A CUSTOM WEST GRAPHICAL USER INTERFACE FOR OPERATOR TRAINING

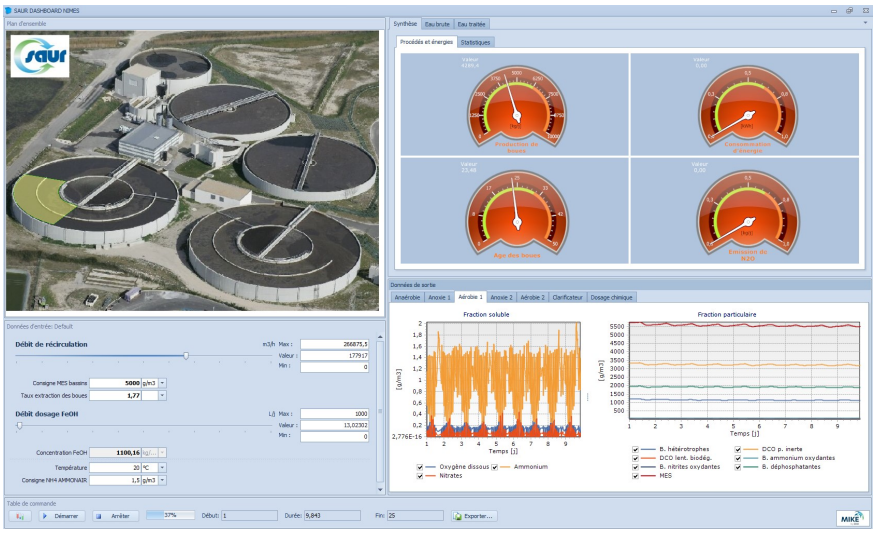
The wastewater treatment plant of Nîmes

SAUR provides a variety of services to the community, including the exploitation and treatment of water. In this capacity, SAUR manages several wastewater treatment facilities in France. A modelling study of the plant of Nîmes was conducted by the French National Research Institute for Agriculture and Environment (IRSTEA) and was aimed at assessing the effectiveness of a novel aeration control logic developed by SAUR. A customised, dashboard-like Graphical User Interface (GUI) was eventually implemented by DHI to exploit the potential of the WEST model as a tool for training the plant operators.

THE WASTEWATER TREATMENT PLANT OF NÎMES

This 230,000 PE plant is located in Nîmes, France, and consists of two parallel activated sludge lines, each comprised of a circular activated sludge tank (with anaerobic, non-aerated and aerated stages) followed by a secondary clarifier.

Two different strategies are used to control aeration: a conventional ORP/DO logic in the first line, and a NH4/DO logic (developed by SAUR and named 'Ammonair') in the second line. The Ammonair controller was implemented and tested on this site to reduce energy consumption, while ensuring the required effluent quality as well as low nitrous oxide (N_2O) emissions.



WEST operator training GUI for the WWTP of Nîmes. © DHI/SAUR

CLIENT

SAUR

CHALLENGE

- Create an ad-hoc operator training GUI for the WEST model of an existing treatment plant
- The GUI is to hide the complexity of the underlying model while exposing the essential control and evaluation elements in a straightforward way

SOLUTION

A dashboard-like GUI that utilises the WEST .NET API and standard graphical WEST modules.

VALUE

The custom GUI:

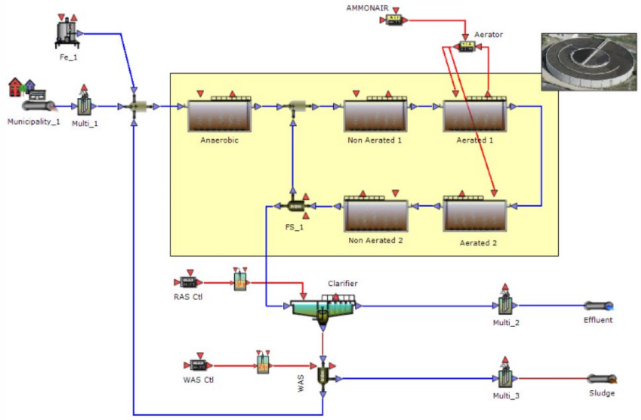
- offers a very intuitive means to interact with the complex mathematical model of the plant
- presents the essential operating parameters that an operator is familiar with and is likely to use in the daily operation
- allows for evaluating scenarios in a very intuitive way – scenarios can be saved (stored) and reloaded

LOCATION / COUNTRY

Nîmes, France

SOFTWARE USED

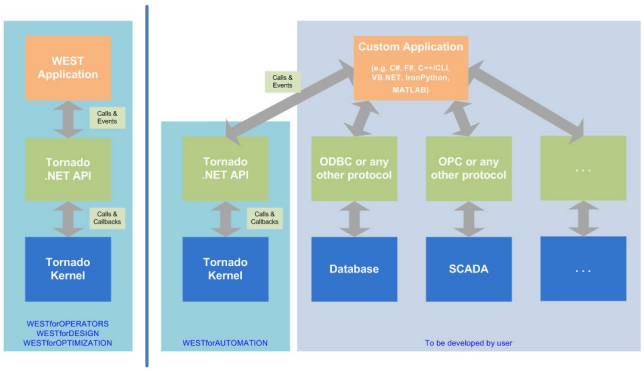
WEST



WEST layout of the WWTP of Nîmes. © DHI/SAUR

THE APPROACH

There are two common approaches to developing custom user interfaces on top of a WEST model. The first is to set up a custom dashboard within WEST itself in a point-and-click fashion, using the graphical widget toolbox that the latter provides. The second concerns developing a fully customised user interface using a general-purpose programming language (typically C#) on top of WESTforAUTOMATION (WfA), which is a software development kit (SDK) for .NET that provides access to the WEST engine. The first approach does not require any programming skills but is constrained in terms of flexibility; the second offers full flexibility but requires a non-negligible programming effort.



Conceptual diagram of the integration of the Tornado API in WEST (left) and in custom applications (right). © DHI/SAUR

For the Nîmes wastewater treatment plant (WWTP), a slightly different approach was followed. Apart from the WfA SDK, a number of graphical modules from the WEST source code base were also re-used in order to speed up the development process while still maintaining full flexibility.

The WfA SDK adheres to the object-oriented paradigm and follows a number of well-known software design principles, such as the singleton, factory, façade and observer patterns. An important reason for adopting .NET's C# language for developing the Nîmes dashboard is precisely its support for events and event handlers, which is .NET's implementation of the observer pattern. Events fired by the WEST engine allow for easily acting upon the simulation advancement in terms of progress indication and visualisation of output.

THE NÎMES DASHBOARD

The GUI proposed for the operator training dashboard consists of four areas:

- An aerial view of the plant with clickable regions
- A control pane below it displaying the process parameters that the operator can act upon
- An output pane (on the right) further subdivided into two regions: the top comprises three tab pages with summary information for the plant and process; the bottom contains a tab page for each clickable region of the aerial view of the plant showing the concentrations of key-components
- A taskbar (at the bottom) which allows for launching a simulation and loading/storing scenarios

The process parameters are:

- The recirculation and excess sludge flow rates
- The mixed liquor suspended solids (MLSS) concentration in the tank
- The ammonia set-point of the Ammonair controller
- The quantity of iron chloride dosed
- The operating temperature

The influent specs (that is, flow rate and concentrations) can be changed by selecting pre-configured influent files. The summary information – which the operator is supposed to monitor to evaluate the performance of the process, are:

- Sludge age (d), Excess sludge production (kg/d), Energy consumption for aeration (kWh), N2O emission (kg/d)
- The effluent quality: average, 95%- and 98%-ile (mg/l) of COD, BOD, ammonia, total nitrogen and total phosphorus

CLIENT TESTIMONIAL

> *We are going to use this tool to explore a variety of operational scenarios in order to best combine the two co-existent aeration control systems on the plant. The tool will ultimately enable us to transfer the Ammonair logic on more of our installations.*
>
> *Fabrice Nauleau-Direction Recherche et Developpement-SAUR*

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