Appendix 8

Sewerage Impact Assessment (SIA)

SECTION 16 PLANNING APPLICATION FOR PROPOSED SOCIAL WELFARE FACILITY (RESIDENTIAL CARE HOME FOR THE ELDERLY (RCHE)) IN LOT 669 S.A SS.2 RP (PART) AND LOT 669 S.B RP (PART) IN D.D.117, YUEN LONG

SEWERAGE IMPACT ASSESSMENT

February 2024

Report No: RT23044-SIA-01_v0

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Project:	SECTION 16 PLANN	ING APPLICATION FOR PRO	POSED SC	CIAL WELFA	RE FACILITY
	(RESIDENTIAL CARE	HOME FOR THE ELDERLY (F	RCHE)) IN LO	DT 669 S.A SS	6.2 RP (PART)
	AND LOT 669 S.B RP	(PART) IN D.D.117, YUEN LON	NG		
	SEWERAGE IMPACT	ASSESSMENT			
Report No.:	Ref: RT23044-SIA-01_	_v0			
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0	16/02/2024	Issued for Comment	KCC	ZC	НМ

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- This report is prepared and submitted by Beexergy Consulting Limited with all reasonable skill to the best of our knowledge, incorporating our Terms and Conditions and taking account of the resources devoted to it by agreement with the client.
- We disclaim any responsibility to the client and others in respect of any matters outside the project scope.
- This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this
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Zoelhan

Zoe Chan Technical Manager



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1 INTRODUCTION

1.1 **PROJECT BACKGROUND**

- 1.1.1. The Turbo Regal Limited (the Project Proponent) is proposed to develop the Social Welfare Facility (Residential Care Home for The Elderly) at Lot 669 S.A ss.2 RP (Part) and Lot 669 S.B RP (Part) in D.D.117, Yuen Long (hereafter refer to the Proposed Development).
- 1.1.2. BeeXergy Consulting Limited was appointed by DeSPACE (International) Limited (the Town Planner) to conduct a Sewerage Impact Assessment (SIA) for the Proposed Development to support the application under Section 16 of the Town Planning Ordinance. The latest architectural drawings and technical information on the Project Site were largely provided by the Project Architect.

1.2 **PROJECT LOCATION**

1.2.1. The Project Site is located at Wong Nai Tun Tsuen, Tai Tong, Yuen Long, bounded by a nullah to the East, farmland to the West, and low-rise residential buildings to the North and South. Figure 1 shows the location of the Project Site and its surrounding area.

1.3 DESCRIPTION OF THE SUBJECT SITE AND PROPOSED DEVELOPMENT

1.3.1. The Project Site area is approximately 2,244m². The Proposed Development is an 8storey building consisting of car parks, kitchen, rehabilitation areas, dormitories, multipurpose rooms, and utility rooms. The master layout plan provided by the Project Architect is enclosed in **Appendix A**.



2 SEWERAGE IMPACT ASSESSMENT

2.1 SCOPE OF WORKS

2.1.1. The objective of this SIA is to assess whether the capacity of the sewerage networking is sufficient to cope with the peak sewage flow arising from the Proposed Development during its operation stage or not and to recommend appropriate mitigation measures to alleviate unacceptable sewerage impact, if any.

2.2 EXISTING SEWERAGE FACILITIES

- 2.1.2. The existing sewerage record from the Lands Department (LandsD) and Drainage Service Department (DSD) are obtained for this SIA and attached in **Figure 2**. There are no existing manholes located within the Project Site. The closest manhole is FHM1035122 which is located approximately 27m away from the boundary of the Project Site.
- 2.1.3. A site survey to identify the existing site condition and surrounding environment was conducted on 11 December 2023. The existing footbridge to the East of the Project Site (+15.3mPD, based on topographic data from the LandsD) is approximately 3.6m above the existing nullah while an unknown pipe with concrete footings was observed at approximately 2.4m above the nullah. Given the above observation and reference to DSD's sewerage connection at Shan Ha Road (FWD1012009), a 2.4m headroom (above the nullah) will be reserved for the sewerage connection across the existing nullah to avoid impact on the nullah's drainage capacity. The site survey record is enclosed in **Appendix B**. Reference case showing the sewerage connection at Shan Ha Road is shown in **Appendix C**.
- 2.1.4. A new terminal manhole (namely S1) will be built to collect the sewage generated from the Proposed Development and connect to the existing manhole FMH1035122 via a 225mm diameter sewer pipe. A 2.4m headroom (above the nullah) will be reserved for the sewerage connection across the existing nullah. The capacity check of the sewer will start from the proposed terminal manhole S1.
- 2.1.5. The location of the proposed termination manhole and connection are shown in Figure 3.

2.3 ASSESSMENT CRITERIA, METHODOLOGY, AND ASSUMPTIONS

2.3.1. The Unit Flow Factors and Global Peaking Factor are adopted from the figures in the Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (Version



1.0)¹ (GESF) issued by the Environmental Protection Department (EPD) in March 2005 to estimate the sewage flows generated from the Project Site.

2.3.2. The Unit Flow Factors and Catchment Inflow Factors as shown in **Table 2.1** below are adopted in the assessment and the surrounding catchments are shown in **Figure 4**.

Parameter	Value	Justification
Population		
Residents in Proposed	360 people	A maximum of 360 bed spaces can be provided
Development		according to proposed development scheme.
Visitors in Proposed	720 people	Assume 2 visitors will visit the resident once per
Development		month.
Employees in Proposed	108 people	Estimated staff at 30% of the residential
Development		population.
Kitchen Operation in	18 people	Estimated staff at 5% of the residential
Proposed Development		population.
Total Residents in	2749 people	2.9 number of persons in average domestic
Catchment A		household size for "Yuen Long – Shap Pat
		Heung West" based on 2021 Population
		Census's Main Table D304.
Total Residents in	296 people	2.9 number of persons in average domestic
Catchment B		household size for "Yuen Long – Shap Pat
		Heung West" based on 2021 Population
		Census's Main Table D304.
Total Residents in	122 people	2.9 number of persons in average domestic
Catchment C		household size for "Yuen Long – Shap Pat
		Heung West" based on 2021 Population
		Census's Main Table D304.
Total Residents in	270 people	2.9 number of persons in average domestic
Catchment D		household size for "Yuen Long – Shap Pat
		Heung West" based on 2021 Population
		Census's Main Table D304.
Total Residents in	113 people	2.9 number of persons in average domestic
Catchment E		household size for "Yuen Long – Shap Pat

Table 2.1	Unit Flow	Factors and	Catchment	Inflow Fact	tors Extracted	from GESE
		i actors anu	Catchinent	innow i ac		

¹ <u>http://www.epd.gov.hk/epd/sites/default/files/epd/english/environmentinhk/water/guide_ref/files/gesf.pdf</u>



		Heung West" based on 2021 Population
		Census's Main Table D304.
Total Residents in	35 people	2.9 number of persons in average domestic
Catchment F		household size for "Yuen Long – Shap Pat
		Heung West" based on 2021 Population
		Census's Main Table D304.
Total Workers in	385 people	0.4 workers per GFA (in 100m ²) based on Table
Catchment G		8 "Storage (All Types)" in the Commercial and
		Industrial Floor Space Utilization Survey
		(CIFSUS) published by the Planning
		Department in 2005.
Total Residents in	9 people	2.9 number of persons in average domestic
Catchment H		household size for "Yuen Long – Shap Pat
		Heung West" based on 2021 Population
		Census's Main Table D304.
Unit Flow Factors	-	-
Residents and Visitors in	0.19m³/day	"Institutional and special class" based on EPD's
Proposed Development		GESF Table T-1.
Employees in Proposed	0.28m³/day	J11 "Community, Social & Personal Services"
Development		based on EPD's GESF Table T-2.
Kitchen Operation in	1.58m³/day	"Commercial employee" and "J10 Restaurants
Proposed Development		& Hotels" based on EPD's GESF Table T-2.
Residents in Catchments	0.27m³/day	"Modern Village" based on EPD's GESF Table
A, B, C, D, E, F, and H		T-1.
Workers in Catchment G	0.18m³/day	"Commercial employee" and Commercial
		activities of "J3 Transport, Storage &
		Communication" based on EPD's GESF Table
		T-2
Catchment Inflow Factor (P _{CIF})	
Discharge from the	1.0	Yuen Long Catchment based on EPD's GESF
Project Site and all		Table T-4.
Catchments		
Note:		
The characteristics of Catchments a	re determined based	on the dominant landuse within the Catchments (Catchments A to
F: Residential; Catchment G: Open	Storage).	



- 2.3.3. With reference to Table T-5 of GESF, a global peaking factor of 8 and 6 (including stormwater allowance) are adopted according to the contributing population.
- 2.3.4. With reference to Table 5 in the Sewerage Manual (Part 1)² issued by the DSD in May 2013, slimed sewer of k_s of 0.6mm under "Poor" condition is assumed for both the sewers from the Subject Site and existing sewerage system in the worst-case scenario. The Colebrook-White Equation will be used to analyse the flow conditions. Equation (ii) for circular pipes flowing partially full is adopted to estimate the sewage flow for the Subject Site and following sewers.

2.4 RESULTS AND DISCUSSION

- 2.4.1. The estimated average flow rate and total peak flow of the Proposed Development are approximately 263.880m³/day and 24.43L/s.
- 2.4.2. Sewage generated from the Proposed Development and surrounding catchment areas will be connected at the downstream of sewage network. The cumulative flow is generally no more than 65.5% of sewer capacity and no adverse sewerage impacts to the existing sewerage system are identified. Therefore, no upgrading or improvement works of the sewerage system are required. Details of the sewage calculation are included in **Appendix D**.

² <u>http://www.dsd.gov.hk/EN/Files/Technical_Manual/technical_manuals/Sewerage_Manual_1_Eurocodes.pdf</u>



3 CONCLUSION

- 3.1.1. A Social Welfare Facility (Residential Care Home for the Elderly) is proposed to develop at Lot 669 S.A ss.2 RP (Part) and Lot 669 S.B RP (Part) in D.D.117, Yuen Long. This is the SIA to support the application under Section 16 of the Town Planning Ordinance.
- 3.1.2. Based on the SIA results, it is found that the existing sewerage system serving the area has sufficient capacity to cater for the sewage generation from the proposed development and the surrounding catchment areas. Adverse sewerage impacts are not anticipated, and thus no upgrading or improvement works are required.







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EXISTING SEWERAGE SYSTEM

FIGURE 2





\\BEEXERGY_NAS\Proj.Work\23_Work\DeSpace - EA for RCHE Development at Tai Tong (W23044)\PREP\Deliverables\SIA Report\RT23044-SIA-01_v0\QGIS\RT23044-SIA-01_qgz







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FIGURE 4 SURROUNDING CATCHMENTS





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APPENDIX A MASTER LAYOUT PLAN





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APPENDIX B SITE SURVEY RECORD





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APPENDIX C REFERENCE CASE AT SHA HA ROAD





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APPENDIX D SEWAGE CALCULATION AND HYDRAULIC CAPACITY CHECK

APPENDIX C - CALCULATION OF SEWAGE FLOW

Development	GFA (m²)	No. of Flat	Occupancy Density ^{(a). (b)} (Number of Persons) (Workers per GFA in 100m ²)	Estimated Population	Unit Flow Factor (m ³ /day)	Estimated Average Dry Weather Flow (m ³ /day)	Catchment Inflow Factor	Estimated Average Dry Weather Flow X Catchment Inflow Factor (m ³ /day)	Remarks						
1) Proposed Development															
Proposed Development Resident		-	-	360	0.19	68.400		68.400	Estimated Population: The proposed development scheme will provide a maximum of 360 bed spaces. Unit Flow Factor: 0.190m ³ /day for 'Institutional and special class' based on EPD's GESF Table T-1						
Proposed Development Community, Social & Personal Services Visitor	+	-	-	720	0.19	136.800		136.800	Estimated Population: Assume 2 visitors will visit the resident per visit. Unit Flow Factor: 0.190m ³ /day for 'Institutional and special class' based on EPD's GESF Table T-1						
Proposed Development Community, Social & Personal Services Employee	10000	-	-	108	0.28	30.240	1.0	30.240	Estimated Population: Estimated staff at 30% of the residential population. Unit Flow Factor: 0.280m ³ /day for "Commercial employee" and "Commercial activities of "J11 Community, Social & Personal Services" based on EPD's GESF Table T-2.						
Proposed Development Kitchen Operation	1	-	-	18	1.58	28.440		28.440	Estimated Population: Estimated staff at 5% of the residential population. Unit Flow Factor: 1.58m ³ /day for "Commercial employee" and "Commercial activities" of "J10 Restaurants & Hotlets' based no EPD's GESF Table T-2.						
	Tota	Avaerage	Daily Dry Weather Flow of Propos	ed Development (m ³ /day)	1		263.880							
2) Catchment A								1							
Residential Area to the along Kiu Hing Road	-	948	2.9	2749	0.27	742.284	1.0	742.284	No. of Flat is estimated by the equation: No. of Building x No. of Storey Occupancy Density: 2.9 Number of persons in average domestic household size for "Yuen Long - Shap Pat Heung West 'based on 2021 Population Census' is Multi Table D304. Unit Flow Factor: 0.270m ³ /day for 'Modern village' based on EPD's GESF Table T-1.						
		Total Avae	rage Daily Dry Weather Flow of C	atchment A (m ³ /da	v)			742.284							
3) Catchment B		Total Arta	rage baily bry freaker rion of o		.,,			142204							
Residential Area to the along Kiu Hing Road	-	102	2.9	296	0.27	79.866	1.0	79.866	No. of Flat is estimated by the equation: No. of Building x No. of Storey Occupancy Density: 2.9 Number of persons in average domestic household size for "Yuen Long - Shap Pat Heung West" based on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.270m ³ /day for 'Modern village' based on EPD's GESF Table T-1.						
	1	Total Avae	rage Daily Dry Weather Flow of C	atchment B (m ³ /da	v)			79.866							
3) Catchment C				,	,,										
Residential Area to the along Kiu Hing Road	-	42	2.9	122	0.27	32.886	1.0	32.886	No. of Flat is estimated by the equation: No. of Building x No. of Storey Occupancy Density: 2.9 Number of persons in average domestic household size for "Yuen Long - Shap Pat Heung West" based on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.270m ³ /day for 'Modern village' based on EPD's GESF Table T-1.						
		Total Avae	rage Daily Dry Weather Flow of C	atchment C (m ³ /da	y)	1		32.886							
4) Catchment D								•							
Residential Area to the along Kiu Hing Road	-	93	2.9	270	0.27	72.819	1.0	72.819	No. of Flat is estimated by the equation: No. of Building x No. of Storey Occupancy Density: 2.9 Number of persons in average domestic household size for "Yuen Long - Shap Pat Heurgy West 'Board on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.270m ³ day for Modern village' based on EPD's GESF Table T-1.						
			D.1. D. 10					70.040							
5) Catchment E		TOTAL AVAG	rage Daily Dry weather Flow of C.	atchiment D (m /da	(y)			72.015							
Residential Area to the along Kiu Hing Road	-	39	2.9	113	0.27	30.537	1.0	30.537	No. of Flat is estimated by the equation: No. of Building x No. of Storey Occupancy Density: 2.9 Number of persons in average domestic household size for "Yuen Long - Shap Pat Heung West" based on 2021 Population Census's Main Table D394. Unit Flow Factor: 0.270m ³ /day for 'Modern village' based on EPD's GESF Table T-1.						
		Total Avae	rage Daily Dry Weather Flow of C	atchment E (m ³ /da	y)			30.537							
6) Catchment F	1		1			1		I.							
Residential Area to the along Kiu Hing Road	-	12	2.9	35	0.27	9.396	1.0	9.396	No. of Hait is estimated by the equation: No. of Building X.No. of Storey Occupancy Density: 2.9 Number of persons in average domestic household size for "Yuen Long - Shap Pat Heung West "based on 2021 Population Census" Shan Table D394. Unit Flow Factor: 0.270m ³ day for Modern village' based on EPD's GESF Table T-1.						
		Total Avag	rage Daily Dry Weather Flow of C	atchment F (m3/da	(N)			9 206							
7) Catchment G		Total Avad	rage baily biy weather now or ca	atenment i (moida	y)			9.596							
Open Storage and Workshop along Kung Um Road	96250	-	0.4	385	0.18	69.300	1.0	69.300	GFA is estimated based on the desktop study. Occupancy Density: 0.4 workers per GFA (in 100m ²) based on Table 8 "Storage (All Types)" in the Commercial and Industrial Floor Space Utilization Survey (CFSUS) published by the Planning Department in 2005. Unit Flow Factor: 0.180m ³ /day for "Commercial employee" and Commercial activities of "J3 Transport, Storage & Communication" based on EPD's GESF Table T-2						
		Total Avae	rage Daily Dry Weather Flow of C	atchment G (m ³ /da	y)			69.300							
8) Catchment H						1									
Residential Area to the along Kiu Hing Road	-	3	2.9	9	0.27	2.349	1.0	2.349	No. of Flat is estimated by the equation: No. of Building x No. of Storey Occupancy Density: 2:9 Number of persons in average domestic household size for "Yuen Long - Shap Pat Heung West David on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.270m ³ /day for 'Modern village' based on EPD's GESF Table T-1.						
	•	Total Avae	rage Daily Dry Weather Flow of C	atchment H (m ³ /da	iy)			2.349							

Note: (a) "Number of Persons" was adopted in the estimation of population for Catchment A to F and G

(b) "Workers per GFA in 100m²ⁿ was adopted in the estimation of population for Catchment H.

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Appendix C - Hydraulic Capacity of the Proposed and Downstream Sewers

Manhole	Cover Level	Manhole	Cover Level	Sewer	Pipe Dia.	Pipe Length	Upstream Invert Level	Downstream Invert Level	g ⁽¹⁾	k, ^{(1), (3)}	s ⁽¹⁾	v ⁽¹⁾	V (1), (2)	Α	Q ⁽⁴⁾	Estimated Capacity	ADWF	Contributing	Peaking	Peak Flow	Capacity	Compliance	Romarke
Reference	mPD	Reference	mPD	Reference	mm	m	mPD	mPD	m/s ²	m		m²/s	m/s	m²	m³/s	L/s	m³/day	Population	Factor	L/s	%	Compliance	Remarks
S1	+15.400	FMH1035122	+15.189		225	26.7	+14.400	+14.000	9.81	0.0006	0.0150	1.31E-06	1.5990	0.0398	0.0636	63.58	263.88	1206	8	24.43	38.4%	Yes	Project Site
FMH1035122	+15.189	FMH1035123	+15.454	FWD1042662	450	46.3	+10.859	+10.708	9.81	0.0006	0.0033	1.31E-06	1.1518	0.1590	0.1832	183.19	1006.16	3955	6	69.87	38.1%	Yes	Project Site + Catchment A
FMH1035123	+15.454	FMH1035124	+15.201	FWD1042663	450	28.5	+10.691	+10.546	9.81	0.0006	0.0051	1.31E-06	1.4426	0.1590	0.2294	229.43	1086.03	4251	6	75.42	32.9%	Yes	Project Site + Catchment A + B
FMH1035124	+15.201	FMH1035125	+14.920	FWD1042664	450	28.7	+10.481	+10.360	9.81	0.0006	0.0042	1.31E-06	1.3117	0.1590	0.2086	208.62	1118.92	4373	6	77.70	37.2%	Yes	Project Site + Catchment A + B + C
FMH1035125	+14.920	FMH1035126	+14.773	FWD1042665	450	41.5	+10.354	+10.213	9.81	0.0006	0.0034	1.31E-06	1.1759	0.1590	0.1870	187.03	1191.74	4643	6	82.76	44.3%	Yes	Project Site + Catchment A + B + C + D
FMH1035126	+14.773	FMH1035127	+14.825	FWD1042666	450	44.3	+10.157	+10.010	9.81	0.0006	0.0033	1.31E-06	1.1619	0.1590	0.1848	184.80	1222.27	4756	6	84.88	45.9%	Yes	Project Site + Catchment A + B + C + D + E
FMH1035127	+14.825	FMH1035128	+14.894	FWD1042667	450	16.8	+9.729	+9.609	9.81	0.0006	0.0071	1.31E-06	1.7122	0.1590	0.2723	272.32	1231.67	4756	6	85.53	31.4%	Yes	Project Site + Catchment A + B + C + D + E + F
FMH1035128	+14.894	FMH1035129	+14.798	FWD1042668	450	29.5	+9.249	+9.194	9.81	0.0006	0.0019	1.31E-06	0.8671	0.1590	0.1379	137.91	1300.97	4756	6	90.35	65.5%	Yes	Project Site + Catchment A + B + C + D + E + F + G
FMH1035129	+14.798	FMH1035130	+14.552	FWD1042669	450	30.6	+9.186	+9.084	9.81	0.0006	0.0033	1.31E-06	1.1646	0.1590	0.1852	185.22	1303.32	4756	6	90.51	48.9%	Yes	Project Site + Catchment A + B + C + D + E + F + G + H

Note:

(1) g=gravitational acceleration; k_s=equivalent sand roughness; s=gradient; v=kinematic viscosity of water; V=mean velocity

(2) The mean velocity (V) is claculated by the Colebrook-White Equation for circular pipes:

$$V = -\sqrt{(8gD_{S})} \log(\frac{ks}{3.7D} + \frac{2.51v}{D\sqrt{(2gD_{S})}})$$

where V = mean velocity (m/s)

g = gravitational acceration (m/s²) D = internal pipe diameter (m) s = slope

ks = roughness coefficient(m)

v = kinematic viscosity of fluid (m²/s)

(3) The value of k_a = 0.6mm is used for the calculation of existing pipe for conservative approach and 0.6mm for proposed new clayware pipe in poor condition based on DSD's "Sewerage Manual" Table 5: Recommended roughness values

(4) Peak flow (Q) is calculated by Q = V x A