7 SEWERAGE AND SEWAGE TREATMENT IMPLICATION

7.1 Legislation and Standards

7.1.1 The design shall comply with the following standards, Codes of Practice and Design Manuals.

(1) DSD Sewerage Manual Part 1 (2013);

(2) DSD Sewerage Manual Part 2 (2013);

(3) DSD Technical Circulars and Practice Notes;

(4) EPD Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0, Report No. EPD/TP 1/05;

(5) The Government of the Hong Kong SAR General Specification for Civil Engineering Works (2006 Edition);

(6) DSD Standard Drawings;

(7) DSD Stormwater Drainage Manual (2013);

(8) BS EN 598 Ductile iron pipes, fittings, accessories and their joints for sewerage applications (2007);

(9) BS 65 Vitrified clay pipes, fittings and ducts, also flexible mechanical joints for use solely with surface water pipes and fittings; and

(10) BS EN 295-1 Vitrified clay pipes systems for drains and sewers (2013).

7.2 Description of Existing Environment

Existing Sewage Treatment Works

7.2.1 Sewage generated from ARQ development is collected at the Kwun Tong Preliminary Treatment Works (KTPTW) for further treatment and disposal. The current capacity of KTPTW was stated as 10.92m^3/s and was recommended to be upgraded from 10.92m^3/s to 13.14m^3/s in the study of "Upgrading of Kwun Tong Preliminary Treatment Works – Feasibility Study" under Agreement No. CE5/2008(DS). The KTPTW upgrading works is anticipated to be completed in June 2021 under Agreement No. CE47/2013(DS) "Upgrading of Kwun Tong Preliminary Treatment Works – Investigation, Design and Construction". Since the first population intake is planned in 2022, no programme gap between the KTPTW upgrading works and the ARQ development is anticipated.

Existing Sewerage System

7.2.2 ARQ development is located within the East Kowloon sewerage catchment and in the study area of C&E Kln SMPs. C&E Kln SMPs gave a proposal for overall sewerage upgrading works to cater for the future developments (including DAR and ARQ developments) in Central and East Kowloon region. The associated sewerage upgrading works are being implemented under construction contract (Contract No. DC/2010/06) Upgrading of Central and East Kowloon Sewerage - Phase 2 and anticipated to be completed in year 2015. Based on the planning programme of ARQ, the first population

intake is planned in 2022. Therefore, it is assumed that all the associated sewerage upgrading works are in place in this sewerage assessment.

7.3 Sewage Estimation and Assessment Methodology

7.3.1 Sewage generated by ARQ development is based on the proposed population and employment data assumed with reference to the RODP. The unit flow used for the estimation follows EPD Technical Paper – Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0, Report No. EPD/TP 1/05.

7.3.2 Based on the RODP of ARQ development, average dry weather flow (ADWF) is estimated and summarized in **Table 7.1**.

Table 7.1: ARQ - Average Dry Weather Flow (ADWF)

Development	Category	Category	Population	Unit Flow Factor (m^3/h/day)	ADWF (m^3/day)
ARQ	Residential	Resident (R2) Subsidized Housing	20,000 5,000	0.27 0.19	5,400 950
	Local Commercial	Employee (J4)	1,314	0.28	368
	Sports Centre and Event/ Cultural Space	Employee (J11)	1,034	0.28	290
	School	Student	3,600	0.04	144
	Divisional Police Station	Employee (J11)	153	0.28	43
	Divisional Fire Station	Employee (J11)	153	0.28	43
	Community Building	Employee (J11)	257	0.28	72
	RCP	Employee (J11)	35	0.28	10
Total		Resident Student/ Employee	25,000 6,546		7,320

7.3.3 Hydraulic analysis using hydraulic software InfoWorks ICM, which based on the latest and calibrated hydraulic model from "Agreement No. CE61/2006(DS) Upgrading of Central and East Kowloon Sewerage – Investigation, Design and Construction", has been conducted to assess impact on the overall sewerage network. Hydraulic model results and calculations refer to Sewerage Impact Assessment (SIA) Report as attached in **Appendix 7.1**.

7.4 Evaluation of Impact on Sewage Treatment Works

7.4.1 After incorporated latest planning information with total 25,000 and 48,600 populations from ARQ and DAR developments in the hydraulic model network, total discharge peak flow from East Kowloon catchment to KTPTW has been evaluated in below **Table 7.2**.

Table 7.2: Total discharge peak flow to KTPTW

Catchment	Population	ADWF (m^3/day)	PWWF (m^3/s)
Kai Tak Development	120,630	31,896	0.89 [1]
Cruise Passenger at Terminal Buildings (Passengers and Crewmembers)	12,900	2,016	0.06 [1]
Cruise Vessel Discharge	-	2,941	0.10 [1]
DWFI from JVBC	-	-	0.50 [1]
Kwun Tong Town Centre Re-development	24,328	10,799	0.31 [2]
Ex-Cha Kwo Ling Kaolin Mine site development	7,280	1,221	0.03 [2]
South East Kowloon (SEK) Catchment (including ARQ, DAR & Comprehensive Development at Yau Tong Bay [YTB] [3])	503,984 (including DAR 53,730 ARQ 31,546 & YTB 24,181)	155,363 (including DAR 9,439 ARQ 7,320 & YTB 6,623)	4.04 [4] (including DAR 0.57 ARQ 0.48 & YTB 0.37)
North East Kowloon (NEK) Catchment	555,854	274,285	6.89 [4]
Total =			12.82

Notes:

[1] From Environmental Impact Assessment Report of Kai Tak Development under Agreement No. CE35/2006(CE) [RODP May 2008] incorporation of Broad Development Parameters of the Applied Use / Development in respect of Application Nos. A/K22/14-15 approved in November 2013

[2] From multiplying peaking factor of Max ($3.9/N^{0.065}$, 2.4) according to EPD's guideline for population > 50,000 (N = contributing population in thousands

[3] From Broad Development Parameters of the Applied Use / Development in respect of Application No. A/K15/96 at Yau Tong Bay with total 24,181 populations approved in February 2013

[4] Flows from hydraulic model networks include domestic flow, commercial flow, student flow, industrial flow, inflow from DWFIs and infiltration from surface water

7.4.2 Based on the latest available development parameters for above on-going projects, total discharge peak flow to KTPTW will be 12.82m^3/s. It shows that KTPTW with 10.92m^3/s capacity is inadequate to cater for the predicted peak flow. It is understood that EPD's "Upgrading of Kwun Tong Preliminary Treatment Works – Feasibility Study, Agreement No. CE5/2008(DS)" recommended to upgrade the peak capacity to 13.14m^3/s and should be adequate. As mentioned in **Section 7.2.1**, no programme gap is anticipated between the completion of the KTPTW upgrading works and the ARQ development.

7.5 Evaluation of Impact on Sewerage System and Mitigation Measures

7.5.1 Improvement recommendations have been drawn for the surcharged sewers with less than 1 metre freeboard caused by ARQ development. 400m of the downstream sewers at Po Lam Road are recommended to be upgraded from size 225mm to 450mm diameter. In addition, no other further downstream sewers are proposed to be upgraded.

7.6 Environmental Acceptability of Schedule 2 Designated Projects

7.6.1 The engineering feasibility study of the proposed ARQ development is a Schedule 3 Designed Project (DP) under the EIAO, whilst there will be two Schedule 2 DPs; i.e. road improvement works and rock cavern developments under the ARQ project. Details of these two Schedule 2 DPs are provided in **Section 1.4** and shown in **Figure 227724/E/0002**.

Road Improvement Works

7.6.2 Three road improvement works were proposed at junction of (J/O) Lin Tak Road and Sau Mau Ping Road, at J/O Clear Water Bay Road and Road L1 of Development of Anderson Road (DAR), as well as at the new merging lane at New Clear Water Bay Road near Shun Lee Tsuen Road. In view of the road project nature, sewerage and sewage implications are not anticipated.

Rock Cavern Developments

7.6.3 The proposed cavern development are located on the hillside of the proposed ARQ Development. According to the best available information at this stage, the caverns are proposed for commercial use (e.g. food and beverage) as well as museum, and its sewerage and sewage implications have been assessed in this Schedule 3 EIA Study. As revealed from the SIA Report, sewage flow of the cavern development is estimated as 110m^3/d, which is around 1.5% out of 7,320m^3/d total sewage flow of ARQ, and has been taken in account in ARQ sewerage system. Therefore, sewerage and sewage implications are not anticipated. Nevertheless, the detailed sewerage and sewage implications of this Schedule 2 DP will be further investigated in a separate EIA under the EIAO.

7.7 Conclusion

7.7.1 After incorporated latest planning information with total 25,000 and 48,600 populations from ARQ and DAR developments in the hydraulic model network, the discharge peak flow from East Kowloon catchment to KTPTW has been evaluated as 10.93m^3/s.

7.7.2 Based on the latest available development parameters for the on-going projects, the total discharge peak flow to KTPTW will be 12.82m^3/s. It shows that KTPTW with 10.92m^3/s capacity is inadequate to cater for the predicted peak flow. It is understood that EPD's "Upgrading of Kwun Tong Preliminary Treatment Works – Feasibility Study, Agreement No. CE5/2008(DS)" recommended to upgrade the peak capacity to 13.14m^3/s and should be adequate. The anticipated completion date of the KTPTW upgrading works is June 2021, whilst the first population intake of the ARQ is planned in 2022, hence no programme gap is anticipated between the completion of the KTPTW upgrading works and the ARQ development.

7.7.3 Two routes are proposed in ARQ sewerage system (total 2.8km long from size 300mm to 450mm diameter) to collect the sewage generated from ARQ development and convey to downstream sewerage system. Sewerage layout plans of the proposed sewerage system are attached in **Appendix 7.2**.

7.7.4 Improvement recommendations have been drawn for the surcharged sewers with less than 1 metre freeboard caused by ARQ development. 400m of the downstream sewers

at Po Lam Road are recommended to be upgraded from size 225mm to 450mm diameter. In addition, no other further downstream sewers are proposed to be upgraded.

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