ACQWS Paper No. 12 Strategy for Long-term Fresh Water Resource

1. The Issue

1.1 It is essential to secure an adequate and reliable fresh water resource to enable 24-hour supply for sustaining the long term development of Hong Kong as a world class city.

2. Background

2.1 We anticipate that the fresh water demand in 2002 is about 946 million cubic metres (mcm). We forecast that the annual fresh water demand will increase to 1,050 mcm in 2021. Under our agreement with the Guangdong Authority, we will draw 800 mcm Dongjiang water in 2002 with an annual increase of 10 mcm up to and including 2004. Ultimately we can draw a maximum of 1,100 mcm/yr Dongjiang water. Together with the local resource of 295 mcm/yr from existing water gathering grounds, we will be able to meet a demand up to 1,395 mcm/yr. Therefore, we do not anticipate any shortage of fresh water resource in the foreseeable future as shown in **Appendix 1**. At present, we are purchasing Dongjiang water at **\$3.085/m³**.

3. Potential New Fresh Water Resources

Collecting Surface Water from New Water Gathering Grounds

3.1 The existing water gathering grounds (WGG) covers about one-third of the land in the territory, from which an average of 295 mcm/yr of surface water can be collected. Some well-protected Country Parks may become WGG. To further extend the WGG outside the Country Parks will require stringent land development controls to protect the water quality, which will in turn significantly undermine the development potential of the areas concerned and meet strong resistance from the local residents. It is therefore not considered a viable alternative.

3.2 By including more Country Parks into our WGG will at most bring about an additional 75 mcm/yr of potable water at a high cost of **\$9.1/m**³, excluding land cost. It should also be noted that it is not a reliable water resource because it is dependent on the amount of rain falling onto the new WGG.

3.3 Increasing the storage capacities of existing impounding reservoirs is very expensive and does not contribute to the mean local annual yield.

Desalination

3.4 Desalination plants using the distillation process consume huge amount of energy. Nowadays they will be considered only when there is a cheap source of energy or waste heat. In fact, more and more new plants adopt the reverse osmosis technology, which produces potable water by passing seawater through membranes with very fine pores. Reverse osmosis desalination is more energy efficient and more environmentally friendly. Reverse osmosis desalination can produce potable water at $7.7/m^3$ in Hong Kong, excluding land cost.

3.5 Desalination is virtually an unlimited fresh water resource in Hong Kong because supply of seawater is unlimited. However, desalination plants can only be set up at coastal sites and they should be compatible with the adjacent landuses. Suitable coastal sites are very limited and the competition to occupy these sites is very keen.

Recycling Effluent

3.6 By using advanced treatment technologies such as membrane filtration, we can treat sewage effluent from secondary sewage treatment plants to drinking water quality standard and transfer it to our impounding reservoirs for blended uses. The cost of this water resource is $5.3/m^3$, excluding land cost. If the effluent from all existing secondary sewage treatment plants is recycled, about 105 mcm/yr recycled effluent can be produced. Recycled effluent is a reliable water resource because the more fresh water we consume, the more sewage effluent will be available for recycling. However, it will be a very long time before the community can be convinced to accept putting recycled effluent back in the reservoirs for potable use.

3.7 Apart from potable use, recycled effluent can be used for nonpotable purposes in order to substitute the fresh water required. Recycled effluent can be used for greening, for industrial processes, and for flushing the toilet where seawater is not available. As the use of recycled effluent requires the installation of dedicated pipe networks to convey the recycled effluent to users, it can only be economically justifiable if the users are in the proximity of the source of supply (sewage treatment plants). The use of recycled effluent in large scale to potential users over the territory will be prohibitively expensive and is considered not an economical option. 3.8 On a local and small scale, reuse of wastewater within a household or within a development to save water are normally carried out on a voluntary basis to cut expenses on water and sewage charges, or to reduce discharge to the environment. Recently the Administration is also considering incentive schemes to promote water recycling facilities within new developments in the context of promoting environmentally friendly buildings.

4. Cost Comparison

4.1 The costs of the new fresh water resources are summarized in **Appendix 2**. While they have not yet included the associated land costs, they are all more expensive than the cost of $4.5/m^3$ in purchasing and treating Dongjiang water to potable standard. Among the new fresh water resources, recycling effluent is the cheapest but it will take a long time to implement this option and to promote public acceptance. Desalination is more expensive. Collecting surface water from new water gathering grounds in Country Parks is the most expensive yet the least reliable water resource.

5. Proposed Strategy

5.1 It can be seen that Dongjiang water at the current price is still the most cost-attractive fresh water resource for Hong Kong. Therefore, it is recommended that:

- (i) we keep on negotiating with the Guangdong Authority for the supply of Dongjiang water at a reasonable price;
- (ii) we continue to monitor the latest development of the desalination and effluent recycling technology and its applicability to the Hong Kong situation; and
- (iii) we would not pursue the extension of local water gathering grounds nor increasing the storage capacity of existing impounding reservoirs at the present moment.

6. Advice Sought

6.1 Members' comments are sought on the results of the study in paragraphs 3 and 4 and the proposed strategy in paragraph 5.

Water Supplies Department March 2002

Fresh Water Demand Forecast and Water Resources

(A) Demand Forecast



(B) Water Resources

- (1) The actual yield from local gathering grounds depends on rainfall. The long-term mean yield of local gathering grounds is 295 mcm/yr.
- (2) The maximum delivery capacity of the Dongshen Water Supply System has allowed 1,100 mcm/yr for Hong Kong:-
 - (a) The agreed supply quantities of Dongjiang water for the years 2002, 2003 and 2004 are respectively 800, 810 and 820 mcm/yr.
 - (b) The supply quantities of Dongjiang water for the years beyond 2004 are yet to be agreed between the Hong Kong and Guangdong Authorities.

Appendix 2



Unit Cost of Various Fresh Water Resources

Note: Unit cost includes cost of water resource and treatment cost