ACQWS Paper No. 20
Total Water Management Strategy in Hong Kong

INTRODUCTION

1. The 2003 Policy Address pledged the implementation of a Total Water Management (TWM) programme to enhance water conservation and water resource protection and to explore new water resources. In late 2005, Water Supplies Department (WSD) commissioned a review study for formulating a TWM strategy that would serve Hong Kong's needs in the long term. This paper seeks Members' views on the outcome of the review study.

WATER DEMAND AND SUPPLY SITUATION

Water Demand

2. In 2007, the total fresh water demand in Hong Kong was 951 million cubic metres (mcm). Domestic (35%) and non-domestic (25%) consumption accounts for most of the water demand. Water mains leakage (23%) aside, the other important consumption of fresh water includes flushing and fire-fighting. Under the scenario of reference population of 8.4 million by 2030[*], the fresh water demand will grow to 1,315 mcm. Fresh water demand from 1996 to 2030 with reference population of 8.4 million by 2030 is shown at **Annex A**.

Water Supply

3. The fresh water supply is composed of two components. Firstly, surface water collected locally from water gathering grounds ("local yield") provides 20 to 30 percent of water supply at present. The local water supply from 1981 to 2006 is shown at **Annex B**. The average annual local yield is 295 mcm per year. The local yield can provide a reliable supply of 210 mcm per year in a one-in-one-hundred year drought (99 percent reliability). Secondly, about 70 to 80 percent of water is imported from Dongjiang under HKSAR's agreement with Guangdong authorities. So far, the largest quantity of Dongjiang water imported was 808 mcm in 2004. The agreed ultimate Dongjiang water supply quantity is 1,100 mcm per

[*] The population scenario is based on Planning Department's reference population forecast to 2030.

year. The maximum capacity available through the Dongjiang water supply system will be sufficient to cope with the projected demand in the coming two decades even under a rapid demand growth scenario.

TOTAL WATER MANAGEMENT STRATEGY

4. A TWM programme based on a suitable integrated strategy is required to better prepare Hong Kong for uncertainties such as acute climate changes. It also helps enhance Hong Kong's role as a good partner of other municipalities in the Pearl River Delta in promoting sustainable development in the light of the rapid growth in water demand in the region.

5. The TWM strategy to be adopted is **proactive management of demand and supply in an integrated, multi-sectoral and sustainable manner**. Taking into account local conditions and overseas experience, the latest review has considered all major options of water demand management measures as well as water supply management measures. Each water demand / supply management option has been evaluated in terms of quantity of water saved or supplied, cost effectiveness, environmental impact and public acceptance.

(A) Water Demand Management

6. On demand management, WSD has long been promoting water conservation. The main measures currently employed are:

(a) public education to promote voluntary water conservation;

(b) active leakage control through a large-scale programme of replacement and rehabilitation of water mains which will end in 2015 and application of new technologies in leakage detection and reduction;

(c) use of seawater for toilet flushing in metropolitan areas and most of the new towns; and

(d) a tiered tariff structure to encourage water conservation.

7. The current review confirmed that the water demand management measures above form an important part of the TWM programme and enhancements should be made. Further water conservation initiatives being considered are as follows.

Public Education on Water Conservation

8. In addition to current measures (including announcement for public interest on TV and radio, leaflets, seminars and exhibitions), public education on water conservation will be stepped up in all sectors and direction. Focus on the next generation in particular will be made whilst education programme for the younger generation will be implemented and due consideration given to including the concept and details of water conservation in the school programmes.

Promotion of Use of Water Saving Devices

9. Water saving devices which use less water than conventional facilities or appliances include taps that limit flow, low-flow showerheads and flow restrictors. The Government will consider promoting usage of water saving devices by enhanced measures. Firstly, WSD will investigate the feasibility of developing a "Water Efficiency Labelling Scheme" (WELS) the concept of which is similar to the Energy Efficiency Labelling Scheme operated by Electrical and Mechanical Services Department. WELS will indicate to consumers the levels of water consumption and efficiency rating of plumbing fixtures and appliances used in toilet, kitchen, bathroom and laundry. It will take about two to three years to set up WELS on a voluntary basis. Publicity campaigns will be launched to promote the Scheme when ready.

10. Secondly, the Government will promote installation of water saving devices in its projects. This will include installation of water-saving devices in new government buildings and, as far as practicable, when retrofitting existing government premises.

Active Leakage Control

11. The current replacement and rehabilitation programme (R&R programme) on 3,000 km of water mains to be implemented through four stages at an estimated cost of about $15.7 billion will be completed in 2015. Subject to WSD's review of the underground asset management, the R&R programme could be extended beyond 2015 to cover the remaining distribution network so as to further reduce the leakage level.

12. WSD could reduce leakage by furtherance of additional initiatives. The first is implementation of the Comprehensive Pressure Management (CPM) using the latest pressure management technologies (for example, installation of flow

modulation pressure reducing valves and flow-meters) to optimise water mains pressure and reduce leakage. Since 2001, a series of small-scale pilot schemes have been successfully implemented. The pilot schemes are being extended to cover service reservoir supply zones such as those in North Point and Shau Kei Wan. Depending on the outcome of these larger-scale pilot schemes, CPM will be implemented in all major supply zones in a phase-by-phase programme. The second leakage control initiative involves enhancement of leakage detection and monitoring using regular surveys and telemetric district metering. By end of 2007, WSD has established 280 district metering areas, each of which is served by an electromagnetic flow-meter and a GSM (global system for mobile communication) data logger for transmitting the flow and pressure data to the control centres via wireless networks. Early signs of leakage will then be more easily detected and remedial actions can be taken. Studies are being carried out for expansion of the district metering scheme to Hong Kong Island, Kowloon Central, Kowloon West and Tsuen Wan East areas.

Use of Seawater for Toilet Flushing

13. WSD has used seawater for toilet flushing in metropolitan areas and most of the new towns to conserve fresh water. The percentage population supplied with seawater for flushing is about 80%. The quantity of seawater used for flushing is equivalent to some 28 per cent of the daily fresh water consumption. WSD has been planning for expansion of the seawater flushing supply system whenever it is economically justified. In this regard, preparatory works are in progress for the supply to PokFulam, Yuen Long and Tin Shui Wai.

Water Reclamation

14. Water reclamation is to use lower quality water to replace high quality water currently used for non-potable purposes such as toilet flushing, irrigation and street cleaning. The most important of this is the use of reclaimed water from sewage treatment works for non-potable use such as toilet flushing. The Government has conducted pilot schemes in Ngong Ping and Shek Wu Hui. The Ngong Ping scheme, commissioned in early 2006, uses reclaimed water for toilet flushing and gardening. The Shek Wu Hui scheme was commissioned in late 2006 and supplies reclaimed water for flushing, gardening and water features. Both pilot schemes will be concluded in the end of 2008. They are being monitored in respect of operating conditions, reclaimed water quality and public acceptance of using reclaimed water. The interim results of surveys on public acceptance to the use of reclaimed water under the two pilot schemes were favourable. Subject to the final results of the two pilot schemes, reclaimed water

from Shek Wu Hui Sewege Treatment Works could be planned for provision to consumers in Sheung Shui / Fanling for toilet flushing and other non-potable uses. This will also bring forth positive impact on water quality at Deep Bay, which currently receives the discharge from the Treatment Works.

15. Other types of water reclamation are reuse of grey water and rainwater harvesting. Grey water is collected from baths, wash-basins and kitchen sinks mainly for toilet flushing. Rainwater can be harvested for purposes such as irrigation and toilet flushing. In the Hong Kong environment, such systems would be very costly to set up and the potential quantity of water saved is small (of the order of a few mcm per year in total). They will not generally be a priority measure in the TWM programme. However, the Government will conduct trials in projects of appropriate scale and nature, to gather experience and encourage private developers to consider them. Both grey water and rainwater recycling systems are being planned for some new public projects such as schools.

(B) Water Supply Management

16. A number of major categories of water supply management options have been evaluated in the latest review on TWM, namely:

(a) To enhance protection and management of existing water resources; and

(b) To explore new water resources such as expansion of water gathering grounds and reservoir storage, and construction of desalination plant.

Protection of Water Resources

17. WSD has ongoing programmes to protect water resources from local yield. The purpose is to rationally assess and monitor activities that may threaten the quality and quantity of water collected in catchments, thereby minimizing wastage of our precious fresh water supply. WSD plans to strengthen the current practice in protection in two aspects. Firstly, a study is in progress to develop the water pollution risks and impact assessment framework for protection of water resources from development in water gathering grounds. The study will also review the current management philosophy, principles and practices for water gathering grounds in Hong Kong.

18. Secondly, proper maintenance of the water gathering grounds in particular the catchwater systems and their adjacent slopes is essential for safe and effective collection of surface water. WSD is planning to start a major capital

works project by 2010 to improve the existing catchwater systems for a total length of about 26 kilometres for completion by 2013.

19. The quality of Dongjiang water has shown marked improvements since the commissioning of the dedicated aqueduct in 2003. We would continue our close dialogue with the Guangdong Authorities and stay vigilant in ensuring that the high quality of the water to Hong Kong is maintained.

New Water Resources

20. Two alternatives of new water resources were evaluated in the latest review on TWM viz. expansion of water gathering grounds and reservoir storage and desalination. Whilst desirable from the viewpoint of enhancing local water resources, expansion of water gathering ground will entail high costs and undermine the development potential of the areas concerned for protection of the water quality. Besides, it will give rise to negative impacts on the environment, in particular the ecology of some sensitive downstream resources. The review thus concludes that the option of expanding water gathering grounds and reservoir storage is of very low priority for Hong Kong.

21. Seawater desalination by reverse osmosis (RO) can yield the largest quantity of new water supply in Hong Kong. It is a proven technology and several RO desalination plant was built worldwide. In 2003, WSD began a pilot desalination plant study using RO technology in Tuen Mun and Ap Lei Chau. The pilot tests were completed in 2007 and confirmed that RO desalination technology is viable for Hong Kong. According to this study, on the positive side, it is the option yielding the largest quantity of new water in the order of hundreds of mcm per year and theoretically as much as needed. It is a proven technology internationally and suitably tested in Hong Kong. The disadvantages are the high capital costs, long implementation time, high level of electricity consumption, and possible negative impact on the marine ecology. In light of this, we will keep the option closely in view for future preparedness, including searching for means of alleviating environmental issues and improving financial viability, taking account of advancement of technology and overseas experience.

FUTURE REVIEW AND CONTINUOUS MONITORING

22. In the proposed integrated strategy for the TWM programme based on the evaluation of the foregoing options under the recent review, initial emphasis will be put on the demand side of stepping up water conservation through active water asset management and leakage control by the Government; and wider

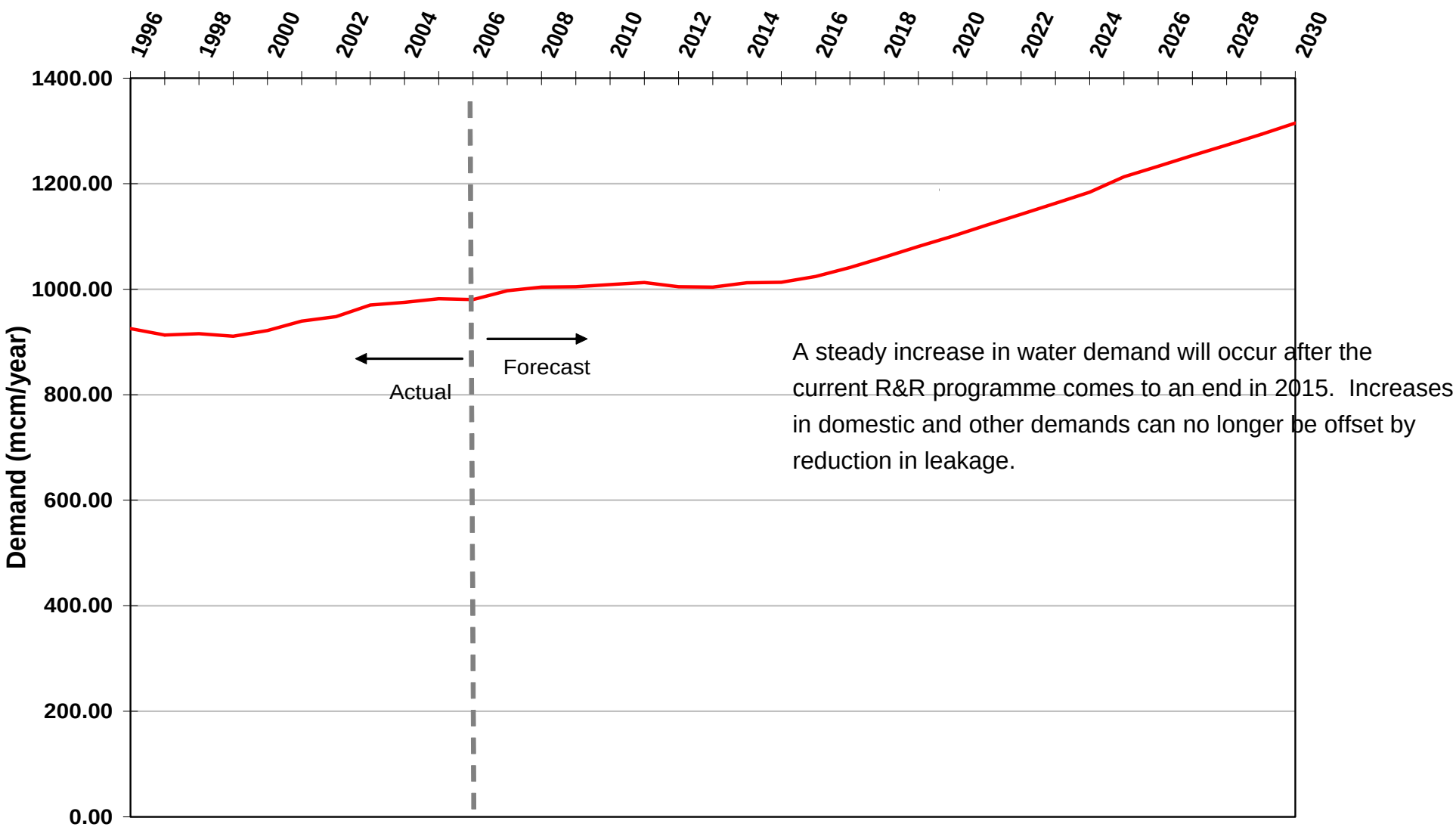
promotion and publicity to the public for water conservation. Non-potable use of reclaimed water will be considered pending final results of the pilot studies. For the supply side, the need and desirability of desalination as a potential option for diversification of water resources would be kept closely in view.

23. The strategy will guide government's long term effort on TWM. It forms the foundation for future reviews and continuous monitoring of the progress of TWM, for adjusting its efforts to suit circumstances, and for initiating new measures to meet challenges, for optimal utilization and development of water resources.

Water Supplies Department
April 2008

Annex A

Fresh Water Demand from 1996 to 2030 with reference population 8.4 million in 2030



Local Water Supply Trend 1981 to 2006

Annex B