Cutting-edge leak detection in an ancient city

A water utility in Jerusalem deployed a revolutionary new system to search for leaks in the city's water infrastructure

Jerusalem is one of the oldest cities in the world, its origins dating back to the fourth millennium BC. It is a city covered with history – monuments and buildings reflecting its colourful past. At the same time, it is dynamic, modern and growing rapidly, placing huge strain on an infrastructure which relies on components that are up to 85 years old.

Since 1996 the Hagihon Company has been the city of Jerusalem's water and wastewater utility, supplying water, sewage and drainage services in the approximately 32,500 acres of the Greater Jerusalem area, and servicing about 1,000,000 residents of the City of Jerusalem and its environs. The company is responsible for development, expansion, operation and maintenance of the water, sewage and drainage networks, in accordance with the city's and towns' growth and development plans.

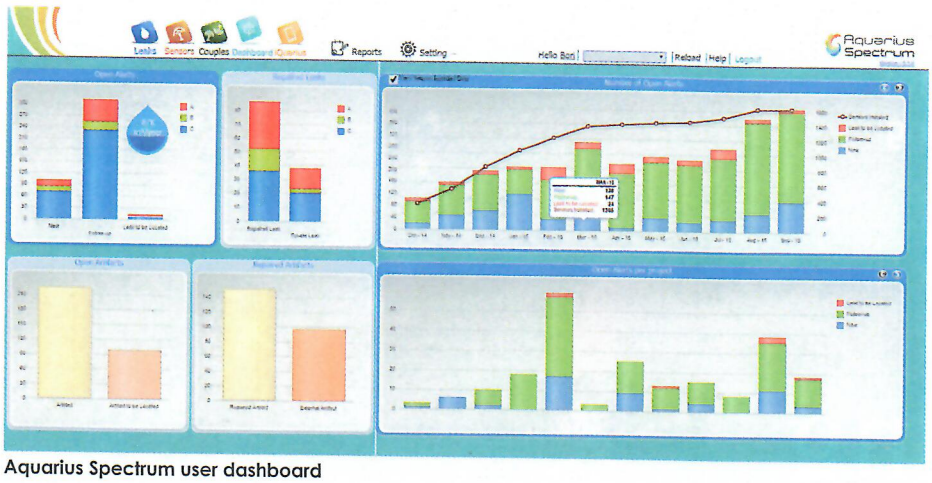
Faced with the challenge of increasing customer satisfaction, and increasing efficiency while reducing costs and non-revenue water (NRW), Hagihon approached Aquarius Spectrum to work on a fixed water monitoring and leak detection system. Aquarius Spectrum is a start-up company based just north of Tel Aviv, Israel. The company was started in 2009 by David Solomon, and specialises in creating sensors and software which can work together for leak detection and pipe condition assessment.

A monumental challenge

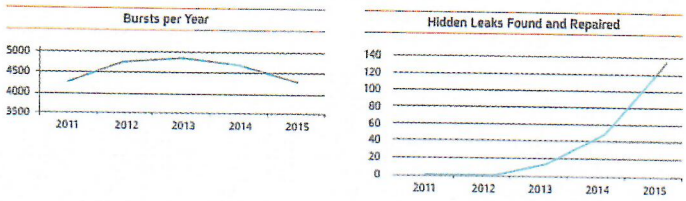
Hagihon's water distribution network is spread across the hilly terrain of Jerusalem, meaning the company has had to create multiple pressure zones using water tanks and Pressure Reducing Valves (PRVs). Aquarius Spectrum successfully overcame these challenging conditions during the implementation of the project.

In September 2013, the utility, together with Aquarius Spectrum, started implementing a fixed water monitoring and leak detection system. More than 1600 acoustic sensors were installed during 18 months to cover most of the utility's water distribution network.

Aquarius Spectrum's solutions feature fixed and mobile acoustic sensors that upload gathered data to the Aquarius servers via cellular communication. The sensors incorporate built-in GPS capabilities, allowing for full-synchronization of readings across multiple sensors.



Aquarius Spectrum user dashboard



The rising trend in the annual number of pipe bursts was halted and a drop in number is evident since the deployment of the system

Each night, at an exact predefined time, all sensors record a noise sample and send the information to the Aquarius Spectrum cloud based servers. The signals are processed, correlation algorithms are executed and alerts are issued to Hagihon regarding leaks or malfunctioning appurtenances, such as throttled valves.

Analysed findings are displayed via a user-friendly browser-based display. From the very first reading, the system started learning the behaviour of the Jerusalem area water distribution network by following its daily trends through every sensor.

Positive results

Results from a recent study by Hagihon indicate a substantial improvement in NRW (Non-Revenue-Water) in the DMAs in which Aquarius Spectrum's system was installed and continuously operated during a period of two years (2014-2015). NRW was reduced in those neighbourhoods by 18%, mainly due to locating and fixing hidden leaks and repairing malfunctioning equipment located by Aquarius. In addition, there is a clear trend of a yearly decline in the number of water pipe bursts.

During the two years prior to the implementation of the Aquarius system in Hagihon, there had been an increasing trend in the number of bursts per year, which was clearly reversed to a declining trend apparent during the two years in which the Aquarius leak detection system was in place.

As of August 2016, the Aquarius-Spectrum system had found more than 226 hidden leaks in the Jerusalem area, 171 of which were in the public distribution network and 55 in private properties. Fixing those leaks resulted in potential savings of over a million cubic meters of water for the utility. NRW was lowered by 18% and the number of visible (reported) leaks and bursts has declined significantly.

In addition, the Aquarius-Spectrum system has discovered more than 250 non-leak faults, including partially closed valves, faulty water meters, malfunctioning non-return valves and other items of equipment under the responsibility of the water utility.

The Aquarius-Spectrum system is helping Hagihon revolutionise the way it manages leak repairs, allowing it to switch from a reactive mode to a planned approach. The utility is now able to plan its repair schedule to fix hidden leaks before they become visible bursts, thus reducing the cost of contractors, avoiding collateral damage to infrastructure, informing consumers well in advance of shutting off of water supply for maintenance, reducing shutoff times and improving customer service by notifying consumers of hidden leaks on their premises. All this saves money and improves the level of service.

Hagihon's CTO, Mr. Aharon Rosenberg, said: "We are excited and proud to be at the forefront of municipal water system technology. The Aquarius Spectrum innovative leak detection system has proven its effectiveness in improving the maintenance of our water pipes network and is changing the way we manage our assets".

Aquarius' fixed system is currently monitoring over 2,000 kilometres of water pipes daily, using more than 3,000 fixed acoustic correlating sensors in major cities in Israel, US and Europe. Each month the company detects hundreds of invisible underground leaks and interferences affecting water networks.

Recently, the company has managed to reduce NRW in some municipal areas by between 20% and 90% through detecting unseen leaks and other problems.

For more information:
This article was written by Aquarius Spectrum, Hagihon and Fluid Handling.
Visit: www.aquarius-spectrum.com

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Sensor on yellow hydrant