



Manteca Wastewater Quality Control Facility

The Manteca WQCF is a 9.87 MGD average day dry weather (ADWF) rated, activated sludge plant, treating typical municipal wastewater with a Modified Ludzack-Ettinger (MLE) process for nitrification and denitrification. The facility features an influent pump station, aerated grit tanks, primary sedimentation basins, fine-bubble activated sludge aeration basins, secondary clarifiers, secondary effluent equalization pond, tertiary filters, UV disinfection and effluent pumping station, on 210 acres. Secondary effluent is land applied during the spring and summer.

Stepping Into a Data-Driven Future

The City of Manteca Wastewater Quality Control Facility is boldly moving into an optimized, data-driven future.

The plant, located in California’s Central Valley, implemented the Claros™ Water Intelligence System from Hach® to optimize data, instrument, and process management throughout their operation. This system of software and connected devices is helping them resolve persistent problems, increase efficiency, and ensure compliance.

Their integrated Claros system is designed to:

- Monitor and auto-adjust process operations to maximize efficiency
- Verify instrument calibration and lab/process correlation
- Allow instant data collection from the field
- Provide data aggregation, visualization, and report generation
- Add value to SCADA data stream and history
- Integrate into existing plant infrastructure





We knew we had a discrepancy between our daily grab samples and what we would expect to see in our process, but we needed to pinpoint the right action to solve the problem.

– Dustin Valiquette,
Chief Plant Operator



Starting point: DAFT foaming

Manteca's operators were aware of a persistent problem: excess foaming at night with their Dissolved Air Flotation Thickener (DAF), as well as problems with Sludge Retention Time (SRT). As the flow decreased dramatically overnight – from a peak of 6.1 MGD to a low of .57 MGD – they were not able to turn down their Return Activated Sludge (RAS) pumps enough, causing the RAS/WAS concentration to significantly drop off from 1.3% to 0.27% TSS. Since the polymer dose to the DAF is fixed, the significant reduction in WAS concentration resulted in an overdose of polymer and excess foaming. In addition, operators couldn't account for overnight changes in the WAS concentration due to lack of visibility, which created an inaccurate and inconsistent SRT.

Plant operators recognized the need for 24/7 visibility into the RAS/WAS concentration and the ability to adjust their process accordingly to prevent the DAF foaming and create a repeatable and precise SRT.

Plant personnel considered a variety of options to address these issues, including more frequent grab sampling, initiating 24-hour composite sampling, or implementing 7-day averaging SRT calculations. But none of these options would meet the criteria to solve the issue. After careful review, it was determined that the plant needed a combination of real-time monitoring, lab/process validation, and the ability to adjust RAS/WAS flow rates as concentrations vary over time. The team at Manteca coordinated with Hach personnel to develop a plan that could be implemented in stages, with scalability to address other plant-wide and future optimization needs. They arrived at a solution that includes the full Claros platform – Data,

Instrument, and Process Management – with a selection of Claros-enabled devices, a new VFD RAS/WAS pump, and integration into existing plant infrastructure and SCADA assets.

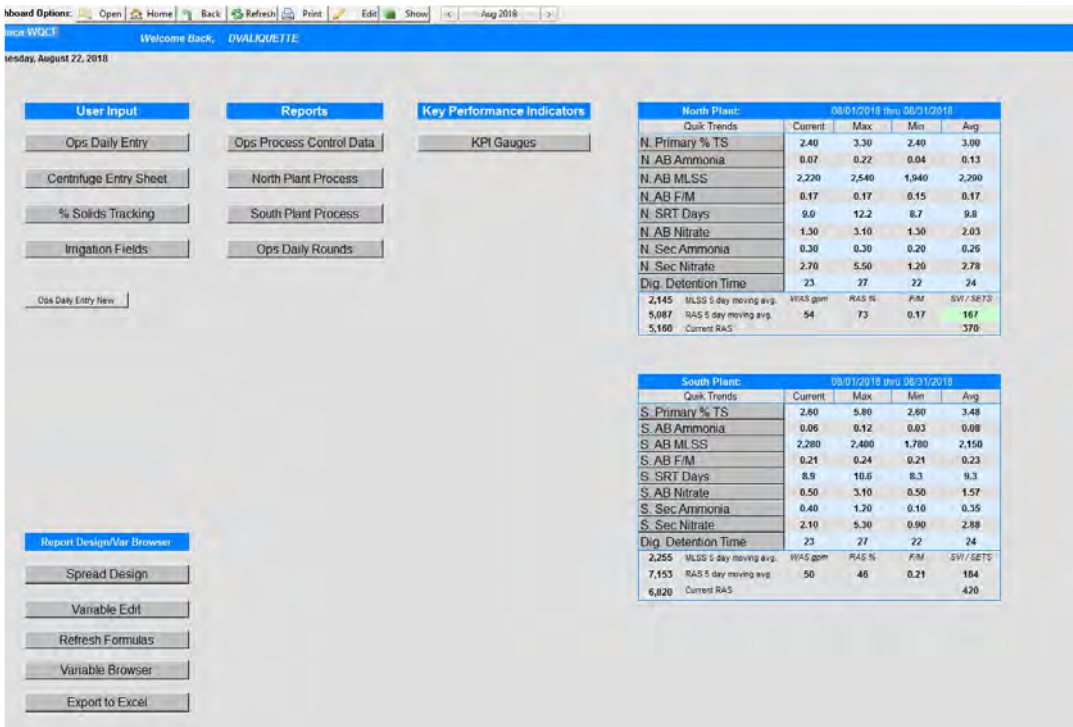
Taking a closer look

Based on plant capacity and operational history, plant staff had a desired 9 day SRT target. Grab samples were typically taken once per day, at 8am but the timing of the daily grab sample coincided with the low point in loading for the day.

Both the mixed liquor and RAS needed to be monitored to better understand the variability of samples. For clarity, it's important to note that Manteca wastes from the RAS. Staff achieved better monitoring with the installation of Claros-enabled Solitax sc process probes to measure Total Suspended Solids (TSS) in both the mixed liquor and the RAS. They then used the data to determine how much error existed in the manual grab sample-based method originally used.

SRT optimization

The conclusions were eye-opening: real-time data versus laboratory tests indicated a significant difference in the sludge retention time. While they were gaining trust in their new online data, the grab samples showed the SRT was nearing 12.2 days, as opposed to their targeted 9 days. On the other hand, the TSS probe data showed that the SRT was actually at 9.05 days, or a 34.8% difference from their grab samples. Believing the grab samples, Manteca wasted to reach 9 days from a perceived 12.2, but in reality over-wasted to an SRT of 6 days. This scenario could have created many other challenges, including settleability problems, degradation of nitrification, and even potential permit violations.



“
 With SCADA, you can get the data, but with WIMS you can do so much more. With WIMS you can run calculations, and modeling, and build KPIs.
 –Dustin Valiquette, Chief Plant Operator
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Verifying instrument data

Because decision-making hinges on the accuracy of the data available, a Claros Instrument Management solution was implemented so plant personnel could validate instrument status and ensure data reliability. Claros Mobile Sensor Management (MSM) was used to confirm the accuracy of the Solitax sensors measuring TSS, allowing sensor information to be available at anytime on any electronic, web-enabled devices as well as on SCADA, and the Claros Water Information Management Solution (WIMS). With MSM, Manteca was able to align process and lab data to correlate and confirm lab-analyzed samples to determine if calibration was required on instruments. Conveniently, with MSM, calibration can be initiated from any web enabled device.

Using data to drive decisions

With new, accurate information driving decisions, Manteca’s staff was able to leverage data within their WIMS software to provide long-term analysis and KPI tracking to better understand the SRT using visual management tools (i.e. dashboards). To do this, a SCADA interface was used to automatically pull the TSS probe data directly from the SCADA historian into WIMS. Then, by trending the baseline data from the online TSS probes, operators had a better understanding of the solids in the treatment process, both with current-state and historical trends, making it possible to sustain the improvements.

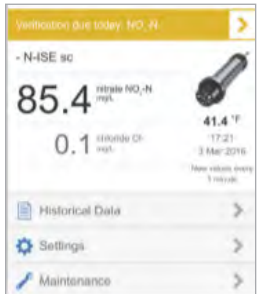
Maintaining instrument health

The backbone of the MSM platform is Prognosis®, the predictive diagnostic system. Prognosis sends alerts when maintenance activities are required; delivers notifications of any instrument issues to ensure accuracy of sensor data; and provides operators with onscreen, step-by-step instructions for carrying out maintenance procedures on any of the devices.

Result: ease of use, time-savings

Data access through MSM gave the operators confidence that their process was running smoothly and efficiently, and saved time so operators could focus on the highest priorities of the plant.

Above left: WIMS ties all data together in one easy-to-read interface.



Above: Mobile Sensor Management tracks instrument status and provides step-by-step instructions to guide maintenance procedures.



If operators see an issue with the DAF discharge quality, we can flag it. We also have set a ranges for the analytical data, and KPIs built to flag and alert bad data.

—Dustin Valiquette, Chief Plant Operator

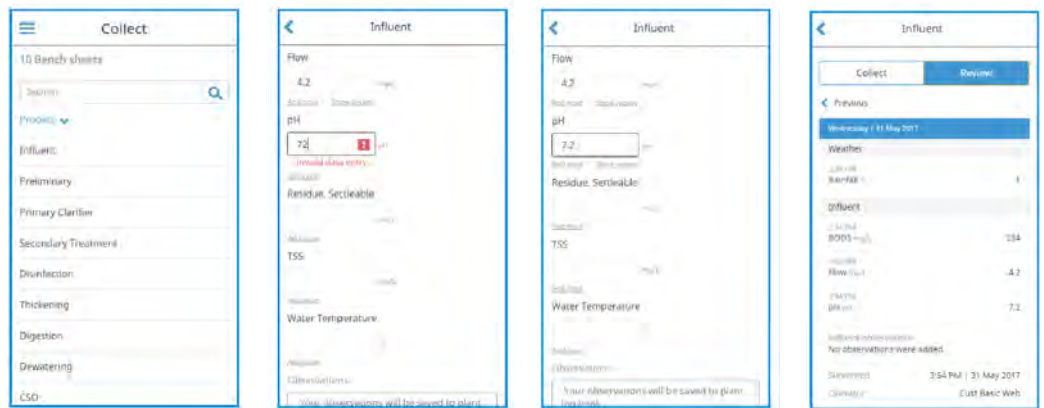


Above, right: Claros Collect allows operators to enter data on a mobile device, instantly sharing data while reducing transcription errors.

Collecting field data

Empowered with tools to use data in ways they'd never experienced before, naturally the desire to improve other data collection processes arose. For example, plant operators also wanted a way to collect field data digitally – going paperless, gaining instant access to data, with data traceability and validation at the source. The solution was Claros Collect, part of the Claros Data Management product suite, which allows users to manually enter data on web-enabled devices. Not only does it automatically validate data at the source of collection by triggering alerts when values are outside an expected range, but it also eliminates the need for manual paper forms and thus reduces transcription errors. Once data is entered, it is immediately available through the entire data system, including WIMS. This enables teams in the field and in the office to be aware of water quality changes and make decisions faster. It is important to note that data can be collected whether a network is available or not. In the event of non-connectivity, data collected from the field is saved on the device until a connection is available and then data is synced and consolidated in Claros WIMS.

Examples of the intuitive interface of Claros Collect, showing (from left to right): 1) Process selected for data Entry 2) Visual warning when invalid data is entered; 3) Data validation; and 4) Data available for review





Automating the process

With reliable information coming from real-time inline sensors via MSM, as well as field data provided through Claros Collect, and validated with lab/process correlation, the plant could more fully leverage their SCADA and WIMS synergy to get the full picture of their water as it moves through the process. Automating control to optimize the system was the next step with a Claros Process Management solution for Sludge Retention Time (CPM-SRT).

CPM-SRT: How it Works

The Claros Process Management (CPM) system for Sludge Retention Time optimizes the process by monitoring minute-by-minute, identifying peaks and valleys in concentrations of MLSS and WAS caused by the variability of the diurnal loading patterns throughout the day, and making real-time setpoint adjustments. Previously, staff took a single grab sample once daily, and did not have visibility into the changing solids concentrations throughout the day. With the SRT controller expanding the operating window with 1440 samples per day – one per minute – the full picture of their solids inventory has come into focus.

Based on this data, the SRT controller calculates the required amount of waste sludge to be removed and then outputs a WAS pump speed setpoint to ensure a consistent SRT that promotes stable nitrification and low energy cost for BOD removal. The calculation is based on the TSS concentration in the aeration basin and in the waste sludge. Optionally, a TSS measurement in the secondary clarifier effluent can be integrated into the calculation. The required aerobic sludge age can either be entered manually or can automatically be calculated based on the actual mixed liquor temperature and aerated volume. Adjustable limits for minimum and maximum TSS concentration in the aeration tank, minimal aerobic sludge age, minimum and maximum pumping rate of the waste sludge and safety factors ensure safe operation and process stability. In addition, the process can be configured for batch-wasting or continuous wasting. Manteca uses the continuous-wasting process.

RAS/WAS room showing Solitax TSS probe in place.



Three weeks after implementation of the CPM-SRT module, the Manteca team was confident enough in the system to transition to automated process control. Now, real-time data continually informs plant personnel about process, while the system optimizes operations 24/7.



You are getting the data in such a way that helps understand what is happening with process.

—Dustin Valiquette, Chief Plant Operator



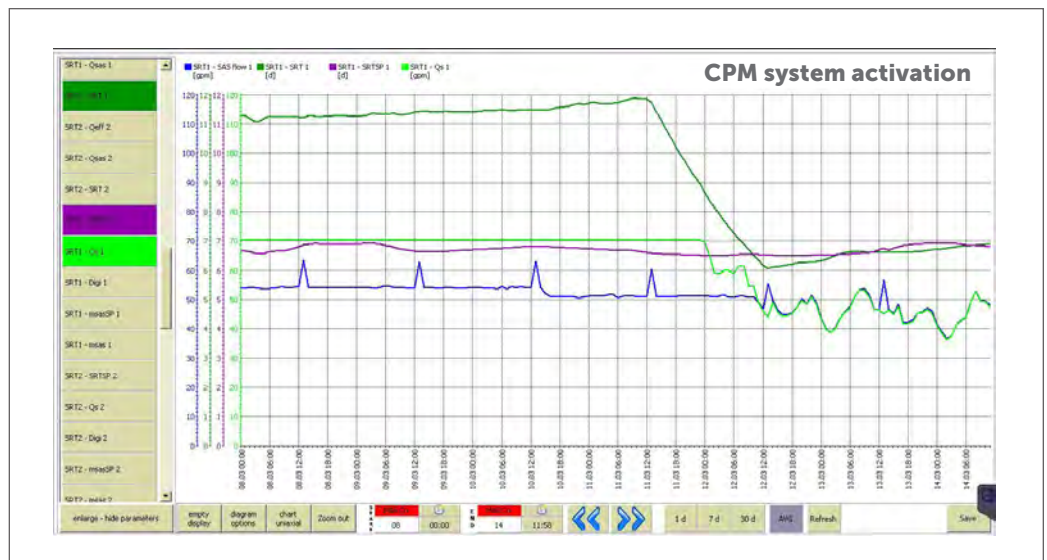
Onboard trending capabilities showing the activation of the SRT system. The graph indicates how the system was able to track and adjust in real time, bringing more stability and a narrower range to plant processes, reducing SRT while maintaining compliance limits.

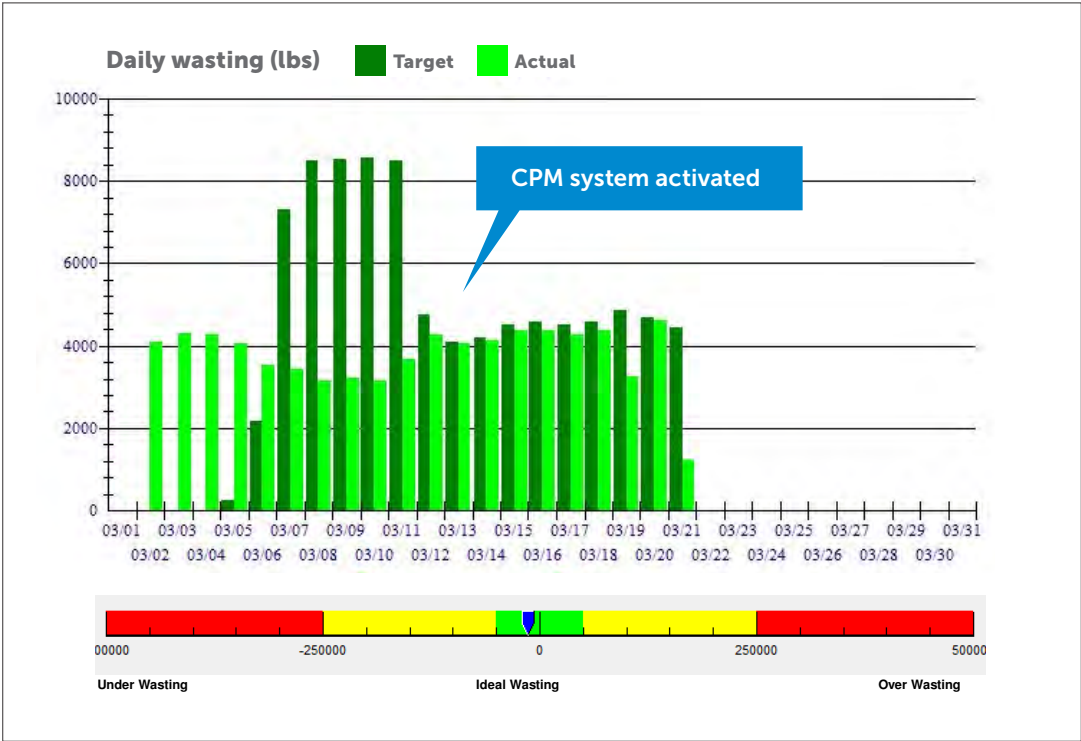
Installing the CPM - SRT system

As much as possible, Claros Process Management systems are integrated into existing plant infrastructure, tailored to the specific plant’s needs. At Manteca, with aeration processes divided between North and South zones, installation proceeded with connected sensors and controllers, including Solitax TSS probes, LDO probes, eWon cellular modem, sc1000 probe modules, and CPM touchscreen.

With real-time data coming through the system, Manteca’s staff were able to learn more about their plant. Surprisingly, the system indicated that actual SRT was much higher than previously thought at around 11 days. Adjustments were made to reach the goal of a 4.9 day SRT.

With that goal achieved and the system providing consistent feedback, the SRT module was activated and now provides increased process consistency (see chart, below).





Plant operators can check for data trends, and see correlations in the process.

Chart (at left) tracks the change in the wasting rates when the CPM-SRT system went fully operational, showing increased consistency in daily wasting (target vs actual).

Conclusion:

With the implementation of the entire Claros platform, the City of Manteca has and will continue to recognize and sustain the following benefits:

- More stable SRT control will allow the plant to produce a more consistent and higher quality effluent while saving money.
- Consistent solid loading rates to WAS thickening processes
- SRT is optimized based on setpoint of temperature in the aeration basins
- Elimination of Nocardia and M. parvicella foam
- Improved settleability (39% reduction in SVI), reduced bulking
- Decreased solids concentration from lower SRT increases secondary capacity.
- Prevention of pin floc/dispersed growth
- Consistent solids yield and growth rate
- Increased MLSS stability
- Decrease in energy costs due to volatile solids being treated in anaerobic digesters instead of in the aeration basin. Volatile solids in aeration basin went up from 76-77% to 82-84%. This also produces more gas from the increased loading of volatiles being destroyed.
- Visual management tools, alerts, and notifications to make real-time decisions
- Complete insight to all the data - anytime, anywhere
- Efficiencies allows plant operators to focus on higher priority issues



Keeping consistent plant process is so important. Claros helps us keep the plant going. Consistency is the key.

- Dustin Valiquette, Chief Plant Operator





Claros software and Claros-enabled Hach devices give plant operators new options for optimization and compliance. Plant managers can tailor solutions to their unique needs by implementing one or more of the Claros modules, including:



Claros Instrument Management

- Mobile Sensor Management (MSM) allows users to view their measurements on any web-enabled device and provides step-by-step instructions to guide maintenance and ensure data accuracy.
- Prognosis predictive diagnostics software alerts operators to upcoming maintenance tasks.



Claros Data Management

- WIMS (Water Information Management Solution) combines lab, process/SCADA, and operator field data in a central, secure database, giving users actionable insights to make more informed decisions.
- Claros Collect allows operators to use any web-enabled device to enter field/bench data – saving time, eliminating paper forms, and reducing transcription errors.



Claros Process Management

- Application specific modules combine software and connected devices to adjust treatment processes in real time, providing visibility and consistency while reducing compliance risk.



With Claros, we're getting data in a way that we can visualize it. That, in turn, allows us to make smart process decisions.

–Dustin Valiquette, Chief Plant Operator



For more about Claros, and Claros-Enabled devices, go to hach.com/claros

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