Chesapeake Bay Program
A Watershed Partnership

Backgrounder

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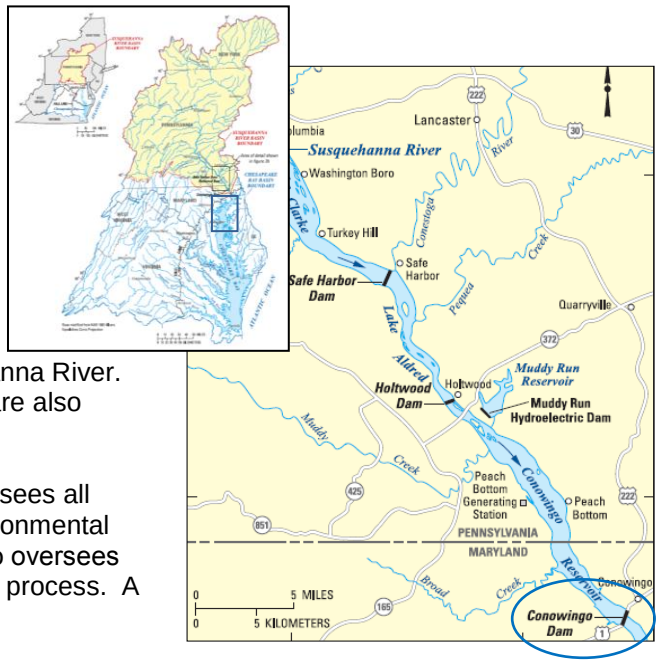
The Conowingo Dam and Chesapeake Bay Water Quality

The Conowingo Dam
The Conowingo Hydroelectric Generating Station (or Conowingo Dam) is a hydroelectric power plant located in Maryland. It is owned and operated by Exelon Corporation.



The dam began operations in 1928, after two years of construction. When it was completed, it was the second largest hydroelectric project in the U.S. Flow of the Susquehanna River powers the dam's eleven turbine generators.

Conowingo is one of several large dams on the Susquehanna River. The areas of the river just upstream of each of the dams are also called "lakes" or "resevoirs".

The Federal Energy Regulatory Commission (FERC) oversees all ongoing operations, including safety inspections and environmental monitoring, at the nation's hydroelectric dams. FERC also oversees the continuance of existing facilities through a re-licensing process. A license is typically issued for a period from 30 to 50 years.

The license on the Conowingo Dam is up for renewal in 2014. Exelon is requesting a 46-year license agreement as part of the relicensing. It is not expected to come up for renewal again for almost 35 years. Therefore the time is right for discussions on and evaluation of the issues at the dam. Top priority issues for consideration during the current relicensing process include: sediment management, fish passage, flow management and water quality. (See "Assessment" section below.)

The Susquehanna River
The Susquehanna is the largest river flowing into the Chesapeake Bay in terms of water volume, watershed size and overall length. The river meets the Chesapeake Bay at its northernmost point near Havre de Grace, Maryland. Its watershed includes innumerable creeks and rivers that flow through New York, Pennsylvania and Maryland and provide the Bay with nearly half of its fresh water each year.

According to the Chesapeake Bay Program estimates, each year, the Susquehanna also provides the Bay with almost half of its nitrogen loads and about one-quarter of its loads for phosphorus and sediment.

While flow and pollution from the Susquehanna can impact the Bay itself, their impact on other tributaries is variable. Generally speaking, the further from the Susquehanna a river is, the less impact the Susquehanna River's flow and pollution will have on it.

Average ANNUAL Pollution Loads (USGS)

Susquehanna River to Bay (1978-2011)

- Nitrogen: 71,000 tons/year
- Phosphorus: 3,300 tons/year*
- Sediment: 2,500,000 tons/year

*Phosphorus levels are related to sediment levels since phosphorus tends to bind i sediment. Nitrogen acts more independently of sediment flow.

Sediment conditions in rivers such as the Potomac, Patuxent, James, York or Rappahannock are impacted more by local land use than sediment originating from the Susquehanna region.

Weather and Its Impacts
Large storms and hurricanes passing through the Bay region are always a concern. However, their duration, severity and path are critical factors in how they impact river flow and the watershed. One only has to look at the last two years for examples of this.

- In 2011, Tropical Storm Lee came to a virtual stop over the upper Bay watershed and provided a deluge of rain to the Susquehanna basin, resulting in an increased flow of nutrients and sediment.
- In 2012, Superstorm Sandy skirted the edge of the Bay watershed and therefore had far less impact on river flows, flooding and pollution entering the Bay from the Susquehanna River.

Regardless of their location in the region, all the Bay's tributaries deliver sediment downstream as a result of precipitation events; those amounts largely depend on how lands around the rivers are used or developed.

Tropical Storm Lee-Related Pollution Loads (USGS)

Susquehanna River to Bay (November 2012)

- Nitrogen: 42,000 tons
- Phosphorus: 10,600 tons*
- Sediment: 19,000,000 tons

*Phosphorus levels are related to sediment levels since phosphorus tends to bind itself to sediment. Nitrogen acts more independently of sediment flow.

Pollution Issues & Findings
Three large reservoirs on the Lower Susquehanna River, each behind a dam, hold back much of the sediment, and the accompanying phosphorous, which would otherwise flow downstream to the Bay. These reservoirs have been an effective "pollution gate" for phosphorus and sediment for three-quarters of a century. This trapping of pollutants is accounted for in the decision tools used in the creation of the Chesapeake Bay Total Maximum Daily Load (TMDL)

Strong storms, severe flooding and faster-moving water can reduce the pollution-blocking ability of the dams along the Lower Susquehanna River. Under such conditions, when runoff and rivers flow at great speeds, the "scouring" of reservoirs increases and large amounts of sediment and phosphorus from behind the dams can escape and flow downstream.

Drawing on decades of monitoring, including efforts during large storms such as Tropical Storm Lee, the U.S. Geological Survey (USGS) published a report in August 2012 on the transitions taking place at the Conowingo reservoir and its declining ability to trap phosphorus and sediment.

USGS scientists and other CBP partners have known that the Conowingo reservoir would reach full capacity at some point and expected its efficiency to decline when that occurred. A 2009 USGS study found the Conowingo's reservoir had *not reached capacity*. The 2012 USGS report revealed that, even though the reservoir is not yet full, loads of phosphorus and sediment to the Bay are increasing. The recent findings provide a better understanding of where the reservoir is in its changing.

How did Tropical Storm Lee's runoff impact some Bay resources? While the runoff from Tropical Storm Lee did deliver significant pollution downstream, our restoration efforts helped the Bay's resilience and supported its ability to absorb the impacts of such weather events. For example, despite the increased sediments into the Bay from this storm, the restored grass beds at Susquehanna Flats (located where the river meets the Bay) remained intact and healthy. Additionally, Maryland's 2011 Oyster Survey noted: "Although high freshwater flows from heavy rains in the spring and two tropical storms in late summer impacted oysters in the Upper Bay, this represented a relatively small proportion of the total oyster population. The lower salinities proved to be beneficial to the majority of oysters in Maryland by reducing disease impacts to allow the yearling oysters to thrive."

For More on Underwater Grasses:
http://www.chesapeakebay.net/presscenter/release/underwater_grasses_survey_shows_both_decline_and_resilience_in_2011
MD Oyster Survey:
http://www.dnr.state.md.us/fisheries/oysters/monitor/reports.asp.

Using this new information, the Chesapeake Bay Program partners will be assessing changes in the trapping capacity of the Conowingo and other dams in the watershed as part of the midpoint assessment of the Chesapeake Bay TMDL in 2017. As appropriate, the most current information will be incorporated into the Chesapeake Bay Program partners' decision-making process for updating their local restoration blueprints, known as Watershed Implementation Plans.

It is also important to note that Susquehanna River pollution trends *above* the river's lower three dams at Marietta, Pennsylvania improved between 1985 and 2010 and also in the shorter 2001-2010 period. After adjusting for differences in river flow, total nitrogen concentrations improved at all monitoring sites and total phosphorous and sediment concentrations improved or showed minimal change.

Assessing the Issues and Moving Ahead
In September 2011, Maryland's Departments of Natural Resources (DNR) and Environment (MDE), along with the Susquehanna River Basin Commission (SRBC), The Nature Conservancy and Chesapeake Bay Program, entered into a 3-year, $1.376 million study led by Army Corps of Engineers. The study team, known as the Lower Susquehanna River Watershed Assessment (LSRWA) is currently evaluating the sediment management options for all of the dams on the Lower Susquehanna River. The first year of the study has been focused on information gathering, data collection and model development.

In addition to evaluating ways to manage pollution issues at the dam under normal and extreme weather conditions, this team is also working to determine the effects to the Chesapeake Bay due to the loss of sediment and nutrient storage behind the many hydroelectric dams on the Lower Susquehanna River.

The LSRWA is also overseeing the data collection, analysis and research on:

- Types and quality of sediments along the river;
- Various impacts with regard to water quality, watershed management, scouring and reservoirs when they reach capacity;
- Sediment management strategies from across the U.S.;
- Management strategies to deal with all the issues.

The LSRWA team is currently focused on evaluating potential sediment management options and developing associated cost estimates.

Possible Solutions
The LSRWA expects to recommend a draft list of sediment management strategies for dams along the Susquehanna River in 2013. Options being discussed include, but are not limited to the following:

- Reducing sediment yield from the watershed
- Minimizing sediment deposition – e.g.: by-pass the dam or modify operations
- Increasing or recovering sediment-trapping volume
- Dredging – e.g.: enlarge the storage capacity
- Innovative Reuse – e.g.: development of light weight aggregate, restore eroded islands
- Replenishment – e.g.: using sediment as landfill cover, to cover abandon mines, as material for agricultural fields

Funding for any sediment remediation will be expensive and no one agency, federal or state, or private entity will be able to address the burden on their own; it will require a coalition of resources.

Summary
Our scientific understanding of the Bay ecosystem and what we can do to restore it is constantly improving. So is our knowledge of how past decisions impact current environmental conditions.

The Conowingo reservoir system was built using the best technology of its time – a time when environmental impacts were not even a consideration. Today we know that preventing or minimizing environmental impacts means a healthier ecosystem and healthier communities. Conowingo is only one example of aging infrastructure, albeit a large one, that needs to be managed differently in order to achieve our water quality goals. Other old, complex systems such as wastewater treatment plants and stormwater systems are already being improved or replaced. Not only do we need to improve the old infrastructure, we also need to use new pollution-reducing practices on agricultural lands and in residential and commercial building practices with greater vigor. Challenges such as Conowingo must certainly be addressed, but they do not impede our current restoration efforts to restore the health of the Chesapeake Bay and rivers. So, problems at Conowingo are one of many complex problems to be solved in the restoration effort; they are no reason to stop doing the work.

All of the jurisdictions in the Bay watershed – the District of Columbia, Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia – are being held to clean water goals and plans that will implement these kinds of practices. Only through this coordinated regional effort can we be successful in restoring the Bay ecosystem.

Over the years, we have seen our past investments in restoration strengthen the Bay's resilience. We've restored rockfish populations, brought crab numbers back to a sustainable level and, more recently, have seen restored grass beds survive and new ones emerge despite heavy rains and sediment-laden runoff. These signs of resiliency are indicators that we are on the right track.

Related Links

- LSRWA Website - http://mddnr.chesapeakebay.net/LSRWA/index.cfm
- CBP program: Non-Tidal Water Quality Monitoring - http://www.chesapeakebay.net/about/programs/qa/nontidal/
- USGS study: *Flux of Nitrogen, Phosphorus, and Suspended Sediment from the Susquehanna River Basin to the Chesapeake Bay during Tropical Storm Lee*, September 2011, as an Indicator of the Effects of Reservoir Sedimentation on Water Quality - http://pubs.usgs.gov/sir/2012/5185/
- Exelon Power - www.exeloncorp.com/powerplants/conowingo