There are Lake Taps … AND THERE IS LAKE DOROTHY.

Albeit a specialized operation, tapping a lake is not new to the underground tunneling industry. However, what went on at Lake Dorothy, Alaska over the past two years is truly unique.

Logistically, before it ever began, the Alaska Electric Light & Power Company (AEL&P) of Juneau, Alaska, knew that the lake tap and tunnel phase of their $64 million Lake Dorothy Hydroelectric Project presented unusually mammoth hurdles. Mainly due to the location of Lake Dorothy, in the remote Tongass National Forest in the mountains above the Taku Inlet.

The purpose of this engineering nightmare is to deliver a large reserve of clean, sustainable energy to the Juneau area. The solution required highly trained specialists with practical experience. Answering the challenge, AEL&P worked with global contractor Redpath Mining and Engineering (Redpath).

REMOTE CONTROL

Construction personnel had to be highly flexible, innovative and able to carefully sequence all portions of the work. Limited to less than one acre storage area for equipment and supplies required versatility and precise planning.

“Something as technically challenging as a lake tap, with only a handful being performed in the United States, is challenging in itself. When you perform a lake tap at a job site with a seasonal construction period, limited helicopter access, adverse weather conditions, a tight project schedule, and remote location in Alaska, the definition of “challenge” takes on a new meaning.”

~ Ben Roberds, Project Superintendent, J.S. Redpath Corporation

After completing 39,908 man hours over 433 days, with no medical aid injuries, the Lake Dorothy tunnel and lake tap finished on schedule, in October, 2008.

A ONE SHOT DEAL

At Lake Dorothy, the Norwegian Lake Tap Method was deployed to physically access a body of water from below the surface without lowering the water elevation. This involves driving a tunnel under the lake to within a few short meters of the edge, leaving a short rock plug between the tunnel and lake bottom. The final plug is then blasted, piercing the lake floor from below. Rock from the plug settles into a trap leaving an unobstructed path for water to flow. You get only one chance to perform a successful lake piercing.

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LIMITED ACCESS AND PROJECT LOGISTICS

There are no roads connecting Juneau to other parts of the state or North America. Therefore, normal freight delivery by truck was not an option. Given uncertain weather windows, constant planning and advanced scheduling was crucial to ensure materials and equipment was available to meet the critical construction schedule.

The job of transporting materials from the staging area to the portal site 3.8 km (2.4 miles) was constantly plagued by unpredictable weather, often limiting safe helicopter access for as long as two weeks at a time.

Once materials and equipment arrived in Juneau, getting to the jobsite was a major challenge as heavy snow fall, dense fog and high winds limited daily access for the construction seasons.

SITE MOBILIZATION

When Redpath arrived at the project site, 10.6 m (35′) of snow had to be removed prior to starting work. It took 21 days to remove enough snow to begin development of a small landing site for delivering mechanized equipment.

Equipment size and weight were major logistical challenges during the entire project. One Hitachi ZX35 excavator and one Ingersoll LM100 track drill were disassembled and flown in, using a Bell 214 helicopter with a lift capacity of 5,500 pounds. Once at the small portal site, the equipment was reassembled. Columbia Helicopters’ Boeing 234 Chinook, with a lift capacity of 11,793 kg (26,000 lbs.) and a Boeing/Kawasaki Vertol 107-II, with a lift capacity of 3,629 kg (8,000 lbs.) transported large equipment. Crews dismantled the larger pieces of mining equipment to meet weight restrictions of these helicopters.

ENVIRONMENTAL CONSIDERATIONS

The proximity of Lake Dorothy to Dorothy Creek required extreme measures to avoid hydrocarbon spills and excavated material from entering the stream:

- Oil and fuel totes were stored in lined containments.
- Absorbent booms were placed in any area where hydrocarbons could potentially seep into the creek.
- Drainage was constructed so that all discharge water from the tunnel and surface areas was pumped to an oil water separator and skimmed as required.
- Fiber Web Typar was placed on four foot lift intervals on the development rock waste pad and road to filter any potential silt that might make its way to the creek. Storm drainage was directed to a settling sump, also lined with Fiber Web Typar.

No incidents or spills requiring agency notification occurred during the project.

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During the start of the 2008 construction season avalanches were a significant danger. Redpath used controlled blasting to intentionally trigger several small avalanches directly above the portal site, preventing larger avalanches from covering the project area and destroying the facilities.

MINING CYCLE

Poor weather conditions and access to the site often prevented mining crews from achieving steady advance rates. A total of 35 weather related delay days were encountered during the 2007 construction season and 33 weather related delays during the 2008 season. However, crews were able to establish the portal site, complete excavation of the 250 m tunnel, including the 415 m$^3$ (14,664 ft$^3$) rock trap excavation, install lake bottom ground support, and complete drilling of the lake tap, in approximately six (6) months.

ACKNOWLEDGEMENTS

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\[\text{The lake tap and tunnel were one phase of the $64 million Lake Dorothy Hydroelectric Project, owned and operated by Alaska Electric Light & Power Company (AEL&P), a private utility located in Juneau, AK. The Lake Dorothy portal site and tunnel are located approximately 25.7 km (16 miles) southeast of Juneau, AK, in the remote Tongass National Forest at an elevation of 701 m (2,300') above sea level in the mountains above the Taku Inlet.}\]