For information

Legislative Council Panel on Planning, Lands and Works

186WC – Replacement and rehabilitation of water mains, stage 3

PURPOSE

This paper informs Members of the background on stage 3 of the replacement and rehabilitation programme of 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 part-upgrade **186WC** to Category A, entitled "Replacement and rehabilitation of water mains, stage 3 - investigation and detailed design", at an estimated cost of $64.7 million in money-of-the-day (MOD) prices, for engaging consultants to carry out investigation and detailed design for the stage 3 works under the water mains replacement and rehabilitation programme.

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 of water mains, 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. 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 to 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 replacement and rehabilitation of the most critical water mains were included in stages 1 and 2 to bring about early benefits. The stage 3 works under **186WC** covers the water mains of the next highest priority. At an estimated cost of $2,500 million, the scope of **186WC** covers sites scattered over various districts throughout the territory as shown in Sketch No. SK 62005/195/001 & 002 (**Enclosure 2**), and comprises the replacement and rehabilitation of -

(a) about 620 km of fresh water mains ranging from 20 to 1 500 millimetres (mm) in diameter including associated service pipes and connections; and

(b) about 180 km of salt water mains ranging from 20 to 1 000 mm in diameter including associated service pipes and connections.

7. To enable the construction works to commence by end 2008 as scheduled, we propose to engage consultants to carry out investigation and design for the replacement and rehabilitation of 560 km of fresh water mains and 160 km of salt water mains. The scope of the proposed consultancy includes –

(a) detailed design of the replacement and rehabilitation works;

(b) traffic impact assessments;

(c) drainage impact assessments;

(d) environmental reviews; and

(e) site investigation and condition survey works.

8. We shall use in-house staffing resources to investigate, design and supervise the replacement and rehabilitation of the remaining ageing water mains (about 60 km of fresh water mains and about 20 km of salt water mains) under the stage 3 works. We plan to start the proposed consultancy and site investigation works in October 2006 for completion by phases before early 2009.

9. The typical details of the replacement and rehabilitation works are shown in Sketch No. SK 62005/208 (**Enclosure 3)**. Wherever beneficial, the trenchless method will be adopted. For replacement works, more durable pipes would be adopted. The durability of the existing and the proposed pipe materials is provided in **Enclosure 4**.

JUSTIFICATION

10. If we do not press on with the replacement and rehabilitation programme, the water supply system would continue to deteriorate and both the number of pipe failures and water loss will continue to increase. In order to sustain the momentum, the stage 3 works should start as soon as possible to ensure the timely completion of the compressed programme within 15 years. Upon the completion of stage 3, about 70% of the water mains by length identified in the Study will be replaced or rehabilitated.

11. To meet the compressed programme of replacement and rehabilitation of the ageing water mains, we need to commence investigation and detailed design of the stage 3 works in October 2006. In view of the scale and complexity, the proposed works demand considerable resources over a relatively short period. Having examined various ways and means of implementing the replacement and rehabilitation programme, we consider that WSD does not have adequate in-house resources to carry out all the works under **186WC** in addition to the other planned projects. It is therefore proposed to part-upgrade **186WC** in July 2006 for appointment of consultants to carry out investigation, impact assessments and detailed design for some of the water mains.

FINANCIAL IMPLICATIONS

12. We estimate the cost of the proposed consultancies for the detailed design, site investigation and assessment works to be $64.7 million in MOD prices, made up of the following –

			$ million	
(a)	Consultants' fees		29.7	
	(i)	Detailed design, tender documentation and assessment	20.9	
	(ii)	Traffic impact assessment	2.1	
	(iii)	Drainage impact assessment	0.5	
	(iv)	Environmental review	1.0	
	(v)	Supervision of site investigation and condition survey works	5.2	
(b)	Site investigation and condition survey works		29.1	
(c)	Contingencies		5.9	
		Total	64.7	(in MOD prices)

13. There will be no additional recurrent expenditure arising from the part of **186WC** we now propose to upgrade to Category A as it entails consultancy services and site investigation works only.

ENVIRONMENTAL IMPLICATIONS

14. The proposed consultancies themselves will not have adverse environmental implications. We will look into the environmental implications of the project. If there is any designated project under the Environmental Impact Assessment (EIA) Ordinance (Cap. 499) identified in the consultancies, we undertake to comply with the statutory process under the EIA Ordinance.

15. We will implement environmental pollution control measures to control the environmental impacts of the associated site investigation and assessment works. The works will only generate a minimal amount of construction and demolition (C&D) materials. We will require the consultants to plan and design the works in such a way to minimise, reuse and recycle C&D materials as much as possible at the construction stage.

16. The proposed site investigation and assessment works will not involve any tree removal or planting proposal.

PUBLIC CONSULTATION

17. We briefed Members on the status of the various stages of the water mains replacement and rehabilitation programme, including **186WC,** when we consulted the Panel on **174WC** – "Replacement and rehabilitation of water mains, stage 1 phase 2" on 28 February 2006.

18. We will consult the relevant District Councils and take their views into consideration at the design stage of **186WC**. We previously consulted all relevant District Councils on **90WC** – "Replacement and rehabilitation of water mains, stage 1 phase 1" and **174WC** – "Replacement and rehabilitation of water mains, stage 1 phase 2". All of them supported the projects.

LAND ACQUISITION

19. The proposed consultancies and site investigation works do not require any land acquisition.

JOB CREATION

20. We estimate that the proposed consultancies and site investigation works will create about 70 jobs (30 jobs for labourers and another 40 for professional/technical staff) providing a total employment of 1100 man-months.

WAY FORWARD

21. We intend to submit the proposed part-upgrading of **186WC** to Category A for consideration by the Public Works Subcommittee in June 2006 with a view to seeking funding approval of the Finance Committee in July 2006.

Environment, Transport and Works Bureau
May 2006

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 Total approved project estimate: $1,327 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 remaining part of the project was upgraded to Category A as **174WC** in April 2006. The construction works will commence in August 2006 for completion in March 2010.

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 proposed construction works are scheduled to commence in January 2007 for completion in June 2011.
186WC	Stage 3 – Replacement and rehabilitation of 620 km of fresh water mains and 180 km of salt water mains Estimated project cost: $2,500 million	Subject to funding approval, consultants will be engaged to carry out investigation and detailed design for the project in October 2006 for completion by phases before early 2009. The proposed construction works are scheduled to commence by end 2008 for completion in 2013.

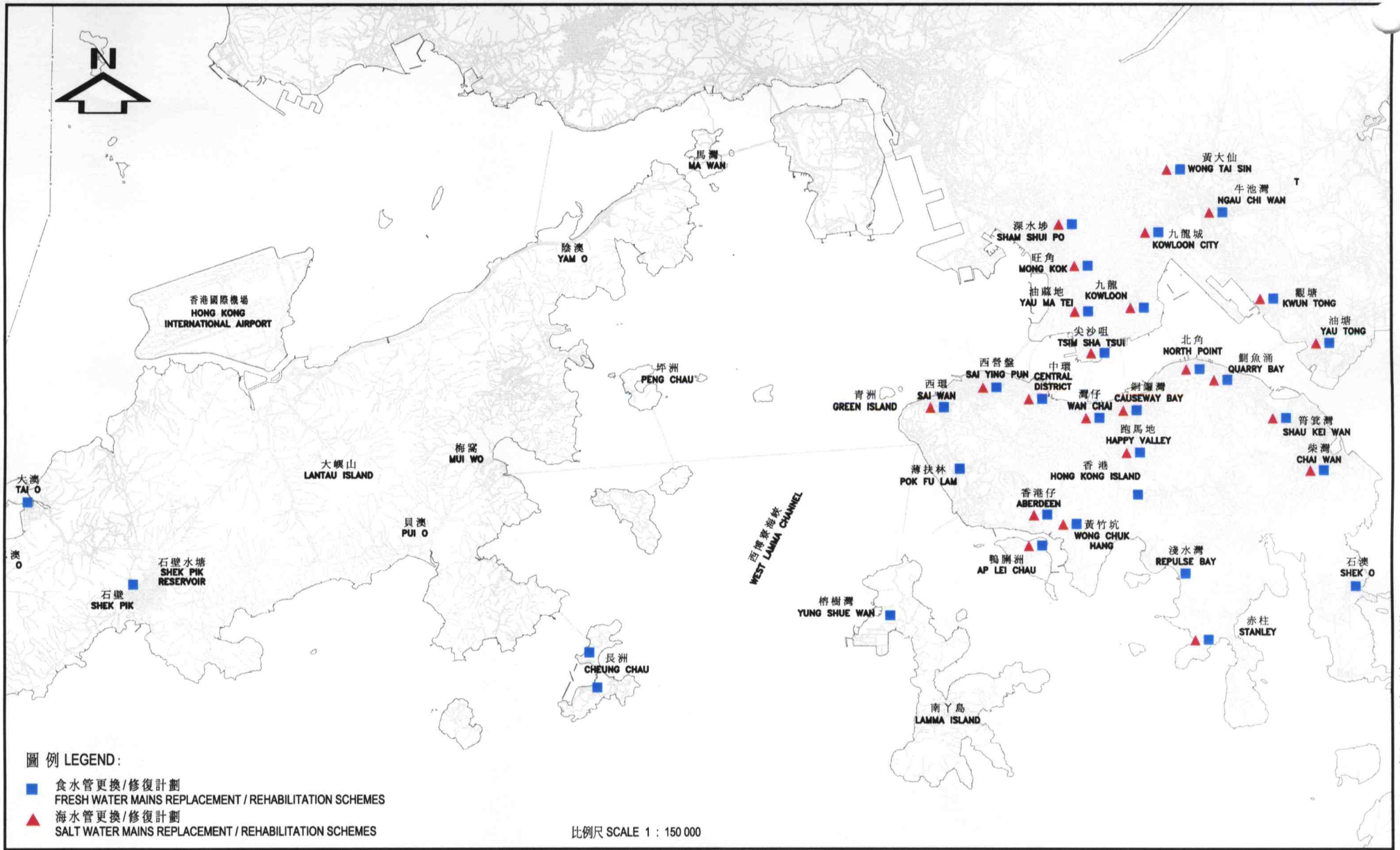


圖 例 LEGEND :

- 食水管更換/修復計劃
  FRESH WATER MAINS REPLACEMENT / REHABILITATION SCHEMES
- 海水管更換/修復計劃
  SALT WATER MAINS REPLACEMENT / REHABILITATION SCHEMES

比例尺 SCALE 1 : 150 000

核准 APPROVED

總工程師/工程管理 CE / PM

31/13/2006

（甲級工程）
(CAT 'A' Submission)

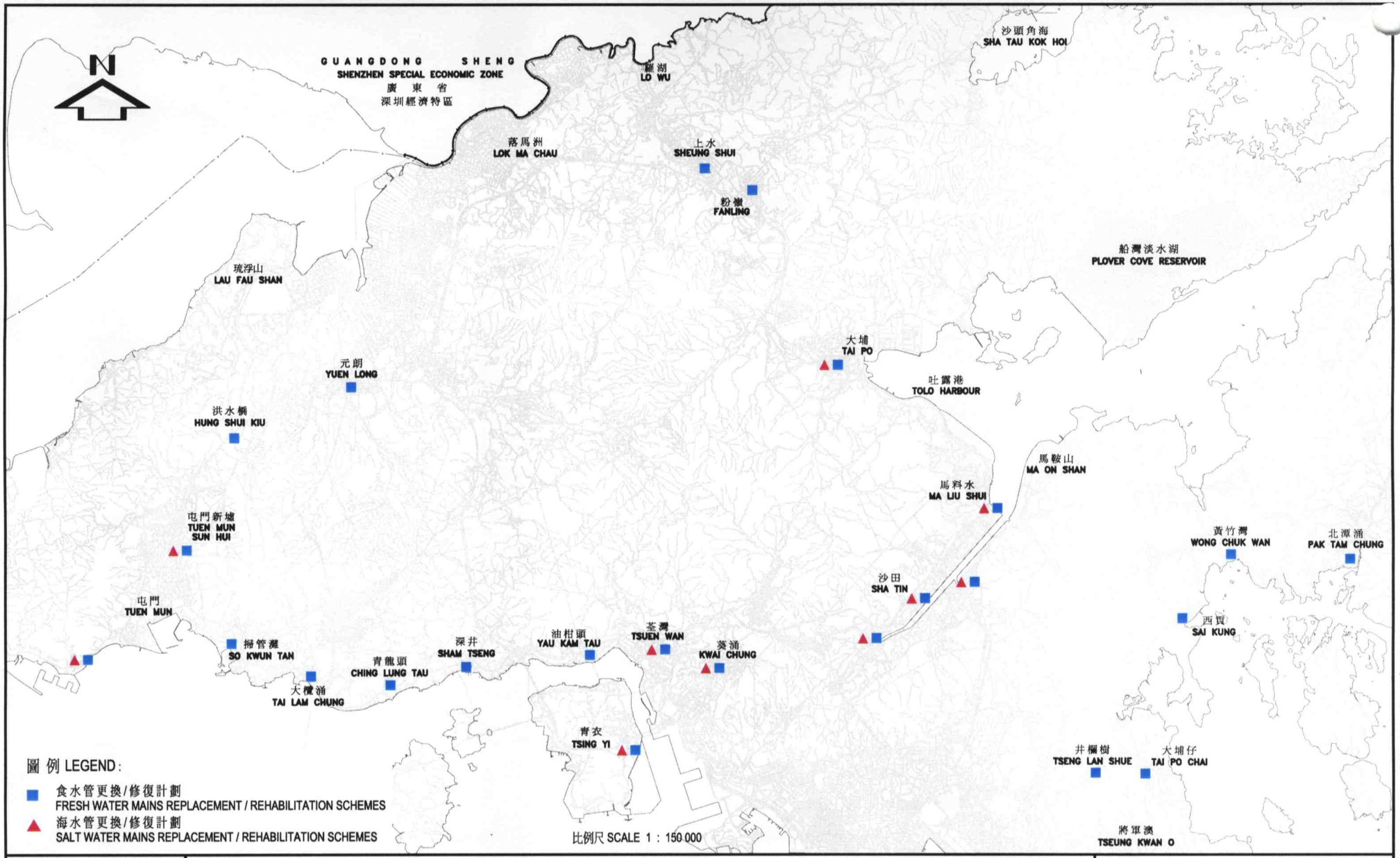
工務計劃項目第186WC號 ----- 更換及修復水管工程第3階段
（圖一 -- 香港，九龍及離島區）
P.W.P. Item no. 186WC ----- Replacement and rehabilitation of water mains, stage 3
(Sheet 1 - Hong Kong, Kowloon & Islands)

水務署
WATER SUPPLIES DEPT.

草圖編號 SKETCH NO. 62005 / 195 / 001

REF. 62005-195_01.DWG

附件二 (第一頁，共二頁) ENCLOSURE 2 (SHEET 1 OF 2)



核准 APPROVED

總工程師/工程管理 CE / PM

31/3/2006

（甲級工程）
(CAT 'A' Submission)

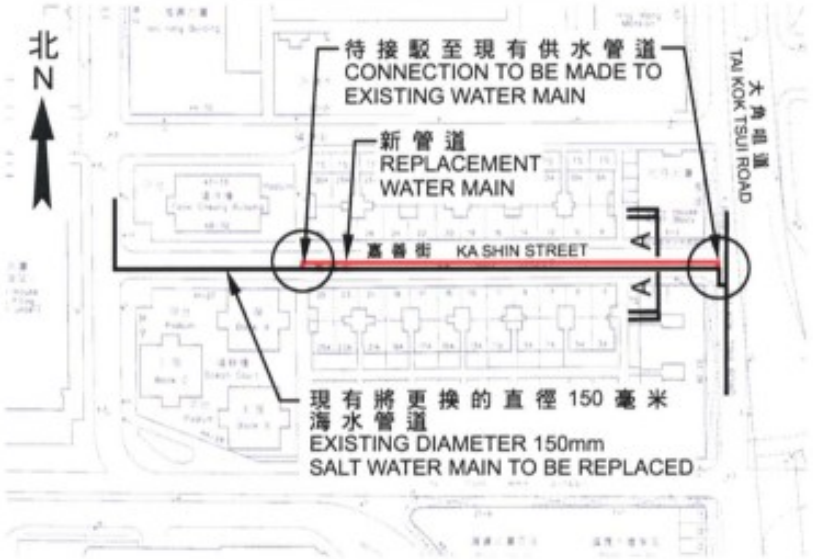
工務計劃項目第186WC號 ----- 更換及修復水管工程第3階段
（圖二 -- 新界區）
P.W.P. Item no. 186WC ----- Replacement and rehabilitation of water mains, stage 3
(Sheet 2 - New Territories)

水務署
WATER SUPPLIES DEPT.

草圖編號 SKETCH NO. SK 62005 / 195 / 002

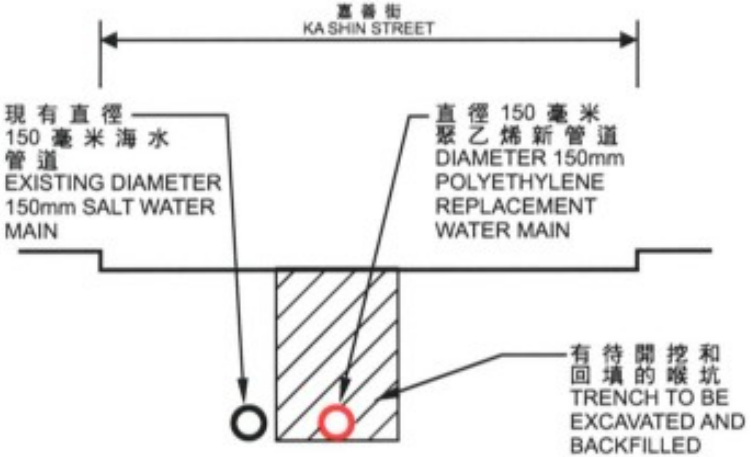
REF. 62005-195_02.DWG

附件二（第二頁，共二頁）ENCLOSURE 2 (SHEET 2 OF 2)

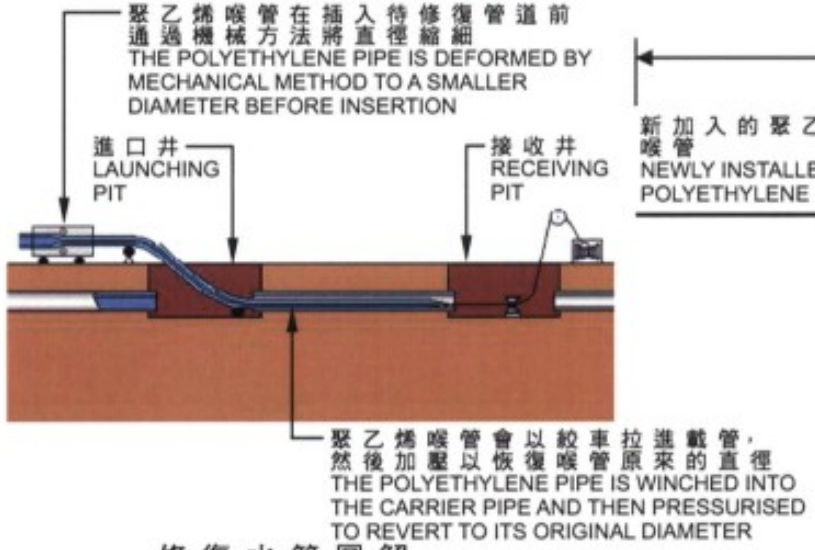


地盤平面圖－更換水管
SITE PLAN - WATER MAIN REPLACEMENT
比例尺 SCALE 1 : 2 000

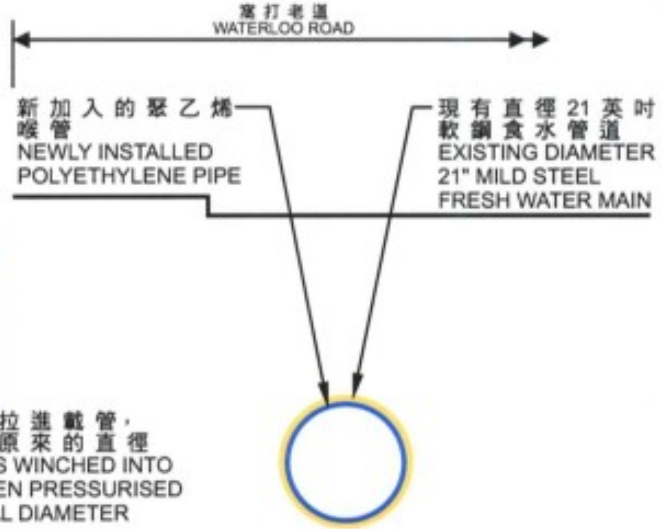
地盤平面圖－修復水管
SITE PLAN - WATER MAIN REHABILITATION
比例尺 SCALE 1 : 2 000



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 CE / PM
26/4/2006

工務計劃項目第186WC號 — 更換及修復水管工程第3階段
更換及修復水管範例
P.W.P. Item no. 186WC — Replacement and rehabilitation of water mains, stage 3
Typical water main replacement and rehabilitation details

水務署
WATER SUPPLIES DEPT.

草圖編號 SKETCH NO. SK 62005 / 208

REF. 62005-208.CDR

附件三 ENCLOSURE 3

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	(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.

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.