Enclosure | 6

Revised Project Profile of Drainage

SMEC
Member of the Surbana Jurong Group

local people
global experience

D03 – Project Profile of Drainage

S12A Rezoning Application – Request for Amendment to the Lung Yeuk Tau and Kwan Tei South OZP from "Residential (Group C)" Zone and "Agriculture" Zone to "Residential (Group A)2" Zone at Various Lots in D.D. 83 and Adjoining Government Land, Lung Yeuk Tau, N.T.

Reference No. 7076933
Prepared for Carlton Woodcraft Manufacturing Ltd
8 November 2023

Document Control

Document:	D03 – Project Profile of Drainage
File Location:	Z:\Jobs\7076933 - Carlton - S12A Lung Yeuk Tau\08 Submission
Project Name:	S12A Rezoning Application – Request for Amendment to the Lung Yeuk Tau and Kwan Tei South OZP from "Residential (Group C)" Zone and "Agriculture" Zone to "Residential (Group A)2" Zone at Various Lots in D.D. 83 and Adjoining Government Land, Lung Yeuk Tau, N.T.
Project Number:	7076933 | D03/01
Revision Number:	2

Revision History

REVISION NO.	DATE	PREPARED BY	REVIEWED BY	APPROVED FOR ISSUE BY
0	15 March 2023	Charls LIANG	Antony WONG	Jacky YAU
1	18 July 2023	Charls LIANG	Antony WONG	Jacky YAU
2	8 November 2023	LUO, KAICHAO	Alex GBAGUIDI	Alex GBAGUIDI

Issue Register

DISTRIBUTION LIST	DATE ISSUED	NUMBER OF COPIES
Carlton Woodcraft Manufacturing Ltd	8 November 2023	1 electronic soft copy

Company Details

Approved by:	SMEC Asia Limited		
Address:	27/F Ford Glory Plaza, 37-39 Wing Hong St, Cheung Sha Wan, Kowloon, Hong Kong		
Tel:	+852 3995 8100	Tel:	+852 3995 8100
Email:	hongkong@smec.com	Email:	hongkong@smec.com

Important Notice

This report is confidential and is provided solely for the purposes of supporting S12A Rezoning Application – Request for Amendment to the Lung Yeuk Tau and Kwan Tei South OZP from "Residential (Group C)" Zone and "Agriculture" Zone to "Residential (Group A)2" Zone at Various Lots in D.D. 83 and Adjoining Government Land, Lung Yeuk Tau, N.T.. This report is provided pursuant to a Consultancy Agreement between SMEC Asia Limited ("SMEC") and Carlton Woodcraft Manufacturing Ltd, under which SMEC undertook to perform specific and limited tasks for Carlton Woodcraft Manufacturing Ltd. This report is strictly limited to the matters stated in it and subject to the various assumptions, qualifications and limitations in it and does not apply by implication to other matters. SMEC makes no representation that the scope, assumptions, qualifications and exclusions set out in this report will be suitable or sufficient for other purposes nor that the content of the report covers all matters which you may regard as material for your purposes.

This report must be read as a whole. Any subsequent report must be read in conjunction with this report.

The report supersedes all previous draft or interim reports, whether written or presented orally, before the date of this report. This report has not and will not be updated for events or transactions occurring after the date of the report or any other matters that might have a material effect on its contents or which come to light after the date of the report. SMEC is not obliged to inform you of any such event, transaction or matter nor to update the report for anything that occurs, or of which SMEC becomes aware, after the date of this report.

Unless expressly agreed otherwise in writing, SMEC does not accept a duty of care or any other legal responsibility whatsoever in relation to this report, or any related enquiries, advice or other work, nor does SMEC make any representation in connection with this report, to any person other than Carlton Woodcraft Manufacturing Ltd. Any other person who receives a draft or a copy of this report (or any part of it) or discusses it (or any part of it) or any related matter with SMEC, does so on the basis that he or she acknowledges and accepts that he or she may not rely on this report nor on any related information or advice given by SMEC for any purpose whatsoever.

Table of Contents

Appendices

List of Tables

List of Figures

1 PROJECT BACKGROUND

1.1 Introduction

1.1.1 The title of the Project is S12A Rezoning Application – Request for Amendment to the Lung Yeuk Tau and Kwan Tei South OZP from "Residential (Group C)" Zone and "Agriculture" Zone to "Residential (Group A)2" Zone at Various Lots in D.D. 83 and Adjoining Government Land, Lung Yeuk Tau, N.T.

1.2 Project Proponent

1.2.1 The Applicant of the Section 12A Rezoning Application, i.e., On Billion International Ltd, is the Project Proponent.

1.3 Contact Person

1.3.1 The Contact Person's details are as follows:

Name:	Ms Isa YUEN
Company:	Aikon Development Consultancy Ltd
Email:	Iyuen@aikon.hk
Telephone:	3180 7811
Address:	Unit 1310, Level 13, Tower 2, Metroplaza, No.223 Hing Fong Road, Kwai Fong, N.T.

1.4 Project Background

1.4.1 With reference to the latest policy address in developing the Northern Metropolis, it is aimed to optimize the use of land resources, adopt a higher development intensity and increase high-quality housing supply. In order to address the aforementioned needs, it is planned to redevelop a land with an area of approximately 22,445m^2 comprising various lots in D.D. 83, and the adjoining government land of about 1,358m^2, Lung Yeuk Tau, New Territories, into proposed flat, shop and services and eating place ("the Site" or "the Proposed Development").

1.4.2 The Site is currently zoned "Residential (Group C)" ("R(C)") and "Agriculture" ("AGR") under the Lung Yeuk Tau and Kwan Tei South Outline Zoning Plan ("OZP"). It was planned to develop a commercial complex for shop and services and eating place, and Residential Development comprising 5 blocks for domestic use.

1.4.3 In this regard, a rezoning application under Section 12A of the *Town Planning Ordinance* ("TPO") to rezone the Site from "R(C)" and "AGR" zones to "Residential (Group A)2 ("R(A)2") zone under Column 1 shall be required. SMEC Asia Ltd ("SMEC") has been commissioned by Carlton Woodcraft Manufacturing Ltd ("the Applicant") to conduct this Project Profile of Drainage to support the application.

1.5 Site Description

1.5.1 The Site is located in a developed area in Lung Yeuk Tau, New Territories, which is a flat land used for workshop, storage and warehouses. Its northern part is currently occupied by a permanent domestic structure, temporary structures for open storage yards, storage of construction materials and workshops, open carparks and vacant land. The southern part is currently occupied by the Applicant for warehouse storage.

1.5.2 As shown on ***Figure 1-1***, Sha Tau Kok Road (Lung Yeuk Tau) Section is located to the immediate north of the Site that runs along the northeast-southwest direction. Across the opposite site of Sha Tau Kok Road (Lung Yeuk Tau) Section, there are San Wai Barracks, a recycling centre and some warehouses. The Site is mainly surrounded by Tung Chun Soy Sauce factory place and some vegetated land to the east, Queen's Hill Estate to the south, village houses and

warehouses to the west, intermixed with temporary structures, scattered vegetated and abandoned land.

1.6 Project Description

1.6.1 The Proposed Development will tentatively comprise a commercial complex and a Residential Development with the following components:

- Five Residential Blocks
- One Clubhouse
- One Swimming Pool
- One Shopping Arcade

1.7 Objectives of this PP

1.7.1 The objectives of this PP are to:

- Assess the potential drainage impacts arising from the Site; and
- Recommend the necessary mitigation measures to alleviate the impacts.

1.7.2 This Project Profile comprises the following Sections, in accordance with DSD Advice Note No. 1 - Application of the Drainage Impact Assessment Process to Private Sector Projects:

- Assess the potential drainage impacts arising from the Site; and
- Recommend the necessary mitigation measures to alleviate the impacts.

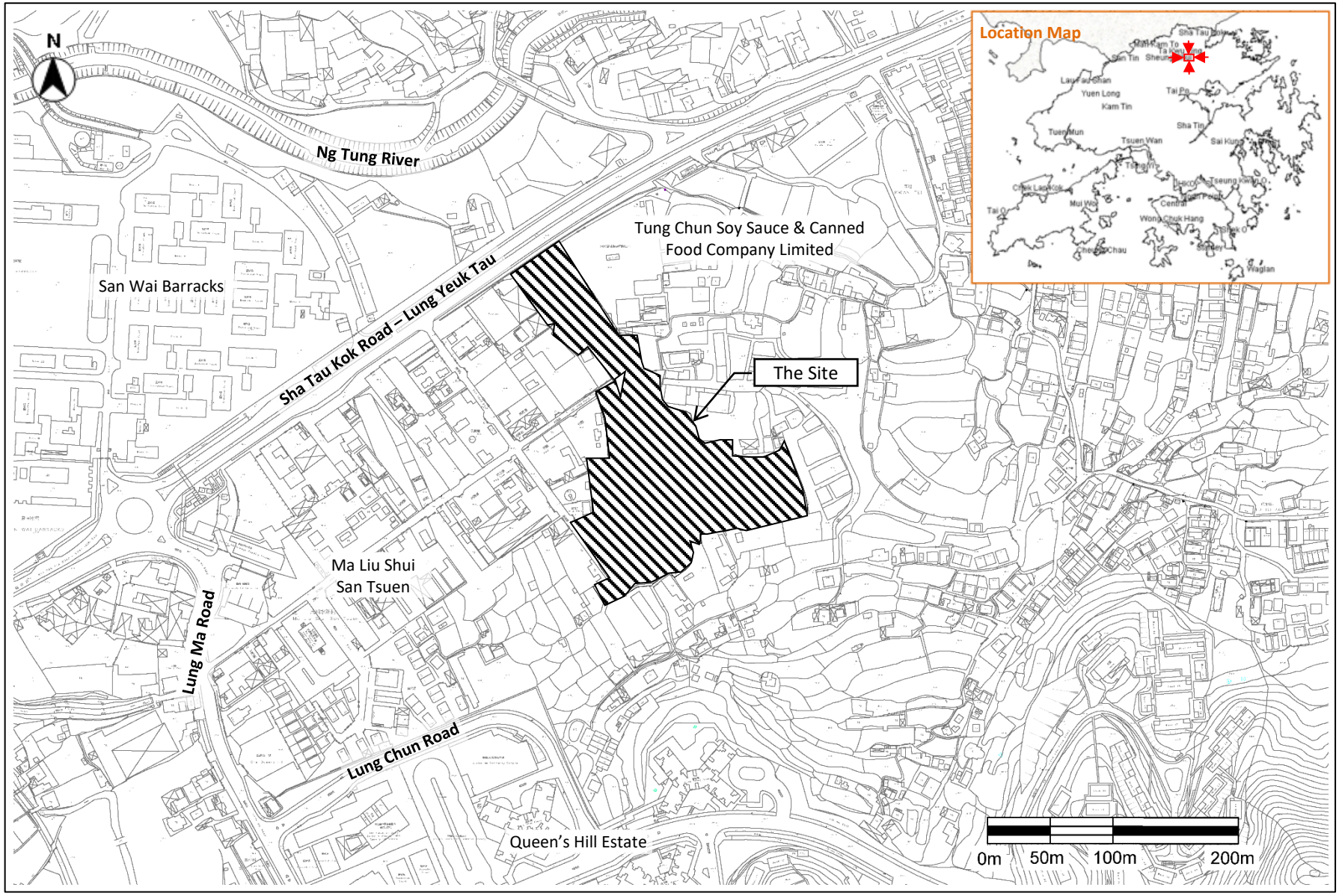
1.8 Reference Materials

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

1.8.2 In evaluating the potential drainage impact arising from the Proposed Development, the following documents have been referred to:

- Drainage Services Department (“DSD”) Publication Stormwater Drainage Manual (with Eurocodes incorporated) – Planning, Design and Management (2018 Edition).
- DSD Publication Stormwater Drainage Manual – Corrigendum No. 1/2022.
- DSD Advice Note No. 1 – Application of the Drainage Impact Assessment Process to Private Sector Projects.
- Survey maps downloaded from Hong Kong Map Service (“HKMS”) 2.0.
- GeoInfo Map (https://www.map.gov.hk/gm/) reviewed on 10 March 2023.

Figure 1-1 Site Location and its Environs



2 DESCRIPTION OF EXISTING ENVIRONMENT AND DRAINAGE CONDITIONS

2.1 Project Implementation

2.1.1 As mentioned in ***paragraph 1.4.3,*** SMEC has been commissioned by the Project Proponent to prepare this PP to study the changes to the drainage characteristics and the potential drainage impacts arising from the Project.

2.1.2 The Project Proponent, subject to the final recommendation of this PP, will be responsible for implementing the proposed works together with all the environmental and drainage mitigation measures.

2.1.3 Construction of the Project will be carried out by the Contractor(s) to be appointed by the Project Proponent at a later stage.

2.2 Project Timetable

2.2.1 The tentative operation of the Proposed Development will be in 2031.

2.2.2 No detailed design including the drainage system is available at this rezoning application stage. The actual drainage construction works will be designed by the drainage engineer to be engaged by the Authorised Person ("AP") of the Proposed Development subject to the approval from the Building Authority and the relevant government departments. The drainage connection proposal will be submitted by the AP at the detailed design stage.

2.2.3 The indicative milestones of the Proposed Development subject to change during the detailed design stage are as follows:

Table 2-1 Indicative Milestones of the Proposed Development

ID	ITEM	ANTICIPATED TIME
1.	Appointing AP	2023
2.	Preliminary Designs	2023 to 2024
3.	Preparation of DIA Study (if required)	2023
4.	Detailed / Finalised Designs	2024
5.	Construction / Implementation	2026 to 2031
6.	Completion / Commencing Operation	2031

2.3 Interaction with Other Projects

2.3.1 With reference to the construction programme of the Project, no concurrent works in the vicinity of the Site are identified at the moment.

3 DESCRIPTION OF CONDITIONS

3.1 Introduction

3.1.1 This section describes the existing and future conditions of the environment at and in the vicinity of the Site.

3.2 Site Location and Topography

3.2.1 As mentioned in paragraph 2.1.2 of the Planning Statement, part of the Site is used for workshop, storage and warehouses. Its northern part is currently occupied by a permanent domestic structure, temporary structures for open storage yards, storage of construction materials and workshops, open carparks and vacant land. The southern part is currently occupied by the Applicant for warehouse storage. The Site is relatively flat with the existing ground elevations of +12.2mPD to +13.3mPD. The Site area is approximately 22,445m^2.

3.3 Statutory Land Use Zoning

3.3.1 As mentioned in ***paragraph 1.1.1***, the Site is currently zoned R(C) and AGR under the Lung Yeuk Tau and Kwan Tei South OZP.

3.4 Existing and Future Conditions

Paved and Unpaved Area of the Site

3.4.1 The total Site area is about is approximately 22,445m^2. In order to understand the existing conditions of the Site and the surrounding area, Site visits were conducted on 6 December 2022 and 18 January 2023. Most of the Site area is hard paved as summarised in ***Table 3-1***.

Table 3-1 Percentage of Paved and Unpaved Areas of the Existing Site

SITE AREA, m^2	PAVED AREA, m^2	UNPAVED AREA, m^2
~22,445	~21,323 (~95%)	~1,122 (~5 %)

3.4.2 As mentioned in paragraph 5.3.1 of the Tree Preservation and Landscape Proposal for the Proposed Development, greenery [note 1] will be provided and the common greenery is calculated in accordance with PNAP APP-152 [note 2]. As mentioned in Table 2 of PNAP App-152, the minimum overall site coverage of greenery for site area between 1,000m^2 and 20,000m^2 should be 20% and that for site area for equal to or larger than 20,000m^2 should be 30% respectively. As mentioned in ***paragraph 3.4.1***, the Site area of the Proposed Development is approximately 22,445m^2. The minimum overall site coverage of greenery for the Proposed Development should therefore be 30% of the Site area.

3.4.3 The total greenery area is proposed to be about 8,026.5m^2 as mentioned in paragraph 5.3.2 of the aforementioned Tree Preservation and Landscape Proposal. The coverage of greenery will be approximately 35.76% for the Proposed Development in accordance with PNAP APP-152.

[1] "Greenery" or "Greenery Area" is area with live plant and soil or similar base defined in BD's PNAP APP-152.

[2] Practice Notes for Authorised Persons, Registered Structural Engineers and Registered Geotechnical Engineers ("PNAP") APP-152 *Sustainable Building Design Guidelines* published by the Building Department ("BD") in January 2016.

Table 3-2 Percentage of Paved and Unpaved Areas of the Proposed Development

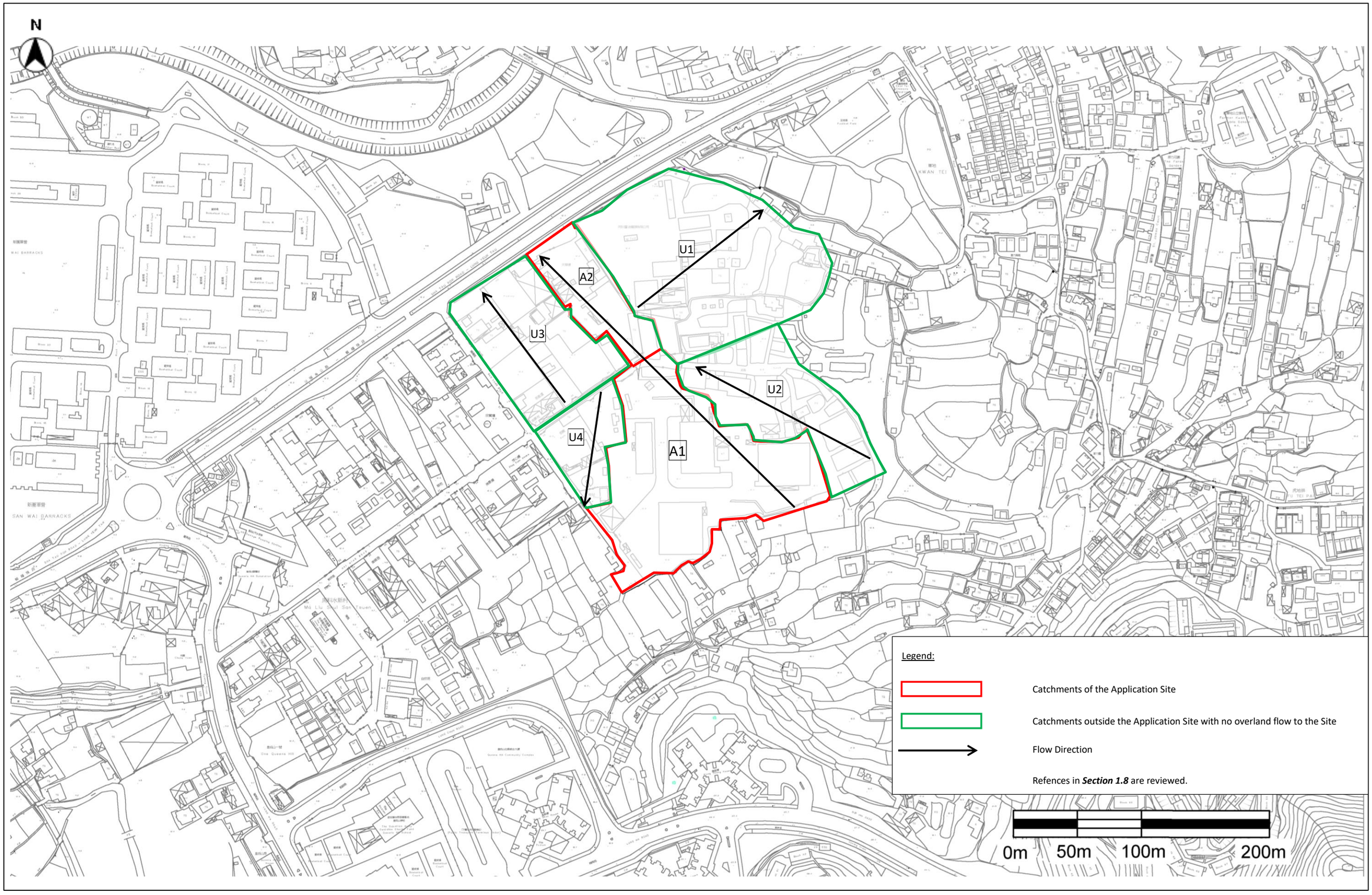
SITE AREA, m^2	PAVED AREA, m^2	UNPAVED AREA, m^2
~22,445	14,418.5 64.24%	8,026.5 35.76%

Catchment Areas

3.4.4 Based on the Site observations and desktop study of the elevations shown on the topographical maps, the identified catchments and anticipated flow directions are shown on ***Figure 3-1***. The catchments are identified as follows:

1. The Site comprises two sub-catchments, Sub-Catchments A1 and A2, with elevations between 12.7mPD and 13.3mPD within A1 and 12.2mPD within A2 respectively.
2. Public roads such as Sha Tau Kok Road – Lung Yeuk Tau, etc. are provided with road drains. Therefore, overland flow from public roads to the Site is unlikely.
3. Other catchments, Catchments U1 to U4 adjacent to the Site, are identified that:
   (a) Since U1 to U4 are outside the Application Boundary, the payment conditions and flow patterns of U1 to U4 will not be changed due to the Proposed Development.
   (b) U1 is an industrial use adjacent to A1 of the Site with elevations between 11.6mPD and 12.2mPD. Most of its site is hard paved and provided with fence walls. The runoff from U1 should be flowed to the northeastern stream. Overland flow from U1 to the Site is unlikely.
   (c) U2 is a rural area adjacent to A2 of the Site with approximately 90% of the area to be vegetated area or bare land while the other 10% of the area to be village houses/paved areas with elevations between 12.5mPD and 13.9mPD. Some runoff from U2 should overland flow onto the Site which can be currently intercepted by the perimeter drains located to the eastern boundary of A2 of the Site.
   (d) There are warehouses and workshops located within U3. Most of its site is hard paved and provided with fence walls with elevations between 12.2mPD and 12.4mPD. U4 is a house development adjacent to A2 of the Site. It is approximately 70% hard paved with elevations between 12.5mPD and 12.6mPD lower than A2 with elevations between 12.7mPD and 13.3mPD. Suggested by DSD comments, the runoff from U3 and U4 have been taken into account for the hydraulic performance check of U-shape surface channel at Sha Tau Kok Road – Lung Yeuk Tau because no existing drainage can be identified for U3 and U4 at Geoinfo Map.

Figure 3-1 *Identified Catchments*



4 DRAINAGE ANALYSIS

4.1 Assumptions and Methodology

4.1.1 Peak instantaneous runoff before and after development of the Project 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* ("SDM").

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

$$Qp = 0.278\ C\ i\ A \qquad \text{--- } \textbf{\textit{Equation 1}}$$

where Qp = Peak Runoff in m^3/s

C = Runoff Coefficient

i = Rainfall Intensity in mm/hr

A = Catchment Area in km^2

4.1.3 Rainfall intensity is calculated using the following expression:

$$\boldsymbol{i = a/(t_d+b)^c} \qquad \text{--- } \textbf{\textit{Equation 2}}$$

where i = Rainfall Intensity in mm/hr

t_d = Duration in minutes (td≤240)

a, b, c = Storm constants (Table 3 of SDM)

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

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

where t_c = time of concentration

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.

4.1.5 Generally, t_0 is much larger than t_f. As shown in the equation of paragraph 3.1.3, 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:

$$\boldsymbol{t_d = t_c = t_o}$$

$$\boldsymbol{t_o = 0.14465\ L/\ (H^{0.2}A^{0.1})} \qquad \text{---- } \textbf{\textit{Equation 4}}$$

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)

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

$$V = \frac{R^{1/6}}{n} \times \sqrt{Rs}$$

--- Equation 6

where V = mean velocity (m/s)
R = hydraulic radius (m)
n = Manning coefficient ($s/m^{1/3}$)
s = hydraulic gradient (energy loss per unit length due to friction)

4.2 Assessment Assumptions

4.2.1 As mentioned in ***Section 3.4***, the Site is currently 95% paved area and 5% soft landscape area. After the Proposed Development, the greenery area would be no less than 30%. The plans showing the existing and proposed pavement condition and site survey photos are provided in ***Appendix A.***

4.2.2 In addition to Catchment A, i.e. the Site, 4 other catchments, U1 to U4 were identified in the surrounding of the Site. As concluded in ***Paragraph 3.4.4***, runoff from U2 may overflow and be intercepted by perimeter drains of the Site while runoff from U3 and U4 will be counted as being collected by the U-shape surface channel, forming the upstream runoff of the site.

4.2.3 With reference to the *Stormwater Drainage Manual*, the runoff coefficients of 0.95 for paved surface and 0.25 for flat grassland were adopted in the runoff calculation as summarised ***Table 4-1.***

Table 4-1 Catchment Surface Characteristics and Runoff Coefficient

CATCHMENTS	SCENARIO OF PROJECT	AREA	SURFACE CHARACTERISTICS	RUNOFF COEFFICIENT
A	Before Development	22,445m^2	95% paved+5% grassland	0.92
	After Development		70% paved+30% grassland	0.70
~~U1~~U2	N/A	9,041m^2	10% paved+90% grassland	0.32
U3	N/A	9,374m^2	10% paved+90% grassland	0.32
U4	N/A	3,415m^2	70% paved+30% grassland	0.74

4.3 Estimated Existing and Future Runoff

4.3.1 The cumulative runoff from Catchment A, U2, U3 and U4 would be calculated using rational method. The runoff was estimated based on the return periods of 2, 10 and 50 years. The runoff calculation is detailed in ***Appendix B.***

4.3.2 With consideration of the climate change effect of 16% for the end of 21st Century mentioned in *Stormwater Drainage Manual Corrigendum No. 1/2022*, the estimated peak runoff generated from the Site before development is 1.070m^3/s and that after development is 0.823m^3/s under 50-year return period.

4.3.3 As shown in ***Table 4-2***, there will be around 19% reduction in the estimated peak runoff from Catchment A (i.e. the Site), after the Proposed Development. Moreover, as mentioned in ***Section 3.4.4***, runoff from Catchments U2 has also been assumed to overflow into the Site and estimated for a conservative approach. Runoff from Catchment U3 and U4 is assumed to share the capacity with the site as upstream flow. The estimated peak runoff from all considered catchment is estimated and summarised in ***Table 4-2***. It shows approximately 16% reduction in the estimated peak runoff after the Proposed Development for the conservative approach.

Table 4-2 Estimated Peak Runoff of the Cumulative Catchments A, U2, U3 and U4

RETURN PERIOD	ESTIMATED PEAK RUNOFF (m^3/s)		% CHANGE
	BEFORE DEVELOPMENT	AFTER DEVELOPMENT	
Catchment A			
2 Years	0.681	0.524	-23.1%
10 Years	0.899	0.691	-23.1%
50 Years	1.070	0.823	-23.1%
Catchments A, U2, U3, and U4			
2 Years	1.031	0.874	-15.2%
10 Years	1.348	1.140	-15.4%
50 Years	1.606	1.359	-15.4%

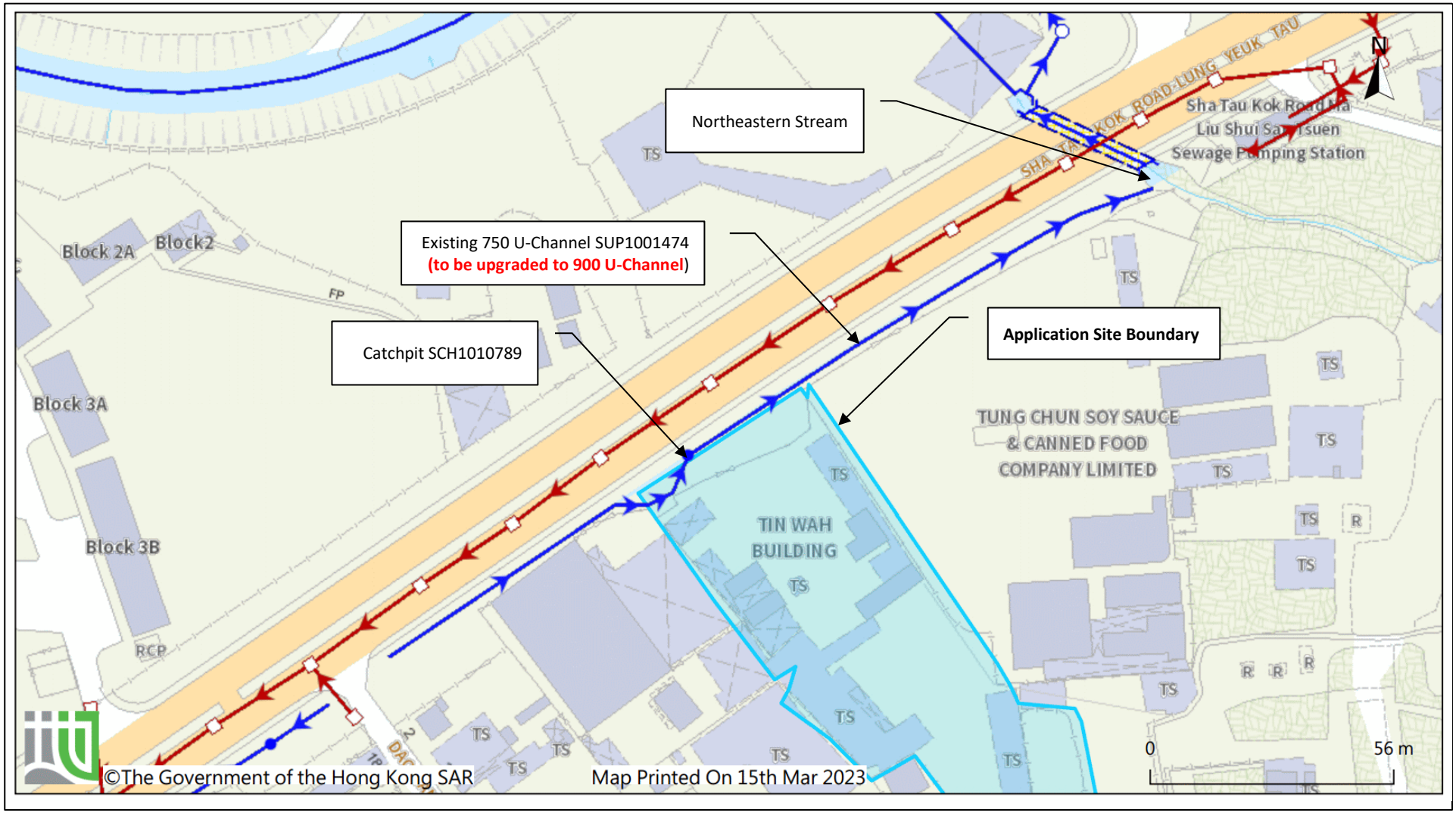
4.4 Drainage Impact Review

4.4.1 As shown in ***Figure 4-1***, surface runoff generated from the Catchment A (i.e. the Site) and Catchment U2 will be collected by the perimeter drains and then be discharged into a 750 U-Channel SUP1001474 via catchpit SCH1010789, which is eventually connecting to northeastern stream.

4.4.2 The hydraulic calculation for the aforementioned 750 U-channel can be referred to ***Appendix C***. The result shows that the existing 750U-channel does not have sufficient capacity to handle the runoff from the cumulative catchments.

4.4.3 In order to mitigate the ~~adverse~~ potential drainage impact, the U-channel with insufficient capacity is proposed to~~shall~~ be upgraded to a 1000mm U-Channel. After the implementation of the upgrading works, the hydraulic calculation shows that the proposed 1000mm U-channel would have sufficient capacity to handle the runoff. There will be no unacceptable drainage impact from the Proposed Development.

Figure 4-1 Proposed Drainage Connection



Notes:

1. The drainage plan was printed on 15 March 2023 from GeoInfo Map.
2. Red lines are foul sewerage system and blue lines are stormwater drainage system.
3. Sufficient areas within the Application Site shall be reserved and provided for the barrier-free maintenance access of the stormwater drainage system adjacent to and within the Application Boundary for the government.

5 DRAINAGE IMPACT REVIEW AND CONCLUSION

5.1.1 The drainage impact from the Site before the Proposed Development and after the Proposed Development has been assessed in this report.

5.1.2 The existing Site is 95% paved which is mainly flat concrete surface. The surface characteristics of the Proposed Development will be changed, in which approximately 70% of the Site will be paved while at least 30% will be landscape area.

5.1.3 The estimated peak runoff generated from the Site before development is 1.070m^3/s and that after development is 0.823m^3/s under a 50-year return period. There will be around 23% reduction in the estimated peak runoff from Catchment A (i.e. the Site), after the Proposed Development.

5.1.4 In addition to Catchment A, 4 other catchments, U1 to U4 were identified in the surrounding of the Site. The runoff from U2 may overflow and be intercepted by perimeter drains of the Site. Even though U1, U3 and U4 would not have obvious drainage connection with the Site, runoff from U3 and U4 has been considered in the hydraulic performance check as the upstream of site.

5.1.5 Moreover, runoff from Catchment U2 has also been assumed to overflow into the Site and estimated for a conservative approach. It shows approximately 15% reduction in the estimated peak runoff after the Proposed Development for the conservative approach.

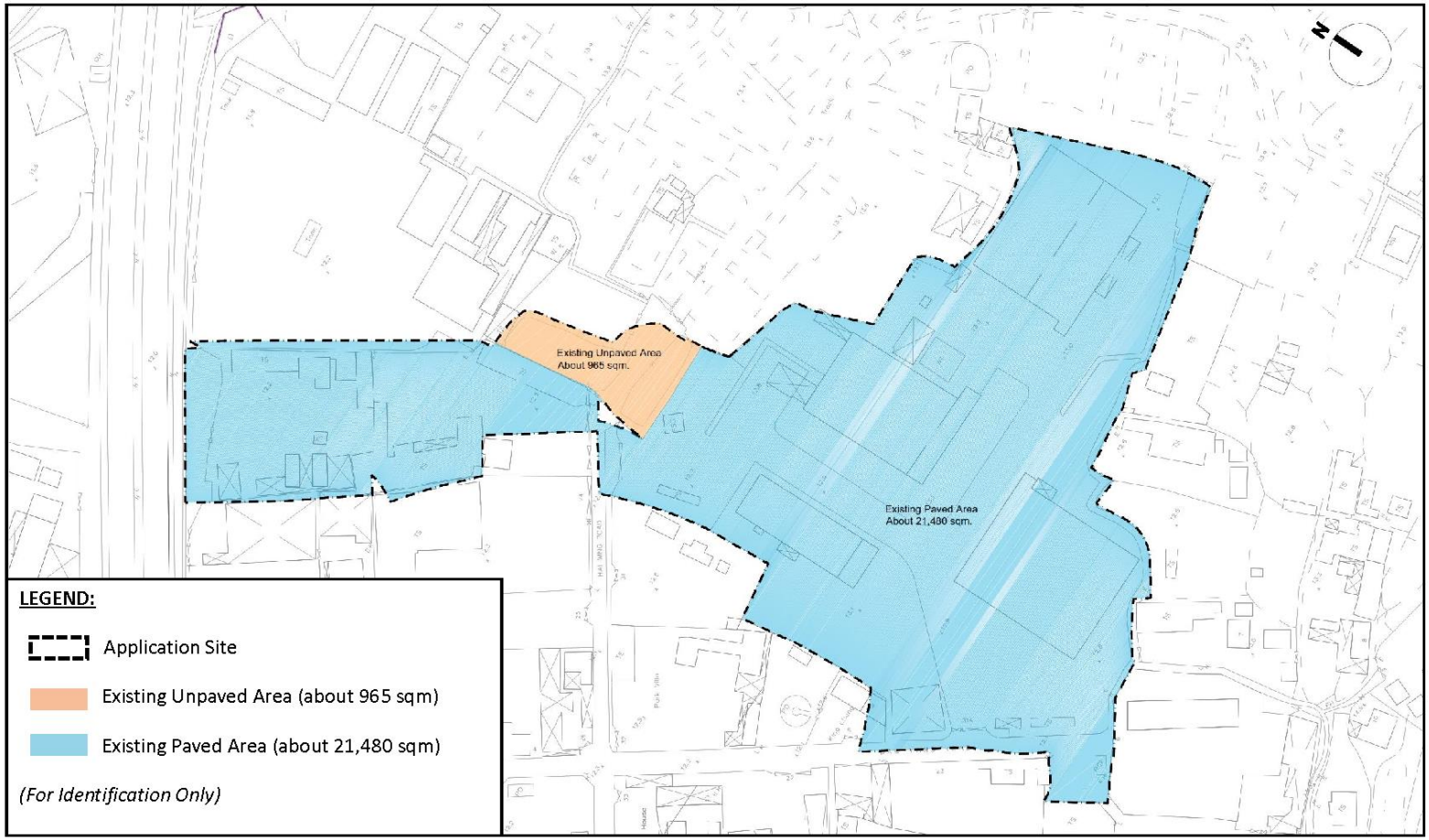
5.1.6 Surface runoff generated from the Catchment A (i.e. the Site) and Catchment U2 will be collected by the perimeter drains and then be discharged into a 750 U-Channel via catchpit SCH1010789, which is eventually connecting to northeastern stream.

5.1.7 In addition, no fence wall or kerbs have been proposed to~~would~~ be erected along the site boundary, subject to change in the detailed design stage. Where any fence wall or kerbs would be erected along the site boundary, peripheral channels should be provided on both sides of the walls or kerbs with details to be agreed by DSD.

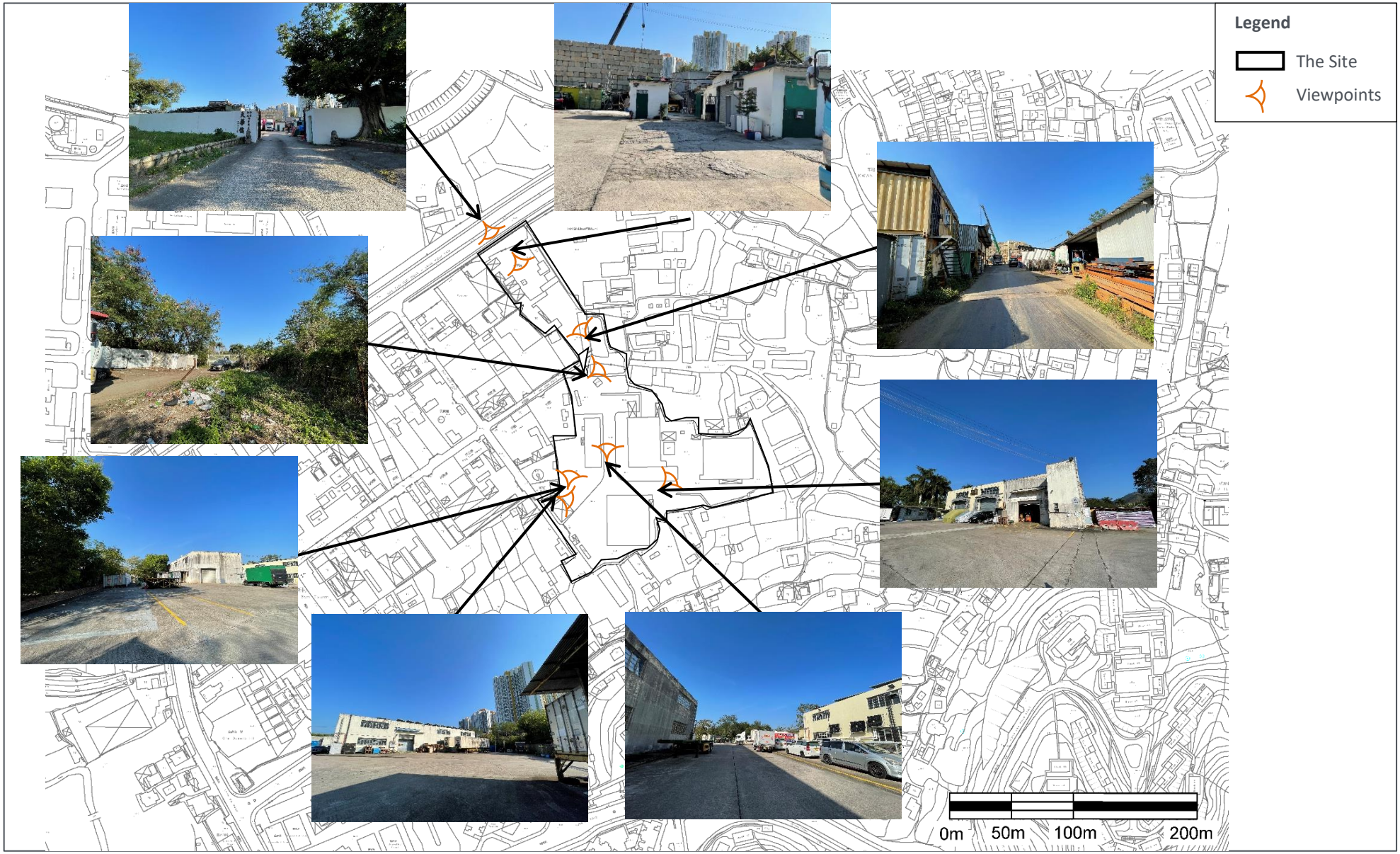
5.1.8 In order to mitigate the ~~adverse~~ potential drainage impact, the 750 U-channel shall be upgraded to a 1000mm U-Channel. After the implementation of the upgrading works, the hydraulic calculation shows that the proposed 1000mm U-channel would have sufficient capacity to handle the runoff. There will be no unacceptable drainage impact from the Proposed Development.

Appendix A EXISTING AND PROPOSED PAVEMENT CONDITION

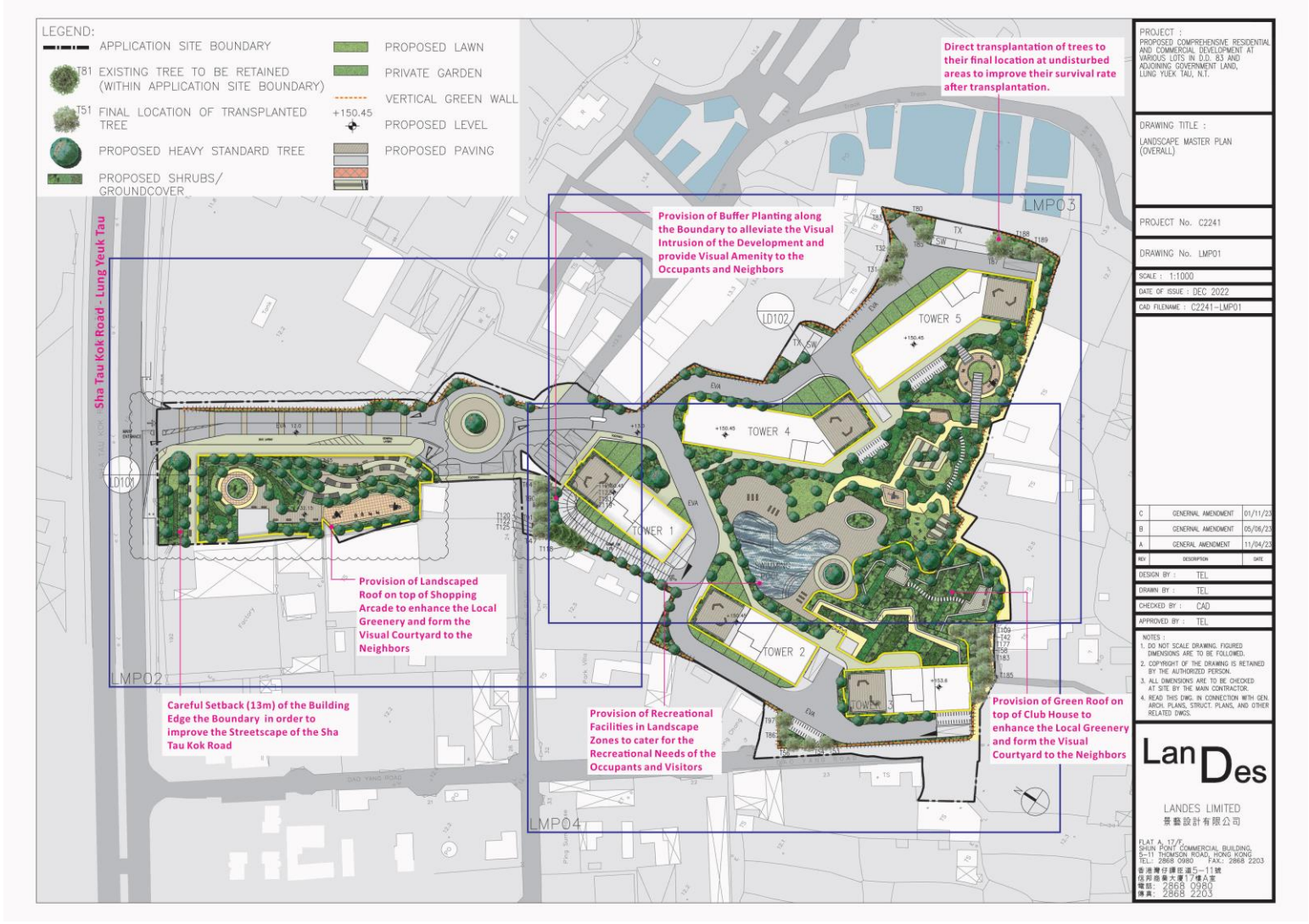
Existing Pavement Condition



Project: Section 12A Planning Application for Proposed Amendment to the Draft Lung Yeuk Tau And Kwan Tei South Outline Zoning Plan No. S/NE-LYT/18 from "Residential (Group C)" Zone and "Agriculture" Zone to "Residential (Group A)2" Zone at Lot Nos. 755, 756, 782 S.A, 789 S.A, 789 RP, 790 S.A ss.1, 790 S.A RP, 791 S.A ss.1, 791 S.A ss.2, 791 S.A ss.3, 791 S.A RP, 791 RP, 792 S.A RP, 792 RP, 793, 794 S.A, 794 RP, 800 S.A RP, 801 S.A, 803 RP, 835 S.B ss.1 S.A, 835 S.B ss.1 RP, 836 S.A, 836 RP, 837, 838 S.A, 838 RP, 839, 840, 841 S.A, 841 S.B, 841 RP, 842 S.A, 842 S.B, 842 RP, 843, 844 S.A, 844 RP and 854 in D.D. 83 and Adjoining Government Land, Lung Yeuk Tau, New Territories	**Title:** Existing Site Condition – Paved and Unpaved Area *Ref.: ADCL/PLG-10248-L006/I001*	**Illustration:** 1 **Scale:** 1:1000 (A3) **Date:** Jul 2023	AiKoN AIKON DEVELOPMENT CONSULTANCY LTD.


Legend
The Site
Viewpoints
0m
50m
100m
200m

Proposed Pavement Condition



Appendix B RUNOFF CALCULATIONS

Calculation of Runoff for Return Period of 2 Years

Catchment ID	Catchment Area (A), km^2	Average slope (H), m/100m	Flow Path Length (L), m	Inlet time (t_0), min [note 2]	Duration (t_d), min [note 2]	Storm Constants			Runoff intensity (i), mm/hr	Runoff coefficient (C) [note 3]	C x i x A	Peak runoff (Q_p), m^3/s	Peak runoff with Climate Change (Q'_p), m^3/s [note 4]
						a	b	c					
Before Proposed Development													
Catchment A	0.0224	0.3	262.0	17.23	17.23	1004.5	17.24	0.644	102.76	0.92	2.110	**0.587**	**0.681**
Catchment U2	0.0090	0.8	124.0	7.53	7.53	1004.5	17.24	0.644	127.13	0.32	0.368	**0.102**	**0.119**
Catchment U3	0.0094	0.2	101.2	8.12	8.12	1004.5	17.24	0.644	125.23	0.32	0.376	**0.104**	**0.121**
Catchment U4	0.0034	0.2	57.7	5.25	5.25	1004.5	17.24	0.644	135.29	0.74	0.342	**0.095**	**0.110**
After Proposed Development													
Catchment A	0.0224	0.4	262.0	16.87	16.87	1004.5	17.24	0.644	103.46	0.70	1.625	**0.452**	**0.524**
Catchment U2	0.0090	0.8	124.0	7.53	7.53	1004.5	17.24	0.644	127.13	0.32	0.368	**0.102**	**0.119**
Catchmnet U3	0.0094	0.2	101.2	8.12	8.12	1004.5	17.24	0.644	125.23	0.32	0.376	**0.104**	**0.121**
Catchment U4	0.0034	0.2	57.7	5.25	5.25	1004.5	17.24	0.644	135.29	0.74	0.342	**0.095**	**0.110**

Calculation of Runoff for Return Period of 10 Years

Catchment ID	Catchment Area (A), km^2	Average slope (H), m/100m	Flow Path Length (L), m	Inlet time (t_0), min [note 2]	Duration (t_d), min [note 2]	Storm Constants			Runoff intensity (i), mm/hr	Runoff coefficient (C) [note 3]	C x i x A	Peak runoff (Q_p), m^3/s	Peak runoff with Climate Change (Q'_p), m^3/s [note 4]
						a	b	c					
Before Proposed Development													
Catchment A	0.0224	0.3	262.0	17.23	17.23	1157.7	19.04	0.597	135.69	0.92	2.787	**0.775**	**0.899**
Catchment U2	0.0090	0.8	124.0	7.53	7.53	1157.7	19.04	0.597	163.39	0.32	0.473	**0.131**	**0.152**
Catchment U3	0.0094	0.2	101.2	8.12	8.12	1157.7	19.04	0.597	161.28	0.32	0.484	**0.134**	**0.156**
Catchment U4	0.0034	0.2	57.7	5.25	5.25	1157.7	19.04	0.597	172.38	0.74	0.436	**0.121**	**0.140**
After Proposed Development													
Catchment A	0.0224	0.4	262.0	16.87	16.87	1157.7	19.04	0.597	136.50	0.70	2.144	**0.596**	**0.691**
Catchment U2	0.0090	0.8	124.0	7.53	7.53	1157.7	19.04	0.597	163.39	0.32	0.473	**0.131**	**0.152**
Catchmnet U3	0.0094	0.2	101.2	8.12	8.12	1157.7	19.04	0.597	161.28	0.32	0.484	**0.134**	**0.156**
Catchment U4	0.0034	0.2	57.7	5.25	5.25	1157.7	19.04	0.597	172.38	0.74	0.436	**0.121**	**0.140**

Calculation of Runoff for Return Period of 10 Years

Catchment ID	Catchment Area (A), km^2	Average slope (H), m/100m	Flow Path Length (L), m	Inlet time (t_0), min [note 2]	Duration (t_d), min [note 2]	Storm Constants			Runoff intensity (i),	Runoff coefficient (C)	C x i x A	Peak runoff (Q_p), m^3/s	Peak runoff with Climate Change
						a	b	c					
Before Proposed Development													
Catchment A	0.0224	0.3	262.0	17.23	17.23	1167.6	16.76	0.561	161.51	0.92	3.317	**0.922**	**1.070**
Catchment U2	0.0090	0.8	124.0	7.53	7.53	1167.6	16.76	0.561	195.01	0.32	0.564	**0.157**	**0.182**
Catchment U3	0.0094	0.2	101.2	8.12	8.12	1167.6	16.76	0.561	192.42	0.32	0.577	**0.160**	**0.186**
Catchment U4	0.0034	0.2	57.7	5.25	5.25	1167.6	16.76	0.561	206.10	0.74	0.521	**0.145**	**0.168**
After Proposed Development													
Catchment A	0.0224	0.4	262.0	16.87	16.87	1167.6	16.76	0.561	162.47	0.70	2.552	**0.709**	**0.823**
Catchment U2	0.0090	0.8	124.0	7.53	7.53	1167.6	16.76	0.561	195.01	0.32	0.564	**0.157**	**0.182**
Catchmnet U3	0.0094	0.2	101.2	8.12	8.12	1167.6	16.76	0.561	192.42	0.32	0.577	**0.160**	**0.186**
Catchment U4	0.0034	0.2	57.7	5.25	5.25	1167.6	16.76	0.561	206.10	0.74	0.521	**0.145**	**0.168**

Notes:

1) Runoff is calculated in accordance with DSD's "*Stormwater Drainage Manual (with Eurocodes incorporated) - Planning, Design and Management* " (SDM), fifth edition, January 2018; and DSD's Stormwater Drainage Manual - Corrigendum No. 1/2022.

2) As mentioned in the DIA Report, Time of Concentration (tc) is assumed to be the same as Inlet Time (t0) and Duration (td) for the worst-case scenario. With reference to *Guidance Notes on Road Pavement Drainage Design* published by the Highways

3) Before the Proposed Development, the Site is approximately 95% paved. After the Proposed Development, 30% of the Site will be soft landscape area. Runoff coefficients 0.95 and 0.25 are therefore adopted for paved andunpaved surface respectively in accordance with DSD's SDM.

4) Table 28 Rainfall Increase due to Climate Change of DSD's *Corrigendum No. 1/2022* of 16% for end of 21st Century is adopted.

Appendix C CALCULATION OF FLOW CAPACITY

Calculations of Drainage Capacity for the Existing U-Channel and Proposed U-Channel

Stormwater Drain	D, m	A_w, m^2	P_w, m	R, m	Gradient, 1 in	s	n	v, m/s	Q_c, m^3/s	Q'_p, m^3/s	Catchments	% of Capacity	Acceptable?
750 U-Channel	0.750	0.502	1.928	0.260	200	0.005	0.016	1.802	0.815	1.529	A, U2, U3, U4	187.7%	No
Proposed 1000 U-Channel	1.000	0.893	2.571	0.347	200	0.005	0.016	2.183	1.754	1.529	A, U2, U3, U4	87.2%	Yes

Legends:

D = diameter, m

A_w = Cross Section Area of Flow, m^2

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^3/s

Q'_p = Estimated Total Peak Flow with Climate Change Effect for Return Period of 50 Years after the Proposed Development, m^3/s

% of capacity = Q'_p / Q_c

Notes:

1. Peak flow of $0.17m^3/s$ from proposed Sewerage Treatment Plant has been also included in the total runoff.
2. The n value of 0.016 in fair condition for concrete-lined channels recommended in Table 13 of the SDM for design purpose is adopted.

local people
global experience

SMEC is recognised for providing technical excellence and consultancy expertise in urban, infrastructure and management advisory. From concept to completion, our core service offering covers the life-cycle of a project and maximises value to our clients and communities. We align global expertise with local knowledge and state-of-the-art processes and systems to deliver innovative solutions to a range of industry sectors.

www.smec.com