



Flexibility, durability, and reliability during an earthquake using PE4710

EBMUD inner harbor crossing

The project

East Bay Municipal Utility District (EBMUD) is a not-for-profit water and wastewater public utility in Oakland, CA. EBMUD is investing more than \$2.8 billion over a 5-year period to rehabilitate water treatment plants, pumping plants, reservoirs, pipelines, wastewater facilities and sewer interceptors. EBMUD is proactively replacing its water pipelines to improve water service, reduce water loss and the number of pipeline breaks in the service area. Half of these pipelines were installed more than 50 years ago. The pipelines are constructed of cast iron, asbestos cement, and steel. EBMUD is recognized as a responsible financial steward and is the only California water utility to receive Moody's Investors Service's highest water bond rating.



Figure 1: Vicinity Map of City of Oakland and Alameda Island

The pipe material selection process highlights HDPE's performance characteristics and shows that it was the best material for the job. Several different piping materials were considered, but with corrosive soils and high ground water levels, metallic pipes were immediately excluded. It came down to plastic pipe where HDPE won out over PVC largely due to the rough terrain and HDPE's ability to be fused together in long strings and drug into place. The use of HDPE also eliminated the need for costly fittings and cut down on installation time due to narrower trench widths than those required for other piping materials.

A substantial amount of pipe was manufactured, shipped, and installed in an extremely short period of time. Plus, various obstacles were encountered in the design and installation of this project which forced several alignment changes throughout the process. There were environmental assessments that were required to be done. Consideration and planning were necessary to account for the endangered plant species and migratory bird population. A large job was obtaining easements from over 50 property owners, and easements for state land, federal land, the Bureau of Indian Affairs were also required, as well as coordination with the US Fish and Wildlife Bureau and the Bureau of Reclamation.

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The specifications

EBMUD provides water service to 40,000 customers on Alameda Island (island) including the U.S. Naval Air Station at Alameda with several underwater pipeline crossings from Oakland to the island (see Figure 1). Only four of the original seven underwater water pipeline crossings are operable. The last crossing failure was in 2009. Hydraulic model investigations determined that the failure of one of the remaining crossings would lead to a reduction in available fire flow rates on the island.

EBMUD created the Alameda-North Bay Farm Island Master Plan in 2014 to address the issue aging Oakland Inner Harbor Crossings. The plan calls for EBMUD to reduce the four water transmission lines that serve Alameda to three transmission lines. In 2016, EBMUD completed an environmental impact report for the full project that prioritized the crossing between Alice Street in Oakland to Webster Street in Alameda. In 2022, EBMUD awarded a \$25 million contract to Cratus Inc., a San Francisco-based construction company, to install a new 32-inch diameter PE4710 pipeline crossing beneath the Oakland Harbor via Horizontal Directional Drilling (HDD) to replace a 1940s-era cast iron pipeline crossing in an area that is susceptible to liquefaction during an earthquake. PE4710 pipe material was chosen because of its flexibility, durability, and reliability during an earthquake.

In Spring of 2023, the approximately 3,000-foot-long pipeline crossing of 32-inch diameter DR9 earthquake-resistant PE4710 pipe was installed. The PE4710 pipe was manufactured by WL Plastics and supplied by P&F Distributors. Before being pulled through the bore hole north of Estuary Park in Oakland on April 7 and 8, construction crews fused together sixty-three 50-foot-long sections of WL Plastics PE4710 pipe along Mitchell Avenue in Alameda and placed it on rollers to reduce friction during the pull (see Figure 2).

“The pull of the new pipe under the estuary was a remarkable feat of engineering and construction,” said EBMUD Board Director Doug Linney. “This work will benefit the 76,000 residents of Alameda for decades to come with a more resilient and reliable water distribution pipeline. We are extremely grateful and proud of this effort, the crews who performed it, and our customers for their patience and support.”

Figure 2: Fused 32-inch diameter PE4710 pipe string on rollers being pulled to the borehole



Contact

Contact WL Plastics for more information

SALES: wlsales@wlplastics.com

TECHNICAL: wltechnical@wlplastics.com

www.wlplastics.com