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UPGRADING THE STONECUTTERS ISLAND CHEMICALLY ENHANCED PRIMARY SEWAGE TREATMENT WORKS – INTEGRATION OF THE PRIMARY SEDIMENTATION TANK PROCESS HYDRAULIC AND FLOW DISTRIBUTION USING COMPUTATIONAL FLUID DYNAMIC MODELLING FOR MAXIMIZING THE TREATMENT WORKS CAPACITY AND PERFORMANCE

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Summary of key findings

The Drainage Services Department (DSD) initiated upgrading of the existing thirty-eight (38) double-deck Primary Sedimentation Tanks (PSTs) with hydraulic enhancement features identified using Computational Fluid Dynamic (CFD) process hydraulic model – High Accuracy Clarifier Model (HACM$^{(c)}$). With the provision of energy disipating and floccuating inlet baffles, an increase of capacity by about 20% was identifed.

Background and relevance

To further improve the water quality of Hong Kong's Victoria Harbor, Hong Kong SAR Government is now implementing the second phase of the Harbor Area Treatment Scheme (HATS) Stage 2A, which comprises a long deep tunnel system to convey sewage from the northern and southwestern shores of Hong Kong Island to a new Main Pumping Station (MPS). Upgrading of the Stonecutters Island (SCI) Sewage Treatment Works (STWs) with Chemically Enhanced Primary Treatment (CEPT) is now underway, and commissioning of the upgraded works is scheduled in end of 2014 with ADWF treatment capacity to be increased from 1.7Mm^3/day to 2.45Mm^3/day.

Results

The new HATS Stage 2A MPS would handle the Stage 2A sewage flows which are ~655,000 m^3/day, while the existing Stage 1 MPS directs ~1,700,000 m^3/day from the western end of Main Distribution Channels (MDCs) under the design ADWF condition with a peak factor of 1.7. The introduction of sewage flows from both the eastern and western ends of the MDCs adversely affects the normal flow distribution pattern from the very long and narrow MDCs to the PSTs (Figure 1.1).

To address this complicated flow distribution issue, another three dimensional CFD model FLOW-3D was employed to quantify and determine necessary measures to be implemented for reducing the extent of flow imbalance under different flow scenarios. The HACM$^{(c)}$ model was brought in again to identify additional option(s) to further maximise the design CEPT capacity.

Discussion

This paper details the integrated use of the PST CFD process and flow hydraulic models and shows that their use was both time- and cost-effective in the upgrading of the PSTs for maximizing treatment capacity and performance taking into account flow imbalance considerations.

Figure 1.1 Tank Layout of SCI STW