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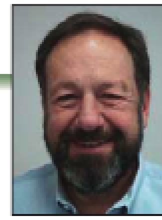

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Science-based Collaboration: Finding Better Ways to Operate the Conowingo Pond

Following a particularly dry spring, the summer of 1999 brought record-setting low flows to the Lower Susquehanna River basin, an area that covers several hundred square miles in southern Pennsylvania and northern Maryland. Because of the drought conditions, the water needs of several local municipalities, a nuclear power plant, and instream flow needs of downstream aquatic resources were all at risk. That summer, releases required to meet permit conditions, and to a lesser extent, water withdrawals, nearly emptied the Conowingo Pond, a 14-mi interstate reservoir formed behind the Conowingo Dam on the Susquehanna River that straddles the Pennsylvania–Maryland state line. The water level in the pond was so low that the cooling water intake for the nearby Peach Bottom Atomic Power Station was threatened. The only safe recourse was to reduce outflow from the dam, but this endangered flows that were critical to fish and other habitats downstream.

To help prevent a recurrence of this event, the Conowingo Pond Workgroup was established in 2002 by the Susquehanna River Basin Commission (SRBC). The commission was created to coordinate the water resources needs of the river—flowing 444 mi through New York, Pennsylvania, and Maryland—for the three states and the federal government. The workgroup was assigned the task of identifying actions that the commission could incorporate into its regulatory and water resource management programs. As the workgroup progressed with its four-year planning effort and reviewed the issues presented by the commission, HydroLogics Inc., a water resources management consulting firm, was retained to develop the models required to evaluate water flow scenarios that the workgroup generated. The models were created using the firm's Computer-Aided Dispute Resolution (CADRe) process and Oasis software, which assist with water system analysis, operations planning, and conflict resolution. After many meetings, the workgroup's report was released in March 2006. The report served as the basis for the SRBC-adopted Conowingo Pond Management Plan. The plan recommended revisions to the previous operations strategy for the pond, which would provide instream flow reliability while preserving water supply reliability, energy production, and other benefits.

THE SUSQUEHANNA: A UNIQUE WATERWAY

The Susquehanna River, the nation's sixteenth largest river, is the largest river locat-

PHOTO: COURTESY EXELON CORP

Located approximately 10 miles upstream from the Chesapeake Bay, the Conowingo Dam spans the Susquehanna River. The dam forms the Conowingo Pond, a long and narrow reservoir that provides water for a large region surrounding Chester, Pa., as well as a backup water supply for Baltimore and Harford counties in Maryland.

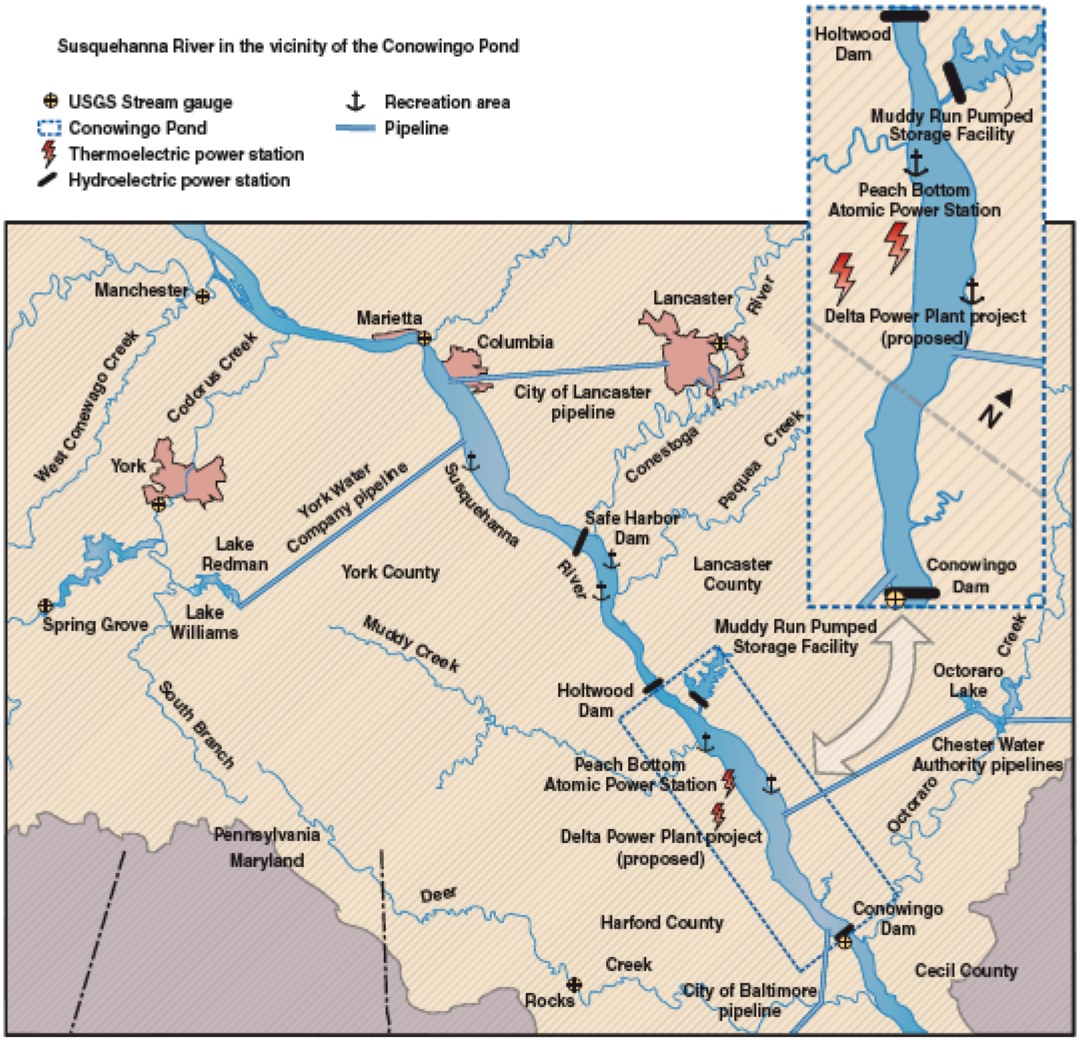
ed entirely in the United States that flows into the Atlantic Ocean, and nearly a mile wide at the Conowingo Dam. The 40,000 cfs average flow of the Susquehanna provides about half of the vital freshwater inflow to the Chesapeake Bay. Ten miles upstream from the bay, the Conowingo Dam, built in 1928, spans the Susquehanna. Minimum-flow releases from the dam support an excellent sport fishery, and a fish lift, installed in 1991, allows some migration of American shad. The minimum flow also helps prevent saltwater intrusion at the water supply intakes at Havre de Grace, Md., where the river empties into the bay.

The dam forms the Conowingo Pond (Figure 1), a long, narrow reservoir with a very small usable storage volume—about two days—relative to the river's flow. The pond serves as a water supply for the Peach Bottom Atomic Power Station, the Muddy Run Pumped Storage Facility, and a large region surrounding Chester, Pa., and is a vital backup water supply for Baltimore and Harford counties in Maryland. The pond is also used for many water recreation activities.

REGULATORY FRAMEWORK

The dam is operated by Exelon Generation Inc., the largest electric and gas company in the United States, and is subject to the requirements of its Federal Energy Regulatory Commission (FERC) license. FERC seasonal minimum-flow requirements were established to provide protection for fishery resources, with highest minimum flows required during the anadromous (from seawater to freshwater) fish migratory period in spring, and intermittent flows permitted only during the winter when fish populations are limited. The minimum-flow requirements were set as a result of a multiparty settlement agreed to in 1988 by the US Fish and Wildlife Service, SRBC, the state of Maryland, the commonwealth of Pennsylvania, and several local environmental groups. Under normal and slightly-below-average flow conditions, there is ample water to meet all water demands, including instream flow releases. However, during more severe low-flow conditions, the structure of the settlement-prescribed operations caused a number of critical events to occur.

FIGURE 1 Water use features associated with Conowingo Pond



The normal minimum releases specified by the FERC permit are set at the lesser of a flow of 5,000 cfs from June to mid-September and 3,500 cfs for the remainder of the year or the pond inflow measured at the nearest upstream gauge. The release is measured as the flow through the dam's turbines for power generation. In addition to the measured discharges, the dam "leaks" about 800 cfs. When flows are not extremely low, local inflow between Marietta (Pa.) and the Conowingo Dam is sufficient to make up the leakage plus consumptive use and exports in the reach.

When flows are at or below the 5,000- (or 3,500-) cfs trigger, the story is different; local inflows can be substantially less than the leakage and sometimes nearly negligible. When the total outflow (leakage, plus the required outflow, plus the evaporative loss, plus the consumptive use in the reach) is greater than the total inflow (gauged flow plus the local inflow), the water level of Conowingo Pond will fall—and it need not fall far for serious consequences to occur. Figure 2 shows the relationship between pond levels and uses. With drawdown of the pool there can be a loss of more than

3.5 GW of electricity generation and downstream fisheries, water supply for the cities of Chester and Baltimore, Md., and recreational uses are all put at risk. If those threats materialize, the pressure to severely curtail environmental releases could be irresistible. The time required for the pond to empty of usable storage is only a matter of weeks. Ensuring the protection of instream flows requires having a protocol for avoiding disaster in place before a drought should occur; there is no time for prolonged regulatory or legal response.

SOLVING THE PROBLEM

The active participants in the workgroup were representatives from federal and state planning and resource management agencies, local jurisdictions, power operators, and local water utilities. Active involvement of the stakeholders in the model development and verification lent credibility to the entire process. Models and performance measures used to evaluate alternatives were developed and refined at workgroup meetings. The collaborative process built critical shared knowledge of the lower Susquehanna system. Computer-aided negotiation sessions where alternatives were developed and evaluated on the spot were particularly effective. The process ensured the full support of recommendations by key stakeholders.

With the CADRe process that was used, it became clear to all the participants that crisis-based management was far too risky. Regardless of the objective—environmental protection, water supply, or power generation—it seemed prudent to take measures to preserve storage in advance. The workgroup identified leakage and minimum-release requirements as the most critical parameters. The supplemental volume provided by water conservation measures and upstream flow augmentation was too small to offer substantial relief; the plan therefore established a formal protocol for credit to offset leakage and specified conditions under which the credit is allowed.

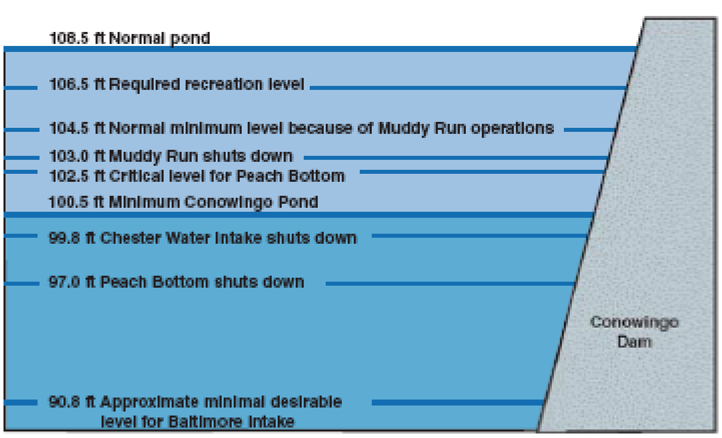
The selected plan included the initiation of a credit for leakage of up to 800 cfs when the flow conditions at the upstream gauge decline to 1,000 cfs greater than the minimum seasonal flow threshold of 5,000 or 3,500 cfs. Additional restrictions prohibit credit for leakage during the spring fish spawning and migration season (April 1–June 30) and limit the credit to the minimum amount necessary to maintain viable pond levels.

MOVING FORWARD

Continued implementation of the Conowingo Pond Management Plan requires that Exelon successfully petition FERC for an amendment to the existing license to include leakage during drought conditions. In addition, the workgroup members agreed to review project operations and conduct a drought operations exercise, regularly assess the short-term potential for extreme drought conditions, and provide annual updates of the plan for a period of five years. Recommendations concerning effects of consumptive use, use of upstream storage, and model maintenance are also going forward. The proposed operating policy ensures that storage will continue to be available during periods of drought.

The scientific tools that were used by the workgroup and all involved parties helped to focus the decision-making process on practical, mutually beneficial alternatives. The credible, stakeholder-designed performance measures and models created a shared language and understanding of the reality of the hydrologic system and the physical capabilities and limitations of the facilities. In the end, the knowledge helped to develop a consensus solution for protecting instream flows and ensures that the Conowingo Pond continues to meet the needs of all of its users.

FIGURE 2 Critical levels of Conowingo Pond



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