
Attachment 3

Revised Sewerage Impact Assessment

Section 16 Planning Application for Proposed Commercial Use at Phase IIa Development of an Approved Master Layout Plan (MLP) with Minor Relaxation of Plot Ratio Restriction (Proposed Amendments to the Approved MLP for Comprehensive Residential, Commercial, Social Welfare Facility and Public Vehicle Park Development; with Minor Relaxation of Plot Ratio Restriction Approved at Phase III)

Sewerage Impact Assessment

July 2026

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1. Introduction

1.1 Background

- 1.1.1 AECOM Asia Company Limited (AECOM) was commissioned by the project proponent to act as the engineering consultant to conduct a Sewerage Impact Assessment (SIA) to support the Proposed Commercial Development to the south of Castle Peak Road, Yuen Long, New Territories.
- 1.1.2 This planning application is submitted for proposed commercial development in Phase IIa of a Comprehensive Commercial/Residential Development at the “Comprehensive Development Area” (“CDA”) to the immediate south of Castle Peak Road in Area 12, Yuen Long. The location plan is shown in **SIA/Figure 1**.
- 1.1.3 The Application Site is zoned “CDA” under the Draft Yuen Long Outline Zoning Plan (OZP) No. S/YL/28 and is the subject of various previously approved planning applications for comprehensive commercial/residential development between 1995 and 2023. Due to multiple ownership involved, a phased development approach has all along been adopted for the various development proposals approved therein.
- 1.1.4 According to the latest planning application No. A/YL/298 for proposed subsidized sale flats (SSF) and social welfare facility (SWF) development approved on 31.3.2023 (hereafter referred to as the “Approved CDA Development”) for the subject “CDA” site, the Approved CDA Development is divided into three phases, including Phase I (i.e. the completed commercial/residential development known as the completed YOHO Midtown at the northern and eastern portions), Phases IIa & IIb (i.e. the approved hotel and flats development at the northwestern portion), and Phase III (i.e. the proposed SSF and SWF under the approved application at the southwestern portion).
- 1.1.5 It should be emphasized that the subject matter of the current planning application is the proposed change in Phase IIa to commercial development only. No change is proposed for Phases I, IIb and III developments within the same “CDA” zone. Under the Approved CDA Development, Phase IIa was proposed for hotel development. However, in order to contribute to achieving home-job balance and creating a mixed-use neighbourhood in Yuen Long District, Phase IIa is now proposed to be a commercial/office development with supporting commercial/retail facilities.
- 1.1.6 This SIA report serves as a supporting document for the S16 Planning Application for amendments to an approved master layout plan. Since the SIA for the “CDA” had already been approved in **March 2026 under approval conditions** of planning application No. A/YL/298 with allowances made for sewage discharge from Phase IIa development, relevant comparisons will be made in this report.

1.2 Objective of this Submission

- 1.2.1 This report outlines the assessment results of the potential sewerage impacts caused by the Proposed Development at Phase IIa of the Application Site. The main objectives of this assessment include the following:
 - (i) Review the existing sewerage conditions;
 - (ii) Outline the methodology adopted in this assessment;
 - (iii) Identify any potential impacts on the current sewerage system due to the sewage discharge from the proposed development in Phase IIa and the existing developments nearby, and compare with the Previously Approved Scheme under planning application No. A/YL/298;
 - (iv) Propose sewerage mitigation measures where appropriate to mitigate the potential sewerage impacts.

1.3 Nomenclature

1.3.1 The following abbreviations and shortened expressions in **Table 1** are adopted in this report.

ADWF	Average Dry Weather Flow
AECOM	AECOM Asia Company Limited
DSD	Drainage Services Department
EPD	Environmental Protection Department
GESF	Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0 (EPD)
GFA	Gross Floor Area
HKPSG	Hong Kong Planning Standards and Guidelines
mPD	Metres above Principal Datum
PlanD	Planning Department
SM(I)	Sewerage Manual Part 1 (3 rd Edition, DSD)
SIA	Sewerage Impact Assessment
UFF	Unit Flow Factor

Table 1 – Nomenclature

2. Development Proposal

2.1 The Proposed Development

- 2.1.1 The Phase IIa development site area is approximately 1,230m² with a proposed total non-domestic Gross Floor Area (GFA) of not more than 12,207m², comprising a commercial/office space of about 11,607m² and commercial/retail area of about 600m². The tentative intake year for the Phase IIa development is 2030.
- 2.1.2 The Master Layout Plan (MLP) of the Proposed Development is shown in **SIA/Figure 2** and the proposed development schedule is summarised in **Table 2** below.

Development Parameters ⁽¹⁾	Phase IIa
Development Site Area	About 1,230m ²
Total Non-domestic GFA for Proposed Commercial Development ⁽²⁾	Not more than 12,207m ²
- Commercial/Office	About 11,607m ²
- Commercial/Retail	About 600m ²
Total Non-domestic Plot Ratio	About 9.93
Maximum Site Coverage	Not exceeding 24m: Not more than 92% Above 24m: Not more than 65%
Maximum Building Height (to the main roof)	Not more than 145mPD
Total No. of Storeys ⁽³⁾	29 storeys
No. of Blocks	1

Table 2 – Development Schedule

Remarks:

- (1) Development parameters shown on this indicative development schedule are for Phase IIa development only (i.e. subject matter of the current planning application).
- (2) Including 'Office', 'Eating Place', 'Place of Entertainment', 'Place of Recreation, Sports or Culture', 'School' (kindergarten, nursery, language, computer, commercial and tutorial schools, art school, ballet and other types of schools providing interest / hobby related courses) and 'Shop and Services'.
- (3) Including 23 commercial / office storeys + 2 commercial / retail storeys (including M/F) + 4 storeys for E&M, carpark and entrance lobby; excluding 1 refuge floor and transfer plate.

3. Assessment Methodology

3.1 Overview of Methodology

- 3.1.1 The estimation of non-domestic sewage flow for the proposed development is in accordance with “*Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0*” (GESF) published by the Environmental Protection Department (EPD). The sewage design is in accordance with the Sewerage Manual published by Drainage Services Department (DSD). The sewage estimation is presented in **Appendix 2**.
- 3.1.2 The estimation of non-domestic population for the proposed development is in accordance with the Hong Kong Planning Standards and Guidelines (HKPSG) published by the Planning Department (PlanD).
- 3.1.3 According to GESF Table T-4, Catchment Inflow Factor (PCIF) of 1.0 for Yuen Long District Catchment is adopted for this design.

3.2 Unit Flow Factors

- 3.2.1 The adopted sewage unit flow factors for sewage estimation and calculation are summarized in **Table 3**.

Development Type	Flow Type	Unit Flow Factor (UFF) (m ³ /head/day)
Commercial / Office	General	0.28
Retail (non-F&B)	J4	0.28
Food and Beverage (F&B)	J10	1.58

Table 3 – Unit Flow Factors adopted in Sewerage Impact Assessment

3.3 Design Population

- 3.3.1 For the non-domestic population, the worker density adopted for business use is made reference to HKPSG Chapter 5 Table 2. A summary of the Phase IIa’s design population can be found in **Table 4** below.

Development Type	GFA (m ²)	Worker Density (m ² GFA per worker)	Total no. of Workers
Commercial / Office	11,607	25	464
Retail (non-F&B)	360 ⁽¹⁾	25	14
F&B	240 ⁽¹⁾	25	10

Table 4 – Total Workers for Phase IIa Development

Remarks:

- (1) Assume commercial/retail GFA comprises of 40% F&B and 60% non-F&B.

4. Sewerage Impact Assessment

4.1 Site Description

- 4.1.1 Phase IIa of the Application Site is bounded by Castle Peak Road – Yuen Long to the North and Yau Tin East Road to the South.

4.2 Existing and Planned Sewerage System

- 4.2.1 According to the GeoInfo Map, there is an existing 450mm diameter sewer along Yau Tin East Road discharging sewage to a downstream 600mm sewer at Castle Peak Road. There is also an existing 600mm diameter sewer along Castle Peak Road to be discharged to Au Tau Sewage Pumping Station. The existing sewerage network in the proximity of Phase IIa is shown in **SIA/Figure 3**.
- 4.2.2 With reference to the approved SIA under planning application No. A/YL/298, to cater for the additional sewage generation from Phases IIa & IIb and III development, there would be two portions of sewage upgrading works to be carried out by Phase III development. Firstly, invert levels of sewers between FMH1019171 and FMH1019177 at Yau Tin East Road would be modified. Secondly, the sewers along Yau Tin East Road which was originally discharged towards Ping Shun Street Sewage Pumping Station would be diverted to the sewers running eastwards of Castle Peak Road, which ultimately discharges to Au Tau Sewage Pumping Station. The proposed sewerage system under Phase III development is extracted in **Appendix 2**. Phase III development is expected to complete by 2030, which matches the tentative intake year of Phase IIa.

4.3 Sewage Estimation for the Proposed Development

- 4.3.1 By adopting the aforementioned design parameters, the average dry weather flow (ADWF) generated from the proposed commercial development of Phase IIa is estimated to be about 149.2 m³/day. The summary table is presented in **Table 5**. Detailed sewage flow estimations refer to **Appendix 1**.

Commercial / Office	
Employees	464
Unit Flow Factor for Commercial / Office (General)	0.28
Sewage Flow from Commercial / Office (m³/day)	130.0
Retail (non-F&B)	
Employees	14
Unit Flow Factor for Retail (J4)	0.28
Sewage Flow from Retail (m³/day)	4.0
Food and Beverage (F&B)	
Employees	10
Unit Flow Factor for F&B (J10)	1.58
Sewage Flow from F&B (m³/day)	15.2
Overall Phase IIa Development	
Total Average Dry Daily Flow (ADWF) (m³/day)	149.2
Peak Flow (L/s)	10.36

Table 5 – Sewage Estimation for the Proposed Development

- 4.3.2 The adopted peaking factor in accordance with GESF Table T-5 is 6 (population range less than 1,000). The peak flow generated from the proposed development is presented in **Table 5**.

5. Potential Sewerage Impacts and Mitigation Measures

5.1 Potential Sewerage Impacts

- 5.1.1 The sewage generated from Phase IIa is proposed to be discharged to the existing sewerage system to the South at Yau Tin East Road.
- 5.1.2 According to the approved SIA under planning application No. A/YL/298, in the assessment of the combined effect of Phase IIa, IIb and III development to the public sewers, a sewage generation of **150.1m³/day** is reserved for Phase IIa development. Extract of the sewage estimation in approved SIA refers to **Appendix 2**.
- 5.1.3 The estimated ADWF for the current proposed commercial development is **149.2m³/day**, which is less than the ADWF estimated for Phase IIa under the approved SIA mentioned in Section 5.1.2 (i.e. **150.1m³/day**).
- 5.1.4 While there is a net reduction in sewage generation by Phase IIa under this planning application, under the approved SIA of Phase III, it was assumed that Phase IIa sewage would be discharged to FMH1039606 at Castle Peak Road. However, under this planning application, Phase IIa sewage is instead proposed to be discharged to the existing sewer between FMH1019170 and FMH1019177 at Yau Tin East Road, which is upstream of FMH1039606. Hydraulic assessment due to the proposed change in discharge point is presented in **Appendix 3**, which indicates that with the proposed sewage upgrading works of Phase III development, the public sewers have sufficient capacity to cater for the discharge of the planned Phase IIa development and hence no adverse impact is envisaged.

5.2 Proposed Mitigation Measures

- 5.2.1 As mentioned in the previous sections, with the mitigation measures to be carried out by Phase III development, which is expected to be completed by 2030, no additional mitigation measure is necessary. **Sewerage manhole FMH1 would be constructed between FMH1019170 and FMH1019177 at Yau Tin East Road to collect sewage discharge from Phase IIa. Proposed sewerage layout refers to SIA/Figure 4. As there may be overlap in construction period between Phase IIa and Phase III development, interfacing with Phase III development would be further coordinated during detailed design and construction stages of the development.**
- 5.2.2 The exact alignment of the proposed internal sewer and the relevant design shall be further reviewed during the detailed design stage and will be submitted to the relevant government departments (e.g. DSD) for approval.

6. Maintenance Responsibility

6.1 Proposed Sewage Terminal Manholes

- 6.1.1 The development will be responsible for the construction and maintenance of all sewerage facilities within the Phase IIa Site Boundary, including all internal sewers and the sewage terminal manhole.

6.2 Proposed External Sewer and Manhole

- 6.2.1 The development is responsible for the construction of the proposed sewerage manholes with the associated sewers. Upon completion, the proposed external sewerage system (including the sewer between terminal manhole and public manhole) will be handed over to DSD for future maintenance.

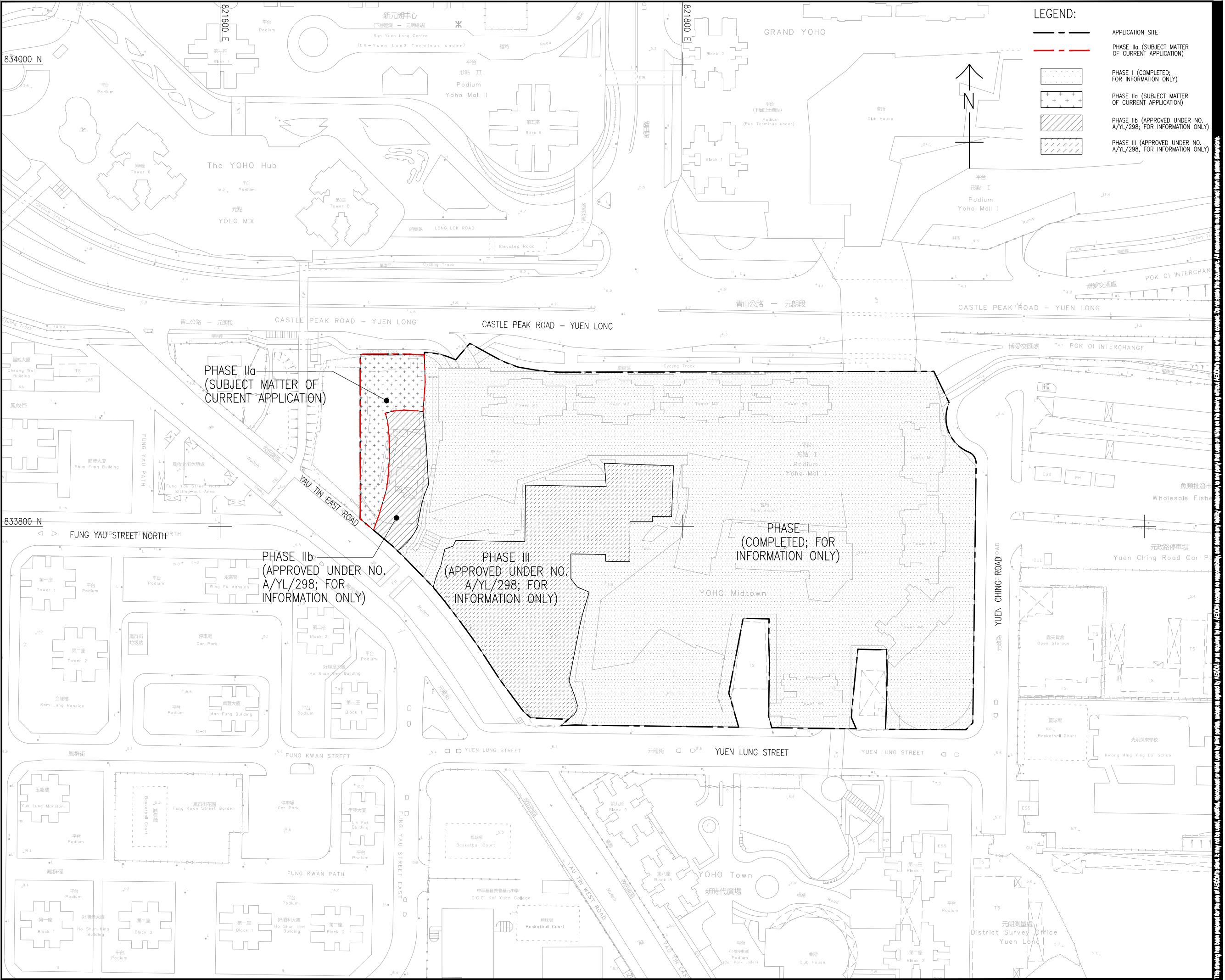
7. Conclusion

- 7.1.1 The SIA for the Application Site was previously approved under planning application No. A/YL/298. Under this planning application, the MLP for Phase IIa is amended, and the sewerage impacts arising from Phase IIa development is assessed under this SIA.
- 7.1.2 Approximately 149.2m³/day of sewage in ADWF would be generated from Phase IIa and conveyed to the existing sewerage system along Yau Tin East Road.
- 7.1.3 The sewage flow (ADWF) of the Proposed Commercial Development (current scheme) is reduced compared to the approved SIA under Application No. A/YL/298 and the proposed upgrading works by Phase III will be completed by 2030, i.e. same as the tentative completion year for the proposed commercial development.
- 7.1.4 Compared with the approved SIA under Phase III, an updated hydraulic assessment is presented in this SIA to relocate the sewage discharge point of Phase IIa from FMH1039606 at Castle Peak Road to between FMH1019170 and FMH1019177 at Yau Tin East Road.
- 7.1.5 Taking into account the above considerations, with the proposed mitigation measures by Phase III development, the Proposed Commercial Development in Phase IIa is therefore acceptable in sewerage terms.

End of Report

Figures

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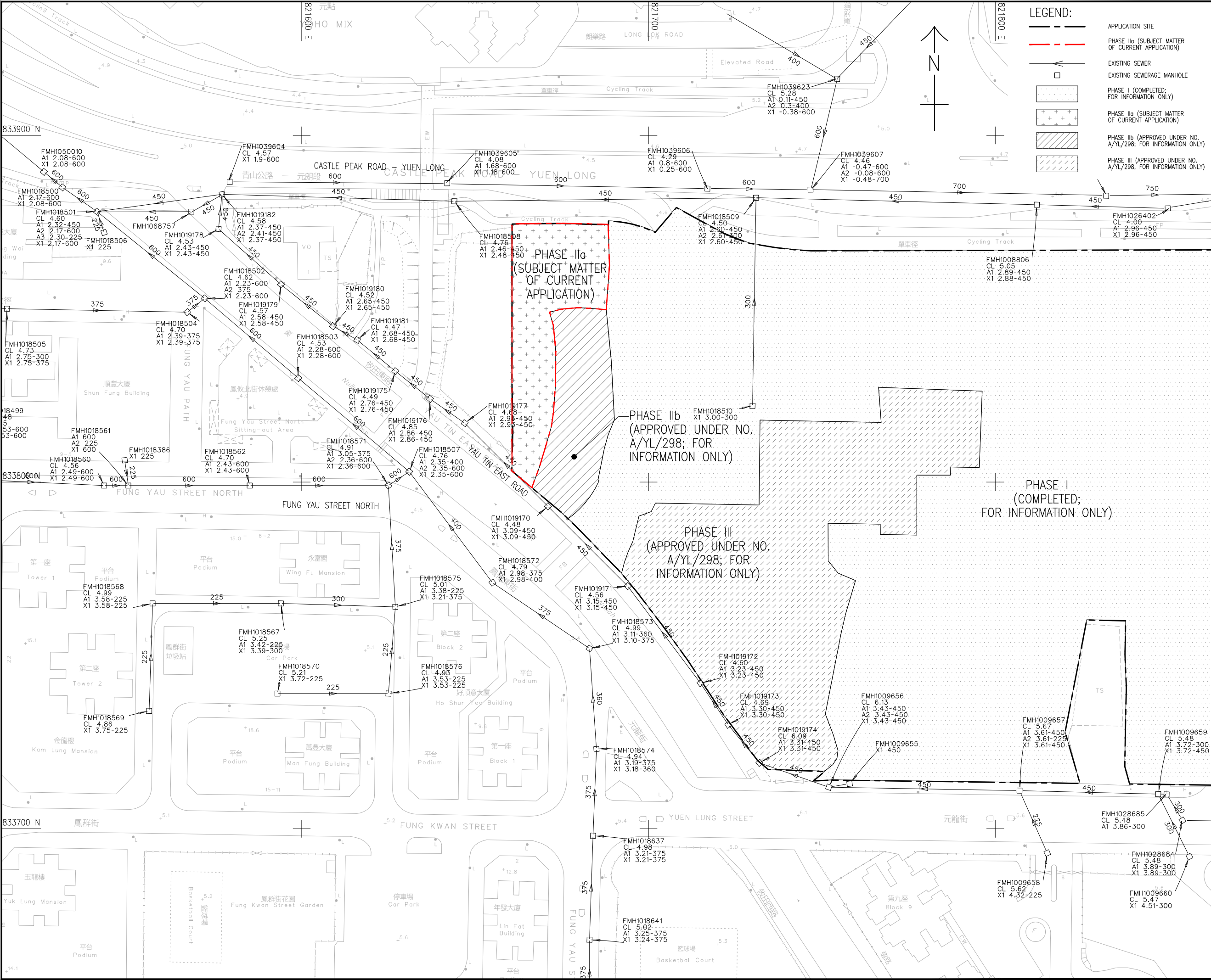
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LEGEND:

- APPLICATION SITE
- PHASE IIa (SUBJECT MATTER OF CURRENT APPLICATION)
- EXISTING SEWER
- EXISTING SEWERAGE MANHOLE
- PHASE I (COMPLETED; FOR INFORMATION ONLY)
- PHASE IIa (SUBJECT MATTER OF CURRENT APPLICATION)
- PHASE IIb (APPROVED UNDER NO. A/YL/298; FOR INFORMATION ONLY)
- PHASE III (APPROVED UNDER NO. A/YL/298; FOR INFORMATION ONLY)

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PROJECT
SECTION 16 PLANNING APPLICATION FOR PROPOSED COMMERCIAL USE AT PHASE IIA DEVELOPMENT OF AN APPROVED MASTER LAYOUT PLAN (MLP) WITH MINOR RELAXATION OF PLOT RATIO RESTRICTION (PROPOSED AMENDMENTS TO THE APPROVED MLP FOR COMPREHENSIVE RESIDENTIAL, COMMERCIAL, SOCIAL WELFARE FACILITY AND PUBLIC VEHICLE PARK DEVELOPMENT; WITH MINOR RELAXATION OF PLOT RATIO RESTRICTION APPROVED AT PHASE III)

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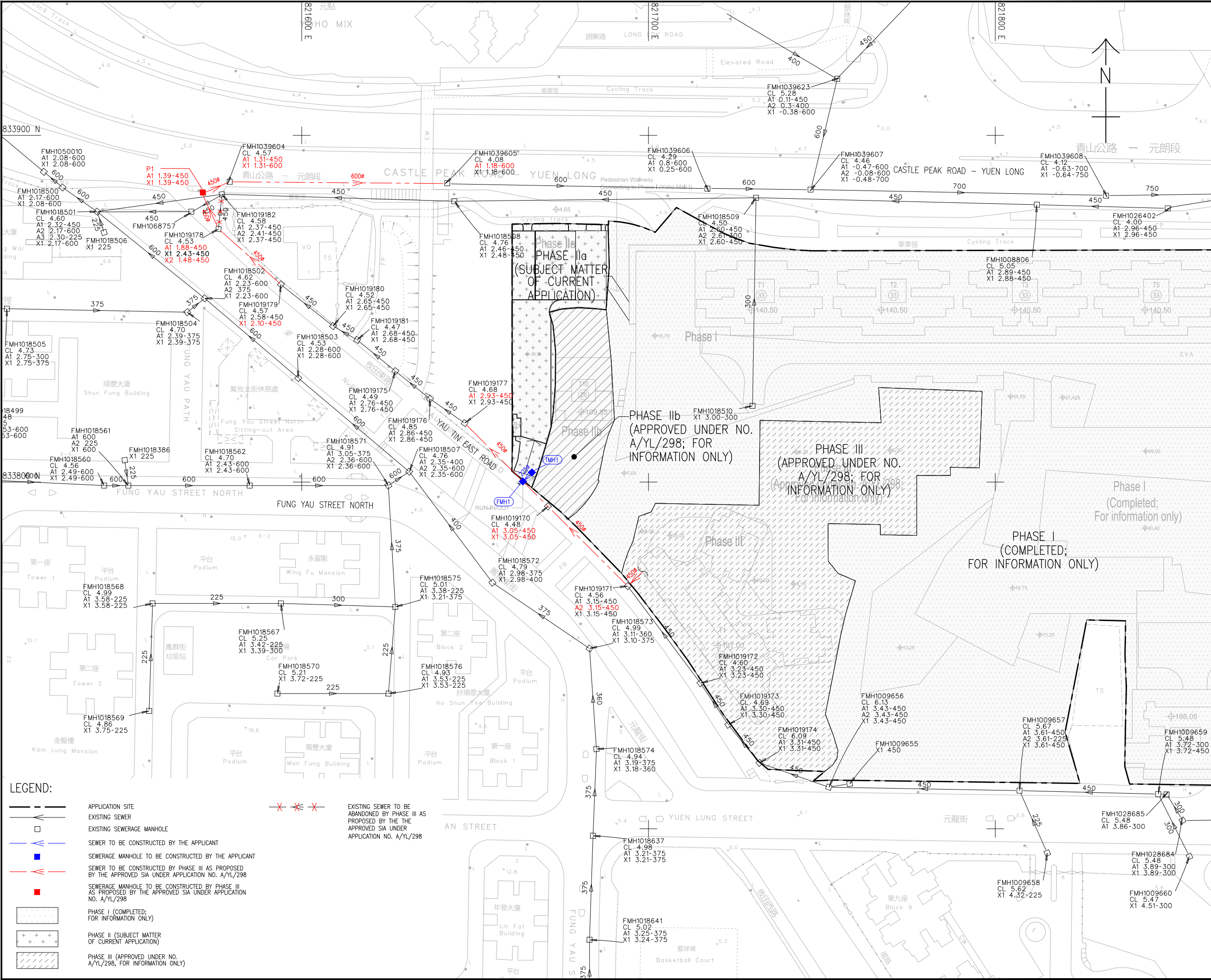
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LEGEND:

- APPLICATION SITE
- EXISTING SEWER
- EXISTING SEWERAGE MANHOLE
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- SEWER TO BE CONSTRUCTED BY PHASE III AS PROPOSED BY THE APPROVED SIA UNDER APPLICATION NO. A/YL/298
- SEWERAGE MANHOLE TO BE CONSTRUCTED BY PHASE III AS PROPOSED BY THE APPROVED SIA UNDER APPLICATION NO. A/YL/298
- PHASE I (COMPLETED; FOR INFORMATION ONLY)
- PHASE II (SUBJECT MATTER OF CURRENT APPLICATION)
- PHASE III (APPROVED UNDER NO. A/YL/298, FOR INFORMATION ONLY)



EXISTING SEWER TO BE ABANDONED BY PHASE III AS PROPOSED BY THE THE APPROVED SIA UNDER APPLICATION NO. A/YL/298

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SECTION 16 PLANNING APPLICATION FOR PROPOSED COMMERCIAL USE AT PHASE IIA DEVELOPMENT OF AN APPROVED MASTER LAYOUT PLAN (MLP) WITH MINOR RELAXATION OF PLOT RATIO RESTRICTION (PROPOSED AMENDMENTS TO THE APPROVED MLP FOR COMPREHENSIVE RESIDENTIAL, COMMERCIAL, SOCIAL WELFARE FACILITY AND PUBLIC VEHICLE PARK DEVELOPMENT; WITH MINOR RELAXATION OF PLOT RATIO RESTRICTION APPROVED AT PHASE III)

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KEY PLAN

21/07/2028

PROJECT NO.

YOHO

AGREEMENT NO.

21/07/2028

SHEET TITLE

PROPOSED SEWERAGE LAYOUT PLAN

SHEET NUMBER

YOHO/SIA/FIGURE 4

Appendix 1

Sewage Estimation of Phase IIa Development

Estimation of Sewage of Phase IIa Development

Type	GFA	Worker Density	Employee	Unit Flow Factor	Flow in ADWF
	(m ²)	(m ² per employee)		(m ³ /day/p)	(m ³ /day)
Commercial / Office	11607.0	25	464	0.28	130.0
Retail Non-F&B (J4)	360.0	25	14	0.28	4.0
F&B (J10)*	240.0	25	10	1.58	15.2
				Total Phase IIa	149.2

*Assume 40% of Commercial/Retail GFA is F&B

Appendix 2

Extract from the Approved SIA under Planning Application No. A/YL/298

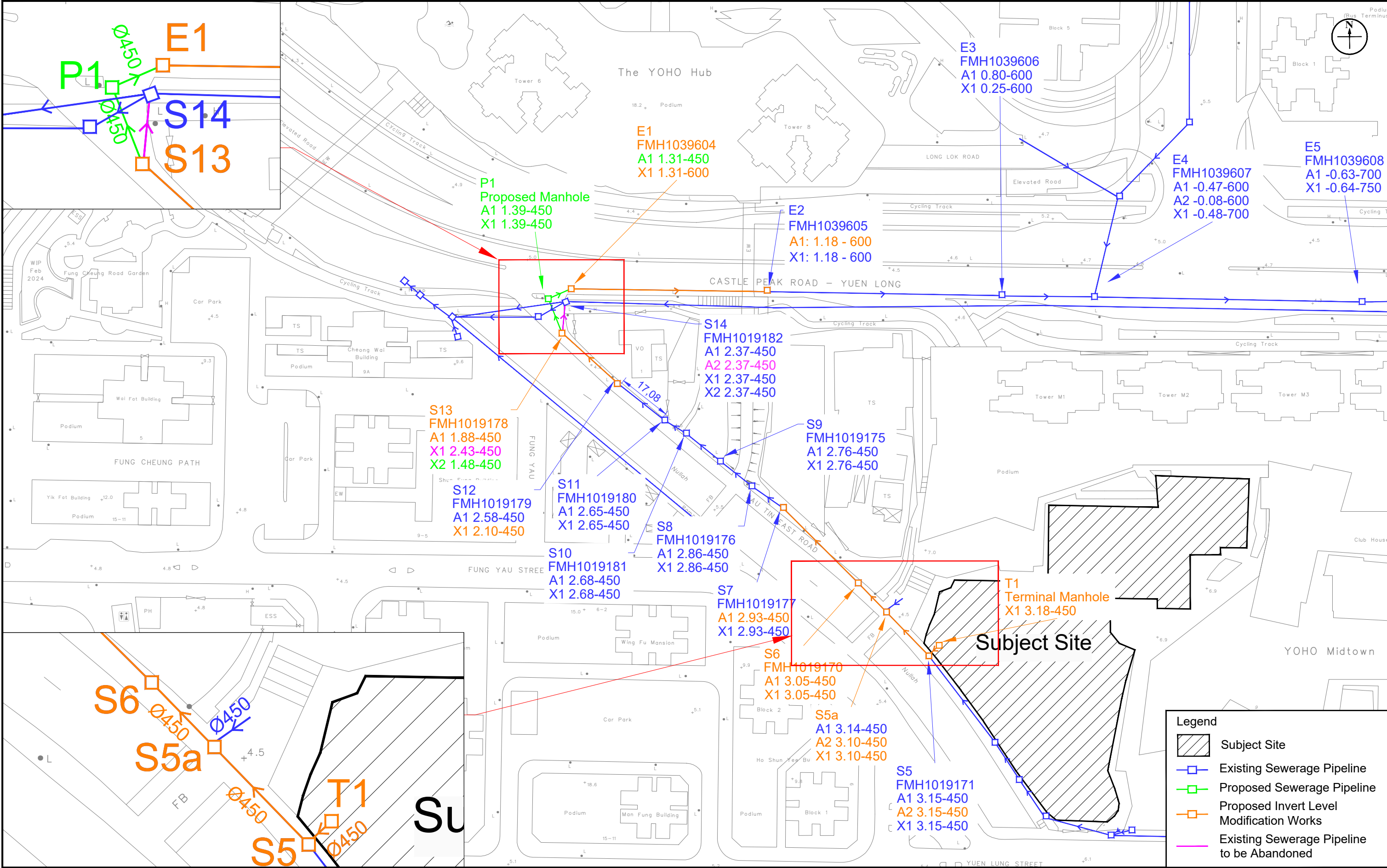


Figure: 2.2a		RAMBOLL	
Title: Proposed and Existing Sewerage System in the Vicinity of the Phase III Development		Drawn by: MW	
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Table 3a Calculation for Sewage Generation Rate of the Existing Surrounding Building

Catchment C1 (E2)

1. Planned G/IC Site for Youth Hostel

ADWF = 171.8 m³/day -- from EPD

Overall Catchment C1 (E2)

Flow Rate (without Catchment Inflow Factor) = 171.8 m³/day
 Catchment Inflow Factor = 1.0 Catchment Inflow Factor for Yuen Long in Table T-4 of GEFS
 Flow Rate (with Catchment Inflow Factor) = 171.8 m³/day

Catchment C2 (E3)

1. Planned Phase 2a Development

ADWF = 150.1 m³/day -- from EPD

reserved flow of Phase IIa,
discharging to FMH1039606

2. Planned Phase 2b Development

Total number of units = 156 units -- from Planning Application A/YL/205
 Total number of residents = 406 people -- (2021 Population Census: Average Household Size of 2.6 in Fung Cheung)
 Design flow = 0.27 m³/person/day -- (Private R2 in Table T-1 of GESF)
 Sewage Generation rate = 109.5 m³/day -- from Planning Application A/YL/205

Overall Catchment C2 (E3)

Flow Rate (without Catchment Inflow Factor) = 259.6 m³/day
 Catchment Inflow Factor = 1.0 Catchment Inflow Factor for Yuen Long in Table T-4 of GEFS
 Flow Rate (with Catchment Inflow Factor) = 259.6 m³/day

Catchment D (E4) (Downstream)

1. Ying Lung Wai & Tsoi Uk Tsuen

Total number of unit = 302 units
 Population = 785 people -- (2021 Population Census: Average Household Size of 2.6 in Shap Pat Heung North)
 Design flow = 0.37 m³/person/day -- (Private R4 in Table T-1 of GESF)
 Sewage Generation rate = 290.5 m³/day

2. Yoho Hub Tower 6 & Tower 8

Total number of unit = 939 units
 Population = 2441 people -- (2021 Population Census: Average Household Size of 2.6 in Yuen Long)
 Design flow = 0.27 m³/person/day -- (Private R2 in Table T-1 of GESF)
 Sewage Generation rate = 659.2 m³/day

Clubhouse

Assumed Area = 1326 m²
 Assumed floor area per employee = 30.3 m² per worker -- (refer to Table 8 of CIFSUS - Community, Social & Personal Services)
 Total number of employees = 44 employees
 Design flow for commercial activities = 0.28 m³/employee/day -- (refer to Table T-2 of GESF - J11)
 Sewage Generation rate = 12.3 m³/day

Shopping Mall

Retail

Assumed Area = 4950 m²
 Assumed floor area per employee = 28.6 m² per employee -- (refer to Table 8 of CIFSUS - Retail Trade)
 Total number of employees = 173 employees
 Design flow for commercial employee = 0.28 m³/employee/day -- (refer to Table T-2 of GESF - J4)
 Sewage Generation rate = 48.5 m³/day

F&B

Assumed Area = 4950 m²
 Assumed floor area per employee = 19.6 m² per employee -- (refer to Table 8 of CIFSUS - Restaurant)
 Total number of employees = 252 employees
 Design flow for commercial employee = 1.58 m³/employee/day -- (refer to Table T-2 of GESF - J10)
 Sewage Generation rate = 398.8 m³/day

Overall Catchment D

Flow Rate (without Catchment Inflow Factor) = 1409.3 m³/day
 Catchment Inflow Factor = 1.0 Catchment Inflow Factor for Yuen Long in Table T-4 of GEFS
 Flow Rate (with Catchment Inflow Factor) = 1409.3 m³/day

Table 2a Hydraulic Capacity of Existing Sewers (for Proposed Development and Surrounding Catchment Areas)

Segment	Manhole Reference	Manhole Reference	Pipe Dia.	Pipe Length	Invert Level 1	Invert Level 2	g	k _s	s	v	V	Area	Q	Estimated Capacity
			mm	m	mPD	mPD	m/s ²	m		m ² /s	m/s	m ²	m ³ /s	L/s
S5 - S5a	FMH1019171	-	450	18.0	3.15	3.14	9.81	0.00060	0.001	0.000001	0.47	0.16	0.07	75
S5a - S6	-	FMH1019170	450	11.9	3.14	3.09	9.81	0.00060	0.004	0.000001	1.31	0.16	0.21	209
S6 - S7	FMH1019170	FMH1019177	450	30.6	3.09	2.93	9.81	0.00060	0.005	0.000001	1.47	0.16	0.23	233
S7 - S8	FMH1019177	FMH1019176	450	12.4	2.93	2.86	9.81	0.00060	0.006	0.000001	1.52	0.16	0.24	242
S8 - S9	FMH1019176	FMH1019175	450	10.9	2.86	2.76	9.81	0.00060	0.009	0.000001	1.95	0.16	0.31	310
S9 - S10	FMH1019175	FMH1019181	450	11.8	2.76	2.68	9.81	0.00060	0.007	0.000001	1.67	0.16	0.27	266
S10 - S11	FMH1019181	FMH1019180	450	6.9	2.68	2.65	9.81	0.00060	0.004	0.000001	1.34	0.16	0.21	213
S11 - S12	FMH1019180	FMH1019179	450	16.3	2.65	2.58	9.81	0.00060	0.004	0.000001	1.33	0.16	0.21	211
S12 - S13	FMH1019179	FMH1019178	450	22.4	2.58	2.43	9.81	0.00060	0.007	0.000001	1.66	0.16	0.26	264

Table 2b Hydraulic Capacity of Existing and Proposed Sewers after Proposed Modification Works (for Proposed Development and Surrounding Catchment Areas)

Segment	Manhole Reference	Manhole Reference	Pipe Dia.	Pipe Length	Invert Level 1	Invert Level 2	g	k _s	s	v	V	Area	Q	Estimated Capacity
			mm	m	mPD	mPD	m/s ²	m		m ² /s	m/s	m ²	m ³ /s	L/s
T1 - S5	T1	FMH1019171	450	4.7	3.18	3.15	9.81	0.00030	0.006	0.000001	1.76	0.16	0.28	280
S5 - S5a	FMH1019171	-	450	18.0	3.15	3.10	9.81	0.00030	0.003	0.000001	1.15	0.16	0.18	183
S5a - S6	-	FMH1019170	450	11.9	3.10	3.05	9.81	0.00030	0.004	0.000001	1.42	0.16	0.23	225
S6 - S7	FMH1019170	FMH1019177	450	30.6	3.05	2.93	9.81	0.00030	0.004	0.000001	1.37	0.16	0.22	218
S7 - S8	FMH1019177	FMH1019176	450	12.4	2.93	2.86	9.81	0.00060	0.006	0.000001	1.52	0.16	0.24	242
S8 - S9	FMH1019176	FMH1019175	450	10.9	2.86	2.76	9.81	0.00060	0.009	0.000001	1.95	0.16	0.31	310
S9 - S10	FMH1019175	FMH1019181	450	11.8	2.76	2.68	9.81	0.00060	0.007	0.000001	1.67	0.16	0.27	266
S10 - S11	FMH1019181	FMH1019180	450	6.9	2.68	2.65	9.81	0.00060	0.004	0.000001	1.34	0.16	0.21	213
S11 - S12	FMH1019180	FMH1019179	450	16.3	2.65	2.58	9.81	0.00060	0.004	0.000001	1.33	0.16	0.21	211
S12 - S13	FMH1019179	FMH1019178	450	22.4	2.10	1.88	9.81	0.00030	0.010	0.000001	2.18	0.16	0.35	347
S13 - P1	FMH1019178	-	450	11.8	1.48	1.39	9.81	0.00030	0.008	0.000001	1.92	0.16	0.30	305
P1 - E1	-	FMH1039604	450	7.9	1.39	1.31	9.81	0.00030	0.010	0.000001	2.21	0.16	0.35	351
E1 - E2	FMH1039604	FMH1039605	600	62.6	1.31	1.18	9.81	0.00030	0.002	0.000001	1.19	0.28	0.54	335
E2 - E3	FMH1039605	FMH1039606	600	74.5	1.18	0.80	9.81	0.00060	0.005	0.000001	1.74	0.28	0.49	491
E3 - E4	FMH1039606	FMH1039607	600	30.2	0.25	-0.08	9.81	0.00060	0.011	0.000001	2.55	0.28	0.72	520
E4 - E5	FMH1039607	FMH1039608	700	84.7	-0.48	-0.63	9.81	0.00300	0.002	0.000001	0.91	0.38	0.35	352
E5 - E6	FMH1039608	FMH1039609	750	36.1	-0.64	-0.73	9.81	0.00300	0.002	0.000001	1.13	0.44	0.50	501
E6 - E7	FMH1039609	FMH1039610	750	42.8	-0.75	-0.85	9.81	0.00300	0.002	0.000001	1.10	0.44	0.48	485
E7 - E8	FMH1039610	FMH1039611	750	24.9	-0.85	-0.91	9.81	0.00300	0.002	0.000001	1.11	0.44	0.49	492
E8 - E9	FMH1039611	FMH1039612	900	10.6	-0.92	-0.96	9.81	0.00300	0.004	0.000001	1.57	0.64	1.00	996
E9 - E10	FMH1039612	FMH1039613	900	19.2	-0.97	-1.01	9.81	0.00300	0.002	0.000001	1.17	0.64	0.74	742
E10 - E11	FMH1039613	FMH1039614	900	33.0	-1.02	-1.12	9.81	0.00300	0.003	0.000001	1.41	0.64	0.89	894
E11 - E12	FMH1039614	FMH1039615	900	17.7	-1.14	-1.19	9.81	0.00300	0.003	0.000001	1.36	0.64	0.86	865
E12 - E13	FMH1039615	FMH1039616	900	46.8	-1.19	-1.28	9.81	0.00300	0.002	0.000001	1.12	0.64	0.71	712
E13 - E14	FMH1039616	FMH1039617	900	58.1	-1.29	-1.42	9.81	0.00300	0.002	0.000001	1.21	0.64	0.77	768
E14 - E15	FMH1039617	FMH1039618	1200	130.5	-1.44	-1.68	9.81	0.00300	0.002	0.000001	1.32	1.13	1.49	1489
E15 - E16	FMH1039618	FMH1039619	900	20.6	-1.69	-1.74	9.81	0.00300	0.002	0.000001	1.26	0.64	0.80	800
E16 - E17	FMH1039619	FMH1039620	900	30.0	-1.75	-1.82	9.81	0.00300	0.002	0.000001	1.23	0.64	0.79	785
E17 - E18	FMH1039620	FMH1039621	900	30.6	-1.83	-1.90	9.81	0.00300	0.002	0.000001	1.22	0.64	0.78	777
E18 - E19	FMH1039621	FMH1039603	900	25.1	-1.91	-1.97	9.81	0.00300	0.002	0.000001	1.25	0.64	0.79	795
E19 - E20	FMH1039603	XPS1001707	900	9.3	-1.97	-2.02	9.81	0.00300	0.005	0.000001	1.77	0.64	1.13	1128

adopted ks value

Remarks:

- (1) g=gravitational acceleration; k_s=equivalent sand roughness; s=gradient; v=kinematic viscosity of water; V=mean velocity
- (2) Table 2: The value of k_s = 3.0mm is used for the calculation of slined concrete sewer, poor condition (based on Table 5: Recommended roughness values in Sewerage Manual)
- (3) Table 2: The value of k_s = 0.6mm is used for the calculation of slined clayware sewer, poor condition (based on Table 5: Recommended roughness values in Sewerage Manual)
- (4) Table 2: The value of k_s = 0.3mm is used for the calculation of slined polyethylene for the proposed sewers, poor condition (based on Table 5: Recommended roughness values in Sewerage Manual)
- (5) The value of velocity (V) is referred to the Tables for the hydraulic design of pipes, sewers and channels (8th edition)
- (6) Equation used:

$$V = -\sqrt{(8gDs)} \log \left(\frac{k_s}{3.7D} + \frac{2.51v}{D\sqrt{(2gDs)}} \right)$$

Table 4a Comparison of the Hydraulic Capacity of Existing Sewers for Sewage Generated from the Proposed Development and Surrounding Catchment Areas

Segment	Pipe Dia. (mm)	Pipe Length (m)	Gradient	Estimated Capacity (L/s)	Catchment Involved	ADWF (m³/day)	Contributing Population	Peaking Factor	Peak Flow from the Proposed Development and Catchment Areas (L/s)	Contribution from the Proposed Development and the Surrounding Catchment Areas (%)	Status
S5 - S5a	450	18.0	0.001	75	S, A	3075	11390	4	142.4	190%	Not OK
S5a - S6	450	11.9	0.004	209	S, A, A1	3099	11478	4	143.5	69%	OK
S6 - S7	450	30.6	0.005	233	S, A, A1	3099	11478	4	143.5	62%	OK
S7 - S8	450	12.4	0.006	242	S, A, A1	3099	11478	4	143.5	59%	OK
S8 - S9	450	10.9	0.009	310	S, A, A1	3099	11478	4	143.5	46%	OK
S9 - S10	450	11.8	0.007	266	S, A, A1	3099	11478	4	143.5	54%	OK
S10 - S11	450	6.9	0.004	213	S, A, A1	3099	11478	4	143.5	68%	OK
S11 - S12	450	16.3	0.004	211	S, A, A1	3099	11478	4	143.5	68%	OK
S12 - S13	450	22.4	0.007	264	S, A, A1	3099	11478	4	143.5	54%	OK

Table 4b Comparison of the Hydraulic Capacity of Existing and Proposed Sewers after Proposed Modification Works for Sewerage Generated from the Proposed Development and Surrounding Catchment Areas

Segment	Pipe Dia. (mm)	Pipe Length (m)	Gradient	Estimated Capacity (L/s)	Catchment Involved	ADWF (m³/day)	Contributing Population	Peaking Factor	Peak Flow from the Proposed Development and Catchment Areas (L/s)	Contribution from the Proposed Development and the Surrounding Catchment Areas (%)	Status
T1 - S5	450	4.7	0.006	280	S	576	2134	6	40.0	14%	OK
S5 - S5a	450	18.0	0.003	183	S, A	3075	11390	4	142.4	78%	OK
S5a - S6	450	11.9	0.004	225	S, A, A1	3099	11478	4	143.5	64%	OK
S6 - S7	450	30.6	0.004	218	S, A, A1	3099	11478	4	143.5	66%	OK
S7 - S8	450	12.4	0.006	242	S, A, A1	3099	11478	4	143.5	59%	OK
S8 - S9	450	10.9	0.009	310	S, A, A1	3099	11478	4	143.5	46%	OK
S9 - S10	450	11.8	0.007	266	S, A, A1	3099	11478	4	143.5	54%	OK
S10 - S11	450	6.9	0.004	213	S, A, A1	3099	11478	4	143.5	68%	OK
S11 - S12	450	16.3	0.004	211	S, A, A1	3099	11478	4	143.5	68%	OK
S12 - S13	450	22.4	0.010	347	S, A, A1	3099	11478	4	143.5	41%	OK
S13 - P1	450	11.8	0.008	305	S, A, A1	3099	11478	4	143.5	47%	OK
P1 - E1	450	7.9	0.010	351	S, A, A1	3099	11478	4	143.5	41%	OK
E1 - E2	600	62.6	0.002	335	S, A, A1	3099	11478	4	143.5	43%	OK
E2 - E3	600	74.5	0.005	491	S, A, A1, C1	3271	12114	4	151.4	31%	OK
E3 - E4	600	30.2	0.011	720	S, A, A1, C1, C2	3530	13075	4	163.4	23%	OK
E4 - E5	700	84.7	0.002	352	S, A, A1, C1, C2, D	4940	18295	4	228.7	65%	OK
E5 - E6	750	36.1	0.002	501	S, A, A1, C1, C2, D	4940	18295	4	228.7	46%	OK
E6 - E7	750	42.8	0.002	485	S, A, A1, C1, C2, D	4940	18295	4	228.7	47%	OK
E7 - E8	750	24.9	0.002	492	S, A, A1, C1, C2, D	4940	18295	4	228.7	46%	OK
E8 - E9	900	10.6	0.004	996	S, A, A1, C1, C2, D, E	6990	25888	4	323.6	32%	OK
E9 - E10	900	19.2	0.002	742	S, A, A1, C1, C2, D, E	6990	25888	4	323.6	44%	OK
E10 - E11	900	33.0	0.003	894	S, A, A1, C1, C2, D, E	6990	25888	4	323.6	36%	OK
E11 - E12	900	17.7	0.003	865	S, A, A1, C1, C2, D, E	6990	25888	4	323.6	37%	OK
E12 - E13	900	46.8	0.002	712	S, A, A1, C1, C2, D, E	6990	25888	4	323.6	45%	OK
E13 - E14	900	58.1	0.002	768	S, A, A1, C1, C2, D, E	6990	25888	4	323.6	42%	OK
E14 - E15	1200	130.5	0.002	1489	S, A, A1, C1, C2, D, E, F	7228	26770	4	334.6	22%	OK
E15 - E16	900	20.6	0.002	800	S, A, A1, C1, C2, D, E, F	7228	26770	4	334.6	42%	OK
E16 - E17	900	30.0	0.002	785	S, A, A1, C1, C2, D, E, F	7228	26770	4	334.6	43%	OK
E17 - E18	900	30.6	0.002	777	S, A, A1, C1, C2, D, E, F	7228	26770	4	334.6	43%	OK
E18 - E19	900	25.1	0.002	795	S, A, A1, C1, C2, D, E, F	7228	26770	4	334.6	42%	OK
E19 - E20	900	9.3	0.005	1128	S, A, A1, C1, C2, D, E, F	7228	26770	4	334.6	30%	OK

Remarks: (1) The value of peaking factor = 4 is used for population 10,000-50,000 incl. stormwater allowance (refers to Table T-5 of GESF)
(2) The value of peaking factor = 6 is used for population 1,000 – 5,000 incl. stormwater allowance (refers to Table T-5 of GESF)

Appendix 3

Hydraulic Calculations

Hydraulic Calculation of Proposed Sewerage System

U/S MH	D/S MH	U/S I.L.	D/S I.L.	Pipe diameter	Pipe Length	Gradient	$k_s^{(1)}$	R	V	Area	Capacity	ADWF	Contributing Population	Peaking Factor ⁽²⁾	Peak Flow	Utilisation	Remarks
		mPD	mPD	mm	m	1 in	mm	m	m/s	m ²	m ³ /s	m ³ /day			m ³ /s	%	
TMH1	FMH1	3.38	3.35	225	2.7	100	0.3	0.05625	1.42	0.040	0.057	149.2	553	6	0.010	18.3%	149.2m ³ /d (ADWF) from Phase IIa Development
FMH1	FMH1019177	3.00	2.93	450	21.9	313	0.3	0.1125	1.23	0.159	0.196	3248.2	12030	4	0.150	76.7%	3099m ³ /d (ADWF) extracted from Phase III Approved SIA (refer to Appendix 2)
FMH1019177	FMH1019176	2.93	2.86	450	12.5	179	0.6	0.1125	1.52	0.159	0.241	3248.2	12030	4	0.150	62.3%	
FMH1019176	FMH1019175	2.86	2.76	450	12.9	129	0.6	0.1125	1.79	0.159	0.284	3248.2	12030	4	0.150	52.9%	
FMH1019175	FMH1019181	2.76	2.68	450	14.3	179	0.6	0.1125	1.52	0.159	0.241	3248.2	12030	4	0.150	62.3%	
FMH1019181	FMH1019180	2.68	2.65	450	8.2	273	0.6	0.1125	1.22	0.159	0.195	3248.2	12030	4	0.150	77.2%	
FMH1019180	FMH1019179	2.65	2.58	450	19.2	274	0.6	0.1125	1.22	0.159	0.194	3248.2	12030	4	0.150	77.3%	
FMH1019179	FMH1019178	2.10	1.88	450	24.3	110	0.3	0.1125	2.09	0.159	0.333	3248.2	12030	4	0.150	45.2%	
FMH1019178	P1	1.48	1.39	450	11.5	128	0.3	0.1125	1.94	0.159	0.309	3248.2	12030	4	0.150	48.7%	
P1	FMH1039604	1.39	1.31	450	8.1	101	0.3	0.1125	2.19	0.159	0.348	3248.2	12030	4	0.150	43.3%	
FMH1039604	FMH1039605	1.31	1.18	600	62.9	484	0.3	0.15	1.18	0.283	0.334	3248.2	12030	4	0.150	45.0%	
FMH1039605	FMH1039606	1.18	0.80	600	75.1	198	0.6	0.15	1.73	0.283	0.489	3420.2	12667	4	0.158	32.4%	172m ³ /d (ADWF) extracted from Phase III Approved SIA (refer to Appendix 2)

$$g = 9.81 \text{ m/s}^2$$

$$\nu = 10^{-6} \text{ m}^2/\text{s}$$

Notes:

⁽¹⁾ Roughness coefficients are assumed to be same as Phase III approved SIA (refer to **Appendix 2**).⁽²⁾ Stormwater allowance is included for existing sewers. No stormwater allowance is considered for the proposed sewer from Phase IIa to the existing sewer.

