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Panel on Development

Meeting on 25 October 2011

Background brief on management of water resources

Purpose

This paper provides background information on the management of water resources in Hong Kong and summarizes the views and concerns expressed by Members on the subject at meetings of the Legislative Council and its committees.

Background

2. In Hong Kong, the responsibility of managing water resources rests with the Water Supplies Department ("WSD") which, apart from providing fresh water to Hong Kong people, also provides seawater for flushing to nearly 80% of the population. Hong Kong enjoys a reliable supply of fresh water. About 20% to 30% of Hong Kong's fresh water supply is surface water collected from local water gathering grounds, and the remaining 70% to 80% is Dongjiang ("DJ") water imported from the Guangdong Province ("GD").

3. Since 2008, WSD has been implementing the Total Water Management ("TWM") strategy to promote sustainable use of water in Hong Kong. TWM is a modern concept for managing water resources in all aspects. It seeks to achieve an optimal balance between water demand and water supply. Initiatives under *Water Demand Management* of TWM strategy include

enhancing public education on water conservation, promoting the use of water saving devices, enhancing water leakage control and extending the use of seawater for toilet flushing. Initiatives under *Water Supply Management* cover strengthening protection of water resources, promoting water reclamation (including reuses of grey water and rainwater harvesting)¹ and development of seawater desalination.

Supply of Dongjiang water

4. The long-term supply of DJ water is secured under the "Agreement for the supply of Dongjiang water to Hong Kong" ("the Supply Agreement") entered between the Hong Kong Government and the GD Provincial Government, which is subject to periodic review of water prices and supply quantities. Prior to 2006, water supply agreements on DJ water were based on a unit water price and annual supply quantities agreed with the GD side. From 2006 onwards, the Supply Agreements adopted a package deal lump sum approach, under which an annual lump sum payment was made to the GD side for supply of an annual agreed quantity of DJ water to meet the needs of Hong Kong. The current Supply Agreement, which covered the period of 2009 to 2011, was signed in December 2008.

Arrangements for the supply of Dongjiang water to Hong Kong between 2009 and 2011

5. The Administration briefed the Panel on Development ("DEV Panel") in October 2008 on the proposed arrangements for the supply of DJ water to Hong Kong between 2009 and 2011 and its financial implications. On 21 November 2008, the Administration sought a supplementary provision of \$84.4 million from the Finance Committee ("FC") to meet additional water purchase cost. To ensure 99% reliability² in water supply to Hong Kong, WSD estimated that an annual quantity of 820 million cubic metres ("mcm") would be required in the period from 2009 to 2011. Taking into account the

¹ Water reclamation is to use recycled water to replace high quality water currently used for non-potable purposes such as toilet flushing, street cleaning, car washing and landscape irrigation. There are different types of waste water that can be recycled, namely, treated effluent from sewage treatment works and grey water from shower, bathtub, sink, kitchen and laundry.

² "99%" reliability means that water supply is maintained round-the-clock even under extreme drought condition with a return period of 1 in 100 years. "Return period" is the average number of years during which a certain severity of drought will occur once, statistically. A longer return period means a rarer chance of occurrence of a more severe drought.

changes in Renminbi and Hong Kong dollar exchange rate, as well as inflation in GD and Hong Kong, the two sides agreed that the water purchase cost for the years of 2009, 2010 and 2011 be increased at the rates of 18.6%, 6.32 % and 6.29% respectively. Hence, as compared to the annual sum of water purchase cost of \$2,494.8 million for 2006 to 2008, the annual sum of water purchase cost for 2009 to 2011 was adjusted to \$2,959 million, \$3,146 million and \$3,344 million respectively. The GD side would strive to maintain the existing DJ water quality which had been upgraded to meet the latest national Type II Standard of GB 3838-2002³.

The package deal lump sum approach versus the unit water price approach

6. According to the Administration, the package deal lump sum approach for purchase of DJ water adopted since 2006 would ensure reliable and flexible water supply to Hong Kong. The Administration explained that if the water purchase price was based on the actual quantity of water delivered without any pre-determined agreed quantities, there would be difficulties in ensuring adequate water supply for Hong Kong's use. The situation could become critical during drought years as there would be no guarantee that GD could meet a sudden surge in demand from Hong Kong given the competitive needs of other GD cities, such as Heyuan, Huizhou, Dongguan, Shenzhen and Guangzhou.

7. The Administration added that it would be unfeasible to agree with the GD side on a unit water price and pay for the actual annual supply quantity. Due to the difficulty for the Administration to advise the GD side of Hong Kong's actual required annual water supply quantity during the negotiation for the unit water price, the GD side would take into account such uncertainty and fix a high unit water price in order to ensure a stable income. A unit price approach would also put the reliability of water supply at risk unless Hong Kong is prepared to reserve a specific annual quantity and pay a retention fee for the reserved quantity to compensate for under-utilizing the DJ water supply system.

³ This standard is applicable for abstraction for human consumption in class one protection zone, habitats for rare and precious aquatic species, etc.

8. The Administration advised that the unit water price and fixed annual supply quantity approach was inflexible. In wet years, surplus DJ water was discharged. The package deal lump sum approach would allow greater flexibility in the daily supply rate of DJ water to tie in with the seasonal fluctuations in the local yield. Under the arrangements, Hong Kong would inform the GD side the actual demand of the territory on a monthly basis, thereby achieving a better control of the storage level in Hong Kong, minimizing water overflow and saving pumping costs.

Quantity and quality of Dongjiang water

9. According to the Administration, under previous and the current Supply Agreements, the GD side should provide an ultimate annual supply quantity of 1 100 mcm in the long run. This ultimate annual supply quantity, as agreed by both Hong Kong and GD sides, was used for planning purpose and had no bearing on the water price for the period from 2009 to 2010. The target date for reaching this quantity would likely be 2030, assuming an average annual growth rate of 1.3% on water demand. For the three years from 2009 to 2011, it was estimated that the required annual supply quantity would be about 820 mcm and the lump sum DJ water price for 2009 to 2011 was calculated on the basis of this estimation.

10. The Administration advised that following the full commissioning of the dedicated aqueduct for DJ water in 2003, the quality of DJ water supplied to Hong Kong had shown remarkable improvement in various aspects. To monitor the quality of water supply and promote transparency, WSD regularly monitored the quality of DJ water received at Muk Wu Pumping Station and published the water quality data at its web site. The Advisory Committee on Quality of Water Supplies ("ACQWS") also regularly appraised the water quality data. In addition, ACQWS visited DJ and its tributaries regularly to inspect the works and measures undertaken to protect DJ water. Separately, since 2001, the GD authorities had provided the water quality data in the east bank section upstream of Taiyuan pumping station (intake point of DJ water supply to Hong Kong) to WSD for publication on the website on an annual basis.

Framework Agreement on Hong Kong/Guangdong Cooperation

11. On 25 May 2010, the Administration briefed DEV Panel on development-related issues under the Framework Agreement on Hong

Kong/GD Cooperation signed by the Chief Executive and the Governor of GD Province in Beijing on 7 April 2010 ("the Framework Agreement"), including the implication of the Framework Agreement on the supply of DJ water. The Administration advised that the provisions in the Framework Agreement relevant to the supply of DJ water were basically reassurance of the ultimate annual supply of 1 100 mcm from DJ as specified in the Supply Agreement. There were also provisions to enhance protection of water resources in DJ catchment to be implemented by the Department of Environmental Protection of GD Province in collaboration with the Department of Water Resources. The works included the development of the DJ Water Quantity and Quality Monitoring and Control System and the regular exchange of water quality monitoring information to further enhance the safety of DJ water supplied to Hong Kong. Major works were expected to complete by 2011.

Water supply management

12. On 25 May 2010, the Administration briefed DEV Panel on progress of the implementation of TWM strategy. On water supply management, the initiatives include strengthening the protection of water resources, studying the feasibility of water reclamation and developing seawater desalination.

13. As advised by the Administration, it had launched the "Inter-Reservoirs Transfer Scheme" project to connect Kowloon Byewash Reservoir with Lower Shing Mun Reservoir by means of a drainage tunnel and convey the overflow water from Kowloon Byewash Reservoir via Lower Shing Mun Reservoir and an existing transfer system to the Sha Tin Water Treatment Works for treatment instead of discharge directly to Victoria Harbour. Upon completion of the project, it was estimated that an average annual additional raw water yield of about 2.5 mcm would be generated. The Administration also planned to implement a project to improve the existing catchwater systems in Shing Mun, Beacon Hill, Golden Hill and Tai Lam Chung for safe and effective collection of surface water.

14. On water reclamation, the Administration advised that two pilot schemes on the recycling of treated effluent in Ngong Ping and Shek Wu Hui had been completed. While the results of the schemes demonstrated that the use of reclaimed water was technically feasible in Hong Kong, there was concern about viability of the technology due to the high production cost involved. In this regard, an inter-departmental working group was set up to

explore means to cut down the cost for provision of reclaimed water for toilet flushing and other non-potable uses for residents in Sheung Shui and Fanling. As for the recycling of grey water and harvesting rainwater for non-potable applications, trial schemes in schools and government facilities were implemented, and the Administration conducted a study to identify possible applications in different types of development and to review the standards adopted in the trial schemes. With reference to international experience, the Administration aimed to develop standards and technical guidelines for the application of recycled water in Hong Kong.

15. As regards the initiative of seawater desalination, having conducted a pilot plant study on the use of the technology of reverse osmosis for seawater desalination, the Administration concluded that seawater desalination remained a costly method for providing fresh water as compared to DJ water. Nevertheless, the Administration advised that it would keep abreast of the latest development in seawater desalination technology overseas in order to monitor the economic viability of this potential source of water supply.

Water demand management

16. Initiatives under TWM strategy to improve water demand management include enhancing the awareness of the public and strengthening public education on water conservation, promoting the use of water saving devices, enhancing water leakage control and extending the use of seawater for toilet flushing.

17. To promote the use of water saving devices, WSD developed a voluntary "Water Efficiency Labelling Scheme" in phases since 2009 to facilitate consumers to select water saving plumbing fixtures and appliances. The Administration issued a technical circular on Green Government Building in April 2009 requiring all new Government buildings to use water saving devices, such as low-flow taps and dual-flush toilets. It also launched a programme for retrofitting Government buildings and schools with water saving devices, and worked with the Hong Kong Green Building Council to promote wider uses of water saving devices.

18. According to the Administration, the water mains replacement and rehabilitation ("R&R") programme launched in 2000 is the key element in WSD's water leakage control measures. R&R programme aims at

replacing/rehabilitating 3 000 km of aged water mains out of the 7 800 km water distribution network in Hong Kong. In 2005, WSD decided to compress R&R programme from a 20-year to a 15-year period targeting for an earlier completion by 2015. In the paper provided to DEV Panel on the initiatives of the Development Bureau in the Chief Executive's Policy Address 2011-2012, the Administration advised that up to the end of September 2011, a total of 1 649 km of pipes had been replaced/rehabilitated resulting in sharp reduction in the number of mains bursts from about 2 500 in 2000-2001 to 609 in 2010-2011 and decrease in water mains leakage rate from 25% in 2001 to 20% in 2011.

19. Following the water main burst incidents at Tsing Yi and Wong Nai Chung Road happened in February and March 2011 respectively, the Administration briefed DEV Panel on 16 July 2011 on its efforts to reduce main bursts. It advised members that with the advancement of technology, WSD had migrated from the traditional waste detection based leakage detection method to a proactive burst prevention based leakage detection method. WSD commissioned a specialist contractor for leakage detection work for North Point and Shau Kei Wan with remuneration on an outcome basis, i.e. payment will only be made to the contractors for leaks verified on site. Separately, pressure management works were implemented to install flow-modulated pressure reducing valves at strategic locations of the distribution network. The valves helped regulate water pressure and hence would reduce water main leaks and bursts.

20. As regards the use of seawater for toilet flushing, the Administration advised DEV Panel at the meeting on 25 May 2010 that the supply of seawater covered a population of around 80%. With the completion of seawater supply systems in Pokfulam, Yuen Long and Tin Shui Wai, the percentage of people in Hong Kong served with seawater for flushing would increase to 85%. Extension of the seawater flushing supply system would be made wherever it is economically justified.

Discussions at the Panel on Development

21. On 28 October 2008, the Administration briefed DEV Panel on the proposed arrangements for the supply of DJ water to Hong Kong between 2009 and 2011. At the meeting, members expressed grave concern on the substantial increases in the water purchase cost. Some members expressed

concern about wastage of fresh water caused by water mains leakage, and urged the Administration to expedite R&R programme for aged water mains. A number of members indicated support to use seawater for toilet flushing and enquired whether the extension plan of using seawater for toilet flushing could be accelerated. They further urged the Administration to enhance public education in water conservation.

22. On 25 May 2010, the Administration briefed DEV Panel on the progress of the initiatives implemented under TWM strategy. While some members expressed support to use seawater for toilet flushing, other members expressed concern about whether the method would pose health hazards and the cost implication on property owners who had to contribute towards pipe installation works for switching to use seawater. On water reclamation, some members suggested that the Administration should consider providing incentives to developers and property owners in the installation of centralized water reclamation systems. Members urged the Administration to expedite completion of R&R programme to reduce water mains leakage and bursts. Some members suggested that WSD should include private housing estates in its regular leakage detection programme and provide incentives for property owners to carry out regular water mains checks and maintenance. For remote waterfront areas, the Administration should consider promoting small scale seawater desalination using solar energy.

23. During the briefing by the Administration on the handling of recent water main burst incidents at the meeting of DEV Panel on 16 July 2011, some members suggested that WSD should learn from main burst incidents to identify and record systematically the positions of the valves of major water supply networks which could help shorten the time taken for isolation of burst mains in future. Members also stressed the importance for WSD to identify the source of a burst incident, which might have been caused by external disturbances, such as the movement of heavy vehicles on the ground, rather than the conditions of the mains.

Discussions at the Finance Committee

24. The Administration sought FC's approval for a supplementary provision of \$84.4 million for meeting the DJ water purchase cost at the FC meeting on 21 November 2008. At the meeting, members expressed concerns including, seawater desalination and use of reclaimed water,

construction of new reservoirs and public education on water conservation. While some members suggested that the Administration should explore measures to reduce the reliance on DJ water, other members considered it necessary for the Administration to step up public education on water conservation and organize more programmes and activities in this area. It was also proposed that the Administration should consider requiring developers to introduce water conservation measures and incorporating such requirements in new building designs.

25. At the special meeting of FC on 23 March 2011, some members expressed concern about possible substantial increase in water prices due to continuing appreciation of Renminbi and urged the Administration to negotiate with the GD side for a reasonable price for supply of DJ water in the next Supply Agreement. Some members also raised concern about possible contamination of DJ water in the event of a nuclear accident at the Daya Bay Nuclear Plant.

Discussions at Council meetings

26. During the Legislative sessions from 2008-2009 to 2010-2011, Members raised five questions relating to the supply of DJ water and water conservation measures at the meetings of 18 February 2009, 29 April 2009, 21 April 2010, 19 May 2010 and 16 February 2011. The hyperlinks to these questions and the Administration's response are given in the **Appendix**.

Latest Development

27. In September 2011, the Ombudsman released his report on direct investigation into WSD's meter reading and billing system⁴. According to the investigation, WSD's regular monitoring programme showed that in 2010-2011, 5% of the in-service meters selected for testing failed its accuracy rule. By projection, 138 000 of the 2.8 million in-service meters in the territory may be inaccurate or defective. The report pointed out a number of deficiencies in the way WSD handled meter reading, defective meters and issuance/adjustment of bills. The deficiencies included insufficient staff

⁴ The report is available on the website of the Office of the Ombudsman (<http://ofomb.ombudsman.gov.hk/doc/DI218.pdf>).

training and monitoring of staff in meter reading, insufficient system checks for identifying defective meters, insufficient monitoring of works orders, inadequate staff instructions, lack of consideration for consumers, etc. The Ombudsman made 12 recommendations to WSD for improving its meter reading and billing system.

28. In the 2011-2012 Policy Address, the Chief Executive announced that the Administration was conducting a detailed study and field surveys to assess the feasibility and cost-effectiveness of building a medium-sized water desalination plant and a site in Tseung Kwan O had been reserved for this purpose.

29. The current Supply Agreement for DJ water will expire at the end of 2011. The Administration will brief DEV Panel on 25 October 2011 on the arrangements for DJ water supply to Hong Kong between 2012 and 2014, the financial implications and the proposal of seeking funding approval from FC. The Administration will also discuss with Panel members other issues related to the management of water resources in Hong Kong.

References

30. A list of relevant papers is in the **Appendix**.

Management of water resources

List of relevant papers

Council/Committee	Date of meeting	Paper
Panel on Development	28 October 2008	<p>Administration's paper on "Dongjiang Water Supply" (LC Paper No. CB(1)90/08-09(03)) http://www.legco.gov.hk/yr08-09/english/panels/dev/papers/dev1028cb1-90-3-e.pdf</p> <p>Administration's paper on "Supplementary Note on Dongjiang Water Supply" (LC Paper No. CB(1)125/08-09(01)) http://www.legco.gov.hk/yr08-09/english/panels/dev/papers/dev1028cb1-125-1-e.pdf</p> <p>Minutes of meeting (LC Paper No. CB(1)395/08-09) http://www.legco.gov.hk/yr08-09/english/panels/dev/minutes/dev20081028.pdf</p>
Finance Committee	21 November 2008	<p>Administration's paper on "Head 194 - Water Supplies Department -- Subhead 223 -- Purchase of water" (LC Paper No. FCR(2008-09)45) http://www.legco.gov.hk/yr08-09/english/fc/fc/papers/f08-45e.pdf</p> <p>Minutes of meeting (LC Paper No. FC82/08-09) http://www.legco.gov.hk/yr08-09/english/fc/fc/minutes/fc20081121.pdf</p>
Council meeting	18 February 2009	<p>Hansard (Question No. 16) (P. 4737 - P. 4741) http://legco.gov.hk/yr08-09/english/counmtg/hansard/cm0218-translate-e.pdf</p>

Council/Committee	Date of meeting	Paper
Council meeting	29 April 2009	Hansard (Question No. 5) (P. 6836 - P. 6842) http://legco.gov.hk/yr08-09/english/counmtg/hansard/cm0429-translate-e.pdf
Council meeting	21 April 2010	Hansard (Question No. 12) (P. 7050 - P. 7054) http://legco.gov.hk/yr09-10/english/counmtg/hansard/cm0421-translate-e.pdf
Council meeting	20 May 2010	Hansard (Question No. 12) (P. 8476 - P. 8580) http://legco.gov.hk/yr09-10/english/counmtg/hansard/cm0519-translate-e.pdf
Panel on Development	25 May 2010	<p>Administration's paper on "Development Related Issues under the Framework Agreement on Hong Kong/Guangdong Co-operation" (LC Paper No. CB(1)1919/09-10(09)) http://legco.gov.hk/yr09-10/english/panels/dev/papers/dev0525cb1-1919-9-e.pdf</p> <p>Administration's paper on "Progress of Implementation of Total Water Management Initiatives" (LC Paper No. CB(1)1919/09-10(03)) http://www.legco.gov.hk/yr09-10/english/panels/dev/papers/dev0525cb1-1919-3-e.pdf</p> <p>Minutes of meeting (LC Paper No. CB(1)2602/09-10) http://legco.gov.hk/yr09-10/english/panels/dev/minutes/dev20100525.pdf</p>
Council meeting	16 February 2011	Hansard (Question No. 7) (P. 5678 - P. 5681) http://legco.gov.hk/yr10-11/english/counmtg/hansard/cm0216-translate-e.pdf

Council/Committee	Date of meeting	Paper
Finance Committee (Special meeting)	23 March 2011	Report on the examination of the Estimates of Expenditure 2011-2012 (Paragraphs 11.5 - 11.6 of Chapter XI) http://legco.gov.hk/yr10-11/english/fc/fc/minutes/sfc_rpt.pdf
Panel on Development	16 July 2011	Administration's paper on "Repair and Replacement of Aged Water Mains and Temporary Water Supply" (LC paper No. CB(1)2225/10-11(01)) http://www.legco.gov.hk/yr10-11/english/panels/dev/papers/devcb1-2225-1-e.pdf
Panel on Development	---	Administration's paper on "Measures to Minimize Fresh Water Losses in Inside Services in Residential Developments" (LC Paper CB(1)2510/10-11(02)) http://www.legco.gov.hk/yr10-11/english/panels/dev/papers/devcb1-2510-2-e.pdf
Panel on Development	14 October 2011	Administration's paper on "Initiatives of Development Bureau in the 2011-12 Policy Address and Policy Agenda" (LC Paper CB(1)35/11-12(01)) http://www.legco.gov.hk/yr11-12/english/panels/dev/papers/dev1014cb1-35-1-e.pdf