

CASE STUDIES ON GROUTING AND LINERS

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Warren Environmental will present on 5 projects where the science of grouting coupled with structural epoxy was used to rebuild, preserve and protect aging infrastructure.

The first project was completed in 1994 at UMass Dartmouth where the process was used to halt the intrusion of over 60,000,000 gallons of ground water per year from entering the collection system and has been reinspected over the past 6 years showing no sign of disrepair saving millions in handling cost of excess water and eliminating the need of two (2) new pump stations.

The second is a project that was completed in the subway system of Washington, DC. where 4 deep access tunnels shafts 300 ft deep by 40ft wide were grouted and lined with 250 mils of structural epoxy saving the subway system over \$2,000,000 annually on associated cost of handling the intrusion of ground water and countless millions loss due to corrosion in the electrical system. On this project after all infiltration of ground water was stopped and the tunnel was lined with epoxy we install a series of vented drains to insure and monitor the build up of ground water on the vertical wall of the structure. We also grouted and lined the Tenley Town Station downtown Washington DC and stopped over 2000 active leaks that were creating a serious safety hazard on the loading platforms and had caused numerous accidents and lawsuits against the Authority. The Tenley Town Station has been leak free for the last 5 years.

The third project is the Liawenee Flume in Tasmania. The US developed grouting and epoxy lining technique is being used to restore the 14 mile Liawenee Flume. The US developed process was by far the best of the products tested by the Tasmania Wind and Water Group and based on the 3 year test results was chosen to complete the project. The test section lined by the Yanks stopped 100% of the ex-filtration in the 400 meter test section and increased the flow by 55%. This project is ongoing at this time with great results.

The fourth project was performed in 1996 in the NY Aqueduct at a depth of 300ft in the Deep Shaft out side Tarrytown, NY. In this section of tunnel, infiltration was destroying the tunnel. The tunnel was restored with total success in December 1996. The 1100 liner feet of 16ft arched tunnel was made leaked tight with injection grout and then epoxy lined with 100mils of NSF structural epoxy. The section was inspected in 1998 – 2001 and 2009 and was in great shape with no infiltration or degradation of the epoxy liner. This section was in the worst condition of the entire 33 miles with severe infiltration of ground water and structural damage caused by continual infiltration of ground water. This section also was being affected by the infiltration of home heating

fuels and other hazardous materials. The grouting program successfully ended the problem.

The fifth project was a cobblestone turn of the century tunnel in Iowa Falls, Iowa. The tunnel was infiltrating hazardous oils and petroleum products of a variety of types associated with a power plant that once set at that site. Numerous means of re- mediation were tried including large scale excavation of the area with no avail. A grout was developed to inject through the walls of the tunnel that will bind up the oils and stop the infiltration into the tunnels. The material was developed specially for this project and testing has confirmed that the material did indeed bind up the hazardous materials and lab tests showed that it will halt the migration of hazardous materials into the tunnel.

The presentation will focus on the many lessons learned over my 30 years in the infrastructure industry. It will focus on safety and confined space projects and how to do projects correct the first time with time proven application methods and products. I will convey the message that safe work practice, proper product selection and training can and will save the owner far more than the experience of the project over the life of the structure. Aqueducts, manholes, large tunnels, pump stations, railroad tunnels or sky scrapers and sub surface floors all have unique challenges for water intrusion remediation and they all can be accomplished with a well planned grouting project.