

**Attachment A-2:
Additional Information for Sand Distribution
in Conowingo Reservoir**

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The following information is provided to help the Lower Susquehanna River Assessment Project in their efforts to study sediment loads from behind a series of hydroelectric dams and associated reservoirs, located on the Lower Susquehanna River draining into the northern Chesapeake Bay. Information provided includes locations and dates of all cores collected by the U.S. Geological Survey (USGS) in the Conowingo Reservoir. In addition, data concerning particle size percentages and total deposition of sand, silt, and clay for specific locations for multiple time periods are included.

Location of Sediment Cores Collected in Conowingo Reservoir

The locations for 72 USGS cores collected over three time periods are presented in figure B1. Beginning with the 1990-1991 collection (23 locations, Hainly and others, 1995), efforts were made to sample as closely to previous sampling points as possible so comparisons could be made over multiple time intervals. For the 1996 sampling (Langland and Hainly, 1997), 29 cores were collected and for the 2000 sampling (Edwards, 2006), 20 cores were collected. Particle size results have been compiled and are available in Cerco (2012).

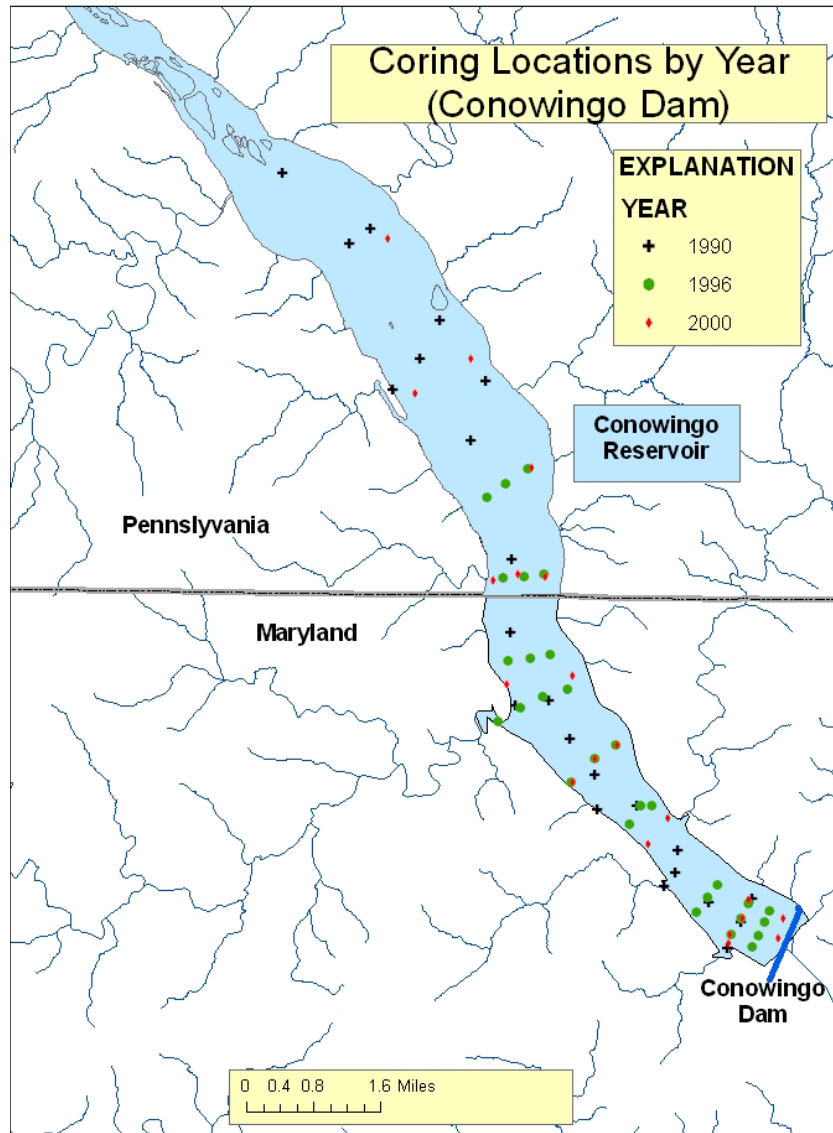


Figure B1. Locations and year for 72 sediment cores collected from Conowingo Reservoir.

The Conowingo Reservoir was divided into 3 sections (upper, middle, and lower) to examine sediment deposition and particle size fractions (figure B2; Langland, 2009). This partitioning was done based on common conveyances, depositional areas, and state of equilibrium. In general, sediment storage capacity in the upper and middle sections is considered in a state of dynamic-equilibrium; in the long-term, the sections are neither net scour or deposit areas. The upper section comprises about 19 percent of the total area of the Conowingo Reservoir, of which about two-thirds is considered to contain very little sediment due to steep channel slopes, high water velocities, and the influence of the Muddy Run hydroelectric pump storage facility near the top of the pool (Hainly

and others, 1995). The middle and lower sections of the reservoir comprise approximately 50 and 31 percent of the total area, respectively.

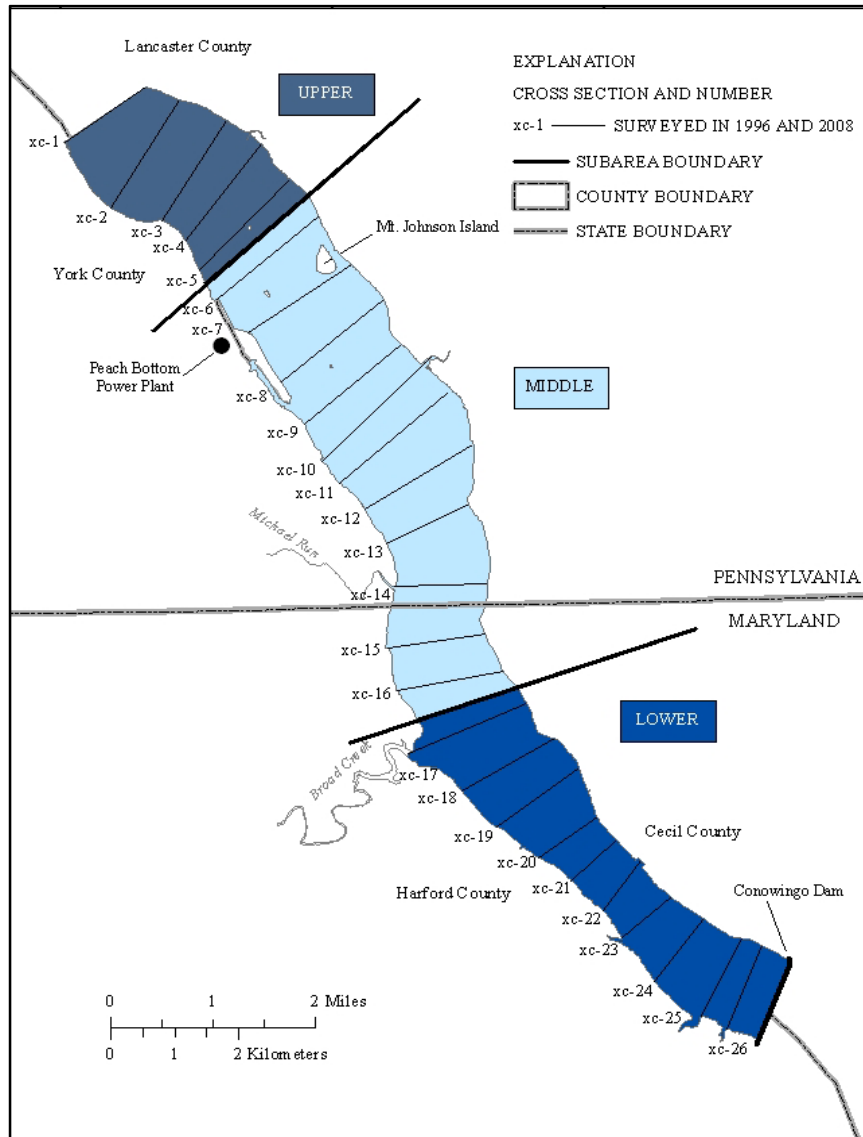


Figure B2. Locations of the Upper, Middle, and Lower sections of Conowingo Reservoir.

Changes in average total sediment deposition and in total sand deposition in the Conowingo Reservoir from the 3 sediment coring studies (1990-01, 1996, and 2000) are presented in table B1. Projections to the year 2012 based on the historical changes and also included in table B1. Percent sand is based predominantly on the uppermost one foot of the sediment cores, areas most prone to

bed scour and movement. Results from the sediment cores indicate the highest percentages of sands are in the upper section. This is an area where sands are deposited due to the loss of flow velocity upon entering the top of the impounded reservoir with a general down gradient distribution of sands to fines. Results also suggest minor changes in percent sands in the upper section. Sand increased in the middle section from approximately 39 to 45 percent (1990-2012), due to continual displacement (scour) of fines with sand during high-flow events. The middle area had the greatest amount of sand deposition. The lower section is the active area for deposition and has seen the greatest increase in sand from 5 to 20 percent (1990 – 2012). Clay fractions in the lower section have been reduced from approximately 35 percent in 1990 to 12 percent in 2000, indicating this is also an active area for scouring.

Table B1. Change in grain-size percentage and deposition for 3 sediment coring studies and projected to 2012 for Conowingo Reservoir. Years grouped by color.

| Year and Location | Total Sediment Deposition (tons) | Average sand (percent) | Total Sand Deposition (tons) |
|---------------------------|---|-------------------------------|-------------------------------------|
| 1990 - Upper | 11,000,000 | 80 | 8,800,000 |
| 1990 - Middle | 64,000,000 | 39 | 24,000,000 |
| 1990 - Lower | 80,500,000 | 5 | 4,000,000 |
| 1996 - Upper | 11,200,000 | 82 | 9,200,000 |
| 1996 - Middle | 62,000,000 | 42 | 26,000,000 |
| 1996 - Lower | 89,800,000 | 8 | 7,200,000 |
| 2000 - Upper | 11,500,000 | 83 | 9,500,000 |
| 2000 - Middle | 63,000,000 | 43 | 26,000,000 |
| 2000 - Lower | 103,000,000 | 15 | 15,500,000 |
| 2012 – Upper (predicted) | 11,500,000 | 84 | 9,660,000 |
| 2012 – Middle (predicted) | 64,000,000 | 45 | 27,500,000 |
| 2012 – Lower (predicted) | 108,000,000 | 20 | 21,600,000 |

References

- Cerco, C.F. 2012, Data assembly for application of the CBEMP in the Lower Susquehanna River Watershed Assessment: Vicksburg, Miss., U.S. Army Engineer Research and Development Center, 31 p.
- Edwards, R. E., 2006, Comprehensive analysis of the sediments retained behind hydroelectric dams of the Lower Susquehanna River: Susquehanna River Basin Commission Pub. 239. (Also available at http://www.srbc.net/pubinfo/techdocs/Publication_239/ExecutiveSummary.pdf.)
- Hainly, R.A., Reed, L.A., Flippo, H.N., Jr., and Barton, G.J., 1995, Deposition and simulation of sediment transport in the Lower Susquehanna River reservoir system: U.S. Geological Survey Water-Resources Investigations Report 95-4122, 39 p.
- Langland, M.J., and Hainly, R.A., 1997, Changes in bottom-surface elevations in three reservoirs on the Lower Susquehanna River, Pennsylvania and Maryland, following the January 1996 flood—Implications for nutrient and sediment loads to the Chesapeake Bay: U.S. Geological Survey Water-Resources Investigation Report 97-4138, 34 p.
- Langland, Michael J., 2009, Bathymetry and sediment-storage capacity change in three reservoirs on the Lower Susquehanna River, 1996-2008: U.S. Geological Survey Scientific Investigations Report 2009-5110, 21 p. (Also available at <http://pubs.usgs.gov/sir/2009/5110/>.)