

Appendix A

Hydraulic Calculations

Table B1 - Population Projection of YLSTW Catchment

Planning Data Zone	Population ⁽¹⁾					
	2016			2031		
	Residential	School Place	Employment	Residential	School Place	Employment
232 ⁽²⁾	11,150	1,800	6,150	11,150	1,800	6,150
177	43,150	5,800	22,450	42,250	7,250	17,200
372	25,600	4,100	14,050	33,300	5,750	16,300

Table B2 - Distribution of Population for Planning Data Zones

Planning Data Zone ⁽⁴⁾	No.	Location	Maximum Plot Ratio (Domestic)	Approx. Site Area (m ²)		2016			2031			
				Residential	School Place	Employment	Residential	School Place	Employment	Residential	School Place	Employment
232	1	OU	5.00			0	0	0	0	0	0	0
	2	OU	-			988,000	0	4,999	0	0	4,999	0
	3	V	-	311,597			3,870	0	3,870	0	0	0
	4	V	5.00	16,394			204	0	204	0	0	0
	5	V	-	114,871			1,427	0	1,427	0	0	0
	6	CDA	-	222,973	222,973	222,973	2,769	1,800	1,151	2,769	1,800	1,151
	7	V	-	231,926			2,880	0	2,880	0	0	0
	8	G/IC	5.00		0		0	0	0	0	0	0
	Total			897,761	222,973	1,190,973	11,150	1,800	6,150	11,150	1,800	6,150
177	1	RI(E)	-	136,751			16,061	0	15,726	0	0	0
	2	RI(E)	-	113,117			13,286	0	13,009	0	0	0
	3	CDA		13,836	13,836		1,625	0	22,450	1,591	0	17,200
	4	R		13,444			1,579	0	1,546	0	0	0
	5	R		60,529			7,109	0	6,961	0	0	0
	6	R		29,713			3,490	0	3,417	0	0	0
	7	S			53,497	53,497	0	5,800	0	0	7,250	0
	Total			367,390	13,836	13,836	43,150	5,800	22,450	42,250	7,250	17,200
372	1	CDA	-	36,583			1,732	0	2,349	2,294	0	2,726
	2	R	-	50,373			2,365	0	3,158	0	0	0
	3	R		22,034			1,043	0	1,382	0	0	0
	4	R		234,288			11,093	0	14,390	0	0	0
	5	CDA		182,189	182,189		8,626	0	11,701	11,423	0	13,574
	6	S			43,268	43,268	0	4,100	0	0	5,750	0
	7	RI(C)		15,212			720	0	954	0	0	0
	Total			540,679	218,772	218,772	25,600	4,100	14,050	33,300	5,750	16,300

(1) - Residential data, school and employment data are extracted from TPEDM 2011 - Table 1, Table 6 and Table 8 respectively.
 (2) - Other than this proposed development, it is unlikely that there exist other planned development within Zone No. 232 that is not known in this stage, adding that the ability for further development within Zone No. 232 is characteristic of the land (either within the wetland buffer zone or already developed). According to the planning data in TPEDM 2011, the population within Zone No.232 grows up rapidly between year 2016 and 2026, which matched with the proposed commission programme of this proposed development. Therefore, it is reasonably believed that the population growth is attributed to this proposed development only.
 For estimating the population in year 2031, the population contributed from this proposed development should be eliminated and therefore population data in year 2016 is adopted.
 (3) - Zone No. and corresponding Land Use Zoning refer to zoning plan in TPEDM 2011.

ARUP		Job No.			
		226464			
Job Title		Member/Location			
Planning and Engineering Study for Wang Chau					
Calculation		Drg. Ref.		Date	
Estimation of Sewage Flow - Existing and Planned Development				16/09/2013	
		Made by	LTT	Chd.	NY

Unit Flow Factor (l/h/d) for Different Types of Flow

		Types of Flow	
		Residential	School
PRH	190		40
Village	150		
New Housing Site	250		
		Employment	
			280
		Social Welfare	
			80
		Retail/Market	
			280
		Industrial	
			2,080

Table B3 - Populations and Existing Sewage Flows in 2031 based on OZP

	Connecting Manhole Ref. (1)	Zone No. (2)	2011-based TPEDM Population Projection				ADWF		
			Residential	School	Employment	Cumulative	Increment (L/s)	Cumulative (L/s)	Cumulative
Existing Sewage Flow	FMH1008697	232	2880	0	52	2933	6.50	22.53	1,947
	FMH1008696		0	0	46	46	0.15		
	FMH1008685		0	0	155	155	0.50		
	FMH1008684		0	0	53	53	0.17		
	FMH1008693		0	0	43	43	0.14		
	FMH1008677		0	0	274	274	0.89		
	FMH1008676		0	0	88	88	0.28		
	FMH1008674		0	0	207	207	0.67		
	FMH1008647		0	0	224	224	0.72		
	FMH1008643		0	0	112	112	0.36		
	FMH1008626		0	0	255	255	0.83		
	FMH1008630		0	0	129	129	0.42		
	FMH1008582		0	0	1341	1341	4.34		
	FMH1008580		0	0	175	175	0.57		
	FMH1008585		0	0	45	45	0.15		
	FMH1008588		0	0	171	171	0.55		
	FMH1008736		0	0	1551	1551	5.03		
FMH1008593	0	0	76	76	0.25				
FMH1017975	177	15,726	0	0	15,726	34.58	349.84	30,226	
FMH1008596	232	8,270	1,800	1,151	11,221	22.75			
FMH1008736	372	2,294	0	2,726	5,019	13.88			
FMH1008736	372	3,158	0	0	3,158	5.48			
Planned Sewage Flow from Other Planned Projects	FMH1008736	New Housing Site at Yuen Long South (368+181+373)	72,000	0	20,000	92,000	273.15		

(1) - Manhole Ref. as per DSD Record Plan

(2) - Zoning plan for TPEDM 2011 refers to **Figure B**

(3) - Residential and employment population for the existing development refer to **Tables B1 & B2**

ARUP		Job No. 226464			
		Member/Location			
Job Title	Planning and Engineering Study for Wang Chau	Drg. Ref.			
Calculation	Estimation of Sewage Flow - Existing and Planned Development	Made by	LTT	Date	16/09/2013
				Chd.	NY

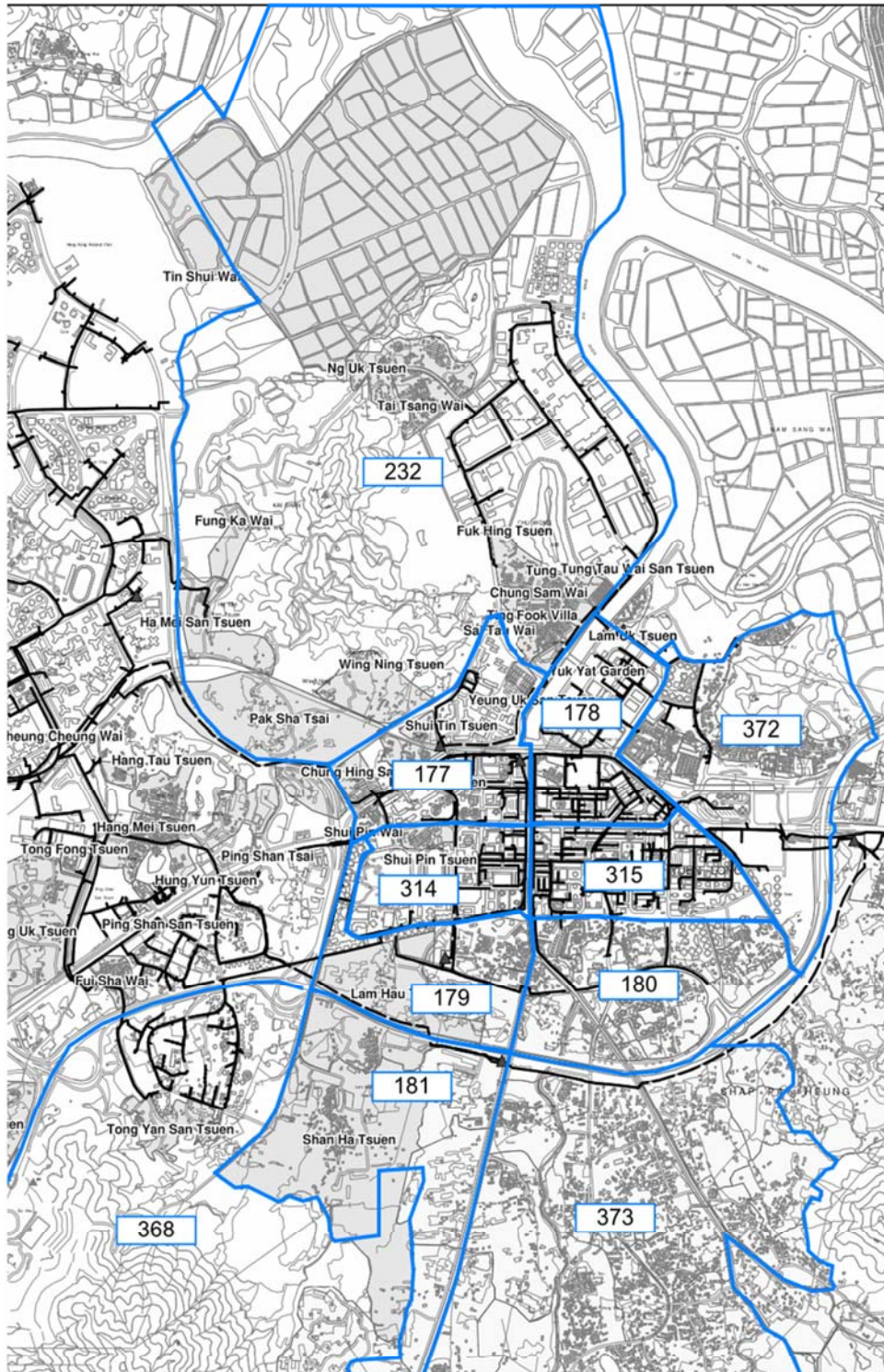


Figure B - Outline Zoning Plan (From TPEDM 2011)

ARUP		Job No.	226464		
		Member/Location			
Job Title	Planning and Engineering Study for Wang Chau		Drg. Ref.		
Calculation	Estimation of Sewage Flow - Proposed Development		Made by	LTT	Date 16/09/2013
			Chd.	NY	

Unit Flow Factor (l/h/d) for Different Types of Flow

	Types of Flow		
	Residential	School	Employment
PRH	190	40	Social 80
Village	150		Retail/Market 280
New Housing Site	250		Industrial 2,080

Table B4 - Populations and Proposed Sewage Flows in 2031

Project Area	Discharge Manhole (1)	ID	No. of units	Population			Cumulative	ADWF		
				Residential	School	Employment		Increment (L/s)	Cumulative (L/s)	Cumulative (m ³ /d)
PH Site Phase 1	FMH 1-1	1	455	1563	0	0	14687	3.44	34.34	2967
	FMH 1-1	2	385	1323	0	0		2.91		
	FMH 1-1	3	700	2405	0	0		5.29		
	FMH 1-1	4	390	1340	0	0		2.95		
	FMH 1-1	5	330	1134	0	0		2.49		
	FMH 2-4	6	390	1340	0	0		2.95		
	FMH 2-4	7	455	1563	0	0		3.44		
	FMH 2-4	8	455	1563	0	0		3.44		
	FMH 2-4	9	385	1323	0	0		2.91		
	FMH 2-4	10	330	1134	0	0		2.49		
School	FMH 1-8	3	0	0	765	0	765	0.35		
G/IC	FMH 1-1	-	0	0	0	1036		0.96		
Retail / Market	FMH 2-4	Under Block 6	0	0	0	56	1260	0.18		
	FMH 2-4	Under Block 7	0	0	0	56		0.18		
	FMH 2-4	Under Block 8	0	0	0	56		0.18		
	FMH 2-4	Under Block 9	0	0	0	56		0.18		
PH Site Phase 2	FMH 3-8	11	870	2989	0	0	42722	6.57	95.56	8257
	FMH 3-8	12	945	3247	0	0		7.14		
	FMH 3-8	13	960	3298	0	0		7.25		
	FMH 3-10	14	810	2783	0	0		6.12		
	FMH 3-10	15	840	2886	0	0		6.35		
	FMH 3-1	16	960	3298	0	0		7.25		
	FMH 3-1	17	920	3161	0	0		6.95		
PH Site Phase 3	FMH 3-10	18	600	2061	0	0	1530	4.53		
	FMH 3-10	19	770	2645	0	0		5.82		
	FMH 3-3	20	960	3298	0	0		7.25		
	FMH 3-3	21	960	3298	0	0		7.25		
	FMH 3-3	22	1080	3710	0	0		8.16		
	FMH 3-3	23	880	3023	0	0		6.65		
School	FMH 3-1	1	0	0	765	0	765	0.35		
	FMH 3-1	2	0	0	765	0	765	0.35		
Retail / Market	FMH 3-8	Under Block 12	0	0	0	56	280	0.18		
	FMH 3-10	Under Block 14	0	0	0	56		0.18		
	FMH 3-10	Under Block 15	0	0	0	56		0.18		
	FMH 3-10	Under Block 18	0	0	0	56		0.18		
	FMH 3-10	Under Block 19	0	0	0	56		0.18		
YLIEE	FMH 4-5	I	0	0	0	243	3887	5.85	93.58	8085
	FMH 4-5	II	0	0	0	243		5.85		
	FMH 4-5	III	0	0	0	243		5.85		
	FMH 4-5	IV	0	0	0	243		5.85		
	FMH 4-5	V	0	0	0	243		5.85		
	FMH 4-5	VI	0	0	0	243		5.85		
	FMH 4-1	VII	0	0	0	243		5.85		
	FMH 4-1	VIII	0	0	0	243		5.85		
	FMH 4-1	IX	0	0	0	243		5.85		
	FMH 4-1	X	0	0	0	243		5.85		
	FMH 4-1	XI	0	0	0	243		5.85		
	FMH 4-1	XII	0	0	0	243		5.85		
	FMH 4-1	XIII	0	0	0	243		5.85		
	FMH 4-5	XIV	0	0	0	243		5.85		
	FMH 4-5	XV	0	0	0	243		5.85		
	FMH 4-5	XVI	0	0	0	243		5.85		
Total								223.48	19308	

Notes

(1) - Manhole ref. refers to Drawing Nos. 226464/OAP/C/201 - 208

Capacity Performance of Existing and Proposed Sewers in 2031

Notes:

(1) Calculate by Colebrook-White Equation

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

where ks is equivalent roughness with value equals 1.5mm for existing sewers.

v is kinematic viscosity of fluid = 1.14 x 10⁻⁶ m²/s and g is the gravity = 9.81m/s²

V is the velocity, D is the diameter of the sewer and S is the gradient of the sewer.

(2) Peaking Factor refers to EPD's GESF Table T-5, excluding stormwater allowance for proposed sewers

Abbreviation:

UP_MAN	DN_MAN	UP_GL	DN_GL	UP_INV	DN_INV	F/C	Peak Flow/Capacity
UP_MAN	Upstream Manhole	ACC_POP	CON_POP	ACC_POP	CON_POP	UP_GL	UP_INV
DN_MAN	Downstream Manhole	CON_POP	CON_POP	DN_GL	DN_GL	DN_INV	DN_INV
ADWF	Average Dry Weather Flow	DIA	DIA	UP_INV	UP_INV	UP_INV	UP_INV
ACC_ADWF	Accumulated Average Dry Weather Flow	LEN	LEN	CAP	CAP	CAP	CAP

Proposed Sewer for PH Site Phase 2 and 3

Manhole		Pipe Parameter										Pipe Parameter		Pipe Parameter					
UP_MAN	DN_MAN	POP	ACC_POP	ADWF	ACC_ADWF	CON_POP	PEAKING FACTOR	Peak Flow (L/s)	DIA (D) (mm)	LEN (m)	UP_GL (mPD)	DN_GL (mPD)	UP_INV (mPD)	DN_INV (mPD)	Gradient (S) ₁ in XX	VEL (m/s)	CAP (L/s)	F/C (%)	Adequate Capacity?
FMH 3-1	No.	7989	14.91	0.00	14.91	4772	5.00	74.56	450	70	11.00	10.00	8.55	7.28	300.00	1.04	165.22	45.13%	YES
FMH 3-2	FMH 3-2	0	7989	0.00	14.91	4772	5.00	74.56	450	80	10.00	9.00	7.55	7.08	300.00	1.04	165.22	45.13%	YES
FMH 3-3	FMH 3-4	16353	35.96	0.00	35.96	11508	3.00	107.89	450	50	9.00	8.50	7.25	7.08	300.00	1.04	165.22	65.30%	YES
FMH 3-4	FMH 3-5	0	16353	0.00	35.96	11508	3.00	107.89	450	80	8.50	8.50	6.92	6.65	300.00	1.04	165.22	65.30%	YES
FMH 3-5	FMH 3-6	0	16353	0.00	35.96	11508	3.00	107.89	450	70	8.50	8.00	6.65	6.42	300.00	1.04	165.22	65.30%	YES
FMH 3-6	FMH 3-7	0	16353	0.00	35.96	11508	3.00	107.89	450	40	8.00	9.00	6.42	6.28	300.00	1.04	165.22	65.30%	YES
FMH 3-7	FMH 3-10	9590	21.15	0.00	21.15	6767	4.00	84.59	450	70	9.00	9.00	7.25	7.02	300.00	1.04	165.22	51.20%	YES
FMH 3-8	FMH 3-9	9590	21.15	0.00	21.15	6767	4.00	84.59	450	60	9.00	9.00	7.02	6.82	300.00	1.04	165.22	51.20%	YES
FMH 3-9	FMH 3-10	0	9590	0.00	21.15	6767	4.00	84.59	450	60	9.00	7.70	5.78	5.68	600.00	1.02	449.43	63.79%	YES
FMH 3-10	FMH 3-11	10600	44532	23.54	95.56	30581	3.00	286.69	750	70	7.70	6.20	4.28	4.17	600.00	1.02	449.43	63.79%	YES
FMH 3-11	FMH 3-12	0	44532	0.00	95.56	30581	3.00	286.69	750	80	6.20	4.20	2.37	2.23	600.00	1.02	449.43	63.79%	YES
FMH 3-12	FMH 3-13	0	44532	0.00	95.56	30581	3.00	286.69	750	60	4.20	4.60	2.13	2.06	780.00	1.00	636.81	45.02%	YES
FMH 3-13	FMH 3-14	0	44532	0.00	95.56	30581	3.00	286.69	900	60	4.60	4.70	2.06	1.98	780.00	1.00	636.81	45.02%	YES
FMH 3-14	FMH 3-15	0	44532	0.00	95.56	30581	3.00	286.69	900	60	4.70	4.60	1.98	1.90	780.00	1.00	636.81	45.02%	YES
FMH 3-15	FMH 3-16	0	44532	0.00	95.56	30581	3.00	286.69	900	60	4.70	4.60	1.98	1.90	780.00	1.00	636.81	45.02%	YES
FMH 3-16	FMH 3-17	0	44532	0.00	95.56	30581	3.00	286.69	900	55	4.60	4.50	1.90	1.83	780.00	1.00	636.81	45.02%	YES

Proposed Sewer within YLIEE

Manhole		Pipe Parameter																	
UP_MAN No.	DN_MAN No.	POP	ACC_POP	ADWF (L/s)	ACC_ADWF (L/s)	CON_POP	PEAKING FACTOR	Peak Flow (L/s)	DIA (D) (mm)	LEN (m)	UP_GL (mPD)	DN_GL (mPD)	UP_INV (mPD)	DN_INV (mPD)	Gradient (S), 1 in XX	VEL (m/s)	CAP (L/s)	F/C (%)	Adequate Capacity?
FMH 4-1	FMH 4-2	1701	1701	40.94	40.94	13101	3.00	122.82	600	65	6.70	6.70	4.80	4.64	400.00	1.08	305.85	40.16%	YES
FMH 4-2	FMH 4-3	0	1701	0.00	40.94	13101	3.00	122.82	600	60	6.70	6.70	4.64	4.49	400.00	1.08	305.85	40.16%	YES
FMH 4-3	FMH 4-4	0	1701	0.00	40.94	13101	3.00	122.82	600	60	6.70	6.70	4.49	4.34	400.00	1.08	305.85	40.16%	YES
FMH 4-4	FMH 4-5	0	1701	0.00	40.94	13101	3.00	122.82	600	60	6.70	6.70	4.34	4.19	400.00	1.08	305.85	40.16%	YES
FMH 4-5	FMH 4-6	2186	3887	52.64	93.58	29944	3.00	280.73	750	70	6.70	6.70	4.19	3.99	350.00	1.33	589.25	47.64%	YES
FMH 4-6	FMH 4-7	0	3887	0.00	93.58	29944	3.00	280.73	750	70	6.70	6.70	3.99	3.79	350.00	1.33	589.25	47.64%	YES
FMH 4-7	FMH 4-8	0	3887	0.00	93.58	29944	3.00	280.73	750	70	6.70	6.70	3.79	3.59	350.00	1.33	589.25	47.64%	YES
FMH 4-8	FMH 4-9	0	3887	0.00	93.58	29944	3.00	280.73	750	58	5.93	5.29	3.39	3.22	350.00	1.33	589.25	47.64%	YES
FMH 4-9	FMH 4-10	0	3887	0.00	93.58	29944	3.00	280.73	750	70	5.29	4.50	3.22	3.02	350.00	1.33	589.25	47.64%	YES
FMH 3-17	FMH 3-18	0	48419	0.00	189.14	60525	2.93	553.47	900	30	4.50	4.20	1.83	1.79	780.00	1.00	636.81	86.91%	YES

1. Existing Sewer along Fuk Hi Street (Connect to YLSTW) - Upgraded

Denotes upgrade on existing sewer system

Manhole		Pipe Parameter																	
UP_MAN No.	DN_MAN No.	POP	ACC_POP	ADWF (L/s)	ACC_ADWF (L/s)	CON_POP	PEAKING FACTOR	Peak Flow (L/s)	DIA (D) (mm)	LEN (m)	UP_GL (mPD)	DN_GL (mPD)	UP_INV (mPD)	DN_INV (mPD)	Gradient (S), 1 in XX	VEL (m/s)	CAP (L/s)	F/C (%)	Adequate Capacity?
FMH 3-18	FMH1008697	0	48419	0.00	189.14	60525	2.93	553.47	900	40	4.20	4.40	1.62	1.60	740.00	1.03	653.89	87.34%	YES
FMH1008697	FMH1008696	2333	51352	6.50	195.64	62606	2.91	569.13	900	43	4.48	4.31	1.74	1.74	740.00	1.03	653.89	87.04%	YES
FMH1008696	FMH1008685	46	51398	0.15	195.79	62654	2.91	569.49	900	43	4.31	4.25	1.74	1.68	740.00	1.03	653.89	87.09%	YES
FMH1008685	FMH1009573	55	51553	0.50	196.30	62815	2.91	570.70	900	20	4.25	4.30	1.65	1.65	740.00	1.03	653.89	87.28%	YES
FMH1009573	FMH1008684	0	51553	0.00	196.30	62815	2.91	570.70	900	20	4.30	4.35	1.65	1.62	740.00	1.03	653.89	87.28%	YES
FMH1008684	FMH1008683	53	51606	0.17	196.47	62870	2.91	571.11	900	5	4.35	4.40	1.62	1.62	740.00	1.03	653.89	87.34%	YES
FMH1008683	FMH1009574	0	51606	0.00	196.47	62870	2.91	571.11	900	13	4.40	4.45	1.62	1.60	740.00	1.03	653.89	87.34%	YES
FMH1009574	FMH1008678	0	51606	0.00	196.47	62870	2.91	571.11	900	25	4.45	4.54	1.60	1.57	740.00	1.03	653.89	87.34%	YES
FMH1008678	FMH1008680	0	51606	0.00	196.47	62870	2.91	571.11	900	6	4.54	4.56	1.57	1.56	740.00	1.03	653.89	87.34%	YES
FMH1008680	FMH1008693	0	51606	0.00	196.47	62870	2.91	571.11	1050	44	4.56	4.70	1.56	1.51	950.00	1.00	865.29	66.00%	YES
FMH1008693	FMH1008677	43	51649	0.14	196.61	62915	2.91	571.44	1050	30	4.70	4.74	1.51	1.48	950.00	1.00	865.29	66.04%	YES
FMH1008677	FMH1008676	274	51923	0.89	197.50	63199	2.90	573.57	1050	30	4.74	4.63	1.48	1.45	950.00	1.00	865.29	66.29%	YES
FMH1008676	FMH1008675	88	52011	0.28	197.78	63290	2.90	574.25	1050	50	4.63	4.54	1.45	1.39	950.00	1.00	865.29	66.37%	YES
FMH1008675	FMH1008674	0	52011	0.00	197.78	63290	2.90	574.25	1050	50	4.54	4.41	1.39	1.34	950.00	1.00	865.29	66.37%	YES
FMH1008674	FMH1008647	207	52219	0.67	198.45	63505	2.90	575.86	1050	40	4.41	4.32	1.34	1.30	950.00	1.00	865.29	66.55%	YES
FMH1008647	FMH1008648	224	52442	0.72	199.18	63737	2.90	577.60	1050	27	4.32	4.24	1.30	1.27	950.00	1.00	865.29	66.75%	YES
FMH1008648	FMH1008649	0	52442	0.00	199.18	63737	2.90	577.60	1050	40	4.24	4.13	1.27	1.23	950.00	1.00	865.29	66.75%	YES
FMH1008649	FMH1008643	0	52442	0.00	199.18	63737	2.90	577.60	1050	48	4.13	4.04	1.23	1.18	950.00	1.00	865.29	66.75%	YES
FMH1008643	FMH1008644	112	52555	0.36	199.54	63854	2.90	578.47	1050	52	4.04	4.19	1.18	1.12	950.00	1.00	865.29	66.85%	YES
FMH1008644	FMH1009399	0	52555	0.00	199.54	63854	2.90	578.47	1050	6	4.19	4.02	1.12	1.12	950.00	1.00	865.29	66.85%	YES
FMH1009399	FMH1008645	0	52555	0.00	199.54	63854	2.90	578.47	1050	43	4.02	4.33	1.12	1.07	950.00	1.00	865.29	66.85%	YES
FMH1008645	FMH1008646	0	52555	0.00	199.54	63854	2.90	578.47	1050	5	4.33	4.30	1.07	1.07	950.00	1.00	865.29	66.85%	YES
FMH1008646	FMH1008626	0	52555	0.00	199.54	63854	2.90	578.47	1050	43	4.30	4.48	1.07	1.02	950.00	1.00	865.29	66.85%	YES
FMH1008626	FMH1008627	255	52810	0.83	200.37	64118	2.90	580.44	1050	51	4.48	4.34	1.02	0.97	950.00	1.00	865.29	67.08%	YES
FMH1008627	FMH1008628	0	52810	0.00	200.37	64118	2.90	580.44	1050	38	4.34	4.21	0.97	0.93	950.00	1.00	865.29	67.08%	YES
FMH1008628	FMH1008629	0	52810	0.00	200.37	64118	2.90	580.44	1050	45	4.21	4.08	0.93	0.88	950.00	1.00	865.29	67.08%	YES
FMH1008629	FMH1008630	229	52939	0.42	200.79	64252	2.90	581.45	1050	35	4.08	3.97	0.87	0.83	950.00	1.00	865.29	67.20%	YES

Manhole		Pipe Parameter													Adequate Capacity?				
UP_MAN No.	DN_MAN No.	POP	ACC_POP	ADWF (L/s)	ACC_ADWF (L/s)	CON_POP	PEAKING FACTOR	Peak Flow (L/s)	DIA (D) (mm)	LEN (m)	UP_GL (mPD)	DN_GL (mPD)	UP_INV (mPD)	DN_INV (mPD)		Gradient (S) 1 in XX	VEL (m/s)	CAP (L/s)	F/C (%)
FMH1008582	FMH1008581	1341	54280	4.34	205.13	65643	2.88	591.81	1200	33	3.97	3.96	0.77	0.73	825.00	1.17	1319.64	44.85%	YES
FMH1008581	FMH1008580	0	54280	0.00	205.13	65643	2.88	591.81	1200	54	3.99	4.13	0.77	0.68	1080.00	1.02	1152.54	51.35%	YES
FMH1008580	FMH1008583	175	54454	0.57	205.70	65824	2.88	593.15	1200	10	4.13	4.13	0.68	0.67	1040.00	1.04	1174.62	50.50%	YES
FMH1008583	FMH1008585	0	54454	0.00	205.70	65824	2.88	593.15	1200	42	4.13	4.28	0.67	0.63	1040.00	1.04	1174.62	50.50%	YES
FMH1008585	FMH1008586	45	54500	0.15	205.85	65871	2.88	593.50	1200	46	4.28	4.39	0.63	0.58	920.00	1.10	1249.30	47.51%	YES
FMH1008586	FMH1008587	0	54500	0.00	205.85	65871	2.88	593.50	1200	7	4.39	4.38	0.58	0.47	63.64	4.22	4769.07	12.44%	YES
FMH1008587	FMH1008588	0	54500	0.00	205.85	65871	2.88	593.50	1200	44	4.38	4.68	0.46	0.64	-244.44				
FMH1008588	FMH1008589	171	54670	0.55	206.40	66048	2.88	594.82	1200	31	4.68	4.57	0.61	0.50	281.82	2.00	2262.64	26.29%	YES
FMH1008589	FMH1008590	0	54670	0.00	206.40	66048	2.88	594.82	1200	43	4.57	4.29	0.50	0.46	1075.00	1.02	1155.24	51.49%	YES
FMH1008590	FMH1008591	0	54670	0.00	206.40	66048	2.88	594.82	1200	52	4.29	4.16	0.46	0.41	1040.00	1.04	1174.62	50.64%	YES
FMH1008591	FMH1008592	0	54670	0.00	206.40	66048	2.88	594.82	1200	41	4.16	4.06	0.41	0.37	1025.00	1.05	1183.24	50.27%	YES
FMH1008592	FMH1008596	0	54670	0.00	206.40	66048	2.88	594.82	1200	43	4.06	3.91	0.37	-0.20	75.44	3.87	4379.60	13.58%	YES
FMH1008596	FMH1008593	1.221	200059	22.75	595.61	190594	2.39	1425.91	1800	48	3.91	3.97	-0.20	-0.24	1200.00	1.25	3169.21	44.99%	YES
FMH1008593	YLSTW	76	200135	0.25	595.85	190673	2.39	1426.40	1800	11	3.97	3.90	-0.24	-0.25	1222.22	1.23	3140.13	45.42%	YES

Proposed Sewer within PH Site Phase 1

Manhole		Pipe Parameter																	
UP_MAN No.	DN_MAN No.	POP	ACC_POP	ADWF (L/s)	ACC_ADWF (L/s)	CON_POP	PEAKING FACTOR	Peak Flow (L/s)	DIA (D) (mm)	LEN (m)	UP_GL (mPD)	DN_GL (mPD)	UP_INV (mPD)	DN_INV (mPD)	Gradient (S) 1 in XX	VEL (m/s)	CAP (L/s)	F/C (%)	Adequate Capacity?
FMH 1-1	FMH 1-2	8800	18.03	18.03	18.03	5771	4.00	72.14	450	67	15.00	15.00	13.05	12.72	200.00	1.27	202.57	35.61%	YES
FMH 1-2	FMH 1-3	0	0.00	0.00	18.03	5771	4.00	72.14	450	67	15.00	15.00	12.72	12.38	200.00	1.27	202.57	35.61%	YES
FMH 1-3	FMH 1-4	0	0.00	0.00	18.03	5771	4.00	72.14	450	67	15.00	14.00	12.38	12.05	200.00	1.27	202.57	35.61%	YES
FMH 1-4	FMH 1-8	0	0.00	0.00	18.03	5771	4.00	72.14	450	67	14.00	9.50	8.05	7.71	200.00	1.27	202.57	35.61%	YES
FMH 2-4	FMH 2-5	7147	15.95	15.95	15.95	5104	4.00	63.80	450	46	10.00	11.00	8.25	8.11	320.00	1.01	159.95	39.89%	YES
FMH 2-5	FMH 2-6	0	0.00	0.00	15.95	5104	4.00	63.80	450	46	11.00	12.00	8.11	7.96	320.00	1.01	159.95	39.89%	YES
FMH 2-6	FMH 2-7	0	0.00	0.00	15.95	5104	4.00	63.80	450	46	12.00	13.00	7.96	7.82	320.00	1.01	159.95	39.89%	YES
FMH 2-7	FMH 2-8	0	0.00	0.00	15.95	5104	4.00	63.80	450	46	13.00	14.00	7.82	7.68	320.00	1.01	159.95	39.89%	YES
FMH 2-8	FMH 1-8	0	0.00	0.00	15.95	5104	4.00	63.80	450	46	14.00	9.50	7.68	7.53	320.00	1.01	159.95	39.89%	YES
FMH 1-8	FMH 1-10	765	16712	0.35	34.34	10988	3.00	103.01	600	60	9.50	6.00	4.33	4.18	400.00	1.08	305.85	31.68%	YES

2. Existing Sewer along Fung Chi Road (Connect to Long Ping SPS) - Upgraded

Denotes upgrade on existing sewer system

Manhole		Pipe Parameter																	
UP_MAN No.	DN_MAN No.	POP	ACC_POP	ADWF (L/s)	ACC_ADWF (L/s)	CON_POP	PEAKING FACTOR	Peak Flow (L/s)	DIA (D) (mm)	LEN (m)	UP_GL (mPD)	DN_GL (mPD)	UP_INV (mPD)	DN_INV (mPD)	Gradient (S) 1 in XX	VEL (m/s)	CAP (L/s)	F/C (%)	Adequate Capacity?
FMH 1-10	FMH1017975	0	16712	0.00	34.34	10988	3.00	103.01	600	31	6.00	6.00	1.90	1.82	400.00	1.08	305.85	31.68%	YES
FMH1017975	FMH1017974	15726	32439	34.58	68.92	22055	3.00	206.76	600	37	6.00	6.03	0.31	0.22	400.00	1.08	305.85	67.60%	YES
FMH1017974	FMH1017979	0	32439	0.00	68.92	22055	3.00	206.76	600	39	6.03	5.82	0.22	0.12	400.00	1.08	305.85	67.60%	YES
FMH1017979	FMH1017978	0	32439	0.00	68.92	22055	3.00	206.76	600	35	5.82	5.54	0.12	0.03	400.00	1.08	305.85	67.60%	YES
FMH1017978	FMH1017977	0	32439	0.00	68.92	22055	3.00	206.76	750	34	5.54	5.23	0.03	-0.05	400.00	1.25	551.03	37.52%	YES
FMH1017977	FMH1017980	0	32439	0.00	68.92	22055	3.00	206.76	750	31	5.23	4.96	-0.05	-0.13	387.50	1.27	559.89	36.93%	YES
FMH1017980	FMH1017981	0	32439	0.00	68.92	22055	3.00	206.76	750	11	4.96	5.04	-0.13	-0.16	387.50	1.27	559.89	36.93%	YES
FMH1017981	Long Ping SPS	0	32439	0.00	68.92	22055	3.00	206.76	750	4	5.04	5.04	-0.30	-0.31	387.50	1.27	559.89	36.93%	YES

Capacity Performance of Existing Sewers in 2031

Notes:

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

where ks is equivalent roughness with value equals 1.5mm for existing sewers.
 v is kinematic viscosity of fluid = 1.14 x 10⁻⁶ m²/s and g is the gravity = 9.81m/s²
 V is the velocity, D is the diameter of the sewer and S is the gradient of the sewer.
 Peaking Factor refers to EPD's GESP Table T-5, excluding stormwater allowance for proposed sewers

Abbreviation:

UP_MAN No.	UPSTREAM Manhole	ACC_POP	CON_POP	Accumulated Population	UP_GL	UPSTREAM Ground Level	F/C	Peak Flow/Capacity
DN_MAN No.	DOWNSTREAM Manhole	ACC_POP	CON_POP	Contributing Population	DN_GL	DOWNSTREAM Ground Level	DN_INV	Downstream Invert Level
ADWF	Average Dry Weather Flow	DIA	DIA	Diameter	UP_INV	UPSTREAM Invert Level	VEL	Velocity
ACC_ADWF	Accumulated Average Dry Weather Flow	LEN	LEN	Length	CAP	CAPACITY		

3. Existing DN600 Rising Main from Long Ping SPS to YLSTW

UP_MAN No.	DN_MAN No.	POP	ACC_POP	ADWF (L/s)	ACC_ADWF (L/s)	CON_POP	PEAKING FACTOR	Peak Flow (L/s)	Pipe Parameter		Area (m ² /s)	VEL (m/s)	Velocity Acceptable?
									DIA (D) (mm)	LEN (m)			
Long Ping SPS	FMH1008736	32439	32439	68.92	68.92	22055	2.50	172.30	600	0.28	0.28	0.61	YES

4. Existing DN1350 to DN1800 Sewerage System from Long Ping SPS to YLSTW

UP_MAN No.	DN_MAN No.	POP	ACC_POP	ADWF (L/s)	ACC_ADWF (L/s)	CON_POP	PEAKING FACTOR	Peak Flow (L/s)	Pipe Parameter								F/C (%)			
									DIA (D) (mm)	LEN (m)	UP_GL (mPD)	DN_GL (mPD)	UP_INV (mPD)	DN_INV (mPD)	Gradient (S) 1 in XX	VEL (m/s)		CAP (L/s)		
FMH1008736	FMH1008737	101729	134168	297.54	366.46	117266	2.61	955.15	1350	29	3.90	4.12	1.32	1.27	580.00	2146.30	1.50	2146.30	44.50%	
FMH1008737	FMH1008735	0	134168	0.00	366.46	117266	2.61	955.15	1350	42	4.12	3.89	1.27	1.21	700.00	1952.93	1.36	1952.93	48.91%	
FMH1008735	FMH1008733	0	134168	0.00	366.46	117266	2.61	955.15	1350	39	3.89	4.29	1.21	1.10	354.55	2747.54	1.92	2747.54	34.76%	
FMH1008733	FMH1008732	0	134168	0.00	366.46	117266	2.61	955.15	1500	44	4.29	4.14	1.10	1.03	628.57	2718.13	1.54	2718.13	35.14%	
FMH1008732	FMH1008731	0	134168	0.00	366.46	117266	2.61	955.15	1500	42	4.14	4.02	1.03	0.93	420.00	3327.58	1.88	3327.58	28.70%	
FMH1008731	FMH1008730	0	134168	0.00	366.46	117266	2.61	955.15	1500	39	4.02	4.15	0.93	0.85	487.50	3087.88	1.75	3087.88	30.93%	
FMH1008730	FMH1008729	0	134168	0.00	366.46	117266	2.61	955.15	1500	42	4.15	4.35	0.85	0.76	466.67	3156.28	1.79	3156.28	30.26%	
FMH1008729	FMH1008728	0	134168	0.00	366.46	117266	2.61	955.15	1500	42	4.35	4.41	0.76	0.89	-323.08	-	-	-	-	
FMH1008728	FMH1008727	0	134168	0.00	366.46	117266	2.61	955.15	1500	29	4.41	4.49	0.89	0.86	966.67	1.24	2189.81	1.24	2189.81	43.62%
FMH1008727	FMH1008726	0	134168	0.00	366.46	117266	2.61	955.15	1500	42	4.49	4.55	0.86	0.82	1050.00	1.19	2100.70	1.19	2100.70	45.47%
FMH1008726	FMH1008719	0	134168	0.00	366.46	117266	2.61	955.15	1500	42	4.55	4.46	0.82	0.78	1050.00	1.19	2100.70	1.19	2100.70	45.47%
FMH1008719	FMH1008720	0	134168	0.00	366.46	117266	2.61	955.15	1500	42	4.46	4.36	0.78	0.74	1050.00	1.19	2100.70	1.19	2100.70	45.47%
FMH1008720	FMH1008716	0	134168	0.00	366.46	117266	2.61	955.15	1500	42	4.36	4.26	0.74	0.70	1050.00	1.19	2100.70	1.19	2100.70	45.47%
FMH1008716	FMH1008717	0	134168	0.00	366.46	117266	2.61	955.15	1500	42	4.26	4.25	0.70	0.66	1050.00	1.19	2100.70	1.19	2100.70	45.47%
FMH1008717	FMH1008718	0	134168	0.00	366.46	117266	2.61	955.15	1500	42	4.25	4.36	0.66	0.62	1050.00	1.19	2100.70	1.19	2100.70	45.47%
FMH1008718	FMH1008713	0	134168	0.00	366.46	117266	2.61	955.15	1500	42	4.36	4.48	0.62	0.58	1050.00	1.19	2100.70	1.19	2100.70	45.47%

Manhole		Pipe Parameter										Peak Flow (L/s)	PEAKING FACTOR	CON_POP	ACC_ADWF (L/s)	ADWF (L/s)	ACC_POP	POP
UP_MAN No.	DN_MAN No.	DIA (D) (mm)	LEN (m)	UP_GL (mPD)	DN_GL (mPD)	UP_INV (mPD)	DN_INV (mPD)	Gradient (S ₁ in XX)	VEL (m/s)	CAP (L/s)	F/C (%)							
FMH1008713	FMH1008714	1500	31	4.48	4.48	0.54	0.54	861.11	1.31	2320.77	41.16%							
FMH1008714	FMH1008715	1500	54	4.48	4.45	0.54	0.51	1384.62	1.03	1828.00	52.25%							
FMH1008715	FMH1008711	1500	42	4.45	4.24	0.51	0.46	933.33	1.26	2228.76	42.86%							
FMH1008711	FMH1008712	1500	42	4.24	4.15	0.46	0.42	1050.00	1.19	2100.70	45.47%							
FMH1008712	FMH1008702	1500	42	4.15	4.26	0.42	0.37	840.00	1.33	2349.88	40.65%							
FMH1008702	FMH1008699	1500	44	4.26	4.38	0.37	0.33	1100.00	1.16	2052.16	46.54%							
FMH1008699	FMH1008700	1500	39	4.38	4.46	0.33	0.29	975.00	1.23	2180.39	43.81%							
FMH1008700	FMH1008701	1500	34	4.46	4.37	0.29	0.25	850.00	1.32	2335.96	40.89%							
FMH1008701	FMH1008625	1500	44	4.37	4.27	0.25	0.21	1100.00	1.16	2052.16	46.54%							
FMH1008625	FMH1008624	1500	42	4.27	4.21	0.21	0.17	1050.00	1.19	2100.70	45.47%							
FMH1008624	FMH1008623	1500	34	4.21	4.20	0.17	0.13	850.00	1.32	2335.96	40.89%							
FMH1008623	FMH1008604	1500	39	4.20	4.70	0.13	0.09	975.00	1.23	2180.39	43.81%							
FMH1008604	FMH1008603	1500	36	4.70	4.49	0.09	0.05	900.00	1.28	2269.85	42.08%							
FMH1008603	FMH1008602	1500	36	4.49	4.40	0.05	0.01	900.00	1.22	2269.85	42.08%							
FMH1008602	FMH1008601	1500	29	4.40	4.30	0.01	-0.02	1000.00	1.22	2152.83	44.37%							
FMH1008601	FMH1008600	1500	39	4.30	4.30	-0.02	-0.05	1258.06	1.09	1918.25	49.79%							
FMH1008600	FMH1008599	1500	39	4.30	4.20	-0.05	-0.09	975.00	1.23	2180.39	43.81%							
FMH1008599	FMH1022261	1500	39	4.20	4.00	-0.09	-0.13	975.00	1.23	2180.39	43.81%							
FMH1022261	FMH1008597	1500	21	4.00	3.90	-0.13	-0.16	814.29	1.35	2386.86	40.02%							
FMH1008597	FMH1008596	1800	36	3.90	3.91	-0.15	-0.20	814.29	1.51	3850.50	24.81%							

Appendix B

Meeting Minutes with DSD
and EPD

Agreement No. CB20120293 Planning and Engineering Study for Public Housing Site and Yuen Long Industrial Estate Extension at Wang Chau

Meeting Minutes for Technical Meeting on SIA with DSD and EPD

Date: 6 Nov 2012 (Tuesday)

Time: 9:30 a.m.

Venue: Conference Hall B on Level 5, Block 4, HAHQ Building, Fat Kwong Street, Homantin

Present	HD	████████████████████	████
	HD	██████████████	██████████
	HD	██████████████	██████
	HD	██████████████	██████
	DSD	████████████████████	██████████
	DSD	██████████████████	██████████████████
	DSD	██████████████	████
	DSD	██████████████	████
	EPD	██████████████████	██████
	EPD	██████████████	██████████
	EPD	██████████████████	██████████
	HKSTP	██████████████████	
	Arup	██████████████	██████
	Arup	██████████████████	██████████████████
	Arup	██████████████	██████████
	Arup	██████████████████	██████████
	Arup	██████████████	██████████████████

Apology Nil

Circulation Those present + Apologies

ACTION

1.0 Project Background

- 1.1 HD introduced the background of the Wang Chau developments. It is a government project and joint venture with HKSTP and HKIEC. Note
- 1.2 Arup made a power point presentation (refer to **Enclosure 1**) and stated that there were basically 2 sewage disposal schemes for the proposed developments: a) to Yuen Long Sewage Treatment Works (YLSTW); and b) to San Wai Sewage Treatment Works (SWSTW). Arup explained the baseline condition of the YLSTW and SWSTW and identified the following 2 key issues to be clarified with EPD and DSD: Note
- i. whether the YLSTW could cater for the discharge of sewage flow generated from the proposed developments (i.e. 15,147m³/day) in the future;
 - ii. whether sewage discharge capacity (i.e. 36,000m³/day) entitled to Yuen Long Industrial Estates (YLIE) is still valid in the future.

2.0 Discussion on Key Issues / Preliminary Findings

Sewage discharge capacity reserve of 36,000m³/day for YLIE

- 2.1 HKSTP stated that HKIEC had paid about half of the construction cost of the YLSTW in 1979 in order to obtain a sewage discharge capacity reserve of 36,000m³/day at YLSTW which has a sewage discharge capacity of 70,000m³/day (refer to **Enclosure 2**). After the YLSTW was handed over to DSD, HKIEC had discussion with DSD for each upgrading of YLIE and DSD replied that the 36,000m³/day entitlement was remained unchanged (refer to **Enclosure 3**). Note
- 2.2 EPD advised that the proposed upgrading works for YLSTW was designed based on the existing sewage flow and pollution load from the YLIE, but not the reserve of 36,000m³/day and the corresponding load. However, the study on the upgrading works at YLSTW had not been committed yet and the scope of study can be changed to suit the needs of Wang Chau developments. Note
- 2.3 EPD advised Arup to contact their Control Office and find out the net increase in sewage flow and pollution load raised from the proposed developments. Arup
- 2.4 EPD advised that they would identify some sites (i.e. existing unsewered villages) for offsetting the additional load from the proposed developments and review their calculation after receiving the information from Arup to meet the requirement of “No net increase in pollution loads to Deep Bay”. EPD
- 2.5 HD advised EPD and DSD to include the preliminary findings from this project into their study on the proposed upgrading works at YLSTW. Note
- 2.6 DSD advised that the upgrading works for SWSTW consists of 2 phases. Study on Phase 1 upgrading works had already been committed and there was not a fixed Note

ACTION

implementation programme for Phase 2 upgrading works. Therefore, this might impose an implication on the feasibility of conveying the sewage flows from Wang Chau developments to SWSTW.

2.7 All concerned parties agreed to focus on the option of conveying the sewage flows from the proposed development to YLSTW at this stage unless the feasibility of this option was found unsatisfactory. Note

3.0 A.O.B.

3.1 EPD asked if the feasibility of Treated Sewage Effluent (TSE) reuse would be explored in this study. HD advised Arup to check the Brief if TSE reuse would be explored. Arup

3.2 The meeting adjourned at 11:00 a.m. Note

--- END ---

Enclosures:

1. Arup's Presentation on the Sewage Disposal Schemes for the Proposed Wang Chau Developments
2. Letter from Public Works Department to HKIEC
3. Letter from DSD to HKIEC