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# Reduction of apparent water losses – the example of Huaraz, Peru

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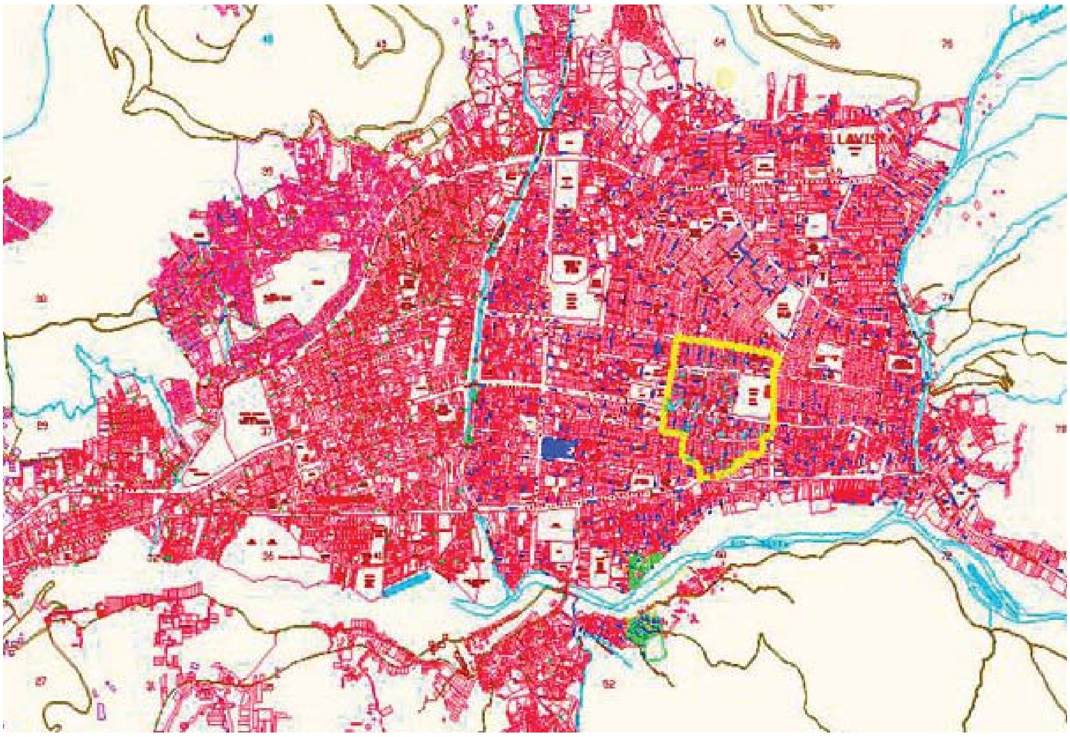
| **Project title** | Investigation of water losses and improvement of hydraulic efficiency in a pilot sector of the town of Huaraz. |
| **Name of area** | Huaraz District, province of Huaraz, Peru |
| **Inhabitants**<br>**service connections** | 101,430<br>22,483 |
| **Non-revenue water** | 51.4% |
| **Project period/status** | 2008-2010 |
| **Reference** | Program of measures with fast impact (PMRI) |

## Background

The city of Huaraz with 100,000 inhabitants is located in northeastern Peru at an altitude of 3,030 metres. Huaraz is a tourist city in the Alley of Huaylas surrounded by the country's largest mountain range. Its water is generated by melting water from the Cordillera Blanca. The water utility Chavin EPS SA is responsible for managing water distribution in the provinces of Huaraz, Huaylas, Chiquián and Aija.

The water utility's overall non-revenue water stands at 51.4% and is higher than the national average of 42.1%. Furthermore, the city has one of the highest consumption rates in the country with a daily per capita water consumption of 388 litres.



Municipality of Huaraz and the pilot area (yellow)

These high losses are generated by a large number of problems including: poor water metering, a large amount of unreported leaks, old pipes, inadequate maintenance techniques and an organisation which is poorly prepared to address these problems. Alternative methodologies were tested within cooperation carried out by GIZ and the water utility in a program of measures with fast impact (PMRI). These included tools, such as water balance, inventory of losses and hydraulic network modelling in order to improve the networks' hydraulic performance and establish a systematic methodology for detecting and controlling water losses.

| Water utilities | Volume produced ($m^3$) | Volume billed ($m^3$) | Percentage of NRW (%) | | | | |
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| | | | 2009 | 2008 | 2007 | 2006 | 2005 |
| **TOTAL** | 1,285,370 | 740,861 | 42.10 | 42.30 | 42.40 | 43.30 | 43.90 |
| **SEDAPAL** | 658,748 | 411,835 | 38.50 | 37.50 | 37.50 | 39.10 | 41.10 |
| **Large-sized** | 393,050 | 215,481 | 43.30 | 45.20 | 46.00 | 46.60 | 46.40 |
| **Medium-sized** | 194,124 | 99,449 | 49.70 | 48.80 | 49.40 | 49.60 | 48.20 |
| **Small-sized** | 39,446 | 14,094 | 53.00 | 62.00 | 54.00 | 53.60 | 50.50 |

Non-revenue water in Peru between 2005 and 2009. (SUNASS, 2010)

## Process development

The work consisted of testing a methodology, using sectorisation and metering as tools to determine and control the condition of the supply system:

- It started with the selection of a pilot area taking into account several criteria, including simplicity of closure, high continuity, high pressure level as well as diverse categories of consumption patterns.
- The technical and commercial cadastral parameters has been updated in order to be used to conduct network modelling and estimate water demand.
- Sectorisation was performed by isolating the pilot area from the rest of the system. The pilot area is composed of 263 service connections.
- Every installed meter was read in order to find out the extent of under-reporting, which was further analysed by brand and age.
- After isolation of the pilot area with single inlet, a bulk meter has been installed, allowing the hourly gross consumption of the sector to be recorded in periods of 24 hours and the water balance to be determined at minimum night flows. In addition, monitoring the tank's water level allowed pressure regulation methods to be adopted.
- An inventory of losses has been carried out allowing the factors causing them to be identified. Commercial and operational corrective measures were taken. Under the new conditions, hydraulic modelling was performed and pressures were regulated within the sector.
- Finally, a new water balance allowed the results of the adopted measures to be measured.

## Results and good practice

The initial water balance showed a non-revenue water level of 69% in an area where 91% of asbestos cement pipes were more than 40 years old and 68% of connections were last metered an average of six years prior.

The loss inventory revealed that 80% of losses were apparent losses and the remaining 20% were real losses.

Corrective measures included installing meters in 121 households, renewing sub-meters and completing the sector metering to 100%. Furthermore, 3.1 km of the water network were inspected with acoustic geophones, ten unreported leaks were detected and repaired, eight of which were found in household connections. The pressure has also been regulated by reducing the peak pressure from 45 to 25 m.

In addition, an overflow in the Batán reservoir that supplies the area was detected where a daily volume of 405 $m^3$ had been wasted. This overflow was corrected by changing the control system. The final water balance showed a non-revenue water level of 29%, which demonstrates the effectiveness of the actions taken.

## Lessons learned

The initial investigation into water loss reduction and operational improvements in a pilot area enabled visible short-term results with reduced investment levels and costs. These results led to general conclusions that can be converted into strategies applicable for the whole system.

The combination of measures, such as sectorisation, determining a water balance and an inventory of losses, allow long-term corrective measures to be identified. Corrective operational measures (installation of meters and leak detection) must be dealt with first. However, the results will not be sustainable without significant investments in rehabilitating old networks.

## References


→ Zegarra, B., Ticona E., Alania, G., Vidalon, F. and Rojas, F., *Reducción de pérdidas y modelación hidráulica.* El ejemplo de Huaraz, Perú. Not published, 2010.

→ SUNASS *Gerencia de supervisión y Fiscalización, Las EPS y su desarrollo*. Not published, 2010.