# OPERATE A WASTEWATER TREATMENT PLANT FROM THE PALM OF YOUR HAND

James L. Hall[1/] and William C. Harrington[2/]

*AUTHORS:* [1/] Engineer, [2/]Senior Engineer, PARSONS, 3450 Buschwood Park Drive. Suite 345. Tampa, Florida 33618
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**Abstract.** As a result of tighter fiscal budgets, municipal utilities are more frequently moving towards facility improvements rather than building new facilities. Work force down sizing is occurring and as a result the operations and maintenance of plants is being neglected. Automated control of these facilities is often one of the principal improvements desired to countermand the increasing demands placed on operators.

The obstacle encountered frequently with plant personnel is the aversion to change and using new technologies. The use of a Personnel Digital Assistant (PDA) not only allows the Operator to view the entire plant processes but is a valuable tool in maintaining control over the processes.

The use of the new system employed for this project resulted in better response time to emergency situations, added convenience or operation, and increased efficiency related to calibration of systems by individual operators.

## INTRODUCTION

The William E. Dunn Water Reclamation Facility (fig.1) is an 11 MGD AWT plant consisting of three phases (I, II and III) of improvements valued at almost $17 million. The plant is located in Pinellas County near the City of Tarpon Springs on Florida's west coast. Phase I construction consisted of building a new administration/operations building. It has an updated control room to monitor the plant's processes and production as well as expanded office space. Phases II and III improvements included demolition work; adding new computers and monitoring capabilities to the new administration/operations building; a new headworks facility with odor control; 12 new biological treatment mixers; new chemical feed equipment; two new 85-foot diameter clarifiers; reclaimed water pumping station modifications; a new sludge rotary drum thickener; belt filter press enhancements; a new maintenance building; reuse water pumping improvements; mechanical pond aerators; painting of new and existing structures; and extensive landscaping. As mentioned above, new computers and monitoring capabilities were added to the new administration building. These technological improvements were accomplished by adding a new PLC based automation system including the development of new Human Machine Interface (HMI) screens using Wonderware, and a wireless LAN system providing the capability to view and operate the facility from a PDA.

## NEW AUTOMATION

The existing instrumentation provided very little automation of plant processes. The Supervisory Control and Data Acquisition (SCADA) system was VAX (Virtual Address eXtension) based system, that system is an operator interface control system that includes support for process control, data acquisition, alarming, trending and management reports. The ability to upgrade HMI screens was extremely limited. The VAX system was retained as a backup system. Phase III of the project aimed at redefining how Pinellas County controls and monitors its wastewater plants through the addition of Modicon Quantum PLCs and the use of Wonderware for HMI screen development.

**Figure 1: Plant overview with Gulf of Mexico in background.**

Inclusion of a wireless LAN system drew scepticism at the onset of the project. However, now that construction is complete plant operators monitor the plant while making rounds and even anticipate problems such as pump failures, high level alarms, chlorine residuals out of range and sludge production issues before they arise. Quicker responses to problems means few plant upsets and better control control without increasing operations staff.

The basis of design for this element of the instrumentation upgrade was the iPAQ Pocket PC 3670. These units were specified to include Pocket Word, Excel and Internet Explorer. The units were supplied with a 206 MHz Intel StrongARM SA-1110 processor, 64-MB memory, Li-Polymer Battery and an Intouch Runtime License to run Wonderware. The specifications required that a Spread Spectrum wireless Ethernet communications system operate throughout the plant utilizing frequency-hopping 2.4 GHz spread spectrum radios with 20-128 ms dwell time and a range of 2000 feet with integrated antennas and 500 feet in office environments. The mobile units are required to move freely from one cell of antenna coverage to another without interruption in network services.

Antennas for the wireless LAN were placed on buildings with the highest elevations. The antennas used were omni-directional, sectional exterior-mounted amplified, interior patch and yagis. These antennas were placed in sixteen strategic areas to provide uninterrupted service to the PDA. The areas coincided with the placement of new PLC control panels installed as part of the Phase III work. A map of the site and antenna coverage areas can be seen in Figure 2. The areas were designed to overlap for consistent coverage throughout the plant. This full range of coverage provided additional convenience of operation. Valves and gates at the headworks could now be adjusted to accommodate flows by an operator on the opposite side of the plant during routine rounds if required.

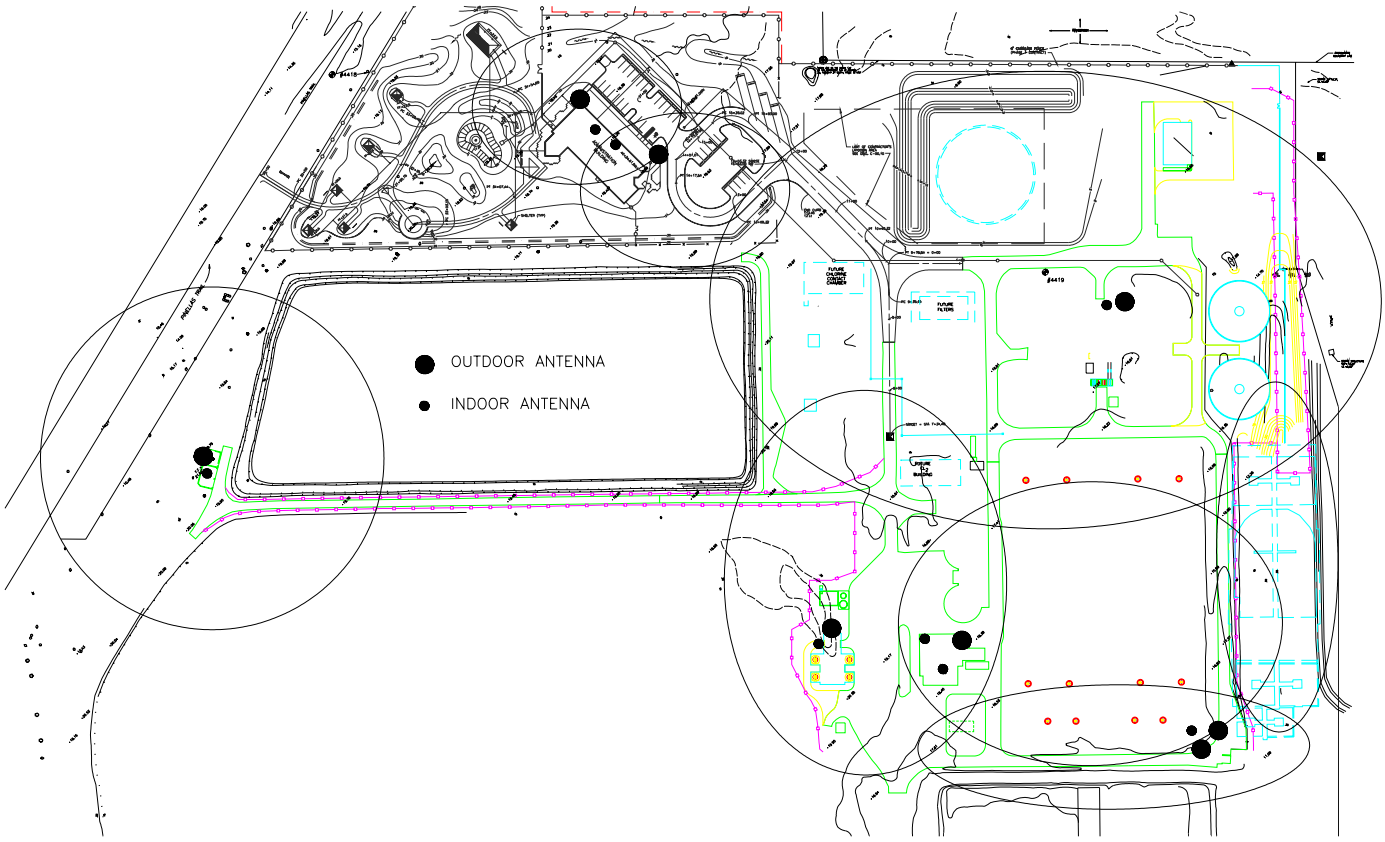


**Figure 2: Plant antenna locations and wireless coverage areas.**

The specified iPAQ supplied was upgraded to the Pocket PC 3835 (fig. 3) which was newer and had many improved features. The unit's display is a color-reflective TFT liquid crystal screen (fig. 4), which provides the same "look" that the flat screen monitors in the SCADA control room provided under the Phase III contract. This continuity in feel was a strong asset when trying to convert plant personnel to new technologies, easing their fears of unfamiliar equipment. The HMI screens originally were able to fit entirely on the 2.26" wide by 3.02" viewing area; however it was quickly discovered that the image was unreadable due to pixel size. Consequently the HMI screens are currently loaded similarly to a computer screen to allow scrolling vertically and horizontally to view the entire picture (fig. 5).

When logged on to the network the data provided is "real-time" which allows the Operator to have visual access to any part of the facility through the HMI screens. Additional features such as the voice recorder and note taker allow the Operator to record spontaneous issues that arise as rounds are being made. For instance while checking sludge blankets an operator notices a piece of equipment has faulted, the operator can record this observation and follow up with the maintenance team. Alarms can be programmed to sound and provide a blinking light to move the Operator's attention to a potential problem area.

## ONE YEAR LATER

After one year of use in the facility there were some items noted that were not initially expected:

1. The user was required to re-log onto the system when changing between antenna coverage areas.
2. Signal occasionally drops out requiring re-logging on to the system.
3. PDA is extremely useful for calibrating chlorine dosages and polymer dosages which used to require radio contact to the SCADA room to verify sample readings.
4. Third shift and weekend crews not using PDA to fullest capabilities or not at all.
5. Technology is new to some employees and is difficult to change "habits" of using the PDA as a tool.

**Figure 3: Upgraded PDA.**

**Figure 4: TFT liquid crystal screen.**

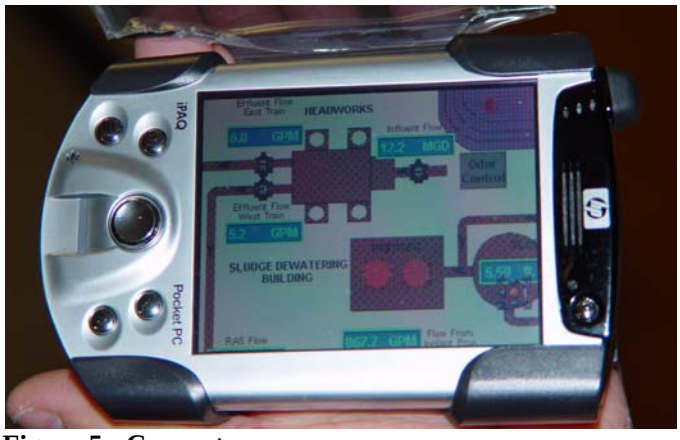


**Figure 5: Computer screen.**

There will always be a percentage of workers that have an aversion to change. Currently, plant managers are attempting to integrate the new technology into routine habits of the plant personnel. This is being accomplished through polling employees with regards to computer literacy and familiarity of the new SCADA system followed by training to meet the needs of the employees. It has been acknowledged that some members on lighter shifts use computers as little as possible. Lead plant operators are attempting to teach by example and use as many of the tools provided under the Phase III contract as possible, such as monitoring other processes via the PDA while visually monitoring others, and actually running equipment as needed during moments of testing or emergency. At the same time other new benefits are being discovered and exploited. Improved efficiency of operation related to calibration of equipment and systems has resulted directly from the use of the PDA. There is no longer a need for a worker in the field to coordinate with a second worker in the control room to calibrate a chemical dosing pump. A worker now can view process data from the PDA and make the appropriate process adjustments single handedly.

## CONCLUSIONS

There is little doubt of the possibilities using this expanding technology. PDA technologies have been widely used in the areas of manufacturing to monitor processes and in public utilities for the collection of data such as water consumption. It is our hope that Plant Managers and Operators will embrace these new operational assets and explore many of the potential benefits that await them. The PDA will never replace personnel, but it can provide information to the Operator on a “real-time” basis that can and will improve the operational conditions of the plant.

## SELECTED REFERENCES

Wayne Nichols, Lead Plant Operator, William E. Dunn Wastewater Treatment Plant