

**Date:** 2002  
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**Publication:** Water Control Quarterly  
**Title:** Working at Ground Zero

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As the recovery and rebuilding of New York City continues, new problems and challenges continue to present themselves at Ground Zero. One such problem is the extensive damage sustained by the "Bathtub", a massive containment area that held the footprint of the Twin Towers. The concrete floor slabs that had provided structural support against the force of the surrounding soils and groundwater adjacent to the Hudson River were completely destroyed by the collapse of Towers 1 and 2. Without this support, the water pressure being exerted on the surrounding Bathtub is causing the walls to shift, creating leaks of up to 100 to 200 gallons per minute, and threatening ground loss and structural failure of the Bathtub.

Each section of the Bathtub's slurry walls consists of a three-foot thick section that is 22-feet wide and roughly 100-feet below street level. Originally, the walls were held in place externally by temporary tie-backs, and internally the structure of the towers provided the bracing. After the collapse, the only thing supporting the interior walls was the debris itself. As debris removal began, external pressure on the outside of the slurry walls caused many of the panels to shift, moving many of them as much as 10-inches.

To deal with this problem, New Jersey-based Moretrench American Corporation, specialists in groundwater control, was retained to operate a dewatering system. Moretrench set up wells and pump stations to remove the groundwater and alleviate some of the pressures exerted on the walls. Forty-five wells were placed along Liberty and West streets, while three others were installed along Greenwich. According to Bill Klingler, on-site project supervisor for Moretrench, "Pumps are removing approximately 325,000 gallons a day from the surrounding wells and construction site."

While the dewatering system helped to alleviate some of the problems, massive amounts of groundwater was still finding its way through cracks and holes in the slurry walls. Additionally, Mueser-Rutledge, the primary consulting engineer firm leading efforts at Ground Zero, projected that they would place approximately 1000 new tie-backs along the Bathtub walls to help stabilize the structure (Photo 1). Installation of the tie-backs requires boring through the walls and placing new cable anchoring systems into the surrounding bedrock. Unfortunately, this action also creates new areas for water to infiltrate back into the construction site (Photo 2).

Moretrench American Corporation was approached for help in solving the problems of the cracks and tie-back installations. Their solution was the use of a single-component, urethane chemical grout called AV-310 Hydro Sealant from Avanti International. The process of sealing the joints and cracks in the slurry walls involved drilling into the structure and bisecting the crack at a 45° angle. The chemical grout was then injected into the wet cracks using a high-pressure airless pump. Since AV-310 is a hydrophilic chemical grout, it is attracted to water and continues to absorb water during the

reaction process. When it was necessary, dry cracks in the slurry walls were flushed with water by a second pump in order to help the grout activate and begin foaming. The chemical grout reacted quickly and expanded in the cracks to provide a flexible seal and stop the flow of water. According to Moretrench's grouting crews, flows as much as 80 to 90 gallons per minute were stopped by using this hydrophilic chemical grout (Photo 3).

The next issue was the water infiltrating through the tie-backs. For this problem, Moretrench had to develop a specialized application method to slow the water and keep the chemical grout in place. They cut the excess cable tendons at the tie-back interfaces and fitted each steel housing with a steel cap, injection port and relief valve. High-pressure pumps were then used to inject the same chemical grout directly into the high-pressure flow, forcing it down the cable housing. This technique contained the leaks long enough for the foaming reaction of the chemical grout to occur, which stopped the leaks.

As of April 2002, Moretrench was continuing the dewatering operation and the grouting of hundreds of tie-backs around the fallen towers. Moretrench is just one of the many companies that has been working around the clock since the tragedy of September 11. Avanti International would like to express its support and admiration for the men and women at Ground Zero, Washington D.C., and Pennsylvania, and all of those who have taken part in the recovery efforts and the rebuilding and healing of America.