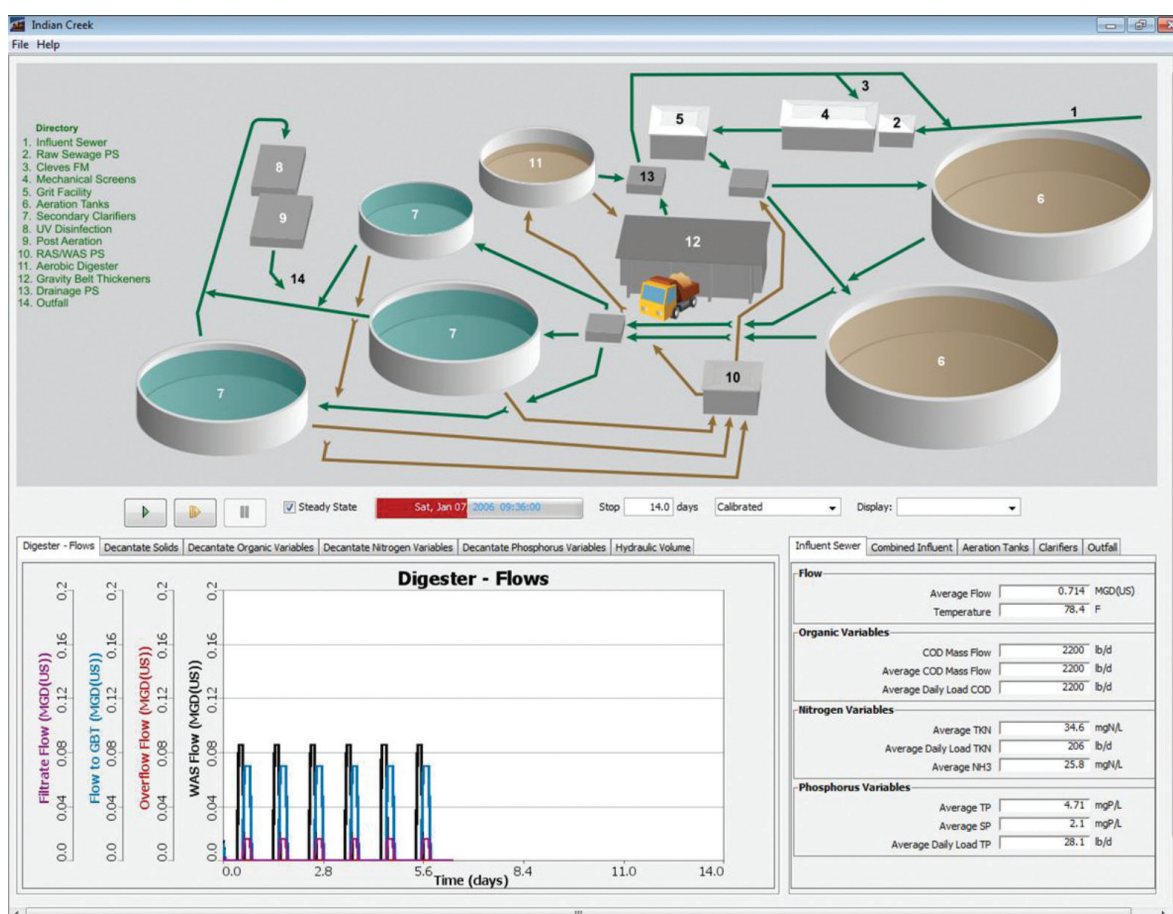


# Customised Operator Interfaces for Advanced Training and Plant Analysis

a 'flight simulator' for water and wastewater treatment plants

Simulation-based training is a mainstay within the military and aviation sectors and fast becoming commonplace within many key industries including oil and gas, marine shipping, nuclear energy and, more recently, healthcare. The benefits of this kind of tool in the water and wastewater industry are many-fold. By replicating an existing supervisory control and data acquisition (SCADA) system, operators are provided with a lifelike training experience with familiar views and functionality, and with plant response and behavior driven by mathematical models of their own treatment plant. The article looks at one of the industry's first such systems.



Courtesy of Hydromantis Environmental Software Solutions Inc

## Scenario

You are in the last 45 minutes of what has been a pretty quiet shift despite the unrelenting rain for the past few days and higher than usual levels in the wet well. You are just in the process of filling out the last couple of entries in your log book when it happens; an indicator light on your SCADA screen flashes red and an audio alert sounds...RAS pump failure. The early morning load is pushing the limits in the wet well and the sludge blanket starts to rise in the secondary clarifiers....What do you do?...Relax, it's just a simulation!

## SimuWorks™

SimuWorks™ is a 'flight simulator' for both water and wastewater treatment plants, representing an evolution in the use of water and wastewater treatment simulation and modelling technology, extending its use beyond the engineering offices.

The loss of process knowledge is a major challenge facing wastewater treatment works (WwTW) owners and operators. As experienced operators consider retirement and make way for the next generation, efficient methods for facilitating the transfer of general and site-specific knowledge is necessary and sophisticated WwTW simulation technology can offer significant advantages.

Created by Hydromantis Environmental Software Solutions Inc, SimuWorks™ replicates existing treatment plant SCADA systems to provide operators a lifelike training experience. With the virtual plant's behaviour and the interface control screens matching that of the actual plant, various training, project and risk analysis, plant optimisation, and process improvement evaluations can be performed in a risk-free environment.

The plant simulators can be deployed as on-site life-size replica control rooms, scaled-down single workstations, or even offered online. Because the simulators are driven by individual plant models and replicated interfaces, a single installation with a library of models could support a regional network of plants while still offering plant specific training and analysis opportunities

### Advantages

The key advantages of treatment plant simulation include:

#### For operator training, development & knowledge capture

- Controlled, safe environment, with no risk to plant.
- Simple or complex scenarios (wet weather event, physical failures, loading changes, etc).
- Site specific models capture a plant's key process knowledge.

#### As a plant analysis tool

- Evaluation of retrofits and optimization of existing plants.
- Validation and introduction of new technologies.
- Plant capacity or lifespan analysis.
- Maintenance forecasting/planning.
- Project or Operational Risk Analysis.
- New process or emergency plan development.
- Forensic analysis and incident management support.

A SimuWorks™ deployment requires the development of a specific model of the target plant using Hydromantis' flagship product GPS-X™, one of the industry's most advanced tools for water and wastewater treatment plant modelling. Once the model is complete and properly calibrated, the site specific systems information (SCADA) interfaces are replicated and a library of training scenarios customised to client requirements. The system does not require extensive hardware and, as the user interface is a replica of the plant's operating systems, training requirements are modest.

### Design and operations opportunities

SimuWorks™ offers numerous design and operations opportunities ranging from determining if the current plant operational strategies are appropriate, through to seeing if low cost retrofits can forestall the need for a costly plant upgrades, while at the same time maintaining effluent quality.

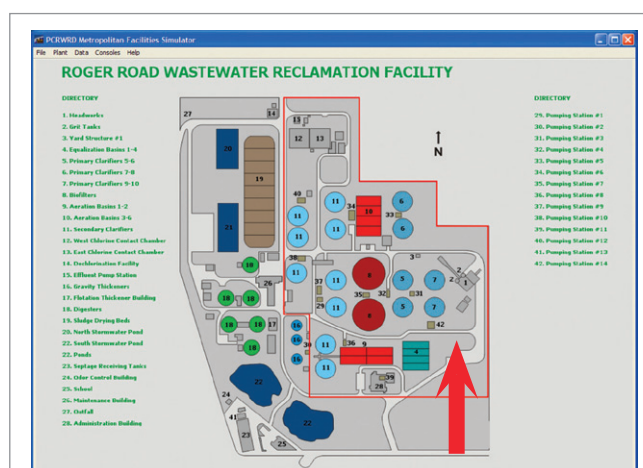
It can assess the impact of different operating control strategies and the effects of increased organic and hydraulic loading on an existing plant and see if bottlenecks exist in the liquid or sludge line and quantify the impact under various loading scenarios. Other examples include:

- Determining the effect of taking process unit operations out of service and under varying conditions to identify risks.
- The impact of varying internal recycle rates, anoxic zones, anaerobic zones on nitrification and denitrification and overall treatability can be assessed.
- Optimising solids handling costs by assessing operating strategies that reduce sludge production while maintaining effluent quality within given guidelines.
- Investigating the effect of treatment control strategies during wet weather flows. Under various storm flow conditions determine the optimum time to bypass in the primary and secondary clarifiers.

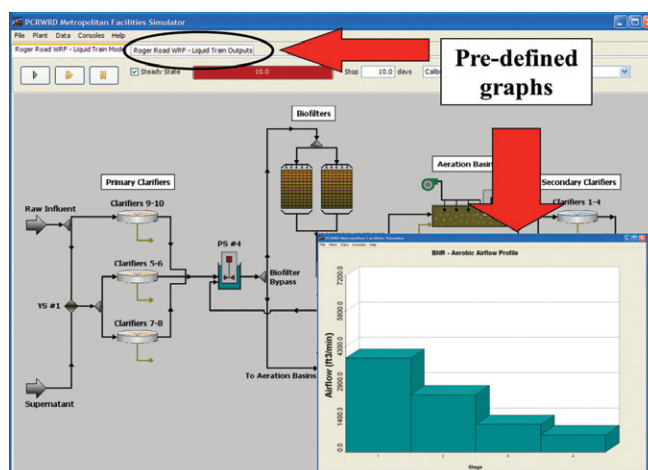
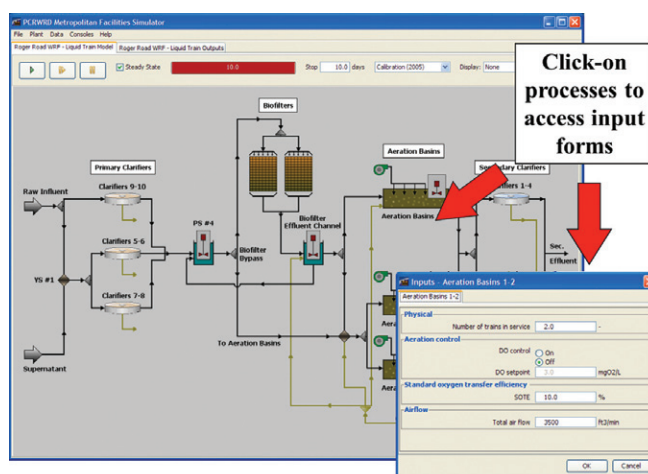
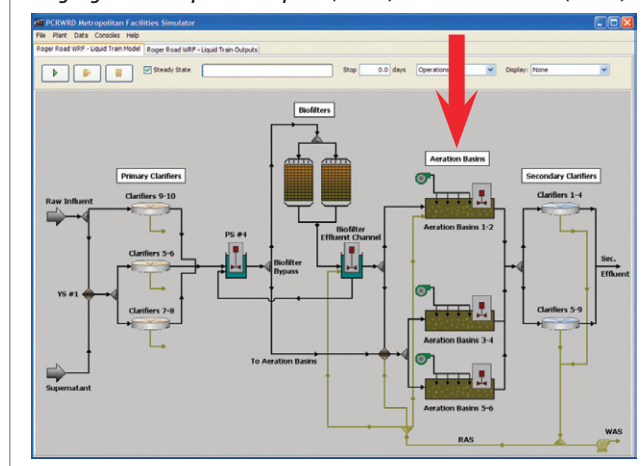
### Cost-saving analysis opportunities

There are many features to SimuWorks™ that enable users to assess potential cost savings. Some examples are below:

- Investigating the potential energy cost savings of implementing dissolved oxygen control or fine tuning DO control strategies given actual dynamic influent data.



Highlight/click on part of the plant (above) to view that section (below)

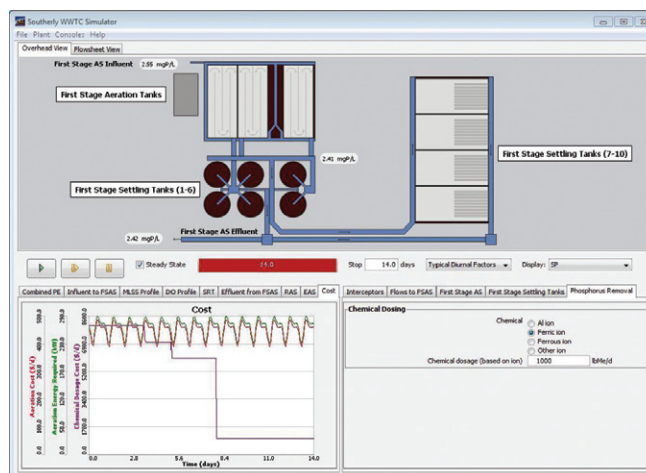


- The selection and evaluation of operational control strategies can be evaluated such as on/off aeration and its impact on nitrification, denitrification and effluent quality. Potential cost savings associated with using various on/off scenarios can be investigated.
- Evaluating phosphorus removal options for operating costs. Compare the operating costs of Bio-P (aeration and pumping costs) vs Chemical P removal (chemical addition costs) for your plant.
- Evaluating dynamic aeration costs by determining airflow requirements throughout the day as influent flow changes. SimuWorks™ can simulate diurnal aeration costs, and optimise aeration energy used by aeration more at night when energy is cheaper.
- Determining the effects of cleaning aeration diffusers and estimate the optimum cleaning frequency thus minimising costs and aeration tank downtime.

### Management and planning opportunities

By using future organic and hydraulic loading estimates the software can determine when the plant will need to be expanded or upgraded. It can also enhance an existing wastewater treatment master plan or facility plan with a process model so that future impacts can be evaluated quickly and accurately.

The effects of flow reduction programs (inflow and infiltration, water conservation, pricing policies, industry pre-treatment) will change the influent loading characteristics by reducing the hydraulic component and increasing the organic component. An assessment of the impact of these programs on the wastewater facility can be carried out. Flow reduction programs will have an impact on future capital plant expansions or retrofits that may have been planned for the wastewater plant. The financial impact of flow reduction (cost savings in postponed plant expansions) can be estimated.



Emergency modelling can be carried out quickly to answer any operational questions associated with taking processes out of service and estimating the effects on plant compliance vs having construction completed faster and what is most cost effective.

### Conclusion

Hydromantis was among the pioneers of commercialising modelling and simulation software for the water and wastewater industry and now, with SimuWorks™, the company is looking to take WwTW training and process analysis opportunities to new heights.

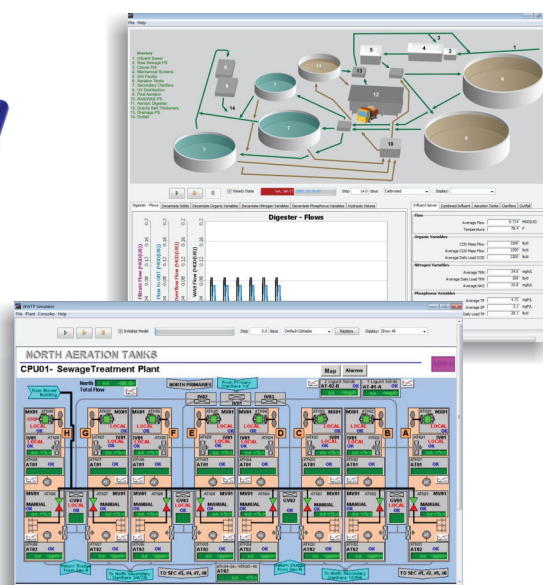
*The Editor & Publishers would like to thank Darren Richarz, VP of Sales & Marketing at Hydromantis Environmental Software Solutions Inc, for providing the above article for publication.*

# SimuWorks™



SimuWorks™, customized wastewater treatment plant dashboards, offers advanced training AND operational efficiencies:

- Operator training & development
- Plant optimization & analysis
- Repair & maintenance planning
- Forensic & incident review
- Project & risk management
- **Win & win**



Simulate your wastewater treatment plant, test out your options in a **risk-free** environment and make better decisions.

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