Magellan Terminal Holdings operates a major petroleum storage terminal in New Haven, Connecticut, which serves Connecticut and other New England states. Located in New Haven Harbor, the terminal has 17 existing storage tanks with a combined capacity of 1.9 million barrels of a variety of refined liquid petroleum product, which is loaded and unloaded from tankers and barges at an existing ship berth. Product is stored onsite and can be transported offsite via a pipeline, trucks, or ships. Magellan forecasted an expanding market for petroleum product storage in New England and was interested in substantially increasing the petroleum storage capacity and transport capabilities at the terminal.

THE CHALLENGE
Kleinfelder was tasked with developing a site plan that maximized the storage capacity of the site, while at the same time providing for new ship docking facilities to maximize the size and types of ships that could dock at the terminal. There were many site constraints to be considered, including: existing tanks and piping throughout the facility; poor soil conditions in the tank area including an underlying 22-foot layer of organic silt, abandoned docking facilities, an existing pier head, and bulkhead line beyond which structures could not be constructed; and the existing federal channel limit beyond which ships could not protrude while docked.

KLEINFELDER’S SOLUTION
Kleinfelder developed a preliminary site plan that included 10 new storage tanks, a new ship dock to accommodate ships up to 700 feet long, 36 feet deep and 40,000 deadweight tonnage, and a separate barge dock for barges up to 250 feet long and 64 feet wide. Docking facilities included: breasting dolphins; mooring dolphins with capstan winches; separate ship and barge dock platforms to accommodate loading/offloading hose racks, pumping equipment, and related safety equipment; pedestrian bridges to connect docks and mooring dolphins; pipe bridges to transport the petroleum product from the docks to the petroleum storage tanks located on land; and steel sheet pile bulkheads to retain the shoreline. Dolphins and docks were proposed to be reinforced concrete supported on vertical and battered concrete-filled steel pipe piles, while access bridges were galvanized steel trusses supported on steel pipe piles. The design included dredging approximately 40,000 cubic yards of material at the new ship dock. Foundations for the new storage tanks utilized ground improvement methods under each tank consisting of 20-inch diameter displacement piers spaced from 4'-6" to 6'-0" on center.

PROJECT RESULTS
Kleinfelder’s proposed site plan will maximize storage capacity at the terminal and significantly increase shipping throughput by providing two docks that allow for one large ship and a smaller barge to be offloaded simultaneously. In addition, the proposed ground improvement system under the proposed new storage tanks was significantly more cost-effective than a more conventional pile-supported foundation.