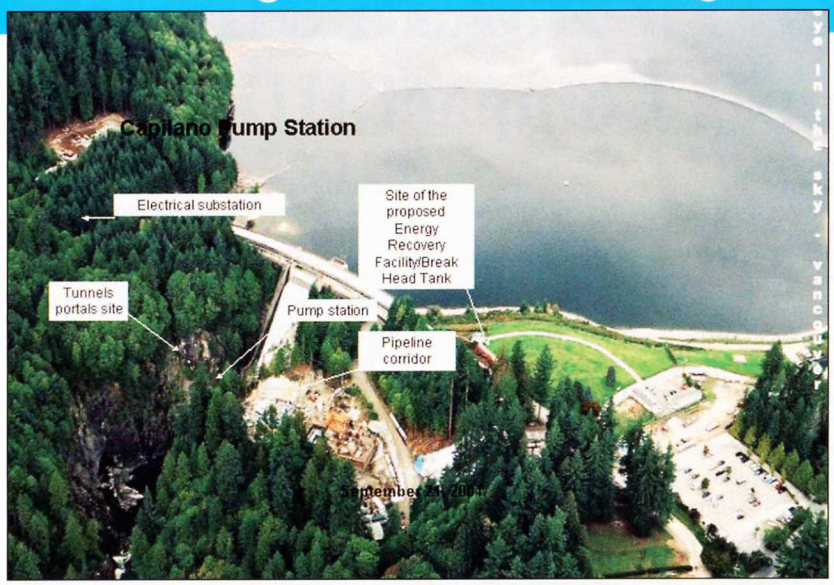
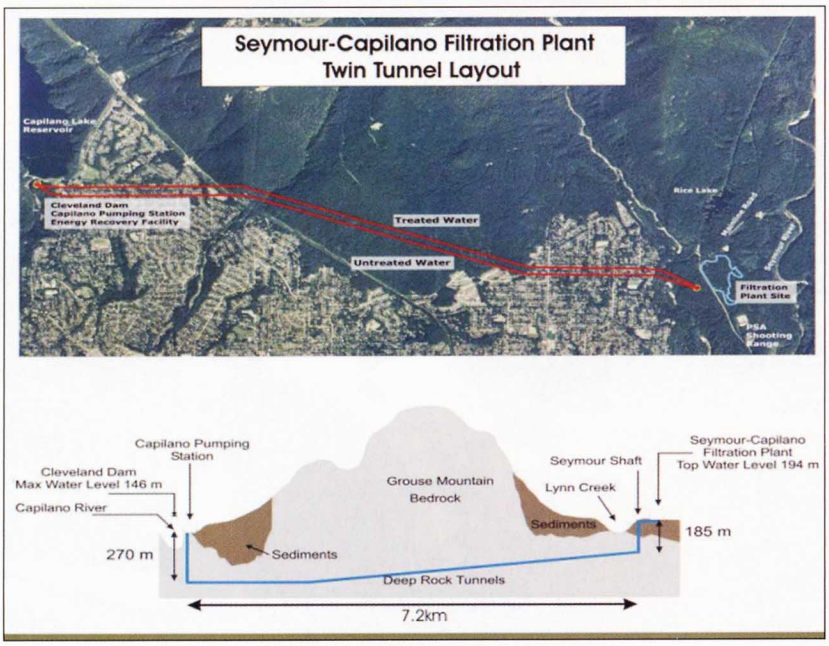
by Tonia Jurbin ■ Contributing Editor

Vancouver's Twin Tunnel

Work Begins On This Long-Term, Enormous Job





The Greater Vancouver Regional District's (GVRD) water supply is in the midst of a $600 million (CDN) upgrade. A filtration plant that, when complete, will be Canada's largest, will have two 4.47 mile long, 12.46-foot diameter tunnels connecting two of the GVRD's three reservoirs that will carry the water from the Capilano reservoir to the filtration plant at the Seymour site and back. A pump station and energy recovery plant complete the 'Seymour – Capilano' filtration project. The three reservoir dams – Seymour Falls, Cleveland and Coquitlam – each hold back roughly a third of the water supply and are in some stage of a major structural retrofit as well.

The meat of this part of the project is the tunnels, but long before the two massive TBM's are transported to site loaded on 160 foot trailers, there is much work to be done. The 36-foot diameter entry shaft at the Seymour end was originally to be driven at the filtration plant area, but preliminary drilling revealed that there was about 300 feet of saturated sands and gravels that would have made for tough shaft sinking. Ground freezing was considered but geotechnical testing showed groundwater that was moving so quickly that it would add heat to the freeze wall quicker than the freeze plant could remove it. Fortunately, using geophysical methods backed up by drilling, designers were able to locate a rock knoll under about 100 feet of bouldery overburden only some 200 feet from the filtration plant.

The first 100 feet of the shaft had been sunk using traditional methods of installing a large cast-in-place shaft collar, installing wire mesh with lattice ring girders (or ring beams), and shotcreting in three-foot lifts. The waste was removed in 10,000- pound loads using a 125-ton crane. Every 60 feet, a water trough is installed in the lining to catch some of the seepage giving relief to the crews and equipment. Close to the bedrock the till gets very dense, and occasionally, a boulder has to be blasted.

Slow start

For various reasons the initial shaft sinking has been considerably slower than expected. The 600-foot shaft was to be completed by the end of May 2005; however, by that time it was only at 120 feet and just 10 feet into the rock.

Bilfinger Berger had been looking to establish a foothold in tunneling in North America as part of their global strategy. There were several tunneling projects out for tender in different parts of North America but they had already invested considerable time familiarizing themselves with Vancouver while doing research for a large transportation project. They considered the terms of the GVRD's tender one of the fairest in terms of risk sharing with provisions for a Geotechnical Baseline Report, a Geotechnical Data Report, Disputes Review Board and Escrow Bid Documents, so they bid ambitiously for this project. Eight contractors were prequalified, only three bid with a remarkable range, the low and winning bid at $99 million (CDN), and the high bid at $237 million (CDN).

Massive spoil

These massive rock excavations will all be converted into spoils and used somewhere within the Lower Seymour Conservation Reserve (LSCR). At the Seymour shaft, typically the 10-foot lifts will be blasted out using about 180 holes and 485 pounds of charge per lift for the two 425-foot long launch chambers, the 250-foot long tail tunnel, (the part built to accommodate the 'tail end' of the TBM), and there is over 9,800 yards of rock to be excavated. The entry shaft at the Seymour end will have 24,000 yards of rock excavated plus about

3,500 yards of overburden and the tunnels themselves will have about 212,000 yards of rock removed. At the Capilano end the 850-foot deep shafts, 9,100 yards will be excavated, and the chamber about 2,600 yards. The shafts at the Capilano end will be raise-bored into the previously excavated chamber. Once in full production, the shaft should advance at the rate of about 2.5 days per 10-foot lift. The shafts will be coated in about 2,600 yards of shotcrete applied from a mini-shotcrete plant that is lowered and then removed from the shaft via an overhead crane as needed.

The TBMs will be pulled back through the 4.5 miles of tunnel, dismantled and removed from the Seymour end. The Capilano shafts are too small at 13 feet to hoist TBM parts out of the Capilano chamber. Other practical challenges to this tunneling work is the fact that they are tunneling downhill at a grade of about 2.33 percent which makes removing waste rock challenging, and also requires the contractor to take particular care with a considerable volume of water that is expected to move through discreet joints in the rock. "We have to be prepared to deal with large volumes of water on short notice," explains Christian Genschel, project manager for Bilfinger Berger Canada Inc.

Bilfinger Berger is also wrestling with the typical difficulties of starting a new business in another country. Mundane tasks such as setting up trailers, purchasing office supplies and finding reliable material suppliers have all taken time at the front end of this project. Having worked on large projects in about 10 countries, Genschel's experience shows and doesn't worry about these obstacles. "We've done everything necessary to be good neighbors, especially with respect to noise reduction, and we can now blast 24/7. In our original bid, we were only going to work 20 hours, five days a week, so I am confident we will meet our target of October 2008."

Editor's Note: Underground Construction *will be following this story with another visit to this interesting job once both TBM's are in full production.*