



**GRANDMAX SURVEYORS LIMITED**  
**俊滙測量師行有限公司**

Date : 28<sup>th</sup> March 2024  
Our Ref. : ADCL/PLG-10278/L004

The Secretary  
Town Planning Board  
15/F., North Point Government Offices  
333 Java Road, North Point, Hong Kong

**By Email and Fax (No. 2877 0245)**

Dear Sir/Madam,

**Section 16 Planning Application for Proposed Temporary Open Storage of Modular Integrated Construction Components and Construction Materials with Ancillary Workshops, Office, Staff Car Park and Machinery for a Period of 3 Years at Lot Nos. 1555 S.A (Part), 1555 S.B RP (Part), 1557 RP (Part), 1558 (Part) and 1559 (Part) in D.D. 107, Sha Po, Kam Tin, Yuen Long, New Territories (Planning Application No. A/YL-KTN/981)**

We refer to the latest comments from Lands Department, Drainage Services Department and Environmental Protection Department and would like to enclose herewith our Responses-to-Comments Table to address the abovementioned departmental comments for their consideration.

Thank you for your kind attention and should you have any queries, please do not hesitate to contact our Miss Zoe LAU or Mr. Thomas LUK at 3180 7811.

Yours faithfully,  
For and on behalf of  
**Grandmax Surveyors Limited**

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Thomas Luk  
Planning Consultant

c.c. Client

Section 16 Planning Application for Proposed Temporary Open Storage of Modular Integrated Construction Components and Construction Materials with Ancillary Facilities for a Period of 3 Years at Lots 1555 S.A (Part), 1555 S.B RP (Part), 1557 RP (Part), 1558 (Part) and 1559 (Part) in D.D. 107, Cheung Chun San Tsuen, Kam Tin, Yuen Long, New Territories

Department	Date	Comments	Responses to Departmental Comments
Lands Department (LandsD)	20.02.2024	Please clarify whether the tower crane will be placed or fixed on the ground. If it will be fixed on ground, please provide the BOA of the tower crane.	The Tower Crane Mast is fixed on the ground, and the BOA is about 9m <sup>2</sup> (about 3.0 m x 3.0 m).

Department	Date	Comments	Responses to Departmental Comments
Drainage Services Department (DSD)	20.02.2024	<p>(i) Para. 3.4.1: Please revise the para. That the purpose of drainage proposal is to identify and provide detailed drainage design to justify the feasibility of the implementation of drainage facilities. As such, detailed invert levels and relevant drainage scheme should be provided for comment in this stage.</p> <p>(ii) Please advise if any site formation/ land filling works to be carried out under this application. Please note that the overland flow from the adjacent lands should not be affected.</p> <p>(iii) Figure 3-1: There are two catchment B in the figure, please revise.</p> <p>(iv) Please indicate the existing public drainage facilities in the vicinity on figure 3-2 for reference.</p> <p>(v) Please explain why the final discharge outlet point not to connect the existing catchpit no. SCH1028778 such that construction of outlet pipe length can be reduced. However, in such case, checking/ upgrading on the discharge condition of outlet pipe DN600 of this catchpit is needed.</p> <p>(vi) The cover and invert levels of the proposed u-channels and catchpits should be shown on the drainage plan.</p>	<p>(i) Noted and revised.</p> <p>(ii) As mentioned in para. 2.1.2 of the Planning Statement, the Site is a gentle flat land. With careful design of site formation and landscape works, no significant cutting/filling works will be required. This is also in line with Item (e)(ii) Part 6 Type(s) of Application Form No. S16-III which no filling of land and excavation of land will be carried out.</p> <p>(iii) Typo and corrected.</p> <p>(iv) Noted and amended, please refer to the revised Figure 3-2 for details.</p> <p>(v) The final discharge outlet point is not connected to the existing catchpit no. SCH1028778 because the capacity of the existing pipe no. SWD1065697 may not be enough. Instead, it is recommended to divert the runoff to a new drain indicated to be U-Channel 3 as shown in Figure 3-2.</p> <p>(vi) Noted, Figure 3-2 has been amended to include invert and cover levels of proposed u-channels and catchpits.</p>

Section 16 Planning Application for Proposed Temporary Open Storage of Modular Integrated Construction Components and Construction Materials with Ancillary Facilities for a Period of 3 Years at Lots 1555 S.A (Part), 1555 S.B RP (Part), 1557 RP (Part), 1558 (Part) and 1559 (Part) in D.D. 107, Cheung Chun San Tsuen, Kam Tin, Yuen Long, New Territories

	<p>(vii) The existing drainage facilities, to which the stormwater of the development from the subject site would discharge, should be indicated on plan. The relevant connection details should be provided for comment.</p> <p>(viii) The applicant should check and ensure the hydraulic capacity of the existing drainage facilities would not be adversely affected by the captioned development. Please provide site photos to show existing condition of the existing drainage facilities which receives the discharge from the application site.</p> <p>(ix) Please clarify whether any walls or hoarding would be erected along the site boundary. Where walls or hoarding are erected are laid along the site boundary, adequate opening should be provided to intercept the existing overland flow passing through the site.</p> <p>(x) Cross sections showing the existing and proposed ground levels of the captioned site with respect to the adjacent areas should be given.</p> <p>(xi) The development should neither obstruct overland flow nor adversely affect existing natural streams, village drains, ditches and the adjacent areas, etc.</p> <p>(xii) The applicant should consult DLO/YL and seek consent from the relevant owners for any drainage works to be carried out outside his lot boundary before commencement of the drainage works.</p> <p>(xiii) It appears that the discharge point is at a DSD's existing channel. If the applicant wishes to make any other connection to the public drainage system in the area, please clarify whether the applicant agrees to abide the following: The applicant shall furnish me with their connection proposal for agreement. After obtaining my agreement, the applicant</p>	<p>(vii) Indicated accordingly. Relevant connection details will be provided in detailed design stage.</p> <p>(viii) Noted. Site photos showing the conditions of existing drainage facilities have been provided in Figure 3-2.</p> <p>(ix) Hoardings are available along the site boundary, adequate openings will be provided along the bottom of the hoardings.</p> <p>(x) Cross sections showing existing ground levels of the site with respect to adjacent areas have been provided in Appendix C.</p> <p>(xi) Noted.</p> <p>(xii) Noted.</p> <p>(xiii) The application for discharging to the DSD's existing channel will be made by the Applicant after obtaining the approval for the planning application. The Applicant agrees to abide the statement.</p>
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		<p>shall submit a duly completed form HBP1 with a cross cheque covering the technical audit fee and a plan showing the detailed of the proposed drainage connection works to this Division for the formal application for the required connection. Upon my acceptance of the connection application, the applicant shall carry out the proposed connection works in accordance with DSD Standard Drawings at the resources of the applicant. The connection pipe outside the lot boundaries shall be handed over to DSD for maintenance after satisfactory technical audit by DSD.</p>	
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Department	Date	Comments	Responses to Departmental Comments
<p>Environmental Protection Department (EPD)</p>	<p>27.02.2024</p>	<p><u>General</u></p> <p>a. whether the proposed use would generate the traffic of heavy vehicles, i.e. vehicles over 5.5 tonnes</p> <p>b. what kind of workshop activities would be involved at the site, i.e description on the process and any machinery would be used during the process</p> <p>c. what kind of construction materials would be stored at the site except MiC components</p>	<p>a. The Proposed Use will generate traffic of heavy vehicles over 5.5 tonnes, which can be referred to the following documents for details:</p> <ol style="list-style-type: none"> <li>1) As mentioned in para. 4.2.1 of the Planning Statement, articulated trailers will be adopted. Articulated trailers will be adopted for delivering MiC components to and from the Site.</li> <li>2) In Table 4.3 of the TIA Report in Appendix I of the Planning Statement, the generation and attraction of both AM and PM Peak periods will be 2 veh/hour and 2 veh/hour for articulated trailers.</li> </ol> <p>b. The works of the Proposed Use will include:</p> <ol style="list-style-type: none"> <li>1) Welding process for the repair of MIC unit or modular steel structure and modular metal scaffolding components</li> <li>2) Drilling process for the purpose of repairing of the above</li> <li>3) And other handheld equipment for the purpose of repairing the MIC or Modular Steel / Scaffolding components</li> </ol> <p>c. Apart from MiC, other construction materials will include:</p> <ol style="list-style-type: none"> <li>1) Modular steel components</li> <li>2) Modular metal scaffolding components</li> <li>3) Equipment for the purpose of modular construction works</li> </ol>

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		<p><u>Environmental Assessment</u></p> <p>d. Section 2 - Please review whether the proposed use is a air-sensitive use under HKPSG and review whether the proposed use is required to fulfill buffer distance requirement.</p> <p>e. Section 3 - It is noted that an quantitative assessment for fixed noise was conducted. Please supplement the calculation spreadsheet for checking.</p>	<p>d. In general, the Proposed Use is not an air sensitive use under HKPSG. Notwithstanding, the Proposed Use will comprise an office and a guardhouse which will be air sensitive uses. As shown in Figure 2-1 of the Environmental Assessment (EA) Report, both the office and guardhouse will be outside the buffer distance and buffer zone which is in line with para. 2.3.6 of the EA Report.</p> <p>e. Calculations for fixed plant noise could be referred to Appendix A of the EA Report. Nevertheless, a copy of the calculation spreadsheet will be provided to EPD for reference.</p>
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## **Temporary Storage for MiC Components and Construction Materials with Ancillary Workshops, Office, Staff Car Park and Machinery at Various Lots in DD 107, Sha Po**

### **Drainage Proposal**

Prepared for:

**Sanfield (Management) Ltd**

**26 March 2024**

# Temporary Storage for MiC Components and Construction Materials with Ancillary Workshops, Office, Staff Car Park and Machinery at Various Lots in DD 107, Sha Po Drainage Proposal

Prepared for  
**Sanfield (Management) Ltd**

For and on behalf of EnviroSolutions & Consulting  <b>Alexi BHANJA</b> Country Manager – Hong Kong					
<b>ESC Project No.</b> EPA23.1044-J.01 <b>Deliverable No.</b> D02 <b>Revision No.</b> 2.2					
<b>File Location</b> <a href="https://envirosc.sharepoint.com/teams/hkprojects/shared%20documents/epa23.1044-j.01%20sha%20po%20site%201/07%20deliverables/drainage%20proposal%20rev2.2.docx">https://envirosc.sharepoint.com/teams/hkprojects/shared documents/epa23.1044-j.01 sha po site 1/07 deliverables/drainage proposal rev2.2.docx</a>					
<b>Rev.</b>	<b>Description</b>	<b>Prepared</b>	<b>Reviewed</b>	<b>Approved</b>	<b>Date</b>
1	Drainage Proposal	MW	JC	AW	14/12/2023
2.2	Drainage Proposal	MW	JC	AW	26/3/2.23
<b>Distribution</b> <input type="checkbox"/> Internal <input checked="" type="checkbox"/> Confidential <input type="checkbox"/> Public					
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# 1 PROJECT BACKGROUND

## 1.1 Introduction

- 1.1.1 Aligning with Government directives to enhance the quantity, speed, efficiency, and quality of housing, the construction industry is spearheading the development of highly productive construction methods, including the widespread adoption of Modular Integrated Construction (“MiC”). MiC, an innovative construction method, involves assembling building components off-site in a controlled environment before transporting and seamlessly integrating them into the construction site.
- 1.1.2 In order to support in adopting MiC, a temporary storage for MiC Components and Construction Materials with Ancillary Workshops, Office, Staff Car Park and Machinery for a period of three years (“the Proposed Development” or “Proposed Use”) at various lots in DD 107, Sha Po, Yuen Long, New Territories (“the Site”) is proposed.
- 1.1.3 The Site is zoned Comprehensive Development Area (1) (“CDA(1)”) under the Approved Kam Tin North Outline Zoning Plan (“OZP”) No. S/YL-KTN/10. In accordance with Note (11) of the OZP, temporary use of development of any land or building exceeding a period of three years will require permission from the Town Planning Board (“TPB”). Therefore, a planning application pursuant to Section 16 of the *Town Planning Ordinance* (“TPO”) is required.
- 1.1.4 In order to support the planning application for the Proposed Development, EnviroSolutions & Consulting Ltd (“ESC”) has been appointed to prepare this Drainage Proposal.

## 1.2 Site Description

- 1.2.1 The Site locations and its environs are shown in **Figure 1-1** which the uses surrounding the Site include:
- To the North: Park Yoho
  - To the East: temporary structures
  - To the South: nullah and open storage
  - To the West: Park Yoho

## 1.3 Project Description

- 1.3.1 The Site area will be approx. 9,705m<sup>2</sup>. The indicative layout of the Proposed Development can be referred to the Planning Statement.
- 1.3.2 The Proposed Use aims to serve as a transshipment depot for MiC components, with the objective of meeting the growing demand for MiC applications while ensuring efficient logistics and seamless implementation of MiC in housing projects. MiC components intended for temporary storage will weigh about 10 to 20 tonnes, with maximum length and width of approx. 8m and 2.5m respectively. The proposed use also serves as a hub for modular construction materials being used for housing project sites in order to promote more Green Construction Methodology. The Proposed Development comprises an open storage area, providing a secure location for the temporary storage of MiC components

and modular construction materials, along with ancillary facilities, including three workshops, an office, a staff car park, a guardhouse and machinery (i.e. tower crane and hoisting crane etc.) to support its operation needs. The proposed ancillary office is a two-storey structure designed to accommodate about 50 staff members. The office is intended to provide administrative/supporting services to facilitate the seamless transshipment of MiC components. The proposed ancillary single-storey workshops, equipped with lifting machinery, will be enclosed, primarily serving for internal quality control and quality assurance checks of MiC components, as well as any necessary final touching-up works before their delivery to construction sites. Additionally, solar panels will be installed on the workshop and office roofs for self-sufficiency purpose, contributing to environmental protection through renewable energy generation.

1.3.3 The operating hours of the Proposed Use will be from 8:00 a.m. to 7:00 p.m. from Monday to Saturday and without operation on Sunday and public holidays.

## 1.4 Objectives of this Report

1.4.1 The objectives of this Drainage Proposal are to:

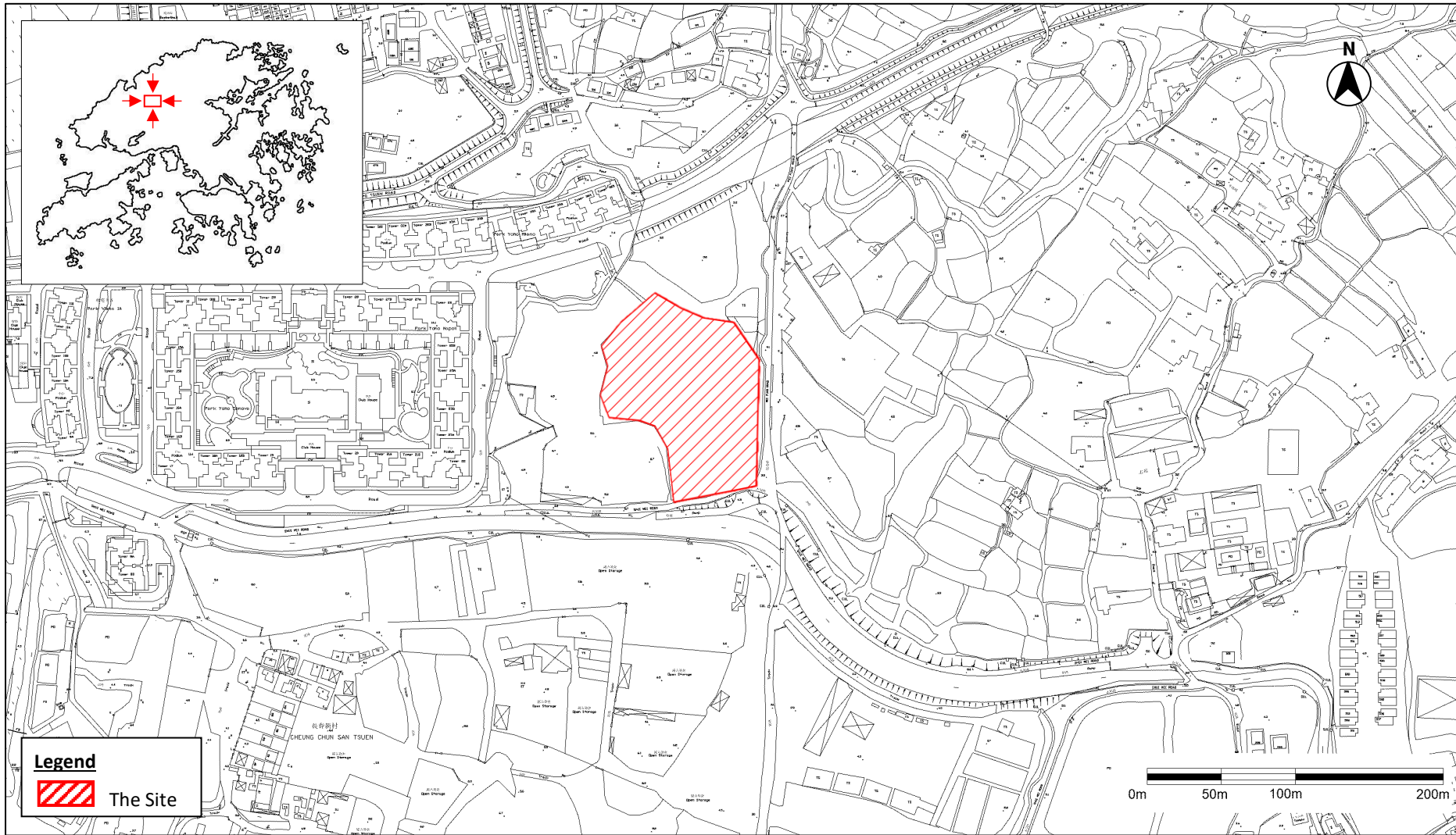
- Assess the potential drainage impacts arising from the Proposed Development.
- Recommend the necessary mitigation measures to alleviate any impacts.

## 1.5 Reference Materials

1.5.1 In evaluating the drainage impact arising from the Proposed Development, the following materials have been referred to:

- Drainage Services Department (“DSD”) publication *Stormwater Drainage Manual (with Eurocodes incorporated) – Planning, Design and Management (2018 Edition)*
- DSD Advice Note No. 1 – Application of the Drainage Impact Assessment Process to Private Sector Projects
- Drainage Services Department publication Technical Note to prepare a “Drainage Submission”.
- Drainage data of GeoInfo Map reviewed on 23 November 2023.

Figure 1-1 Site Location and its Environs



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## 2 DESCRIPTION OF EXISTING ENVIRONMENT AND DRAINAGE CONDITIONS

### 2.1 Site Location and Topography

2.1.1 As illustrated in **Figure 1-1**, the Site is located to the south of a nullah and the north of the other nullah.

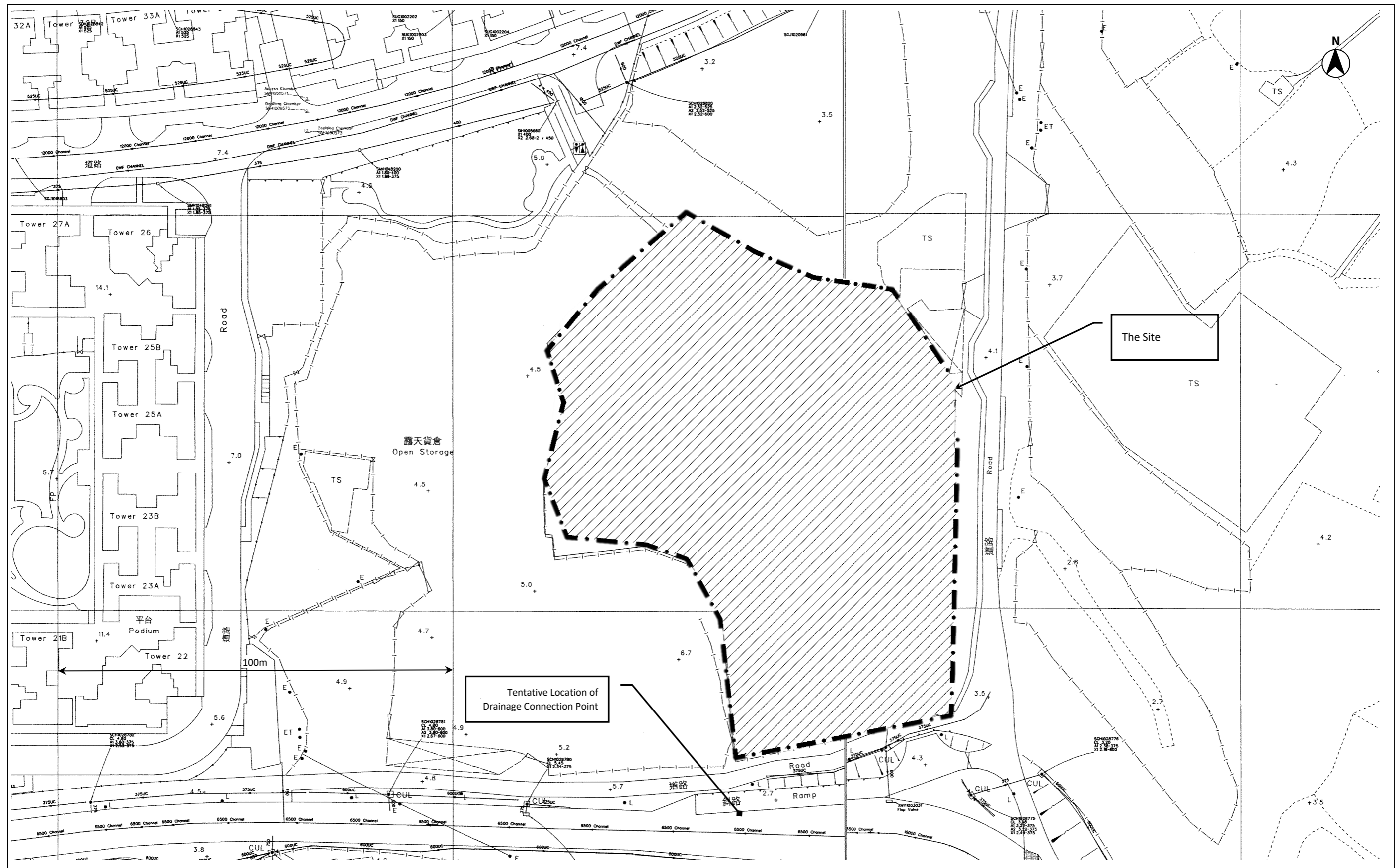
2.1.2 With reference to the layout plans appended to the Planning Statement, the Site elevations range between +3.31mPD and +4.20mPD.

### 2.2 Existing Baseline Conditions

2.2.1 Majority of the Site area is currently paved.

2.2.2 With reference to the drainage layout plans obtained from the DSD as shown in **Figure 2-1**, it is proposed to divert the Site runoff to the nullah to the south of the Site.

Figure 2-1 Drainage Layout Plan



### 3 DRAINAGE ANALYSIS

#### 3.1 Assumptions and Methodology

3.1.1 Peak instantaneous run off before and after the Proposed Development was calculated based on the Rational Method. The recommended physical parameters, including runoff coefficient (C) and storm constants for different return periods, are as per the *Stormwater Drainage Manual*.

3.1.2 The Rational Method has been adopted for hydraulic analysis and the peak runoff is given by the following expression:

$$Q_p = 0.278 C i A \quad \text{--- Equation 1}$$

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

3.1.3 Rainfall intensity is calculated using the following expression:

$$i = \frac{a}{(t_d + b)^c} \quad \text{--- Equation 2}$$

where  $i$  = rainfall intensity in mm/hr  
 $t_d$  = duration in minutes ( $t_d \leq 240$ )  
 a,b,c = storm constants given in table 3 of SDM

3.1.4 For a single catchment, duration ( $t_d$ ) can be assumed equal to the time of concentration ( $t_c$ ) which is calculated as follows:

$$t_c = t_0 + t_f \quad \text{--- Equation 3}$$

where  $t_c$  = time of correction  
 $t_0$  = inlet time (time taken for flow from the remotest point to reach the most upstream point of the urban drainage system)  
 $t_f$  = flow time

3.1.5 Generally,  $t_0$  is much larger than  $t_f$ . As shown in Equation 2,  $t_d$  is the divisor. Therefore, larger  $t_d$  will result in smaller rainfall intensity ( $i$ ) as well as smaller  $Q_p$ . For the worst-case scenario,  $t_f$  is assumed to be negligible and so:

$$t_c = t_0 = t_f$$

$$t_0 = \frac{0.14465 L}{H^{0.2} A^{0.1}} \quad \text{--- Equation 4}$$

where 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)

3.1.6 On the other hand, the capacity of open channel has been calculated using the Manning's Equation:

$$V = \frac{R^{1/6}}{n} \times \sqrt{Rs} \quad \text{--- Equation 5}$$

where V = mean velocity (m/s)  
R = hydraulic radius (m)  
n = Manning coefficient (s/m<sup>1/3</sup>)  
s = hydraulic gradient (energy loss per unit length due to friction)

## 3.2 Assessment Assumptions

### Identification of Catchments

- 3.2.1 With reference to the layout plans and the elevations as mentioned in **paragraph 2.1.2**, the areas to the north, east and south of the Site are lower than the Site. For the area to the immediate west of the Site, there is an existing open storage. This open storage to the west of the Site should be filled ponds for plant nursery which was approved with conditions by the TPB on 10 September 1999 (TPB's ref.: A/YL-KTN/95). One of its approval conditions was "The provision of drainage facilities to the satisfaction of the Director of Drainage Services or of the Town Planning Board". Although the existing use of the aforementioned open storage could not be observed during the site visit on 9 April 2020 because the open storage was fenced off, according to the satellite photograph dated 16 March 2020 that open storage is still used for plant nursery. Therefore, drainage facilities should be provided for the aforementioned open storage. Hence, there should be no runoff overflowing to the Site.
- 3.2.2 As mentioned in **paragraph 2.2.2** and indicated on **Figure 2-1**, it is recommended to divert the runoff from the Site to the open channel/nullah to the south of the Site. Therefore, the Site itself is the only catchment to be assessed and three sub-catchments, Catchments A, B and C, have been indicated and shown on **Figure 3-1**.

## 3.3 Estimated Runoff

### Peak Runoff from the Site

- 3.3.1 Based on the assumptions as described in **Section 3.2**, the runoff from the Site was estimated based on the return periods of 2, 10 and 50 years summarised in **Table 3-1** and detailed in **Appendix A**.

*Table 3-1 Estimated Peak Runoff of the Site*

RETURN PERIOD	ESTIMATED PEAK RUNOFF (m <sup>3</sup> /s)
2 Years	0.433
10 Years	0.537
50 Years	0.596

### 3.4 Proposed Indicative Drainage Layout

3.4.1 A proposed drainage layout showing U-channels and invert levels has been indicated based on the calculations in **Appendix B**. The U-channels of the indicative drainage layout and their invert levels are summarised in **Table 3-2** and shown on **Figure 3-2**.

*Table 3-2 Summary of Indicative U-channels*

DESCRIPTION	SIZE (mm)	RELATED CATCHMENT	RUNOFF (m <sup>3</sup> /s)	CAPACITY (m <sup>3</sup> /s)	% OF CAPACITY USED	SUFFICIENT CAPACITY?
U-Channel 1 with gradient of 1:200	Not less than Ø590mm	Catchment A of the Site	0.339	0.430	79	Yes
Boundary-Channel 2 with gradient 1:200	Not less than Ø530mm	Catchment B & C of the Site	0.258	0.323	80	Yes
U-Channel 3 with gradient 1:200	Not less than Ø720mm	Catchment A,B & C of the Site	0.596	0.731	82	Yes

3.4.2 The indicative outfall to be provided with a sand trap is tentatively connected to the open channel/nullah via U-Channel 3 as shown on **Figure 3-2**. The typical design of catchpit and sand trap can be referred to **Figure 3-3** and **Figure 3-4**. With the provision, implementation and maintenance of the indicative drainage layout, no adverse drainage impact due to the Proposed Development is anticipated.

3.4.3 Indicative cross-section drawings can be referred to **Appendix C**.



Figure 3-1 Identification of Catchments

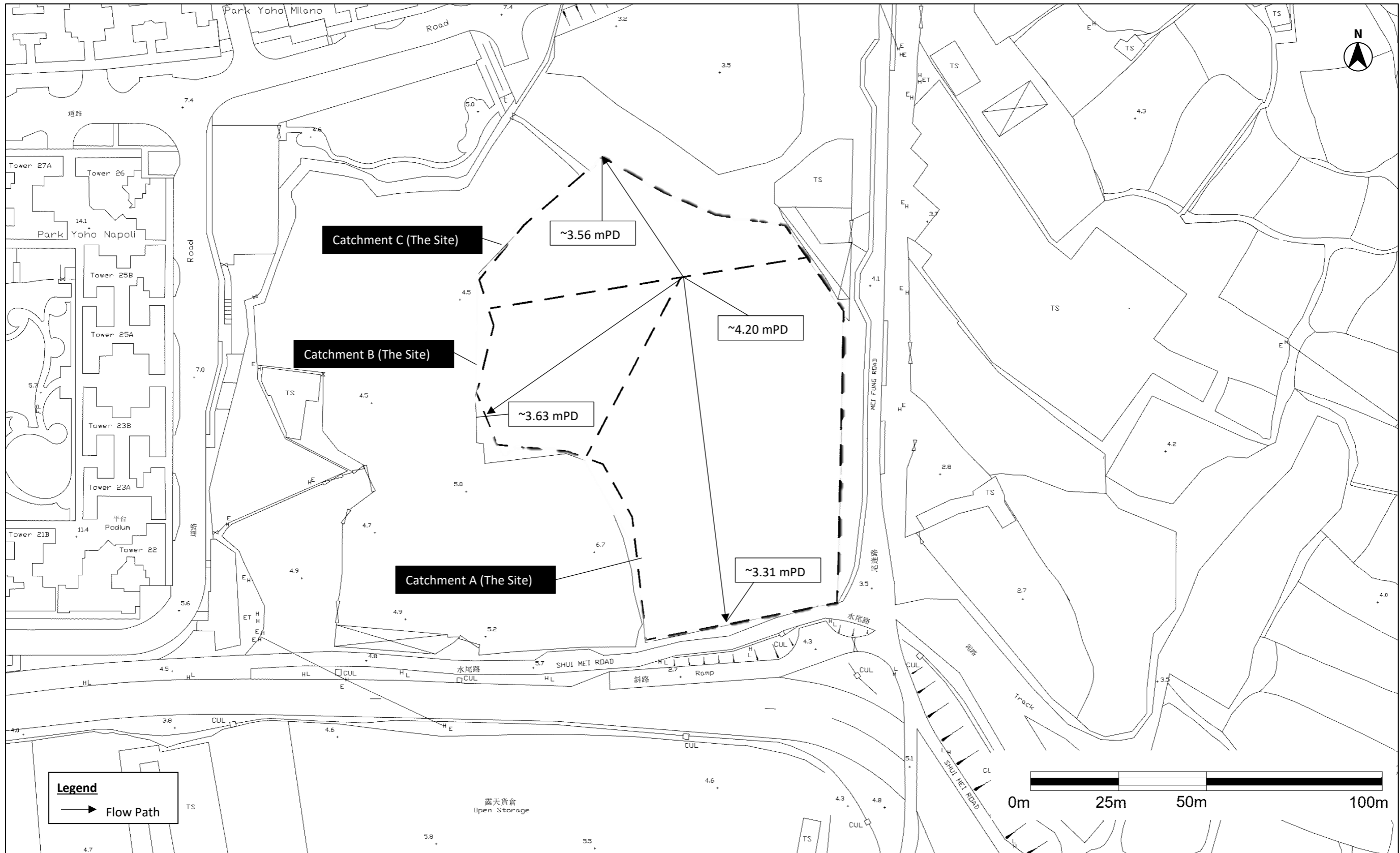


Figure 3-2 Indicative Proposed Drainage Diversion Layout

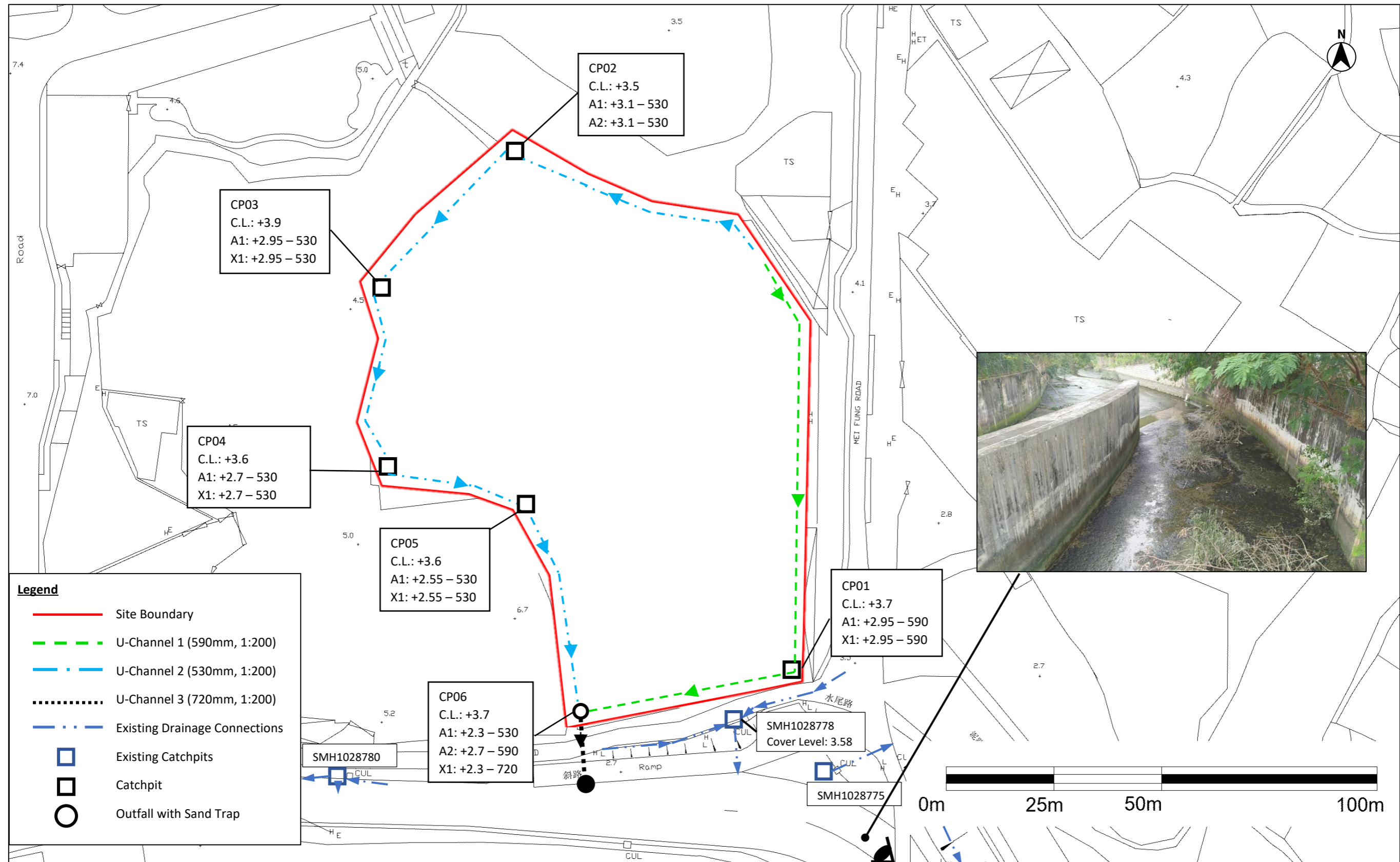


Figure 3-3 Typical Details of Catchpit and Sand Trap

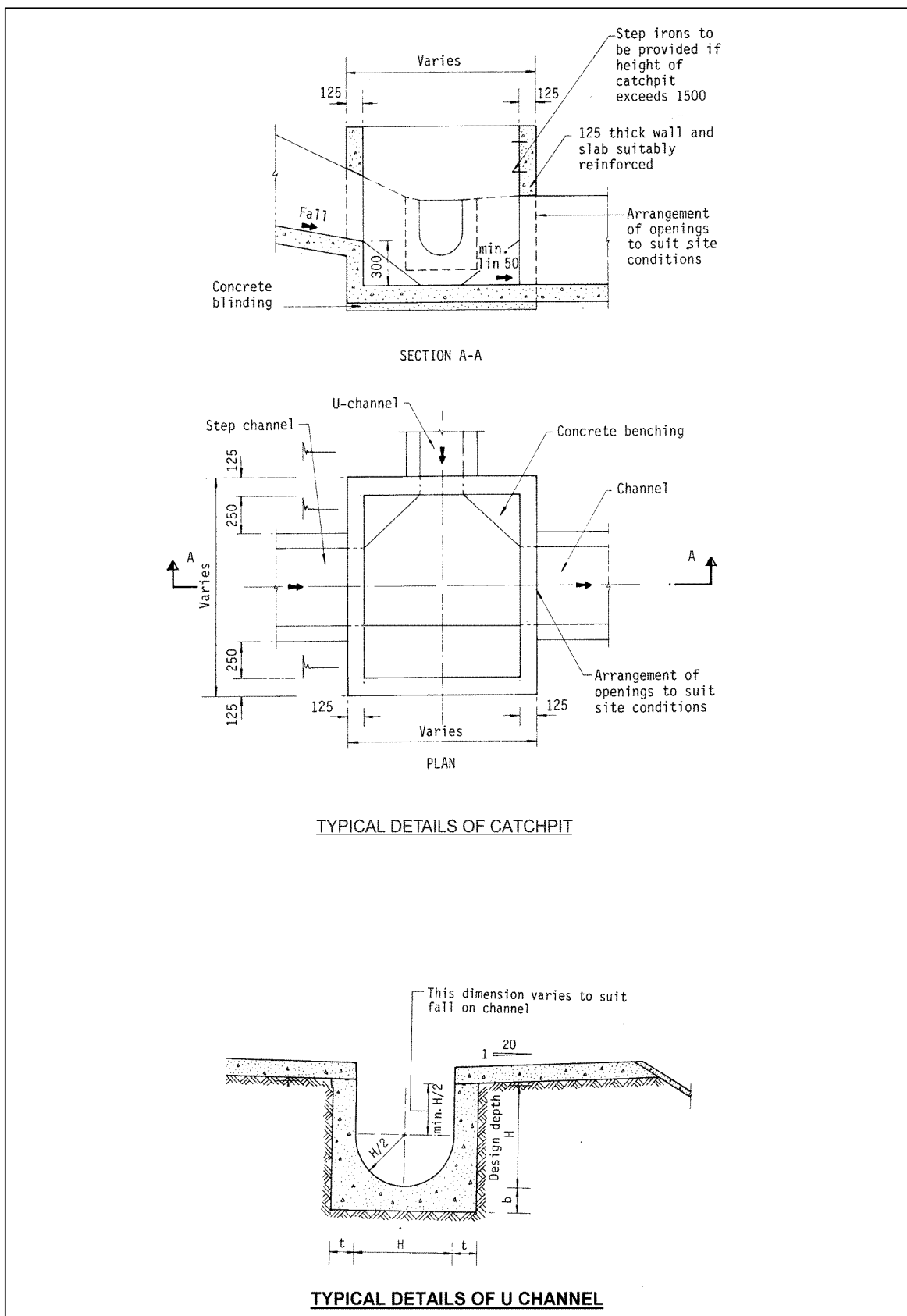
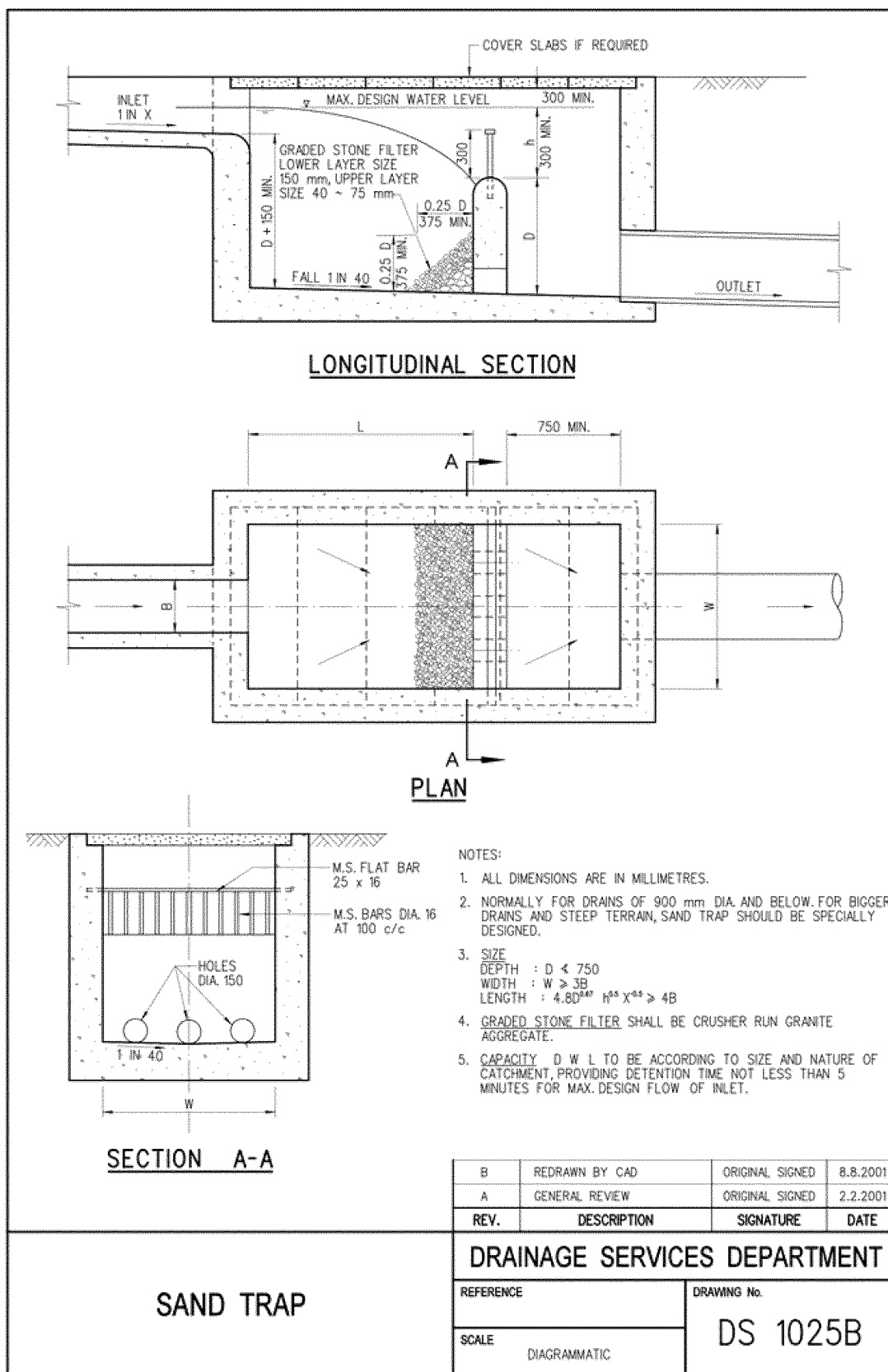


Figure 3-4 Typical Details of Sand Trap



## 4 CONCLUSION

- 4.1.1 Potential drainage impacts that may arise from the Site after construction of the Proposed Development have been assessed.
- 4.1.2 The peak runoff before and after development of the Site has been estimated using the Rational Method and based on the catchment surface characteristics for the existing environment and the Proposed Development. The estimated peak runoff generated from the Site is 0.596m<sup>3</sup>/s under a 50 years return period.
- 4.1.3 The indicative drainage layout shown on **Figure 3-2** will properly divert the runoff arising from the Site which there should currently be no runoff from any upper catchments overflowing the Site. The runoff should be diverted to an open channel/nullah to the south of the Site according to the drainage plan shown on **Figure 2-1** and **Figure 3-2**. As such, no adverse drainage impact is anticipated.
- 4.1.4 Since this Drainage Proposal has been prepared based on the limited information available at this planning stage, the drainage layout shown on **Figure 3-2** is indicative only. The Applicant has committed to do the following if this planning application is approved:
1. Appoint a qualified surveyor to carry out topographical survey to identify, AS A MINIMUM, the existing elevations of the Site and within 200m from the Site boundaries. The topographical survey results mentioned shall be summarised in a Topographical Survey Report to be certified by the qualified surveyor.
  2. Appoint a qualified engineer to prepare an Updated Drainage Proposal in accordance with relevant DSD guidelines, including *Technical Note to prepare a "Drainage Submission" and Stormwater Drainage Manual – Planning, Design and Management*, the latest DSD drainage records/SMO survey maps and the Topographical Survey Report mentioned above. The Updated Drainage Proposal shall include, AS A MINIMUM, the following information:
    - a. Identification of upper and lower catchments, if any, with reference to the Topographical Survey Report.
    - b. Review the extents of the cumulative catchments, if any, upon completion of topography survey and subsequently review the sizes of the proposed drainage facilities indicated on **Figure 3-2**.
    - c. Proposed drainage layout showing AS A MINIMUM the cover levels and invert levels of the U-channels, catchpits and sand traps.
    - d. Cross section plans showing the existing and proposed ground levels of the Site with respect to adjacent areas.
    - e. Provision of sand trap or similar before the collected runoff is discharged to public drainage facilities.
    - f. Provision of standard details to indicate the sectional details of the proposed drainage layout plan.
    - g. All other information and calculations required in relevant DSD guidelines.
    - h. Recommendation for providing adequate opening for any walls or hoarding to be erected along the Site boundary to allow any overland flow passing through the Site walls/hoarding so that such runoff can be properly intercepted and diverted by the proposed drainage system within the Site.

- i. Interpretation that no overland flow shall be obstructed and there will be no adverse impact on the existing natural streams, village drains, ditches and the adjacent areas, etc. due to the Proposed Development.
  - j. Prior to commencing the proposed drainage work, obtain Consent from the District Lands Office/Yuen Long and/or any other government departments for public lots; and/or owners of private lot to the drainage connection into the municipal drainage system.
3. The Updated Drainage Proposal shall be certified by the qualified engineer and annexed with the Topographical Survey Report certified by the qualified surveyor, and shall be submitted to TPB/DSD for approval.
4. Provide, implement and maintain all the mitigation measures to be recommended in the approved Updated Drainage Proposal to ensure that no additional drainage impact due to the Proposed Development will result in flooding/ponding to other off-site areas.

## Appendix A      Runoff Calculations

### Calculation of Runoff for Return Period of 2 Years

Catchment ID	Catchment Area (A), km <sup>2</sup>	Average slope (H), m/100m	Flow path length (L), m	Inlet time (t <sub>0</sub> ), min	Duration (t <sub>d</sub> ), min	Storm Constants			Runoff intensity (i), mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q <sub>p</sub> ), m <sup>3</sup> /s
						a	b	c				
Catchment A (The Site)	0.0059	0.90	99.0	6.14	6.14	499.8	4.26	0.494	157.15	0.95	0.0056	0.244
Catchment B (The Site)	0.0019	0.84	68.0	4.79	4.79	499.8	4.26	0.494	168.36	0.95	0.0018	0.085
Catchment C (The Site)	0.0020	1.77	40.7	2.45	2.45	499.8	4.26	0.494	195.12	0.95	0.0019	0.105
<b>Total</b>											<b>0.433</b>	

### Calculation of Runoff for Return Period of 10 Years

Catchment ID	Catchment Area (A), km <sup>2</sup>	Average slope (H), m/100m	Flow path length (L), m	Inlet time (t <sub>0</sub> ), min	Duration (t <sub>d</sub> ), min	Storm Constants			Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q <sub>p</sub> ), m <sup>3</sup> /s
						a	b	c				
Catchment A (The Site)	0.0059	0.90	99.0	6.14	6.14	471.9	3.02	0.397	195.85	0.95	0.0056	0.304
Catchment B (The Site)	0.0019	0.84	68.0	4.79	4.79	471.9	3.02	0.397	208.68	0.95	0.0018	0.105
Catchment C (The Site)	0.0020	1.77	40.7	2.45	2.45	471.9	3.02	0.397	240.32	0.95	0.0019	0.129
<b>Total</b>											<b>0.537</b>	

### Calculation of Runoff for Return Period of 50 Years

Catchment ID	Catchment Area (A), km <sup>2</sup>	Average slope (H), m/100m	Flow path length (L), m	Inlet time (t <sub>0</sub> ), min	Duration (t <sub>d</sub> ), min	Storm Constants			Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q <sub>p</sub> ), m <sup>3</sup> /s
						a	b	c				
Catchment A (The Site)	0.0059	0.90	99.0	6.14	6.14	451.3	2.46	0.337	218.52	0.95	0.0056	0.339
Catchment B (The Site)	0.0019	0.84	68.0	4.79	4.79	451.3	2.46	0.337	231.50	0.95	0.0018	0.116
Catchment C (The Site)	0.0020	1.77	40.7	2.45	2.45	451.3	2.46	0.337	263.93	0.95	0.0019	0.141
<b>Total</b>											<b>0.596</b>	

Note:

1) Runoff is calculated in accordance with DSD's "Stormwater Drainage Manual (with Eurocodes incorporated) - Planning, Design and Management" (SDM), fifth edition, January 2018.



## **Appendix B**      Calculation of Drainage Capacity

### Calculation of Drainage Capacity for Return Period of 50 Years

#### **Indicative Drainage capacity of the Internal Drainage System**

Channel	Catchments	Shape	D, m	Depth, m	Slope (s)	$A_w$ , m <sup>2</sup>	$P_w$ , m	R, m	n	v, m/s	$Q_c$ , m <sup>3</sup> /s	$Q_p$ , m <sup>3</sup> /s	Capacity	Remark
U-Channel 1	Catchment A	U-Shape	0.590	0.295	0.005	0.311	1.517	0.205	0.016	1.536	0.430	0.339	79%	OK
U-Channel 2	Catchment B & C	U-Shape	0.530	0.265	0.005	0.251	1.363	0.184	0.016	1.430	0.323	0.258	80%	OK
U-Channel 3	Catchments A, B & C	U-Shape	0.720	0.360	0.005	0.463	1.851	0.250	0.016	1.754	0.731	0.596	82%	OK

#### **Legend**

D = diameter, m

$A_w$  = Cross Section Area of Flow, m<sup>2</sup>

$P_w$  = Wetted Perimeter, m

R = Hydraulic Radius =  $A_w/P_w$ , m

s = Hydraulic Gradient

n = Manning's roughness coefficient

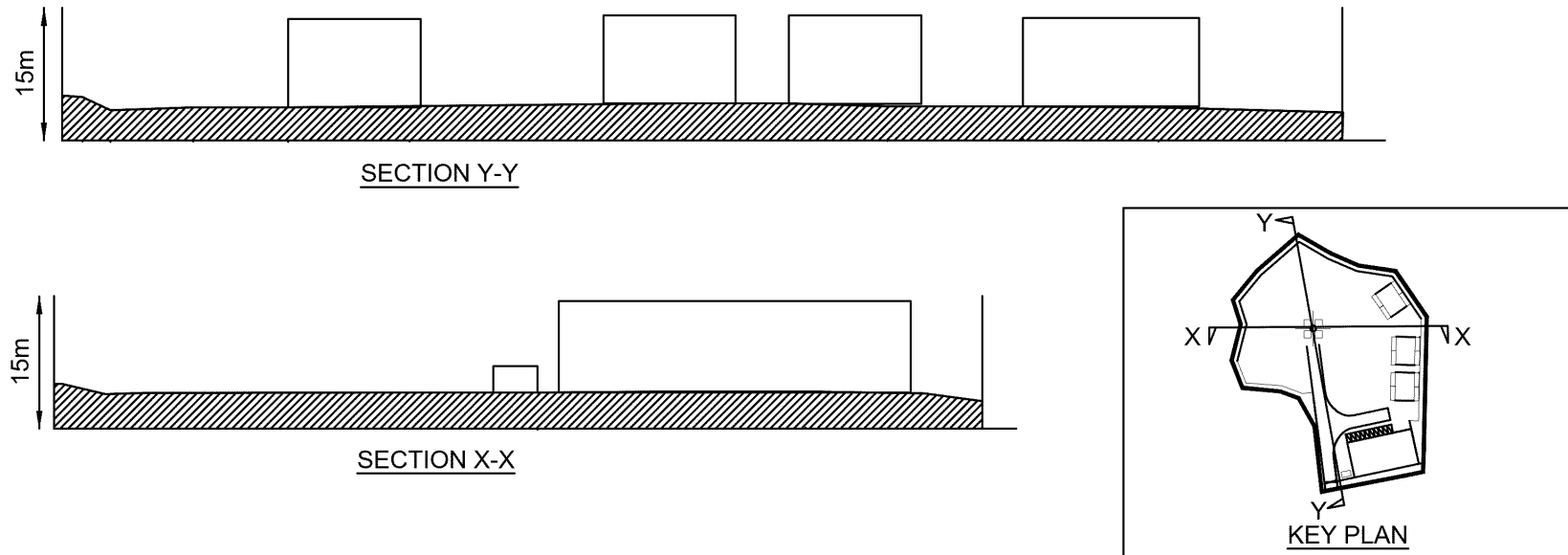
V = Mean Velocity, m/s

$Q_c$  = Flow Capacity (10% sedimentation inclusive), m<sup>3</sup>/s

$Q_p$  = Estimated Peak Flow, m<sup>3</sup>/s

## **Appendix C**      Cross Section of the Site and the Surrounding Area After the Proposed Development

Figure C-1 Cross Section





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**Accountability**

We understand the importance of being accountable to each other and our clients.



**Passion**

We are completely passionate about providing practical solutions and outcomes that deliver for our clients.



**Insight**

We work in an environment that encourages and values insight as a critical quality which informs our decisions and our clients and supports practical solutions and project delivery.



**Integrity**

We behave with respect and honesty toward each other, our clients and our stakeholders.