

## **CHAPTER 12**

### **Water Supplies Department**

<p><b>Water losses from unauthorised consumption and inaccurate metering</b></p>
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**Audit Commission  
Hong Kong  
25 October 2011**

*This audit review was carried out under a set of guidelines tabled in the Provisional Legislative Council by the Chairman of the Public Accounts Committee on 11 February 1998. The guidelines were agreed between the Public Accounts Committee and the Director of Audit and accepted by the Government of the Hong Kong Special Administrative Region.*

Report No. 57 of the Director of Audit contains 12 Chapters which are available on our website at <http://www.aud.gov.hk>.

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# **WATER LOSSES FROM UNAUTHORISED CONSUMPTION AND INACCURATE METERING**

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## **PART 1: INTRODUCTION**

1.1 This PART describes the background to the audit and outlines the audit objectives and scope.

### **Background**

#### ***Water supplies in Hong Kong***

1.2 The Water Supplies Department (WSD) is responsible for supplying fresh water and salt water (seawater for flushing) in Hong Kong. In 2010, the WSD supplied 936 million cubic metres (Mm<sup>3</sup>) of fresh water and 270 Mm<sup>3</sup> of salt water for consumption by Hong Kong's population of seven million for domestic and non-domestic use.

1.3 About 70% to 80% of fresh water in Hong Kong is supplied from Dongjiang (East River) in the Guangdong Province under the Dongjiang Water Supply Agreement, supplemented by rainwater collected from catchments in the territory. According to a paper submitted to the Panel on Development of the Legislative Council in October 2011, the Guangdong Provincial Government would supply water to Hong Kong from 2012 to 2014 at the costs of \$3,539 million for 2012, \$3,743 million for 2013 and \$3,959 million for 2014. To reduce fresh water consumption, salt water is supplied for flushing in most of the areas in Hong Kong. Fresh water consumption is metered and chargeable based on the quantity consumed, while salt water is supplied free of charge.

#### ***Sustainable use of water resources***

1.4 Water is a scarce resource. Since 2008, the WSD has been implementing a Total Water Management Strategy that aims to achieve an optimal balance between water demand and supply in order to ensure sustainable use of water. The Strategy covers four main areas, namely water conservation, new water resources, water reclamation and the management of water resources. WSD key initiatives in water demand management include stepping up public education on water conservation, promoting the use of water saving devices, enhancing water leakage control, and extending the use of salt water for flushing to more areas. Regarding supply management, the WSD has implemented measures to protect water resources within catchments, reservoirs, and the water supply and distribution systems.

1.5 In order to gauge public views on water conservation, in August 2011, the WSD commenced a domestic water consumption study as a new initiative under the WSD's Total Water Management Strategy. In the study, the WSD would select 1,000 domestic

households randomly from its customer database for conducting interviews on their water consumption habits, their levels of awareness and their views on WSD promotion activities concerning water conservation. The study was scheduled for completion in December 2011, which aimed to identify general water consumption patterns of domestic household users, with a view to implementing new water conservation initiatives and promoting sustainable use of water.

### *Apparent losses of water*

1.6 According to the International Water Association (Note 1), there are two types of water losses in water supply and distribution systems, namely:

- (a) **Real water losses**, which refer to losses from leakages in joints and fittings of water mains, and bursts and leaks in water supply and distribution systems (Note 2); and
- (b) **Apparent water losses**, which refer to water consumed by users but not metered nor charged, due to **unauthorised water consumption** and **inaccurate metering**.

1.7 Apparent water losses from unauthorised water consumption and inaccurate metering will result in under-collection of water charges and loss of government revenue. At times, unauthorised water consumption may result in water wastage and water contamination (e.g. inflow of salt water into a fresh water system — see Case 4 in para. 3.6). According to the WSD's estimates, in 2010, the notional quantity of apparent water losses totalled 34.94 Mm<sup>3</sup> (representing 4% of the total fresh water supply in the year), of which:

- (a) 17.30 Mm<sup>3</sup> were attributed to unauthorised water consumption (involving estimated notional water charges foregone of \$79.2 million — Note 3); and
- (b) 17.64 Mm<sup>3</sup> were attributed to inaccurate metering (involving estimated notional water charges foregone of \$80.8 million).

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**Note 1:** *The Association has 10,000 individual and 500 corporate members from 130 countries. It aims to provide innovative, pragmatic and sustainable solutions to water supply problems.*

**Note 2:** *In 2010, the Audit Commission completed a review of managing and reducing water main bursts and leaks (see para. 1.10).*

**Note 3:** *The estimate was based on the rate of \$4.58 per cubic metres for fresh water used for trade purposes as specified in the Waterworks Regulations (Cap. 102A).*



### *Unlawful water taking*

1.8 The Prosecution Unit of the Development Branch of the WSD (Note 4) is responsible for taking enforcement action under section 29 of the Waterworks Ordinance (Cap. 102) against unlawful water taking. Suspected cases from other WSD branches/divisions, other government departments, and members of the public are referred to the Prosecution Unit for investigation. In 2010, the Unit took prosecution action in 92 cases, of which 91 resulted in convictions.

### *Water meter accuracy*

1.9 The WSD installs water meters to register the quantity of fresh water consumed by domestic and non-domestic customers in buildings and premises (Note 5). While water pipes for domestic water supply are normally of 15 millimetre (mm) diameter, those for non-domestic water supply are of larger diameters, ranging from 15 mm to 300 mm diameters (Note 6). Hence, corresponding types of water meters are installed for water pipes of different diameters. With the passage of time after installation, the accuracy of water meters in registering the quantity of water consumption may deteriorate as a result of wear and tear of mechanical parts. **As of July 2011, there were 2.77 million 15-mm meters and 34,000 large meters (namely 25-mm to 300-mm meters).**

### *Audit review*

1.10 In 2010, the Audit Commission (Audit) completed a review of managing and reducing water main bursts and leaks (real water losses referred to in para. 1.6(a)). The results of the review were included in Chapter 8 of the Director of Audit's Report No. 55 of October 2010. Audit has recently conducted another review of the WSD to examine its actions taken to minimise water losses from unauthorised water consumption and inaccurate metering (apparent water losses referred to in para. 1.6(b)), focusing on the following areas:

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**Note 4:** *The authority for taking enforcement action under the Waterworks Ordinance is vested in the Water Authority, who is the Director of Water Supplies. For simplicity, the Water Authority is referred to as the WSD in this Report.*

**Note 5:** *According to the WSD, water supply will also be provided to temporary structures if it is technically feasible and the waterworks requirements are met. The WSD will notify the Buildings Department of the existence of suspected irregularities (such as roof top structures and partitioned units).*

**Note 6:** *Water pipes for non-domestic water supply are those of 15-mm, 25-mm, 40-mm, 50-mm, 80-mm, 100-mm, 150-mm, 200-mm and 300-mm diameters.*

- (a) enforcement action against unlawful water taking (PART 2);
- (b) inspection of unauthorised water consumption (PART 3);
- (c) management of water meter accuracy (PART 4); and
- (d) performance reporting (PART 5).

Audit has found that there are areas where improvements can be made by the WSD, and has made a number of recommendations to address the issues.

### **General response from the Administration**

1.11 The **Director of Water Supplies** agrees with the audit recommendations in this Report. He has said that the WSD will continue taking forward the necessary enhancement measures to reduce apparent water losses and to improve its services.

### **Acknowledgement**

1.12 Audit would like to acknowledge with gratitude the full cooperation of the staff of the WSD and the Food and Environmental Hygiene Department (FEHD) during the course of the audit review.

## **PART 2: ENFORCEMENT ACTION AGAINST UNLAWFUL WATER TAKING**

2.1 This PART examines the enforcement action taken by the WSD in combating unlawful water taking, focusing on:

- (a) enforcement action under the Waterworks Ordinance (paras. 2.2 to 2.13); and
- (b) prosecution of unlawful water taking:
  - (i) at FEHD markets (paras. 2.14 to 2.22);
  - (ii) for flushing at residential developments (paras. 2.23 to 2.30); and
  - (iii) at construction sites (paras. 2.31 to 2.39).

### **Enforcement action under the Waterworks Ordinance**

2.2 Section 29 of the Waterworks Ordinance stipulates that:

- (a) except with the permission of the WSD, no person shall:
  - (i) take water from the waterworks other than through a fire service, an inside service (Note 7) or a public standpipe (Note 8);
  - (ii) take water through a fire service for any purpose other than for fire fighting;
  - (iii) take water through an inside service for any purpose other than that for which the water is supplied;
  - (iv) take water through a fire service or an inside service which is not measured by a meter; or
  - (v) divert water from the waterworks system; and

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**Note 7:** *An inside service includes pipes and fittings in premises, and those between premises and public mains.*

**Note 8:** *A public standpipe is installed by the WSD for supplying water to the public free of charge, such as those installed in typhoon anchorages for the floating population.*

- (b) any person who contravenes section 29 of the Waterworks Ordinance shall be guilty of an offence. The offender shall also be liable to pay a charge for the water so taken.

2.3 Section 35(1) of the Waterworks Ordinance provides that an offender of section 29 of the Ordinance shall be liable on summary conviction to a maximum fine of \$25,000. Section 35(2) further provides that, if the offence under section 29 is a continuing one, the offender shall be liable to a further fine of \$1,000 for every day or part of a day during which the offence continues. Figure 1 is an extract of a WSD leaflet on unlawful water taking.

Figure 1

Extract of leaflet on unlawful water taking



Source: WSD records

2.4 The WSD Prosecution Unit (see para. 1.8) is one of the two units of the Prosecution and Quality Management Section (see WSD organisation chart at Appendix A). The Section is headed by a Senior Engineer. The Prosecution Unit has an establishment of 13 staff, comprising 1 Superintendent (Unit head), 3 Prosecution Officers (each heads a prosecution team), 3 Assistant Prosecution Officers and 6 Consumer Services Inspectors. The duties of the Unit include:

- (a) conducting inspections and investigations of suspected cases referred to the Unit by other WSD branches/divisions (notably the Customer Services Branch), other government departments (notably the Fire Services Department (FSD), the Environmental Protection Department (EPD) and the FEHD), and members of the public;
- (b) carrying out surprise inspections of suspected premises and buildings (such as those where nearby buildings have recently been involved in unlawful water taking); and
- (c) taking prosecution actions on unlawful water taking after obtaining sufficient evidence.

### ***2003 Review***

2.5 According to the WSD, its officers sometimes encounter difficulties in promptly gaining access to premises for collecting evidence for prosecution action against unlawful water taking. Section 12 of the Waterworks Ordinance provides that except in the case of urgency, WSD staff may not enter any premises unless the consent of the occupier of such premises or a warrant issued by the Magistrate is first obtained. In 2003, the WSD commenced a review (2003 Review) of the WSD's authority in taking prosecution action under the Waterworks Ordinance, and to explore the possibility of prosecuting offenders under the Theft Ordinance (Cap. 210).

2.6 In the 2003 Review, after seeking advice from the Department of Justice, the WSD noted that:

- (a) prosecution under the Theft Ordinance might not enhance the WSD's enforcement power on unlawful water taking;
- (b) other than by admissions of the defendants, circumstantial evidence might be sufficient to establish liability for unlawful water taking. The extent of success in obtaining circumstantial evidence in a suspected case depended on the thoroughness of investigation and the experience of WSD officers in detecting existence of such evidence; and

- (c) the WSD might seek assistance from the Hong Kong Police Force in providing training on investigation and collection of evidence.

2.7 Since the 2003 Review, officers of the Prosecution Unit have attended prosecutor training courses organised by the Department of Justice and investigation skills training programmes by the Hong Kong Police Force. In December 2006, the maximum fine under the Waterworks Ordinance increased from \$5,000 to \$25,000 (see para. 2.3). In 2009, after seeking legal advice in one case, the WSD successfully prosecuted an offender using circumstantial evidence.

## Audit observations and recommendation

### *Convictions of unlawful water taking*

2.8 Table 1 shows, from 2008 to 2010, the numbers of prosecution and conviction cases, the fines imposed and the recovery of charges for water taken unlawfully under sections 29 and 35(1) of the Waterworks Ordinance.

**Table 1**  
**Prosecution and conviction of unlawful water taking**  
**(2008 to 2010)**

<b>Year</b>	<b>Prosecution case (Note 1)  (No.)</b>	<b>Conviction case (Note 2)  (No.)</b>	<b>Fine  (\$)</b>	<b>Water charges recovered  (\$)</b>
2008	60	60	143,700	316,488
2009	76	76	170,450	610,411
2010	92	91	247,600	1,035,254
<b>Total</b>	<b>228</b>	<b>227</b>	<b>561,750</b>	<b>1,962,153</b>

*Source:* WSD records

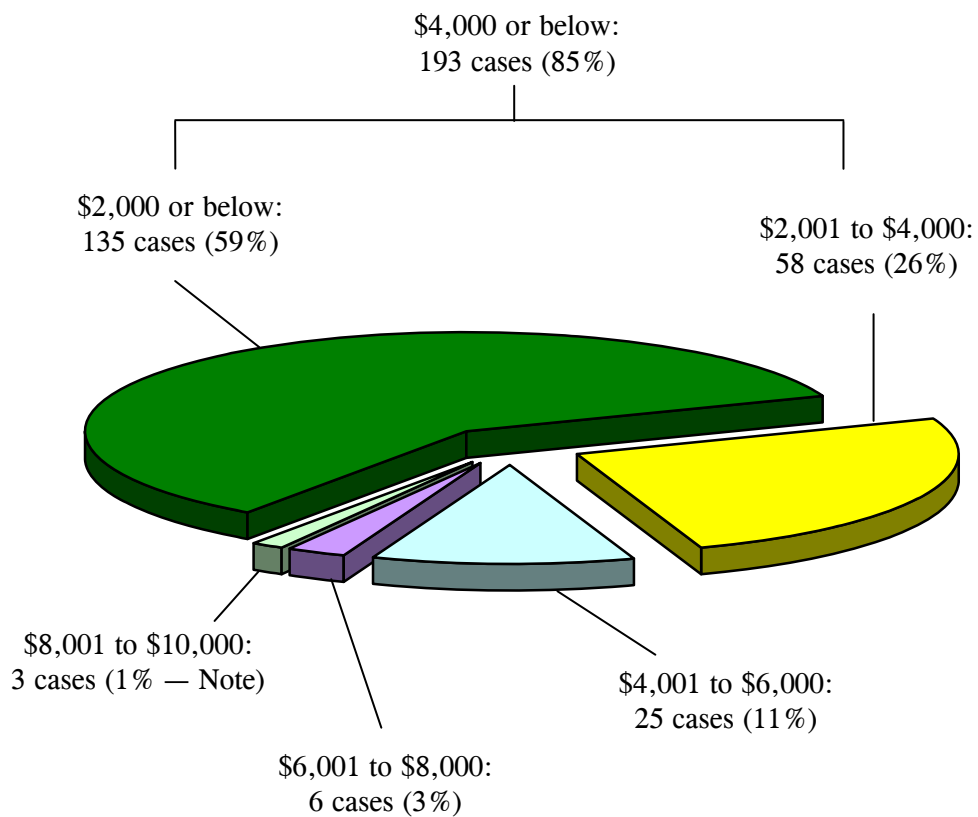
*Note 1:* The number of prosecution cases in a year was based on the number of related summonses issued in that year.

*Note 2:* Prosecution action on a suspected case might span over two years. In this Table, the year of a conviction case relates to the year of issuing a summons.

2.9 As shown in Table 1, the number of conviction cases of unlawful water taking increased by 52% from 60 in 2008 to 91 in 2010. According to the WSD, the increase was a result of the WSD's investigations targeting at high-risk areas. The total amount of fines imposed in the three years was \$561,750. Audit analysis of the amounts of fine imposed in individual cases between 2008 and 2010 is shown in Figure 2.

**Figure 2**

**Fines on unlawful water taking  
(2008 to 2010)**



*Source: Audit analysis of WSD records*

*Note: In all 3 cases, the fine imposed was \$10,000.*

2.10 As shown in Figure 2, from 2008 to 2010, 85% of fines imposed on individual offenders of unlawful water taking were \$4,000 or below, and the highest fine of \$10,000 (which was only 40% of the maximum fine of \$25,000 under the Waterworks Ordinance) was imposed in three cases. Audit also noted that, during the period, only one offender was fined \$3,000 under section 35(2) of the Waterworks Ordinance for continuous unlawful water taking (see para. 2.3) for 40 days.

2.11 According to the WSD's estimates, in 2010, water losses of 17.30 Mm<sup>3</sup> were attributed to unauthorised water consumption (see para. 1.7(a)). From 2008 to 2010, the number of conviction cases of unlawful water taking increased by 52% from 60 to 91 a year. Furthermore, unlawful water taking may result in water wastage and water contamination. **Therefore, the WSD needs to review its strategy in addressing the problem of unlawful water taking, with a view to identifying and implementing improvement measures in areas of publicity, education, inspection and prosecution action.**

#### *Audit recommendation*

2.12 **Audit has recommended that the Director of Water Supplies should conduct a review of WSD strategy in addressing the unlawful water taking problem, with a view to identifying and implementing improvement measures.**

#### **Response from the Administration**

2.13 The **Director of Water Supplies** agrees with the audit recommendation.

#### **Prosecution of unlawful water taking**

2.14 The WSD has classified unlawful water taking cases into eight categories, namely trade, flushing, construction, domestic, cleansing, irrigation, fire services and air-conditioning. Table 2 shows, by category, the numbers of prosecution and conviction cases, the fines and recovery of water charges on unlawful water taking over the period 2008 to 2010.



**Table 2**  
**Categories of prosecution and conviction cases**  
**(2008 to 2010)**

<b>Category</b>	<b>Prosecution case (No.)</b>	<b>Conviction case (No.)</b>	<b>Fine (\$)</b>	<b>Water charges recovered (\$)</b>
(a) Trade (Note)	72	72	182,350	451,407
(b) Flushing	48	48	168,000	1,479,879
(c) Construction	35	35	83,900	12,264
(d) Domestic	28	27	49,900	9,372
(e) Cleansing	26	26	46,350	2,006
(f) Irrigation, fire services and air-conditioning	19	19	31,250	7,225
<b>Total</b>	<b>228</b>	<b>227</b>	<b>561,750</b>	<b>1,962,153</b>

*Source: WSD records*

*Note: This category included trading, manufacturing and general business operations.*

### **Unlawful water taking at markets**

2.15 As shown in item (a) of Table 2, from 2008 to 2010, there were 72 conviction cases of unlawful water taking for trade purposes. Audit examination revealed that, of the 72 cases (involving estimated unlawful water taking of 98,560 cubic metres (m<sup>3</sup>)), 25 (35%) took place at 7 FEHD public markets and cooked food markets (FEHD markets — see Table 3).

**Table 3**  
**Number of conviction cases at FEHD markets**  
**(2008 to 2010)**

FEHD market	Year			Total (d) = (a) + (b) + (c)
	2008 (a)	2009 (b)	2010 (c)	
Public Market A	1	–	4	5
Public Market B	1	–	3	4
Cooked Food Market C	–	3	2	5
Cooked Food Market D	–	–	4	4
Cooked Food Market E	–	–	4	4
Cooked Food Market F	1	–	1	2
Cooked Food Market G	1	–	–	1
<b>Total</b>	<b>4</b>	<b>3</b>	<b>18</b>	<b>25</b>

Source: WSD records

### Audit observations and recommendations

2.16 As shown in Table 3, the number of conviction cases of unlawful water taking at FEHD markets increased from 4 in 2008 to 18 in 2010 (350% increase). Audit noted that, in one case in 2009 and two cases in 2010, repeated offences were committed by the same stall operator at Cooked Food Market C. Notwithstanding the repeated offences by the same operator, the WSD had not informed the FEHD about the three offences, nor similar offences committed by other operators at FEHD markets. As a result, the FEHD could not take necessary follow-up action (e.g. the issue of warning letters). Under the market-stall tenancy agreement, the FEHD may issue a warning letter to a tenant for any non-compliance with the legal provisions relating to the use of a market stall. The FEHD may terminate a tenancy agreement after the issue of three warning letters to a tenant within a period of six months.

2.17 In Audit's view, the WSD needs to inform the FEHD about substantiated unlawful water taking cases found at FEHD markets. Upon receipt of such information, the FEHD needs to take enforcement action under the market-stall tenancy agreements, with a view to preventing and deterring unlawful water taking activities at its markets.

2.18 As shown in paragraph 2.15, FEHD markets are one of the high-risk areas involving unlawful water taking. Audit noted that FEHD officers conducted regular inspections at FEHD market stalls to ensure compliance with the tenancy requirements. To enhance the effectiveness of detecting unlawful water taking at FEHD markets, FEHD officers need to report suspected cases to the WSD for follow-up action. In this connection, the WSD needs to provide related training to FEHD officers.

*Audit recommendations*

2.19 Audit has *recommended* that the Director of Water Supplies should:

- (a) inform the Director of Food and Environmental Hygiene about substantiated unlawful water taking cases at FEHD markets; and
- (b) in collaboration with the Director of Food and Environmental Hygiene, provide training to FEHD officers on detecting unlawful water taking activities at FEHD markets.

2.20 Audit has also *recommended* that the Director of Food and Environmental Hygiene should:

- (a) take necessary enforcement action under the market-stall tenancy agreements on tenants who have been convicted of unlawful water taking offences at FEHD markets; and
- (b) instruct FEHD officers to report suspected unlawful water taking activities at FEHD markets to the WSD for follow-up action.

## **Response from the Administration**

2.21 The **Director of Water Supplies** agrees with the audit recommendations. He has said that the WSD will liaise with the Director of Food and Environmental Hygiene to provide training to FEHD officers on detecting unlawful water taking activities at FEHD markets.

2.22 The **Director of Food and Environmental Hygiene** agrees with the audit recommendations.

## **Unlawful water taking for flushing at residential developments**

2.23 As shown in item (b) of Table 2 in paragraph 2.14, from 2008 to 2010, there were 48 conviction cases of unlawful water taking for flushing. A total fine of \$168,000 was imposed and water charge of \$1,479,879 was recovered.

## **Audit observations and recommendations**

2.24 Audit examination revealed that, of the 48 conviction cases (involving estimated unlawful water taking of 323,118 m<sup>3</sup>):

- (a) 13 cases related to unlawful water taking at more than one block of each of five residential developments. Case 1 is an example; and
- (b) 8 cases (including 6 of the 13 cases in (a) above) related to repeated convictions of unlawful water taking by the same offenders. Case 2 is an example.

## Case 1

## Unlawful water taking at four blocks in Development A

1. In September 2004, the WSD installed bulk meters (Note 1) outside the boundaries of Development A to monitor fresh water supplied to it.

2. In January 2007, the WSD noted that, between October 2004 and March 2006, the average total water consumption registered by the bulk meters was 1,874 m<sup>3</sup> a day, which was 551 m<sup>3</sup> (42%) more than the average total consumption of individual household meters of 1,323 m<sup>3</sup> a day. The WSD conducted checking of the inside services but no irregularities were found.

3. In March 2009, upon receiving a complaint about unlawful water taking in Development A, the WSD conducted investigations but no irregularities were found. During the inspections, WSD officers needed to wait for some time before they were granted the right of access by the management office. Subsequently, with a search warrant, WSD officers gained instant access to the roofs and found that fresh water was directed from the fresh water tanks to the flushing water tanks (owing to break-downs of the flushing systems) at four blocks of buildings in Development A.

4. In August 2009, four summonses were issued to the management office under section 29 of the Waterworks Ordinance and another four summonses under regulation 23(1) of the Waterworks Regulations (Cap. 102A — Note 2).

5. In September 2009, the management office was convicted of the offences with fines of \$8,000 imposed under section 29 of the Waterworks Ordinance and \$3,200 under regulation 23(1) of the Waterworks Regulations. Water charge of \$57,149 was recovered for unlawful water taking of 12,478 m<sup>3</sup> for 79 days.

***Audit comments***

6. Unlawful water taking was found at more than one block in a residential development. However, WSD staff had difficulties in gaining instant access to conduct investigations at places suspected of unlawful water taking.

*Source: WSD records*

*Note 1: The WSD installs bulk meters outside the boundaries of some residential developments to monitor the total quantity of water supplied to individual developments.*

*Note 2: Regulation 23(1) of the Waterworks Regulations prohibits the installation of a booster pump on an inside service without the permission of the WSD. The maximum penalty is \$10,000.*

## Case 2

### Repeated convictions of unlawful water taking in Development B

1. In October 2007, during a surprise inspection, the WSD noted that fresh water was unlawfully taken for flushing at two blocks in Development B.
2. In January 2008, the Owners' Corporation (OC) admitted taking fresh water unlawfully for flushing for about 28 months, claiming that the well supplying water for flushing had been dried up (there was no salt water supply in the area).
3. In March 2008, the WSD advised the OC of the need to remove the illegal connections. One summons was issued to the OC under section 29 of the Waterworks Ordinance and another summons under regulation 23(1) of the Waterworks Regulations.
4. In April 2008, the OC requested a time extension for removal of the illegal connections. The OC was convicted of the offences with fines of \$5,000 imposed under section 29 of the Waterworks Ordinance and \$1,000 under regulation 23(1) of the Waterworks Regulations. Water charge of \$69,622 was recovered.
5. In May 2008, the WSD refused to grant a time extension and issued a reminder for the removal works. The WSD received the OC's application for temporary fresh water supply for flushing.
6. In June 2008, the WSD requested the OC to revise the plumbing drawings for the temporary works. In July 2008, the OC submitted the revised plumbing drawings to the WSD. In September 2008, the WSD approved the application.
7. Between June 2008 and October 2008, the WSD found that unlawful water taking continued. In September 2008, the OC admitted continuous unlawful water taking.
8. In January 2009, one summons was issued to the OC under section 29 and another under regulation 23(1).
9. In February 2009, the OC was convicted of the offences with fines of \$10,000 imposed under section 29 and \$2,000 under regulation 23(1). Water charge of \$7,871 was recovered.
10. Up to July 2011, the temporary works had not been carried out. Meanwhile, the WSD was monitoring the water consumption of Development B.

#### *Audit comments*

11. Unlawful water taking continued in a residential development notwithstanding that the OC had been convicted of the offences.

Source: WSD records

2.25 As taking fresh water unlawfully for flushing may lead to water wastage and water contamination, the WSD needs to consider conducting publicity campaigns, targeting at estate management agencies and management offices of residential developments. The WSD needs to highlight the legal liabilities of committing the offence.

2.26 As illustrated in Cases 1 and 2, some residential developments, owing to break-downs of their flushing systems, used fresh water unlawfully for flushing. Audit notes that since 2002, the WSD has implemented the “Quality Water Recognition Scheme for Buildings” programme to promote regular inspections and proper maintenance of fresh water plumbing systems and water tanks by owners and management agencies of buildings. **The WSD needs to encourage residential developments to properly maintain their flushing systems.**

2.27 Audit noted that in Case 2, the OC admitted in January 2008 having unlawfully taken water for 28 months. However, the OC continued to take water through illegal connections after the conviction. In the letters issued to the OC requiring removal of the illegal connections, the WSD stated that it was empowered under section 10 of the Waterworks Ordinance to disconnect a fire service or an inside service if the OC failed to carry out the required repair works. However, the WSD did not inform the OC about the provision under section 35(2) of the Ordinance that the OC might be liable to a further fine of \$1,000 for every day or part of a day during which the offence under section 29 continued (see para. 2.3). **Audit considers that OCs should be provided with the information because it may provide a deterrent effect to them on unlawfully taking water continuously.**

2.28 Since 2003, the WSD has installed bulk meters at strategic locations outside the boundaries of selected residential developments and villages to monitor the fresh water consumption by comparing the quantity of water consumption registered by the bulk meters with the aggregate quantity of individual household meters. The WSD conducts site inspections on cases with significant variances to investigate whether there is unlawful water taking or inside service leakage for taking appropriate remedial measures. Subject to availability of resources, the WSD has planned to install bulk meters, by 2015, for 246 large residential developments and 294 villages. Up to June 2011, the WSD had installed bulk meters for 45 (18%) residential developments and 51 (17%) villages only. **As bulk meters are effective means for detecting unlawful water taking (see Case 1), the WSD needs to expedite action to install bulk meters for residential developments and villages.**

*Audit recommendations*

2.29      **Audit has recommended that the Director of Water Supplies should:**

- (a)      **conduct publicity campaigns on prevention of taking fresh water unlawfully for flushing, targeting at estate management agencies and management offices in residential developments, and highlight in the campaigns the legal liabilities of committing the offence;**
- (b)      **take measures to encourage residential developments to properly maintain their flushing systems;**
- (c)      **include in warning letters issued to offenders of unlawful water taking the legal provision of a further fine of \$1,000 for every day or part of a day during which the offence continues; and**
- (d)      **expedite action to install bulk meters for residential developments and villages.**

**Response from the Administration**

2.30      The **Director of Water Supplies** agrees with the audit recommendations. He has said that:

- (a)      publicity measures on prevention of unlawfully taking fresh water for flushing will be enhanced;
- (b)      the WSD will explore ways to encourage building owners to properly maintain their flushing systems, in consultation with the Working Group on Water Quality in Buildings under the Advisory Committee on Quality of Water Supplies (Note 9); and
- (c)      expeditious action to install bulk meters for residential developments and villages will be taken subject to resources and site constraints.

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**Note 9:**    *Members of the Committee include academics, district councillors and government officials.*



## **Unlawful water taking at construction sites**

2.31 As shown in item (c) of Table 2 in paragraph 2.14, from 2008 to 2010, there were 35 conviction cases of unlawful water taking at construction sites. A total fine of \$83,900 was imposed and water charge of \$12,264 was recovered.

## **Audit observations and recommendations**

2.32 Audit examination revealed that:

- (a) of the 35 cases, 9 (26%) related to government contractors/sub-contractors; and
- (b) of the 9 cases, 4 involved unlawful water taking from pedestal fire hydrants. Case 3 is an example.

### Case 3

#### Unlawful water taking by a government contractor

1. In June 2008, Contractor A was awarded Contract A for carrying out landslip preventive works for a government department, commencing June 2008.

2. In November 2008, the WSD received an application for provision of portable water meters from Contractor A. The WSD requested Contractor A to provide additional information for the application.

3. In January 2009, the Prosecution Unit received a WSD referral case about unlawful water taking at a pedestal fire hydrant. The Unit conducted an investigation and found that a fake meter adaptor was connected to the fire hydrant, with water taken through a hosepipe to a construction site. A site supervisor of Contractor A admitted unlawful water taking and disconnected the fake meter adaptor in the presence of WSD officers. Subsequently, the WSD conducted another investigation and found that a fake meter adaptor was again connected to the fire hydrant. Another employee of Contractor A disconnected the fake meter adaptor in the presence of WSD officers.

4. In February 2009, the WSD received a revised application for provision of portable water meters. The WSD approved the application and informed Contractor A of the approval.

5. In April 2009, regarding the offence in January 2009 (see para. 3 above), a summons was issued to the site supervisor of Contractor A under section 29 of the Waterworks Ordinance and another summons under section 31 (Note).

6. In May 2009, the site supervisor of Contractor A was convicted of the offences with fines of \$3,000 imposed under section 29 and \$1,500 under section 31. Water charge of \$523 was recovered.

#### *Audit comments*

7. Control over unlawful water taking at government works sites should be strengthened.

*Source: WSD records*

*Note: Section 31 of the Waterworks Ordinance governs alterations, interference, damages or destruction to waterworks. The maximum fine is \$25,000.*

2.33 The WSD requires works contractors to apply for provision of portable water meters from the WSD if they wish to take water from pedestal fire hydrants for use at temporary works sites. After WSD approval, a works contractor may install water meters provided by the WSD for taking water from nearby fire hydrants (see Figure 3). The contractor needs to pay water charges every month based on meter readings.

**Figure 3**

**Portable water meter installed in a fire hydrant**



Source: WSD records

2.34 In Case 3, Contractor A applied for provision of portable water meters in November 2008, 132 days after commencement of the landslip preventive works in June 2008, and the WSD approved the application 91 days later in February 2009. In January 2009, unlawful water taking was found at the temporary works site. Audit noted that, according to the Project Administration Handbook for Civil Engineering Works, a project engineer should submit an application for temporary supply of water before the award of a contract to ensure water is supplied shortly after commencement of the works. **To prevent unlawful water taking at government works sites, the WSD needs to remind works departments of the need to comply with this requirement.**

2.35 Under section 5.1.3 of the Contractor Management Handbook issued by the then Environment, Transport and Works Bureau (Note 10) in July 2005, violation of laws may lead to the taking of actions such as removal, suspension, downgrading or demotion of a contractor. A government department needs to assess a contractor's compliance with laws in his performance reports, normally on a quarterly basis. The government department should send copies of any adverse performance reports to the Development Bureau for monitoring the overall performance of government works contractors.

2.36 In December 2006, after deciding to prosecute a government works contractor on unlawfully taking water from a fire hydrant, the WSD provided the relevant information to the responsible government department for taking follow-up action. In May and September 2011, the WSD informed Audit that:

- (a) regarding the 9 conviction cases of unlawful water taking at government works sites between 2008 and 2010 (see para. 2.32(a)), the responsible government departments were not notified on the grounds of privacy as the defendants in such cases were employees of the contractors, who were individual persons; and
- (b) nonetheless, the WSD agreed that information in the public domain could be released to the responsible government departments.

2.37 To prevent works contractors from unlawfully taking water for use at government works sites, Audit considers that the responsible government departments need to be informed of any such substantiated cases so that they can take appropriate action, such as reflecting the offences in contractor performance reports. **In this connection, the WSD needs to consider providing the responsible government departments with information of conviction cases of unlawful water taking at their works sites.**

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**Note 10:** *In July 2007, the Development Bureau was formed to take over, among others, the works policy portfolio of the Environment, Transport and Works Bureau.*

*Audit recommendations*

- 2.38      **Audit has recommended that the Director of Water Supplies should:**
- (a)      **remind works departments of the need to comply with the requirement under the Project Administration Handbook for Civil Engineering Works of submitting an advance application for temporary water supply; and**
  - (b)      **consider providing the responsible government departments with information of conviction cases of unlawful water taking at their works sites.**

**Response from the Administration**

2.39      The **Director of Water Supplies** agrees with the audit recommendations. He has said that the WSD will regularly remind works departments of the need to submit advance applications for temporary water supply at works sites.

## PART 3: INSPECTION OF UNAUTHORISED WATER CONSUMPTION

3.1 This PART examines inspections of suspected unauthorised water consumption carried out by the WSD Prosecution Unit, focusing on:

- (a) inspections of referral and complaint cases (paras. 3.4 to 3.15);
- (b) surprise inspections (paras. 3.16 to 3.20); and
- (c) investigations of suspected cases (paras. 3.21 to 3.30).

### Inspections by Prosecution Unit

3.2 The Prosecution Unit conducts inspections of suspected cases of unauthorised water consumption referred by other WSD units, other government departments, and members of the public. From time to time, the Prosecution Unit receives complaints on suspected cases of unlawful water taking from the public by phone (through the WSD Customer Telephone Enquiry Centre — Note 11), in writing or by e-mail. The Prosecution Unit has set **a target of conducting an inspection of a complaint case within five working days** after receiving related information. In 2010, 98% of the suspected cases referred to the Prosecution Unit met the target.

3.3 In addition to handling referral and complaint cases, the Prosecution Unit selects suspected buildings and premises for carrying out surprise inspections, such as those where unlawful water taking offences have been found in nearby premises. Table 4 shows the number of inspections conducted by the Unit from 2008 to 2010.

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**Note 11:** *The Centre provides a round-the-clock hotline service to the public.*

**Table 4**  
**Inspections of suspected unauthorised water consumption cases**  
**(2008 to 2010)**

Inspection case	No. of inspections			Total	Percentage
	2008	2009	2010		
(a) Referral by WSD units	184	212	188	584	24%
(b) Referral by government departments	23	18	4	45	2%
(c) Complaint by public	329	259	174	762	32%
(d) Surprise inspection (Note)	660	201	159	1,020	42%
<b>Total</b>	<b>1,196</b>	<b>690</b>	<b>525</b>	<b>2,411</b>	<b>100%</b>

*Source: WSD records*

*Note: Since June 2009, the Prosecution Unit has conducted inspections of street fire hydrants by car. Such inspections are not included in this Table.*

### Inspections of referral and complaint cases

3.4 According to the WSD Consumer Services Technical Manual, any WSD officer who discovers contraventions to the Waterworks Ordinance or the Waterworks Regulations should attempt to collect evidence as far as possible, and to identify the person who has committed the offence in the first instance, so that the Prosecution Unit may follow up the case without undue difficulties. In 2006, the Customer Services Branch issued an instruction specifying that, upon discovery or receipt of a report of any contravention of the Waterworks Ordinance or the Waterworks Regulations, WSD officers should immediately report the suspected cases to the Prosecution Unit. The Unit provides training to WSD officers to deal with unauthorised water consumption cases. From 2008 to 2010, the Prosecution Unit carried out inspections of 584 cases (24% of the total 2,411 cases) referred by other WSD units (see item (a) in Table 4).

## **Audit observations and recommendations**

### ***Staff training***

3.5 From January 2004 to July 2011, the Prosecution Unit provided the following training to WSD officers:

- (a) in 2004, two half-day seminars on “Curbing unauthorised taking of water” for about 200 technical officers of the Customer Services Branch;
- (b) in 2008 and 2010, two sessions on prosecution as part of the induction training for newly recruited Consumer Services Inspectors; and
- (c) in February 2011, one half-day talk on “Experience sharing on Prosecution and Customer Services” for some professional and technical officers.

3.6 **Audit examination of the cases referred by WSD units (see Cases 4 and 5) reveals that the WSD needs to consider implementing a regular training programme for its officers on handling suspected unlawful water taking cases, particularly on evidence collection and experience sharing of conviction cases.**



#### **Case 4**

##### **Suspected unlawful water taking at a building**

1. In August 2010, during an investigation of a complaint case of the presence of salt water in a fresh water system, a WSD officer noted that there was an alteration of the inside services of a building for using fresh water for flushing, which subsequently led to the inflow of salt water into the fresh water system.
2. During the investigation, the officer did not conduct a test to collect evidence to substantiate the presence of salt water in the fresh water system.
3. The Prosecution Unit found in an investigation carried out later on the same day that there was insufficient evidence for taking prosecution action.

*Source: WSD records*

#### **Case 5**

##### **Suspected unlawful water taking at a village flat**

1. In August 2010, in handling a complaint case, a WSD officer noted an unauthorised connection of a water pipe to a village flat, but he did not conduct an investigation inside the flat to ascertain whether there was unlawful water taking. When the Prosecution Unit later conducted an investigation, the unauthorised connection had been removed.
2. In November 2010, 95 days after conducting the investigation, the investigation officer of the Prosecution Unit submitted an interim investigation report to the Superintendent of the Unit. In January 2011, 155 days after noting the incident, the Prosecution Unit received a witness statement from the WSD officer who first observed the unauthorised connection.
3. The Prosecution Unit did not take prosecution action owing to lack of sufficient evidence. The Unit considered that conducting an investigation inside the flat immediately after the WSD officer's observation might provide evidence for taking prosecution action.

*Source: WSD records*

### *Assistance from government departments*

3.7 From 2005 to 2009, the WSD issued memoranda to 12 target government departments (Note 12) to encourage the reporting of unauthorised use of water at construction sites. From 2008 to 2010, the Prosecution Unit conducted investigations of 45 cases referred by other government departments (including 25 cases by the FSD, 8 cases by the FEHD and 8 cases by the EPD). The number of referral cases was reduced from 23 in 2008 to 4 in 2010 (83% reduction). **Audit considers that the WSD needs to periodically seek assistance from target government departments for reporting suspected cases to the WSD for follow-up action. The WSD also needs to provide training to the officers of these departments to help detect unlawful water taking.**

### *Public education*

3.8 From 2008 to 2010, the Prosecution Unit conducted 762 inspections of suspected cases of unauthorised water consumption referred by members of the public (see item (c) of Table 4 in para. 3.3). To promote public awareness and reporting of suspected unlawful water taking activities, the WSD has prepared the following publicity materials for distribution to the public or uploading onto the WSD's website:

- (a) two information leaflets for distribution to the public, namely:
  - (i) "Unlawful taking of water is prohibited" (see Figure 1 in para. 2.3); and
  - (ii) "Proper use of fire fighting hose reels in buildings";
- (b) two stickers for distribution to the public, namely:
  - (i) "Misuse of fire services water"; and
  - (ii) "Misuse of flushing water"; and
- (c) a 15-second video on "It is illegal to take water from fire hose reels for uses other than fire fighting" uploaded onto the WSD's website.

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**Note 12:** *The target government departments included the Buildings Department, the Civil Engineering and Development Department, the EPD, the FEHD and the Highways Department.*

3.9 Table 5 shows the number of publicity activities held from 2008 to 2010.

**Table 5**  
**WSD publicity activities**  
**(2008 to 2010)**

Publicity activity	Year			Information leaflets/stickers distributed (see para. 3.8(a) and (b))
	2008 (No.)	2009 (No.)	2010 (No.)	
(a) Customer liaison group meeting	3	3	3	Yes (at one meeting a year)
(b) Open day	1	1	1	Yes
(c) Water supplies seminar	1	1	1	Yes (2008 and 2009 only)
(d) Quality Water Recognition Scheme for Buildings certificate presentation ceremony	1	1	1	Yes
(e) School visit	0	18	137	No
(f) Others (Note)	1	3	7	No
<b>Total</b>	<b>7</b>	<b>27</b>	<b>150</b>	

Source: WSD records

Note: These include the World Water Monitoring Day, seminars on Hong Kong waterworks monuments, certificate presentation ceremonies for water conservation ambassadors, and exhibitions.

3.10 As shown in Table 5, the WSD had enhanced its publicity activities by increasing the number of school visits from 18 in 2009 to 137 in 2010. While the WSD distributed information leaflets/stickers to promote public awareness and reporting of suspected unlawful water taking activities at some customer liaison group meetings, open days and water supplies seminars, it did not do so during school visits and some other WSD publicity activities. **The WSD needs to enhance its publicity efforts in the prevention of unlawful water taking.**

*Audit recommendations*

- 3.11      **Audit has recommended that the Director of Water Supplies should:**
- (a)      **consider implementing a regular training programme for WSD officers on handling suspected unlawful water taking cases, particularly on evidence collection and experience sharing of conviction cases;**
  - (b)      **periodically seek assistance from target government departments (such as the FSD, the FEHD and the EPD) for reporting suspected unlawful water taking cases to the WSD for follow-up action;**
  - (c)      **provide training to the officers of target government departments to help detect unlawful water taking; and**
  - (d)      **enhance the WSD's publicity efforts in the prevention of unlawful water taking.**

**Response from the Administration**

3.12      The **Director of Water Supplies** agrees with the audit recommendations. He has said that the WSD will liaise with the government departments concerned to provide training to their officers for detecting unlawful water taking.

3.13      The **Director of Fire Services** has said that the FSD will continue its existing practices of referring to the WSD suspected unlawful water taking cases noted during its routine inspections of fire hydrants and building fire service installations for WSD follow-up action.

3.14      The **Director of Food and Environmental Hygiene** agrees with the audit recommendation in paragraph 3.11(b).

3.15      The **Director of Environmental Protection** agrees with the audit recommendation in paragraph 3.11(b).

## Surprise inspections

3.16 From 2008 to 2010, the WSD carried out 1,020 surprise inspections on unauthorised water consumption (see item (d) of Table 4 in para. 3.3), focusing mainly on cooked food stalls, public markets, residential buildings and villages.

## Audit observations and recommendations

### *Risk-based strategy*

3.17 In May, August and September 2011, the WSD informed Audit that:

- (a) since February 2011, the WSD had adopted a water loss management strategy on reducing water losses. The strategy comprised identifying risk areas for investigation, conducting cost and benefit analyses, formulating action plans and overseeing their implementation;
- (b) as part of the overall strategy on reducing water losses, the Prosecution Unit would adopt a risk-based approach to reducing unauthorised water consumption;
- (c) based on the available resources, the Senior Engineer and the Superintendent of the Unit would give verbal instructions to their subordinates for conducting surprise inspections; and
- (d) the selection of buildings and premises for conducting surprise inspections based on a risk-based strategy was a newly-conceived initiative and documented records had yet to be prepared.

**Audit considers that the WSD needs to document its risk-based strategy for conducting surprise inspections.**

3.18 Audit research revealed that some Australian water authorities had adopted the following strategies for detecting unlawful water taking:

- (a) installing meters for some fire services facilities (such as fire hydrants — Note 13); and

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**Note 13:** *In September 2011, the FSD informed Audit that water to be supplied to fire services facilities should not be affected by the installation of meters.*

- (b) carrying out investigations on water accounts with unusually low water consumption.

**Audit considers that the WSD needs to take into account good overseas practices in formulating its risk-based strategy for conducting surprise inspections.**

#### *Audit recommendations*

**3.19 Audit has recommended that the Director of Water Supplies should instruct the Prosecution Unit to:**

- (a) **formulate and document a risk-based strategy for conducting surprise inspections, taking into account good overseas practices; and**
- (b) **devise and implement a structured programme for conducting surprise inspections.**

#### **Response from the Administration**

**3.20 The Director of Water Supplies agrees with the audit recommendations. He has said that:**

- (a) conducting surprise inspections is part of the overall risk-based strategy for the reduction of water losses. The WSD will document the considerations for the identification of target premises for reference by the Prosecution Unit in arranging surprise inspections; and
- (b) the WSD will issue detailed guidelines on conducting surprise inspections for reference by the Prosecution Unit.

#### **Investigations of suspected cases**

**3.21 After conducting an investigation on a suspected case of unauthorised water consumption, the responsible investigation officer of the Prosecution Unit will report the findings to the Superintendent of the Unit. If action is required to terminate unauthorised connections (remedial action), the Superintendent will refer the case to the responsible district officers of the Customer Services Branch.**

## Audit observations and recommendations

### *Remedial action*

3.22 Audit examination of all the 111 cases of suspected unauthorised water consumption inspected by the Prosecution Unit from October to December 2010 revealed that:

- (a) 25 cases (23%) involved non-compliance with the Waterworks Ordinance and prosecution actions were taken by the Unit;
- (b) 28 cases (25%) were found to have no irregularities or not involving unmetered water supply; and
- (c) 58 cases (52%) involved possible loss of government revenue from unauthorised water consumption as the water supply was unmetered. However, there was insufficient evidence for taking prosecution actions. Of these 58 cases, the district officers of the Customer Services Branch took remedial actions in 43 cases to terminate the unauthorised connections. For the remaining 15 cases, no remedial action was required.

3.23 Audit noted that, of the 43 cases in paragraph 3.22(c) where the Prosecution Unit had informed the Customer Services Branch to take remedial action on terminating unauthorised connections:

- (a) in 13 (30%) cases, the investigation officers of the Prosecution Unit took 11 to 25 working days after the last inspections to report the findings to the Superintendent of the Unit; and
- (b) in 13 (30%) cases, the district officers of the Customer Services Branch took more than 10 working days to complete the remedial action (terminating unauthorised connections) after receiving notifications from the Prosecution Unit. Of these 13 cases, the remedial works for 2 cases took 126 and 136 working days to complete whereas those for 11 cases took 14 to 62 working days.

3.24 In August 2011, the WSD informed Audit that:

- (a) the Superintendent of the Prosecution Unit reviewed all cases of suspected unauthorised water consumption without prosecution, and the Senior Engineer overseeing the Unit reviewed at least 10% of such cases on a monthly basis.

The Unit considered all circumstantial evidences for prosecution and where necessary, sought legal advice for consideration of taking prosecution action; and

- (b) although there were no statistics on the dates of submitting investigation reports, the Superintendent monitored closely the investigation of suspected cases. In 2010, about 94% of the complaint cases were finalised within five months.

3.25 Audit noted that the investigation officers of the Prosecution Unit sometimes took a long time to submit investigation reports to the Superintendent (see para. 3.23(a)). Furthermore, as shown in Case 5 (see para. 3.6), the investigation officer only submitted an interim investigation report to the Superintendent 95 days after conducting the investigation, during which the unauthorised connection was found to have been removed.

3.26 **Audit considers that WSD investigation officers need to promptly submit investigation reports, so that the Customer Services Branch can be informed earlier to take remedial action. The WSD also needs to maintain information on the time of submission of investigation reports to help monitor the progress of investigations of suspected cases. Furthermore, the Customer Services Branch needs to take prompt remedial action to cease unlawful water taking after receiving notifications from the Prosecution Unit.** Prompt action to combat unauthorised water consumption could help minimise water losses.

#### *Maintenance of investigation records*

3.27 Audit examination revealed that:

- (a) investigation results of cases referred by the WSD Customer Telephone Enquiry Centre and the Customer Services Branch were recorded in the computerised Customer Care and Billing System (CCBS), while those of cases received by post or e-mails from the public were recorded in case files;
- (b) details of surprise inspection cases requiring follow-up actions were maintained in case files while those of cases without the need for follow-up actions were only recorded in the diaries of individual investigation officers; and
- (c) the Prosecution Unit maintained a computerised summary of cases under investigation for monitoring the progress of investigations. However, the summary did not include surprise inspection cases without the need for follow-up actions, which accounted for 975 (96%) of the 1,020 surprise inspection cases conducted from 2008 to 2010 (see item (d) of Table 4 in para. 3.3).



3.28 In Audit's view, the WSD needs to maintain records of investigations on all suspected cases in a centralised computer system, which would facilitate the monitoring of progress of investigations, taking of prompt follow-up action and formulation of the risk-based strategy (see para. 3.17).

#### *Audit recommendations*

3.29 Audit has *recommended* that the Director of Water Supplies should:

- (a) instruct investigation officers of the Prosecution Unit to submit investigation reports as early as practicable;
- (b) instruct district officers of the Customer Services Branch to take prompt remedial action to cease unlawful water taking after receiving notifications from the Prosecution Unit; and
- (c) maintain records of investigations on all suspected cases in a centralised computer system, including the time of submission of investigation reports and the progress of follow-up action.

#### **Response from the Administration**

3.30 The Director of Water Supplies agrees with the audit recommendations. He has said that:

- (a) verbal instructions on submitting investigation reports as early as practicable will be documented as a standing instruction for circulation to the staff of the Prosecution Unit every six months;
- (b) the WSD will re-circulate relevant instructions to district officers of the Customer Services Branch on taking prompt remedial action to cease unlawful water taking; and
- (c) the existing record system using computerised spreadsheets will be reviewed and extended to centrally record details of investigations on all suspected cases and the progress of follow-up action.

## PART 4: MANAGEMENT OF WATER METER ACCURACY

4.1 This PART examines actions taken by the WSD on improving accuracy of water meters, focusing on:

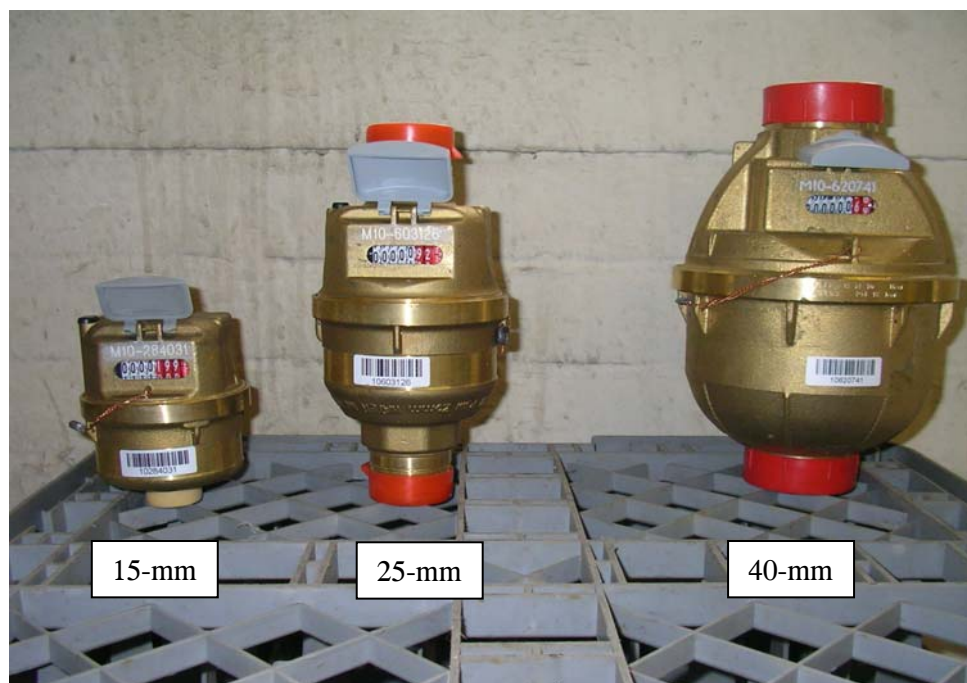
- (a) water meter replacement programmes (paras. 4.8 to 4.29); and
- (b) water meter replacement strategy (paras. 4.30 to 4.35).

### Water meters

4.2 As of July 2011, the WSD had installed about 2.77 million 15-mm meters and 34,000 large meters (25-mm to 300-mm meters — see para. 1.9). Figure 4 shows three water meters of different sizes.

Figure 4

WSD water meters



Source: WSD records

4.3 For billing purposes, readings of all domestic meters and most non-domestic meters are taken by WSD meter readers (Note 14) every four months using hand-held computers. For about 5,000 large-consumption non-domestic meters, their readings are taken on a monthly basis. At times, some meters cannot be read owing to their inaccessibility (e.g. meters located in locked premises). If a meter cannot be read, the meter reader will issue a standard drop card requesting the customer to contact the WSD to arrange a convenient time for meter reading. If a meter cannot be read on two consecutive occasions, the CCBS will generate a letter requesting the registered customer to contact the WSD. If the same meter cannot be read on the fourth consecutive occasions, the CCBS will generate an order requiring WSD field staff to conduct a site inspection and a special meter reading. Under the circumstances, the WSD will make estimates of water consumption based on previous consumption records of the customers.

4.4 Meter readers are responsible for reporting abnormalities (such as suspected unlawful water taking or malfunction of water meters) observed during meter readings by inputting the appropriate codes into hand-held computers. Meter readings and observations are downloaded onto the CCBS for billing and follow-up actions respectively. Based on meter readers' observations recorded in the CCBS, officers of the Customer Services Branch will take appropriate follow-up actions, such as conducting site inspections or replacing meters.

#### ***Water meter accuracy***

4.5 Under regulation 30(2) of the Waterworks Regulations, a water meter shall be deemed to register correctly if its inaccuracy does not exceed 3% above or below ( $\pm 3\%$ ) the correct amount. The WSD has laid down an accuracy requirement of  $\pm 2\%$  in its procurement specification of meters. The WSD has set a long-term overall performance target that 100% of water meters should attain the accuracy rate of  $\pm 3\%$ . According to the WSD, in 2010-11, 95% of 15-mm meters achieved this accuracy rate.

4.6 Owing to mechanical wear and tear, aged water meters become less accurate in registering the quantity of water consumption. In May 1995, the WSD completed a review (1995 Review) of the accuracy of 15-mm meters. The results indicated that meter accuracy would deteriorate with the passage of time and tended to under-register the quantity of water consumption. This potential under-registration of water consumption will lead to under-collection of water charges and loss of government revenue. Periodic replacement of aged meters is an effective means to enhance meter accuracy and minimise loss of government revenue.

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**Note 14:** *As of July 2011, there were 153 meter readers.*

4.7 Under the Waterworks Ordinance, the WSD may install, inspect, test, regulate, alter, repair or remove any part of the waterworks (including meters) or inside service in any premises, subject to obtaining the consent of the occupier of such premises or a warrant issued by the Magistrate.

## **Water meter replacement programmes**

### ***15-mm water meters***

4.8 After completing the 1995 Review, the WSD found that replacing 15-mm meters aged over 12 years would help ensure that 96% of the meters would attain the  $\pm 3\%$  accuracy rate, and would help achieve a net financial gain of \$27.6 million (additional water charges plus saving in maintenance cost, and less meter replacement cost) a year. During the 10 years from 1996-97 to 2005-06, the WSD replaced 1.23 million 15-mm meters aged over 12 years by using its departmental resources. During the five years from 2006-07 to 2010-11, the WSD implemented a meter replacement programme (2006 Meter Replacement Programme) to replace another 1.27 million 15-mm meters aged over 12 years at a total cost of \$250.8 million, of which \$35.5 million (14%) was funded under the Capital Works Reserve Fund and \$215.3 million (86%) under WSD departmental vote.

4.9 In implementing meter replacement programmes, Senior Waterworks Inspectors of the four Sections (namely Hong Kong and Islands, Kowloon, New Territories East and New Territories West Sections) of the Customer Services Branch select appropriate meters in their regions for replacement based on meter installation dates (recorded in the CCBS), locations and costs. Meter replacements are carried out by WSD term contractors or in-house staff. The WSD issues works orders to its term contractors to replace a batch of meters in the same location or residential development with a view to lowering cost. After meter replacements, the WSD will inform the customers concerned by providing a leaflet (see Figure 5).

Figure 5

## Extract of leaflet on meter replacement

**水務署**  
Water Supplies Department

## Advice to the Customer upon Meter Replacement

We have replaced your meter. The domestic meter we use is of volumetric rotary piston type, which measures the volume of water flow through the meter. Since the volumetric measurement of such device will not be affected by the flow rate, its measurement is the most reliable. Also, before the replacement, we have conducted three rounds of test on new meters to ensure that the inaccuracy does not exceed 3 per cent above or below the correct amount as per the requirement of the Waterworks Regulations.

**After meter replacement, some customers may find increase in water consumption probably because :**

- (1) the old meter had already been used for a long time to give a reading smaller than actual ;
- (2) the filter of the old meter might be clogged up to weaken the water pressure. Therefore, upon meter replacement, the water pressure resumes normal. If the degree of tap opening is unchanged, the flow rate will increase. Hence, please adjust the degree of tap opening.

We would also like to draw your attention to the following probable cause of water charge increase and corresponding solutions :

**Common causes for increase in water charges**

- Leaking pipes or taps (The customer is responsible for the proper maintenance of supply pipes and the proper use of water).
- Being forgotten to turn off the water tap.
- Increase in water consumption: Since the charge of domestic supply is calculated on a progressive tariff structure. Therefore, if the volume of consumption increases and falls into a higher charging tier, water charges payable will also substantially increase.
- Illegal water connections or unlawful taking of potable water to use for flushing.

**Corresponding solutions**


- Carry out proper maintenance work. (Note: Except for work of a minor nature, such as rewashing of a tap, the customer should employ a licensed plumber to do the job.)
- Ensure closure of the tap or use automatic water taps.
- Adopt effective ways to save water.
- Disconnect the illegal pipes.

**Simple and convenient ways to detect water leakage by the customer :**

- (1) Turn off all the water taps in the premises tightly ;
- (2) Find out the serial number of the water meter on the water bill, go to the water meter room or meter position and record the digit at the far right of the display window of the meter. Check again after ten minutes and record the digit once more. Compare the two records to see if the digit of the meter rotates ;
- (3) If the digit does rotate, employ a licensed plumber to check and repair.

If you have any doubt about the accuracy of the water meter, you may apply for a meter test at your own expense and have to pay a fee in advance. If inaccuracy of the meter is confirmed to exceed 3 per cent above or below the correct amount, the test fee will be refunded and the water charges will be adjusted appropriately in accordance with the Waterworks Regulations. Otherwise, there will be neither refund of test fee nor adjustment of water charge.

**Water Authority**



G05-073\_cen

Source: WSD records

4.10 Under the 2006 Meter Replacement Programme, 79% of the replacement works were carried out by term contractors and the remaining 21% by WSD staff. Up to March 2011, 1.26 million (99%) of the 1.27 million meters planned under the Programme (see para. 4.8) had been replaced. The WSD has set a target of replacing 210,000 water meters aged over 12 years in 2011-12.

### *Large water meters*

4.11 In May 1997, the WSD completed a review (1997 Review) of the accuracy of large water meters. The results revealed that the optimal service life of 25-mm to 100-mm meters would be **seven years** and that of 150-mm to 300-mm meters would be **four years**. Since then, the WSD has replaced about 5,000 aged large meters a year, representing 15% of the 34,000 large meters in service (see para. 4.2).

### *Improvements in meter accuracy*

4.12 If a customer lodges a complaint about the accuracy of a meter, he may apply for a meter test at his own cost (the cost will be borne by the WSD if the meter is found to have over-registered or under-registered water consumption). Furthermore, the WSD makes use of the CCBS to identify suspected cases of under-registration of water consumption by some meters, and conducts testing of such meters. An upward adjustment will be made to a water bill if the related meter is found to have under-registered water consumption, and vice versa. According to the WSD's records, after implementation of the 2006 Meter Replacement Programme for 15-mm meters (see para. 4.8) and the replacement programme for large meters (see para. 4.11), there had been improvements in the meter accuracy. For example:

- (a) the percentage of 15-mm meters attaining the  $\pm 3\%$  accuracy increased from 92.8% in 2006-07 to 95% in 2010-11; and
- (b) the number of substantiated complaint cases on over-charging of water consumption was reduced from 70 in 2006-07 to 29 in 2010-11 (representing a 59% reduction). Details are shown in Table 6.

**Table 6**  
**Substantiated complaint cases of meter inaccuracy**  
**(2006-07 to 2010-11)**

<b>Year</b>	<b>Complaint  (No.)</b>	<b>Substantiated case with water bill adjustment  (No.)</b>	<b>Net amount of downward water bill adjustment (Note)  (\$)</b>
2006-07	707	70	875,740
2007-08	621	56	431,803
2008-09	519	40	143,359
2009-10	687	47	142,717
2010-11	538	29	258,790
<b>Total</b>	<b>3,072</b>	<b>242</b>	<b>1,852,409</b>

*Source: WSD records*

*Note: Of the 242 cases, 237 (98%) involved downward adjustments and 5 (2%) involved upward adjustments of water charges.*

#### ***Ombudsman's recent review***

4.13 In September 2011, the Office of The Ombudsman completed a review of the WSD's water meter reading and billing system. In his review report, The Ombudsman made recommendations to the WSD in areas of meter reading, testing of meters, enhancement to the CCBS, monitoring of works orders for meter replacements, communication with customers, and staff training and monitoring. The WSD accepted the recommendations for implementation.

#### **Replacement of 15-mm water meters**

4.14 Table 7 shows an ageing analysis of the 2.77 million 15-mm meters in service as of July 2011.

**Table 7**  
**Ageing analysis of 15-mm meters**  
**(July 2011)**

<b>Age (Year)</b>	<b>Meter in service (No.)</b>	<b>Percentage</b>	
Over 30	20,872	1 %	} 161,043 (6%)
21 to 30	53,850	2 %	
13 to 20	86,321	3 %	
12 and below	2,608,405	94 %	
<b>Total</b>	<b>2,769,448</b>	<b>100%</b>	

*Source: Audit analysis of WSD records*

### **Audit observations and recommendations**

4.15 As shown in Table 7, of the 2.77 million 15-mm meters, 161,043 meters (6%) had been installed for over 12 years (3% for over 20 years). Owing to wear and tear over time, these aged meters are prone to inaccuracy. In May 2011, the WSD informed Audit that the reasons for not replacing some of the aged meters were:

- (a) inside service defects (such as defective control valves, and badly corroded or leaking inside services or communal services) were found in some water supply and distribution systems. The WSD would carry out meter replacements after the completion of the repair works by the registered customers;
- (b) the WSD could not gain access to some meters. For example, some meters were located inside locked premises but the WSD was unable to contact the occupiers. In the circumstance, the WSD had to send notices to the occupiers or contact the related parties (such as management offices) to find ways to replace the meters; and
- (c) some management offices, occupiers or registered customers of some buildings did not allow the WSD (or its term contractors) to replace the related meters. The WSD had to tackle this problem by approaching them repeatedly to explain the need for meter replacements, or by giving verbal warnings to them.



4.16 As aged water meters are prone to under-registering water consumption, the WSD needs to expedite action to replace the 161,043 15-mm meters aged over 12 years. The WSD also needs to make an estimate of the potential under-registration of water consumption of these aged meters for assessing the urgency of meter replacements.

4.17 Audit noted that the WSD had encountered difficulties in obtaining the cooperation of the management offices, occupiers or registered customers for meter replacement (see para. 4.15(c)). **To tackle these problems, the WSD needs to consider issuing warning letters and taking enhanced enforcement action (e.g. applying for a warrant from the Magistrate to gain access to premises — see para. 4.7). The WSD also needs to conduct publicity campaigns on meter replacements to inform the public of the need for meter replacements.**

#### *Audit recommendations*

4.18 **Audit has recommended that the Director of Water Supplies should:**

- (a) **expedite action to replace 15-mm water meters aged over 12 years;**
- (b) **estimate the potential under-registration of water consumption of 15-mm meters aged over 12 years;**
- (c) **accord high priority to replacing aged 15-mm meters long overdue for replacement;**
- (d) **consider issuing warning letters to, and taking appropriate enforcement actions on, management offices, occupiers and registered customers who do not render the necessary assistance for meter replacements; and**
- (e) **conduct publicity campaigns on meter replacements.**

#### **Response from the Administration**

4.19 The **Director of Water Supplies** agrees with the audit recommendations. He has said that:

- (a) expeditious action to replace aged 15-mm water meters exceeding their optimal service lives will be taken subject to resources availability; and
- (b) the WSD will publicise the meter replacement programmes.

## Replacement of large water meters

4.20 Audit analysis of large meters in service revealed that, as of July 2011, 10,581 (31% of the total of 33,826 meters) 25-mm to 100-mm meters, and 47 (30% of the total of 157 meters) 150-mm to 300-mm meters had exceeded their optimal service lives of seven years and four years respectively (see Table 8).

**Table 8**  
**Ageing analysis of large meters**  
**(July 2011)**

Age (Year)	Meter in service (No.)	Percentage	
<b>25-mm to 100-mm meter (optimal service life of 7 years)</b>			
Over 20	3	1%	} 10,581 (31%)
11 to 20	3,196	9%	
8 to 10	7,382	21%	
7 and below	23,245	69%	
<b>Total</b>	<b>33,826</b>	<b>100%</b>	
<b>150-mm to 300-mm meter (optimal service life of 4 years)</b>			
11 to 16	10	6%	} 47 (30%)
5 to 10	37	24%	
4 and below	110	70%	
<b>Total</b>	<b>157</b>	<b>100%</b>	

Source: Audit analysis of WSD records

## Audit observations and recommendations

4.21 Aged meters pose a risk of under-registration of water consumption and lead to under-collection of water charges. **The WSD needs to expedite action to replace aged large meters exceeding their optimal service lives of seven years (for 25-mm to 100-mm meters) and four years (for 150-mm to 300-mm meters). The WSD also needs to accord high priority to replacing aged large meters long overdue for replacement.**

### *Audit recommendations*

4.22 **Audit has recommended that the Director of Water Supplies should:**

- (a) **expedite action to replace aged large water meters which have exceeded their optimal service lives; and**
- (b) **accord high priority to replacing aged large meters long overdue for replacement.**

## Response from the Administration

4.23 The **Director of Water Supplies** agrees with the audit recommendations. He has said that expeditious action to replace aged large water meters exceeding their optimal service lives will be taken subject to resources availability.

## Replacement of water meters for government establishments

4.24 Fresh water supply to government establishments is provided free of charge. The WSD maintains Waterworks Operating Accounts to record operating costs and notional revenue for services provided to government departments. The Waterworks Accounts Committee (Note 15) meets once a year to examine the Accounts.

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**Note 15:** *The Committee is chaired by the Permanent Secretary for Financial Services and the Treasury (Treasury) with members comprising the Director of Water Supplies, and senior officers of the Financial Services and the Treasury Bureau, the Development Bureau, the Information Services Department, the Treasury and the WSD.*

## Audit observations and recommendation

4.25 Audit examination revealed that, as of July 2011, there were 12,264 water meters installed in government establishments, of which 1,134 (9%) had exceeded their optimal service lives (see Table 9).

**Table 9**  
**Meters in government establishments**  
**(July 2011)**

Type of meters	Optimal service life (Year)	Meter in service (a) (No.)	Meter exceeding optimal service life (b) (No.)	Percentage $(c) = \frac{(b)}{(a)} \times 100\%$
15-mm	12	9,463	483	5%
25-mm to 100-mm	7	2,781	641	23%
150-mm to 200-mm	4	20	10	50%
<b>Overall</b>		<b>12,264</b>	<b>1,134</b>	<b>9%</b>

Source: Audit analysis of WSD records

4.26 The WSD provides water consumption reports to some government bureaux and departments (B/Ds) for them to monitor their water consumption and take appropriate water conservation measures where necessary. Furthermore, significant increases in water consumption of a government establishment over a period of time may indicate leakage in the water supply and distribution system, calling for investigations and rectifications. In 2010-11, the WSD provided annual departmental water consumption reports to seven B/Ds (Note 16) and periodic reports on specific water accounts to four B/Ds (Note 17) in response to their requests.

4.27 As one of the water demand management initiatives under the Total Water Management Strategy (see para. 1.4), the WSD commissioned two consultancy studies in 2010 (target completion in 2011) to review the water consumption of parks and swimming pools of the Leisure and Cultural Services Department and the WSD's installations, with a view to compiling best practice guidelines. As of September 2011, the review was in progress. The WSD has planned to conduct further studies in 2012 and 2013 on major government facilities consuming about 90% of the total government water consumption. **B/Ds need to set good examples by maintaining accurate meters in government establishments. This can provide reliable information for the formulation of water conservation strategies.**

#### *Audit recommendation*

4.28 **Audit has recommended that the Director of Water Supplies should expedite action to replace aged water meters exceeding their optimal service lives in government establishments.**

#### **Response from the Administration**

4.29 The **Director of Water Supplies** agrees with the audit recommendation. He has said that expeditious action to replace aged meters in government establishments exceeding their optimal service lives will be taken subject to resources availability.

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**Note 16:** *The seven B/Ds were the Agriculture, Fisheries and Conservation Department, the Civil Aviation Department, the Correctional Services Department, the Education Bureau, the Department of Health, the FEHD and the Hong Kong Police Force.*

**Note 17:** *The four B/Ds were the Government Logistics Department, the Government Property Agency, the Leisure and Cultural Services Department and the Marine Department.*

## Water meter replacement strategy

### *2009 Review*

4.30 In October 2009, 14 years after the 1995 Review (see para. 4.6), the WSD commenced another review (2009 Review) of the strategy for 15-mm meter replacement. The review was originally scheduled for completion in March 2011, which was later extended to September 2011.

## Audit observations and recommendations

### *Meter replacement strategy reviews*

4.31 With rapid advancements in technologies, more reliable and cost-effective water meters and meter reading methodologies have emerged from time to time. In 2009, the WSD commenced a review of the meter replacement strategy for 15-mm meters, 14 years after the 1995 Review. Audit also noted that, since the 1997 Review (see para. 4.11), the WSD had not conducted any review of the replacement strategy for large meters. **The WSD needs to conduct periodic reviews of the meter replacement strategies for both 15-mm and large meters, taking into account new types of water meters and new meter reading methodologies available.**

4.32 Audit noted that the WSD made reference to strategies and practices adopted by some overseas water authorities, including those of Australia and the United States of America, in drawing up meter replacement plans. The water meter replacement cycles of some of these water authorities were determined based on cost-and-benefit analyses, taking into account the water cost, meter type and age, customer average water consumption and meter replacement cost. Audit research revealed that some overseas water authorities had adopted different strategies for meter replacement. For example:

- (a) according to the water authority of **Singapore**, in 2008, it adopted a strategy of:
  - (i) replacing a domestic water meter upon its cumulative meter registration reaching 4,000 m<sup>3</sup> or the meter reaching the age of 15 years;
  - (ii) replacing non-domestic meters every seven years; and
  - (iii) replacing meters for large-consumption customers every year; and

- (b) according to the water authority of **Macao**, new analysis models had been developed to locate problematic water meter categories for identifying suitable arrangements and priority for meter replacement. After adopting these models, the water authority estimated that the efficiency of meter replacement had increased by 20% as compared with the previous replacement scheme which was based on the years of manufacturing and readings of meters.

### ***Management information***

4.33 Audit noted that the WSD would re-condition (Note 18) selected aged large meters to extend their service lives. However, the dates of re-conditioning of these meters were not readily available from the CCBS, adversely affecting analyses of aged meters for replacement. **Audit considers that, on the basis of service years after meter re-conditioning, the WSD needs to consider producing periodic ageing-analysis reports for meters exceeding their optimal service lives for management information, monitoring and prompt replacement action.**

### ***Audit recommendations***

4.34 **Audit has recommended that the Director of Water Supplies should:**

- (a) **conduct periodic reviews of the meter replacement strategies for 15-mm and large meters, with reference to good overseas practices; and**
- (b) **examine the feasibility of producing from the CCBS periodic ageing-analysis reports for large meters based on their service years after meter re-conditioning.**

### **Response from the Administration**

4.35 The **Director of Water Supplies** agrees with the audit recommendations. He has said that the WSD will examine (together with the contractor of the CCBS) the feasibility of generating periodic ageing-analysis reports for large meters based on their service years after meter re-conditioning.

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**Note 18:** *A used meter can be re-conditioned by replacing the worn-out parts so that the meter can be reused. The WSD examines the cost-effectiveness, availability of spare parts and manpower to decide whether a meter should be disposed of or re-conditioned.*

## **PART 5: PERFORMANCE REPORTING**

5.1 This PART examines the performance reporting of the WSD's actions and effectiveness in reducing unauthorised water consumption and improving meter accuracy.

### **Performance targets and indicators**

5.2 The WSD publishes key performance targets, indicators and levels of achievement in its annual Controlling Officer's Report (COR). WSD Annual Reports and performance pledge booklets also include standards of service, performance targets and achievements. Some performance information is also uploaded onto WSD website.

#### ***Guidelines on performance reporting***

5.3 In September 2009, the Civil Service Bureau issued Circular No. 7/2009 "Performance Pledges in the Civil Service", setting out the guidelines for the implementation of performance pledges in the civil service. In its circular memorandum on submission of draft Estimates of General Revenue Account issued in October each year, the Financial Services and the Treasury Bureau also provides guidelines to B/Ds on developing performance targets and indicators.

### **Audit observations and recommendations**

#### ***Performance targets for enforcement actions***

5.4 Effective setting of performance targets and timely publishing of the extent of achievement of the targets help enhance public accountability and provide incentives for service improvements. The WSD has included in its COR the following performance indicators relating to enforcement actions under the Waterworks Ordinance and the Waterworks Regulations:

- (a) the number of prosecutions in a year (e.g. 167 cases in 2010); and
- (b) the total amount of fines imposed resulting from the prosecutions (e.g. \$366,500 in 2010).



5.5 To further enhance public accountability, the WSD needs to consider setting performance targets and indicators on the number of publicity campaigns, seminars, and training sessions for the promotion of combating unauthorised water consumption. In this connection, Audit noted that the WSD had set a target that its Prosecution Unit needed to conduct an investigation within five working days after receiving a complaint on suspected unauthorised water consumption (see para. 3.2). However, this performance target was not included in the COR of the WSD.

*Performance targets for meter accuracy and replacement*

5.6 In its CORs from 2007-08 to 2011-12, the WSD published performance targets on attaining the meter accuracy of within  $\pm 3\%$  (see Table 10).

**Table 10**

**Performance targets for meter accuracy in CORs  
(2007 to 2011)**

Year	Long-term target	Annual target	Actual achievement
2007	100%	93.7%	93.1%
2008	100%	93.7%	93.6%
2009	100%	94.5%	94.1%
2010	100%	95.3%	94.8%
2011	100%	95.3%	Not yet available

Source: WSD records

5.7 The WSD published its long-term target (of 100% meters meeting the  $\pm 3\%$  accuracy rate), the annual targets (ranging from 93.7% to 95.3%) and actual achievements (ranging from 93.1% to 94.8%) in its COR. However, Audit noted that, in its Annual Reports and performance pledge booklets, the WSD only published the long-term target and actual achievements, without the annual targets. **The WSD needs to include the annual targets in the two publications. The WSD also needs to upload the annual targets onto its website.**

5.8 To make estimates of meter accuracy, the WSD selected 500 15-mm water meters every month for testing (125 meters randomly selected from the CCBS and 375 from closed customer accounts based on the meter-age distribution). According to the WSD, only 15-mm meters were selected for testing because they accounted for 99% of the total number of meters installed.

5.9 Audit noted that, in 2010-11, water charge revenue relating to large meters (25-mm to 300-mm meters) amounted to \$872 million, accounting for 34% of the total water charge revenue of \$2.56 billion. **In view of the high percentage of water charge revenue involved, the WSD needs to consider selecting samples of large meters for carrying out accuracy tests. It also needs to consider setting performance targets on the percentages of 15-mm and large meters beyond their optimal service lives and the percentages of such meters to be replaced annually.**

#### *Audit recommendations*

5.10 **Audit has recommended that the Director of Water Supplies should:**

##### *Performance targets for enforcement actions*

- (a) **set performance targets and indicators on the number of publicity campaigns, seminars, and training sessions for the promotion of combating unauthorised water consumption;**
- (b) **publish in WSD publications and on WSD website:**
  - (i) **the extent of achieving the performance targets on combating unauthorised water consumption; and**
  - (ii) **the performance target and extent of achievement on the time for conducting an investigation after receiving a complaint on suspected unauthorised water consumption;**

*Performance targets for meter accuracy and replacement*

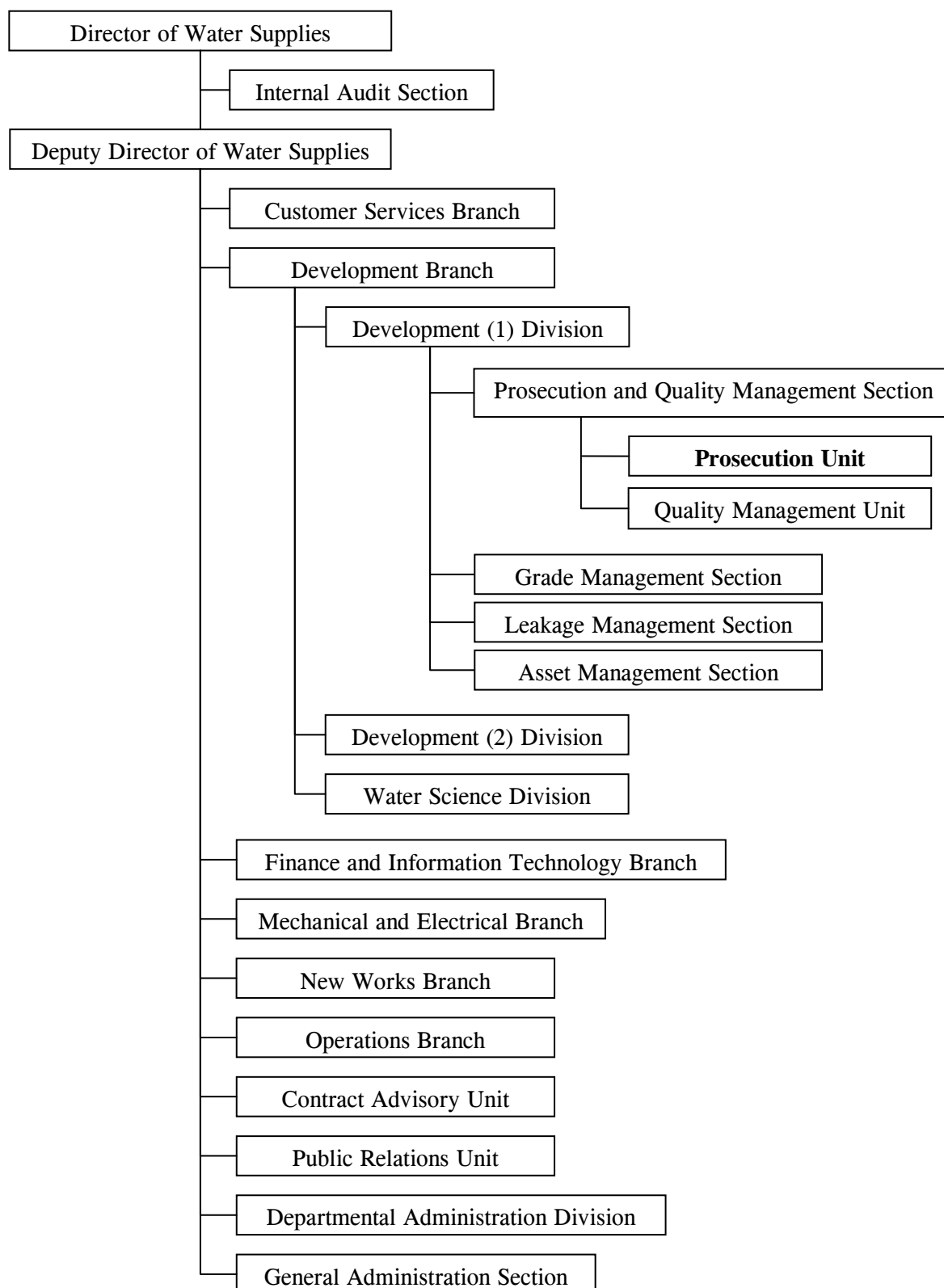
- (c) **publish annual targets on water meter accuracy in WSD publications and on WSD website;**
- (d) **include large water meters in selecting samples for accuracy testing;**
- (e) **set performance targets on the percentages of 15-mm and large meters beyond their optimal service lives, and the percentages of such meters to be replaced annually; and**
- (f) **publish the extent of achieving the performance targets on water meters in WSD publications and on WSD website.**

**Response from the Administration**

5.11 The **Director of Water Supplies** agrees with the audit recommendations.

5.12 The **Secretary for Financial Services and the Treasury** has said that, while the Director of Water Supplies as the Controlling Officer agrees to consider including new performance targets and indicators in the COR, the Financial Services and the Treasury Bureau will keep in view the WSD's implementation of the audit recommendations in preparing the draft Estimates in future.

**Organisation chart of Water Supplies Department  
(August 2011)**



Source: WSD records

**Acronyms and abbreviations**

Audit	Audit Commission
B/Ds	Bureaux/departments
CCBS	Customer Care and Billing System
COR	Controlling Officer's Report
EPD	Environmental Protection Department
FEHD	Food and Environmental Hygiene Department
FSD	Fire Services Department
m <sup>3</sup>	Cubic metres
mm	Millimetres
Mm <sup>3</sup>	Million cubic metres
OC	Owners' Corporation
WSD	Water Supplies Department