

Appendix 2

Accepted Drainage Proposal

**Proposed Temporary Warehouse
(Excluding Dangerous Goods Godown)
For a Period of 3 Years in “Residential (Group D)” Zone,
Lot Nos. 146 S.B. ss.1, 149, 150 (Part), 151, 152(Part) and 153
in D.D.128, Ha Tsuen, Yuen Long, New Territories, Section 16A
Application No. A/YL-HTF/1137-2**

**Drainage Impact Assessment on
Proposed Surface Drainage Outflow
(Rev. B)**

(MWA/202308/DIA-02b)

December 2023

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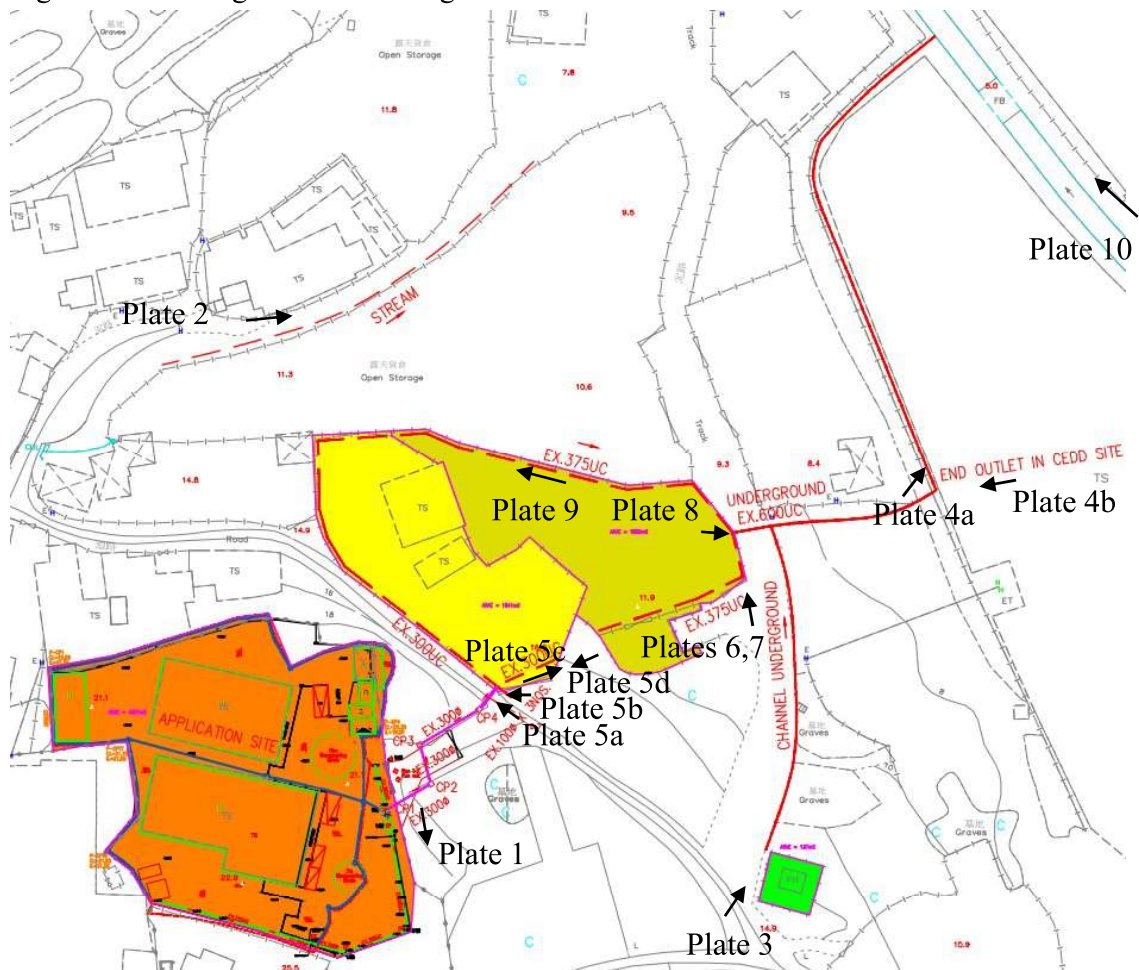
- A Proposed Drainage Details for the Application Site
- B CCTV Report
- C Checking of Drainage Capacity
- D Response to DSD's Comments

1. INTRODUCTION

Application for the proposed temporary warehouse (excluding Dangerous Goods Godown) for a Period of 3 years has been submitted to Planning Department at Lots 146 S.B. ss.1, 149, 150(Part), 151, 152(Part) and 153 in DD128. The extent for the application is given in Figure 1 in **Appendix A**.

This report is prepared to support the drainage proposal so as to:-

- (a) Identify the existing channel/gully and provide site record photos.
- (b) Demonstrate with hydraulic calculation that the proposed drainage facilities are adequate to collect, convey and discharge the surface runoff.



The summary of the site record photo is given as:-

Record Plate	Description/Findings	Time
1	The upper lot over the application site is discharged over the paved open space.	Current
2	The existing stream to the north of the application site collect most runoff for adjacent areas and roads.	Current
3	The catchment include the surface runoff from a WSD pump room	Current
4a 4b	The existing drainage path is intercepted by CEDD project YL/2020/03 and to be collected by existing 600mm U-channel	Current
5a 5b 5c 5d	Existing Drainage within STT 3162	Current
6	Nearby application site downstream site containing the 375UC	Current
7	375UC downstream	Current
8	Start of Existing 600 pipe	Current
9	375 UC existing discharge route	Current
10	Existing Nullah	Current
11	Aerial Photo showing U-channel from WSD Pump Room	Year 1995
12	Aerial Photo showing surface channel under construction	Year 1996
13	Aerial Photo showing surface channels	Year 2021

Plate 1 – The drainage runoff from the upper lot



Plate 2 – Surface Runoff collected by an existing open stream



Plate 3 – Adjacent WSD Catchpit



Plate 4a Existing 600 UC



Plate 4b Existing Outlet in CEDD Site



Plate 5a Existing Terminal Manhole



Plate 5b



Plate 5c



Plate 5d



Plate 6 – Nearby Planning Application Downstream in Lot 50

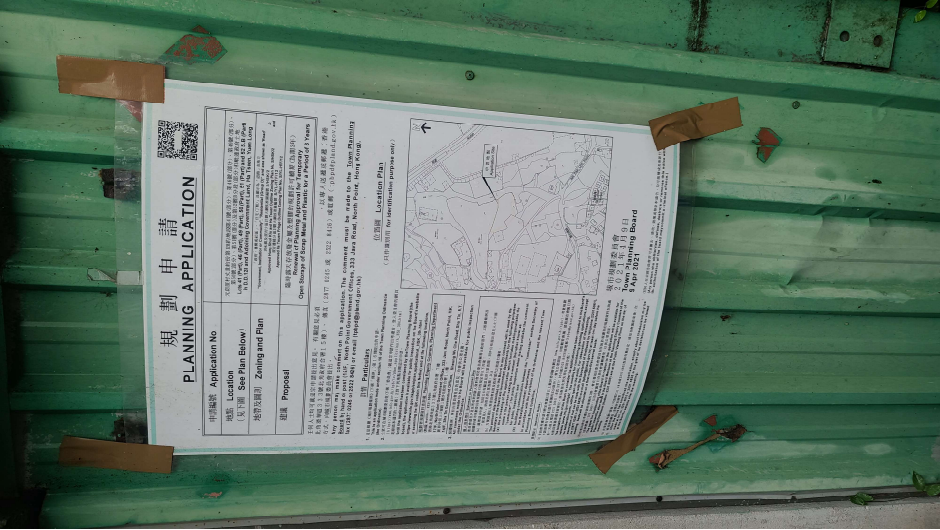


Plate 7 – 375 UC in Lot 50



Plate 8 – Start of 600mm Pipe in Lot 50 (after cleaning)



Plate 9 – 375 UC in Lot 50



Plate 10 – Existing Nullah



Plate 11 Year 1995 Aerial Photo shows U-Channel being constructed



Plate 12 – Downstream U-channel being Constructed (1996)



Plate 13 U-channel alignment before cover up



2.2 Existing Catchment Collected by the Drainage Provision

The catchment collected by the terminal 600 mm U-channel is as shown in Appendix C. The catchment collected from the application site is given in **Appendix C**.

The CCTV report giving the condition of the underground pipe from the application site to the 300UC is presented in **Appendix B**. As some part of the pipe was broken, the pipes are to be reconstructed in the drainage proposal with Figure 1 in **Appendix A**.

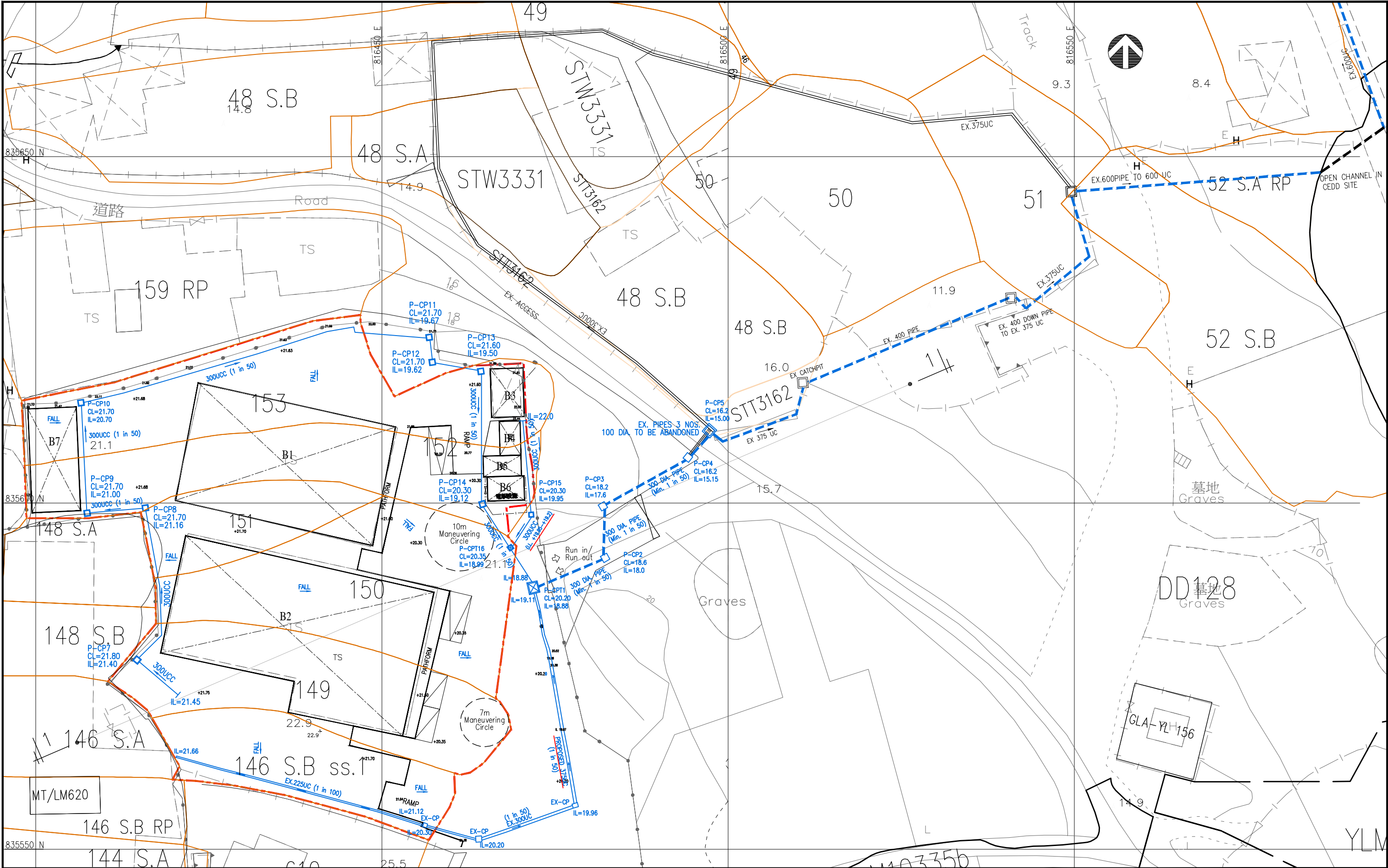
3. ASSESSMENT OF DRAINAGE CAPACITY

The drainage capacity within the application site is to be collected by existing 225UC falling 1 in 100 in the small part at the southern end, and 300UC falling 1 in 50 at the other parts. The runoff of 1 in 200 year return period rainstorm is calculated using rational method according to the TGN30 and latest Stormwater Drainage Manual, 2018. The checking is given in **Appendix C**.

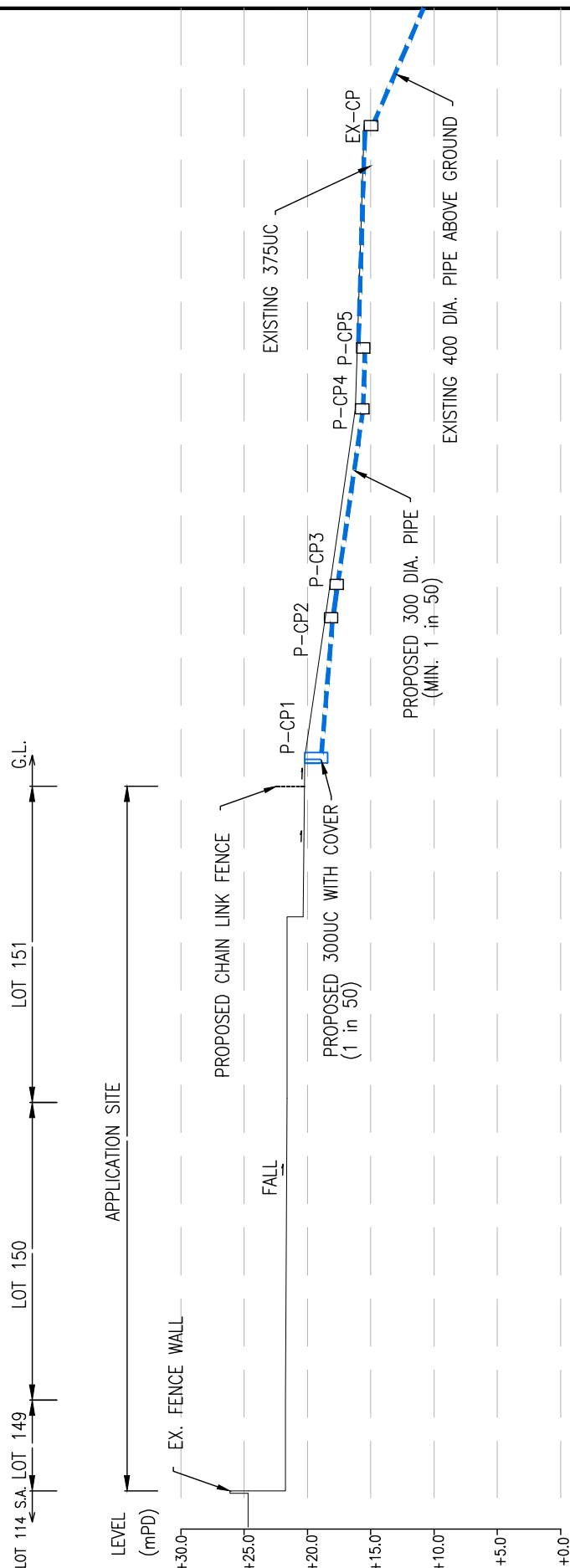
The capacity of the downstream U-channels are also checked in **Appendix C**. In view of the short term application, the increment for weather changes is not considered with the checking.

The capacity of the drainage system is found adequate.

Appendix A



Legends: Lot Boundary Line Application Site Boundary Line +22.9 Existing Spot Level (mPD)  Existing Gate Ex-CP Existing Catchpit CPT16 Proposed Catchpit with Trap CP7 Proposed Catchpit without Trap  Proposed 300mm U-Channel with cover (Fall 1 in 50) CL= Covered Level (mPD) IL= Invert Level (mPD)				Project : Proposed Temporary Warehouse (Excluding Dangerous Goods Godown) for a Period of 3 Years at Lot Nos. 146 S.B ss.1, 149, 150, 151, 152 & 153 in D.D.128, Ha Tsuen, Yuen Long, N.T.		Drawing Title : Site Layout Plan		Consultant :  Man Chi <u>Consultants And Construction Limited</u>	
				Drawing No. Figure 1		Date : Dec. 2023		Scale : 1 : 500	



SECTION 1-1

Project :

Proposed Temporary Warehouse (Excluding Dangerous Goods Godown)
for a Period of 3 Years at Lot Nos. 146 S.B. ss.1, 149, 150, 151,
152 & 153 in D.D.128, Ha Tsuen, Yuen Long, N.T.

Consultant :

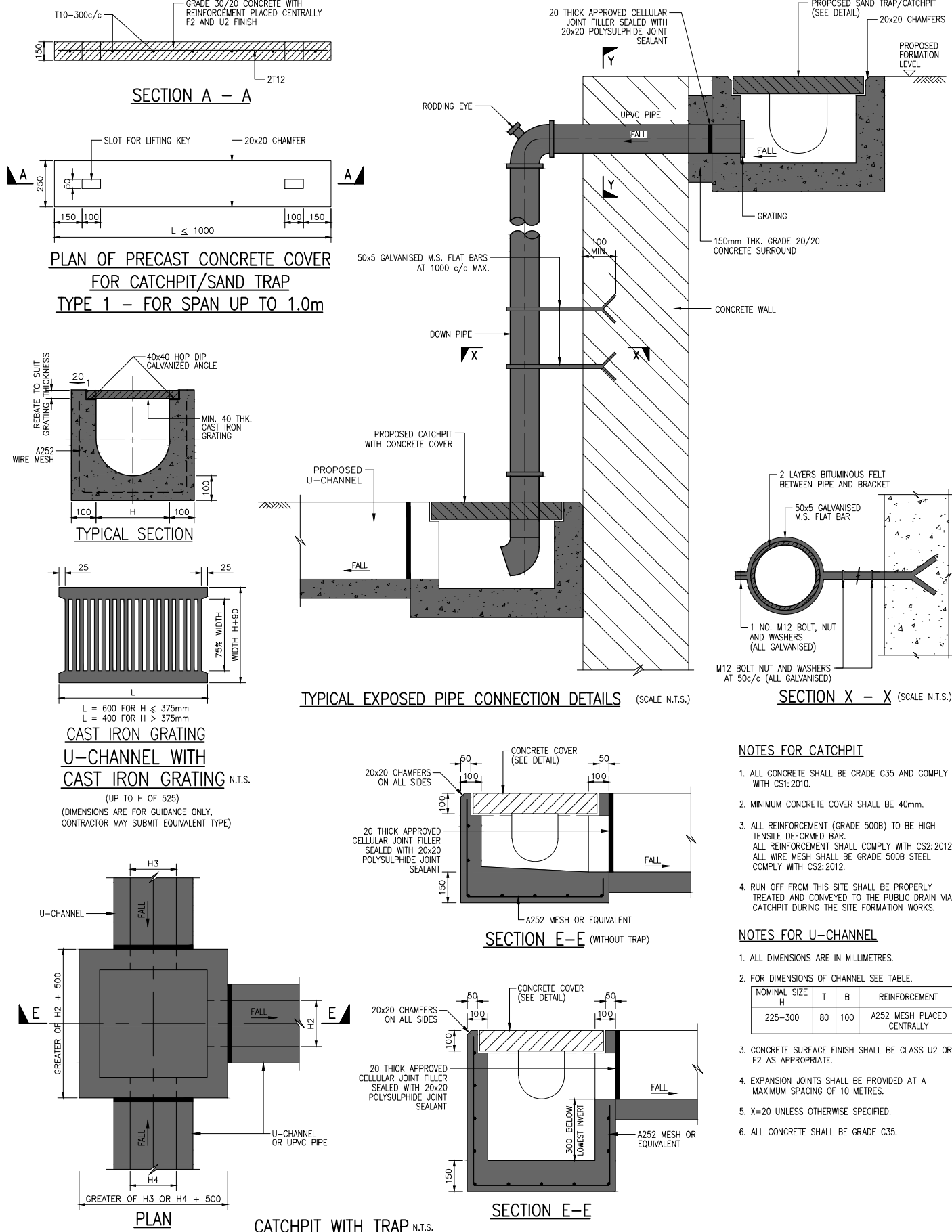
MC Man Chi
Consultants And Construction Limited

Drawing Title : Section

Drawing No. Figure 2

Date : Dec. 2023

Scale : 1:500



Project :
Proposed Temporary Warehouse
(Excluding Dangerous Goods Godown)
for a Period of 3 Years at Lot Nos.
146 S.B ss.1, 149, 150, 151, 152&153
in D.D.128, Ha Tsuen, Yuen Long, N.T.

Drawing Title :
Typical Details

Drawing No. Figure 3

Consultant :
MC Man Chi
Consultants And Construction Limited

Date : Aug. 2023 Scale : N.T.S.

Appendix B



啟 聲 渠 務 有 限 公 司

Initial Drainage Company Limited

**CCTV Inspection of
Existing Drainage
At**

Fung Kong Tsuen

Storm Water Pipe

CCTV Report

*Inspection Undertaken by
Initial Drainage Co., Ltd.
Address: P.O.Box 357
Yuen Long Delivery Office*

Tel No. : 2219 0119

Fax No. : 2219 0669

Email: initialdrainage@yahoo.com.hk

CCTV Survey Report

W.O. :
Location : Fung Kong Tsuen
Date of Survey : 13-Jan-23
Duty : Storm Water Pipe
Page : 1 to 4

W.O. :
Location : Fung Kong Tsuen
Date of Survey : January 13, 2023

Statement of Conformity

This is to certify that qualified personnel have under taken the coding for this Variation Order and reports are compiled in accordance with the contract specification, MSCC (**Manual of Sewer Condition Classification**) (Fourth Edition), SPM (**Standard Practice Manual**) and certified by the undersigned.

For and on behalf of



Mr. Cheung Chi Hung

Brisbane Water Training Centre Certificate No.SA NO. 22

Appendix A

CCTV Survey Results

啟聲渠務有限公司
Initial Drainage Company Limited
Fung Kong Tsuen

Recommended Remedial Action Sheet

Date of Survey: 13-Jan-2023

Serial No.	Sheet No.	Manhole No.		Faults					SRM Grade		Remedial Action Proposal
		From	To	Code	Description	%	Chainage		Struct	Serv	
1	1	CP1	CP2	B	Broken Pipe	at	16.65	m	4		Install Patch Lining
2	2	CP3	CP2	B	Broken Pipe	at	7.69	m	4		Install Patch Lining

W.O.					Survey Date:					13-Jan-23
Sheet No. : 1					DRAINAGE SCHEDULE					
Location : Fung Kong Tsuen										
Survey ID	MANHOLE NO:		PIPE		MANHOLE (FROM)				COMMENT	
	FROM	TO	LENGTH (m)	SIZE (mm)	MATERIAL	Stream	C.L	DEPTH (mm)		
1	CP1	CP2	18.14	200	PVC	DS				
2	CP3	CP2	8.79	200	PVC	US				
3	CP3	CP4	9.01	200	PVC	DS				
4	CP4	Outlet	6.15	100	PVC	DS				

Total: 42.09

W.O.																						
Sheet No.		: 1				COLOUR CCTV DRAINAGE SURVEY																
Location		: Fung Kong Tsuen																				
LOCATION						PIPE						SERVICE CONDITION						MISC				
Survey ID.	VIDEO	MANHOLE		Length	HOLE	CRACKED	FRACTURED	BROKEN	DEFORMED	COLLAPSED	JOINT DISPLACED	OPEN JOINT	ROOTS	INFILTRATION	ENCRUSTATION / SCALE	SILT	GREASE	OBSTRUCTION	DEBRIS	LINE	SURVEY ABANDONED	CAMERA UNDERWATER
		FROM	TO																			
1		CP1	CP2	18.14				1														
2		CP3	CP2	8.79				1														
3		CP3	CP4	9.01																		
4		CP4	Outlet	6.15																		
TOTAL =					0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0

GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5
			1	
			1	
0	0	0	2	0

W.O.

SHEET NO.: 1

PIPE SIZE :	200	mm	DATE:	13-Jan-23	REFERENCE:	
MATERIAL :	PVC		LOCATION :	Fung Kong Tsuen		
DUTY :	Foul		MANHOLE NO :	CP1	TO	CP2
SHAPE :	CIRCULAR		MANHOLE I.L. :	Down Stream		

[illegible]

Initial

CCTV SURVEY-PHOTOGRAPHIC SHEET

W.O.
Location : Fung Kong Tsuen

Sheet no. 01
Date : 13-Jan-23

CCTV Survey Photographs



PHOTO NO.: 001
MANHOLE NO.: CP1 to CP2
DIA/SIZE: 200 mm
CHAINAGE: 0.1 m
DESCRIPTION:

General Photograph

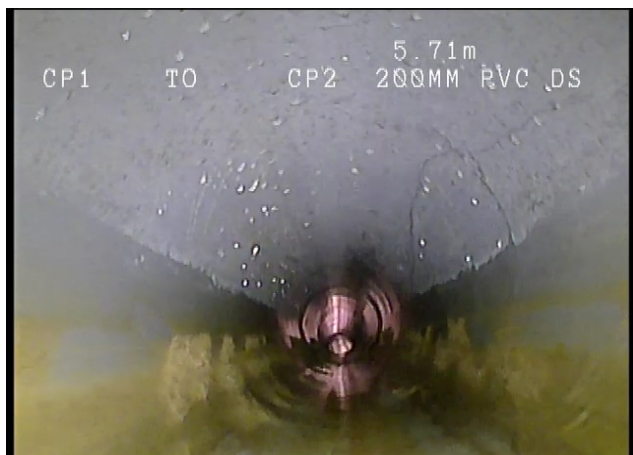


PHOTO NO.: 002
MANHOLE NO.: CP1 to CP2
DIA/SIZE: 200 mm
CHAINAGE: 5.71 m
DESCRIPTION:

General Photograph



PHOTO NO.: 003
MANHOLE NO.: CP1 to CP2
DIA/SIZE: 200 mm
CHAINAGE: 10.65 m
DESCRIPTION:

General Photograph

Initial

CCTV SURVEY-PHOTOGRAPHIC SHEET

W.O.
Location : Fung Kong Tsuen

Sheet no. 01
Date : 13-Jan-23

CCTV Survey Photographs

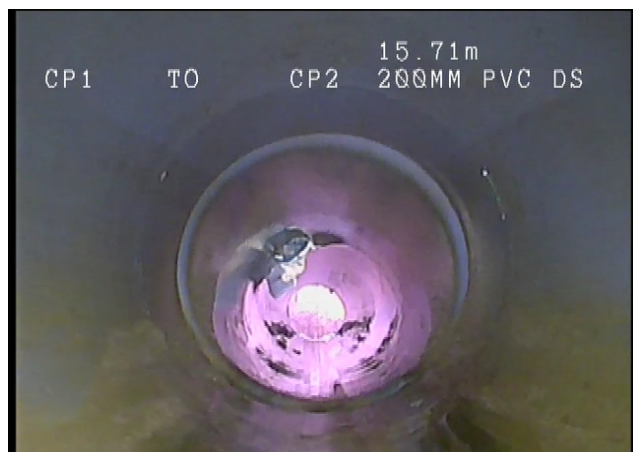


PHOTO NO.: 004
MANHOLE NO.: CP1 to CP2
DIA/SIZE: 200 mm
CHAINAGE: 15.71 m
DESCRIPTION:

General Photograph

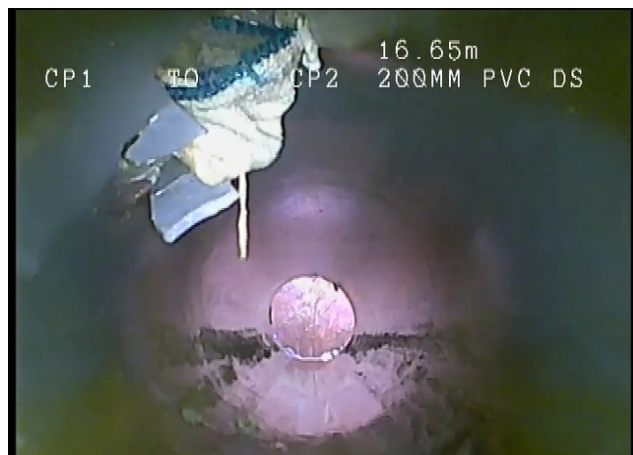


PHOTO NO.: 005
MANHOLE NO.: CP1 to CP2
DIA/SIZE: 200 mm
CHAINAGE: 16.65 m
DESCRIPTION:

Pipe broken from 10 o'clock to 12 o'clock.

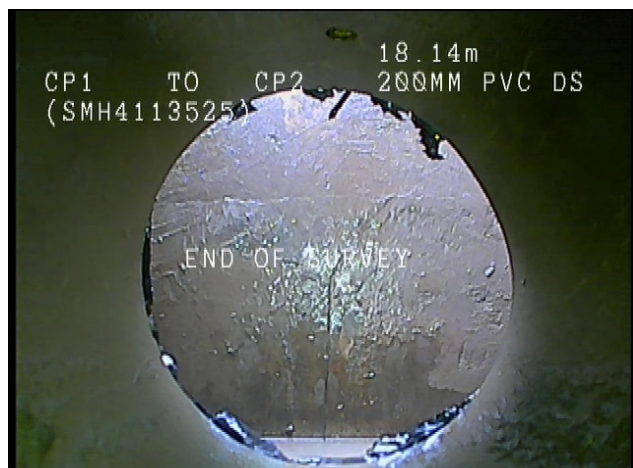


PHOTO NO.: 006
MANHOLE NO.: CP1 to CP2
DIA/SIZE: 200 mm
CHAINAGE: 18.14 m
DESCRIPTION:

Finish of Survey

CP2

W.O.

SHEET NO.: 2

PIPE SIZE :	200	mm	DATE:	13-Jan-23	REFERENCE:	
MATERIAL :	PVC		LOCATION :	Fung Kong Tsuen		
DUTY :	Foul		MANHOLE NO :	CP3	TO	CP2
SHAPE :	CIRCULAR		MANHOLE I.L. :	Up Stream		

[illegible]

Initial

CCTV SURVEY-PHOTOGRAPHIC SHEET

W.O.
Location : Fung Kong Tsuen

Sheet no. 02
Date : 13-Jan-23

CCTV Survey Photographs



PHOTO NO.: 007
MANHOLE NO.: CP3 to CP2
DIA/SIZE: 200 mm
CHAINAGE: 0 m
DESCRIPTION:

General Photograph



PHOTO NO.: 008
MANHOLE NO.: CP3 to CP2
DIA/SIZE: 200 mm
CHAINAGE: 5.27 m
DESCRIPTION:

General Photograph

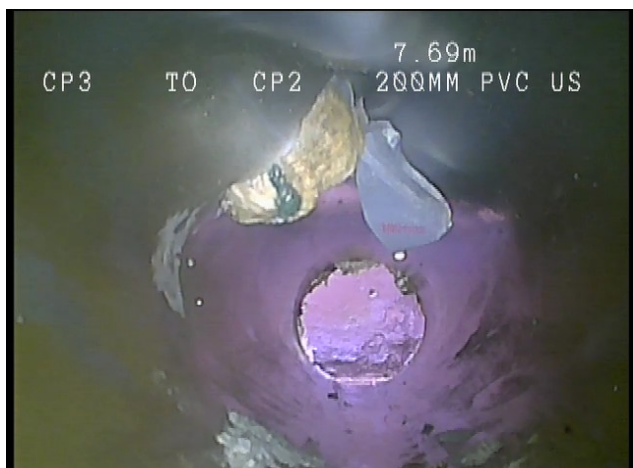


PHOTO NO.: 009
MANHOLE NO.: CP3 to CP2
DIA/SIZE: 200 mm
CHAINAGE: 7.69 m
DESCRIPTION:

Pipe broken from 10 o'clock to 12 o'clock.

W.O.

SHEET NO.: 3

PIPE SIZE :	200	mm	DATE:	13-Jan-23	REFERENCE:	
MATERIAL :	PVC		LOCATION :	Fung Kong Tsuen		
DUTY :	Foul		MANHOLE NO :	CP3	TO	CP4
SHAPE :	CIRCULAR		MANHOLE I.L. :	Down Stream		

[illegible]

Initial

CCTV SURVEY-PHOTOGRAPHIC SHEET

W.O.
Location : Fung Kong Tsuen

Sheet no. 03
Date : 13-Jan-23

CCTV Survey Photographs



PHOTO NO.: 010
MANHOLE NO.: CP3 to CP4
DIA/SIZE: 200 mm
CHAINAGE: 0 m
DESCRIPTION:

General Photograph



PHOTO NO.: 011
MANHOLE NO.: CP3 to CP4
DIA/SIZE: 200 mm
CHAINAGE: 5.6 m
DESCRIPTION:

General Photograph

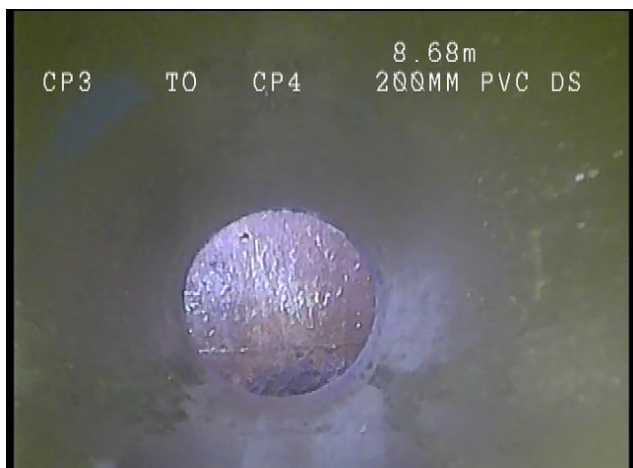


PHOTO NO.: 012
MANHOLE NO.: CP3 to CP4
DIA/SIZE: 200 mm
CHAINAGE: 8.68 m
DESCRIPTION:

General Photograph

W.O.

SHEET NO.: 4

PIPE SIZE :	100	mm	DATE:	13-Jan-23	REFERENCE:	
MATERIAL :	PVC		LOCATION :	Fung Kong Tsuen		
DUTY :	Foul		MANHOLE NO :	CP4	TO	Outlet
SHAPE :	CIRCULAR		MANHOLE I.L. :	Down Stream		

[illegible]

Initial

CCTV SURVEY-PHOTOGRAPHIC SHEET

W.O.
Location : Fung Kong Tsuen

Sheet no. 04
Date : 13-Jan-23

CCTV Survey Photographs



PHOTO NO.: 013
MANHOLE NO.: CP4 to Outlet
DIA/SIZE: 100 mm
CHAINAGE: 0.43 m
DESCRIPTION:

General Photograph

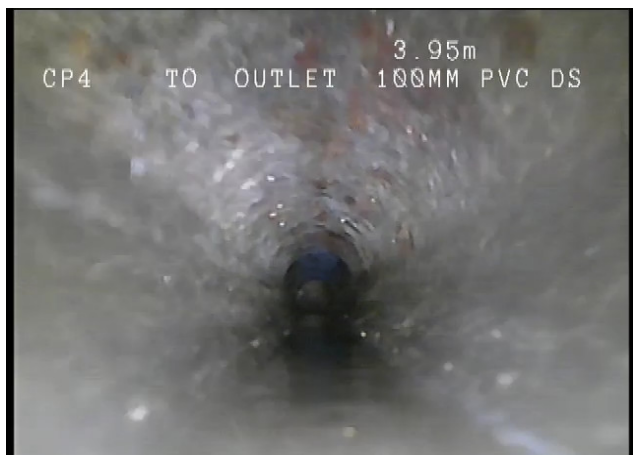


PHOTO NO.: 014
MANHOLE NO.: CP4 to Outlet
DIA/SIZE: 100 mm
CHAINAGE: 3.95 m
DESCRIPTION:

General Photograph

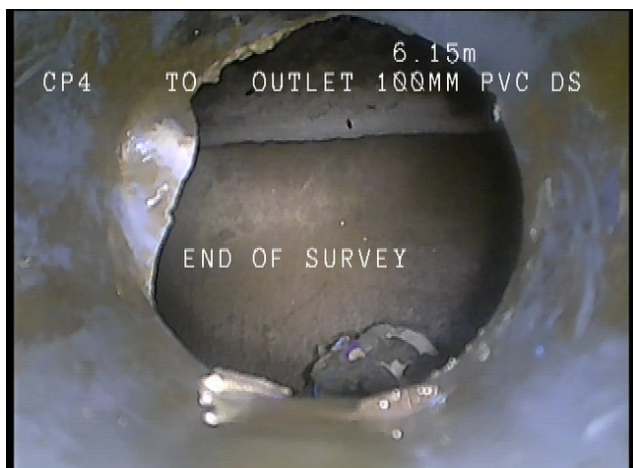


PHOTO NO.: 015
MANHOLE NO.: CP4 to Outlet
DIA/SIZE: 100 mm
CHAINAGE: 6.15 m
DESCRIPTION:

Finish of Survey

Outlet

Appendix B

Progress Photographs

Progress Photographs

Location: Fung Kong Tsuen

Date: 13-Jan-23



PHOTO 1



PHOTO 2



PHOTO 3



PHOTO 4

Appendix C

Sewer Condition Codes

STRUCTURAL DEFECTS - PIPE SEWERS (渠道結構的缺點)

Code	Description (說明)	Grade (分級)
B	Broken Pipe	4
BJ	Broken Pipe at Joint	4
BR	Branch (Major)	0
CC	Crack Circumferential	2
CCJ	Crack Circumferential at Joint	2
CL	Crack Longitudinal	2
CLJ	Crack Longitudinal at Joint	2
CM	Cracks Multiple	3
CMJ	Cracks Multiple at Joint	3
CN	Connection	0
CNI	Connection Intruding	4
CX	Connection Defective	4
CXI	Connection Defective Intruding	4
D	Deformation 5%	3
D	Deformation 10%	3
D	Deformation 15%	4
D	Deformation 20%	4
D	Deformation 25%	5
D	Deformation 30% or more	5
DC	Diameter Change	0
FC	Fracture Circumferential	3
FCJ	Fracture Circumferential at Joint	3
FL	Fracture Longitudinal	3
FLJ	Fracture Longitudinal at Joint	3
FM	Fractures Multiple	4
FMJ	Fractures Multiple at Joint	4
H	Hole	4
HSH	Hydrogen Sulphide Heavy	4
HSL	Hydrogen Sulphide Light	2
HSM	Hydrogen Sulphide Medium	3
JDL	Joint Displaced Large	3
JDM	Joint Displaced Medium	2

STRUCTURAL DEFECTS - PIPE SEWERS (渠道結構的缺點)

Code	Description (說明)	Grade (分級)
JN	Junction	0
JX	Junction Defective	4
LC	Lining Change	0
LD	Lining Deviates Down	0
LL	Lining Deviates Left	0
LR	Lining Deviates Right	0
LU	Lining Deviates Up	0
MC	Material Change	0
MH	Manhole/ node	0
OJL	Open Joint Large	3
OJM	Open Joint Medium	2
PC	Pipe Length Change	0
SC	Shape Change	0
SSS	Surface Damage Spalling Slight	2
SSM	Surface Damage Spalling Medium	3
SSL	Surface Damage Spalling Large	4
SWS	Surface Damage Wear Slight	2
SWM	Surface Damage Wear Medium	3
SWL	Surface Damage Wear Large	4
X	Collapse	5
FH	Finish of Survey	0
G	Gully	0

SERVICE DEFECTS - PIPE SEWERS (渠道服務的缺點)

Code	Description (說明)	Grade (分級)
CU	Camera Underwater	鏡頭潛水
DE	Debris (non-silt/grease)	垃圾碎 (非淤泥/油脂)
DEJ	Debris at Joint (non-silt/grease)	垃圾碎在接口位 (非淤泥/油脂)
DEG	Debris Grease 5%	垃圾碎, 油脂 5%
DEG	Debris Grease 5%-20%	垃圾碎, 油脂 5%-20%
DEG	Debris Grease 20%+	垃圾碎, 油脂 20%+
DEGJ	Debris Grease at Joint 5%	垃圾碎, 油脂在接口位 5%
DEGJ	Debris Grease at Joint 5%-20%	垃圾碎, 油脂在接口位 5%-20%
DEGJ	Debris Grease at Joint 20%+	垃圾碎, 油脂在接口位 20%+
DES	Debris Silt 5%	沙石, 淤泥 5%
DES	Debris Silt 5%-20%	沙石, 淤泥 5%-20%
DES	Debris Silt 20%+	沙石, 淤泥 20%+
DESJ	Debris Silt at Joint 5%	沙石, 淤泥在接口位 5%
DESJ	Debris Silt at Joint 5%-20%	沙石, 淤泥在接口位 5%-20%
DESJ	Debris Silt at Joint 20%+	沙石, 淤泥在接口位 20%+
EH	Encrustation Heavy	嚴重凝結物
EHJ	Encrustation Heavy at Joint	嚴重凝結物在接口位
EL	Encrustation Light	輕微凝結物
ELJ	Encrustation Light at Joint	輕微凝結物在接口位
EM	Encrustation Medium	中度凝結物
EMJ	Encrustation Medium at Joint	中度凝結物在接口位
ESH	Encrustation Scale Heavy	嚴重鐵銹
ESL	Encrustation Scale Light	輕微鐵銹
ESM	Encrustation Scale Medium	中度鐵銹
FH	Finish Survey	探測完成
GO	General Observation	一般觀察點
GP	General Photograph	一般相片點
ID	Infiltration Dripper	渠筒內發現有滴水
IDJ	Infiltration Dripper at Joint	在接口位有滴水
IG	Infiltration Gusher	渠筒內發現有水湧出
IGJ	Infiltration Gusher at Joint	在接口位有水湧出
IR	Infiltration Runner at Joint	渠筒內發現有水流
IRJ	Infiltration Runner at Joint	在接口位有水流

SERVICE DEFECTS - PIPE SEWERS (渠道服務的缺點)

Code	Description (說明)	Grade (分級)
IS	Infiltration Seep	渠筒內發現有水滲出
ISJ	Infiltration Seep at Joint	滲漏在接口位
OB	Obstruction 100%	阻塞物
OBJ	Obstruction at Joint	阻塞物在接口位
R	Remarks	註解
RF	Roots Fine	樹根鬚
RFJ	Roots Fine at Joint	樹根鬚在接口位
RM	Roots Mass 5%	樹根堆 5%
RM	Roots Mass 5%-20%	樹根堆 5%-20%
RM	Roots Mass 20%+	樹根堆 20%+
RMJ	Roots Mass at Joint 5%	樹根堆在接口位 5%
RMJ	Roots Mass at Joint 5%-20%	樹根堆在接口位 5%-20%
RMJ	Roots Mass at Joint 20%+	樹根堆在接口位 20%+
RT	Roots Tap	樹根束
RTJ	Roots Tap at Joint	樹根束在接口位
RS	Repaired Section	補渠位置
SA	Survey Abandoned	探測終止
ST	Start of Survey	開始進行探測
V	Vermin	渠道內發現有老鼠
WL	Water Level	水位

REMARK COMMENT (建議方法)

Code	Description (說明)
HJ	HIGH PRESSURE JETTING(10000 PSI)
RL	RELINING
RP	REPLACEMENT
UTO	Unable to open
UTS	Unable to Survey
S	Start
C	Continue
F	Finish

高壓通渠(10000 磅)
 加裝纖維渠筒
 更換渠筒
 井蓋未能開啟
 未能檢測
 開始
 繼續
 完

Notes on CCTV Sewer Survey

GRADING SYSTEM

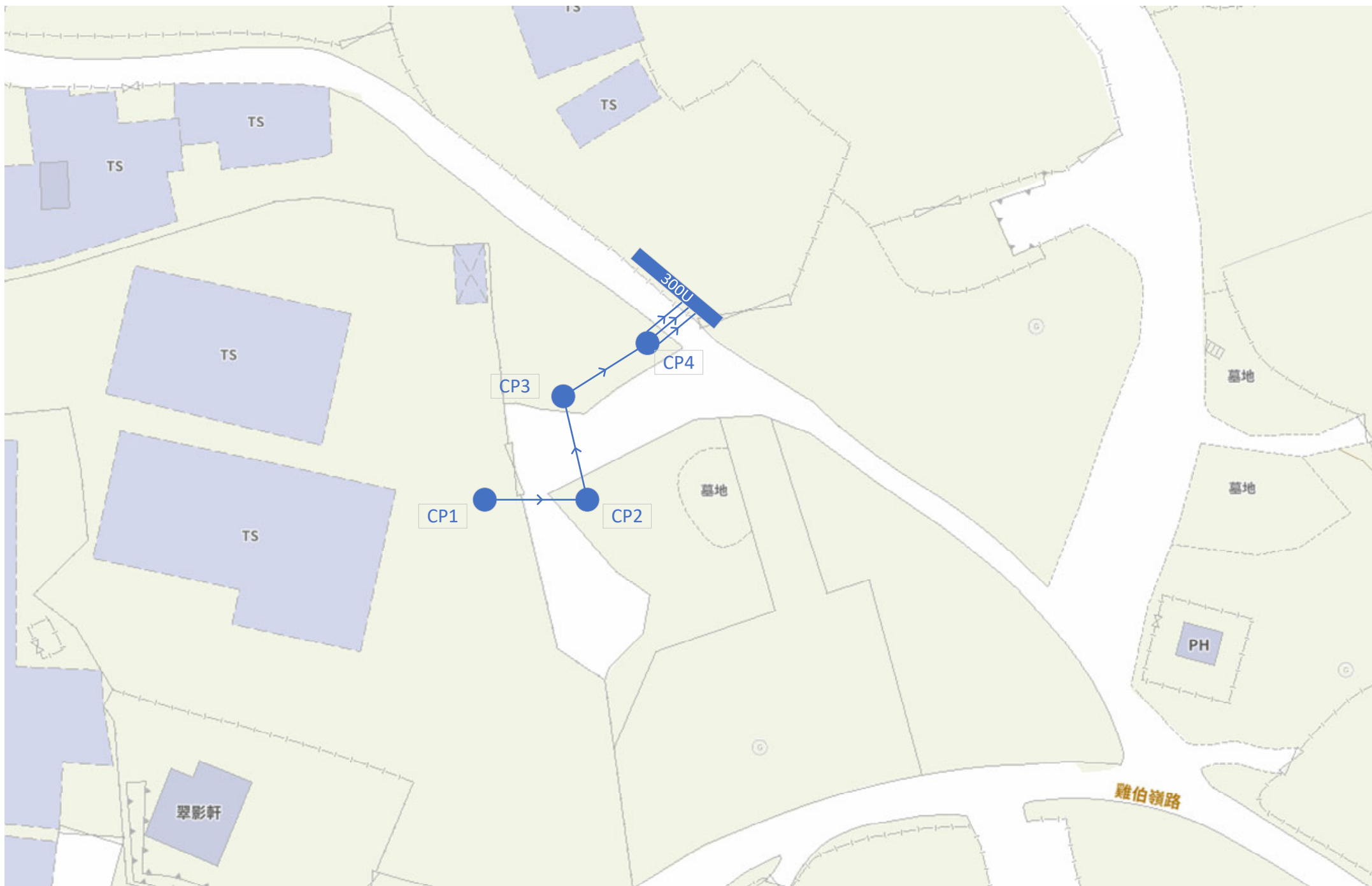
Each pipeline has a sewer grade after CCTV survey

The highest grade of each pipeline in the survey would be the action level of it.

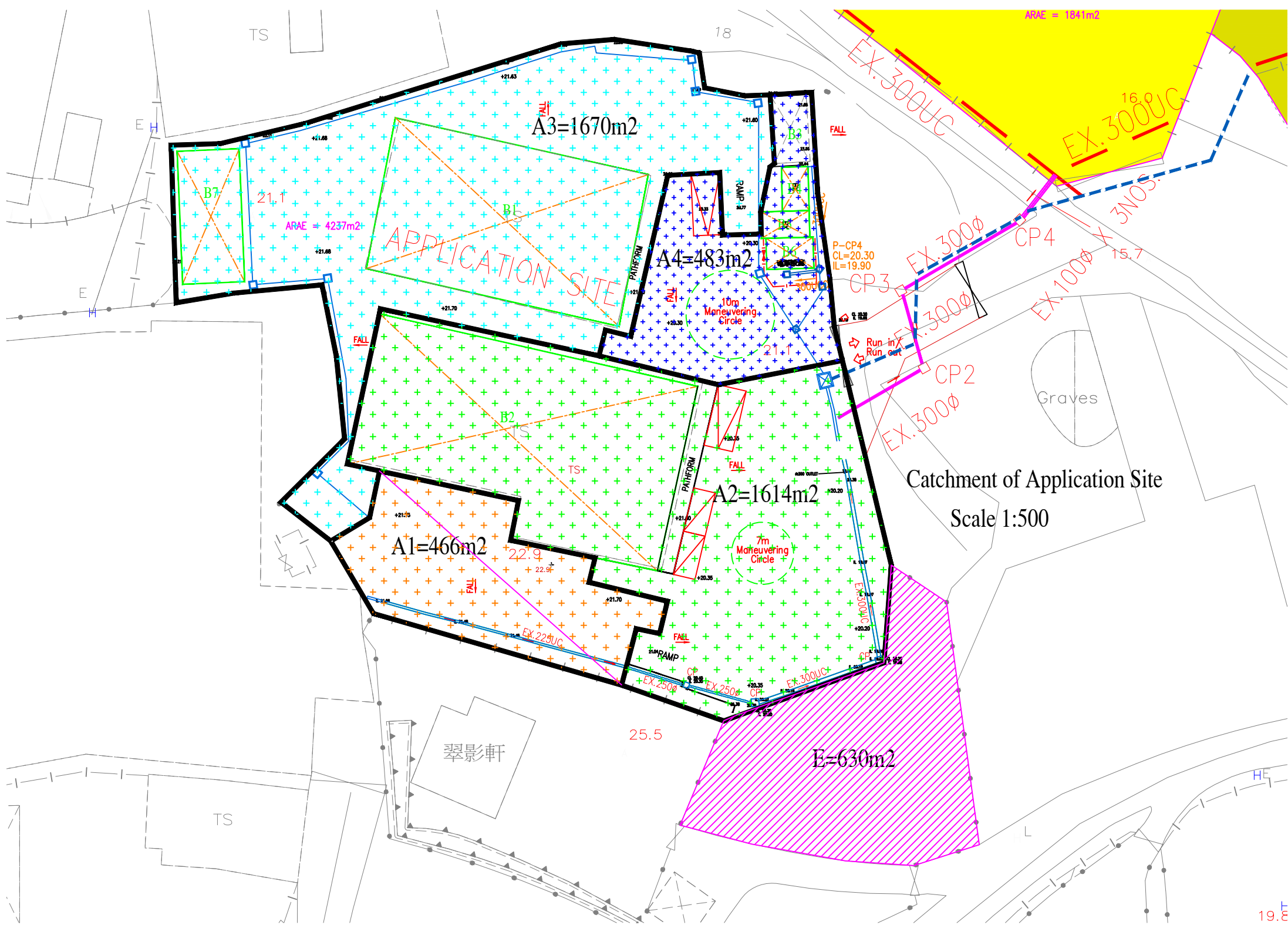
Grade 0	No defect was found
Grade 1	Normal Condition
Grade 2	Acceptable condition
Grade 3	Need to consider the area surrounding the sewer and the probability of environmental impact if no action taken
Grade 4	Fairly urgent, look at the sewer briefly, engineering and environmental improvement are needed
Grade 5	Urgent, look at the sewer, and add engineering and environmental improvements immediately

Appendix D

Site Layout Plan



Appendix C



Calculation of U-channel capacity within Application Site

Catchment ID	Area (m ²)	Run-off Coefficient	Longest Flow Path L (m)	Highest Catchment Level (mPD)	Outlet Level (mPD)	δh (m)	Drop in 100m H m per 100m	Time of Entry t _e (min)	U-channel Length w (m)	Assumed Velocity v (m/sec)	Time of Flow t _f (min)	Time of Concentration T _c (min)	Rainfall Intensity (TGN 30) (mm/hr)	Peak Runoff Q (litre/min)	Highest U-channel End (mPD)	Gradient (1 in)
A1	466	0.9	36	21.75	21.7	0.05	0.14	4.181	30	2	0.250	4.431	372	2600	-	-
A2	1614	0.9	61.5	21.75	19.97	1.78	2.89	3.436	90	2	0.750	4.186	377	9127	-	-
A3	1670	0.9	68	21.75	20.77	0.98	1.44	4.353	83	2	0.692	5.045	362	9068	-	-
A4	483	0.9	29	21.65	21.1	0.55	1.90	1.989	82	2	0.683	3.000	402	2912	-	-
E	630	0.9	66	25.5	20.2	5.3	8.03	3.304	86	2	0.717	4.020	380	3591	-	-
Total	4863															

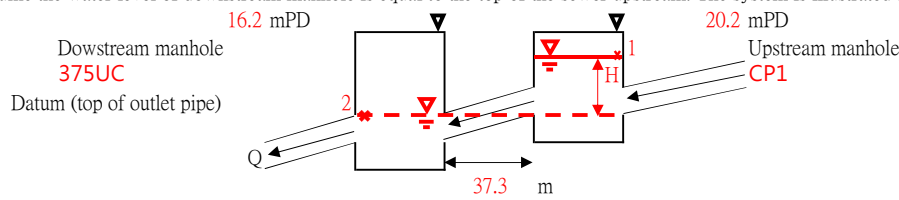
Collect Area	Total Peak Run-off (litre/min)	Required Pipe/Channel	Channel Capacity (litre/min)	Velocity in Chart	
Catchment A1	2600	225UC 1 in 100	3800	1.35m/sec	OK
Catchment A1+A2+E	15318	375UC 1 in 50	20000	2.75m/sec	OK
Catchment A3+A4	11981	300UC 1 in 50	12000	2.4m/sec	OK
Catchment A1+A2+A3+A4 +E	27299	375UC 1 in 25	30000	4m/sec	OK
		600 Dia. Pipe		5.6m/sec <6m/sec	OK

Fall from +11.9 to +9.3 within 50m (Fall 1 in 20)

Refer separate page

Checking 300 mm Pipe Capacity from site

Assume the water level of downstream manhole is equal to the top of the sewer upstream. The system is illustrated as below:-



Ground level (upstream):	21.1 mPD	Downstream invert lev:	15 mPD
Pipe Dia.:	300 mm	Datum lev.:	15.3 mPD
Cross-section area:	0.0706858 m ²	Design flow rate:	0.455 m ³ /s
Length of pipe:	37.3 m	FOS against overflow:	1
		Factored flow rate:	0.455 m ³ /s
		Mean velocity of flow:	6.437 m/s

Water Level in Downstream Manhole = 11.90 mPD

Head loss Calculation

Hydraulic dia of pipe (D _h):	0.3 m	Reynold's Number, Re: VD/v:	1931100
Kinematic viscosity of sewage(v):	1.00E-06 m ² /s	Roughness (ε):	0.00015 m
Mean velocity of flow(V):	6.437 m/s		

By Colebrook White Equation

$$\frac{1}{\sqrt{f}} = -2 \log \left(\frac{\epsilon}{3.7 D_h} + \frac{2.51}{Re \sqrt{f}} \right)$$

by try and error method:

Let

$$\frac{1}{\sqrt{f}} = 7.730149 \quad 7.676171 \quad 7.67659 \quad 7.676587 \quad 7.676587 \quad 7.676587$$

$$-2 \log \left(\frac{\epsilon}{3.7 D_h} + \frac{2.51}{Re \sqrt{f}} \right) = 7.730149 \quad 7.676171 \quad 7.676591 \quad 7.676587 \quad 7.676587 \quad 7.676587$$

Therefore:

$$\frac{1}{\sqrt{f}} = 7.676587$$

and Darcy friction coefficient, f= 0.016969

Assume entrance loss coefficient

Entrance loss (kent): 0.42237 m

Exist Loss (kexit): 0.84474 m

By Darcy-werebach equation, total head loss (h_{fo})= (fL/D_h)*v²/2g++kent+kexit = 5.723

Total head at each point:

Pressure head at point 1 (P1): 0 m Pressure head at point 1 (P2): 0 m

Velocity head at point 1 (V1): 0 m Velocity head at point 1 (V2): 0 m

Elevation head at point 1 (Z1): H m Elevation head at point 1 (Z2): -3.40 m

By Bernoulli equation includes head loss:

$$(P_1/\rho g + V_1/2g + Z_1) - (P_2/\rho g + V_2/2g + Z_2) = h_{fo}$$

$$(0+0+H)-(0+0+3.4) = 5.723 \text{ m}$$

$$H = 2.323 \text{ m} \quad (17.623 \text{ mPD})$$

Water Top Level at Upstream Manhole = 17.623 mPD

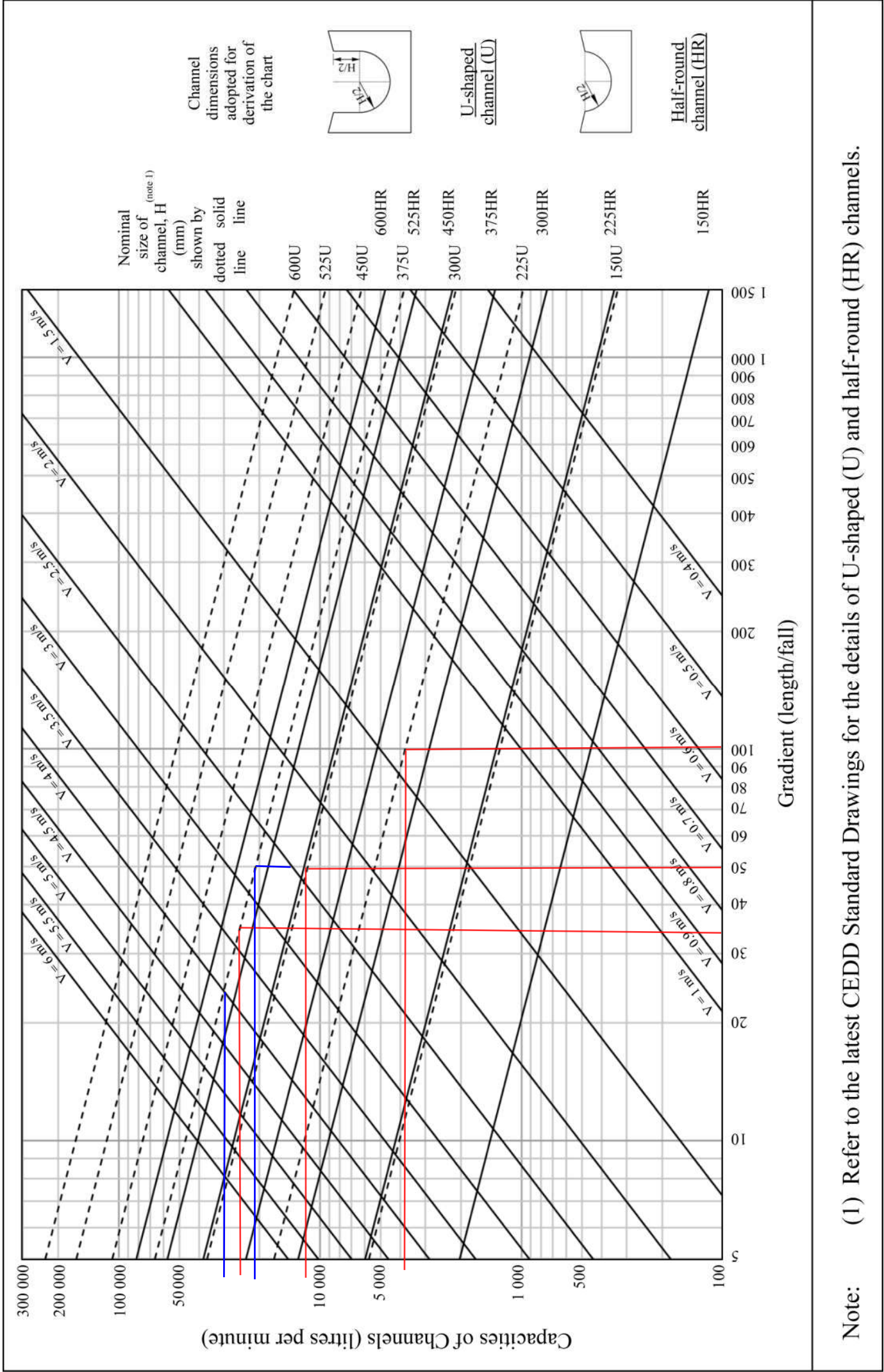
Freeboard = 2.577 m

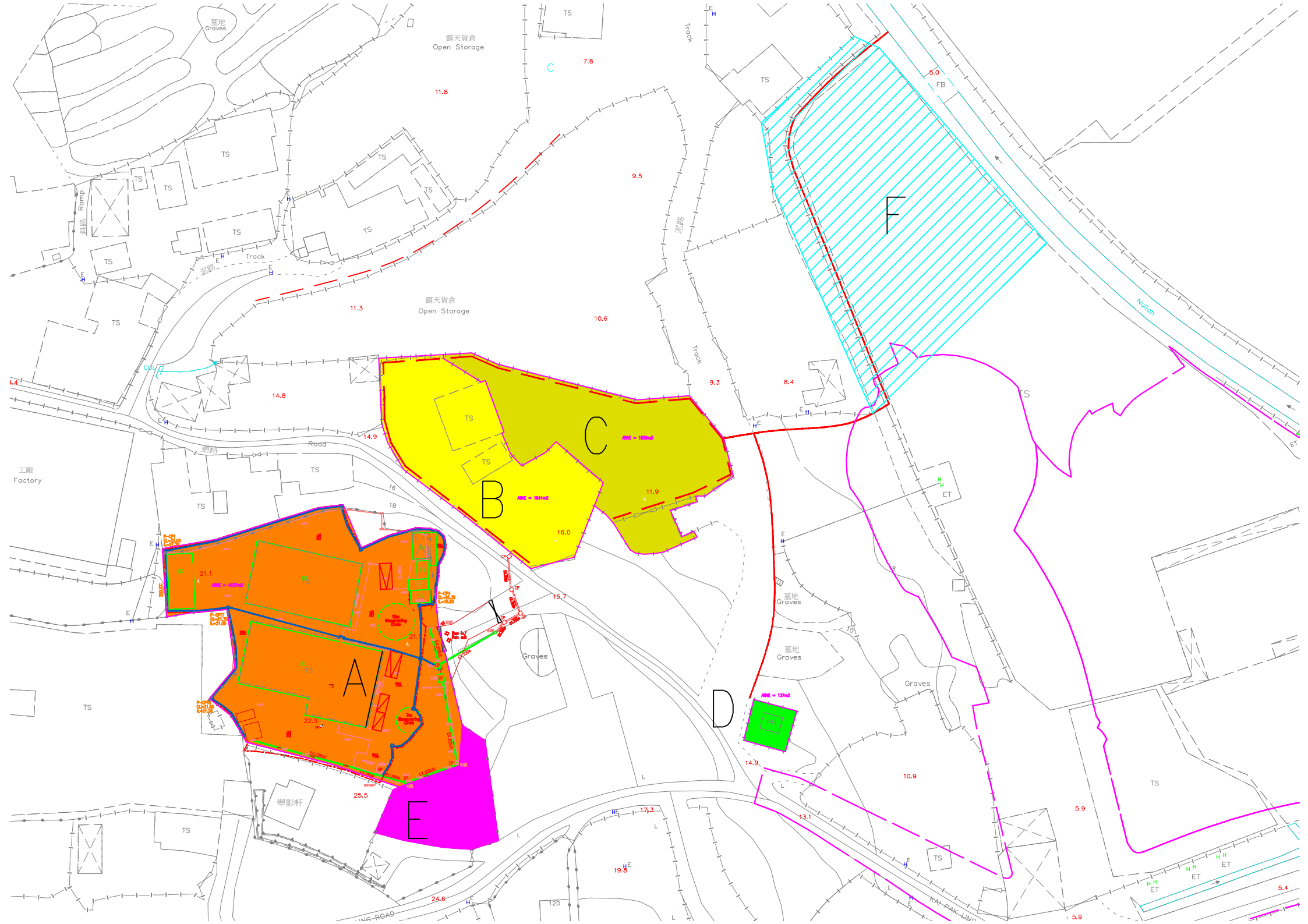
lower than than 18.8 mPD OK

GEO Technical Guidance Note No. 43 (TGN 43)
Guidelines on Hydraulic Design of U-shaped and Half-round Channels on Slopes

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





Calculation of U-channel capacity with Catchment Areas

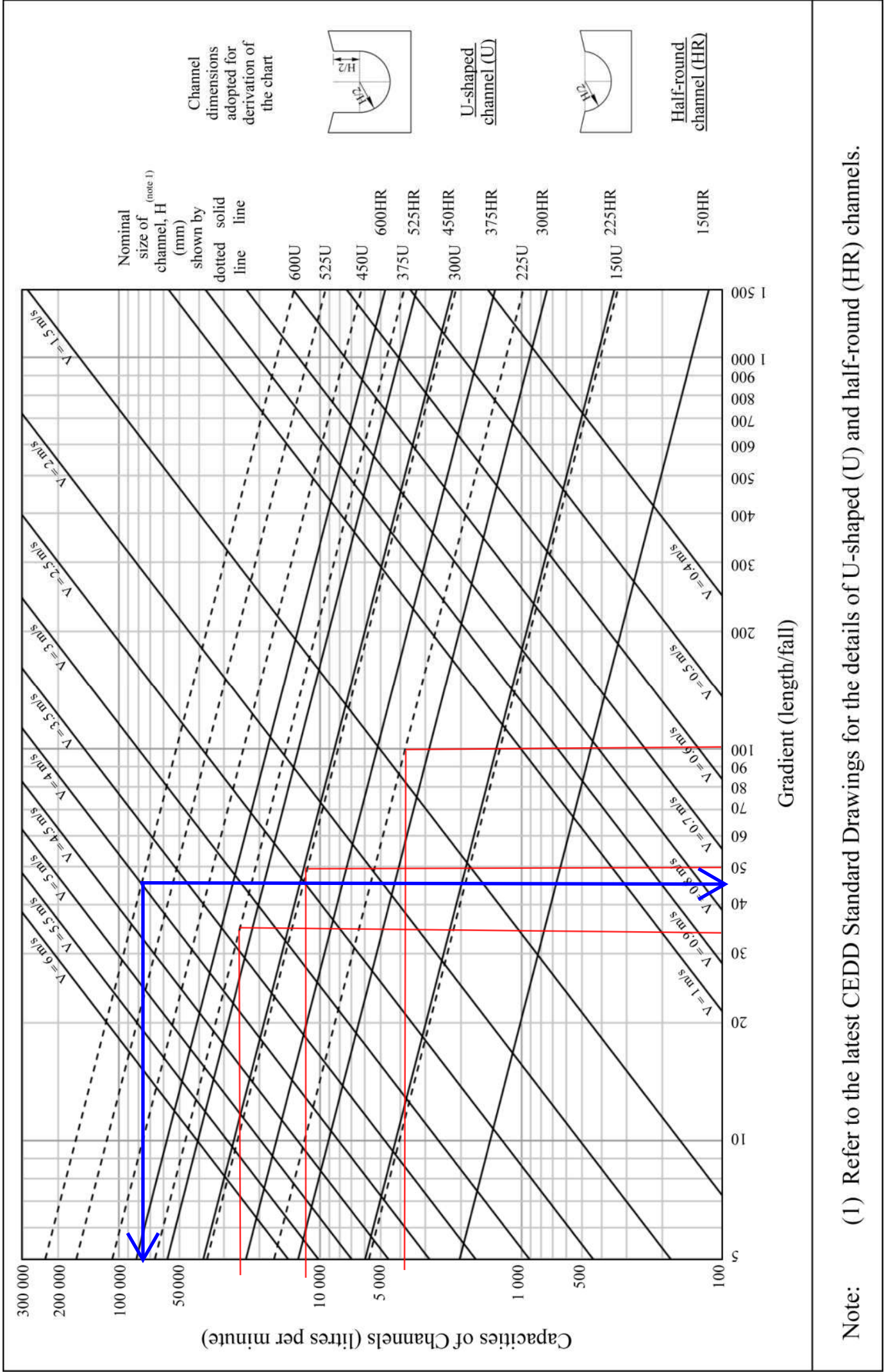
Catchment ID	Area (m2)	Run-off Coefficient	Longest Flow Path L (m)	Highest Catchment Level (mPD)	Outlet Level (mPD)	δh (m)	Drop in 100m H (m per 100m)	Time of Entry t_e (min)	U-channel Length w (m)	Assumed Velocity v (m/sec)	Time of Flow t_f (min)	Time of Concentration T_c (min)	Rainfall Intensity (TGN 30) (mm/hr)	Peak Runoff Q (litre/min)	Highest U-channel End (mPD)	Gradient (1 in)
A	4233	0.9	140	22.9	18.8	4.1	2.93	7.087	240	2	2.000	9.087	311	19747	-	-
B	1841	0.9	65	16	14.8	1.2	1.85	3.922	90	2	0.750	4.672	368	10162	-	-
C	1839	0.9	36	14.8	9.3	5.5	15.28	1.423	83	2	0.692	2.115	402	11089	-	-
D	137	0.9	15	14.9	14.8	0.1	0.67	1.439	82	2	0.683	2.122	402	826	-	-
E	630	0.9	66	25.5	20.2	5.3	8.03	3.304	86	2	0.717	4.020	380	3591	-	-
F	4165	0.9	110	8.4	5	3.4	3.09	5.517	120	2	1.000	6.517	340	21242	-	-

Collect Area	Total Peak Run-off (litre/min)	Provided Pipe/Channel	Channel Capacity (litre/min)	Velocity in Chart	
A+B+C+D +E+F	66657	600UC 1 in 45	75000	4m/sec	OK

GEO Technical Guidance Note No. 43 (TGN 43)
Guidelines on Hydraulic Design of U-shaped and Half-round Channels on Slopes

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



Appendix D

Responses to DSD's Comments Dated 4.10.2023

DSD Comment	Our response to DSD's Comments
(i) We note that the applicant will coordinate with the Civil Engineering and Development Department (CEDD)'s contractor to verify the location of existing drainage facility, which may be located in CEDD's site and is part of the proposed discharge path from the application site. Please note that the existing drainage facility should be identified to demonstrate its presence.	The existing 600mm pipe is terminated at the CEDD site, and discharged to the existing 600UC as shown in the drainage proposal plan (Figure 1 of Appendix A). The record photos are presented with Plates 4a, 4b, and Plates 5a, 5b, 5c, 5d in the report text.
(ii) Based on the site photos submitted, it is noted that some surface channels, such as those indicated in record plate items 7 to 9 of Section 2.1, are covered with debris. Please carry out necessary maintenance works and provide updated site photos to demonstrate the existing condition of channels. The applicant is reminded to identify the owner of the existing facilities and obtain consent from the owner prior to commencement of the proposed works.	The debris was cleaned are presented in the new photo. The owner of the existing facilities has been identified and maintenance work has been carried out. The works in the private lots was also found existing (375 UC and 400 pipes above ground). Full consents has been obtained from the owner for the use of the facilities. The record photos are presented with Plates 4a, 4b, and Plates 5a, 5b, 5c, 5d in the report text.
(iii) Appendix A: As stipulated in Section 11.10 of the Stormwater Drainage Manual published by the Drainage Services Department, backdrop manholes should be used at catchpit P-CPT16 where the level difference between the proposed connection invert level and outlet invert level is greater than 600mm.	Noted. The invert level difference is reduced to less than 600mm.

(iv) Appendix D: According to item (i) of the R-to-C, please clarify whether the rigid fence wall are within the boundary of application site. Please note that items (x) to (xii) of our previous comments dated 2.12.2022(and stated in letter to you dated 5.12.2022) are still valid. Adequate opening should be provided at the existing fence wall within the application site to intercept the existing overland flow passing through the site. As such, external catchment shall be considered in the calculation.	Noted. The addition catchment E (external catchment) from the upper lot is added to the calculation. The proposed surface channel is changed to 375UC from 300UC accordingly.
(v) Appendix D: According to item (iii) of the R-to-C, example provided in our previous comment is only for your reference. It is noted that gradients of several u-channels, including those proposed to be in gradient of min. 1 in 50, are still found too steep. Please review the proposed drainage system and consider using step channel or downpipe for such connections. Please note that the velocity of flow at u-channel should not exceed the maximum permissible velocity of 4m/s as stipulated in Section 5.1 of GEO Technical Guidance Note No. 43 (TGN 43).	Noted. The flow velocity of u-channel is limited to less than 4m/sec.