Appendix C

Revised Sewerage Impact Assessment

Section 12A Planning Application – Proposed Innovation and Technology Hub at Various Lots in D.D. 82 and D.D. 86 and Adjoining Government Land, Man Kam To, New Territories

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Sewerage Impact Assessment Report

T&SH/001/Issue 7

Binnies Hong Kong Limited
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Hong Kong

January 2025

DOCUMENT CONTROL			Section 12A Planning Application – Proposed Technology and Science Hub at Various Lots in D.D. 82 and D.D. 86 and Adjoining Government Land, Man Kam To, New Territories	No:	001
AMENDMENT RECORD				Prepared by:	Binnies
Sewerage Impact Assessment Report				Initial:	HLam
				Date:	January 2025

Pages	Date	Issue No	Description	Initials
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All	June 2024	5	Issue for comment	HLam
All	August 2024	6	Issue for comment	HLam
All	January 2025	7	Issue for retention	HLam

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LIST OF DRAWINGS

Appendix

	Name	Signature	Date
Prepared	John TANG		January 2025
Checked	Harry LAM		January 2025
Reviewed	Sylvia CHAN		January 2025

1. INTRODUCTION

1.1 Binnies Hong Kong Limited (Binnies) has been commissioned to carry out sewerage impact assessment to support a Section 12A planning application for proposed amendments to the Approved Man Kam To Outline Zoning Plan (Proposed Amendment) for proposed Innovation and Technology Hub (Proposed Development) at various lots in D.D. 82 and D.D. 86 and adjoining government land in Man Kam To, New Territories (Application Site). This report presents the findings of the sewerage impact assessment for the Proposed Development at the Application Site.

1.2 The Application Site is currently located at agriculture land as shown in ***Drawing No. T&SH/LP/001***.

1.3 The Proposed Development consists of data centre, R&D centre, commercial building, ancillary dormitories and residential flats. The Development Site occupies an area of approximately 12.6 ha.

1.4 The Proposed Development layout is shown in ***Appendix A***. A summary of key information of the Proposed Development is shown below in ***Table 1***.

Table 1--- Development Schedule

		Proposed Development
Site Area		About 125,863 m^2
Development Site Area		About 102,461 m^2
Overall Plot Ratio		5.23
- Non-Domestic PR		3.57
- Domestic PR		1.66
Tentative Intake Year		2028
Data Centre	Gross Floor Area (GFA)	86,400 m^2
	Estimated Number of Working Population (1)	**432**
R&D Centre	GFA	268,780 m^2
	Estimated Number of Working Population (2)	**5,375**
Commercial	GFA	9,276 m^2
	Estimated Number of Working Population (3)	**400**
Kindergarten	GFA	724 m^2
	No. of Classroom	6
	Estimated Number of Students (7)	**180**
	Estimated Number of Working Population (7)	**16**
Ancillary Dormitories	GFA	63,900 m^2
	No. of Flats	1,392
	Estimated Number of Population	**3,758**

		Proposed Development
Other Residential Uses	GFA	106,500 m^2
	No. of Flats	2,320
	Estimated Number of Population	**6,264**
Clubhouse	GFA	3,500 m^2
	Estimated Number of Working Population (4)	**50**

(1) An assumption of 200m^2 per worker is assumed for Data Centre, with reference to Employment Density Guide (3rd Edition) in UK.
(2) An assumption of 50m^2 per worker is assumed for R&D Centre, with reference to Employment Density Guide (3rd Edition) in UK.
(3) An assumption of 25m^2 per worker is assumed for commercial uses (retail, F&B), with reference to Hong Kong Planning Standards and Guidelines (HKPSG) Chapter 5.
(4) According to APP-104, a maximum area of 3,500 m^2 can be applied for GFA concession for a development with domestic GFA of >100,000 m^2 to 125,000 m^2. The clubhouse GFA (intended for use by residents of Other Residential Uses) is proposed to be exempted from GFA calculation. An assumption of 70m2 per worker is assumed for Clubhouse (Amusement & Entertainment Centres), with reference to Employment Density Guide (3rd Edition) in UK.
(5) With reference to the Table 7 of "Usage Ratio for the GFA of Private Commercials (excluding shops) by Economic Activity and Broad Are" published by Planning Department. 13.8% utilization of Private Commercials GFA for Restaurants is assumed.
(6) With reference to the Table 8 of "Commercial and Industrial Floor Space Utilization Survey" published by Planning Department, the density of employees adopted in the assessment are 5.1 / 100 m^2 GFA
(7) The kindergarten with 6-classroom of about 724 m^2 GFA fulfils the minimum floor space requirement specified in the EBD's Operation Manual for Pre-primary Institute. Indicative only, subject to detailed design. The working population of is based on a Teacher – Minimal Pupil ratio of 1:11 according to EDB's Report on the Review of the Kindergarten Education Scheme (August 2021)

1.5 This SIA report comprises the following sections after this introduction:

- ***Section 2*** discusses the existing sewerage and sewage facilities in the vicinity of the Application Site;
- ***Section 3*** presents the estimation of sewage generated from the Proposed Development;
- ***Section 4*** assesses the potential impacts arising from the Proposed Development and proposed mitigation measures; and
- ***Section 5*** provides conclusion and recommendation of the SIA report.

2. EXISTING SEWERAGE AND SEWAGE FACILITIES IN THE AREA

2.1 According to the latest Drainage Record Plan from Drainage Services Department (DSD), there are no public sewerage connection is available at the Application Site. There are 250 mm rising mains at Lin Ma Hang Road in the vicinity of the Application Site.

2.2 The Application Site is located within the sewage catchment of Shek Wu Hui Sewage Treatment Works (SWHSTW). Sewage generated from the existing villages at Ta Kwu Ling in proximity to the Application Site is currently collected and conveyed by the existing sewage pumping stations at North East New Territories, through the existing rising mains at Ping Che Road, Lin Ma Hang Road and Man Kam To Road to SWHSTW for treatment and disposal. The existing public sewerage system is shown in ***Drawing No. T&SH/SIA/001***.

2.3 The capacity of the SWHSTW will be increase from 105,000 m^3/day to 190,000 m^3/day after completion of Shek Wu Hui Effluent Polishing Plant (SWHEPP) Improvement Scheme. The SWHEPP Improvement Scheme are being implemented in phases, to cope with the developments in North East New Territories in the future.

2.4 The sewerage system in North East New Territories Sewerage System would be upgraded under Contract No. DC/2021/02 "North East New Territories Sewerage System Upgrade". The works include construction of two sewage pumping stations, upgrading of seven existing sewage pumping stations and construction of the associated sewerage in the North East New Territories. The layout plan of the proposed works under this contract is enclosed in ***Appendix B***.

3. ESTIMATED QUANTITY OF SEWAGE

Population Forecast

3.1 A population forecast was undertaken to identify the design population of the Proposed Development. The design residential population of the Development Area is estimated by the following equation:

Design Residential Population = Number of Residential Unit x Person-Per-Unit Ratio

3.2 Person-Per-Unit Ratio of 2.7 was adopted, which was estimated based on the average household size of the Territory and North District in 2021 Census.

3.3 Based on the above assumption, the design population is summarized in ***Table 2*** below:

Table 2 --- Estimated Population

Domestic Population		
	Ancillary Dormitories	**Other Residential Uses**
No. of Residential Units	1,392	2,320
Person-Per-Unit Ratio	2.7	
Design Population *Residential*	3,758	6,264
Total Domestic Population	**10,022**	
Non-Domestic Population		
Data Centre	432	
R&D Centre	5,375	
Commercial	400	
Kindergarten Students	180	
Kindergarten Staff	16	
Clubhouse	50	
Total Non-Domestic Population	**6,453**	
Total Design Population	**16,475**	

Estimation of Sewage Flow

3.4 The Average Dry Weather Flow (ADWF) was estimated by referencing the "Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (Version 1.0)" (GESF) published by Environmental Protection Department (EPD) in 2005.

3.5 The Proposed Development is shown on ***Drawing No. T&SH/MLP/001*** and the design assumptions are summarized in ***Table 3***.

Table 3 --- Estimated Sewage Flow Generated from the Population

	Design Population	Unit Flow Factor (m^3/person/day)	Estimated Sewage Flow (m^3/day)
Domestic Private (R2)	6,264	0.270	1,691.3
Domestic Institutional	3,758	0.190	714.0
Transport, Storage & Communication (J3)	432	0.180	77.8
Finance, Insurance, Real Estate & Business Services (J6)	5,375	0.080	430.0
Wholesale & Retail (J4)	400	0.280	112.0
School student	180	0.040	7.2
Community, Social & Personal Services (J11)	66	0.280	18.5
Catchment Inflow Factor			1.00
Total ADWF			3,050.8

3.6 The discharge from the club house and swimming pool shall apply for a discharge licence under the Water Pollution Control Ordinance (WPCO), and the discharge shall comply with the terms and conditions of a licence and the standards for effluents specified in the licence.

3.7 For the swimming pool in the proposed development, the estimation of backwash flow from the swimming pool is summarized in ***Table 4***.

Table 4 --- Estimated Sewage Flow from Swimming Pool

Pool Volume	25 m x 10 m x 1.8m = 450 m^3
Turnover Rate	6 hr
Surface Loading Rate of Filter	50 m^3/ m^2/hr
Filter Areas Required	450 / 6 /50 1.50 m^2 (1 filter)
Backwash Duration	7 min /day
Backwash Flow Rate	30 m^3/ m^2/hr
Design Flow for Swimming Pool Backwashing	30 x 1.5 x 7 /60 **= 5.25 m^3/day** **= 0.061 l/s**

3.8 Peak flows are estimated by multiplying the average dry weather flows by appropriate peaking factors. The peaking factors established in the GESF are adopted to assess the performance of the sewerage systems. The peaking factors used in this SIA are reproduced in ***Table 5***.

Table 5 --- Adopted Peaking Factors

	Peaking Factor for Sewers (Population 10,000-50,000)	**Peaking Factor for Preliminary Sewage Treatment Works / Pumping Stations (Population 10,000-25,000)**
Stormwater allowance excluded	3	2.5
Stormwater allowance included	4	3.5

3.9 Bleed-off water generated from the A/C system of the Data Centre will be discharged to retention tank before discharge to the public sewerage system. The amount of bleed-off water from cooling tower is estimated as 1,000 m^3/day based on the floor area of Data Centre. The bleed off water from the freshwater cooling chiller should be recycled for flushing use as far as practical, with any excess bleed off be discharged into the sewerage system.

3.10 Peaking factors of 4 and 3.5 will be adopted for design of the proposed sewer and sewage treatment plant for the Proposed Development, respectively. The design total sewage flow generated from the Development is summarized in ***Table 6*** and detailed in ***Appendix C***.

Table 6 --- Design Total Sewage Flow

Item	**From Population**	**Swimming Pool**	**Bleed-off Water**	**Total**	**Units**
Total ADWF	3,050.8	5.3	1,000	4,056.1	m^3/day
	35.3	0.1	11.6	47.0	l/s
Total Peak Flow (for sewer)	12,203.2	5.3	1,000	13,224.2	m^3/day
	141.2	0.1	11.6	153.1	l/s
Total Peak Flow (for pumping station / treatment works)	10,677.8	5.3	1,000	11,696.2	m^3/day
	123.6	0.1	11.6	135.4	l/s

3.11 The design ADWF for the Application Site is 4,056 m^3/day or 47.0 l/s. The design peak flow for the proposed sewer within the residential development site is 13,224 m^3/day or 153.1 l/s, while the design peak flow for proposed on-site STP is 11,696 m^3/day or 135.4 l/s.

4. POTENTIAL IMPACTS ON SEWERAGE NETWORKS & PROPOSED MITIGATION MEASURES

Impact on Existing Sewerage System

4.1 Currently, there is no public sewerage connection available at the Application Site. The Proposed Development will generate additional sewage flows and loads to the sewage catchment of SWHSTW.

4.2 It is noted that Tong Fong Sewage Pumping Station (TFSPS) and Lin Ma Hang Road Sewage Pumping Station (LMHRSPS), in the proximity of the Application Site, are planned to be reconstructed and upgraded respectively, under PWP item No. 409DS – North East New Territories Sewerage System Upgrade. However, their existing / planned pumping capacity are not sufficient to cater for the additional sewage flow generated from the Proposed Development (ADWF of 4,056 m^3/day).

Proposed Mitigation Measures

4.3 The Application Site is located within the Deep Bay Water Control Zone (WCZ). The treated sewage effluent generated from the development site, if discharged directly or in-directly to the Deep Bay, is required to comply with 'No net increase in pollution load' Policy. Effluents discharged into Deep Bay are required to be properly treated prior to final disposal so as not to cause net increase in pollution load to Deep Bay. Suitable mitigation measures should therefore be applied to minimise the identified water quality impacts.

4.4 To mitigate the potential sewerage impact arising from the Proposed Development and meet the relevant discharge standards. It is proposed to construct an on-site Tertiary sewage treatment plant (STP) adopting Membrane Bioreactor (MBR) technology with ultra-filtration for treatment of sewage generated from the Proposed Development, as shown in ***Drawing No. T&SH/SIA/002***. Membrane Bio-Reactor (MBR) system recommended as the treatment process requires smaller footprint and generates high quality effluent to meet the discharge requirements. The treated effluent should fulfil the discharged standard specified in ***Table 7***, and will comply with the standards stipulated under *Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* (TM-DSS).

Table 7 --- WPCO Licence Standards for Private Tertiary STP (for discharge into Deep Bay) (6)

Parameter	Unit	Tertiary Effluent Standards (Upper Limit)
BOD_5	mg/L	10
TSS	mg/L	10
TN	mg/L	20
TP	mg/L	2
Ammonia-N (2)	mg/L	5
E. coli	count / 100 mL	100 (5)

(1) Discharge licence issued under the Water Pollution Control Ordinance (WPCO) (Cap. 358).
(2) Ammonia-N standard is applicable for discharge to be made into inland waters of Deep Bay.
(3) For specific case where STP receives influent stream of high TN load (e.g. pre-treated landfill leachate). TN standard of ≤ 15 mg/L should be adopted.
(4) Monthly geometric mean.
(5) E. coli standards are set based on the WPCO TM and receiving water body.
(6) The effluent standards listed in Table 8 are specifically for reference to setting WPCO Licence conditions for discharges to be made into Group D inland water and coastal waters (specified in the WPCO TM) of Deep Bay. Depending on the water body receiving the discharge, the more stringent set of the effluent standards should be adopted as appropriate.

4.5 The STP is a 2-storey high building structure with the majority of the treatment facility located in the basement of the building. The above ground and underground footprint of the STP buildings are about 1800 m^2 and 3000 m^2 respectively. The height of the building structure is anticipated to be approximately +12 mPD with basement level to be approximately +1 mPD.

4.6 The following components would be located at the basement of the STP:

- Preliminary Treatment
- Grit Removal System
- Equalization Tank
- MBR Sludge Thickeners and Dissolved Air Floatation Unit
- MBR and Fine Screen

4.7 The sludge storage/transfer area, blower room, membrane maintenance room, odour control room, chemical compound, switch room, control room, transformer room and the access and lifting area are located at the ground floor and first floor of the STP.

4.8 Mitigation measures, such as covering up the major odour sources, providing adequate ventilation, use of active carbon at exhaust and odour removal system, would be proposed to mitigate the potential impact to the sensitive receivers.

4.9 All pumps, motors, blowers and other mechanical equipment will be enclosed in structures or located underground as far as practicable. All openings for ventilation will be located away from sensitive receivers as far as practicable and if required, fitted with acoustic louvers. It is envisaged that any potential noise generation can be readily mitigated.

4.10 During emergency situations, such as loss of power supply at the onsite STP, or mechanical faults / equipment failures, untreated sewage effluent may overflow and cause potential impacts at downstream. With the 'no net increase of pollution load' requirement as stipulated in the Town Planning Board Guideline, any discharge of sewage leading to a net increase in pollution load is not environmentally acceptable. To minimise the risk of untreated sewage effluent discharge due to emergency events, a number of contingencies will be provided at the onsite STP, such as equalization tank (minimum 2,028 m^3 to store three times of ADWF for a period of 4 hours), dual or standby power supply, standby sewage treatment units for major equipment, including pump, to allow for emergency shutdown or partial shutdown for maintenance, flow sensors and alarm systems. With these contingency measures in place, the risk of untreated sewage effluent discharge to Deep Bay WCZ due to emergency events is considered to be minimised.

4.11 Sewage generated from the Application Site would be conveyed by the internal sewerage system to the STP for treatment. The treated sewage would be discharged to Ping Yuen River. The hydraulic calculation of the internal sewerage system is presented in ***Appendix C***.

Construction and Maintenance Responsibility

4.12 The sewage facilities provided as part of the proposed private housing development inside the Application Site would be constructed, operated and maintained by the developer or the management of the development after completion.

Environmental Impact Assessment Ordinance

4.13 Since the installed capacity of the proposed sewage treatment works is 4,056 m^3/day (less than 5,000 m^3/day), the proposed STP would not constitute designated project (DP) under Item F.1 and F.2 of Part I, Schedule 2 to the Environmental Impact Assessment Ordinance (EIAO).

5. CONCLUSION

5.1 The report aims to assess the sewerage impact arising from the Proposed Development to the existing and planned public sewerage networks.

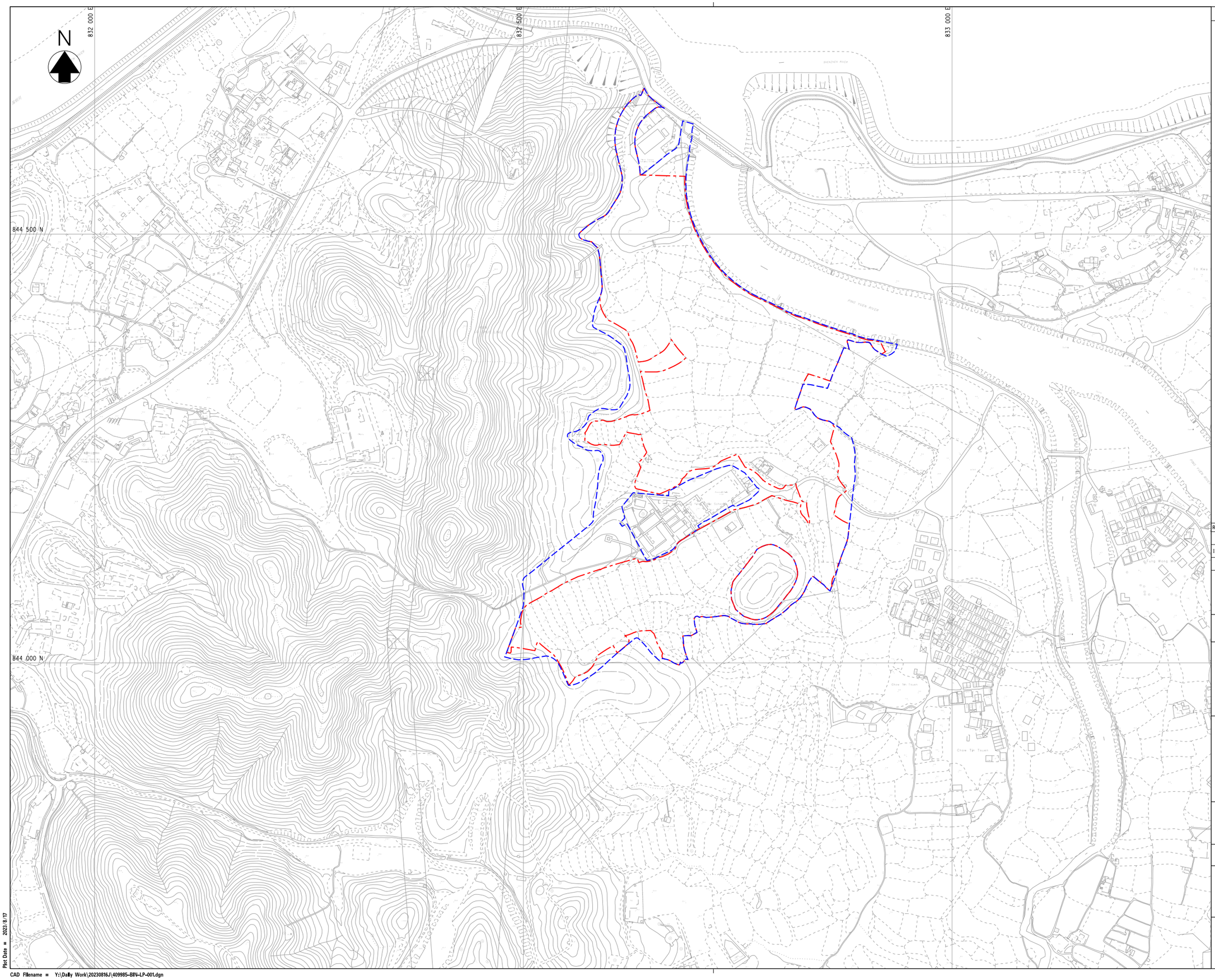
5.2 The proposed development will introduce new populations and generated additional sewage flow of 4,056 m^3/day (ADWF) in the sewage catchment of SWHSTW.

5.3 Sewage generated from the Proposed Development would be conveyed to the proposed on-site STP for treatment and subsequent discharge to Ping Yuen River to mitigate the potential sewerage impact arising from the Proposed Development.

5.4 Detail design of the proposed STPs and internal sewerage system would be further considered during the detailed design stage to collect the sewage flow generated from the development.

END OF TEXT

Drawings



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NOTES:

1. ALL LEVELS ARE IN mPD.
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LEGEND:

DEVELOPMENT SITE

APPLICATION SITE BOUNDARY

Revision	Date	Description		Initial
	Designed	Checked	Drawn	Checked
Initial	KCT	HLam	SZ	SC
Date	MAY 2022	MAY 2022	MAY 2022	MAY 2022

Approved

Contract no.

Contract title

S.12A PLANNING APPLICATION FOR REZONING OF VARIOUS LOTS IN DD82 AND DD86 AND ADJOINING GOVERNMENT LAND

Drawing title

LAYOUT PLAN

Drawing no.	Revision
409985/BIN/LP/001	-

Scale
A1 1:2000
A3 1:4000

香港特別行政區政府渠務署
THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION DRAINAGE SERVICES DEPARTMENT

BINNIES HONG KONG LIMITED
賓尼斯工程顧問有限公司

Plot Date = 2023/8/17

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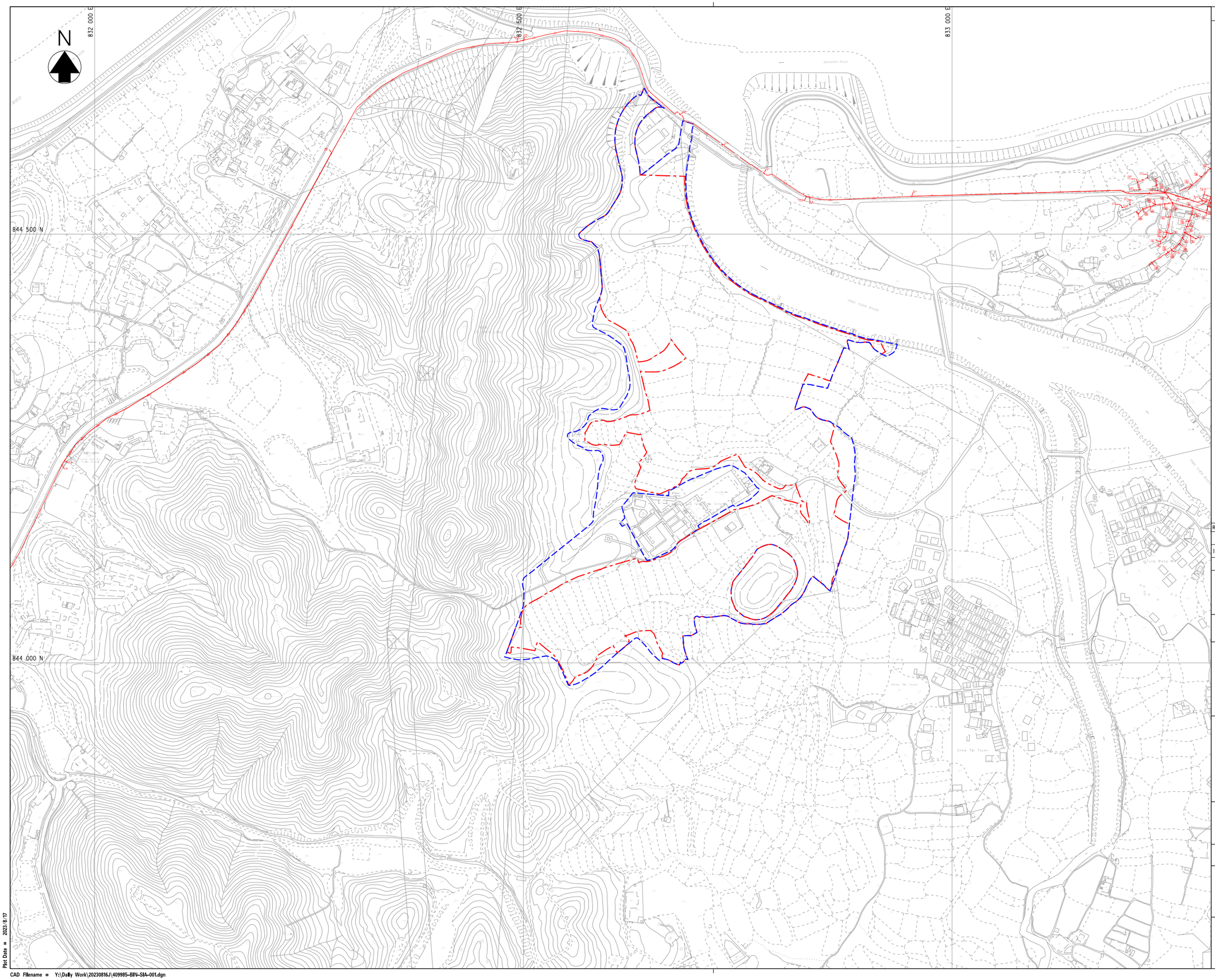

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NOTES:

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LEGEND:

- DEVELOPMENT SITE
- APPLICATION SITE BOUNDARY
- SEWERAGE SYSTEM

Revision	Date	Description		Initial
	Designed	Checked	Drawn	Checked
Initial	KCT	HLam	SZ	SC
Date	MAY 2022	MAY 2022	MAY 2022	MAY 2022

Approved

Contract no.

Contract title

S.12A PLANNING APPLICATION FOR REZONING OF VARIOUS LOTS IN DD82 AND DD86 AND ADJOINING GOVERNMENT LAND

Drawing title

EXISTING SEWERAGE LAYOUT

Drawing no.	Revision
409985/BIN/SIA/001	-

Scale
A1 1:2000
A3 1:4000

香港特別行政區政府渠務署
THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION
DRAINAGE SERVICES DEPARTMENT

BINNIES HONG KONG LIMITED
賓尼斯工程顧問有限公司

Plot Date = 2023/8/17

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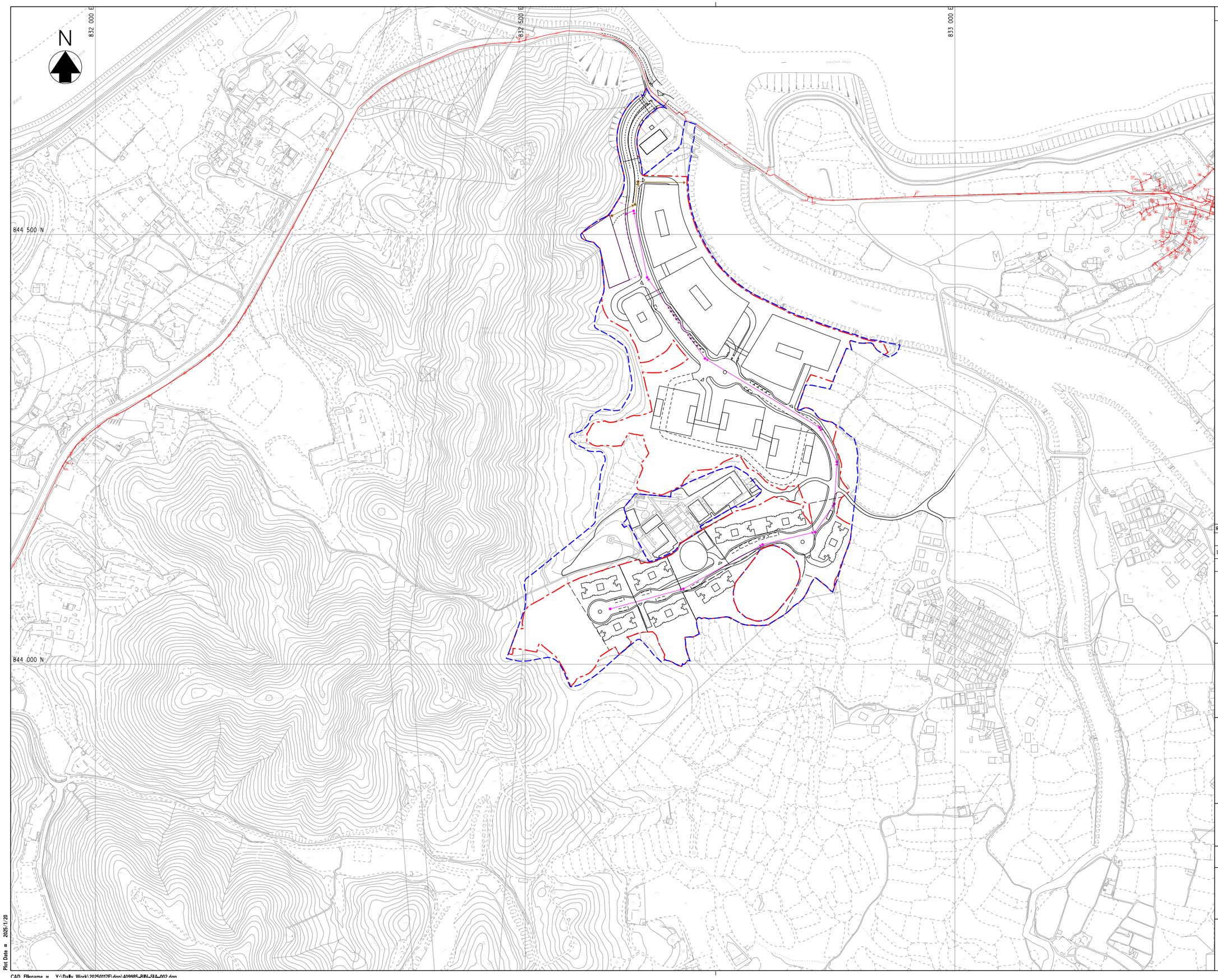

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NOTES:

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2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

LEGEND:

- DEVELOPMENT SITE
- APPLICATION SITE BOUNDARY
- EXISTING SEWERAGE SYSTEM
- PROPOSED SEWERAGE TREATMENT PLANT
- PROPOSED SEWERAGE TREATMENT PLANT (UNDERGROUND EXTENT)
- PROPOSED SEWER
- PROPOSED DICHARGE PIPE

Revision	Date	Description		Initial
	Designed	Checked	Drawn	Checked
Initial	KCT	HLam	SZ	SC
Date	MAY 2022	MAY 2022	MAY 2022	MAY 2022

Approved

Contract no.

Contract title

S.12A PLANNING APPLICATION FOR REZONING OF VARIOUS LOTS IN DD82 AND DD86 AND ADJOINING GOVERNMENT LAND

Drawing title

PROPOSED SEWERAGE SYSTEM

Drawing no. 409985/BIN/SIA/002

Revision -

Scale A1 1:2000
A3 1:4000

香港特別行政區政府渠務署
THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION
DRAINAGE SERVICES DEPARTMENT

BINNIES HONG KONG LIMITED
賓尼斯工程顧問有限公司

Plot Date = 2025/1/20

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Appendix A

Master Layout Plan

LEGEND

- APPLICATION SITE BOUNDARY
- DEVELOPMENT SITE BOUNDARY
- SITE FORMATION LEVEL
- SITE RUN-IN/OUT
- ACCESS TO BASEMENT CARPARK
- R&D CENTRE
- DATA CENTRE
- RESIDENTIAL
- COMMERCIAL
- ANCILLARY DORMITORIES
- CLUBHOUSE
- LANDSCAPE AREA
- SEWAGE TREATMENT PLANT
- PROMENADE

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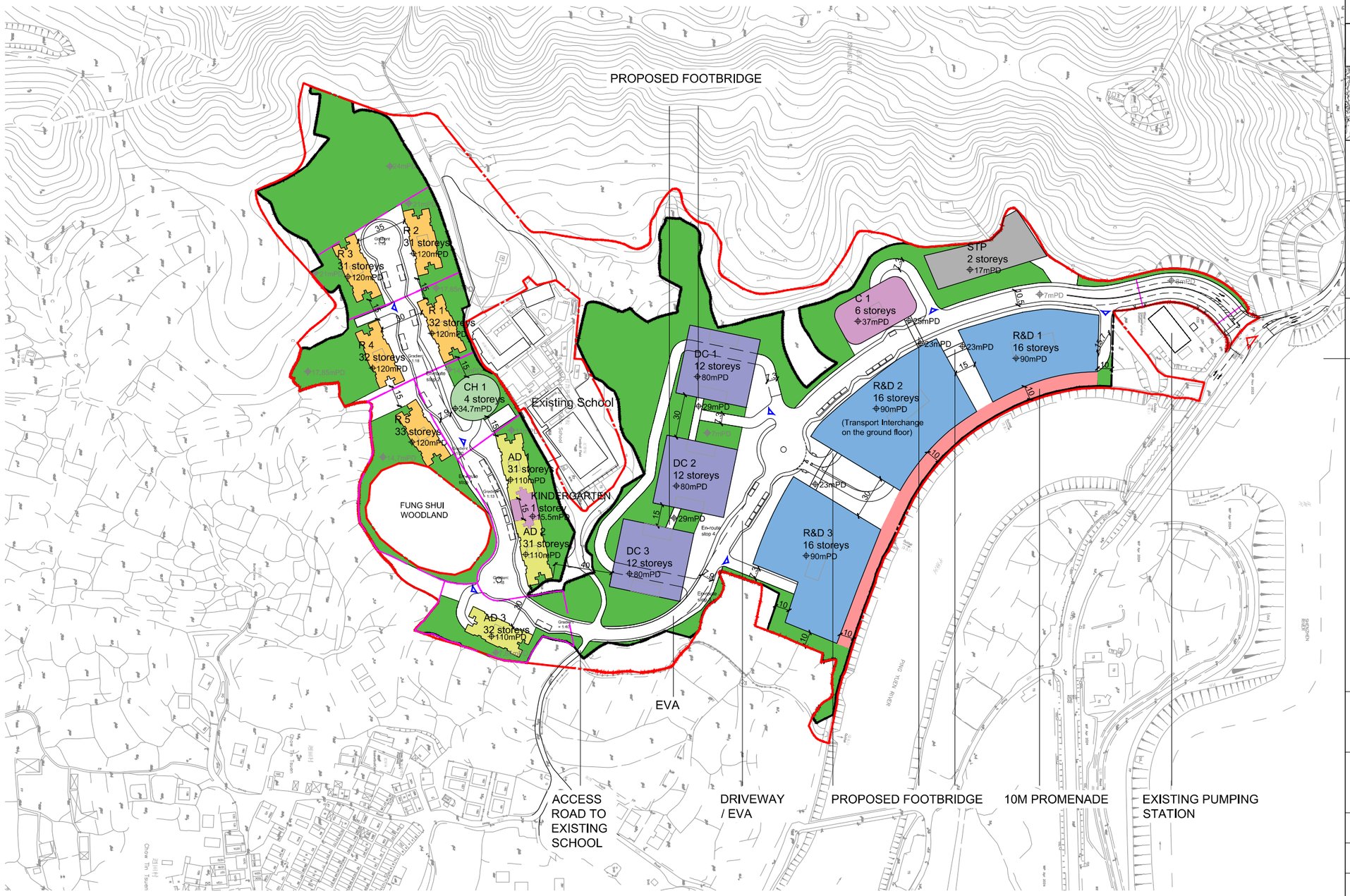

Deloitte.

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Rev.	Date	Description

Notes
1. Do not scale drawings. Dimensions govern.
2. Verify dimensions in field. Notify WCWP of discrepancies.
3. Dimensions in mm unless otherwise noted.
4. Not for construction unless expressly certified.

Key Plan

Client
Hong Kong International Innovation Tech Hub

Consultants

Issue
Planning Application

BD Ref: BD 2/9188/10 (PT. II)
FSD Ref: FP 8/9584/VII <131>

Authorized Person

Project
The Nexus

Project Number	Date
20027	20241219
Scale	Drawn/Approved
1:3000 at A3	CL/TL

Title
Master Layout Plan

Number	Revision
MLP-001	-

Appendix B

Layout Plan of North East New Territories Sewerage System Upgrade

圖例
LEGEND :

現有污水泵喉及無壓污水渠
EXISTING RISING MAINS AND GRAVITY SEWERS

擬建的雙管污水泵喉及無壓污水渠
PROPOSED TWIN RISING MAINS AND GRAVITY SEWERS

擬建的單管污水泵喉
PROPOSED SINGLE RISING MAIN

重建現有污水泵房
EXISTING SEWAGE PUMPING STATION TO BE RECONSTRUCTED

① 塘坊污水泵房
TONG FONG SEWAGE PUMPING STATION

② 沙嶺污水泵房
SHA LING SEWAGE PUMPING STATION

提升現有污水泵房
EXISTING SEWAGE PUMPING STATION TO BE UPGRADED

③ 白鶴山污水泵房
PAK HOK SHAN SEWAGE PUMPING STATION

④ 五洲南路污水泵房
NG CHOW SOUTH ROAD SEWAGE PUMPING STATION

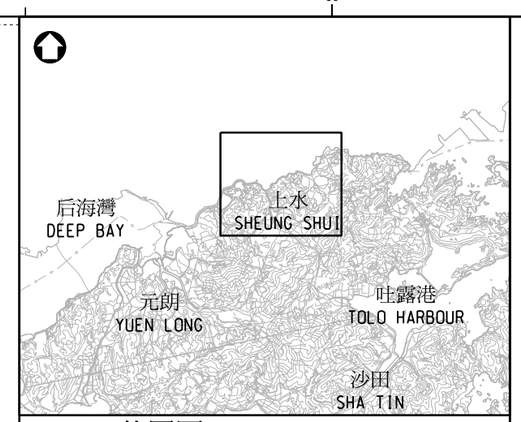
⑤ 坪洋二號污水泵房
PING YEUNG NO. 2 SEWAGE PUMPING STATION

⑥ 坪洋三號污水泵房
PING YEUNG NO. 3 SEWAGE PUMPING STATION

⑦ 隔田污水泵房
KAT TIN SEWAGE PUMPING STATION

⑧ 蓮麻坑路污水泵房
LIN MA HANG ROAD SEWAGE PUMPING STATION

⑨ 新界東北堆填區污水泵房
NORTH EAST NEW TERRITORIES LANDFILL SEWAGE PUMPING STATION



位置圖 LOCATION PLAN
比例 SCALE 1 : 500 000

版 no.	日 期 date	修 改 項 目 description	簡 簽 initial
修 訂 REVISION			

	姓 名 name	日期 date
繪 畫 drawn	*SIGNED* L. L. LIU	13 APR 2021
核 對 checked	*SIGNED* C. M. MAK	13 APR 2021
批 核 approved	*SIGNED* P. Y. CHENG	13 APR 2021

圖 則 名 稱 drawing title

工務工程計劃編號409DS
- 提升新界東北污水收集系統
PWP ITEM NO. 409DS
- NORTH EAST NEW TERRITORIES SEWERAGE SYSTEM UPGRADE

圖 則 編 號 drawing no.	比例 scale
DCM/2021/005	1 : 30 000

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DRAINAGE SERVICES DEPARTMENT
GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION

Appendix C

Hydraulic Calculation of Sewerage System

Binnies Hong Kong Limited

Project: Section 12A Planning Application – Proposed Innovation and Technology Hub at Various Lots in D.D. 82 and D.D. 86 and Adjoining Government Land, Man Kam To, New Territories

Subject: Sewerage Calculation

Development Type	Domestic - Population	Non-domestic Population	Global Unit Flow Factor (m3/head/day)	Flow Type	ADWF (m3/day)	Remark
Data Centre		432	0.180	Commercial Employee and J3 Transport, Storage & Communication	77.8	
R&D Centre		5,375	0.080	Commercial Employee and J6 Finance, Insurance, Real Estate & Business Services	430.0	
Commercial Centre		400	0.280	Commercial Employee and J4 Wholesale & Retail	112.0	
Ancillary Dormitories	3,758		0.190	Domestic - Institutional	714.0	
Other Residential Uses	6,264		0.270	Domestic - Private (R2)	1,691.3	
Clubhouse		50	0.280	Community, Social & Personal Services J11	14.0	
Kindergarten						
Student		180	0.040	School Student SS	7.2	6 Classrooms
Staff		16	0.280	Community, Social & Personal Services J11	4.5	Minimal pupil ratio of 1:11 according to EDB's Report
				ADWF	**3,050.8**	

Backwash flow from Swimming Pool	Pool Volume=	25m x 10 m x 1.8m	450	m3
	Turnover Rate=		6.0	hr
	Surface Loading Rate of Filter=		50.0	m3/m2/hr
	Filter Areas Required =		1.50	m2
	Backwash Duration		7	min/day
	Backwash Flow Rate		30.0	m3/m2/hr
	Design Flow for Backwashing		5.25	m3/day
	Total ADWF		**3,056.0**	m3/day
Assumed Bleed-off water from Data Centre (Cooling Towers)	=		**1,000.0**	m3/day
	=		**0.0116**	m3/s

Catchment Inflow Factor =		1		
Total ADWF for Proposed Development (without proposed cooling tower)=		3,056	m3/day	
=		0.035	m3/s	
=		35.370	l/s	
Total ADWF for Proposed Development (with proposed cooling tower)=		4,056	m3/day	
=		0.047	m3/s	
=		46.944	l/s	
Peaking Factor for Sewer=		4		incl. stormwater allowance
Peak Flow Rate of Sewer (without proposed cooling tower)=		0.141	m3/s	
=		141.481	l/s	
Peak Flow Rate of Sewer (with proposed cooling tower)=		0.153	m3/s	
=		153.055	l/s	
Peaking Factor for Treatment Works=		3.5		incl. stormwater allowance
Peak Flow Rate of Treatment Works (without proposed cooling tower) =		0.124	m3/s	
=		123.796	l/s	
Peak Flow Rate of Treatment Works (with proposed cooling tower) =		0.135	m3/s	
=		135.370	l/s	

Hydraulic Analysis for Pipe Capacity (internal sewer)

Surface roughness ks =		3.000	mm	slimed sewers
Kinematic viscosity v =		0.00001	m2/s	
Frictional gradient Sf 1 in		100		
Proposed Pipe Size D =		450	mm	
Hydraulic radius R =D/4 =		0.113	m	
Mean velocity (Colebrook-White)	$\bar{V} =$	$-\sqrt{32gRS_f}\log\left[\frac{k_s}{14.8R}+\frac{1.255v}{R\sqrt{(32gRS_f)}}\right]$		
=		1.631	m/s	
Flow capacity of proposed sewer Q =		**V x Cross Section Area of Drain**		
		0.259	**m3/s**	
Design flow capacity of proposed sewer Q (Assume 10% siltation)=		**0.233**	**m3/s**	
>Required Flow Capacity=0.153m3/s ?		**Yes**	**m3/s**	