Oral Presentation

Effect of Hydropower Peaking and Floodplain Drainage on Instream Dissolved Oxygen in the Roanoke River, North Carolina

Presenter: Loren Wehmeyer, Hydrologist, U.S. Geological Survey, llwehmey@usgs.gov

Co-author(s): Jerad D. Bales U.S. Geological Survey, Office of the Chief Scientist for Hydrology; jdbales@usgs.gov

Understanding the relation between dam release characteristics, floodplain drainage and instream dissolved oxygen in coastal areas is important for natural resource management and ecosystem protection. Data collected between 1998 and 2001 at 1 streamflow measurement site, 13 floodplain water-level sites, and 5 continuous water-quality monitoring sites, and data collected from 1998-2005 at 4 raingages, 4 water quality monitoring sites and 1 streamflow-measurement site in the Roanoke River between Roanoke Rapids Dam (river mile 129) and the Highway 45 bridge near Westover, North Carolina (river mile 1.6), were used to identify statistical relations and discernable quantitative or qualitative patterns among hydropower peaking, streamflow, floodplain water levels, and instream dissolved oxygen.

Some key findings from this study are listed below.

- In general, the daily range in flows was either fairly small (less than 2,000 cubic feet per second 40 percent of the time), or fairly large for hydropower peaking (15,000-19,000 cubic feet per second 40 percent of the time).
- Dissolved-oxygen concentrations commonly decrease with increasing distance downstream from Roanoke Rapids Dam. The median hourly dissolved-oxygen concentration change (adjusted for timing so the same pulse of water is theoretically measured) between Oak City and Jamesville was -0.5 to -1.0 milligrams/liter across a wide range of flow conditions.
- Many occurrences of median daily dissolved-oxygen concentrations less than 5 milligrams per liter were associated with floodplain drainage.
- All of the occurrences of median daily dissolved-oxygen concentrations less than 5 milligrams/liter occurred during the months May – November, with the greatest number of occurrences during June when summer hydropower peaking begins.
- Statistically significant decreases of instream dissolved oxygen were associated with large storm events causing floodplain inundation and subsequent drainage.
- A consistent relation between instream dissolved oxygen and dam peaking operations was not evident based on the available data.