Attachment 2

Extract of Revised Drainage and Sewerage Impact Assessment

2. DRAINAGE IMPACT ASSESSMENT

2.1 Appraisal of Drainage Impact

2.1.1 The Application Site is served by existing drainage systems. According to the drainage plan (**Appendix 2.2**), a Ø300 mm drainage pipe runs along the back alley of the Application Site and connects to the existing Ø300 mm drainage pipe (SWD7015179), which then discharges to the Ø2250 mm drainage pipe along Canal Road East. The Application Site is vacant and 100% paved currently.

2.1.2 The estimated surface runoff under the existing and future conditions of the Application Site is shown in **Appendix 2.1**. 20% greenery coverage would be provided for the Proposed Development as a resilient measure. The peak 1-in-50-year runoff from the site remains unchanged at 0.0173 m^3/s. The surface runoff generated from the Application Site will be collected and connected to the aforementioned drainage pipe (existing private stormwater manhole) and there is no change of flow regime.

2.1.3 Although greenery will be provided after development, it is expected that the surface runoff will remain unchanged. Therefore, it is anticipated that there is no adverse impact on the existing drainage pipe receiving runoff from the site.

2.1.4 The applicant will be responsible to maintain the proposed drainage pipeline connection.

2.1.5 It is expected that the Proposed Development (with reduced surface runoff and same flow regime) would not result in worsened drainage impact.

3. SEWERAGE IMPACT ASSESSMENT

3.1 Scope of Work

3.1.1 The aim of this study is to assess whether the existing sewerage facilities serving the Application Site are sufficient to cope with the sewage flow from the Proposed Development.

3.2 Assessment Criteria and Methodology

3.2.1 Environmental Protection Department's (EPD's) Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning, Version 1 (GESF) has been referred to for the purposes of estimating the quantity of the sewage generated from the Proposed Development and the existing catchment area. Sewage flow parameters and peaking factors in this document have been adopted for this SIA.

3.2.2 Based on the building types in the area, the following unit flow factors are used in the SIA calculation:

- Residents: 0.27 m^3/person/day (R2)
- Clubhouse Staff: 0.28 m^3/day (J11 - Community, Social & Personal Services)
- F&B employee: 1.58 m^3/day (J10 – Restaurants & Hotels)

3.2.3 Catchment Inflow Factor (P_{CIF}) of Wan Chai (1.00) has been applied in the assessment.

3.3 Existing and Future Sewerage System

3.3.1 According to the existing drainage plan (**Appendix 2.2**), there is a Ø150mm private sewer along the lane at the back alley of the Application Site (to the south of the Application Site) and then connected to the existing public manhole (FMH7061661).

3.3.2 As the existing public sewer along Matheson Street is missing invert level, minimum velocity of 1m/s (based on DSD's sewerage manual) is adopted in the hydraulic calculation in this SIA to cater for worse scenario.

3.3.3 The latest drainage plan for the Application Site was approved on 2 February 2023. In accordance with that approved plan, the developer has already installed a new 225mm diameter sewerage pipeline from terminal manhole T1 to existing private sewerage manhole F15 in accordance with the approved plan. For the proposed development, the same connection which is already completed will be adopted.

3.3.4 The existing and future sewers in the vicinity of the Application Site are shown in **Figure 3.1**.

3.4 Wastewater Generated by the Proposed Development

3.4.1 Wastewater arising from the Proposed Development will be primarily contributed by residents and staff.

3.4.2 Detailed calculation for the Proposed Development is given in **Table 3.1** below and **Appendix 3.1**.

Table 3.1 Estimated Peak Flow

Development Parameters	Proposed Development		
	Residential Tower	Clubhouse	Commercial Area (F&B)
Total number of units	66	-	-
Assumed Area (m^2)	-	52	162
Number of Population	152(1)	2	9
Design Flow (m^3/person/day)	0.27(2)	0.28(3)	1.58(4)
Flow Rate (m^3/day)	**41.0**	**0.6**	**14.2**
Total Flow Rate with P_{CIF} (m^3/day)	**55.8**		
Peak Flow (L/s)	**5.2**		

(1) 2021 Population Census – Average Household Size of 2.3 in Canal Road
(2) Refer to Table T-1 of GESF – Private R2
(3) Refer to Table T-2 of GESF – J11 Community, Social & Personal Services
(4) Refer to Table T-2 of GESF – J10 Restaurants & Hotels

3.5 Discussion

3.5.1 Wastewater from the Proposed Development will be discharged to the existing private sewerage manhole F15.

3.5.2 The potential sewerage impact due to the Proposed Development has been quantitatively addressed. Sewage generation rate from the Application Site is estimated to be: 55.8m^3/day.

3.5.3 According to Table 4a of **Appendix 3.1**, regarding the sewage generation rate from the Proposed Development and surrounding areas (**Figure 3.2**), seven of the existing private sewerage pipelines would not have adequate capacity to receive the flow, while the existing government sewerage pipelines would have adequate capacity.

3.5.4 Therefore, a sewage retention tank will be proposed for the Proposed Development such that the sewage will be discharged during non-peak sewage discharge period only. It is committed that the sewage would not be discharge during the peak sewage discharge period. Furthermore, the proposed sewage retention tank will be provided with adequate capacity to prevent potential overflow of sewage.

3.5.5 The applicant will be responsible to maintain the proposed sewerage pipeline connection which is already implemented, and the construction, operation & maintenance of the proposed sewage retention tank. With the proposed connection and sewage retention tank for the discharge of sewage during non-peak sewage discharge period in place, the sewerage system will have adequate capacity to cater the sewage from the Proposed Development and nearby catchments.

4. OVERALL CONCLUSION

4.1 Conclusion

4.1.1 A development including residential flat with shop and services/eating place is proposed at 42-44 Yiu Wa Street. The potential sewerage impact has been quantitatively addressed.

4.1.2 The Application Site is currently served by drainage system. The Proposed Development would result in reduced surface runoff and would follow the same flow regime as per existing condition (connected to the same stormwater manhole as it was before development). Resilient measures in terms of 20% greenery is proposed to reduce surface runoff when compared to the existing condition. No worsened drainage impact is therefore anticipated.

4.1.3 Sewage generated from the Proposed Development will be discharged and connected to the existing private manhole F15 at the back alley of the Application Site. The proposed connection resembles the connection shown in the drainage plan approved on 2 February 2023 and already implemented.

4.1.4 Based on the sewerage impact assessment results, it is found that the capacity of the existing private sewerage system serving the area would not be sufficient to cater for cumulative sewage generated from the Proposed Development and nearby catchment areas. Sewage retention tank for the Proposed Development will be proposed and the sewerage flow will be discharged during non-peak period.

4.1.5 With the proposed works and proposed holding tank, this SIA confirms the feasibility of the Proposed Development in terms of no insurmountable sewerage impacts on public sewerage system are anticipated. Nevertheless, surcharged conditions are identified in private sewers at the back alley of the Application Site. .

Appendix 2.1 Detailed Drainage Impact Assessment Calculation

For Proposed Flat with Shop and Services/Eating Place in "Commercial" Zone on Draft Wan Chai Outline Zoning Plan No. S/H5/32 at 42-44 Yiu Wa Street and 28-29 Canal Road East, Hong Kong

Table 1 - Proposed Catchment Areas and Run-off (1 in 50 year)

$$Q_p = 0.278\ C\ i\ A$$

where Q_p = peak runoff in m^3/s
C = runoff coefficient (dimensionless)
i = rainfall intensity in mm/hr
A = catchment area in km^2

Notes:

Site Area 274 m^2

Catchments are small, so Rational Method is appropriate

1 in 50-year (according to Table 3 of DSD Manual)

a= 505.5

b= 3.29

c= 0.355

Surface Characteristics	*Runoff coefficient, C**
Asphalt	0.70 - 0.95
Concrete	0.80 - 0.95
Brick	0.70 - 0.85
Grassland (heavy soil**)	
Flat	0.13 - 0.25
Steep	0.25 - 0.35
Grassland (sandy soil)	
Flat	0.05 - 0.15
Steep	0.15 - 0.20

	Catchment	Discharge Manhole	Paved	Unpaved	Area (m^2)	Total t_c [1] (min)	Intensity (mm/h)	Weighted Runoff Coefficient	Run-off (m^3/s)	Run-off [2] (m^3/s)	Run-off [3] (m^3/s)
Existing	**Subject Site**										
	S1	T1	100%	0%	274	5.00	239	0.95	0.0173	0.0192	0.0200
Future	**Subject Site**										
	S1	T1	80%	20%	274	5.00	239	0.95	0.0173	0.0192	0.0200

Remarks:

[1]. Assumed Time of Concentration

[2]. Runoff includes rainfall increase due to Climate Change 11.1% in the mid 21st Century

[3]. Runoff includes rainfall increase due to Climate Change 16% in the end of 21st Century

For Proposed Flat with Shop and Services/Eating Place in "Commercial" Zone on Draft Wan Chai Outline Zoning Plan No. S/H5/32 at 42-44 Yiu Wa Street and 28-29 Canal Road East, Hong Kong
Hydraulic Calculations of Proposed Drainage System

Table 2a - 1 in 50 year Runoff of Future Catchments (m^3/s)

Runoff at	Catchment	
	S1	Total
T1	0.017	**0.02**

Table 3a - Hydraulic Capacities for Existing Drainage System

Segment	Manhole Reference	Manhole Reference	Type of Channel	Pipe Dia.	Pipe Length	Invert Level 1	Invert Level 2	g	k_s	s	Gradient	v	V	Area	Q	Q_{silt} [1]
				mm	m	mPD	mPD	m/s^2	m		1 in	m^2/s	m/s	m^2	m^3/s	m^3/s
T1 - S1	-	-	Circular	250	1.6	2.82	2.71	9.81	0.0030	0.073	14	0.000001	2.97	0.05	0.15	0.14

Table 4a - Comparison of Runoff from Proposed Catchments and Hydraulic Capacities of Existing Drainage System

Segment	Manhole Reference	Manhole Reference	Pipe Dia.	Q_{silt} [1]	Catchment Involved	Runoff	Occupancy	Sufficient Capacity?	Runoff [2]	Occupancy	Sufficient Capacity?	Runoff [3]	Occupancy	Sufficient Capacity?	Runoff [4]	Occupancy	Sufficient Capacity?
			mm	m^3/s		m^3/s			m^3/s			m^3/s			m^3/s		
T1 - S1	-	-	250	0.14	S1	0.02	12.5%	YES	0.02	13.8%	YES	0.02	14.5%	YES	0.02	16.2%	YES

Remarks:
1. Qsilt: 10% reduction in flow for gradient is not greater than 1 in 25, 5% reduction in flow for gradient greater than 1 in 25.

Runoff [2] represents the situation in Mid 21st Century of 11.1%
Runoff [3] represents the situation in Late 21st Century of 16.0%
Runoff [4] represents the situation in Late 21st Century due to design allowance with additional runoff of 12.1%