## Appendix 3B Part 1: Calculation of Odour Emission Rate (Unmitigated Scenario)

Odour sources to be open: inlet works, grit chambers, equalisation tank, SBR, sludge thickeners, sludge digesters. Odour Sources to be covered: screenings and grits storage area, return liquor pumping station.

Sewage Characteristics:				
Temp	=	30 <sup>o</sup> C	or	86.00 F
ORP (mV)	=	50 mV	(for septic sewage)	
A (m <sup>3</sup> )	=	0.5 x surface	e area of tank	
V (air change per hour)	=	5		
Cf	=	0.52 for 5 Air	Change Per Hour (ACPH)	
DF (OUm <sup>-3</sup> )	=	$1.6 \times (T/10)^{4.9} \times (ORP + 200)^{-0.59}$		
E (OUs <sup>-1</sup> )	=	DF x A x (V/3600) x Cf		

Source ID				DF (OUm <sup>-3</sup> ) E	$(OUs^{-3}) = E(0)$	OUm <sup>-2</sup> s <sup>-1</sup> )
S1	Inlet Works					
	<b>T</b> ( )					
	L (m)	=	7.4			
	W (m)	=	1.5			
	No. of duty units	=	1 (+1 sta	ndby)		
	Area (m²)	=	11.0	2335.49	9.30	0.8434
S2	Grit Chambers					
	Diameter (m)	=	2.1			
	No. of duty units	=	1 (+ 1 star	ndby)		
	Area (m <sup>2</sup> )	=	3.6	2335.49	3.00	0.8434
S3	Equalization Tanks					
	L (m)	=	15.7			
	W (m)	=	13.0			
	No. of duty units	=	1			
	Area (m <sup>2</sup> )	=	204.1	2335.49	172.13	0.8434
S4 to S7, S7a	SBR A to E					
	L (m)	=	15.5			
	W (m)	=	7.0			
	No. of units	=	5			
	Area (m <sup>2</sup> )	=	542.5	2335.49	457.53	0.8434
S8	Sludge Thickener					
	Diameter (m)	=	5.0			
	No. of duty units	=	1 (+ 1 sta	ndby)		
	Area (m <sup>2</sup> )	=	19.6	2335.49	16.55	0.8434
S9	Sludge Digester					
	L (m)	=	8.6			
	W (m)	=	6.6			
	No. of duty units	=	1 (+ 1 star	ndby)		
	Area (m <sup>2</sup> )	=	56.8	2335.49	47.87	0.8434
1	1					

Source ID				DF (OUm <sup>-3</sup> ) E (	OUs <sup>-3</sup> ) E (OU1	n <sup>-2</sup> s <sup>-1</sup> )
S10	Vent of Deodourisation Unit					
	For screenings and grit stora	ge area:				
	L (m)	=	12.5			
	W (m)	=	8.5			
	No. of duty units	=	1			
	Area (m <sup>2</sup> )	=	106.3			
	$A(m^3)$	=	53.1			
	V (ACPH)	=	5			
	Air flow rate (m3/hr)	=	265.6	2335.49	89.61	
	Return Liquor Pumping Stat	ion				
	L (m)	=	4.70			
	W (m)	=	3.0			
	No. of duty units	=	1			
	Area (m <sup>2</sup> )	=	14.1			
	$A(m^3)$	=	7.1			
	V (ACPH)	=	5			
	Air flow rate (m3/hr)	=	35.3	2335.49	11.89	
	For Emission from Deodouri	sation Units	:			
Inlet	Total E (OUs <sup>-1</sup> )	=			101.50	
	$DF(OUm^{-3})$	=			2335 49	
	H2S conc. (ppm)	=			1.17	
<u>Outlet</u>	Total E (OUs <sup>-1</sup> )	=			0.51	
(assume 99.5%	DF (OUm <sup>-3</sup> )	=			11.68	
removal efficiend	H2S conc. (ppm)	=			0.0058	
	Total air flow rate (m3/hr)	=			300.9	
	Dia of pipe (m)	=			0.30	
	Pipe area (m2)	=			0.07	
	Exit velocity (m/s)	=			1.18	

P1	Peng Chau Sewage Put (Provided by DSD)	mping Station			
Inlet	H <sub>2</sub> S conc. (ppm)	=		5.00	
	DF (OUm <sup>-3</sup> )	=		10000	
Outlet	H2S conc. (ppm)	=		0.025	
(99.5% removal	DF (OUm <sup>-3</sup> )	=		50	
efficiency)	Vent pipe dimensions (	m)	=	0.6 x 0.6	
	Vent pipe area (m <sup>2</sup> )		=	0.36	
	Air flow rate $(m^3/h)$		=	1505	
	Total Outlet E (OUs <sup>-1</sup> )		=	20.90	
	Exit velocity (m/s)		=	1.16	
	Exit height (m)		=	3.00	

## Appendix 3B Part 2: Calculation of Odour Emission Rate (Mitigated Scenario)

Odour sources to be covered: inlet works, grit chambers, equalisation tank, SBR, sludge thickeners, sludge digesters, screenings and grits storage area, return liquor pumping station.

Sewage Characteristics:						
Temp	=	30 °C	or	86.00 F		
ORP (mV)	=	50 mV	(for septic sewage)			
A (m <sup>3</sup> )	=	0.50 x surface area of tank				
V (air change per hour)	=	5				
Cf	=	0.52 for 5 Air Cha	ange Per Hour (ACPH)			
DF (OUm <sup>-3</sup> )	=	$1.6 \times (T/10)^{4.9} \times (ORP + 200)^{-0.59}$				
E (OUs )	=	DF x A x $(V/3600)$ x Cf				

Source ID				DF (OUm <sup>-3</sup> ) E (OU	$\text{Us}^{-3}$ ) E (OUm <sup>-2</sup> s <sup>-1</sup> )
SM1	Vent of Deodourisation Unit				
	For inlet works:				
	L (m)	=	7.4		
	W (m)	=	1.5		
	No. of duty units	=	1 (+ 1 standby	7)	
	Area (m <sup>2</sup> )	=	11.0		
	$A(m^3)$	=	5.5		
	V (ACPH)	=	5.0		
	Air flow rate (m3/hr)	=	27.6	2335.49	9.30
	For Grit Chambers:				
	Diameter (m)	=	2.1		
	No. of duty units	=	1 (+ 1 standby	7)	
	Total Area (m <sup>2</sup> )	=	3.6		
	$A(m^3)$	=	1.8		
	V (ACPH)	=	5.0		
	Air flow rate (m3/hr)	=	8.9	2335.49	3.00
	For equalisation tank:				
	L (m)	=	15.7		
	W (m)	=	13.0		
	No. of duty units	=	1		
	Area (m <sup>2</sup> )	=	204.1		
	A (m <sup>3</sup> )	=	102		
	V (ACPH)	=	5		
	Air flow rate (m3/hr)	=	510.3	2335.49	172.13
	For SBR:				
	L (m)	=	15.5		
	W (m)	=	7.0		
	No. of duty units	=	5 (one of whic	ch is for future expans	sion)
	Total Area (m²)	=	542.5		
	$A(m^3)$	=	271		
	V (ACPH)	=	5		
	Air flow rate (m3/hr)	=	1356.3	2335.49	457.53
	For sludge thickeners:				
	Diameter (m)	=	5.0		
	No. of duty units	=	1.0 (+ 1 standby	7)	
	Total Area (m²)	=	19.6		
	$A(m^3)$	=	10		
	V (ACPH)	=	5		
	Air flow rate (m3/hr)	=	49.1	2335.49	16.55
	For sludge digesters:				
	L (m)	=	8.6		
	W (m)	=	6.6	<b>`</b>	
	No. of duty units	=	1 (+ 1 standby	7)	
	Area (m <sup>2</sup> )	=	56.8		
	$A(m^3)$	=	28		
	V (ACPH)	=	5		
	Air flow rate (m3/hr)	=	141.9	2335.49	47.87

Source ID				DF (OUm <sup>-3</sup> ) E	(OUs <sup>-3</sup> )	E (OUm <sup>-2</sup> s <sup>-1</sup> )
	For screenings and grit storage	TO 3703.				
	I (m)	=	12.5			
	W (m)	=	8.5			
	No. of duty units	=	1			
	Area (m <sup>2</sup> )	=	106.3			
	$A(m^3)$	=	53			
	V (ACPH)	=	5			
	Air flow rate (m3/hr)	=	265.6	2335.49	89.61	
	Return Liquor Pumping Stat	ion				
	L (m)	=	4.70			
	W (m)	=	3.0			
	No. of duty units	=	1			
	Area (m <sup>2</sup> )	=	14.1			
	$A(m^3)$	=	7.1			
	V (ACPH)	=	5			
	Air flow rate (m3/hr)	=	35.3	2335.49	11.89	
	For Emission from Doodouri	eation Unite				
<b>T</b> 1 .		sation onits.			007.00	
Inlet	Total E (OUs)	=			807.88	
	DF (OUm <sup>3</sup> )	=			2335.49	
	H2S conc. (ppm)	=			1.17	
Outlet	Total E (OUs <sup>-1</sup> )	=			4.04	
(assume 99.5%	DF (OUm <sup>-3</sup> )	=			11.68	
removal efficiency)	H2S conc. (ppm)	=			0.0058	
	Total air flow rate (m3/hr)	=			2394.80	
	Dia of pipe (m)	=			0.40	)
	Pipe area (m2)	=			0.13	
	Exit velocity (m/s)	=			5.30	)

P1	Peng Chau Sewage Pun	ping Station			
	(Provided by DSD)				
Inlet	H <sub>2</sub> S conc. (ppm)	=		5.00	
	DF (OUm <sup>-3</sup> )	=		10000.00	
Outlet	H2S conc. (ppm)	=		0.025	
(99.5% removal	DF (OUm <sup>-3</sup> )	=		50.00	
efficiency)	Vent pipe dimensions (n	ı)	=	0.6 x 0.6	
	Vent pipe area (m <sup>2</sup> )		=	0.36	
	Air flow rate (m <sup>3</sup> /h)		=	1505.00	
	Total Outlet E (OUs <sup>-1</sup> )		=	20.90	
	Exit velocity (m/s)		=	1.16	
	Exit height (m)		=	3.00	

## Appendix 3B Part 3: Calculation of Odour Emission Rate (Unmitigated Scenario) (when Drying Bed is Used)

Odour sources to be open: sludge drying Bed. Odour sources to be covered: inlet works, grit chambers, equalisation tank, SBR, sludge thickeners, sludge digesters, screenings and grits storage area, return liquor pumping station.

Sewage	Characteristics:
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Servige Characteristics.						
Temp	=	30 °C or	86.00 F			
ORP (mV)	=	50 mV (for septic se	wage)			
$A(m^3)$	=	0.50 x surface area of tank				
V (air change per hour)	=	5				
Cf	=	0.52 for 5 Air Change Per Hour	(ACPH)			
DF (OUm <sup>-3</sup> )	=	1.6 x (T/10) <sup>4.9</sup> x (ORP + 200) <sup>-0.59</sup>				
E (OUs <sup>-1</sup> )	=	DF x A x (V/3600) x Cf				

Source ID				DF (OUm <sup>-3</sup> ) E (	$OUs^{-3}$ ) E ( $OUm^{-2}s^{-1}$ )
SM1	Vent of Deodourisation Unit				
	For inlet works:				
	L (m)	=	7.4		
	W (m)	=	1.5		
	No. of duty units	=	1 (+ 1 standb	py)	
	Area (m <sup>2</sup> )	=	11.0		
	A (m <sup>3</sup> )	=	5.5		
	V (ACPH)	=	5.0		
	Air flow rate (m3/hr)	=	27.6	2335.49	9.30
	For Grit Chambors				
	Diamotor (m)	-	21		
	No. of duty units	_	2.1 1 (+ 1 standh	av)	
	Total Area $(m^2)$	_	26	<i>y</i> )	
	Iotal Area (m)	=	3.0		
	A (m <sup>o</sup> )	=	1.8		
	V (ACPH)	=	5.0	2225 10	2.00
	Air flow rate (m3/hr)	=	8.9	2335.49	3.00
	For equalisation tank:				
	L (m)	=	15.7		
	W (m)	=	13.0		
	No. of duty units	=	1		
	Area (m <sup>2</sup> )	=	204.1		
	$A(m^3)$	=	102		
	V (ACPH)	=	5		
	Air flow rate (m3/hr)	=	510.3	2335.49	172.13
	For SBR:				
	L (m)	=	15.5		
	W (m)	=	7.0		
	No. of duty units	=	5 (one of whi	ich is for future exp	ansion)
	Total Area (m²)	=	542.5		
	$A(m^3)$	=	271		
	V (ACPH)	=	5		
	Air flow rate (m3/hr)	=	1356.3	2335.49	457.53
	For sludge thickeners:				
	Diameter (m)	=	5.0		
	No. of duty units	=	1.0 (+ 1 standb	ov)	
	Total Area (m <sup>2</sup> )	=	19.6	57	
	$\Lambda$ (m <sup>3</sup> )	_	10		
	X (M)	=	10		
	Air flow rate $(m_3/hr)$	=	491	2335 49	16 55
	For sludge digesters:				
	L (m)	=	8.6		
	W (m)	=	6.6		
	No. of duty units	=	1 (+ 1 standb	py)	
	Area (m <sup>2</sup> )	=	56.8		
	$A(m^3)$	=	28		
	V (ACPH)	=	5		
	Air flow rate (m3/hr)	=	141.9	2335.49	47.87

Source ID				DF ( $OUm^{-3}$ ) E (	OUs <sup>-3</sup> )	E (OUm <sup>-2</sup> s <sup>-1</sup> )
	For correspings and grit stores					
	I (m)	=	12.5			
	W(m)	=	85			
	No. of duty units	=	1			
	Area (m <sup>2</sup> )	=	106.3			
	$\Lambda (m^3)$	_	53			
	$V(\Delta CPH)$	=	5			
	Air flow rate (m3/hr)	=	265.6	2335.49	89.61	
	Return Liquor Pumping Stat	ion				
	L (m)	=	4.70			
	W (m)	=	3.0			
	No. of duty units	=	1			
	Area (m <sup>2</sup> )	=	14.1			
	$A(m^3)$	=	7.1			
	V (ACPH)	=	5			
	Air flow rate (m3/hr)	=	35.3	2335.49	11.89	
	For Emission from Deodouri	sation Unit	2.			
Inlat	Total E (OUe <sup>-1</sup> )	=	2.		807.88	
muer	$DE (OLm^3)$	_			2225 40	
	DF (OUm)	=			2333.49	
	н25 сонс. (ррнт)	-			1.17	
Outlet	Total E (OUs <sup>-1</sup> )	=			4.04	
(assume 99.5%	DF (OUm <sup>-3</sup> )	=			11.68	
removal efficiency)	H2S conc. (ppm)	=			0.0058	
	Total air flow rate (m3/hr)	=			2394.80	
	Dia of pipe (m)	=			0.40	
	Pipe area (m2)	=			0.13	
	Exit velocity (m/s)	=			5.30	
S2	Drying Bed					
	L (m)	=	18.00			
	W (m)	=	10.0			
	No. of duty units	=	2			
	Area (m <sup>2</sup> )	=	360.0	2335.49	303.61	0.8434

P1	Peng Chau Sewage Pur	nping Station			
	(Provided by DSD)				
Inlet	H <sub>2</sub> S conc. (ppm)	=		5.00	
	DF (OUm <sup>-3</sup> )	=		10000.00	
Outlet	H2S conc. (ppm)	=		0.025	
(99.5% removal	DF (OUm <sup>-3</sup> )	=		50.00	
efficiency)	Vent pipe dimensions (r	n)	=	0.6 x 0.6	
	Vent pipe area (m <sup>2</sup> )		=	0.36	
	Air flow rate $(m^3/h)$		=	1505.00	
	Total Outlet E (OUs <sup>-1</sup> )		=	20.90	
	Exit velocity (m/s)		=	1.16	
	Exit height (m)		=	3.00	

## Appendix 3B Part 4: Calculation of Odour Emission Rate (Mitigated Scenario) (when Drying Bed is Used)

Odour sources to be covered: inlet works, grit chambers, equalisation tank, SBR, sludge thickeners, sludge digesters, sludge drying bed, screenings and grits storage area, return liquor pumping station.

Sewage Cha	racteristics:
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Temp	=		30 <sup>o</sup> C	or	86.00 F
ORP (mV)	=		50 mV	(for septic sewage)	
A (m <sup>3</sup> )	=	0	.50 x surface area	a of tank	
V (air change per hour)	=		5		
Cf	=	0	.52 for 5 Air Chai	nge Per Hour (ACPH)	
	=	0	.26 for 10 Air Cha	ange Per Hour (ACPH)	
DF (OUm <sup>-3</sup> )	=	1.6 x (T/10) <sup>4.9</sup> x (ORP +	- 200) <sup>-0.59</sup>		
E (OUs <sup>-1</sup> )	=	DF x A x (V/3600) x Cf	f		

Source ID				DF (OUm <sup>-3</sup> ) E (O	$Us^{-3}$ ) E (OUm^{-2}s^{-1})
SM1	Vent of Deodourisation Unit				
	For inlet works:				
	L (m)	=	7.4		
	W (m)	=	1.5		
	No. of duty units	=	1 (+ 1 standb	y)	
	Area (m <sup>2</sup> )	=	11.0		
	$A(m^3)$	=	5.5		
	V (ACPH)	=	5.0		
	Air flow rate (m3/hr)	=	27.6	2335.49	9.30
	For Crit Chambana				
	Diamatar (m)	_	2.1		
	No. of duty units	_	2.1 1 (+ 1 standb	<b>T</b> ()	
	T-t-1 A $r_{r_{r_{r_{r_{r_{r_{r_{r_{r_{r_{r_{r_{r$	_		y)	
	Iotal Area (m)	=	3.6		
	A (m <sup>o</sup> )	=	1.8		
	V (ACPH)	=	5.0	2225 40	2.00
	Air flow rate (m3/ hr)	=	8.9	2335.49	3.00
	For equalisation tank:				
	L (m)	=	15.7		
	W (m)	=	13.0		
	No. of duty units	=	1		
	Area (m <sup>2</sup> )	=	204.1		
	$A(m^3)$	=	102		
	V (ACPH)	=	5		
	Air flow rate (m3/hr)	=	510.3	2335.49	172.13
	For SBR:				
	L (m)	=	15.5		
	W (m)	=	7.0		
	No. of duty units	=	5 (one of whi	ich is for future expan	sion)
	Total Area (m <sup>2</sup> )	=	542.5		
	A (m <sup>3</sup> )	=	271		
	V (ACPH)	=	5		
	Air flow rate (m3/hr)	=	1356.3	2335.49	457.53
	For sludge thickeners:		5.0		
	Diameter (m)	=	5.0	\ \	
	No. of duty units	=	1.0 (+ 1 standb	y)	
	Total Area (m <sup>-</sup> )	=	19.6		
	$A(m^3)$	=	10		
	V (ACPH)	=	5		
	Air flow rate (m3/hr)	=	49.1	2335.49	16.55
	For sludge digesters.				
	I (m)	_	86		
	W (m)	=	6.6		
	No of duty units	=	1 (+ 1 standb	v)	
	Area $(m^2)$	=	56.8	<i>J</i> /	
	$\Delta (m^3)$	_	28		
	V (ACPH)	_	20		
	Air flow rate (m3/hr)	=	141.9	2335.49	47.87

Source ID				DF (OUm <sup>-3</sup> )	E (OUs <sup>-3</sup> )	E (OUm <sup>-2</sup> s <sup>-1</sup> )
	For any animation and with store					
	For screenings and grit stora	ge area:	10 5			
	L (m)	=	12.5			
	vv (m)	_	0.5			
	1 No. of duty units	-	1			
	Area (m)	=	106.3			
	$A(m^3)$	=	53			
	V (ACPH)	=	5			
	Air flow rate (m3/hr)	=	265.6	2335.49	89.61	-
	Return Liquor Pumping Stat	tion				
	L (m)	=	4.70			
	W (m)	=	3.0			
	No. of duty units	=	1			
	Area (m <sup>2</sup> )	=	14.1			
	$A(m^3)$	=	71			
	V (ACPH)	=	5			
	Air flow rate (m3/hr)	=	35.3	2335.49	11.89	)
	Drving Bed					
	L (m)	=	18.00			
	W (m)	=	10.0			
	No. of duty units	=	2			
	Area (m <sup>2</sup> )	=	360.0			
	$A(m^3)$	=	180			
	V (ACPH)	=	10 (recom efficien	mended by the eng	ineer to ensure	sludge drying
	Air flow rate (m3/hr)	=	1800.0	2335.49	303.61	
	For Emission from Deodouri	isation Units:				
Inlet	Total E (OUs <sup>-1</sup> )	=			1111.50	)
	DF (OUm <sup>-3</sup> )	=			2335.49	)
	H2S conc. (ppm)	=			1.17	,
Outlet	Total E (OUs <sup>-1</sup> )	=			5.56	5
(assume 99.5%	DF (OUm <sup>-3</sup> )	=			11.68	3
removal efficiency)	H2S conc. (ppm)	=			0.0058	;
	Total air flow rate (m3/hr)	=			4194.80	)
	Dia of pipe (m)	=			0.40	)
	Pipe area (m2)	=			0.13	5
	Exit velocity (m/s)	=			9.28	;

P1	Peng Chau Sewage Pum	ping Station			
	(Provided by DSD)				
Inlet	H <sub>2</sub> S conc. (ppm)	=		5.00	
	DF (OUm <sup>-3</sup> )	=		10000.00	
Outlet	H2S conc. (ppm)	=		0.025	
(99.5% removal	DF (OUm <sup>-3</sup> )	=		50.00	
efficiency)	Vent pipe dimensions (m	l)	=	0.6 x 0.6	
	Vent pipe area (m <sup>2</sup> )		=	0.36	
	Air flow rate (m <sup>3</sup> /h)		=	1505.00	
	Total Outlet E (OUs <sup>-1</sup> )		=	20.90	
	Exit velocity (m/s)		=	1.16	
	Exit height (m)		=	3.00	