Annex B

Replacement Pages of Drainage and Sewerage Impact Assessment

Table 4-2 Sewage Flow Estimation for the Existing and Proposed Redevelopment

Existing Development		
Care & Attention Home (G/F-2/F)		**Remarks**
Generation from Staff		
Total Floor Area	1707 m^2	
Worker Density (in 100m2)	3.3 person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
Total number of person	57 persons	
Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
ADWF	16.0 m^3/day	
Generation from Residents		
Total number of residents	143 persons	Full capacity of subsidised places (https://www.elderlyinfo.swd.gov.hk /en/content/pok-oi-hospital-yeung-c hun-pui-care-and-attention-home)
Unit Flow Factor	0.19 m^3/person/day	Referred to the planning unit flow for Domestic (housing type specific) - Institutional and special class in Table T-1 of GESF.
ADWF	27.2 m^3/day	
Kitchen		
Total Floor Area	61.5 m^2	
Worker Density (in 100m^2)	5.1 person/100 m^2	Refer to worker density for "Restaurants" in Table 8 of CIFSUS.
Total number of person	4 persons	
Unit Flow Factor	1.58 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J10 Restaurants & Hotels" in Table T-2 of GESF.
Average Sewage Discharge	6.3 m^3/day	
Total Average dry weather flow of the Existing Development	**49.5 m^3/day**	
Contributing Population	**183**	
Catchment Inflow Factor	**1.0**	
Revised Total Average Dry Weather Flow	**49.5 m^3/day**	
Peaking Factor	**8**	Referred to the Peaking Factor (including stormwater allowance) for facility with existing upstream sewerage in Table T-5 of GESF.
Peak Flow	**0.0046 m^3/s**	
Proposed Redevelopment		
Child Care Centre (G/F)		
Generation from Staff		**Remarks**
Total Floor Area	324 m^2	
Worker Density (in 100m2)	3.3 person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
Total number of persons	11 persons	

Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
Average Sewage Discharge	3.0 m^3/day	
Elderly Day Care (1/F)		
Generation from Staff		
Total Floor Area	510 m^2	
Worker Density (in 100m2)	3.3 person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
Total number of persons	17 persons	
Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
Average Sewage Discharge	4.7 m^3/day	
Care & Attention Home (1/F-4/F)		
Generation from Staff		**Remarks**
Total Floor Area	2557 m^2	
Worker Density (in 100m2)	3.3 person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
Total number of persons	85 persons	
Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
Average Sewage Discharge	23.8 m^3/day	
Generation from Residents		
Total number of residents	192 persons	full capacity of 192-place residential care home for elderly
Unit Flow Factor	0.19 m^3/person/day	Referred to the planning unit flow for Domestic (housing type specific) - Institutional and special class in Table T-1 of GESF.
Average Sewage Discharge	36.5 m^3/day	
Hostel for Severely Mentally Handicapped Persons (5/F)		
Generation from Staff		
Total Floor Area	682 m^2	
Worker Density (in 100m2)	3.3 persons	
Total number of persons	33 persons	Refer to SWD staffing establishment for HSMH, around 0.66 workers/resident (i.e.50 nos of bed).
Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
Average Sewage Discharge	9.2 m^3/day	
Generation from Residents		
Total number of residents	50 persons	full capacity of 50 place for HSMH
Unit Flow Factor	0.19 m^3/person/day	Referred to the planning unit flow for Domestic (housing type specific) - Institutional and special class in Table T-1 of GESF.
Average Sewage Discharge	9.5 m^3/day	
Hostel for Moderately Mentally Handicapped Persons (6/F)		
Generation from Staff		**Remarks**
Total Floor Area	537 m^2	
Worker Density (in 100m2)	3.3 persons	
Total number of persons	16 persons	Refer to SWD staffing establishment for HSMH, around 0.38 workers/resident.

Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
Average Sewage Discharge	4.5 m^3/day	
Generation from Residents		
Total number of residents	40 persons	full capacity of 40 place for HMMH
Unit Flow Factor	0.19 m^3/person/day	Referred to the planning unit flow for Domestic (housing type specific) - Institutional and special class in Table T-1 of GESF.
Average Sewage Discharge	7.6 m^3/day	
Day Activity Unit, Clinic, Massage, Showroom (7/F&8/F)		
Generation from Staff		
Total Floor Area	1168 m^2	
Worker Density (in 100m2)	3.3 person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
Total number of persons	39 persons	
Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
Average Sewage Discharge	10.8 m^3/day	
Kitchen(8/F)		
Total Floor Area	200 m^2	
Worker Density (in 100m2)	5.1 person/100 m^2	Referred to the worker density of Restaurants (All Types) in Table 8 of CIFSUS
Total number of persons	11 persons	
Unit Flow Factor	1.58 m^3/person/day	Referred to the planning unit flow for Commercial Employee + Restaurants & Hotels - J10 in Table T-2 of GESF.
Average Sewage Discharge	17.4 m^3/day	
Canteen(8/F)		
Total Floor Area	77 m^2	
Worker Density (in 100m2)	5.1 person/100 m^2	Referred to the worker density of Restaurants (All Types) in Table 8 of CIFSUS
Total number of persons	4 persons	
Unit Flow Factor	1.58 m^3/person/day	Referred to the planning unit flow for Commercial Employee + Restaurants & Hotels - J10 in Table T-2 of GESF.
Average Sewage Discharge	6.3 m^3/day	
Integrated Vocational Rehabilitation Services Centre (9/F)		
Generation from Staff		
Total Floor Area	416 m^2	
Worker Density (in 100m2)	3.3 person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
Total number of persons	14 persons	
Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
Average Sewage Discharge	3.9 m^3/day	
Total Average dry weather flow of the Proposed redevelopment	**137.2 m^3/day**	
Contributing Population	**508**	
Catchment Inflow Factor	**1.0**	

Revised Total Average Dry Weather Flow	**137.2 m^3/day**	
Peaking Factor	**6**	Referred to the Peaking Factor (excluding stormwater allowance) for facility with new upstream sewerage in Table T-5 of GESF.
Peak Flow	**0.0095 m^3/s**	
Difference of the proposed and existing development		
Difference in ADWF and peak flow of proposed redevelopment and existing development	**ADWF: +87.7 m^3/day** **Peak flow: +0.0049 m^3/s**	

4.3. Estimation of Sewage Flow from Streams

4.3.1. Different streams (i.e. Stream A and B) are defined as shown in ***Figure 3.1*** to consider existing sewage generation. Stream A consists of discharge from Ching Chung Care and Attention Home for the Aged while Stream B consists of discharge from Sha Chau Lei Tsuen. The sewage is discharged into the existing 150 - 300mm public sewerage pipes along the access road to the west. Stream A is discharged at FMH1009619 to join the discharge from Project Site while Stream B joins further downstream at FMH1009602.

4.3.2. Both Stream A and B are assumed to have 100% capacity at the convergent sewer of all discharge to the stream to estimate the total average day flow generated from the surrounding of the Project Site.

4.4. Estimation of Peak Discharge

4.4.1. Catchment inflow factor ("P_{CIF}") caters for the net overall ingress of wastewater to the sewerage system. They are catchment-dependent and applicable to major sewerage facilities of a catchment.

4.4.2. In accordance with Table T-4 of the GESF, P_{CIF} of 1.00 is adopted for existing sewerage as concerned sewerage system is identified in "Yuen Long".

4.4.3. Revised average dry weather flow ("revised ADWF") is determined by production of average dry weather flow and catchment inflow factor. Contributing population is then calculated by dividing the revised ADWF by 0.27. The calculated contributing population is finally used for selection of peaking factors.

4.4.4. Based on **Table 4-3** which is also presented in Table T-5 in GESF, the peaking factors for each sewer are chosen in the hydraulic calculation for peak flow estimation. The peaking factor excluding stormwater allowance is used in the peak flow estimation of proposed development. Meanwhile the peaking factor including stormwater allowance is used in stream with existing upstream (Stream A and Stream B).

Appendix C1

Calculation of Flow Capacity of Existing Development

Calculation of Flow Capacity of Existing Development

Sewer No.				Material	Internal Diameter (m) [a]	Cross-section Area (m^2)	Length (m)	Inlet mPD US_IL (m) [a]	Outlet mPD DS_IL (m) [a]	Hydraulic pipeline roughness (m) [b]	Hydraulic Gradient	Mean Velocity (m/s) [c]	Max Capacity of Sewer (m^3/s)	Total Average Dry Weather Flow m^3/day	Catchment Inflow Factor [f]	Revised Total Average Dry Weather Flow [g] m^3/day	Contributing Population [d]	Peaking Factor [e]	Peak Discharge from Project Site m^3/day	Peak Discharge through Manhole m^3/s	Percentage of capacity [h]	Percentage Contribution by Existing Development	Remark
ID	From	ID	To		D	A	l				s	V											
FTMH1	Site	S1	FMH1009620	Clayware	0.150	0.018	4.89	4.88	4.39	0.003	0.101	2.47	0.044	49.5	1.0	49.5	183	8.0	395.6	0.0046	11%	11%	Site (Existing)
S1	FMH1009620	S2	FMH1009619	Clayware	0.300	0.071	4.96	4.38	4.34	0.003	0.008	1.12	0.079	49.5	1.0	49.5	183	8.0	395.6	0.0046	6%	6%	Site (Existing)
Stream A	FTH1003105	S2	FMH1009619	Clayware	0.150	0.018	3.78	4.374*	4.34	0.003	0.009	0.73	0.013	140.4	1.0	140.4	520	8.0	1123.2	0.013	100%	/	Stream A: Assumed 100% capacity
S2	FMH1009619	S3	FMH1009618	Clayware	0.300	0.071	17.31	4.33	4.26	0.003	0.004	0.79	0.056	189.9	1.0	189.9	703	8.0	1518.8	0.018	32%	8%	Site (Existing) + Stream A
S3	FMH1009618	S4	FMH1009615	Clayware	0.300	0.071	2.54	4.26	4.24	0.003	0.008	1.10	0.078	189.9	1.0	189.9	703	8.0	1518.8	0.018	23%	6%	Site (Existing) + Stream A
S4	FMH1009615	S5	FMH1009614	Clayware	0.300	0.071	11.55	4.24	4.18	0.003	0.005	0.89	0.063	189.9	1.0	189.9	703	8.0	1518.8	0.018	28%	7%	Site (Existing) + Stream A
S5	FMH1009614	S6	FMH1009613	Clayware	0.300	0.071	19.18	4.15	4.04	0.003	0.006	0.94	0.066	189.9	1.0	189.9	703	8.0	1518.8	0.018	26%	7%	Site (Existing) + Stream A
S6	FMH1009613	S7	FMH1009612	Clayware	0.300	0.071	20.61	4.03	3.87	0.003	0.008	1.09	0.077	189.9	1.0	189.9	703	8.0	1518.8	0.018	23%	6%	Site (Existing) + Stream A
S7	FMH1009612	S8	FMH1009603	Clayware	0.300	0.071	22.51	3.85	3.75	0.003	0.004	0.83	0.058	189.9	1.0	189.9	703	8.0	1518.8	0.018	30%	8%	Site (Existing) + Stream A
S8	FMH1009603	S9	FMH1009602	Clayware	0.300	0.071	8.43	3.73	3.62	0.003	0.013	1.42	0.100	189.9	1.0	189.9	703	8.0	1518.8	0.018	18%	5%	Site (Existing) + Stream A
Stream B	FMH1009604	S9	FMH1009602	Clayware	0.225	0.040	5.72	3.63	3.62	0.003	0.002	0.43	0.017	183.6	1.0	183.6	680	8.0	1468.8	0.017	100%	/	Stream B: Assumed 100 % capacity
S9	FMH1009602	S10	FMH1009601	Clayware	0.300	0.071	11.50	3.61	3.51	0.003	0.009	1.16	0.082	373.5	1.0	373.5	1383	6.0	2240.7	0.026	32%	6%	Site (Existing) + Stream A+ Stream B

[a] Reference from GeoInfo Map, * inlet height calculated with min 1:150 gradient for 150mm pipe (as suggested by DSD)

[b] Roughness values adopted in the calculations is based on the interpolated values for velocities between 0.75 m/s and 1.2 m/s in accordance with the DSD's Sewerage Manual.
For public sewers, assumed clayware slimed sewers in "poor" condition, ks value of 3.0mm is adopted.

[c] The velocity is calculated using the Colebrook-White Formula:

$$V = -2\left(2gDS\right)^{0.5}\log\left(\frac{k}{3.7D} + \frac{2.5\nu}{D\left(2gDS\right)^{0.5}}\right)$$

where
k = Colebrook-White roughness coefficient, in meter
V = mean velocity (m/s)
D = circular cross-section pipe, inside diameter (m)
S = slope, in meters per meter
ν = kinematic viscosity of water, in meter per second (0.000001306 m/s)
g = gravitational acceleration (m/s2) (9.807m/s2)

[d] The Contributing Population is defined as:

$$\text{Contributing Population} = \frac{\text{Calculated total average flow } (m^3/\text{day})}{0.27\ (m^3/\text{person/day})}$$

[e] Reference from Table T-5 of Guidelines for Estimating Sewage Flows for Sewerage Infrastructure Planning
[f] Reference from Table T-4 of Guidelines for Estimating Sewage Flows for Sewerage Infrastructure Planning
[g] Revised Total Average Dry Weather Flow = Total Average Dry Weather Flow x Catchment Inflow Factor
[h] Pipe segment that exceeded 100% used capacity are bolded and underlined

Appendix C2

Calculation of Flow Capacity of Proposed Redevelopment

Calculation of Flow Capacity of Proposed Redevelopment

Sewer No.				Material	Internal Diameter (m) [a]	Cross-section Area (m^2)	Length (m)	Inlet mPD US_IL (m) [a]	Outlet mPD DS_IL (m) [a]	Hydraulic pipeline roughness (m) [b]	Hydraulic Gradient	Mean Velocity (m/s) [c]	Max Capacity of Sewer (m^3/s)	Total Average Dry Weather Flow	Catchment Inflow Factor	Revised Total Average Dry Weather Flow [g]	Contributing Population	Peaking Factor	Peak Discharge from Project Site m^3/day	Peak Discharge through Manhole m^3/s	Utilization	Percentage Contribution by Proposed Development [i]	Remark
ID	From	ID	To		D	A	l				s	V		m^3/day	[f]	m^3/day	[d]	[e]			[h]		
FTMH1	Site	S1	FMH1009620	Clayware	0.200	0.031	4.89	4.88	4.39	0.003	0.101	3.01	0.094	137.2	1.0	137.2	508	6.0	823.2	0.010	10%	10%	Site (Proposed)
S1	FMH1009620	S2	FMH1009619	Clayware	0.300	0.071	4.96	4.38	4.34	0.003	0.008	1.12	0.079	137.2	1.0	137.2	508	8.0	1097.6	0.013	16%	16%	Site (Proposed)
Stream A	FTH1003105	S2	FMH1009619	Clayware	0.150	0.018	3.78	4.374*	4.34	0.003	0.009	0.73	0.013	140.4	1.0	140.4	520	8.0	1123.2	0.013	100%	/	Stream A: Assumed 100% capacity
S2	FMH1009619	S3	FMH1009618	Clayware	0.300	0.071	17.31	4.33	4.26	0.003	0.004	0.79	0.056	277.6	1.0	277.6	1028	6.0	1665.6	0.019	35%	23%	Site (Proposed) + Stream A
S3	FMH1009618	S4	FMH1009615	Clayware	0.300	0.071	2.54	4.26	4.24	0.003	0.008	1.10	0.078	277.6	1.0	277.6	1028	6.0	1665.6	0.019	25%	16%	Site (Proposed) + Stream A
S4	FMH1009615	S5	FMH1009614	Clayware	0.300	0.071	11.55	4.24	4.18	0.003	0.005	0.89	0.063	277.6	1.0	277.6	1028	6.0	1665.6	0.019	30%	20%	Site (Proposed) + Stream A
S5	FMH1009614	S6	FMH1009613	Clayware	0.300	0.071	19.18	4.15	4.04	0.003	0.006	0.94	0.066	277.6	1.0	277.6	1028	6.0	1665.6	0.019	29%	19%	Site (Proposed) + Stream A
S6	FMH1009613	S7	FMH1009612	Clayware	0.300	0.071	20.61	4.03	3.87	0.003	0.008	1.09	0.077	277.6	1.0	277.6	1028	6.0	1665.6	0.019	25%	16%	Site (Proposed) + Stream A
S7	FMH1009612	S8	FMH1009603	Clayware	0.300	0.071	22.51	3.85	3.75	0.003	0.004	0.83	0.058	277.6	1.0	277.6	1028	6.0	1665.6	0.019	33%	22%	Site (Proposed) + Stream A
S8	FMH1009603	S9	FMH1009602	Clayware	0.300	0.071	8.43	3.73	3.62	0.003	0.013	1.42	0.100	277.6	1.0	277.6	1028	6.0	1665.6	0.019	19%	13%	Site (Proposed) + Stream A
Stream B	FMH1009604	S9	FMH1009602	Clayware	0.225	0.040	5.72	3.63	3.62	0.003	0.002	0.43	0.017	183.6	1.0	183.6	680	8.0	1468.8	0.017	100%	/	Stream B: Assumed 100 % capacity
S9	FMH1009602	S10	FMH1009601	Clayware	0.300	0.071	11.50	3.61	3.51	0.003	0.009	1.16	0.082	461.2	1.0	461.2	1708	6.0	2767.2	0.032	39%	16%	Site (Proposed) + Stream A+ Stream B

[a] Reference from GeoInfo Map. * inlet height calculated with min 1:150 gradient for 150dmm dioe (as suggested by DSD)

[b] Roughness values adopted in the calculations is based on the interpolated values for velocities between 0.75 m/s and 1.2 m/s in accordance with the DSD's Sewerage Manual.
For public sewers, assumed clayware slimed sewers in "poor" condition, ks value of 3.0mm is adopted.

[c] The velocity is calculated using the Colebrook-White Formula:

$$V = -2\left(2gDS\right)^{0.5}\log\left(\frac{k}{3.7D} + \frac{2.5\nu}{D\left(2gDS\right)^{0.5}}\right)$$

where
k = Colebrook-White roughness coefficient, in meter
V = mean velocity (m/s)
D = circular cross-section pipe, inside diameter (m)
S = slope, in meters per meter
v = kinematic viscosity of water, in meter per second (0.000001306 m/s)
g = gravitational acceleration (m/s2) (9.807m/s2)

[d] The Contributing Population is defined as:

$$\text{Contributing Population} = \frac{\text{Calculated total average flow } (m^3/day)}{0.27\ (m^3/person/day)}$$

[e] Reference from Table T-5 of Guidelines for Estimating Sewage Flows for Sewerage Infrastructure Planning
For sewers FTMH1 to S1, peaking factor (excluding storm water allowance) for facility with new upstream sewergae is adopted.
For sewers S1 to S10, peaking factor (including storm water allowance) for facility with existing upstream sewergae is adopted.

[f] Reference from Table T-4 of Guidelines for Estimating Sewage Flows for Sewerage Infrastructure Planning

[g] Revised Total Average Dry Weather Flow = Total Average Dry Weather Flow x Catchment Inflow Factor

[h] Pipe segment that exceeded 100% used capacity are bolded and underlined

[i] Percentage contribution by proposed development= $\frac{\text{Peak Discharge through Manhole } (m3/s)}{\text{Max Capacity of Sewer } (m^3/s)}$