

Appendix I
Drainage Impact Assessment

Sum Wui Investment Limited

Proposed Temporary Open Storage of Construction Materials and Machinery with Ancillary Facilities and Associated Filling of Land for a Period of 3 Years at Various Lots in D.D. 128 Pak Nai, Yuen Long, New Territories

Drainage Impact Assessment



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Issue 3

July 2025

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**Proposed Temporary Open Storage of Construction Materials and Machinery with Ancillary
Facilities and Associated Filling of Land for a Period of 3 Years at Various Lots in D.D. 128
Pak Nai, Yuen Long, New Territories**

Drainage Impact Assessment

Approved for Issue by:	
	
Position:	<u>Deputy Managing Director</u>
Date:	<u>22 July 2025</u>

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Proposed Temporary Open Storage of Construction Materials and Machinery with Ancillary Facilities and Associated Filling of Land for a Period of 3 Years at Various Lots in D.D. 128 Pak Nai, Yuen Long, New Territories

Drainage Impact Assessment

Issue	Prepared by	Reviewed by	Date
1	EM	BLE	13 June 2024
2	EM	BLE	17 Dec 2024
3	EM	BLE	11 July 2025

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Content

1.0	Introduction	1
2.0	Existing Site Condition.....	2
3.0	Design Methodology and Assumptions.....	3
4.0	Drainage Design	6
5.0	Conclusion.....	7

List of Appendix

Appendix A: Drawing
Appendix B: Design Calculation
Appendix C: Site Photos

List of Tables

Table 3-1: Runoff Coefficient
Table 3-2: Minimum Pipeline Cover and Manhole Spacing Requirements
Table 3-3: Storm Constant for SDM

Abbreviations

D.D. Demarcation District
DSD Drainage Services Department
SDM Stormwater Drainage Manual



1.0 Introduction

- 1.1 This submission presents the drainage design for Proposed Temporary Open Storage of Construction Materials and Machinery with Ancillary Facilities and Associated Filling of Land for a Period of 3 Years at Various Lots in D.D. 128 Pak Nai, Yuen Long, New Territories.
- 1.2 Previous Drainage Impact Assessment of the captioned site was prepared in 2023. The application for permission under Section 16 of the Town Planning Ordinance was approved in Feb 2024 while the approval condition on the submission of drainage proposal was also approved in Feb 2025.
- 1.3 The Site area is about 9,938m². After development, the paving of the site remains as soil and asphalt for open storage of construction materials and machinery, site office and guard room with total GFA of about 60 m².
- 1.4 Mannings (Asia) Consultants Limited (MACL) was commissioned by Sum Wui Investment Limited to undertake the drainage impact assessment for the proposed development.
- 1.5 In this connection, the assessment has been conducted in order to assess the adequacy of the proposed drainage system.



2.0 Existing Site Condition

- 2.1 The application site area is paved with soil and asphalt. The soil area is about 2,999 m² and the asphalt area is about 6,939m². Site photos are shown in **Appendix C**.
- 2.2 There is an existing natural stream right in the eastern side of the site. The critical size of the natural stream is about 4m wide and 2m high. The area in south outside the site flow toward the site and discharge to the natural stream. The total catchment area is 19,677m². Catchment Plan is shown in **Appendix A**.



3.0 Design Methodology and Assumptions

Design Code

3.1 The below design codes are to be followed for this design assessment:

- Stormwater Drainage Manual (DSD) - Fifth Edition, January 2018;
- Stormwater Drainage Manual (DSD) - Corrigendum No. 1/2022;
- Stormwater Drainage Manual (DSD) - Corrigendum No. 1/2024;
- Stormwater Drainage Manual (DSD) - Corrigendum No. 2/2024;
- BS 5911 Code of Practice for Precast Concrete Pipe Design
- DSD Standard Drawings

Design Parameters

3.2 Design Parameters

a) Runoff Coefficient

Table 3-1 Runoff Coefficients

Surface Characteristic	Runoff Coefficient, C
Concrete	0.95
Asphalt	0.70
Grassland (heavy soil**) Flat	0.25
Roofing	1.00

Roughness Coefficient for pipe flow $k_s = 3$

b) Minimum Pipeline Cover and Manhole Spacing Requirements

Table 3-2 Minimum Pipeline Cover and Manhole Spacing Requirements

Minimum pipeline cover	
In Roads	0.9 m
In footways and verges	0.45 m
Manhole spacing requirements	
D < 675 mm	80 m
675 < D < 1050	100 m
D > 1050	120 m

c) Bedding factors

- Granular bedding : 1.9
- Plain concrete bedding : 2.6
- Reinforced concrete bedding with allowance for minimum steel area : 3.4
- Concrete Surround : 4.5



d) Design Flow Velocity

- Minimum : 1 m/s
- Maximum : 3 m/s (desirable)
: 6 m/s (absolute)

3.3 The return period of 1 in 10 years is to be adopted for the drainage impact assessment.

3.4 Description of Analysis Method

- a) Rational method is to be adopted for calculation of the peak runoff. The formula is extracted from Section 7.5.2(a) of Stormwater Drainage Manual (SDM) which is to estimate the stormwater runoff as shown below:

$$Q_p = 0.278 CiA$$

Where

Q_p	= peak runoff in m^3/s
C	= runoff coefficient (dimensionless)
i	= rainfall intensity in mm/hr
A	= catchment area in km^2

- b) 10% reduction of the flow area is allowed taken into account of the decomposition of siltation as per DSD's SDM 2018.
- c) The time of concentration used for determining the duration of the design storm is considered by the time of entry and the time of flow,

$$t_c = t_e + t_f \quad t_f = L/V$$

- d) where t_o = inlet time (time taken for flow from the remotest point to reach the most upstream point of the urban drainage system)

Where

t_f	= flow time
L	= Length of drain
V	= flow velocity

- e) The time of entry or time of flow in the hinterland is calculated using the Bransby William's Equation.

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

Where

t_e	= time of concentration (min)
L	= catchment length (m)
A	= catchment area (m^2)
H	= average catchment slope (m/100m)



- f) The rainfall intensity is extracted from the Section 4.3.2 of SDM which is to estimate the Intensity-Duration –Frequency (IDF) Relationship.

$$i = a / (t_d + b)^c$$

Where I = extreme mean intensity in mm/hr
 t_d = duration in minutes ($t_d < 240$), and
 a, b, c = storm constants given in table 3a of SDM Corrigendum No. 1/2024 as below

Table 3-3 Storm Constant of SDM (HKO Headquarters)

Return Period T (years)	10
a	485
b	3.11
c	0.397

- g) Colebrook-White Equation is used in hydraulic design for pipe flow.

$$V = -\sqrt{(32gRs)} \log \left(\frac{k_s}{14.8R} + \frac{1.255v}{R\sqrt{(32gRs)}} \right)$$

Where:

V = mean velocity (m/s)
 g = gravitational acceleration (m/s^2)
 R = hydraulic radius (m)
 D = pipe diameter (m)
 k_s = equivalent sand roughness (m)
 v = kinematic viscosity of fluid (m^2/s)
 s = frictional slope (energy gradient due to frictional loss)



4.0 Drainage Design

- 4.1 The proposed drainage system consists u-channels and underground pipes as shown in **Appendix A**. Flow from the catchment area will be collect by the proposed U-channels and discharge to an existing natural stream (critical size of the natural stream is about 4m wide and 2m high) at the eastern side of the site.
- 4.2 The drainage system is proposed to have sufficient capacity to cater the flow from the catchment area. The calculation is presented in **Appendix B**.
- 4.3 The flow from the catchment area will be collected by the proposed drainage system and be discharged to the existing stream at the eastern side of the site. Since the paving condition of the application site remain unchanged, no additional flow is anticipated to flow to the stream.



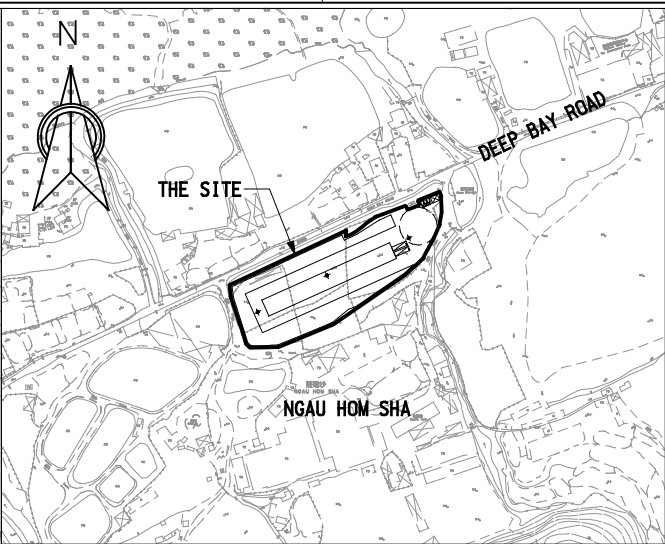
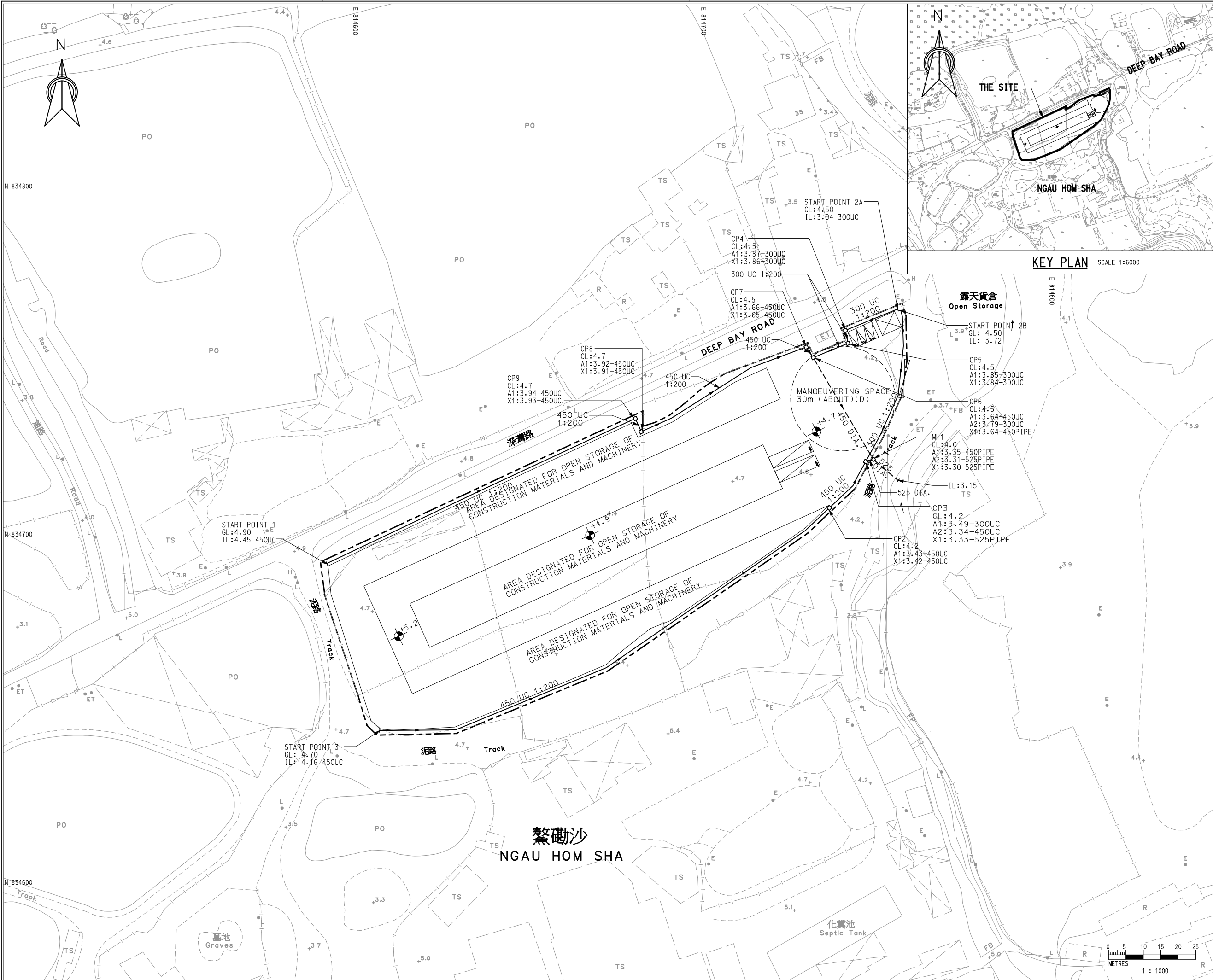
5.0 Conclusion

- 5.1 The drainage design of the proposed development has been conducted. Based on the calculation, the proposed drainage design had enough adequacies to cater the surface water. Also, no additional flow is anticipated to flow to the existing natural stream. Hence, no adverse drainage impact shall be aroused due to the development.



Appendix A

Drawings



- NOTES :**
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
 - ALL LEVELS ARE IN mPD METRE ABOVE HONG KONG PRINCIPAL DATUM.

- LEGEND :**
- APPLICATION SITE
 - STRUCTURE
 - PARKING SPACE
 - L/UL SPACE
 - INGRESS / EGRESS
 - PROPOSED U-CHANNEL
 - PROPOSED PIPE
 - PROPOSED CATCHPIT
 - PROPOSED MANHOLE
 - PROPOSED GROUND SURFACE LEVEL

Rev.	Description of Revision	Date	Ckd.
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Client
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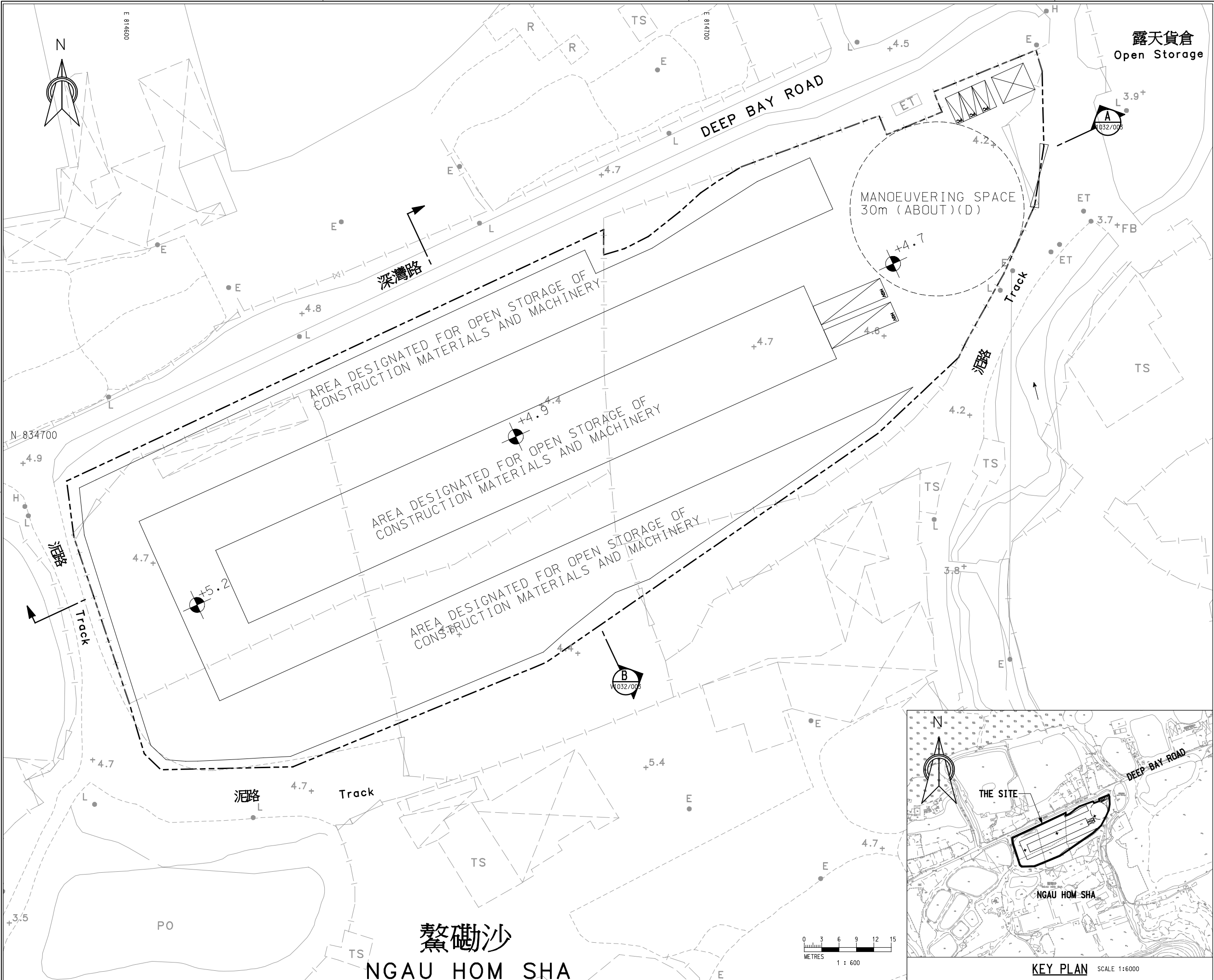
Consultants
MANNINGS (Asia) Consultants Limited

Scale In A3 AS SHOWN		Date JUL 2025
Designed EM	Drawn KAM	Checked BLE
Design Team Leader SC		Date JUL 2025
Approved KTC		Date JUL 2025

Project
PROPOSED TEMPORARY OPEN STORAGE OF CONSTRUCTION MATERIALS AND MACHINERY WITH ANCILLARY FACILITIES AND ASSOCIATED FILLING OF LAND FOR A PERIOD OF 3 YEARS AT VARIOUS LOTS IN D.D. 128 PAK NAI, YUEN LONG, NEW TERRORIES

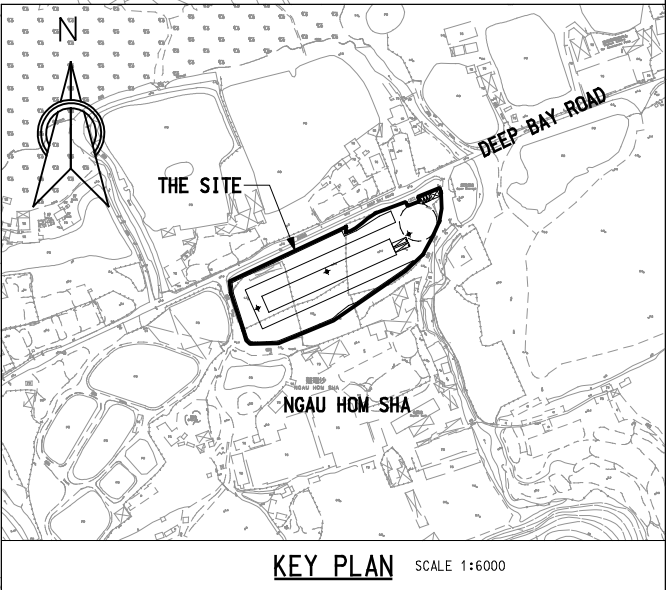
Title
DRAINAGE LAYOUT PLAN

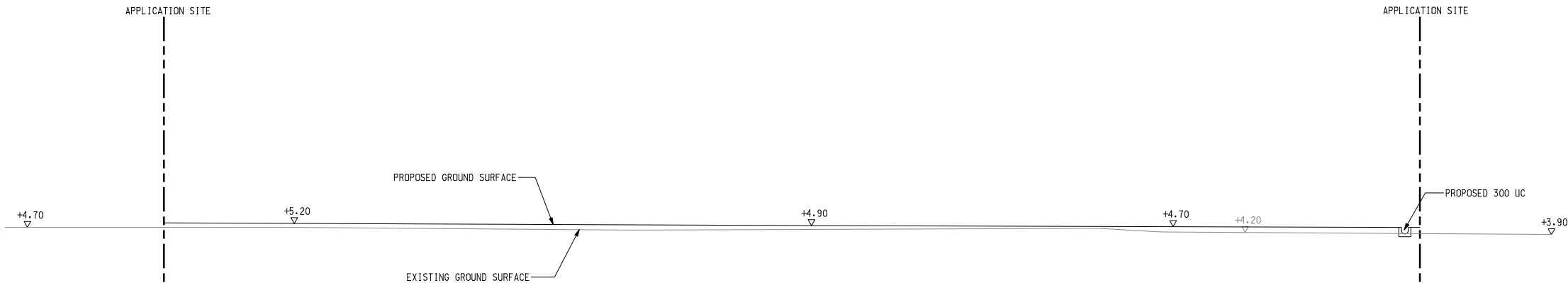
Drawing No. V1032/001	Stage D	Rev. B
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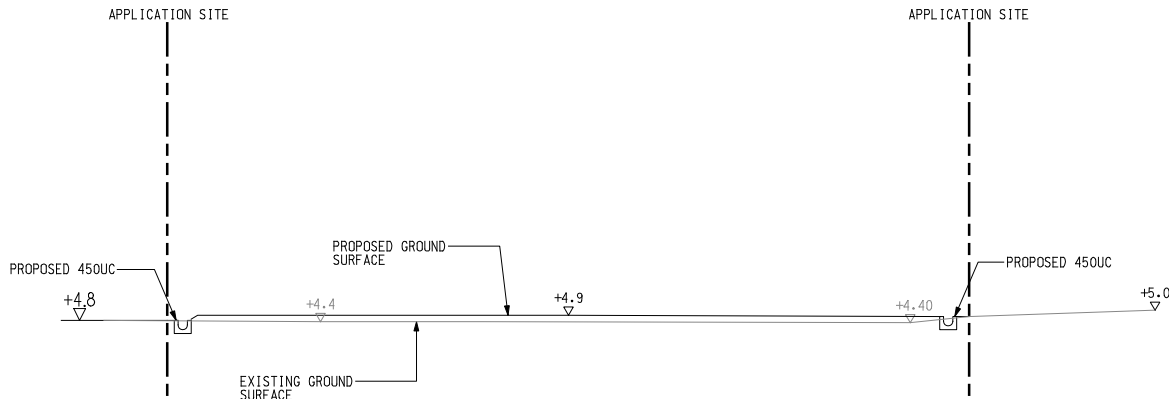
- NOTES :**
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
 - ALL LEVELS ARE IN mPD METRE ABOVE HONG KONG PRINCIPAL DATUM.
- LEGEND :**
- APPLICATION SITE
 - STRUCTURE
 - PARKING SPACE
 - L/UL SPACE
 - INGRESS / EGRESS
 - PROPOSED GROUND SURFACE LEVEL

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Client			
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Designed EM	Drawn KAM	Checked BLE	
Design Team Leader SC		Date JUL 2025	
Approved KTC		Date JUL 2025	
Project			
PROPOSED TEMPORARY OPEN STORAGE OF CONSTRUCTION MATERIALS AND MACHINERY WITH ANCILLARY FACILITIES AND ASSOCIATED FILLING OF LAND FOR A PERIOD OF 3 YEARS AT VARIOUS LOTS IN D.D. 128 PAK NAI, YUEN LONG, NEW TERRITORIES			
Title			
GENERAL LAYOUT PLAN			
Drawing No. V1032/002		Stage D	Rev. B

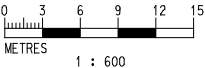




SECTION A
SCALE 1:300



SECTION B
SCALE 1:300



- NOTES :
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
 2. ALL LEVELS ARE IN mPD METRE ABOVE HONG KONG PRINCIPAL DATUM.

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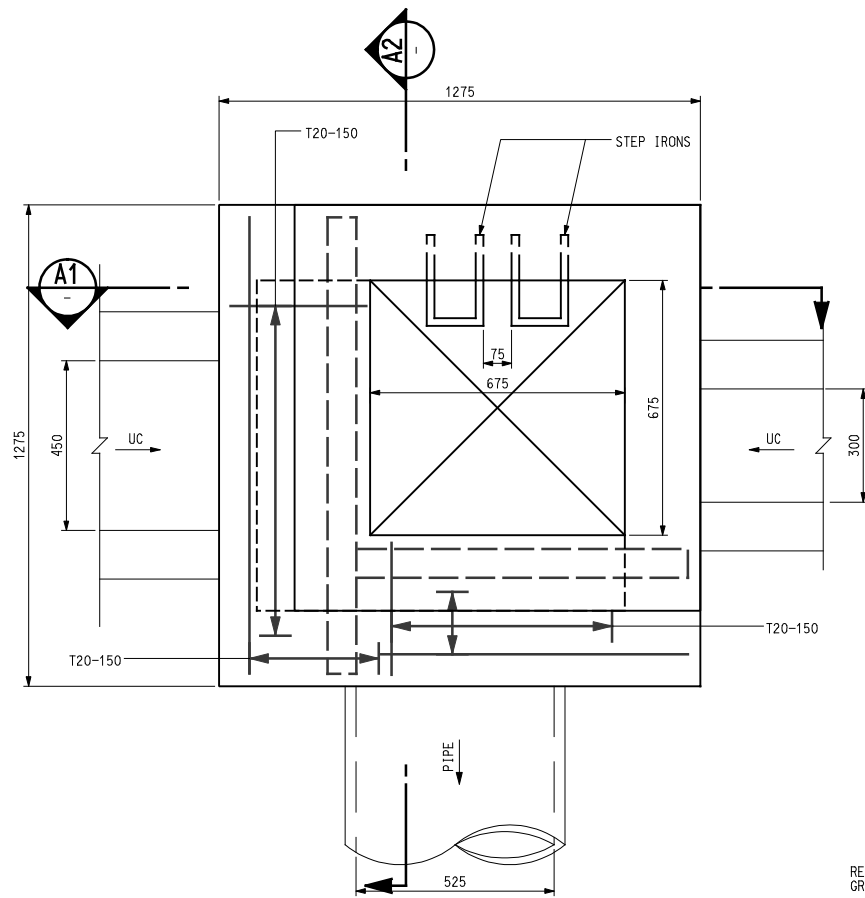
Consultants


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Approved KTC		Date JUL 2025

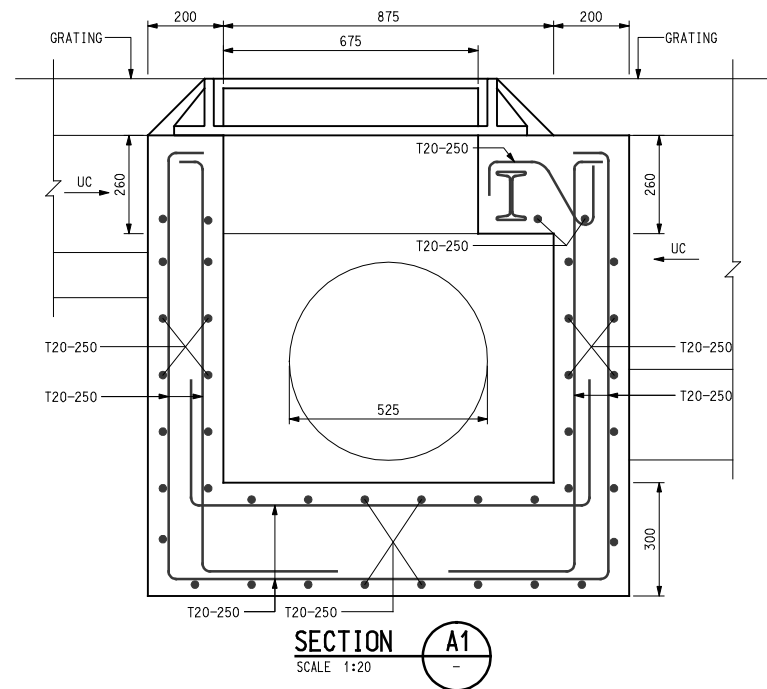
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PROPOSED TEMPORARY OPEN STORAGE OF CONSTRUCTION MATERIALS AND MACHINERY WITH ANCILLARY FACILITIES AND ASSOCIATED FILLING OF LAND FOR A PERIOD OF 3 YEARS AT VARIOUS LOTS IN D.D. 128 PAK NAI, YUEN LONG, NEW TERRITORIES

Title
CROSS SECTION

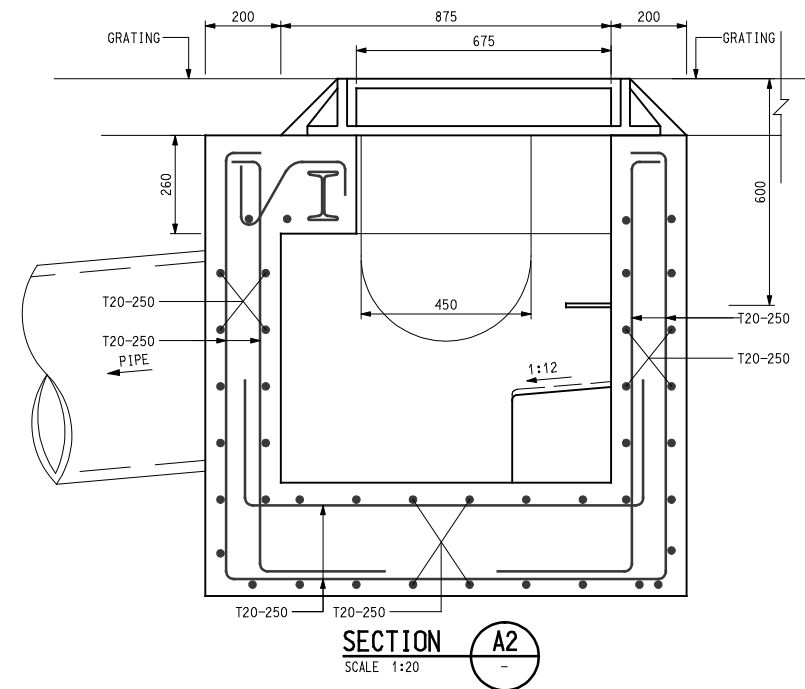
Drawing No. V1032/003	Stage D	Rev. B
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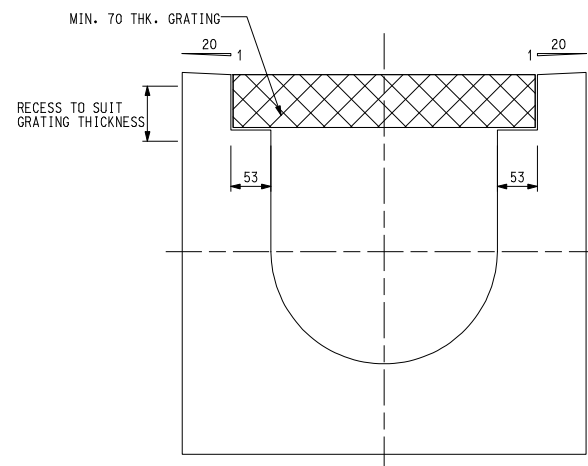
TYPICAL DETAILS OF CATCHPIT TYPE A
SCALE 1:20



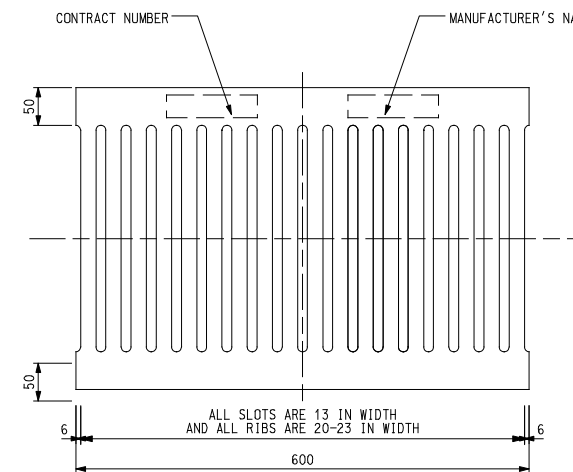
SECTION A1
SCALE 1:20



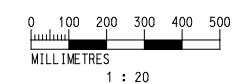
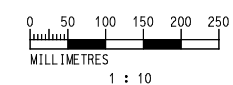
SECTION A2
SCALE 1:20



TYPICAL CROSS SECTION OF CHANNEL
SCALE 1:10

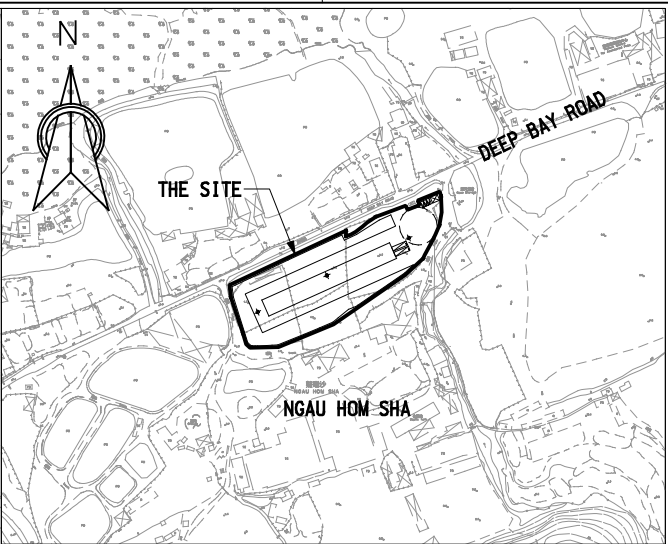
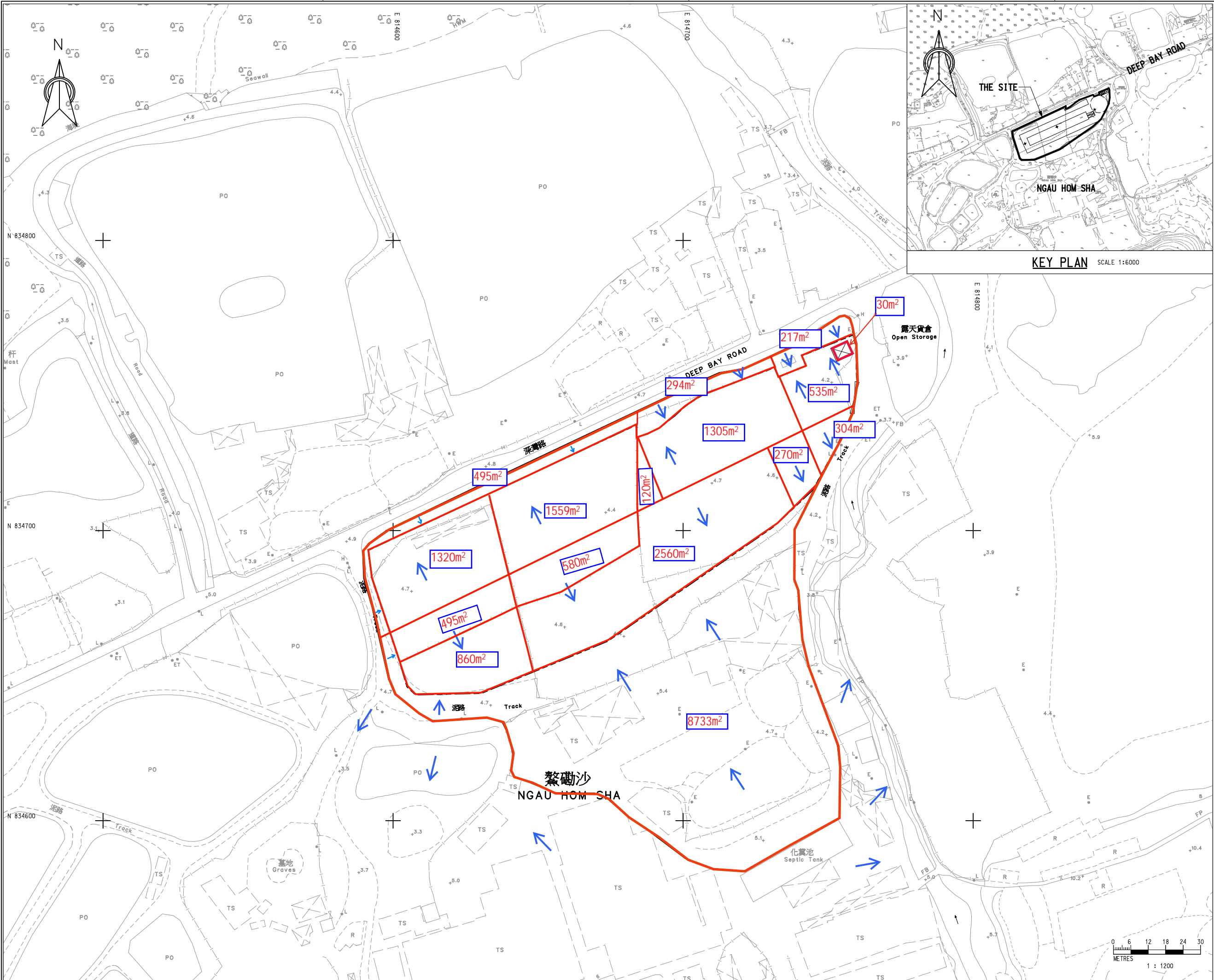


TYPICAL GRATING
SCALE 1:10



- NOTES :**
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
 2. ALL LEVELS ARE IN mPD METRE ABOVE HONG KONG PRINCIPAL DATUM.
 3. LETTERING FOR CONTRACT NO. AND MANUFACTURER'S NAME SHALL BE RAISED 2mm ABOVE NORMAL SURFACE.

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Designed EM	Drawn KAM	Checked BLE	
Design Team Leader SC		Date JUL 2025	
Approved KTC		Date JUL 2025	
Project PROPOSED TEMPORARY OPEN STORAGE OF CONSTRUCTION MATERIALS AND MACHINERY WITH ANCILLARY FACILITIES AND ASSOCIATED FILLING OF LAND FOR A PERIOD OF 3 YEARS AT VARIOUS LOTS IN D.D. 128 PAK NAI, YUEN LONG, NEW TERRITORIES			
Title			
TYPICAL DETAILS OF DRAINAGE			
Drawing No. V1032/004		Stage D	Rev. A




KEY PLAN SCALE 1:6000

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. ALL LEVELS ARE IN mPD METRE ABOVE HONG KONG PRINCIPAL DATUM.

LEGEND :

- APPLICATION SITE
- CATCHMENT AREA

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Designed EM	Drawn KAM	Checked BLE	
Design Team Leader SC		Date JUL 2025	
Approved KTC		Date JUL 2025	
Project			
PROPOSED TEMPORARY OPEN STORAGE OF CONSTRUCTION MATERIALS AND MACHINERY WITH ANCILLARY FACILITIES AND ASSOCIATED FILLING OF LAND FOR A PERIOD OF 3 YEARS AT VARIOUS LOTS IN D.D. 128 PAK NAI, YUEN LONG, NEW TERRITORIES			
Title			
CATCHMENT PLAN			
Drawing No. V1032/011		Stage D	Rev. B



Appendix B

Design Calculations

Mannings (Asia) Consultants Ltd.												Job No.		Sheet No.	Rev.
Calculation Sheet												Member / Location			
Job Title: Proposed Temporary Open Storage of Construction Materials and Machinery with Ancillary Facilities and Associated Filling of Land for a Period of 3 Years at Various Lots in D.D. 128 Pak Nai, Yuen Long, New Territories												Org. Ref.			
												Made By		Date	

The drainage design is referring to DSD's SDM 2018 & Corrigendum No. 1/2022 and Corrigendum No. 1/2024
1 in 10 year design return period is taken.

Rational method is used for calculation of the peak runoff. The formula is extracted from Section 7.5.2 (a) of SDM.
 $Q_p = 0.278 C_i A$
Where Q_p = peak runoff in m^3/s
 I = rainfall intensity in mm/hr
 A = catchment area in km^2

Runoff Estimation for U-Channel

Location	Catchment Area (m^2) Inclement	Catchment Area (m^2) Accumulated	Catchment Area Remarks	Longest flow path (m)	Gradient (m per 100m)	t_o (min) = $0.14465L / (H^{0.2} A^{0.1})$	Length of Channel (m)	$t_f = L/v$ (min)	$t_c = t_o + t_f$ (min)	Runoff coeff.	Total Catch. Area (m^2)	10 year Intensity (mm/hr)	10 year design runoff = $0.278 C_i A$ (m^3/s)	Total Flow ¹ (m^3/s)	Proposed Size of U-Channel (mm)
Start Point 1 - CP8	0	495	Outside the site	25	0.008	5.11	100	1.14	6.24	0.25	495	199.64	0.01	0.08	450
	1320+120	1440	Inside the site (Asphalt)							0.70	1440		0.06		
	1559	1559	Inside the site (Soil)							0.25	1559		0.02		
	294	789	Outside the site							0.25	789		0.01		
CP8 - CP6	1305	2745	Inside the site (Asphalt)	-	-	-	57	0.65	6.89	0.70	2745	194.40	0.10	0.14	450
	0	1559	Inside the site (Soil)							0.25	1559		0.02		
Start Point 2A - CP6	0	217	Outside the site	8	0.013	1.62	31	0.57	2.19	0.25	217	250.17	0.00	0.03	300
	30	30	Inside the site (Roffing)							1.00	30		0.00		
	535	535	Inside the site (Asphalt)							0.70	535		0.03		
Start Point 3 - CP2	0	8257	Outside the site	91	0.008	14.14	147	1.67	15.81	0.25	8257	150.93	0.09	0.21	450
	0	476								0.95	476		0.02		
	495+2560	3055	Inside the site (Asphalt)							0.70	3055		0.09		
	860+580	1440	Inside the site (Soil)							0.25	1440		0.02		
CP2 - CP3	0	8257	Outside the site	-	-	-	17	0.19	16.01	0.25	8257	150.32	0.09	0.22	450
	0	476								0.95	476		0.02		
	270	3325	Inside the site (Asphalt)							0.70	3325		0.10		
	0	1440	Inside the site (Soil)							0.25	1440		0.02		
Start Point 2B - CP3	0	304	Inside the site (Asphalt)	15	0.010	3.08	25	0.46	3.53	0.7	304	228.69	0.01	0.01	300

Notes:
1. The largest total flow is used for Checking the Capacity of proposed U-channel in separate spreadsheet.

Mannings (Asia) Consultants Ltd.		Job No.	Sheet No.	Rev.
Calculation Sheet		Member / Location		
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		Made By	Date	

Checking of Capacity (450UC)

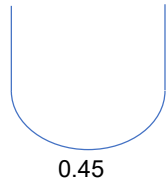
Input Data

Width of UC	=	0.45	m		0.225
Height of UC	=	0.45	m		
Design Runoff	=	0.22	m ³ /s		0.225

(Q_{discharge})

Flow capacity, Q

$$Q = \frac{A \times r^{2/3} \times s^{1/2}}{n}$$



where

A	=	cross sectional area of flow (m ²)	=	0.181	m ²
r	=	hydraulic radius (m)			
s	=	slope of the water surface or the linear hydraulic head loss (m/m)			
n	=	Manning coefficient of roughness			

Hydraulic radius

r	=	$\frac{A}{P}$			
p	=	wetted perimeter (m)	=	1.16	m
r	=	0.16	m		

Slope

s	=	0.005	m/m		
---	---	-------	-----	--	--

Manning coefficient of roughness

n	=	0.014			
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Therefore,

Q	=	0.26	m ³ /s		> Design runoff, OK!
V	=	Q/A	=	1.47	m/s

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Calculation Sheet		Member / Location		
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		Made By	Date	

Checking of Capacity (300UC)

Input Data

Width of UC	=	0.3	m	0.15	
Height of UC	=	0.3	m		
Design Runoff	=	0.03	m ³ /s	0.15	

(Q_{after, uncov.})

Flow capacity, Q

$$Q = \frac{A \times r^{2/3} \times s^{1/2}}{n}$$

where

A	=	cross sectional area of flow (m ²)	=	0.080343 m ²
r	=	hydraulic radius (m)		
s	=	slope of the water surface or the linear hydraulic head loss (m/m)		
n	=	Manning coefficient of roughness		

Hydraulic radius

r	=	$\frac{A}{P}$		
p	=	wetted perimeter (m)	=	0.77 m
r	=	0.10	m	

Slope

s	=	0.005	m/m
---	---	-------	-----

Manning coefficient of roughness

n	=	0.014
---	---	-------

Therefore,

Q	=	0.09 m ³ /s	> Design runoff, OK!
V	=	Q/A	= 1.12 m/s

Stormwater Drainage Design

Manhole		Catchment Area			Length (m)	Nominal Diameter (mm)	Gradient, S _f		Roughness Coefficient (m)	Velocity (m/s)	Time of Flow (min)	Time of Conc. (min)	Rainfall Duration (min)	10 year Intensity (mm/hr)	Runoff Coeff.	10 year Runoff (m³/s)	Total Flow (m³/s)	Capacity (m³/s)	Adjusted Capacity > Total Flow ?	Cover Level		Invert Level	
From	To	Increment (m²)	Accu. (m²)	Remarks			(%)	1 in												From (mPD)	To (mPD)	From (mPD)	To (mPD)
CP6	MH1	-	1006	Outside the site	32	450	0.9	110.3	3.0	1.473	0.36	7.26	7.26	191.67	0.25	0.013	0.158	0.211	Yes	4.50	4.50	3.64	3.35
		-	30	Inside the site (Roofing)											1.00	0.002							
		-	3280	Inside the site (Asphalt)											0.70	0.122							
		-	1559	Inside the site (Soil)											0.25	0.021							
CP3	MH1	-	8257	Outside the site	2	525	1.0	100.0	3.0	1.712	0.02	16.03	16.03	150.26	0.25	0.086	0.226	0.334	Yes	4.50	4.00	3.33	3.31
		-	476												0.95	0.019							
		-	3629	Inside the site (Asphalt)											0.70	0.106							
		-	1440	Inside the site (Soil)											0.25	0.015							
MH1	Existing Stream	-	9263	Outside the site	9	525	1.7	60.0	3.0	2.212	0.07	16.09	16.09	150.05	0.25	0.097	0.350	0.431	Yes	4.00	4.00	3.30	3.15
		-	476												0.95	0.019							
		-	30	Inside the site (Roofing)											1.00	0.001							
		-	6909	Inside the site (Asphalt)											0.70	0.202							
		-	2999	Inside the site (Soil)											0.25	0.031							

Mean Velocity is calculated by Colebrook- White equation

Where:
V̄ =Mean Velocity (m/s)
R =Hydraulic Diameter (m)
Ks =Surface Roughness (m)
V =Kinematic viscosity (kg/ms)
Sf =Slope of Hydraulic Gradient
g =Gravity (m/s2)

$$\bar{V} = -\sqrt{32gRS_f} \log \left[\frac{k_s}{14.8R} + \frac{1.255\nu}{R\sqrt{32gRS_f}} \right]$$

The Roughness Coefficient Ks is assumed to be 3 for concrete.
Peak Runoff is estimated using rational method according to SDM.



Appendix C

Site Photo

