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# Development of a leakage control system at the water supply network of the city of Patras

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**Abstract**

High leakage levels in the water supply network of the city of Patras is one of the most important issues, which must be dealt by the Municipal Enterprise of Water Supply and Sewerage of Patras (DEYAP). DEYAP provides services to the 3rd largest city of Greece, Patras and the environs, covering a service area of 333 km$^2$ and a population of approximately 240.000. It is responsible for the Operation and Maintenance of the Water Supply system comprising a network of 1000 km of water pipes and 134.000 customer water meters.

The Non-Revenue Water is approximately 55% of the System Input Volume from which a significant proportion is estimated as being physical losses. Until now the approach to leakage control is a passive one, whereby leaks are repaired only when they become visible. However, DEYAP is developing a permanent Leakage Control System according to the International Water Association (IWA) methodology.

For the implementation of this system a project is currently under construction, including the Establishment of DMAs, Pressure Management, Creation of a GIS-based decision support system, Aggregation of various operational Databases through development of an intelligent reporting software with data warehouse techniques, Procurement of Leak detection equipment and training DEYAP's personnel in the operation of Pressure Management systems.



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## 1. Introduction

Water loss from piped network has long been a feature of operations management, even in countries with a well-developed infrastructure and good operating practices. The key to developing a water loss strategy is to gain a better understanding of the reasons for losses and the factors that influence them. Techniques and procedures can then be developed and tailored to specific network characteristics and local influencing factors to tackle each of the causes in order of priority.

Water loss occurs in all distribution systems, only the volume of loss varies. This depends on the characteristics of the pipe network and other local factors, the water utility's operational practices and the level of technology and expertise applied to controlling loss. One of the cornerstones of a water loss strategy is therefore to understand the relative significance of the real losses, that water being physically lost from the distribution network and to apply efficient and effective strategies to combat this loss.

The Water Loss Task Force of the International Water Association defined four principal methods for tackling the problem of physical losses in water distribution networks, namely: Pressure Management, Active Leakage Control, Speed and Quality of repairs and Infrastructure Rehabilitation Management. In addition the subdivision of the water distribution network into DMAs (District Metered Areas) is a prerequisite for the continuous monitoring of leakage and the application of Pressure Management.

This paper presents a case study and describes all the actions which DEYAP is taking to reduce and control Real Losses through the construction of the necessary infrastructure required for the effective application of Pressure Management and Active Leakage Control.

## 2. Methodology

### *2.1 Establishment of DMAs*

The distribution network has been divided into hydraulically discrete sectors (DMAs) using the digitized maps of the water supply network with ground contours.

In total 47 DMAs will be established in the water supply network of the city. Most of these will be also PMA's (Pressure Management Areas), in other words there will also be control of the pressure. Factors which were taken into consideration in the design of the DMAs were the topography, existing boundaries, natural features such as railways, rivers, major roads. In the design of the DMAs an effort was made to have their inlets branching off the trunk mains thus improving the control of the DMAs without affecting the flexibility of the trunk mains network. In case that this was not possible and cascading DMAs are formed, bulk flow meters were installed measuring imports and exports of water.

The elevation difference in the pressure zones ranges from 20 to 40 m.

In addition, the water supply networks of seven small communities in the surrounding areas, where the terrain is very steep, were divided into pressure zones and 39 small DMAs – PMAs were created. Monitoring of flow in these networks will help eliminate illegal connections, which seems to be a significant part of the high NRW values.

In most cases the zone boundaries are created by closing a number of valves. This choice will allow in the future to change the boundaries, if it is necessary, in order to improve sectorisation, hydraulic performance and operation of the network.

All the boundary valves have been checked for water tightness and a sign plate indicating that it is a boundary valve is securely placed inside the valve access shaft, in order to avoid accidental opening and to ensure that the valves will remain closed.

All DMAs have one inlet point, where a flow meter is installed and the flow is monitored on a time base of 1 minute interval. This makes possible the analysis of the night flow and helps in the water balance calculations.