

Agreement No. CE31/2014 (CE)  
Engineering Study for Police Facilities in Kong Nga Po - Feasibility Study  
Environmental Impact Assessment Report

## Appendix 6.1

### Proposed Sewer Pipeline Design

Foulwater Drains Capacity Design Check (By Colebrook White Equation)

By Colebrook White Equation

$$V = -\sqrt{(8gDs)} \log \left( \frac{k_s}{3.7D} + \frac{2.51\nu}{D\sqrt{(2gDs)}} \right)$$

V = mean velocity (m/s)

g = gravitational acceleration (m/s<sup>2</sup>)

D = internal pipe diameter (m)

k<sub>s</sub> = hydraulic pipeline roughness (m)

ν = kinematic viscosity of fluid (m<sup>2</sup>/s)

s = hydraulic gradient (energy loss per unit length due to friction)

Assumptions:

1. Pipe roughness, k<sub>s</sub> = 1.5 mm
2. Gravitational acceleration, g = 9.81 m/s<sup>2</sup>
3. Kinematic viscosity, ν = 1.14E-06 m<sup>2</sup>/s

(refer to Sewerage Manual Part 1 - Table 5, assume "Clayware" under normal condition)

(Transitional flow and water at 15 degree celcius)

Pipe Information											Capacity and Velocity Check								
Pipe no.		From	To	Pipe Diameter mm	Pipe Length m	Ground Level (US) mPD	Invert Level (US) mPD	Ground Level (DS) mPD	Invert Level (DS) mPD	Gradient 1 in	Cumulative Sew age Flow l/s	Contributing Population	Peak Factor †	Peak Factor Cumulative Sew age Flow l/s	Pipe Full Flow Capacity l/s	Pipe Full Flow Velocity m/s	Utilization %	Flow Capacity Check	Full Flow Velocity Check
1		PT4	PT3	225	543	64.000	62.000	55.000	54.000	68	0.86	276	6	5.17	55.4	1.39	9%	OK	OK
2		PT3	PT2	225	53	55.000	54.000	52.000	51.000	18	0.86	276	6	5.17	108.8	2.74	5%	OK	OK
3		PT2	PT1	225	185	52.000	51.000	48.500	41.300	19	1.30	416	6	7.80	104.7	2.63	7%	OK	OK
4		PT1	Pumping Station	225	46	48.500	41.300	48.500	40.500	58	1.74	556	6	10.42	60.2	1.51	17%	OK	OK
	Rising Main	Pumping Station	CH.1090	100	460	48.500		43.954			1.74	556	3	5.21	9.4	1.20	-	OK	OK
		CH.1090	CH.0880	300	210	43.954	42.829	30.206	28.481	15	1.74	556	6	10.42	256.8	3.63	4%	OK	OK
OWTF2		CH.0880	CH.0800	300	80	30.206	28.481	25.219	23.579	16	4.86	1556	6 †	16.67	243.2	3.44	7%	OK	OK
		CH.0800	CH.0320	300	480	25.219	23.579	25.274	19.886	130	4.86	1556	6 †	16.67	85.9	1.22	19%	OK	OK
		CH.0320	CH.0080	300	160	25.274	19.886	11.652	9.927	16	4.86	1556	6 †	16.67	245.1	3.47	7%	OK	OK
		CH.0080	CH.0000	300	80	11.652	9.927	10.693	8.868	76	4.86	1556	6 †	16.67	112.8	1.60	15%	OK	OK

† Peaking Factors excluding stormwater allowance are adopted for new upstream sewerage network of Police Facilities at Kong Nga Po and OWTF2

‡ Peaking Factor of 2 is adopted to sewage flow from OWTF2 according to section 7.4.5 of *Organic Waste Treatment Facilities Phase 2: Feasibility Study Engineering Feasibility Study Final Report* of Contract CE 34/2011 (EP); Peaking Factor of 6 is adopted for remaining sewage flow.