PREPARING FOR SCADA: THE HIDDEN WORK BEHIND A SUCCESSFUL AUTOMATION PROJECT

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ABSTRACT

Many regional water treatment plants continue to operate using conventional electrical and mechanical control systems with little or no supervisory control. While implementing a modern SCADA platform is often viewed as a software project, Glen Innes Severn Council found that the greatest challenges lay in preparing the plant itself.

This paper follows the journey from a mechanically controlled water treatment plant to one ready for a modern Ignition SCADA platform. Rather than focusing solely on the software, it explores the practical issues uncovered during the project, including ageing electrical infrastructure, inconsistent control philosophies, instrumentation limitations, communications, control voltages and operational requirements. Each challenge required careful planning and staged upgrades before a reliable SCADA system could be successfully implemented.

The presentation discusses the decision-making process, lessons learned and engineering solutions developed throughout the project, highlighting how each step laid the foundation for a robust and scalable automation system. Attendees will gain practical insights into preparing existing water treatment plants for digital transformation and understand why successful SCADA implementation begins long before the first screen is built.

1.0 INTRODUCTION

Glen Innes Water Treatment Plant (WTP) is a conventional treatment plant serving Glen Innes in the Northern Tablelands of New South Wales. The plant has a nominal capacity of 10 ML/day and an average daily demand of approximately 1.4 ML/day. Raw water can be supplied from Beardy Waters Weir, Eerindii Ponds and the Red Range Road bores, with the Quarry bore available as an additional drought source. Treatment includes powdered activated carbon dosing, alum and hydrochloric acid dosing, polymer addition, clarification, three sand filters, pH correction and chlorine gas disinfection.

Prior to the current project, the plant operated almost entirely in manual mode using hardwired electro-mechanical controls, timers and relay-based automation dating largely from the early 1980s. The main mimic panel provided the operator interface through selector switches, pushbuttons, indicator lights, ammeters and process displays. Although a Sharp/Honeywell ZV-120CU was present, detailed investigation later established that it was not controlling the treatment process as originally understood. The plant had no modern plant-wide SCADA system providing supervisory control, comprehensive alarming, historical trending or integrated management of critical control points (CCPs).

The journey toward SCADA accelerated in 2023 when Council was selected to participate in the NSW Government's Advanced Operational Support (AOS) Program. The program included assessment of online monitoring capability and an operational review of the WTP. The AOS review, undertaken in November 2023, identified minimal and unreliable alarming, no automatic shutdowns for critical conditions, and gaps in online monitoring and control. Filtered-water turbidity and chlorine residual were specifically identified as areas requiring integration into future SCADA, with appropriate alarming and shutdown functions.

What initially appeared to be a project centred on CCP instrumentation, PLC replacement and SCADA implementation developed into a broader plant modernisation exercise. As design progressed, the condition and configuration of the existing electrical and control infrastructure became a major project constraint. The work required to make the plant ready for SCADA became as important as the SCADA system itself.

2.0 DISCUSSION

2.1 From Operational Review to SCADA Scope

The AOS review provided a structured assessment of the operational risks that had developed around the existing control arrangement. It identified that the plant generally operated with an operator onsite because there was no SCADA monitoring and alarming of filtered-water turbidity and no capability to automatically shut down the plant following a CCP exceedance. Raw-water turbidity, pH and temperature were not monitored online, and a previous unexplained raw-water pump start had resulted in flooding at the plant. The erroneous start had not appeared in the existing controller logs, reducing operator confidence in automated raw-water pump operation.

The review also identified limitations around chemical dosing and filtration. Loss of chemical dosing could not be reliably detected, some dosing processes were not flow paced, filter headloss indication was unreliable or out of service, and backwash flow monitoring had been disconnected. Backwashing was primarily time based. These findings showed that improved instrumentation alone would not provide the desired outcome; the plant required a control system capable of collecting, validating and acting on process information.

The resulting tender scope sought to install a new PLC, migrate control from the existing mimic panel, integrate existing and new process instrumentation, and install a plant SCADA system for process control and CCP management. A key requirement was development of a Functional Design Specification (FDS). Because reliable contemporary control documentation was limited, the contractor was required to reverse engineer the ZV-120CU and electro-mechanical controls, document the existing control logic, and then develop the future control philosophy with Council.

2.2 Detailed Investigation Changes the Project

The original tender was developed on the understanding that the existing Sharp/Honeywell ZV-120CU formed part of the plant control system and that its logic would need to be reverse engineered as part of the PLC migration. As the project moved into detailed design, however, the available early-1980s drawings could not be relied upon to describe the as-installed plant. SAFEgroup Automation therefore recommended a detailed electrical audit to establish how the plant was actually controlled and to reduce the technical, operational and commissioning risks associated with the upgrade.

The January 2026 audit established that the treatment process was controlled almost entirely through hardwired electro-mechanical components, relay logic and timers. The Honeywell unit was not running the plant as originally understood and was effectively associated with alarm and indication functions. This finding fundamentally changed the project. Rather than replacing an obsolete controller and transferring its program into a new PLC, the existing plant control functions first had to be traced through the electrical installation, documented and redesigned for modern PLC control.

The audit then exposed the scale of the underlying electrical issues. Most control components dated from the original 1980s installation, with obsolete hardware, degraded wiring and limited spare capacity. Mixed 24 VAC and 240 VAC conductors were found within the same cables, LV and ELV wiring lacked appropriate segregation, multiple 240 VAC control supplies originated from different motor starter cells, and 240 VAC was present at operator-facing pushbuttons and selector switches. Instrumentation issues included power cables and, in some cases, earth conductors being used within 4-20 mA signal circuits.

Documentation and maintainability were also significant concerns. Numerous cables were unlabelled, redundant wiring and devices remained in the panel, undocumented bridges had been installed across control circuits, and some terminations and conductor insulation had deteriorated. The audit concluded that the existing installation was unsuitable for direct migration to a modern PLC-based automation platform. The proposed SCADA upgrade had therefore uncovered a much larger requirement: the electrical and control foundation of the plant had to be corrected before reliable automation could be implemented.

Rather than attempting to resolve these issues during the final PLC cutover, Council and the automation contractor developed a dedicated electrical enabling works package. Its purpose was to prepare the existing infrastructure for staged migration, improve electrical safety and compliance, remove redundant equipment, create physical space and segregation, and reduce commissioning risk before installation of the new PLC panel.

A central part of this work was migration of motor starter control toward 24 VDC. A new central 24 VDC supply and distribution arrangement was specified, with each motor starter provided with an individually protected control circuit. Interposing relays and associated control modifications allow the existing starters to interface with the ELV PLC system while providing clearer isolation and fault finding. Existing 240 VAC operator devices on the front of the mimic panel were also identified for relocation so that LV circuits could be removed from the operator interface.

Cabling remediation formed another major component. Mixed LV and ELV cables were identified for replacement or re-routing, and analogue loops were specified to use suitable shielded instrumentation cable. Redundant wiring and equipment were to be removed rather than left abandoned in the panel. These measures established a cleaner and more documented electrical baseline for the PLC migration and reduced the number of unknowns that would otherwise have been carried into commissioning.

The enabling works were deliberately designed to be staged and, wherever possible, non-intrusive to plant operation. This was essential because the WTP remained a critical operating asset throughout the project. The need to maintain water production influenced the sequencing of electrical modifications, the retention of existing functions during transition, and the approach to final PLC cutover.

2.4 Designing the Future Control System

With the plant being prepared electrically, the control system design could focus on the operational outcomes that had triggered the project. The tender specification required the new PLC and SCADA system to provide supervisory control, remote monitoring, alarming, historical data, reporting and integration of CCP management. Individual instrument status and health were to be visible in SCADA, and CCP alarms were to be separated from standard process alarms so that water-quality risks were immediately apparent to operators.

The proposed CCP philosophy includes adjustment and critical alarm levels, configurable delays, latching of critical alarms and interlocks that prevent affected processes from remaining available for automatic operation when a critical CCP condition is active. The specification also calls for alarm redirection, historical records, event logging and remote access. This represents a substantial change from the previous operating environment, where the availability of reliable alarms, trends and automatic responses was limited.

Ignition is the selected SCADA platform for the modernised system. Within the context of this project, the important lesson is that platform selection is only one part of successful SCADA delivery. The usefulness of the final SCADA system depends on reliable field signals, suitable electrical interfaces, documented control logic, appropriate interlocks and an operating philosophy that reflects how the plant is actually run. The work undertaken before screen development is therefore fundamental to the quality of the final system.

2.5 Lessons for Similar Upgrades

- **Start with operational risk, not software.** The project gained direction from identified water-quality and operational risks. CCP monitoring, alarms and shutdown capability defined what the control system needed to achieve.
- **Understand the existing plant before finalising the new design.** Reverse engineering and detailed electrical investigation exposed conditions that were not apparent from the original high-level concept.
- **Treat enabling works as a project in their own right.** Electrical segregation, control-voltage conversion, cabling remediation and removal of redundant equipment reduced risk before PLC cutover.
- **Design around operations.** A live WTP cannot be treated like a greenfield automation

project. Staging, temporary operating arrangements and operator involvement are essential.

- **SCADA quality depends on the plant underneath it.** A modern HMI cannot compensate for unreliable instrumentation, poor cabling, undocumented logic or unsuitable electrical interfaces.

3.0 CONCLUSION

The Glen Innes WTP project demonstrates that implementing SCADA in an ageing regional treatment plant is not simply a software installation. The AOS process identified genuine water-quality and operational risks, and the original tender translated those risks into requirements for new PLC control, CCP management and SCADA. Detailed design then revealed that the existing electrical and control infrastructure required significant preparation before those outcomes could be delivered safely and reliably.

The resulting journey has included tracing and documenting hardwired relay controls, addressing obsolete hardware, converting key control functions toward 24 VDC, improving voltage segregation and instrumentation cabling, and developing the enabling works required to remove the existing mimic panel entirely. These works establish the foundation for the new PLC/control panel and Ignition SCADA system, with improved alarming, trending, interlocking, remote visibility and operational control.

The principal lesson is straightforward: successful SCADA implementation begins well before the first screen is built. For utilities considering similar upgrades, early investigation of the existing electrical, instrumentation and control environment can reduce commissioning risk, improve project definition and ultimately produce a more reliable and maintainable control system.

4.0 ACKNOWLEDGEMENTS

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