Appendix 11

Drainage Impact Assessment

Lot 4822 in D.D. 104, Kam Pok Road and the adjacent Government Land, Mai Po, Yuen Long

Drainage Impact Assessment

July 2025

Date	Revision	Prepared by	Checked by	Approved by
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邁進基建環保工程顧問有限公司

TABLE OF CONTENTS

LIST OF APPENDICES

1. INTRODUCTION

1.1 Meinhardt Infrastructure & Environmental Ltd (MIEL) has been commissioned to conducted a Drainage Impact Assessment ("DIA") to demonstrate the proposed medium-rise residential development on the Application Site is technically feasible in the drainage aspect

1.2 The Application Site (hereinafter referred to as "the Site") is located east of Kam Pok Road near Fairview Park in Yuen Long. The Site location is shown in Figure 1 in **Appendix A**.

1.3 The objectives of this DIA are as follows:

- Review the existing drainage condition of the Application Site based on available information;
- Outline the methodology adopted in this assessment;
- Outline changes to the drainage characteristics and potential drainage impacts which may arise from the Proposed Development, especially in the respect of the following:
  - Effect on the existing drainage conditions;
  - Susceptibility to flooding of neighboring areas upstream or downstream of the Proposed Development; and
  - Assessing the drainage impact upon completion of the Proposed Development.
- Propose drainage mitigation measures where appropriate to mitigate the potential drainage impact arise from the Proposed Development.

2. GENERAL SITE DESCRIPTION

2.1 The Site is bounded by Fung Chuk Road, Ha Chuk Yuen Road, Kam Pok Road and Ha San Wai Road with an area of about 37,870m^2. It locates in the vicinity of Fairview Park, Villa Camellia, Helene Terrace, 3-storey village dwellings in Ha San Wai and Light Public Housing at Yau Pok Road.

2.2 The existing topography of the Site is sloping gently from the north towards the south with ground level varies from +7.0mPD to +4.3mPD approximately.

3. DEVELOPMENT PROPOSAL

3.1 The proposed development comprises five medium-rise residential buildings with a domestic plot ratio of 1.5, a club house, one 6-classroom kindergarten and a neighbourhood elderly centre. The building heights of these 5 residential towers are 16 residential storeys high. The total domestic GFA is about 56,805m^2. Upon completion in 2031, the proposed development will provide a total of 1,303 private high-quality flats.

3.2 The proposed development also includes a two-storey clubhouse, which includes a restaurant, an indoor swimming pool and an outdoor swimming pool. The GFA of the clubhouse and the 6-classroom kindergarten are about 2,272m^2 and 380m^2 respectively. The neighbourhood elderly centre with NOFA is 303m^2.

3.3 The proposed master layout plan is shown in Figure 1 in **Appendix A**.

4. EXISTING STORMWATER DRAINAGE SYSTEM OF THE AREA

4.1 Part of the Site is currently being used a temporary car park and the Site is surrounded by open channels. A main drainage channel, Ngau Tam Mei Channel (NTMC), is running alongside Kam Pok Road to the west of the Site. Two rectangular channels of 6.0 m and 7.2 m wide are located at the east and south of the Site along Ha Chuk Yuen Road and Ha San Wai Road respectively. The 6m rectangular channel along Ha Chuk Yuen Road connects to the flood relief pond located at the north of Fung Chuk Road. The stormwater storage in the flood relief pond is pumped to NTMC by Chuk Yuen Stormwater Pumping Station (CYSPS).

4.2 There are stormwater drains of diameter ranging from 225 mm to 750 mm along carriageways of Fung Chuk Road, Ha Chuk Yuen Road and Ha San Wai Road to collect surface runoff from road gullies and surface channels for subsequent discharge to the abovementioned open channels.

4.3 There are surface channels with size ranging from 300 mm to 600 mm at north and north-east of the Site that connect to the stormwater drains along carriageways of Fung Chuk Road and Ha Chuk Yuen Road.

4.4 In addition, there are surface channels with size ranging from 225 mm to 375 mm at west of the Site for discharging surface runoff to NTMC via 3 nos. of existing 450 mm dia. pipe (Outlet 1, 3 & 4) and a 2.5 m (H) x 2.1 m (W) box culvert (Outlet 2). Flap valves are found installed at all outlets to prevent back flows from NTMC.

4.5 The existing drainage layout plan and catchment plan are shown in Figure 2 in **Appendix B**.

5. PROPOSED STORMWATER DRAINAGE SYSTEM OF THE AREA

5.1 The existing connecting drains that connect between the Site and the public drainage system and Outlet 1, 2, 3 and 4 will be retained to convey the surface runoff from the proposed residential development. However, the existing surface channels are proposed to be demolished to suit the proposed residential development.

5.2 It is proposed that the surface runoff from the proposed residential development will be conveyed by the proposed internal drains within the site boundary and be discharged to the abovementioned connecting drains and outlets. The delineation of catchments for the proposed residential development is presented in Figure 3 in **Appendix C**.

5.3 In order to match the formation level of the subject development, the existing uncovered wing wall structure at upstream of the existing box culvert within the site will be demolished and decked over.

5.4 The internal drains will be designed and assessed in the detailed design stage while the capacities of the connecting drains and outlet have been assessed and discussed in section 7.

6. DESIGN CRITERIA, ASSUMPTIONS AND METHODOLOGY OF DRAINAGE IMPACT ASSESSMENT

Design Standards

6.1 The following design manual(s) have been used in this drainage impact assessment:

- Stormwater Drainage Manual (SDM) 5th Edition published by Drainage Services Department (DSD)

- Stormwater Drainage Manual Corrigendum No. 1/2022 published by Drainage Services Department (DSD)
- Stormwater Drainage Manual Corrigendum No. 1/2024 published by Drainage Services Department (DSD)
- Advice Note No.1 – Application of the Drainage Impact Assessment Process to Private Sector Projects published by Drainage Services Department (DSD)

Flood Protection Level

6.2 The proposed development located at Kam Pok Road, which is a suburb area currently. It is noted that there are various developments in the vicinity of the Site. As such, it is anticipated that the area surrounded the Site will change to an urban area. Therefore, the flood protection levels adopted in this assessment are as follows:

- 1 in 50-year return period flood protection level for branch drainage system
- 1 in 200-year return period flood protection level for trunk drainage system

Rainfall Intensity

6.3 The rainfall profile adopted in this assessment are formulated by the following equations as stipulated in section 4.3.3 of SDM.

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

where i = extreme mean intensity in mm/hr
t_d = rainstorm duration (in minutes)
a, b, c = storm constants

6.4 The storm constants are referenced to **Table 6.1** which is duplicated from Table 3a in SDM Corrigendum No.1/2024.

Table 6.1 Storm Constants of HKO Headquarters

Return Period	a	b	c
50	505.5	3.29	0.355
200	508.8	3.46	0.322

6.5 The rainfall intensity should be multiplied by a factor of 1.16 for the climate change effect up to end-21st century and a factor of 1.121 for design allowance.

Runoff Coefficient

6.6 Rational Method is adopted for estimation of surface runoff for the Site. The runoff coefficients used are shown in below **Table 6.2**.

Table 6.2 Storm Constants of HKO Headquarters

Surface Characteristics	Runoff Coefficient, C
Paved Area	0.95
Unpaved Area	0.30

Sediment Depth

6.7 5% sediment depth is applied for the pipe gradient greater than 1 in 25 and 10% sediment depth is applied for the pipe gradient equal and less than 1 in 25.

Hydraulic Analysis

6.8 Colebrook-White Equation is adopted for the hydraulic analyses.

Roughness Coefficient

6.9 A roughness coefficient k_s=3mm is adopted for the Colebrook-White Equation.

Gradient

6.10 The gradient of drains is calculated based on the available information. For those drains without sufficient information to determine the gradient, 1 in 150 is assumed in this assessment.

7. DRAINAGE IMPACT ASSESSMENT

Change in Catchment Characteristics

7.1 The proposed residential development will change the catchment characteristics within the site boundary. The summary of changes is presented in below **Table 7.1**.

Table 7.1 Change in Catchment Characteristics

	Paved Area (m^2)	Unpaved Area (m^2)	Total Area within the Site Boundary (m^2)
Pre-Development	24,085	13,785	37,870
Post-Development	22,370	15,500	37,870

Change in Surface Runoff

7.2 The amount of surface runoff in the post-development condition is different from the pre-development condition due to the change in catchment characteristics. The surface runoff under 1 in 50-year return period and 1 in 200-year return period flood protection level is presented in below **Table 7.2**. Detailed calculations are shown in **Appendix D**.

Table 7.2 Change in Surface Runoff

Site Condition	Rainfall Intensity (1 in 50-year return period) (mm/hr)	Surface Runoff (1 in 50-year return period) (m^3/s)	Rainfall Intensity (1 in 200-year return period) (mm/hr)	Surface Runoff (1 in 200-year return period) (m^3/s)
Pre-Development	310.24	2.330	332.66	2.498
Post-Development	310.24	2.234	332.66	2.395

Drainage Impact Assessment

7.3 It is noted that the total amount of surface runoff in post-development condition is less than that in pre-development due to the increase in unpaved area. As such, there will be no adverse drainage impacts to the existing drainage system including NTMC.

7.4 The capacities of the connecting drains and outlets have been assessed. The results show that all of them have sufficient capacities to convey the surface runoff from the proposed residential development. The summaries of the results are presented in **Table 7.3** and **7.4** and detail calculations are shown in **Appendix D**.

Table 7.3 Summary of Drainage Impact Assessment Results for 1 in 50-year Return Period Flood Protection Level

Discharge Point	Drain Size (mm)	Gradient	Peak Surface Runoff (m^3/s)	Capacity (m^3/s)	Spare Capacity (m^3/s)	Full Bore Velocity (m/s)
Outlet 1	450	1 in 150	0.074	0.181	0.107	1.263
Outlet 3	450	1 in 150	0.035	0.181	0.146	1.265
Outlet 4	450	1 in 150	0.015	0.181	0.166	1.264
SMH1038285	600	1 in 50	0.032	0.665	0.633	2.612
SMH1038283	600	1 in 13	0.060	1.423	1.363	5.297
SMH1038240	600	1 in 55	0.078	0.636	0.558	2.499
SMH1019340	450	1 in 10	0.011	0.756	0.745	5.007

Table 7.4 Summary of Drainage Impact Assessment Results for 1 in 200-year Return Period Flood Protection Level

Discharge Point	Drain Size (m)	Gradient	Peak Surface Runoff (m^3/s)	Capacity (m^3/s)	Spare Capacity (m^3/s)	Full Bore Velocity (m/s)
Outlet 1	2.1(W) x 2.5(H)	1 in 500	2.154	8.220	6.065	1.740

8. MAINTENANCE RESPONSIBILITY

8.1 During the construction phase, the Applicant will be responsible for the maintenance of all existing surface channels, internal drainage system within the boundary of the Site, while the existing outlet pipes outside the Site boundary/ box culvert with wing walls shall be maintained by corresponding government departments.

8.2 Upon the completion of construction, no additional drainage outlet will be resulted and the Applicant will be responsible for the maintenance of proposed surface channels and internal drainage system, including the proposed sand trap within the Site boundary.

8.3 The maintenance responsibility of all drainage facilities outside the Site will remain unchanged.

9. CONCLUSION

9.1 This report has assessed the drainage impact due to the proposed development of Lot 4822 in D.D. 104 and the adjacent government land, Kam Pok Road, Mai Po, Yuen Long.

9.2 The surface runoff collected from the proposed development will be conveyed by the proposed internal drainage system, which will be designed in detailed design stage, and then be discharged to the connecting drains between the Site and public drainage system.

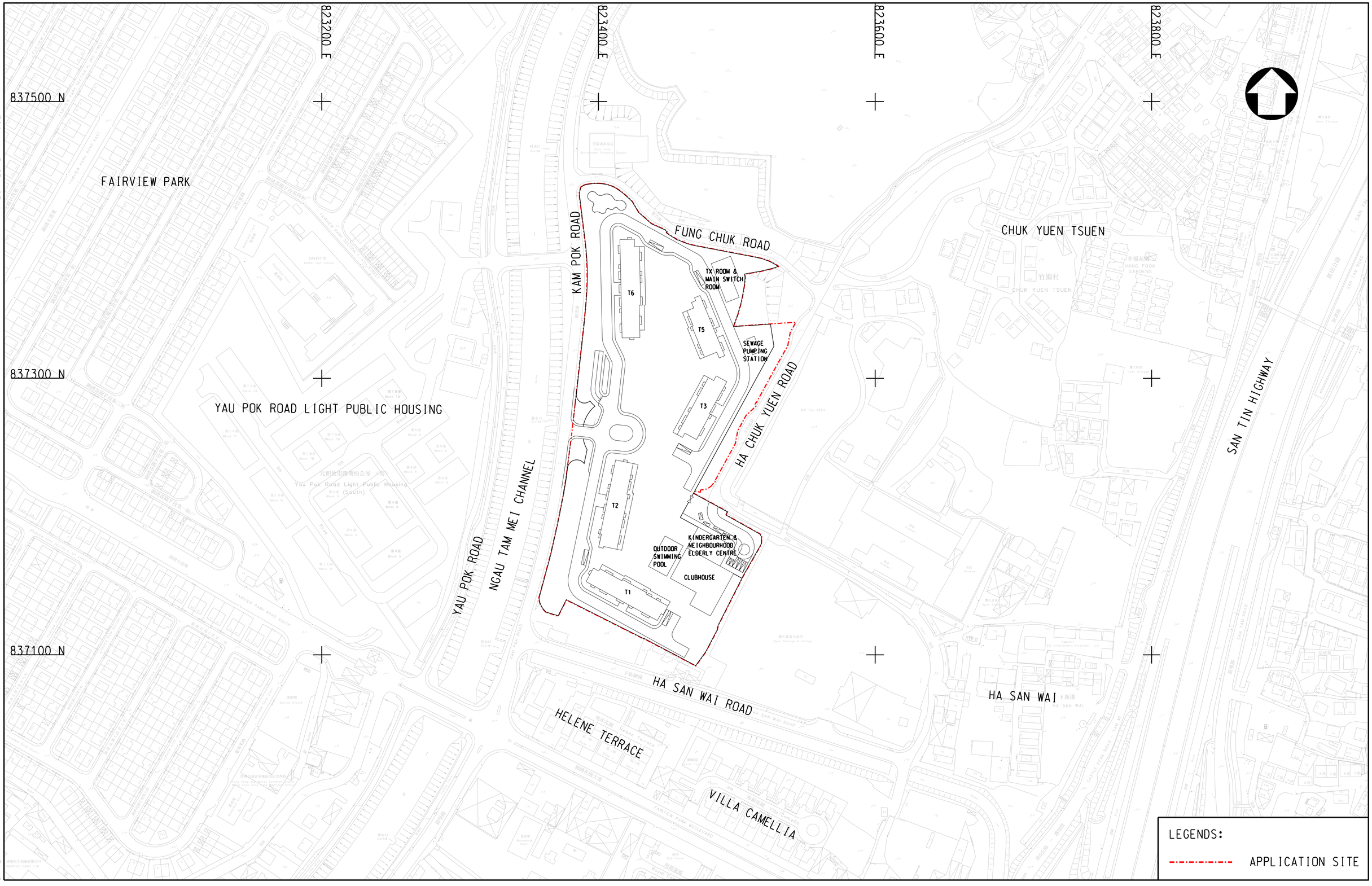
9.3 Based on the assessment results, the surface runoff in post-development status is less than that of the pre-development status. As such, it is anticipated that there is no adverse drainage impact to the existing drainage system due to the proposed residential development.

9.4 The connecting drains are also assessed and the results show that all connecting drains have sufficient capacities to cater the surface runoff from the Site.

APPENDIX A –

SITE LOCATION AND MASTER LAYOUT PLAN

PLOTTED BY : $USER$



PLOT DRV : $PLTDRVL$

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LOT 4822 IN D.D. 104, KAM POK ROAD AND THE ADJACENT GOVERNMENT LAND, MAI PO, YUEN LONG

LOCATION PLAN AND PROPOSED MASTER LAYOUT PLAN

FIGURE 1

Scale 1 : 1250(A1)

CAD FILE : $FILE$

PLOT DATE & TIME : $DATE$ $TIME$

APPENDIX B –

EXISTING DRAINAGE LAYOUT PLAN

PLOTTED BY : $USER$

837100 N
837200 N
837300 N
823400 E
823500 E

KAM POK ROAD
KAM POK ROAD
NGAU TAM MEI CHANNEL
BOX CULVERT
2.5m(H)x2.1m(W)
OUTLET 1
OUTLET 2
OUTLET 3
OUTLET 4
450ø
225U
375U
600U
450U
300U
EXISTING WING WALL
SCH1019340
SMH1038285
SMH1038283
SMH1038220
SMH1038240
HA CHUK YUEN ROAD
FUNG CHUK ROAD
Cycling Track
Nullah
Open Storage
Open Storage & Garage
WIP Jan 2025
WIP Feb 2024

LEGENDS:

- APPLICATION SITE
- EXISTING U-CHANNEL
- EXISTING STEP CHANNEL
- EXISTING STORM DRAIN
- EXISTING CATCHPIT
- EXISTING OUTLET
- EXISTING MANHOLE
- PAVED AREA (24085m²)
- UNPAVED AREA (13785m²)

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LOT 4822 IN D.D. 104, KAM POK ROAD AND THE ADJACENT GOVERNMENT LAND, MAI PO, YUEN LONG

EXISTING DRAINAGE LAYOUT PLAN

FIGURE 2

Scale 1 : 500 (A1)

PLOT DRV : $PLTDRVL$

CAD FILE : $FILE$

PLOT DATE & TIME : $DATE$ $TIME$

APPENDIX C –

PROPOSED DRAINAGE LAYOUT PLAN

PLOTTED BY : $USER$

837100 N
837200 N
837300 N
823400 E
823500 E

KAM POK ROAD
KAM POK ROAD

OUTLET 1
450ø
BOX CULVERT
2.5m(H)x2.1m(W)
NGAU TAM MEI CHANNEL
OUTLET 2
OUTLET 3
450ø
OUTLET 4
450ø

AREA A1= 2850m²
AREA A2= 1370m²
AREA A3= 570m²
AREA A4
= 690m²
AREA A5
= 780m²
AREA A6= 1445m²
AREA A7
= 430m²
AREA A8= 29735m²
AREA B1
= 935m²
AREA B2
= 775m²

T1
T2
T3
T5
T6
OUTDOOR
SWIMMIMNG POOL
CLUBHOUSE
KINDERGARTEN &
NEIGHBOURHOOD
ELDERLY CENTRE

SMH1038285
SMH1038283
SCH1019340
SMH1038220
SMH1038240

600U
300U
300U
600U
450U
600U

HA CHUK YUEN ROAD
FUNG CHUK ROAD

LEGENDS:

- APPLICATION SITE
- EXISTING U-CHANNEL
- EXISTING STORM DRAIN
- EXISTING CATCHPIT
- EXISTING OUTLET
- EXISTING MANHOLE
- PAVED AREA (22370m²)
- UNPAVED AREA (15500m²)
- CATCHMENT

PLOT DRV : $PLTDRVL$

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LOT 4822 IN D.D. 104, KAM POK ROAD AND THE ADJACENT GOVERNMENT LAND, MAI PO, YUEN LONG

PROPOSED DRAINAGE LAYOUT PLAN

FIGURE 3

Scale 1 : 500 (A1)

CAD FILE : $FILE$

PLOT DATE & TIME : $DATE$ $TIME$

APPENDIX D –

DETAILED CALCULATIONS FOR DRAINGE IMPACT ASSESSMENT

91469 - Lot 4822 in D.D. 104, Kam Pok Road and the Adjacent Government Land, Mai Po, Yuen Long - Drainage Impact Assessment

(Estimation of Surface Runoff) (1 in 50-year)

Condition	Catchment Area						Time of Concentration	i	Peak
	Paved Area		Unpaved Area		Total			**50**	Runoff
	Sub-catchment (m^2)	Accumulative Area (m^2)	Sub-catchment (m^2)	Accumulative Area (m^2)	Sub-catchment (m^2)	Accumulative Area (m^2)	t_c (min)	yr (mm/h)	(m^3/s)
Pre-development	24,085	24,085	13,785	13,785	37,870	37,870	5.00	310.24	2.330
Post-development	22,370	22,370	15,500	15,500	37,870	37,870	5.00	310.24	2.234

Notes: Rational Method is adopted for the peak runoff estimate i.e. $Qp = 0.278\ C\ i\ A$

The runoff coefficient of 0.95 for the paved area, 0.3 for the unpaved area and 1.0 for pond area have been adopted.

The time of concentration is assumed to be 5 minutes.

91469 - Lot 4822 in D.D. 104, Kam Pok Road and the Adjacent Government Land, Mai Po, Yuen Long - Drainage Impact Assessment (Estimation of Surface Runoff) (1 in 200-year)

Condition	Catchment Area						Time of Concentration	i	Peak
	Paved Area		Unpaved Area		Total				
	Sub-catchment (m^2)	Accumulative Area (m^2)	Sub-catchment (m^2)	Accumulative Area (m^2)	Sub-catchment (m^2)	Accumulative Area (m^2)	t_c (min)	**200** yr (mm/h)	Runoff (m^3/s)
Pre-development	24,085	24,085	13,785	13,785	37,870	37,870	5.00	332.66	2.498
Post-development	22,370	22,370	15,500	15,500	37,870	37,870	5.00	332.66	2.395

Notes: Rational Method is adopted for the peak runoff estimate i.e. Qp = 0.278 C i A
The runoff coefficient of 0.95 for the paved area, 0.3 for the unpaved area and 1.0 for pond area have been adopted.
The time of concentration is assumed to be 5 minutes.

91469 - Lot 4822 in D.D. 104, Kam Pok Road and the Adjacent Government Land, Mai Po, Yuen Long - Drainage Impact Assessment (Discharge Points Assessment) (1 in 50-year return period)

US	DS	Catchment Area						Channel character								Hydraulic parameter		Time of Concentration	i	Peak	Full bore	Full bore	Q_{check}
		Paved Area		Unpaved Area		Total		channel shape	No. of pipes	pipe size			invert level		channel slope	ks (mm)	3.0000	t_c	**50** yr	Runoff	Capacity	Velocity	(capacity - peak runoff)
		Sub-catchment (m^2)	Accumulative Area (m^2)	Sub-catchment (m^2)	Accumulative Area (m^2)	Sub-catchment (m^2)	Accumulative Area (m^2)			width (mm)	height (mm)	length (m)	US (mPD)	DS (mPD)		cross area (m^2)	Wetted Perimeter (m)	(min)	(mm/h)	(m^3/s)	(m^3/s)	(m/s)	(m^3/s)
Catchment A1	Outlet 1	0	0	2,850	2,850	2,850	2,850	CC	1	450	450	19.1	2.620	2.493	0.007	0.143	1.375	5.00	310.24	0.074	0.181	1.263	0.107
Catchment A2	Outlet 3	0	0	1,370	1,370	1,370	1,370	CC	1	450	450	25.7	2.150	1.978	0.007	0.143	1.375	5.00	310.24	0.035	0.181	1.265	0.146
Catchment A3	Outlet 4	0	0	570	570	570	570	CC	1	450	450	36.4	1.350	1.107	0.007	0.143	1.375	5.00	310.24	0.015	0.181	1.264	0.166
Catchment A4	SMH1038285	256	256	434	434	690	690	CC	1	600	600	10.3	1.250	1.050	0.020	0.254	1.833	5.00	310.24	0.032	0.665	2.612	0.633
Catchment A5 + Catchment B1	SMH1038283	280	280	1,435	1,435	1,715	1,715	CC	1	600	600	3.9	1.400	1.100	0.076	0.269	1.860	5.00	310.24	0.060	1.423	5.297	1.363
Catchment A6 + Catchment B2	SMH1038240	360	360	1,860	1,860	2,220	2,220	CC	1	600	600	5.6	1.780	1.680	0.018	0.254	1.833	5.00	310.24	0.078	0.636	2.499	0.558
Catchment A7	SMH1019340	0	0	430	430	430	430	CC	1	450	450	3.7	2.520	2.150	0.099	0.151	1.395	5.00	310.24	0.011	0.756	5.007	0.745

Notes: Rational Method is adopted for the peak runoff estimate i.e. Qp = 0.278 C i A
The runoff coefficient of 0.95 for the paved area and 0.3 for the unpaved area have been adopted.
The time of concentration is assumed to be 5 minutes.

91469 - Lot 4822 in D.D. 104, Kam Pok Road and the Adjacent Government Land, Mai Po, Yuen Long - Drainage Impact Assessment (Discharge Points Assessment) (1 in 200-year return period)

US	DS	Catchment Area						Channel character								Hydraulic parameter		Time of Concentration	i	Peak	Full bore	Full bore	Q_{check}
		Paved Area		Unpaved Area		Total		channel shape	No. of pipes	pipe size			invert level		channel	ks (mm)	3.0000		**200**	Runoff	Capacity	Velocity	(capacity - peak runoff)
		Sub-catchment	Accumulative Area	Sub-catchment	Accumulative Area	Sub-catchment	Accumulative Area			width	height	length	US	DS	slope	cross area	Wetted Perimeter	t_c	yr				
		(m^2)	(m^2)	(m^2)	(m^2)	(m^2)	(m^2)			(mm)	(mm)	(m)	(mPD)	(mPD)		(m^2)	(m)	(min)	(mm/h)	(m^3/s)	(m^3/s)	(m/s)	(m^3/s)
Catchment A8	Outlet 2	22,114	22,114	7,621	7,621	29,735	29,735	BC	1	2100	2500	33.0	2.000	1.950	0.002	4.725	8.700	5.00	332.66	2.154	8.220	1.740	6.065

Notes: Rational Method is adopted for the peak runoff estimate i.e. Qp = 0.278 C i A
The runoff coefficient of 0.95 for the paved area and 0.3 for the unpaved area have been adopted.
The time of concentration is assumed to be 5 minutes.