Appendix 5.01a Methodology for Background Pollution Loading Inventory

1 INTRODUCTION

1.1 A comprehensive pollution loading inventory for background discharges outside the catchments of Kai Tak Development areas and Tolo Harbour was compiled for Ultimate Design Scenario (UDS) for operational phase modelling. The methodologies for compiling the background pollution loading are given in this Appendix.

1.2 For the construction phase modelling for Tolo Harbour in Year 2026, the key background pollution loading to Tolo Harbour would be the polluted storm water discharges in the area. The background storm loading to Tolo Harbour in Year 2026 would follow that for operational phase modelling for UDS to address the uncertainties of storm pollution in future as discussed in Section 5 of the EIA Report and therefore not presented in this Appendix.

2 STORM OUTFALLS

2.1 The key sources of water pollution in storm outfalls include:

- Pollution due to sewage from unsewered developments (dry weather load)
- Pollution due to expedient connections from trade and residential premises, and integrity problems of aged drainage and sewerage systems (dry weather load)
- Pollution due to livestock waste (dry weather load)
- Rainfall related load.

2.2 The total pollution load discharged via the storm system would cover the dry weather load and rainfall related load.

Dry Weather Load

2.3 Domestic, commercial and industrial activities are the principle sources of dry weather load in storm drains. Total pollution loads generated from these activities were compiled by catchment areas as shown in **Figure 2.1** below with reference to the latest projected population and employment data provided by the Planning Department (PlanD). Details of these planning data and the methodology for calculating the pollution loads from domestic commercial and industrial activities are given in Section 4 of this Appendix.

2.4 It was assumed that a portion of total pollution load generated within a catchment would be lost to the storm system whilst the rest of the flow would be diverted to the sewerage system. The assumed percentages of pollution load discharged into the storm system for different catchments are presented in **Table 2.1**.

2.5 The percentage interceptions assumed in **Table 2.1** were based on the implementation schedule for sewerage improvement projects as adopted under the approved EIA for Harbour Area Treatment Scheme (HATS) Stage 2A. The pollution loading in the storm system contributed from domestic, commercial and industrial activities was compiled to the catchment levels shown in **Figure 2.1**. The pollution loading compiled for each catchment was distributed to appropriate discharge points (i.e. storm culverts / outfalls, rivers and nullahs). It was assumed that these storm pollutions would be evenly distributed amongst the major storm water discharge points within the catchment.

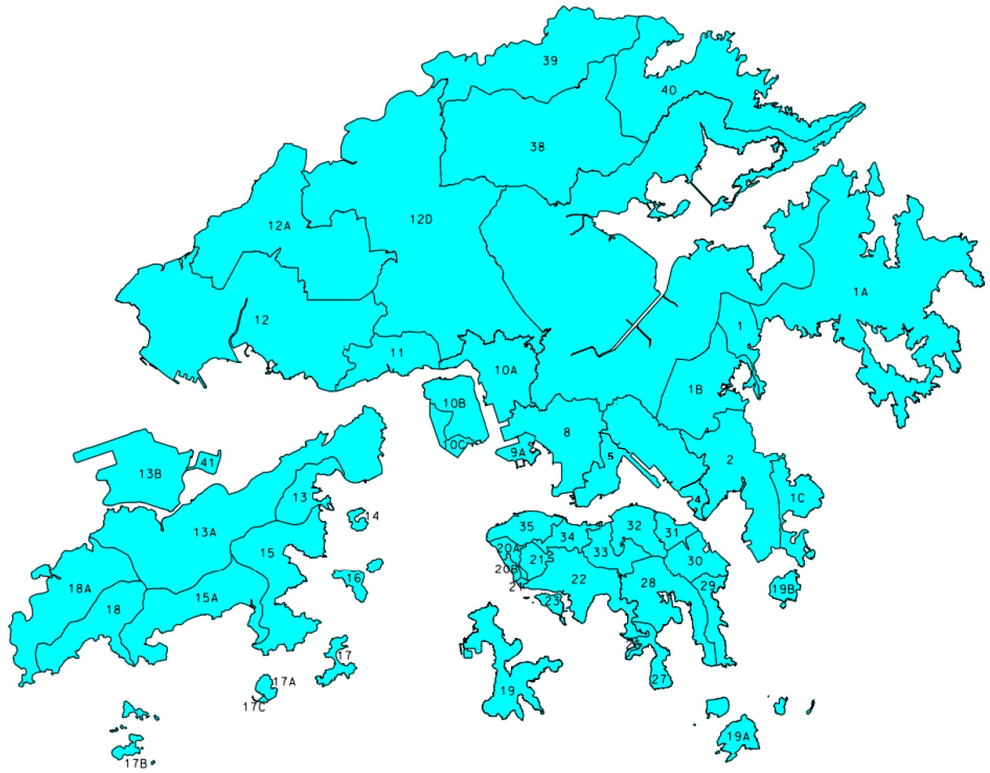

Figure 2.1 Sewage Catchment Boundaries

Table 2.1 Assumed % of Pollution Load in the Storm System for UDS

Catchment	Catchment ID	Assumed % of Load in the Storm System	Foul interception to:
		UDS	UDS
Sai Kung	1	10%	Sai Kung Sewage Treatment Works (STW)
Sai Kung Country Park	1a	50%	
Pak Sha Wan	1b	10%	
Clear Water Bay	1c	100%	-
Tseung Kwan O	2	5%	Stonecutters Island Sewage Treatment Works (SCISTW) under the Harbour Area Treatment Scheme (HATS)
Yau Tong	4	10%	
Central Kowloon, South Kowloon	5	10%	
Northwest Kowloon	8	10%	
Stonecutters	9a	10%	
Kwai Chung and Tsuen Wan East	10a	10%	
Tsing Yi	10b	10%	
Potential Reclamation Site at Tsing Yi	10c	0%	
Tsuen Wan West (Rural Area)	11	10%	Sham Tseng STW
Tuen Mun	12	10%	Pillar Point STW
Yuen Long and Tin Shui Wai and Deep Bay Streams	12a	10%	San Wan STW for discharge via North West New Territories (NENT) outfall
Kam Tin and Yuen Long New Town	12d	10%	Yuen Long STW for discharge via North West New Territories (NENT) outfall
Discovery Bay	13	0%	Siu Ho Wan STW
North Lantau	13a	10%	
Chek Lap Kok (including Third Runway)	13b	0%	
Peng Chau	14	30%	Peng Chau STW
Mui Wo	15	10%	Mui Wo STW
South Lantau	15a	100%	-
Hei Ling Chau	16	0%	Hei Ling Chau STW
Cheung Chau	17	30%	Cheung Chau STW
Shek Kwu Chau	17a	100%	-
Tai A Chau	17b	0%	Tai A Chau PTW
Potential Reclamation Site at Shek Kwu Chau for Integrated Waste Management Facilities (IWMF)	17c	0%	Zero wastewater / sewage discharge was proposed
Shek Pik	18	10%	Shek Pik STW
Tai O	18a	10%	Tai O STW
Lamma Island	19	30%	Yung Shue Wan STW and Sok Kwu Wan STW
Poi Toi Islands	19a	100%	-
Tung Lung	19b	100%	-
Pokfulam Sandy Bay	20a	10%	SCISTW
Cyber Port	20b	10%	SCISTW
Wah Fu Estates and Mt. Kellet	21	10%	SCISTW
Aberdeen, Shouson Hill and Repulse Bay, South Bay	22	10%	SCISTW
Ap Lei Chau	23	10%	SCISTW
Chung Hom Kok	26	10%	Stanley STW

Catchment	Catchment ID	Assumed % of Load in the Storm System	Foul interception to:
		UDS	UDS
Stanley	27	10%	
Tai Lam	28	10%	
Shek O	29	10%	Shek O STW
Chai Wan	30	10%	SCISTW
Shau Kei Wan	31	10%	
North Point	32	10%	SCISTW
Wan Chai East	33	10%	SCISTW
Wan Chai West	34	10%	
Western and Central, Green Island	35	10%	SCISTW
Sheung Shui and Fanling	38	10%	Shek Wo Hui STW
North New Territories	39	95%	
Sha Tau Kok	40	10%	Sha Tau Kok STW
Hong Kong Boundary Cross Facilities (HKBCF)	41	0%	STW on HKBCF Island
Sunny Bay	42	0%	Proposed new Siu Ho Wan STW
Siu Ho Wan	43	0%	
Lung Kwu Tan	44	0%	Proposed new Lung Kwu Tan STW

2.6 The livestock waste load discharged via rivers / streams adopted under the approved EIA for HATS Stage 2A as shown in **Table 2.2** were directly applied in this Study. Loading of livestock waste directly to the storm system was expected to be gradually reduced in future. Hence, adopting the loading assumed in the HATS Stage 2A project was considered conservative.

Table 2.2 Livestock Waste Load Assumed for UDS

Catchment	River Name	Flow (m^3/d)	SS (kg/d)	TKN (kg/d)	NH_3-N (kg/d)	TP (kg/d)	*E. coli* (counts/d)
Tsueng Kwan O	Tseng Lan Shue River	2	0	0	0	0	6.98E+11
Sheung Shui and Fanling	Shenzhen River	3216	363	41	22	18	9.28E+14
Yuen Long, Tin Shui Wai and Kam Tin	Shan Pui Ho River	5034	568	65	34	28	1.45E+15
	Tin Shui Wai Nullah	4190	473	54	28	24	1.21E+15
Deep Bay	Sheung Pak Nai Stream	97	11	1	1	1	2.79E+13
	Ha Pak Nai Stream	677	76	9	5	4	1.95E+14

2.7 The total dry weather load in the storm outfall would include the loading contributed from domestic, commercial and industrial activities and the loading from livestock discharges (if any) as shown in **Table 2.2**.

Rainfall Related Load

2.8 It was assumed that a rainfall volume of greater than 10mm per day (and rainfall intensity greater than 2mm/hr) would give rise to runoff. The runoff percentage adopted under the EIA for HATS Stage 2A was used for this Study, which was based on the long-term (30-year) average rainfall data recorded from the Hong Kong Observatory. The calculation of the runoff percentage is shown below:

Runoff percentage = (Sum of the rainfall volume for the days with rainfall volume > 10mm and intensity > 2mm/hr within the season) ÷ Total rainfall volume for the season x 100%

2.9 Rainfall data from May to September represent the values for wet season, and those from November to March represent the values for dry season.

2.10 The 30-year long-term average rainfall data was used to determine the daily runoff value as shown below:

Daily runoff value (m/day) = 30year long term average daily rainfall data x runoff percentage

2.11 Thus, the runoff value was calculated as 0.01104 m/day and 0.00102 m/day for wet and dry seasons respectively.

2.12 The amount of rainfall related load that would be discharged into the sea depends on the amount of impermeable area within each catchment. It was assumed that all urbanized/developed areas within the catchment would be impermeable. The daily volume of runoff generated within each catchment was estimated as shown below:

Daily volume of runoff in each catchment (m^3/day)
= daily runoff value (m/day) x impermeable area within each catchment (m^2)

2.13 The daily volume of runoff estimated for each catchment was multiplied with the runoff concentrations to derive the rainfall related loading. The assumed runoff concentrations are shown in **Table 2.3**.

Table 2.3 Event Mean Concentrations for Stormwater Runoff

TSS (g/m^3)	BOD_5 (g/m^3)	NH_3N (g/m^3)	Cu (g/m^3)	TP (g/m^3)	OrthoP (g/m^3)	Silicate (g/m^3)	TON (g/m^3)	TKN (g/m^3)
43.25	22.48	0.20	0.01	0.20	0.04	3.28	0.40	1.40

Source of reference: EPD Pilot Study of Storm Pollution

2.14 The rainfall related loading was compiled to the catchment levels shown in **Figure 2.1**. The pollution loading compiled for each catchment was distributed to appropriate discharge points (i.e. culverts, outfalls, rivers and nullahs). It was assumed that the rainfall related loading would be evenly distributed amongst the major storm water discharge points within the catchment.

3 SEWAGE OUTFALLS

3.1 A portion of the total loads from domestic, commercial and industrial activities generated in each catchment would be allocated to the sewerage system according to the percentage of storm interception shown in **Table 2.1**. The remaining portion of the total load in each catchment would be distributed to the storm system.

3.2 Besides the pollution loads from domestic, commercial and industrial activities, the sewerage system would also receive pollution loads from landfills and beaches as most of the landfill sites and beach facilities would be connected to the sewerage system. **Table 3.1** and **Table 3.2** show the pollution load of relevant landfills and beaches adopted under the approved EIA for HATS Stage 2A. These loading data were directly adopted in this Study for UDS. The beach loading was included for the wet season simulations only. Loading from landfills and beaches that would not be connected to the STW is given in Section 6 of this Appendix. The effect of this point source pollution loading was considered localized. Contributions of these point source pollution loads would be insignificant as compared to the overall pollution loading that would be discharged into the sea. Possible change of these point source loads would unlikely affect the overall modelling results.

Table 3.1 Pollution Flows and Loads from Landfills

	Discharge Location	Flow (m3/d)	BOD (kg/d)	SS (kg/d)	Org-N (kg/d)	NH_3-N (kg/d)	*E. coli (no./d)*	Cu (g/d)
SHUEN WAN LANDFILL								
Shuen Wan Landfill	Foul sewer to Tai Po STW	110	8	28	13	76	7.65E+05	2
NEW STRATEGIC LANDFILLS								
WENT	Foul sewer to NWNT sewage outfall	714	2648	288	190	1690	4.97E+06	14
SENT	Foul sewer to SCISTW	523	30	131	26	1	3.64E+06	10
NENT	Foul sewer to Shek Wu Hui STW	541	11	53	22	1	3.76E+06	11
NWNT LANDFILLS								
Pillar Point Valley	Foul sewer to Pillar Point STW	3283	3165	822	389	2511	2.28E+07	66
Ngau Tam Mei	Foul sewer to SCISTW	200	193	50	24	153	1.39E+06	4
Siu Lang Shui								
Gin Drinkers Bay								
Ma Tso Lung								
URBAN LANDFILLS								
Jordan Valley	Foul sewer to SCISTW	638	615	160	76	488	4.44E+06	13
Ma Yau Tong Central								
Sai Tso Wan								
Ma Yau Tong West								
Ngau Chi Wan								
TKO LANDFILLS								
TKO I	Foul sewer to SCISTW	69	66	32	8	52	4.77E+05	1

Table 3.2 Pollution Loads from Beach Users in Bathing Season

Gazetted Beach	Discharge Location	Flow (m^3/day)	BOD (g/day)	SS (g/day)	Org-N (g/day)	NH_3-N (g/day)	*E. coli* (no./day)	TP (g/day)	OrthoP (g/day)
Big Wave Bay	Shek O STW	3	788	657	432	985	1.04E+13	224	133
Hairpin		1	334	278	183	417	4.41E+12	95	57
Shek O		20	4895	4079	2685	6118	6.46E+13	1393	829
Deep Water Bay	SCISTW	22	5436	4530	2982	6795	7.17E+13	1547	921
Middle Bay		3	667	556	366	833	8.80E+12	190	113
Repulse Bay		44	10968	9140	6017	13710	1.45E+14	3121	1858
South Bay		2	584	487	321	730	7.71E+12	166	99
Chung Hom Kok	Stanley STW	1	225	187	123	281	2.96E+12	64	38
St. Stephen's		4	875	729	480	1094	1.15E+13	249	148
Stanley Main		6	1504	1254	825	1880	1.98E+13	428	255
Turtle Cove		1	268	223	147	334	3.53E+12	76	45
Silvermine Bay	Mui Wo STW	0	112	93	61	140	1.47E+12	32	19
Hung Shing Yeh	Yung Shue Wan STW	1	308	256	169	384	4.06E+12	88	52
Lo So Shing		0	68	57	37	85	8.99E+11	19	12
Kwun Yau Wan	Cheung Chau STW	0	94	78	52	117	1.24E+12	27	16
Tung Wan, Cheung Chau		4	1089	908	598	1362	1.44E+13	310	185
Silverstrand	Sai Kung STW	18	4556	3797	2500	5695	6.01E+13	1297	772
Trio (Hebe Haven)		3	632	527	347	790	8.34E+12	180	107
Anglers'	Sham Tseng STW	0	87	73	48	109	1.15E+12	25	15
Approach	Sham Tseng STW	0	77	64	42	96	1.02E+12	22	13
Casam	Sham Tseng STW	0	63	53	35	79	8.36E+11	18	11
Gemini	Sham Tseng STW	0	41	34	23	52	5.44E+11	12	7
Hoi Mei Wan	Sham Tseng STW	0	85	71	47	107	1.13E+12	24	14
Lido	Sham Tseng STW	3	662	552	363	828	8.74E+12	188	112
Ting Kau	Sham Tseng STW	0	26	22	14	32	3.42E+11	7	4
Butterfly	Pillar Point STW	17	4248	3540	2331	5310	5.61E+13	1209	720
Castle Peak		2	605	504	332	756	7.98E+12	172	102
Kadoorie		22	5561	4634	3051	6951	7.34E+13	1582	942
New Cafeteria		8	2045	1704	1122	2556	2.70E+13	582	346
Old Cafeteria		3	732	610	401	915	9.65E+12	208	124
Golden Beach		22	5505	4587	3020	6881	7.26E+13	1566	932

3.3 The total load generated in the sewerage system would be reduced after the treatment processes. **Table 3.3** shows the treatment processes for major STW. It should be noted that SCISTW, Pillar Point Sewage Treatment Works (PPSTW), Siu Ho Wan Sewage Treatment Works (SHWSTW), San Wai Sewage Treatment Works (SWSTW), Yuen Long Sewage Treatment Works (YLSTW) and Sham Tseng Sewage treatment Works (SHTSTW) are not included in **Table 3.3** as the methodologies for compiling the loading discharged from these STW are discussed separately in Section 5 of this Appendix. The treatment efficiencies for different treatment processes are given in **Table 3.4** for reference.

Table 3.3 Summary of Major Sewage Treatment Works and the Corresponding Treatment Levels

STW	Assumed Treatment Level UDS
Stanley	Secondary treatment with disinfection
Shek O	Preliminary treatment
Tai O	Secondary treatment
Cheung Chau	Secondary treatment
Mui Wo	Secondary treatment with disinfection
Peng Chau	Secondary treatment with disinfection
Shek Wu Hui	Secondary treatment with disinfection
Sha Tau Kok	Secondary treatment with disinfection
Sai Kung	Secondary treatment with disinfection
Yung Shue Wan	Secondary treatment
Sok Kwu Wan	Secondary treatment
Hei Ling Chau	Secondary treatment with disinfection
Shek Pik	Secondary treatment with disinfection

Table 3.4 Treatment Efficiency for Treatment Works

Types of Treatment Plant	BOD_5	TSS	NH_3-N	Org-N	OrthoP	TP	Cu	*E. coli*
Screening Plants[A]	0%	0%	0%	0%	0%	0%	0%	0%
Primary Treatment (no disinfection)	32.5%	55%	0%	15%	0%	15%	26%	50%
Primary Treatment (with disinfection)	32.5%	55%	0%	15%	0%	15%	26%	99.95%
Chemical Enhanced Primary Treatment (CEPT) (with no disinfection)[B]	55%	70%	10%	45%[C]	60%	60%	80%	50%
Chemical Enhanced Primary Treatment (CEPT) (with disinfection)[B]	55%	70%	10%	45%[C]	60%	60%	80%	99.95%
Secondary Treatment (no disinfection)	85%	90%	75%	80%	35%	50%	74%	94%
Secondary Treatment (with disinfection)	85%	90%	75%	80%	35%	50%	74%	99.97%

Note
A. It was assumed that the reduction of the pollution parameters was insignificant in screening plants. Therefore, the removal rates for these parameters were all assumed zero.
B. Based on estimation from the SSDS EIA Study: Technical Note 1 (Revised) Wastewater Flows and Loads and Effluent Characteristics.
C. The removal rate of org-N was calculated from the removal rates of NH3-N and total N (10% and 25% respectively) assuming that NH3-N contributes about 57% of total N in raw sewage.

3.4 The on-site STW recently proposed under the HKBCF was also included in the loading inventory for water quality impact assessment. The assumed flow and effluent quality of this local STW were based on that adopted in the approved EIA for HKBCF as presented in the **Table 3.5** below.

Table 3.5 Assumed Flow and Effluent Quality for HKBCF On-site STW

Flow	BOD_5	SS	NH_4N	Ortho-P	Total P	Total N	Cu	*E. coli*
1,628	20	30	40	2	7	50	30	1,000
m^3/d	Mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	cfu /100ml

4 POLLUTION LOADS FROM DOMESTIC, COMMERCIAL AND INDUSTRIAL ACTIVITIES

4.1 Population and Employment Statistics

Time Aspect

4.1.1 The Enhanced 2011-based Territorial Population and Employment Data Matrices (TPEDM) provided by Planning Department were used to compile the pollution loads from domestic, commercial and industrial activities. The TPEDM provide the projected population breakdown by Planning Vision and Strategy (PVS) zones for Years 2011, 2021, 2026, 2031, 2036 and 2041. The loading for the assessment year (UDS) was estimated based on a 10% extrapolation of the projected population for 2041.

Spatial Aspect

4.1.2 To facilitate the estimation of pollution loading, the population and employment data were required to be presented at the level of catchment areas shown in **Figure 2.1** of this Appendix. However, the projected population from the TPEDM was provided in a much smaller scale at PVS zones. Population and employment data for each sewage catchment area were estimated by overlaying the PVS zones on top of the layout of the sewage catchment area for allocating the appropriate PVS zones to the sewage catchment area.

4.2 Data Manipulation

4.2.1 The TPEDM provides the number of usual residents, mobile residents and school places within the territory at PVS zones.

4.2.2 Employment population was divided by 19 job types under the TPEDM as listed below:

- S1 Agriculture, forestry and fishery, mining and quarrying
- S2 Manufacturing
- S3 Electricity and gas supply, water supply, sewerage and waste management
- S4 Construction
- S5 Import and export trade
- S6 Wholesale
- S7 Retail trade
- S8 Transportation, storage, postal and courier services
- S9 Short term accommodation activities,
- S10 Food and beverage service activities
- S11 Information and communication
- S12 Financial and insurance activities
- S13 Real estate activities
- S14 Professional scientific/technical administrative and support service activities
- S15 Public administration
- S16 Education
- S17 Human health activities
- S18 Other social & personal services
- S19 Works activities within domestic households

4.2.3 The population data from the TPEDM were manipulated and presented at the following categories:

- Residential population (by usual residents and mobile residents)
- Transient Population (by total employment number and total school places), where total employment=the Sum of S1 to S19
- Number of employees in commercial sector (=S3+S4+S6+S7+S8+S9+S10+S11+S17+S18)
- Number of employees in manufacturing sector (=S2).

4.2.4 The domestic pollution load to be generated from a catchment would be affected by the number of resident population and transient population within the catchment. The total employee number comprises 19 job types listed above. Commercial effluents were contributed from job S3, S4, S6 to S11, S17 and S18. Industrial effluents were contributed from job type S2.

4.2.5 In order to provide a better estimation of pollution loads from industrial processes, the number of employees in manufacturing sector (S2) was further broken down into 6 sub-categories, namely food, textiles, leather, paper, manufacturing and machinery. Projected employment statistics were not available for these 6 sub-categories. It was noted that the size for each of these 6 sub-categories was estimated under the EPD Update Study [(1)]. To estimate the size of these 6 sub-categories for this Study, it was assumed that the share of each sub-category in the manufacturing sector provided in the Update Study would be the same as that for UDS.

4.3 Unit Flow and Load Factors

4.3.1 Relevant per head flow and load was assigned to residential, transient, commercial and industrial population to obtain the quantity and quality of total untreated wastewater by individual catchment areas. **Table 4.1** to **Table 4.5** shows the flow and load factors.

Table 4.1 Domestic Flow and Load Factors for Resident Population

Description	Flow [1] (m^3/d/head)	SS [2]	BOD_5 [2]	TKN [2]	NH_3-N [2]	TP [3]	Cu [3]	*E. coli* [2]
	UDS	(all in g/d/head except *E. coli* in no./d/head)						
Usual residents								
Sandy Bay	0.35	40	42	8.5	5.0	1.33	0.0065	4.3E+10
Stanley, Discovery Bay	0.29	40	42	8.5	5.0	1.33	0.0065	4.3E+10
Shek O	0.35	40	42	8.5	5.0	1.33	0.0065	4.3E+10
Outlying Island, Sai Kung	0.27	40	42	8.5	5.0	1.33	0.0065	4.3E+10
Yuen Long, Mui Wo	0.25	40	42	8.5	5.0	1.33	0.0065	4.3E+10
Aberdeen, Wan Chai, North Lantau	0.23	40	42	8.5	5.0	1.33	0.0065	4.3E+10
Sha Tin, Tai Po	0.22	40	42	8.5	5.0	1.33	0.0065	4.3E+10
San Wai	0.23	40	42	8.5	5.0	1.33	0.0065	4.3E+10
Wah Fu, Shek Wu Hui, N	0.21	40	42	8.5	5.0	1.33	0.0065	4.3E+10
Northwest Kowloon, Tuen Mun, Central, North Point	0.2	40	42	8.5	5.0	1.33	0.0065	4.3E+10
Ap Lei Chau, Chai Wan, Shau Kei Wan, Central Kowloon, East Kowloon, Kwai Chung, Tsing Yi, Tseung Kwan O	0.19	40	42	8.5	5.0	1.33	0.0065	4.3E+10
Mobile residents	0.19	40	42	8.5	5.0	1.33	0.0065	4.3E+10

Source of reference:
1. Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (Version 1.0), EPD, March 2005
2. DSD Sewerage Manual
3. EPD Update Study

(1) CE42/97 Update on Cumulative Water Quality and Hydrological Effect of Coastal Development and Upgrading of Assessment Tool" (Update Study)

Table 4.2 Domestic Flow and Load Factors for Transient Population

Description	Flow [1] (m^3/d/head)	SS [2]	BOD_5 [2]	TKN [2]	NH_3-N [2]	TP [3]	Cu [3]	*E. coli* [2]
		(all in g/d/head except *E. coli* in no./d/head)						
Employed population	0.08	34	34	6.7	4.0	1.06	0.0052	3.5E+10
Students	0.04	34	34	6.7	4.0	1.06	0.0052	3.5E+10

Source of reference:
1. Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (Version 1.0), EPD, March 2005
2. DSD Sewerage Manual
3. EPD Update Study

Table 4.3 Flow and Load Factors for Commercial Activities

Description	Flow [1] (m^3/d/employee)	SS [2]	BOD_5 [2]	TKN [2]	NH_3-N [2]	TP [3]	*E. coli* [2]
		(all in g/d/head except *E. coli* in no./d/head)					
Electricity Gas & Water (S3)	0.25	25	53	2.5	0.8	0.53	0
Transport, Storage & Communication (S8 & S11)	0.1	25	53	2.5	0.8	0.53	0
Wholesale & Retail (S6 & S7)	0.2	25	53	2.5	0.8	0.53	0
Construction (S4)	0.15	25	53	2.5	0.8	0.53	0
Restaurants & Hotels (S9 & S10)	1.5	25	53	2.5	0.8	0.53	0
Community, Social & Personal Services (S17 & S18)	0.2	25	53	2.5	0.8	0.53	0

Source of reference:
1. Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (Version 1.0), EPD, March 2005
2. DSD Sewerage Manual
3. EPD Update Study

Table 4.4 Flow Factors for Industrial Activities

Catchment	Flow [1] (m^3/d/employee)
S2 Manufacturing	
Hong Kong Island (except Aberdeen & Ap Lei Chau), San Po Kong	0.25
North West Kowloon	0.45
East Kowloon, Sha Tin, Lantau Island (except Mui Wo)	0.45
Central Kowloon, North District, Aberdeen, Ap Lei Chau	0.55
Tsuen Wan, Kwai Chung	0.65
Tai Po	0.75
Tuen Mun, Tseung Kwan O, Yau Tong, Cheung Chau, Mui Wo	1
Tsing Yi	1.5
Sai Kung, Yuen Long	2

Source of reference:
1. Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (Version 1.0), EPD, March 2005

Table 4.5 Load Factors for Industrial Activities

Category	SS [1]	BOD_5 [1]	TKN [1]	NH_3-N [1]	Cu [1]	*E. coli* [1]
	(all in g/d/employee except *E. coli* in no./d/employee)					
S2 Manufacturing						
Food	502	713	39	0	0	0
Textiles	2095	3680	67	0	4.4	0
Leather	115	115	29	7	0.1	0
Paper	2228	2150	33	0	0	0
Manufacturing	355	931	0	0	2.4	0
Machinery	40	90	29	22	0.9	0

Source of reference:
1. EPD Update Study

4.3.2 Pollution load generation factors for OrthoP and silica were not available. The following assumptions were adopted for calculating OrthoP and silica loading in raw sewage.

- TP to OrthoP was 1.68 based on the actual measurements of raw sewage at Sha Tin STW and Yuen Long STW.
- The silica content was approximately 9 mg/l based on the actual measurements of raw sewage at Sha Tin STW.

5 CONCURRENT DISCHARGES FROM HATS AND OTHER MAJOR STW

5.1 Effluent discharges from the key STW within the modelling areas have been considered separately. These key discharges include the effluent flow from SCISTW, PPSTW, SHWSTW, NWNT outfall (including YLSTW and SWSTW) and SHTSTW.

SCISTW

5.2 In UDS, all the outfalls of the preliminary treatment works in the Victoria Harobour would be decommissioned and the sewage would be diverted to the SCISTW for Chemically Enhanced Primary Treatment (CEPT) with disinfection.

5.3 To take account of the key background pollution loading for cumulative assessment, pollution loading from the HATS was considered separately. It was assumed under this Assignment that the existing treatment process of HATS would not be further upgraded in the future for conservative assessment. Chemically Enhanced Primary Treatment (CEPT) with disinfection was assumed as the ultimate treatment process of HATS for water quality modelling which involves a discharge of effluent at the existing SCISTW. The HATS flow and effluent concentrations assumed in the UDS are given in **Table 5.1** below.

Table 5.1 Assumed Flow and Effluent Concentrations for HATS in UDS

Parameters	Ultimate Scenario (1)
Ultimate Design Flow (m^3 per day)	2.45M
BOD_5 (mg/l)	64
SS (mg/l)	48
Total Kjeldahl Nitrogen (mgN/l)	31
NH_3-N (mgN/l)	25
Total Phosphorus (mgP/l)	3.1
Orthophosphate (mgP/l)	2
Total nitrite and nitrate (mgN/l)	0
Copper (mg/l)	0.023
Silicate ($mgSiO_2$/l)	8.6
E. coli (no./100ml)	20,000

Notes:
(1) Based on the information provided in the approved EIA study for HATS Stage 2A.

Remaining STWs

5.4 It was proposed to use the design plant capacity to calculate the loading discharged from the major STW for UDS as shown below:

- PPSTW – 241,000 m^3/day
- SHWSTW – 180,000 m^3/day
- YLSTW – 70,000 m^3/day
- SWSTW – 260,000 m^3/day
- SHTSTW – 17,000 m^3/day

5.5 The treatment process for all the above listed STW would be CEPT plus disinfection except for the YLSTW where secondary treatment plus disinfection would be provided. The effluent concentrations assumed for PPSTW, SHWSTW, NWNT outfall (receiving effluent from YLSTW and SWSTW) and SHTSTW were based on the information from recent EIA studies including the approved EIAs for Upgrading of PPSTW and Upgrading and Expansion of SWSTW.

5.6 These remaining STWs have discharge points in the western waters of Hong Kong. The closest outfall of these western STWs are located over 20 km and 60 km (sea distance) away from the Kai Tak Development (KTD) waters and Tolo Harbour respectively. Tolo Harbour in particular is a land-locked water body in the eastern waters with minimal influence from the western waters. Possible changes in the design capacities of these

western STWs would not affect the overall conclusion of this water quality impact assessment.

6 POINT SOURCE POLLUTION LOADS

6.1 The pollution loads from typhoon shelters, marine culture zones adopted in the approved EIA for HATS Stage 2A are summarized in **Table 6.1** and **Table 6.2**. These pollution loads were included in the water quality model under UDS for cumulative assessment. Loading from landfills and beaches that would not be connected to the STW is summarized in **Table 6.3** and **Table 6.4**.

Table 6.1 Pollution Flows and Loads from Typhoon Shelter

Typhoon shelters	Flow (m^3/d)	BOD (g/d)	SS (g/d)	Org-N (g/d)	NH3-N (g/d)	*E. coli* (no./d)	Copper (g/d)	TP (g/d)	OrthoP (g/d)	Silicate (g/d)
Shau Kei Wan	149	41670	39686	3473	4961	4.27E+14	6	1320	785	1279
Sam Ka Tsuen	39	10803	10289	900	1286	1.11E+13	2	342	204	332
Kwun Tong	22	6055	5766	505	721	6.20E+12	1	192	114	186
Causeway Bay	179	50099	47714	4175	5964	5.13E+13	8	1586	944	1538
Yau Ma Tei	184	51643	49183	4304	6148	5.29E+13	8	1635	973	1586
Rambler Channel	36	10032	9554	836	1194	1.03E+13	2	318	189	308
Aberdeen	388	108746	103568	9062	12946	1.11E+14	17	3444	2050	3339
Tuen Mun	138	38643	36803	3220	4600	3.96E+13	6	1224	728	1186
Cheung Chau	166	46597	44378	3883	5547	4.77E+13	7	1476	878	1431
Shuen Wan (Yim Tin Tsai)	49	13712	13059	1143	1632	1.40E+13	2	434	258	421
Sai Kung	81	22794	21709	1899	2714	2.33E+13	4	722	430	700
Chai Wan	44	12347	11759	1029	1470	1.26E+13	2	391	233	379
To Kwa Wan	53	14840	14133	1237	1767	1.52E+13	2	470	280	456

Table 6.2 Pollution Flows and Loads from Marine Culture Zone

Marine Culture Zone	BOD (g/d)	SS (g/d)	Org-N (g/d)	NH3-N (g/d)	TP (g/d)	OrthoP (g/d)
Sha Tau Kok	42806	124916	10569	38075	2038	1595
Ap Chau	999	2915	247	888	48	37
Kat O	7705	22485	1902	6854	367	287
O Pui Tong	25113	73284	6200	22338	1196	936
Sai Lau Kong	1712	4997	423	1523	82	64
Wong Wan	5351	15615	1321	4759	255	199
Tap Mun	17217	50244	4251	15315	820	642
Kau Lau Wan	2663	7773	658	2369	127	99
Sham Wan	42948	125333	10604	38202	2045	1600
Lo Fu Wat	1284	3747	317	1142	61	48
Yung Shue Au	81330	237341	20081	72343	3872	3031
Leung Shuen Wan	4114	12006	1016	3659	196	153
Tiu Cham Wan	4043	11798	998	3596	192	151
Tai Tau Chau	14934	43582	3687	13284	711	557
Kai Lung Wan	6432	18769	1588	5721	306	240
Kau Sai	10987	32062	2713	9773	523	409
Ma Nam Wat	9536	27829	2355	8482	454	355
Po Toi O	9084	26510	2243	8080	432	339
Po Toi	33579	97990	8291	29868	1599	1251
Sok Kwu Wan	25969	75783	6412	23099	1236	968
Lo Tik Wan	11011	32131	2719	9794	524	410
Ma Wan	50939	148650	12577	45310	2425	1898
Yim Tin Tsai	35552	103750	8778	31624	1693	1325
Cheung Sha Wan	19025	55518	4697	16922	906	709

Marine Culture Zone	BOD (g/d)	SS (g/d)	Org-N (g/d)	NH3-N (g/d)	TP (g/d)	OrthoP (g/d)
Yim Tin Tsai (East)	35499	103750	4406	31754	1197	1051
Tung Lung Chau	18996	55518	2358	16992	640	562

Table 6.3 Pollution Flows and Loads from Landfills

Landfill	Flow (m3/d)	BOD (kg/d)	SS (kg/d)	Org-N (kg/d)	NH_3-N (kg/d)	*E. coli* (no./d)	Cu (g/d)
Shuen Wan Landfill Leachate seepage into coastal waters	50	10	10	10	90	3.48E+05	1

Table 6.4 Pollution Flows and Loads from Beaches

Gazetted Beach	Flow (m^3/d)	BOD (g/d)	SS (g/d)	Org-N (g/d)	NH_3-N (g/d)	*E. coli* (no./d)	TP (g/d)	OrthoP (g/d)
Cheung Sha Lower	1	245	204	135	307	3.24E+12	70	42
Cheung Sha Upper	0	95	79	52	118	1.25E+12	27	16
Pui O	1	152	126	83	190	2.00E+12	43	26
Tong Fuk	1	188	156	103	234	2.48E+12	53	32
Hap Mun Bay	13	3204	2670	1757	4004	4.23E+13	912	543
Kiu Tsui	1	353	294	194	441	4.66E+12	100	60
Tung Wan, Ma Wan	2	485	404	266	607	6.40E+12	138	82
Clear Water Bay 1st	5	1340	1117	735	1675	1.77E+13	381	227
Clear Water Bay 2nd	46	11385	9487	6246	14231	1.50E+14	3240	1928