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River and Marine Water Quality in Hong Kong in 2011

INTRODUCTION

The Environmental Protection Department (EPD) conducts long-term monitoring of river and marine water quality and publishes the annual reports in the following year. The 2011 river and marine water quality reports are now available for the public's reference at the EPD's website (<http://www.epd.gov.hk>)¹. This paper summarises the state of rivers and marine waters in Hong Kong in 2011 for Members' information.

RIVER WATER QUALITY

2. The overall water quality of Hong Kong's rivers in 2011 continued to perform well. In terms of compliance with the statutory Water Quality Objectives (WQOs), the compliance rate in 2011 was 88% compared with 89% in 2010.

3. Similarly, the Water Quality Index (WQI) which indicates the general health of the inland water courses continued to perform well in 2011. In 2011, 54% of the river monitoring stations were graded "Excellent" and 28% "Good". These include the majority of the monitoring stations in Lantau Island, eastern New Territories, southwestern New Territories and Kowloon.

4. The good compliance rates (**Figure 1 of Annex**) were the result of the implementation of pollution control legislation, including the Water Pollution Control Ordinance and the Livestock Waste Control Scheme introduced under the Waste Disposal Ordinance, and the extension of the sewerage network to local villages under the Sewerage Master Plans and the gradual connection of village

¹ EPD ceased producing CD-ROMs since 2007, and only web-based versions of the reports are available.

houses to the new sewers.

5. In spite of the improving water quality trend, 35% of the 82 monitoring stations still contained high (over 10,000 cfu/100mL) to very high (over 100,000 cfu/100mL) levels of *E. coli* bacteria. These stations are mostly located in the northwestern part of the New Territories (for example Yuen Long Creek and Kam Tin River), and some in North District (for example River Indus, River Beas and River Ganges) and eastern New Territories (for example Tai Po River).

MARINE WATER QUALITY

6. The overall WQO compliance rate for 2011 was 75% compared with 80% in 2010 (**Figure 2 of Annex**). The lower overall WQO compliance rate compared with 2010 was mainly due to a decline in the compliance rate with the dissolved oxygen (DO) objective (from 71.1% in 2010 to 69.7% in 2011) and the total inorganic nitrogen (TIN) objective (from 65.2% in 2010 to 50.7% in 2011).

a) Dissolved Oxygen (DO)

7. Non-compliance with the DO objective in 2011 was observed in the Tolo Harbour and Channel, Victoria Harbour and Western Buffer Water Control Zones (WCZs). As pointed out in previous years, the DO levels in a water body can be affected by organic pollution as well as natural factors such as temperature and stratification of the water column. Since 2011's monitoring data, on the basis of parameters such as organic nitrogen and 5-day Biochemical Oxygen Demand (BOD₅), did not show any obvious sign of an increase in organic pollution in Hong Kong's waters, the lower compliance rate with the DO objective in 2011 was likely related to the hot weather experienced during the summer months.

8. According to Hong Kong Observatory's weather report in 2011, there was an exceptionally strong anticyclone covering southern China during August making Hong Kong unusually hotter. That month's mean temperature was one of the three highest for August since 1884. During the summer months of 2011, low DO levels were observed in many parts of Hong Kong's waters largely due to the unusually hot weather.

9. The correlation of low DO level with high temperature was also supported by the statistical analyses of marine data collected between 2002 and 2011. We observe that the decreasing DO levels were statistically and significantly correlated

with increasing water and/or air temperature of various marine water bodies in Hong Kong during the last decade (**Figure 3 of Annex**).

10. The low bottom DO levels of the water bodies observed in the summer months may also be related to stratification of the water column, which is formed as a consequence of water masses with different densities. Water density is strongly influenced by temperature and salinity; with less dense, warmer surface waters floating on top of denser, colder waters. Water is unable to mix across the boundary between the surface layer and lower layer, but wind, upwelling, downwelling and storms help move water across the boundary. For semi-enclosed water bodies such as Tolo Harbour which is protected from the wind by the surrounding topography or land masses, the water column is readily “stratified” and separated into distinct top and bottom layers during the hot summer months, or during periods of heavy rainfall when the warmer surface runoff, which is less saline and lighter than sea water, drains into the sea.

b) Total Inorganic Nitrogen (TIN)

11. In terms of nutrients, although the overall annual average levels of TIN in Victoria Harbour only increased from 0.34 mg/L in 2010 to 0.39 mg/L in 2011, the compliance rate with the TIN objective in this WCZ decreased markedly from 90% in 2010 to 30% in 2011. The higher non-compliance rate in 2011 was partly due to the fact that out of the 10 stations in the Victoria Harbour WCZ, 6 stations in the central and western parts of Victoria Harbour which marginally complied with the objective (TIN level below 0.4 mg/L) in 2010 could not comply with the WQO in 2011. The increase in TIN levels could be due to a higher background TIN level under the influence of Pearl River discharge, as reflected in the increase in TIN levels in many stations in the Northwestern and Southern WCZs, the year-to-year normal range of fluctuation of the discharge from the Tolo Harbour Effluent Export Scheme and surface run-off, as well as the gradual increase in the flow from the four preliminary treatment plants located between North Point and Central during the period.

12. On the other hand, the WQO compliance rates in 2011 in other WCZs, e.g. Port Shelter, Mirs Bay, Eastern Buffer, Junk Bay, Southern, Northwestern and Deep Bay, were largely similar to those in 2010.

13. At a level similar to previous years, a total of 17 red tide incidents were reported in the territory in 2011. There was no record of any red tide-related fish kill during 2011.

CONCLUSIONS

14. In 2011, the river water quality in Hong Kong continued to perform well with 82% of the monitoring stations achieving a “Good” or “Excellent” WQI grading. However, *E. coli* levels in excess of 10,000 cfu/100ml were still found in 35% of the monitoring stations located mostly in the northwestern part of the New Territories, and some in North District and eastern New Territories.

15. For marine waters, the overall WQO compliance rate for 2011 was 75%, compared with 80% in 2010. The lower overall compliance rate in 2011 was mainly due to a decline in the compliance rates with the DO objective and the TIN objective. The low DO compliance rate in 2011 was due to low DO levels observed in many parts of Hong Kong’s waters which were largely due to the unusually hot summer. Non-compliance with the TIN objective recorded in the Victoria Harbour WCZ in 2011 might be due to a higher background TIN level under the influence of Pearl River discharge, the year-to-year normal range of fluctuation of the discharge from the Tolo Harbour Effluent Export Scheme and surface run-off, as well as the continued increase in the amount of treated sewage discharged from the four preliminary treatment plants located between North Point and Central during the period. After the commissioning of Harbour Area Treatment Scheme Stage 2A in 2014, we anticipate that the pollution load into Victoria Harbour will be significantly reduced when the effluent from the four preliminary treatment plants are intercepted from direct discharge and collected for treatment at the Stonecutters Island Sewage Treatment Works.

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