

Harbour-front Enhancement Committee

Protecting the Water Quality of Victoria Harbour

PURPOSE

The purpose of this paper is to inform members about the water quality of Victoria Harbour and how it is protected for the purpose of achieving the intended beneficial uses and sustained viability of the ecosystem, through the implementation of the Harbour Area Treatment Scheme (HATS) and various sewerage/drainage programmes.

BACKGROUND

2. Victoria Harbour lies between the heavily urbanized areas of the Kowloon Peninsula and the northern shore of Hong Kong Island. Its natural depth and sheltered location make it a valuable asset of Hong Kong and its waters have been used for various purposes, including navigation, anchorage, recreation, and transportation.

3. Until relatively recently about 1.7 million tonnes of sewage from the approximately four million people living around the harbour was discharged largely untreated into the sea each day. This led to unacceptable levels of water pollution. Various measures have been adopted in order to remedy this situation and improve water quality, as further described below.

MEASURES TAKEN TO PROTECT THE WATER QUALITY OF VICTORIA HARBOUR

4. The key to improving water quality in Victoria Harbour and elsewhere lies in preventing the discharge of untreated or inadequately treated sewage. The Government has a three-pronged approach for dealing with the problem: (1) controlling pollution at source, (2) through provision of sewers and treatment facilities, collecting and treating sewage to the proper treatment level, and (3) intercepting polluted flows in stormwater drains.

Controlling Pollution at Source

5. The declaration of Water Control Zones (WCZs) under the Water Pollution Control Ordinance (WPCO) gives the Environmental Protection Department (EPD) the power to ensure that the quality of the effluents being discharged into the WCZs will meet the standards consistent with the need to protect the receiving water

bodies, and which are specified in licenses issued under the WPCO. By early 1996, all ten WCZs, covering the whole of Hong Kong and including Victoria Harbour, had been declared. To enforce the WPCO and minimize pollution the EPD regularly inspects dischargers, responds to complaints, and prosecutes offenders.

Collecting and Treating Sewage

6. In the early 1990s, the Government formulated seven Sewerage Master Plans (SMPs) for the Victoria Harbour catchment to identify sewerage infrastructure needs for meeting the population and development demands, and improving the water quality in local coastal waters (Figure 1). The majority of the improvement works recommended in the SMPs have been implemented. Much of the SMP works were related to increasing the capacity of the sewerage system (e.g. upgrading sewers and sewage pumping stations, upgrading the preliminary treatment works, and providing diversion sewers). Some were for rehabilitation of the sewer systems. A portion of the works also benefited the stormwater quality directly, including the provision of dry weather flow interceptors (DWFIs) (e.g. in East and West Kowloon) and correction of expedient connections to the stormwater drains as identified during the field investigations and surveys.

7. With rapid re-development and growth, and the re-distribution of populations in the Harbour catchment, reviews of the SMPs are being conducted on a rolling basis and proposals for additional upgrading works are being pursued.

8. In addition to upgrading the local sewerage networks through the implementation of the works recommended in the SMPs, the Government has also upgraded the harbour area sewage treatment at a strategic level through the implementation of the Harbour Area Treatment Scheme (HATS). Stage 1 of HATS, which was brought into full operation in late 2001, included the construction of a chemically-enhanced primary sewage treatment works at Stonecutters Island, and a system of deep tunnels for the transfer of untreated sewage to the works. The treated sewage is discharged through a tunneled outfall into the western part of the Harbour. The areas served by Stage 1 include the whole of Kowloon Peninsula, Tseung Kwan O, Kwai Chung, Tsing Yi, Tsuen Wan, Shau Kei Wan and Chai Wan (Figure 2).

9. To cater for future increases in sewage flow and provide the necessary treatment for the currently untreated sewage from the north and western shores of Hong Kong Island the Government plans to implement HATS Stage 2. Following various studies and trials, and a public consultation exercise which included consultation with the HEC on 4 November 2004, the Government proposed that the implementation of Stage 2 should be taken forward in a phased manner. Stage 2A will provide additional facilities and sewage tunnels to convey all the sewage from the northern and western areas of Hong Kong Island to the Stonecutters Island Sewage Treatment Works for chemical treatment and disinfection. Stage 2B will involve further raising the treatment level by constructing a biological treatment plant at a site

adjacent to Stonecutters Island. Stage 2A is targeted for full commissioning in 2014, but disinfection facilities are planned to be advanced to 2009 to enable early reopening of some beaches in the Tsuen Wan area currently closed to swimmers. The timing for construction of Stage 2B will be reviewed in 2010/11 taking into account trends in population growth, sewage flows and water quality.

Intercepting Polluted Flows in Stormwater Drains

10. The sewerage programme is helping to improve water quality, but on its own it may not directly enhance the public's enjoyment and experience at the Harbour's edge because stormwater discharging from seawall outfalls can be polluted, odorous and aesthetically unpleasant.

11. Stormwater is polluted because some establishments and members of the public illegally use the stormwater system for disposal of their sewage or wastewaters. Other non-point sources of pollutants, such as oil, animal faeces, etc. found on the streets also get flushed down into the stormwater system whenever streets are cleaned or when it rains.

12. Enforcement against illegal connections has rectified many sewage-related problems, especially from the industrial and commercial sectors, but it is still not sufficient to stop all of the pollution going into the stormwater drains. Most of the problems occur in older urban areas. At strategic locations in the Harbour catchment therefore, DWFIs have been installed and operated to reduce the polluted flow in the stormwater drains discharging into the Harbour. However, DWFIs are normally installed in the upstream catchment and cannot completely remove all polluted flow, in particular during rainstorms when overflow is allowed.

ACHIEVEMENTS AND AREAS OF IMPROVEMENT

13. As a result of our water pollution abatement programmes carried out over the last 20 years, there have been significant improvements to Hong Kong's general water quality:

- For rivers and streams, the rate of compliance with the Water Quality Objectives (WQOs) has increased from 49% in 1986 to 85% in 2005, while the proportion of monitoring stations with "Excellent" or "Good" grading has climbed from 34% to 81%.
- In terms of bathing beaches, the number of beaches with "Good" grading has more than doubled in the last two decades from 23% to 56%.
- For marine waters, the overall compliance with the WQOs has increased from 76% in 1986 to 85% in 2005. Red tides were a very serious problem in Tolo Harbour in the 1980s with 43 cases recorded in 1988. With the improvement of water quality in Tolo Harbour, red tides have been

reduced to around ten cases each year and the associated fish kills are rare nowadays.

14. The Regional Offices of EPD have been cracking down on improper sewage connections in industrial, commercial and residential premises to prevent people from discharging their sewage or wastewaters down stormwater drains, rather than into sewers. Apart from conducting some 20,000 inspections of dischargers annually, the EPD also works closely with other government departments, the concerned District Councils, and the Incorporated Owners of affected buildings to rectify misconnections of sewer and stormwater systems within buildings or premises. Partnership programmes with the construction industry, restaurants, vehicle repair workshops, and property management firms have also helped, in particular in educating the trades, to avoid discharging foul water directly to the water bodies.

Improvements Brought by HATS Stage 1

15. The commissioning of HATS Stage 1 at the end of 2001 has resulted in significant water quality improvements in most parts of Victoria Harbour. Under Stage 1, every day about 1.4 million tonnes of sewage generated on both sides of the Harbour are collected and treated. As a result, about 600 tonnes of sewage sludge and its associated pollutants are prevented from entering the Harbour daily, dissolved oxygen levels have increased by about 10% overall, toxic ammonia levels have decreased by about 25% and *E.coli* (an indicator of disease-causing organisms) levels have reduced by 50% (Figure 3). In 2005, the percentage compliance with the marine WQOs within the Victoria Harbour Water Control Zone was 83%, considerably higher than the 50% recorded in 2001 before HATS Stage 1 was fully commissioned.

Improvements to be Achieved by HATS Stage 2A

16. Stage 2A will provide chemical treatment to tackle the remaining portion of untreated sewage, amounting to around 450,000 tonnes a day, now entering into the Harbour and polluting the sea from the northern and western parts of Hong Kong Island (Figure 1). It will also provide disinfection of all its effluent. When Stage 2A is completed, based on the same performance indicators achieved by HATS Stage 1, it is expected that a further 190 to 500 tonnes of sludge would be prevented from being discharged into the Harbour every day. Other pollutants will also be further reduced. In particular, sewage pathogens (using *E.coli* as an indicator of disease-causing organisms) will be reduced by 90% in the Harbour after disinfection facilities are put in place. Toxic ammonia will be further reduced by an average of 10%, and nutrients, in terms of total inorganic nitrogen and phosphorus (which in rich supply can promote excessive algal growth), by a further 5% and 8% respectively. The dissolved oxygen level is also expected to further increase by 5%.

Adhering to the Polluter-pays Principle

17. Over the coming 10 years, the Government will need to commit more than \$20 billion to build HATS Stage 2A and other sewerage programmes throughout the territory. The annual operating expenditure of sewage treatment services will increase from about \$1,150 million in 2006/07 to \$2,450 million by 2016/17. These figures illustrate that sewage treatment infrastructure requires very substantial capital investment, incurs significant recurrent operating expenses, and requires a long planning lead-time for implementation. If the sewage charge is not adjusted over the coming ten years, the recovery rate will further decline from 54% of the operating cost at present to 33% in 2016/17. Rather than moving closer to a sustainable approach based on the polluter-pays principle we would be moving further away from it. We have drawn up a proposal for adjusting the sewage charge in a gradual manner over the next ten years with the aim that by 2016/17 80% of the operating costs attributable to the sewage charge will be recovered from the users of sewage services. This will mean that the average domestic sewage charge bill will rise from approximately \$11 per month now to about \$27 per month in ten years' time, through a series of modest increases of \$1 to \$2 per month each year. Even after these planned increases Hong Kong's sewage charges will remain amongst the lowest in developed cities around the world (Figure 4).

18. We plan shortly to introduce legislation into the Legislative Council that stipulates the charges to apply over the next ten years, to achieve the target described above. It is vitally important the legislature and the whole community give their support to the planned increases in order to place the water quality of our Harbour on a sustainable footing for the future.

Polluted Flows Intercepted by DWFIs and Other Remedial Actions

19. A map showing the locations of the DWFIs around the Harbour is shown in Figure 5. These interceptors are intended to remove polluted flows that arise from non-point sources (e.g. street washing or flushing) or from defective connections. However, during and immediately following large storm events, the DWFI systems may experience excessive flows and need to discharge part or all of the intercepted flows to the nearby stormwater systems or water bodies.

20. The Government has also implemented other measures to remedy possible pollution of the Harbour at specific locations. One area of focus has been the Kai Tak Nullah, a major stormwater channel in southeast Kowloon which has long been a source of complaint for its bad odour. In 2003 more than 20 misconnections were identified and rectified. As a result, the polluted organic load in the nullah was drastically reduced by 260 kilogrammes per day – the equivalent of sewage from 4,700 people. The odour level is now much reduced, fish have returned to the nullah, and egrets are feeding from its waters.

21. Past implementation of sewerage projects have also resulted in significant improvement of water quality in certain areas. One prominent example is the Kwun Tong Typhoon Shelter, the water quality data (including Dissolved Oxygen, 5-day Biochemical Oxygen Demand, and *E.coli*) of which have shown significant improvement in the past 19 years. This has been due to various efforts, including the provision of DWFIs for rectifying expedient connections, and sewerage upgrading works as a result of the implementation of works recommended in the relevant SMPs. The diversion of the stormwater discharge away from the Sam Ka Tsuen Typhoon Shelter has also resulted in better water quality in the typhoon shelter.

22. Collaborative efforts have also been made with other departments to deal with pollution problems at other specific locations. DSD has been undertaking culvert cleansing and desilting operations to alleviate the odour problem along the waterfront in Tsuen Wan and the Yau Ma Tei Typhoon Shelter. The DWFI at Nullah Road, Mongkok, has also been recently re-engineered by DSD to enhance the removal of the pollution load from upstream, thereby reducing a good proportion of the potential contribution to the odour problem at the Yau Ma Tei Typhoon Shelter.

23. To cater for the Government's plan to develop a cruise terminal at the far end of the old Kai Tak Airport runway, and generally improve the water environment around south-east Kowloon, an action plan has been put in place involving various departments in tackling the water-related pollution problems in the Kai Tak Approach Channel (KTAC) and its catchment. Key actions include the implementation of sewerage infrastructure improvements and upgrading works upstream of the KTAC by DSD to cater for the increased demand from developments in the area, and the carrying out of site surveys by EPD to identify any expedient connections in the public sewerage and drainage networks for immediate rectification. As a result of these actions, the water quality and odour problem in KTAC are expected to see significant improvement in future years.

WAY AHEAD

24. Pollution in stormwater drains is an issue that we need to continue to tackle in protecting our Harbour. It has been estimated that as much as 12 per cent of the organic pollution (in terms of biological oxygen demand) could be carried in the stormwater drains. The pollution comes from two major sources, namely expedient connections to the drains and street-level pollution. This underscores the continuing need for the Government to be vigilant in maintaining and upgrading sewers, to take enforcement action against expedient connections, and to implement specific measures and works targeted at the removal of polluted flows in stormwater drains.

25. Apart from the work related to the SMPs and their reviews, HATS remains as the most important initiative for bringing about concrete improvement to the water quality of the Harbour. The proposal to phase the construction of HATS Stage 2 will bring about early improvements in the water quality of the Harbour, and re-opening of

Tsuen Wan beaches closed as a result of HATS Stage 1, and while at the same time maximizing cost-effectiveness. The implementation of HATS Stage 2 is subject to the approval by the Legislature of the Administration's proposal for increases in sewage charges under the polluter-pays principle, as described in paragraph 18.

Environmental Protection Department
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Figure 1 : Sewerage Master Plans Showing the Territory-Wide Catchment Areas

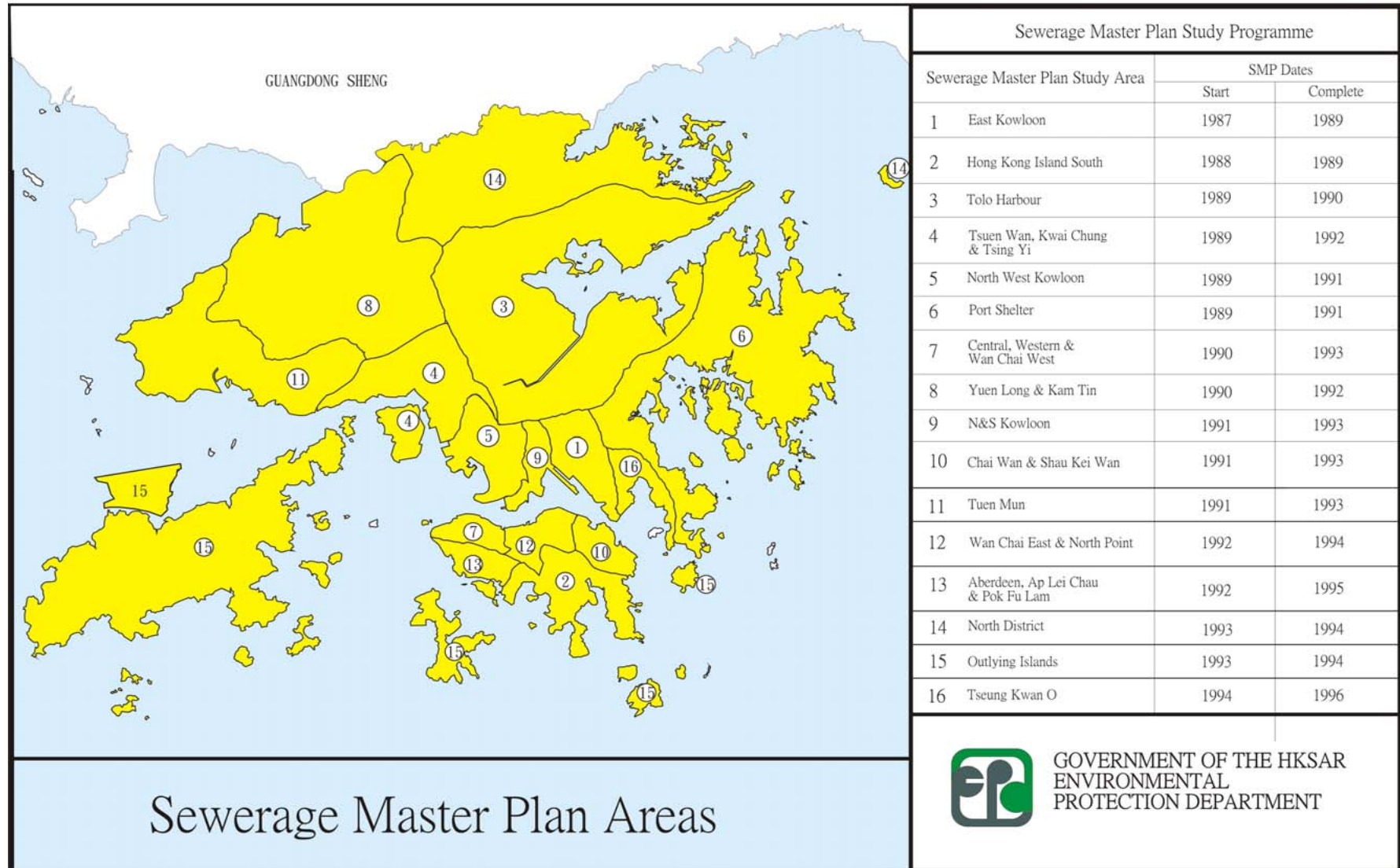


Figure 2 : The Harbour Area Treatment Scheme (HATS)

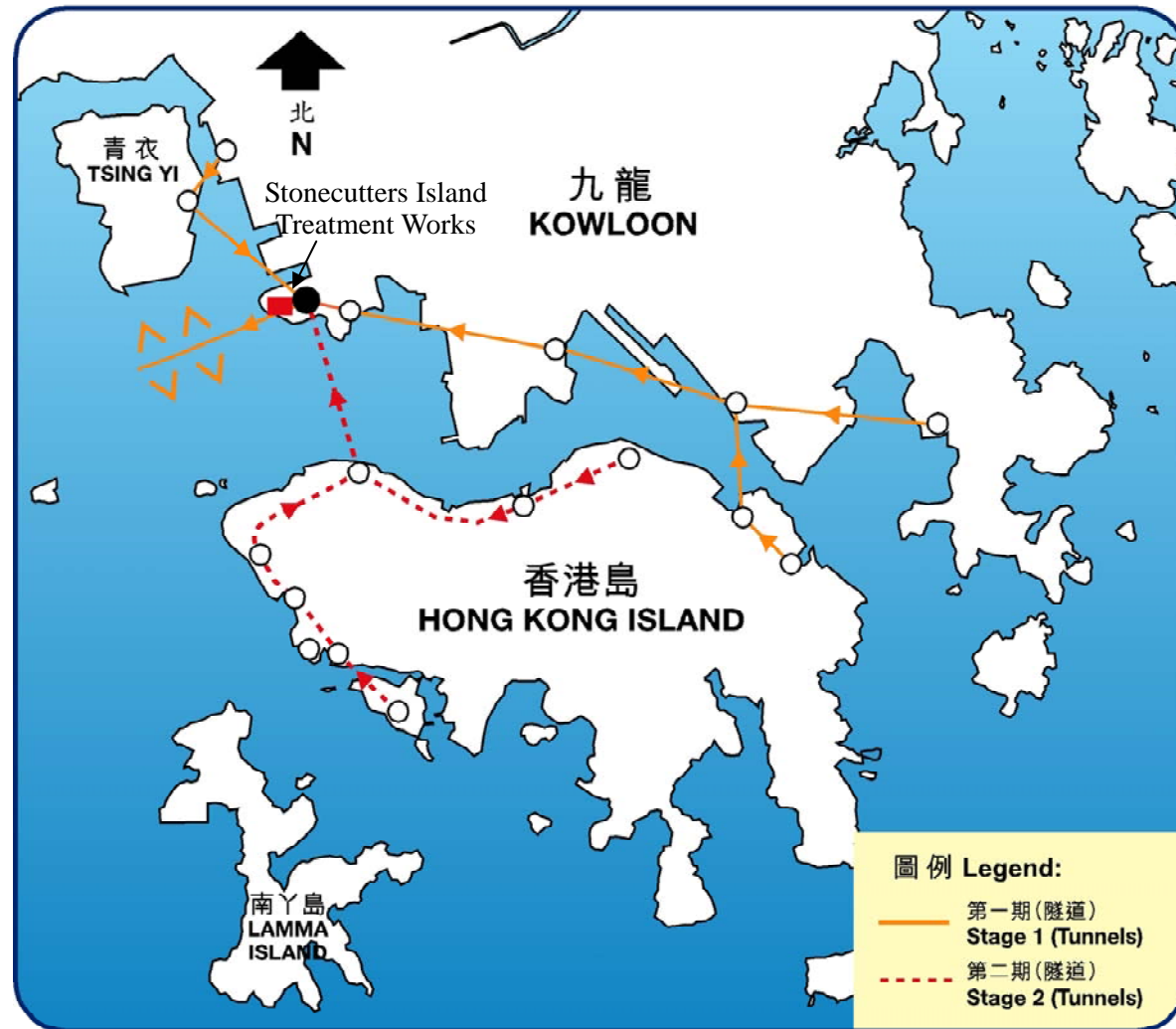


Figure 3 : Water Quality Improvement by HATS Stage 1

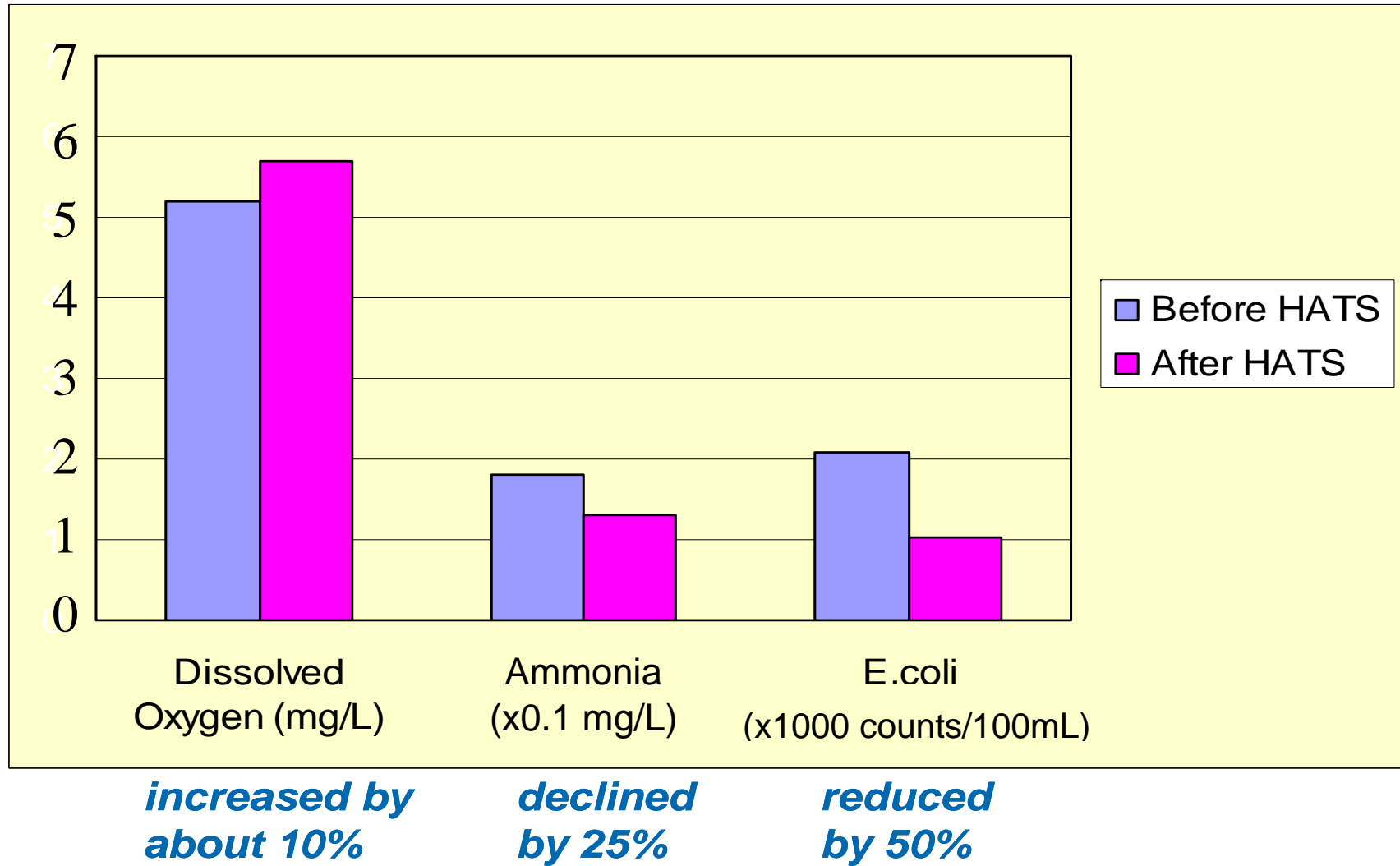


Figure 4 : Sewage Charges in Major Cities

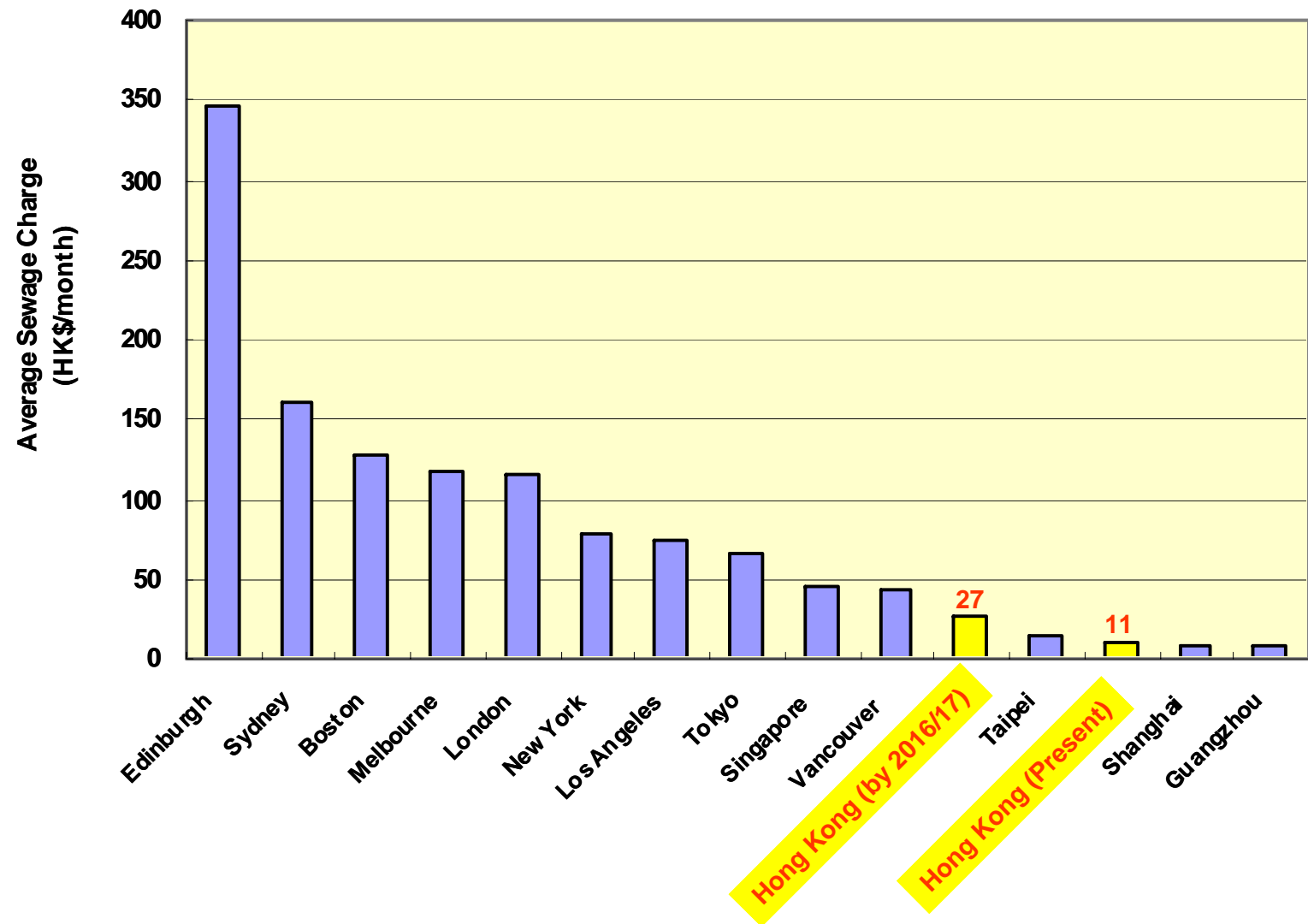


Figure 5 : Locations of Dry Weather Flow Interceptors (DWFIs) Around Victoria Harbour

