Drainage Impact Assessment for Proposed Residential Care Home for the Elderly (RCHE) Development at Tung Tsz, Tai Po

C241003W-02-A

PREPARED FOR

R LEE Architects (HK) Ltd

PREPARED BY

Eddy Ng
BSc(Hons), MHKIOA, MIOA, MMOIA, MIET,
MAES, MASHRAE, MHKIEIA, REnv, BEAM Pro

APPROVED BY

Wong Kam San
MSc, CEng, MIOA,
MHKIOA, AFCHKRI, MHKIEIA, MHKIQEP

27 December 2024

Contents

1. Background

The applicant, R Lee Architect, intends to develop one 10-storey building block situated at Tung Tyz, Tai Po, New Territories for the Proposed Residential Care Home for the Elderly (RCHE) Development.

The purpose of this report is to conduct a Drainage Impact Assessment (DIA) to assess the potential sewerage impact arising from the proposed development.

2. Objective

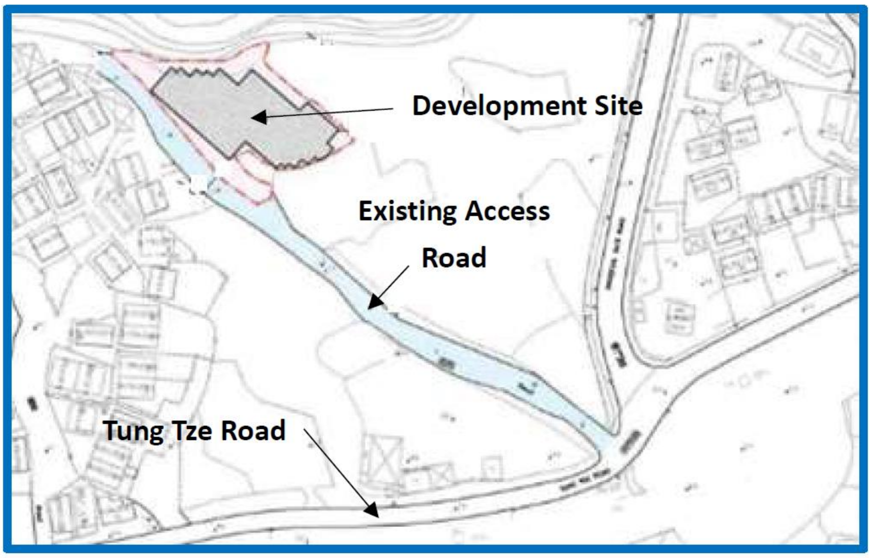
These DIA objectives are to assess the potential sewerage impact arising from the proposed development and recommend mitigation measures, if necessary, to alleviate the impacts.

3. Site Information

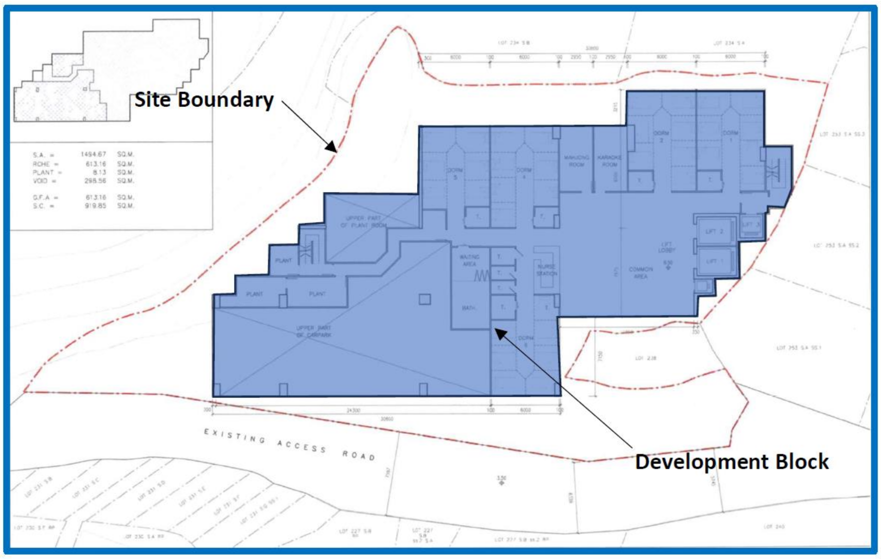
The Premise: D.D.23, Lot 232RP, 232 S.A. RP, 232 S.A.ss. 1 to 14, 232 S.B. RP, 232 S.B. ss 1 to 2, 232 S.C. to 232 S.E., 233 RP, 233 S.A to 233 S.M., 237 S.R. 238, 239 RP, 239 SG.

Address: Tung Tsz, Tai Po

Location Plan:



Development Plan:



Development Schedule: Proposed Residential Care Home for the Elderly (RCHE) Development

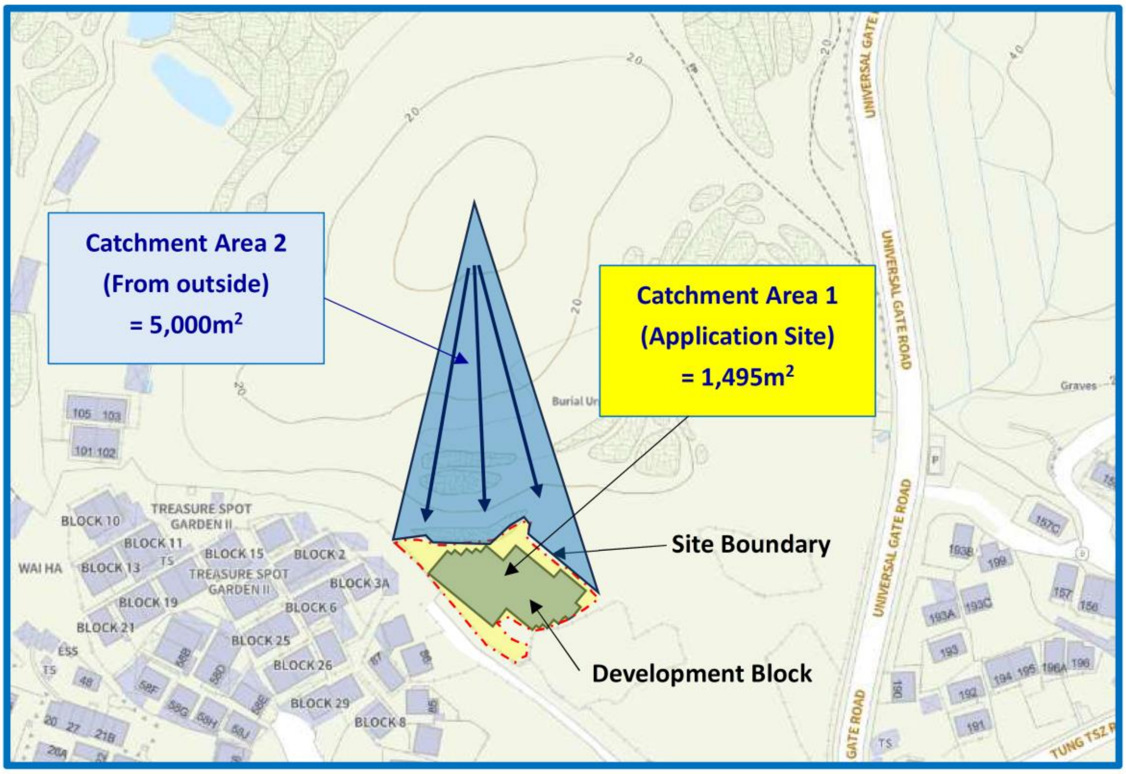
Site Area:	1,494.67m^2
Class of Site:	A
Proposed Plot Ratio for Non-domestic:	5.57 < 9.5
Proposed Site Coverage above for Non-domestic (Above 15m):	61.09% < 80%
Proposed Building Height:	34.50mPD
Absolute Height:	31.0m
Proposed No. of storey:	10 storeys

Proposed Gross Floor Area

LG/F (ENTRANCE & CARPARK)	:	606.13m²	
UG/F (RCHE)	:	613.16 m²	
1/F-5/F (RCHE)	:	916.89m² x 5 storeys = 4584.45 m²	(45 no. of beds x 5 storey)
6/F (RCHE)	:	886.14 m²	(17 no. of suites)
7/F (RCHE)	:	759.44 m²	(11 no. of suites)
8/F (MANAGEMENT OFFICE)	:	764.44 m²	
R/F (SKY GARDEN)	:	110.07 m²	
TOTAL	:	**8323.83 m² (89597 ft²) (28 no. of suites & 225 no. of beds)**	

4. Drainage Impact Assessment

i) Catchment Areas



Catchment Area 1 (Application Site) = 1,495m^2
Catchment Area 2 (From the adjacent hillside) = 5,000m^2

ii) Design Manuel
DSD - STORMWATER DRAINAGE MANUAL

iii) Design Method
a) Rational Method (DSD STORMWATER DRAINAGE MANUAL 7.5.2)
Qp = 0.278CiA
Where
Qp = peak runoff in m^3/s
C = runoff coefficient (dimensionless)
i = rainfall intensity in mm/hr
A = catchment area in km^2

b) Runoff Coefficient
In Hong Kong, a value of C = l.0 is commonly used in developed urban areas. In less developed areas, appropriate C values in order to ensure that the design would be fully cost-effective.

Surface Characteristics	**Runoff coefficient, C***
Asphalt	0.70-0.95
Concrete	0.80-0.95
Brick	0.70-0.85
Grassland (heavy soil**)	
Flat	0.13-0.25
Steep	0.25-0.35
Grassland (sandy soil)	
Flat	0.05-0.15
Steep	0.15-0.20

The surface of the site will be covered by Asphalt, the C1 should be 0.85 (Mid value) and the surface of the adjacent hill side is Grassland (heavy soil, the C2 should be 0.15.

c) 6.6.1 Village Drainage and Main Rural Catchment Drainage Channels
'Village Drainage' refers to the local stormwater drainage system within a village. A stormwater drain conveying stormwater runoff from an upstream catchment but happens to pass through a village may need to be considered as either a 'Main Rural Catchment Drainage Channel' or 'Village Drainage', depending on the nature and size of the upstream catchment. In any case, the impact of a 50-year event should be assessed in the planning and design of village drainage system to check whether a higher standard than 10 years is justified. (50 Years is used.)

d) Rainfall Intensity

Table 2d – Intensity-Duration-Frequency (IDF) Relationship of North District Area
for durations not exceeding 240 minutes

Duration (min)	Extreme Intensity x (mm/h) for various Return Periods T(year)						
	2	5	10	20	50	100	200
240	28.5	37.7	43.4	48.6	54.9	59.4	63.6
120	42.2	54.7	62.5	69.6	78.4	84.7	90.8
60	61.0	75.7	84.3	92.0	101	108	114
30	84.0	100	110	118	128	135	142
15	106	127	139	150	163	173	182
10	119	141	155	168	184	196	208
5	138	161	177	193	216	234	254

i (rainfall intensity) = 101mm/hr (Duration of 60min is used)

e) Calculations of Water Flow

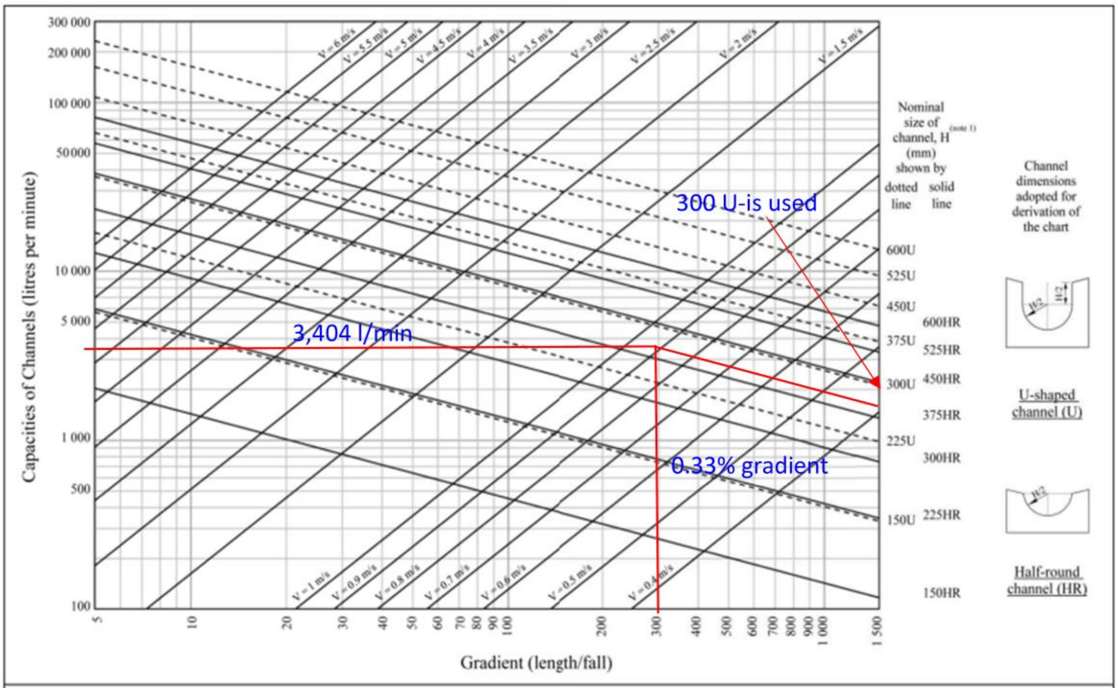
Qp = 0.278CiA
C1 = 0.85 (Asphalt)(mid value) (Application Site)
C2 = 0.15 (Grass Land (Sandy Soil) (Adjacent Area)
i = 101 mm/hr
A1 = 1,495m^2 (0.001495km^2) (Application Site)
A2 = 1,200m^2 (0.001200km^2) (Adjacent Hill Side)
Qp = 0.278 x 101 x ((0.85 x 0.001495) +(0.15 x 0.005000))
Qp =0.0567 m^3/s or 3,404 l/min

For conservative calculations, all catchment areas are combined for all U-Channels.

f) Design of U-channel

GEO Technical Guidance Note No. 43 (TGN 43) Guidelines on Hydraulic

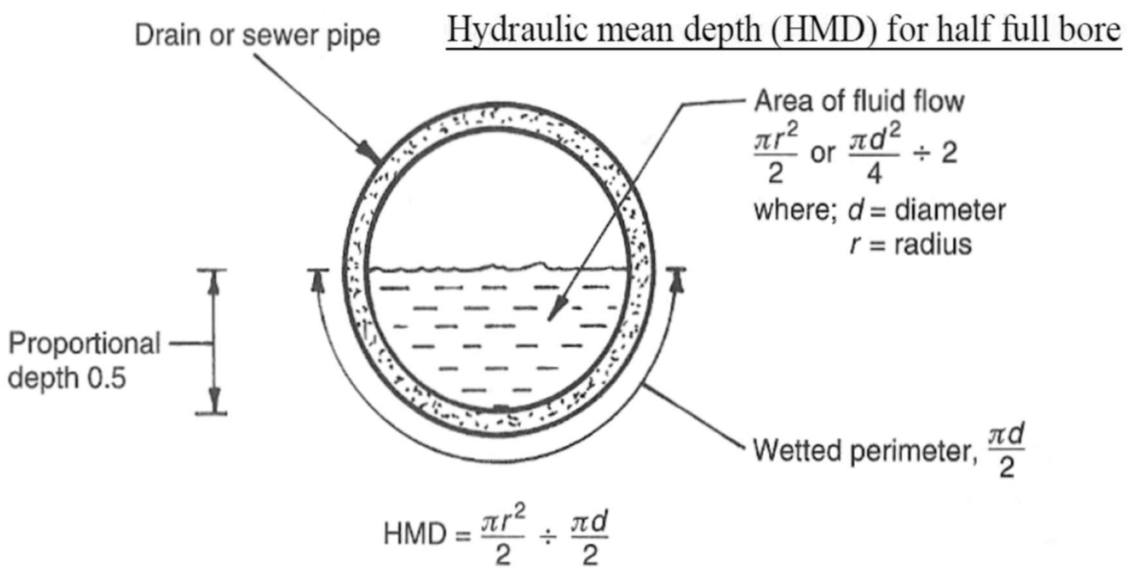
Figure 1 - Chart for the rapid design of U-shaped and half-round channels up to 600 mm



Note: (1) Refer to the latest CEDD Standard Drawings for the details of U-shaped (U) and half-round (HR) channels.

For 3,404 l/min, 300 U-channel is used

f) Design of Pipe



Depth of flow	HMD
0.25	Pipe dia. (m) / 6.67
0.33	Pipe dia. (m) / 5.26
0.50	Pipe dia. (m) / 4.00
0.66	Pipe dia. (m) / 3.45
0.75	Pipe dia. (m) / 3.33
Full	Pipe dia. (m) / 4.00

69

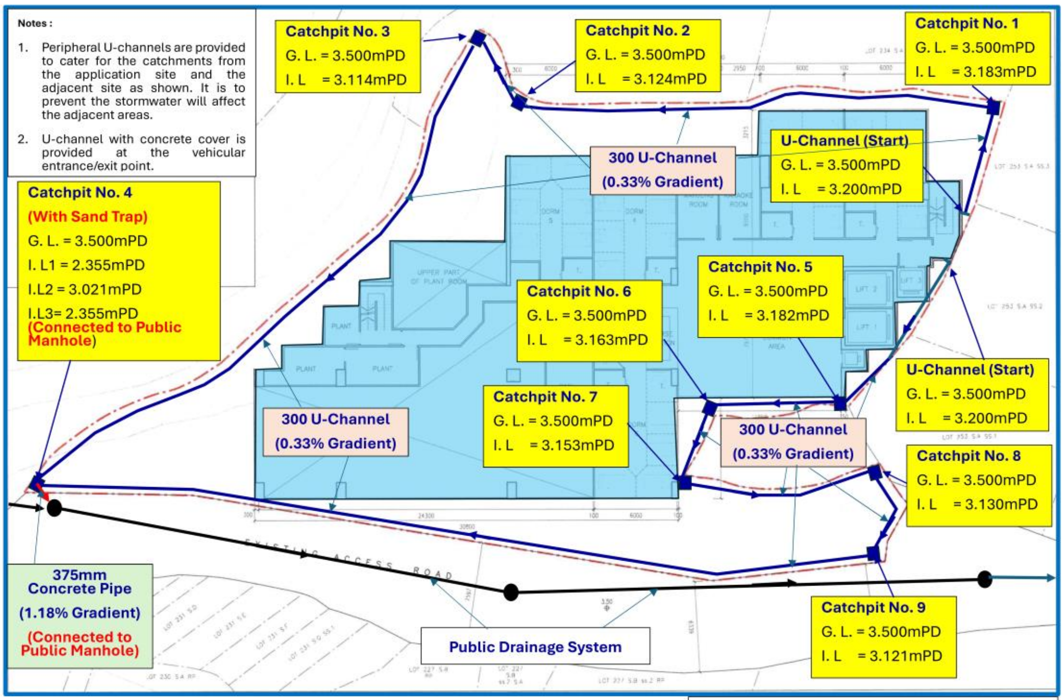
The 0.5 full bore, velocity of 1.5m/s and 375mm pipe is used.

The capacity of the pipe :

Q = V x A = 1.5 x πx (0.375)2/4 x 0.5 = 0.0828m^3/s > 0.0567m^3/s, OK

Chezy‟s formula:
where
V = velocity of flow = 1.5m/s
m = hydraulic mean depth (HMD) → HMD = 0.375 / 4.00 = 0.09375
C = Chezy coefficient = (0.09375)1/6/(0.015(concrete pipe))= 44.94
1.5 = 44.94 x (0.09375 x i)0.5
(1.5/44.94)2 = 0.09375 x i
Thus i = 0.01188 or 1.18% (i = inclination or gradient as 1/X)

iv) Drainage Plan



Proposed Drainage Plan

Drawing No. TT 001

5. Conclusion

Since there is no change of total catchment areas and the total Stormwater flow (0.057m^3/s) from this developing area is considered small in quantity and therefore the impact is negligible.

Sewerage Impact Assessment for Proposed Residential Care Home for the Elderly (RCHE) Development at Tung Tsz, Tai Po

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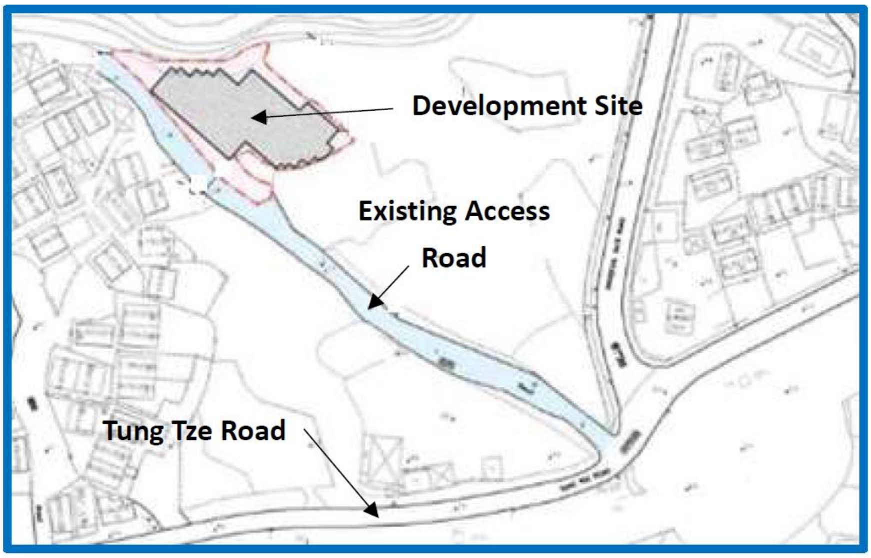
Location Plan:	

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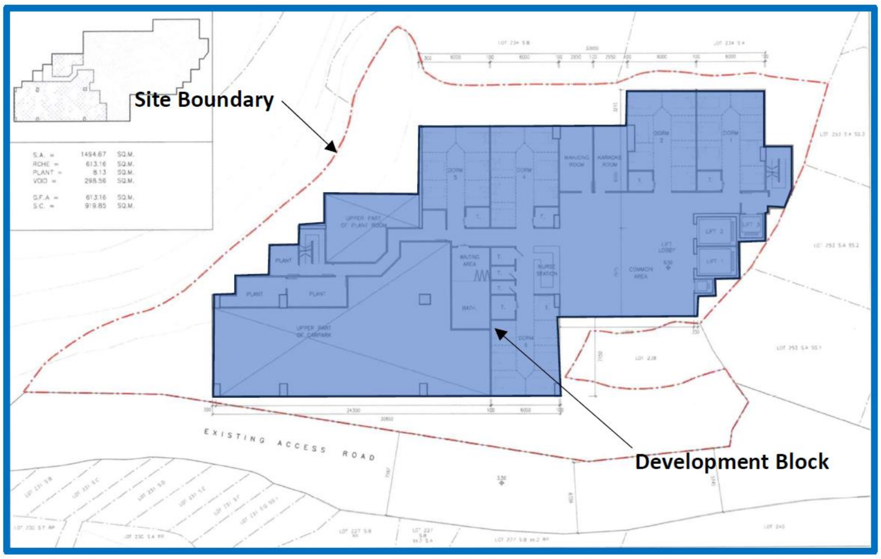

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4. Sewage Impact Assessment

i) No. of Residents/Employees

a) No. of Residents = 253 beds

b) No. of Employees = 120 Nos. (About 2 times as recommended by Code of Practice for Resident Care Home)

ii) Estimated Sewage Flows :

EPD Technical Paper Report No. EPD/TP1/05 – Table T-2 (Unit Flow Rate Factor of Commercial Flows and Student Flows)

8. UNIT FLOW FACTORS – COMMERCIAL AND INSTITUTIONAL FLOWS

8.1 Commercial flows comprise flows due to commercial activities and due to employees. Flows from Job types J2 – J12 are classified as commercial flows. The unit flow factors of the 11 Job types are provided in **Table T-2** below. The derivation of the UFFs of employees and students were presented in **Appendix III.**

Table T-2 : Unit Flow Factors of Commercial Flows and Student Flows

	Unit (per)	Datum (2002) (m^3/day)	Increase per Annum (m^3/day)	Planning for Future (m^3/day)
Commercial Employee	employee	0.080	-	0.080
Commercial activities				
(a) Specific trades:				
J2 Electricity Gas & Water	employee	0.250	-	0.250
J3 Transport, Storage & Communication	employee	0.100	-	0.100
J4 Wholesale & Retail	employee	0.200	-	0.200
J5 Import & Export	employee	-	-	-
J6 Finance, Insurance, Real Estate & Business Services	employee	-	-	-
J7 Agriculture & Fishing	employee	-	-	-
J8 Mining & Quarrying	employee	-	-	-
J9 Construction	employee	0.150	-	0.150
J10 Restaurants & Hotels	employee	1.500	-	1.500
J11 Community, Social & Personal Services	employee	0.200	-	0.200
J12 Public Administration	employee	-	-	-
(b) General –territorial average	employee	0.200	-	0.200
School student	person	0.040	-	0.040

Notes of Table T-2:

(1) For planning of a new sewerage system, the planning unit flow factors should be used and the worst possible combination of commercial flows for the future development scenarios should be considered to ensure that the sewerage system under planning will be sustainable.

(2) For job types J10 and J11, the "per-employee" unit flow factor takes into account the flows of customers and/or tenants.

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

EPD/TP 1/05 Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Page 9 of 14

Site	**Use**	**Global Unit Flow Factor (m3/person/day)**	**No. of Residents/Employees**	**ADWF (m3/day)**
Tung Tyz, Tai Po	RCHE J11 (Community, Social & Personal Service)	0.200	253 residents + 120 staff = 373	74.6

iii) Sewer Pipe Design :
For sewer pipe, one quarter (1/4) full bore is used to allow space for a core of air in centre of the stack and the air keeps fluctuations to a minimum.

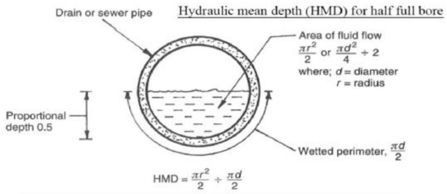
Minimum velocity of 0.7m/s (smaller than 300mm diameter) is used for maintaining self-cleansing purpose.

To facilitate inspection and cleaning, pipe should not be less than 200mm diameter.

Design Flow = 74.6m^3/day or 0.000863m^3/s

1/4 full bore, velocity of 0.7m/s and 225mm pipe is used.

The capacity of the pipe :
Q = V x A = 0.7 xπx $(0.225)^2$/4 x 0.25 = 0.00695m^3/s 0.000863m^3/s, **OK**



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Full	Pipe dia. (m) / 4.00

69

Chezy"s formula: $V = C\sqrt{m \times i}$

where V = velocity of flow = 0.7m/s

m = hydraulic mean depth (HMD) → HMD = 0.225 / 6.67 = 0.0337

C = Chezy coefficient = $(0.0337)^{1/6}$/(0.015(concrete pipe))= 37.89

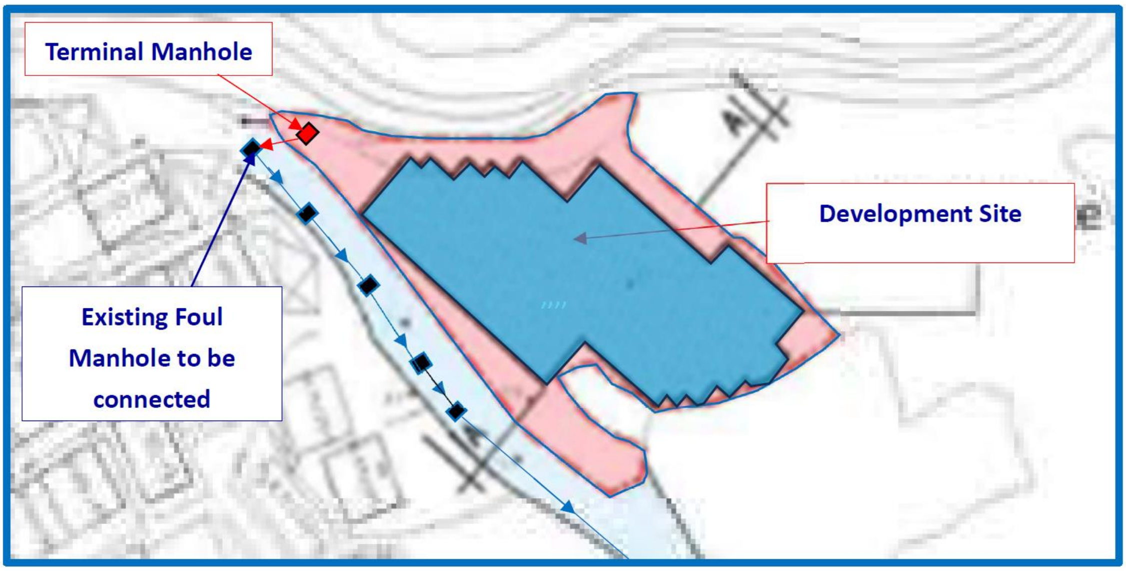
0.7 = 37.89 x $(0.0337 \text{ x } i)^{0.5}$

$(0.7/37.89)^2$ = 0.0337 x i

Thus i = 0.0101 or **1.01%** (i = inclination)

iv) Connection to Public Foul System :

The foul water from the developing site will be discharged into the nearby existing Foul Manhole (as shown below).



5. Conclusion :

The total foul water flow (0.000863m3/s) from this developing area is considered small in quantity and therefore the impact is negligible.