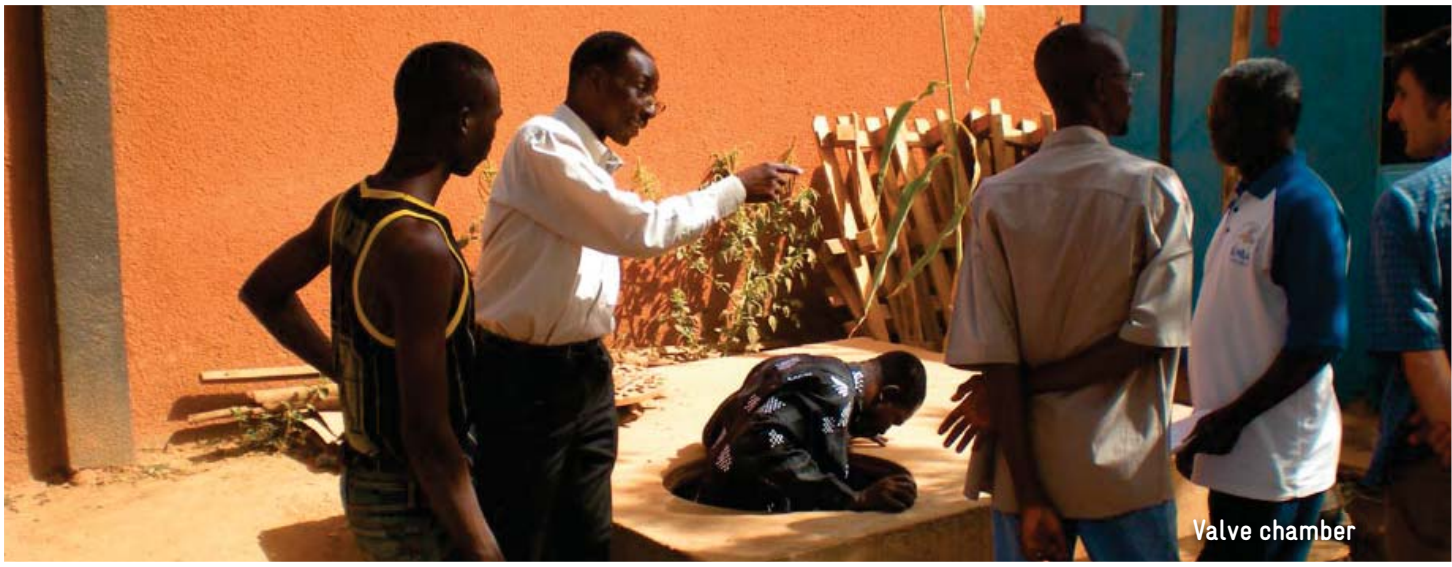
Location of valve chamber on plan



Valve chamber

Hydraulic modelling – the example of Ouagadougou, Burkina Faso

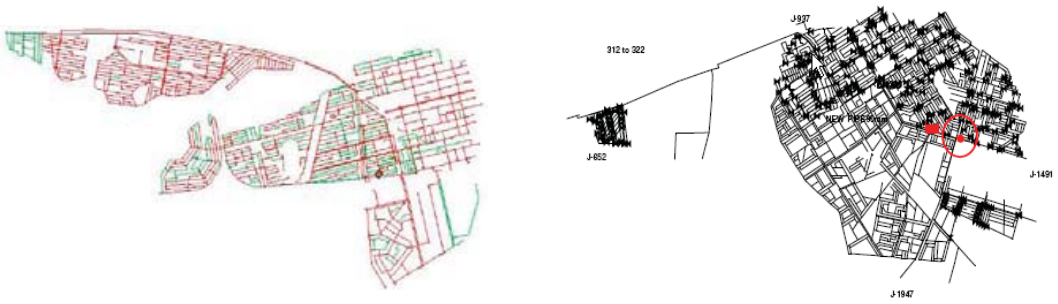
Project title	Hydraulic modelling Burkina Faso
Name of areas	Ouagadougou, water supply areas R7 and RE
Water losses **Supply area RE** **Supply area R7**	 306m³/day 120m³/day
Project period/ status	February to November 2009

Background

Drinking water is a scarce resource in Burkina Faso, and large parts of the city of Ouagadougou are spreading into the surrounding areas without organised water supply each year. Supply areas R7 and RE *(see Figure on next page)* have had continuous water supply without interruptions since completion of the Ziga Project in 2006. Despite the benefits of this project, real water losses have been seen to increase since the system is operated continuously. This is due to the fact that the distribution pipes are constantly producing higher leak flow rates under increased pressure. The objective of implementing pilot projects in the supply areas R7 and RE is to reduce real water losses to 20%.

The Office National de l'Eau et de l'Assainissement (ONEA) is the national water and sewage authority and the biggest national water company. Institutional restructuring has separated rural and urban water supply. This reform aimed to make the

company financially viable, and to make access to water and sanitation affordable for low-income areas. The introduction of hydraulic modelling improved maintenance cost efficiency and decision-making in medium to long term. Today, ONEA is considered to be one of the best-managed companies in the region.



GIS representation of supply area R7 (left) and EPANET critical point identification in supply area RE (right)

Process development – hydraulic modelling

One goal of hydraulic modelling is to identify the best technical and economical solution for a water supply network. The system has to be understood to propose alternatives and to be optimised. In the present case, hydraulic modelling was an important step to investigate the possibility of installing a pressure management system and consisted of the following steps:

Step 1: data collection and model set-up

- → ONEA supplied their existing hydraulic model to the solution provider.
- → Updating the hydraulic model in EPANET (software tool for modelling from US EPA) for the water distribution network with regards to DMAs R7 and RE (small diameters, internal loops, disconnected pipelines, etc.).

Step 2: model corrections

- → Verification of input data and plausibility check – formal, logical and temporally consistence of data.
- → Inaccuracies with major impacts on the modelling quality have been corrected in coordination with ONEA.

Step 3: model calibration

- → The calibration process was performed on the corrected models, using the consumption patterns observed during days when simultaneous flow and pressure measurements were performed.
- → Pipe roughness has been considered depending on the pipe material and age.
- → Verification of the reservoir level and its impacts on modelling.
- → Minor losses were introduced into the model.

Step 4: valve selection

- → The calibrated model has been used for simulation runs of the DMAs. The analysis of the simulation results has been used to select and dimension the proper pressure reducing valves.

Results and strategy

The recommended solution for an efficient PM system in both DMAs (R7 & RE) provides for the use of several inlets equipped with pressure reduction valves. In both cases, best results are obtained with dynamically controlled pressure reduction valves in order to lower unnecessary excess pressure during night hours. The *following Table* shows simulation results for several model variants:

Reduction of water losses [m³/day]		
Alternative	PRV – fixed outlet control	PRV – critical point control
PRV at the outlet of the reservoir (variant R7-1)	116	120
Creating three independent sectors, each with one PRV at the inlet (variant R7-2)	51	79
PRV at the outlet of the reservoir (variant RE-1)	65	231
One PRV at each of the two main supply points (variant RE-2)	289	305

Comparison of simulated water loss reduction with two variants

Alternative R7-2 is recommended for area R7 as it offers more flexibility in operating the system. Three valves are installed at the main supply points for each newly created sub area, helping to reduce the subsequent water losses per day. The set point of each valve can be adjusted according to the requirements of each area.

RE-2 is the recommended option for area RE. In this option, two DN 300 valves are installed at the main supply points.

Best practice

In this case study, hydraulic network models were used to design the DMA and select and dimension the PRV. This process requires that reliable input data is available about the existing network and predictions regarding population development, water consumption trends and planned rehabilitation and extension measures in the analysed water supply network.

Lessons learned

- The results of the model are only reliable if the input data is accurate.
- Hydraulic modelling allows time and financial savings, as several options can be simulated and compared, without needing real implementation.
- Cooperation and constant communication with local partners is necessary to gain a clear picture of the actual condition of a water distribution system.
- Model calibration based on data from measurement campaigns is essential to produce reliable results.

Further development/future outlook

The next step will be to install the pressure management system in area R7 and optimise sector RE.

References

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- VAG – Armaturen GmbH website, *www.vag-armaturen.com*, visited July 2010.
- ONEA website, *www.burkina.at/ONEA*, visited July 2010.

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