# THE NEXT STEP TOWARD AUTOMATION

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## The Problem

The Dallas Water Utilities Southside Wastewater Treatment Plant (SWWTP) located southeast of the Dallas metropolitan area is an advanced treatment facility with an average rating of 110 MGD and a maximum rating of 195 MGD. The operations and maintenance staff has an excellent record for maintaining plant operations well within permit compliance and has been recognized for excellence in operations by the U.S. Environmental Protection Agency, receiving the 2002 National Clean Water Act Operations and Maintenance Excellence award as well as the EPA Double Platinum Award for ten consecutive years. The facility has had a Process Control System since the mid 1980's; however, initial attempts to implement process automation were largely unsuccessful. Plant staff has historically used the control system as a monitoring tool with very limited process automation.

In early 2000, DWU management recognized the need to begin planning for the replacement of the process control system. A number of the system components had become obsolete and were becoming increasing difficult to maintain. In particular, the Programmable Logic Controllers (PLCs) were fast reaching the end of their operational service life and needed replacing. Additionally, the facility was scheduled to undergo significant plant expansion in several process areas along with the implementation of new process technologies. It was clearly not feasible to add the monitoring and control elements required by the additional process capacity and new process technologies to the existing control system.

In addition, plant management recognized that the increased plant capacity along with the operational concepts associated with the new process technologies would impose additional demands on the operations and maintenance staff. They realized that in addition to upgrading the control system hardware and software, a significant level of process automation would need to be implemented in order to continue the successful, high quality operation of the facility.

**Goals and Objectives**

The overall goal of the Southside PCS Expansion Project was to not only replace the existing control system but to also increase the general level of automatic controls at the facility while maintaining the tradition of excellence in operations. In addition, specific goals of the project included:

- Implementation of modern, non-proprietary technology
- Emphasis on low maintenance costs
- Implementation of automation strategies to control chemical usage and to manage power consumption
- Minimize the need for additional operations staff by automating labor-intensive operations
- Coordinate with other projects under design and construction, including providing infrastructure support.

**Identifying the Problem**

PLC-based control strategies had been developed as part of the existing control system which was implemented in the 1980's. However, over the years, due to numerous problems with

the control logic, plant staff had lost confidence in the accuracy of the control strategies and had largely abandoned their use. Some of the problems with the existing automation strategies were clearly a result of inaccurate, faulty, or misapplied process instrumentation. In addition, the original PLC strategies were poorly documented and thus difficult to update as process requirements changed. Because of these limitations, the PCS system had declined to a "monitoring only" system.

SWWTP Management recognized that simply replacing the hardware and software would not lead to the level of improved operations required at the facility. A focused effort would be needed to affect a change in the operational environment. In addition, the SWWTP faced unique challenges in a PCS expansion project because of several ongoing design and construction projects.

**The Solution**

The PCS Expansion Project was begun with the explicit understanding that, in addition to replacing the system hardware and software, a key goal of the project was to significantly increase the level of automaton at the SWWTP facility. Because of the importance of this project, it has been implemented as a stand-alone project, not part of an overall process expansion project. A team of specialty engineering firms was chosen to design the project, including Process Control experts, Process Engineers, Network Design Engineers and Electrical Engineers.

An extensive preliminary design process was begun, focusing on how the facility was operated and how those operations could be improved. Specific improvements were designed to

improve plant operations and to provide an open architecture control system for future expansion. Some highlights of the overall design process are:

*Process Automation Workshops*

A series of detailed process automation workshops were held with SWWTP operations staff; focusing on specific process areas. These workshops began with an evaluation of existing operational methods and then moved to a discussion of alternate control methodologies. One key premise of the workshop was that the process was not being changed, but the process control methodology was being optimized. This involved considering where to design additional instrumentation and control equipment without significantly altering the process stream. These workshops required both process control experts as well as process engineers. The product of these workshops was a set of plant control narratives describing the operational concepts to be implemented during the PCS Expansion Project. These narratives were developed into detailed control strategies during the design process. A list of the process areas in which automation strategies were implemented includes:

- Pump Station C (influent pumping)
- Grit Removal
- Chlorination / Dechlorination
- Sulfur Dioxide System
- Tertiary Treatment (Effluent Filtering)
- Sludge Facilities
- Linear Lake Pump Station

*Infrastructure Improvements*

A key infrastructure improvement for the facility was the design of an open architecture fiber optic based Ethernet network. The network designed included failover capability and considerations for significant expansion. Additionally, care was taken to support other projects in progress. To support other projects which were in design at the same time, a portion of the network design was split from the overall PCS Expansion to be implemented in individual process expansion projects.

*Control System Architecture*

The overall PCS architecture utilizes a Commercial-Off-the-Shelf Human-Machine-Interface (HMI) system communicating over a fiber optic based Ethernet network to a number of PLCs located in key process areas as depicted in Figure 1.

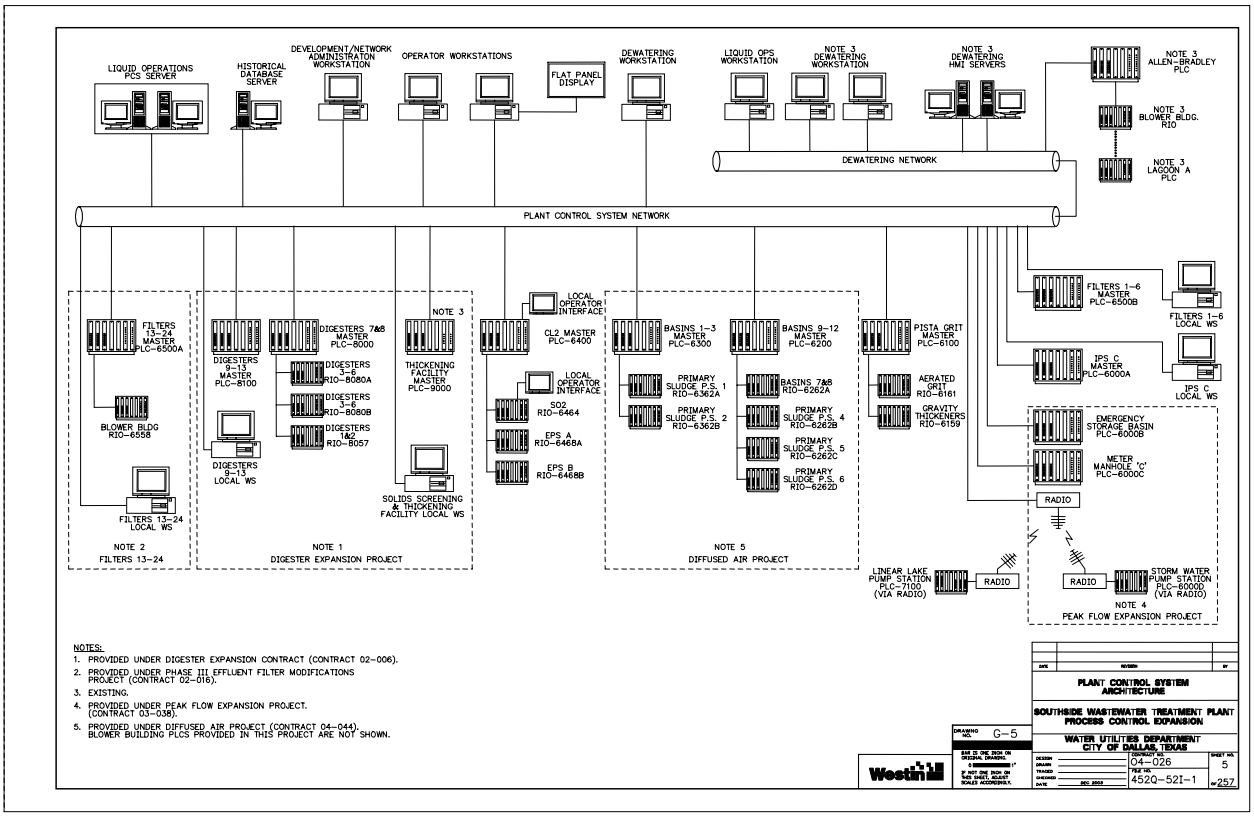


Figure 1 – SWWTP PCS Architecture

The PCS Expansion project has set the stage for the SWWTP to continue its tradition of excellence in plant operations via an increased level of overall process automation. The lessons learned throughout this project are valuable to Dallas Water Utilities and other Utilities around the nation.