3 Existing Water Quality Objectives

3.0.1 Water Quality Objectives (WQOs) are benchmarks which collectively define the water quality of a water body, and they should be achieved and maintained in order to promote the conservation and best use of a water body.

3.0.2 WQOs are established by the Secretary for the Environment (SEN) under the Water Pollution Control Ordinance (WPCO, Cap 358), upon consultation with the Advisory Council on the Environment (ACE). SEN can amend the WQOs after consultation with the ACE.

3.0.3 Based on the WQOs, the Government plans and develops major infrastructures in a suitable way which minimise their impact on the quality of a specific water body, plan and implement sewage infrastructure programmes to intercept pollution sources, and formulate and implement pollution control strategies, with a view to protecting the marine waters from pollution.

3.0.4 WQOs can be numeric or narrative, and include various parameters to describe the physical, chemical and biological properties of the marine environment. The WQOs currently in use in Hong Kong were established in the 1980's. A summary table of WQOs is listed in "page A-11, Appendix A, 2007 Marine Water Quality in Hong Kong"[1]. For details of the WQOs for each Water Control Zone, the reader can visit the following website http://www.legislation.gov.hk/eng/home.htm (and input Chapter: 358).

3.0.5 Over the years, there have been significant scientific advancement in and water science and water quality management technology, and emergence of new uses of our waters such as marine parks and reserves for conservation and education purposes, etc. In light of these, a number of areas of improvement, and changes for the WQOs are identified and discussed in paragraphs below.

3.1 Areas of improvement, and changes identified

3.1.1 *Need for updating the WQOs in light of the latest scientific evidence, overseas practices and local conditions:*

- While most WQOs (e.g., dissolved oxygen, unionized ammonia, nutrients, chlorophyll-*a*, SS) were developed according to the then best available information, they may need to be updated with respect to the latest scientific knowledge and overseas practices, and local conditions.

- *Some of the WQOs may be more conservative*: For example, the current WQO for unionized ammonia is set at 21 μg ammonia-N/L. Compared with most countries, the current WQO for ammonia appears to be stringent (e.g., for protection of ecosystem: 910 μg/L total ammonia-N and for protection of aquaculture: 100 μg/L (unionized-ammonia) in Australia and New Zealand (ANZECC and ARMCANZ, 2000a); for freshwater: 766 μg/L total ammonia-N in Canada (CCME, 1996) and 1270 μg/L total ammonia-N in USA (USEPA, 1986). Furthermore, this ammonia standard is applied for all WCZs in Hong Kong regardless of the BUs (except Tolo Harbour and

[1] Link : http://www.epd.gov.hk/epd/english/environmentinhk/water/marine_quality/mwq_report.html

Channel). Nevertheless, it is noted that Mainland's WQO for unionized ammonia is also set at 20 μg ammonia-N/L for all places.

- *Some of compliance requirements require further review*: The current DO standard is based on 90% compliance, and depth average and bottom level values. It is believed that such consideration is to take into account natural fluctuations. Unlike other water quality parameters, mass mortality may occur within hours when DO falls beyond the critical tolerance level of marine animals. Thus, the minimum DO, but not the current 90% compliance, is the primary concern for ecosystem protection. In an eutrophic system where hypoxia is likely to occur, DO may be very high at the surface of the water column but very low in the bottom waters. There is a need to review the present approach of presenting the compliances in terms of depth average values, taking into account natural fluctuations commonly found in local marine waters.

- The limiting factor(s), including levels of nutrients, that trigger algal bloom can be very different in different parts of Hong Kong waters. For example, there is evidence to suggest that the trigger value for nutrients in Hong Kong should be site specific, and nutrients may not be a limiting factor in Victoria Harbour and its vicinity, according to the more updated researches (Ho et al., 2008; Yin and Harrison, 2008). On the other hand, the southern and western waters, are subject to more regional background influence of the Pearl River (Chau and Jiang, 2003; Chau, 2005; 2006; Wurl et al., 2006; EPD, 2007).

- The present WQOs for toxic substances are narrative, and quantitative benchmarks, which become more common overseas practices, are not available.

- *Absence of Biological criteria:* At present, almost all WQOs (except *E. coli*) are based on chemical and physical parameters. However, measurements of physical and chemical parameters *per se* may not be sufficient because pollutants typically exist in different chemical forms, while the bioavailability, toxicity and environmental impact of a chemical differ from one form to another. It has been well recognized that physical and chemical parameters are indirect measures of the health or state of the environment and that the best way to protect environments is to monitor the biology of the environments directly (e.g., ANZECC and ARMCANZ, 2000a). It is for this reason that greater emphasis is now being placed on biomonitoring as a means of determining the health of ecosystems and that biomonitoring is now being built into the water quality management systems of many developed nations.

Alternative microbiological standards for bathing beaches.

3.1.2 - The WHO bathing water guidelines published in 2003 recommended the use of enterococci as a faecal indicator for marine bathing waters. This was derived from risk of bathers to marine waters in temperate northern European waters, and revealed that intestinal enterococci showed a clear dose-response relationship between faecal pollution and the risk of the bathing-related illnesses. The Singapore and Western Australian governments apply the WHO guidelines, and the US and EU also adopt enterococci (or a combination of both enterococci and coliform group bacteria indicators) as the microbiological indicators of marine water quality for bathing.

- The existing WQOs (≤ 180 count/100ml *E. coli*) and grading system for bathing beaches were set by reference to the then WHO guidelines, and the results of the epidemiological studies jointly conducted in late 80's and early 90's by EPD and the University of Hong Kong. In light of the international trend of adopting the WHO guidelines or alternative bacteria indicators (e.g. enterococci), the existing WQOs and bacteria indicators need to be revisited to see if they are still fit for long-term protection of our bathing beaches. The need for and feasibility of adopting enterococci as an alternative/supplementary bacteria indicator will also be examined.

WQOs for supporting certain BUs are not available or not comprehensive

3.1.3 The need for current review of WQOs can be exemplified by the following concerns.

- The existing WQOs were established in 1987 or before. Since then, a number of new sensitive receivers, e.g., marine parks and marine reserve, marine mammals and SSSIs have been identified/ established, and currently there is no WQO to support these sensitive receivers. Water quality requirements for supporting marine parks, marine reserve, SSSI, oyster culture grounds, marine fish culture, marine mammals, mangroves, corals are likely to be very different, but these requirements have not been examined thus far.

- The WQOs for mariculture are less comprehensive as compared with some overseas standards. Some overseas practices have included parameters for toxicants or persistent chemicals to enhance protection of waters for seafood culture and harvest from the human health perspective.

3.1.4 Major changes have occurred since the first declaration of the WCZs and establishment of the current WQOs. The most significant changes include:

- Since 2001, the Harbour Area Treatment Scheme (HATS) has commenced to collect the sewage produced from over 4 million people from northern shores of Hong Kong Island and southern shores of Kowloon peninsula, and to discharge the collected sewage from the Stonecutters STW after removing 70% of BOD, 80% of SS and some nutrients using a chemically-enhanced-primary-treatment (CEPT) process. The water quality in the Harbour, in particular the Eastern Harbour, has improved considerably. But the water quality near Tsing Yi and the Tsuen Wan beaches is less ideal than without the plume.

- The water quality in Tolo Harbour has improved considerably after implementation of the Tolo Harbour Action Plan in 1987. Details of the plan, and its environmental benefits is outlined in the ACE paper 30/97 presented to the Advisory Council on the Environment on 26 May 1997[2].

- In the last two decades, the majority of local industries that produce wastewater discharges have moved to the Mainland. Coupled with a tighter pollution control, pollution loading from the local industry to our marine waters has been substantially reduced.

- The increase in environmental awareness and hence a higher environmental quality is expected from the general public.

[2] Link : http://www.epd.gov.hk/epd/english/boards/advisory_council/files/ace_paper9730.pdf