West Palm Beach Gains Water Landmark

The American Water Works Association has presented the city of West Palm Beach a Water Landmark Award for significance in the history of public Water supply for its 1926 pumping station.

West Palm Beach's water system began in 1894 with a water supply owned by Henry Flagler's Florida East Coast Hotel Company—Flagler had completed the first section of the Royal Poinciana the previous year. When the town of West Palm Beach authorized a thirty-year franchise for water service within its boundaries, the Florida East Coast Hotel Company built and operated a water plant at Clear Lake, about a mile west of Lake Worth, in 1901. In 1909 the water plant became part of Flagler's West Palm Beach Water Company.

Customers during the next decade forced the issue for a better product, which resulted in construction of a 3-MGD filtration plant in 1920. By early 1925 additional capacity brought the water to 6-MGD filtration treatment.

AWWA representative Bevin Beaudet, deputy administrator of Palm Beach County (center), presented the Landmark Award to Water Plant

With continued increases in demand, the Flagler company underwent a significant capital expansion and completed construction of a 20-MGD filtration plant in early 1927. The construction included the pumping station, which was the site of the first FWPCOA meeting in 1941.

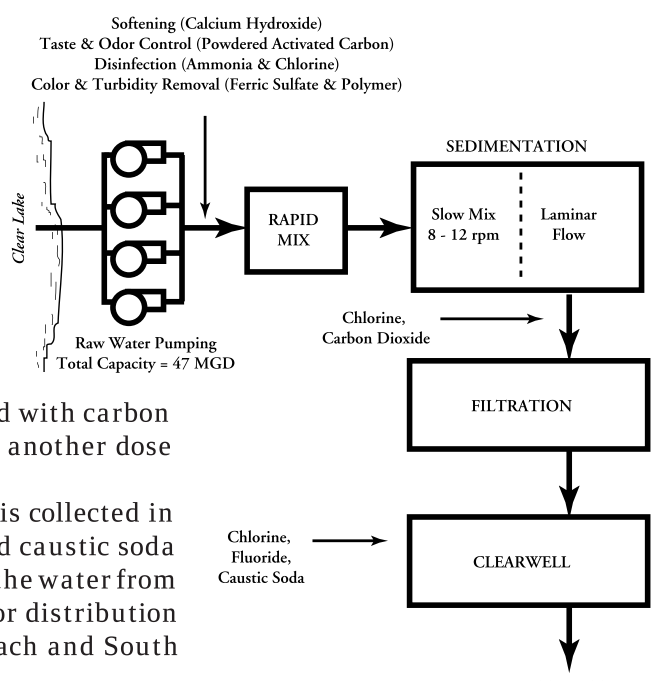
The city purchased the water treatment plant in 1955 and continually increased the capacity until by 1988 it had reached 47 MGD.

The facility today is on a 55-acre site on Clear Lake—the same site where all the developmental stages of water treatment have occurred since the beginning.

Water from Clear Lake is pumped to the treatment plant by four pumps with a total rated capacity of 47 MGD. Treated with ammonia and chlorine for disinfection, ferric sulfate and polymer for color and turbidity removal, lime for softening, and powdered activated carbon for taste and odor control, the water passes through a rapid mix chamber before flowing by gravity into flow stabilization chambers and into slow mixing. While the rapid mixing disperses the chemicals, slow mixing suspend precipitated materials so they do not settle prematurely. Subsequent laminar flow with sludge scrapers allows settlement and removal of the precipitates.

After settling and prior to filtration the water is treated with carbon dioxide for stabilization (to decrease the pH) and receives another dose of chlorine to maintain disinfection.

After flowing through the filters by gravity, the water is collected in a clearwell. The filtered water is treated with fluoride and caustic soda and receives still another dose of chlorine. Lift pumps take the water from the clearwell and a 5 million gallon ground storage tank for distribution to the city of West Palm Beach and the towns of Palm Beach and South Palm Beach.



Aeration System Increases Digestion Rate at Marineland

William McGowan

Marineland of Florida is a popular marine and freshwater aquatic attraction and resort located south of St. Augustine on Highway A1A. It has two motels with laundry facilities, two restaurants, several snack bars, and a full service campground and marina.

Marineland is served by a 0.06 MGD modular pre-cast concrete, extended aeration wastewater treatment plant with a 0.01 mg aerobic digester.

Waste rates vary seasonally, but averaged 183 gpd during 1993. Under low load conditions the digester functioned adequately, but during peak load periods high waste rates overloaded the system and it was necessary to remove 2500 to 7500 gallons of digester solids per month by truck for agricultural land application.

In February 1993 Marineland's Director of Operations Frank Hughes and I met with Gene E. Keyser and Ellis Barnes of Key Solutions, Inc., Jacksonville. Keyser described an aeration system he had developed. It was designed to increase the digestion rate in aerobic digesters by increasing oxygen transfer efficiency, accelerating volatile solids oxidation, and thus reducing the volume of solids removed from the digester for land application.

The system, consisting of a small compressor, a 2HP low pressure circulating pump, and Keyser's air delivery equipment, was installed in Marineland's digester on an experimental basis on March 7, 1993.

Installation was quite simple. The pump section and discharge were installed at opposite ends of the 23-foot long rectangular digester. Air was injected into the discharge from the pump via three aerators at a rate of 0.25 – 1.0 cubic feet per minute (CFM) each. The low air feed rates reflect the high oxygen transfer capability of the system.

The first observed effect of the aeration process was the formation of a thick, odorless layer of solids on the digester surface. The recirculated flow (underflow) showed decreasing suspended solids content until, about two weeks after start-up, the underflow was relatively clear with low observed suspended solids.

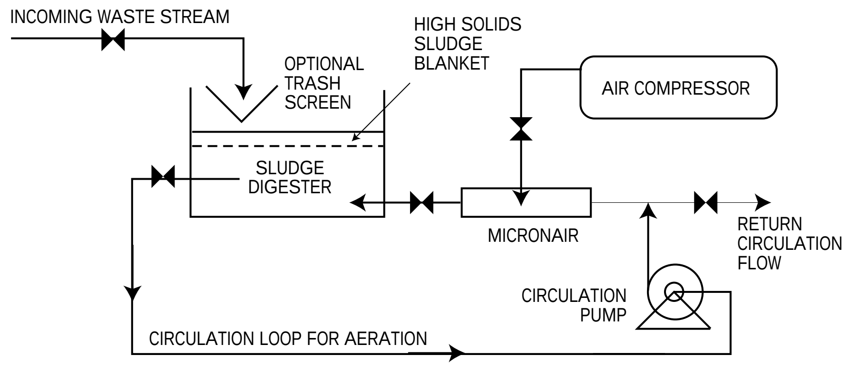
At this point we began supernating the underflow back to the plant process and wasting to the digester.

The modular design of the Marineland system allows us to shut-off the diffusers in an aeration to concentrate solids prior to waste. This results in a waste activated sludge solids concentration of approximately 20,000 mg/L.

The low volume, high solids waste had no observed adverse impact on the digester process.

Under high influent flow conditions additional underflow was returned to the plant to make room for a higher WAS rate.

A supernate–waste schedule was developed that significantly improved the operability of the plant because of the continuous availability of digester capacity for peak loading wasting. Being able to waste on a regular schedule without 24–72 hour interruptions for digester settling/supernation allows us to better control the **Fim** ratio in the plant.



Digester loading for the first twelve months of operation (March 1993 through February 1994) was:

Hydraulic loading:	66,965 gal.	WAS
Total Solids (Est.)	10,450 lbs.	MLSS
Volatile Solids @80%:	8,360 lbs.	MLVSS

During this period the system treated approximately 7.6 MG of influent with an average CBOD5 of 202 mg/L. Under normal operating conditions the digester would have produced 32,500 gallons of excess solids for land applications. With the Key Solutions aeration system, the digester produced no excess solids during the twelve month operating period. Solids removal by truck was completely eliminated. Based upon peak period sludge hauling removal by truck, it was estimated that equipment costs for the system, about $1800, were recovered in six months. Operating costs for the 2-HP circulating pump and the 6-HP compressor were considered a nominal cost factor.

With solids handing costs rising rapidly in response to new regulatory requirements Marineland expects to reduce it's cost substantially with this new aeration technology.

One application of Micronair technology consists of a recirculation loop that uses underflow from the digester to deliver micron-sized bubbles of air. The tiny bubbles are created in a controlled manner by adjustment of pressure and flow through the aeration element. Compressed air is the source of oxygen, entering the recirculation through a stainless steel microporous membrane.

The objectives of the system are: eliminate sludge hauling; provide conditions for the adequate, economical, and complete conversion of volatile sludge solids to carbon dioxide, nitrogen, and water; and provide near infinite solids residence time for sludge digestion to achieve Part 503 compliance.

The WAS and primary sludge solids are separated from water by the same equipment and operation that continuously supplies oxygen for digestion. Infinite solids residence times are achieved by leaving the biosolids in tankage under conditions where they can be efficiently and completely biodegraded.

William D. McGowan, an A operator and owner of Florida Environmental Services of Bunnell, provides operational, analytical, and consulting services to private utilities. He has operated the Marineland Wastewater Treatment facility since 1987.

Wastewater Treatment Facility Safety…

The Importance of Communication and Teamwork

John Armstrong and Roy Pelletier

May the force of safety be with you!

Working in the wastewater industry is not inherently dangerous. Certain precautions, however, are necessary to prevent unexpected occurrences from causing injury. We are all aware of the potential hazards we may encounter on our jobs. Common sense is a key element in not allowing a risky task to result in an injury. There is, however, a natural human tendency toward complacency. Urgency to get the job done, coupled with complacency, can set us up for an accident.

"I've done this job a thousand times…I don't need to go back to the truck and get my gloves this time." How many times have you heard, or possibly said, a statement like that? No one wants to get hurt on the job, but we all make mistakes from time to time. When we come to view safety rules as a means by which our personal health is protected, we can embrace safe work practices as an indispensable element of our job instead of a hindrance. Maybe you've done the job a thousand times before without getting hurt, but maybe you've been lucky to avoid an injury doing the task without proper safety precautions.

Our individual work practices can have a powerful influence on our co-workers. When an experienced operator reaches inside a pump to pull rags with bare hands, it sends a message to the less experienced person that it's okay. Or, worse yet, operators who do take the extra time to wear appropriate safety equipment are teased and verbally abused by "old hands." Does someone have to have hands sliced open by a razor blade in the rags or be stuck by a needle before we all willingly use the proper tools and wear our gloves? The less experienced operator who tries to do things the fast and easy way may not be so lucky.

Teamwork requires that we think first of the overall good of the job. One costly injury can more than wipe out all the savings that may have been realized from getting the job done fast, not to mention the *pain* from an accident—pain hurts! The macho "I'm not afraid of anything" attitude has no place in a wastewater treatment plant. The often-heard phrase "the job comes first" doesn't mean safety isn't part of the "job." "Safety" and the "job" must be one and the same. Overall efficiency and quality can only be enhanced through safe work practices. If you embrace safe work practices, then the person working with you will certainly feel more comfortable doing the same thing. Teamwork requires that we subordinate our personal way of doing things to the overall good of our co-workers.

A vital element of teamwork is communication. We all have a responsibility to inform our co-workers when they are endangering themselves or others. While we cannot stop people from doing things they have absolutely made up their mind to do, we can at least inform them of the potential consequences of their actions. Most people are reasonable and will welcome tactful pointers. Sometimes we find ourselves in situations where we have to be very blunt. Just because the entire crew is in the hole digging up the force main without proper shoring doesn't mean you have to get in there with them just because "everyone was doing it." Most situations will not be that drastic, but you can't support your family if you are buried alive.

Safety measures are a vital forum for building teamwork and encouraging communication between workers and management. It is important that each person express his or her safety concerns no matter how trivial they may seem. There are things that we see and come in contact with on our jobs that management may not even be aware of. Management cannot take action on items it is not aware of. Continued input by each individual is crucial to everyone's well being.

Safety committees can also be used as an effective tool to encourage safe work practices. A safety committee can relieve management from some of the daily safety pressures, as well as encourage team participation in ensuring the plant is a safer place to work. Team participation is the key to a successful safety committee. When everyone, including the plant manager, is rotated through the safety committee, safe work practices become a conscious concern of each individual.

One of the most important things we can do in attempting to realize effective communication is to listen…really listen. Thoughtful attention to what your co-workers or supervisor is saying could prevent an injury. Sometimes the really important aspects of someone's comments need to be considered in context to realize the value. When the third shift operator comments in a safety meeting that an inlet valve of a raw sewage pump is jammed open. Does it get blown off to a "so what"? Next week another operator tries to close the valve, but it's stuck, so he or she thinks that the valve is closed. The operator then proceeds to remove the inspection plate to de-tag the pump and floods the pump room dry well. If we don't understand what something means we have the responsibility to ask for clarification. When people do not listen to one another there is no communication. A clearer explanation today can prevent a trip to the emergency room tomorrow. Thoughtful attention is vital to staying on top of what is really happening in a wastewater treatment plant.

Effective leadership is the key to making facility safety a reality. Without open concerns and proper examples of management and supervision, no safety program will be effective. Leadership is the art of influencing and directing people in such a way as to win their confidence, obedience, respect and loyal cooperation in the achievement of a common goal. The common goal in this case being an efficient, cost effective, and accident free workplace. Management and supervision actively integrate safe work practices with treatment plant operations and maintenance. One accident can easily cost far more than what is saved by taking short cuts on safety.

No team is complete without an effective leader. The plant staff cannot function as a team, with respect to facility safety, without the coordination and cooperation of the supervisors. Safe personal examples and a willingness to encourage teamwork and communication are the supervisor's keys to an accident free day on the job. The single fastest way for a supervisor to sabotage his or her role as a leader is to show open contempt for safe work practices. If the supervisor climbs down in a manhole, maybe just to check the job, how will the crew feel when told *they* have to have a confined space permit, setup a tripod, wear a harness, carry a gas detector, and possibly utilize other safety equipment?. Obviously, this approach won't work very well. "Do as I say, not as I do" has no place in the management of a wastewater facility. Supervisors who will not follow the same safety rules their crews are expected to follow are a direct threat to the health and safety of the workers who report to them.

Supervisors and managers sometimes find themselves in the position of being "old hands" and viewed by the newer people as the experts. What would the newer staff members think if the experts say "we've been doing things a certain way for so long, we don't have time for all that safety stuff." The new O&M people may feel threatened if they go against the way of the expert. Supervisors and managers really do have an extremely important responsibility to guide their employees in the "new ways" of safety. New safety practices often require energy and attention that may not have been utilized previously. In the past all of the immediate attention may have been poured into getting the job done quickly. Job task time allocations will no doubt change with the observance of safety practices. At first, the job task will take longer to perform because the safety aspects and equipment are foreign. As time passes and experience is gained, the job with safety procedures will go much faster. Ultimately, with experience, safe work practices, like wearing respiratory protection when changing chlorine, will become a natural and integral part of every task performed in the treatment plant operations and maintenance.

Each individual, regardless of the circumstance, is ultimately responsible for his own safety. All the safety policies, procedures and equipment in the world are meaningless if not utilized and faithfully adhered to. Pressure to accomplish a task quickly is no excuse for an accident. Each individual plays a vital role in the safety of the entire group. We all have something valuable to offer to the job. We must help ourselves and help each other to stay safe. Always remember, no job is so important that we cannot take the time to do it safely.

Roy A. Pelletier is with N-Viro International Corporation Professional Services Group, Coral Springs. John R. Armstrong is an operator and safety officer at Orlando's Water Concerv II Facility.

Understanding Gas Detector Sensors

Doug Prentiss

During recent months I have received dozens of calls concerning the types of sensors used in gas detectors. The controversy is broad range sensors versus substance-specific sensors, and the arguments for both sides are compelling.

In attempting to make things perfectly clear, OSHA seems to have stirred up things. The source of the confusion it seems is the technical amendment issued by OSHA for the final rule of Permit Required Confined Spaces (56 FR 28814,May 19, 1994). Many of us were simply overwhelmed by the basic regulation, let alone splitting hairs about which sensor technology was best.

It is, however, an important issue which must be addressed. The facts of the matter are that OSHA did not express a preference for either type of detector. Instrument selection is left up to the employer. OSHA did, however, reference specific application where each type of sensor works best and those references are what you need to understand.

In the simplest terms, the substance-specific device is used where all potential hazards have been identified. Broad range detectors are preferred where all the hazards have not been identified, simply because they indicate the presence of a much larger number of potential toxic hazards.

A broad range sensor is much like a flammable sensor. It identifies many flammable materials. The broad range sensor performs in a similar way for toxics. It indicates the presence of a large group of toxic materials.

However, no detector built by anyone detects everything!

Still confused? Push your eyelids back open and read how one organization determined it needed a broad range detector in addition to the substance-specific devices in use for years.

A collection system crew checked a manhole prior to entry and got readings of 21 percent oxygen, 0 percent flammables, and 0-ppm of H_2S. The crew foreman noted discoloration, strange odors, and unusual material in the manhole and did not allow an entry. As they investigated the source of unusual material they found a commercial business dumping illegally into the sewer and creating a toxic atmosphere the H_2S sensor would not detect.

A lift station crew had a similar experience in a wet well entry in a different commercial area. In this case the business was cooperating fully with industrial pre-treatment rules but was still releasing a toxic gas that was not the H_2S the substance specific toxic sensor recognized.

While the two incidents were handled differently at an administrative level, the resolution for the workers was the same. It was determined that a broad range detector property configured would give indications of the presence of all the toxics used at either one of these two industrial sites. The detector was purchased and is now in use for all entries into man holes and lift stations in commercial areas.

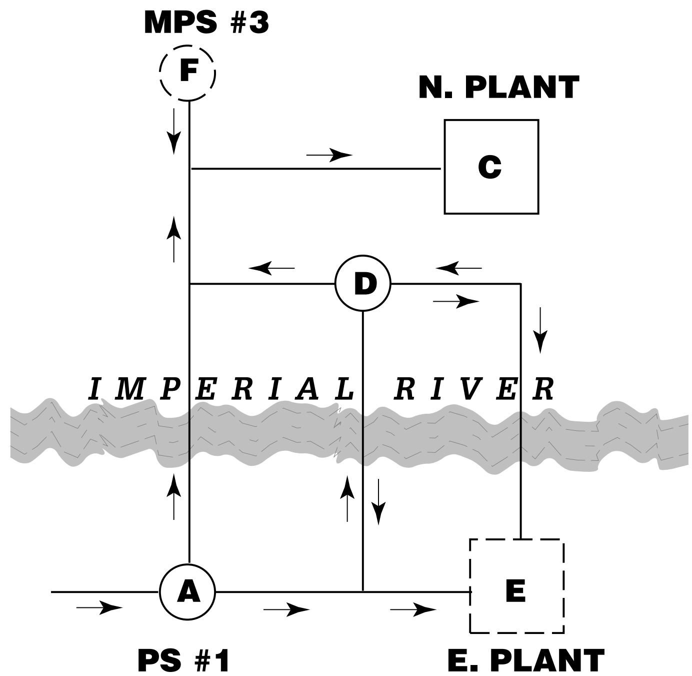
Will that detector work for everything, everywhere? No, but it will detect scores of chlorinated solvents, cleaning agents, hydrocarbon fuels, and organic compounds which can frequently be found in sewers. While the controversy on sensors will continue, there is no question that it is the employer's responsibility to select the detector the workers use based on an actual evaluation of the hazards they face. It is that evaluation that will determine whether substance specific or broad range is best.

Douglas B. Prentiss is utility training officer for Gainesville Regional Utilities

Unconventional Wastewater Collection System

Robert Wright and James McGee

New and unconventional methods were used throughout the development phase of Bonita Springs Utilities' new wastewater collection system. Beginning with the planning phase, the not-for-profit utility first established who desired earliest service and how much they were willing to pay with respect to a monthly charge. The utility next retained a financial consultant to determine the bond issue which could be issued to finance the first phase of the new system based on the number of service requests and a maximum monthly sewer charge limitation. An engineering firm was retained next to design a system which would serve the designated customers within the construction budget established and stipulated by the proposed bond issue. In order to accomplish this objective, it was necessary to revise the utility's recently completed sewer master plan and recommended two 6-MGD wastewater treatment plants rather than one 12-MGD wastewater treatment plant in order to reduce the cost of the larger diameter forcemains and pump stations associated with the single plant concept.



Schematic diagram of BSU wastewater pumping and transmission system.

Dual Direction Pump Stations

The Phase I wastewater collection system incorporated many of the design features of a conventional water distribution system. Primary forcemains were designed to be interconnected or "looped" so as to be able to pump in either of two different directions. The ability to pump wastewater in two different directions serves two purposes. The primary one is to divert flow from the existing North WWTP to the future East WWTP when the capacity of the former is reached but growth within its service area is expected to increase. The second purpose is to have the flexibility to reroute flows and minimize pollution impacts if a major forcemain break occurs at the river crossing. The pump stations were located and the forcemains sized so that the maximum hydraulic gradient elevation between all pump stations was 100 feet. This particular feature helped with the ease and consistency of design pertaining to the numerous secondary pump stations and forcemains that were connected to and served by the primary pump stations and forcemains.

The ground elevations throughout the entire wastewater pumping and transmission system are relatively uniform and flat. Because of this topographical characteristic, a "goose neck" piping configuration was made in the forcemain at each of the primary pump stations. The top elevation of the pipe fitting was set just slightly higher than the highest forcemain elevation between the pump station and the downstream manhole. The benefits of this forcemain design configuration included the reduction of odors at the pump station, corrosion of piping and valves, and the number of air/vacuum release valves.

A New Type of Aerial River Crossing Pipe

A 16-inch diameter high density, SDR 11, polyethelene pipe was used for the first time to be attached to a FDOT bridge. The use of this type of pipe overcame structural weight limitations, problems associated with a highly corrosive environment, and permitting obstacles related to crossing a Florida outstanding water. The Imperial River estuary splits the wastewater collection system area almost in half. It had to be crossed in order to pump wastewater from the southern regions of the utility service area to the regional treatment plant located on the other side of the river. Both sides of the river bank were lined with mangroves which presented a major permitting obstacle for a subaqueous river crossing type design. The polyethelene pipe that was attached to the FDOT bridge weighed only 29 pounds per foot compared to an equivalent ductile iron pipe which weighs 104 pounds per foot. The polyethelene pipe is corrosion resistant, is manufactured with an ultraviolet inhibitor, and butt welded which eliminates the potential for joint leakage. Its main disadvantage, when compared to metal pipe, is its large coefficient of thermal expansion. This feature posed a major design challenge which was solved by using a unique and custom designed pipe hanger. The pipe was assembled on the ground and pushed 900 feet across the bridge without the need for any construction or installation equipment above or below the bridge. This operation resulted in no disruption of either boat or vehicle traffic.

A Different Construction Approach

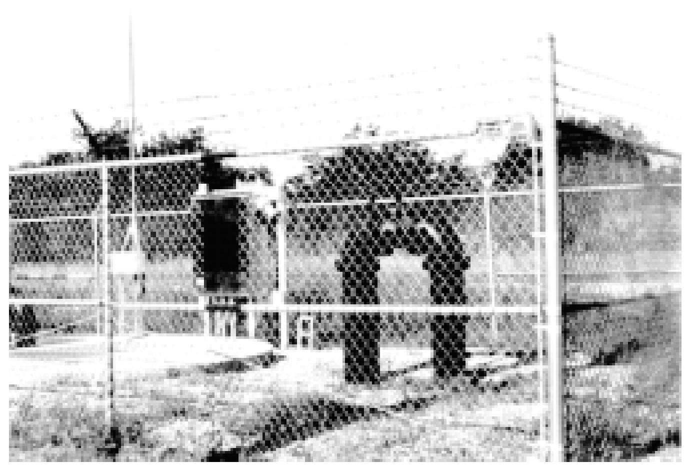
The construction of the BSU wastewater pumping and transmission system involved the need for obtaining the approval of nine separate government regulation agencies claiming jurisdiction over various aspects of the project. In some cases, one agency wouldn't grant the approval until another agency granted theirs. Legal and financial obligations mandated that BSU have their project completed by a specific date. The permitting process began as early as possible during the design phase. The project was bid even before all permits were in hand. The utility trusted their design engineers with their belief that they could strongly defend their design of the project and could overcome any opposition that may surface by the regulators. After the bid was awarded, the selected contractor agreed to construct only those segments of the project that had permit approval. As one example, the river crossing pipe, which hangs on the FDOT bridge, was one of the last segments of the project to be installed because permit approval wasn't received until after half-way through the construction period. Despite the risks involved, the excellent working team consisting of the utility, engineer, and contractor allowed the project to be completed on time and under budget.

The project area was located in areas that were built out, and most areas included streets that were already paved. During construction, time and money were saved by using a soil cement mixture ("flowable fill") as backfill material when open roadway cuts were utilized rather than boring and jacking an encasement pipe under existing roadways.

The "flowable fill" specified by Lee County Department of Transportation sets so as to support traffic within four hours. Flowable fill is designed to be manually excavated (in the event of future line maintenance requirements) and is easily excavated in order to overlay with rigid pavement. Further, after two years in service there is very little evidence of settling or erosion in the filled areas.

Robert R. Wright, P.E., D.E.E., is currently vice president, Missimer International, Inc. He was formerly with Boyle Engineering Corporation as project manager of the project described in this article. James L. McGee, P.E., Ph.D., is a staff engineer with Bonita Springs Utilities, Inc.

16-inch polyethelene forcemain suspended from FDOT bridge.



Submersible pump station with elevated forcemain design configuration