Asset management, water quality and leakage control of small water systems: the case of Nicosia Cyprus

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Cyprus

one River Basin (9 hydrological areas / 70 sub river basins)
- Area: 9250 km² (47% arable, 19% forest and 34% uncultivated land)
- Population 850,000
- Semi arid climate
- Numerous small catchments
- No perennial rivers
- Rainfall 1970-2009 470mm
  - 1900-1969 540mm
  - Drop of 40% drop in river runoff
The Water Board of Nicosia is a public utility company formed in 1953 and its role is to supply potable water in good quality and in sufficient quantity to the citizens of the Greater Nicosia Area (more than 350,000 inhabitants). The water distribution network covers an area of more than 91 Km2 and exceeding in length 1,240 km of water mains. Nearly 23, 8 million m3 of water annually are distributed to approximately 125,000 customer connections.
Water Quality of the distribution system

Cypriot legislation and relevant regulations related to water quality control intended for human consumption {N87 (I) 2001, N 275 (I) 2004}
The analyses include monitoring of chemical (pH, conductivity, ammonium, nitrates, and aluminium) and microbiological (coliforms, E. coli, enterococcus, pseudomonas aeruginosa, total bacterial number, and clostridium perfingens) properties of the water. Based on Cypriot legislation, for the microbiological analysis, WBN is only required to take into consideration the counts of E. coli, and enterococcus.

The results are obtained from both the State General Laboratory and the private accredited laboratory.
Annual chemical (red) and microbiological (blue) discrepancies for the years 2010-2015. (Numbers on the top of columns indicate the total number of samples analyzed that specific year)
Monthly chemical (red) and microbiological (blue) discrepancies for the years 2014 (A) and 2015 (B). (Numbers on the top of columns indicate the total number of samples analyzed that specific month)

An interesting trend was observed for the chemical parameters. All the discrepancies from the allowable limits were caused by elevated levels of aluminum (Al+3)

the discrepancies observed for both the chemical and the microbiological analysis are relatively low and are limited below 9% annually. Microbiological contamination is attributed to aged pipelines, not adequate water circulation due to dead ends, frequent water cuts (especially during the summer months).
Leakage Control Strategy

The Water Losses for a whole system or for a partial system are calculated as the difference of systems input volume and authorized consumption. The water losses consist of Real (physical losses of leaks, bursts and overflows) and Apparent Losses (meter inaccuracies and unauthorized consumption).

In Nicosia, the capital city of the Mediterranean island nation of Cyprus, that proportion reached as high as 30% at certain times.
The equipment used in the field is mainly Permanent Data Loggers and Leak Noise Correlator.
The WBN operates a SCADA (Supervisory Control and Data Acquisition) system consisting of 53 electronic telemetry stations placed in various points in the water distribution network and in all water reservoirs. From these stations data is continuously collected regarding the flow and pressure of water in the network. From the reservoirs, data is collected regarding the inflow and outflow of water, chlorination, and the level of water.
Non-Revenue Water (NRW) expressed as (%) of total quantity distributed in Nicosia, Cyprus from 2007 until 2016 (the blue colored line indicates the year average).
Integrating water management functions such as asset management, water quality, and leakage control on a sustained basis at the Water Board of Nicosia, key areas:

- IT Solutions: The implementation of IT systems with emphasis on the integration with existing IT infrastructure in Distribution Management, Laboratory Management, Maintenance Management, Customer Services, Rehabilitation Planning and Management Reporting.
- Data Quality: all the methodologies of quality assurance and quality control (QA/QC) for sampling and subsequent laboratory and data analysis.
- Institutional Strengthening activities with emphasis on Problem Analysis, Priorities for Change, Business Processes, Training and Action Plans formulation and their implementation