For discussion
on 25 May 2010

Legislative Council Panel on Development

Progress of Implementation of Total Water Management Initiatives

PURPOSE

This paper updates Members on the progress of the various initiatives implemented under the Total Water Management (TWM) strategy since its promulgation in 2008.

BACKGROUND

2. We consulted Members on the TWM Strategy for Hong Kong in May 2008. We informed Members that with our local water resources and a steady Dongjiang water supply, Hong Kong has not experienced any water rationing since 1982. We also pointed out that to better prepare Hong Kong for uncertainties such as acute climate changes and low rainfall and to enhance Hong Kong's role as a good partner to other municipalities in the Pearl River Delta, we need to promulgate the TWM strategy, with the objective to promote sustainable use of water.

3. The TWM strategy is an integrated, multi-sectoral approach built on good water demand and supply management initiatives, covering the following aspects :-

<u>Water Demand Management</u>

(a) To enhance public education on water conservation
(b) To promote use of water saving devices
(c) To enhance water leakage control
(d) To extend use of seawater for toilet flushing

<u>Water Supply Management</u>

(a) To strengthen protection of water resources
(b) To actively consider water reclamation (including reuses of grey water and rainwater harvesting)
(c) To develop the option of seawater desalination

4. In implementing the initiatives under the TWM strategy, we are aware that the average per capita daily water consumption rate in Hong Kong on both potable water and flushing water stands at a relatively high level of around 130 and 90 litres per capita per day respectively. Thus our focus in the TWM strategy is placed firstly on water demand management. We consider there is possible scope for reduction in consumption and this could be achieved through public education campaigns and the use of water saving devices. On the management of our aged water distribution network, we have employed new technologies on water main leakage detection and pressure management measures which have helped to control water loss in our network and hence the demand.

5. The progress of the TWM initiatives implemented last year is summarized in the ensuing paragraphs.

WATER DEMAND MANAGEMENT

(a) To Enhance Public Education on Water Conservation

"Water Conservation Starts from Home" Education Campaign

6. As a first step to enhance public education on water conservation, we distributed our booklet on TWM Strategy in November 2008 to various sectors of the community, including District Councils, tertiary education institutions, secondary and primary schools. To encourage our younger generation to appreciate the need for water conservation and develop water saving habits, we launched the first and second phase of a **water conservation campaign** entitled "Water Conservation Starts from Home" for primary school students in January and December 2009 respectively. A total of 103 schools and about 33,000 students took part in the campaign.

School Water Audit

7. Furthermore, we are carrying out a pilot scheme of **school water audits** for 5 primary schools. In the first part of the audits, WSD staff would introduce water conservation concept, knowledge and tips to the students. In the second part, with the assistance of teachers and WSD staff, students in participating primary school would form groups to collect and analyse water consumption information of the school, to examine areas where water conservation is feasible, to develop and make suggestions for appropriate water conservation practices in the school. We trust that through this activity based audit exercise, students will not only learn the concept, knowledge and tips of water conservation but will also put them into practice helping the school to

achieve actual saving in water consumption.

Secondary School Teaching Kit

8. Apart from primary school students, we have also started to address the secondary school students. We are in the process of preparing a **teaching kit** on water supplies aiming at providing supplementary reference materials for teachers and students on the liberal studies curriculum. The kit will have four parts, covering our precious water resources, quality water, water infrastructures as well as protection and effective use of water resources. It will serve to provide a handy and comprehensive reference for teachers and students to facilitate the acquiring of in-depth understanding of water supply issues and the appreciation of the importance of water conservation.

Other Public Education Programmes and Resources

9. As a further step to enhance public education on water conservation, we are planning to acquire resources for the setting up of a **dedicated team** in WSD to take charge of all matters related to water conservation and to establish a **water conservation education centre** for the public. In addition to exhibiting relevant information on water conservation, the centre will serve as a resource outlet where members of the public can see various water treatment technologies, distribution methods, leakage detection methods, pressure management technologies, water reclamation technologies as well as live demonstration on the effectiveness of various water saving devices.

10. In addition, we have put in place a **public relation activities programme** for water conservation comprising a series of television and radio announcements for arousing public interest; newspaper supplements, press briefings and advertisements on specific topics; public seminars and talks during the Building Safety Carnival, the Science in Public Service Fun Fair and Water Treatment Works Open Days; as well as exhibitions in housing estates to convey the important message of water conservation to different walks of life.

Water Saving Guidelines for Government Departments

11. We have also planned to review the water consumption practice of major water users within the Government. We will commission a consultancy study to review the water consumption practice in WSD's installations and that in parks and swimming pools of the Leisure and Cultural Services Department. Through the process, we aim to develop **water saving guidelines** for these facilities without compromising the level of services to the public. We will gradually extend such review work to other major water users in the Government.

Conservation through Tariff Review

12. There are opinions in the community that Government should raise the water tariff as a means to curb water demand. For example, the Civic Exchange published in December 2009 the "Liquid Assets - Water Security and Management in the Pearl River Basin and Hong Kong", which stated, inter alia, that :

- Hong Kong's domestic water use of about 220 litres per capita per day is substantially higher than the global average of around 170 litres per capita per day on fresh water.
- Hong Kong's water charge is amongst the lowest in the world. It equates to about 0.25% of the average household expenditure, as compared with the 0.5% to 0.9% in the major cities in Asia and 0.5% to 1.5% elsewhere in United States and Europe.
- The low tariff structure of Hong Kong's water charge attributes to the steady rise in per capita consumption of fresh water.

13. We have taken note of the high water consumption and our analysis has indicated that the consumption comprises around 130 litres potable water and 90 litres flushing water. Whilst around 80% flushing water in Hong Kong is by seawater, it has not changed our primary objective of promoting water conservation through demand management. Thus we do not rule out the option of changing the water tariff structure to induce a reduction in consumption. We are **reviewing the water tariff structure** for this purpose.

(b) To Promote Use of Water Saving Devices

Water Efficiency Labelling Scheme

14. We have taken forward the development of a voluntary "**Water Efficiency Labelling Scheme**" (WELS) in phases to facilitate consumers to select water saving plumbing fixtures and appliances. In the first phase, we have worked on showers for bathing because of the relatively high share of household water consumption through use of showers. We launched showers for bathing as the first product under WELS in September 2009. The scheme adopted a grading type labelling system and classified showers for bathing into four grades. The process, classification, details of the grading and promotion pamphlet are set out in **Appendix 1**.

15. As of 7 May 2010, 32 models have been registered. Details of all registered showerheads have been promulgated in the WSD website. We are planning to extend the scheme to water taps and washing machines in the next phase which will be launched in 2010-11.

Use of Water Saving Devices in Government Buildings and Schools

16. The Government issued a technical circular on Green Government Buildings in April 2009 requiring all new Government buildings to use **water saving devices** such as low-flow taps and dual-flush toilets amongst other environmental friendly measures. We have also launched a programme for retrofitting Government buildings and schools with water saving devices. The retrofitting works contracts for around 23,000 water saving devices commenced in late 2009 with completion scheduled for end 2011. As of 7 May 2010, about 3,700 water saving devices have been installed in Government buildings and schools. Upon completion of the programme, we anticipate an annual saving of about 2 million cubic metres (mcm) fresh water consumption, 0.8 mcm salt water consumption and 1.5 million kilowatt-hour energy consumption for treatment and delivery of water.

Promotion through Hong Kong Green Building Council

17. We have worked with the Hong Kong Green Building Council to promote wider uses of water saving devices through the Building Environmental Assessment Method (BEAM) Plus scheme. Water conservation features adopted in the design of a building will be eligible for credits. In so doing we hope to encourage private developers to make more use of water saving devices and water conservation features both in new developments and in renovation projects.

(c) To Enhance Water Leakage Control

The Programme to Replace and Rehabilitate Aged Water Mains

18. The water mains replacement and rehabilitation (R & R) programme, which aims at replacing/rehabilitating 3,000 km of aged water mains out of the 7,800 km water distribution network, is a key element in active leakage control. The programme was originally planned to be implemented in phases for completion within a 20-year period by 2020. To bring about earlier improvement to the supply system and minimise inconvenience to the public due to frequent main bursts, we decided in 2005 to compress the programme from a 20-year to a 15-year period targeting for an earlier completion by 2015.

19. The R & R programme has passed through the difficult initialization period and is achieving a steady state of progress, as illustrated in **Appendix 2** together with some illustrations of rehabilitation techniques. With experience gained over the past years, and the availability of more skilled workers, the rate of progress of R & R works has improved in recent years. We are now proceeding with an average rate of replacing/rehabilitating over 30 km

of water mains per month. As of end April 2010, stage 1 has been substantially completed while stage 2 and stage 3 works are in progress with 70% and 17% completed respectively. A total of 1,263 km of pipes has been replaced/rehabilitated since the commencement of the works in late 2000.

20. In prioritising the works, we consider the probability of failure of individual sections of water mains and the consequence of their failure. We have also established a procedure to investigate each water main burst case in detail and if necessary, the concerned section of water mains will be injected into the R & R programme or re-prioritised under the programme to an earlier stage.

21. Moreover, with the advance in material science, we take the opportunity to adopt pipes made with more durable materials in the R&R programme with a view to enhancing the reliability of the water supply and distribution system, reducing main bursts and leaks.

Leakage Control, Monitoring and Detection

22. We have been carrying out leakage monitoring based on **waste detection method** since around 1940's to 1950's. The key plan showing the established waste detection areas (WDAs) is given in **Appendix 3**. Currently, we have established 1,055 WDAs in our network and we are carrying out leakage detection in a 18-month cycle for each WDA.

23. With the advancement of technology, we are now migrating from the waste detection based leakage detection to proactive **burst prevention based** leakage detection. We select part of our water distribution network to form a district metering area (DMA) and arrange to install an electromagnetic flow meter and a pressure logger at selected locations for more efficient leakage detection. Since 2000, we have established 354 DMAs in our water distribution network. Establishment of DMAs is however complicated and difficult to accomplish in urban setting due to the general lack of space for equipment installation.

24. Aged private water mains are also prone to leakage. With the DMA technology, we have also started a pilot scheme on the monitoring of the water consumption of large housing estates and villages in a bid to identify leakage in the private water mains. At present, 44 of the 354 DMAs are established for large housing estates.

25. In 2008, we started to conduct leakage tests using a new generation of **noise loggers**, which can automatically transmit leak noise data to our control centre through GSM network. In the light of the water main burst incident at Gloucester Road on 31 August 2009 that caused serious traffic congestion on the

Hong Kong Island, we have extended the use of noise loggers for continuous monitoring of the condition of the crossings across Gloucester Road pending their replacement. All crossings in Gloucester Road have now been replaced. We also completed the leakage detection of all 551 water main crossings on red routes[1] and 1,146 water main crossings on pink routes[1]. Six leaking mains were identified and repaired. Noise loggers are being installed on the 551 water main crossings on red routes for continuous monitoring till their replacement.

26. To strive for further improvement, we plan to conduct a pilot scheme on a **new technology** recently developed overseas for leakage detection of in-service pressurised water mains. The technology will have instrument comprising a CCTV camera or an acoustic sensor for insertion via access point into water main not less than 300 mm in diameter to inspect its internal conditions or detect leakage points. The pilot scheme is planned to commence in late 2010. At this juncture, we are preparing the procurement documents and forming access holes in selected water mains by hot tapping method.

27. The advanced leakage control, monitoring and detection works are illustrated in **Appendix 4**.

Pressure Management

28. Under high supply pressure, leakage is more likely to develop at the joints and valves of the water mains. The installation of flow-modulated pressure reducing valves can help to regulate water pressure and hence reduce water leakage. The principle, set up and illustrative result of pressure management are detailed in **Appendix 5**. For new development areas like south-east Kowloon, we will make provision for pressure management to ensure that the future water pressure within the pipe networks in such areas will be optimised. We anticipate that the number of bursts and water main leakages within the new development areas would be significantly reduced with these new installations.

29. Implementing pressure management in existing developed areas is, however, a very difficult task. First of all, a lot of existing old buildings adopt the direct feed plumbing design that takes water directly from our supply network. Reducing pressure in our supply network may affect customers in these old buildings and thus restricting the scope of pressure reduction. Secondly, the identification of appropriate locations for construction of the chambers for installation of the pressure reducing devices in existing pipe networks is a very

[1]Red and pink routes are major roads administratively classified in accordance with their importance and traffic volume to facilitate the management of the road system. Examples of red routes include Gloucester Road, Princes Margret Road and Cross Harbour Tunnel, whereas Waterloo Road and Nathan Road are examples of pink routes.

challenging task due to the congested underground conditions.

30. Notwithstanding the difficulties, we have been implementing pressure management on a trial basis by establishing a series of **small-scale pressure management areas** (PMAs) in the water distribution network of developed areas. Performances of some of the established PMAs are satisfactory as reported in detail in **Appendix 6**.

31. We are planning to progressively extend pressure management to the other developed areas. Out of a total of 17 major supply zones of our water supply distribution network, investigation studies for 7 zones have been completed and those for another 5 zones are now in progress. Works for establishment of the pressure management schemes in 4 major supply zones out of the initial 7 major supply zones are in progress. Details of these pressure management schemes are in **Appendix 7**.

Interim Results on Leakage Control

32. With the R & R works completed to-date, coupled with the pro-active leakage control measures described above, the annual number of bursts has been reduced from the peak of about **2,500** in 2000/01 to **990** in 2009/10 as shown in **Appendix 8**. The leakage rate has been reduced from **25%** in 2001 to **21%** in 2009. We anticipate the water main leakage rate will further decrease to **15 %** upon completion of the current R & R programme. We will strive to attain a lower figure with proactive leakage control and pressure management measures described above. We are also in a process of enhancing our equipment for flow measurements in our supply and distribution system for more precise accounts of the usage of water.

(d) To Extend Use of Seawater for Toilet Flushing

33. We have been using seawater for toilet flushing in the metropolitan areas and most of the new towns, covering a population of around 80%. In 2009, we commissioned the seawater supply to Disneyland. We are also carrying out construction works for the supply of seawater to Pokfulam, Yuen Long and Tin Shui Wai areas. With the completion and commissioning of these new systems, the percentage of people in Hong Kong served with seawater for flushing will increase to **85%**. The seawater supply zones in Hong Kong are as shown in **Appendix 9.** We have also commenced the planning work to extend seawater flushing supply system to Tung Chung area. The progress of the above-mentioned projects is summarized in **Appendix 10**. We will continue to evaluate the cost effectiveness of extending the seawater supply system to other areas, taking into account other alternatives such as water reclamation, grey water reuse and rainwater harvesting. Extension of the seawater flushing

supply system will be made wherever it is economically justified.

WATER SUPPLY MANAGEMENT

(a) To Strengthen Protection of Water Resources

34. In the course of formulating the flood control strategy for West Kowloon by Drainage Services Department (DSD), we have explored the feasibility of achieving water conservation as part of flood control. We have developed a project entitled "Inter-Reservoirs Transfer Scheme" to connect Kowloon Byewash Reservoir with Lower Shing Mun Reservoir by means of a drainage tunnel and convey the overflow water from Kowloon Byewash Reservoir via Lower Shing Mun Reservoir and an existing transfer system to the Sha Tin Water Treatment Works for treatment instead of discharge directly to Victoria Harbour. Upon completion of the project, it would generate an average annual additional raw water yield of about 2.5 mcm. In addition, we are planning to start another capital project for the improvement of the existing catchwater systems in Shing Mun, Beacon Hill, Golden Hill and Tai Lam Chung with a total length of about 26 km for safe and effective collection of surface water.

(b) To Actively Consider Water Reclamation

35. Water reclamation is to use recycled water to replace high quality water currently used for non-potable purposes such as toilet flushing, street cleaning, car washing and landscape irrigation. There are different types of waste water that can be recycled, namely, treated effluent from sewage treatment works and grey water from shower, bathtub, sink, kitchen and laundry. These different sources of recycled water require different treatment technologies to achieve acceptable standards for reuse. Generally speaking, recycling treated effluent from secondary sewage treatment works is more costly and more sophisticated system is needed. Recycling grey water or harvesting rainwater requires less sophisticated system and can be more readily implemented, even within individual developments.

36. The two pilot schemes on the recycling of treated effluent in Ngong Ping and Shek Wu Hui have been completed and concluded that the **use of reclaimed water** is technically feasible in Hong Kong. At present, the Ngong Ping scheme is still in operation while the Shek Wu Hui scheme has been converted for use internally by DSD. The main issue is that the production cost is still not at an economically viable level. We have formed an inter-departmental working group to explore ways and means to cut down the cost of reclaimed water supply for provision of reclaimed water to residents in

Sheung Shui and Fanling for toilet flushing and other non-potable uses.

37. As for the recycling of grey water and harvesting rainwater for non-potable applications, the Government has also implemented some trial schemes in schools and government facilities. At the same time, we are undertaking a study to identify possible applications in different types of development and to review the standards adopted in the trial schemes, with reference to international experience, aiming at the development of standards and technical guidelines for use in Hong Kong. Application schematic diagram and illustrative design of possible application in high rise buildings are set out in **Appendix 11**.

(c) To Develop the Option of Seawater Desalination

38. Seawater desalination using **reverse osmosis** could produce the largest quantity of new water resources because of our close proximity to the sea. It is a proven technology and has been tested in Hong Kong via a pilot plant study. With the advance in technology such as development in energy recovery devices and use of large diameter reverse osmosis membranes, it is hoped that the production cost of fresh water by seawater desalination will fall to an economically viable level in the coming future. As such, we will further pursue this initiative with close monitoring of development overseas.

THE WAY FORWARD

39. The TWM strategy provides a firm foundation for us to move towards sustainable use of our precious water resources. TWM needs the support and participation of all members of the community. Hong Kong needs a new attitude, a new lifestyle that gives priority to caring the environment and preserving precious water resources. Through continuous review and monitoring, the WSD will strengthen the water demand management initiatives and at the same time, we will continue to explore new technologies and new ways for development of new water resources in a cost effective manner. We welcome views from Members and will advise Members further when there are new developments on the TWM initiatives.

Development Bureau
Water Supplies Department
May 2010

List of Appendices

Appendix 1

Process, classification, grading and promotion pamphlet for Water Efficiency Labelling Scheme (WELS) on Showers for Bathing

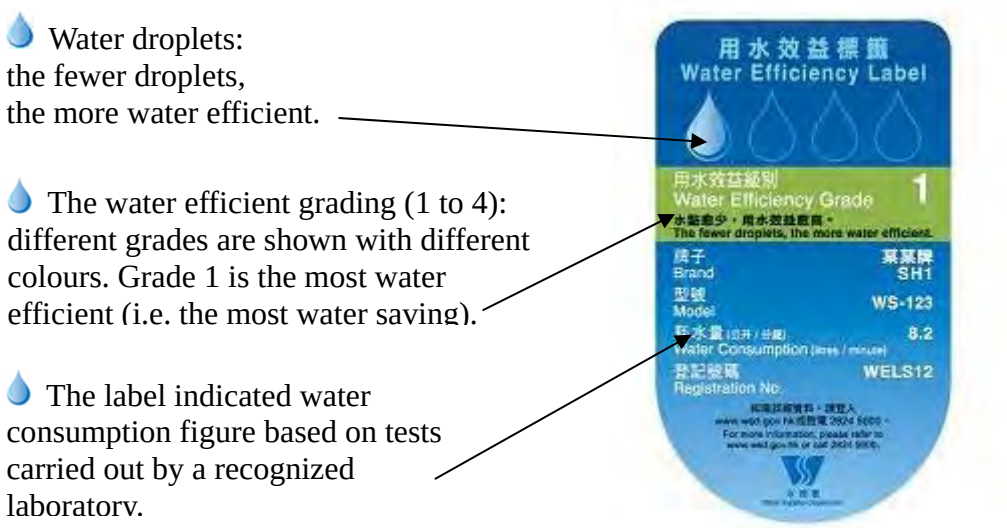
To promote the use of water efficient devices, the WSD has rolled out a voluntary Water Efficiency Labelling Scheme (WELS). The WELS covers the common types of plumbing fixtures and water-consuming appliances. Registered products will be affixed with a water efficiency label that informs consumers its level of water consumption and water efficiency to help consumers choose water efficient products for water conservation.

The WELS is implemented in phases for different groups of plumbing fixtures and appliances. The first group of products for implementation of the WELS is showers for bathing, of which registration already began in September 2009. As of 7 May 2010, 32 showers are registered under the WELS scheme. Details of all registered showerheads would be promulgated in the following link to WSD web site:

http://www.wsd.gov.hk/en/plumbing_and_engineering/wels/index.html

The Water Efficiency Label shows the following details:

- Water droplets: the fewer droplets, the more water efficient.
- The water efficient grading (1 to 4): different grades are shown with different colours. Grade 1 is the most water efficient (i.e. the most water saving).
- The label indicated water consumption figure based on tests carried out by a recognized laboratory.



Note : Full and simplified versions of the label have dimensions of 85mm x 50mm and 40mm x 20mm respectively.

As WELS is new to Hong Kong, in particular to the stakeholders involved in the business of plumbing fixtures and water-using appliances, their support to the scheme is vital for its success. As such, WSD had arranged a two-stage consultation exercise. WSD first put forward a framework document of the scheme for consulting trade members, learned societies, relevant government organisations and the Independent Commission Against Corruption. Views were also obtained from any other interested parties through the Business Consultation e-Platform operated by the Economic Analysis and Business Facilitation Unit. WSD then developed the scheme document providing details of the scheme for the second stage of the consultation. At the same time, a business impact assessment (BIA) was conducted to ensure that the scheme would not result in monopolistic competition nor disproportionate treatment to the small and medium enterprises. The finalised scheme document, with grading as shown in Table 1 below, was submitted to the World Trade Organization's (WTO) Technical Barriers to Trade (TBT) Committee for an assessment on compliance with the relevant WTO provisions.

Table 1

Nominal Flow Rate *f* (litres/minute) ***See Note***	**Water Efficiency Grade**	**Symbolic Presentation on the Water Efficiency Label**
$f \leq 9.0$	Grade 1	1 water droplet
$9.0 < f \leq 12.0$	Grade 2	2 water droplets
$12.0 < f \leq 16.0$	Grade 3	3 water droplets
$f > 16.0$	Grade 4	4 water droplets
Note: Nominal flow rate means the average flow rate measured at pressures of 150 kPa, 250 kPa and 350 kPa.		

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Promotion Pamphlet

水務署
Water Supplies Department

Water Efficiency Labelling Scheme - Showers for Bathing

What is the voluntary Water Efficiency Labelling Scheme?

The Water Supplies Department (WSD) has launched the voluntary Water Efficiency Labelling Scheme (WELS) to help consumers select water efficient plumbing fixtures and appliances for water conservation. The scheme will be implemented in phases for different fixtures and appliances. The first product under the scheme is showers for bathing.

What does a water efficiency label look like?

There are two versions of the water efficiency label - the full and the simplified versions.

The full version shows the following details:

- The water efficiency grading (1 to 4): different grades are shown with different colours. Grade 1 is the most water efficient (i.e. the most water saving).
- Water droplets: the fewer droplets, the more water efficient.
- The water consumption figure based on tests carried out by a recognised laboratory.

The simplified version shows only the water efficient grading:

A registered shower shall have a full version label affixed to its body or packing. Suppliers may affix the smaller simplified version to the shower body.

What are the benefits of using water efficient showers and taking shorter showers?

A conventional shower uses about 15 to 25 litres of water per minute, while the most water efficient showers use just about 9 litres of water per minute or less. This represents about 40% to 60% or more in water saving. In addition, the less time you spend in the shower, the more water you save.

Further information

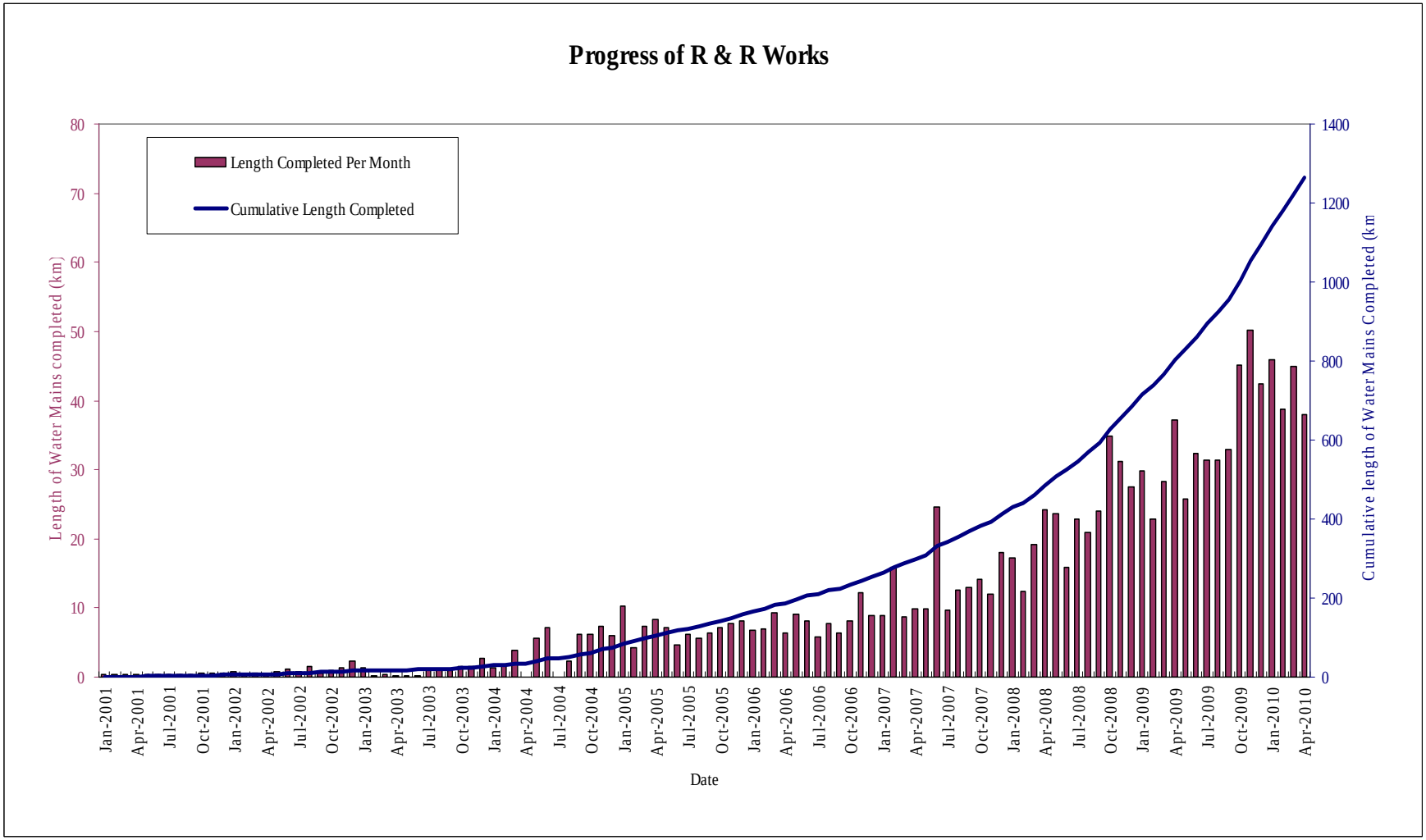
For more information about the scheme and water efficient showers, please visit WSD's website http://www.wsd.gov.hk/en/plumbing_and_engineering/wels/index.html

If the water supply pressure at your premises is lower than normal (e.g. flats on the top floors of a building without pressure boosting installations), you should consult the supplier of your water heater before procuring a water efficient shower.

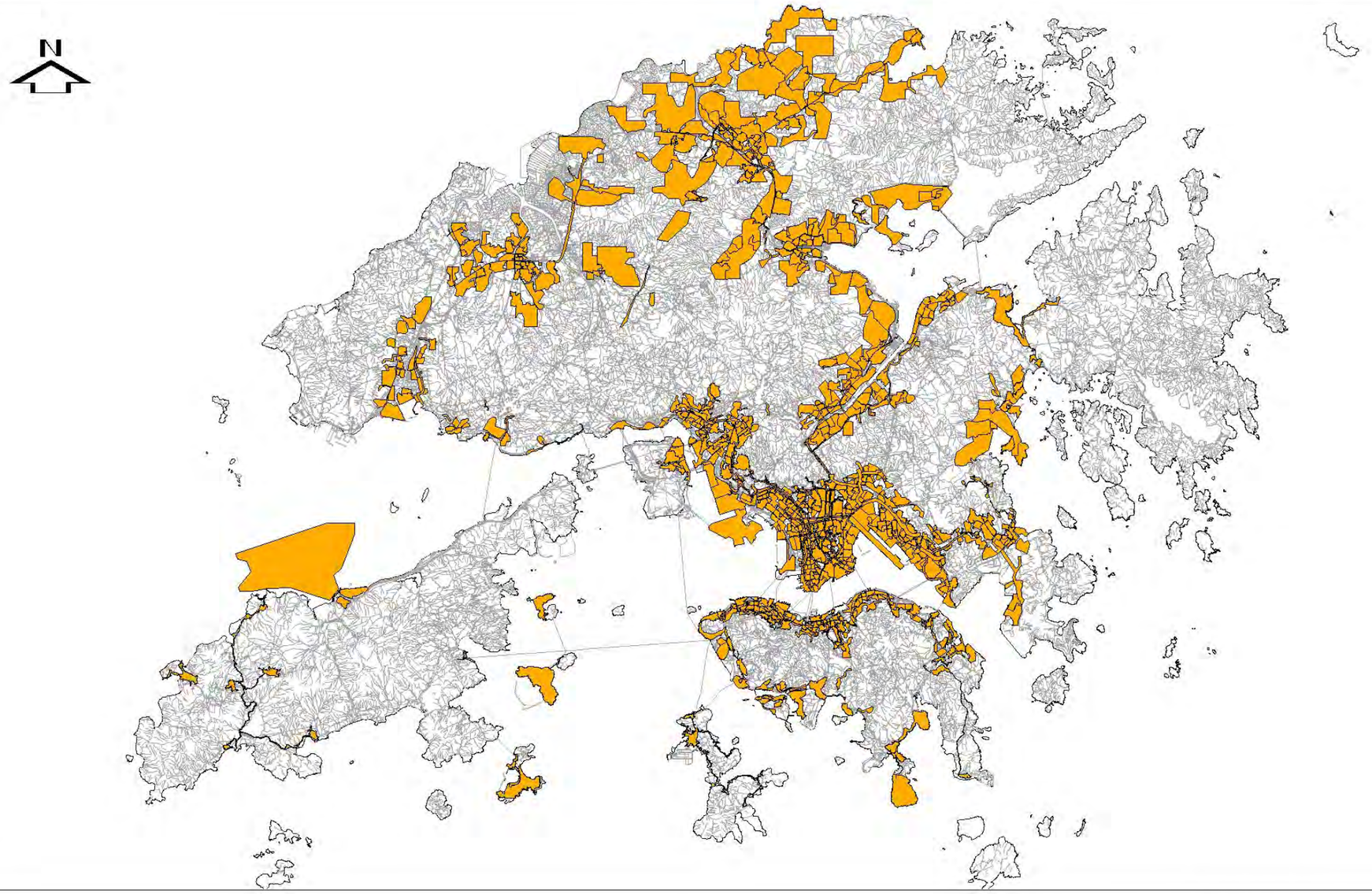
珍惜點滴
SAVE WATER

Appendix 2

Progress of R & R Works and Illustrations of Rehabilitation Techniques



Illustrations of Rehabilitation Techniques	
	An example of rehabilitation of aged water mains using swagelining method at Tai Po Road – Sha Tin (大埔公路沙田段). Swagelining method adopts a technique to temporarily reduce the diameter of the PE pipe in-situ by pulling it through a reducing die. The polyethylene (PE) pipe is then installed into the existing host pipe. The diameter of the PE pipe will resume to its original size upon water/steam curing. Since such rehabilitation technique only involves limited excavation, the impact to the traffic will be significantly reduced. The excavation pit will be temporarily decked over with steel plates to maintain the traffic during peak hours. The construction works can also be resumed efficiently by setting up the appropriate temporary traffic arrangement and removal of the steel plates.
	An example of rehabilitation of aged water mains using close fit lining method at Kimberly Road. The method uses pre-folded U-shaped PE pipe for installation into the existing host pipe. Then the pre-folded U-shaped PE pipe would resume to its original circular shape by pressurized steam curing. While rehabilitation technique will minimize impacts to the traffic, it can fully utilize the underground space as well by making use of the existing aged water main alignment.



食水測漏區位置圖
KEY PLAN OF FRESH WATER WASTE DETECTION AREAS

圖例 LEGEND:

食水測漏區
Fresh Water - W.D.A.

資料更新於2010年1月29日
Data was updatedon 29 Jan 2010

圖則名稱 DRAWING TITLE:

食水測漏區位置圖
KEY PLAN OF FRESH WATER WASTE DETECTION AREA

圖則編號 DRAWING NO. SK66005/3

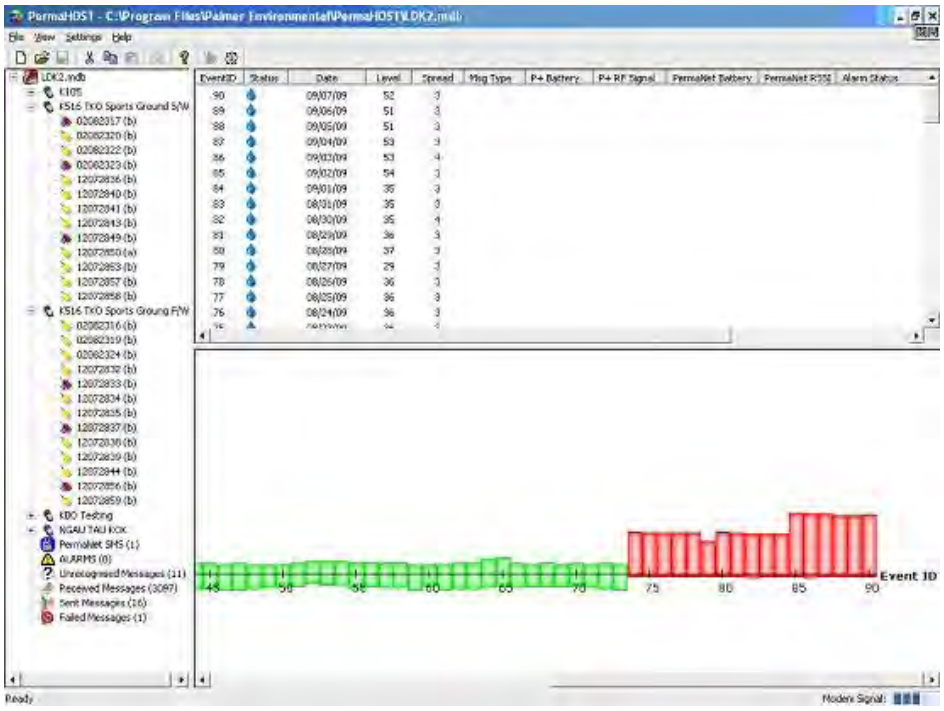
水 務 署
Water Supplies Department

Advanced Leakage Control, Monitoring and Detection Works

I. Locating leak with Noise Loggers

Typical Equipment

Typical Set-up

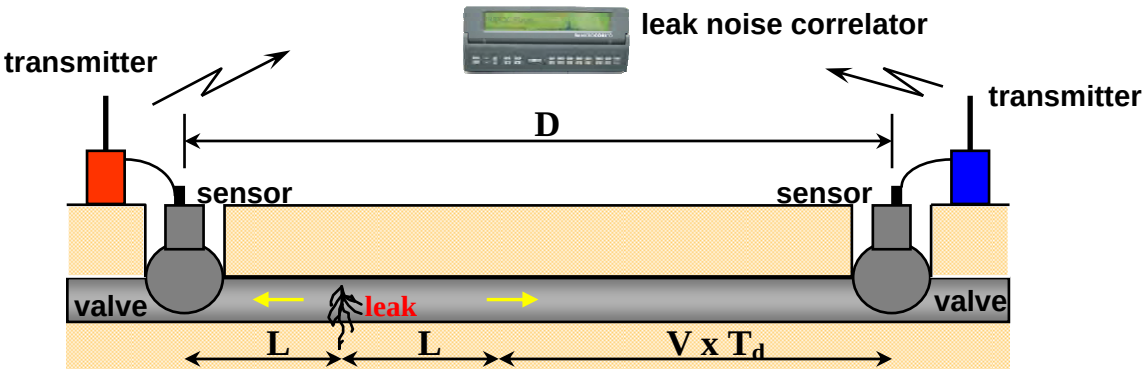


Illustrative Result

Note:

The bar above the horizontal axis represents the main noise level. The bar below the horizontal axis represents the spread of the noise level distribution. A high main noise level and narrow noise spread indicates a possible leak and is highlighted in red. A low main noise level and wide noise spread indicates "no leak" and is highlighted in green.

II. Pinpointing Leak with Leak Noise Correlator



Pinpoint Leak Location in a Pipe

Note:

(1) A leak noise correlator is used to pinpoint the location of a leak along a section of water main. Two sensors are deployed on the valves on either side of the suspected leak location. Before carrying out the pinpointing by using leak noise corrector, the distance between the two sensors (D), pipe diameter and the pipe material are required to be input to the leak noise corrector.

(2) When there is a leak, the leak noise will propagate along the water main and reach the two sensors with a time difference $T_{d.}$ and then to the correlator via the transmitters. A correlation peak will be shown on the display screen of the correlator, indicating a possible leak.

(3) The leak position is calculated by the correlator using the formula $L = (D – V \times T_d) / 2$, where T_d is the time difference and V is the sound velocity along the water main based on the input data.

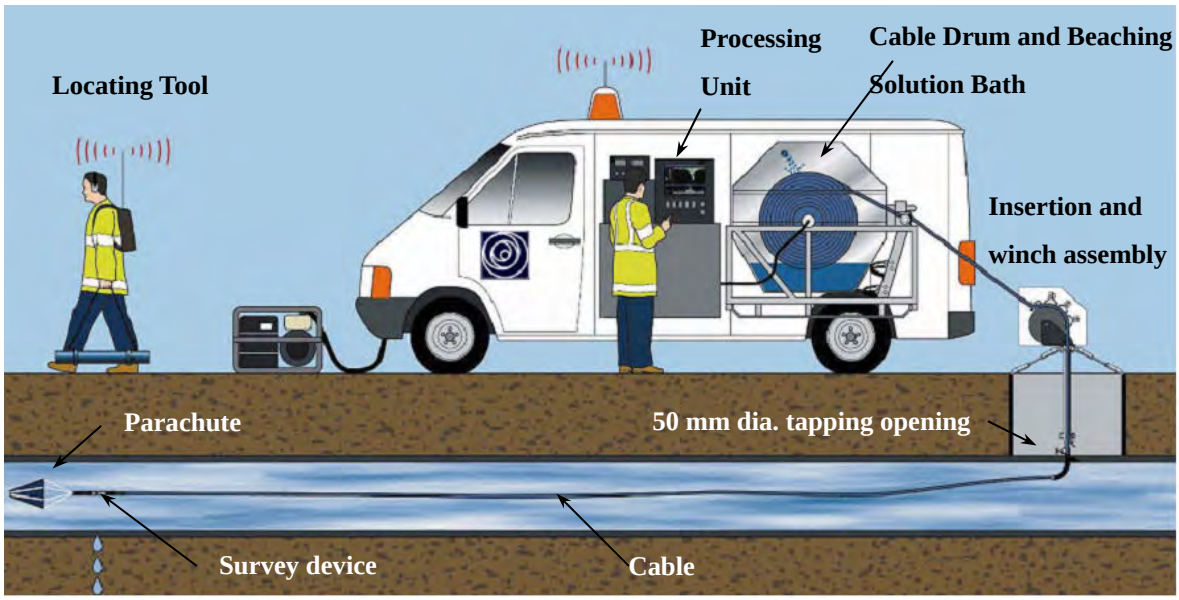
Taking Measurement

III. New Technology for Condition Assessment of Water Mains

The new technology is a non-destructive, condition assessment tool that is used to inspect the interior and detect leaks in large diameter (300 mm dia. and above) pressurised water mains without interruption of service.

The system will be able to operate in an in-service pressurised water main by insertion of a cable with the survey device (a CCTV camera or acoustic sensor) through any tapping opening that is at least 50 mm in diameter. Under the flow of water, the parachute at the front end of the cable will carry the survey device and cable through the section of water main to be surveyed, providing real-time inspection of the internal conditions of the water main and detection of any leak in the water main. The position of defect or leak can then be marked on the ground surface, facilitating subsequent repairs.

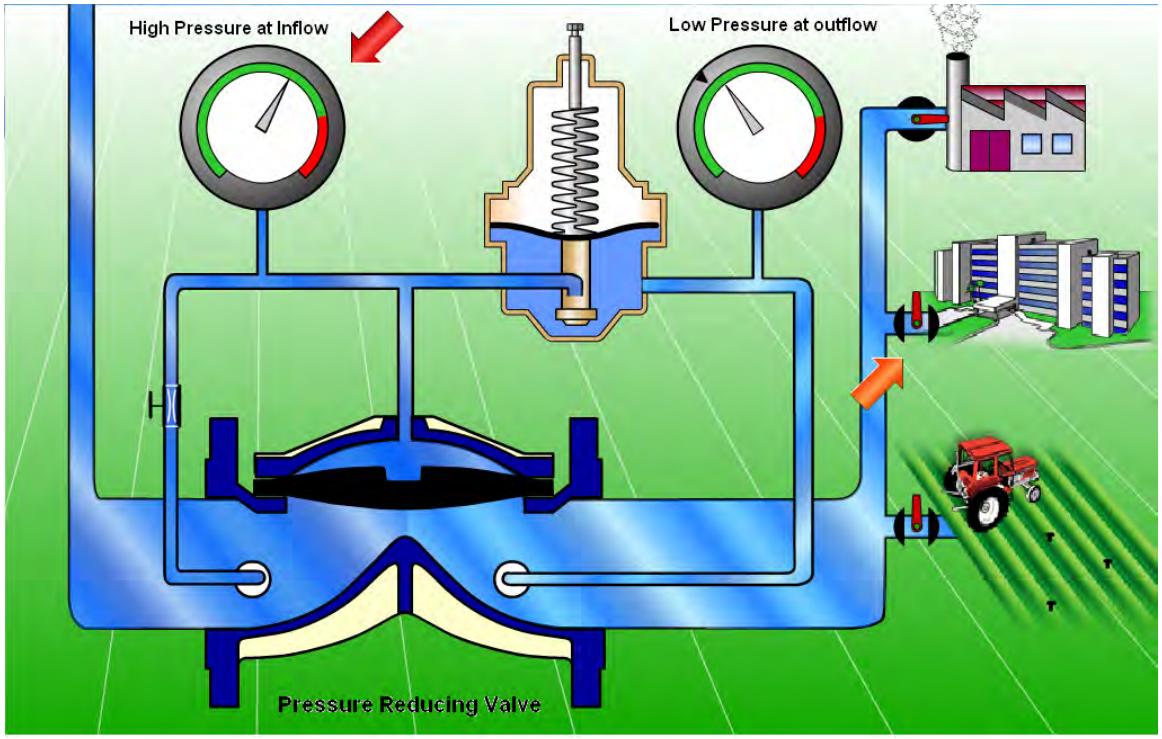
Since the cable is connected to the control equipment on the ground surface and can be controlled to permit halting of the survey device at any position, it not only transmits the survey signal in real time, but also increases substantially the sensitivity, accuracy and effectiveness of detecting defects or leaks.



Typical Set-up of the System

Appendix 5

The Principle, Set-up and Illustrative Result of Pressure Management



Principle of Pressure Management

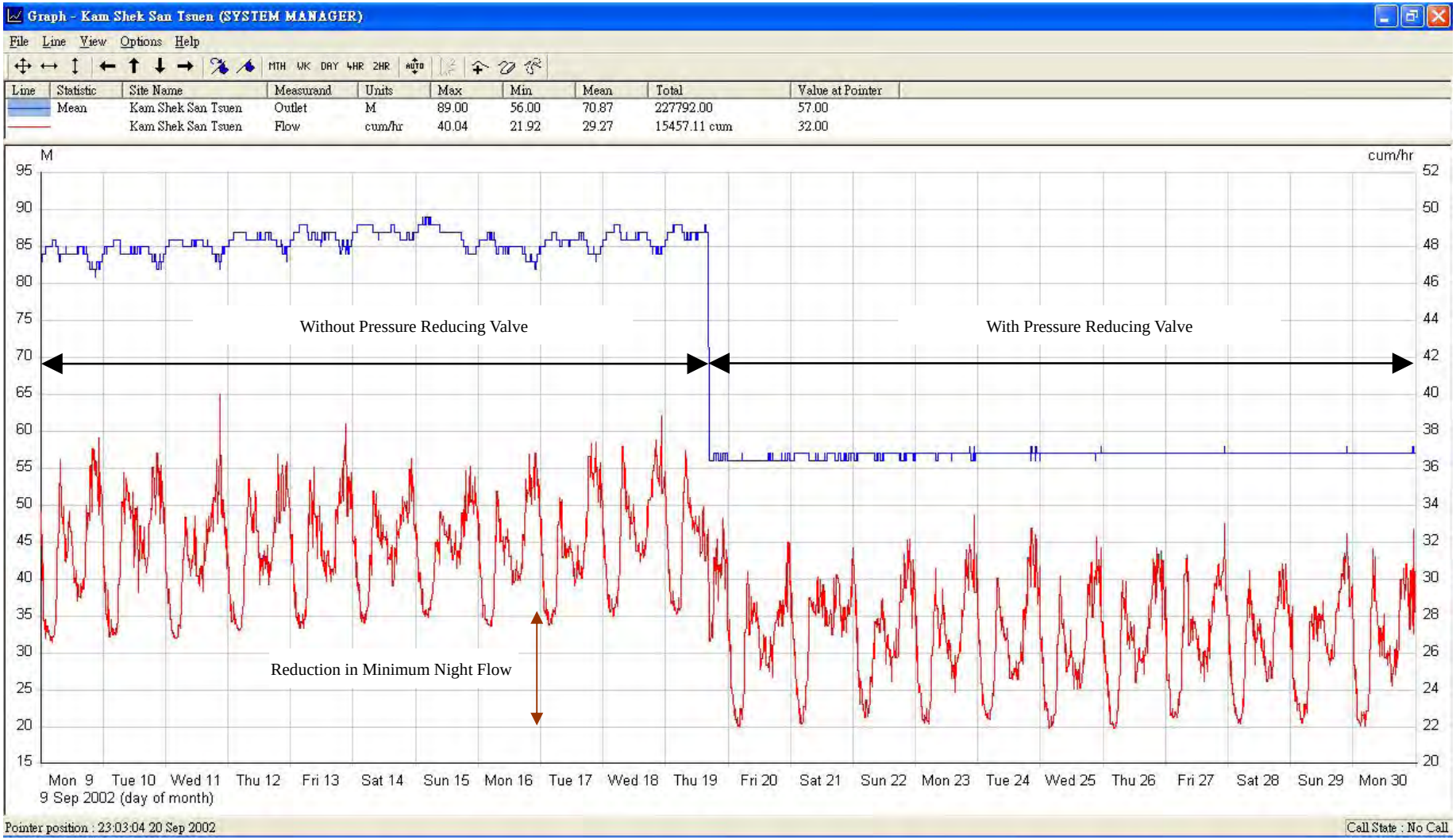
Note:

Service reservoirs are located at high level to distribute water to customers to cater for the hilly topography of Hong Kong. For water mains close to the level of the service reservoirs, the supply pressure is relatively low. For water mains with a big level difference from the service reservoirs, they are subject to relatively high supply pressure. Under high supply pressure, leakage is more likely to develop at the joints and valves of the water mains. With the advance in technology, the installation of flow-modulated pressure reducing valves can help to regulate the water pressure and hence to reduce water leakage while maintaining adequate water pressure for the supply to consumers.

Pressure Reducing Valve and Flowmeter

Pilot Valve

A Typical Set-Up



Illustrative Result

Note:

The supply water pressure and the flow rate within the water main are shown in blue and red respectively in the chart. As can be seen from the chart, the water consumption at night time is relatively stable. When pressure reducing valve was added and the water pressure was reduced, there was a corresponding reduction in night flow, indicated that the leakage was also reduced.

Appendix 6

Performance of Small-scale Pressure Management Areas

No.	Pressure Management Area Location	Average consumption Before Pressure Management (m^3/day)	Water saving arising from pressure management (m^3/day) (see Note)	Ratio of water saving to average water consumption (in %)
1	Lei Yue Mun	4,144	313	7.6%
2	Tai Tam Reservoir Road	561	116	20.6%
3	Chung Hom Kok	915	20	2.2%
4	Fairview Park (FW)	6,848	684	10.0%
5	Fairview Park (TMF)	2,666	471	17.7%
6	Ah Kung Tin	1,280	504	39.4%
7	Hong Lok Yuen (FW)	3,827	614	16.0%
8	Hong Lok Yuen (TMF)	1,801	598	33.2%
9	Kam Shek New Village	153	20	13.3%
10	Sha Tau Kok (FW)	1,492	936	62.8%
11	Tai Mong Tsai	3,603	77	2.1%
12	Tai Lam Wu	349	34	9.7%
13	Tseng Lan Shue	559	212	38.0%
14	Sheung Tsuen/Pak Heung	214	29	13.7%
15	Po Kong Village Road	1,306	369	28.2%
16	Shui Tau	1,076	210	19.5%
17	Tai Mei Tuk Village	543	125	22.9%
18	Po Sam Pai	330	102	30.9%

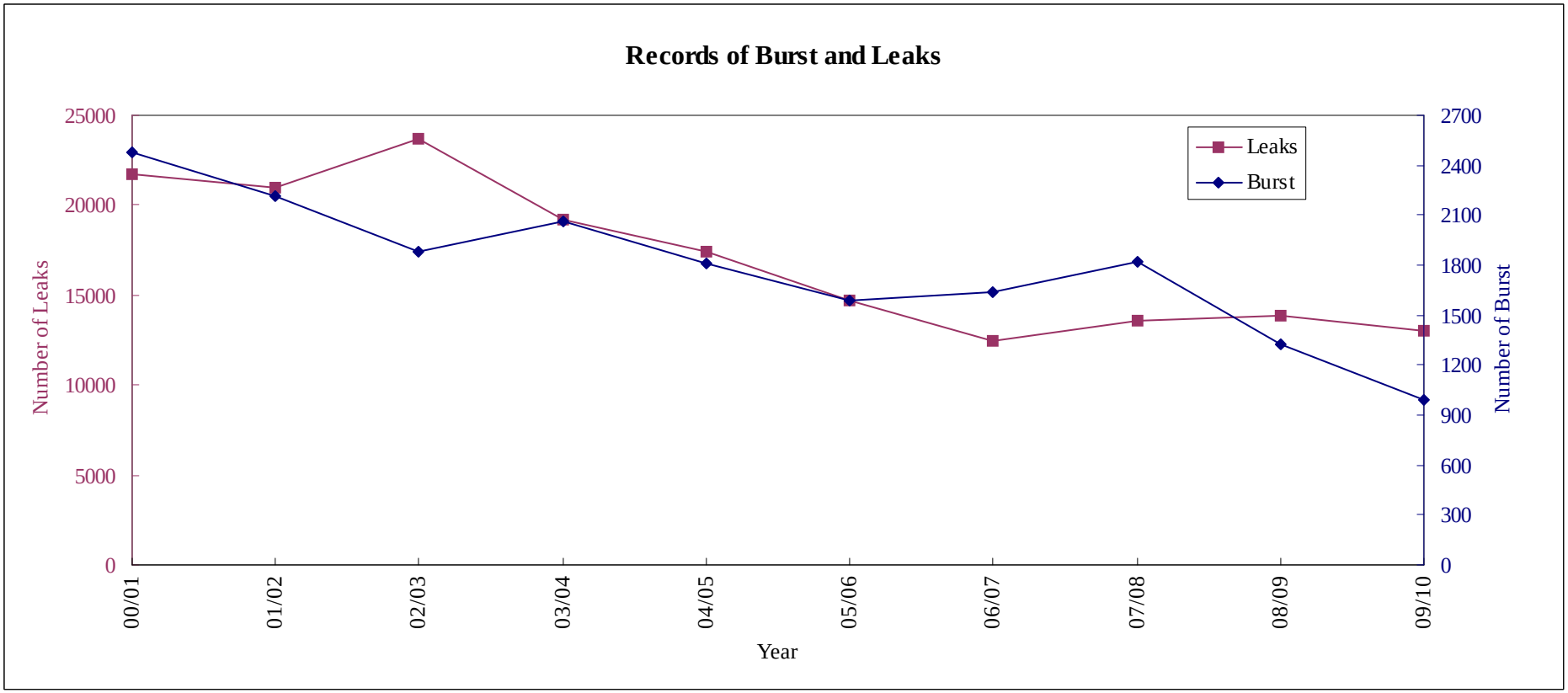
Note:Water saving is derived by comparing the average consumption before and after implementation of pressure management scheme.

Appendix 7

Pressure Management Schemes for the 17 Major Supply Zones (MSZ)

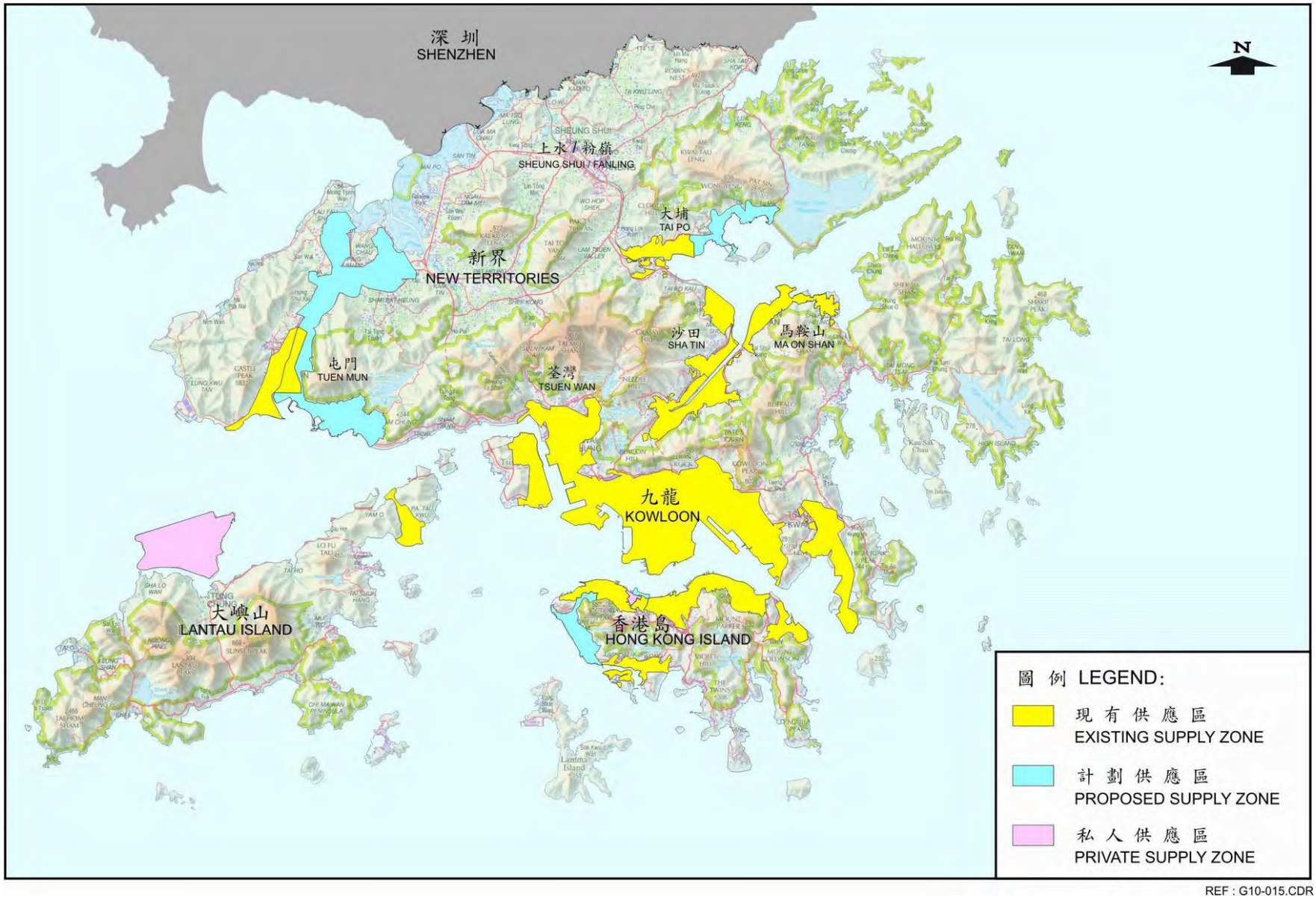
Major Supply Zones	Study	Construction
North Point & Shau Kei Wan Tai Po Tsuen Wan East (half MSZ) Western Kowloon Central (half MSZ) (Total 4 nos. MSZ)	Completed	In progress
Kowloon West (half MSZ) Central Eastern Sai Wan (Total 3.5 nos. MSZ)	Completed	Preparation of design and construction consultancy in progress
Tsuen Wan West (half MSZ) Tuen Mun Sai Kung Aberdeen Red Hill (Total 4.5 nos. MSZ)	Commenced in Feb 2009	
Kowloon East Sha Tin Yuen Long Sheung Shui / Fanling Islands (Total 5 nos. MSZ)	Under planning	

Appendix 8


Records of Burst and Leaks
Number of Leaks
25000
20000
15000
10000
5000
0
Number of Burst
2700
2400
2100
1800
1500
1200
900
600
300
0
Leaks
Burst
00/01
01/02
02/03
03/04
04/05
05/06
06/07
07/08
08/09
09/10
Year

Appendix 9

Salt Water Supply Zones in Hong Kong



REF : G10-015.CDR

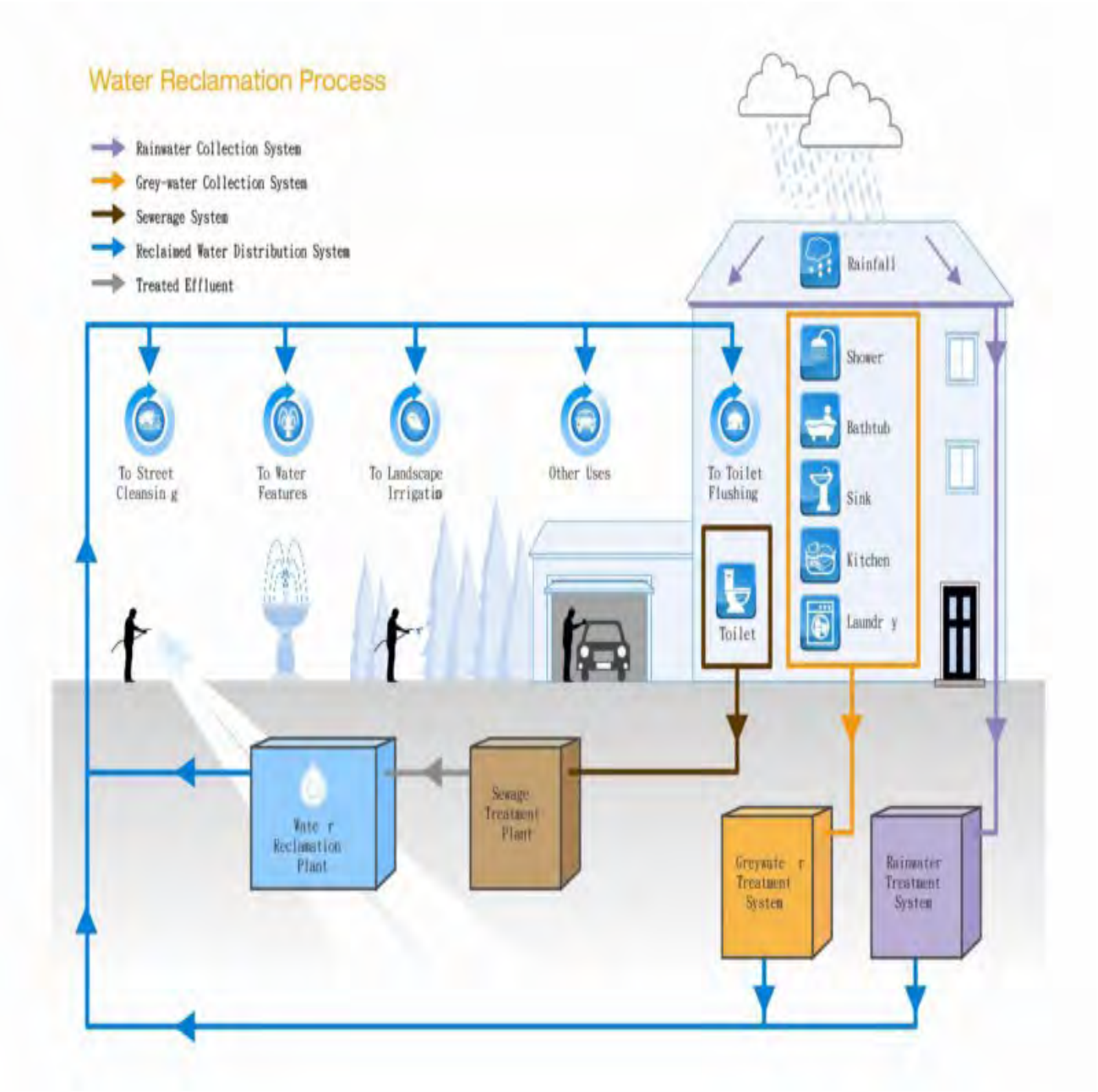
Appendix 10

Progress of Salt Water Supply Projects

Project	Construction Start Date	Construction Completion Date	Progress Status	Remark
Salt water supply system for Penny's Bay (Disneyland)	1/2007	9/2009	Substantially completed.	Commissioned in end Nov 2009.
Salt water supply system for Pok Fu Lam area	10/2009	12/2012	Currently under construction.	
Salt water supply for Northwest New Territories – stage 1	2/2008	Late 2012	Currently under construction.	The proposed salt water supply zone covers the Tuen Mun East, Yuen Long and Tin Shui Wai areas.
Salt water supply for Northwest New Territories – remaining works	5/2009	Late 2014	Currently under construction.	
Tung Chung	-	-	Under planning.	

Appendix 11

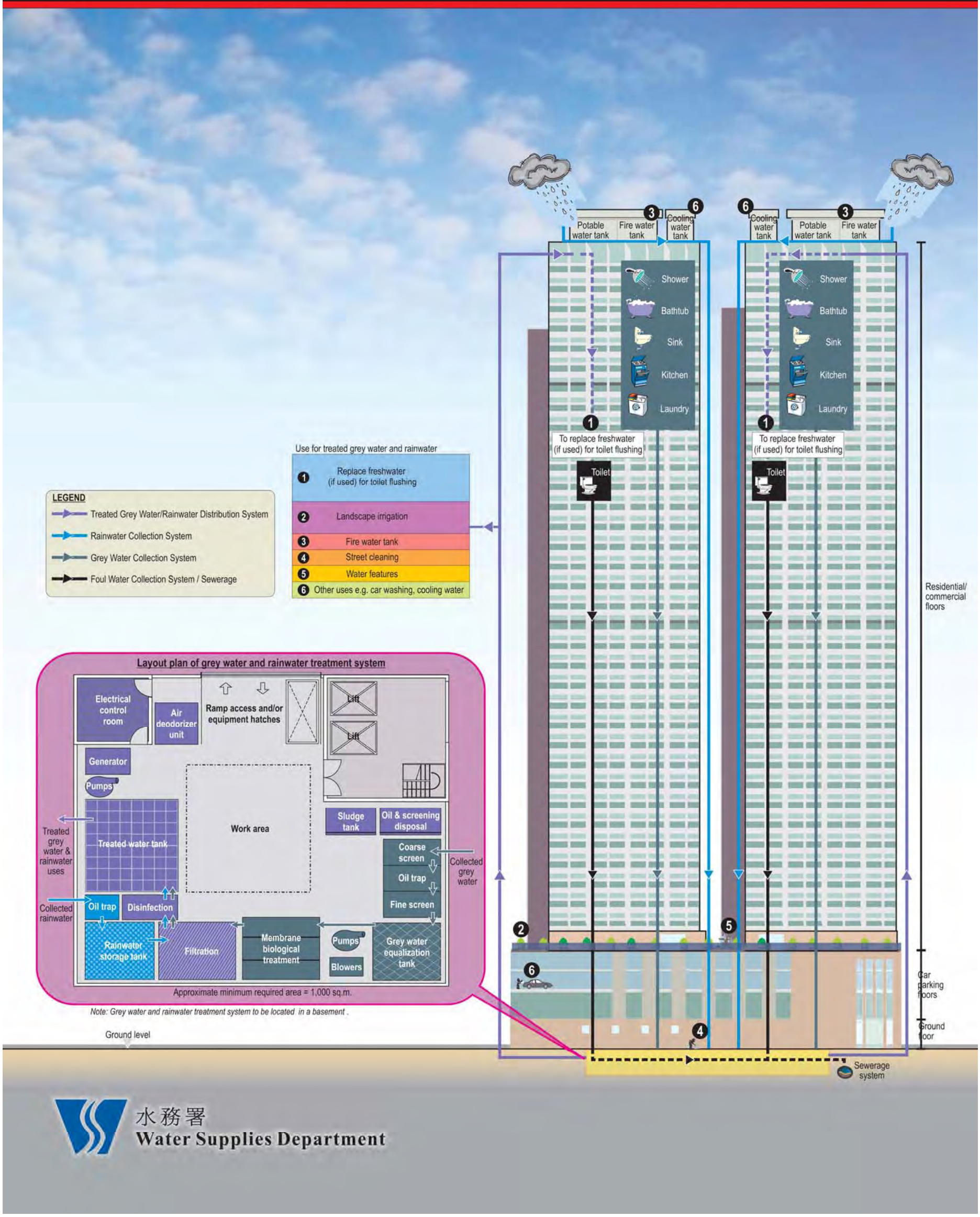
Water Reclamation - Grey Water Recycling and Rainwater Harvesting Application Schematic Diagram and Illustrative Design in High Rise Buildings



Schematic Diagram for Water Reclamation Process

GREY WATER RECYCLING AND RAINWATER HARVESTING

ILLUSTRATIVE DESIGN IN HIGH RISE BUILDINGS



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Water Supplies Department