Drainage Impact Assessment Report for Section 16 Planning Application A/NE-LYT/841 for Proposed Temporary Open Storage of Construction Materials and Machineries with Ancillary Facilities for a Period of 3 Years and Associated Filling of Land at Various Lots in D.D. 83, Lung Yeuk Tau, New Territories

DRAINAGE IMPACT ASSESSMENT REPORT

Reference: 31064-R02-01
Date: July 2025

AXON
CONSULTANCY

Contents

1 Introduction

1.1 Background

The Applicant intends to seek Town Planning Board ("TPB") approval for a Section 16 Planning Application No. (A/NE-LYT/841) for a Proposed Temporary Open Storage of Construction Materials and Machineries with Ancillary Facilities for a Period of 3 Years and Associated Filling of Land at Various Lots in D.D. 83, Lung Yeuk Tau, New Territories (hereafter "the proposed development"). The application site location is shown in **Figure 1.1**.

In the Approved Lung Yeuk Tau & Kwan Tei South Outline Zoning Plan No. S/NE-LYT/19 (referred to as the "OZP"), the Application Site is zoned as “Agriculture” and “Residential (Group C) uses, in which "Open Storage" use does not fall into either column 1 or column 2 of the Schedule of Uses. Consequently, obtaining planning permission from TPB is necessary for the proposed open storage in a temporary basis under Section 16 of the Town Planning Ordinance, based on the TPB Guideline PG-No. 13G.

This submission intends to demonstrate the overall drainage design and provide basic information and is structured to follow the requirement of Stormwater Drainage Manual – Planning, Design and Management (2018 Edition) (SDM) and the Stormwater Drainage Manual Corrigendum (2022 Edition).

AXON Engineering & Consulting Limited (AXON) was commissioned to carry out a Drainage Impact Assessment (DIA) report for the proposed development.

1.2 Objectives

The Drainage Impact Assessment has the following objectives:

- to assess the potential drainage impacts arising from the proposed development; and
- to recommend the necessary mitigation measures to alleviate the impacts, if necessary.

1.3 References

Reference is made to the following document:

1. Stormwater Drainage Manual (SDM) – 5th Edition issued by Drainage Services Department (DSD)

2. Stormwater Drainage Manual Corrigendum No. 1/2022 issued by DSD

3. Drainage Services Department Advice Note No. 1 – Application of the Drainage Impact Assessment Process to Private Section Project

4. Technical Note to prepare a Drainage Submission issued by DSD

2 Baseline Conditions and Review Methodology

2.1 Site Description

The application site is bound by Lots 731 (Part), 745 RP (Part), 749 (Part), 750 (Part), 751 S.A (Part), 751 RP (Part), 752 (Part), 753 S.A, 753 RP (Part), 754 (Part), 757 (Part), 758 (Part), 759 (Part), 761 (Part), 777 (Part) and 778 (Part) in D.D. 83 and Adjoining Government Land, Lung Yeuk Tau, New Territories. The site is accessible by an existing van track branching off from Hai Wing Road.

2.2 Site Conditions and Discharge Strategies

The application site has an approximate area of 15,090 m^2 in total. It is fully enclosed by boundary walls with sufficient openings. As the site is entirely paved, with no plans for any further site formation work associated with the proposed development, it is anticipated that the surface water runoff will stay consistent with this application.

The site itself features a flat terrain, with elevations ranging from +12.73 mPD to +14.57 mPD, as indicated in **Figure 2.1**. **Figure 2.1** shows the catchment areas and path flow of the application site. To prevent overland flow from the application site to its surroundings, U-channels with covers will be proposed along the southern side of the site, as well as at the run-in/out.

In catchments A and D, the storm water primarily flows from northeast to southwest and will be collected via the proposed u-channel system.

In catchment B, the surface runoff mainly flows from north to south and will be collected through the designated surface channels.

In catchment C, the rainfall typically flows from southeast to northwest and will be collected using the well-designed drainage system.

2.3 Calculation Methodology for Runoff

Peak instantaneous runoff values for the development were calculated based on the Rational Method and with recommended physical parameters including runoff coefficient (C) and rainfall intensity (i) for different return periods referred to the SDM.

The Rational Method is adopted for hydrological analysis and the peak runoff is calculated based on the following equation:

$$Q_p = 0.278\,C \times i \times A$$

where
- Q_p = Peak Runoff, m^3/s
- C = Runoff Coefficient
- i = Rainfall Intensity, mm/hr
- A = Catchment Area, km^2

The paved area of the site will account for about 15,090 m^2. The runoff coefficient of 0.90 (concrete) was assumed.

Based on the storm constants for the 50-year return period recommended in the SDM, the appropriate rainfall intensities (i) were calculated based on the following equation:

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

where
- i = Rainfall Intensity, mm/hr
- a,b,c = Storm constants recommended in table 3 of the SDM
- t_d = Rainfall duration, $t_d \leq 240$ min.

When the rainfall intensity (i) corresponds to the design rainfall duration (t_d) as same as the time of concentration (t_c), the maximum peak runoff occurs. Time of concentration is the time for a droplet to flow from the remotest point in the catchment to its discharge location. For each single catchment, the time of concentration equals the summation of the inlet time and flow time:

$$t_c = t_o + t_f$$

where t_c = Time of concentration of a catchment, min.
t_o = Inlet time, min.
t_f = Flow time, min.

The inlet time is the time required for the runoff to travel from the remotest point in each catchment to the most upstream point of the stormwater collection system. It is estimated by Brandsby William's Equation:

$$t_o = \frac{0.14465L}{H^{0.2} \times A^{0.1}}$$

where t_o = Inlet time, min.
A = Catchment area, m^2
H = Average slope, measured along the line of natural flow, from the summit of the catchment to the point under consideration, m / 100 m
L = distance (on plan) measured on the line of natural flow between the summit and the point under consideration, m

Also, the flow time is the time required for the collected rain water flowing from the most upstream point to the ultimate discharged point within the drainage system. It is estimated by this Hydraulic Equation:

$$t_f = \sum_{j=1}^{n} \frac{L_j}{V_j}$$

where t_f = Flow time, min.
L_j = Length of j^{th} reach of drain
V_j = Flow velocity in j^{th} reach of drain

2.4 Calculation Methodology for Pipe Capacity Checking

Because the catchment areas are approximate 1.5 ha, u-channels are recommended to be constructed to collect the stormwater runoff within the site. The collected stormwater in catchments A, B, C and D should finally be diverted to the local village drainage system via the proposed U-channel system and the proposed connection D1 and D2.

For the worst-case scenario, bad condition of the concrete pipe is assumed for Manning's roughness coefficient (coefficient value is 0.016) for calculating capacities of concrete U-channel using Manning's Equation. Typical designs of the U-channel and Catchpit are shown in **Annex B**.

The U-channel and pipe capacities was calculated based on the following equation:

$$Q_c = V \times A_f$$

where Q_c = U-channel and pipe capacities, m^3/s
V = Mean velocity, m/s
A_f = Flow area with 5-10% reduction, 5% reduction for channel/pipe gradient > 1 in 25; 10% reduction for other cases

Manning's Equation for calculating the U-channel and pipe velocity was adopted for this analysis:

$$V = \frac{R^{2/3} \times S^{1/2}}{n}$$

where V = Mean velocity, m/s
S = Slope of the total energy line
n = Manning's roughness coefficient
R = Hydraulic radius, m

2.5 Summary of Assessment Assumptions

The assumptions of the Drainage Impact Assessment are summarised below for ease of reference:

- A 50-year return period was adopted; and
- A runoff coefficient of 0.90 (concrete) for the paved area was assumed; and
- Manning's roughness coefficient of 0.016 for U-channels was adopted; and
- 5% reduction was adopted in flow area if the gradient was greater than 1 in 25; and
- 10% reduction was adopted in flow area in other cases.

3 Assessment Results

The estimated peak runoff of each catchment area is calculated based on 50 years return period and is summarised in **Table 3.1** below, runoffs and capacities of the proposed drainage system are summarised in **Table 3.2.** The proposed layout plan of the drainage system and detailed calculations are provided in **Figure 3.1** and **Annex A**, respectively.

Table 3.1 Estimated Peak Runoffs of Each Catchment Area

Catchment ID	Catchment Area, m^2	Peak Runoff, m^3/s
A	6307	0.3182
B	3824	0.2008
C	3197	0.1725
D	1762	0.0976

Table 3.2 Estimated Runoffs and Capacities of the U-channels

U-Channel	Catchment Served	Actual Runoff, m3/s	% of Capacity Flow	Sufficient Capacity (Y/N)
UC1 (225mm)	**A(1%)**	**0.0032**	**12%**	**Y**
UC2 (225mm)	**A(5%)**	**0.0159**	**31%**	**Y**
UC3 (375mm)	**A(20%)**	**0.0636**	**47%**	**Y**
UC4 (450mm)	**A(30%)**	**0.0955**	**55%**	**Y**
UC5 (450mm)	**A(50%)**	**0.1591**	**65%**	**Y**
UC6 (600mm)	**A(70%)**	**0.2227**	**60%**	**Y**
UC7 (600mm)	**A(75%)**	**0.2387**	**64%**	**Y**
UC8 (750mm)	**A(90%)**	**0.2864**	**42%**	**Y**
UC9 (750mm)	**A(96%)**	**0.3055**	**45%**	**Y**

U-Channel	Catchment Served	Actual Runoff, m3/s	% of Capacity Flow	Sufficient Capacity (Y/N)
UC10 (450mm)	C(45%)	0.0776	45%	Y
UC11 (375mm)	C(40%)	0.0690	65%	Y
UC12 (375mm)	D(50%)	0.0488	46%	Y
UC13 (375mm)	D(50%)	0.0488	46%	Y
UC14 (375mm)	D(50%)	0.0488	46%	Y
UC15 (375mm)	D(50%)	0.0488	46%	Y
UC16 (375mm)	C(2%)+D(50%)	0.0522	49%	Y
UC17 (375mm)	C(4%)+D(50%)	0.0557	52%	Y
UC18 (375mm)	C(10%)+D(50%)	0.0660	62%	Y
UC19 (600mm)	B(85%)+C(45%)	0.2484	67%	Y
UC20 (750mm)	B(88%)+C(55%)+D(50%)	0.3204	48%	Y
UC21 (225mm)	B(5%)	0.0100	37%	Y
UC22 (225mm)	B(4%)	0.0080	30%	Y
UC23 (225mm)	B(3%)	0.0060	22%	Y
UC24 (150mm)	B(2%)	0.0040	44%	Y
UC25 (150mm)	B(1%)	0.0020	22%	Y
UC26 (150mm)	B(1%)	0.0020	22%	Y

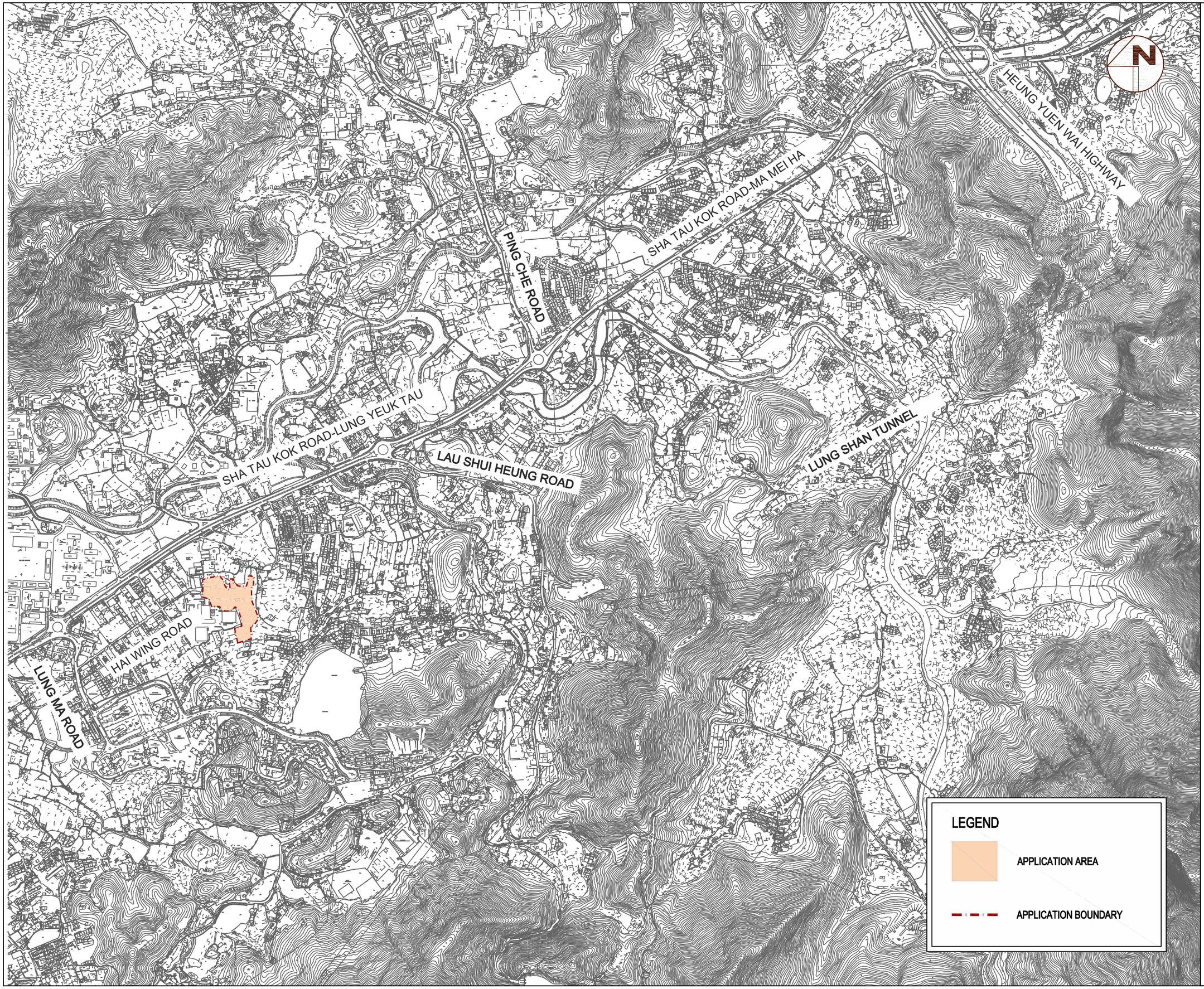
4 Summary and Conclusions

A Drainage Impact Assessment has been designed for Section 16 Planning Application No. A/NE-LYT/841 for a Proposed Temporary Open Storage of Construction Materials and Machineries with Ancillary Facilities for a Period of 3 Years and Associated Filling of Land at Lots 731 (Part), 745 RP (Part), 749 (Part), 750 (Part), 751 S.A (Part), 751 RP (Part), 752 (Part), 753 S.A, 753 RP (Part), 754 (Part), 757 (Part), 758 (Part), 759 (Part), 761 (Part), 777 (Part) and 778 (Part) in D.D. 83 and Adjoining Government Land, Lung Yeuk Tau, New Territories.

A drainage system has been proposed for diverting stormwater flows to avoid flooding in the site and its surrounding areas.

The result table of drainage analysis shown in **Annex A** has demonstrated that there would be no significant impact on the site and the surroundings at the peak runoff under 50 years return period.

Figures



Drainage Impact Assessment for Proposed Temporary Open Storage of Construction Materials and Machineries with Ancillary Facilities for a Period of 3 Years and Associated Filling of Land at Various Lots in D.D. 83, Lung Yeuk Tau, N.T.

SITE LOCATION

FIGURE 1.1

Scale : 1:10000 (A3)

Date : JUL 2025

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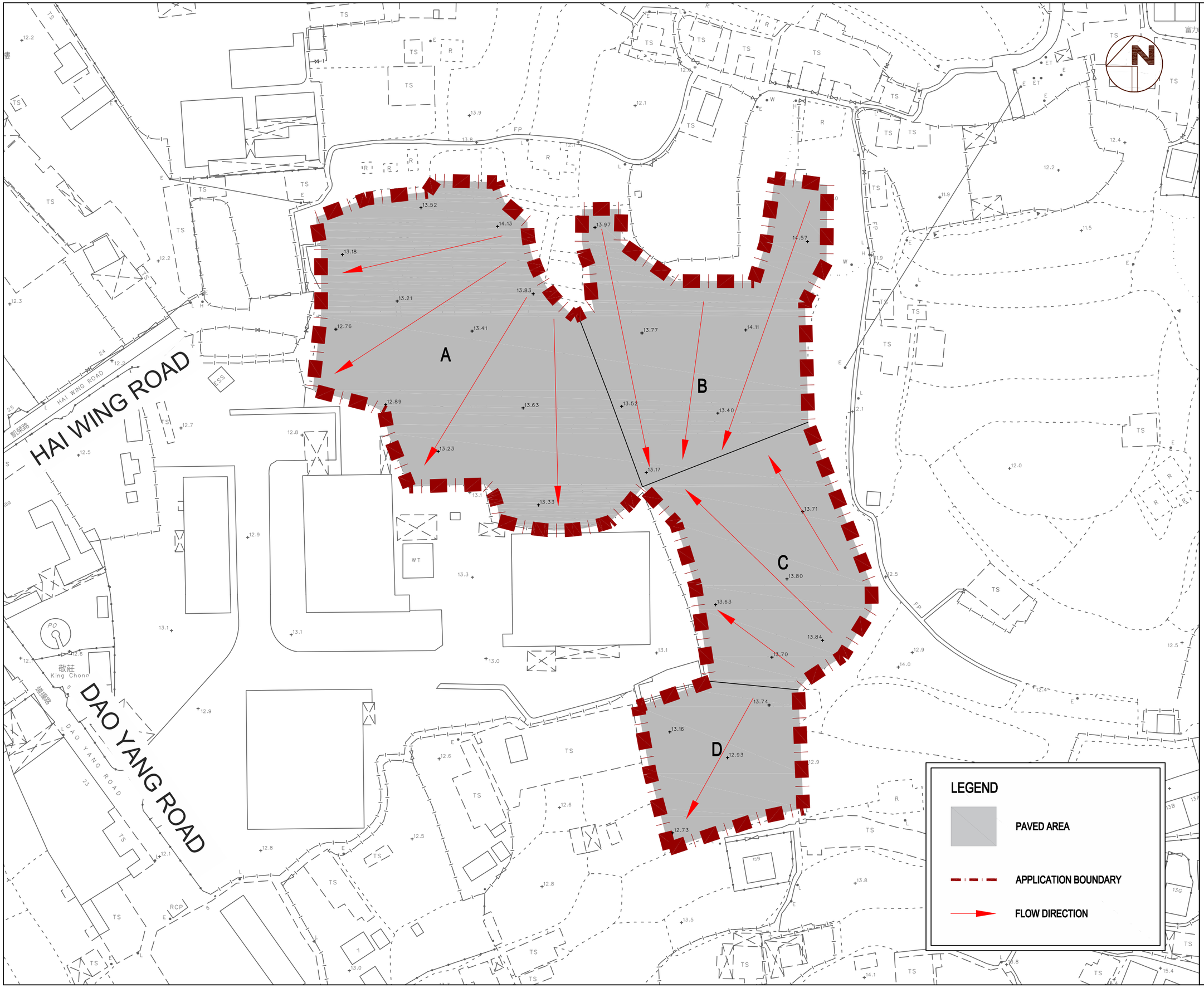
C:\USERS\USER\DESKTOP\3106#\DATA\DRAWING (DIA)\3106#-FIGURE 1.1.DWG

Drainage Impact Assessment for Proposed Temporary Open Storage of Construction Materials and Machineries with Ancillary Facilities for a Period of 3 Years and Associated Filling of Land at Various Lots in D.D. 83, Lung Yeuk Tau, N.T.

CATCHMENT AREAS

FIGURE 2.1



Scale : 1:2000 (A3)

Date : JUL 2025

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C:\USERS\USER\DESKTOP\3106\DATA\DRAWING (DJA)\3106-FIGURE 2.1.DWG

Drainage Impact Assessment for Proposed Temporary Open Storage of Construction Materials and Machineries with Ancillary Facilities for a Period of 3 Years and Associated Filling of Land at Various Lots in D.D. 83, Lung Yeuk Tau, N.T.

PROPOSED DRAINAGE PLAN

FIGURE 3.1

Scale : 1:2000 (A3)

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C:\USERS\USER\DESKTOP\31064\DATA\DRAWING\DIA\31064-FIGURE 3.1.DWG

HAI WING ROAD

DAO YANG ROAD

U CHANNEL WITH HEAVY DUTY COVER

CP1
CL 13.84
A1 13.56 - 225UC1
X1 13.56 - 225UC2

CP2
CL 13.23
A1 12.79 - 225UC2
X1 12.79 - 375UC3

CP3
CL 12.96
A1 12.45 - 375UC3
X1 12.45 - 450UC4

CP4
CL 12.89
A1 12.35 - 450UC4
X1 12.35 - 450UC5

CP5
CL 12.89
A1 12.16 - 450UC5
X1 12.16 - 600UC6

CP6
CL 13.47
A1 12.05 - 600UC6
X1 12.05 - 600UC7

CP7
CL 13.33
A1 12.01 - 600UC7
X1 12.01 - 750UC8

CP8
CL 13.14
A1 11.90 - 750UC8
X1 11.90 - 750UC9

CP9
CL 13.17
A1 11.83 - 750UC9
A2 12.10 - 450UC10
X1 11.83 - 750UC31

CP10
CL 13.60
A1 12.20 - 375UC11
X1 12.20 - 450UC10

CP11
CL 13.65
A1 12.44 - 375UC12
X1 12.44 - 375UC11

CP12
CL 12.97
A1 12.54 - 375UC13
X1 12.54 - 375UC12

CP13
CL 12.89
A1 12.46 - 375UC14
X1 12.46 - 375UC15

CP14
CL 13.76
A1 12.31 - 375UC15
X1 12.31 - 375UC16

CP15
CL 13.85
A1 12.23 - 375UC16
X1 12.23 - 375UC17

CP16
CL 13.78
A1 12.15 - 375UC17
X1 12.15 - 375UC18

CP17
CL 14.23
A1 11.91 - 375UC18
A2 12.16 - 600UC19
X1 11.91 - 750UC20

CP18
CL 14.12
A1 11.71- 750UC20
A2 13.28 - 225UC21
X1 - D1

CP19
CL 14.55
A1 13.32 - 225UC22
X1 13.32 - 225UC21

CP20
CL 14.48
A1 13.39 - 225UC23
X1 13.39 - 225UC22

CP21
CL 14.49
A1 13.41 - 150UC24
X1 13.41 - 225UC23

CP22
CL 14.15
A1 13.55 - 150UC25
X1 13.55 - 150UC24

CP23
CL 13.90
A1 13.61 - 150UC26
X1 13.61 - 150UC27

CP24
CL 13.97
A1 13.55 - 150UC27
A2 11.49 - 750UC28
X1 - D2

CP25
CL 13.71
A1 12.84 - 225UC29
A2 11.63 - 750UC31
X1 11.63 - 750UC28

CP26
CL 13.72
A1 13.44 - 225UC30
X1 13.44 - 225UC29

UC1 UC2 UC3 UC4 UC5 UC6 UC7 UC8 UC9 UC10 UC11 UC12 UC13 UC14 UC15 UC16 UC17 UC18 UC19 UC20 UC21 UC22 UC23 UC24 UC25 UC26 UC27 UC28 UC29 UC30 UC31

D1 D2

A B C D

LEGEND

PAVED AREA

APPLICATION BOUNDARY

D1 PROPOSED UNDERGROUND CONNECTION TO VILLAGE DRAIN

UC1 PROPOSED U-CHANNEL WITH COVER AND FLOW DIRECTION

CP1 PROPOSED CATCHPIT WITH COVER

Annex A

Calculations of Drainage Impact

Drainage Analysis

Part A - Estimation of Peak Runoff

Return Period (No. of Years): **50**

Catchment ID	Catchment Area (A), m^2	Level difference, dh, m	Average Low Distance, L	Average Slope (H), m/100m	Flow Path Length (L), m	Inlet Time (t_o), min.	Time of Concentration (t_c), min.	Storm Constants			Runoff Intensity (I) mm/hr	Surface	Runoff Coefficient (C)	Peak Runoff (Qp), m3/s	Inside site boundary (Y/N)
								a	b	c					
A	6307	1.37	65.0	2.108	65	3.38	6.1241	1167.6	16.76	0.561	201.6	Concrete	0.90	0.3182	Y
B	3824	1.40	65.0	2.154	65	3.53	4.5423	1167.6	16.76	0.561	209.9	Concrete	0.90	0.2008	Y
C	3197	0.67	45.0	1.489	45	2.68	3.5338	1167.6	16.76	0.561	215.7	Concrete	0.90	0.1725	Y
D	1762	1.01	30.0	3.367	30	1.61	2.6226	1167.6	16.76	0.561	221.3	Concrete	0.90	0.0976	Y

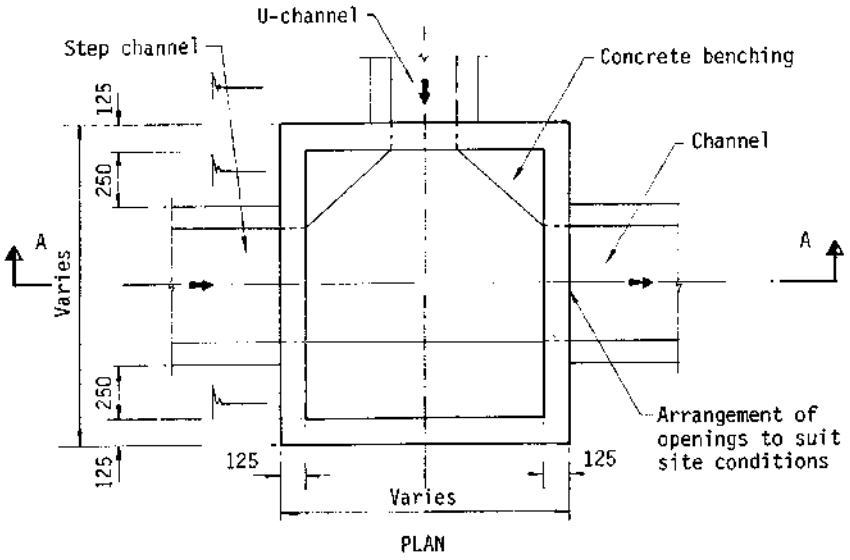
Part B - Estimated Channel Capacities

The fair condition of concrete-lined channels is considered for the value of n fir Manning equation (DSD SDM Table 13)

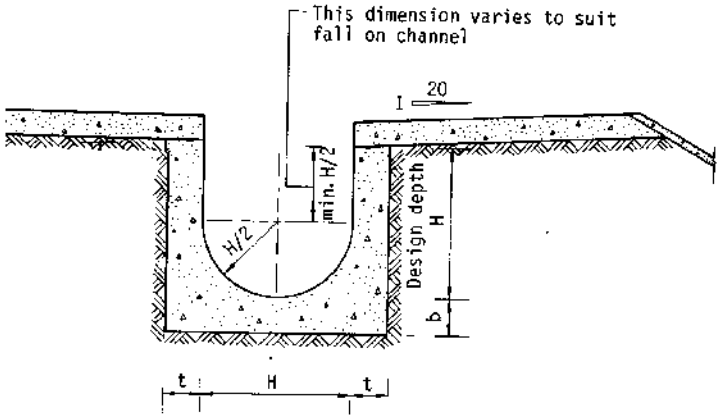
U-Channel	Diameter, mm	Design Depth, mm	Manning's roughness coefficient	Channel Gradient	Cross Section Area, m^2	Wetted perimeter, m	Hydraulic radius, m	Mean velocity, m/s	Capacity, m^3/s	Catchment Served	Actual Runoff, m^3/s	% of Capcity Flow	Sufficient Capacity (Y/N)
UC1(to CP1)	225	225	0.016	0.005	0.0407	0.6909	0.0589	0.6688	0.0272	A(1%)	0.0032	12%	Y
UC2(from CP1 to CP2)	225	225	0.016	0.018	0.0407	0.6909	0.0589	1.2689	0.0516	A(5%)	0.0159	31%	Y
UC3(from CP2 to CP3)	375	375	0.016	0.008	0.1130	1.1515	0.0981	1.1892	0.1344	A(20%)	0.0636	47%	Y
UC4(from CP3 to CP4)	450	450	0.016	0.005	0.1627	1.3819	0.1177	1.0616	0.1727	A(30%)	0.0955	55%	Y
UC5(from CP4 to CP5)	450	450	0.016	0.010	0.1627	1.3819	0.1177	1.5014	0.2443	A(50%)	0.1591	65%	Y
UC6(from CP5 to CP6)	600	600	0.016	0.005	0.2892	1.8425	0.1570	1.2861	0.3720	A(70%)	0.2227	60%	Y
UC7(from CP6 to CP7)	600	600	0.016	0.005	0.2892	1.8425	0.1570	1.2861	0.3720	A(75%)	0.2387	64%	Y
UC8(from CP7 to CP8)	750	750	0.016	0.005	0.4519	2.3031	0.1962	1.4923	0.6744	A(90%)	0.2864	42%	Y
UC9(from CP8 to CP9)	750	750	0.016	0.005	0.4519	2.3031	0.1962	1.4923	0.6744	A(96%)	0.3055	45%	Y
UC10(from CP10 to CP9)	450	450	0.016	0.005	0.1627	1.3819	0.1177	1.0616	0.1727	C(45%)	0.0776	45%	Y
UC11(from CP11 to CP10)	375	375	0.016	0.005	0.1130	1.1515	0.0981	0.9401	0.1062	C(40%)	0.0690	65%	Y
UC12(from CP12 to CP11)	375	375	0.016	0.005	0.1130	1.1515	0.0981	0.9401	0.1062	D(50%)	0.0488	46%	Y
UC13(to CP12)	375	375	0.016	0.005	0.1130	1.1515	0.0981	0.9401	0.1062	D(50%)	0.0488	46%	Y
UC14(to CP13)	375	375	0.016	0.005	0.1130	1.1515	0.0981	0.9401	0.1062	D(50%)	0.0488	46%	Y
UC15(from CP13 to CP14)	375	375	0.016	0.005	0.1130	1.1515	0.0981	0.9401	0.1062	D(50%)	0.0488	46%	Y
UC16(from CP14 to CP15)	375	375	0.016	0.005	0.1130	1.1515	0.0981	0.9401	0.1062	C(2%)+D(50%)	0.0522	49%	Y
UC17(from CP15 to CP16)	375	375	0.016	0.005	0.1130	1.1515	0.0981	0.9401	0.1062	C(4%)+D(50%)	0.0557	52%	Y
UC18(from CP16 to CP17)	375	375	0.016	0.005	0.1130	1.1515	0.0981	0.9401	0.1062	C(10%)+D(50%)	0.0660	62%	Y
UC19(to CP17)	600	600	0.016	0.005	0.2892	1.8425	0.1570	1.2861	0.3720	B(85%)+C(45%)	0.2484	67%	Y
UC20(from CP17 to CP18)	750	750	0.016	0.005	0.4519	2.3031	0.1962	1.4923	0.6744	B(88%)+C(55%)+D(50%)	0.3204	48%	Y
UC21(from CP19 to CP18)	225	225	0.016	0.005	0.0407	0.6909	0.0589	0.6688	0.0272	B(5%)	0.0100	37%	Y
UC22(from CP20 to CP19)	225	225	0.016	0.005	0.0407	0.6909	0.0589	0.6688	0.0272	B(4%)	0.0080	30%	Y
UC23(from CP21 to CP20)	225	225	0.016	0.005	0.0407	0.6909	0.0589	0.6688	0.0272	B(3%)	0.0060	22%	Y
UC24(from CP22 to CP21)	150	150	0.016	0.005	0.0181	0.4606	0.0392	0.5104	0.0092	B(2%)	0.0040	44%	Y
UC25(to CP22)	150	150	0.016	0.005	0.0181	0.4606	0.0392	0.5104	0.0092	B(1%)	0.0020	22%	Y
UC26(to CP23)	150	150	0.016	0.005	0.0181	0.4606	0.0392	0.5104	0.0092	B(1%)	0.0020	22%	Y
UC27(from CP23 to CP24)	150	150	0.016	0.005	0.0181	0.4606	0.0392	0.5104	0.0092	B(2%)	0.0040	44%	Y
UC28(from CP25 to CP24)	750	750	0.016	0.005	0.4519	2.3031	0.1962	1.4923	0.6744	A(100%)+B(5%)+C(45%)+ D(50%)	0.4547	67%	Y
UC29(from CP26 to CP25)	225	225	0.016	0.040	0.0407	0.6909	0.0589	1.8916	0.0769	A(4%)	0.0127	17%	Y
UC30(to CP26)	225	225	0.016	0.005	0.0407	0.6909	0.0589	0.6688	0.0272	A(3%)	0.0095	35%	Y
UC31(from CP9 to CP25)	750	750	0.016	0.005	0.4519	2.3031	0.1962	1.4923	0.6744	A(96%)+B(5%)+C(45%)+ D(50%)	0.4419	66%	Y

Annex B

Typical Design of U-channel and Catchpit



TYPICAL DETAILS OF CATCHPIT



TYPICAL DETAILS OF U CHANNEL

Extracted from: *Technical Note to prepare a "Drainage Submission "(relating to applications for temporary change of land use such as temporary storage areas, car parks, workshops, small factories .....etc. under S.16 of the town Planning Ordinance published by DSD in November 2011*