Sustainable DMA Management to Monitor and Reduce Leakage

- This article, by John Morrison and Steve Tooms, has been written to promote the publication of the IWA Water Loss Task Force (WLTF) DMA Guidance Notes.

Introduction

District Metered Area (DMA) management is a well proven technique which when implemented correctly in conjunction with other measurers can effectively assist reduce or monitor leakage levels with the distribution network.

The technique as currently practised has been utilised for over 25 years. DMA management is basically the measurement of flows into discrete parts of the network and the subsequent analysis of the flow particularly at night to estimate the level of leakage (typically the night flow into an area minus the assessed customer night use) and determine the level leakage that can be reduced.

The use of DMAs has proved suitable for leakage control with many differing network configurations, irrespective of whether the customers are unmetered or metered and on both continuous and intermittent supply systems. One American network, which has a Customer Automatic Meter Reading System that allows for customer meter readings during minimum night hours, is linking actual customer consumption at night to DMA night flow to enhance the leakage analysis. (Philadelphia Water Department)

In combination with other techniques (such as pressure management, free/subsidised quick repair of bursts on private supply pipes, etc.), DMA management has helped the water industry in England and Wales reduce leakage significantly and one company has reduced leakage by nearly 50 percent over 10 years (Figure 1).

![Leakage ML/day](chart.png)

Figure 1. An example of how a UK water utility has reduced leakage by DMA management
Examples of the successful implementation of DMAs, and the subsequent reduction of leakage, are not confined to the UK, and the DMA Guidance Notes publishes examples from:

- El Dorado Irrigation District, California, USA
- California, USA
- Water Board of Lemosos, Cyprus
- Johore, Malaysia
- Halifax Regional Water Commission, Canada
- Jakarta, Indonesia

Over the last 20 years or so various key international documents have been published which aim to improve water loss management. These are:

1980 Leakage Control Policy and Practice (Report 26), UK
1987 District Metering: Part 2: System Operation, UK
1994 Managing Leakage Reports, UK
1999 A Manual of DMA Practice, UK
2001 Leakage Management and Control, WHO, Geneva
2002 Losses in Water Distribution Networks, UK
2004 Managing Leakage by District Metered Areas, UK
2005 Managing and Reducing Losses from Water Distribution Systems, Australia
2006 Water losses control in drinking water systems, Portugal
2007 Leakage Management Technologies, AWWA

The latest publication, from the IWA Water Loss Task Force (WLTF), is “DMA Guidance Notes”, available as a download from the WLTF web site www.iwaom.org/wltf. The Guidance Notes are intended as an introduction for leakage practitioners to the benefits, design and management of active leakage control activities based on the use of DMAs. It is part of a series of Guidance Notes prepared by the WLTF to cover all aspects of Water Loss Management.

**Sustainable DMA Management**

DMA management is only successful if it is introduced as part of a total sustainable package, as the technique is part of a permanent long-term strategy to monitor, reduce and control leakage. Often this long-term commitment is not well understood and planned for.

For the technique to be sustainable three key conditions have to be created:

- Commitment from key decision-makers within the utility
- Adequate technical understanding
- The organisational and information systems

**Commitment:**
Many words have been written about how to persuade an organisation to accept new practices. However, the basic requirement is to develop a convincing argument in favour of change, and this should be soundly based on engineering principles and facts. In the utility there should be a long-term commitment at director level to the strategy, a clear understanding of what is required and the financial implications. This commitment should be cascaded down throughout the utility and the key requirements identified, to enable commitment and enthusiasm for the total package at all levels. Unfortunately there are many instances where trial DMAs have been introduced into a utility, but in the long term these have not been successful because not all of the requirements to ensure sustainability have been put in place. DMA management is often considered as just the creation of areas that can be measured.

However, there are numerous examples of utilities where DMAs have been implemented successfully. These demonstrate that the technique can be sustained, and the IWA DMA Guidance Notes illustrate examples of these successes. There are also some simple but persuasive mathematical and economic models to illustrate the benefits of DMAs in practice.

**Technical Understanding:**

The development of the ‘BABE’ (Background and Bursts Estimates) component analysis of leakage (Lambert, 1994)\(^{(12)}\) has been a big contribution to the technical understanding and analysis of leakage. It enables the interaction of activities such as run time of bursts, and the pressure and size of DMAs to be understood. This technical understanding was further enhanced by the FAVAD (Fixed and Variable Area Discharges) concept (May, 1994)\(^{(13)}\), which allowed different BABE components of Real Losses to be assigned different pressure flow relationships, leading to the ability to separate 24-hour DMA inflow data into components. Figure 2 illustrates the diurnal flow pattern and the components of night flow.
For successful implementation, this technical understanding needs to be spread to a number of people within the organisation. To achieve this, a training programme will be required, tailored to the needs of the different departments and skill levels within the utility.

Good technical understanding of the issues also leads to good design. The initial design contributes to the sustainability of the DMA. The design should consider pressures, topography, size of DMA required and a good understanding of how the network is operated, with practical considerations. If these factors are considered there is no reason why the basic configuration of the DMA cannot be permanent - many of the DMAs set up some 20 years ago still function today as originally designed.

**Systems:**

With this technical understanding it is possible to develop the systems required to make the DMAs sustainable. The criteria for this would typically be:

- Data flow capture
- Data storage and analysis of flows
- Work management
- Mapping of network GIS
- Customer records
- DMA maintenance

With the correct systems in place it is possible to have effective analysis of flows to direct leakage technicians to the most effective areas to carry out location and repair of bursts.

As each of the systems and methods are developed and enhanced, training should be seen as an ongoing commitment as new staff are recruited, systems developed and enhanced and new equipment becomes available to undertake the various tasks. Figure 3 summarises all the requirements, and their interaction, for system sustainability.

DMA management as one of the tools to monitor and control leakage must not be seen as a ‘quick fix’. It is a long term commitment, which, if implemented correctly with a full understanding of the sustainable issues, can be one of the most effective measures to safeguard the planet’s most precious resource.
The Way Ahead:

For utilities there is an ever-growing range of equipment and techniques that are promoted as the way ahead. In reality each piece of equipment or technique is one of many tools available in the leakage control toolbox, which need to be used in conjunction with other tools. At “Water Loss 2007” the specialised conference of the WLTF to be held in Bucharest, Romania from 23 - 26 September 2007, these and other aspects of Water Loss Management will be discussed and debated. The aim is to identify when the various techniques and tools are best utilised, how these should be integrated, and to collate this work into future Guidance Notes.

References


(11) AWWARF report “Leakage Management Technologies” due for publication late 2007
