



Lower Meramec Wastewater Treatment Plant

St. Louis, Missouri, USA



General Contractor
KCI CONSTRUCTION

Owners
THE METROPOLITAN ST. LOUIS SEWER DISTRICT (MSD)

Engineering
CRAWFORD MURPHY & TILLY

Applicator
COATINGS UNLIMITED

Project Type
CORROSION AND HUMIDITY CONTROL

Products
CONCENTRATE, MODIFIED, MEGAMIX I, XYCRYLIC ADMIX, GAMMA CURE

Fig 1 -- Xypex Concentrate, Modified, Megamix I, Xycrylic Admix, and Gamma Cure were used to repair and waterproof a 20-story deep lift station at the Lower Meramec Wastewater Treatment Plant near St. Louis, Missouri, USA.

The Lower Meramec Wastewater Treatment Plant (LMWTP) was completed in 2007 and includes the treatment plant, lift station, interceptor tunnel, gravity sewers and electric substation (fig 1). The \$230 million project enabled the Metropolitan St. Louis Sewer District (MSD) to decommission two ground level sewage treatment lagoons and consolidate and improve the discharge into the Meramec River, a major tributary to the Mississippi.

A four-mile long 12.5-foot diameter (3.66 m) tunnel was built approximately 200 feet underground and conveys wastewater to the LMWTP by gravity from the Baumgartner and Meramec lagoons and other sources. Three 2,000 hp and two 750 hp pumps are housed in a 223-foot deep by 90-foot diameter shaft and used to lift wastewater from the Baumgartner tunnel to the treatment facility at ground level (fig 2). An integrated screening structure was

built upstream from the lift station to filter debris from the sewage flow and prevent damage to the pumps.

Remediation Required

By 2017, the high humidity and water intrusion from cracks in the concrete walls of the lift station had begun to cause wide spread corrosion to metal and concrete surfaces. In the summer of 2018, MSD initiated a Corrosion and Humidity Control Improvement project to remediate the damage within the lift station.

Engineering services for the project were provided by Crawford Murphy & Tilly (CMT) of St. Louis. The general contractor for the project was KCI Construction. "The project has taken about two years to complete," notes CMT senior engineer Rick Huber. "We have replaced certain steel piping with stainless steel. We have replaced metal air ducts and plenums with fiberglass and repaired and protected the concrete structure with Xypex crystalline waterproofing products."



Fig 2 -- Lift station for the Lower Meramec Wastewater Treatment Plant pumps sewage from the four-mile long Baumgartner interceptor tunnel — located 200 feet underground—up to the water treatment plant at ground level.





Fig 3 -- During construction of the 223 ft deep by 90 ft in diameter lift station shaft. Slurry wall construction was used to reach bedrock at about 100 feet.



Fig 4 -- Looking up from 223 feet below ground to the top of the lift station. Ground water intrusion and constant high humidity led to serious corrosion and deterioration within just a few years.

According to Huber, “Based on our research, we determined that Xypex products stood the best chance of countering the constant negative side water pressure on this deep structure. We knew from experience that epoxies and other coatings would not be able to stop the moisture and would probably pop off the wall.”

Towering Structure Poses Challenge

The first challenge faced by the Xypex applicators—Coatings Unlimited of St. Louis—was how to reach the curved walls of the 90-foot diameter lift station shaft (figs 3&4). CMT believed the project would require workers to be lowered in crane buckets; however, a subcontractor was ultimately hired to build an eight-story tall scaffold around the interior of the shaft (fig 5).

“We believed the limit for scaffolding down there was going to be about 40 to 50 feet,” Huber says. “We were pleasantly surprised they were able to do the whole job from scaffolding. That saved a lot of time.”

Once all 7,639 pieces of scaffolding were installed, the Coatings Unlimited crew pressure washed the concrete surfaces up to 117 feet with 7,000 psi water. The upper 106 feet of lift station lining exhibited only minor water intrusion that would be addressed at a later date as needed. About 3,100 feet of construction joints and other cracks were chipped out using jackhammers (fig 6) and filled with Xypex Concentrate in ‘Dry-Pac’ form.

Like all Xypex coating and repair products, Xypex Concentrate contains a mixture of Portland cement, sand and active proprietary chemicals that diffuse into the concrete substrate and react with moisture and the constituents of hardened concrete to cause a catalytic reaction. This reaction generates a non-soluble crystalline formation throughout the pores and capillaries that exist in all concrete. In this way, water and other liquids are prevented from penetrating the concrete from any direction.



Fig 5 -- More than 7,600 pieces of scaffolding were required to reach the circular walls lining of the lift station in order to apply several Xypex products to repair and protect the concrete. Other corrective measures taken included replacing badly corroded steel pipe with stainless steel pipe and steel ducts and plenums with fiberglass.

Some of the most actively leaking cracks were filled with Xypex Patch’n Plug, a specially designed, fast-setting, hydraulic cement compound that incorporates Xypex crystalline technology and can stop flowing water in seconds (fig 7).

Crystalline Product System

Once all joints and cracks had been repaired, the entire interior concrete surface of the lift station—up to 117 feet—was treated with a three-product system consisting of a base layer of Xypex Concentrate, a reinforcing layer of Xypex Modified and a final treatment of Xypex Gamma Cure, a curing accelerant and evaporation retarder (fig 8). Approximately 34,000 ft² of concrete were treated with Xypex products, amounting to about 21,000 pounds of product.

Xypex Modified chemically reinforces Xypex Concentrate to produce a harder finish that resists even extreme hydrostatic pressure, seals hairline cracks up to 0.4 mm, resists aggressive chemicals, and cannot be punctured or torn. Gamma Cure is often used to help provide optimal curing conditions for Xypex coating products where water curing is difficult, particularly on vertical surfaces.



Fig 6 -- More than 3,100 feet of joints and cracks were jackhammered, cleaned and plugged before the walls were sealed with a Xypex Concentrate, Modified and Gamma Cure.



Fig 7 -- All cracks and joints were jackhammered, cleaned and plugged. Here, an applicator checks the readiness of a long crack.



Fig 8 -- Xypex Concentrate is premixed for brush application to the lift station walls. Concentrate in Dry-Pak form was used to fill construction joints and cracks. Actively leaking cracks were filled with Xypex Patch'n Plug.



Fig 9 -- The lift station floor was coated with Xypex Concentrate and Megamix I fortified with Xycrylic Admix.

The floor of the lift station was also repaired and coated with Xypex products, including Concentrate and Megamix I fortified with Xycrylic Admix (fig 9). Megamix I is a blend of Portland cement, treated silica sand, fibers and proprietary chemicals that is applied as a parge coating by brush, trowel or spray. Xycrylic Admix is a water-based, high solids, polymer dispersion that improves curing qualities, enhances bond, reduces shrinkage cracking, and imparts excellent water and weather resistance.

Xypex regional representative Rich Bowling notes, "This project showed the versatility and effectiveness of the Xypex line of repair and protection products under very challenging conditions. The hydrostatic pressure at 200 feet underground can be very strong. This is exactly what Xypex is designed for."

Throughout the course of the project, Bowling took part in regular meetings with officials and managers to report on application progress and address any concerns. "When it makes sense or is requested by a customer, we provide advice and guidance on site or wherever it's required. Our goal is always to ensure success."

Meeting Client Needs

Crawford Murphy & Tilly's Rick Huber noted that this was his firm's most extensive experience with Xypex products to date; however, thanks to the success of the lift station project, the firm is now recommending Xypex whenever it fits project requirements.

"We have already found new projects where Xypex products can help. For instance, we specified Xypex Admix for a large concrete municipal water tank that is at risk for flood water exposure. That's under construction right now. We've also specified it on other pump stations and diversion structures."