GOLD BAR THICKENER/FERMENTER OPERATIONAL IMPROVEMENTS

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Introduction

Wastewater treatment plants face an enormous responsibility and competing pressures from several directions. EPCOR's Gold Bar Wastewater Treatment Plant (GBWWTP) is one of Canada's largest Class IV wastewater treatment plants and treats over 100 billion litres of Edmonton's wastewater every year, or more than 310 million litres per day (MLD)—enough to fill 124 Olympic-size swimming pools every day. The City of Edmonton's Combined Sewer Overflow (CSO) Control Strategy will result in a much greater amount of wastewater being sent to Gold Bar, up to 1200 million litres per day and beyond. This CSO Control Strategy will also increase the solids sent to the plant. In order to manage this increase, the plant must identify the most productive and safe methodology to treat as much wastewater as possible, while minimizing the impact on the North Saskatchewan River and surrounding region and ensuring that there is no interruption to treatment, which could result in sewer backup and other issues. The most obvious solution – expansion of the physical plant – is very difficult. Gold Bar is bounded on three sides by some of the most popular parks in Edmonton, and on the fourth by the North Saskatchewan itself. Space is tight and construction is heavily constrained.

Project Highlights

- New narrative dramatically increased solids treatment capacity, protecting the North Saskatchewan River
- New simulation method used to test in a safe, controlled "sandbox": 24 million pieces of data, 16,000 lines of code, and customized, automated data visualization
- Identified critical operator-needed information and fixed key issues
- Removed months of reduced operation during testing from the project timeline
- Increased effective digester capacity by 30% and tripled peak load buffering
- Deferred up to $15 million in potential capital construction for at least five years

Exceptional challenges require innovative solutions. EPCOR has developed the Solids Handling Protocol, which involved a full overhaul of the solids handling strategy and the development of new, automated process strategies to dramatically increase throughput, centering on upgrades to the thickener/ fermenter strategy. Cybertech Automation Inc., experts in process automation, developed the strategy working closely with EPCOR, and SMA Consulting Ltd. used advanced simulation techniques to perform a comprehensive analysis of the new operations process.

The innovative approach began with embedding EPCOR personnel, including operators, into the project team – a standard practice in the petroleum industry, but not in wastewater. Cybertech compiled and updated existing documentation, integrating operators' expertise and detailed process descriptions, to produce an initial operational strategy of the entire process. The four tanks had previously been designed to run only as fermenters, with no buffering capacity. The new strategy automated running these as thickeners or fermenters, effectively adding new "virtual" tanks to the plant. With the new process, the thickener/fermenters can now buffer more than three times the solids loading from a single storm event as before. Operators can make the choice to run any tank as either a fermenter or a thickener, depending on expected needs, and the strategy ensures the digesters downstream are not dangerously overfed or starved. The increased thickening of the solids has also resulted in an approximate 30% effective increase in the digester capacity.

Nevertheless, ensuring the completeness of the strategy – not to mention determining best practices for operator decision-making – was a delicate and complex process, with an enormous potential for encountering unforeseen issues. Working closely with the Gold Bar team and Cybertech, SMA developed a combined discrete event and continuous simulation to capture the solids flow in the system, using real minute-by-minute input data and incorporating both the new automation and the new strategies for operators. The simulation was created using *Simphony*, a flexible and powerful simulation environment built at the University of Alberta. Once the model was developed, sixteen potential scenarios were run, which covered a wide range of operational possibilities, and a customized visualization report was created to analyze the 1.5 million pieces of data produced for each scenario (24 million pieces of data in total). It was an iterative process, allowing the team to discuss issues, adjust the strategy, and see the effects in far more detail than would be possible in reality. The use of simulation as a "sandbox" refinement technique allowed EPCOR to implement the changes with confidence and eliminate months of reduced capacity during live testing. The new process for the thickener/fermenters has succeeded far beyond expectations: a similar increase in capacity would have required additional sludge storage and thickening facilities costing up to $15 million.

Innovation

- Cost-effective and schedule-efficient: the project was completed in approximately two months
- Can be used to give operators a better understanding of the overall process
- Custom simulation created using locally-developed Simphony
- Integrated with the *R* statistical computing environment
- First use of simulation to model integration of control logic and procedures at Gold Bar
- Complex simulation of entire process, integrated with highly flexible visualizations
- Used locally developed *Simphony* simulation and state-of-the-art statistical software

AN ENVIRONMENTAL CATCH-22

The North Saskatchewan River flows southwest to northeast through a 22-km long valley in the City of Edmonton, the largest stretch of urban parkland in North America. The river supplies drinking water for Edmonton and several downstream communities. It is also a popular site for recreational use. Unfortunately, the City of Edmonton, like many pre-1940 municipalities, is serviced in part by combined sewers which carry both storm water and wastewater. During heavy rains, these sewers can overflow into the North Saskatchewan, affecting the water quality and potentially public health. The City of Edmonton implemented the CSO Control Strategy to reduce the number and volume of these events. The strategy has several components. A number of initiatives have been launched to improve Gold Bar's capacity for treating liquids and solids so that it can handle peak flows during severe storms. The ultimate goal is to treat as much wastewater as possible; this project helped to ensure that the GBWWTP stayed a major player in enabling the City to meet this goal.

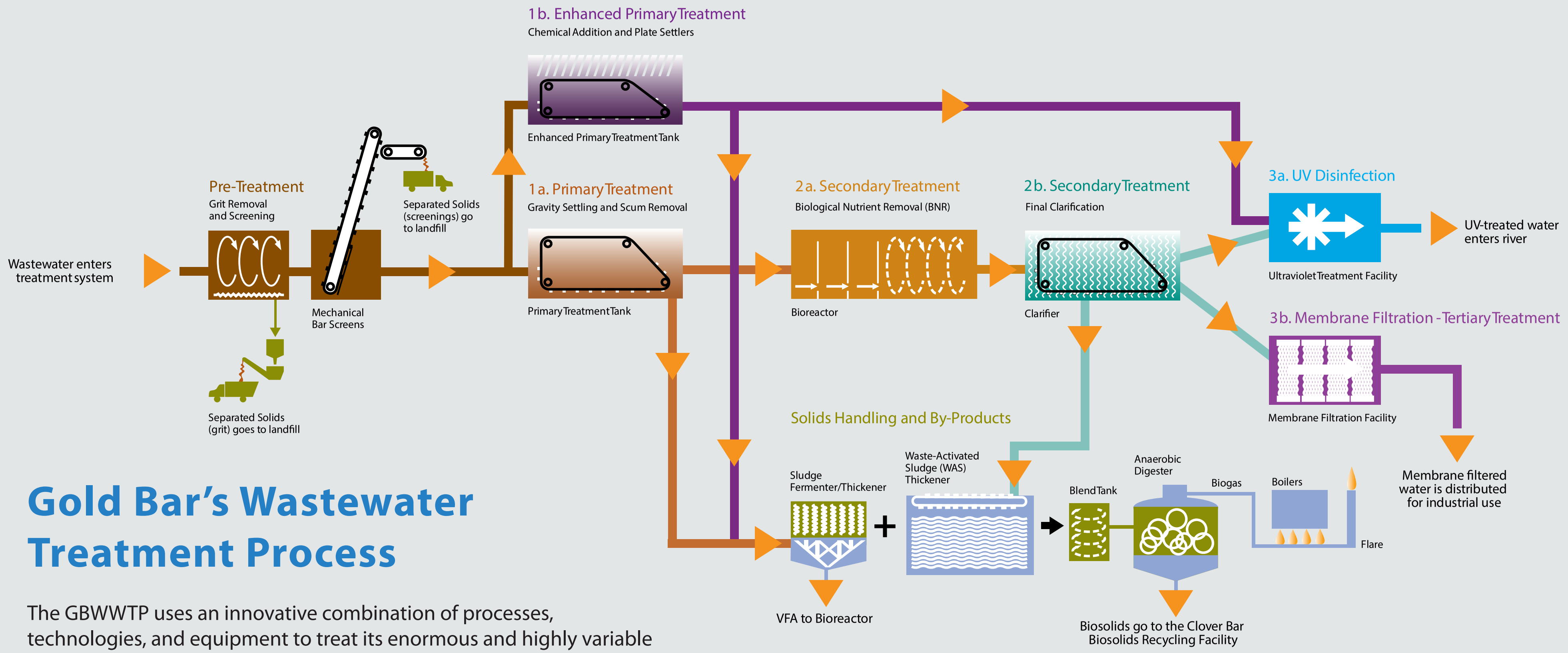
Improving GBWWTP's treatment capacity requires better processing methods; however, these are difficult to develop and implement due to the same environmental pressures that make capacity issues such an urgent problem in the first place. Changes can be discussed and analyzed, but ultimately the final test is to implement the new method live, during the day-to-day operations of the plant. The plant's delicate environmental position also contributes to a challenge related to training. Training new operators, or training operators on a new process, can be challenging as live processing conditions offer little room for error and the required operator interventions may not be obvious. In general, the fewer required operator interventions the better. Such interventions increase the chances of operator error, since plant operators simultaneously oversee numerous systems. These challenges leave Gold Bar in an extremely difficult position: the changes to the complex processes, technologies, and equipment which are needed to help the City protect the North Saskatchewan River at the same time run the risk of disrupting operations at the plant and ultimately harming the river. The project team met this challenge head-on by beginning from the existing process and ensuring that the model and solutions reflected a detailed and thorough understanding of that process, its components, and the larger context.

The Thickener/Fermenter Challenge

The thickener/fermenters are a vital part of the wastewater treatment process. They receive solids from the primary treatment process. They process solids into a form which the digesters can handle, buffer peak flows so they do not harm the digesters, and are also responsible for producing the volatile fatty acids (VFAs) needed for the bioreactors to function.

COMPLEX AND DELICATE

The processes involved in operating the thickener/fermenters are both complex and very delicate, due to biochemical pressures, interacting variables, and their key position in the system. The difference between a thickener, a fermenter, and a digester is largely a matter of time. If the sludge is left to sit for too short a time, it will not properly ferment; if it is left too long, it will begin to digest in a tank that cannot accommodate this process, and may produce dangerous concentrations of methane and hydrogen sulphide gas. To avoid disrupting the delicate biological processes in the digesters, the solids must be pumped to the digesters carefully and without sudden jumps in volume, and must be balanced with the thicken waste activated sludge (TWAS) stream which is also pumped to the digesters. The fermenters must not receive solids too quickly



Gold Bar's Wastewater Treatment Process

The GBWWTP uses an innovative combination of processes, technologies, and equipment to treat its enormous and highly variable daily wastewater intake.

GRIT TANKS AND CLARIFIERS

The grit tanks and clarifiers process first screens out heavy and lighter material from the incoming flow. The remaining wastewater goes to the primary treatment clarifiers, where solids can begin to separate from the primary effluent. At this stage, approximately 50% of these solids can be extracted for solids treatment.

LIQUIDS VS. SOLIDS AT GOLD BAR

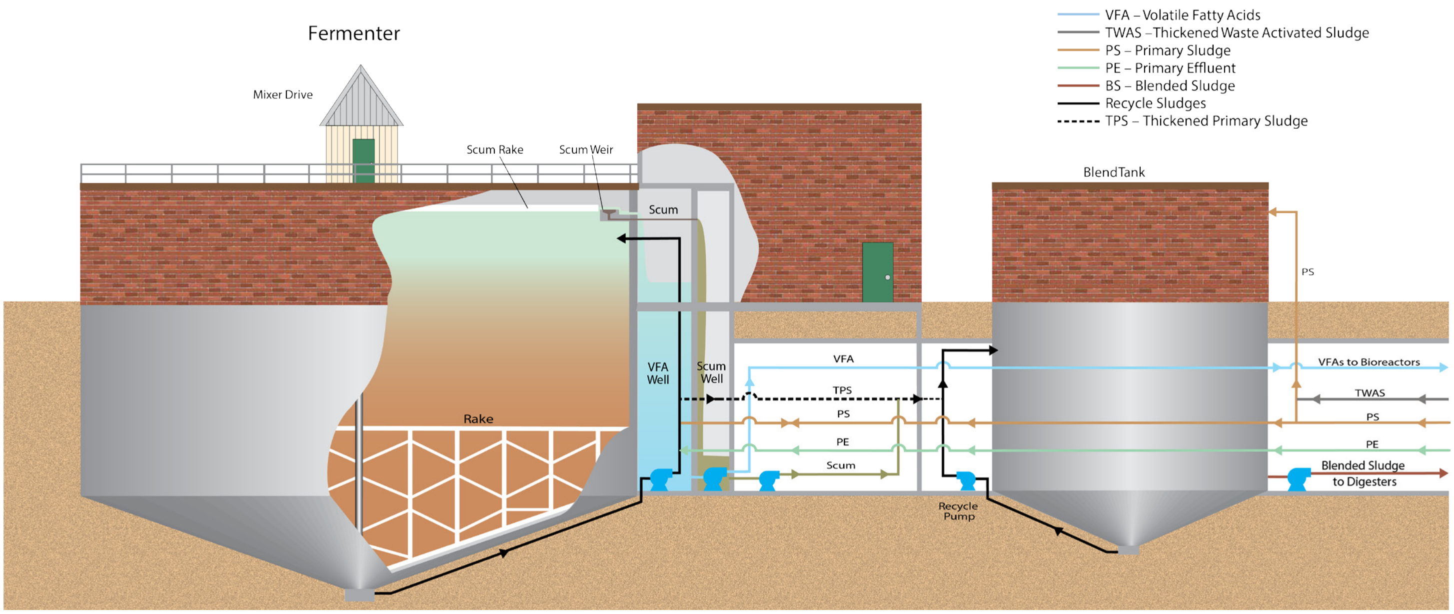
After the clarifiers, the liquids move on to the secondary treatment phase, including nutrient removal, final clarification, and UV disinfection, before being returned to the North Saskatchewan River. The solids are handled separately through a number of processes that dynamically interact, depending on the needs of the plant and its capacity demands.

THICKENER/FERMENTERS

The solids from the clarifiers are received by four thickener/fermenter tanks, whose operational processes are the focus of this project. These tanks contain no added oxygen or heat and can be used for either thickening or fermenting. The thickening operation uses gravity to separate the solids from liquids; higher density solids can settle and compact at the bottom. In fermenting, the solids remain in the tanks for longer, enabling the necessary microbes to grow and reproduce. These organisms break down the solids and produce Volatile Fatty Acids (VFAs) that are returned to the liquids stream and fed to the bioreactors, which, in turn, remove unwanted carbon, phosphorus, and nitrogen. This prevents these nutrients from harming the river ecosystem.

DIGESTERS AND BEYOND

The solids are then sent on to the digesters, which improve the microbes' ability to break down the solids into biogas. Gold Bar produces almost 11 million cubic metres of biogas per year, or enough to heat about 4,000 homes for a year. This gas is used to heat the plant, saving $1 million annually. The remaining solids are pumped to the Clover Bar Waste Management Facility, where they are further processed before being turned into compost or used in other innovative ways.



Thickener/fermenter structure and process at Gold Bar Wastewater Treatment Plant

either. One of the four thickener/fermenter tanks must always operate as a fermenter in order to provide VFAs to the bioreactors. Without VFAs, the bioreactors can't perform their vital task of protecting the North Saskatchewan River by stripping nutrients, especially phosphates, out of the primary effluent. The four tanks are run in many different configurations to accommodate the wide range of flow and temperature operating conditions, and there is no redundancy: each tank must be operational to allow Gold Bar to deal with peak flows. The operational control of the treatment process must therefore be precise, flexible, and reliable.

Complexity

- Simulation model produced 1.5 million pieces of data for each of the 16 scenarios modeled (24 million total pieces of data)
- Custom automated visualizations for each scenario
- Multiple interacting processes including automation and operator input
- 16,000 lines of code
- Each scenario took 2 hours to run
- Visualization script processes 1.5 million pieces of data for each scenario

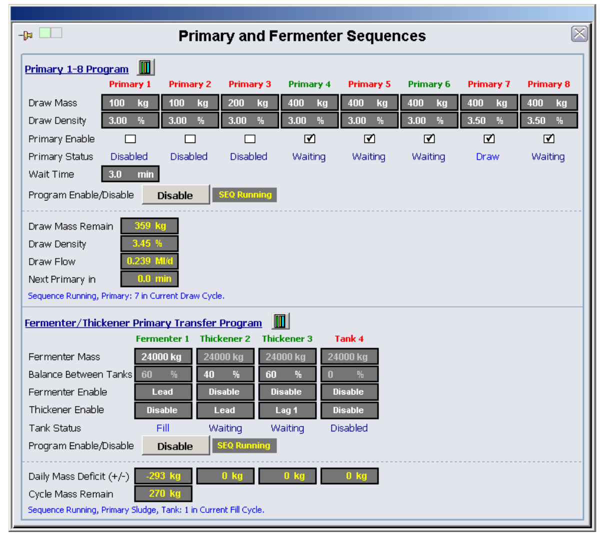
EXISTING CONTROL PROCESS

Gold Bar uses the DeltaV Distributed Control System (DCS), an industry standard for process automation and control. The system provides a framework for communication with meters and plant equipment, operator display, alarms, and data management, but the actual process strategies are purpose-built for Gold Bar. It is a complex and delicate system, with over fifteen thousand alarm settings and thousands of control variables. The plant's operations are also continuously evolving as the engineers and operators strive for process improvement, and the documentation lag inherent in such a large system can make any changes challenging.

As the thickener/fermenter tanks are existing equipment, naturally a previous control strategy had been in place for some time. However, it was only designed to allow the tanks to operate as fermenters, and with the increases in wastewater and solids experienced in the past few years as Edmonton continues the implementation of its Combined Sewer Overflow strategy, running only fermenters was not enough. To accommodate this, the plant personnel developed methods for effectively manually operating one or more of the fermenter tanks as thickeners. The fermenters operate according to a continuous flow and can't accommodate spikes; thickeners can help to buffer flow to the digesters and thus can be vital for managing flow under peak conditions. Based partly on the operators' assessment of the situation, determining whether a tank should be used as a fermenter or thickener required manual operation, which was difficult to manage and not very efficient. Frequent operator intervention increases the potential for error, particularly as it relates to controlling the flow to the digesters. Excess solids were also backing up into the primary clarifiers, which was causing problems with hydrogen sulphide. A solution was needed.

The Innovative New Control Strategy

The new control strategy for the thickener/fermenters, designed by Cybertech, is designed to continuously feed the digesters, to ensure that required levels of VFAs are being produced, and to reduce the amount of solids held in the primary clarifiers. One of the key drivers of the success of this project was the integration of senior operations personnel into the team. This is not normal practice in the wastewater industry, where new construction is delivered with process strategies already developed, but it's common in the petroleum industry and it added significant value to this project. Operator integration enabled the process strategy development to draw on the experience of those most familiar with the equipment and the normal operations of the plant, and helped smooth the transition from the old strategy to the new strategy. The operators on the team were able to identify potential issues and points of confusion early, when fixing them was still simple, as well as provide valuable insight into the information the operators would need.



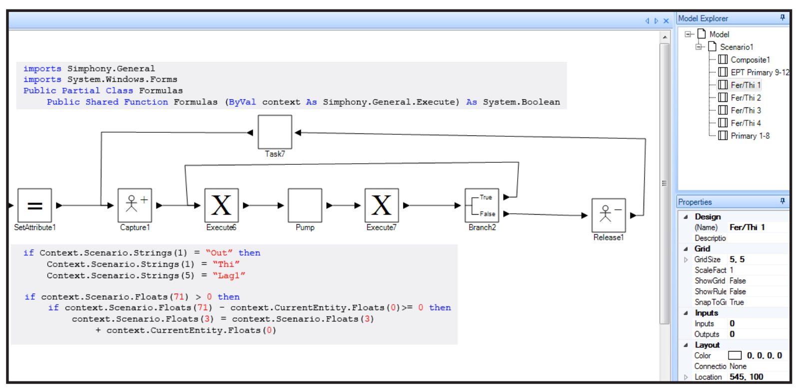
Operator control screen after process improvement, which was organized using the simulation findings so that the most important information for operators was communicated

The updated strategy involves significant automation as well as fundamental changes to the way the thickener/fermenters were operated. These significant modifications combined with the delicate implementation process meant a detailed review of the strategy was required. Once the draft strategy had been created, SMA Consulting therefore began the development of the simulation model. The first pass of the simulation for the new process strategy was then developed based on the draft and an extensive set of meetings between Cybertech and the plant's operations personnel. As the simulation developed, Cybertech fed new information into the operational strategy and further refined it in a series of iterations by collecting new input and feedback from operations personnel. The simulation also shaped how the operator's view of the process would look, informing the updating of the displays themselves. Previously, only basic information was shown (e.g., pump on/off, flow values, etc.). Because the simulation helped to indicate the key process data required for proper operation, that information could be emphasized on the operator control screens. Operator input was prioritized and dynamically utilized from step one and in all subsequent iterations and revisions. The coordination of these inputs added considerably to the complexity of the design of the strategy, but ultimately ensured that there were no surprises for the plant's operations team once the strategy was implemented.

Testing with Simulation

24 MILLION PIECES OF DATA

Through a dynamic and ongoing conversation with plant personnel and Cybertech, SMA captured and translated the logic of the existing system into the model, which was validated against existing data as well as expert opinion and experience. The model integrated drag-and-drop graphical elements and hierarchical modelling logic with custom computer code to handle the more complex interactions in the system. The team was therefore able to explore the sludge processing strategy using real input data, but without running a live test. Sixteen scenarios were defined in terms of the season from which the data was drawn, whether peak flow spikes were introduced, the possibility of primary or outflow pump outage, the speed of the pump, and initial tank settings. Each simulated operational process model produced one month's worth of minute-by-minute operations for each scenario: 1.5 million pieces of data for each scenario, or 24 million pieces in total. The full simulation, including all scenarios, included roughly 16,000 lines of code, and each scenario took about two hours to run.



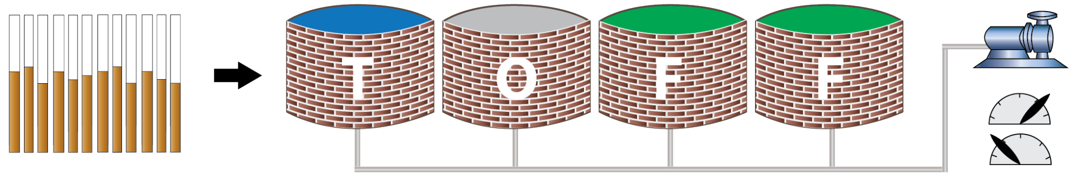
Extract of the Simphony simulation model with sample code

SMA created the model using the powerful *Simphony.NET* simulation software, a process interaction simulation environment that uses a combination of discrete event and continuous simulation modelling. Discrete event simulation models a system using a sequence of events. The effects of each event are recorded and the simulation moves to the next event in the sequence. It is assumed that there are no changes to the system between events. With continuous simulation, the simulation timespan is divided into small slices and the effects of activities occurring in each slice are recorded. Changes to the system are assumed to be continuous. *Simphony.NET* is the second generation of *Simphony*, implemented using .NET and allowing for modular, hierarchical modelling. It provides the capacity to build custom user templates, incorporating custom logic and elements, as well as allowing the use of standard templates to build models. Full statistical information can be collected, and sophisticated custom reports can be built. *Simphony.NET* was created and developed at the University of Alberta.

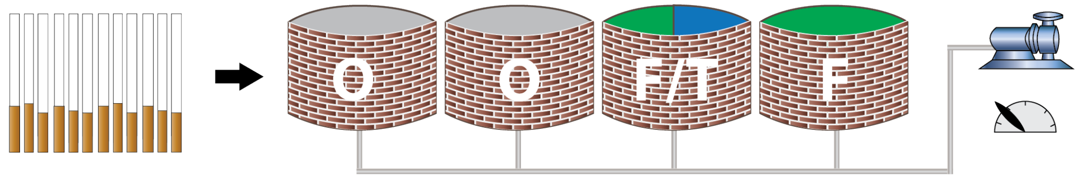
SCENARIOS TESTED

The sixteen distinct processing scenarios that the model simulated reflected a range of variables, data, and settings. The comprehensiveness of the model means that a wide range of issues can be explored and discussed freely, without the possibility of impacting the general operations of the plant. As the scenarios were developed over time, additional scenarios could be introduced to explore questions which arose from the initial scenarios or to test potential solutions.

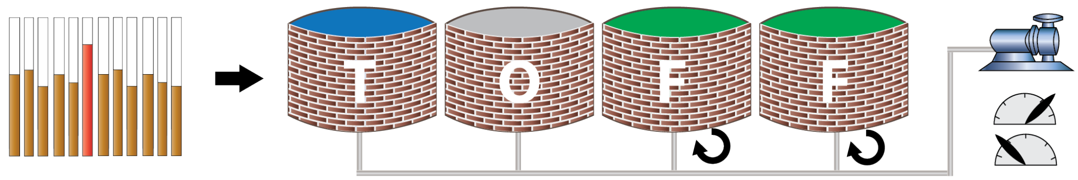
Scenario modeling is one of the most important benefits of any simulation, allowing creativity to flourish among the project team. The ability to ask "what if" and get a trustworthy answer can spark true innovation. In this project, numerous changes to the logic were developed and tested through scenario modeling prior to being included in the strategy.



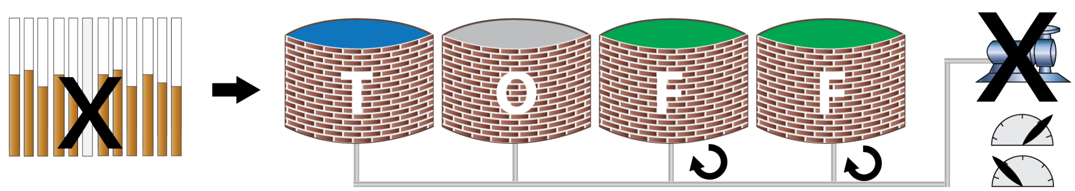
Summer Scenarios



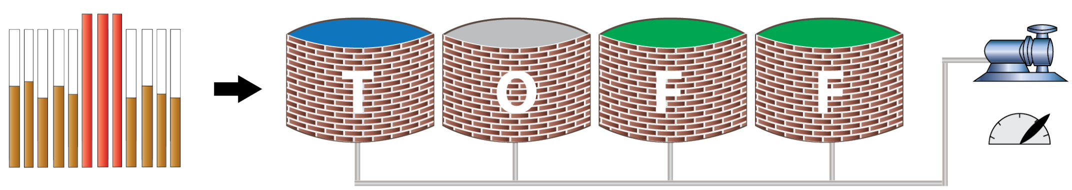
Winter Scenarios



Input Spike Scenarios



Primary and Pump Outage Scenarios



Maximum Solids Scenarios

Summer Scenarios

Two scenarios were modelled based on data taken from a typical high-flow summer month. One of these scenarios assumed a low pump speed; the other assumed a high pump speed. In both cases, one thickener and two fermenters were used. *Total scenarios: 4*

Winter Scenarios

Two scenarios which looked at the effects of different tank operating strategies were run using data taken from a typical low-flow winter month. *Total scenarios: 2*

Input Spike Scenarios

The effects of a one-day input spike of approximately three times average summer loading in the middle of a typical summer month were examined, using both high and low pump speeds. An additional scenario which used a different method for feeding the fermenters was also run. *Total scenarios: 4*

Primary and Pump Outage Scenarios

When problems such as outages in the primaries or pumps occur for the thickener/fermenter tanks, the typical response is to shut down the system as a whole. For this scenario, SMA simulated a 12-hour outage occurring for the primary clarifiers and/or the output pumps during an input spike approximately three times average summer loading, with both high and load pump speeds and with and without a different method for feeding the fermenters. *Total scenarios: 7*

Maximum Solids Scenarios

These scenarios represented a "stress test" of the thickener/fermenter process. One scenario had solids input of about six times average summer loading per day for three days; the other had about eight times average summer loading per day for three days. These scenarios both saw major negative consequences. *Total scenarios: 2*

ISSUES AND SOLUTIONS

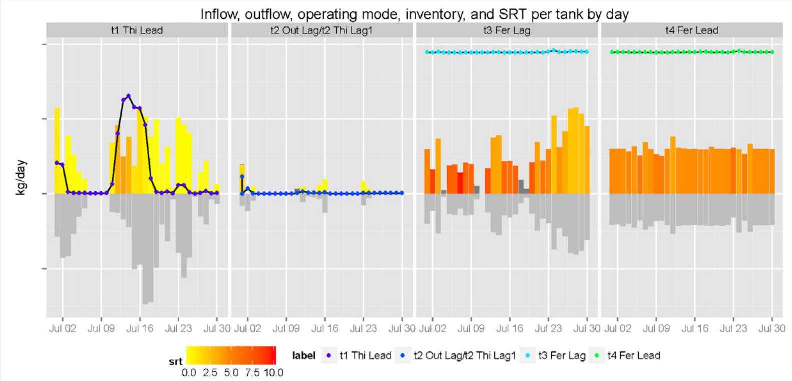
A number of important issues were identified or confirmed through the scenario modelling process (Table 1). Most of these issues, especially the fermenter input capacity accumulation, would otherwise be difficult to capture, demonstrate, or explain prior to the implementation of the new operation strategy. Troubleshooting issues in an in-use

CUSTOMIZED VISUALIZATION

The simulation was integrated with flexible and customized visualization techniques, which allowed plant personnel to see the detailed outcomes of each potential scenario. These visualizations were developed and scripted using the open-source statistical computing suite, *R*, which meant not only that SMA could fully customize the product to meet EPCOR's needs, but also that once created, the visualizations could be automated so they could be easily created from the 1.5 million pieces of data generated by each of the sixteen scenarios. Six key visualizations are shown here.

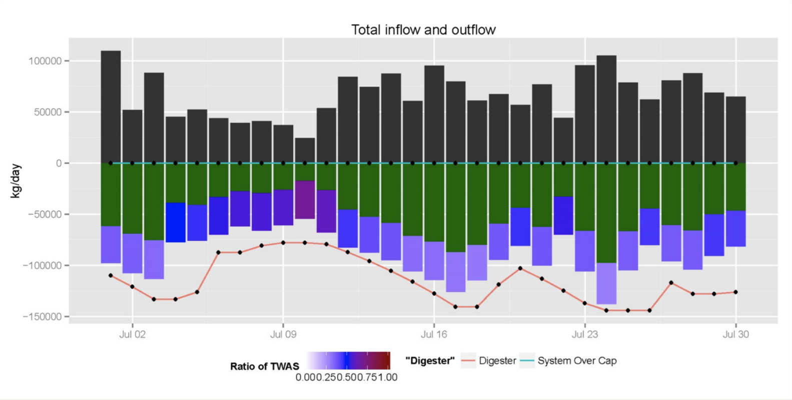
Tank Graph: Inflow, Outflow, Operating Mode, Inventory, and Solids Retention Time (SRT) For Each Tank by Day

This graph shows each tank's operations over the month-long period. Each subgraph is labeled with the operating modes for each tank over the course of the simulation – the tank number, whether it is a fermenter ("Fer") or thickener ("Thi"), and so forth. The coloured, positive bars show inflow in kg of solids, shaded by solids retention time. Gray positive bars have SRTs higher than 10 days. The light gray, negative bars show outflow. Finally, the lines show the inventory levels for each tank. This graph was one of the most important in the simulation, as it shows the day-to-day operations of each tank at a very detailed level.



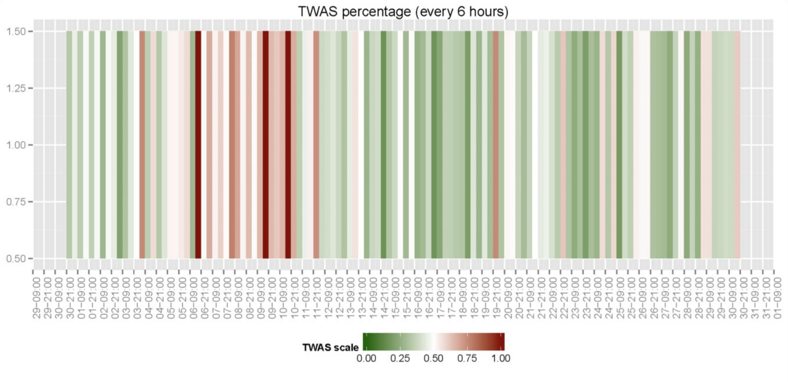
System Graph

The system graph is similar to the tank graph but for the entire system, showing total inflow and outflow for each day, as well as the digester capacity (manually set by the operator) and the amount sent to the digester from the thickener/fermenters and from the thickened waste activated sludge (TWAS). Inflow is shown as dark gray, positive bars; outflow is shown as negative bars, stacked, with TWAS (coloured by ratio) and outflow (green). This graph was key for identifying any spikes to the digester, as well as whether the digester capacity is ever exceeded. For optimal operations, the digester capacity should be kept quite consistent.



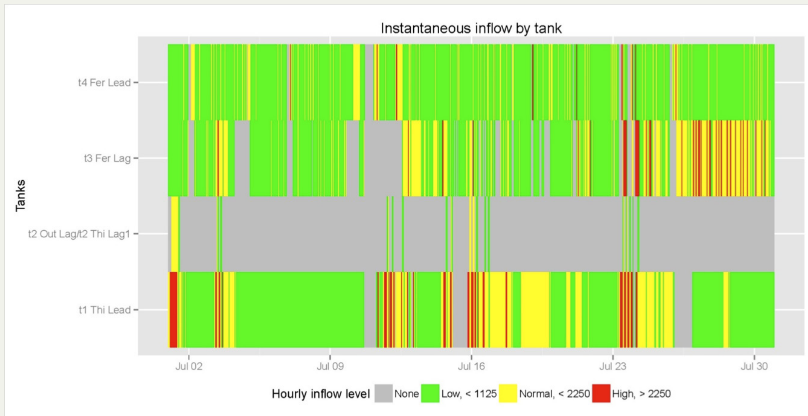
TWAS Percentage

The TWAS graph shows the thickened waste activated sludge (TWAS) percentage every six hours over the course of the month. Thickened waste activated sludge is produced by the bioreactors and should be diluted through the addition of biosolids before the mixture is pumped to the digesters to avoid upsetting the biological balance in the digesters. When the TWAS percentage exceeds 60%, as seen here at several points, the digesters can be negatively affected, potentially resulting in high levels of hydrogen sulphide gas.



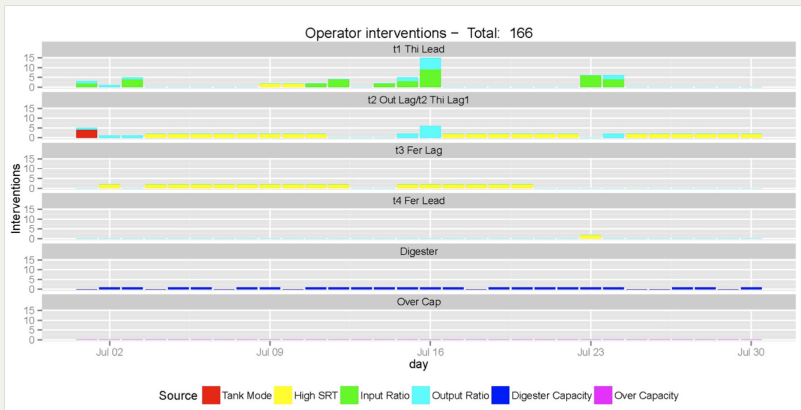
Hourly Inflow

This graph shows the hourly inflow by tank over the period of a month. Each band of coloured lines represents one tank's inflow, and is coloured by whether the inflow rate is low, normal, or high. Inflow rates that are too high run the risk of blowing out the protective sludge blanket at the top of the liquid levels.



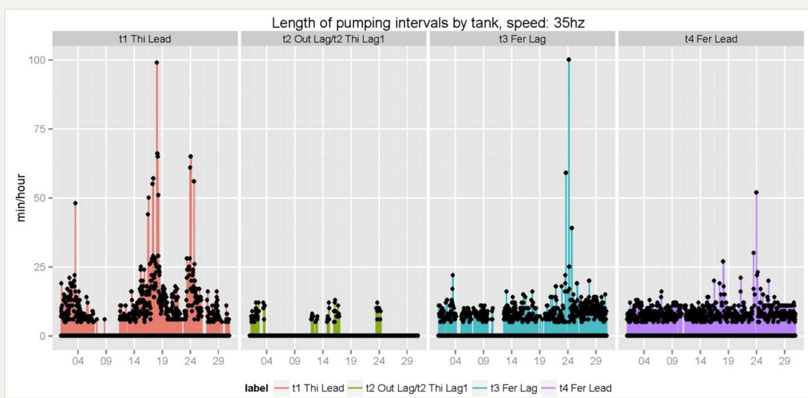
Operator Interventions

This graph shows daily operator interventions on each tank and the digester by type. Operator interventions are an important measure of a process because any time an operator must intervene in the system, there is the chance of the system becoming unstable: a delay in making a necessary change, an incorrect intervention, and so forth. The total number of operator interventions and their type were used to evaluate the stability of each scenario.



Pump Usage

The final graph showed the length of pumping intervals by tank. The four tanks share a pump and compete for it on a first-come first-served basis. Pumping intervals are expected to be between 5 and 30 minutes. As seen here, there are no pumping intervals less than five minutes, but there are several that are longer than thirty minutes.



system is much more challenging—especially if the reaction of the system is somewhat counterintuitive, as was seen in a few cases in the thickener/fermenters. The Gold Bar team was also able to test some potential solutions to the issues in the simulation, both control logic changes and procedure changes. Finally, some events previously thought to be potential issues, such as the potential for the pump to be captured and monopolized by one of the thickener/fermenters, were found to be actually not very problematic.

The Benefits of Innovation, Without the Risks

This project resulted in a number of benefits, for EPCOR, the Gold Bar Wastewater Treatment Plant, the City of Edmonton, and the North Saskatchewan River. The key objective of improving the operational process to increase the plant's wastewater treatment capacity was met. To date, the direct result of upgrading the controls has been a minimum 1.5% increase in solids concentration for the digester feed, resulting in an effective increase of 30% in digester capacity. The buffering capacity of the thickener/fermenter tanks has also more than tripled, which allows Gold Bar to receive more solids during a single storm event. Achieving this enormous improvement would have otherwise required a sludge storage tank and additional sludge

Table 1. Issues identified through the scenario modelling process

Issue	Description	Potential Solutions
Fermenter input capacity accumulation	If solids levels spike after a period of low solids input, this can overwhelm the fermenters	4 potential control logic changes identified 1 potential procedure change identified
Lag fermenter starvation	In a typical winter month, one of the fermenters will not receive enough solids	2 potential control logic changes identified
High solids retention times (SRTs)	Solids were being retained in the tanks for too long in some scenarios, which can result in dangerous hydrogen sulphide or methane gas	2 potential control logic changes identified
Thickener pumping quota accumulation	If solid levels spike after a period of low solids input, this can result in thickeners pumping for hours at a time	1 potential control logic change identified
Pump capture	Thickeners and fermenters sometimes end up pumping for four or five times as long as expected	Accept – simulation did not show very negative effects
High thickened waste activated sludge (TWAS) ratios	The ratio of thickened and fermented solids to solids from the bioreactors (called TWAS) is occasionally too low; this is important to balance for digester health	1 potential procedure change identified

thickening facilities. Had a major infrastructure project like that been necessary, it could have cost up to $15 million and potentially risked environmental impacts to the river and the surrounding region due to live testing and construction. In addition, design and construction would have taken upwards of one year, instead of only a few months. In the end, the only added equipment was a group of density meters, strategically placed according to the simulation's findings to monitor the flow out of the blend tanks.

Serious Issues Identified

Using the simulation, EPCOR and Cybertech were able to identify and address a number of serious issues in the operating strategy for critical control components at Gold Bar. In several of the scenarios, for instance, the daily solids retention time (SRT) was greater than 10 days; this finding is important because high SRTs can result in negative consequences such as hydrogen sulphide gas. The simulation also confirmed a number of observations made during an earlier review. For example, the simulation identified, across several scenarios, that a spike in input solids after a long period of low solids input can result in fermenter capacity issues.

Virtualizing Risk

The simulation also rendered all of the risks virtual only, rather than requiring that they occur under a live flow test of the process: some of the issues identified could have resulted in overflowing the tanks, upsetting the digesters or the fermenters, or producing high levels of hydrogen sulphide gas. Potential issues that came up in the simulation were dealt with in the simulation, and the insight into the internal workings of the process made identifying what had gone wrong much easier. A lengthy period of about 3-6 months of bug testing and operator uncertainty was thus avoided, and the new strategy was implemented with a far higher degree of confidence than is typical.

Improving Quality Control

Process simulation has now been successfully implemented in several other Gold Bar projects; such a practice change also impacts the measurement of the overall success of a project. The strategy development process has gained a hitherto impossible degree of quality control, with profound insight into exactly how well the operation was performing and what might be adjusted to improve it even further. In addition, by borrowing well-honed practices from the oil and petroleum industry, Cybertech and SMA implemented a more robust operator input component, with significant benefits for this project.

Tight Timelines

The entire project was completed in less than six months, giving Gold Bar ample time before the challenges of the first spring melt. All of the project's costs were funded with minimal impact to rate payers. As noted, under normal circumstances, the only way to increase a comparable amount of capacity would be by building new infrastructure and passing along the costs to Edmonton taxpayers, requiring Edmonton City Council's approval for rate increases. The project also created an opportunity for EPCOR to get a significant headstart on the required training.

Treating More Wastewater

The simulation also resulted in important benefits beyond the plant. The operations process could be tested and fine-tuned without disrupting plant operations and potentially harming either the plant or the environment. Every drop of wastewater that Gold Bar is able to treat protects the North Saskatchewan River; the improvement in capacity and operations which has been achieved will help to facilitate the City's CSO Control Strategy, improving water quality in the river.

Protecting the Environment

- Virtually testing the new thickener/fermenter processes within the simulation model, preventing problems during implementation
- Allows Gold Bar to treat more wastewater, protecting the North Saskatchewan River
- No need for new construction in a sensitive area

Benefit to society

- Protecting Edmonton's North Saskatchewan River Valley
- Facilitating Edmonton's Combined Sewer Overflow Control Strategy
- Allowing Gold Bar to treat more wastewater
- Potentially saving or deferring up to $15 million in capital construction, which benefits taxpayers
- Preventing disruption to park users and nearby residents

Conclusion

The Gold Bar Wastewater Treatment Plant is receiving higher levels of wastewater and solids as Edmonton continues to implement its CSO Control Strategy, but summer storms can overwhelm plant capacity. To prevent flooding the plant during storms, some of the flow received has to be diverted to the North Saskatchewan River. Gold Bar has embarked on a complete overhaul of its solids handling processes to increase treatment capacity. As part of this overhaul, the Gold Bar Thickener/Fermenters Operational Strategy Improvement Project offers an exciting, innovative prospect: dramatically increasing throughput and buffering capacity with only changes to the process strategy, and using simulation modelling to test changes to a complex and environmentally-sensitive system under safe, controlled conditions. The model was able to incorporate the interaction between automated processes and operator intervention and make the complex interactions and timings visible for discussion and analysis by the Gold Bar team. This discussion was further enhanced through the customized, automated visualizations generated from the simulation results. These findings could then be backfed into the operational strategy. The result was a new process strategy which was implemented within a few months, increased buffering capacity by 200% and digester capacity by 30%, and deferred up to $15 million in potential capital construction to the benefit of taxpayers. Most importantly, though, the strategy helps protect the North Saskatchewan River by allowing Gold Bar to treat more wastewater.

Already, EPCOR has incorporated simulation modeling into several new studies, including the digesters and lagoons which are the next steps in the wastewater treatment process. The simulation may ultimately be used for operator training purposes as well. As Edmonton and the surrounding region continue to grow, the pressure on Gold Bar will only increase. The new thickener/fermenter operations process improvement represents a vital piece of meeting this urgent challenge and a roadmap for future process optimization.