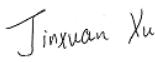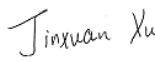# Appendix F

# Drainage Impact Assessment

# Drainage Impact Assessment (DIA)

# Proposed Residential Care Homes for the Elderly (RCHE) at Lot DD101 76 S.G & 76 S.H, Mai Po, Yuen Long
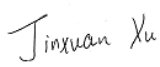
**6 SEPTEMBER 2024**

**REVISION 1**

wsp

# QUALITY MANAGEMENT

| ISSUE/REVISION | REVISION 0 | REVISION 1 | REVISION 2 | REVISION 3 |
|---|---|---|---|---|
| Remarks | | | | |
| Date | 08 Mar. 2024 | 01. sept.-24 | | |
| Prepared by | Jinxuan. Xu | Jinxuan. Xu | | |
| Signature | *Jinxuan Xu* | *Jinxuan Xu* | | |
| Checked by | Alex Cheung | Alex Cheung | | |
| Signature | | | | |
| Authorised by | Kau, Paul | Kau, Paul | | |
| Signature | | | | |

Proposed Residential Care Homes for the Elderly (RCHE) at Lot DD101 76 S.G & 76 S.H, Mai Po, Yuen Long
Drainage Impact Assessment (DIA) – Revision 1

WSP
September 2024
Page i

## Signatures

Prepared by

_Jinxuan Xu_

_____

Jinxuan Xu
Consultant

Reviewed by

_____

Alex Cheung

Technical Director

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Proposed Residential Care Homes for the Elderly (RCHE) at Lot DD101 76 S.G & 76 S.H, Mai Po, Yuen Long
Drainage Impact Assessment (DIA) – Revision 1

WSP
September 2024
Page ii

# **Table of Contents**

Proposed Residential Care Homes for the Elderly (RCHE) at Lot DD101 76 S.G & 76 S.H, Mai Po, Yuen Long      WSP
Drainage Impact Assessment (DIA) – Revision 1      September 2024
Page iii

# 1. INTRODUCTION

## 1.1 Background

1.1.1 WSP (Asia) Limited (hereinafter "WSP") was commissioned by Gotland Enterprises Ltd. to carry out a Drainage Impact Assessment (DIA) for a proposed residential care homes for the elderly (RCHE) at Lot DD101 76 S.G & 76 S.H, Mai Po, Yuen Long (hereinafter "Application Site").

1.1.2 The Application Site falls under the Mai Po & Fairview Park Outline Zoning Plan No. S/YL-MP/6 (the "OZP"), and is zoned "Village Type Development".

## 1.2 Application Site and its Environs

1.2.1 The Application Site is about 8,428.96 m$^2$, generally bounded by Castle Peak Road – Mai Po to the southeast, fishponds and an open storage to the northwest, Hop Shing Wai to the northeast, and Tam Kon Chau Road, Mai Po Lo Wai and a fishpond to the southwest, as shown in **Figure 1**.

1.2.2 The proposed Application Site comprises comprehensive elderly care home facilities, landscaped open spaces, sewerage treatment plant, and car parks. The master layout plan of proposed development is shown in **Appendix A**.

Proposed Residential Care Homes for the Elderly (RCHE) at Lot DD101 76 S.G & 76 S.H, Mai Po, Yuen Long
Drainage Impact Assessment (DIA) – Revision 1

WSP
September 2024
Page 1

# 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 and surrounding areas.

## 2.2 Methodology

2.2.1 This DIA is carried out in accordance with the requirements of "Advice Note No. 1 – Application of the Drainage Impact Assessment Process to Private Sector Projects" issued by Drainage Services Department (DSD), as well as the Stormwater Drainage Manual - Fifth Edition (SDM).

2.2.2 The Application Site is located in the North District Area of rainfall zone. The flood level of 1 in 50-year return period is considered to check whether a higher standard than 10 years can be justified, although the Application Site will drain to a village drainage.

2.2.3 The potential drainage impact considered the climate change effects up to end of 21st century. Referring to the Table 28 and 31 in the Stormwater Drainage Manual- Corrigendum No. 1/2022, 28.1 % rainfall increase due to climate change, including 16% rainfall increase and 12.1% design allowance, is included in the runoff calculations.

2.2.4 As the catchment areas are all fairly small, the Rational Method (as outlined in Section 7.5.2 of the SDM) is used for the calculation of runoff.

$$Q = 0.278CiA$$

Where Q = peak runoff in m$^3$/s

C = runoff coefficient (dimensionless)

i = rainfall intensity in mm/hr

A = catchment area in km

2.2.5 Runoff coefficients of 0.9 and 0.3 are adopted for the paved areas and unpaved areas (i.e. soft landscape), respectively.

2.2.6 The reclaimed water from the on-site STP is also included in the overall runoff calculations.

2.2.7 Colebrook-White Equation is used for the assessment of the capacity of the storm pipe from the manhole SMH1012332 to the outlet SNF1002684. The upstream inflow from the Catchment A located at east of the Castle Peak Road-Mai Po is taken as the baseflow in the storm pipe, as shown in **Figure 2**. The rainfall runoff generated from the proposed

Proposed Residential Care Homes for the Elderly (RCHE) at Lot DD101 76 S.G & 76 S.H, Mai Po, Yuen Long
Drainage Impact Assessment (DIA) – Revision 1

WSP
September 2024
Page 2

Application Site accessed to the storm pipe from the manhole SMH1012333, as shown in **Figure 2**.

Proposed Residential Care Homes for the Elderly (RCHE) at Lot DD101 76 S.G & 76 S.H, Mai Po, Yuen Long
Drainage Impact Assessment (DIA) – Revision 1

WSP
September 2024
Page 3

# 3. DRAINAGE IMPACT ASSESSMENT

## 3.1 EXISTING DRAINAGE CONDITION WITHIN THE APPLICATION

3.1.1 An existing ditch around the Application Site collects its runoff before directly discharging to a tributary of Mai Po River (thereafter named as Mai Po Tributary). Based on the site visit, the upper reaches of Mai Po Tributary is a shallow water puddle with overgrown weeds, as show in **Appendix B**.

3.1.2 The catchments of the Application Site and A has been delineated based on their boundaries and terrains, as shown in **Figure 2**, and their catchment characteristics before development are summarised in **Table 3-1**. Under the pre-development scenario, the catchment A is a mountain forest adopting 0.3 for runoff coefficient, meanwhile, the Application Site is used as an open storage area for container trunk parking adopting 0.9 for runoff coefficient.

## 3.2 Proposed Development and Drainage System

3.2.1 A set of internal peripheral drains are proposed across the Application Site to collect stormwater runoff from the Proposed Development. It runs from a proposed internal storm pipe with dia. 750mm and slope of 1 in 250 to the existing dia. 1500mm drains through connecting to the Manhole SMH1012333, as shown in **Figure 2**.

3.2.2 The receiving public drain with size from DN1050 to DN1650 laid along Castle Peak Road-Mai Po and Tam Kon Chau Road, and eventually discharge to the Mai Po Tributary. The receiving drain only cater the runoff from the Catchment A before the development of Application Site.

3.2.3 The catchments of the Application Site and A has been delineated based on their boundaries and terrains, as shown in **Figure 2**, and their catchment characteristics after development are summarised in **Table 3-1**. The characteristic of Catchment A will be consistent with that before development, at the same time, 20% of Application Site area will be switch to greenery area after development adopting 0.3 for runoff coefficient, with 80% of Application Site remaining as paved area adopting 0.9 for runoff coefficient.

**Table 3-1 Summary of Catchment Characteristics**

| Catchments | Paved Area (m$^2$) | Greenery Area (m$^2$) | Total Area (m$^2$) | Assuming Receiving Manhole |
|---|---|---|---|---|
| Pre-development Scenario | | | | |
| A | 0 | 32,934.8 | 32,934.8 | SMH1012332 |
| Application Site | 8,428.9 | 0 | 8428.9 | SMH1012333 |
| Post-development Scenario | | | | |
| A | 0 | 32,934.8 | 32,934.8 | SMH1012332 |

Proposed Residential Care Homes for the Elderly (RCHE) at Lot DD101 76 S.G & 76 S.H, Mai Po, Yuen Long
Drainage Impact Assessment (DIA) – Revision 1

WSP
September 2024
Page 4

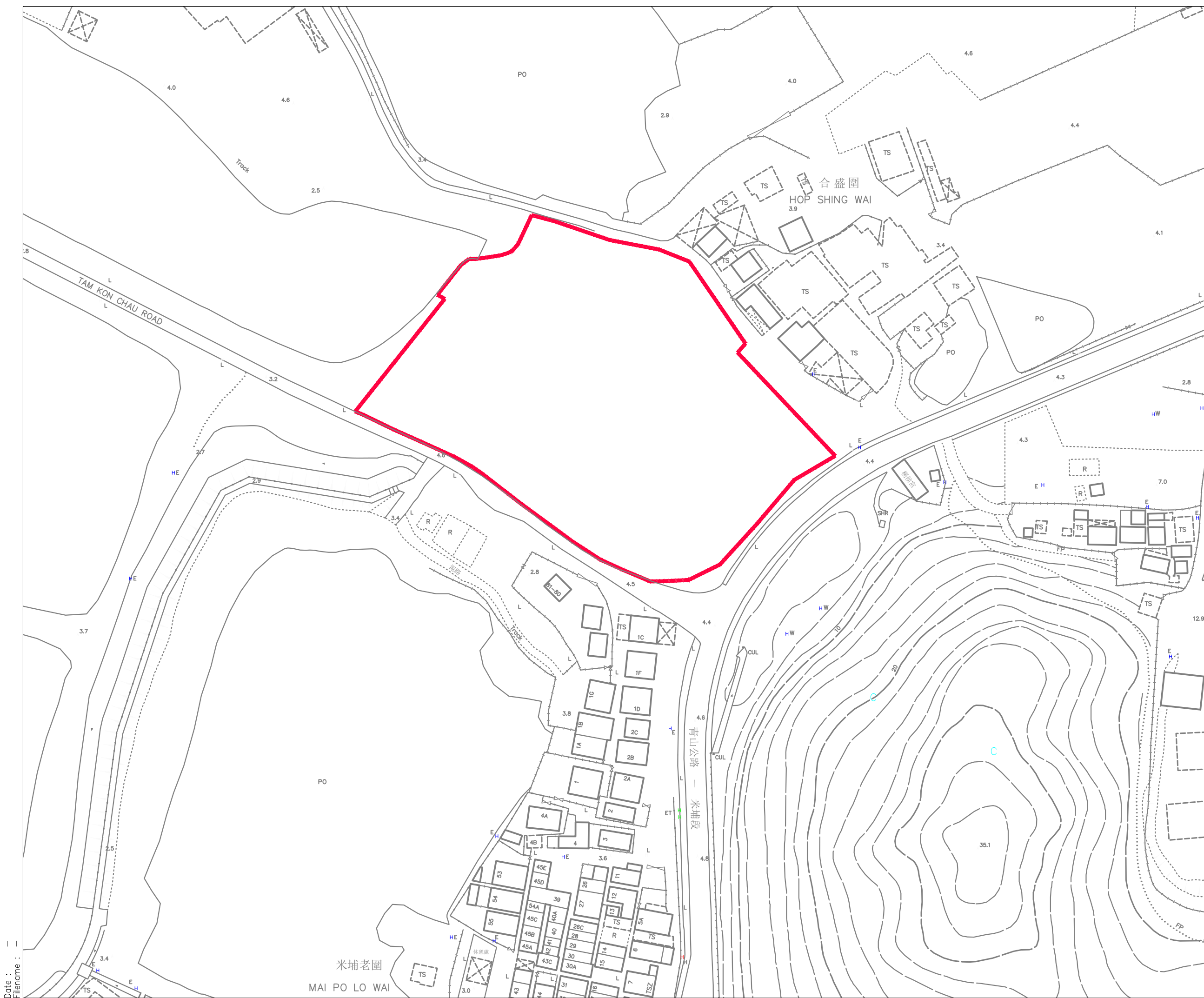| Application Site | 6,743.1 | 1,685.8 | 8,428.9 | SMH1012333 |

Note: the greenery area of Application Site under post-development scenario takes the minimum requirement of 20% of Application Site area as the worst case.

3.2.4    As shown in Appendix C, the maximum peak rainfall runoff under 50-year return period from the Application Site is $1m^3$/s.

3.2.5    The SIA of the Application Site demonstrated that $42.97m^3$/day reclaimed water after tertiary treatment of Membrane Bioreactor process by the on-site sewage treatment plant which cannot be reused will also be discharged to the public drain pipes. Assume the worst case that this water will be discharged to the public drain in 1 hour per day, so the additional flow rate of the reclaimed water is $0.012m^3$/s.

3.2.6    An assessment has been carried out to check the capacity of receiving public drain from the manhole SMH1012332 to the outlet SNF1002684, with details shown in **Appendix C**. As revealed from the assessment result, the receiving public drain from the manhole SMH1012333 to the outlet SNF1002684, which has a maximum capacity of $1.82m^3$/s, is sufficient to receive the storm runoff from the Application Site as well as the Catchment A.

Proposed Residential Care Homes for the Elderly (RCHE) at Lot DD101 76 S.G & 76 S.H, Mai Po, Yuen Long
Drainage Impact Assessment (DIA) – Revision 1

WSP
September 2024
Page 5

# 4. CONCLUSIONS

4.1.1   This DIA is prepared to assess the impact to the drain from the manhole SMH1012332 to Outlet SNF1002684 arising from the proposed development of Application Site.

4.1.2   The proposed development comprises comprehensive elderly care home facilities, landscaped open spaces, sewerage treatment plant, and car parks. The total site area is approximately 8,428.96 m².

4.1.3   After development, surface runoff generated from the Application Site would be discharged into an existing pipe via existing manhole SMH1012333. Meanwhile, the residual reclaimed water that cannot be reused would be discharged to the same pipe as the surface runoff. The results of hydraulic analysis demonstrate that the existing pipe has enough capacity to cater for the addition of surface runoff from the Application Site.
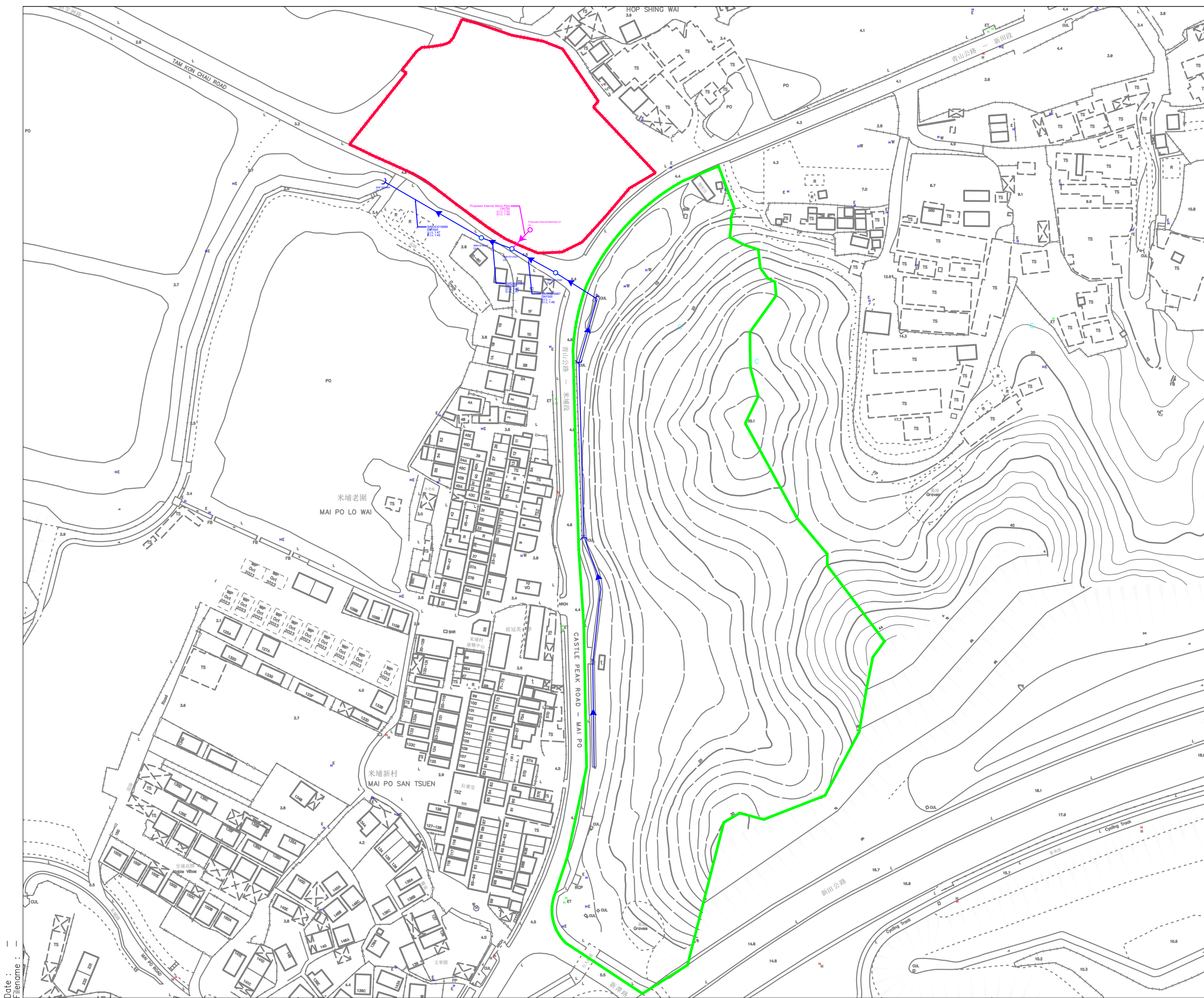
Proposed Residential Care Homes for the Elderly (RCHE) at Lot DD101 76 S.G & 76 S.H, Mai Po, Yuen Long
Drainage Impact Assessment (DIA) – Revision 1

WSP
September 2024
Page 6

# Figures

LOCATION PLAN

LEGENDS:

APPLICATION SITE BOUNDARY

合盛圍
HOP SHING WAI

米埔老圍
MAI PO LO WAI

TAM KON CHAU ROAD

青山公路 — 米埔段

| Rev | Description | | By | Date |
|---|---|---|---|---|

Consultant

**wsp**

Project title

DRAINAGE IMPACT ASSESSMENT

for Proposed Residential Care Homes for the Elderly (RCHE) at Lot DD101 76 S.G & 76 S.H, Mai Po, Yuen Long

Drawing title

SITE LOCATION

| Drawing no. | | Rev. |
|---|---|---|
| FIGURE 1 | | 0 |

| Drawn | Date | Checked | Approved |
|---|---|---|---|
| JX | MARCH2024 | – | – |

| Scale | Status |
|---|---|
| – | |

LOCATION PLAN

LEGENDS:

APPLICATION SITE
BOUNDARY

BOUNDARY OF
CATCHMENT A

EXISTING STORM
PIPE/CHANNEL

EXISTING STORM
MANHOLE

**SWD1019988** STORM PIPE NUMBER
**DN 1500** PIPE DIAMETER
**U.I.L 1.48** UPSTREAM INVERT LEVEL
(mPD)
**D.I.L 1.47** DOWNSTREAM INVERT
LEVEL (mPD)

**SMH1012333** STORM MANHOLE NUMBER
**CL --** COVER lEVEL (mPD)

PROPOSED INTERNAL
STORM PIPE

PROPOSED STORM
MANHOLE

| Rev | Description | By | Date |
|-----|-------------|-----|------|

Consultant

wsp

Project title

DRAINAGE IMPACT ASSESSMENT

for Proposed Residential Care Homes for
the Elderly (RCHE) at Lot DD101 76 S.G &
76 S.H, Mai Po, Yuen Long

Drawing title

CATCHMENTS PLAN AND STORM PIPES
UNDER ASSESSMENT

| Drawing no. | | Rev. |
|-------------|--|------|
| FIGURE 2 | | 0 |

| Drawn | Date | Checked | Approved |
|-------|------|---------|----------|
| JX | SEPTEMBER2024 | -- | -- |
| Scale | | Status | |
| -- | | | |

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# Appendixes

# Appendix A

Master Layout Plan of

the Proposed Development

MASTER LAYOUT PLAN

N

TAM KON CHAU ROAD

CASTLE PEAK ROAD - SAN TIN

ROAD

Track

泥路

landscape garden

landscape garden

EVA crash gate

EVA crash gate

main entrance

to/from basement

+4.55mPD
+4.55mPD
+38.75mPD
+42.75mPD
+4.55mPD
+19.40mPD
+19.40mPD
+15.10mPD
+15.10mPD
+4.40mPD
+19.40mPD
+19.40mPD
+34.55mPD
+38.75mPD
+4.40mPD
+4.55mPD
+4.55mPD
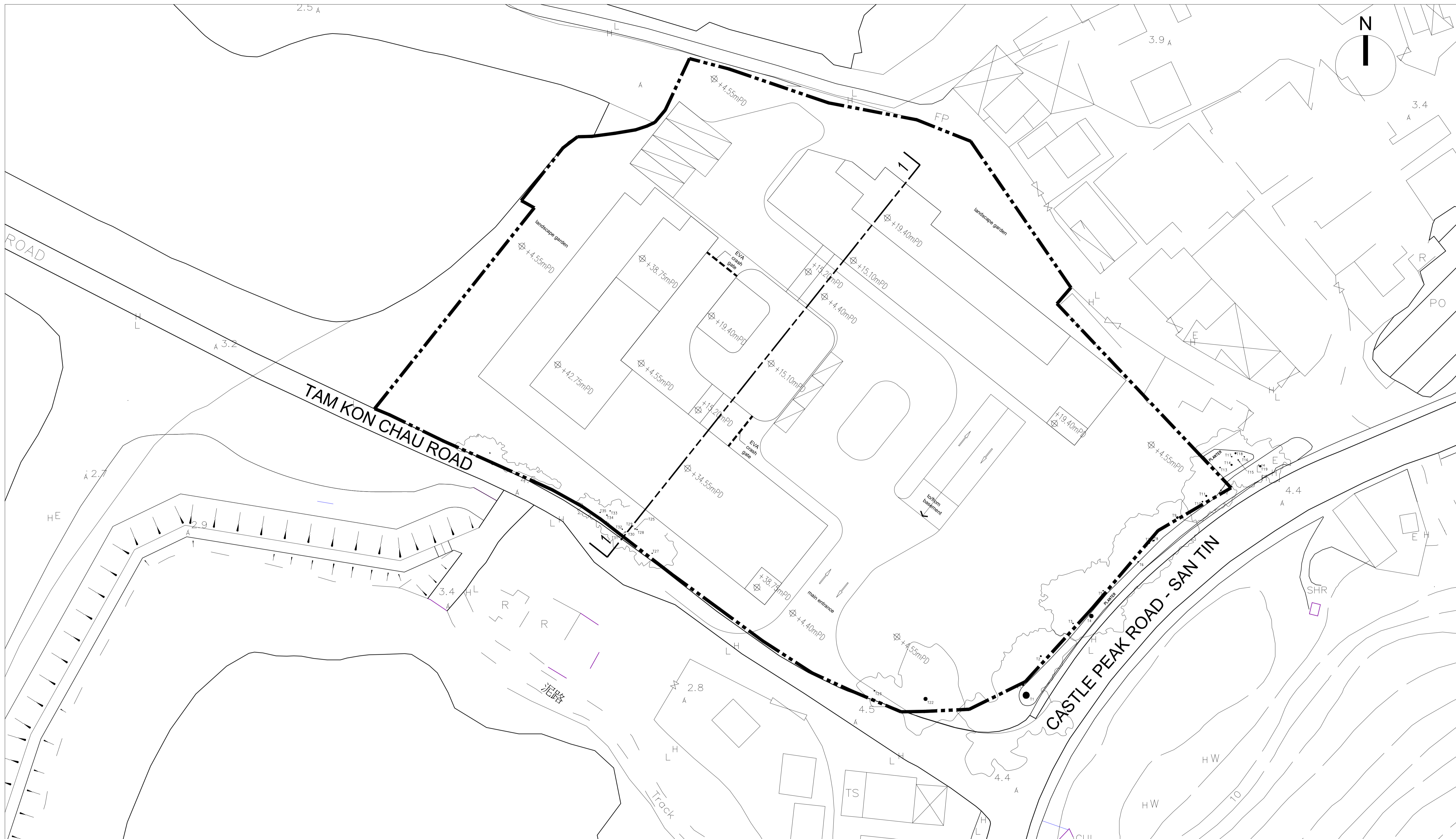
LEGEND

LANDSCAPE GARDEN/LANDSCAPE AREA

APPLICATION SITE

BASEMENT OUTLINE

LWK
+PARTNERS

參考編號
REFERENCE No.

繪圖
DRAWING
A-1

# Appendix B

Site Visit Photos

Figure 1. Existing outlet of application site and upper reaches of Mai Po Tributary


Figure 2. Existing outlet of application site

Figure 3. Upper reaches of Mai Po Tributary


Figure 4. Existing ditch

# Appendix C

Hydraulic Assessment

## Appendix C-Hydraulic Assessment of Existing and Proposed Pipes under 50-Ye

| Manhole | | Channel/ Pipe | Catchment | Catchment Area (0.9)[i] | | Catchment Area (0.3)[i] | | Length (m) | Nominal Diameter (mm) | Invert Level | | Gradient, $S_f$ | | Velocity (m/s)[ii] | Time of Flow (min) $t_f$ | Time of Conc. (min) $t_c$[iii] | Rainfall Duration (min) | 50-year Intensity (mm/hr)[iv] | 50-year Intensity with Climate Change (mm/hr)[iv] | 50-year Runoff (m³/s)[v] | Reclaimed water (m³/s) | Total[vi] | Capacity (m³/s) | Ratio Capacity Runoff (%)[vii] | Ratio Capacity > Runoff ? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| From | To | | | Increment (m²) | Accu. (m²) | Increment (m²) | Accu. (m²) | | | From (mPD) | To (mPD) | (%) | 1 in | | | | | | | | | | | | |
| Proposed Internal Manhole A1 | SMH1012333 | Pipe | Application Site | 6743.1 | 6743.1 | 1685.8 | 1685.8 | 10.00 | 750 | 1.52 | 1.48 | 0.4 | 250 | 1.77 | 0.09 | 10.09 | 10.09 | 183.28 | 234.79 | 0.43 | 0.012 | 0.44 | 0.70 | 63% | Yes |
| SMH1012332 | SMH1012333 | Pipe | A | 0.0 | 0.0 | 32934.8 | 32934.8 | 22.60 | 1500 | 1.49viii | 1.48 | 0.0 | 2260 | 0.89 | 0.42 | 3.26 | 3.26 | 241.71 | 309.63 | 0.85 | - | 0.85 | 1.42 | 60% | Yes |
| SMH1012333 | SMH1012334 | Pipe | A+Application Site | 0.0 | 6743.1 | 0.0 | 34620.6 | 13.80 | 1500 | 1.48 | 1.47 | 0.1 | 1380 | 1.15 | 0.20 | 13.46 | 13.46 | 168.25 | 215.53 | 0.99 | 0.012 | 1.00 | 1.82 | 55% | Yes |
| SMH1012334 | SNF1002684 | Pipe | A+Application Site | 0.0 | 6743.1 | 0.0 | 34620.6 | 50.20 | 1650 | 1.47 | 1.45 | 0.0 | 2510 | 0.90 | 0.93 | 14.40 | 14.40 | 164.83 | 211.15 | 0.97 | 0.012 | 0.98 | 1.73 | 57% | Yes |

Remarks:

i. The runoff coefficient is 0.9 for paved area, and 0.3 for greenery area.

ii. Colebrook-White equation is used for velocity calculation, $k_s$=0.6 mm, v= 0.000001 m²/s

iii. Time of concentration ($t_c$)=inlet time ($t_o$)+flow time ($t_f$). Inlet time($t_o$)= $0.14465L/H^{0.2}A^{0.1}$. $t_o$ for the Catchment A (natural catchment) = $0.14465 \times 113.2m/[(44mPD-4.4mPD)/113.2m \times 100]^{0.2}(32667m^2)^{0.1}$=2.84min. Assume 10 min for the $t_o$ for the catchment of Application Site. Flow time ($t_f$)=L/V$_j$, $t_f$ for the drain from SMH1012332 to SMH1012333=22.60m/0.893m/s/60=0.42min; $t_f$ for the drain from SMH1012333 to SMH1012334=13.8m/1.146m/s/60=0.2min; $t_f$ for the drain from SMH1012334 to SNF1002684= 50.2m/0.898m/s/60=0.93min. $t_c$ for the for the drain from SMH1012333 to SMH1012334= 0.2min+0.42min+2.84min+10min=**13.46**min, because the runoff from the catchments of A and Application Site will discharge to the drain. $t_c$ for the for the drain from SMH1012334 to SNF1002684=13.46+0.93=**14.40**min.

iv. Rainfall Intensity(i)= a / ($t_d$ + b)c × 1.281(climate change factor, refers to the Table 28 and 31 in the Stormwater Drainage Manual-Corrigendum No. 1/2022 ). Constants a,b,c equal to 474.6, 2.90 and 0.371. respectively, referring to Table 3a of the SDM Corrigendum No.1/2024.

v. 50-year peak runoff ($Q_p$)=0.278 CiA

vi. Total runoff from Manhole SMH1012333 to Outlet SNF1002684 =50-year runoff +reclaimed water of 0.012m³/s

vii. Assumption of 10% reduction in flow area for siltation allowance is included in the capacity calculation.

viii. No records found in the DSD Drainage Record Plan, so 1.49 mPD is assumed to be the invert level of the drain from SMH1012332 to SMH1012333. The assumption does not affect the assessment result, because the runoff from the Application Site is added to the downstream pipe.