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Management of Non-Revenue Municipal Water

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Abstract : The problem of non-revenue water (NRW) from municipal water distribution networks is common in many countries such as Turkey, where the average yearly water losses are around 50% . Water losses can be divided into two major types namely: 1) Real or physical water losses, and 2) Apparent or commercial water losses. Total water losses in Antalya city, Turkey is around 45%. Methods: A research study was conducted to develop appropriate methodologies to reduce NRW. A pilot study area of about 60 thousands inhabitants was chosen to apply the study. The pilot study area has a supervisory control and data acquisition (SCADA) system for the monitoring and control of many water quantity and quality parameters at the groundwater drinking wells, pumping stations, distribution reservoirs, and along the water mains. The pilot study area was divided into 18 District Metered Areas (DMAs) with different number of service connections that ranged between a few connections to less than 3000 connections. The flow rate and water pressure to each DMA were on-line continuously measured by an accurate flow meter and water pressure meter that were connected to the SCADA system. Customer water meters were installed to all billed and unbilled water users. The monthly water consumption as given by the water meters were recorded regularly. Water balance was carried out for each DMA using the well-know standard IWA approach. There were considerable variations in the water losses percentages and the components of the water losses among the DMAs of the pilot study area. Old Class B customer water meters at one DMA were replaced by more accurate new Class C water meters. Hydraulic modelling using the US-EPA EPANET model was carried out in the pilot study area for the prediction of water pressure variations at each DMA. The data sets required to calibrate and verify the hydraulic model were supplied by the SCADA system. It was noticed that a number of the DMAs exhibited high water pressure values. Therefore, pressure reducing valves (PRV) with constant head were installed to reduce the pressure up to a suitable level that was determined by the hydraulic model. On the other hand, the hydraulic model revealed that the water pressure at the other DMAs cannot be reduced when complying with the minimum pressure requirement (3 bars) as stated by the related standards. Results: Physical water losses were reduced considerably as a result of just reducing water pressure. Further physical water losses reduction was achieved by applying acoustic methods. The results of the water balances helped in identifying the DMAs that have considerable physical losses. Many bursts were detected especially in the DMAs that have high physical water losses. The SCADA system was very useful to assess the efficiency level of this method and to check the quality of repairs. Regarding apparent water losses reduction, changing the customer water meters resulted in increasing water revenue by more than 20%. Conclusions: DMA, SCADA, modelling, pressure management, leakage detection and accurate customer water meters are efficient for NRW.

Keywords : NRW, water losses, pressure management, SCADA, apparent water losses, urban water distribution networks
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