Appendix 6

SEWERAGE IMPACT ASSESSMENT

Section 12A Planning Application For Proposed Redevelopment of Evangel Hospital at No. 222 Argyle Street, Kowloon

Sewerage Impact Assessment Report

Project No.:	BATC51701	Rev.:	1

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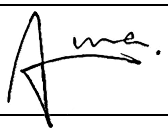
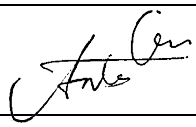
Signature			
Date	11 March 2025	11 March 2025	11 March 2025

HISTORY LOG

Document No.	Rev No.	Issue Date	Purpose of Issue	Revised Sections
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1 INTRODUCTION

1.1 Egis Engineering and Consulting Hong Kong Limited (Egis) was commissioned to prepare and submit this Sewerage Impact Assessment (“SIA”) in support of Section 12A Planning Application ("S12A") / Rezoning Request ("RR") for Proposed Amendment to the Approved Ma Tau Kok Outline Zoning Plan No. S/K10/30 ("Approved OZP") to relax the Building Height Restriction ("BHR") for the Redevelopment of Evangel Hospital at No. 222 Argyle Street, Kowloon (the “Site” / “Application Site”).

1.2 The Site is currently zoned “Government, Institution or Community” (“G/IC”) with a maximum Building Height Restriction (“BHR”) of 5 storeys as stipulated on the Approved OZP. The Rezoning Request (“RR”) is proposed to relax the maximum BHR to 110mPD to facilitate the redevelopment of EH (“Proposed Hospital Redevelopment”). An Indicative Development Scheme (“IDS”) is put forth to demonstrate the feasibility of the proposed development parameters.

1.3 This SIA aims to ascertain adequate capacity of the existing sewerage system to cope with the sewage generated from the Site under the IDS as the gross floor area for medical services has increased. The scope of this SIA includes catchment study of the Site, discussion on potential sewerage impact on the existing sewerage system and any recommendation on feasible mitigation measures, if applicable.

1.4 The development parameters of the IDS are summarized in **Table 1.1** below.

Table 1.1 Development Parameters of the IDS

Development Parameters	**Information**
Site Area	Approximately 1,463 m^2
Proposed Gross Floor Area (GFA)	Approximately 18,331 m^2
Proposed Building Height (Maximum at Main Roof Level)	Not more than 110mPD
Proposed Plot Ratio	Approximately 12.53
Site Coverage	Below 39m: Approximately 83% Above 39m: Approximately 65%
Number of Storeys	22 Storeys (including 9-storey podium) over 2 Levels of Basement
Commencement Year	2032/2033

2 STANDARDS AND REGULATIONS ON WATER QUALITY

2.1 Water quality in Hong Kong is subject to the provisions of the Water Pollution Control Ordinance (Cap 358), 1980 (WPCO). Territorial Water has been subdivided into ten Water Control Zones (WCZ) and four supplementary water control zones. The Application Site is in the Victoria Harbour Control Zone. A Technical Memorandum on Standards for Effluents discharged into Drainage and Sewerage Systems, Inland and Coastal Water (TMES) has been issued, which requires licensing of all discharges into all public sewers and drains. The water quality standards will have to be complied during the operation stages.

2.2 Discharge of sewage from the Application Site shall also be referenced to Building (Standards of Sanitary Fitments, Plumbing, Drainage Works and Latrines) Regulations 40(1), 40(2), 41(1), 90 and recap in ProPECC PN 5/93.

3 EXISTING AND PROPOSED SEWERAGE ARRANGEMENT

3.1 Currently, sewage from the Evangel Hospital is discharged to existing public manhole FMH4027505 in Fu Ning Street via an existing terminal manhole and connection pipe. The sewage discharged from the Site runs along a series of foul sewer with size of 225mm – 375mm in diameters along the Argyle Street and converge with other sewerage flows at existing public manhole FMH4099762 near Argyle Street Playground.

3.2 Under the IDS, sewage generated from the Evangel Hospital will be discharged to existing public manhole FMH4027505 via a terminal manhole. The sewage discharged from the Site will run along a series of foul sewer with size of 225mm – 375mm in diameters along the Argyle Street and converge with other sewerage flows at existing public manhole FMH4099762 near Argyle Street Playground.

3.3 The Project Proponent shall be responsible for the implementation and maintenance of internal sewerage facilities within the Site.

4 ASSESSMENT METHODOLOGY

Sewage Loadings

4.1 The quantities of the sewage generated from the Site and the existing surrounding development have been estimated in accordance with the guidelines set out in EPD Report No. EPD/TP 1/05 Guidelines for Estimating Sewage Flows (GESF) for Sewerage Infrastructure Planning Version 1.0 ("GESF").

4.2 With reference to GESF, the Global Unit Flow Factors and the Global Peaking Factors are presented in **Table 4.1** and **Table 4.2**.

4.3 The population data of the IDS is provided by Project Proponent dated 27 September 2024. Depending on their work nature, the population is categorized into the following categories:

- Clinical Staff (J11)
- Supporting Staff (J6); and
- F&B Staff (J10)

4.4 The number of residential units of existing developments in the vicinity is referenced from property agency website online. The residential density is region-specific which is referenced from the District Profiles (Population and Households) conducted by Census and Statistic Department in 2023. Based on the location of the Project Site, i.e., Kowloon City, the residential density of 2.7 persons/unit is adopted. For the existing residential developments in the vicinity, it is assumed that the number of management staff is 5% of the total number of residents as referenced to the previously approved SIA report. The population data regarding students, teachers and catering staff of the education institutions is also referenced to the previously approved SIA report.

Capacity of Foul Sewer

4.5 Information regarding existing foul sewers is referenced from Common Spatial Data Infrastructure (CSDI). The allowable flow rate of the existing foul sewers was calculated by using the Colebrook-White Equation in accordance with DSD's Sewerage Manual Part 1.

4.6 Locations of the manholes and foul sewers are presented in **Appendix A**. The sewage loadings from the IDS and other existing buildings are presented in **Appendix B**.

Table 4.1 Global Unit Flow Factor (UFF)

Type	Units Flow Factors (m^3/person/day)
Domestic (R2)	0.27
Supporting Staff (J6)	0.08

F&B Staff (J10)	1.58
Clinical Staff (J11)	0.28
Management Staff for Existing Residential Developments (J11)	0.28
Teacher	0.28
Student	0.04

Table 4.2 Global Peaking Factor

Population	**Peaking Factor**
< 1000	8
1000 – 5000	6
5000 – 10000	5
10000 – 50000	4
> 50000	Max ($\frac{7.3}{N^{0.15}}$, 2.4)

Note:
N is the contributing population in thousands

5 IMPACT EVALUATION

Application Site

5.1 According to Note (2) of Table T-2 under GESF, for job types J10 and J11, the "per-employee" unit flow factor takes into account the flows of customers and/or tenants. Thus, it is expected that the sewage generated from clinical staff has already accounted for that discharged from patients. These patients are therefore not included in our sewerage estimation.

5.2 General activities such as toilet flushing, washing and cleaning are considered as the major sources of sewage discharge from the Site.

5.3 The estimated total sewage generated is 208.1 m^3/day, which has taken into account all activities such as outpatient service, inpatient service, general operation and catering to be carried out within the Site. Further study shall be conducted at the lease modification stage to determine whether or not the existing terminal manhole and connection pipe require replacement.

Sewerage Impact from Zone A, B and C

5.4 Zone A consists of Pooi To Primary School, Ma Tau Chung Government Primary School, Christian Alliance P.C. Lau Memorial International School, Notre Dame Colleage, Calton Mansion, Harvest Court and Hoover Court where sewage is converged to Manhole FMH4027497. Please refer to **Appendix A**. The total sewage generated from Zone A is 265.6 m^3/day.

5.5 Zone B consists of Sapphire Court, Garfield Court, Elite House and Lorna Villa where sewage is converged to Manhole FMH4027498, FMH4027499 and FMH4027500 accordingly. The total sewage generated from Zone B is 110.4 m^3/day.

5.6 Zone C consists of cluster of upstream developments where sewage is converged to Manhole FMH4027383. For ease of calculation under this assessment, sewer FWD4028630 is assumed full bore to estimate the total sewage generated from Zone C. As indicated in **Appendix C1**, the average flow from Zone C is 0.0151 m^3/s, which is equivalent to approximately 1,305m^3/day.

Cumulative Sewerage Impact from Project Site, Zone A, B and C

5.7 Together with sewage flow from Zone A, B and C, the maximum occupancy of existing public sewer is 118%, which is identified in two sewer sections from FMH4027500 to FMH4027383. One sewer (i.e. between FMH4027498 to FMH4027499) is identified with pipe occupancy of 99%. In accordance with Section 5.1.1 of DSD's Sewerage Manual Part 1, the maximum design capacity of circular pipe can attain about 93% of the maximum discharge. As such, sewerage exceedance is expected at four sewer sections from FMH4027498 to FMH4027383. Please refer to **Appendix C2**.

5.8 Based on the current result of hydraulic assessment, four sewer sections may likely be required upgrading from 225mm to 300mm. The total length of upgrading

works is approximately 140m. Upon mitigation measure (i.e. upgrading works), the maximum occupancy of sewers is likely be no more than 76%, which is way less than the 93% of maximum discharge under Section 5.1.1 of SDM. Please refer to the mitigated scenario under **Appendix C3**.

5.9 The upgraded sewers shall be handed over to DSD for maintenance upon satisfactory completion.

Way Forward

5.10 While the above sewerage estimation is conducted based on best available information, significant interpolation on the slope of sewer between FMH4027498 to FMH4027383 is inevitable due to substantial missing data. As such, accurate assessment of the existing sewerage system with respect to the IDS is difficult.

5.11 In this regard, it is recommended that a detailed survey of the sewerage system shall be conducted at the Lease Modification Stage to ensure that the most accurate data are adopted. The sewerage assessment shall be thoroughly reviewed and updated if necessary. Details shall be submitted to EPD and DSD for agreement prior to construction (as part of the main submission to Buildings Department). Government funding support for the sewerage works is critical, practically for the more “strategic level” upgrading elements, which would be required in any case.

6 CONCLUSION

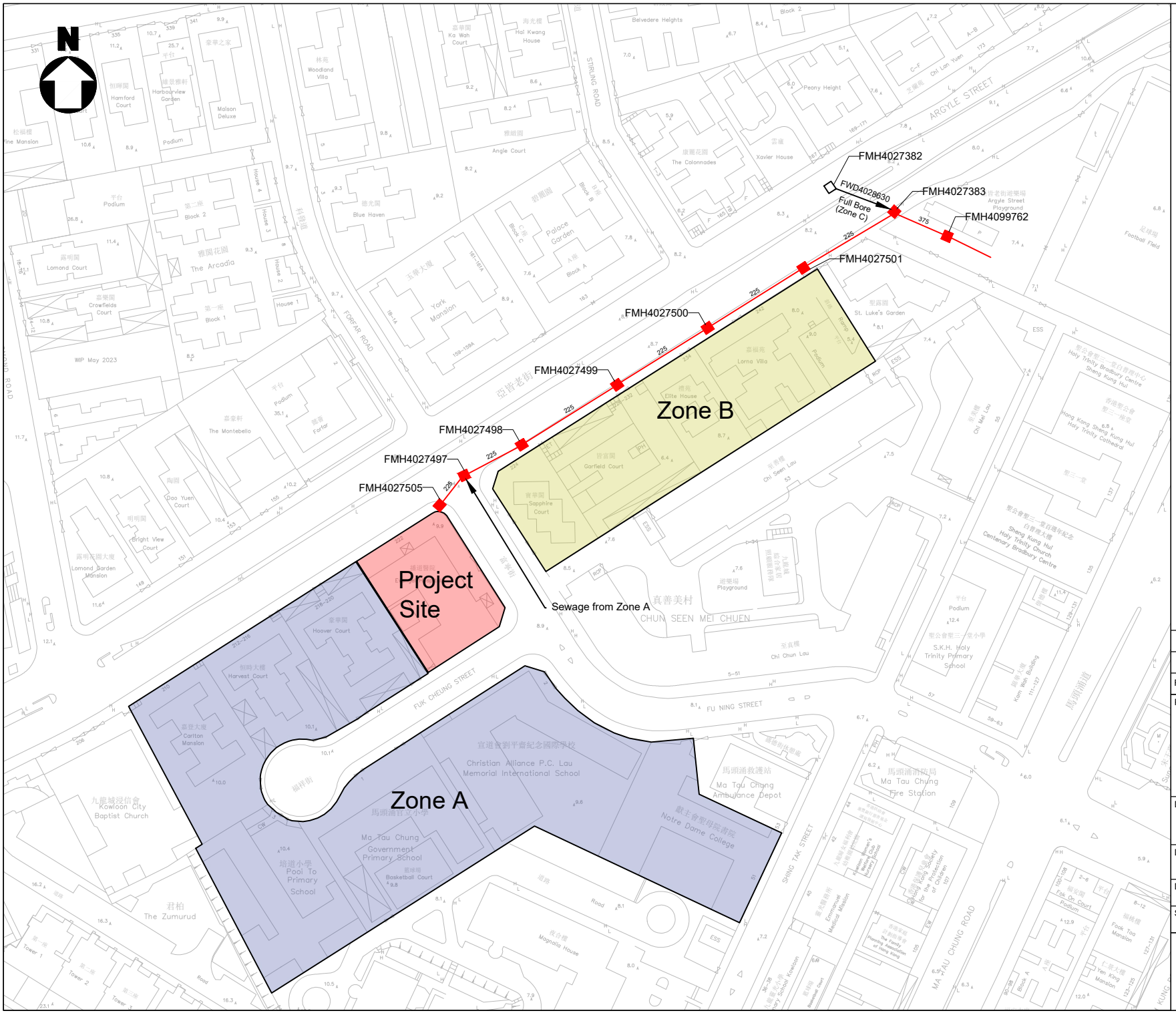
6.1 A SIA has been carried out in support of the S12A Planning Application for the Proposed Redevelopment of Evangel Hospital at No. 222 Argyle Street, Kowloon. It is expected that the total sewage flow of 208.1 m^3/day will be generated from the full operation of the Site under the IDS. Sewage from the Site would be converged to the public sewerage system, similar to the existing condition.

6.2 From the currently available data, the current hydraulic assessment has indicated that sewerage exceedance is expected from FMH4027498 to FMH4027383. In order to cater for the sewage generated from the future redevelopment of the Site, these four sections of 225mm clayware sewer may likely be required to be upgraded to 300mm clayware sewer to minimize any adverse sewerage impact.

6.3 As there is a significant amount of missing data on the existing sewerage system which on some degree affects the accuracy of sewerage assessment, it is therefore recommended that a detailed survey on the existing sewerage system to be conducted at the Lease Modification Stage to ensure that the most accurate data are adopted in the sewerage assessment. The sewerage assessment shall be thoroughly reviewed and updated if necessary.

7 APPENDICES

Appendix	Title
Appendix A	Drainage Record
Appendix B	Domestic and Commercial Loading
Appendix C1	Full Bore Calculation of Sewer FWD4028630
Appendix C2	Detailed Calculation of Allowable Flow Rate of Existing and Proposed Foul Sewers (Base Case)
Appendix C3	Detailed Calculation of Allowable Flow Rate of Existing and Proposed Foul Sewers (Mitigated Case)



Legend

- Existing Sewerage Manhole
- Existing Sewer (Main Flow)
- Existing Sewer (Branch Flow)

REV.	DESCRIPTION	BY	DATE

PROJECT TITLE

Proposed Redevelopment of Evangel Hospital at 222 ArgyleStreet, Kowloon

DRAWING TITLE

Drainage Record

DRAWING NO.			REV.
Appendix A			1
DRAWN	DATE	CHECKED	APPROVED
ALA	16/12/24	CCK	CCK
SCALE		STATUS	
NOT SHOWN			

egis

Project Title: **Proposed Redevelopment at 222 Argyle Street, Kowloon**

Revision: **1**

Region: **Kowloon City**

Residential Density, Person/Unit [1]: **2.70**

Pcif [2]: **1.00**

Zone ID	Description	General Use	Specific Type [3]	No.of Residential Unit [4]	GFA	Worker Density Per 100m2 GFA [6]	Population [7a & 7b]	Global Unit Factor [8]	Sewage Discharge with Catchment Inflow Factor (m^3/d) [9]	Inflow to Manhole No.	Remarks [10]
Project Site	Evangel Hospital [5]	Commercial	J6 Finance, Insurance, Real Estate & Business Services	/	/	/	194	0.08	15.5	FTMH-01	
	Evangel Hospital [5]	Commercial	J10 Restaurants	/	/	/	23	1.58	36.3	FTMH-01	
	Evangel Hospital [5]	Commercial	J11 Community, Social & Personal Services	/	/	/	558	0.28	156.2	FTMH-01	
Zone A	Pooi To Primary School	Commercial	Teacher	/	/	/	37	0.28	10.4	FMH4027497	[11]
	Pooi To Primary School	Commercial	Student	/	/	/	516	0.04	20.6	FMH4027497	[11]
	Pooi To Primary School	Commercial	J10 Restaurants	/	/	/	5	1.58	7.9	FMH4027497	[11]
	Ma Tau Chung Government Primary School	Commercial	Teacher	/	/	/	51	0.28	14.3	FMH4027497	[11]
	Ma Tau Chung Government Primary School	Commercial	Student	/	/	/	750	0.04	30.0	FMH4027497	[11]
	Ma Tau Chung Government Primary School	Commercial	J10 Restaurants	/	/	/	5	1.58	7.9	FMH4027497	[11]
	Christian Alliance P.C. Lau Memorial International School	Commercial	Teacher	/	/	/	22	0.28	6.2	FMH4027497	[11]
	Christian Alliance P.C. Lau Memorial International School	Commercial	Student	/	/	/	260	0.04	10.4	FMH4027497	[11]
	Christian Alliance P.C. Lau Memorial International School	Commercial	J10 Restaurants	/	/	/	5	1.58	7.9	FMH4027497	[11]
	Notre Dame College	Commercial	Teacher	/	/	/	53	0.28	14.8	FMH4027497	[11]
	Notre Dame College	Commercial	Student	/	/	/	594	0.04	23.8	FMH4027497	[11]
	Notre Dame College	Commercial	J10 Restaurants				5	1.58	7.9	FMH4027497	[11]
	Calton Mansion	Domestic	Private R2	66	/	/	178	0.27	48.1	FMH4027497	
	Calton Mansion	Commercial	J11 Community, Social & Personal Services	/	/	/	9	0.28	2.5	FMH4027497	management staff etc. @5% of resident population
	Harvest Court	Domestic	Private R2	36	/	/	97	0.27	26.2	FMH4027497	
	Harvest Court	Commercial	J11 Community, Social & Personal Services	/	/	/	5	0.28	1.4	FMH4027497	management staff etc. @5% of resident population
	Hoover Court	Domestic	Private R2	33	/	/	89	0.27	24.1	FMH4027497	
	Hoover Court	Commercial	J11 Community, Social & Personal Services	/	/	/	4	0.28	1.2	FMH4027497	management staff etc. @5% of resident population
Zone B	Sapphire Court	Domestic	Private R2	20	/	/	54	0.27	14.6	FMH4027498	
	Sapphire Court	Commercial	J11 Community, Social & Personal Services	/	/	/	3	0.28	0.8	FMH4027498	management staff etc. @5% of resident population
	Garfield Court	Domestic	Private R2	56	/	/	151	0.27	40.8	FMH4027499	
	Garfield Court	Commercial	J11 Community, Social & Personal Services	/	/	/	8	0.28	2.1	FMH4027499	management staff etc. @5% of resident population
	Elite House	Domestic	Private R2	20	/	/	54	0.27	14.6	FMH4027500	
	Elite House	Commercial	J11 Community, Social & Personal Services	/	/	/	3	0.28	0.8	FMH4027500	management staff etc. @5% of resident population
	Lorna Villa	Domestic	Private R2	48	/	/	130	0.27	35.0	FMH4027500	
	Lorna Villa	Commercial	J11 Community, Social & Personal Services	/	/	/	6	0.28	1.8	FMH4027500	management staff etc. @5% of resident population
Zone C	Other Upstream Catchment (Assumed Full Bore at FWD4028630)								1305	FMH4027383	Refer to Appendix C1

Note:

1. Based on Census and Statistics Department - District Profiles (Population and Households) (2023)
2. Based on Table T-4 of GESF.
3. Based on Table T-1 (For Domestic Use) and Table T-2 (For Commercial Use) of GESF
4. For existing developments, number of residential units is obtained from property agency online.
5. Population data is provided by Project Proponent dated 27 September 2024.
6. Based on Table 8 of Commercial and Industrial Floor Space Utilization Survey - Planning Department, if applicable.

7a. Domestic population is given by *No. of Residential Unit x Residential Density*

7b. Commercial Population is given by Working *Area / 100 x Worker Density Per 100m2 Working Area*

8. Based on Table T-1 (For Domestic Use) and Table T-2 (For Commercial Use) of GESF
9. Sewage Discharge with Catchment Inflow Factor is given by *Population x Global Unit Factor x Catchment Inflow Factor*
10. Ratio of management staff to existing residential population of a particular residential building is referenced to the previously approved SIA Report for the Proposed Redevelopment of Evangel Hospital in 2023 under TPB Application No. Y/K10/5.
11. Population of students, teachers and catering staff of the abovementioned education institutions is referenced from the previously approved SIA Report for the Proposed Redevelopment of Evangel Hospital in 2023 under TPB Application No. Y/K10/5.

Appendix C1

Project Title: Proposed Redevelopment at 222 Argyle Street, Kowloon
Revision: 1
Scenario: Estimation of Total Sewage Loading from Zone C

From Manhole No.	To Manhole No.	Diameter, m [1]	Length, m [1]	Inlet invert level, mPD [1]	Outlet invert level, mPD [1]	Slope, s [2]	Pipe Material	Roughness Values, m	Velocity, m/s [3]	Capacity, m3/s	Average Flow, m^3/s	Average Flow from previous section' m^3/s	Total Average Flow, m^3/s	Contributing Population [5]	Peaking Factor [6]	Total Peak Flow (m^3/s)	% of Pipe Capcity Occupied	Remarks
FWD4028630		0.375	25	5.3	5.26	0.0016	Clayware	0.00015	0.818	0.090	0.0151	0.0000	0.0151	4818	6	0.090	100%	Full Bore (Zone C)

Note
1. Information of the invert level and diameter of the existing foul sewer are extracted from the previously approved SIA report.
2. Slope of sewer is given by (Inlet Invert Level - Outlet Invert Level)/Length of sewer.
3. Flow velocity for clayware pipe under poor condition. For conservative consideration of the full bore estimation, slimmed condition is not considered.
4. Based on Section 12 *For circular pipes flowing full,*
5. Based on Table T-5 of GESF.

For circular pipes flowing full,

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

Where
V = mean velocity (m/s)
g = gravitational acceleration (m/s2)
D = internal pipe diameter (m)
ks = hydraulic pipeline roughness (m)
v = kinematic viscosity of fluid (m2/s)
s = hydraulic gradient (energy loss per unit length due to friction)

By assuming full bore condition at existing sewer FWD4028630, the average flow is estimated to be 0.0151m3/s, which is equivalent to approximately 1305m3/day.

Appendix C2

Project Title: Proposed Redevelopment at 222 Argyle Street, Kowloon
Revision: 1
Scenario: Base Case

From Manhole No.	To Manhole No.	Diameter, m [1]	Length, m [1]	Inlet invert level, mPD [1]	Outlet invert level, mPD [1]	Slope, s [2]	Pipe Material	Roughness Values, m	Velocity, m/s [3]	Slimmed Condition				Average Flow, m^3/s	Average Flow from previous section' m^3/s	Total Average Flow, m^3/s	Contributing Population [6]	Peaking Factor [7]	Total Peak Flow (m^3/s)	% of Pipe Capcity Occupied	Remarks
										Pipe Classification	Roughness Values, m [4]	Velocity under slimmed condition, m/s	Capacity, m3/s [5]								
Sewerage System																					
FMH4027505	FMH4027497	0.225	11.8	7.85	6.28	0.1331	Clayware	0.00015	5.687	Slimmed Sewer (Clayware, 1.2m2/s)	0.0006	4.803	0.191	0.0000	0.0024	0.0024	771	8	0.0193	10%	Evangel Hospital (Inflow)
FMH4027497	FMH4027498	0.225	20.0	6.28	6.14	0.0070	Clayware	0.00015	1.269	Slimmed Sewer (Clayware, 1.2m2/s)	0.0006	1.091	0.043	0.0031	0.0024	0.0055	1754	6	0.0329	76%	Zone A (Inflow)
FMH4027498	FMH4027499	0.225	35.5	6.14	--	0.0053	Clayware	0.00015	1.097	Slimmed Sewer (Clayware, by Interpolation)	0.0011	0.866	0.034	0.0002	0.0055	0.0057	1811	6	0.0340	99%	Zone B (Inflow)
FMH4027499	FMH4027500	0.225	34.1	--	--	0.0053	Clayware	0.00015	1.097	Slimmed Sewer (Clayware, by Interpolation)	0.0011	0.866	0.034	0.0005	0.0057	0.0062	1970	6	0.0369	107%	Zone B (Inflow)
FMH4027500	FMH4027501	0.225	35.9	--	--	0.0053	Clayware	0.00015	1.097	Slimmed Sewer (Clayware, by Interpolation)	0.0011	0.866	0.034	0.0006	0.0062	0.0068	2163	6	0.0406	118%	Zone B (Inflow)
FMH4027501	FMH4027383	0.225	33.9	--	5.41	0.0053	Clayware	0.00015	1.097	Slimmed Sewer (Clayware, by Interpolation)	0.0011	0.866	0.034	0.0000	0.0068	0.0068	2163	6	0.0406	118%	
FMH4027383	FMH4099762	0.375	17.2	5.41	--	0.0296	Clayware	0.00015	3.651	Slimmed Sewer (Clayware, 1.2m2/s)	0.0006	3.127	0.345	0.0151	0.0068	0.0218	6981	5	0.1091	32%	Zone C (Inflow)

Note
1. Information of the invert level and diameter of the existing foul sewer are extracted from Common Spatial Data Infrstructure (CSDI) and previously approved SIA report. Missing information is denoted as "--".
2. Slope of sewer is given by (Inlet Invert Level - Outlet Invert Level)/Length of sewer. For sewer from FMH4027498 to FMH4027383, average slope is assumed. For sewer between FMH4027383 and FMH4099762, the average slope between FMH4027383 and FSH4001941 is adopted, i.e. slope = 5.41m-3.87m/52m = 0.0296
3. Flow velocity for clayware pipe under poor condition.
4.Roughness of pipe under slimmed condition. Shall the flow velocity of pipe be between 0.75m/s to 1.20m/s, interpolation of Ks will be applied.
5. Capacity of pipe refers to pipe under slimmed condition for conservative consideration
6. Based on Section 12 of GESF.
7. Based on Table T-5 of GESF.

For circular pipes flowing full,

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

Where
V = mean velocity (m/s)
g = gravitational acceleration (m/s2)
D = internal pipe diameter (m)
ks = hydraulic pipeline roughness (m)
v = kinematic viscosity of fluid (m2/s)
s = hydraulic gradient (energy loss per unit length due to friction)

Appendix C3

Project Title: Proposed Redevelopment at 222 Argyle Street, Kowloon
Revision: 1
Scenario: Mitigated Case

From Manhole No.	To Manhole No.	Diameter, m [1]	Length, m [1]	Inlet invert level, mPD [1]	Outlet invert level, mPD [1]	Slope, s [2]	Pipe Material	Roughness Values, m	Velocity, m/s [3]	Slimmed Condition				Average Flow, m^3/s	Average Flow from previous section' m^3/s	Total Average Flow, m^3/s	Contributing Population [6]	Peaking Factor [7]	Total Peak Flow (m^3/s)	% of Pipe Capcity Occupied	Remarks
										Pipe Classification	Roughness Values, m [4]	Velocity under slimmed condition, m/s	Capacity, m3/s [5]								
Sewerage System																					
FMH4027505	FMH4027497	0.225	11.8	7.85	6.28	0.1331	Clayware	0.00015	5.687	Slimmed Sewer (Clayware, 1.2m2/s)	0.0006	4.803	0.191	0.0000	0.0024	0.0024	771	8	0.0193	10%	Evangel Hospital (Inflow)
FMH4027497	FMH4027498	0.225	20.0	6.28	6.14	0.0070	Clayware	0.00015	1.269	Slimmed Sewer (Clayware, 1.2m2/s)	0.0006	1.091	0.043	0.0031	0.0024	0.0055	1754	6	0.0329	76%	Zone A (Inflow)
FMH4027498	FMH4027499	**0.300**	35.5	6.14	--	0.0053	Clayware	0.00015	1.317	Slimmed Sewer (Clayware, 1.2m2/s)	0.0006	1.138	0.080	0.0002	0.0055	0.0057	1811	6	0.0340	**42%**	Zone B (Inflow)
FMH4027499	FMH4027500	**0.300**	34.1	--	--	0.0053	Clayware	0.00015	1.317	Slimmed Sewer (Clayware, 1.2m2/s)	0.0006	1.138	0.080	0.0005	0.0057	0.0062	1970	6	0.0369	**46%**	Zone B (Inflow)
FMH4027500	FMH4027501	**0.300**	35.9	--	--	0.0053	Clayware	0.00015	1.317	Slimmed Sewer (Clayware, 1.2m2/s)	0.0006	1.138	0.080	0.0006	0.0062	0.0068	2163	6	0.0406	**50%**	Zone B (Inflow)
FMH4027501	FMH4027383	**0.300**	33.9	--	5.41	0.0053	Clayware	0.00015	1.317	Slimmed Sewer (Clayware, 1.2m2/s)	0.0006	1.138	0.080	0.0000	0.0068	0.0068	2163	6	0.0406	**50%**	
FMH4027383	FMH4099762	0.375	17.2	5.41	--	0.0296	Clayware	0.00015	3.651	Slimmed Sewer (Clayware, 1.2m2/s)	0.0006	3.127	0.345	0.0151	0.0068	0.0218	6981	5	0.1091	32%	Zone C (Inflow)

Note
1. Information of the invert level and diameter of the existing foul sewer are extracted from Common Spatial Data Infrstructure (CSDI) and previously approved SIA report. Missing information is denoted as "--".
2. Slope of sewer is given by (Inlet Invert Level - Outlet Invert Level)/Length of sewer. For sewer from FMH4027498 to FMH4027383, average slope is assumed. For sewer between FMH4027383 and FMH4099762, the average slope between FMH4027383 and FSH4001941 is adopted, i.e. slope = 5.41m-3.87m/52m = 0.0296
3. Flow velocity for clayware pipe under poor condition. For the proposed sewer, clayware sewers are assumed which shall be subject to change depending on the result of detailed survey in the later stage of the Project.
4. Roughness of pipe under slimmed condition. Shall the flow velocity of pipe be between 0.75m/s to 1.20m/s, interpolation of Ks will be applied.
5. Capacity of pipe refers to pipe under slimmed condition for conservative consideration
6. Based on Section 12 of GESF.
7. Based on Table T-5 of GESF.

For circular pipes flowing full,

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

Where
V = mean velocity (m/s)
g = gravitational acceleration (m/s2)
D = internal pipe diameter (m)
ks = hydraulic pipeline roughness (m)
v = kinematic viscosity of fluid (m2/s)
s = hydraulic gradient (energy loss per unit length due to friction)