
Enclosure | 2

Revised Sewerage Impact Assessment



D02 Sewerage Impact Assessment

S12A Rezoning Application – Request for Amendment to the Lung Yeuk Tau and Kwan Tei South OZP from “Residential (Group C)” Zone and “Agriculture” Zone to “Residential (Group A)2” Zone at Various Lots in D.D. 83 and Adjoining Government Land, Lung Yeuk Tau, N.T.

Reference No. 7076933
Prepared for Carlton Woodcraft Manufacturing Ltd
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1 INTRODUCTION

1.1 Project Background

- 1.1.1 With reference to the latest policy address in developing the Northern Metropolis, it is aimed to optimise the use of land resources, adopt a higher development intensity and increase high-quality housing supply. In order to address the aforementioned needs, it is planned to redevelop a land with an area of approximately 22,445m² comprising various lots in D.D. 83, and the adjoining government land with an area of about 1,358m², Lung Yeuk Tau, New Territories, into proposed flat, shop and services and eating place (“the Site” or “the Proposed Development”).
- 1.1.2 The Site is currently zoned “Residential (Group C)” (“R(C)”) and “Agriculture” (“AGR”) under the Lung Yeuk Tau and Kwan Tei South Outline Zoning Plan (“OZP”) No. S/NE-LYT/19. It is planned to develop a commercial complex for shop and services and eating place, and Residential Development comprising five blocks for domestic use. For the Proposed Development, it is proposed to amend the Site to “Residential (Group A)2” (“R(A)2”) by submitting an application under Section 12A of the *Town Planning Ordinance* (“TPO”).
- 1.1.3 In order to support the rezoning application, SMEC Asia Ltd (“SMEC”) has been commissioned to prepare this Sewerage Impact Assessment (“SIA”) Report to evaluate and assess impacts from the Proposed Development on the downstream public sewerage system. Effective mitigation measures to reduce any adverse sewerage issues identified will be recommended.

1.2 Site Description

- 1.2.1 The Site is located in a developed area in Lung Yeuk Tau, New Territories, which is a flat land used for workshop, storage and warehouses. Its northern part is currently occupied by a permanent domestic structure, temporary structures for open storage yards, storage of construction materials and workshops, open carparks and vacant land. The southern part is currently occupied for warehouse storage.
- 1.2.2 As shown on **Figure 1-1**, Sha Tau Kok Road (Lung Yeuk Tau) Section is located to the immediate north of the Site that runs along the northeast-southwest direction. Across the opposite site of Sha Tau Kok Road (Lung Yeuk Tau) Section, there are San Wai Barracks, a recycling centre and some warehouses. The Site is mainly surrounded by Tung Chun Soy Sauce factory place and some vegetated land to the east, Queen’s Hill Estate to the south, village houses and warehouses to the west, intermixed with temporary structures, scattered vegetated and abandoned land.

1.3 Project Description

- 1.3.1 The Proposed Development will tentatively comprise a commercial complex and a Residential Development with the following components:
- Five Residential Blocks
 - One Clubhouse
 - One Swimming Pool
 - One Commercial Complex
 - One Sewage Treatment Plant (“STP”)
- 1.3.2 The tentative intake year of the Proposed Development is 2031.

1.4 Objective of the Report

- 1.4.1 The objectives of this SIA are to:
- Assess the potential sewerage impacts arising from the Proposed Development.

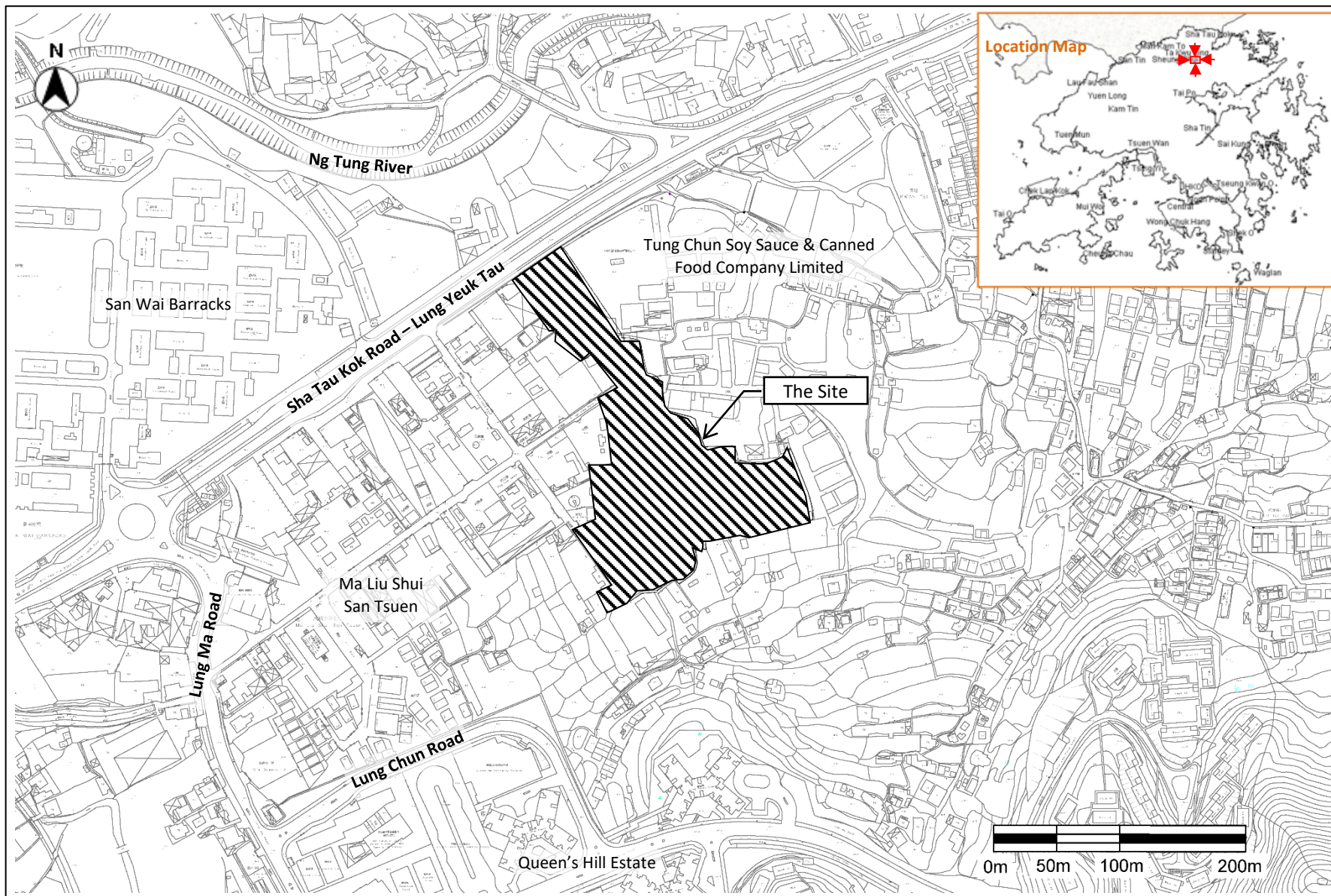
- Recommend the necessary mitigation measures to alleviate the impacts.

1.5 Reference Materials

1.5.1 In evaluating the sewerage impact arising from the Project, the following documents have been referred to:

- Drainage Services Department (“DSD”) publication *Sewerage Manual (with Eurocodes incorporated) (Part 1) Key Planning Issues and Gravity Collection System, 3rd Edition, May 2013*
- Environmental Protection Department (“EPD”) publication *Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0, March 2005 (“GESF”)*
- GeoInfo Map (<https://www.map.gov.hk/gm/>) reviewed on 7 February 2023
- Water Pollution Control Ordinance (WPCO) Technical Memorandum Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters

Figure 1-1: Site Location and its Environs



2 EXISTING ENVIRONMENT AND BASELINE CONDITIONS

2.1 Existing Baseline Conditions

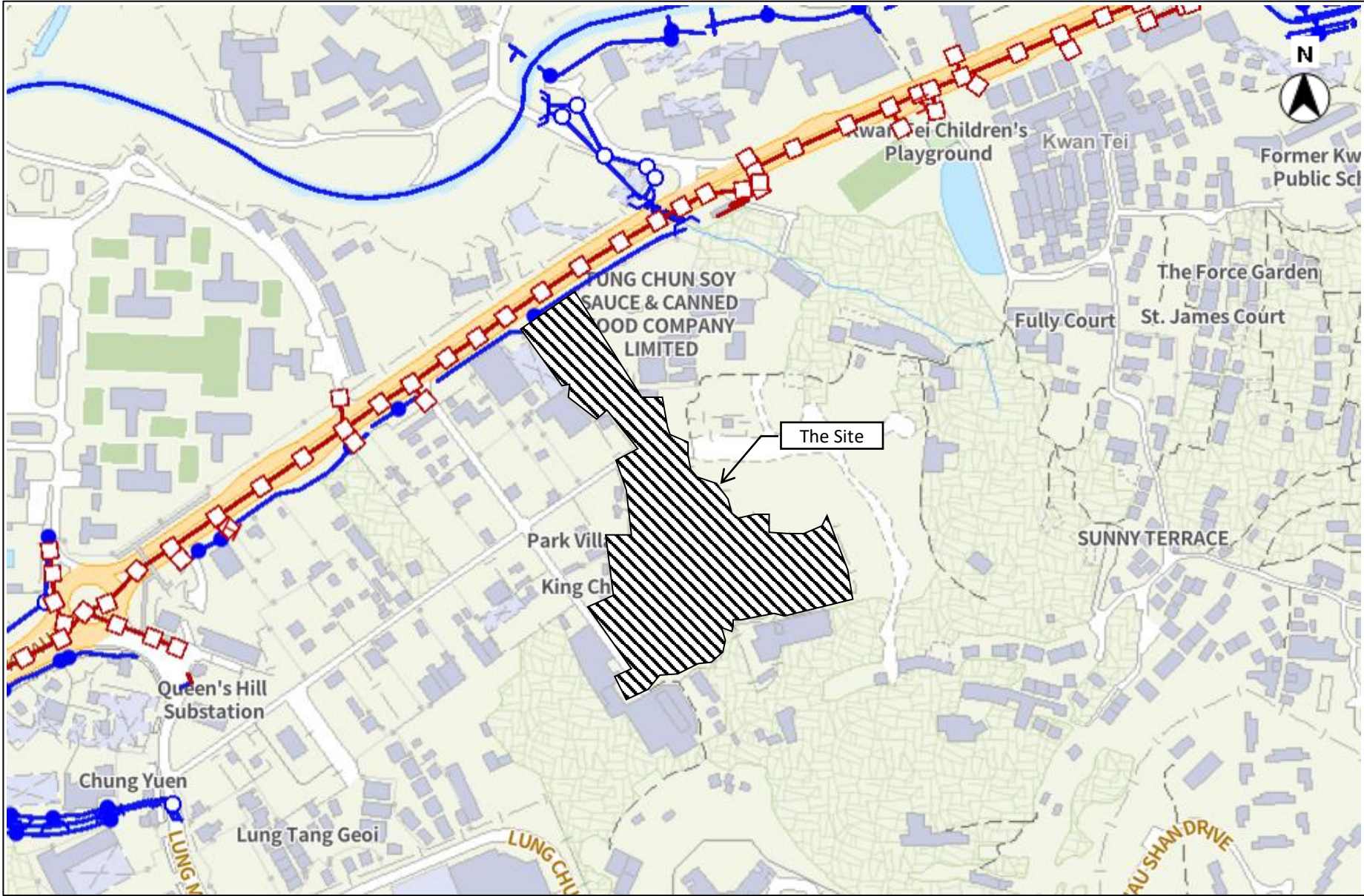
2.1.1 Based on the sewerage data of GeoInfo Map checked on 7 February 2023 and the sewerage layout plan shown on **Figure 2-1**; there is existing municipal sewerage system running along Sha Tau Kok Road (Lung Yeuk Tau) Section from the north of the Site and then to the northwest of it. Informed by EPD, the available spare flow capacity of sewage treatment system at Sha Tau Kok Road has been reserved for other planning purposes, and alternative sewage disposal scheme instead of discharging sewage into the sewerage system along Sha Tau Kok Road.

2.2 Sewerage Discharge for the Proposed Development

2.2.1 During the operation of the Proposed Development, the major sources of sewage will be the sewage generated by the staff and visitors of the commercial complex, the sewage generated by the residents and staff of the Residential Development, as well as the wastewater generated from the swimming pool of the club house.

2.2.2 Due to insufficient capacity of the existing public sewerage system, an on-site STP is proposed to treat the sewage generation from the Proposed Development. Two separated discharge system will be constructed for the proposed STP. One is for discharging the treated effluent from STP to the drainage channel along Sha Tau Kok Road, which will convey to Ng Tung River and eventually flow to Deep Bay. The other serve as an emergency discharge system to discharge the untreated sewage into the public sewer system under Sha Tau Kok Road in case the STP equipment experiences failure or malfunction. The estimated total daily sewage generation from the Proposed Development and capacities of the STP as well as the proposed discharge system are discussed in the subsequent sections.

Figure 2-1: Existing Sewerage Layout Plan



3 SEWERAGE ANALYSIS

3.1 Assumptions and Methodology

3.1.1 In order to assess the acceptability of the sewerage impact arising from the Proposed Development, the anticipated sewage generation has been estimated based on Environmental Protection Department (“EPD”)’s *Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning* (“GESF”) shown in **Table 3-1**. **Suggested by EPD, the peaking factor for the proposed STP will be taken as 2.5.**

Table 3-1: Parameters for Estimating Wastewater Generation from the Proposed Development

PARAMETER	VALUE	REMARK
Generation from Residents of Residential Development		
No. of Residents	9,915	As advised by the Applicant.
Unit Flow Factor of Residents	0.270m ³ /day/person	The unit flow factor for “Private R2” given in Table T-1 of GESF.
Generation from Staff of Residential Development		
Total Area	3,650m ²	Non-domestic GFA as advised by the Applicant.
No. of Staff	121	Worker density by All Type for “Community, Social & Personal Services” is 3.3 staff in 100m ² as stated in Table 8 of Commercial and Industrial Floor Space Utilization Survey.
Unit Flow Factor of Staff	0.280m ³ /day/staff	The unit flow factor for employees of “J11 Community, Social & Personal Services” + that for commercial employee given in Table T-2 of GESF. For J11, the “per-employee” unit flow factor takes into account the flows of customers and/or tenants.
Generation from Retail Staff of Commercial Complex		
Total Area	3,220m ²	As advised by the Applicant.
No. of Staff	113	Worker density by All Type for “Retail Trade” is 3.5 staff in 100m ² as stated in Table 8 of Commercial and Industrial Floor Space Utilization Survey.
Unit Flow Factor of Staff	0.280m ³ /day/staff	The unit flow factor for employees of “J4 Wholesale & Retail” given in Table T-2 of GESF + that for commercial employee.
Generation from Restaurant Staff of Commercial Complex		
Total Area	2,390m ²	As advised by the Applicant.
No. of Staff	120	Worker density by All Type for “Restaurants” is 5.1 staff in 100m ² as stated in Table 8 of Commercial and Industrial Floor Space Utilization Survey.
Unit Flow Factor of Staff	1.580m ³ /day/staff	The unit flow factor for employees of “J10 Restaurants & Hotels” + that for commercial employee given in Table T-2 of GESF. For J10, the “per-employee” unit flow factor takes into account the flows of customers and/or tenants.

PARAMETER	VALUE	REMARK
Generation from Swimming Pool of Clubhouse		
Total Area	525m ²	The tentative design of the swimming pool is provided by the Applicant.
Water Depth of Swimming Pool	1.25 m	As advised by the Applicant.
Time for Completely Changing Water	6 hours	CAP 132CA Swimming Pools Regulation.
Filtration Rate	40 m ³ /m ² -hour	The average high-rate filtration for domestic pool ^[Note 1]
Backwash Rate	0.81 m ³ /m ² -min	The maximum typical backwash rate for combined air-water backwash ^[Note 2]
Maximum capacity of Swimming Pool	175 persons	Determined from the rate of 1 person for every 3 square meters of water surface.
No. of shower heads	7 showers	One water closet shall be provided for every 25 persons in reference to Swimming Pool Licence Application Guideline. Client states one shower will be provided for each water closet.
Average maximum flow rate of shower heads	10 L/min	Based on Water Supply Department Domestic Water Consumption Survey 2015.
Sewage Generation per Shower Head	7.8 m ³ /day	The daily operation time of clubhouse is tentative assumed to be 13 hours.
Total Sewage Generation by the shower facilities in Clubhouse	54.6 m ³ /day	Divided from assuming shower under usage all the time in operation hours of Clubhouse
Others		
Catchment Inflow Factor	1.0	Catchment inflow factor for North District is adopted as stated in Table T-4 of GESF.
Peaking Factor	2.5	Suggested by EPD, peaking factor for new sewage treatment works is adopted as 2.5.

Note:

1. The average high-rate filtration for domestic pool in Plumbing Engineering Services Design Guide - Domestic Swimming Pool
2. Wastewater Engineering - Treatment, Disposal, Reuse, 4th ed., Metcalf and Eddy

3.2 Proposed Sewage Treatment Plant and Discharge Arrangement

3.2.1 The calculation of the estimated sewage generation is provided in **Appendix A**. The average dry weather flow from the Proposed Development is calculated to be 3005.4m³/day during its commission stage. The contributing population would be 1,1131 referring to GESF. The peak flow is estimated to be 7513.5m³/day.

3.2.2 Because of the constrain of the existing public sewer system mentioned in **Section 2.1.1**, an on-site STP is proposed to handle the sewage from the Proposed Development. The STP is located at the B1/F of the shopping arcade of the proposed development. As the effluent will be discharged through the public drainage system, the treatment level of the proposed STP will be

set to be tertiary treatment. The treatment process is tentatively proposed to be membrane bioreactor and ultrafiltration. The WPCO license standards for private tertiary sewage treatment plant (for discharge into Deep Bay) will be adopted as the effluent discharge standard for the proposed STP as shown in Table 3-2.

Table 3-2: Discharge Standards of the Effluent from Proposed STP

PARAMETER	UNIT	Tertiary Effluent Standards (Upper Limit)
BOD ₅	mg/L	10
TSS	mg/L	10
TN	mg/L	20
TP	mg/L	2
Ammonia-N	mg/L	5
<i>E.Coli</i>	Counts/100 ml	100

3.2.3 The tentative schematic diagram of the proposed STP is presented in **Figure 3-1**. The sewage generated from the residential buildings and shopping arcade will be collected in sewage storage tank. After the pre-treatment process in fine screen and grit separator, primary treatment process in dissolved air floatation system, secondary treatment process in membrane bioreactor and lastly tertiary treatment process in ultrafiltration system, the sewage will be treated into effluent that can satisfy the discharge standards mentioned above. Whenever it is necessary, the effluent will undergo chlorine dosage in the effluent tank as additional disinfection measure to suppress the bacteria count before discharging.

3.2.4 The design capacity of the proposed STP is 5000m³/day, which is 66% higher than the ADWF. The treatment demand between the design capacity and the peak flow will be covered by the 752m³ sewerage storage tank, which can sustain 6 hours of ADWF and provide sufficient retention for the surplus sewage flow during the peak hours. The 66% excessive partition of design capacity over the ADWF will enable the rapid evacuation of the sewage storage tank during the non-peak hours and provide buffer to sustain the capacity loss due to the potential equipment damage.

3.2.5 As mentioned in Section 2.2.2, two separated discharge system will be constructed to connected the proposed STP to the public sewer system and drainage channel respectively. The location of the proposed STP and the alignment of the discharge system is shown in **Figure 3-2**. During the normal operation, the treated effluent will be pumped through the effluent discharge system from the effluent tank of the proposed STP to the drainage channel SUP1001474 along Sha Tau Kok Road at the site boundary. If the STP experience equipment failure and malfunction, the sewage storage tank can provide a 6-hour retention time for emergency response. If emergency discharge is found necessary, the untreated raw sewage in the sewage storage tank will be pumped through the emergency discharge system to sewer manhole FMH1003633 on Sha Tau Kok Road, and discharge to the public sewerage system after agreeing with DSD about the discharge quantity and discharge flow rate. The remaining portion of sewage that could not be covered by the available capacity of public sewerage system will be collected by sewage suction truck.

3.2.6 Extensive effort will be expedited to avoid the occurrence for emergency discharge. In order to achieve this, the design of STP and associated pumping system will be cautiously reviewed to include additional provisions including as follows:

- Design capacity of proposed STP has been set to be 5000m³/day, which is 66% over the ADWF to sustain capacity loss due to potential equipment failure.

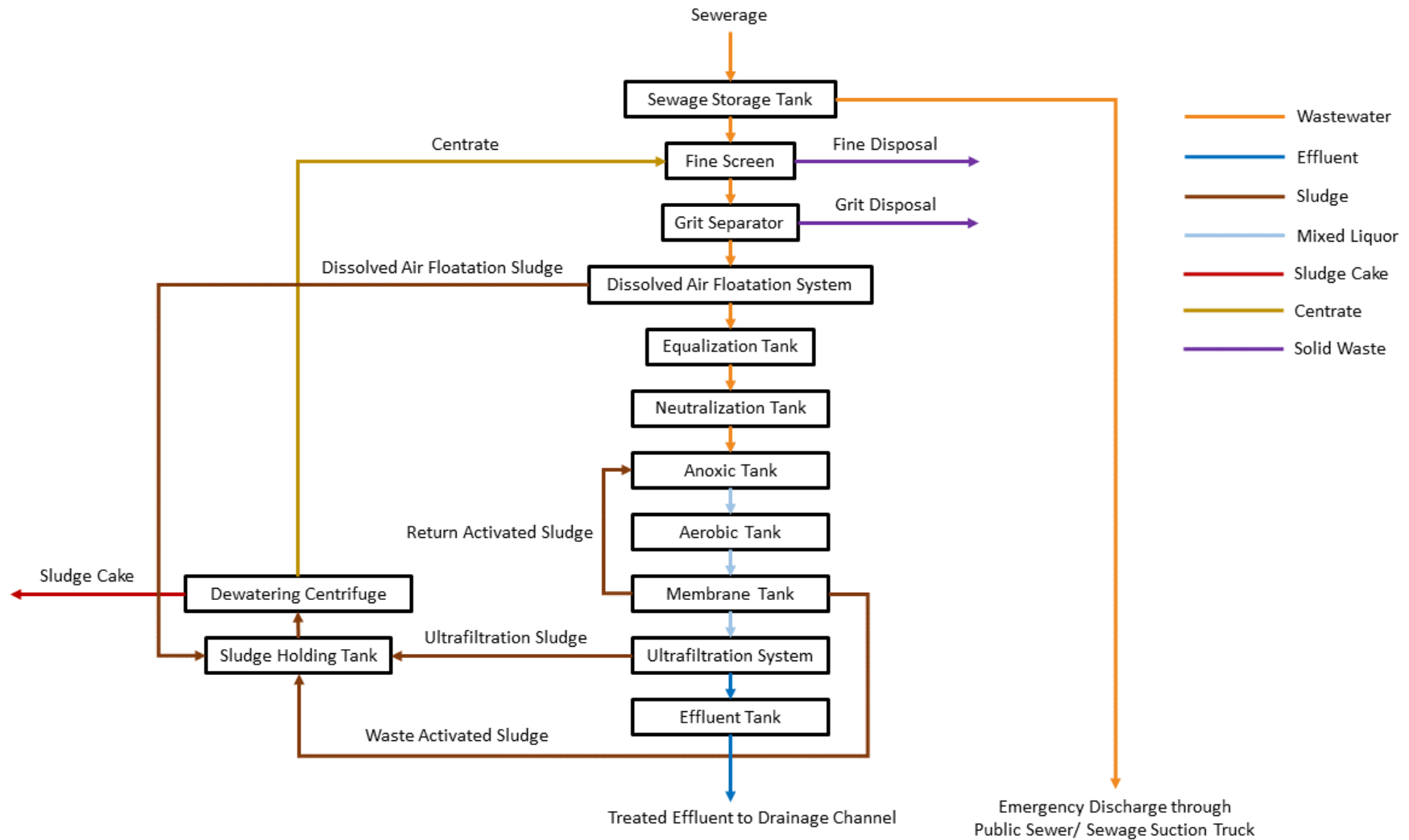
- Sewage Storage tank or equivalent facility with capacity of 752m³ storage volume will be equipped to the proposed STP to provide sufficient retention time for the emergency response action.
- Standby pumps and treatment facilities would be provided in case of unexpected breakdown of pumping and treatment facilities such that the standby pumps and treatment facilities could take over and function to replace the broken pumps and treatment facilities;
- Uninterruptible power supply system will be installed to protect the proposed STP from power shutdown.
- Flow meter for pumps, level sensors for tanks, and gate valves for pipes shall be installed and connected with alarm signaling system to keep monitoring on flow rate of each treatment system to avoid overflow.

3.2.7 To provide a mechanism to minimize the impact of emergency discharges and facilitate subsequent management of any emergency, Emergency Response Plan and Efficient Handling Management System will be formulated prior to commissioning of STP during the detailed design stage to set out the emergency response procedures and actions to be followed in case of equipment or sewage treatment failure or malfunction. The quantity percentage of sewage that will be discharged through the emergency discharge system should also be estimated and achieved consent with DSD before the commissioning of STP. The Developer will be responsible for the operation of the STP and the mitigation measures to be carried out inside the STP per the contingency plan to be prepared and agreed with EPD, DSD and relevant parties. Regular maintenances and inspections to all treatment system, mechanical works and dosing system are necessary to maintain a good operation condition.

3.2.8 Referring to the Outline Zoning Plan No. S/NE-LYT/19 Section 7, the on-site sewage treatment facilities should preferably be connected back to public sewerage network once completion of the full upgrade of Shek Wu Hui Sewerage Treatment Works and with sufficient capacity to accommodate the additional flow. Once the public sewerage system underneath Sha Tau Kok Road is updated and sufficient available capacity can be provided for the direct discharge from the proposed development, the project team can explore the opportunity of turning the emergency discharge system into a conventional sewerage connection system to convey the sewage from the proposed development to sewer manhole FMH1003633.

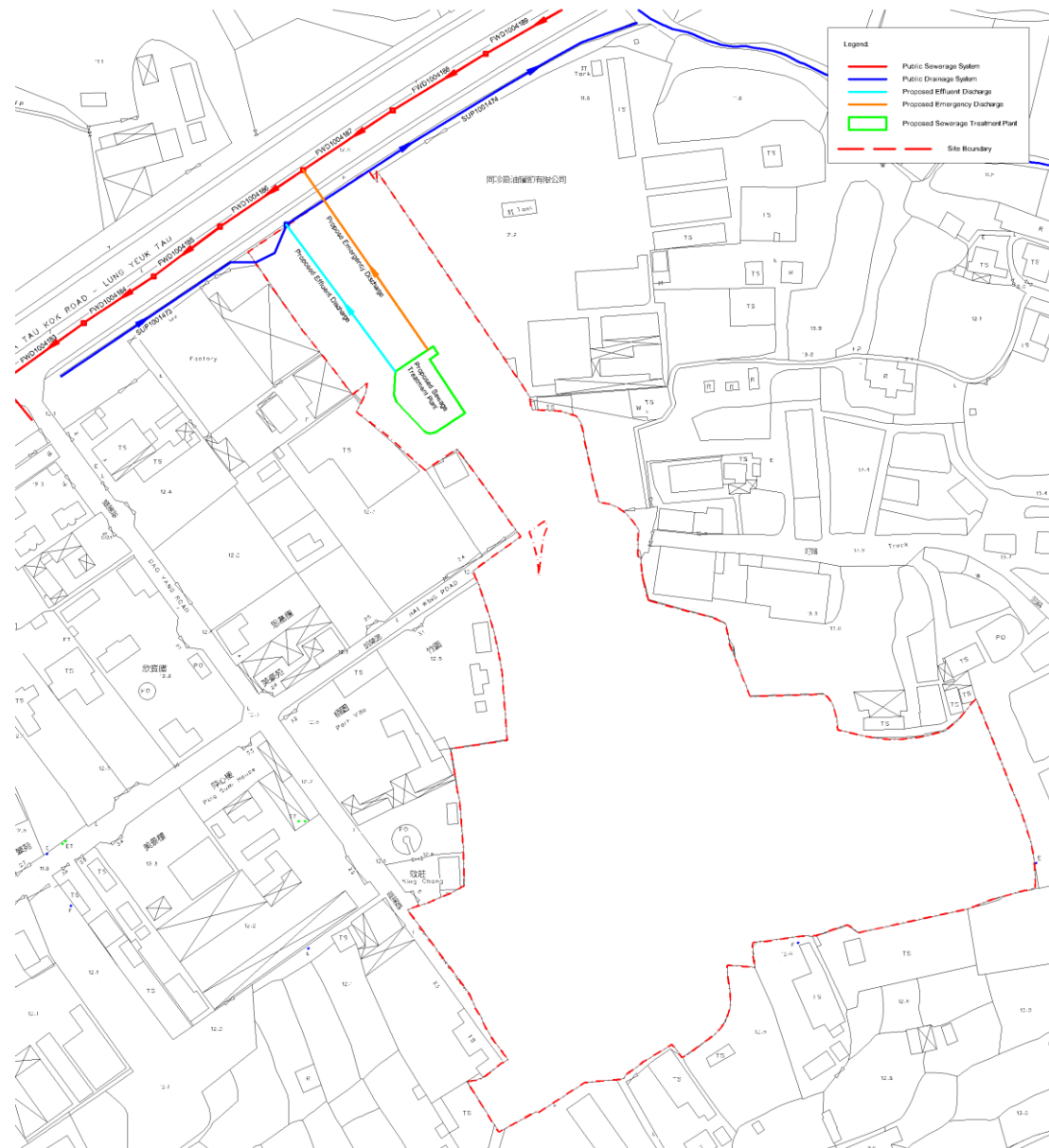
3.2.9 With the provision of the tertiary level on-site STP, the treated effluent from the STP will be treated to satisfy the WPCO license standards for private tertiary sewage treatment plant (for discharge into Deep Bay) before discharging into the stormwater drainage system while the emergency discharge is through the existing public sewerage system and sewage suction truck. No adverse sewerage impact from the Proposed Development is anticipated. e

Figure 3-1: Tentative Schematic Diagram of Proposed Sewage Treatment Plant



Note: The chemical dosing system and mechanical works are omitted in this tentative schematic diagram.

Figure 3-2: Tentative Location of Proposed Sewerage Treatment Plant and Discharge Arrangement



4 CONCLUSION

- 4.1.1 It is proposed to develop the Site at various lots in D.D. 83, and the adjoining government land, Lung Yeuk Tau, New Territories, into proposed flat, shop and services and eating place. The Site is currently zoned “Residential (Group C)” (“R(C)”) and “Agriculture” (“AGR”) under the Lung Yeuk Tau and Kwan Tei South Outline Zoning Plan No. S/NE-LYT/19. This Sewerage Impact Assessment is carried out in order to support the Section 12A planning application for the Proposed Development.
- 4.1.2 The total estimated Average Daily Dry Weather (ADWF) flow from the Proposed Development is about 3,005.4 m³/day. An on-site Sewage Treatment Plant (“STP”) with the capacity of 5,000m³/day is proposed to handle the sewage arising from the Site. The effluent from the STP will be discharged to nearby stormwater drainage system and eventually reach Ng Tung River after tertiary treatment. And one additional discharge system will be connected to the public sewerage system serving as optional route for emergency discharge.
- 4.1.3 Overall, the sewerage analysis indicates that no unacceptable sewerage impact is anticipated with the provision of on-site STP and the proposed discharge arrangement.

Appendix A **CALCULATION OF SEWAGE GENERATION DURING OPERATION OF THE PROPOSED DEVELOPMENT**

D02 SEWERAGE IMPACT ASSESSMENT

S12A Rezoning Application – Request for Amendment to the Lung Yeuk Tau and Kwan Tei South OZP from “Residential (Group C)” Zone and “Agriculture” Zone to “Residential (Group A)2” Zone at Various Lots in D.D. 83 and Adjoining Government Land, Lung Yeuk Tau, N.T.
Prepared for Carlton Woodcraft Manufacturing Ltd

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Appendix A - Calculation of Sewage Generation

Calculation of Sewage Generation from the Proposed Development, Upstream and Downstream Catchments	Remarks/ Justification	
Catchment 1 - Proposed Development		
2a) Sewage generated by the Residential Development		
i. Sewage generated by Residents of the Residential Development		
No. of Flats	= 3305 flats	As advised by the Applicant.
Total population in Proposed Residential Development	= 9915 persons	As advised by the Applicant.
Unit Flow Factor (UFF) per resident	= 0.27 m ³ /day/person	Unit flow factor for Private R2 type in Table T-1 of Ref. 2.
Total Sewage Generation by the Residents of the Residential Development	= 2677.1 m ³ /day	
ii. Sewage generated by Staff of the Residential Development		
Total Gross Floor Area (GFA) of non-domestic portion of Residential Development	= 3650 m ²	As advised by the Applicant.
Staff occupancy density	= 30.3 m ² /staff	Worker density Industry Group (All Type) for "Community, Social & Personal Services" is 3.3 staff in 100m ² as stated in Table 8 of ref. 1.
No. of Onsite Staff (e.g. security, management office, clubhouse etc.)	= 121 staff	
Unit Flow Factor (UFF) per staff	= 0.28 m ³ /day/staff	Refer to "Commercial Employee" + J11 "Commercial, Social & Personal Services" of Table T-2 of Ref. 2.
Total Sewage Generation by the Staff of the Residential Development	= 33.88 m ³ /day	
Total Sewage Generation by Residents and Staff for the Proposed Residential Development	= 2710.9 m³/day	
2b) Sewage generated by the Commercial Complex		
i. Sewage generated by Staff of Retail Shops of the Commercial Complex		
Total Gross Floor Area (GFA) of Retail Shops of the Commercial Complex	= 3220 m ²	As advised by the Applicant.
Staff occupancy density	= 28.6 m ² /staff	Worker density Industry Group (All Type) for "Retail Trade" is 3.5 staff in 100m ² as stated in Table 8 of ref. 1.
No. of Staff of Retail Shops	= 113 staff	
Unit Flow Factor (UFF) per staff	= 0.28 m ³ /day/staff	Unit flow factor for "Commercial Employee + J4 Wholesale & Retail" in Table T-2 of ref. 2.
Total Sewage Generation by the Staff of Retail Shops of the Commercial Complex	= 31.6 m ³ /day	
ii. Sewage generated by Staff of Restaurants of the Commercial Complex		
Total Gross Floor Area (GFA) of Restaurants of the Commercial Complex	= 2390 m ²	As advised by the Applicant.
Staff occupancy density	= 19.6 m ² /staff	Worker density Industry Group (All Type) for "Restaurants" is 5.1 staff in 100m ² as stated in Table 8 of ref. 1.
No. of Staff of Retail Shops	= 122 staff	
Unit Flow Factor (UFF) per staff	= 1.58 m ³ /day/staff	Unit flow factor for "Commercial Employee + J10 Restaurants & Hotels" in Table T-2 of ref. 2.
Total Sewage Generation by the Staff of Restaurants of the Commercial Complex	= 192.76 m ³ /day	
Total Sewage Generation by Staff of the Commercial Complex	= 224.4 m³/day	
2c) Sewage generated by the Clubhouse		
i. Sewage generated by Staff of Clubhouse		
Total Gross Floor Area (GFA) of the Clubhouse	= 3650 m ²	Worker density Industry Group (Private Commercials) for "Community, Social & Personal Services" is 3.3 staff in
Staff occupancy density	= 2.3 staff/100m ²	
No. of Staff of Clubhouse	= 84 staff	Unit flow factor for "Commercial Employee + J11 Community, Social & Personal Services" in Table T-2 of ref. 2.
Unit Flow Factor (UFF) per staff	= 0.28 m ³ /day/staff	
Total Sewage Generation by the Staff at Clubhouse	= 23.52 m ³ /day	
2d) Wastewater generated from Swimming Pool in the Clubhouse		
Approximate Area of Swimming Pool	= 525.4 m ²	Based on estimation from survey map.
Average Water Depth of Swimming Pool	= 1.25 m	As advised by the Applicant.
Approximate Size of Swimming Pool	= 656.7 m ³	
Time for Completely Changing Water	= 6 hours	The minimum turnover time in ref. 3.
Turnover Rate	= 109.5 m ³ /hour	
Filtration Rate	= 40 m ³ /m ² -hour	The average high rate filtration for domestic pool in ref. 4.
Filter Area	= 2.7 m ²	
No. of Filters used for Filtration	= 1	
Backwash Rate	= 0.81 m ³ /m ² -min	The maximum typical backwash rate for combined air-water backwash in Table 11-12 of ref. 5.
Estimated flow from the Swimming Pool	= 15.5 m³/day	7 minutes for cleaning the filter by backwashing water excluding the air scouring time is recommended in B8.5.5 of
	= 0.18 l/s	
Maximum Capacity of Swimming Pool	= 175 person	Determined from the rate of 1 person for every 3 square meters of water surface.
No. of shower heads	= 7 shower	One water closet shall be provided for every 25 persons in reference to Swimming Pool Licence Application
Average maximum flow rate of shower heads	= 10 l/min	Based on Water Supply Department Domestic Water Consumption Survey 2015.
Sewage Generation per Shower Head	= 7.8 m ³ /day	The daily operation time of clubhouse is tentative assumed to be 13 hours.
Total Sewage Generation by the shower facilities in Clubhouse	= 54.6 m ³ /day	Divided from assuming shower under usage all the time in operation hours of Clubhouse
Estimated flow from the Swimming Pool Shower Facilities	= 54.6 m³/day	
	= 0.63 m³/day	
Catchment Inflow Factor	= 1.0	Catchment inflow factor of North District, ref.1.
Total sewage generated from Catchment 1 (Proposed Development)	= 3005.4 m³/day	

Note:

- Commercial and Industrial Floor Space Utilization Survey, Planning Department, 2005
- Environmental Protection Department (EPD) publication Guidelines for Estimating Sewage Flows (GESF) for Sewage Infrastructure Planning Version 1.0, March 2005.
- CAP 132CA Swimming Pools Regulation
- Plumbing Engineering Services Design Guide - Domestic Swimming Pool
- Wastewater Engineering - Treatment, Disposal, Reuse, 4th ed., Metcalf and Eddy
- General Specification for Swimming Pool Water Treatment Installation in Government Buildings of HKSAR, 2012 ed., Architectural Services Department

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