For discussion
on 28 February 2006

Legislative Council Panel on Planning, Lands and Works
174WC – Replacement and rehabilitation of water mains, stage 1 phase 2

PURPOSE

This paper updates Members on the stage 1 phase 2 of the replacement and rehabilitation programme for aged water mains undertaken by the Water Supplies Department (WSD) as a continuation of efforts to solve the problem due to bursts and leaks of these water mains.

2. We intend to upgrade the remaining part of **174WC** "Replacement and rehabilitation of water mains, stage 1 phase 2" to Category A at an estimated cost of about $1 211 million in money-of-the-day (MOD) prices.

BACKGROUND

3. Hong Kong's fresh water and salt water supplies are provided through a network of about 7 400 kilometres (km) of water mains. Most of these water mains are underground. About 45% of the water mains were laid more than 30 years ago. They are approaching the end of their service lives and have become increasingly difficult and costly to maintain. As a result of the aging problem, we face an increasing number of main bursts causing inconvenience to the public and loss of precious water resources. The previous way of carrying out piece-meal and small-scale replacement works was not considered effective. WSD therefore engaged consultants in February 1996 to carry out an Underground Asset Management Study (the Study) to develop a comprehensive and cost-effective management plan for the water supply network. The Study recommended the replacement and rehabilitation of some 3 000 km of aged water mains in stages to prevent further deterioration of the water supply network.

4. In view of the large scale of works and the long project duration, we have planned to carry out the programme in four stages, with higher priority given to the replacement and rehabilitation of the more critical water mains to bring about early benefits. A description of the current status of the first three stages is presented at **Enclosure 1**, whereas the works under stage 4 of the programme are at the initial planning stage.

5. To bring about earlier improvement to the supply system and minimise inconvenience to the public due to frequent main bursts, we have advanced the completion of the whole replacement and rehabilitation programme from 2020 to 2015. We will continue reviewing the programme taking into account prevailing constraints and the residual life of the watermains to be replaced, with a view to completing the works within a shorter timeframe before 2015.

PROPOSAL

6. The original scope of **174WC** comprised the replacement and rehabilitation of approximately 210 km of fresh water mains and 40 km of salt water mains. The Finance Committee has previously approved the part-upgrading of **174WC** to Category A as **178WC** and **185WC** for early implementation of parts of the works. We now propose to upgrade to Category A the remaining scope of works under **174WC** scattered in various districts throughout the territory as shown in Sketch No. SK 62005/106/001 (**Enclosure 2**), which comprise the replacement and rehabilitation of -

(a) about 203 km of fresh water mains ranging from 20 to 1 000 millimetres (mm) in diameter including service pipes and connections; and

(a) about 36 km of salt water mains ranging from 25 to 600 mm in diameter including associated service pipes and connections.

7. Due to insufficient in-house resources, we plan to implement the proposed works commencing from August 2006 for completion in March 2010, to be supervised partly by consultants and partly by in-house resources. The construction period includes allowance for laying associated service pipes and completing service connections to households.

8. Typical details of water main replacement and rehabilitation works are shown in Sketch No. SK 62005/106/002 (**Enclosure 3**). Wherever beneficial and practical, rehabilitation[1] by trenchless methods rather than traditional replacement methods will be adopted, as the former technique generally requires less excavation and reduces environmental impacts and disturbance to traffic. For water main replacement works, more durable pipes compared with the existing ones will be adopted. The durability of the existing and the proposed pipe materials is provided in **Enclosure 4**.

[1] Rehabilitation methods are generally classified as trenchless methods (sometimes referred to as 'minimum dig' or 'reduced dig' methods). In these techniques, a new pipe is launched from a 'launching pit' and travels along the existing pipe route to a 'receiving pit' without opening up the road surface for the whole length of the pipe.

JUSTIFICATION

9. If we do not carry out the replacement and rehabilitation as recommended in the Study, the water supply system would continue to deteriorate and both the number of pipe failures and water loss will continue to increase. To bring about earlier improvement to the supply system and minimise inconvenience to the public due to frequent main bursts and loss of precious water resources, the proposed works should start as soon as possible.

FINANCIAL IMPLICATIONS

10. We estimate the cost of the proposed works to be about $1 211 million in MOD prices made up as follows –

			$ million	
(a)	Water main replacement by		630	
	(i) traditional mainlaying method	545		
	(ii) trenchless methods[2]	85		
(b)	Water main rehabilitation by trenchless methods		349	
(c)	Environmental mitigation measures		9	
(d)	Consultants' fees for		113	
	(i) contract administration	3		
	(ii) site supervision	110		
(e)	Contingencies		110	
		Total	1 211	(in MOD prices)

[2] Water main replacement by trenchless methods refers to the use of pipe jacking, micro-tunnelling or boring techniques to construct underground pipelines without opening up the road surface for the whole length of the pipelines. We will adopt trenchless methods for mainlaying works in areas with serious traffic and environmental problems.

11. No additional recurrent expenditure will arise from completion of the proposed works.

ENVIRONMENTAL IMPLICATIONS

12. This is not a designated project under Environmental Impact Assessment Ordinance (Cap.499). We carried out a Preliminary Environmental Review in 2000 and concluded that the project would have no long-term environmental impact. Short-term construction impacts could be mitigated through the implementation of standard pollution control measures. We have included about $9 million in MOD prices to implement these mitigation measures and will incorporate these requirements into the works contracts for implementation.

13. We have considered the alignments of the proposed water mains in the planning and design stages to reduce the generation of construction and demolition (C&D) materials where possible. In addition, we will require the contractors to reuse inert C&D materials (e.g. excavated soil) on site or in other suitable construction sites as far as possible, in order to minimize the disposal of C&D materials to public fill reception facilities[3]. We will encourage the contractors to maximize the use of recycled or recyclable C&D materials, as well as the use of non-timber formwork to further minimize the generation of construction waste.

14. We will also require the contractors to submit waste management plans (WMP) for approval. The WMP will include appropriate mitigation measures to avoid, reduce, reuse and recycle C&D materials. We will ensure that the day-to-day operations on site comply with the approved WMP. We will control the disposal of public fill and C&D waste to public fill reception facilities and landfills respectively through a trip-ticket system. We will require the contractors to separate public fill from C&D waste for disposal at appropriate facilities. We will record the disposal, reuse and recycling of C&D materials for monitoring purposes.

15. We estimate that the project will generate about 245 000 tonnes of C&D materials. Of these, we will reuse about 102 000 tonnes (about 42%) on site and deliver 138 000 tonnes (about 56%) to public fill reception facilities for subsequent reuse. In addition, we will dispose of 5 000 tonnes (about 2%) at landfills. The total cost for accommodating C&D materials at public fill reception facilities and landfill sites is estimated to be about $4.35 million for this project (based on an unit cost of $27/tonne

[3] Public fill reception facilities are specified in Schedule 4 of the Waste Disposal (Charges for Disposal of Construction Waste) Regulation. Disposal of public fill in a public fill reception facilities requires a licence issued by the Director of Civil Engineering and Development.

for disposal at public fill reception facilities and $125/tonne at landfills[4]).

16. The proposed works will not involve any tree removal or planting proposal.

TRAFFIC IMPLICATIONS

17. We have carried out traffic impact assessments (TIA) for the proposed works. The TIA have concluded that the proposed works would not cause unacceptable traffic impact. We will implement temporary traffic arrangements to minimise impacts on traffic during construction. Furthermore, trenchless methods will be used whenever practicable to rehabilitate the water mains along busy roads, e.g. Connaught Road and Austin Road.

PUBLIC CONSULTATION

18. We consulted the Legislative Council Panel on Planning, Lands and Works on 8 January 2001 regarding implementation of the stage 1 phase 2 works, and received support from Members. We consulted the Panel again by circulation of an information paper in May 2005 on part-upgrading of **174WC** to Category A as **185WC**. Members had no objection to the proposal.

19. We consulted the 10 concerned District Councils from August 2005 to January 2006. All the District Councils supported implementation of the works. A table showing details of the consultations with various District Councils is at **Enclosure 5**. In view of some District Councils' concern about traffic and environmental impacts arising from the proposed works, we will implement adequate traffic and environmental mitigation measures under the works contracts. We will also closely monitor implementation of these mitigation measures and the interfacing of works, and will keep the relevant District Councils informed during the project period.

LAND ACQUISITION

20. The proposed works do not require any land acquisition.

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[4] This estimate has taken into account the cost for developing, operating and restoring the landfills after they are filled and the aftercare required. It does not include the land opportunity cost for existing landfill sites (which is estimated at $90/m^3$), nor the cost to provide new landfills, (which is likely to be more expensive) when the existing ones are filled.

JOB CREATION

21. We estimate that the proposed works will create about 370 jobs for labourers and another 80 for professional/technical staff providing a total employment of 17 000 man-months.

WAY FORWARD

22. We intend to submit the proposed upgrading of the remaining part of **174WC** to Category A for consideration by the Public Works Sub-committee in April 2006 with a view to seeking funding approval of the Finance Committee in the same month.

Environment, Transport and Works Bureau
February 2006

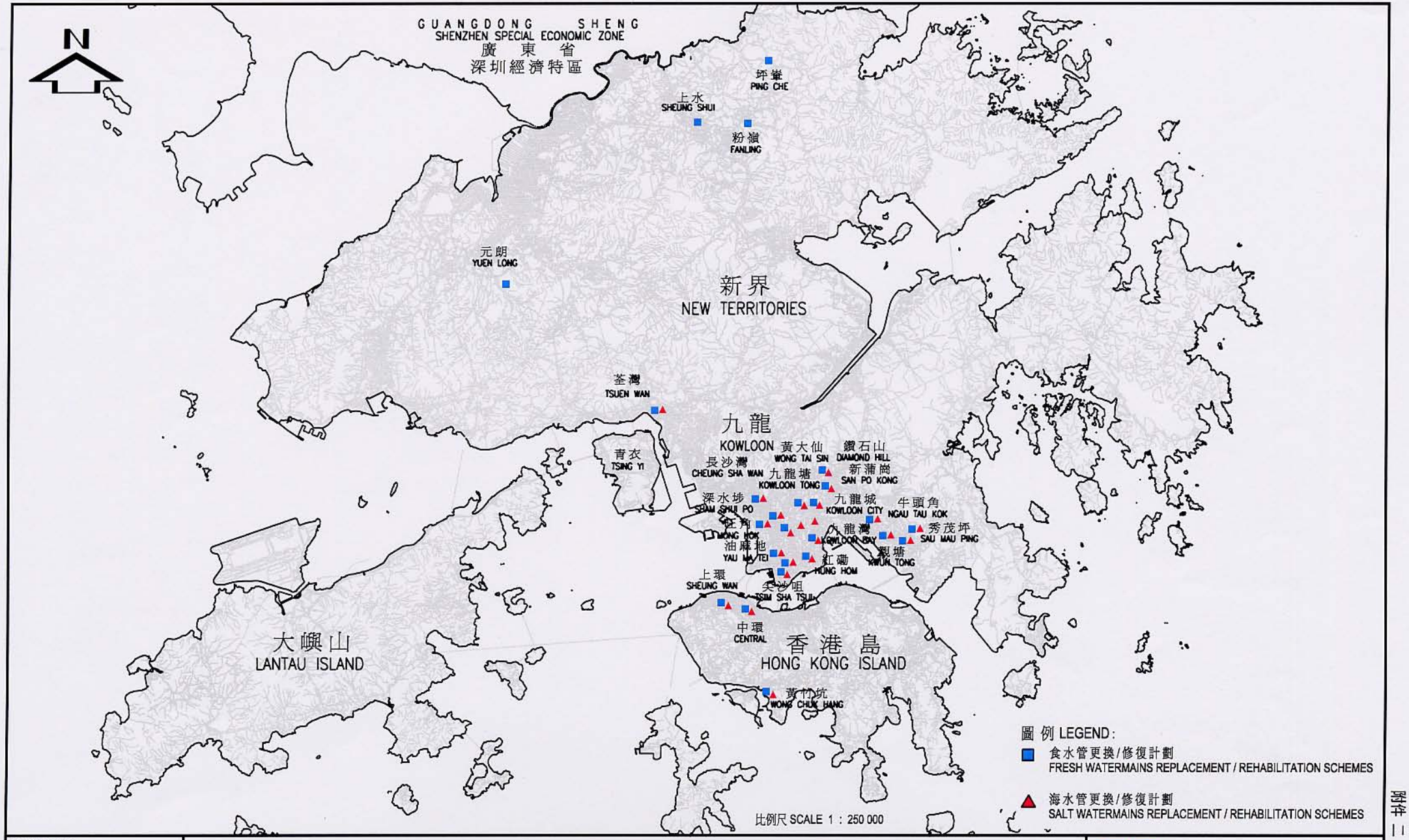
Enclosure 1

Current status on the first three stages of the water mains replacement and rehabilitation programme

PWP Item	Item Description	Status
90WC	Stage 1 phase 1 – Replacement and rehabilitation of 246 km of fresh water mains and 104 km of salt water mains Total approved project estimate: $2,432 million	The project was part-upgraded to Category A in several packages as **95WC, 175WC, 177WC** and **179WC** for engaging consultants to carry out investigation and detailed design, and for implementing the early parts of the works. The remaining part of the project was upgraded to Category A as **90WC** in May 2003. Construction works are now in progress for completion in December 2008.
174WC	Stage 1 phase 2 – Replacement and rehabilitation of 210 km of fresh water mains and 40 km of salt water mains Estimated project cost: $1,271 million	The project was part-upgraded to Category A as **178WC** for engaging consultants to carry out investigation and impact assessments. Detailed design of the proposed works is now substantially completed partly by consultants funded by Block Vote **9100WX** and partly by in-house resources. The project was part-upgraded to Category A again as **185WC** in June 2005 for construction of the works in Sha Tin and Tai Wai. The works in Sha Tin and Tai Wai are in progress for completion by December 2007. The anticipated commencement and completion of the construction works under the remaining part of **174WC** will be August 2006 and March 2010 respectively.

Enclosure 1

PWP Item	Item Description	Status
182WC	Stage 2 – Replacement and rehabilitation of 670 km of fresh water mains, 80 km of salt water mains and 3 km of raw water mains Estimated project cost : $2,600 million	The project was part-upgraded to Category A as **184WC** in March 2005 for engaging consultants to carry out investigation and detailed design which are proceeding. The anticipated commencement and completion of the construction works will be January 2007 and June 2011 respectively.
186WC	Stage 3 – Replacement and rehabilitation of about 800 km of water mains Estimated project cost: $2,500 million	Detailed planning is in progress. The proposed works are scheduled to commence in end 2008 for completion in 2013.



核准 APPROVED

總工程師/工程管理部 CE / PM

13 / 2 / 2006

（甲級工程）
(CAT 'A' Submission)

工務計劃項目174WC ----- 更換及修復水管工程第1階段第2期
P.W.P. NO. 174WC ----- REPLACEMENT AND REHABILITATION OF WATER MAINS, STAGE 1 PHASE 2

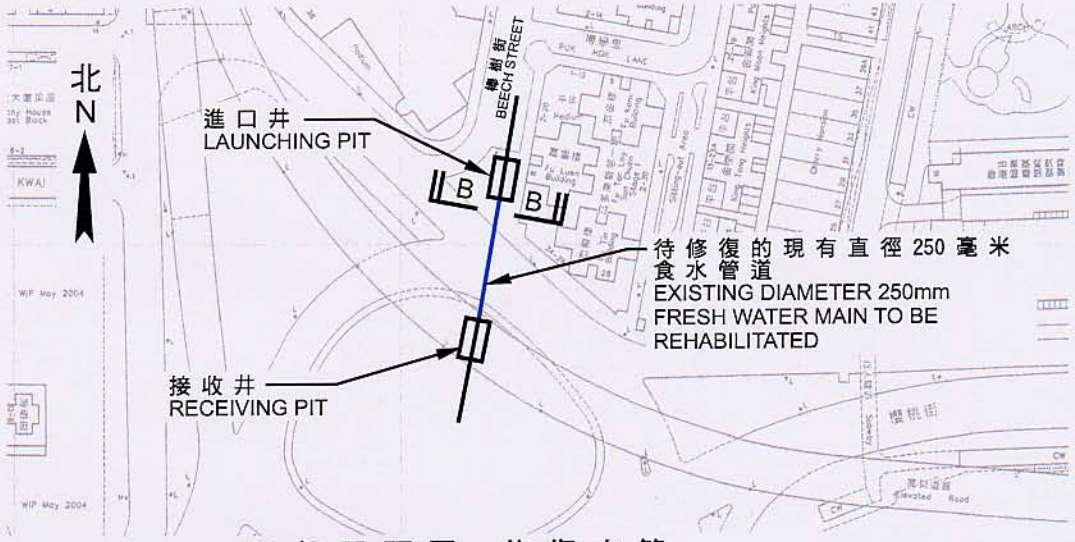
水務署
WATER SUPPLIES DEPT.

草圖編號 SKETCH NO. SK 62005 / 172 / 001

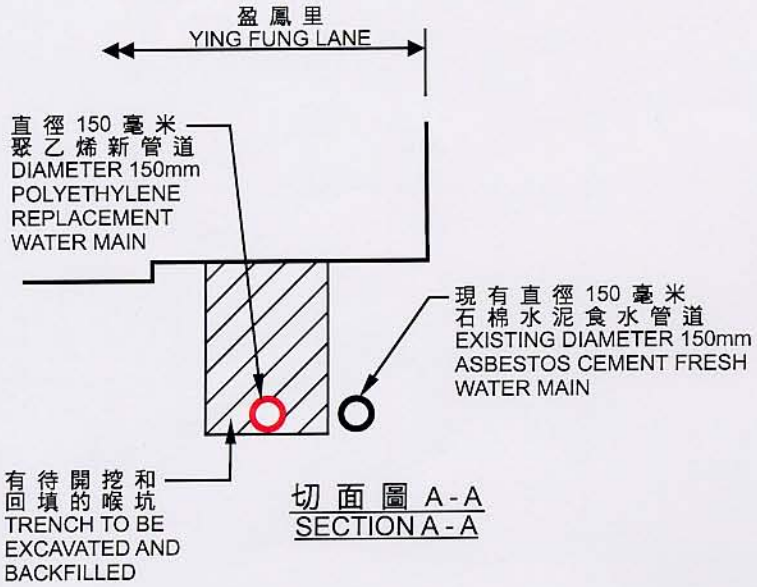
REF. 62005 - 172.DWG

附件二 ENCLOSURE 2

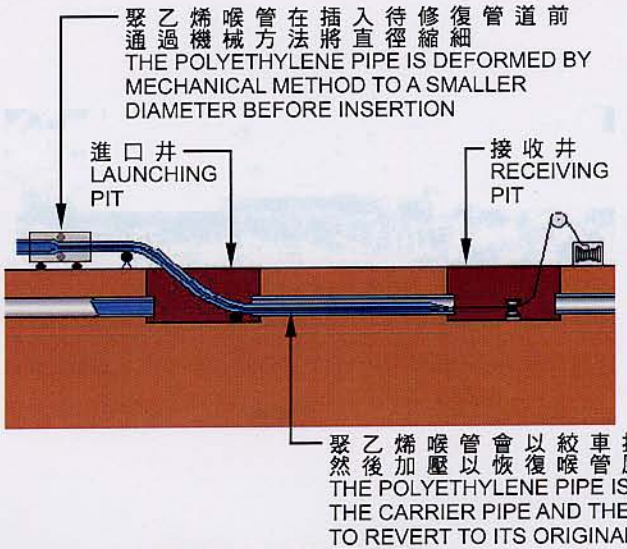
地盤平面圖－更換水管
SITE PLAN - WATER MAIN REPLACEMENT
比例尺 SCALE 1 : 2 000



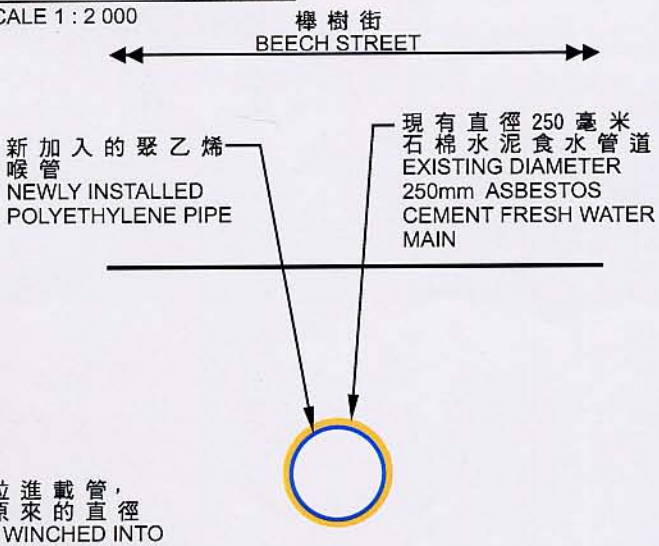
地盤平面圖－修復水管
SITE PLAN - WATER MAIN REHABILITATION
比例尺 SCALE 1 : 2 000



切面圖 A-A
SECTION A - A



修復水管圖解
WATER MAIN REHABILITATED
ILLUSTRATION



切面圖 B-B
SECTION B - B

核准 APPROVED
總工程師/工程管理部 CE/PM
13/2/2006

工務計劃項目174WC — 更換及修復水管工程第1階段第2期
更換及修復水管範例
P.W.P. No. 174WC — Replacement and rehabilitation of water mains, stage 1 phase 2
Typical water main replacement and rehabilitation details
（甲級工程）
(CAT 'A' Submission)

水務署
WATER SUPPLIES DEPT.
草圖編號 SKETCH NO. SK 62005 / 172 / 002
REF. 62005-172.CDR

附件三 ENCLOSURE 3

Enclosure 4

174WC – Replacement and rehabilitation of water mains, stage 1 phase 2
Durability of Existing and Proposed Pipe Materials

Age Distribution of Existing Water Mains

The age distribution of the existing water mains in Hong Kong is as follows –

Age (year)	>50	30-50	20-30	10-20	<10
Percentage	16	29	16	15	24

Service Life of Existing Pipe Materials

2. There are different pipe materials being used in our water supply network. The service life of a water main will vary with the ground condition and the water it carries. For fresh water mains, the service life is around 50 years for mild steel and ductile iron pipes. Galvanised iron pipes were widely used in the 50's and 60's which have screw joints subject to external corrosion and hence a shorter service life of about 30 years.

3. For salt water mains, because of the corrosive action of the salt water, the service life is comparatively shorter. 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.

Proposed Pipe Materials

4. With the advancement in technology, there are more durable pipes with longer service life available in the market. The following pipe materials are proposed for the replacement works of the project –

Enclosure 4

Pipe Diameter	Existing pipe materials	Pipe materials to be used for the replacement works
700 mm and above	Mild steel (with bituminous lining)	Mild steel (with concrete or epoxy lining)
300 mm to 600 mm	Cast iron and asbestos cement	Ductile iron (with cement mortar lining)
Below 300 mm	Cast iron, asbestos cement, galvanised iron and unplasticised polyvinyl chloride	Polyethylene

Main Characteristics of Proposed Pipe Materials

5. The main characteristics of the proposed pipe materials listed above are as follows –

Pipe Material	Main Characteristics
Mild steel	(a) Widely used throughout the world for large diameter pipes. (b) Most commonly jointed by welding. Durability of these pipes depends on effectiveness of the external and internal protection to the pipes. (c) Epoxy lining or concrete lining exhibits better corrosion resistance than bituminous lining.
Ductile iron	(a) Mostly used for medium size water mains. (b) Push-in rubber ring joint is the most commonly used type of jointing. (c) Well-protected against corrosion with a cement mortar lining.

Enclosure 4

Pipe Material	Main Characteristics
Polyethylene	(a) Widely used nowadays for small diameter water mains. There is an increasing tendency for these pipes to be used for larger water mains. (b) Butt-welded or electro-fusion joints are usually used for jointing. (c) Exhibits good corrosion resistance.

Service life of Proposed Pipe Materials

6. With the use of more corrosion resistant protective lining, we expect that the typical service life of mild steel and ductile iron pipes be increased from about 50 to 60 years for fresh water mains.

7. For salt water mains, the typical service life of ductile iron pipes is estimated to be about 40 years. Polyethylene pipes have good resistance to corrosion and have a life expectance of about 50 years. This would greatly elongate the replacement and rehabilitation cycle of water mains.

Pipe Materials Used in other Countries

8. The pipe materials stated above have proven to be durable and suitable and are widely used in Japan, the United States, the United Kingdom and other European countries for comparable projects. Mild steel, ductile iron and polyethylene pipes are predominantly used for large, medium and small diameter water mains respectively in these countries.

Enclosure 5

174WC – Replacement and rehabilitation of water mains, stage 1 phase 2

Consultations with District Councils

District Council	Date of Meeting	Decision
Central and Western District Council	24 November 2005 and 19 January 2006	Supported
Kowloon City District Council Traffic and Transport Committee	29 September 2005	Supported
Kwun Tong District Council Traffic and Transport Committee	1 September 2005	Supported
North District Council District Development and Environmental Improvement Committee	26 September 2005	Supported
Sham Shui Po District Council Traffic Committee	27 October 2005	Supported
Southern District Council Planning, Works and Housing Committee	24 October 2005	Supported
Tsuen Wan District Council Environmental and Health Affairs Committee	1 September 2005 and 3 November 2005	Supported
Tsuen Wan District Council Traffic and Transport Committee	4 November 2005	Supported
Wong Tai Sin District Council	13 September 2005	Supported
Yau Tsim Mong District Council	25 August 2005	Supported
Yuen Long District Council Town Planning and Development Committee	14 September 2005	Supported

(Note : All District Councils supported this project to proceed to the construction phase.)