

Appendix C

**Replacement pages of the Sewerage Impact Assessment
Report**

- 3.1 The Application Site is zoned as “Other Specified Uses (Cemetery)” (“OU(Cemetery)”) under the Draft Chai Wan Outline Zoning Plan No. S/H20/26. It is situated at the south-east corner of the existing HKBA Cemetery, covering an area of approximately 482 m².
- 3.2 Adjacent to the Application Site on the west are the existing columbarium blocks and temple of the Hong Kong Buddhist Cemetery, which provides a total of 7,545 niches. There is also an existing office with five staff members located about 50 m to the west of the site.
- 3.3 HKBA is intended to develop a four-storey columbarium building, over a basement floor, on the Application Site. Upon completion of the Proposed Development, it is expected to provide an additional of 17,095 niches (16,014 standard niches and 1,081 large niches), male and female toilets on the basement floor, and two staff positions in the office. The layout plan of the Application Site is shown in **Appendix 3.1**.

4 ASSESSMENT METHODOLOGY

- 4.1 The assessment has been carried out in accordance with the guidelines set out in the Guidelines for Estimating Sewage Flows (GESF) for Sewage Infrastructure Planning Version 1.0, Report No. EPD/TP 1/05, published by the Environmental Protection Department (EPD).

Unit Flow Factor – Commercial and Institutional Flows

- 4.2 The Unit Flow Factor (UFF) for commercial and institutional flows based on the EPD’s GESF are shown in **Table 4.1**.

Table 4.1 Unit Flow Factor for Commercial and Institutional Flows

| Commercial | Unit Flow Factors ⁽ⁱ⁾ (m ³ /person/day) |
|--|--|
| Commercial Employee | 0.080 |
| Commercial activities | |
| (a) Specific trades: | |
| J11 Community, Social & Personal Services | 0.200 |

Note:

- (i) The UFF adopted is the “Planning for Future UFF”.

- 4.3 With reference to the approved Final Drainage, Sewerage and Utilities Impact Assessment (DSUIA) Study Report of the Agreement No. CE55/2011 (CE) Potential Sites for Columbarium Developments – Group B – Feasibility Study in **Appendix 4.1**, a UFF of 0.010 m³/person/day is adopted for estimating the sewage flow generated from visitors within the study area of the project. The UFFs for different sources of sewage generated from the Proposed Development are summarised in **Table 4.2** below.

Table 4.2 Unit Flow Factors for Different Sources of Sewage

| Source of Sewage | Units Flow Factors (m ³ /person/day) |
|------------------|--|
| Staff | 0.280 |
| Visitor | 0.010 |

6 PLANNED SEWERAGE SYSTEM

6.1 According to the current information available, no planned sewerage system is found in the vicinity of the Application Site. Further confirmation will be made with the DSD and the EPD in due course.

7 SEWERAGE GENERATION ESTIMATION

7.1 Sewage will be generated from the proposed toilets of the columbarium building to be used by staff and visitors at the Proposed Development.

7.2 Although there are no planned sewerage system upgrades, a sewerage system will be designed to handle the sewage generated from the Proposed Development. As a conservative approach, it is assumed that all staff and visitors (existing and proposed columbarium buildings) may use the proposed toilet during normal days and festive periods.

7.3 The estimated average and peak sewage flows generated from the Proposed Development during normal days and festive periods are summarised in **Table 7.1** below. Detailed sewage flow calculations are attached in **Appendix 7.1**.

Table 7.1 Estimated Sewage Flows during Normal Days and Festive Periods

| Scenario | Design Population | | Unit Flow Factor (m ³ /person/day) | Average Dry Weather Flow (ADWF) (m ³ /day) | Total ADWF (m ³ /day) |
|-----------------|-------------------|-----------------------|--|--|-------------------------------------|
| | Staff | Visitors | | | |
| Normal Days | Staff | 7 | 0.28 | 1.96 | 4.42 |
| | Visitors | 246 ⁽ⁱ⁾ | 0.01 | 2.46 | |
| Festive Periods | Staff | 7 | 0.28 | 1.96 | 169.51 |
| | Visitors | 16,755 ⁽ⁱ⁾ | 0.01 | 167.55 | |

Notes:

(i) Based on the approved DSUIA under CE55/2011 (CE), the niche-visitor ratio of 0.01 and 0.68 have been adopted for calculating the daily number of visitors of proposed columbarium during normal days and festive periods, respectively. For this assessment, 24,640 niches are to be provided and thus the total number of visitors is taken as 246 (24,640 x 0.01 = 246) for normal days, and 16,755 (24,640 x 0.68 = 16,755) for festive periods as the worst scenario.

8 PROPOSED SEWERAGE SYSTEM AND IMPACT ASSESSMENT

- 8.1 As stated in **Section 5**, the nearest public sewerage system is located about 300m away uphill, to the west of the Application Site. It is required to construct a rising main to convey sewage uphill before connecting to the public sewerage system.
- 8.2 The construction of an underground rising main will involve excavation works to be conducted along Cape Collinson Road. However, Cape Collinson Road between Ling Shing Road and Shek O Road is a one-way road and contains sections where two lanes merge into one lane. The construction of this rising main may result in temporary road closure, which will affect road users including private vehicles, public light buses, hearses and prison vans. Future maintenance works may also cause adverse impact to the traffic along the road if any leakage of sewage is detected.
- 8.3 Another method is the construction of a short rising main to lift sewage up from the proposed columbarium building to the back of the cemetery and convey the sewage by gravity sewer along the southern lot boundary before connecting to the public sewerage system at Cape Collinson Road. Nevertheless, along the southern boundary there are existing graves, stairs, trees and drainage channels, construction of such sewerage system may cause severe disturbance to them.
- 8.4 Therefore, it is unlikely feasible to utilise rising main to convey sewage from the proposed columbarium building to the public sewerage system either along Cape Collinson Road or the southern lot boundary.
- 8.5 In this regard, the provision of an on-site sewage treatment plant (STP) at the Basement (B/F) of the proposed development would be the recommended approach for treating the sewage generated from the Proposed Development. This on-site STP shall be designed in accordance to EPD's "Guidelines for the Design of Small Sewage Treatment Plant". The estimated peak flow arriving the STP and the corresponding design flow of STP were calculated in **Table 8.1** below.

Table 8.1 Estimated Sewage Flow Arriving the STP and the Corresponding Design Flow

| Scenario | Total ADWF (m ³ /day) | Hourly-ADWF (m ³ /hr) | Peaking Factor | Peak Flow (m ³ /hr) | Design Flow of STP (m ³ /hr) |
|-----------------|----------------------------------|----------------------------------|----------------|--------------------------------|---|
| Normal Days | 4.42 | 0.49 (i) | 6 (ii) | 2.95 | 1.47 (iv) |
| Festive Periods | 169.51 | 18.83 (i) | 4 (iii) | 75.34 | 56.50 (iv) |

Notes:

- (i) The peak hourly dry weather flow is based on 9 hours operation time of the proposed columbarium;
- (ii) According to EPD's "Guidelines for the Design of Small Sewage Treatment Plant", peak flow = 6 ADWF for population equal to or under 1000;
- (iii) According to EPD's "Guidelines for the Design of Small Sewage Treatment Plant", peak flow = 4 ADWF for population over 1000;
- (iv) Based on EPD's "Guidelines for the Design of Small Sewage Treatment Plant", with the provision of equalisation tank, the STP can be designed to handle 3 ADWF, excess flow over 3 ADWF will be equalised in equalisation tank. For normal days, design flow of STP = 3 x 0.49 = 1.47 m³/hr; for festive periods, design flow of STP = 3 x 18.83 = 56.50 m³/hr.

- 8.6 The proposed STP will adopt the tertiary treatment process of Membrane Bioreactor (MBR) technology capable of treating the sewage to a standard acceptable by the EPD for discharge to the existing stream or the nearest storm drain.
- 8.7 Despite the existing septic tank is functioning properly and is regularly maintained, it would not be used after the set-up of the proposed on-site STP. Upon completion of the Proposed Development, the sewage pipe of the existing toilet would be connected to the proposed on-site STP.
- 8.8 A water gathering ground is located near IL 7755 RP. **Figure 8.1** illustrates the area of water gathering ground (WGG) and the flow direction of treated effluent. The treated effluent discharged from the Application Site will flow along the existing stream and enter the drainage system near Fei Tsui Road. Therefore, no effluent will be discharged into the WGG.

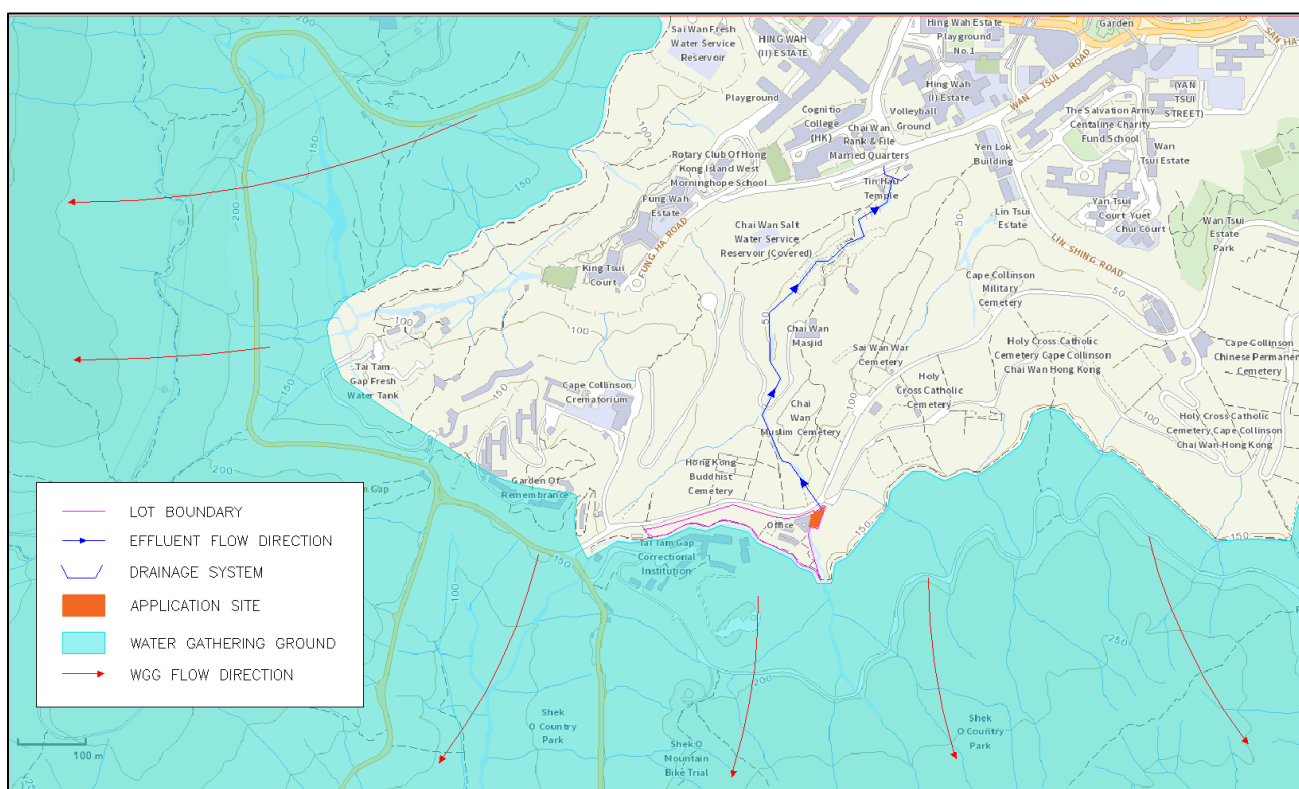


Figure 8.1 Flow Direction of Treated Effluent and Area of Water Gathering Ground

Sewage Treatment during Normal Days

- 8.9 During normal days, the sewage arising from the Proposed Development will be treated by the on-site STP built within the Application Site. Due to the low anticipated sewage generation on normal days and relatively high anticipated sewage generation on festive periods, the on-site STP will be designed for handling the sewage generated only in the normal days (i.e. STP Design Flow = $4.42 \text{ m}^3/\text{day} \times 3 / 9 = 1.47 \text{ m}^3/\text{hr}$), while other sewage treatment options will be proposed for the festive periods in the following sections.

Sewage Treatment Options during Festive Periods

Option 1: MBR package plant and discharge to adjacent stream or drainage system

- 8.10 Under this option, an MBR package plant will be employed to operate in parallel with the on-site STP to cater high sewage flow. The MBR package plant can be disassembled from the site after each festive period.
- 8.11 The MBR package plant shall be capable to accommodate the sewage flow in festive periods (i.e. Design Flow = $169.51 \text{ m}^3/\text{day} \times 3 / 9 = 56.50 \text{ m}^3/\text{hr}$). The treated effluent will be discharged to the existing stream or the nearest drainage system. The effluent will be treated to the acceptable standards as stated in Table 4 in the WPCO-TM for discharge to the Group B inland waters.
- 8.12 As sewage is discharged to the on-site STP and the MBR package plant for treatment, it will cause no adverse impacts to the nearby sewerage system.
- 8.13 The tentative management department and maintenance department of the proposed works is summarised in Table 8.2.

Table 8.2 Management Department and Maintenance Department of Proposed Works for Option 1

| Proposed Works for Option 1 | Management Department | Maintenance Department |
|-----------------------------|-----------------------|------------------------|
| On-site STP | HKBA | HKBA |
| MBR Package Plant | HKBA | HKBA |

Option 2: Portable toilets and deliver sewage away by desludging vehicles

- 8.14 This option suggests the provision of portable toilets for temporary storage of the additional sewage generated during festive periods. A sufficient number of portable toilets should be provided at a designated area near the Proposed Development. The portable toilet can be a commercially available cabin toilet (Refer to Figure 9.2) with four toilet rooms and four urinals equipped inside.
- 8.15 According to the information provided by the supplier, each cabin toilet has a sewage storage capacity of 7 m^3 . If desludging exercises are performed three times per day, a total of eight cabin toilets can cater the total ADWF of $170 \text{ m}^3/\text{day}$ (i.e. 170 m^3 per day / 7 m^3 per cabin toilet / 3 desludging exercises per day = 8 → 8 cabin toilets required).
- 8.16 The sewage stored in the portable toilets (average sewage generated = $170 \text{ m}^3/\text{day}$) shall be emptied and tanked away daily by desludging vehicles. Three desludging exercises will be performed for each cabin toilet per day; hence 57 m^3 of sewage has to be collected each time. Provided that a desludging vehicle has a storage capacity of 10 m^3 , six vehicles should be arranged for each cleaning. As a result, three trips ($170 \text{ m}^3 / 10 \text{ m}^3$ per vehicle per trip / 6 vehicles = 2.8 → 3 trips) will be required per vehicle and there will be 18 trips in total.

- In case of any failures on the STP, or receiving any alarms that may potentially cause an overflow, the on-site staff must close the existing and proposed toilets and all staff and visitors will use the portable toilets only. Desludging vehicle will be arranged for removing the sewage in the STP and the on-site STP would undergo repair works and testing. The STP and both toilets would not be opened until the repair works and testing are completed;
- The proposed toilet and the existing toilets will not be open to public during the festival periods; and
- Raw sewage will be tanked away to appropriate public sewage treatment works in case the operation of the STP could not be resumed after all the above mitigation measures utilised.

10.2 Another problem associated with the STP is the malfunction of the system due to poor maintenance and operation. The following measures are therefore suggested to ensure proper function of the STP and the quality of treated effluent.

Operation and maintenance plan

- Experienced technicians shall be assigned to operate the STP and shall strictly comply with the operating procedures stipulated in the operation and maintenance manuals;
- The daily flow rate shall be monitored for both normal days and festive periods. “Return Sludge Ratio” shall also be adjusted when necessary, in order to control the mixed liquor concentration in the MBR tank;
- In the event that there is only a few or no hydraulic loading, aeration should be performed intermittently to suspend the mixed liquor in the MBR tank;
- The STP shall be maintained in a tidy manner by hosing down regularly, scraping of the walkways, whitewashing the walls, cleaning and painting the metalwork and maintaining adequate lighting and ventilation;
- Adequate spare parts for the plant shall be made readily available by storage; and
- Regular inspection and maintenance of the STP shall be conducted by qualified personnel.

11 CONCLUSIONS

- 11.1 The sewerage impact assessment has been carried out for the proposed 4-storey columbarium at part of IL 7755 RP and Government Land sandwiched between IL 7755 RP and IL 7713, at Cape Collinson Road, Chai Wan. The Proposed Development will generate sewage due to the proposed toilets to be used by staff and visitors. It is estimated that the total average sewage flow generated from the proposed columbarium is 4.42 m³/day and 169.51 m³/day during normal days and festive periods respectively.
- 11.2 At present, there is no existing public sewerage system in the vicinity of the Application Site. The provision of an on-site STP would be the recommended sewage treatment solution for the site.
- 11.3 Taking into consideration the huge difference in the amount of sewage between normal days and festive periods, the on-site STP will be designed to treat the sewage generated during normal days only, whilst two other options are proposed to handle the additional sewage arising in the festive periods.
- 11.4 An additional MBR package plant will be provided and will operate in parallel with the on-site STP to cater the higher sewage flow during festive periods for option 1. However, the use of MBR package

Sewage Generation Estimation

No. of Niches 24640 ^a

| Niche-Visitor Ratio | |
|---------------------|------|
| Normal Days | 0.01 |
| Festival Period | 0.68 |

Normal Days

| Source of Sewage | Population | | Unit Flow Factor | | Average Dry Weather Flow ADWF (m ³ /day) |
|------------------|------------|--------------|------------------|--------------|--|
| Staff | 7 | | 0.28 | ^b | 1.96 |
| Visitors | 246 | ^d | 0.01 | ^c | 2.46 |
| Total | 253 | | - | | 4.42 |

Festive Periods

| Source of Sewage | Population | | Unit Flow Factor | | Average Dry Weather Flow ADWF (m ³ /day) |
|------------------|------------|--------------|------------------|--------------|--|
| Staff | 7 | | 0.28 | ^b | 1.96 |
| Visitors | 16755 | ^d | 0.01 | ^c | 167.55 |
| Total | 16762 | | - | | 169.51 |

Notes:

- a) The number of niches is taken as 24,640 (i.e. the total number of niches in existing and proposed columbarium buildings) as a conservative approach.
- b) UFF based on the EPD's GESF, Table T-2 "Commercial Employee".
- c) UFF based on approved DSUIA under CE55/2011 (CE).
- d) Based on the approved DSUIA under CE55/2011 (CE), the niche-visitor ratio of 0.01 and 0.68 have been adopted for calculating the daily number of visitors of proposed columbarium during normal days and festive periods, respectively. For this assessment, 24,640 niches are to be provided and thus the total number of visitors is taken as 246 (24,640 x 0.01 = 246) for normal days, and 16,755 (24,640 x 0.68 = 16,755) for festive periods as the worst scenario.