

Enclosure | 5

---

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  
2 November 2023

# Document Control

Document:	D02 Sewerage Impact Assessment
File Location:	Z:\Jobs\7076933 - Carlton - S12A Lung Yeuk Tau\08 Submission
Project Name:	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.
Project Number:	7076933   D02/01
Revision Number:	2

## Revision History

REVISION NO.	DATE	PREPARED BY	REVIEWED BY	APPROVED BY
0	10 March 2023	Pinky LAM	Charls LIANG	Antony WONG
1	18 July 2023	Pinky LAM	Fred NG	Fred NG
2	2 November 2023	LUO, KAICHAO	Alex GBAGUIDI	Alex GBAGUIDI

## Issue Register

DISTRIBUTION LIST	DATE ISSUED	NUMBER OF COPIES
Carlton Woodcraft Manufacturing Ltd	2 November 2023	1 electronic soft copy

## Company Details

Approved by:	SMEC Asia Limited		
Address:	27/F Ford Glory Plaza, 37-39 Wing Hong St, Cheung Sha Wan, Kowloon, Hong Kong		
Tel:	+852 3995 8100	Fax:	+852 3995 8101
Email:	hongkong@smec.com	Website:	<a href="http://www.smec.com">www.smec.com</a>

The information within this document is and shall remain the property of: SMEC Asia Limited

## Important Notice

This report is confidential and is provided solely for the purposes of supporting 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.. This report is provided pursuant to a Consultancy Agreement between SMEC Asia Limited (“SMEC”) and Carlton Woodcraft Manufacturing Ltd, under which SMEC undertook to perform specific and limited tasks for Carlton Woodcraft Manufacturing Ltd. This report is strictly limited to the matters stated in it and subject to the various assumptions, qualifications and limitations in it and does not apply by implication to other matters. SMEC makes no representation that the scope, assumptions, qualifications and exclusions set out in this report will be suitable or sufficient for other purposes nor that the content of the report covers all matters which you may regard as material for your purposes.

This report must be read as a whole. Any subsequent report must be read in conjunction with this report.

The report supersedes all previous draft or interim reports, whether written or presented orally, before the date of this report. This report has not and will not be updated for events or transactions occurring after the date of the report or any other matters that might have a material effect on its contents or which come to light after the date of the report. SMEC is not obliged to inform you of any such event, transaction or matter nor to update the report for anything that occurs, or of which SMEC becomes aware, after the date of this report.

Unless expressly agreed otherwise in writing, SMEC does not accept a duty of care or any other legal responsibility whatsoever in relation to this report, or any related enquiries, advice or other work, nor does SMEC make any representation in connection with this report, to any person other than Carlton Woodcraft Manufacturing Ltd. Any other person who receives a draft or a copy of this report (or any part of it) or discusses it (or any part of it) or any related matter with SMEC, does so on the basis that he or she acknowledges and accepts that he or she may not rely on this report nor on any related information or advice given by SMEC for any purpose whatsoever.

# Table of Contents

## Main Text

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1-1</b>
1.1	Project Background .....	1-1
1.2	Site Description .....	1-1
1.3	Project Description .....	1-1
1.4	Objective of the Report .....	1-1
1.5	Reference Materials .....	1-2
<b>2</b>	<b>EXISTING ENVIRONMENT AND BASELINE CONDITIONS .....</b>	<b>2-1</b>
2.1	Existing Baseline Conditions .....	2-1
2.2	Sewerage Discharge for the Proposed Development .....	2-1
<b>3</b>	<b>SEWERAGE ANALYSIS .....</b>	<b>3-1</b>
3.1	Assumptions and Methodology .....	3-1
3.2	Results and Discussion .....	3-3
<b>4</b>	<b>CONCLUSION .....</b>	<b>4-1</b>

## Appendices

### APPENDIX A CALCULATION OF SEWAGE GENERATION DURING OPERATION OF THE PROPOSED DEVELOPMENT

## List of Tables

Table 3-1: Parameters for Estimating Wastewater Generation from the Proposed Development .....	3-1
Table 3-2: Discharge Standards of the Effluent from STP .....	3-3

## List of Figures

Figure 1-1 Site Location and its Environs.....	1-3
Figure 2-1 Existing Sewerage Layout Plan .....	2-2
<b>Figure 3-1 Indicative Location of the Proposed STP and Drainage Pipes .....</b>	<b>3-5</b>

# 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 22,445m<sup>2</sup> comprising various lots in D.D. 83, and the adjoining government land with an area of about 1,358m<sup>2</sup>, 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.

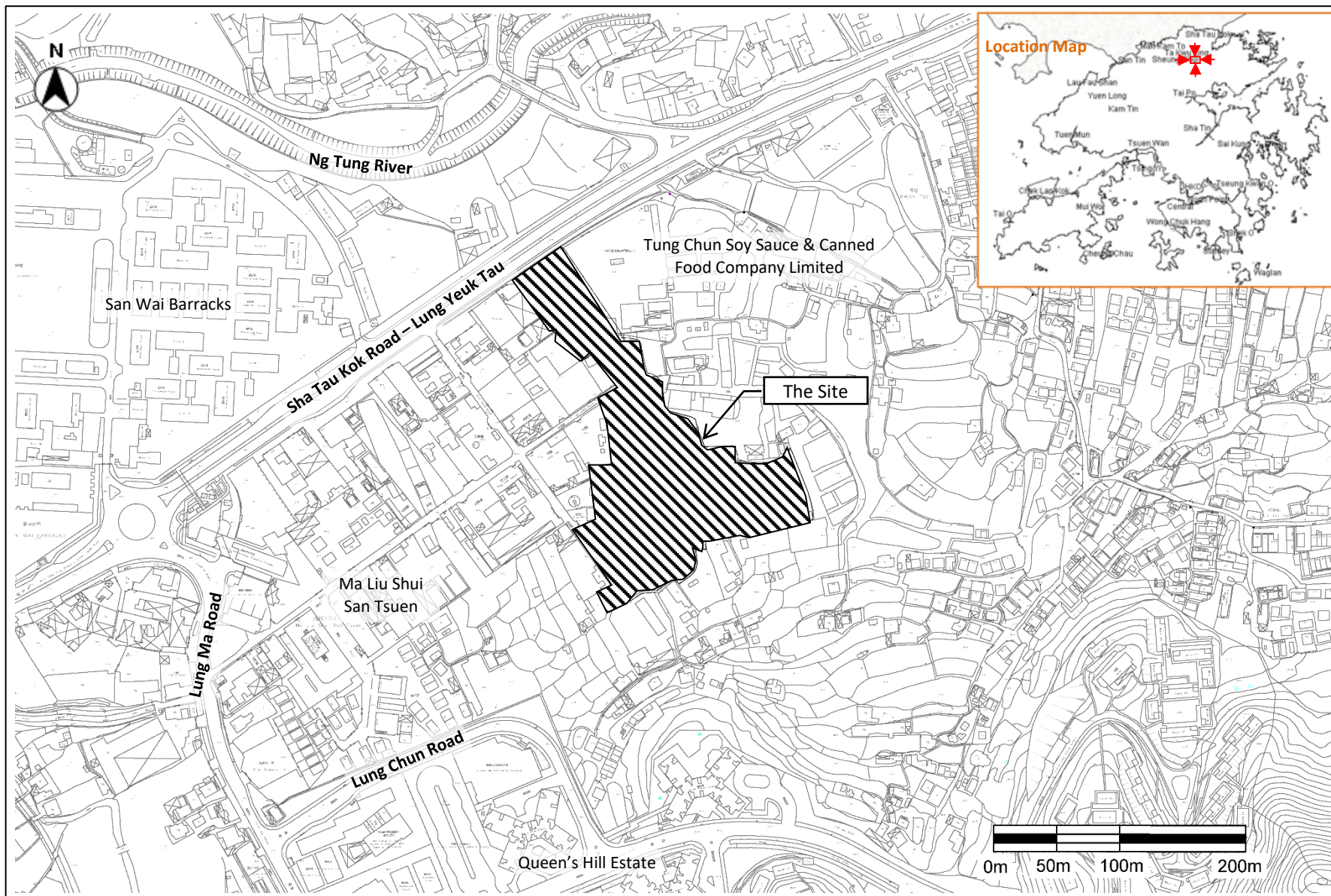
- Recommend the necessary mitigation measures to alleviate the impacts.

## 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

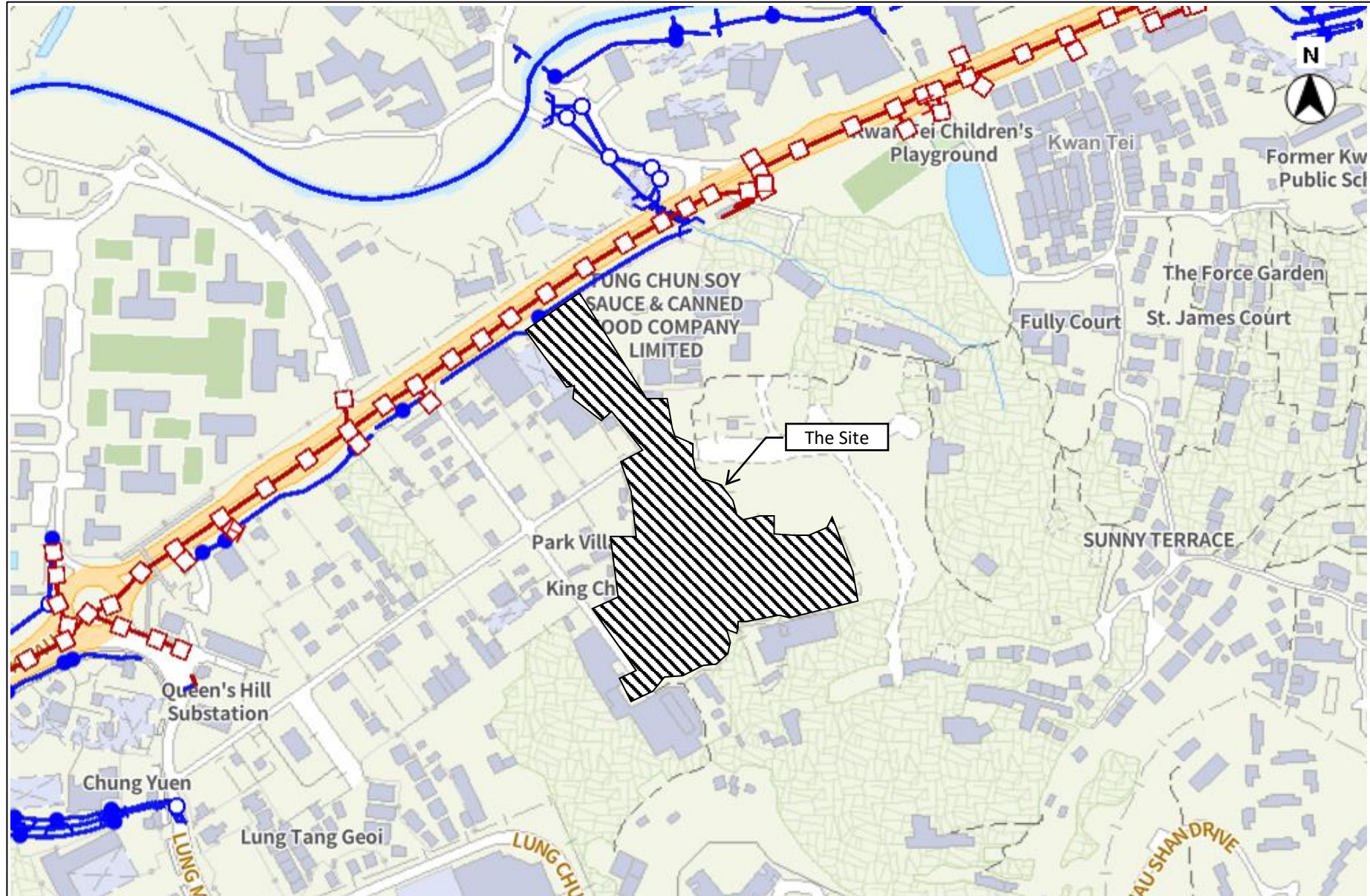
2.1.1 Based on the sewerage data of GeoInfo Map checked on 7 February 2023 and the sewerage layout plan shown on **Figure 2-1**, there is existing municipal sewerage system running along Sha Tau Kok Road (Lung Yeuk Tau) Section from the north of the Site and then to the northwest of it. Nevertheless, there is no available capacity in the existing sewerage system to cope with the sewage generated from the Proposed Development.

### 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. The effluent from the STP is proposed to be discharged via two proposed drainage pipes (including one duty pipe and one standby pipe for emergency use) to the nearby stormwater drainage system and eventually reach Ng Tung River. The estimated total daily sewage generation from the Proposed Development and capacities of the STP as well as the proposed drainage pipes 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**.

*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 <sup>3</sup> /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 <sup>2</sup>	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 <sup>2</sup> as stated in Table 8 of Commercial and Industrial Floor Space Utilization Survey.
Unit Flow Factor of Staff	0.280m <sup>3</sup> /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 <sup>2</sup>	As advised by the Applicant.
No. of Staff	113	Worker density by All Type for “Retail Trade” is 3.5 staff in 100m <sup>2</sup> as stated in Table 8 of Commercial and Industrial Floor Space Utilization Survey.
Unit Flow Factor of Staff	0.280m <sup>3</sup> /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 <sup>2</sup>	As advised by the Applicant.
No. of Staff	120	Worker density by All Type for “Restaurants” is 5.1 staff in 100m <sup>2</sup> as stated in Table 8 of Commercial and Industrial Floor Space Utilization Survey.
Unit Flow Factor of Staff	1.580m <sup>3</sup> /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 <sup>2</sup>	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 <sup>3</sup> /m <sup>2</sup> -hour	The average high rate filtration for domestic pool <sup>[Note 1]</sup>
Backwash Rate	0.81 m <sup>3</sup> /m <sup>2</sup> -min	The maximum typical backwash rate for combined air-water backwash <sup>[Note 2]</sup>
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 <sup>3</sup> /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 <sup>3</sup> /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	8 for contributing population <1,000 6 for contributing population from 1,000 to 5,000 5 for contributing population from 5,000 to 10,000 4 for contributing population from 10,000 to 50,000	Peaking factor (including stormwater allowance) for sewers is adopted as stated in Table T-5 of GESF.

**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 Results and Discussion

- 3.2.1 The calculation of the estimated sewage generation is provided in **Appendix A**. As can be seen, the total daily sewage generated from the Proposed Development is calculated to be **3005.4** m<sup>3</sup>/day during operation. **The contributing population would be 1,1131 referring to GESF.**
- 3.2.2 As mentioned in **Paragraph 2.2.2**, an on-site STP is proposed to handle the sewage from the Proposed Development. The effluent from the STP will be discharged via the proposed drainage pipe (i.e. the duty pipe) to nearby stormwater drainage system and will eventually flow to Ng Tung River. Another standby pipe is proposed to cater the capacity for the sewerage flow from the housing site only during emergency. The STP is proposed to be located on B1/F of the shopping arcade of the Proposed Development. The indicative location of the STP site and the connection between the STP and existing stormwater drainage system is shown on **Figure 3-1**. The detailed connection between the STP and receiving stormwater manhole shall be further coordinated with DSD in the detailed design stage.
- 3.2.3 The design capacity of the proposed STP is approximately **7000** m<sup>3</sup>/day with tertiary treatment standard, which could handle the estimated total daily sewage generated from the Proposed Development. **As the contributing population has exceed 10,000**, Peaking factors of **45** would be applied to all major treatment units and electrical and mechanical equipment in reference to **Table 3-1 to the Guidelines for the Design of Small Sewage Treatment Plant**. (i.e. able to handle **147,000** m<sup>3</sup>/day, with design capacity of **73,0500** m<sup>3</sup>/day) to deal with diurnal and seasonal flow variation.
- 3.2.4 All discharges from the STP are proposed to comply with the **WPCO license standards for private tertiary sewage treatment plant (for discharge into Deep Bay)**. **The combination of Membrane Bioreactor and ultra-filtration will be adopted as sewage treatment technology to help achieve the standards.** The **detailed** discharge standards are summarized in **Table 3-2**:

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

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

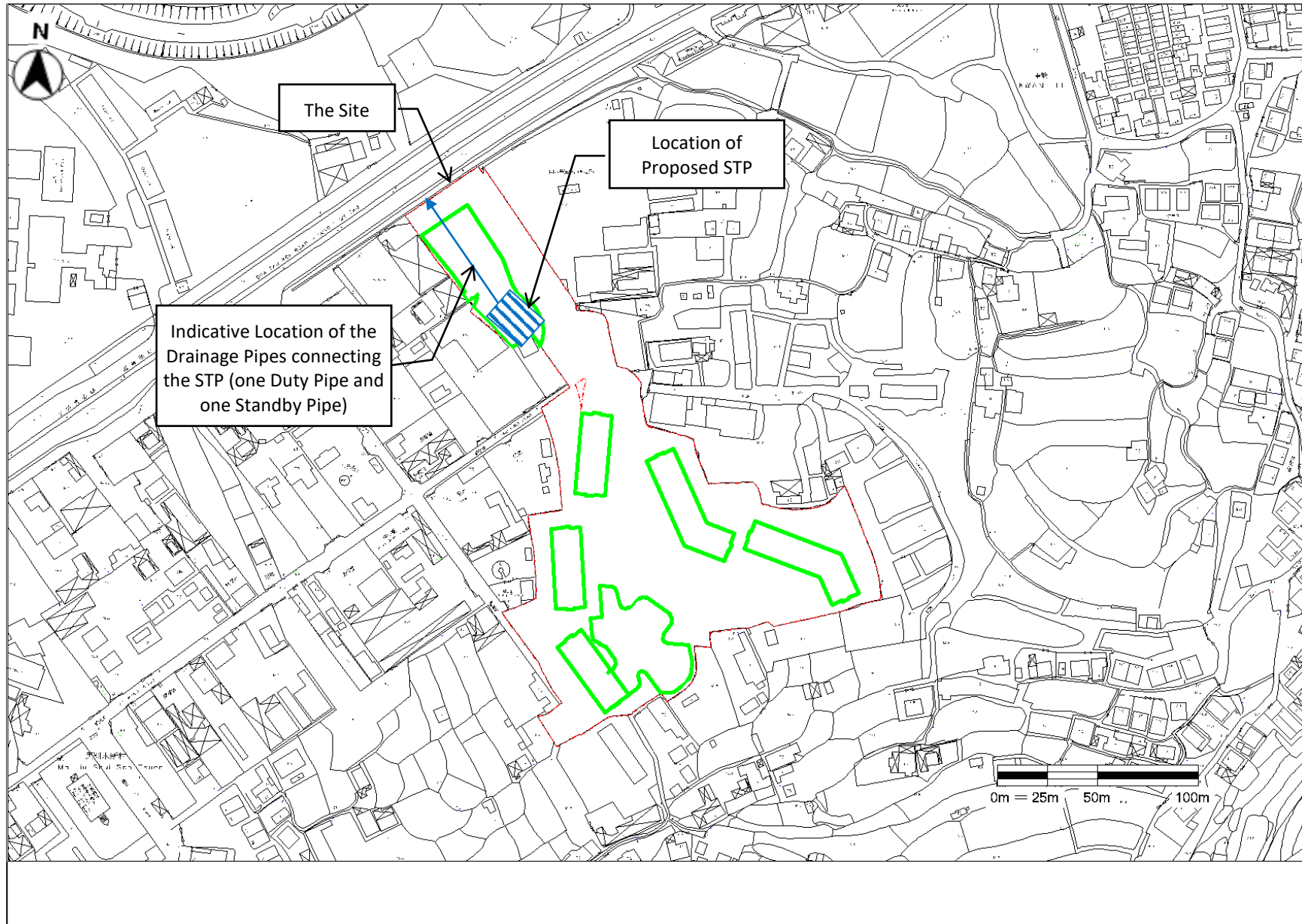
- 3.2.5 Extensive effort will be expedited to avoid the occurrence for emergency discharge. In order to achieve this, the design of STP and associated pumping system will be cautiously reviewed to include additional provisions including as follows:
- Applied peaking factors of **4** for all major treatment units and electrical and mechanical equipment (i.e., able to handle **7,000** m<sup>3</sup>/day, with design capacity of **3,500** m<sup>3</sup>/day) to avoid equipment failure;
  - 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;
  - Back-up power by mobile emergency generator will be provided in case of power failure to secure the operation of inlet pumping system to convey raw sewage to equalization tanks

for temporary storage (875m<sup>3</sup>, i.e. 6-hour storage at ADWF) to avoid sewage backflow to the Proposed Development.

- Flow measurement and level sensors will be installed and connected with alarm signaling system to keep monitoring on inflow rate to avoid sewage overflow.

- 3.2.6 To provide a mechanism to minimize the impact of emergency discharges and facilitate subsequent management of any emergency, an Emergency Response Plan will be formulated prior to commissioning of STP to set out the emergency response procedures and actions to be followed in case of equipment or sewage treatment failure. 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 and relevant parties. Regular maintenances and inspections to all treatment units, penstocks and plant facilities are necessary to maintain a good operation condition.
- 3.2.7 With the provision of the on-site STP, the treated effluent from the STP is proposed to be discharged into the stormwater drainage system. Therefore, no adverse sewerage impact from the Proposed Development is anticipated.

Figure 3-1 Indicative Location of the Proposed STP and Drainage Pipes



## 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 m<sup>3</sup>/day. An on-site Sewage Treatment Plant (“STP”) with the capacity of 7,000m<sup>3</sup>/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, via a proposed drainage pipe (with one standby pipe is proposed for emergency use).
- 4.1.3 Overall, the sewerage analysis indicates that no unacceptable sewerage impact is anticipated with the provision of on-site STP.



---

# 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

SMEC Internal Ref. 7076933 |  
D02/01  
2 November 2023

Appendix A - Calculation of Sewage Generation

Calculation of Sewage Generation from the Proposed Development, Upstream and Downstream Catchments	Remarks/ Justification	
<b>Catchment 1 - Proposed Development</b>		
<b>2a) Sewage generated by the Residential Development</b>		
<b>i. Sewage generated by Residents of the Residential Development</b>		
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 <sup>3</sup> /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 <sup>3</sup> /day	
<b>ii. Sewage generated by Staff of the Residential Development</b>		
Total Gross Floor Area (GFA) of non-domestic portion of Residential Development	= 3650 m <sup>2</sup>	As advised by the Applicant.
Staff occupancy density	= 30.3 m <sup>2</sup> /staff	Worker density Industry Group (All Type) for "Community, Social & Personal Services" is 3.3 staff in 100m <sup>2</sup> 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 <sup>3</sup> /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 <sup>3</sup> /day	
<b>Total Sewage Generation by Residents and Staff for the Proposed Residential Development</b>	<b>= 2710.9 m<sup>3</sup>/day</b>	
<b>2b) Sewage generated by the Commercial Complex</b>		
<b>i. Sewage generated by Staff of Retail Shops of the Commercial Complex</b>		
Total Gross Floor Area (GFA) of Retail Shops of the Commercial Complex	= 3220 m <sup>2</sup>	As advised by the Applicant.
Staff occupancy density	= 28.6 m <sup>2</sup> /staff	Worker density Industry Group (All Type) for "Retail Trade" is 3.5 staff in 100m <sup>2</sup> 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 <sup>3</sup> /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 <sup>3</sup> /day	
<b>ii. Sewage generated by Staff of Restaurants of the Commercial Complex</b>		
Total Gross Floor Area (GFA) of Restaurants of the Commercial Complex	= 2390 m <sup>2</sup>	As advised by the Applicant.
Staff occupancy density	= 19.6 m <sup>2</sup> /staff	Worker density Industry Group (All Type) for "Restaurants" is 5.1 staff in 100m <sup>2</sup> 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 <sup>3</sup> /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 <sup>3</sup> /day	
<b>Total Sewage Generation by Staff of the Commercial Complex</b>	<b>= 224.4 m<sup>3</sup>/day</b>	
<b>2c) Sewage generated by the Clubhouse</b>		
<b>i. Sewage generated by Staff of Clubhouse</b>		
Total Gross Floor Area (GFA) of the Clubhouse	= 3650 m <sup>2</sup>	Worker density Industry Group (Private Commercials) for "Community, Social & Personal Services" is 3.3 staff in
Staff occupancy density	= 2.3 staff/100m <sup>2</sup>	
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 <sup>3</sup> /day/staff	
Total Sewage Generation by the Staff at Clubhouse	= 23.52 m <sup>3</sup> /day	
<b>2d) Wastewater generated from Swimming Pool in the Clubhouse</b>		
Approximate Area of Swimming Pool	= 525.4 m <sup>2</sup>	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 <sup>3</sup>	
Time for Completely Changing Water	= 6 hours	The minimum turnover time in ref. 3.
Turnover Rate	= 109.5 m <sup>3</sup> /hour	
Filtration Rate	= 40 m <sup>3</sup> /m <sup>2</sup> -hour	The average high rate filtration for domestic pool in ref. 4.
Filter Area	= 2.7 m <sup>2</sup>	
No. of Filters used for Filtration	= 1	
Backwash Rate	= 0.81 m <sup>3</sup> /m <sup>2</sup> -min	The maximum typical backwash rate for combined air-water backwash in Table 11-12 of ref. 5.
<b>Estimated flow from the Swimming Pool</b>	<b>= 15.5 m<sup>3</sup>/day</b>	7 minutes for cleaning the filter by backwashing water excluding the air scouring time is recommended in B8.5.5 of
	<b>= 0.18 Vs</b>	
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 <sup>3</sup> /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 <sup>3</sup> /day	Divided from assuming shower under usage all the time in operation hours of Clubhouse
<b>Estimated flow from the Swimming Pool Shower Facilities</b>	<b>= 54.6 m<sup>3</sup>/day</b>	
	<b>= 0.63 m<sup>3</sup>/day</b>	
Catchment Inflow Factor	= 1.0	Catchment inflow factor of North District, ref.1.
<b>Total sewage generated from Catchment 1 (Proposed Development)</b>	<b>= 3005.4 m<sup>3</sup>/day</b>	

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

local people  
global experience

---

SMEC is recognised for providing technical excellence and consultancy expertise in urban, infrastructure and management advisory. From concept to completion, our core service offering covers the life-cycle of a project and maximises value to our clients and communities. We align global expertise with local knowledge and state-of-the-art processes and systems to deliver innovative solutions to a range of industry sectors.