SealGuard / Sub-Technical

Case Study – Crack Injection – Fresh Water Pump Station

Challenge Faced

A 110 year old drinking water pump station located in a large coastal city was suffering from major water exfiltration due to deterioration of the concrete in the building itself and also in the sluice gates and water transmission tunnel leading into it. Estimated water loss was estimated at 1,000 gallons per minute. Further complicating the project was the presence of a tidal estuary just a couple of hundred yards from the pump station and the strict requirement that nothing used to seal the leaks can be released into the water supply. In addition the pumps could only be shut down for 4-5 hours daily or the water would back up in the supply tunnel and flood the pump station. Finally, circumstances made it impossible to draw the water down to perform interior repairs to the water supply tunnel or interior sluice gates.

The Project

Given the strict need to prevent the escape of any grouting materials into the water supply, (the reason for this was due to fear that reacted urethane could get stuck in the pumps, not because of any particular health hazard, HyperFlex is NSF approved for contact with potable water), it was decided that we would go after the leaks from the outside of the supply tunnel and sluice wall where the sluice gates are joined to the building, an approximately 60'x12' area riddled with cracks and leaking in total 40-50 gallons per minute.

Example of the leaks formed in basement walls.

The second part of this grouting project was to take place outside, where a seriously leaking manhole and the main leaks identified by the ROV were to be excavated and exposed then grouted from the outside. Unfortunately, the excavation contractor hit six feet of solid concrete just 1/3 of the way into what was to be a 15 foot deep excavation. This left us no way to safely inject urethane directly into the leaks on the exterior of the sluice or water tunnel.

The picture below shows the cumulative effect of the multiple leaks into the partial excavation pit.

Our Solution

As according to our original plan, we began inside the basement of the pump station. We used SealGuard II tube sets to shut off the most aggressive water infiltration, then packers, an electric grout pump and 5 gallon pails of HyperFlex. Divers were stationed on the other side of the wall in the sluice area to warn if any urethane foam was escaping into the water (none did). In addition to crack injection, we used HyperFlex to fill voids on the outside of the basement walls caused by years of water flow. As we filled these voids we noticed water levels in the excavation pit were lowering somewhat from where they were when we started as we effectively pushed the water back and held it in the sluice with HyperFlex. Just to give an idea of the magnitude of the leaks in the basement, we used 24 tubes of SealGuard II and 350 pounds (Seven 5 gallon pails) of HyperFlex.

We were still left with substantial leaks coming from the areas of the tunnel and sluice gates we could not reach because of the unforeseen concrete slab. Our solution made this project into a very interesting combination of the most modern polyurethane grouting formulations and one of the oldest leak stopping materials available; Oakum Rope. The only way to access these cracks in the walls of the tunnel and sluice was from the inside, and fixing a 1 ½ in wide, 8 foot long crack under 8 feet of water is not easy at all, especially when it is impossible to use grout. We had the divers take the rope and, using a putty knife, force it into the cracks. The oakum expands as it gains water and forms an extremely tight, if somewhat temporary (3-5 year) seal. Since divers go into the tunnel for routine inspections every 12-24 months, the cracks can be inspected and re-chinked when necessary

After shutting off the remaining small leaks over the next day or so, flow into the excavation pit was next to nil. This project is a great reminder that sometimes the oldest technology can work better than the newest, in certain circumstances!

The excavated pit at the conclusion of our project

These photographs show the dry basement wall after our grouting project. The darker areas are from the hydraulic cement we used to repair our injections sites.

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