

Project Summary

Organization:

SimTejo

Solution:

Water and Wastewater

Location:

Lisbon, Portugal

Project Objective:

- Address overflow and flooding issues related to the wastewater system and tide
- Integrate the large amount of information generated by the sewer, meteorology, and estuary models into an integrated system
- Enable proactive operational management while simplifying the presentation of results enough for non-specialists

Products used:

SewerGEMS
WaterObjects.NET

Fast Facts

- Regular flooding occurred due to uncontrolled stormwater, tide impact, and huge quantities of grit and coarse solids entering the sewerage systems
- SimTejo directed Hidromod to develop AQUASAFE for integrated management of SimTejo's drainage and wastewater treatment
- AQUASAFE integrates data and software, including SewerGEMS, to generate accurate forecasts for the management and operations teams at SimTejo

ROI

- The availability of simplified data and reports accounts for €120,000 savings per year in specialized engineers and consulting
- The automated integration of models and data saves €200,000 annually
- The functional failure of pumping stations was reduced by 61 percent, saving €100,000 per year in maintenance and €30,000 in penalties annually
- Improved efficiency for 90 pumping stations is expected to yield a 2 percent reduction in energy consumption, saving approximately €160,000

SimTejo Implements Real-time Integrated System to Accurately Predict Sewer Overflows in Lisbon's Water Network

Bentley's WaterObjects.NET Technology Enables AQUASAFE Solution to Automate and Connect SewerGEMS to Real-time Data and Weather Forecast

Frequent Flooding Drives Need for Forecasting

Lisbon Portugal's sewerage network, which is managed by Saneamento Integrado dos Municípios do Tejo e Trancão (SimTejo), comprises separate sanitary sewers and combined wastewater systems, as well as partially separate systems. As is typical in the Mediterranean region, Lisbon experiences short, intense periods of heavy rainfall that often lead to flash floods, which when combined with high tides often cause the network to fail. Although SimTejo had access to large amounts of infrastructure and operational data from their water network, they needed a way to consolidate and integrate the huge amount of information into useful, actionable data. To provide real-time data for modeling emergency and planning scenarios, and real-time operations, SimTejo chose Bentley developer partner Hidromod to help create a tool that enabled management of drainage and wastewater treatment.

The sewerage systems managed by SimTejo were all constructed using different materials and components such as inverted siphons and pumping stations. These components were installed at different time periods, and consequently parts of the system are in better condition than others. The network flooded regularly at sewers, pumping stations, and wastewater treatment plants, as uncontrolled stormwater and huge quantities of grit and coarse solids entered the sewerage systems. In addition, Lisbon's topographic and geographic characteristics cause the tide to affect the downtown river front, where permanent tide valves had to be installed to prevent flooding when heavy concentrated rainfall coincided with high tides.

From Reactive to Proactive Operational Management

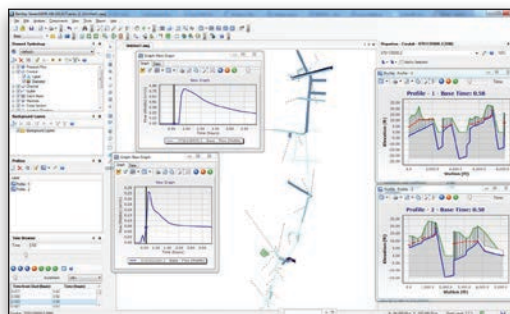
SimTejo realized it needed to be able to consolidate a huge amount of information, including SCADA data, sampling data, data from quality probes, as well as other sources, such as hydraulic model results from SewerGEMS. SimTejo was already using modeling tools such as SewerGEMS for planning activities, but wanted a way to use these tools to enable real-time forecasting potential overflows, uncontrolled discharges, and flows into the wastewater treatment plant. In addition, to increase efficiency and improve planning, SimTejo needed a system that could not only integrate all available information, but also provide non-specialist staff with clear, simple reporting that would be customized according to the users' needs and skills.

SimTejo worked with Hidromod, a member of Bentley's developer network, creating AQUASAFE according to SimTejo's needs and requirements, to integrate the management of drainage, wastewater treatment, and disposal information. Using AQUASAFE provides SimTejo

with integrated models and real-time data, enabling proactive management, including forecasting and short-term planning, while simplifying the presentation of results for non-specialist and operations staff.

AQUASAFE was first applied in the pilot system of Beirilas, an area in the north of Lisbon with a population of about 204,000, which includes

a wastewater treatment plant, eight pumping stations, and 18 kilometers of sewer mains.



Wastewater flows calculated by SewerGEMS are automated by AQUASAFE.

“Further savings were achieved from improved operations and maintenance, which reduced the number of man-hours required for maintenance processes...”

– Pedro Pova, SimTejo

SimTejo

R&D Project Manager

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Real-time Information

AQUASAFE automated the execution of Bentley's SewerGEMS and connected it to real-time data and weather forecasts. SewerGEMS – used for the analysis of the sewer system, including the catchment area, and for offline studies to improve operations and energy efficiency on the pumping system – was seamlessly integrated using Bentley's WaterObjects.NET customization technology.

The sewer model automatically runs every 15 minutes with updated measured rainfall and rainfall forecasts from an operational meteorological forecast model (MM5 is provided by Instituto Superior Técnico). This allows SewerGEMS to provide a 24-hour forecast of flows, velocity, water levels and pump behavior in the drainage network, land overflows, and incoming flows to the wastewater treatment plant. Lastly, the discharges calculated from SewerGEMS are used as boundary conditions by MOHID, an estuary currents and level model, provided by the Instituto Superior Técnico.

AQUASAFE also connects to additional data coming from rain gauges, flow meters, pumping stations, a water quality probe, and radar and satellite images. AQUASAFE automates all of this, providing real-time integrated data that would have been virtually impossible to obtain without the addition of numerous engineers and specialists.

Customized Presentation of Results

To meet the varied needs of SimTejo's users – from management to operators – the results AQUASAFE generated needed to be simple enough for non-specialists, and customizable for different users' skills and needs.

To achieve this, AQUASAFE was engineered using client-server architecture. A single server is responsible for aggregating the different data sources and managing the sewer model executions. Several configurable clients connect to the AQUASAFE server and display data in the form of maps, tables, graphs, charts, and alerts. All data sources can be combined in Excel reports using templates created by users.

Making Models Available to Operators

Implementing AQUASAFE enabled SimTejo to provide hydraulic and wastewater treatment models typically used by engineers to the operators, extending the use of these models from a planning application to a decision-making tool, integrated into day-to-day operations. Ultimately, AQUASAFE will help SimTejo personnel prevent, detect, and respond to a wide range of situations, including normal operation, emergencies, and customer complaints. Implementing the new system reduced pumping station failure by 61 percent, saving €100,000 in annual maintenance costs and €30,000 in penalties per year. Additionally, improving the efficiency of 90 pumping stations is expected to earn a 2 percent reduction in energy consumption. Considering that in 2011 the cost of energy for pumping was close to €8 million, this represents an annual savings of approximately €160,000. SimTejo anticipates a further €180,000 annual energy savings related to the wastewater treatment plant.

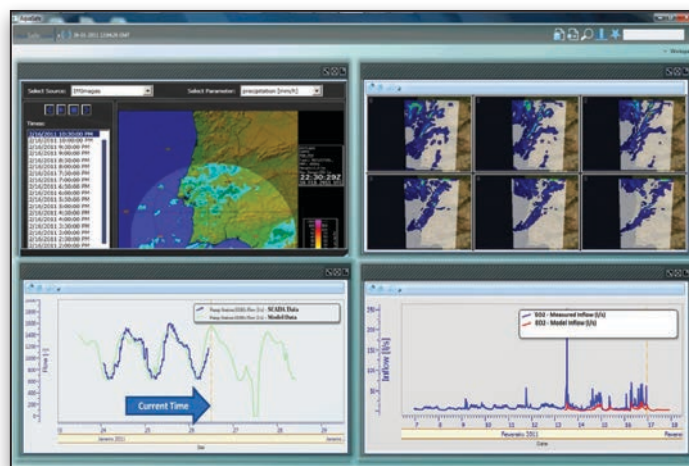
Observed Improvements

Pedro Pova, R&D project manager at SimTejo, said:

“This system has been online since February 2011 providing constant and accurate forecasts for the management and operations teams at SimTejo.

“It now takes no more than 15 minutes to detect and alert abnormal behaviors on flow meters by comparing measured flow with modeled flows, as well as just five seconds to produce accurate combined sewer overflow (CSO) and estuary discharge reports for environmental authorities. Preventing infrastructure collapse and flooding increased public safety and helped protect Lisbon's waterways from pollutants.”

Pova continued: “Further savings were achieved from improved operations and maintenance, which reduced the number of man-hours required for maintenance processes, and the need for specialized engineers to run models and integrate data from different sources. This resulted in an annual savings of €120,000 in specialized engineers and consulting, as well as €200,000 in integrating models and databases.”



AQUASAFE provides results in an easy-to-use layout.