

Measuring customer night use - Severn Trent makes major investment in Socrates

Severn Trent Water has implemented the inclusion of Socrates within their leakage management strategy. The determination of accurate customer night use is providing more robust reporting information, whilst also helping target leakage more efficiently within District Meter Areas (DMAs). Until recently customer night use has been derived solely from existing individual household monitors but it was identified that Socrates derived data could add considerable value to this important information.



Seasonally accurate customer night use data – why is it important?

The importance of seasonally accurate customer night use information is becoming more evident, especially in areas of the network where leakage is proving difficult to reduce further. Unsuitable night use

can lead to inefficiencies as valuable leakage reduction resources are deployed to the lower priority areas, and possibly more than once! Better understanding of consumption patterns is the key to identifying true leakage and thus the appropriate action required.

Household monitors pose problems for measuring summer night use

Many UK water companies use individual household monitors to measure per capita consumption. A typical installation is established at Severn Trent Water, where one thousand carefully chosen homes are monitored by SMS loggers. This provides a statistically robust estimate of daily per capita consumption.

Severn Trent Water investigated the best method for collecting accurate customer night use information. It was found that household monitors could give them reliable night use information in winter months but there would be value in a solution that could help assess the summer

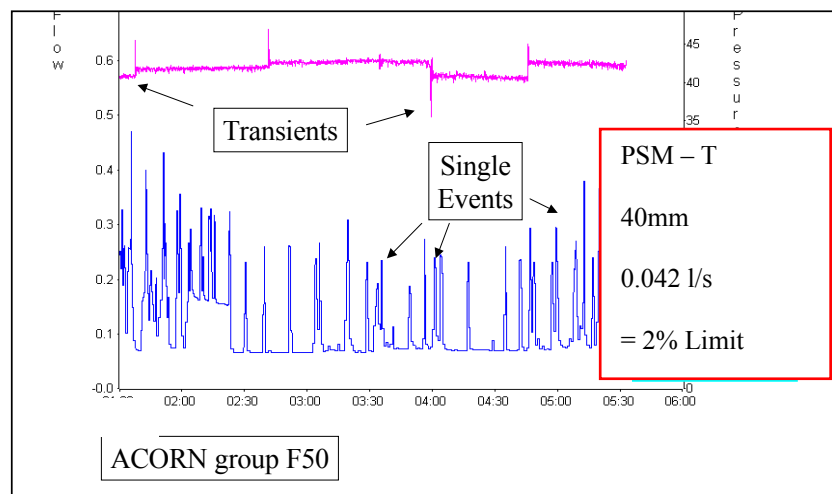


Figure 1 – Socrates Penetration to Core Flow on a Small CMA

night use more rigorously. Typical winter night time consumption showed about 85% of properties using no water during the minimum hour, with the remainder (15%) using an average of around 12 litres. The average winter night use was approximately 1.9 l/prop/hr. However, using the household monitor alone for these calculations in summer was found to be much more problematic.

In summer months Severn Trent found that the majority of customers used virtually no water and a small proportion used 11-15 l/prop/hr. However, a tiny proportion (typically 1 - 4 properties) were using very large quantities - up to 1,500 l/hr! It was not totally surprising that this extra usage exhibited patterns typical of hose pipe and sprinkler users. Even though tiny numbers of aberrant properties were involved their effect on the night use estimation was disproportionately large. Using this information the night use average works out at 4.76 l/prop/hr! With so few properties contributing to the bulk of the consumption, statistical confidence is thus lower than during the winter period, manifesting itself as a more variable estimate of night use.

Whilst the aberrant night use, being but a relatively small component of the total daily use, had little impact on the per capita consumption estimate it had the potential to have a larger impact on leakage management. Severn Trent Water recognised that it was important to have the very best understanding of the leakage characteristics within a particular DMA, at any chosen time of the year. Thus, if this was to be achieved the information from individual consumption meters could benefit from augmented data from another source in deriving night use information.

Socrates measures night use, leakage and consumption

To enhance the quality of night use data, Severn Trent Water recently chose the Primayer system, Socrates. This proven technology is specifically designed for determining reliable measurements of night use, leakage and consumption. It has the considerable advantage of being able to separate out consumption data from night-flows in moderately large groups of properties. Using groups of properties means that much larger samples can be used to improve reliability of statistical calculations.

Socrates is also highly cost effective; 50 Socrates units can monitor 50,000 properties whereas an equivalent household monitor needs 50,000 data loggers! Furthermore, household monitors need constant vigilance in tracking changes in household composition (family numbers, ages, employment status, water use profile, etc). By contrast Socrates tracks groups of similarly classed properties, considerably reducing this bureaucratic burden and enabling the user to get key information efficiently.

Severn Trent Water has procured approximately 100 Socrates units. Most of these are deployed on consumption monitor areas to collect the night use data for clearly definable types of domestic consumers (ACORN groups). The intention is that the collected data is used to derive a statistically justifiable night use for those DMAs with the same type of domestic customers. By using the Socrates data in this way, Severn Trent Water will be able to more confidently predict how much of any night flow is usage and thereby the leakage element. This is seen as a major factor in being able to maintain efficiency during the summer months.

How Socrates works

The Socrates system physically comprises a very fast sampling data logger with a large memory. It interfaces to standard metering technology and is optimally suited in this application for monitoring groups of up to 1000 properties. Fast sampling enables Socrates to cut through intermittent use (washing machines, toilet flushing etc), penetrating to the relatively stable underlying night time core flows, as demonstrated in Figure 1.

However, fast sampling only is not enough. Socrates also uses unique filtering algorithms to eliminate false measurements caused by meter 'jitter' pressure transients and network flow oscillations. These errors can be significant and must be taken into account to obtain reliable information. Finally, Socrates' software reduces the large quantity of sampled data into a conveniently managed data set containing all the key statistics describing the behaviour of the network. This clarity is of great benefit to those managing the water networks.

High yield Socrates data

So what exactly can be extracted from Socrates data? Because it takes many thousands of measurements Socrates maximises the chance of finding genuine night flow values between customer use 'events.' There is a saying which could have been invented for Socrates, "if you do not look, you cannot see!" Socrates minima can be significantly lower than traditional 15 minute averages recorded by traditional loggers. This is demonstrated in Figures 2 and 3.

On small DMA's the minima will be close to, if not actually at, the true leakage level of the network. It is not possible to reconstruct these genuine minimum values by

somehow 'calibrating' standard 15 minute averages. There really is no substitute for recording and **actually looking** at the detailed data. This is exactly what Socrates does.

This has the potential to be very significant both for Leakage Reporting and Leakage Management. For some users Socrates could provide the justifiable evidence that the actual leakage levels are lower than previously reported, whilst for others it may strengthen a case for extra investment in leakage reduction.

An important feature of Socrates processing for zonal leakage management is the way in which a series of Socrates

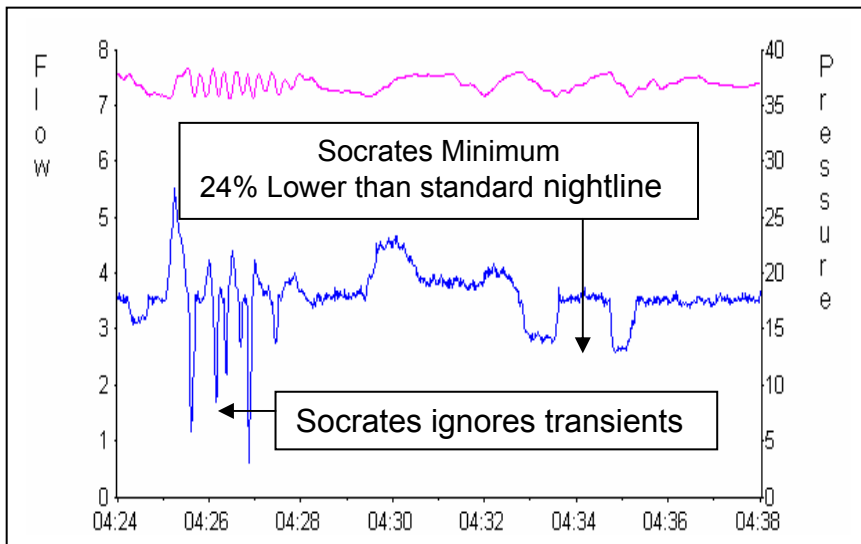


Figure 2 - What conventional 15 minute averaging hides! Example where trade use is identified.

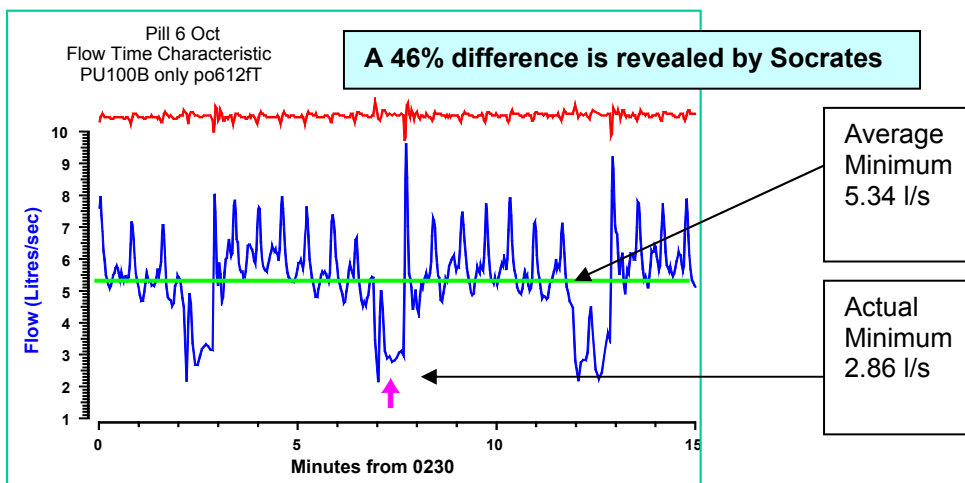


Figure 3 – Conventional 15 minute averaging can hide massive differences.

night flow values can be further analysed to yield a realistic estimate of leakage in a network. Figure 4 shows a group of 30 sequential Socrates night line values for a 1000 property network. Even though Socrates has cut through the user events, it is evident that the baseline is still varying.

A strikingly simple model developed for Socrates identified the variation as being caused by changing continuous use in the network, e.g. taps left dripping, overflowing cisterns, etc, as seen in Figure 5.

The variation in the baseline over a series of nights can be teased apart by statistical processing within Socrates to reveal a robust estimate of the ultimate leakage level. This estimate depends on measured data only – data which is unique to the particular DMA being examined. Once a

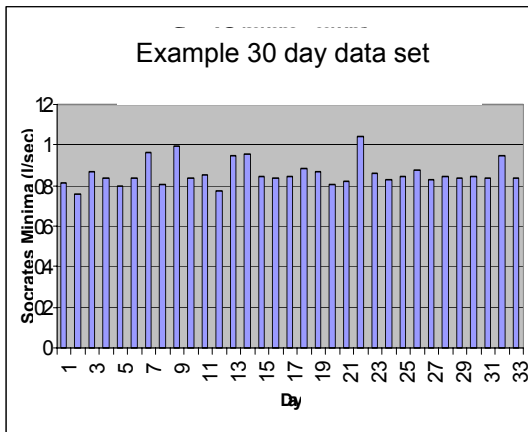


Figure 4 – Nightly variation in Socrates minima.

leakage value has been determined, everything else follows - customer night use and even per capita consumption if district population statistics are available. From the regulatory point of view, this technique is advantageous because no hard-to-justify company wide 'constants' are required; **every network is analysed on its own merits.**

The value of Socrates to Severn Trent Water

The ability of Socrates to gather and analyse data for 30 sequential night lines will be of particular significance to Severn Trent Water. This will be the key to understanding the real usage during the summer months, even where some demand patterns exhibited characteristics typical of hose pipe and sprinkler users.

By using Socrates to collect and analyse water usage it will now be possible to more accurately determine and assign legitimate usage to certain ACORN groups. This data can then be used to arrive at a 'most likely' legitimate night use in any DMA (where the make up of differing ACORN groups is known).

Severn Trent believes that Socrates should prove its value as an important and cost effective part of their determination of accurate levels of legitimate consumption and thereby reported leakage. By applying Socrates derived data to DMA's, it is also likely to be possible to achieve higher levels of efficiency in targeting leakage. The benefits to improved efficiency should be particularly evident during the summer months where there has been a significant

problem. Severn Trent Water is now confident that they are developing a robust method to overcome this problem.

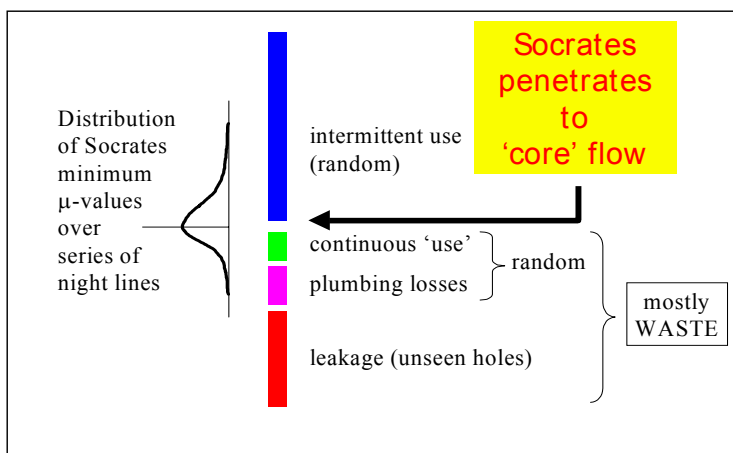


Figure 5 - Components of Core Flow – the distribution of Socrates minima yields robust estimate of leakage level without recourse to 'constants'

