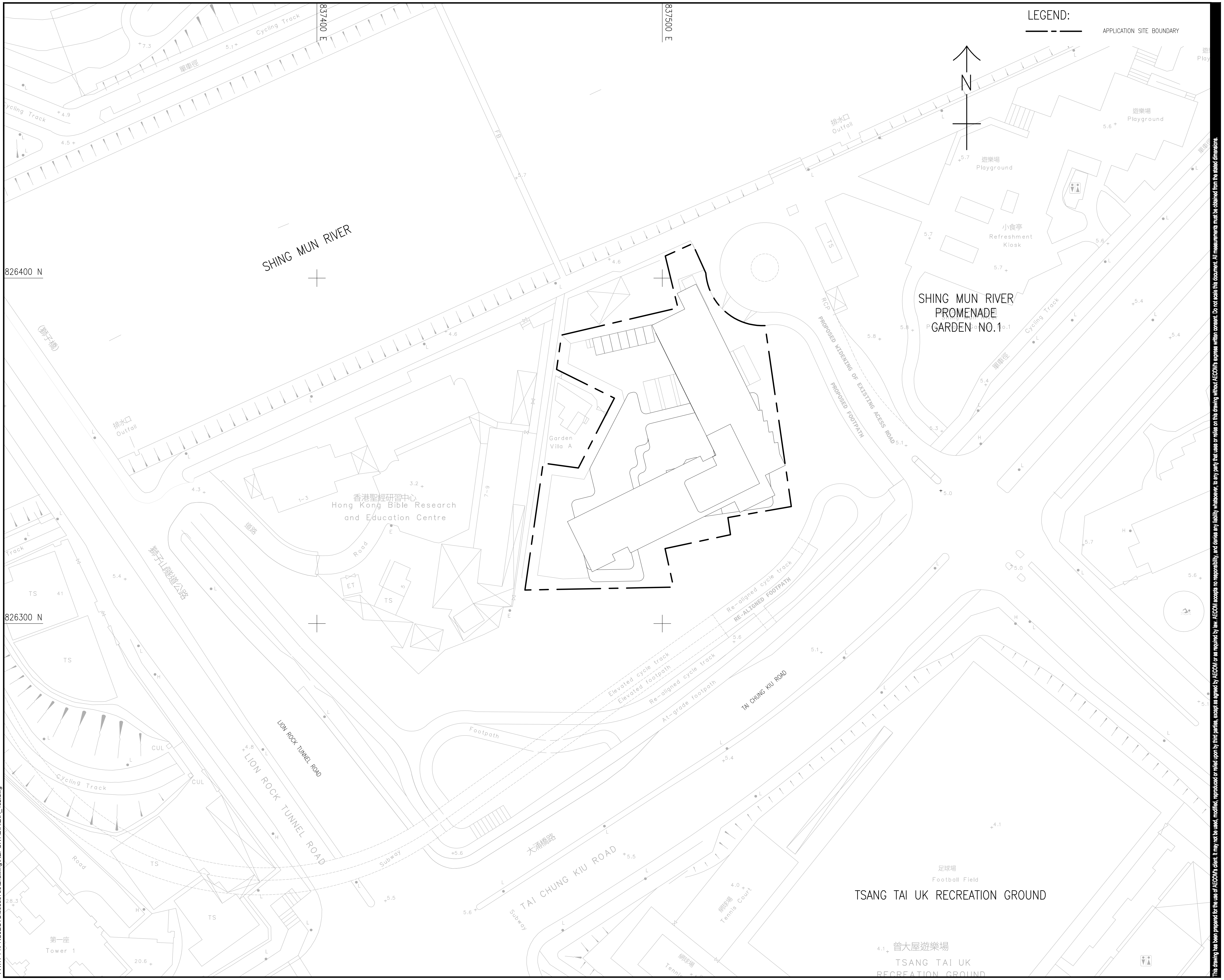

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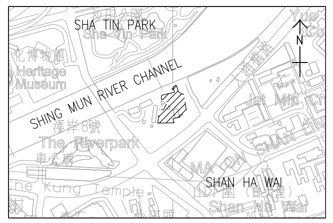

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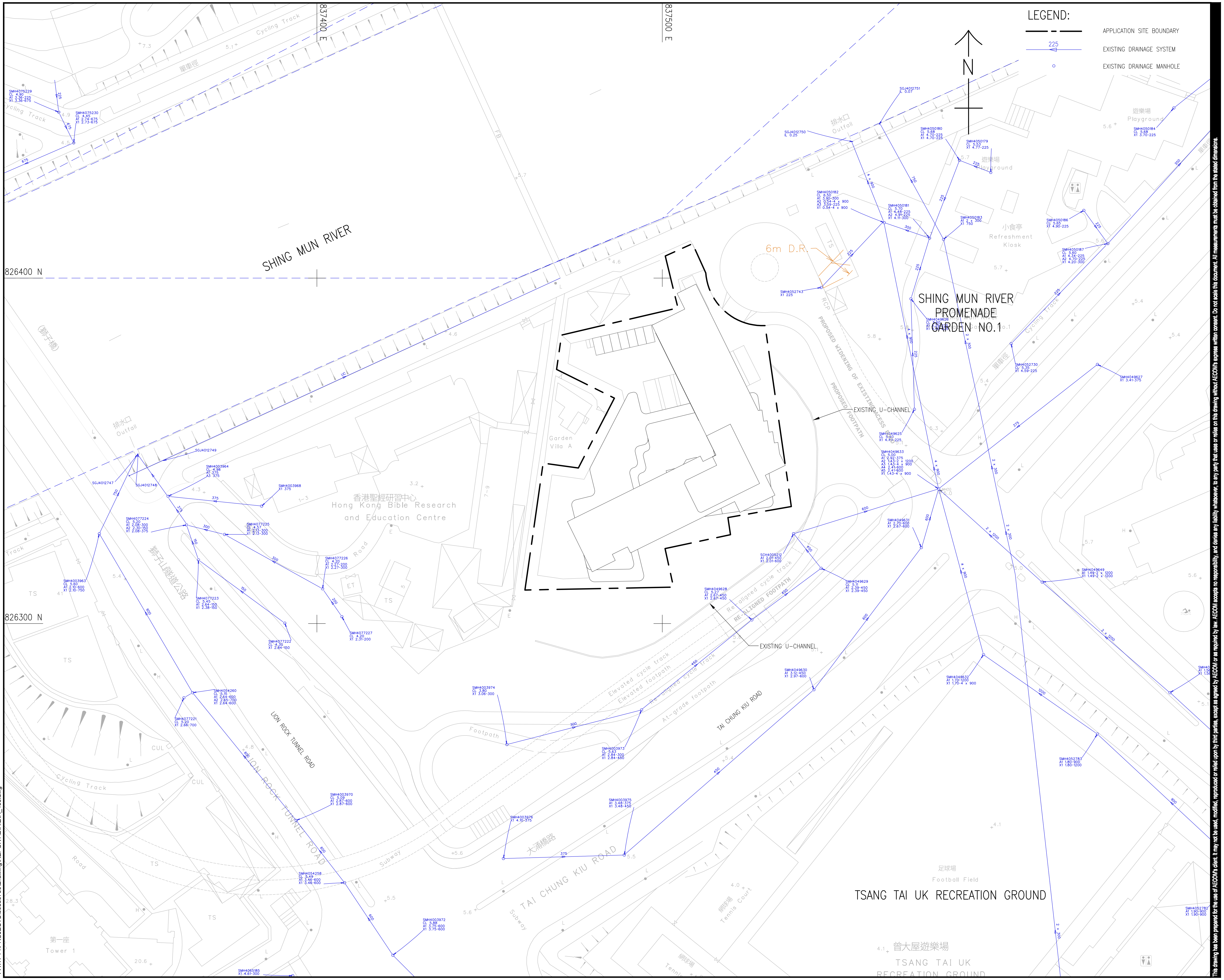

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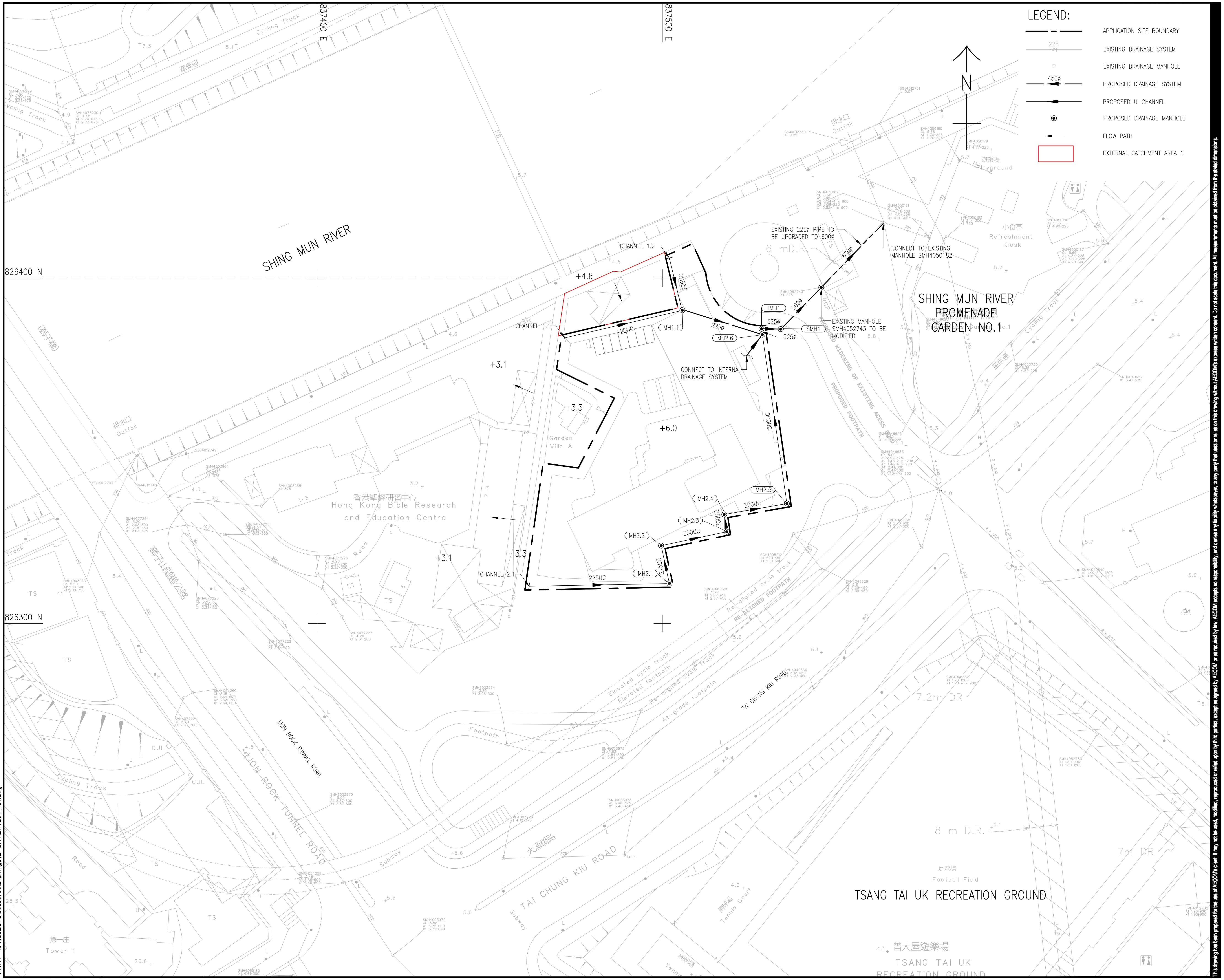

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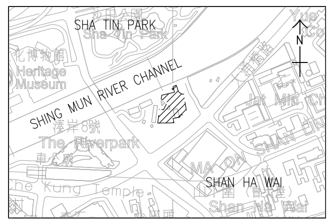

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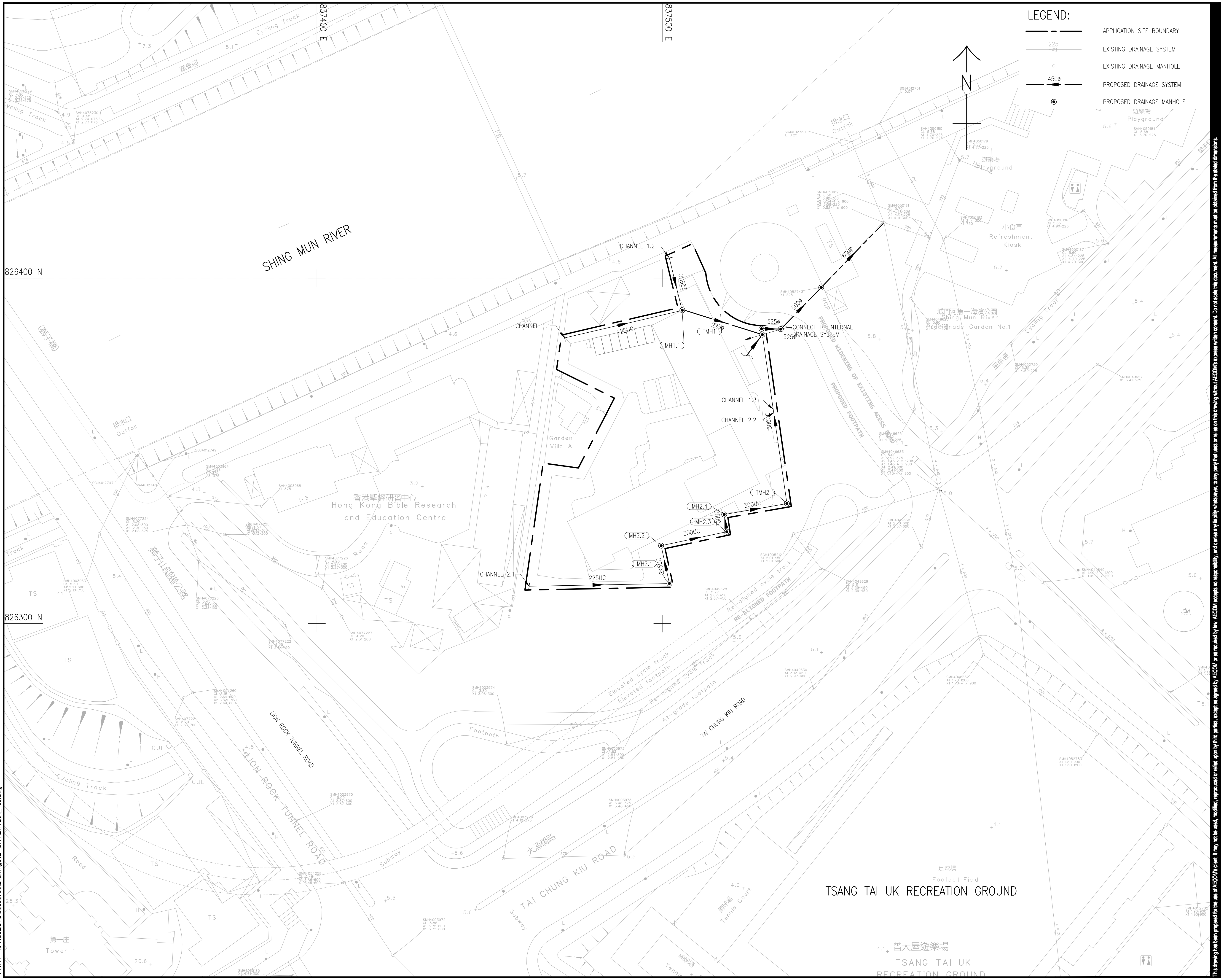

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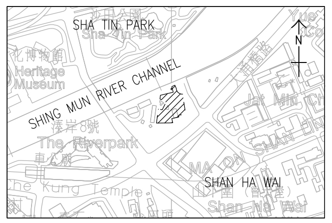

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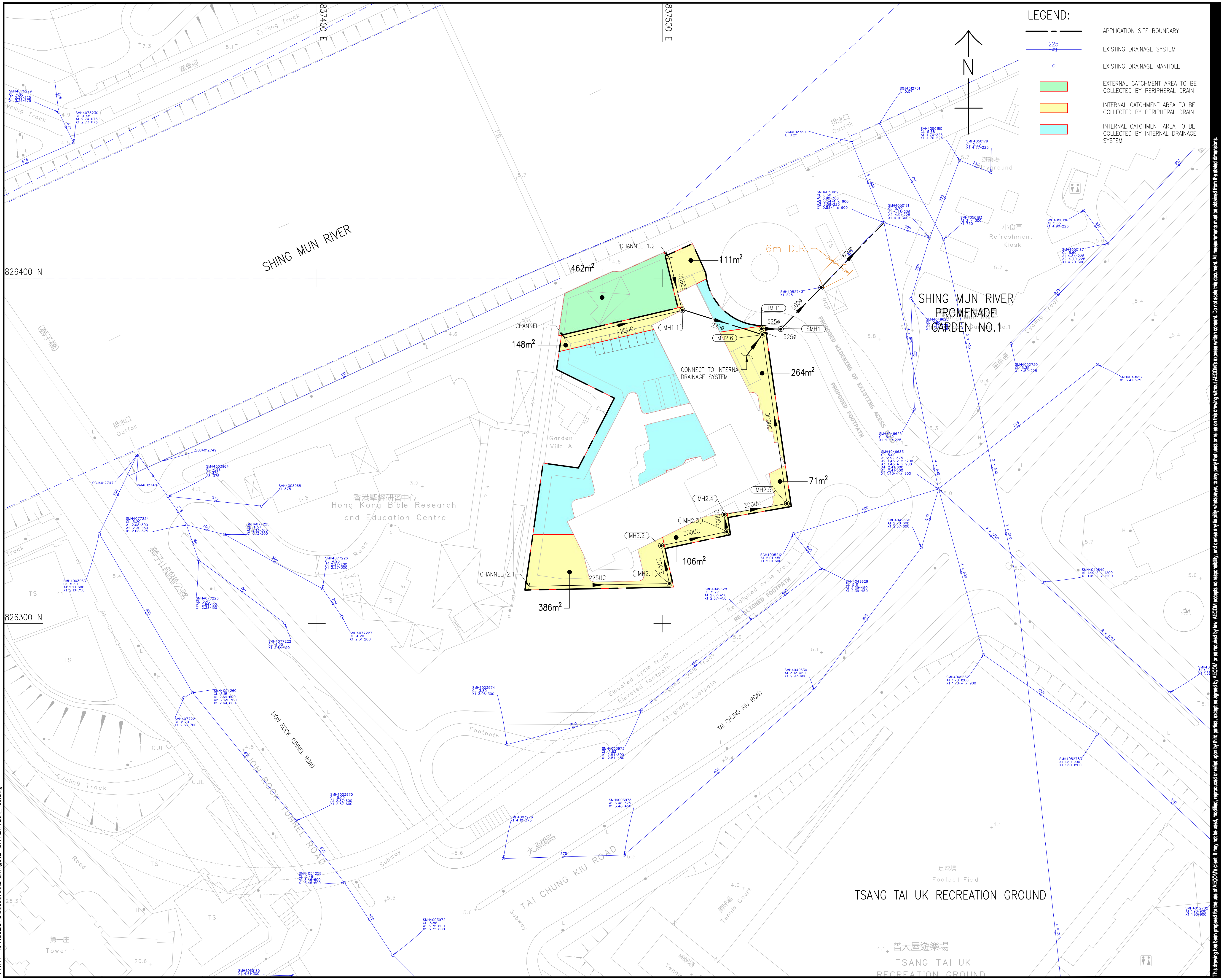

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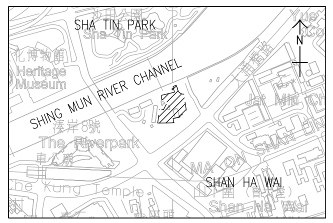

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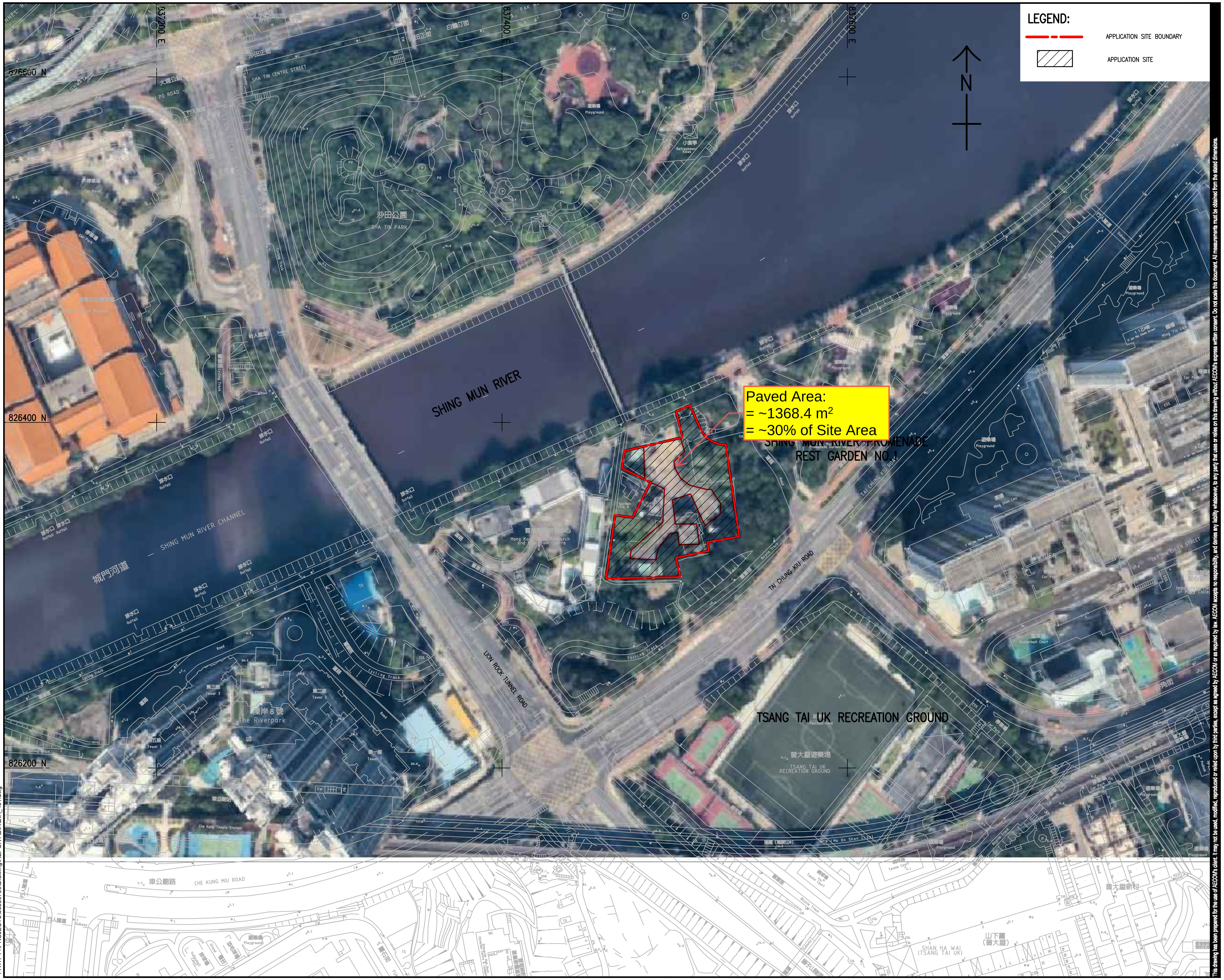
Annex 1

Aerial Photo



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PROJECT 項目

PROPOSED HOTEL AT VARIOUS LOTS IN D.D. 184 AND ADJOINING GOVERNMENT LAND NEAR JAT MIN CHUEN, SHA TIN, N.T.

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SITE LOCATION PLAN

SHEET NUMBER 圖紙編號

FIGURE 1

Annex 2

Surface Runoff Estimation

Annex 2 - Surface Runoff Estimation

A) SURFACE RUNOFF ESTIMATION

The surface runoff in the development would be collected by internal road drainage system which would be designed to the road drainage standard as stipulated in HyD's "Guidance Notes on Road Pavement Drainage Design".

Therefore t_d = 5.0 min

B) RAINFALL INTENSITY

The Intensity-Duration-Frequency data can be expressed by the following algebraic equation:

$$i = \frac{a}{(t_d + b)^c} \quad \textit{(SDM 4.3.2)}$$

where i = extreme mean intensity in mm/hr
t_d = duration in minutes (t_o less than or equal to 240), and
a, b, c = storm constants given in SDM - Corrigendum No. 1/2024 Table 3a

For 50-year return period, according to SDM - Corrigendum No. 1/2024 Table 3a

a = 505.5
b = 3.29
c = 0.355

==> i = 239 mm/hr

Considering:

1	Rainfall increase in Climate Change	=	16%	*(Table 28, SDM Corrigendum No. 1/2022)*
2	Design Allowance in End of 21st Century	=	12.1%	*(Table 31, SDM Corrigendum No. 1/2022)*

==> i = *239x(1+16%+12.1%)*
= *306* mm/hr

C) PEAK RUNOFF ESTIMATION

PRE-DEVELOPMENT

The peak runoff by Rational Method is given by the following expression:

Q_p = *0.278 C i A* *(SMD7.5.2)*

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

Site Area	=	4,561.5	m^2	
Paved Area	=	1,368.45	m^2	(C = 0.95)
Unpaved Area	=	3,193.05	m^2	(C = 0.3)

Weighted C Value = 0.495

==> Q_p = *0.192* m^3/s

POST-DEVELOPMENT

The peak runoff by Rational Method is given by the following expression:

Q_p = *0.278 C i A* *(SMD7.5.2)*

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

Site Area	=	4,561.5	m^2	
Paved Area	=	4,105.35	m^2	(C = 0.95)
Unpaved Area	=	456.15	m^2	(C = 0.3)

Weighted C Value = 0.885

==> Q_p = *0.344* m^3/s

Annex 3

Hydraulic Calculation of Proposed Drainage Facilities

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Section 12A Planning Application for Proposed Amendments to the Sha Tin Outline Zoning Plan to Rezone "Open Space" Zone to "Other Specified Use (Hotel Development with Historical Building Preserved)" Zone in Support of Proposed Hotel Development at Various Lots in D.D. 184 and Adjoining Government Land, Sha Tin, New Territories

Annex 3 - Hydraulic Calculation of Proposed Drainage Facilities

k_s (con) =	0.15	mm	
viscosity =	1E-06	m^2/s	Date: Apr-26
return period	50	yrs	By:

Manhle No.		Ground Level		Pipe								Design Flow									
					Level						Catchment						Time of Concentration	Rainfall Intensity	Discharge	Discharge with Climate Change	Utilization
U/S	D/S	U/S	D/S	Nominal Dia.	U/S	D/S	Length	Grad	Velocity	Time of Flow	Capacity	Paved	Ceoff.	Unpaved	Ceoff.	Upstream	Total				
		mPD	mPD	mm	mPD	mPD	m	1 in	m/s	min	m^3/s	m^2		m^2			m^2	min	mm/hr	m^3/s	m^3/s	%
MH1.1	MH2.6	6.00	6.00	300	3.18	3.02	24.0	150	1.39	0.29	0.088	0	0.95	0	0.35	546	546	5.57	232.98	0.035	0.045	52%
MH2.6	TMH1	6.00	6.00	525	3.02	3.00	1.8	100	2.43	0.01	0.473	4105	0.95	456	0.35	300	4360	7.35	218.35	0.265	0.339	72%
TMH1	SMH1	6.00	6.00	525	2.85	2.80	5.2	100	2.43	0.04	0.473	0	0.95	0	0.35	4360	4360	7.36	218.26	0.265	0.339	72%
SMH1	SMH4052743	6.00	6.00	600	2.80	2.63	17.2	100	2.64	0.11	0.671	0	0.95	0	0.35	4360	4360	7.40	218.00	0.264	0.338	50%
SMH4052743	SMH4050182	6.00	6.00	600	2.63	2.37	26.0	100	2.64	0.16	0.671	0	0.95	0	0.35	4360	4360	7.51	217.22	0.263	0.337	50%

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Annex 3 - Hydraulic Calculation of Proposed Drainage Facilities

Project No.
Date Apr-26 Sheet
By

Channel																				For 50 Years Return Period				Utilization
U/S	D/S	Length (m)	Ground Level U/S mPD	Ground Level D/S mPD	Invert Level U/S mPD	Invert Level D/S mPD	Depth Check U/S m	Depth Check D/S m	Grad. 1 in	Catchment Area (m^2) Paved	Ceoff.	Unpaved	Ceoff.	Equivalent Area	Total Area	Base Size (mm)	Starting Point Shape	Full Bore Velocity (U shape) m/s	Full Bore Capacity m^3/s	Time of Conc. min	Rainfall Intensity mm/hr	Discharge m^3/s	Discharge with Climate Change m^3/s	%
Channel 1.1	MH1.1	35.50	3.70	3.70	3.40	3.18	0.30	0.52	160	264[1]	0.95	116[1]	0.35	291	291	225	U	1.03	0.042	5.00	238.58	0.019	0.025	58.8
Channel 1.2	MH1.1	15.40	3.70	3.70	3.40	3.18	0.30	0.52	70	227[1]	0.95	116[1]	0.35	256	256	225	U	1.56	0.063	5.00	238.58	0.017	0.022	34.2
Channel 2.1	MH2.1	42.80	6.00	6.00	5.81	5.53	0.19	0.47	150	386	0.95	0	0.35	367	367	225	HR	1.07	0.043	5.00	238.58	0.024	0.031	71.9
MH2.1	MH2.2	11.44	6.00	6.00	5.53	5.45	0.47	0.55	150	0	0.95	0	0.35	0	367	225	U	1.07	0.043	5.18	236.78	0.024	0.031	71.3
MH2.2	MH2.3	19.40	6.00	6.00	5.45	5.36	0.55	0.64	225	106	0.95	0	0.35	101	467	300	U	1.05	0.076	5.49	233.81	0.030	0.039	51.1
MH2.3	MH2.4	5.01	6.00	6.00	5.36	5.34	0.64	0.66	225	0	0.95	0	0.35	0	467	300	U	1.05	0.076	5.56	233.06	0.030	0.039	50.9
MH2.4	MH2.5	18.64	6.00	6.00	5.34	5.26	0.66	0.74	225	71	0.95	0	0.35	67	535	300	U	1.05	0.076	5.86	230.37	0.034	0.044	57.6
MH2.5	MH2.6	50.00	6.00	6.00	5.26	5.01	0.74	0.99	200	264	0.95	0	0.35	251	786	300	U	1.12	0.081	6.60	224.05	0.049	0.063	77.5

Note 1: Channel 1.1 and 1.2 is designed to cater for the External Catchment Area 1. Based on the aerial photo in Annex 1, the External Catchment Area 1 is mainly unpaved. For conservative estimation purposes, it is assumed that 50% of the area is paved.

[redacted]


[redacted]