

Taking a 50 Year Old WWTF to the Next Century

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MCRD/ERR Parris Island

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- Parris Island is one of the most visited military facilities in the world, hosting more than 100,000 visitors a year.
- It is the home of the Eastern Recruiting Region and Recruit Training for all male Marines east of the Mississippi River and all female marines nation-wide.
- There is a staff of over 2,500 Marines, Sailors and civilians to keep Parris Island operational.

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- The wastewater treatment facility with associated lift stations serves the whole military and training complex.
- The Seaboard system age and resulting deterioration was reaching the point where the continuous repair costs were exceeding the replacement costs.



WWTF Overview

- The Parris Island depot rises a maximum of 32 feet above sea level, and operates a single secondary Waste Water Treatment Facility (WWTF).
- The WWTF was originally constructed in 1947.
- Wastewater generated on Parris Island is conveyed to the treatment plant via 32 lift stations.
- Five additional lift stations are located at and used by the treatment plant.

WWTF Overview

- The collection system consists of approximately 34 miles of gravity and forced flow lines.
- The treatment plant is a secondary trickling filter plant with a current operating capacity of 1.5 million gallons per day (mg/d) and discharges through an outfall pipeline extending into the Beaufort River.
- The plant operates under NPDES permit number SC 00002577 issue by the South Carolina Department of Health and Environmental Control.

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WWTF Overview

- The daily average flow is 750,000 gallons per day.
- The original design capacity of the WWTF was 3.0 mg/d.
- The current overall operational capacity of the treatment facility is 1.5 mg/d due to the repiping of one of the original primary clarifiers to provide intermediate clarification processes.

WWTF Overview

- With this design it has improve the overall treatment process. This facility averages 92-98% removal of BOD and TSS.
- This facility won the USEPA Region IV Operation and Maintenance Excellence Award in 1995 and 1999.

WWTF Overview

- Due to failure or downtime of the Seaboard system the base risked a large wastewater spill that would cause a direct impact to the Beaufort or the Broad River.
- Due to age of the plant we were looking into becoming more modern and efficient to meet future operation, maintenance, and regulatory requirements.

Existing SCADA

- The WWTF SCADA system was a Seaboard style telemetry monitor for 32 remote lift stations and the main processing area.
- The multiple failures of the system were attributed to humidity, age, and lightning damage.

Existing SCADA

- Alarms were routed to a panel in the main operator's office at the WWTF.
- When the office was not occupied, no alarms were automatically routed from this office to alert staff.
- This situation resulted in a slow response to abnormal or emergency conditions.

Solution

- It was realized that utilizing present technology, significantly more real time information (like the measurement of tank levels, volumes, pump capacity and flows) could be obtained and subsequently utilized for diagnostic functions.
- Tying the WWTF SCADA system in to the Central Energy Plant computer system would allow for 24 hr, 7 day monitoring.

WWTF Main Office Display



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- DOE Science and Technology Laboratory located in Richland, WA.
- Operated by Battelle Memorial Institute for the Department of Energy since 1965.
- Decision Support for Operations and Maintenance program upgrading operation of Central Energy Plants, Cogeneration Plants, EMCS building control systems, and WWTF operations from a central location.

WWTF System Inspection

- PNNL recommended and performed a thorough inspection of the complete system to clearly establish the baseline condition.
- The inspection included all wiring, sensor and monitoring devices, controllers, telemetry, and SCADA software.
- Assessment of this information was then used to develop a master plan for modification/ upgrade/ replacement of part or all of the system.

WWTF SCADA Upgrades

- PNNL staff designed SCADA control cabinets to be built and installed in each lift station.
- Lord & Company, Inc., instrumentation and control systems specialists, were contracted to build, install and commission the cabinets.
- New UL Labeled weather proof control panels were made up with Allen Bradley Micro 1000 Programmable Logic Controllers (PLCs), power supplies, interface relays for pump monitoring and override float operations in case of PLC failure.

External View of Typical Lift Station



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Typical Lift Station



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Typical Lift Station Panel with UPS



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WWTF SCADA Upgrades

- Communications were upgraded by including a Johnson radio communications system interface in each cabinet to establish data transmission with the main radio in the WWTF operator's office.
- Uninterruptible Power Supplies were provided in each of the 32 cabinets for backup power of the control and radio links to continue monitoring during power outages.

Process Monitoring

- The wastewater treatment process was analyzed to see if some of the alarm or monitoring points should be changed from solely high level to full level monitoring.
- This change would allow for better process control along with warning alarms before critical levels are reached and provide a significant reduction in event response time with an associated reduction in environmental risk.

Process Monitoring

- Lord & Company, Inc. installed a Milltronics ultrasonic level detection system in each remote lift station sump to increase monitoring capability.
- The existing float control systems were reset and used as alarm and backup control.

Software

- PNNL engineers used a Rockwell Systems Commercial-off-the-Shelf (COTS) software program for the WWTF application.
- RSView32, running under Windows NT4.0, minimized compatibility issues with the existing DSOM software at the Central Energy Plant (CEP).
- This provides for an interface between the CEP and the WWTF Operator's office for alarm response and monitoring capabilities.

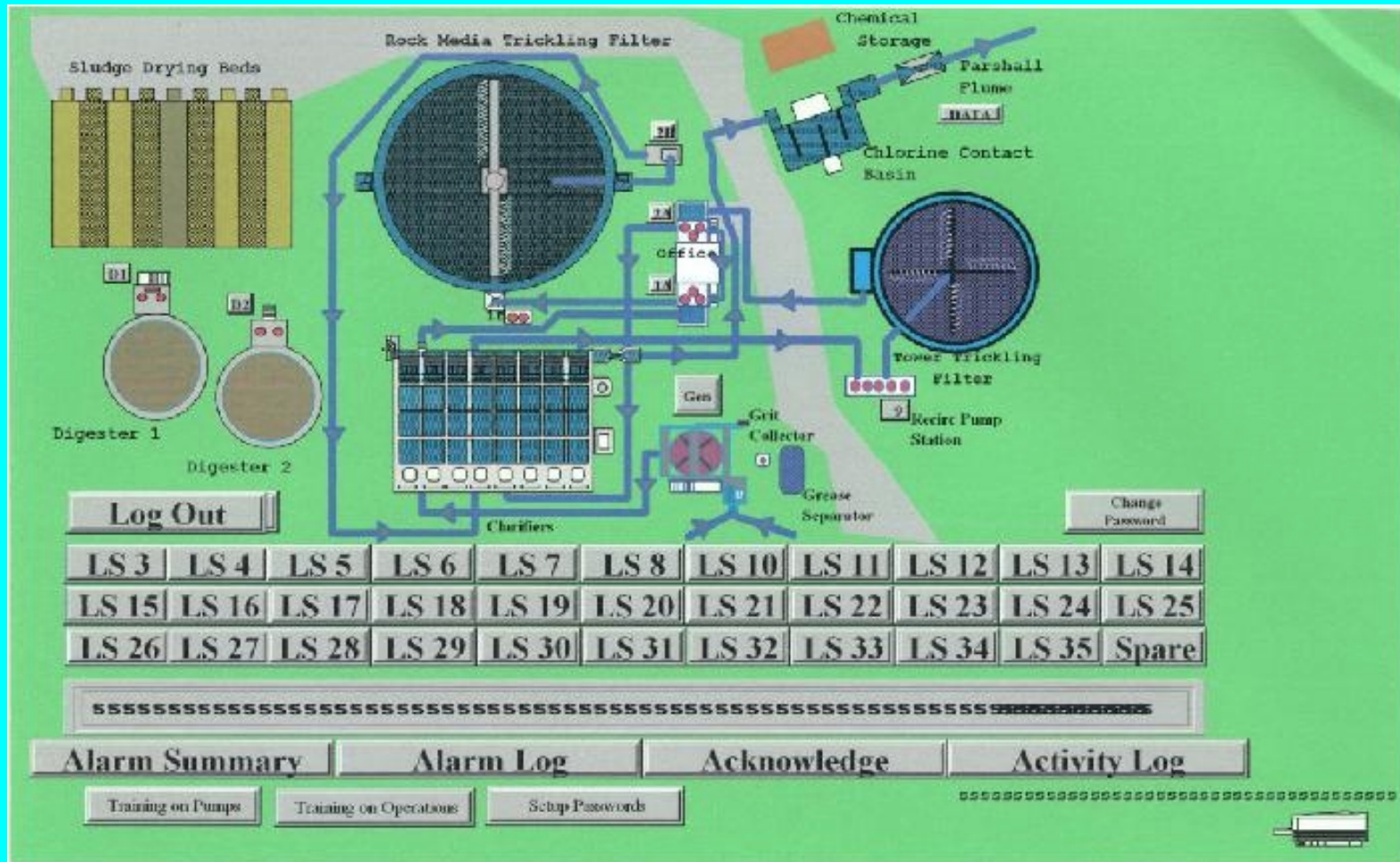
Software Utilization

- The Graphical User Interface (GUI) was designed and set up by PNNL staff for simple point and click operation by the WWTF operators.
- An administrative level of security was established to allow supervisory personnel the ability to change pump automatic switchover setpoints and level alarm setpoints from the WWTF Operator's console.
- All the lift stations and their associated alerts and alarms are accessible from one main screen display.

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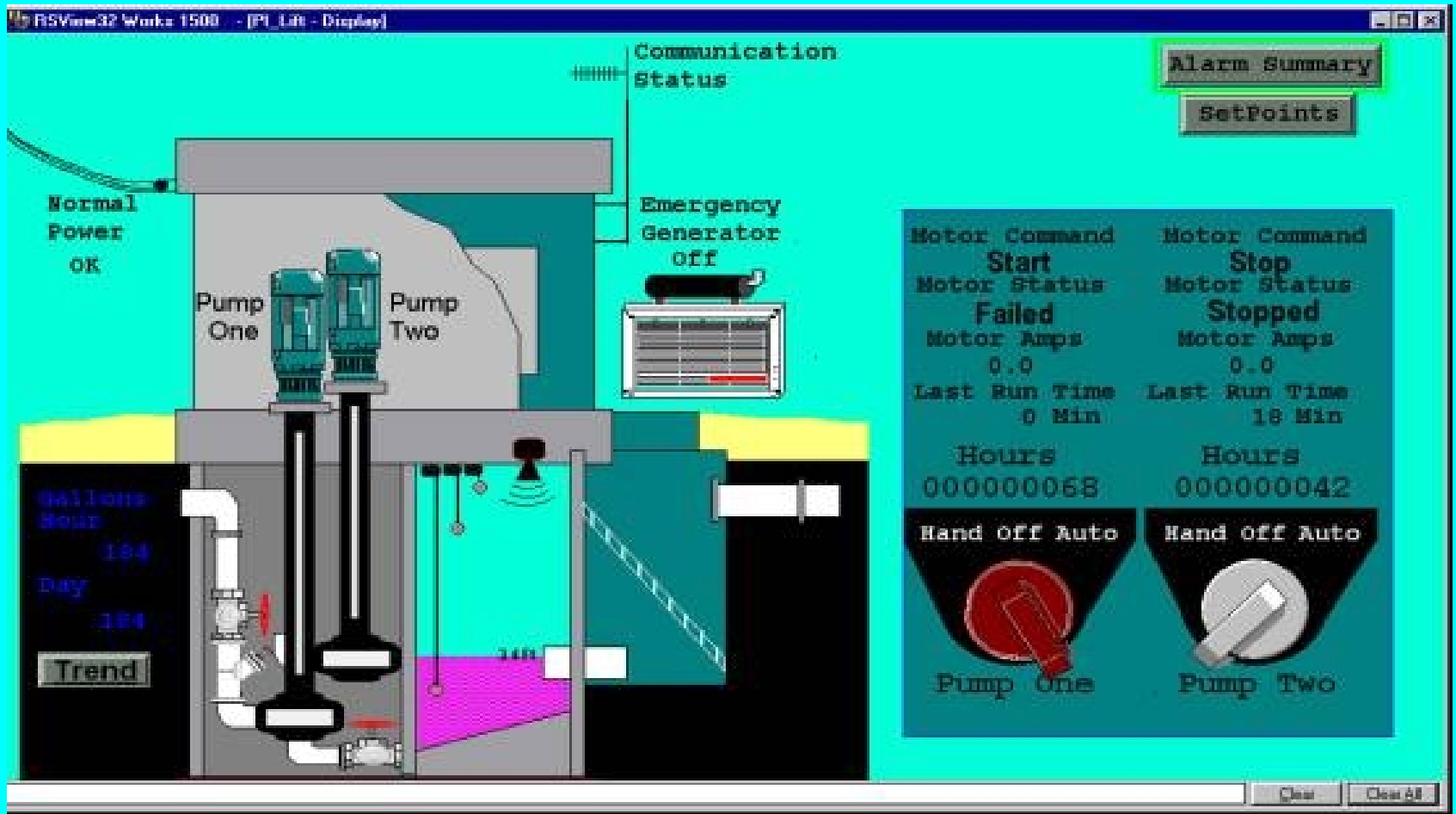
PI WWTF Main Screen Display



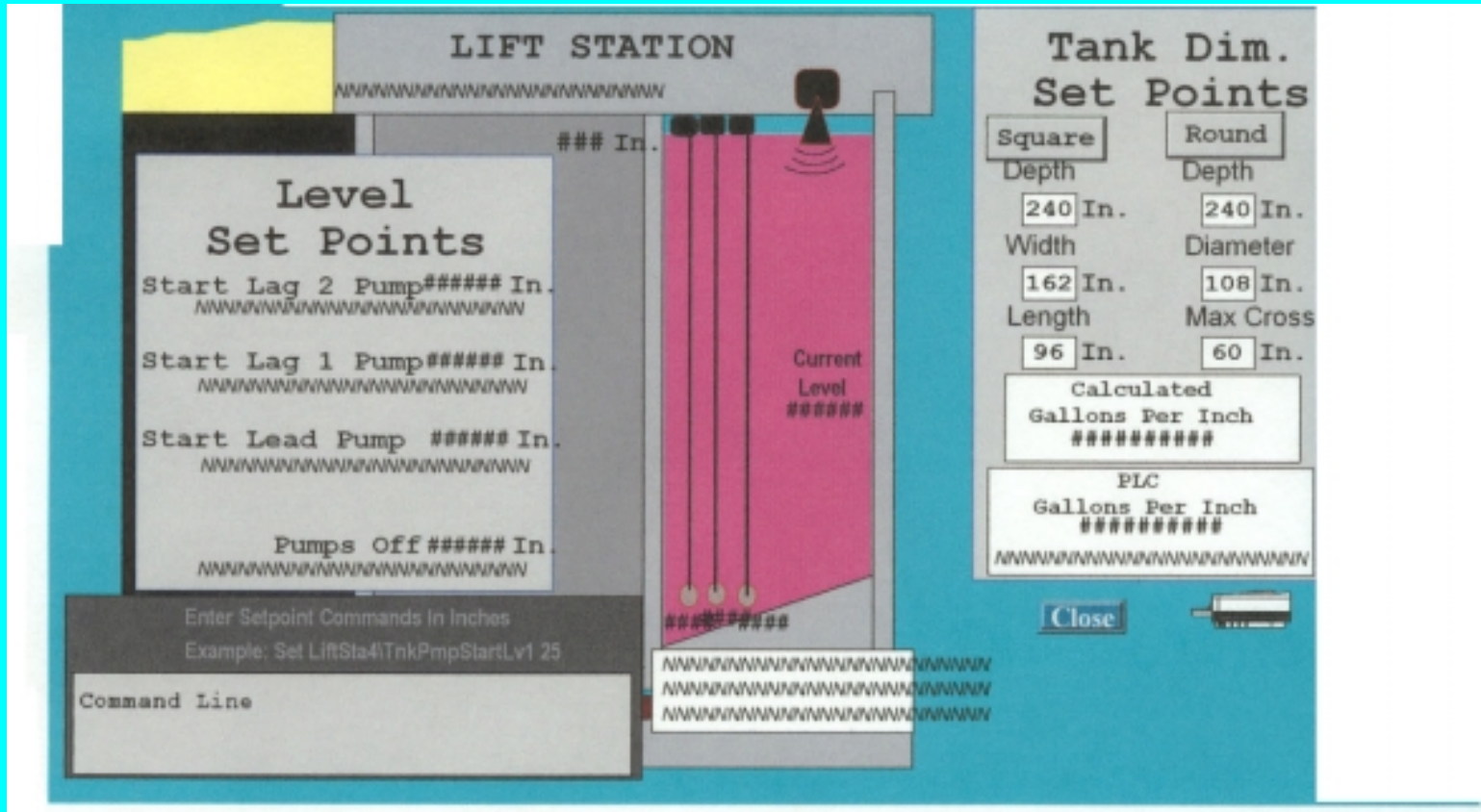
System Design

- Each lift station is represented by a graphic depicting sump level, pump status, communications status, and remote generator status under loss of power conditions.
- The software provides the operators with the ability to trend data, remotely start and stop pumps, and change the auto mode sequence for automatic pump start and stop operations.

Typical Lift Station Display



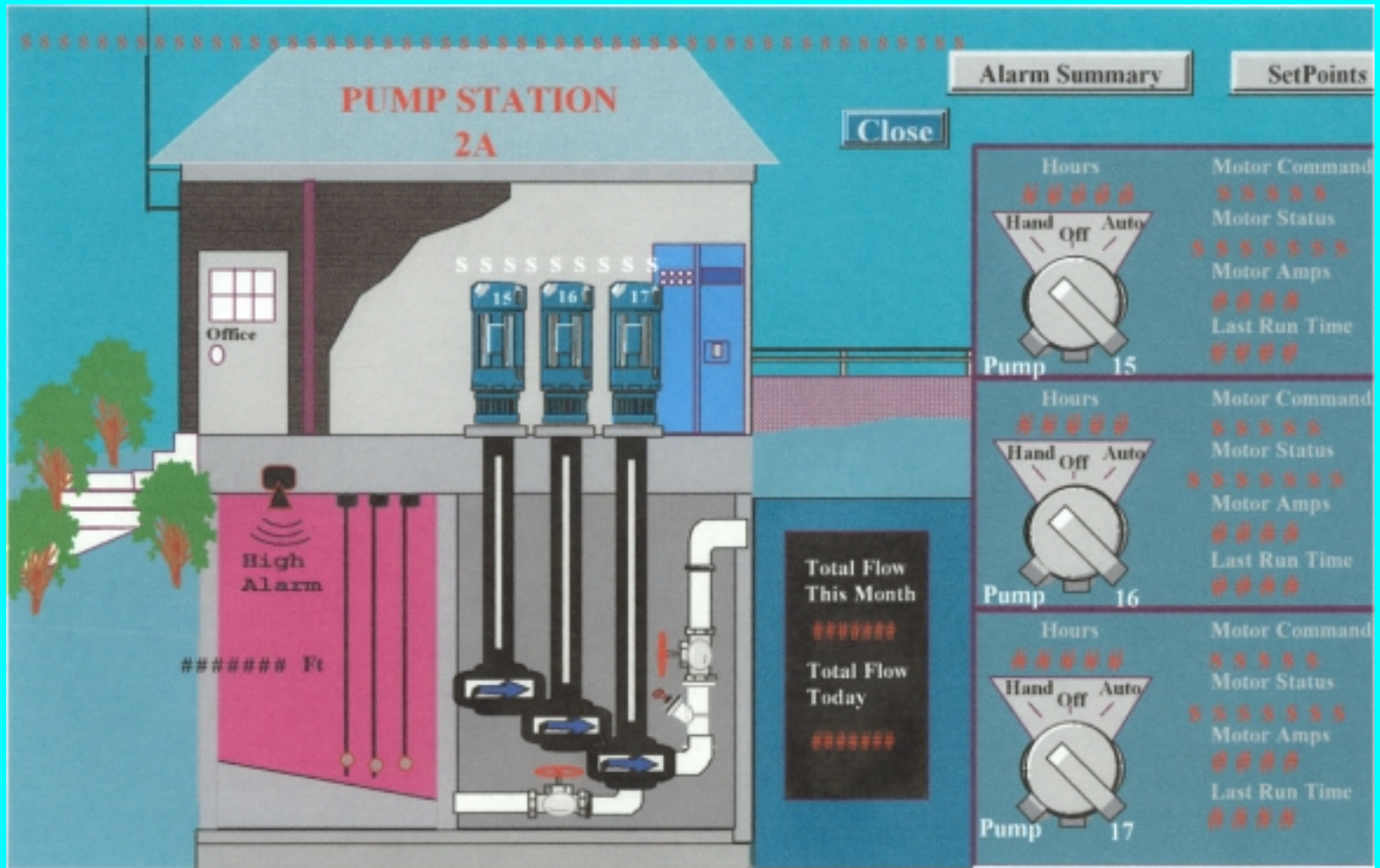
Lift Station Setpoints Screen



System Design

- With the supervisory access activated, supervisors can change alarm points, auto pump start and stop points, and level control set points through a simple-to-use set points interface screen.
- Operators can virtually examine trend data on all values monitored such as run times, pump amperage, and pump capacity.

Pump Station 2 A



Communications

- Each of the remote terminal units (RTU's) used a Johnson Data Telemetry model T-96SR radio modem designed primarily for SCADA system and telemetry use.
- The Johnson Data Telemetry model T-BASE/R was used in the Wastewater Treatment Facility Operator's office as the "Master Radio".
- The T-BASE/R is basically the same unit as the T-96SR radio with an additional port for on-line diagnostics utilizing an existing Government-licensed frequency.

The Final Step

- The final step in upgrading the WWTF will be to install and tie in instrumentation for monitoring and control of the main wastewater treatment plant components to the existing software system that is controlling the lift stations.
- This will allow the complete process to be monitored and controlled from the WWTF Operator's console with backup monitoring at the CEP during unmanned conditions.

Results

- less environmental risk,
- higher reliability, and
- a more effective process for collecting and processing wastewater at Parris Island.
- The expected reduction in manpower requirements necessary to operate this system will allow the WWTF Supervisor to shift his resources from daily operations to preventive and proactive maintenance, resulting in a better operating facility over the long term.