



Largo Wastewater Treatment Plant

Florida, USA



General Contractor
KIEWIT WATER FACILITIES GROUP

Owner
CITY OF LARGO, FLORIDA

Engineer
CPH, INC.

Applicator
EXCELETECH COATINGS & APPLICATIONS

Products
MEGAMIX II WITH BIO-SAN, CONCENTRATE

Project Type
WASTEWATER TREATMENT IMPROVEMENT

Fig 1 -- Xypex Megamix II with Bio-San was used to repair and protect critical Biological Nutrient Removal (BNR) systems at the Largo Wastewater Treatment Plant (WWTP) located in Largo, Florida, USA.

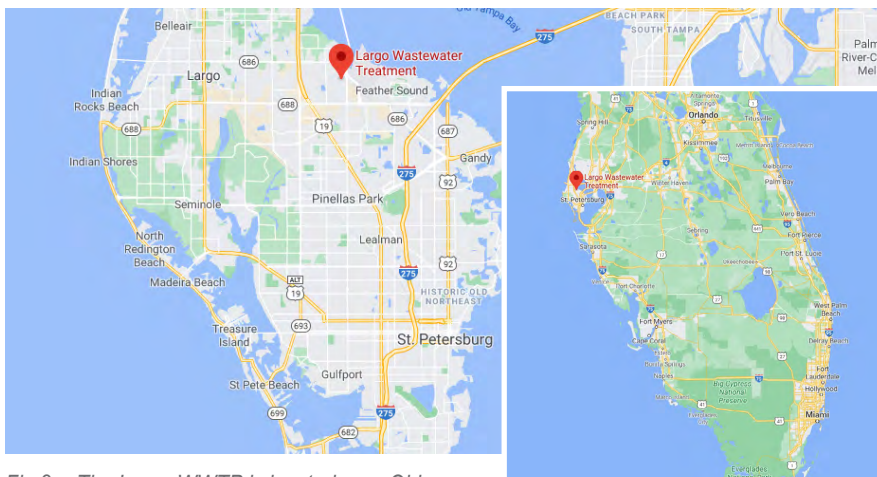


Fig 2 -- The Largo WWTP is located near Old Tampa Bay, just west of Tampa, Florida. The WWTP has been under Florida Department of Environmental Protection (FDEP) order since 2012 to reduce nitrogen and phosphorous discharges into the bay.

Largo, Florida, is a seaside city nestled on the Pinellas Peninsula along the Gulf of Mexico and across the bay from Tampa (fig 2). The city has a rich history rooted in citrus farming and cattle ranching. With 84,000 residents, population growth has transformed Largo into a bedroom community and a tourist destination thanks to its historic structures, white sand beaches, golf courses and ample shopping (fig 3).

Pinellas County—home to Largo, Clearwater and St. Petersburg—is the most densely populated county in the state. For more than a decade, Largo has been working to improve its only wastewater treatment plant (WWTP) in order to reduce sanitary sewer overflows, accommodate population growth, replace deteriorated structures, and provide cleaner effluent discharge.

Challenges

The 50-year-old plant, located on the eastern edge of the city, discharges treated effluent

into Feather Sound on Old Tampa Bay. Since 2012, the plant has been under orders from the Florida Department of Environmental Protection (FDEP) to reduce the levels of nitrogen and phosphorous in its discharge.

Too much of these naturally occurring nutrients can cause algal blooms that block sunlight thereby killing plants and reducing the water's oxygen content, ultimately killing fish and other aquatic organisms. Known as eutrophication, this process can damage drinking water resources, decimate recreation and aesthetic value, and cause taste and odor problems.



Fig 3 -- Largo, Florida, is a major tourist destination featuring white sand beaches, golf courses, shopping, and natural attractions such as the 100-acre Florida Botanical Gardens.

One of the other major goals of the city's \$60 million investment in its 18 million gallon per day (mgd) WWTP was to rehabilitate and harden many of its critical structures to improve and extend the life of the plant for many more decades (fig 4). As with most WWTPs, most of the important structures were built with cast-in-place concrete.



Fig 4 -- New influent pumping station installed at the Largo WWTP, along with a 5 million gallon equalization tank, is capable of holding the storm surge flows experienced during hurricanes and other extreme weather events.

Of particular focus for the Largo WWTP renovation project were the three main treatment “trains” that comprise the biological nutrient removal (BNR) system. Based on the modified Bardenpho process, each train consists of five 25 ft x 100 ft concrete channels that serve as bioreactors to remove wastewater impurities and reduce nitrogen and phosphorous.

Search for Solution

Each five-chamber BNR train is coupled with two large circular secondary clarifiers (fig 5) that are positioned down the center of the plant, directly adjacent to the BNR trains. The concrete BNR trains were in need of the highest level of restoration, having been exposed to physical and chemical attack throughout 50 years of service.

The concrete structures found in most wastewater treatment plants are subject to some of the harshest environments imaginable, including abrasion erosion, chemical attack, chloride ion-induced corrosion, freeze-thaw conditions, and microbiologically induced corrosion (MIC).

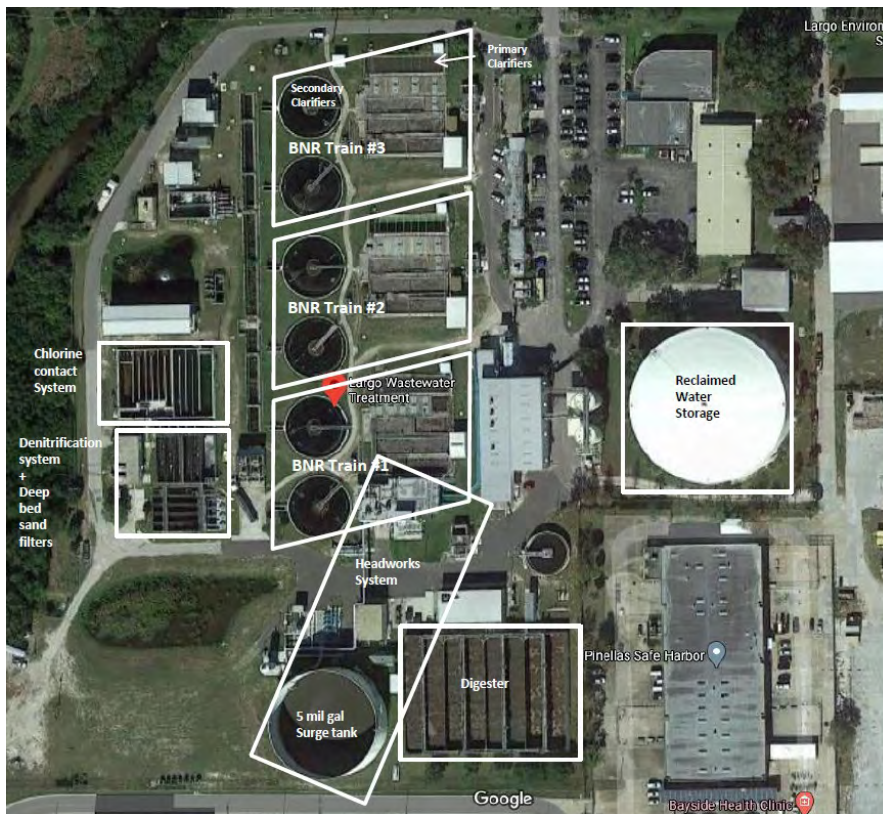


Fig 5 -- The city of Largo, Florida, has invested more than \$60 million in recent years to upgrade its primary WWTP. Xypex Megamix II with Bio-San and Xypex Concentrate were used to restore the three biological nutrient removal (BNR) “trains” at the plant.

Damage to the BNR trains and associated clarifiers (fig 6) ranged from concrete tanks with large cracks and exposed aggregate to structures with less severe deterioration and only minor cracking. Many solutions were suggested, but the decision came down to two candidates:

- Xypex **Megamix II with Bio-San**, a one-step repair mortar that provides both crystalline waterproofing technology and a mineral-based antimicrobial that kills acid-generating bacteria; and
- A multi-product system that would have required multiple steps to restore the damaged concrete and provide a waterproof coating.



Fig 6 -- Xypex Megamix II with Bio-San repair mortar and Xypex Concentrate crystalline concrete waterproofing and repair treatment were used to restore many years of concrete deterioration at the Largo Wastewater Treatment Plant. Megamix saved time by allowing the repair and long-term protection of damaged concrete in one step.

Protection and Repair in One Step

“For the Largo WWTP, we recommended the use of Xypex Megamix II with Bio-San, which was specifically developed for this type of application,” notes David Mahler, P.E., senior vice president of CPH Engineers, a multi-disciplinary architecture and engineering firm based in Orlando, Florida. “It makes sense to use one repair product versus having to apply three or

four to achieve the same goal.”



Fig 7 -- **LEFT:** Here, one of the 25 ft x 100 ft multi-compartment BNR channels is undergoing rehabilitation using Xypex Megamix II with Bio-San repair mortar to rebuild severely deteriorated concrete. **RIGHT:** shows BNR channel after restoration with Xypex Megamix II with Bio-San. Black strip is a layer of coal tar epoxy applied as added protection in H₂S gas hot zone.

Xypex Megamix II with Bio-San is a resurfacing mortar that combines [Xypex crystalline waterproofing technology](#) with a mineral-based antimicrobial that kills the Thiobacillus group of bacteria species responsible for microbial induced corrosion (MIC). Xypex also offers Bio-San in an admixture—Xypex [Bio-San C500](#)—that provides the same protection for precast and cast-in-place concrete structures.

“Bio-San antimicrobial components are fixed in a mineral matrix that becomes an integral part of the concrete, whether applied as a repair mortar or as an admixture,” explains Christy Krone, a Florida representative for Xypex Chemical Corp. “The antimicrobial ingredients work indefinitely to destroy harmful bacteria at a cellular level. It cannot be washed off or wear out.”

Exceletech Coatings and Applications of Clermont, Florida, was selected to repair the Largo WWTP BNR infrastructure. The firm prepared the concrete tanks by pressure washing the damaged walls to remove loose concrete and other debris.

Large cracks were power-chiseled to create a space to accept a dry-pack of Megamix II with Bio-San, which was then covered with a top coat of Megamix II with Bio-San. The Xypex repair mortar can be applied via sprayer or trowel

at a thickness of 3/8 to 2 inches. It must be applied to a surface in saturated surface dry (SSD) condition (fig 7).

For BNR tanks and secondary clarifiers with only minor cracking or other superficial damage, Exceletech applied Xypex [Concentrate](#), a crystalline waterproofing and protective coating. Like Megamix II with Bio-San, Xypex Concentrate diffuses into the concrete substrate and reacts with water and the by-products of cement hydration causing a catalytic reaction.

This reaction generates a non-soluble crystalline formation throughout the pores and capillary tracts of the concrete. Xypex Concentrate has been shown in the laboratory to penetrate to a depth of up to 12 inches and can seal cracks up to 0.4 mm. Both Concentrate and Megamix II permanently seal concrete, preventing the penetration of water and other liquids from any direction, even under high hydrostatic pressure.

Both Xypex Megamix II with Bio-San and Concentrate provide chemical resistance against the attack of acids, chlorides, sulfates, carbonation and other negative effects. Xypex products provide permanent protection that will not degrade like synthetic coatings and membranes.

Saves Time and Money

“We have recommended the use of Xypex crystalline repair and admixture products for many years,” CPH’s Mahler says. “When it comes to wastewater infrastructure in particular, we require that Xypex be used in precast and cast-in-place structures. It’s easy to use and very effective in protecting concrete from multiple exposures.”

Mahler noted that Florida’s Orange County, located in central Florida and home to the city of Orlando, requires Xypex products be used in all of its wastewater structures, including those precast and cast-in-place.

In one case, he explains how Xypex crystalline waterproofing admixture was added to the concrete used to replace a concrete sewage lift station that had become hopelessly damaged by microbial induced corrosion in the late 1990s after just seven or eight years of use.

“We recently had a chance to look in that structure, more than 20 years later, and it still looks almost like new,” Mahler notes. “It was a structure that had a force main coming into it and was very turbulent. That’s when you can get extreme levels of hydrogen sulfide gas released, which results in very rapid concrete corrosion. Common coatings like coal tar epoxies just don’t hold up under these extreme conditions.”

He further explains that it is sometimes appropriate to use multiple products to repair and coat a structure; however, this can take extra time and still does not provide the same benefit as an integral repair product such as Xypex Megamix II with Bio-San or Xypex Concentrate.

“We have used Xypex enough to know it works and provides reliable results we can count on. Why would I recommend three or four products when I can use one. It saves time and money and keeps the work on schedule. It costs a little more up front, yet can extend the life of a structure far beyond that provided by conventional coatings.”