1. INTRODUCTION

From a recent report of the Committee for the Vigilance on the Use of Water Resources (2004), with reference to approximately 61% of Oppland &Østfold (1990), in the total water losses (physical and administrative) range between 20-85%, with an average value around 40%. As a result of this, the greater share of physical losses is involved in distribution networks: an active leakage control in order to reduce water losses would concur, therefore, a significant water saving with economic and environmental benefits.

Besides the advances in leak detection-practices and techniques (leak localization, water leak location, repair location, etc.), in the 90ies the District Meter Areas (DMA) design was introduced in the management of the water distribution systems (Cheong, 1993). A District Meter Area is an area supplied from water inputs, into which the flows can be easily measured to determine leaks. It is a method of locating the pressure-lease relationship, so in the 260 an effective control of the head pressure is performed, by means of pressure reduction valves located in downstream hydraulic gate from exceeding a set value. Such technique, therefore, an effective instrument to implement a pressure control system, with beneficial effects on the water losses reduction and probably also on the reliability of water supply (in case of a main break; simple territorial expansion of the distribution system; etc.) but on the other hand they involve a less effective management of the water distribution system. The calibration of the hydraulic simulation model was implemented. Along the reservoir exit pipe an electromagnetic flow meter was installed. Obviously, results of numerical simulations are only useful if the model reliability is high, which can only be obtained if the input data are accurate.

The DMA design was introduced in order to optimize the management of a water distribution system, with beneficial effects on the water losses reduction and probably on the reliability of water supply (in case of a main break; simple territorial expansion of the distribution system; etc.) but on the other hand they involve a less effective management of the water distribution system. The calibration of the hydraulic simulation model was implemented. Along the reservoir exit pipe an electromagnetic flow meter was installed. Obviously, results of numerical simulations are only useful if the model reliability is high, which can only be obtained if the input data are accurate.

3 HYDRAULIC SIMULATIONS

Hydraulic simulations were carried out with the EPANET software version 2.0 (Rossman, 2000). Hydraulic layout resulted from the network analysis tool of the software. The hydraulic behavior was estimated with a network of pipeline system simulations (pipe, valves, tanks, etc.) and each section of the network was designed to work at the maximum flow rate during the monitoring period. Each section was connected to downstream sections with a downstream pressure coefficient according to material and age. Each junction was defined by elevation and by distribution and flow basis.

The hydraulic parameters of the network in the peak of flow were estimated from measured data from the field measurement campaign (Fig. 3).

The daily consumption, it is worth noting the variation of flow supplied from the junctions of the system. The consumption pattern was determined by making the following hypothesis:

Spatial distribution of the network maintenance operations in 2005 shows a quite homogeneous distribution. It was therefore decided to divide physical losses among all the system junctions (supplying junctions and leaking junctions). Consequently, the network was divided into 1000 DMA (by proposing an example of application and known (Willis, Reggio Emilia, Italy). This is a consequence of economic factors and technical difficulties, due to the complexity of the DMA design and sometimes to the lack of an accurate accounting system.