DRAINAGE IMPACT ASSESSMENT REPORT

FOR

PROPOSED TEMPORARY WAREHOUSE (STORAGE OF CONSTRUCTION MATERIALS, METAL AND ELECTRONIC PARTS) AND OPEN STORAGE OF CONSTRUCTION MATERIALS FOR A PERIOD OF 3 YEARS AT LOTS 130 (PART), 131, 132 (PART), 134(PART), 260(PART), 261(PART), 262, 263, 264 AND 268(PART) IN D.D.128 AND ADJOINING GOVERNMENT LAND, HA TSUEN, YUEN LONG, NEW TERRITORIES

Date : October 2024

Report no. SDP/HT/001B

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APPENDIX

REFERENCES

1. Stormwater Drainage Manual, Planning Design and Management by DSD
2. Geotechnical Manual for Slopes by GEO
3. Standard Drawings by DSD

1. Introduction

This report presents the drainage impact assessment (DIA) to the existing drainage system outside the site from the proposed temporary warehouse (storage of construction materials, metal and electronic parts) and open storage of construction materials at lots 130 (part), 131, 132 (part), 134 (part), 260 (part), 261 (part), 262, 263, 264 and 268 (part) in D.D.128 and adjoining Government Land, Ha Tsuen, Yuen Long, New Territories.

The objective of the DIA report is to outline the catchment areas in the vicinity of the site, identifies and quantifies the potential drainage impact due to the proposed works and recommend the necessary mitigation measures to alleviate the impacts. The plan showing the the proposed surface channel and existing drainage system in the vicinity of the site is appended in **Appendix A**.

2. Design Parameters & Assumptions

The design criteria to be used for the modeling assessment are based on the standards set out in the Stormwater Drainage Manual, Fifth Edition (SDM). According to Section 6.6.1 of the SDM, the existing village drainage system in the vicinity of the development is classified as main rural catchment drainage system. Table 10 of the SDM recommends to be adopted a 50 years design return period storm event for the main rural drainage branch system.

<u>Stormwater Runoff (Q)</u>

The rate of stormwater runoff used in this assessment report is estimated by the "Rational method" in which the peak runoff is calculated from the formula:

$$Q = K \times i \times A / 3600$$

where Q = maximum runoff (L/s)

i = design mean intensity of rainfall (mm/hr)

A = area of catchment (m^2)

K = runoff coefficient

Time of Concentration (tc)

The time of concentration is defined as the time required for stormwater runoff to flow from the most remote part of the catchment area to the point in the drainage system under consideration. Based on the assumptions adopted in the Rational Method, this is the time taken for the peak runoff to become established at the considered section.

The time of concentration comprises the time for water flowing within natural catchments and along the man-made drainage pipes/channels. For natural catchments, the time of concentration is estimated by the modified form of the Brandsby William's equation.

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

Where t_o = time of concentration of a natural catchment (min.)

A = catchment area (m^2)

H = average slope (m per 100m), measured along the line of natural flow, from the summit of the catchment to the point under consideration

L = distance (on plan) measured on the line of natural flow between the summit and the point under consideration (m)

Mean Rainfall Intensity (i)

Mean rainfall intensity-duration curves attached in this report are based on the Statistical analysis of long term rainfall records from the Hong Kong Observatory. A return period of 50 years is adopted.

Runoff Coefficient (K)

The value of K is taken as 1 for developed paved area. For vegetated ground, the value of K is taken as 0.3.

Calculation of flow capacity for Existing Stream and Box Culvert

Manning's Formula can be used to determine the capacity of the existing stream and box culvert

$$Q = K\ A\ R^{2/3}\ S^{1/2} \div n$$

Q = flow rate
A = cross sectional area of stream
R = hydraulic radius
S = slope of the stream
K = constant which is 1.49 for S.I. unit
n = surface roughness

3. Existing Drainage Condition

A plan showing the existing catchments is enclosed in **Appendix A**. Currently, the surface runoff collected from the site is discharging to the existing 1.5m wide stream located at the west of the site and connected to existing 1.5m width and 1.1m depth box culvert. As per the existing site condition, an additional peripheral U-channels area is considered necessary for the proposed development. A drainage proposal is required to be carried out for the proposed development.

4. Proposed Stormwater Drainage

The proposed stormwater drainage works include surface U-channels at the peripheral of the site collecting the runoff from catchments within the site. The U-channels will connect and discharge the surface runoff to the existing stream located at the west of the site. Catchpits with 300mm sump are proposed at the discharged points of the proposed U-Channel to desilt the surface water before discharging to the drainage outside. The proposed stormwater drainage layout plan is shown in **Appendix A**.

5. Effect on Drainage Characteristics and Potential Drainage Impact from Proposed Works

Since the proposed works only consist of the proposed temporary warehouse (storage of construction materials, metal and electronic parts) and open storage of construction materials, it is found that the proposed works would not obstruct the flow of the rain water run-off collected from the catchment areas to existing stream neither at its up-stream nor immediately down-stream. Besides, the catchment areas have no significant changes before and after the proposed works. It is considered the proposed works will not induce any adverse effect to the existing rain-water discharge system.

The capacity of the existing stream and box culvert was checked and presented in **Appendix B**. Based on the assessment, it is found that the existing stream and box culvert has enough capacity to collect the run-off from its up-stream catchment area.

6. Mitigation Measures On The Existing Streamcourse During Construction Stage and Operation Stage

A desilted catchpit would be proposed at the runoff's terminated discharge point prior to the discharging the runoff to the existing stream. The desilted catchpit would be constructed during the construction stage to prevent the sand / construction debris discharged into the existing stream during the construction works. Erosion protection measures such as discharge apron would be provided to the existing streamcourse at the outlet of proposed outfall.

7. The Monitoring of Mitigation Measures

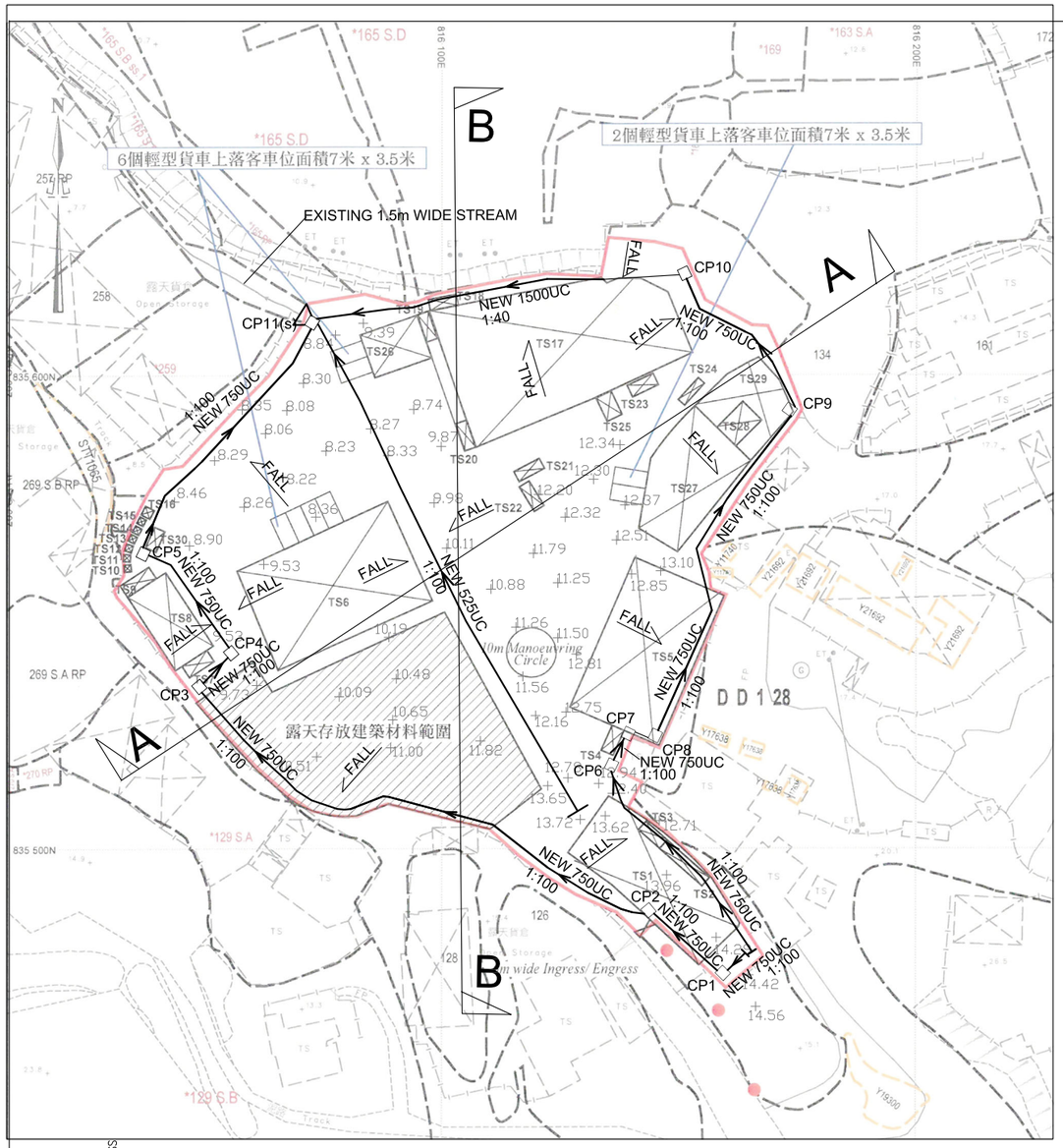
The proposed desilted catchpit would be regularly desilted by the applicant to prevent sand, silt, cementitious material or other objects from being washed down into the existing streamcourse.

8. Conclusion

Based on the above discussion, it is considered that no potential drainage impact would be raised to the existing drainage system in the vicinity of the proposed works because the stream and box culvert has enough capacity to collect the runoff from its up-stream catchment areas where the proposed works located. The proposed works are considered acceptable from the stormwater drainage point of view and will have no adverse effect on the drainage system outside

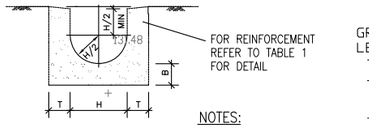
Appendix A

The Plan of the Proposed Works



LEGEND:

+12.34	EXISTING GROUND LEVEL AT +12.34mPD
1:100 NEW 750UC →	PROPOSED 750mm U–CHANNEL WITH GRATING AT FALL 1: 100 (MIN)
1:100 NEW 525UC →	PROPOSED 525mm U–CHANNEL WITH GRATING AT FALL 1: 100 (MIN)
CP11(s) □	PROPOSED COVERED DESILTED CATCHPIT NO. CP11
CP1 □	PROPOSED COVERED CATCHPIT NO. CP1
◁	PROPOSED DISCHARGE APRON



U–CHANNEL

COMPLY WITH FIG 8.11 OF GEOTECHNICAL MANUAL FOR SLOPES

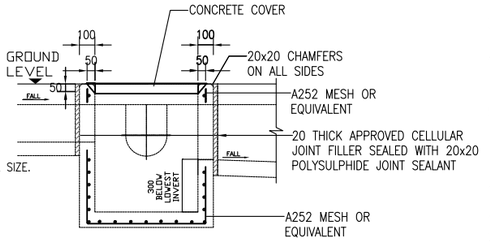
NOTES:

1. H = NOMINAL CHANNEL SIZE.

CATCHPITS

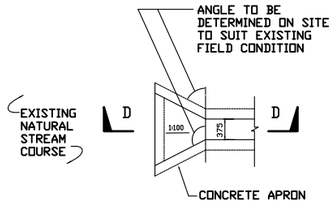
1 ALL DIMENSIONS ARE IN MILLIMETRES

2 CONCERTE SURFACE FINISH SHALL BE CLASS U2 OR F3 AS APPROPRIATE



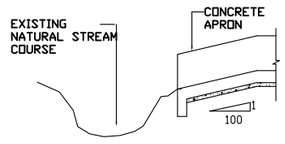
SECTION D – D WITH DESILTED TRAP

COMPLY WITH CEDD'S DRAWING NO. DS C2405 AND C2406I



PLAN OF U–CHANNEL DISCHARGE POINT

N.T.S.



SECTION D – D

N.T.S.

GENERAL NOTE

1. THE PROPOSED DRAINAGE WORK, WHETHER WITHIN OR OUTSIDE THE LOT BOUNDARY, SHOULD BE CONSTRUCTED AND MAINTAINED BY THE LOT OWNER AT HIS OWN EXPENSE. FOR WORKS TO BE UNDERTAKEN OUTSIDE THE LOT BOUNDARY, PRIOR CONSENT AND AGREEMENT FROM DLO AND/OR RELEVANT PRIVATE LOT OWNER SHOULD BE SOUGHT.
2. THE 100mm OPENING AT 1m C/C SHALL BE PROVIDED AT THE BOTTOM OF HOARDING OR WALLS IF ANY.

CONCRETE STRENGTH AND STEEL REINFORCEMENT SPECIFICATION FOR DRAINAGE DETAILS

1. CONCRETE GRADE FOR CATCHPITS AND U–CHANNEL SHALL BE 30D DESIGN IN COMPLIANCE WITH CS1 : 2010 FOR BLINDING LAYER SHALL BE 15D, DESIGN COMPLY WITH CS1–2010.
2. ALL MAIN BARS TO BE HOT ROLLED HIGH YIELD STEEL DEFORMED BAR COMPLM WITH CS2 : 2012
   Y – HIGH YIELD BAR 500 MPa
   M – MILD STEEL BAR 250 MPa
3. CONCRETE COVER TO MAIN REINFORCEMENT TO BE 50mm.
4. LAP LENGTH FOR ALL BARS TO BE 46x DIAMETER OF LARGER BAR TO BE LAPPED.
5. REACTIVE ALKALI CONTENT EXPRESSED IN SODIUM OXIDE PER CUBIC METER OF CONCRETE SHOULD NOT EXCEED 3KG AS PER PNAP APP–74.

HALF ROUND, U, AND STEPPED – CHANNELS

1 ALL DIMENSIONS ARE IN MILLIMETERS

2 CONCRETE SURFACE FINISHING SHALL BE CLASS U2 OR F2 AS APPROPRIATE

3 FOR HALF ROUND AND U – CHANNEL, SPACING OF EXPANSION JOINT IN CHANNELS, BERMS AND APRON TO BE 10m MAXIMUN. FOR STEPPED CHANNELS, EXPANSION JOINTS TO BE PROVIDED AT A MAXIMUN SPACING OF 10m.

4 DIMENSIONS FOR HALF ROUND AND U–CHANNELS SEE TABLE 1.

5 THE COVER FOR U–CHANNELS AND CATCHPIT SHALL COMPLY WITH CEDD'S STANDARD DRAWINGS NO. C2405 TO C2407 AND C2412.

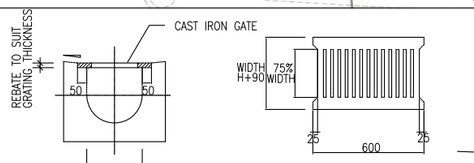
6 ALL PROPOSED U–CHANNELS SHALL BE COVERED WITH GRATING

TABLE 1 : DIMENSION OF U–CHANNEL AND HALF–ROUND CHANNEL

NORMAL SIZE H	T	B	REINFORCING
<300	100	100	NIL
375 – 675	150	150	NIL
750 – 900	175	175	A252 MESH PLACED CENTRALLY

PROPOSED CATCHPIT SCHEDULE

CATCHPIT NO.	C.L. (mPD)	I.L. (mPD)
CP1	14.29	13.44
CP2	13.96	13.11
CP3	9.73	8.88
CP4	9.73	8.80
CP5	8.90	8.05
CP6	12.94	12.09
CP7	12.94	12.02
CP8	12.94	11.97
CP9	12.37	11.20
CP10	12.30	10.70
CP11(s)	8.84	7.24

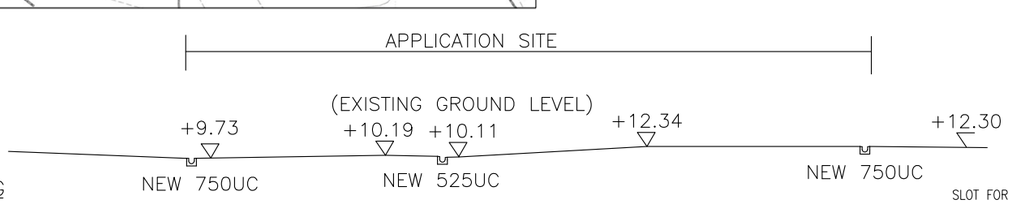


TYPICAL SECTION

CAST IRON GRATING

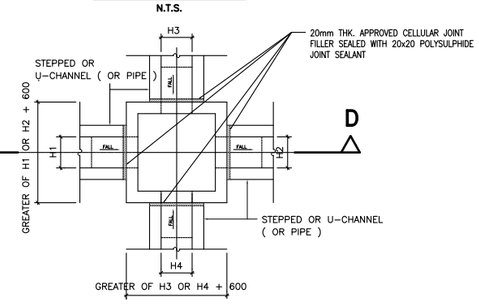
(DIMENSIONS ARE FOR GUIDANCE ONLY. CONTRACTOR MAY SUBMIT EQUIVALENT TYPE)

U–CHANNEL WITH CAST IRON GRATING



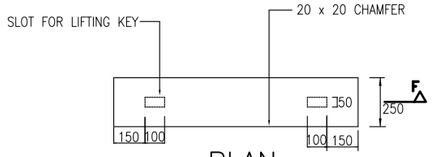
SECTION A–A

REMARKS : NO FILLING WORKS FOR THIS APPLICATION



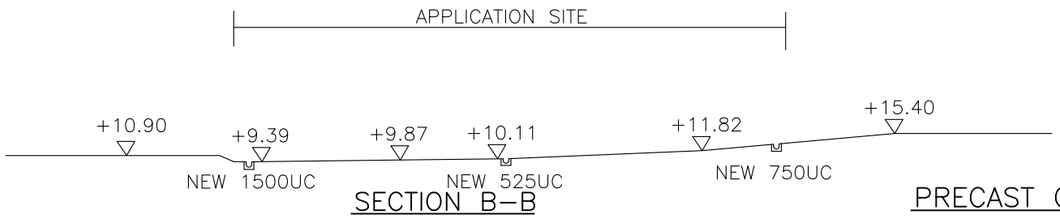
PLAN

TYPICAL DETAILS OF CATCHPIT



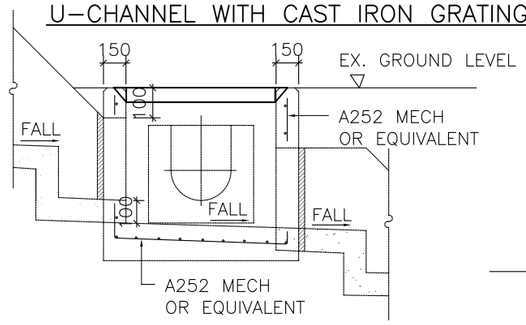
PLAN

N.T.S.



SECTION B–B

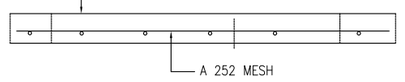
REMARKS : NO FILLING WORKS FOR THIS APPLICATION



SECTION D–D

N.T.S.

GRADE 25D CONCRETE WITH ONE LAYER OF A 252 MESH REINFORCEMENT PLACED CENTRALLY F2 AND U2 FINISH



PRECAST CONCRETE COVERS FOR CATCHPIT

N.T.S.

REV	DESCRIPTION	CHECKED	APPROVED	DWN	DATE
A	DSD's COMMENT	RC	AY	RY	AUG 24
	PLANNING SUBMISSION	RC	AY	RY	JULY 24

PROJECT TITLE:

STORMWATER DRAINAGE PROPOSAL AT LOTS 130(PART) 131, 132(PART), 134(PART), 260(PART), 261(PART) 262, 263, 264 AND 268(PART) IN D.D.128 HA TSUEN, YUEN LONG, NEW TERRITORIES

DRAWING TITLE:

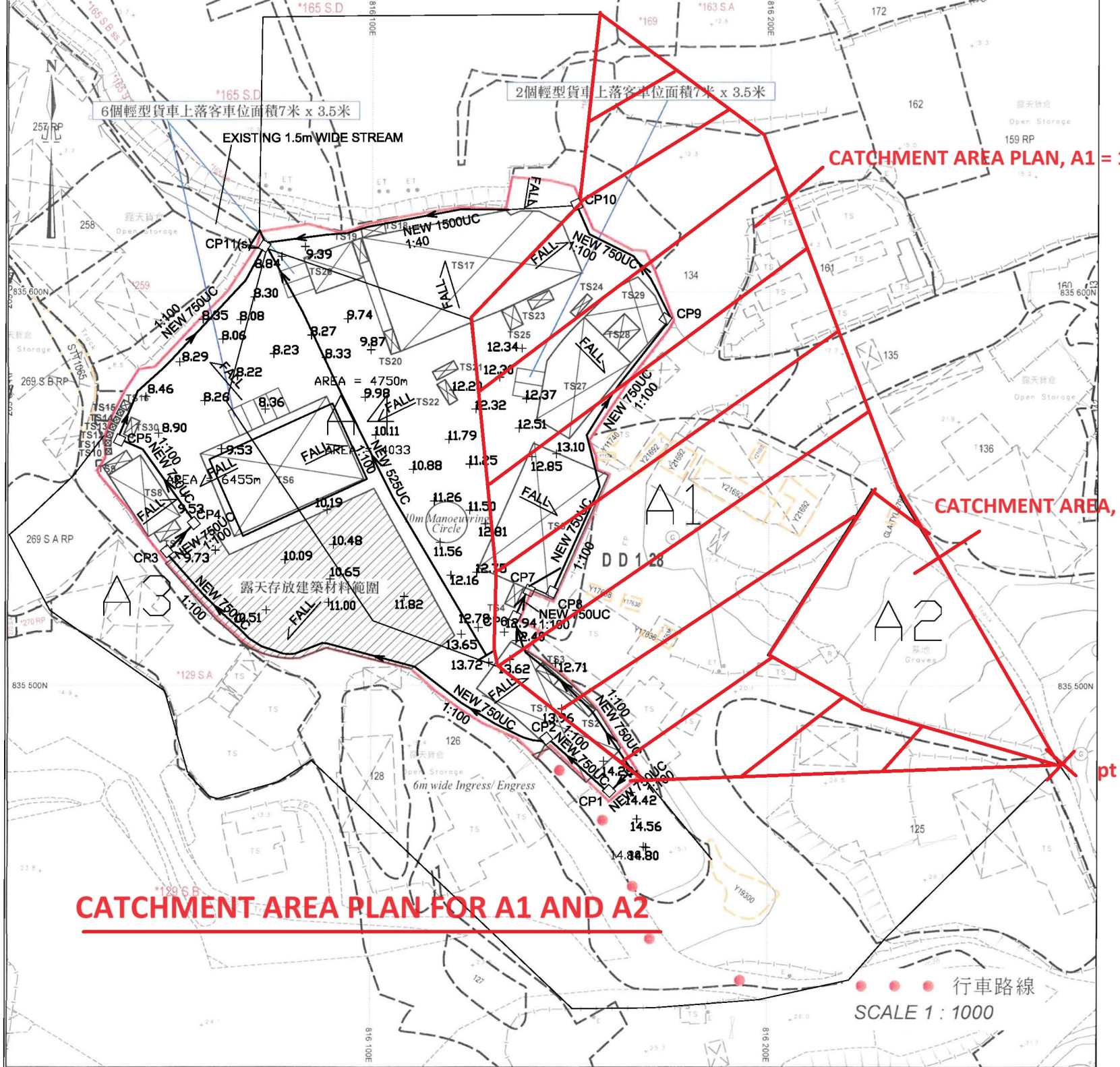
DRAINAGE PROPOSAL PLAN AND TYPICAL DETAILS

SCALE :	N.T.S.		CAD FILE: CAD_REF
DRAWN	RY		DRAWING NO. SDP001A
S.D	RY		
DESIGNED	RC		
CHECKED	AY		
			B.D. REF. NO.:

Appendix B

Drainage Design of Proposed U-channel

and Existing 1.5m Wide Stream & Box Culvert


CATCHMENT AREA PLAN, A1 = 12696m2
CATCHMENT AREA, A2 = 2436m2
pt A
CATCHMENT AREA PLAN FOR A1 AND A2
SCALE 1 : 1000
行車路線
6個輕型貨車上落客車位面積7米 x 3.5米
2個輕型貨車上落客車位面積7米 x 3.5米
EXISTING 1.5m WIDE STREAM
露天存放建築材料範圍
AREA = 4750m
AREA = 6455m
AREA = 1033
A1
A2
A3
CP1
CP2
CP3
CP4
CP5
CP7
CP8
CP9
CP10
CP11(S)
NEW 1500UC 1:40
NEW 750UC 1:100
NEW 525UC 1:100
FALL
6m wide Ingress/ Egress
10m Manoeuvring Circle
DD 128

Drainage Design at lot 130, 131, 132, 134, 260 to 264, 268 in DD128 Ha

Project No.: Tsuen, Yuen Long Date: 15-Aug-24

Prepared by: Ray Cheng

Check for the drainage capactiy of proposed 750UC

Catchment area,	A1	=	12696	m^2	Assume k = 1.0 for paved surface
	A2	=	2436	m^2	Assume k = 0.3 for unpaved surface
	Total Area, A	=	16696 + 0.3x2436		
		=	13426.8	m^2	

Use Rational Method from Geo-Manual

$Q = kiA/3600$ where,

Q = Maximum runoff (lit/sec)
k = Runoff coefficient
i = Design mean intensity of rainfall (mm/hr)
A = Total catchment area (m^2)

Longest distance from summit point to outlet, CP10 (Ld) = 310.00 m

Shortest distance from summit point to outlet, CP10 (Ls) = 183.00 m

Elevation of remote point (Pt A)	=	35.20	mPD
Elevation of outlet point, CP10	=	10.70	mPD
Average fall, H	=	$(z_1-z_2)/L_s$ x 100	
	=	13.39	m per 100m

From TGN30

$T_c = 0.14465 \times L_d / (H^{0.2} \times A^{0.1})$

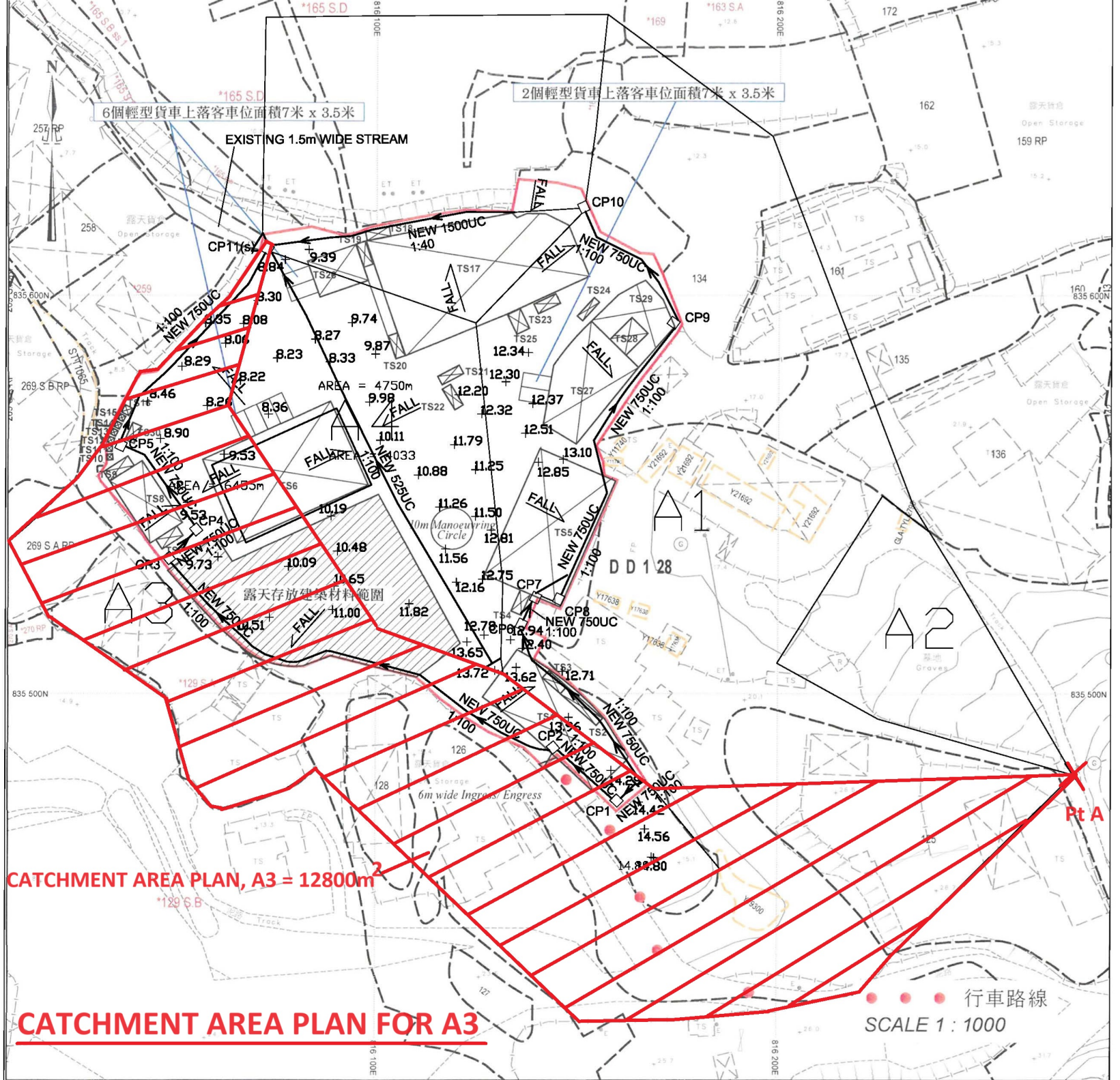
$= 10.19$ min

Assume a 1 in 50 year design rainfall return period for rural area
From Geo-Manual (Fig 8.2)

i	=	265	mm/hr
Q	=	kiA/60	x 1.138
		67485	lit/min

From TGN 43A1
For proposed 750 UC with 1 in 100 gradient

Maximum capacity	=	74700	lit/min	>	67485	o.k.
The corresponding velocity	=	3.35	m/s	<	4	o.k.


6個輕型貨車上落客車位面積7米 x 3.5米
2個輕型貨車上落客車位面積7米 x 3.5米
EXISTING 1.5m WIDE STREAM
CP10
CP11(S)
CP9
CP8
CP7
CP6
CP5
CP4
CP3
CP2
CP1
NEW 1500UC 1:40
NEW 750UC 1:100
NEW 525UC 1:100
AREA = 4750m
AREA 1643m
10m Manoeuvring Circle
露天存放建築材料範圍
6m wide Ingress/ Egress
DD 128
A1
A2
A3
Pt A
CATCHMENT AREA PLAN, A3 = 12800m2
CATCHMENT AREA PLAN FOR A3
行車路線
SCALE 1 : 1000

Drainage Design at lot 130, 131, 132, 134, 260 to 264, 268 in DD128 Ha

Project No.: Tsuen, Yuen Long Date: 15-Aug-24

Prepared by: Ray Cheng

Check for the drainage capactiy of proposed 750UC

Catchment area, A3 = 12800 m^2 Assume k = 1.0 for paved surface

Use Rational Method from Geo-Manual

$Q = kiA/3600$ where,

Q = Maximum runoff (lit/sec)
k = Runoff coefficient
i = Design mean intensity of rainfall (mm/hr)
A = Total catchment area (m^2)

Longest distance from summit point to outlet, CP11(s) (Ld) = 375.00 m
Shortest distance from summit point to outlet, CP11(s) (Ls) = 240.00 m

Elevation of remote point (Pt A) = 35.20 mPD
Elevation of outlet point, CP11(s) = 7.24 mPD

Average fall, H = $(z_1-z_2)/L_s$ x 100
= 11.65 m per 100m

From TGN30

T_c = $0.14465 \times L_d / (H^{0.2} \times A^{0.1})$
= 12.89 min

Assume a 1 in 50 year design rainfall return period for rural area
From Geo-Manual (Fig 8.2)

i = 255 mm/hr
Q = kiA/60 x 1.138
61907 lit/min

From TGN 43A1
For proposed 750 UC with 1 in 100 gradient

Maximum capacity	=	74700	lit/min	>	61907	o.k.
The corresponding velocity	=	3.35	m/s	<	4	o.k.

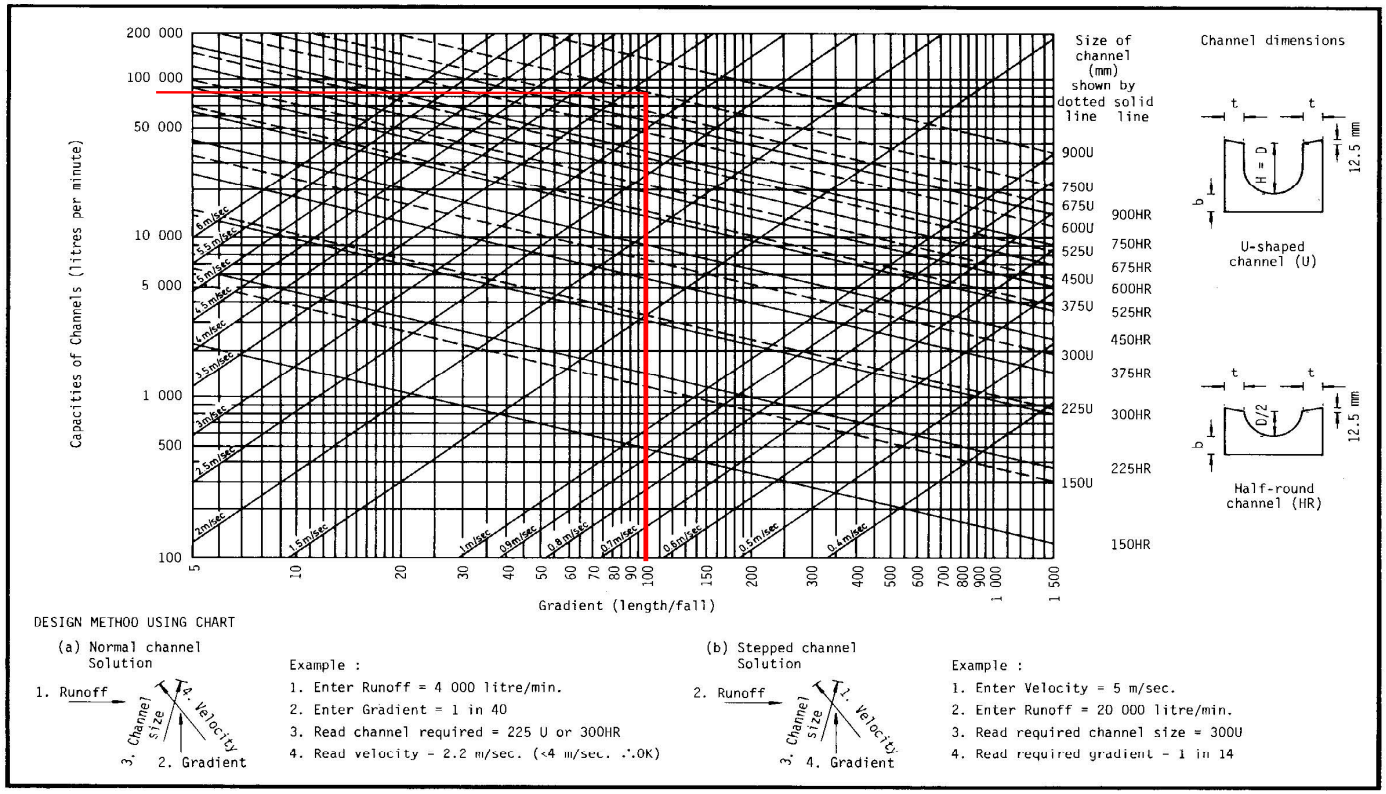
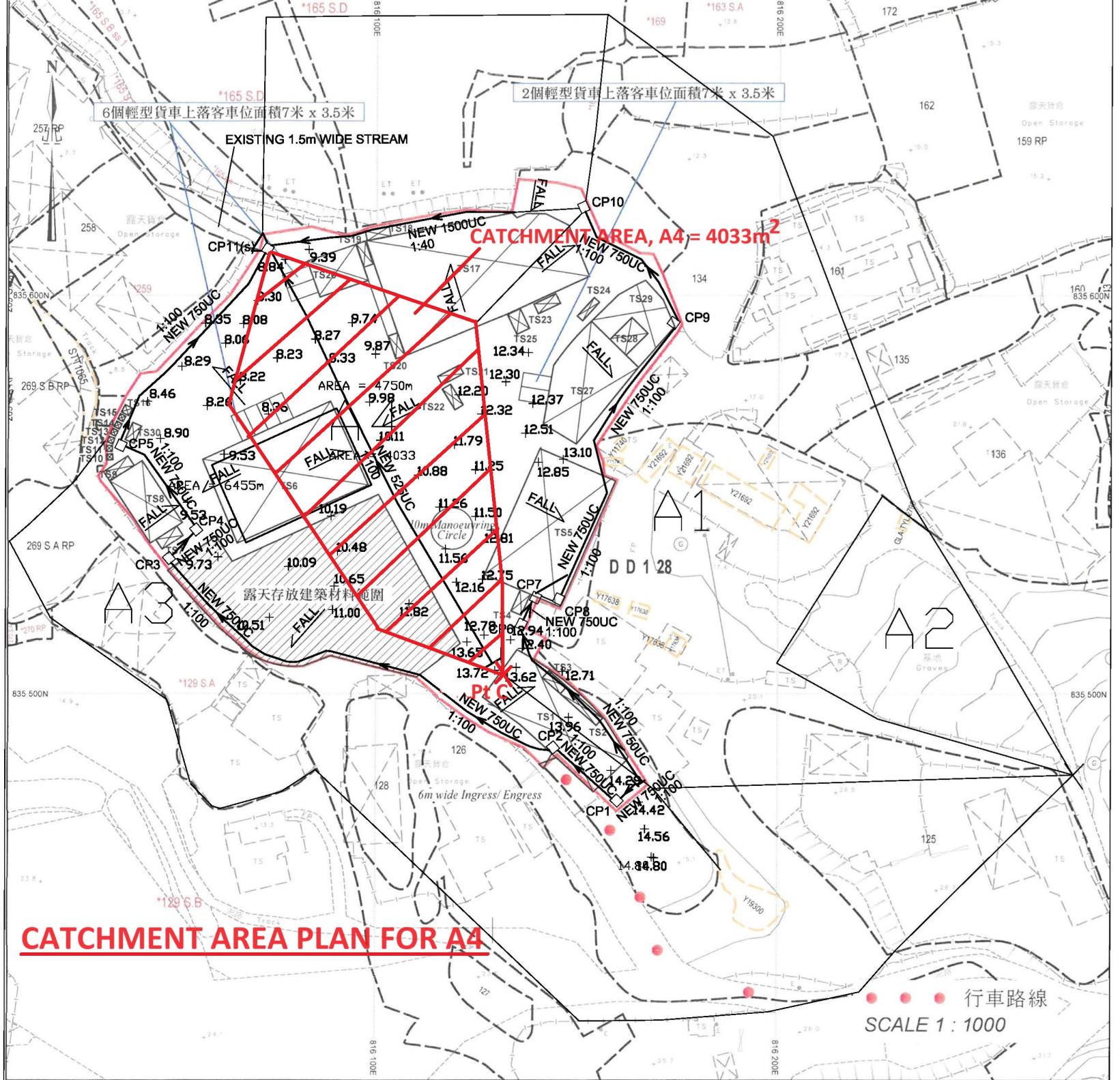


Figure 8.7 - Chart for the Rapid Design of Channels

Since 10% reduction would be considered for deposition of sediment, the capacity of the proposed 750UC should be 83000 x 0.9 = 74,700 lit/min,



CATCHMENT AREA PLAN FOR A4

Drainage Design at lot 130, 131, 132, 134, 260 to 264, 268 in DD128 Ha
Project No.: Tsuen, Yuen Long Date: 15-Aug-24
Prepared by: Ray Cheng

Check for the drainage capactiy of proposed 525UC

Catchment area, A4 = 4033 m^2 Assume k = 1.0 for paved surface

Use Rational Method from Geo-Manual

$Q = kiA/3600$ where,

Q = Maximum runoff (lit/sec)
k = Runoff coefficient
i = Design mean intensity of rainfall (mm/hr)
A = Total catchment area (m^2)

Longest distance from summit point to outlet, CP11(s) (Ld) = 137.00 m
Shortest distance from summit point to outlet, CP11(s) (Ls) = 120.00 m

Elevation of remote point (Pt C) = 13.72 mPD
Elevation of outlet point, CP11(s) = 7.24 mPD

Average fall, H = $(z_1-z_2)/L_s$ x 100
= 5.40 m per 100m

From TGN30

T_c = $0.14465 \times L_d / (H^{0.2} \times A^{0.1})$
= 6.17 min

Assume a 1 in 50 year design rainfall return period for rural area
From Geo-Manual (Fig 8.2)

i = 310 mm/hr
Q = kiA/60 x 1.138
23713 lit/min

From TGN 43A1
For proposed 525 UC with 1 in 100 gradient

Maximum capacity	=	32400	lit/min	>	23713	o.k.
The corresponding velocity	=	2.50	m/s	<	4	o.k.

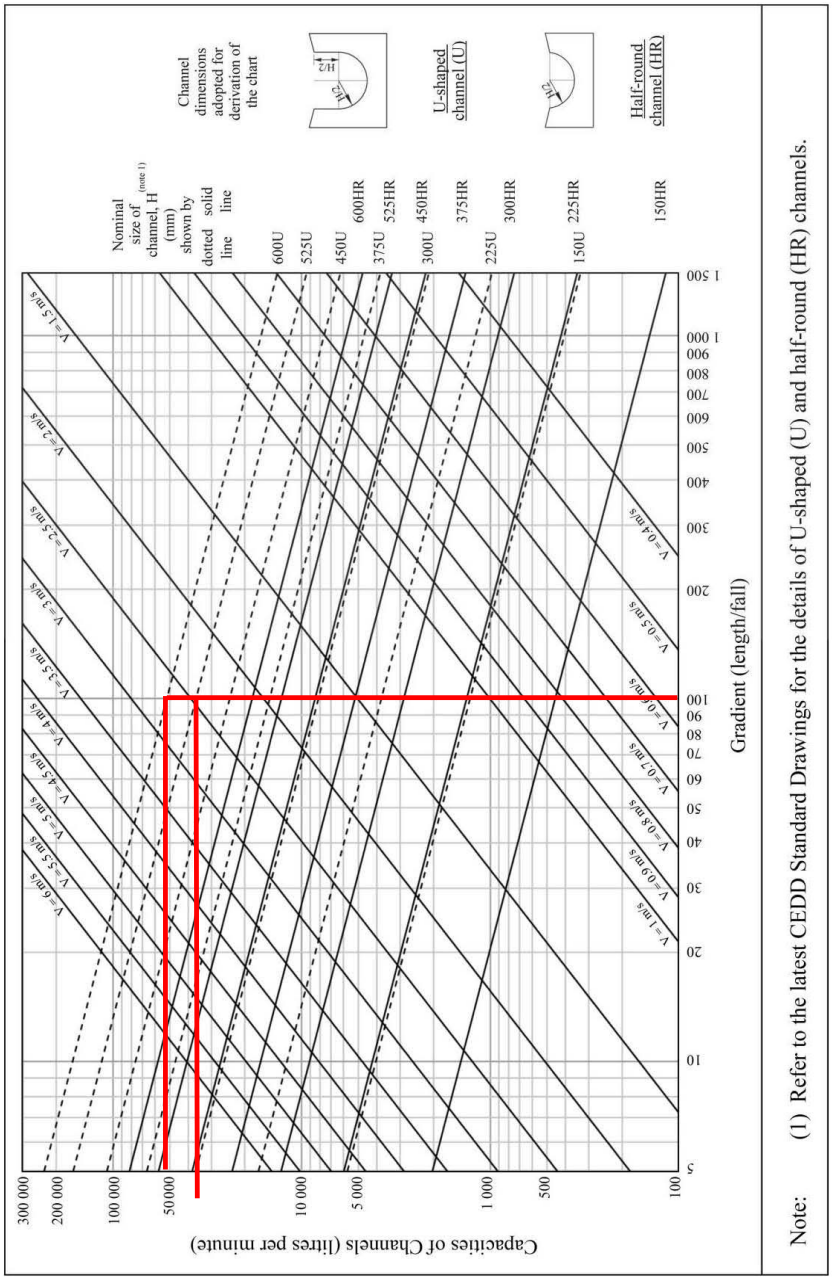


Figure 1 - Chart for the rapid design of U-shaped and half-round channels up to 600 mm

Note: (1) Refer to the latest CEDD Standard Drawings for the details of U-shaped (U) and half-round (HR) channels.

Since 10% reduction would be considered for deposition of sediment, the capacity of the proposed 525UC should be 36000 x 0.9 = 32,400 lit/min,

Pt C

Pt Y

CATCHMENT AREA, A6 = 2814m^2

CATCHMENT AREA, A5 = 48151m^2

CATCHMENT AREA, A2 = 2436m^2

CATCHMENT AREA PLAN FOR EX. STREAM AND BOX CULVERT

Drainage Design at lot 130, 131, 132, 134, 260 to 264, 268 in DD128 Ha

Project No.: Tsuen, Yuen Long Date: 29-Oct-24

Prepared by: Ray Cheng

Check for the drainage capactiy of existing stream and box culvert

Catchment area,	A5	=	48151	m^2	Assume k = 1.0 for paved surface
	A2	=	2436	m^2	Assume k = 0.3 for unpaved surface
	A6	=	2814		
	Total Area, A	=	48151 + 0.3x(2436+2814)		
		=	49726	m^2	

Use Rational Method from Geo-Manual

$Q = kiA/3600$ where,

Q = Maximum runoff (lit/sec)
k = Runoff coefficient
i = Design mean intensity of rainfall (mm/hr)
A = Total catchment area (m^2)

Longest distance from summit point to outlet, Pt Y (Ld) = 400.00 m

Shortest distance from summit point to outlet, Pt Y (Ls) = 255.00 m

Elevation of remote point (Pt C)	=	36.50	mPD
Elevation of outlet point, Pt Y	=	7.24	mPD
Average fall, H	=	$(z_1-z_2)/L_s$ x 100	
	=	11.47	m per 100m

From TGN30

T_c = $0.14465 \times L_d / (H^{0.2} \times A^{0.1})$

= 12.02 min

Assume a 1 in 50 year design rainfall return period for rural area
From Geo-Manual (Fig 8.2)

i	=	260	mm/hr
Q	=	kiA/60	x 1.138
		245215	lit/min

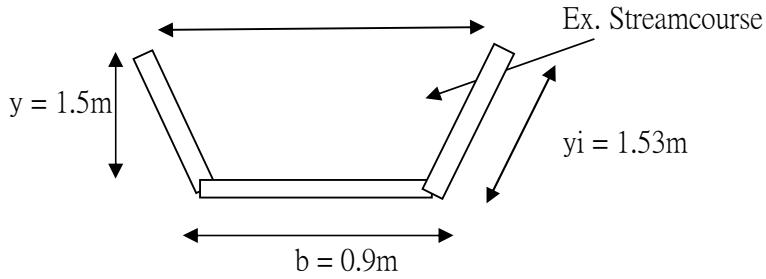
Drainage Design and Checking Page no.

Project No.: Date: 29-Oct-24
Prepared by: Ray Cheng

Check for the drainage capactiy **(Existing trapezoidal shape Stream course)**

From Manning Equation, for existing 0.9m width bottom and 1.5m width top and 1.5m depth trapezoidal streamcourse B = 1.5m

Max. capacity of streamcourse, $Q = \frac{k\,(R^{2/3})(S^{1/2})}{n} A$



R= A/ P and P = b + B + yi

R= 0.39 k = 1.49
S = 0.025 n = 0.04

Q = 342288 lit/min > 245215 lit/min O.K.

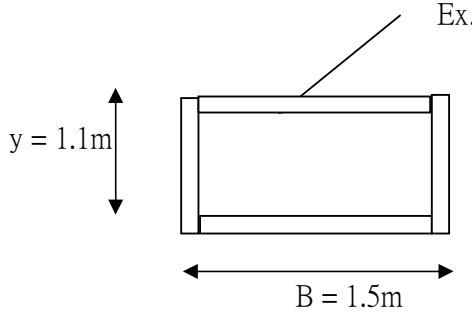
Drainage Design and Checking Page no.

Project No.: Date: 29-Oct-24
Prepared by: Ray Cheng

Check for the drainage capactiy **(Existing 1.5m width and 1.1m depth Box Culvert)**

From Manning Equation, for existing 1.5m width and 1.1m depth Box Culvert

Ex. Box Culvert



Max. capacity of streamcourse, $Q = \frac{k\,(R^{2/3})(S^{1/2})}{n} A$

$R = A/P$ and $P = 2y + B$

R= 0.50 k = 1.49
S = 0.025 n = 0.04

Q = 402226 lit/min > 245215 lit/min O.K.

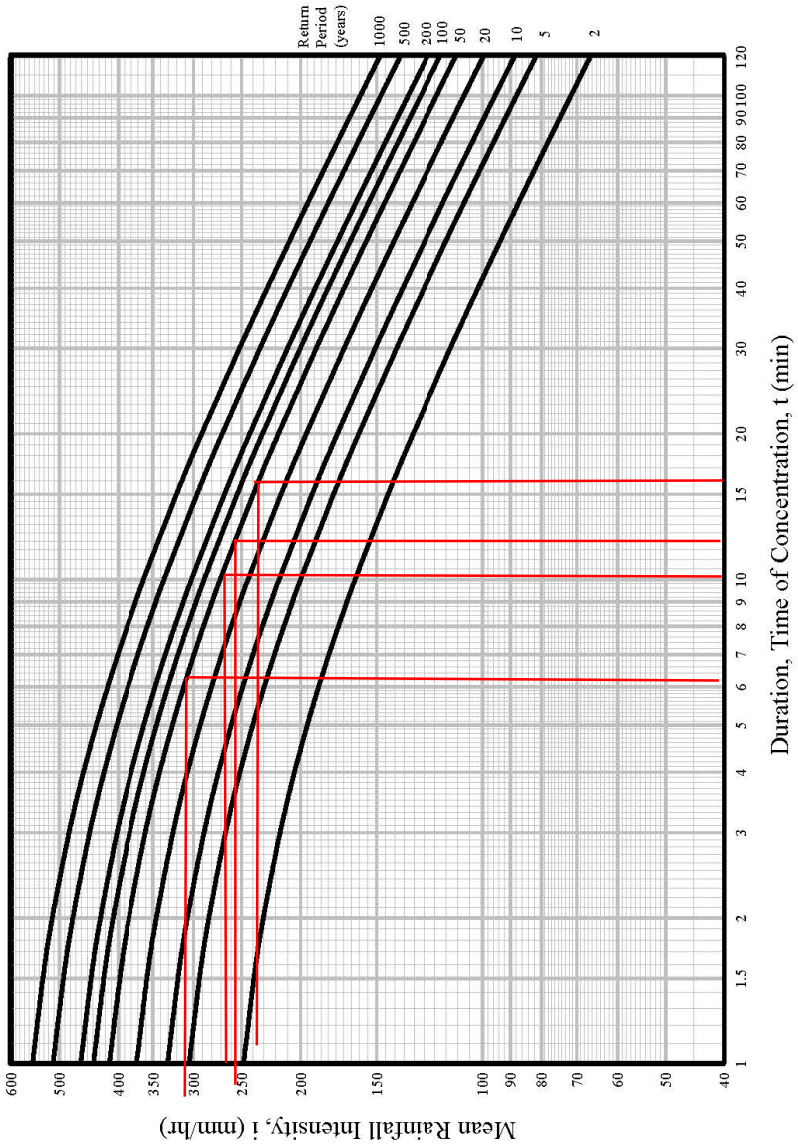


Figure 1 – Updated Intensity-Duration-Frequency Curves

Notes:
1. These IDF curves are to supersede those given in Figure 8.2 of the Geotechnical Manual for Slopes (GCO, 1984).
2. These IDF curves have not incorporated any projected climate change effects. Except for temporary slope drainage design, the mean rainfall intensity given by these IDF curves shall be increased by 13.8% for incorporating climate change effects.
3. The mathematical formulae of these IDF curves are shown in Table 1 of Annex TGN 30 A1.

Appendix C

Photo of Existing Stream and Box Culvert

Photo of Existing Stream

Photo of Existing Box Culvert