

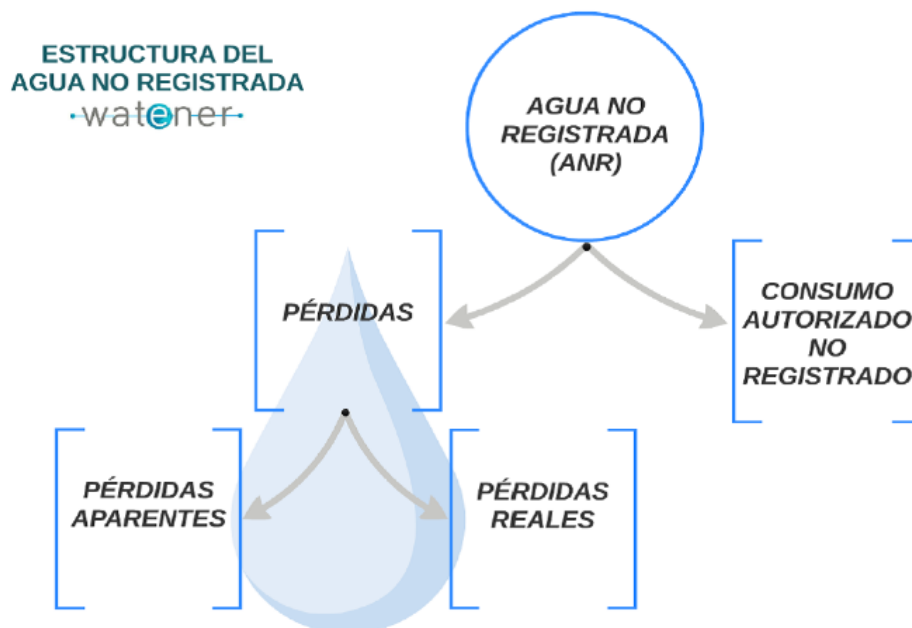
Description of the Challenge

The challenge proposed by the Board has the title: ***“How can we measure the authorized consumption of wastewater (other than leakages) to determine such magnitude in the local supply systems for better financial and environmental management?”***

This challenge responds to the needs described below:

Context

The Unregistered Water (UW) structure in the water supply networks is divided into losses and unregistered authorised consumption. Unregistered authorised consumption is mainly originated at fire hydrants and hose faucets installed in the municipal supply systems.



UNREGISTERED WATER STRUCTURE Unregistered Water (UW)

Apparent Losses Losses Real Losses Unregistered Authorised Consumption

The former is used by the fire brigade in fire-fighting tasks and the latter is municipal use, mainly plant watering, street cleaning and other municipal uses. As these are facilities without control or measurement, their incorrect use is usual. Nowadays, the flow applied to these uses is estimated without any procedure or calculation algorithm.



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The Board wishes to improve the present situation through knowledge of that authorised consumption in order to make adequate use of natural and material resources. To paraphrase Lord Kelvin (British Mathematical Physicist 1824 – 1907): “What is not defined cannot be measured. What is not measured cannot be improved. What is not improved is always degraded”.

The solution that has been considered is to install an opening and closing detector on the equipment to send a signal to the Board’s control system, that would calculate how long it remains open. As the pressure in the area is known, and the pipe diameter, the volume consumed could be calculated. The disadvantage lies in obtaining a compact, reliable solution, both for signals as well as communications, that is also financially feasible.



Illustration 1. Hose faucet 1



Illustration 2. Fire hydrant 1



Illustration 3. Hose faucet with stand-pipe attached

Needs

The Water Board is the manager of the water supply and drainage in the province of Bizkaia, serving 1 million inhabitants. Its scope originally concentrated on the high-level network, that is providing service to the town councils, and these in turn served their citizens. As the years have elapsed, the Board has gradually taken charge of the low-level management, its service reaching the citizen end-users in certain municipal districts.

That change has meant that certain water hydrants, that previously had been assigned to the town councils, have come under the control of the Board. The Board now manages 3000 km of distribution network with a total of 3,636 fire hydrants and 9,541 hose faucets in service. These

water outlets, on the contrary to the consumers' outlets, do not have a meter, and thus the volume of water used at these points is thus unknown.



Illustration 4. Example of hose faucet without a meter

The first challenge to resolve would be to ascertain the volume of water used by the hydrants, or effective estimation so as to know the flows consumed. Once these are known in the pilot scheme, one could appraise whether it is necessary to know the volume of the unregistered authorised consumption throughout the whole of the Board's network, or whether it may be estimated based on that pilot scheme.



Illustration 5. Municipalities with low-level management by the Board

Technically, the challenge is resolved, and among the approaches to the solution that the Board has analysed to measure the volume it has considered installing a meter. However, the problem that solution raises is that it is intrusive and works would have to be performed: drilling the

street or pavement, installing the meter, repaving the site, etc. Such works might amount to an average of 2,000 euros, and considering that there are more than 13,000 hydrants and hose faucets on the Board's network, the cost of more than 25 million euros cannot be borne. That is why a cheap, innovative solution is required.

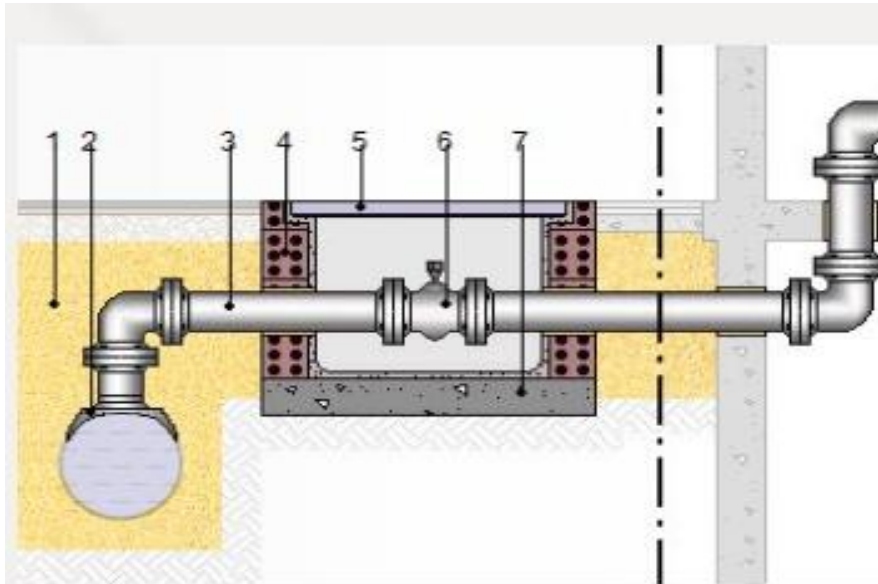


Illustration 6: example of the works and inspection trap required to install a meter

Objectives

The aim is to ascertain the unregistered authorised consumption and to reduce it, which would give rise to the following benefits:

- Reduction of unregistered water in the supply systems.
- Reduction of breakages of the hydrants due to their unauthorised use.
- Lower water consumption at origin, as this is a scarce resource, and lower consumption of energy and the reagents necessary to process it. All of this would provide environmental improvement.

An indicator of success would be to be able to measure unregistered authorised consumption.

The solution proposed must be able to measure or estimate the volume consumed by this equipment and would have to report these figures to the Board's network at least daily. The communication network must be reliable and low consumption.



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Context for use in the pilot scheme

At present there is no data on the amount of unregistered authorised water, and thus the initial status is unknown. In the present situation, a monthly flow through each hydrant is estimated and that is how the total amount of water consumed by hydrants is obtained. Bearing in mind that:

$$\textit{Flow supplied} = \textit{Flow billed} + \textit{Losses} + \textit{Unregistered authorised consumption}$$

We have an equation in which only two values are known: the flow supplied and the flow billed and, however, the losses and unregistered authorised consumption are not measured. By measuring the unregistered authorised consumption, only one unknown factor would be left in the equation, and thus this could also be known.

A pilot scheme in a municipal district is thus proposed to attempt to evaluate this situation, to monitoring it and, if it involves the benefits stated, it could be studied in detail in other municipal districts, or an estimate could be calculated based on the data obtained in the test scheme. The test scheme may also lead to the conclusion that there are hose faucets that are not used and could thus be sealed off.

As the Board's network is very large, the municipal district of Santurtzi is proposed for the pilot scheme. There are 92 hose faucets and 33 fire hydrants on the municipal network. The objective would be to ascertain the volume of unregistered authorised use that arises, either throughout the whole municipal district, or in certain sectors of it.



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