

**For discussion
on 25 January 2005**

**Legislative Council Panel on Planning, Lands and Works
182WC – Replacement and Rehabilitation of Water Mains, Stage 2**

PURPOSE

This paper informs Members of the background on stage 2 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 **182WC** to Category A, entitled “Replacement and rehabilitation of water mains, stage 2 – investigation and detailed design”, for engaging consultants to carry out investigation and detailed design for the works under **182WC**.

BACKGROUND

3. Hong Kong’s fresh water and salt water supplies are provided through a network of about 7 200 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.

4. Due to a considerable length of water mains approaching the end of their service life, we face an increasing number of main bursts causing more and more inconvenience to the public. The previous way of carrying out piece-meal and small-scale replacement works is not considered effective. WSD therefore engaged consultants in February 1996 to carry out an Underground Asset Management Study (UAMS) to develop a comprehensive and cost-effective management plan for the water supplies 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. The whole

replacement and rehabilitation programme was originally scheduled for completion by 2020. 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.

5. 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 two stages is presented as follows -

PWP Item	Item Description	Status
90WC	<p>Stage 1 Phase 1 – Replacement and rehabilitation of 246 km of fresh water mains and 104 kilometres 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 implementing the early phases of the works and for engaging consultants to carry out investigation and detailed design.</p> <p>The remainder part of the project was finally 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>Estimated project cost : \$1,270 million</p>	<p>The project was partly upgraded to Category A as 178WC in March 2001 for engaging consultants to carry out investigation and impact assessments. The investigation has been completed and the detailed design is proceeding.</p>

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 upgraded to Category B in September 2004. In-house staff resources would be used to investigate, design and supervise the replacement and rehabilitation of about 100 km of water mains ¹ whereas those of the remaining 653 km of water mains will be carried out by consultants subject to funding approval.

6. As regards the subsequent stages, we will review the supply network and propose the improvement works with a view to completing all the works recommended in the UAMS by 2015.

SCOPE OF WORKS

7. The replacement and rehabilitation of the most critical water mains were included in stage 1 to bring about early benefits. The stage 2 works under **182WC** covers the water mains of the next highest priority. The sites of the proposed works spread over the territory, as shown Sketch Nos. 62004/070/001 and 002 (**Enclosure 1**). The 653 km of water mains covered by the proposed consultancy comprise –

- (a) about 580 km of fresh water mains ranging from 15 millimetres (mm) to 1 500 mm in diameter;
- (b) about 70 km of salt water mains ranging from 25 mm to 800 mm in diameter; and
- (c) about 3 km of raw water mains ranging from 1 400 mm to 2 300 mm in diameter.

¹ Consisting of about 90 km of fresh water mains ranging from 20 mm to 450 mm in diameter, and about 10 km of salt water mains ranging from 25 mm to 150 mm in diameter.

8. The scope of the proposed consultancy includes –
- (a) traffic impact assessments;
 - (b) drainage impact assessments;
 - (c) environmental reviews;
 - (d) detailed design of the replacement and rehabilitation works; and
 - (e) site investigation works and pipe condition surveys.

9. The typical details of the replacement and rehabilitation works are shown in Sketch No. 62004/075 (**Enclosure 2**). 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 3**.

JUSTIFICATION

10. If we do not press on with the replacement and rehabilitation programme recommended in the UAMS, 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 2 works should start as soon as possible to ensure the timely completion of the compressed programme within 15 years. Upon the completion of stage 2, about 45% of the water mains by length identified in the UAMS will be replaced or rehabilitated.

11. In view of the scale and the 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 **182WC** in addition to the other planned projects. It is therefore proposed to part-upgrade **182WC** in February 2005 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 consultancy for the investigation and detailed design to be \$53 million in MOD prices made up of the following –

	\$ million	
(a) Design, tender documentation and assessments	22	
(b) Traffic impact assessments	2	
(c) Drainage impact assessments	1	
(d) Environmental reviews	1	
(e) Supervision of site investigation works	4	
(f) Site investigation works	18	
(g) Contingencies	5	
	<hr/>	
Total	53	(in MOD prices)

13. The proposed consultancy will not give rise to any recurrent expenditure.

ENVIRONMENTAL IMPLICATIONS

14. The proposed consultancy will not have any major adverse environmental impacts save for some minor inconveniences associated with the site investigation works. Necessary mitigation measures would be introduced.

15. We will implement pollution control measures to control the environmental impacts of the associated construction works. If any part of the works is identified to be designated projects under the Environmental Impact Assessment (EIA) Ordinance, we undertake to comply with the statutory process under the EIA Ordinance.

PUBLIC CONSULTATION

16. We will consult the relevant District Councils and take into consideration the views expressed at the design stage. We also wish to report that WSD previously consulted all District Councils on **90WC** and all of them supported the project to proceed to construction phase.

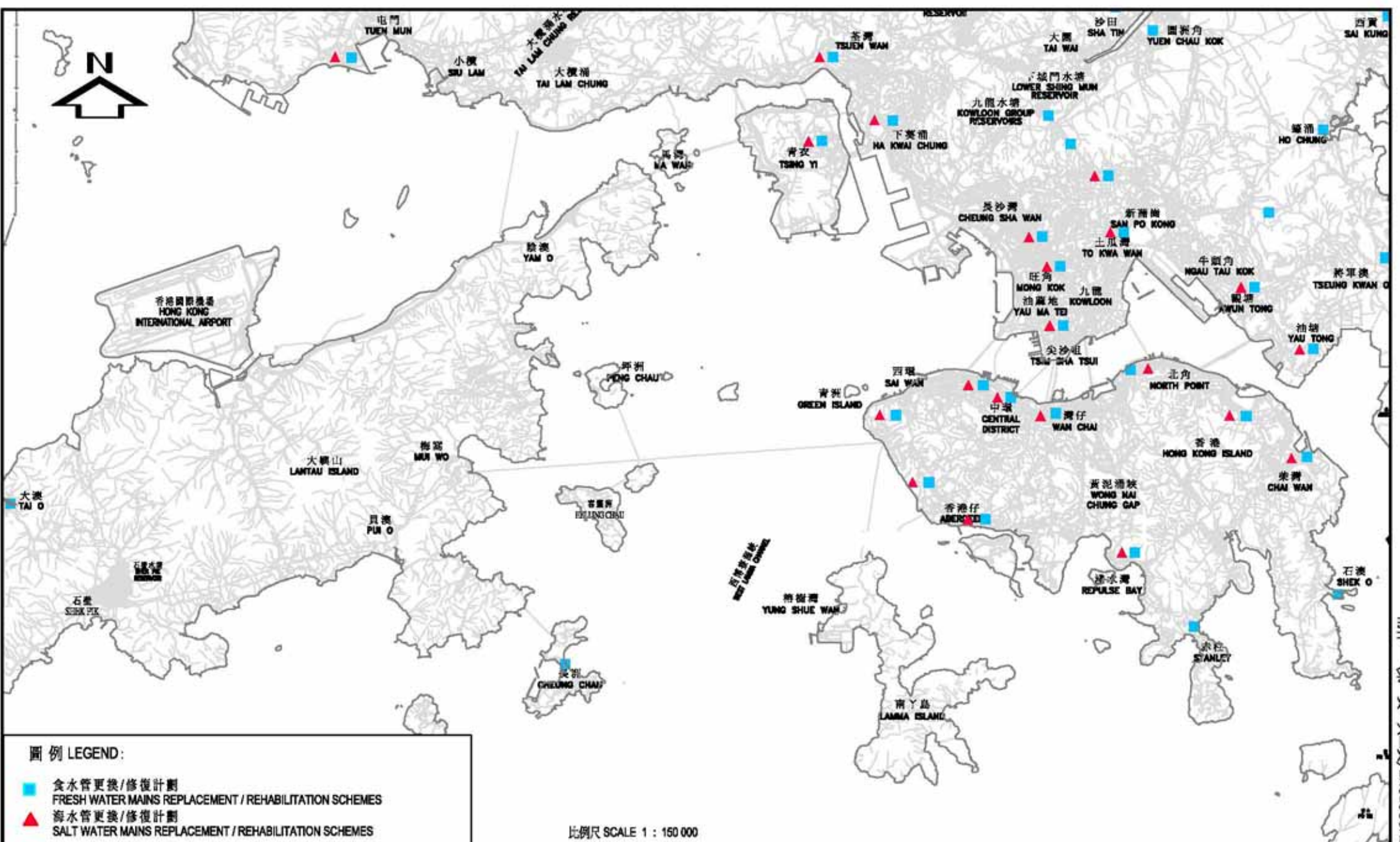
LAND ACQUISITION

17. The proposed consultancy does not require any land acquisition.

WAY FORWARD

18. We intend to submit the proposed part-upgrading of **182WC** for consideration by the Public Works Subcommittee in February 2005 with a view to seeking funding approval by the Finance Committee in March 2005. Upon the funding approval, we will commence the proposed consultancy in June 2005 for completion in May 2007.

*Environment, Transport and Works Bureau
January 2005*



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

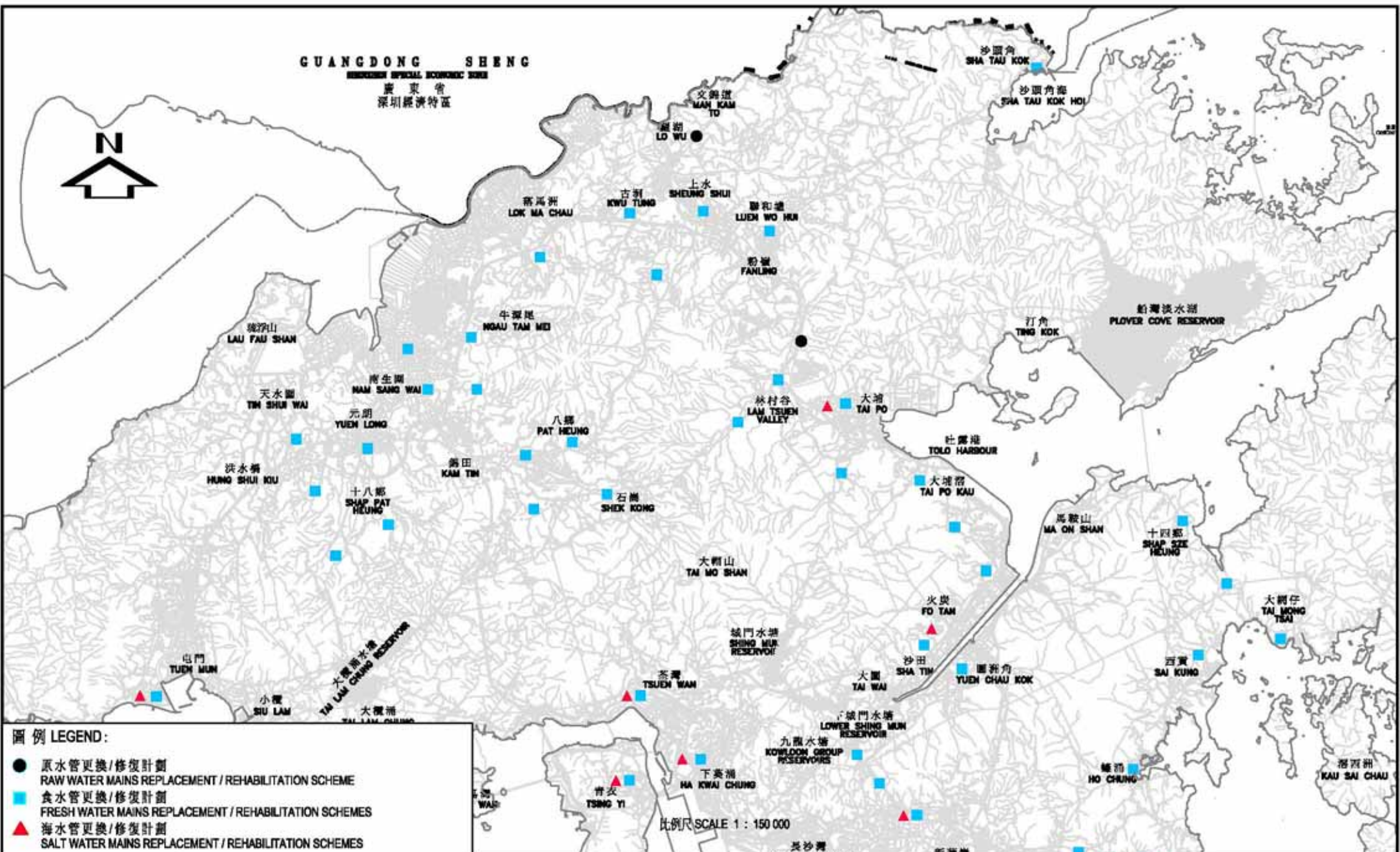
比例尺 SCALE 1 : 150 000

核准 APPROVED
 總工程師/顧問工程經理 CE / CM
 / /

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. 62004 / 070 / 001

GUANGDONG SHENG
 廣東省
 深圳經濟特區



圖例 LEGEND:

- 原水管更換/修復計劃
RAW WATER MAINS REPLACEMENT / REHABILITATION SCHEME
- 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/顧問工程師管理 CE / CM

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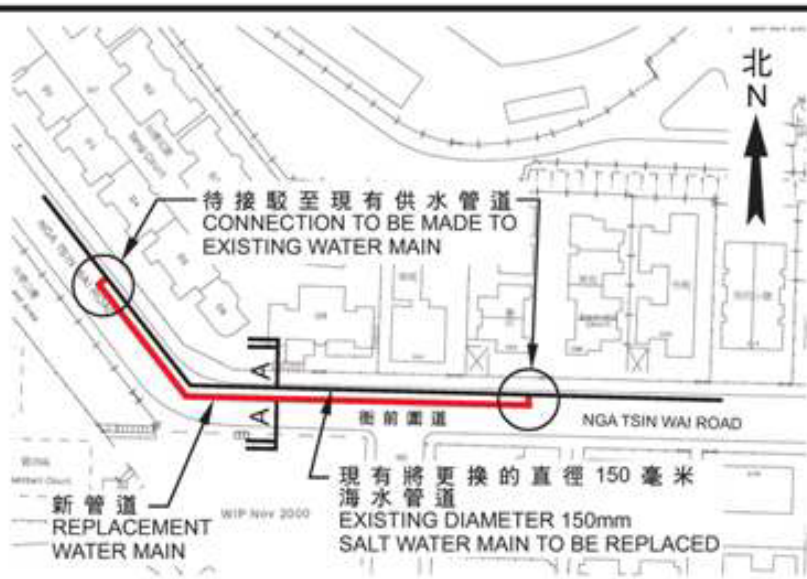
工務計劃項目 182WC — 更換及修復水管工程第2階段
 (圖二-新界區)
 P.W.P. NO. 182WC — REPLACEMENT AND REHABILITATION OF WATER MAINS, STAGE 2
 (SHEET 2 - NEW TERRITORIES)



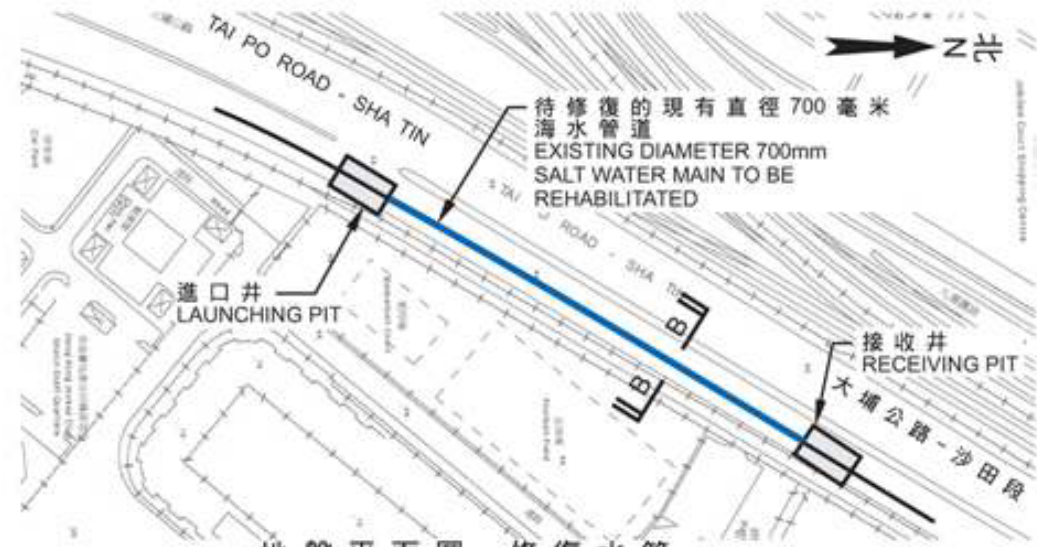
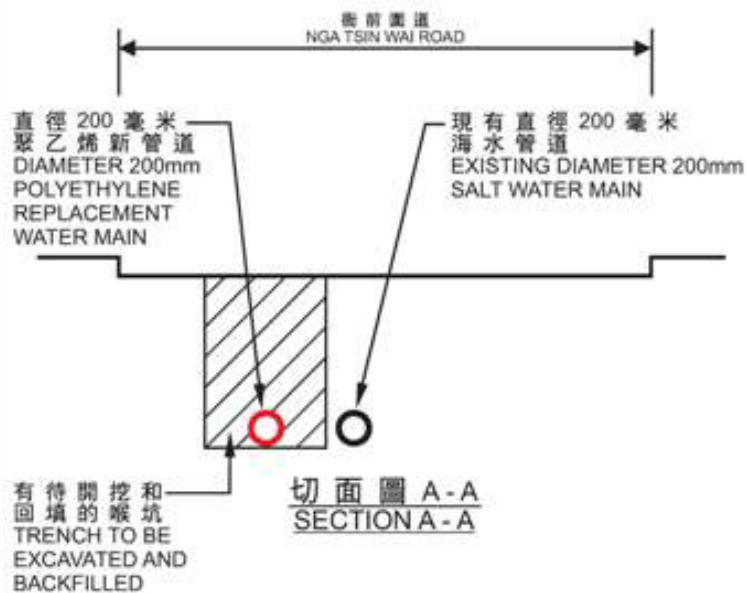
水務署
 WATER SUPPLIES DEPT.

草圖編號
 SKETCH NO. SK 62004 / 070 / 002

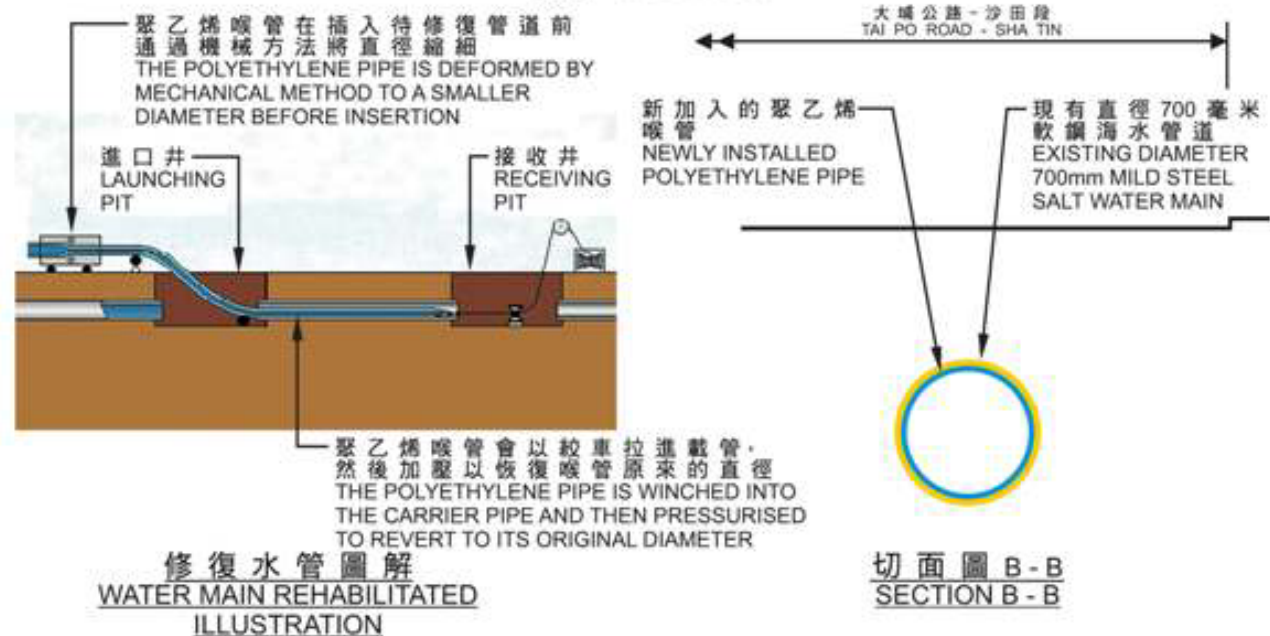
附件一 (第二頁, 共二頁) ENCLOSURE 1 (SHEET 2 OF 2)



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



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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

水務署 WATER SUPPLIES DEPT.
草圖編號 SK 62004 / 075
REF: 62004-075.CDR

**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. Pending completion of the detailed design, the following pipe materials may be used 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)

Pipe Diameter	Existing pipe materials	Pipe materials to be used for the replacement works
400 mm to 600 mm	Cast iron and asbestos cement	Ductile iron (with cement mortar lining)
300 mm and below	Cast iron, asbestos cement, galvanised iron and unplasticised polyvinyl chloride	Polyethylene

Main Characteristics of Proposed Pipe Materials

5. The main characteristics of the pipe materials stated at 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.
Polyethylene	<ul style="list-style-type: none"> (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 50 years to about 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 expectancy of about 50 years. This would greatly elongate the replacement/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.