

For information

**Legislative Council Panel on Planning, Lands and Works
182WC – Replacement and rehabilitation of water mains, stage 2**

PURPOSE

This paper updates Members on stage 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 **182WC** “Replacement and rehabilitation of water mains, stage 2” to Category A at an estimated cost of about \$ 3 192 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 water mains to be replaced, with a view to completing the works within a shorter timeframe before 2015.

PROPOSAL

6. The remaining scope of stage 2 works under **182WC** comprise the replacement and rehabilitation of water mains scattered in various districts throughout the territory as shown in Sketch Nos. SK 62006/025/001 & 002 (**Enclosure 2**) and summarised below :

- (a) about 670 km of fresh water mains ranging from 20 to 1 500 millimetres (mm) in diameter including associated service pipes and connections;
- (b) about 80 km of salt water mains ranging from 25 to 800 mm in diameter including associated service pipes and connections; and
- (c) about 3 km of raw water mains ranging from 1 200 to 2 300 mm in diameter.

7. Finance Committee has previously approved the part-upgrading of **182WC** to Category A as **184WC** for engaging consultants to carry out investigation and detailed design of the works. We now propose to upgrade the remaining scope of works under **182WC** to Category A.

8. Due to insufficient in-house resources, we plan to implement the proposed works commencing from early 2007 for completion in June 2011, 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.

9. The typical details of the replacement and rehabilitation works are shown in Sketch No. SK 62006/026 (**Enclosure 3**). Wherever beneficial, the trenchless method will be adopted. For replacement works, more durable pipes will be adopted. The durability of the existing and the proposed pipe materials is provided in **Enclosure 4**.

JUSTIFICATION

10. 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. Upon completion of **182WC**, about 45% of the water mains by length identified in the Study will be replaced or rehabilitated.

FINANCIAL IMPLICATIONS

11. We estimate the cost of the proposed works to be about \$3 192 million in MOD prices made up as follows –

		\$ million
(a)	Water main replacement by	2 034
	(i) traditional mainlaying method	1 982
	(ii) trenchless methods ¹	52
(b)	Water main rehabilitation ² by trenchless methods	574
(c)	Environmental mitigation measures	27
(d)	Consultants' fees for	267
	(i) contract administration	11
	(ii) site supervision	256
(e)	Contingencies	290
	Total	<u>3 192 (in MOD prices)</u>

¹ 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.

² 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.

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

ENVIRONMENTAL IMPLICATIONS

13. This is not a designated project under Environmental Impact Assessment Ordinance (Cap. 499). 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 \$27 million in MOD prices to implement these mitigation measures and will incorporate these requirements into the works contracts for implementation.

14. 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 facilities³. 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.

15. 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.

16. We estimate that the project will generate C&D materials in the order of 1 219 200 tonnes. Of these, we plan to reuse about 752 000 tonnes (about 61.7%) on site and deliver 460 000 tonnes (about 37.7%) to public fill reception facilities for subsequent reuse. In addition, we plan to dispose of 7 200 tonnes (about 0.6%) at landfills. The total cost for accommodating C&D materials at public fill reception facilities and landfill sites is estimated to be about \$13.32 million for this project (based

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 public fill reception facilities requires a license issued by the Director of Civil Engineering and Development.

on an unit cost of \$27/tonne for disposal at public fill reception facilities and \$125/tonne at landfills⁴).

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

TRAFFIC IMPLICATIONS

18. 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 for works along busy roads, e.g. Nathan Road and Queensway.

PUBLIC CONSULTATION

19. We consulted the Legislative Council Panel on Planning, Lands and Works (the Panel) on 25 January 2005 regarding the engagement of consultants to carry out investigation and detailed design of the stage 2 works, and received general support from Members.

20. We also briefed Members on the various stages of the water mains replacement and rehabilitation programme, including the stage 2 works under **182WC**, when we consulted the Panel on **174WC** – “Replacement and rehabilitation of water mains, stage 1 phase 2” on 28 February 2006. We consulted the Panel again by circulation of an information paper on 15 May 2006 when we proposed to upgrade part of **186WC** – “Replacement and rehabilitation of water mains, stage 3” for the investigation and detailed design for the stage 3 works.

21. We consulted the concerned District Councils from October 2005 to June 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

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/m³), nor the cost to provide new landfills, (which is likely to be more expensive) when the existing ones are filled.

these mitigation measures and the interfacing of works, and will keep the relevant District Councils informed during the project period.

LAND ACQUISITION

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

JOB CREATION

23. We estimate that the proposed works will create about 1 085 jobs (880 for labourers and another 205 for professional/technical staff) providing a total employment of 51 800 man-months.

WAY FORWARD

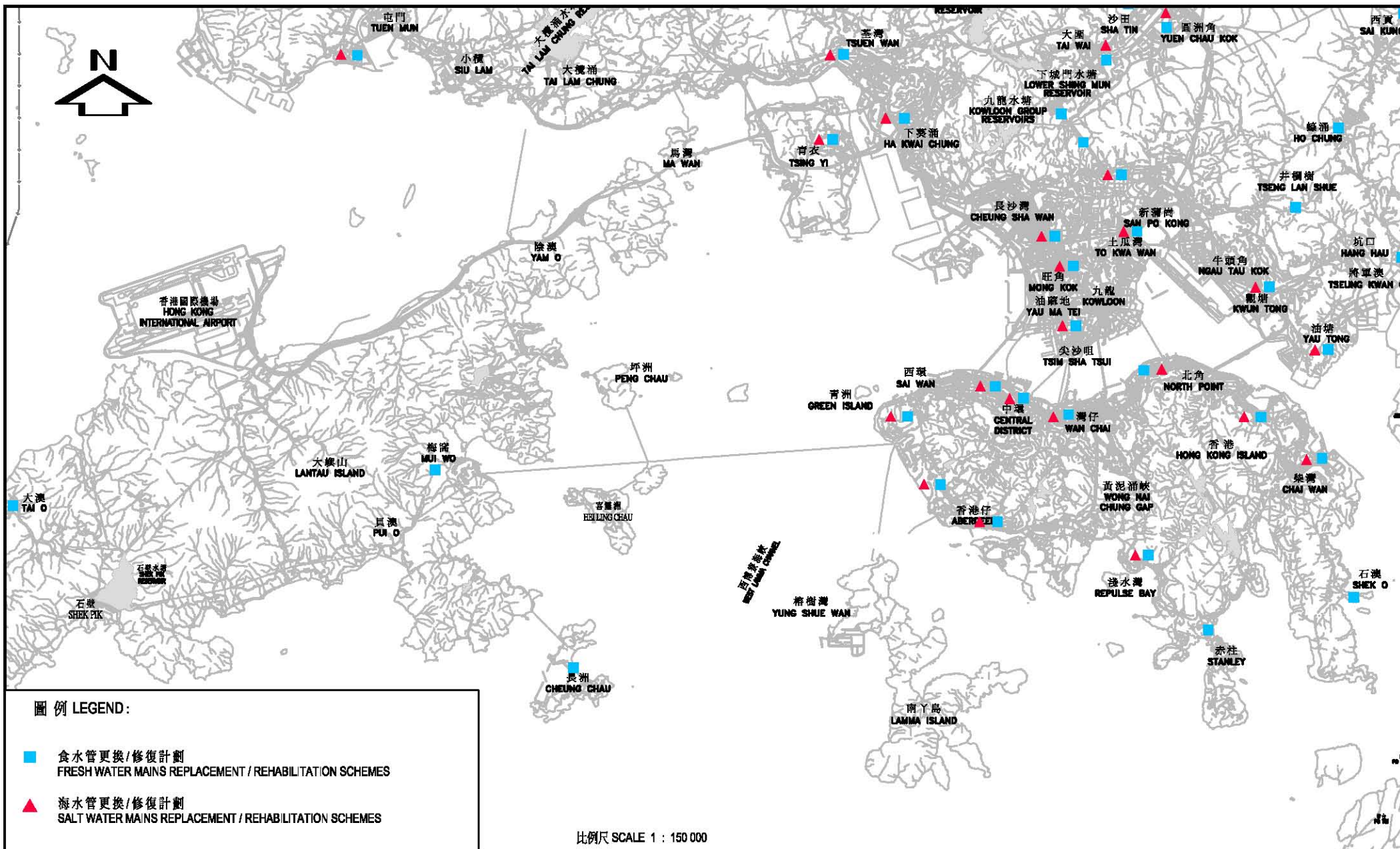
24. We intend to submit the proposed upgrading of the remaining part of **182WC** to Category A for consideration by the Public Works Sub-committee in October 2006 with a view to seeking funding approval from the Finance Committee in November 2006.

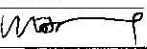
Environment, Transport and Works Bureau
July 2006

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

PWP Item	Item Description	Status
90WC	<p>Stage 1 phase 1 – Replacement and rehabilitation of 246 km of fresh water mains and 104 km of salt water mains</p> <p>Total approved project estimate: \$2 432 million</p>	<p>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.</p> <p>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.</p>
174WC	<p>Stage 1 phase 2 – Replacement and rehabilitation of 210 km of fresh water mains and 40 km of salt water mains</p> <p>Total approved project estimate: \$1 327 million</p>	<p>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.</p> <p>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.</p> <p>The remaining part of the project was upgraded to Category A as 174WC in April 2006. Construction works will start in August 2006 for completion in March 2010.</p>

PWP Item	Item Description	Status
182WC	<p>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</p> <p>Estimated project cost for the remaining part of 182WC: \$3 192 million</p>	<p>The project was part-upgraded to Category A as 184WC (Approved project estimate : \$52.9 million) in March 2005 for engaging consultants to carry out investigation and detailed design which are proceeding.</p> <p>Subject to funding approval, the proposed construction works are scheduled to commence in early 2007 for completion in June 2011.</p>
186WC	<p>Stage 3 – Replacement and rehabilitation of 620 km of fresh water mains and 180 km of salt water mains</p> <p>Estimated project cost for the remaining part of 186WC: \$2 438 million (Sept 2005 price level)</p>	<p>The project was part-upgraded to Category A as 187WC (Approved project estimate : \$64.7 million) in July 2006 for engaging consultants to carry out investigation and detailed design.</p> <p>The proposed investigation and design consultancies are scheduled to commence in October 2006 for completion by phases before early 2009. Construction works are scheduled to start by end 2008 for completion in 2013.</p>



核准 APPROVED

 總工程師/顧問工程經理 CE / CM
 20 / 6 / 2006

(甲級工程)
 (CAT 'A' Submission)

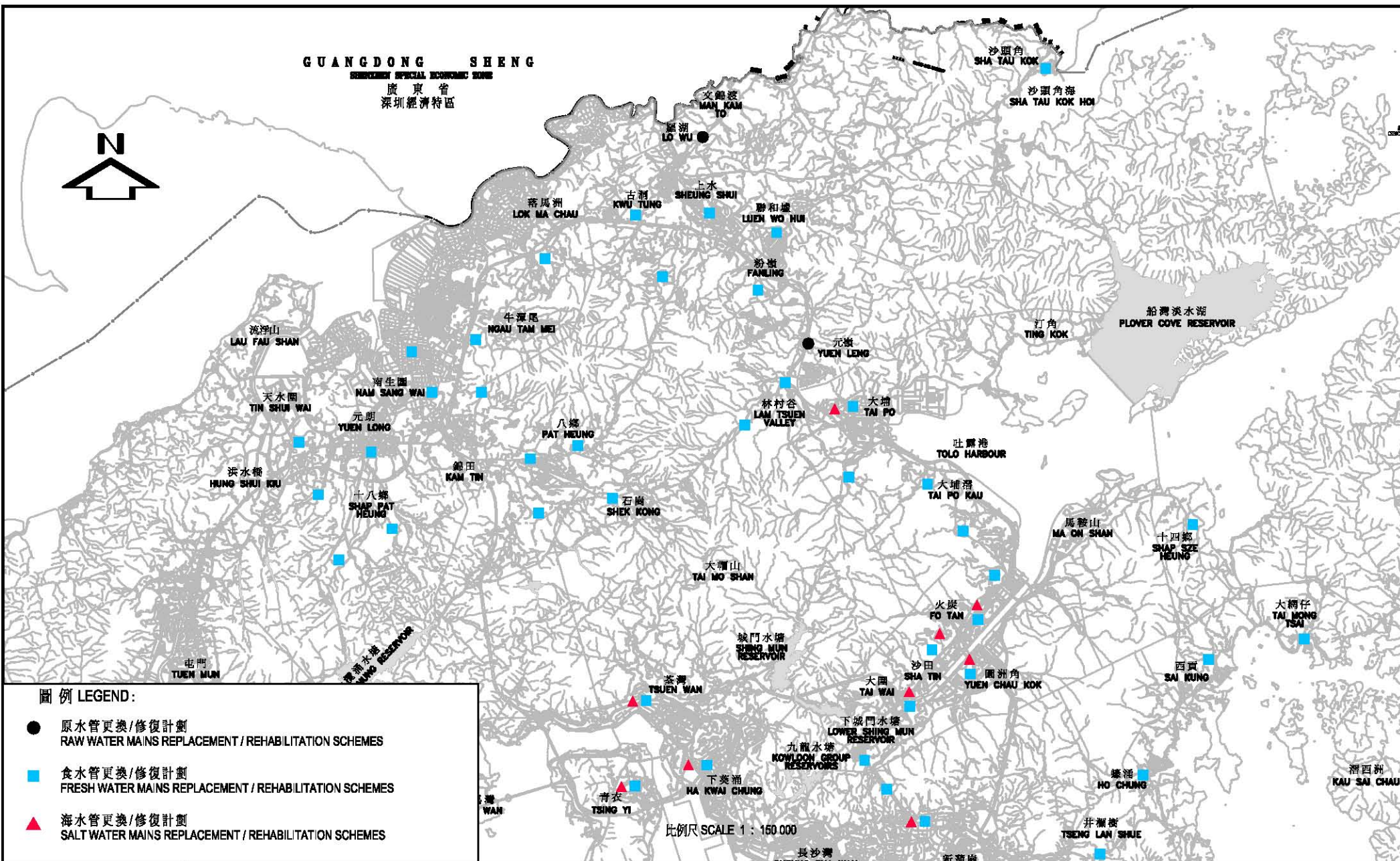
工務計劃項目 182WC —— 更換及修復水管工程第2階段
 (圖一—香港、九龍及離島區)
 P.W.P. NO. 182WC —— REPLACEMENT AND REHABILITATION OF WATER MAINS, STAGE 2
 (SHEET 1 - HONG KONG, KOWLOON & ISLANDS)



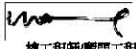
水務署
 WATER SUPPLIES DEPT.

草圖編號
 SKETCH NO.

SK 62006 / 025 / 001



核准 APPROVED


總工程師/顧問工程經理 CE / CM

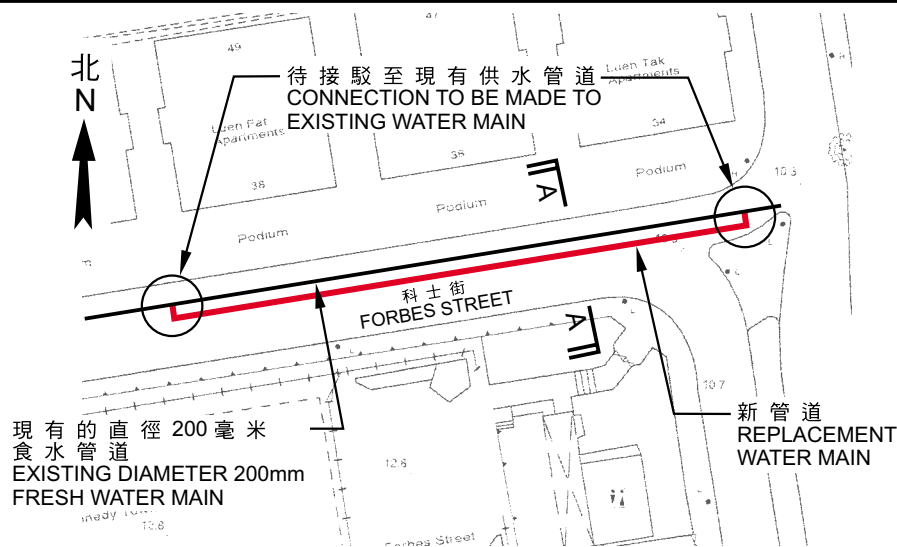
20 / 6 / 2006

(甲級工程)
(CAT 'A' Submission)

工務計劃項目 182WC —— 更換及修復水管工程第2階段
(圖二—新界區)
P.W.P. NO. 182WC —— REPLACEMENT AND REHABILITATION OF WATER MAINS, STAGE 2
(SHEET 2 - NEW TERRITORIES)

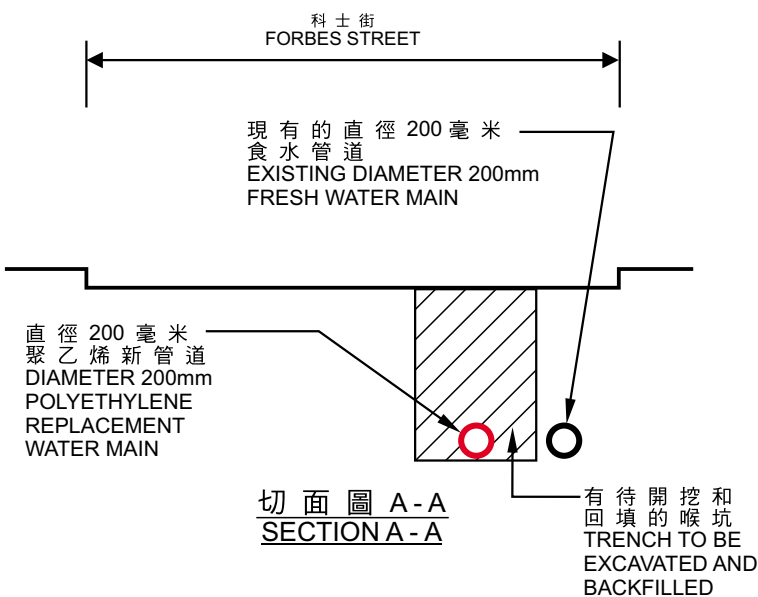
 水務署
WATER SUPPLIES DEPT.

草圖編號 SKETCH NO. SK 62006 / 025 / 002

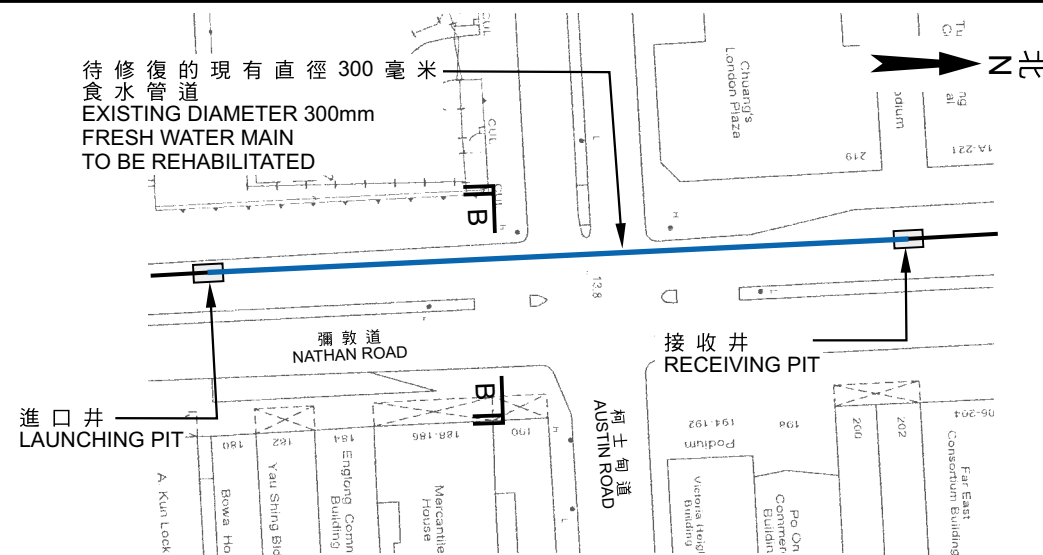


地盤平面圖 - 更換水管
SITE PLAN - WATER MAIN REPLACEMENT

比例尺 SCALE 1 : 1 000

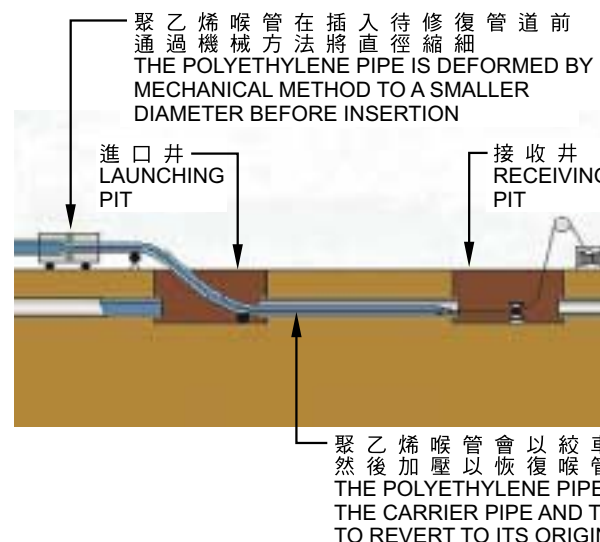


切面圖 A-A
SECTION A-A

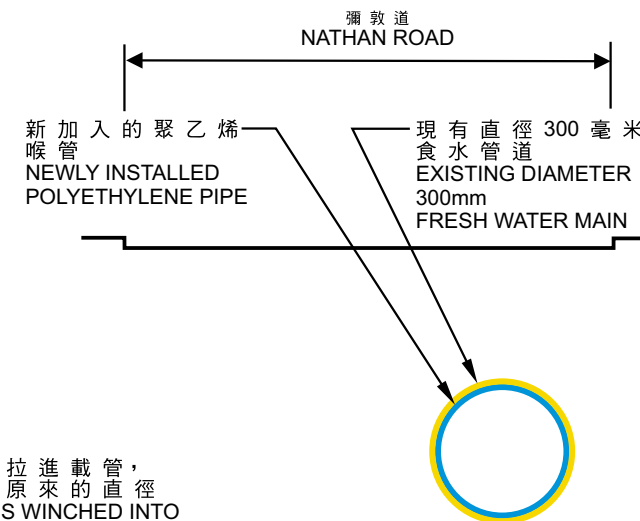


地盤平面圖 - 修復水管
SITE PLAN - WATER MAIN REHABILITATION

比例尺 SCALE 1 : 1 000



修復水管圖解
WATER MAIN REHABILITATION
ILLUSTRATION



切面圖 B-B
SECTION B-B

核准 APPROVED
總工程師/顧問工程管理 CE/CM
30 / 6 / 2006

工務計劃項目182WC — 更換及修復水管工程第2階段
更換及修復水管範例
P.W.P. NO. 182WC — REPLACEMENT AND REHABILITATION OF WATER MAINS, STAGE 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 SK 62006 / 026
SKETCH NO.

182WC – Replacement and rehabilitation of water mains, stage 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 –

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	<ul style="list-style-type: none"> (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	<ul style="list-style-type: none"> (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.

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.

182WC – Replacement and rehabilitation of water mains, stage 2

Consultation with District Councils

District Council	Date of Meeting	Decision
Southern District Council Planning, Works and Housing Committee	24 October 2005	Supported
Tsuen Wan District Council Environmental and Health Affairs Committee, and Traffic and Transport Committee	3 November 2005 & 4 November 2005	Supported
Central and Western District Council	24 November 2005 & 19 January 2006	Supported
Kwai Tsing District Council Traffic and Transport Committee	16 February 2006	Supported
Tuen Mun District Council Environmental, Hygiene and District Development Committee	17 March 2006	Supported
Yuen Long District Council Town Planning and Development Committee	22 March 2006	Supported
Islands District Council Environment Improvement and Food Hygiene Committee	27 March 2006	Supported
Wan Chai District Council Planning, Transport and Environmental Protection Committee	28 March 2006	Supported
Eastern District Council Works and Development Committee, and Traffic and Transport Committee	21 April 2006	Supported
Sai Kung District Council Traffic and Transport Committee	13 April 2006	Supported

Enclosure 5 (Page 2)

District Council	Date of Meeting	Decision
Yau Tsim Mong District Council	27 April 2006	Supported
Wong Tai Sin District Council	2 May 2006	Supported
Tai Po District Council Environment, Housing and Works Committee	12 May 2006	Supported
North District Council District Development and Environmental Improvement Committee	15 May 2006	Supported
Kowloon City District Council Traffic and Transport Committee	25 May 2006	Supported
Kwun Tong District Council Traffic and Transport Committee	8 June 2006	Supported
Sham Shui Po District Council Traffic Committee	22 June 2006	Supported
Sha Tin District Council Development and Housing Committee	27 June 2006	Supported