

## **The Shenandoah and the Chesapeake Bay**

The waters of the Shenandoah river have flowed through some of the oldest and most important events in the history of the United States. The first evidence of inhabited structures in North America has been unearthed along the North and South Forks of the Shenandoah near Front Royal, Virginia. This national historic landmark dates to 9300 B.C. and was the home of Paleo-Indians who used the site until about 6800 B.C. Around 900 A.D., the Shenandoah saw the beginnings of farming by Native Americans.

European settlers, beginning with John Lederer, a German doctor, first explored the valley west of the Blue Ridge in 1669. Lederer crested the Blue Ridge near what is now Swift Run Gap in Madison County, Virginia on March 14, 1669. Lederer left thorough notes of his journeys including descriptions of terrain, wildlife and a wide variety of indian tribes and customs. Some of those tribes included: Iroquois, Shawnee, Algonquins, Monocans, Catawbas and Piscataway. Ultimately, much of this land fell under British ownership. Prior to the Revolutionary War, a young George Washington surveyed parts of the Shenandoah valley for Lord Thomas Fairfax, an Englishman who had inherited much of northern and western Virginia.

General Thomas "Stonewall" Jackson, a fellow Virginia son and a Shenandoah valley native, won fame and admiration during the Civil War defending the Valley for the Confederates. "Stonewall" Jackson is credited as being largely responsible for the protection of this important breadbasket of the Confederate army in the early part of the war.

### **THE WATERSHED**

Flowing northward, west of the Blue Ridge, the Shenandoah river proper begins at Front Royal, Virginia at the confluence of the North Fork Shenandoah and the South Fork Shenandoah. About 60 miles downstream, the Shenandoah empties into the Potomac river at Harpers Ferry, West Virginia. The North Fork Shenandoah begins in New Market, Virginia while the South Fork originates at Port Republic, Virginia at the confluence of the North, Middle and South rivers.

With a 3,000 square mile drainage area--almost two million acres--the Shenandoah watershed drains a large portion of Virginia west of the Blue Ridge. The Shenandoah watershed's recreational resources, large agriculture industry, dense animal population, and industrial sites create a setting that requires careful management and a watchful eye to protect the health of the Shenandoah and the Chesapeake Bay.

### **RECREATION**

This massive watershed is also blessed with an abundance of natural springs and streams and, as a result, 223 river miles of the Shenandoah and its tributaries are designated trout-fishing waters. Hundreds of fishermen are drawn each year for the reward of native and hatchery-raised trout. Another water activity for which the Shenandoah is popular is whitewater rafting. A 1992 study found that between June 13 and September 7 of that year, 11,072 people swam or floated down the River on rafts, innertubes, canoes or kayaks.

In recent years however, during the hot, dry summer season, the Shenandoah and

its tributaries have experienced periods of low water flow--so low that fish populations and recreational use were affected. The most severe declines in water level occur on the North Fork Shenandoah where there is basically no water flow during the month of August. These periods of low water flow have sparked efforts to have Clarke, Warren, Shenandoah and Page counties designated as Surface Water Management Areas. This designation would require permits for large water withdrawals and approved conservation plans for all future water users. Concerned parties continue to document low flow periods and their impacts.

Even recreational use has a toll on the environment however. With ever-increasing numbers of visitors each year, the Shenandoah basin must absorb recreational impacts as well as those of year-round residents and industries. Increasing recreational use in fact has prompted the West Virginia Department of Natural Resources to begin a study to determine the impact of recreation on the River's health.

## **AGRICULTURE AND THE SHENANDOAH**

Throughout the Shenandoah watershed, an extensive and varied agriculture industry thrives. Corn, hay and orchards dominate the cropland while densely populated livestock operations including poultry, dairy, beef and swine, utilize untilled land. Several counties in the Shenandoah valley are the top agriculture producing counties in Virginia. Unfortunately, roughly 60 percent of the nitrogen and 68 percent of the phosphorous entering the Shenandoah river are linked to cropland agriculture. Farms still account for as much as 37 percent of land adjacent to the River despite the region's growing population and close proximity to urban centers. Compared to other regions of the state, the 1993 Virginia Nonpoint Source Pollution Watershed Assessment Report found that the Shenandoah valley ranks among the state's highest for pollution potential from agricultural land. The application of natural and commercial fertilizer and sludge to agricultural lands is identified as the major cause.

Fertilizer application of all types has increased in recent years and agriculture-intensive areas such as the Shenandoah valley are seeing the results of over-fertilization. In fact, available nutrients per acre from animal waste exceeded per-acre requirements for normal crop growth by as much as three times. The same report found that the number one priority in Virginia for nutrient loading from animal waste was the North Fork subbasin of the Shenandoah watershed. The North Fork Shenandoah region is home to many large scale poultry, dairy and beef operations. The effects of high levels of nutrients in the North Fork are compounded by its propensity toward low water levels during the summer season. During this time, agriculture is at its peak and without a reduction in runoff, nutrient concentrations rise.

## **SOME SOLUTIONS**

The chicken, broiler and turkey farms of the Shenandoah valley are an important part of the poultry industry. In all, there are more than 800 poultry producers in the Shenandoah valley and over half of them are in Rockingham county alone. Several counties in the Shenandoah watershed have taken steps to curb the impact of poultry litter on the Shenandoah river. Some have developed restrictive regulations for poultry litter and manure handling. These regulations may involve approved litter storage facilities that are impermeable to groundwater and protected from the

weather, and approved nutrient management plans on file with the county.

Various agriculture and natural resource arms of the Federal and state government are conducting special programs in the Shenandoah watershed in an attempt to alleviate stress on the Shenandoah's water quality. Most of these projects focus on the North river which feeds into the South Fork Shenandoah. The North river drains primarily western and southern Rockingham county, areas that are heavily agricultural with over a dozen large poultry and dairy operations. Due to the severity of the erosion and nutrient loading, Virginia has designated the North river as the number one priority for water quality improvement. In addition, the North river may be the first in Virginia to be chosen as a Surface Water Management Area. Other ongoing efforts include: land use surveys, composting demonstrations, groundwater sampling and mapping, and incentive payments for installation of Best Management Practices.

Best Management Practices, or BMPs, include a variety of techniques for protecting and enhancing soil quality by preventing the erosion of nutrients and soil particles. Some examples include: conservation tillage, strip-cropping, permanent vegetative cover, streambank protection and animal waste facilities. These and other BMPs are being implemented by farmers throughout the Shenandoah valley. The most effective BMP for reducing soil runoff and nitrogen and phosphorous erosion is strip-cropping. In the Shenandoah valley, 1,282 acres are known to be strip-cropped through state cost-share programs, while many more are likely to be through voluntary efforts and as a result of the Food Securities Act. Those acres known to be strip-cropped have prevented 24,841 tons of soil, 135,133 pounds of nitrogen, and 27,363 pounds of phosphorous from eroding between 1986 and 1992. Overall, strip-cropping represents nearly half of the soil, nitrogen and phosphorous protected in the Shenandoah valley by BMPs. State cost-share programs paid for over one third of the implementation costs.

In 1992, the governors of Virginia, Maryland, Pennsylvania, the mayor of the District of Columbia and the Director of the EPA signed amendments to the historic 1987 Chesapeake Bay Agreement. These amendments refocused attention not on the Bay's main stem, but upstream on the tributaries. Virginia, along with the other states, was divided into tributary basins in order to address nutrient loading at the source. These "Tributary Strategies" are developed by state and local government officials before being made available for public review and input.

## **INDUSTRY AND THE SHENANDOAH**

Agriculture is not the only pollutant source however. Today, the Valley is home to more than 1.5 million people--over a quarter of Virginia's total population. People are moving to rural areas, as well as urban centers such as Harrisonburg, Winchester and Front Royal, and estimates are that a 20 percent increase in population is expected over the next 30 years. Such an influx will undoubtedly increase demands on the River. Already Harrisonburg is among the top five percent of urban areas as a priority for urban pollution. Further the Shenandoah valley is home to a variety of industries which are potential sources of point source pollution. These point sources can have a great effect on the water quality of the Shenandoah.

Findings of elevated levels of polychlorinated biphenyls (PCBs) in the Shenandoah have been linked to the Avtex Corporation, a rayon manufacturing company. Avtex was found to have illegally discharged 1.5 million gallons of PCBs into the River two

miles south of Front Royal, Virginia. Avtex was closed in 1989 by order of the Environmental Protection Agency (EPA) and the Virginia State Water Control Board. Cleanup efforts are ongoing. The effects on the River were extensive and quite harmful. High levels of PCBs were found in fish and sediment samples at several water monitoring stations resulting in fish consumption advisories. The Virginia Department of Health advises that from the state route 619 bridge on the South Fork and from Passage Creek on the North Fork downstream to their confluence at Front Royal and then on to the West Virginia state line, no fish should be consumed from the Shenandoah due to contamination by PCBs.

E.I. DuPont de Nemours and Co. was found to have released mercury in the South Fork Shenandoah between 1929 and 1950. Similar contamination effects were discovered and fish consumption advisories are also in place as a result of this pollutant. The Virginia Department of Health advises that on the South Fork from Waynesboro to the Page/Warren county line, adults should consume no more than one half-pound serving of fish per week and that small children and pregnant women should consume no fish as a result of mercury contamination.

The single largest point source contributor of nitrogen in 1985 was the Avtex plant which poured about 515,000 pounds of nitrogen into the Shenandoah each year. With the closing of Avtex in 1989, a major source of nitrogen loading was eliminated. Other significant reductions in nitrogen occurred as a result of the opening of the Opequon treatment facility which, although it replaced two older facilities, provides a higher degree of water treatment. Also both the DuPont and Merck corporations reduced their nitrogen output by about 60 and 50 percent respectively. For phosphorous, a significant amount of the reduction in loading is as a result of the phosphorous ban which forced all municipal water treatment plants to remove much more phosphorous from water than they had previously. Watershed models of point source nutrient loading estimate that in 1985, 2.114 million pounds of nitrogen and 568,000 pounds of phosphorous per year. By 1991 those levels had fallen to 1.772 million pounds of nitrogen and 352,000 pounds of phosphorous.