



WANDA

Deltares systems

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Deltares
Enabling Delta Life



Designed for engineers by engineers

WANDA

We believe that a thorough understanding of the hydraulic behaviour in a pipeline system is essential to guarantee a low cost, safe and reliable system. However, it is our experience that getting such thorough understanding of this behaviour in the system, especially the dynamic behaviour, is often considered a complex task.

With our software program WANDA, we aim to simplify this task so that you can get a thorough understanding of your pipeline system with just a few clicks. Its user friendly interface enables engineers to easily use the advanced tools of the program without having to deal with superfluous features. Moreover, its intelligent components and standard-setting GUI enable users to carry out any hydraulic analysis in the most efficient way.

WANDA is a program designed *for engineers by engineers* to perform a fast and reliable hydraulic analysis. Over the past 40 years, Deltares has been developing the water hammer software, WANDA, to assist hydraulic engineers in the hydraulic analysis of pipeline systems. It has been extensively tested and validated by experiments and field measurements. As of today, WANDA is recognized by many users both nationally and internationally as a fast, easy and reliable hydraulic modelling program.

Quotes from our users:

"I am sure that once future clients know the WANDA program capabilities and use it, then this software shall dominate the market very fast due to its unique features."

"With WANDA, we can perform our studies 4 times faster than with other comparable software programs."

"WANDA is definitely our favorite program for surge analysis. If we would have to choose, we would choose WANDA over any other software program."

Assess your pipeline system throughout the entire lifecycle

You can apply WANDA in a vast number of industries, throughout the entire lifecycle of a pipeline system.

Industries

- Drinking water and wastewater transportation systems
- Firefighting systems
- (Process) plant piping
- Water treatment facilities and desalination plants
- Slurry transport and sludge handling
- Transport in mining industry
- District heating systems
- Oil or LNG (off-)loading systems
- Industrial cooling water systems
- Underground salt mining
- Hydraulic machinery
- Intake/outfall structures

Lifecycle

- Conceptual design
 - Feasibility studies
 - Component selection and sizing
 - Design optimization
 - Pump energy evaluation
- Detailed design
 - Selection and sizing of anti-surge provisions
 - Design of normal and emergency control procedures
- Commissioning
 - Setup of commissioning tests
 - Digital commissioning of critical PLCs
 - Model calibration for operational use
- Operation
 - Operator training simulator
 - Model predictive control
 - System extensions – temporary modifications



Saving capital costs by surge vessel optimisation with WANDA



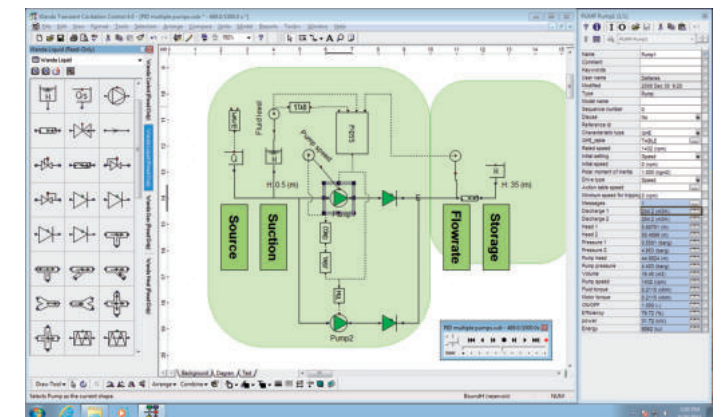
Successful WANDA application in a sea water reverse osmosis (SWRO) train optimisation study

Enjoy WANDA's simple and intuitive User Interface

WANDA's simple and intuitive user interface will help you set up your model fast and easy. The *"drag and drop"* principle allows you to select components such as pumps and valves from a library and place them into the model diagram. Component properties such as pump discharge and valve size can then be entered in the property window. After simulation, you can view the results in spreadsheet and graph format. The time navigator then allows you to view an animation of the results, and see detailed results at any moment in time.

Special features:

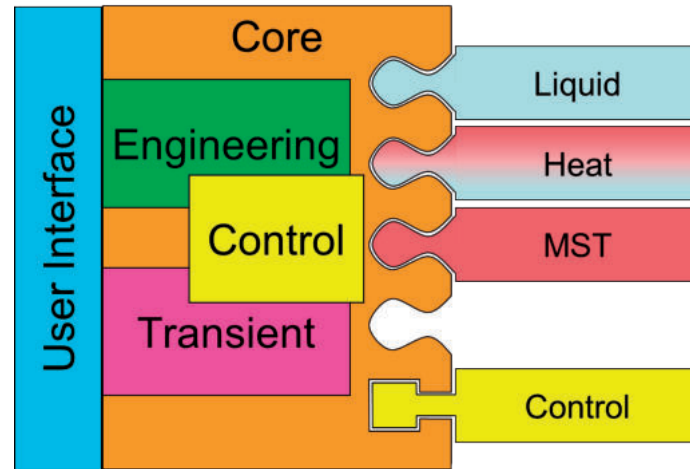
- Intuitive look and feel based on iGrafx Flowcharter®
- Copy/paste of components, diagrams, graphs, tabular results and input parameters
- Different layers for text and background
- connector-tool to separate details or subsystems from the main model
- input and output properties in spreadsheet view
- Comparison of complete cases with case-compare
- Animation function to analyse wave propagation and reflection
- Several unit systems (standard SI, US, UK, user defined) are supported



WANDA's easy to use interface

WANDA's modes & modules

WANDA consists of 2 calculation modes (Engineering and Transient) and 4 modules (Liquid, Heat, Multi-species transport and Control). The modes are integrated in the core of WANDA, together with the system control functionality. The modules are connected to the core upon request of the user when the software is purchased. Each mode contains a component library specific for that domain. The user can then access the modes and modules through the user interface.



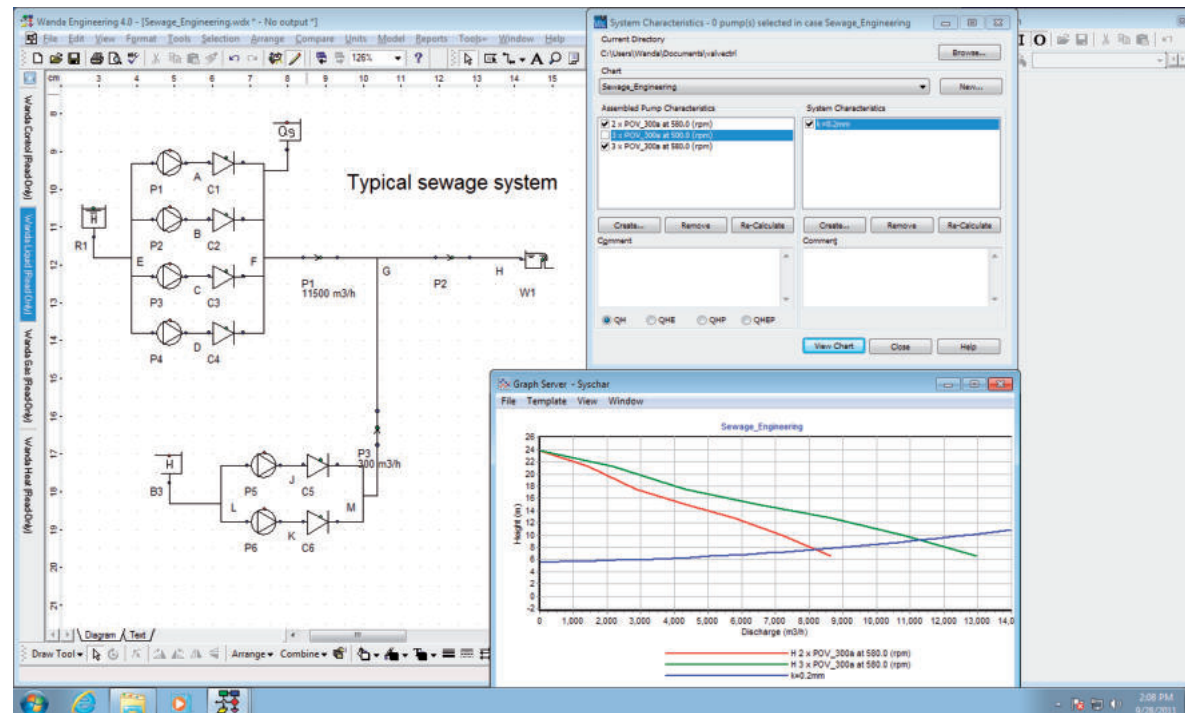
The architecture of WANDA 4

Engineering mode

The Engineering mode is used for steady state analysis of the pipeline system. This mode allows you to perform common activities in the hydraulic design of the pipeline system, such as pipe sizing and capacity analysis. In this mode, the performance of the pipeline system can be quickly analysed and optimised through continuous parameter changes and reruns.

This mode assists you with:

- Head loss calculations
- Pipe, pump & valve sizing
- Flow capacity analysis
- Hydraulic gradient & pressure analysis
- Pump & System characteristic plotting
- Optimization of multi-pump operation
- Impact analysis of system changes



Hydraulic design of a pipeline system

Transient mode

The Transient mode is used for unsteady (transient) analysis of the pipeline system. This mode allows you to analyse incidents such as pump trips and valve closures, and the consequential reaction of surge towers, relief valves and control systems. In this mode, the pipeline system can be designed to withstand these incidents and ensure a safe & reliable operation.

Incidents

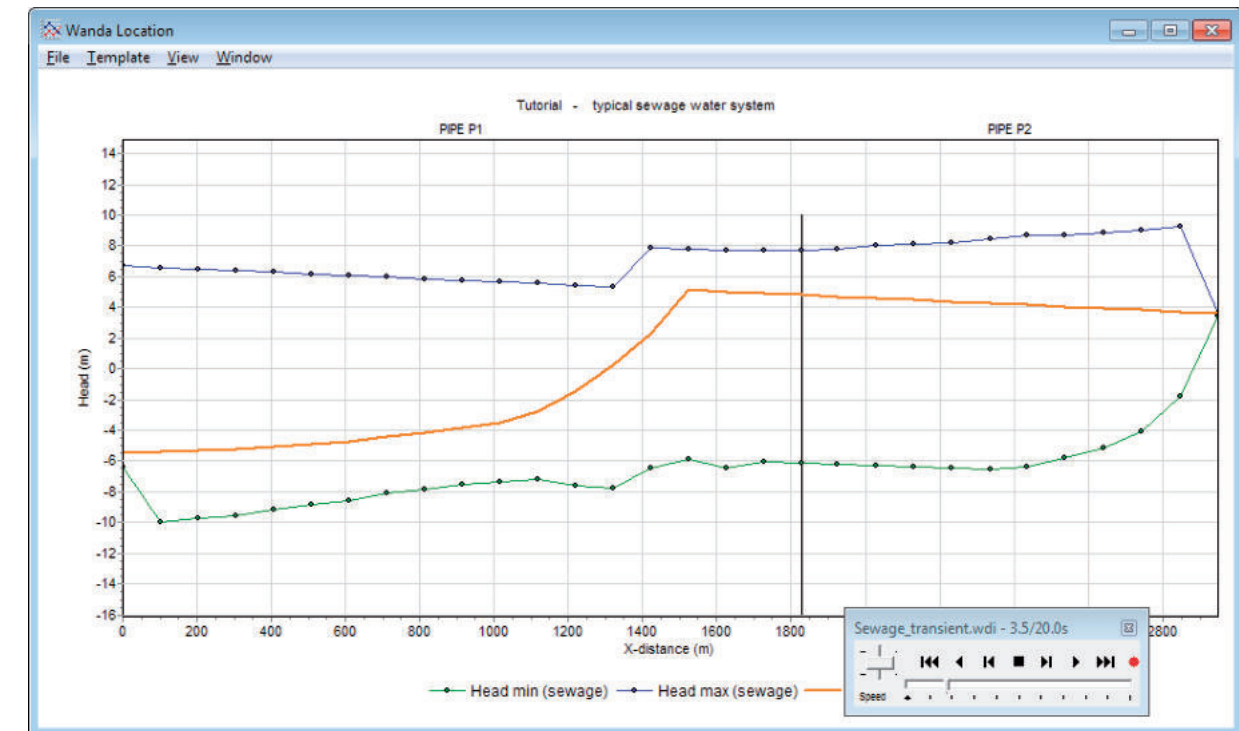
- Valve closure/opening
- Pump trip or start-ups

Protection

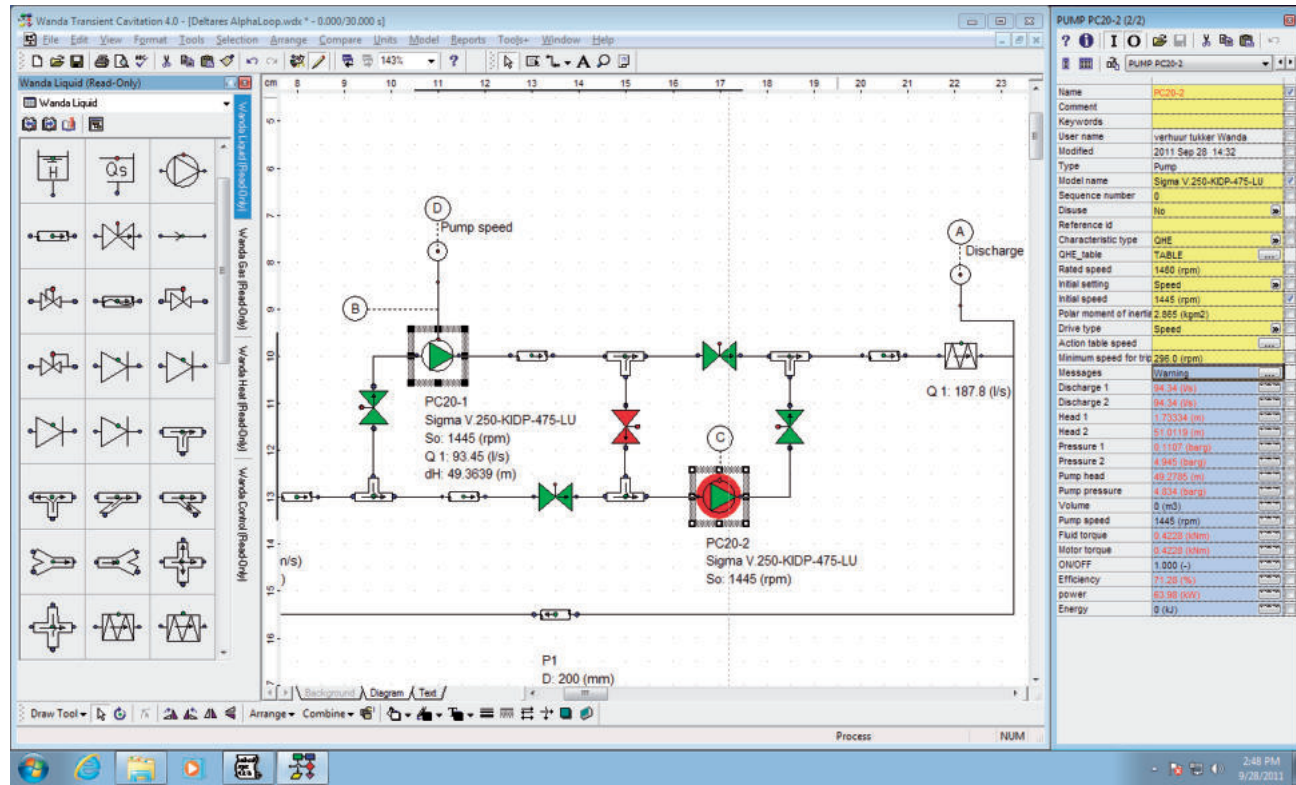
- Surge towers
- Air vessels
- Pressure relief valves
- Air vents
- Control systems

Phenomenon

- Pressure & discharge change
- Pressure wave propagation
- Water hammer
- Wave reflection
- Line packing
- Cavitation



Analysis of pressure wave propagation through a pipeline



Modelling a pumping station in WANDA

Liquid module

With the Liquid module, you can model and analyse a pipeline system for liquid transport. This module contains a wide variety of hydraulic components, including special components such as, surge protection equipment and free surface flow pipes. With this module, you can also access the special system characteristic plotting and pump operation optimization features to improve the performance of your pumping station.

Library components

- Storage tanks
- Pumps
- Pipes
- Control valves
- Check valves
- Junctions
- Weirs
- Surge vessels
- PRV's
- Vents

(special) features

- Accurate head loss of T-, Y- and X-junctions
- Newtonian and non-Newtonian fluids (slurries)
- Active pumps, (control) valves and air vessels
- Filling of pipelines
- Free surface (pipe) flow
- Transition of partially filled to completely filled pipelines
- Reaction-type turbine behaviour
- Dynamic check valve behaviour
- System characteristic plotting
- Pump operation optimization

Heat module

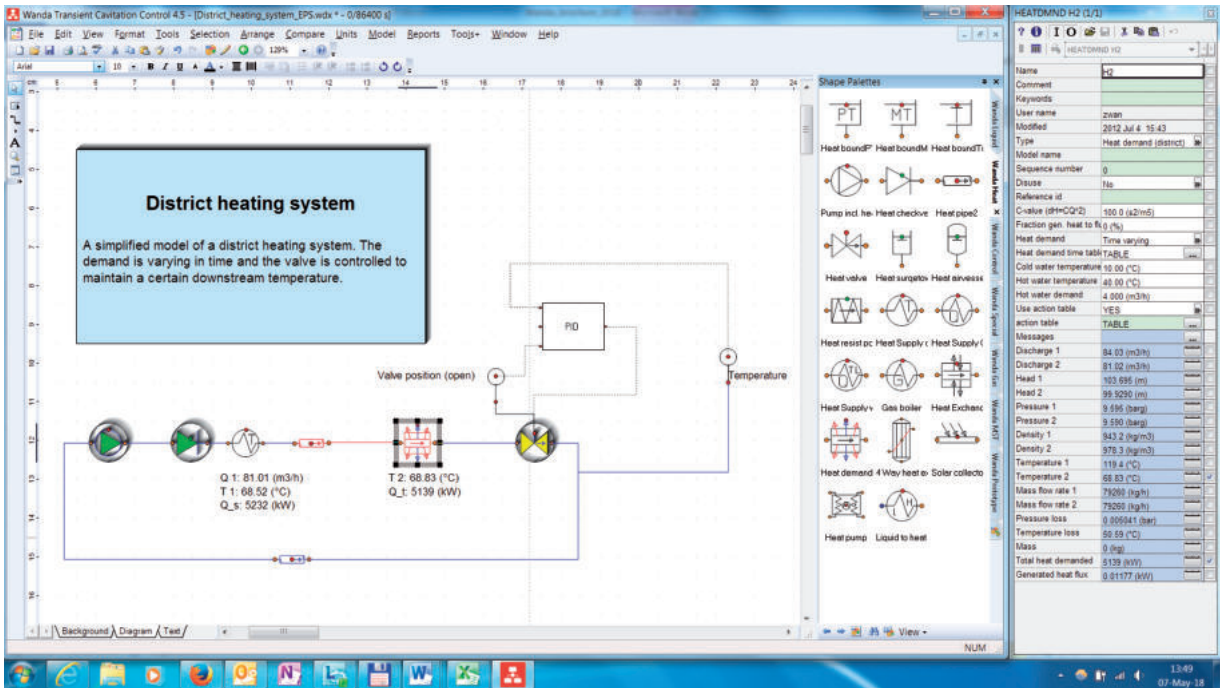
With the Heat module, you can model and analyse a pipeline system for heat transport via liquid flow. This module allows you to model district heating networks and process industry piping, for which temperature and heat loss play an important role in the design of a pipeline system.

Library components

- Heat suppliers
- Heat exchangers
- Pump
- Pipes
- Control valves
- Check valves
- Surge vessels

(special) features

- Temperature dependent fluid properties
- Heat transport due to flow
- Heat transfer to and from the surroundings
- Heat transfer by dedicated components (heat exchangers)
- Heat generation by friction

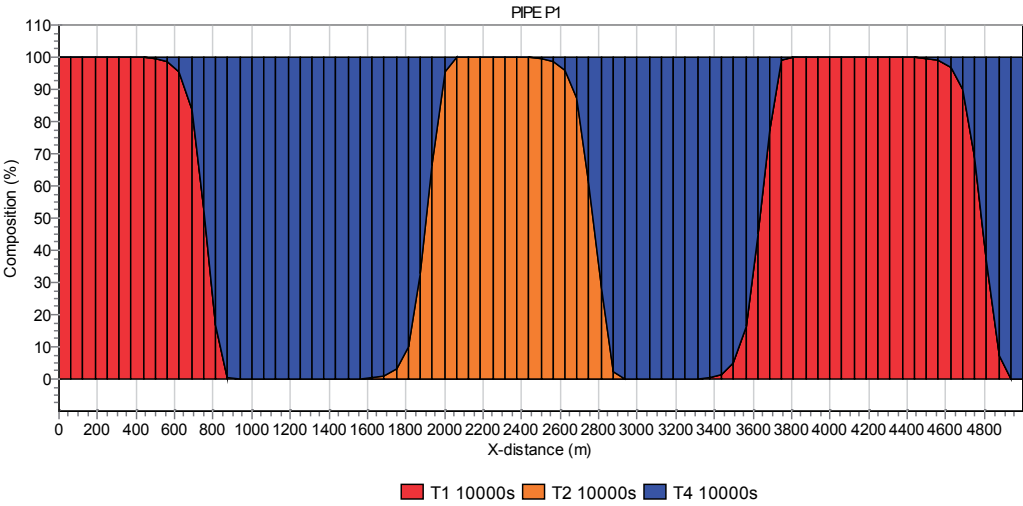


Modelling a district heating system in WANDA

Multi-Species Transport (MST) module

With the Multi-Species Transport (MST) module, you can model and analyse transport of separate batches of fluids through a pipeline system. This module can be used in mining and dredging industry, where multiple fluids are transported in batches.

Library components	(special) features
- Storage tanks - Pumps - Pipes - Control valves - Check valves	- Newtonian and non-Newtonian fluids - Multiple fluids in batches within the pipelines - Specified properties, friction model and water hammer parameters per fluid



Analysis of batch flow of multiple species through a pipeline

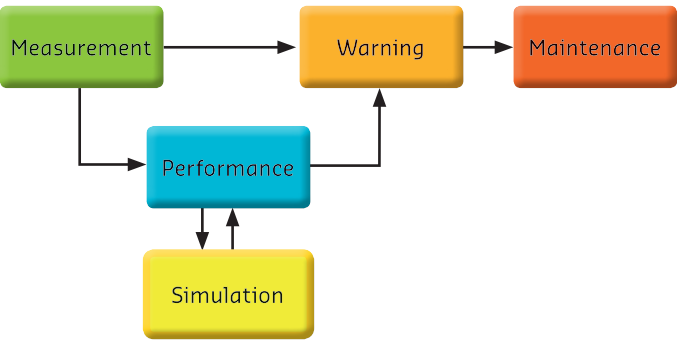
Control module

The Control module allows you to link a control system to a hydraulic system. This enables you to evaluate the effectiveness of different control philosophies on the hydraulic system and to optimise the control properties. The Control module can be combined with the Liquid, Heat and MST module.

Library components	(special) features
- Sensor and generators (logical or numerical output) - Conditional operators (IF-statements and switches) - Logic operators (AND, OR, exclusive OR, NOT) - Numeric operators (add, multiply, functions, etc.) - Continuous controllers (PID-controllers incl. start/stop)	- Advanced pumping station controllers including parameters for ramp-up time, minimum speed, etc. - Control of all active components, such as valves, pumps, etc. - Varying of boundary conditions (pressure head or discharge)

Couple WANDA to SCADA systems

WANDA can also be coupled to SCADA systems. Through this coupling, WANDA can serve as a performance monitoring system, with a real time comparison of monitoring data and WANDA simulations. It also allows the setup of an operator trainer simulator, where operators can practice their reaction on a simulated incident in a pipeline system.



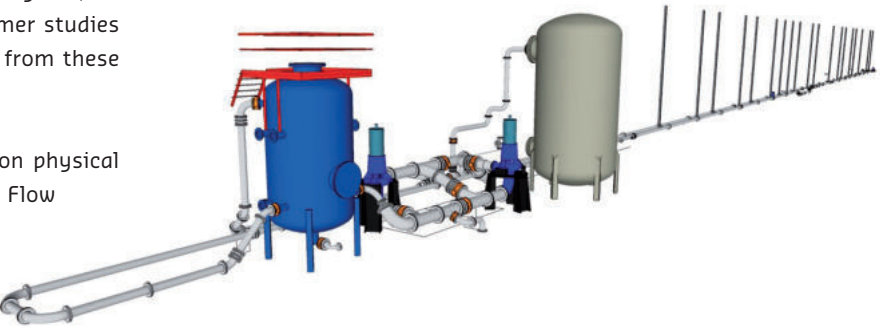
Performance monitoring through coupling with SCADA system

Developed on experience & expertise

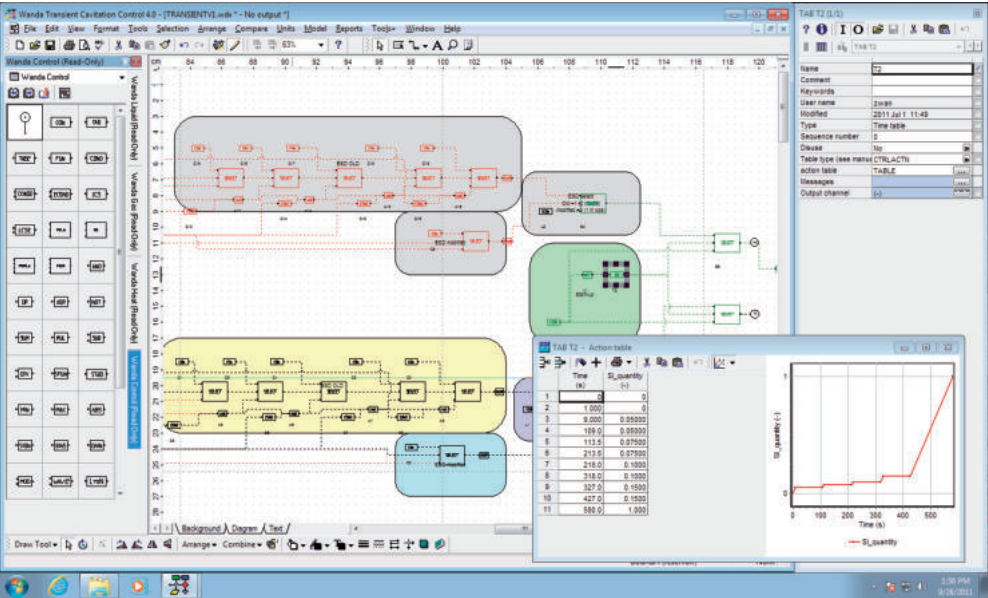
We first started developing WANDA in the 1970's, and have continued to develop WANDA ever since. Throughout the years, we have used WANDA to perform numerous Water Hammer studies all around the world. The experiences that we gained from these studies have all been incorporated into WANDA.

The development of modelling components is based on physical model testing in our own large-scale, Multiphase Flow Facility (alpha-loop) as well as on site testing at our clients. In addition, we design fit for purpose modelling components based on specific client requests.

Over the years, WANDA has been licensed world-wide to many well-known water authorities, pipeline owners, consultants and production companies. Deltares' reputation and decades-long experience are a guarantee for the high quality of this powerful simulation software package.



Deltares' Multiphase Flow Facility (Alpha-loop)



Modelling a control system in WANDA



Deltares carries out Water Hammer analysis for large bulk water transmission projects using WANDA

Want to know more?

Please visit our website: www.deltares.nl/en/software/wanda/

Here you can:

- find information on our license and service packages
- request a free trial license for 1 month
- get in touch with our experts

Learn how to use WANDA?

- Deltares organises courses on a yearly basis for basic and advanced use of WANDA. For more information, please visit our website: www.deltares.nl/en/academy-courses/

Hydraulics for Infrastructure and Industry department

Other capabilities:

