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# Numerical Study and Modeling of the Water Supply Network in the Northern Region of the Province of Sidi Yacine: Wilaya of Sidi Belabbes, Algeria

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**ABSTRACT**

Algeria is generally a semi-arid climate country, indicating water scarcity from both a hydrological and urban perspective. Furthermore, the population growth continues to increase, demanding a greater water supply. This study focuses on optimizing the existing water supply network of Sidi Yacine, which has been subject to analysis regarding storage and/or destocking in reservoirs, as well as identifying existing deficiencies in the distribution network. The study specifically targets the northeastern part of the city, utilizing simulation through the EPANET software. The approach involves field surveys to simulate the water supply network using EPANET, aiming for a better qualitative assessment of the simulation and/or modeling results. The objective is to propose alternative solutions to address current and future problems. The three scenarios applied to the model have yielded results compliant with operational standards in a section of the network. Consequently, the installation of a booster station in the study area is proposed to ensure optimal water supply.

**Keywords :** Sidi Yacine, Simulation, Pressure, Failures, Optimal Network, EPANET

## 1 Introduction

Our work consists of modeling the water supply network of Sidi Yacine from a hydraulic perspective. Sidi Yacine, a urban center within the city of Sidi Bel Abbés, faces numerous issues regarding its potable water supply. Indeed, several failures in the water supply network have been recorded, notably including insufficient water supply to the network. The creation of the model proceeded through several phases. Firstly, the crucial phase involved data collection on-site to understand the comprehensive functioning of the network. The second phase involved familiarizing ourselves with the EPANET software for network simulation and creating the model based on the collected data. The final phase consisted of launching a simulation of the hydraulic behavior of the system to obtain results on parameters such as flow rates, velocities, and pressures, which enable system analysis.

## 2 Experimental

The EPANET software provides a user-friendly interface. Its flexibility and simplicity allow us to conduct two types of simulations:

Instantaneous simulation, which is necessary for evaluating the network after sizing to monitor and verify flow conditions. In our case, this type of simulation provides an overview of our network and verifies flow conditions.

Long-duration simulation, which allows us to track the network's evolution over a specified period (24 hours, 48 hours, 72 hours, etc.) with regular time steps. Monitored operational parameters include reservoir level variations, pressure changes at any point in the network, accessory operations, etc. This type of simulation enables us to test and adjust the operational network.



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## 3 Results and Discussion

The results of the simulation of our potable water supply system have allowed us to identify the hydraulic state of the nodes and arcs throughout the simulation. Additionally, they have enabled us to select consumption model 2, which provides a peak water balance of 201 l/s and pressures that approximate operational standards, with a minimum of 1.4 bars and a maximum of 4.8 bars. These pressures are higher compared to the first consumption model. However, the hydraulic parameters do not meet the operational standards of water supply networks

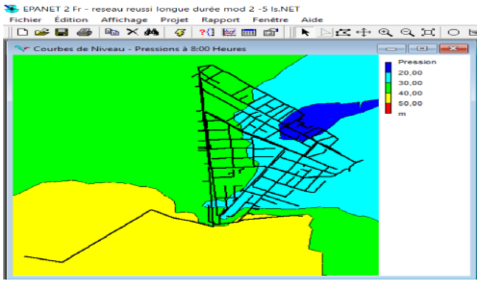


**Figure1**: Pressure envelopes at 08:00 for model 2"

## 4 Conclusions

Based on the obtained results, we were able to propose three scenarios, each assigned to two consumption models, for optimizing the current network. After analyzing the scenarios, those assigned to the second model yielded results that approximate operational standards, with a minimum pressure of 1.4 bars and a maximum of 4.8 bars. These pressures are higher compared to the first consumption model in the southern part of the studied network. However, it is necessary to equip the network with a booster station in the northeastern zone to ensure optimal performance

## References

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