



for a greener tomorrow

AQUATORIA® – SMART WATER SOLUTION

From control to optimisation



- Reduction of water and energy losses
- Reduction of maintenance costs
- Reduction of on-site visits
- Increased overall equipment efficiency

Precise control for urban water systems

Aquatoria® is a smart software solution for municipal water systems, providing precise process control over all aspects of water supply and distribution.



Developed specifically to meet key challenges facing the water industry and built on Mitsubishi Electric's MAPS solution, Aquatoria® helps maintain optimum water quality while reducing incidence of leaks. It thereby improves operational efficiencies and delivers significant reductions in total cost of ownership for water utilities.

Aquatoria® can be configured to identify inefficiencies in equipment operation and it can automatically optimise active pumping stations while controlling and managing pressure, resulting in significant reductions in energy consumption.

The system reduces water utility costs:

Reduction of energy consumption

- Elimination of excess pressure by harmonising pumping station operation with consumer demand
- Elimination of inefficient VFD-driven pump operating modes
- Automated tools for optimal pumping unit set selection at each station

Reduction of leakages

- Load reduction within the water distribution system by ensuring compliance with pressure regulation standards
- Burst pipeline diagnostics

Reduction of maintenance requirements

- Automatic diagnostics of pumping unit operation
- Emergency prevention diagnostics through predictive algorithms
- Reduced staff numbers and fewer skilled service staff

Water intake

Task: Water drawing at minimum energy cost.

Outcome: Evaluating the well pump operational efficiency. Selecting optimum set and operation mode for the wells consolidated by a general pipe and allowing for their cross-impact.

Consumer

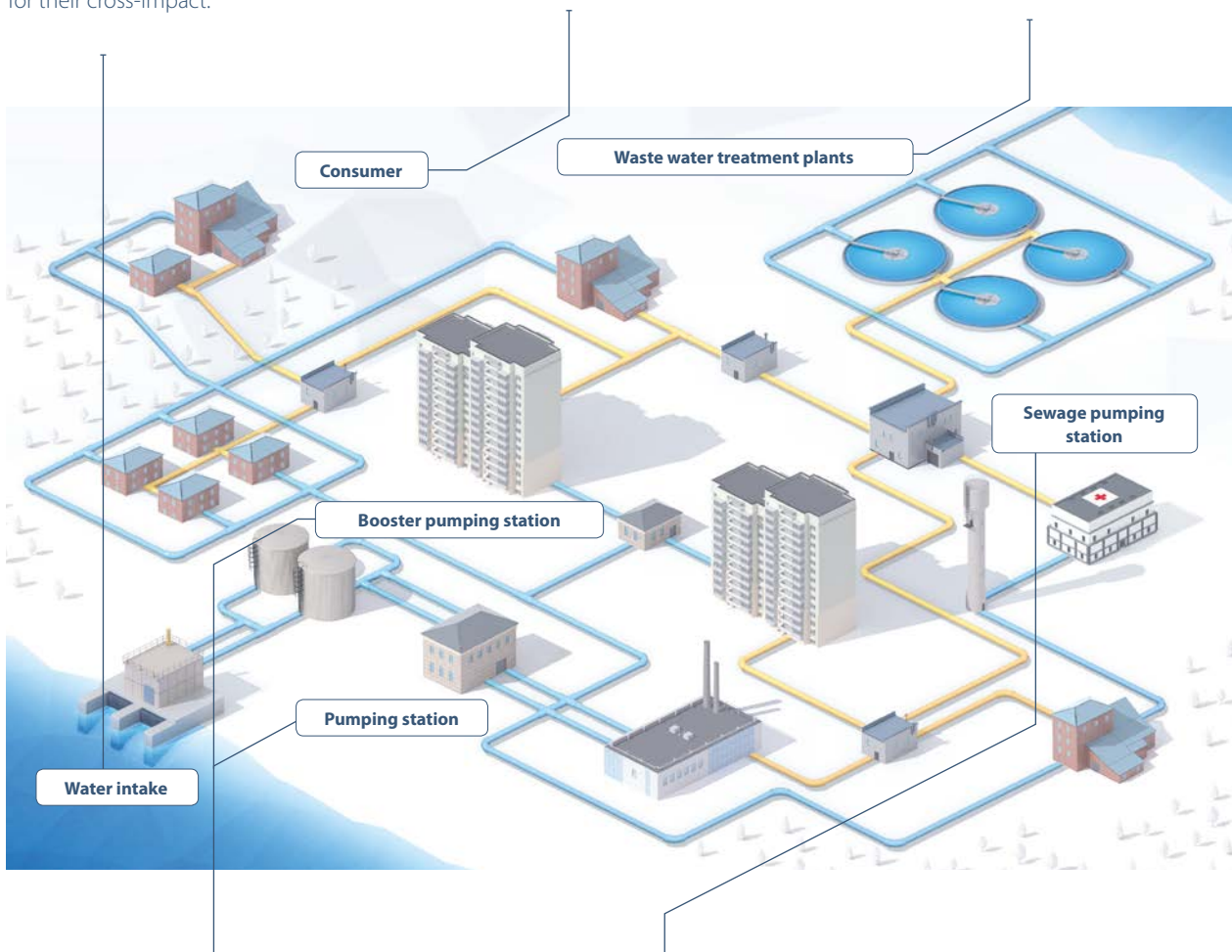
Task: Uninterrupted, energy efficient water supply to the consumer with minimal leakages.

Outcome: Interacted water supply system control, based on pressure value at the consumer.

Waste water treatment plants

Task: Maintaining quality of wastewater treatment at minimum energy cost.

Outcome: Automating aerotank air supply. Specifying air pumps and blower optimum operation modes using fuzzy logic algorithms.



Pumping/booster pumping station

Task: Maintaining feed pressure at the consumer within local regulations. Leakage and operating cost reductions.

Outcome: 1. Using stationary check points or hydraulic network models for station control depending on pressure value at the consumer.

2. Constantly controlling the frequency converter to manage the efficiency of the pump. Excluding low efficiency operation modes.

3. Suggesting pumps with as low as practicable energy consumption.

Sewage pumping station

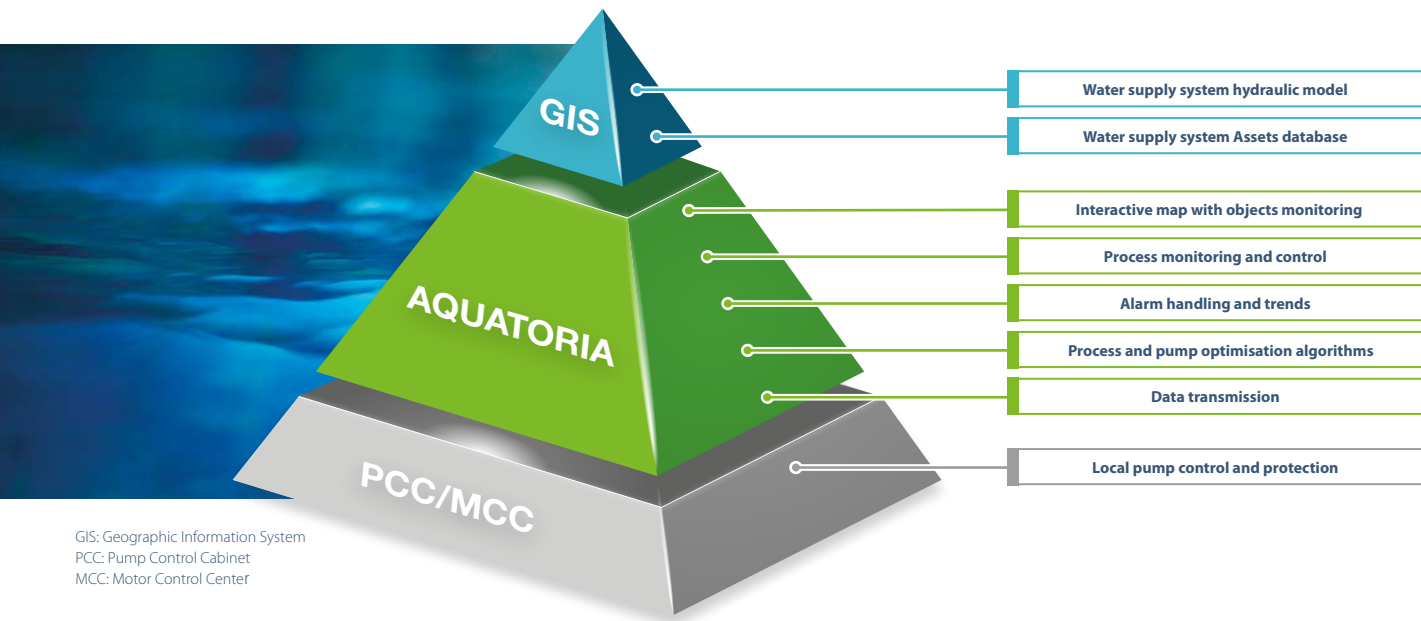
Task: Wastewater collection and pumping at minimum energy cost.

Outcome: Controlling the sewage pumping station based on uniform transportation of water to treatment plants. Maintaining water levels in the tank and specific pressure values in the pressure header and draft tubes.

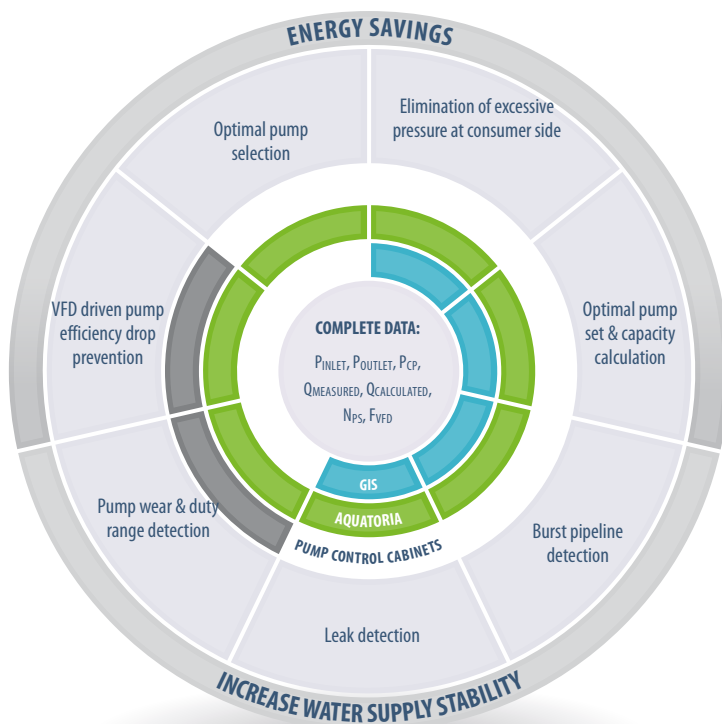


Structure

Efficient management of the whole water distribution system can only be possible when both water and process data flow concurrently giving a real-time picture of the process. When it comes to optimisation of energy consumption, leaks detection or asset management, a perfectly structured communication system between facilities and the control room is a key element for distributed control systems.



Integrated Approach to Efficient Water Supply and Distribution



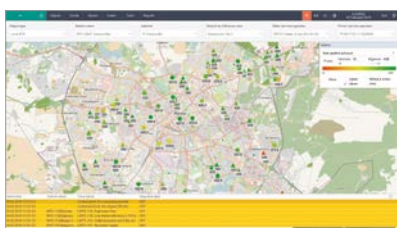
The lack of a consistent approach to control systems development often causes integration problems when combining systems of different manufacturers under a single 'umbrella'. That's why the unified concept Aquatoria® has been developed – the concept of integrated control systems deployment for municipal water distribution systems.

The Aquatoria® approach is based on so called hybrid networks which combine algorithms of classic neural networks for self-learning capabilities with fuzzy logic algorithms for automated control.

Aquatoria® lays down the principles of control system development in this field and defines the concrete technical requirements. It is designed to deliver maximum energy efficiency within a process as well as an uninterrupted water supply. In addition the system reduces power consumption, water leaks and equipment maintenance costs.

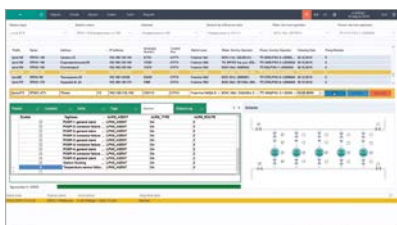
Modules of Aquatoria®

Aquatoria® offers workstation software based on Mitsubishi Electric's MAPS SCADA which enables flexible adaptation to specific customer requirements. Customisation can be done by the end-user or System Integrator which helps cut system maintenance costs and reduces the reliance between the water utility and the solution provider.



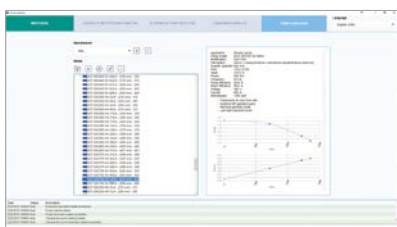
Geo module

Built on an interactive map, the Geo Module locates facilities, helping to manage and control them. Flexible settings provide maximum visibility and eliminate redundant information on the operator display. The module allows an operator to easily search pumping stations and check their process parameters should there be any customer complaints.



Pumping station configuration module

This allows users to add new or edit existing pumping stations in the configuration of installed pumping units, valves, VFDs, sensors and metering equipment. Its main purpose is to eliminate the need for SCADA programming when controlled objects are added or edited. Using a parameterisation approach it significantly reduces reliance on qualified operating personnel.



Pumping selection module

The Pumping Selection Module allows users to evaluate the alignment of installed pumps with water supply modes and to select the best combination for power efficiency and extended service life. The module includes a pumps database containing more than 2,000 pumps from various manufacturers.



Analytic reports module

This performs automatic on-line running conditions analysis of pumping stations as well as the whole water supply process. It identifies abnormal process behaviour and deviations in the supply system, warning users as they occur. The module is designed to eliminate the need for continuous manual analysis by water utility staff.



Infrastructure diagnostics module

This allows users to evaluate causes of poor quality in communication channels and identify problem locations. The module automatically backs up the pump controller PLC programming of the control program, drive parameters and electrical documentation for each station that can then be archived to simplify maintenance.



Adaptive control module

This comprises several software algorithms designed to optimise pressure in the water supply system and eliminate low efficient operation of VFD controlled pumps. The module contains sophisticated process forecasting and neural fuzzy algorithms to eliminate the need for manual adjustments and enable adaptiveness of control.

Audit

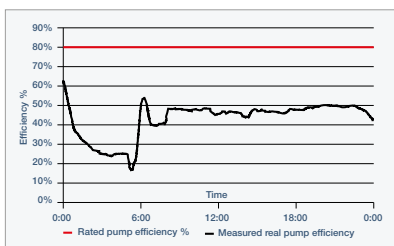
Prior to implementing Aquatoria®, we recommend an audit of a selected pumping station to identify any issues particularly in relation to the power usage of such station and ancillary pumping equipment that could indicate leakage or water loss. Conducted without any interruption or deterioration to the consumer water supply, audits contribute to the process of continuous improvement and help in developing action plans to ensure maximum return on investment.



Typically the audit consists of:

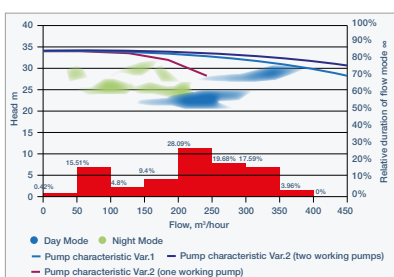
- Evaluation of relative efficiency of pumping equipment through deployment of station-based RTU devices
- Evaluation of consumer-side pressure distribution through deployment of pressure-monitoring checkpoints
- Identification of instances of inefficient power consumption and leakages

Analysing station efficiency



This example shows the results of real pumping efficiency compared to the rated efficiency.

Pump unit operation mode



In this example the audit identifies a significant difference between a pump's operating efficiency and its rated values.

The audit process

Using an innovative combination of software and hardware, the audit evaluates energy efficiency at water intake facilities as well as booster and sewage pumping stations. RTU devices and pressure monitoring checkpoints transmit information to a data processing workstation. A detailed report including recommendations for improvement in station operation modes as well as recommendations for pumping equipment selection will be prepared.

Measuring equipment set up at the local pumping stations measures and transmits:

- Water inlet and outlet pressure data
- Pumping unit power supply parameters (voltage, frequency, current, power)
- Water flow

Consumer-side monitoring checkpoints measure pressure at locations identified as having the most ineffective water supply. Gathered data is compared to standard conditions to determine the extent of any over-pressure in the network.

Audit recommendations

Following the audit, any of the following recommendations may be made:

1. Elimination of circuit over-pressure helps improve the quality of the water supply and emergency response times to:

- Reduce station energy costs
- Reduce leakage rate and outbreak risk
- Improve water supply and improve emergency response times

2. Replacement of existing pumping units to:

- Reduce station energy costs
- Reduce pumping equipment operating costs

References



Minsk Water Utility

Minsk city:	Population 1.9m
Application:	117 boosting stations, 24 bore holes
Investments:	€720K
Average ROI:	3.2 years (only based on energy consumption)

Additional benefits after 3 months of operation

- Average pressure decrease – 7%
- 3 backvalves malfunctions encountered
- 12 pumps out of duty range identified

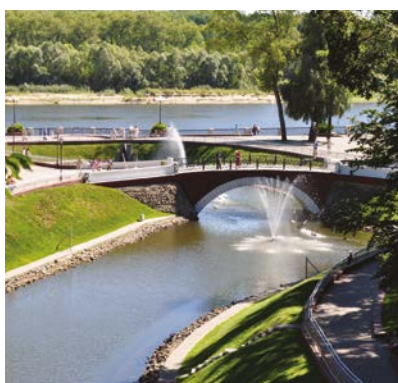


Mogilev Water Utility

Mogilev city:	Population 360K
Application:	78 bore holes, 3 main pumping stations
Investments:	€490K
Average ROI:	3.2 years (only based on energy consumption)

Additional benefits after 3 months of operation:

- Average pressure decrease – 6%
- 9 backvalves malfunctions encountered
- 7 pumps out of duty range identified



Gomel Water Utility

Gomel city:	Population 510K
Application:	39 bore holes, 2 main pumping stations, 8 boosting stations
Investments:	€220K
Average ROI:	4.2 years (only based on energy consumption)

Additional benefits after 3 months of operation:

- Average pressure decrease – 9%
- 3 backvalves malfunctions encountered
- 4 pumps out of duty range identified



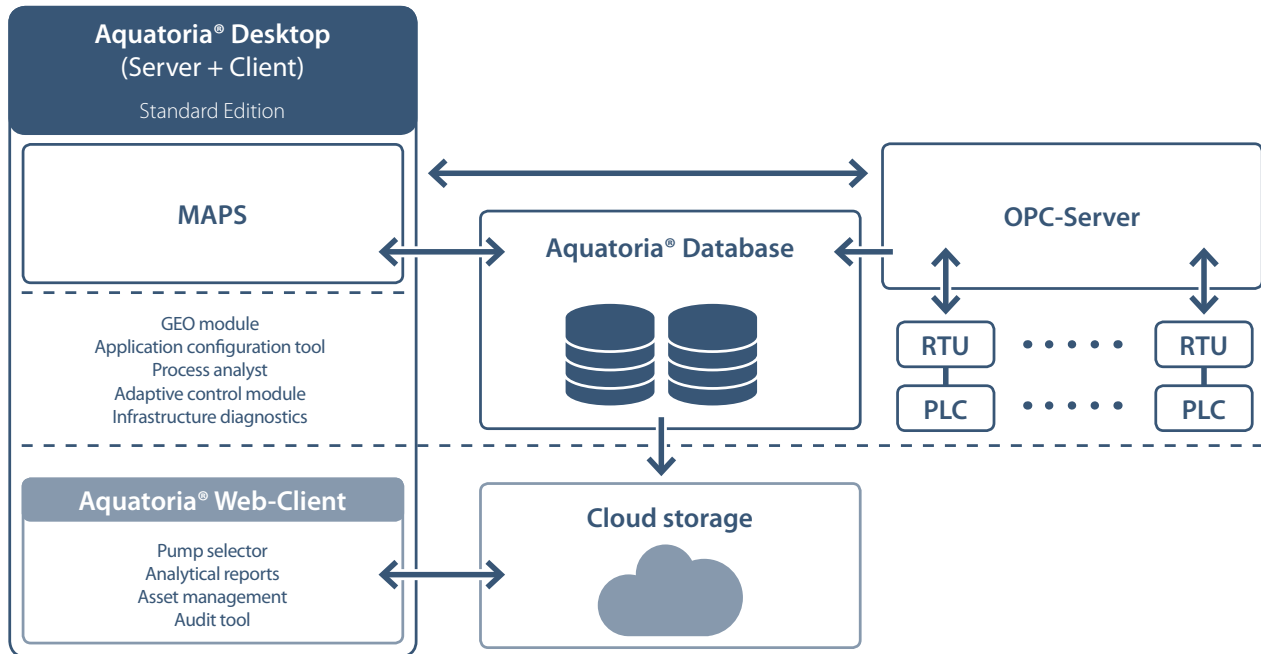
Orsha Water Utility

Orsha city:	Population 116K
Application:	2 main pumping stations, 10 bore holes
Investments:	€125K
Average ROI:	2.7 years (only based on energy consumption)

Additional benefits after 3 months of operation:

- Average pressure decrease – 10%
- 2 backvalves malfunctions encountered
- 5 pumps out of duty range identified

Architecture



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