



HERCULES CEMENT PLANT CASE STUDY: BETWEEN A ROCK AND A FLUID PLACE

One of the biggest challenges facing just about any mining operation is dewatering the quarry site. The act of mining itself, digging deep into the earth's surface to extract valuable rock, opens up passages that allow underground water to escape and flow into the work area. That's exactly the challenge that faced Hercules Cement Company's plant in Stockertown, PA. The plant was constructed in 1907 and became fully operational as a quarry in 1917. The Hercules Cement Plant, owned by RC Cement Company, produces over one million tons of Portland cement per year.

The process of making cement begins in the quarry where over 1.5 million tons per year of limestone is mined. Like most quarries, more and more water infiltrates the work area as mining progresses deeper over the years. However, the Hercules plant has the largest pumping capacity of any quarry in the state. The Lehigh Valley in Pennsylvania, where the Hercules plant is located, carries the distinction of being the second most active sink-hole area in the United States. There are caves, sinkholes, and open underground cavities on site, and much of the infiltrating water originates from nearby Bushkill Creek. Approximately 85 percent of the earth on the Hercules site is comprised of limestone. Much of the limestone is fractured and soluble making it a natural conductor for subsurface water. Ironically the drought that occurred a few years ago exacerbated the problem because the cracks in the rock that were filled with clay dried out during the dry period and the following rains flushed out this clay allowing additional conduits for water flow.

Waging the Water Battle

"It's a constant fight to keep the water out of the mining area," explains Jack Farrell, sales manager, Godwin Pumps. Bridgeport, NJ-based Godwin Pumps has been the dewatering consultant for the Hercules plant for seven years. Up until 1996, a few submersible electrical pumps provided by a local general rental company were used for dewatering at Hercules. "But the water problem at Hercules worsened, and we had bigger pumps and newer technology that could handle the volume to get the job done for them," said Farrell.

"Our initial work at the Hercules site involved installing and providing two Godwin HL6 Dri-Prime® diesel-powered rental pumps. These pumps were designed to be heavy duty, solids handling, automatic self-priming pumps. The pumps worked so well that Hercules later decided to purchase the pumps," says Farrell. Hercules needed the diesel Dri-Prime technology to handle restarts in the event of emergency power loss situations. Quarry Superintendent Bruce Gassler explains, "At Hercules, we have an interruptible supply agreement with the local power company. In essence, we have agreed to allow the power company to reduce our power consumption when required; however, the water doesn't stop flowing. The Godwin diesel-driven pumps do not need electricity and automatically self prime."

Pumping Up and Out

The Hercules site can be divided into two basic sections, the lower quarry area or F Level and the upper

water detention area or East Dam, with each section containing a lake. The lower lake in the F Level is formed from infiltrated groundwater as a result of the mining operation. To dewater the quarry area, Hercules pumps water from the F Level 150 feet up and 2500 feet horizontally to the East Dam detention area. The water from the East Dam area is pumped out to the nearby Bushkill Creek in a controlled fashion.



30,000 gallons per minute coming from the F Level and bypassing the flow around the current East Dam retention lake and removing 100 million gallons of water from a portion of the East Dam retention lake so that a dam-like wall could be built to retain a smaller East Dam retention pond.

Over the following few years, the problem with infiltrating water became much worse due to climate changes, alternating drought and wet conditions, increasing rate of water infiltration, and the expansion of the quarry. At this point, it was believed that the Hercules quarry would operate for just a few more years, since most of the material that could be excavated economically had been already mined. To handle the increasing infiltration of water on what was thought to be a temporary basis, Hercules added a few more pumps. According to Farrell, Hercules needed a supplier that was ready to roll with the type, size, and number of pumps needed to keep the quarry operational. In addition, they needed reliable high head pumps and an expert service department, because the pumps had to operate 24 hours per day. Gassler said, "Godwin installed complete pumping systems for us, from suction lines to high head pumps, to 1,100 feet of fused 12-inch HDPE discharge pipe – all within 24-hour notification."

There are two Godwin HL6 and eight HL10 Dri-Prime® high-volume, high head, diesel-driven pumps in the F Level pumping 30,000 gallons per minute. In the East Dam area, four Godwin HL6 and two HL10 Dri-Prime pumps were added to the permanent electric pumps in order to handle peak flows and in the event of power outages.

John Michael Paz, president of Godwin Pumps comments, "One of the real benefits we brought to Hercules is our diligence. For instance, Godwin mechanics make each client feel that their project is a top priority. Our chief road mechanic, Paul Natalino, provided regular service on the pumps at Hercules every other week, and as a result everything ran smoothly. When a client needs to pump 40 to 45 mgd to keep their operation going, like Hercules does, they can't tolerate a lack of service or delays in delivery of equipment."

Reducing a Lake to a Pond

An updated mining plan provided by Albany, NY-based Earth Tech indicated the need to mine the reserves located under the East Dam area as quickly as possible. Earth Tech has been Hercules' mining consultant for the past 30 years, providing reserve analysis, geologic investigations and permit management.

Rick Ackerman, Earth Tech's Group Manager for the Construction Materials and Mining Group, said, "Investigations revealed that a substantial reserve of quarry rock exists under a major portion of the 10-acre upper water detention lake—the East Dam." In order to access the newly found material, the East Dam retention lake had to be reduced to one-tenth its current size. The process involved handling the current

This is where Godwin's engineering prowess really came into play. "It truly was a team effort on the part of Godwin, Hercules and Earth Tech staff," said Earth Tech's Project Manager, Patricia Jinks. "Godwin's product is very reliable and their 24-hour service is outstanding. Just as important, they truly try to find the least cost alternatives for their clients."

A temporary sump was built near the East Dam retention lake in order to prevent the day-to-day dewatering flow from the F Level from entering the East Dam. This was necessary in order to empty the East Dam retention lake to allow for the construction of the retaining wall. Twelve Godwin HL10 Dri-Prime pumps were temporarily installed to handle the 30,000 gallon per minute operational flow. A 1,500-foot gravity pipe was used to temporarily deliver the water from the F Level to the temporary sump. "We faced a real sedimentation challenge and had to muck out five feet of silt," said Godwin's Farrell. "We then used four Godwin HL6 Dri-Prime and two Godwin Heindra 150 hydraulic submersible pumps to empty the portion of the lake area that later would be quarried." The dewatering of the lake took two weeks, and the temporary sump setup to handle the daily flow had to be maintained for seven weeks while the new retaining wall was constructed for the smaller East Dam retention pond, a process lengthened by an extremely wet season. An estimated 4.8 billion gallons of water was pumped during the project.

Reducing the 10-acre pond to one-tenth its original size is not an easy task. Hercules' Gassler, concludes, "With water management being extremely critical to our mining operation, pumping needs must be handled immediately and Godwin swiftly responds with a simple phone call. The 24-hour, 7 days-a-week service provided by Godwin to Hercules is the foundation of our long term business relationship."



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