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Meeting of the Panel on Planning, Lands and Works on 25 January 2005

Replacement and rehabilitation of water mains

Background Brief

Introduction

Hong Kong's fresh water and salt water supplies are provided through a network consisting of approximately 7 200 kilometres of water mains. Most of these water mains are underground and different pipe materials have been used. The service life of a water main varies with the material used, the ground condition and the water it carries. For fresh water mains, the service life for mild steel and ductile iron pipes is around 50 years. Galvanized iron pipes which were widely used in the fifties and sixties have screw joints subject to external corrosion and hence a shorter service life of about 30 years. For salt water mains, because of the corrosive action of the salt water, the service life is comparatively shorter and in the case of pipe materials used in older days such as cast iron and asbestos cement, the service life could be as short as 20 years.

Underground Asset Management Study

2. About 45% of Hong Kong's water mains were laid more than 30 years ago as part of the development of urban areas and new towns. Some have been in use for 50 to 60 years and are approaching the end of their service life. From 1994 to 1997, there were around 19 000 pipe failures per year comprising water bursts and leaks. The number was increased to 25 700 in 1998. In view of the increasing number of pipe failures and considerable length of water mains approaching the end of their service life in the foreseeable future, WSD engaged consultants in February 1996 to carry out Underground Asset Management Study to develop a comprehensive and cost-effective management plan for the water supply network.

3. The Underground Asset Management Study was completed at the end of 1997. Taking into account the capital cost of the replacement and rehabilitation works, savings in maintenance costs, the loss of water and the social implications

of leakage and main bursts, the Study recommended the replacement and rehabilitation of some 3 000 kilometres of aged water mains in stages in 20 years to prevent further deterioration of the water supply network.

Water Mains Rehabilitation Scheme

4. The replacement and rehabilitation project, known as the Water Mains Rehabilitation Scheme (the Scheme) was carried out in stages since 1999. The details of the scope of works in different phases of stage 1 of the Scheme, the date of the works projects approved by Public Works Subcommittee and the Finance Committee, and the progress of the approved works are set out in **Appendix I**.

5. Over the years, members expressed the following two major concerns when considering the works projects under the Scheme:

- (a) the need to co-ordinate waterworks with other road opening works to minimize disruption; and
- (b) the leakage rate after completion of the Scheme remains high.

Co-ordination of waterworks with other road opening works

6. The disruption to traffic and inconvenience to the public caused by road opening works has long been a subject of concern to members. In order to minimize road opening works, co-ordination of works projects at the early planning stage is considered important by members. Members note that all works departments have drawn up their five-year and 10-year works programme and the information is consolidated and circulated among the works departments. The department responsible for a project involving road opening works will notify other works departments as well as private utility undertakers at the planning stage of the project. Where practicable, the works of two works departments will be included in a single contract, while private utility undertakers will be advised to schedule their works to tie in with the schedule of public works projects to minimize road openings. Under existing policy, utility undertakers are not permitted to carry out road opening works at new roads within five years after the completion of the new roads. For existing roads where major improvements works have been undertaken, the restriction period is three years.

7. On 14 May 2003 the Legislative Council passed the Land (Miscellaneous Provisions) (Amendment) Bill 2002 to improve regulation of excavation in unleased land. A charging and penalty system for street excavation works was established. This includes the implementation of an excavation permit fee system and a levy on economic costs of traffic delay for excavation works affecting a carriageway after expiry of the original permit period without good reason.

Leakage rates

8. When members were briefed on the Scheme, they noted that upon completion of the Scheme, the number of pipe failures per year would be reduced from the 1999 level of 27 200 to 15 000 and the loss of fresh water would be reduced from 220 million to 180 million cubic meters per year. This represented an improvement in the leakage rate of the water mains from 25% to 15% of the water consumption level, on the assumption that the annual water consumption level would increase by 20% in 20 years' time. Based on the cost of \$3 per m³ for purchasing Dongjiang water from the Mainland, the cost of 220 million m³ would be around \$660 million. Implementation of the Scheme would bring about savings in water mains maintenance of about \$2.2 billion and reduce the economic loss of some \$1.6 billion caused by water bursts over the 20-year period. However, a leakage rate of 15% was considered high by some members.

9. According to the Administration, leakage of water mains is a common problem worldwide. There is a need to strike a balance between the cost of replacement and maintenance and the cost of water loss and disruption of water services. Compared with other water authorities worldwide, the performance of Hong Kong is very good. The leakage rates in some overseas countries are as follows:

<u>Country/Place</u>	<u>Leakage rate</u>
Taiwan	19%
United Kingdom	19%
Portugal	15%
Sweden	14.6%
Finland	12%

10. Construction of the stage 1 works commenced in December 2000. In order to bring about earlier improvement to the supply system so as to reduce inconvenience to the public due to frequent main bursts, WSD has recently reviewed the whole replacement and rehabilitation programme, and recommended that it be compressed from 20 years to 15 years. The programme is now scheduled for completion by 2015.

Other measures to prevent and reduce water mains bursts

11. In addition to the Scheme, members note the following measures taken by the Administration to reduce the number of water mains bursts:

- (a) Using stronger and better quality pipe materials, such as ductile iron pipes, mild steel pipes and polyethylene pipes, to replace the

cast iron pipes, asbestos cement pipes, galvanized iron pipes and PVC pipes in new water main works;

- (b) Setting up Roadwork Inspection Teams to step up the surveillance of roadwork activities which may affect water mains, and giving advice to the contractors concerned on the proper protection of water mains. Warnings will be issued if necessary;
- (c) Undertaking territory-wide leak detection tests regularly to identify leaks in water mains at an early stage so as to prevent them from developing into bursts;
- (d) Enhancing the knowledge and awareness of contractors and all parties concerned, including government departments, large organizations, utility undertakers and consultants, on the importance of avoiding damage to water mains by issuing to them various publicity materials; and
- (e) Converting existing water mains record plans to digital format and making full use of the computerized mapping system to facilitate the updating of and access to information, as well as information exchange with other utility undertakers and government departments.

12. A list of relevant papers with their hyperlinks is in **Appendix II**.

Water Mains Rehabilitation Scheme

Project Item No.	Scope of Works	Approved Estimate	Approved by Public Works Subcommittee (PWSC)	Approved by Finance Committee (FC)	Latest Position
PWSC(1999-2000)65 90WC – Replacement and rehabilitation of watermains, stage 1 phase 1	Investigations and impact assessments consultancy for phase 1B works comprising the replacement or rehabilitation of – (a) approximately 220 kilometres of fresh water mains ranging in diameter from 150 millimetres to 1 400 millimetres throughout the territory; and (b) approximately 100 kilometres of salt water mains ranging in diameter from 150 millimetres to 1 000 millimetres throughout the territory	\$66.3 million	20-10-1999	12-11-1999	Completed
PWSC(2000-01)51 90WC – Replacement and rehabilitation of water mains, stage 1 phase 1	The replacement and rehabilitation of – (a) approximately 12.5 kilometres of fresh water mains and 3.4 kilometres of salt mains and associated service connections in Sheung Shui, Tai Po and Sha Tin under the phase 1A works; and	\$115.3 million	25-10-2000	17-11-2000	(a) Scheduled for completion by the end of 2005

Project Item No.	Scope of Works	Approved Estimate	Approved by Public Works Subcommittee (PWSC)	Approved by Finance Committee (FC)	Latest Position
	(b) approximately 1.6 kilometres of fresh water mains and 0.9 kilometres of salt water mains and associated service connections in Mong Kok under the phase 1B works				(b) Scheduled for completion in 2006
<p>PWSC(2000-01)91 90WC – Replacement and rehabilitation of water mains, stage 1 phase 1</p> <p>174WC – Replacement and rehabilitation of water mains, stage 1 phase 2</p>	<p><u>90WC</u></p> <p>(a) consultancy for the detailed design, site investigations and supplementary impact assessment for the phase 1B works comprising the replacement and rehabilitation of –</p> <ul style="list-style-type: none"> - approximately 218 kilometres of fresh water mains ranging from 150 millimetres to 1 400 millimetres in diameter; and - approximately 99 kilometres of salt water mains ranging from 150 millimetres to 1 000 millimetres in diameter <p>(b) the replacement of approximately 500 metres of fresh water mains and 700 metres of salt water mains, ranging from 150 millimetres to 400 millimetres in diameter, along Java Road from North Point Road to Tin Chiu Street under the phase 1B works</p>	(a) + (b) \$69.8million	21-2-2001	9-3-2001	<p>(a) Completed</p> <p>(b) Completed</p>

Project Item No.	Scope of Works	Approved Estimate	Approved by Public Works Subcommittee (PWSC)	Approved by Finance Committee (FC)	Latest Position
	<p><u>174WC</u></p> <p>(c) the investigation and impact assessment consultancy for the replacement and rehabilitation works throughout the territory of approximately 210 kilometres of fresh water mains ranging from 150 millimetres to 600 millimetres in diameter and 40 kilometres of salt water mains ranging from 150 millimetres to 450 millimetres in diameter.</p>	(c) \$21.6 million			(c) Completed
<p>PWSC(2001-02)68 90WC – Replacement and rehabilitation of water mains, stage 1 phase 1</p>	<p>(a) Phase 1A (final part) – the replacement and rehabilitation of about 14.3 km of fresh water mains ranging from 80 millimetres (mm) to 300 mm in diameter and the associated service connections in Yuen Long and Fanling.</p> <p>(b) Part of phase 1B –works in Kowloon City, Wong Tai Sin and Sham Shui Po, comprising –</p> <p>(i) the replacement of about 1.4 km of fresh water mains and 1.0 km of salt water mains ranging from 150 mm to 600 mm in diameter and the associated</p>	\$117.5 million	31-10-2001	23-11-2001	<p>(a) Scheduled for completion by the end of 2005</p> <p>(b) Scheduled for completion in mid 2005</p>

Project Item No.	Scope of Works	Approved Estimate	Approved by Public Works Subcommittee (PWSC)	Approved by Finance Committee (FC)	Latest Position
	<p>service connections in To Kwa Wan and Ma Tau Kok in the Kowloon City District;</p> <p>(ii) the replacement of about 1.4 km of fresh water mains and 0.8 km of salt water mains ranging from 150 mm to 200 mm in diameter and the associated service connections in the Diamond Hill areas in the Wong Tai Sin District; and</p> <p>(iii) the replacement of about 2.1 km of fresh water mains and 1.7 km of salt water mains ranging from 100 mm to 700 mm in diameter and the associated service connections in the Sham Shui Po and Cheung Sha Wan areas</p>				
<p>PWSC(2003-04)4 90WC – Replacement and rehabilitation of water mains, stage 1 phase 1</p>	<p>The replacement and rehabilitation of approximately 213 kilometres of fresh water mains and 95 kilometres of salt water mains and the associated service pipes throughout the territory</p>	<p>\$2,063.4 million</p>	<p>9-4-2003</p>	<p>16-5-2003</p>	<p>Scheduled for completion by 2008</p>

Replacement and rehabilitation of water mains

List of relevant papers

Council/Committee	Date of meeting	Paper
Planning, Lands and Works (PLW) Panel	13 May 1999	LC Paper No. CB(1)1296/98-99(03) http://www.legco.gov.hk/yr98-99/english/panels/plw/papers/pl1305_5.htm) LC Paper No. CB(1)1384/98-99 http://www.legco.gov.hk/yr98-99/english/panels/plw/papers/p1384e.pdf) LC Paper No. CB(1)1805/98-99 http://www.legco.gov.hk/yr98-99/english/panels/plw/minutes/pl130599.htm
Public Works Subcommittee (PWSC)	20 October 1999	PWSC(1999-2000)65 http://www.legco.gov.hk/yr99-00/english/fc/pwsc/papers/p99-65e.pdf) PWSC19/99-00 http://www.legco.gov.hk/yr99-00/english/fc/pwsc/minutes/pw201099.htm)
Finance Committee (FC)	12 November 1999	FCR(1999-2000)42 http://www.legco.gov.hk/yr99-00/english/fc/fc/papers/fc121142.pdf) FC46/99-00 http://www.legco.gov.hk/yr99-00/english/fc/fc/minutes/fc121199.pdf)
PLW Panel	18 October 2000	LC Paper No. CB(1)209/00-01 http://www.legco.gov.hk/yr00-01/english/panels/plw/minutes/pl181000.pdf)

Council/Committee	Date of meeting	Paper
PWSC	25 October 2000	PWSC(2000-01)51 http://www.legco.gov.hk/yr00-01/english/fc/pwsc/papers/p00-51e.pdf PWSC18/00-01 http://www.legco.gov.hk/yr00-01/english/fc/pwsc/minutes/pw251000.pdf
FC	17 November 2000	FCR(2000-01)41 http://www.legco.gov.hk/yr00-01/english/fc/fc/papers/f00-41e.pdf FC27/00-01 http://www.legco.gov.hk/yr00-01/english/fc/fc/minutes/fc171100.pdf
PLW Panel	8 January 2001	LC Paper No. CB(1)367/00-01(03) http://www.legco.gov.hk/yr00-01/english/panels/plw/papers/a367e03.pdf LC Paper No. CB(1)699/00-01 http://www.legco.gov.hk/yr00-01/english/panels/plw/minutes/pl080101.pdf
PWSC	21 February 2001	PWSC(2000-01)91 http://www.legco.gov.hk/yr00-01/english/fc/pwsc/papers/pw00-91e.pdf PWSC83/00-01 http://www.legco.gov.hk/yr00-01/english/fc/pwsc/minutes/pw210201.pdf
FC	9 March 2001	FCR(2000-01)80 http://www.legco.gov.hk/yr00-01/english/fc/fc/papers/f00-80e.pdf FC124/00-01 http://www.legco.gov.hk/yr00-01/english/fc/fc/minutes/fc090301.pdf

Council/Committee	Date of meeting	Paper
PWSC	31 October 2001	PWSC(2001-02)68 http://www.legco.gov.hk/yr01-02/english/fc/pwsc/papers/p01-68e.pdf PWSC30/01-02 http://www.legco.gov.hk/yr01-02/english/fc/pwsc/minutes/pw011031.pdf
FC	23 November 2001	FCR(2001-02)39 http://www.legco.gov.hk/yr01-02/english/fc/fc/papers/f01-39e.pdf FC29/01-02 http://www.legco.gov.hk/yr01-02/english/fc/fc/minutes/fc011123.pdf
Council meeting	26 June 2002	Hansard http://www.legco.gov.hk/yr01-02/english/counmtg/hansard/cm0626ti-translate-e.pdf
PWSC	9 April 2003	PWSC(2003-04)4 http://www.legco.gov.hk/yr02-03/english/fc/pwsc/papers/p03-4e.pdf PWSCI(2003-04)3 http://www.legco.gov.hk/yr02-03/english/fc/pwsc/papers/pwscicb1-3-e.pdf PWSC113/02-03 http://www.legco.gov.hk/yr02-03/english/fc/pwsc/minutes/pw030409.pdf
FC	16 May 2003	FCR(2003-04)7 http://www.legco.gov.hk/yr02-03/english/fc/fc/papers/fc03-07e.pdf FC136/02-03 http://www.legco.gov.hk/yr02-03/english/fc/fc/minutes/fc030516.pdf

Council/Committee	Date of meeting	Paper
PLW Panel	18 May 2004	LC Paper No. CB(1)1823/03-04(03) (http://www.legco.gov.hk/yr03-04/english/panels/plw/papers/plw0518cb1-1823-3e.pdf) LC Paper No. CB(1)2365/03-04 (http://www.legco.gov.hk/yr03-04/english/panels/plw/minutes/pl040518.pdf)