



Executive Summary, Conclusions and Recommendations

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Background

The National Audit Office (NAO) carried out the performance audit: “Water Loss Control Management by the Water Services Corporation”. Wherever possible, the report takes into consideration data available up to 2008. This report examines how the Water Services Corporation (WSC) carries out its responsibilities to minimise water losses.

In theory, the water available in the System Input Volume (SIV), that is the water available for distribution, should be wholly accountable through metered billing. The WSC’s water production in Malta and Gozo amounts to nearly 31 million cubic metres. In practice, due to a number of factors, a discrepancy between the SIV and the amount of metered water materialises. Water losses can be categorised as real and apparent losses. As at end 2007, these losses amounted to over 41 per cent of the water available for distribution.

Real losses are physical water losses from the pressurised distribution system, up to the point of customer metering. The volume lost through all types of leaks, bursts and overflows depends on frequencies, flow rates, and average durations of individual leaks. The WSC estimated that real losses amounted to over 18 per cent of the SIV (5.6 million cubic metres) in 2007. Real losses are valued at variable cost of water production and distribution incurred by the Corporation.

Apparent losses refer to the water that is consumed but is not properly measured, accounted or paid for. In 2007 the WSC estimated that apparent losses amounted to around 23 per cent (7.13 million cubic metres) of the SIV. Apparent losses are valued at retail billing rates. Consequently, such losses cost the WSC revenue and distort data on customer consumption patterns.

This audit focused on the WSC’s management regarding real and apparent losses. In this respect, the main objectives of this exercise included the determination of:

- the adequacy of the WSC’s initiatives to detect, monitor and record water losses; and
- the adequacy of the WSC’s management of water loss control.

Real Losses

An Infrastructure Leakage Index (ILI) close to 1.0 demonstrates that all aspects of a successful leakage management policy are being implemented – such a ratio is, in practice, unattainable since it denotes that all of the losses incurred by a system are unavoidable losses. Economic values of the ILI depend on the system specific marginal cost of real losses, and typically lie in the range of 1.5 – 2.5 for most systems.¹ The WSC is aiming to attain an ILI of 2.0 by 2009. Since 2001, the ILI within the hydrologically encapsulated zones in Gozo remained stable at 1.5. For zones in Malta, the ILI decreased from an average of 5.0 in 2004 to 2.97 in 2008.

Trunk mains water balances are accurate to within five per cent, which is the potential error margin of meters. To date trunk mains and reservoir losses were not included in the WSC’s estimation of real losses. These losses are instead being considered as a balancing item under apparent losses in order to reconcile the water account. At the time of writing this report, the WSC was in the process of centralising the responsibility to account for trunk mains and reservoir losses by allocating such responsibility to its Control Room.

Since the establishment of the Corporation in 1992, the WSC adopted a strategy to substantially reduce real losses. Such strategy involved the following major phases:

- i. Efforts to quantify real losses;

¹ Thornton J. (2002). Water Loss Control Manual, McGraw-Hill: USA (p.48).

- ii. A business re-engineering programme which divided the Maltese Islands into four Regions (the Northern, Central and Southern Regions in Malta, and Gozo) to optimise the efficiency and control of all the WSC's operations;
- iii. Pilot studies and trials in order to develop strategies, test and monitor leakage control methodologies; and
- iv. Implementation of the leakage control management methodology - currently in use by the WSC. This approach encompasses five interrelated components: pressure management, active leakage localisation, network rationalisation, dynamic leak repair, and the replacement of critically weak pipe-work.

The WSC was actively implementing the above methodology throughout the four regions. This claim is not only supported by the actual ILI results but by a number of good practices observed during the course of this audit, namely:

- the use of Information Technology (IT) to monitor water leakages enables the WSC to locate water leakage to within one of its three hundred encapsulated hydrological zones;
- the various pilot studies which were embarked upon;
- a provision in the WSC's quality service charter to repair reported leaks within 24 hours; and
- regular and formal management meetings to discuss issues related to water management within the four regions.

Despite the foregoing, this audit revealed that the opportunity exists for the WSC to further exploit the benefits of IT. In fact, in-house developed software - the Water Accounting System (WAC) - was hardly utilised by the Corporation since it was not supported with Automated Meter Reading (AMR) technology. Although the implementation of the latter technology is actively being pursued by the Corporation, the WAC is now considered as obsolete. The Corporation is in the process of commissioning a state of the art computerised system to comprehensively handle real and apparent losses. The new technology is also viewed by the WSC as complimentary to the AMR project.

In addition, substantial backlogs of postings relating to cost of repairs has only recently been cleared up. The lack of computerised records in this regard prohibited the WSC from having up to date management information to gauge the cost efficiency and effectiveness of repairs

being undertaken. The Corporation remedied this situation through the introduction of electronic job sheets and costing systems.

Apparent Losses

The Corporation's strategic plan for 2005 – 2008 aimed to reduce apparent losses from the 23.2 per cent recorded at end 2007 to around 18.6 per cent of the SIV – a decrease of 20 per cent. Such a target, however, was considered as premature since it is only recently that work to compile an *ad hoc* strategy to deal with apparent losses has started.

As at end 2007, the WSC estimated apparent losses at around 23 per cent of the SIV. However, the WSC has not fully broken down this amount into the various components – such as, billing system errors and unauthorised consumption. Such a state of affairs prohibits the Corporation from compiling a more realistic strategy, where resources are allocated in accordance with priorities, to tackle apparent losses. The WSC contends that it will be in a stronger position to analyse apparent losses once the AMR is implemented.

One of the principal contributors to apparent losses is customer meter inaccuracies. Customer meter inaccuracies refer to the under-registration of consumption of water meters. This generally occurs due to the quality and inaccuracy of meters. In order to deal with meter inaccuracies, the WSC replaced most of the meters installed with Class D meters, which are considered more accurate than the previous Class. As at September 2008, 16,350 were Class C or older (pre 1994) whilst another 25,250 were Class D but did not have a pulse output to which an AMR module can be connected.

The weighted average meter inaccuracy, based on the findings of a WSC's internally commissioned study on the performance of domestic customer water meters, stands at nearly 16 per cent. This implies that the WSC is not billing 16 per cent of water consumption due to the inaccuracies of meters. The problem is mainly caused by meters which are aged 10 years and over. There are over 51 per cent of these meters installed. The combined estimated weighted average error of these meters results in the WSC not billing over 13 per cent of water consumption. During the period 2009 – 2011, the WSC is planning to replace 120,000 'old' meters. The Corporation contends that through this initiative the combined estimated weighted average error rate of meters would decrease to around 5.75 per cent.

Indirect plumbing systems, which are widespread in Malta and Gozo, are a significant contributor to meter under-registration. These plumbing systems are generally dependant on float-valve controlled water storage – such as roof water storage tanks. An internal study by the WSC in September 2008 concluded that with a roof storage tank

(indirect) system, no matter how efficient the low-flow and starting-flow characteristics of a new rotary piston mechanical meter are, there will always be a quantity of water that would be consumed without the billing meter registering it. On the assumption that average domestic consumption amounts to 318 litres of water daily, the WSC's study team contends that an indirect plumbing system will result in an under registration of the 'best' meter tested by 2.8 litres of water daily or 0.9 per cent of consumption.

Meter reading inaccuracies contribute to apparent losses. The use of technology has drastically reduced the Corporation's billing system data errors. The WSC has already embarked on projects like the Off-Site Meter Reading (OMR) - a hand-held computer that has replaced the old manual (paper-based) record system. Its advantages include the transferring of metering activity information directly into the billing database on the same day² and the avoidance of a possible human inputting error. In fact, since the introduction of the OMR, data handling errors emanating from transcription or posting errors are considered as insignificant. The introduction of AMR will further facilitate water losses management since it would enable the Corporation to obtain customer meter readings at a single cut-off date.

The improvements registered by the WSC in the estimation procedures of unread meters resulted in a decrease of apparent losses. Legal Notice 331 / 2008 places the onus for ensuring that customers' meters are read and that the Corporation is duly informed by the WSC's clients. The WSC makes an estimate of consumption in situations where no actual readings are available and where the user has not forwarded the relative meter reading. WSC's estimation procedure entails establishing an average daily consumption rate as based on two historical actual readings, one of which has to be dated at most 540 days and the other at most 1,080 days back from the day when consumption is to be estimated. The NAO's verification exercise, based on 146 out of the 210,035 estimations of meter readings, revealed that in 56 per cent of the cases (82 cases) it was not possible for the WSC to derive an estimate since there were no previous readings available. In these cases, the bills were based on benchmarks.

According to the WSC's records, 11,517 accounts out of a total of 210,035 accounts³ have not had any actual meter reading during the period reviewed: January 2003 – July 2006. A random sample of 372 of these 11,517 accounts revealed that in 203 cases – 55 per cent, the WSC had no access to consumers' premises. In another 108 of the sampled cases – 29 per cent, the customer indicated that the meter would no longer be used. The WSC's

'accessibility' problem can be contextualised against the National Statistics Office's (NSO) estimate that, as at end 2005, there were over 53,000 unoccupied dwellings in Malta and Gozo.

Following the verification of billing errors claims by consumers (claims variations), the Corporation duly refunds the over-charged amount to the claimant. Although the Corporation's accounting records are duly updated, the electronic system in place does not permit that the relative changes be made to the water account. This situation potentially leads to under registration of apparent losses since claims variations generally relate to over-estimated consumption.

The WSC is tackling water theft in a reactive manner as it limits its efforts to investigating reports from the public. Such reports are followed up by WSC inspectors. Generally, perpetrators prefer to avoid court proceedings and settle the issue immediately by paying the amounts due. Recent legislative amendments, incorporated in Legal Notice 331 / 2008, place the WSC in a position to take a stricter stance with regards to water theft. This Legal Notice stipulates that damages payable for water theft are not to be less than €1,500.

Conclusions

This audit established that generally the WSC's initiatives to detect, monitor and record water losses have led to significant reductions in water losses. The results attained by the WSC are also a positive indicator of the adequacy of the WSC's management of water loss control, particularly with regards minimising real losses. Despite the progress registered the opportunity exists for the WSC to decrease the level of water losses from the 41 per cent of the SIV (as at end 2007) to a level of losses which is closer to what is considered as unavoidable losses.

The WSC's efforts to curb real losses have proved successful although predetermined ILI targets in the 300 zones were marginally missed. Minimising real losses entailed a significant capital investment in Malta's water distribution infrastructure. Moreover, such a capital expenditure was complemented with the Corporation adapting the corresponding business, technical and management practices. It is also worth noting that, through its Customer Care Section, the WSC enabled consumers to contribute towards minimising water losses by reporting leakages. Despite the progress registered the Corporation has to continue with its efforts to further decrease real losses.

² WSC Annual Report 2002/3, Operations Review, p. 13.

³ Throughout this report, the number of accounts quoted may vary. This is due to different cut off dates utilised for the various audit tests undertaken.

In contrast, the WSC is increasingly shifting its focus to tackle apparent losses. As a consequence, initiatives intended to reduce apparent losses have been mainly directed at reducing data handling errors and the replacement of older meters. Such an approach is understandable since errors of this type not only have an impact on any apparent losses estimation but also negatively affect the Corporation's clients through erroneous billing. Moreover, the WSC has completed studies on the impact of the indirect plumbing system and the under-registration of meters.

The Corporation is in the process of awarding the relative contracts relating to the implementation of the AMR. This will facilitate meter reading and consequently enable a more accurate calculation of apparent losses. In addition, the opportunity exists for the Corporation to further increase its efforts towards minimising water theft.

Recommendations

In view of the foregoing, the NAO proposes that the WSC considers the implementation of the following recommendations:

- i. The calculation of the ILI be fine tuned to render such calculations more reliable. This entails that the WSC reconsiders its practice to utilise as a constant factor in the ILI calculation the legitimate night consumption throughout all zones. The legitimate night consumption could be based on additional criteria, such as industrial, commercial, agricultural, entertainment zones, etc., other than just residential areas;
- ii. The introduction of an economic leak intervention model be considered. This will further aid the WSC in prioritising its schedule of infrastructural, maintenance and repairs;
- iii. A strategy on how the WSC plans to minimise apparent losses be drawn up and communicated to all stakeholders involved;
- iv. The relative adjustment to the water account be made following the verification of billing errors claims by consumers. Such an approach will ensure a more reliable estimate of water losses;
- v. Recommendations proposed through the WSC's internal study 'A Research Projected at Improving the Water Metering Policy of The Water Services Corporation of Malta' be followed up. The potential benefits to be derived by following up this study's recommendations will not only reduce apparent losses but will also contribute towards ensuring that the Corporation recoups all revenue due related to consumption;
- vi. Co-ordination between the various sections of the WSC be enhanced to enable the Corporation to take on a more pro-active role to tackle water theft. The opportunity exists for the WSC to tackle theft through a risk analysis approach. Such an approach would take into consideration clients' particular characteristics (namely, industrial, commercial, agricultural, entertainment and residential) and consumption trends. Moreover, this approach would be complemented with reports from the public as well as inspections by the WSC; and
- vii. Strict application be made of penalties existing in current legislation.