APPENDIX F

Sewerage Impact Assessment

THE HONG KONG BUDDHIST ASSOCIATION

APPLICATION FOR PERMISSION UNDER SECTION 16 OF THE TOWN PLANNING ORDINANCE (CAP. 131)
FOR MINOR RELAXATION OF BUILDING HEIGHT RESTRICTION FROM 2 STOREYS TO 4 STOREYS FOR PROPOSED 4-STOREY COLUMBARIUM AT PART OF INLAND LOT NO. 7755 RP AND GOVERNMENT LAND SANDWICHED BETWEEN INLAND LOT NO. 7755 RP AND INLAND LOT NO. 7713, CAPE COLLISON ROAD, CHAI WAN

SEWERAGE IMPACT ASSESSMENT REPORT (REVISION 0)

JANUARY 16, 2024

CONFIDENTIAL

THE HONG KONG BUDDHIST ASSOCIATION

APPLICATION FOR PERMISSION UNDER SECTION 16 OF THE TOWN PLANNING ORDINANCE (CAP. 131) FOR MINOR RELAXATION OF BUILDING HEIGHT RESTRICTION FROM 2 STOREYS TO 4 STOREYS FOR PROPOSED 4-STOREY COLUMBARIUM AT PART OF INLAND LOT NO. 7755 RP AND GOVERNMENT LAND SANDWICHED BETWEEN INLAND LOT NO. 7755 RP AND INLAND LOT NO. 7713, CAPE COLLISON ROAD, CHAI WAN

SEWERAGE IMPACT ASSESSMENT REPORT (REVISION 0)

PROJECT NO.: 2535833A
DATE: JANUARY 16, 2024

WSP
7/F ONE KOWLOON
1 WANG YUEN STREET
KOWLOON BAY, HONG KONG

PHONE: +852 2579-8573
FAX: +852 2856-9902
WSP.COM

QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
Remarks				
Date	16 January 2024			
Prepared by	Michelle Cheung			
Signature				
Checked by	Dr Alex Cheung			
Signature				
Authorised by	Dr Paul Kau			
Signature				
Project number	2535833A			
File reference				

SIGNATURES

PREPARED BY

Michelle Cheung
Consultant

REVIEWED BY

Dr. Alex Cheung
Technical Director

This report was prepared by WSP (Asia) Ltd. (WSP) for the account of the Hong Kong Buddhist Association, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

The original of the technology-based document sent herewith has been authenticated and will be retained by WSP for a minimum of ten years. Since the file transmitted is now out of WSP's control and its integrity can no longer be ensured, no guarantee may be given to by any modifications to be made to this document.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

1.1 WSP (Asia) Ltd. was commissioned by the Hong Kong Buddhist Association (HKBA) to conduct a sewerage impact assessment (SIA) for the application for permission under Section 16 of the Town Planning Ordinance (Cap. 131) for minor relaxation of building height restriction of part of Inland Lot No. 7755 RP (IL 7755 RP) and Government Land sandwiched between IL 7755 RP and IL 7713 for a 4-storey columbarium. Hereafter the Proposed Development on the site area is referred as the Application Site.

1.2 HKBA has been operating the Hong Kong Buddhist Cemetery and Columbarium at IL 7755 RP since decades ago. With the growing and aging population in Hong Kong, the number of deaths and cremations have been rising gradually year by year, resulting in an increasing demand for niches. HKBA, therefore, has planned to expand the existing cemetery to relieve the shortage of niches and to meet the demand of her members.

1.3 The main objectives of this SIA include the followings:

- Access the sewage generated from the Proposed Development;
- Review the condition of the existing sewerage system in the vicinity of the Application Site and assess potential impact on the existing or planned sewerage facilities due to the Proposed Development;
- Outline the methodology used in this assessment;
- Assess any potential impact on the existing or planned sewerage facilities due to the Proposed Development; and
- Suggest mitigation measures or any other measures to minimise the potential sewerage impact from the Proposed Development.

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 Project Site is located in the Eastern Buffer Water Control Zone. A Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (WPCO-TM) has been issued, which requires licensing of all discharges into all public sewers and drains. The water quality standards must be complied during the operation stages.

2.2 In addition, as stipulated in the Building (Standards of Sanitary Fitments, Plumbing, Drainage Works and Latrines) Regulations 40(1), 40(2), 41(1), 90 and recap in Professional Persons Environmental Consultative Committee Practice Notes (ProPECCPNs) 1/23, foul water should be discharged to a foul sewer or to any approved facility where there is no public sewer in the vicinity during operational phase.

3 OUTLINE OF THE APPLICATION SITE

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 m^2.

3.2 Adjacent to the Application Site on the west is the existing columbarium block, 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

Note:
(i) The UFF adopted is the "Planning for Future UFF".

4.3 Since it is anticipated that toilet use will contribute the most to the sewage generation, the sewage generation estimation will base on the number of staff and visitors. Therefore, the commercial activities as stated in Table T-2 of the GESF will not be considered.

4.4 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 m^3/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	0.080
Visitor	0.010

Peaking Factor

4.5 Peaking factors are catered to the seasonal/diurnal fluctuation and the typical amount of infiltration and inflow. The peaking factors shall be following the EPD's GESF and are shown in **Table 4.3**.

Table 4.3 Peaking Factors (P) for Various Population Ranges

Population Range	Peaking Factor (including stormwater allowance) for facility with existing upstream sewerage	Peaking Factor (excluding stormwater allowance) for facility with new upstream sewerage
< 1,000	8	6
1,000 – 5,000	6	5
5,000 – 10,000	5	4
10,000 – 50,000	4	3
> 50,000	Max ($7.3/N^{0.15}$, 2.4)	Max ($6/N^{0.175}$, 1.6)

Note:
N = Contributing population in thousands

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

4.6 Under normal condition, peaking factors (excluding stormwater allowance) are applicable to planning sewerage facilities receiving flow from new upstream sewerage systems which essentially have no misconnections and defects for infiltration. If there is doubt about the service conditions of the upstream sewerage systems for the planning horizons under consideration, peaking factors (including stormwater allowance) should be used.

Niche-Visitor Ratio

4.7 The Niche-Visitor Ratio has been adopted for calculating the daily number of visitors during normal days and festive periods. These assumptions are made in accordance with the approved DSUIA Study Report of CE55/2011 (CE). **Table 4.4** summarises the niche-visitor ratio.

Table 4.4 Niche-Visitor Ratio at Different Periods

Period	Niche-Visitor Ratio
Normal Days	1:0.01
Festive Periods	1:0.68

5 EXISTING SEWERAGE SYSTEM

5.1 According to the latest sewage record plan from the Drainage Service Department (DSD) (**Appendix 5.1**), there is no existing sewerage system within the Application Site. The nearest public sewerage system is about 300m away uphill, to the west of the Application Site.

5.2 Based on the approved drainage plans in the 1980s, an underground septic tank with a soakaway system was installed to treat the amount of sewage generated from the existing toilet inside the office building. The septic tank is located to the north of the existing temple, adjacent to the office building. The layout plan of the existing septic tank and soakaway system is illustrated in **Figure 5.1** below.

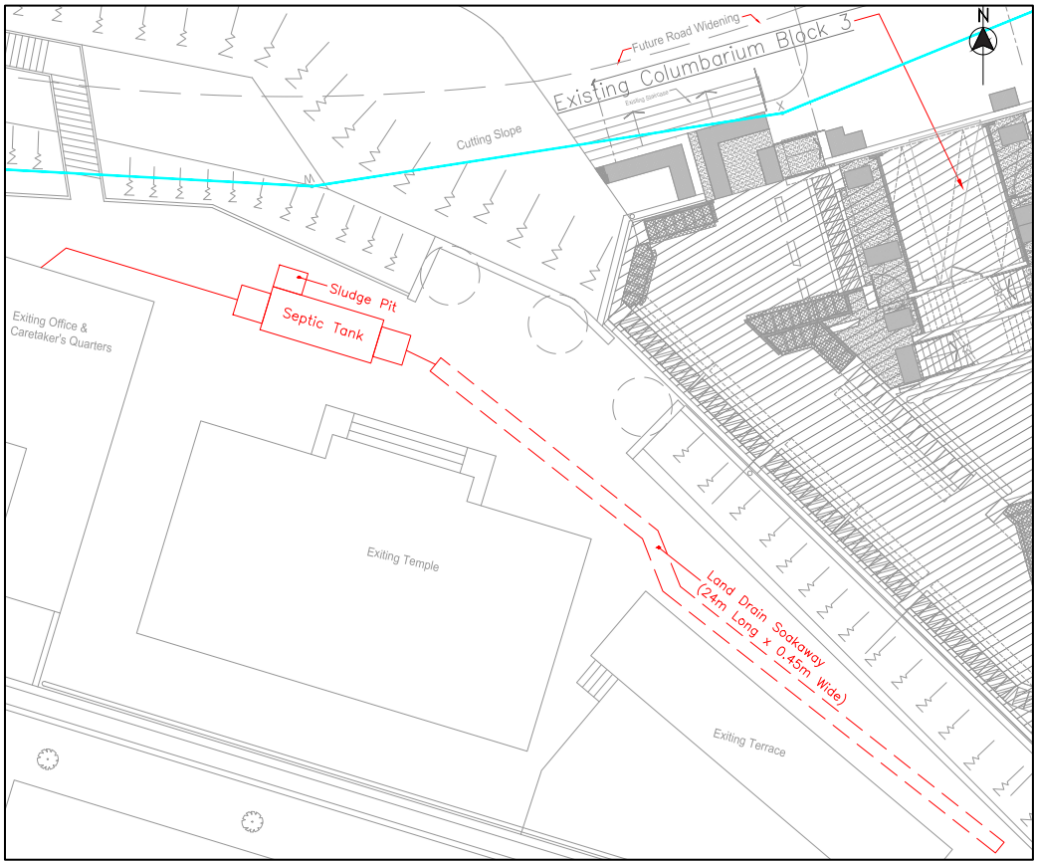


Figure 5.1 Layout Plan of Existing Septic Tank and Soakaway System

5.3 The tank dimension is approximately 3.2 m x 1.2 m x 2.2 m, with a total capacity of 3,078 L. The outlet of the septic tank is connected to a land drain soakaway system through a 100mm diameter pipe. The soakaway system consists of a 24 m long x 0.45 m wide soakaway trench and a perforated pipe drain, extending from the north of the existing temple to the eastern end of the existing cemetery.

5.4 A sludge pit was connected at the side of the septic tank to gather the settled sludge from the bottom of the tank. The sludge is removed by a specialist contractor at least once every 6 months. The volume of sludge is approximately 1 m^3 for each desludging arrangement.

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)
Normal Days	Staff	7	0.08	0.56	3.02
	Visitors	246 (i)	0.01	2.46	
Festive Periods	Staff	7	0.08	0.56	168.11
	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) 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	3.02	0.34 (i)	6 (ii)	2.02	1.01 (iv)
Festive Periods	168.11	18.68 (i)	4 (iii)	74.72	56.04 (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 0.34 = 1.01 m^3/hr; for festive periods, design flow of STP = 3 x 18.68 = 56.04 m^3/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.

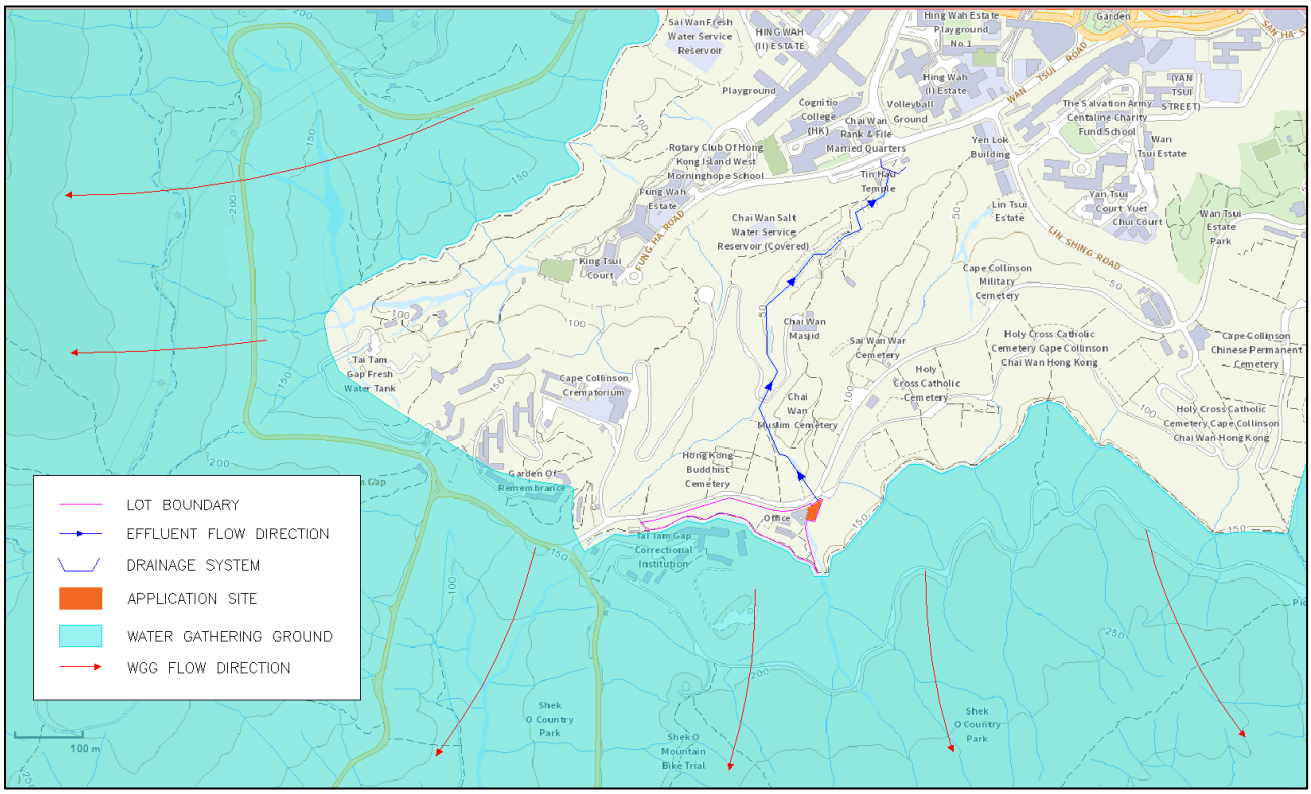


Figure 8.1 Flow Direction of Treated Effluent and Area of Water Gathering Ground

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 = 3.02 m^3/day x 3 / 9 = 1.01 m^3/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 = 168.11 m^3/day x 3 / 9 = 56.04 m^3/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 168 m^3/day (i.e. 168 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 = 168 m^3/day) shall be emptied and tanked away daily by desludging vehicles. Three desludging exercises will be performed for each cabin toilet per day; hence 56 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 (168 m^3 / 10 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.

8.17 The collected sewage will be tanked away by desludging vehicles to the nearest sewage treatment works (STW) for disposal. For Hong Kong Island region, the nearest STW which receives sewage transported by desludging vehicles is the Ap Lei Chau Preliminary Treatment Works (ALCPTW). According to the Press Releases of HKSAR *"LCQ22: Impact of sewage treatment on quality of water bodies in Hong Kong – Annex 1"*, the average daily treatment capacity of ALCPTW is about 26,000 m^3/day. As the estimated sewage generated during festive periods is 168 m^3/day, it will only cause an 0.65% increase to the daily treatment capacity of ALCPTW. Therefore, the impact on the STW due to the increase in sewage flow during festive periods is insignificant.

8.18 In addition, as the discharge sewage loads may become heavy during the period generated from similar facility, the delivery schedule of the desludging vehicles can be arranged hourly. (i.e. say two vehicles discharge 20 m^3 per hour), thereby preventing the large scale disposal to the ALCPTW. Through implementation of a steady sewage removal rate, the impact of sewage loads on ALCPTW can be further minimised.

8.19 The tentative management department and maintenance department of the proposed works is summarised in **Table 8.3**.

Table 8.3 Management Department and Maintenance Department of Proposed Works for Option 2

Proposed Works for Option 2	Management Department	Maintenance Department
On-site STP	HKBA	HKBA
Portable Toilets	HKBA	HKBA

8.20 **Table 8.4** compares the sewage treatment options for the Proposed Development.

Table 8.4 Comparison between the Two Sewage Treatment Options

Sewage Treatment Options	Option 1 – MBR package plant and discharge to adjacent stream or drainage system	Option 2 – Portable Toilets and deliver sewage away by desludging vehicles
Availability of Space	• The additional package plant could be a large, tailor-made container (approximately 12.0 m x 2.1 m x 2.1 m minimum) with all equipment fitted inside. • Limited space to place such container in close proximity to the proposed columbarium building.	• Portable toilets are flexible and can be placed along both sides of the road near the proposed columbarium building.
Cost Implication	The use of an MBR package plant involves high capital, operational and maintenance cost. • *Capital Cost* – although achieving high quality effluent, employing MBR technology is very expensive. The use of such an expensive MBR package plant for the short festive periods in a year is considered not cost effective. In addition, the proposed toilet and the plumbing network within the Proposed Development has to be specifically designed so that it is able connect to the package plant in the future. • *Operational Cost* – MBR system consumes significant energy for its aeration and filtration processes. • *Maintenance Cost* – requires skilled workers for maintaining and disassembling the system.	The use of portable toilets involves low capital, operational and maintenance cost. • *Capital Cost* – the cost for employing portable toilets is low. • *Operational Cost* – the energy consumption of portable toilets is low. Energy is mainly consumed for ventilation and lightning purposes. • *Maintenance Cost* – requires non-skilled workers to provide daily desludging service.
Adaptability	• The MBR package plant requires a long start-up time for sludge seeding and system tuning in order to attain optimal performance.	• The setup process of portable toilet is quick and easy.

Sewage Treatment Options	Option 1 – MBR package plant and discharge to adjacent stream or drainage system	Option 2 – Portable Toilets and deliver sewage away by desludging vehicles
		• Portable toilet does not require system tuning process and is ready for use after being transported to the site.
Impact on Environment or Existing Sewage System	• The treated effluent will be discharged to the existing stream or the nearest storm drain in accordance with the Group B inland waters discharge standards stipulated in the *WPCO-TM*. • Therefore, it will cause no impact to the environment and existing sewage system.	• Sewage stored in the portable toilets will be emptied and tanked away to ALCPTW by desludging vehicles on daily basis. The potential impact to the existing PTW would be insignificant as the amount of sewage being transported to the PTW is small compared to its treatment capacity. • Leakage from portable toilets or from the collection of sewage will cause potential impacts to the environment. However, these could be minimised through suitable preventive measures, for examples: provides secondary containment for portable toilets and sewage collection process.

8.21 For Option 1, the provision of an MBR package plant would involve a considerably high capital, operational and maintenance cost. Even if it is transported to the site, it cannot start operating directly as it requires a long start-up time for the plant to attain optimal performance. Space is also a constraint for placing such a large container close to the Proposed Development. Therefore, this option is not recommended.

8.22 The use of portable toilets during festive periods is simple and flexible in option 2, which is expected to require less technical workforce and low capital, operational and maintenance cost. In addition, the setup process of portable toilet is quick and easy. Option 2 is therefore recommended.

9 RECOMMENDED SEWAGE TREATMENT ARRAGEMENT

On-site Sewage Treatment Plant during normal days

9.1 It is proposed to install an on-site STP for the treatment of sewage generated by the staff and visitors of the columbarium during normal days. The average sewage flow to the proposed on-site STP is 3.02 m^3/day. According to the EPD's *"Guidelines for Design of Small Sewage Treatment Plant"*, the on-site STP shall be designed to handle a peak flow of three times the ADWF of normal days (i.e. 1.01 m^3/hr). In addition, the on-site STP shall treat the sewage to a standard acceptable by the EPD for discharge to the existing stream. The treated effluent from the proposed on-site STP should complied with the standards for effluents discharged into Group B inland waters as stipulated in *WPCO-TM* (**Appendix 9.1**). The typical appearance of a small scale MBR plant is illustrated in **Figure 9.1**. The Schematic diagram of the treatment process is shown in **Appendix 9.2**.

Figure 9.1 Typical appearance of a small scale MBR plant

(Source: Dunwell's Bio-Toilet in Zero Carbon Building, Dunwell Group)

Portable Toilets during Festive Periods

9.2 During festive periods, portable toilets will be arranged, whilst both the existing and proposed toilets will not be opened to public. All visitors will be directed to use the portable toilets by the on-site staff or the notice placed in front of both toilets. As only staff will be allowed to use the toilets, the average sewage flow to the proposed on-site STP is 0.56 m^3/day. In addition, approximately eight cabin toilets (each with four toilet rooms and four urinals) will be erected near the entrance of the Proposed Development. Six desludging vehicles will be arranged to tank away sewage from the cabin toilets and discharge to ALCPTW. Various portable toilets for special events or festive days are shown in **Figure 9.2**.

Figure 9.2 Typical Portable Toilets (Left) and Cabin Toilet (Right)
(Source: Toi Toi Hong Kong Ltd.)

10 RECOMMENDED PREVENTIVE MEASURES

10.1 Although the capacity of the STP is sufficient to cope with the amount of sewage generated from the Proposed Development during normal days, overflow of raw sewage can be a significant problem to the existing environment. As such, the following preventive measures are suggested:

Prevention of overflow of raw sewage

- Provision of equalisation tank to store up 3 times of ADWF of normal days for a period of 2 hours (i.e. 3.02 m^3/day x 3 x 2 hours / 9 = 2.01 m^3);
- Dual or standby power supply;
- Standby unit for major equipment to allow partial shut down for maintenance;
- Flow measurement and level sensors connected with alarm signalising system will be installed to keep monitoring on inflow rate to avoid sewage overflow;
- Trained staff should be allocated for monitoring and inspecting the STP frequently;

- 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 3.02 m^3/day and 168.11 m^3/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

plant would involve numbers of constraint in terms of high capital, operational and maintenance cost, availability of space and system adaptability.

11.5 In option 2, sufficient portable toilets will be provided for the temporary storage of the additional sewage during festive periods. This option is simple and flexible, and is ready for use after being transported to the site. This option is therefore recommended.

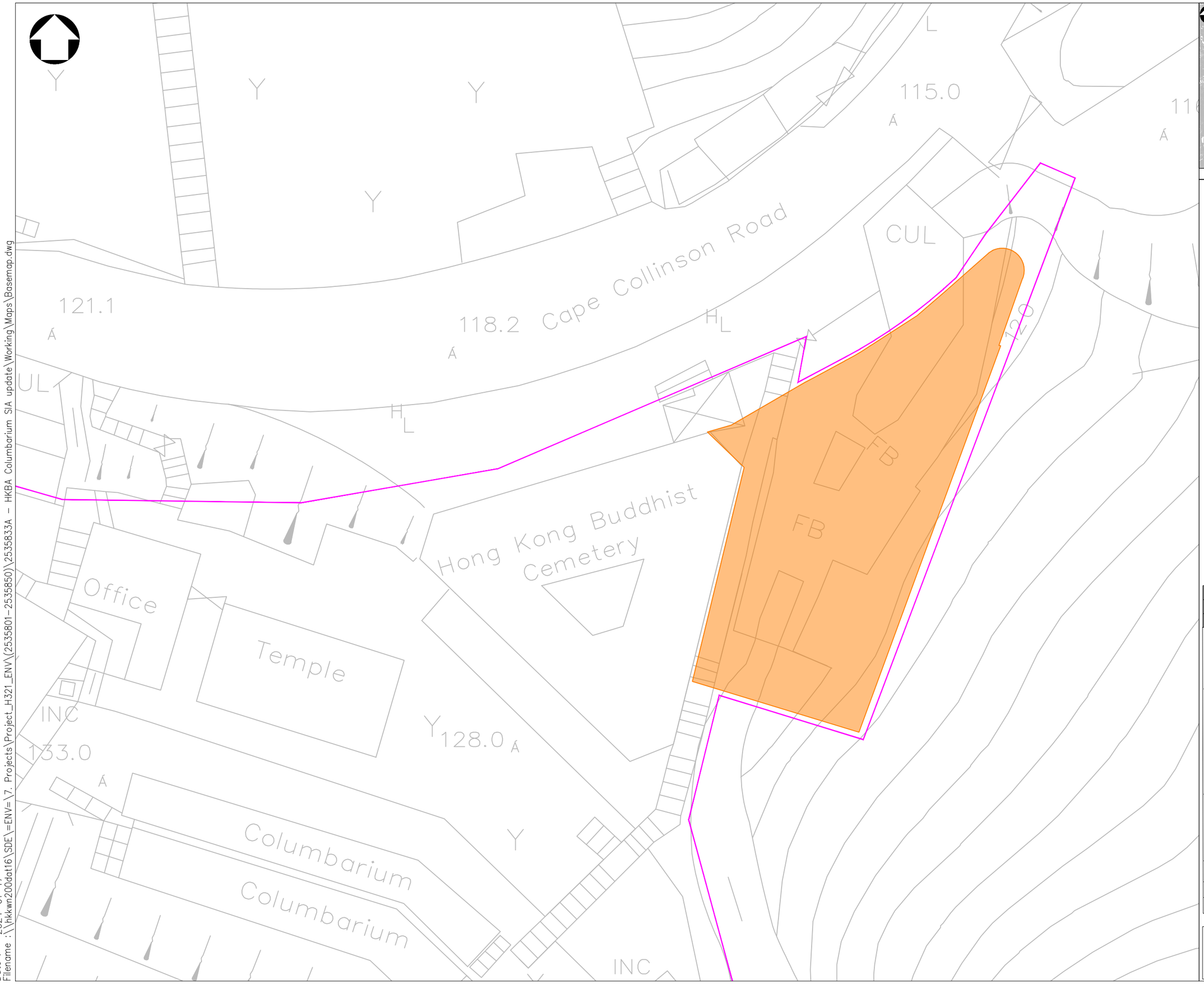
11.6 In view of this, the on-site STP will be the sewage treatment arrangement for normal days and portable toilets will be arranged for festive periods. The effluent discharged from the Proposed Development shall comply with the discharge standard of Group B inland waters. Proper preventive measures and maintenance works should also be taken in the prevention of possible operational problems associated with the proposed STP.

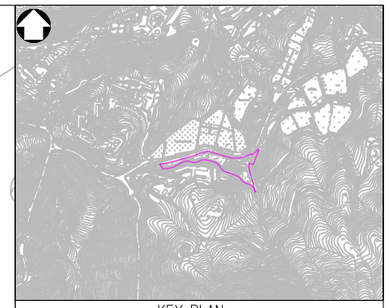
11.7 During festive periods, toilets will be closed to public and visitors will be directed to use the portable toilets provided on the site. Sewage stored in the portable toilets will be tanked away by desludging vehicles and will be discharged to the ALCPTW.

APPENDICES

APPENDIX 3.1

LAYOUT PLAN OF APPLICATION SITE





KEY PLAN

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. ALL LEVELS ARE IN METRES (M) AND RELATIVE TO HONG KONG PRINCIPAL DATUM (mPD).

LEGEND :

PROPOSED LOT BOUNDARY

PROPOSED DEVELOPMENT

	Description	By	Date

Consultant

wsp

Project title

APPLICATION FOR PERMISSION UNDER SECTION 16 OF THE TOWN PLANNING ORDINANCE (CAP. 131) FOR MINOR RELAXATION OF BUILDING HEIGHT RESTRICTION FROM 2 STOREYS TO 4 STOREYS FOR PROPOSED 4-STOREY COLUMBARIUM AT PART OF INLAND LOT NO. 7755 RP AND GOVERNMENT LAND SANDWICHED BETWEEN INLAND LOT NO. 7755 RP AND INLAND LOT NO. 7713, CAPE COLLISON ROAD, CHAI WAN

Drawing title

LAYOUT PLAN OF APPLICATION SITE

Drawing no.			Rev.
APPENDIX 3.1			1
Drawn	Date	Checked	Approved
MC	JAN 2024	AC	AC
Scale		Status	
N.T.S.		–	

Date : 2024-01-17
Filename : \\hkkwn200dat16\SDE\=ENV=\7. Projects\Project_H321_ENV\(2535801-2535850)\2535833A - HKBA Columbarium SIA update\Working\Maps\Basemap.dwg

APPENDIX 4.1

EXTRACT FROM CE 55/2011 (CE) FINAL DRAINAGE, SEWERAGE AND UTILITIES IMPACT ASSESSMENT STUDY REPORT (REV. 2)

4 Sewerage Impact Assessment

4.1 Methodology and Design Criteria

4.1.1 Methodology

4.1.1.1 The objectives of the SIA and procedure of assessment are summarized as follows:

- To assess the available capacities in the existing facilities, of the sewerage system, and to determine whether there are spare capacities to support the new developments;
- To outline, the sewerage system requirements, i.e. sewers, detention tank, etc;
- To recommend appropriate mitigation measures.

4.1.1.2 The sewage flow has 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.

4.1.2 Design Criteria

4.1.2.1 The criteria are based on EPD's report on GESF. The main relevant criteria are detailed below:

Unit Flow Factors (UFF) – Commercial and Institutional Flows

4.1.2.2 The unit flow factors for commercial and institutional flows due to commercial activities and employed population will be in accordance with EPD's GESF and are extracted and shown in **Table 4.1**.

Table 4.1 Unit Flow Factors for Commercial and Institutional Flows

Commercial	Unit Flow Factor (m^3/h/d)
Commercial Employee	0.080

4.1.2.3 The total unit flow generated from an employee in a particular trade is the sum of the unit flow factor of the employee and the unit flow factor of commercial activities of a particular trade under consideration.

4.1.2.4 The UFF for staff at the proposed columbarium is the same as that for commercial employee (i.e.0.08 m^3/head/day). Making reference to the project of Tung Tsz Road Monastery as well as Kai Tak Cruise Terminal in which the UFF for visitors was taken as 0.009 and 0.01m^3/head/day respectively, the UFF for visitors to the columbarium is assumed to be 0.01 m^3/head/day. The UFFs for different sources of sewage generated from the proposed columbarium facilities are summarized in **Table 4.2** below.

Table 4.2 Unit Flow Factors for Different Sources of Sewage

Source of Sewage	Unit Flow Factor ($m^3/h/d$)
Staff	0.080
Visitor	0.010

4.1.3 Peaking Factors

4.1.3.1 Peaking factors cater for seasonal/diurnal fluctuation and normal amount of infiltration and inflow. The peaking factors shall be in accordance to EPD's GESF and are shown in **Table 4.3**.

Table 4.3 Peaking Factors for Various Population Ranges

Population Range	Peaking Factor (including stormwater allowance) for facility with existing upstream sewerage	Peaking Factor (excluding stormwater allowance) for facility with new upstream sewerage
Sewers		
< 1,000	8	6
1,000 – 5,000	6	5
5,000 – 10,000	5	4
10,000 – 50,000	4	3
> 50,000	Max ($7.3/N^{0.15}$, 2.4)	Max ($6/N^{0.175}$, 1.6)
Sewage Treatment Works and Preliminary Treatment Works		
< 10,000	4	3
10,000 – 25,000	3.5	2.5
25,000 – 50,000	3	2
> 50,000	Max ($3.9/N^{0.065}$, 2.4)	Max ($2.6/N^{0.065}$, 1.6)

Note:

N = Contributing population in thousand

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

4.1.3.2 Under normal condition, peaking factors (excluding stormwater allowance) are applicable to planning sewerage facilities receiving flow from new upstream sewerage systems which essentially have no misconnections and defects for infiltration. If the service conditions of the upstream sewerage systems for the planning horizons under consideration are unclear, peaking factors (including stormwater allowance) shall be used. For the design purpose, the peaking factors (including stormwater allowance) shall be used.

4.1.3.3 Considering all kinds of sewerage systems, it is found that the use of rising main would have constraints on future operation, high maintenance cost as well as potential environmental nuisances, and is therefore not recommended. On-site sewage treatment plant, such as membrane bio-reactor treatment plant, is the recommended solution. During the infrequent festive days in a years, detention tanks and portable toilets can be used for temporary storage of sewage.

4.2 Tsuen Wan District Eastern Site

4.2.1 Existing and Planned Sewerage Network

Existing Sewerage Network

4.2.1.1 Based on DSD record plan, there are an existing 700mm rising main and a 225mm gravity sewer at Cheung Tung Road near the Study Area. (see **Figure no. TWE-S-01**).

Planned Sewerage Network

4.2.1.2 According to current information available, no planned sewerage network is found in the vicinity of the Study Area. Further confirmation will be made with DSD and EPD in due course.

4.2.2 Predicted Sewage Generation

4.2.2.1 For the proposed columbarium, sewage will be generated from the proposed toilets and washing facilities of the columbarium buildings for use by staff and visitors.

4.2.2.2 Although there is no planned sewerage system upgrades, the sewerage system is designed to handle the sewage discharge from all visitors and staff at the project site.

4.2.2.3 The estimated average and peak sewage flows generated from the columbarium during normal days are summarised in **Table 4.4** below. Detailed sewage flow calculations are contained in **Appendix B1**.

Table 4.4 Estimated Sewage Flows during Normal Days

Source of Sewage	No. of people	Average Sewage Flow (m^3/day)	Peak Sewage Flow (l/s) (1)
Staff	6	0.48	0.044
Visitors	103	1.03	0.095
	Total	**1.51**	**0.139**

Notes:

(1) Global Peaking factor = 8 (EPD's GESF Table T-5, population <1,000 including stormwater allowance)

4.2.2.4 During festive periods, the estimated average and peak sewage flows generated are summarised in **Table 4.5** below. Detailed sewage flow calculations are contained in **Appendix B1**.

Table 4.5 Estimated Sewage Flows during Festive Periods

Source of Sewage	No. of people	Average Sewage Flow (m^3/day)	Peak Sewage Flow (l/s) (1)
Staff	6	0.48	0.028
Visitors	7004 (2)	70.04	4.053
	Total	**70.52**	**4.081**

Notes:

(1) Global Peaking factor = 5 (EPD's GESF Table T-5, population 5,000 – 10,000 including stormwater allowance)

(2) Based on FEHD's data that the factor of 0.68 has been adopted for planned columbarium at Tsang Tsui, which has made reference to Junk Bay Chinese Permanent Cemetery, for calculating the daily number of visitors. For our columbarium, the 10,300 niches are assumed to open in one go. Thus the total number of visitors is taken as 7004 (10,300 x 0.68 = 7004) as the worst scenario for assessment.

4.2.3 Sewerage Proposal

4.2.3.1 The nearest sewer to Tsuen Wan District Eastern Site is a 225mm gravity sewer at Cheung Tung Road inside the drainage reserve in Siu Ho Wan Bus Depot. The total peak sewage flow will be 4.081 l/s. and considering the capacity of the existing 225mm sewer, the total peak sewage flow from the proposed development is about 11% of the capacity, which might cause significant impact to the existing sewer.

Table 4.6 Capacity of the existing Sewerage Pipe

Pipe Size (mm)	Average Slope (%)	Capacity (m3/s)	Capacity (l/s)
225	0.546	0.04	38.25

4.2.3.2 In this regards, two toilet systems shall be incorporated into the site. One toilet system will be provided for operation staff toilet and designated visitor's toilet, which will be open in normal days and connects with the on-site sewage treatment plant. Another toilet system will be provided for visitors during festive periods and it will connect with detention tank.

Normal Days (non-festive periods)

4.2.3.3 The small amount of sewage generated from the columbarium development (average sewage generated = 1.51m^3 per day), mainly from the operational staff and minimal visitors, will be conveyed directly to the proposed on-site sewage treatment facility for treatment and disposal.

Festive Periods

4.2.3.4 Visitor's toilet will be open, the sewage collected from the visitor's toilet (average sewage generated = 70.72m^3 per day) will be conveyed to detention tank (internal size = 5.4m x 5.4m x 5m deep = 145.8m^3, twice the size of average sewage generated for contingency that the desludging service can be suspended for one day). During off-peak period, the sewage in the detention tank with subsequent tanking away by desludging vehicles (total trip per day = 70.72m^3 / 12m^3 per vehicle = 5.90 ➔ 6 nos. max.) to the nearby Siu Ho Wan Sewage Treatment Works. Deodorization measures for the proposed detention tank will be provided to ensure that the odour and noise level will be kept to an acceptable level during operation stage.

4.2.3.5 Due to the huge number of visitors during festive periods, portable toilets may need to be provided at the Study Area with a view to shortening the waiting time at the discretion of the venue management as appropriate.

4.2.3.6 Considering the extreme case that maintenance of the detention tank happens in festive period, only portable toilets can be utilized. As one portable toilet can serve 640 nos. of visitors according to information from the suppliers and the assumption that it remains on site for one day, the maximum number of portable toilets required is 10,400/640 = 16.3 nos., say 17 nos.

4.2.3.7 The preliminary arrangement of on-site treatment facility, detention tank and portable toilets is shown in **Figure no. TWE-S-02.**

4.3 Tsuen Wan District Western Site

4.3.1 Existing and Planned Sewerage Network

Existing Sewerage Network

4.3.1.1 Based on DSD record plan, no existing sewerage network in vicinity of the Study Area at the north side of North Lantau Highway (see **Figure no. TWW-S-01**).

Planned Sewerage Network

4.3.1.2 According to current information available, no planned sewerage network is found in the vicinity of the Study Area. Further confirmation will be made with DSD and EPD in due course.

4.3.2 Predicted Sewage Generation

4.3.2.1 For the proposed columbarium, sewage will be generated from the proposed toilets and washing facilities of the columbarium buildings for use by staff and visitors.

4.3.2.2 Although there is no planned sewerage system upgrades, the sewerage system is designed to handle the sewage discharge from all visitors and staff at the project site.

4.3.2.3 The estimated average and peak sewage flows generated from the columbarium during normal days are summarised in **Table 4.7** below. Detailed sewage flow calculations are contained in **Appendix B2**.

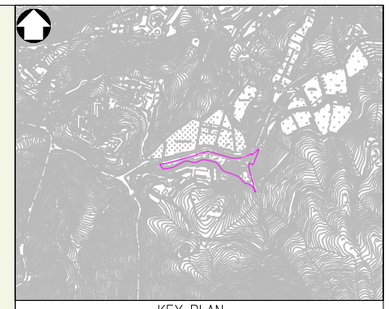
Table 4.8 Estimated Sewage Flows during Normal Days

Source of Sewage	No. of people	Average Sewage Flow (m^3/day)	Peak Sewage Flow (l/s) (1)
Staff	6	0.48	0.044
Visitors	100	1.00	0.093
	Total	**1.48**	**0.137**

Notes:

APPENDIX 5.1

LAYOUT PLAN OF EXISTING SEWERAGE SYSTEM



KEY PLAN

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. ALL LEVELS ARE IN METRES (M) AND RELATIVE TO HONG KONG PRINCIPAL DATUM (mPD).

LEGEND :

- PROPOSED LOT BOUNDARY
- PROPOSED DEVELOPMENT
- EXISTING SEWER MANHOLE
- EXISTING SEWER MAIN

	Description	By	Date

Consultant

wsp

Project title

APPLICATION FOR PERMISSION UNDER SECTION 16 OF THE TOWN PLANNING ORDINANCE (CAP. 131) FOR MINOR RELAXATION OF BUILDING HEIGHT RESTRICTION FROM 2 STOREYS TO 4 STOREYS FOR PROPOSED 4-STOREY COLUMBARIUM AT PART OF INLAND LOT NO. 7755 RP AND GOVERNMENT LAND SANDWICHED BETWEEN INLAND LOT NO. 7755 RP AND INLAND LOT NO. 7713, CAPE COLLISON ROAD, CHAI WAN

Drawing title

LAYOUT PLAN OF EXISTING SEWERAGE SYSTEM

Drawing no.	Rev.
APPENDIX 5.1	1

Drawn	Date	Checked	Approved
MC	JAN 2024	AC	AC

Scale	Status
N.T.S.	–

Date : 2024-01-17
Filename : \\hkkwn200da116\SDE\=ENV=\7. Projects\Project_H321_ENV\(2535801-2535850)\2535833A - HKBA Columbarium SIA update\Working\Maps\Basemap.dwg

APPENDIX 7.1

DETAILED CALCULATION OF SEWAGE GENERATION

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		0.08	[b]	0.56
Visitors	246	[d]	0.01	[c]	2.46
Total	253		-		3.02

Festive Periods

Source of Sewage	Population		Unit Flow Factor		Average Dry Weather Flow - ADWF (m^3/day)
Staff	7		0.08	[b]	0.56
Visitors	16755	[d]	0.01	[c]	167.55
Total	16762		-		168.11

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.

APPENDIX 9.1

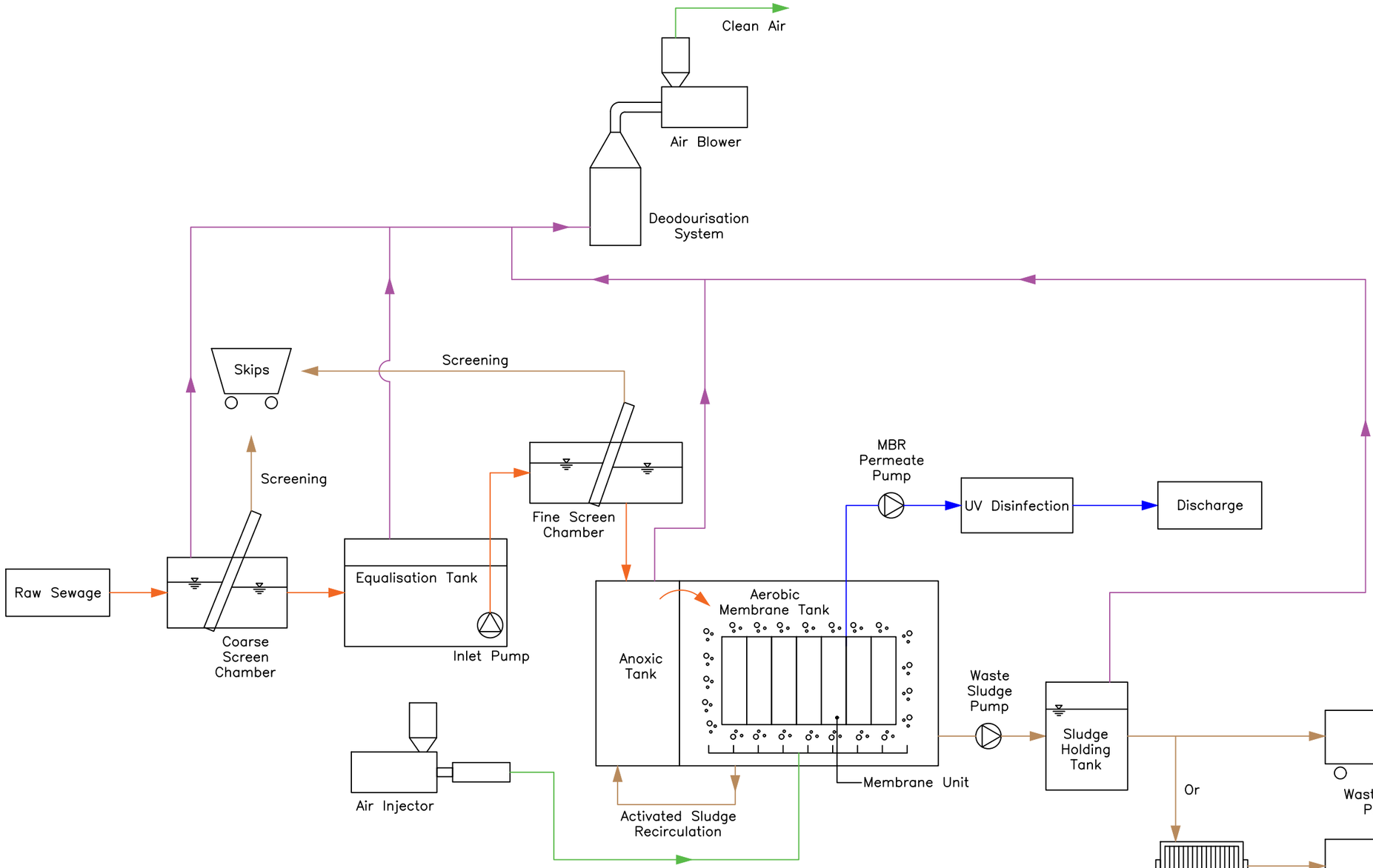
RELEVANT DISCHARGE STANDARD OF TREATED EFFLUENT

(WPCO-TM TABLE 4 STANDARDS FOR EFFLUENTS DISCHARGED INTO GROUP B INLAND WATERS)

Flow rate Determinand	≤ 200 m^3/day
pH (pH units)	6.5 – 8.5
Temperature (°C)	35
Colour (lovibond units) (25mm cell length)	1
Suspended Solid (mg/L)	30
BOD (mg/L)	20
COD (mg/L)	80
Oil & Grease (mg/L)	10
Iron (mg/L)	10
Boron (mg/L)	5
Barium (mg/L)	5
Mercury (mg/L)	0.001
Cadmium (mg/L)	0.001
Selenium (mg/L)	0.2
Other Toxic Metals Individually (mg/L)	0.5
Total Toxic Metals (mg/L)	2
Cyanide (mg/L)	0.1
Phenols (mg/L)	0.1
Sulphide (mg/L)	0.2
Fluoride (mg/L)	10
Sulphate (mg/L)	800
Chloride (mg/L)	1000
Total phosphorus (mg/L)	10
Ammonia nitrogen (mg/L)	5
Nitrate + nitrite nitrogen (mg/L)	30
Surfactants (total)	5
E. coli (count/100mL)	100

APPENDIX 9.2

SCHEMATIC DIAGRAM OF ON-SITE STP



Membrane Bioreactor System (MBR)

LEGEND:

- SEWAGE FLOW
- EFFLUENT FLOW
- SLUDGE FLOW
- ODOUR FLOW
- AIR FLOW

Rev	Description	By	Date

Consultant

wsp

Project title

APPLICATION FOR PERMISSION UNDER SECTION 16 OF THE TOWN PLANNING ORDINANCE (CAP. 131) FOR MINOR RELAXATION OF BUILDING HEIGHT RESTRICTION FROM 2 STOREYS TO 4 STOREYS FOR PROPOSED 4-STOREY COLUMBARIUM AT PART OF INLAND LOT NO. 7755 RP AND GOVERNMENT LAND SANDWICHED BETWEEN INLAND LOT NO. 7755 RP AND INLAND LOT NO. 7713, CAPE COLLINSON ROAD, CHAI WAN

Drawing title

SCHEMATIC DIAGRAM OF ON-SITE STP

Drawing no.	Rev.
APPENDIX 9.2	2

Drawn	Date	Checked	Approved
JT	26/11/2020	AI	AC

Scale: N.T.S.

Status