Dam Restoration Keeps Military Moving Forward

by JoAnne Castagna

Since 1802, the tradition at the US Military Academy at West Point has been to graduate highly trained military officers. Over 900 cadets are commissioned annually to serve their country and ensure our American way of life.

For just as long, the US Army Corps of Engineers began its roots at West Point and has worked with the Academy ensuring the Army's officers are prepared for their important missions by providing optimum training and living facilities.

This past winter, the Corps' New York District began restoring a historic dam and reservoir, near the shore of the Hudson River on the grounds of the sprawling campus, to ensure a continuous fresh water supply and to prevent a potential flooding hazard.

The US Military Academy was established in 1802, primarily to train engineers. The Academy sits on the western shore of the Hudson River, approximately 50 miles north of New York City in lower Orange County. Since its establishment, the US Military Academy at West Point and the US Army Corps of Engineers has shared a close relationship.

In the late 1800s, the Academy needed an additional source of drinking water. The Corps augmented the Academy's drinking water system by constructing the Lusk Dam and Reservoir in 1895, now considered significant elements within the Academy's National Historic Landmark property.

The Lusk Reservoir Dam serves the Academy with fresh water. The reservoir dam is a large, arched masonry block structure – 225-feet long and 35-feet high. A few years ago, it was observed during a Corps inspection that leaks were present behind a buildup of efflorescence raising concerns that there could be a more serious future problem down the road if the dam was left unmonitored.

The dam was constructed under the direction of Captain James L. Lusk, a West Point graduate. The dam created the reservoir. To date, water is piped in from area ponds, creeks and brooks into this reservoir and the water is purified by the Academy's water treatment plant.

Since the dam is located upstream and adjacent to several high-occupancy Academy facilities, such as the Association of Graduates Building, any potential structural problems in the dam are unacceptable.

During the winter of 2005, the New York District was assisted by the Baltimore and Philadelphia districts and performed the dam's first cleaning in its 100 years of service.

The joints on the downstream face of the dam were cleaned of efflorescence, which is crystallization that had accumulated on its surface. Leaks that were covered by crystallization crust were located, cleaned and sealed. The cleaning provided the Corps a "fresh face"

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Courtesy of USACE-NY District

A 1895 photo of a Corps engineer standing on the recently constructed Lusk Reservoir Dam

Right: New York State map showing project location near the Hudson River

Courtesy of USMA-WP

Courtesy of Milton N. Ricks, USACE-NY District

A worker cleans calcite buildup on the dam's masonry stones by sandblasting them with small coarse grained silica, glass-like particles under water pressure.

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to observe and categorize leaks currently present at the dam and determine any further repairs that may be needed.

"Efflorescence is caused by the dissolving calcium carbonate in the dam's mortar with the reservoir water. The water up there is slightly acidic so it reacts chemically with the mortar between the dam's stones," said Marty Goff, project engineer with the Corps' New York District.

"When efflorescence builds up over the stones, it becomes difficult to determine the location of leaks because the water from the leak is diverted. The water from the leak is moving under the efflorescence crust and away from the leak source. By cleaning away the efflorescence we will be able to see the actual location of the leak," said Goff.

Goff said that it took a month to clean the dam and that the cleaning technique they used was like cleaning a shower stall that has lime buildup.

The dam's stones were cleaned by being sandblasted with small coarse grained silica, glass-like particles, under water pressure to remove the calcite buildup along the seams of the dam's masonry stones.

Workers performed the cleaning by standing on a platform, similar to those used by high-rise building window washers, which were lowered over the side of the dam's stone balustrade and eight-foot wide brick walkway.

When the cleaning was completed, leaks were found, and are being repaired. In the near future, plans include inspections of the structural condition of the dam's upstream face using a dive team because this portion of the structure needs to be visually examined.

Goff hopes to correlate the leak locations on the downstream face with the upstream face cracks which will allow them to determine future work.

Suggestions for engineers who plan to perform similar dam restoration work include:

- Work closely with your environmental and cultural resources staff on the project because they can be invaluable in the selection of the proper cleaning method. Even though the focus of the project is dam safety, it's important to keep aware of the cultural and environmental resource impacts of the work being performed.
- Ensure you have enough time to perform the project. For example, if the dam is located in a cold climate region avoid the fall timeframe, which may cut your restoration time short.

"If we didn't clean the dam we would not be aware of the severity of the seepage problem which could be the result of a more significant problem," said Goff.

"The location and hazard classification of this dam makes it essential that we monitor and maintain it on a regular basis. If the dam were to ever experience a breach the potential for loss of life would be high."

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Courtesy of USACE-NY District

Lusk Reservoir Dam, a masonry block structure