potomac conservancy

State of the Nation's River
POTOMAC WATERSHED 2007

Watershed Stressed from Poor Land Use, Rates a D+

Development, when not done in a sustainable fashion, causes many of the ills that face the Potomac watershed today: loss of forest and tree cover, increased paved surfaces, and replacement of traditional family farms by industrial agriculture. *The destruction of streamside and in-stream habitats and the fragmentation of our remaining wooded landscapes lead the list of consequences of unchecked development in the watershed.*

The landscapes and waters of the Potomac watershed are the foundation of much of the region's beauty and quality of life. This report provides an overview and assessment of the condition of the nation's river and offers solutions on how to meet the needs of our populace while maintaining vigorous and healthy lands and waters.

Although this report draws from the past, it charts a course toward a future where the river is fishable and swimmable 365 days per year. At this point, we are not close to that goal. Having a river that can be safe for human contact and that provides a home for healthy fish that are safe to consume will be achieved through action on land that supports and sustains healthy waters. Taking the actions outlined in this report will help guide us toward that goal.

Our Growing Challenge

A growing population stresses and alters the natural state of its land. In the last three decades, many areas in the watershed have seen their population more than double. Currently, much of the watershed is forested (55% in 2001), with agriculture occupying the second largest area (28%), and developed areas the third largest (9.7%). However, the amount of developed land in the watershed has doubled since 1970, with related losses of agricultural and forested land.

By far, the most densely populated area is the Middle Potomac, including Washington, DC, which is home to 3.72 million (or ~70%) of the watershed's population. Fast-growing or rapidly urbanizing areas include the sub-watersheds of the Monocacy and Lower Potomac (*see chart below*). Development in fast-growing sub-watersheds, particularly the City of Frederick, Maryland, and in Prince William, Virginia, and Charles County, Maryland, has a major impact on water quality.

And there is no end in sight. In the next 20 years, the population of the Potomac watershed is expected to grow 10% each decade, adding 1 million inhabitants to reach a population of 6.25 million.

The Watershed

Winding its way from its origins at Fairfax Stone, West Virginia, the Potomac River travels through varied landscapes until it reaches the Chesapeake Bay at Point Lookout, Maryland. The land plays an important role in watershed and river system health, and the physical, chemical, and biological viability of the river system. For more information on the watershed, go to www.potomac.org.

Geological Regions: Appalachian Plateau, Ridge & Valley, Blue Ridge, Piedmont, Coastal Plain

River Miles Main Stem: 383; Main stem plus major tributaries: 12,878

Major Tributaries: North Branch, Savage, South Branch, Cacapon, Shenandoah, Antietam Creek, Monocacy

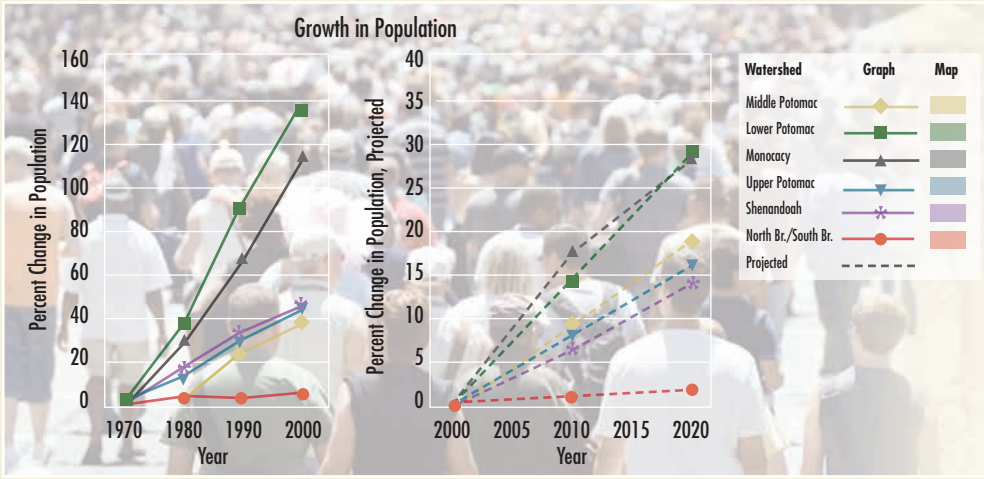
Major Sub-watersheds: North/South Branch, Monocacy, Shenandoah, Upper, Middle and Lower Potomac

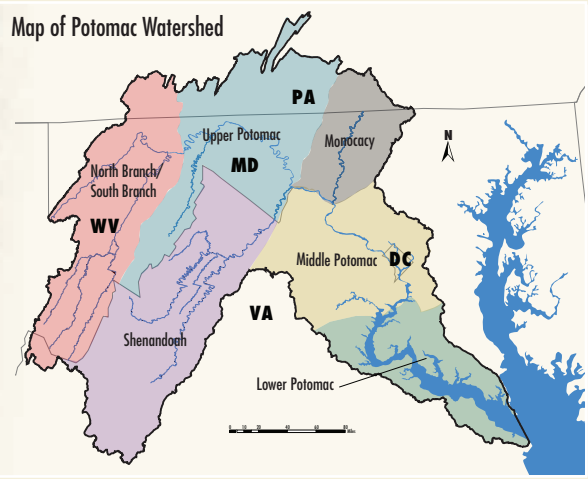
Water Use: 488 million gallons per day (ICPRB, 2000). The Potomac River supplies almost 90% of the drinking water to the DC metro area.

Land Mass: 14,670 square miles

Land Use: 55% forested, 28% agriculture, 5% water and wetlands, 9.7% developed, 3% other

Population: 5.24 million in watershed; 357 persons per square mile





Source: Chesapeake Bay Program

Masthead and watershed photos: Ed Neville

Key to this Report

Trend

▲ Increasing

◀▶ No significant change

▼ Decreasing

Impact/Effect

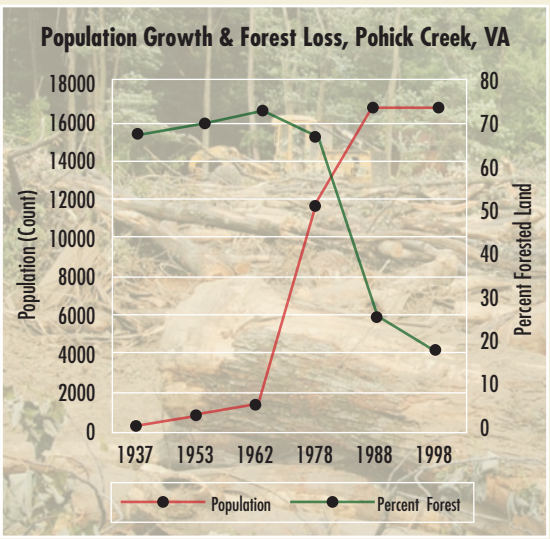
Positive

Neutral

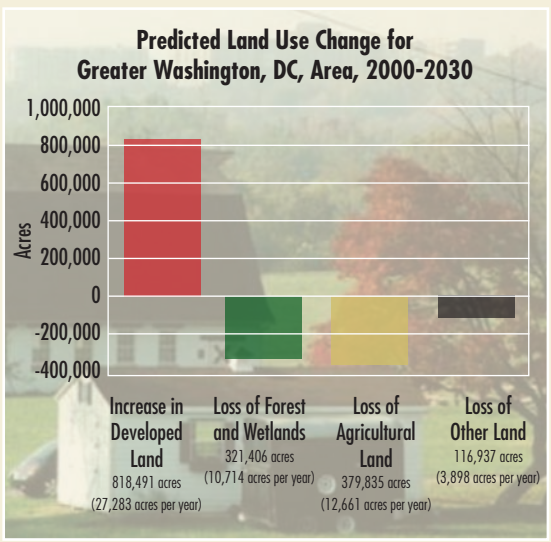
Negative

Land Use

Problems on land eventually translate into problems in the river. Whether it is soil from construction sites, farm runoff carrying pesticides and nutrients, or rainwater running off steaming asphalt parking lots, our rivers face numerous challenges.



Source: Mid-Atlantic Regional Earth Sciences Applications Center, College Park, MD



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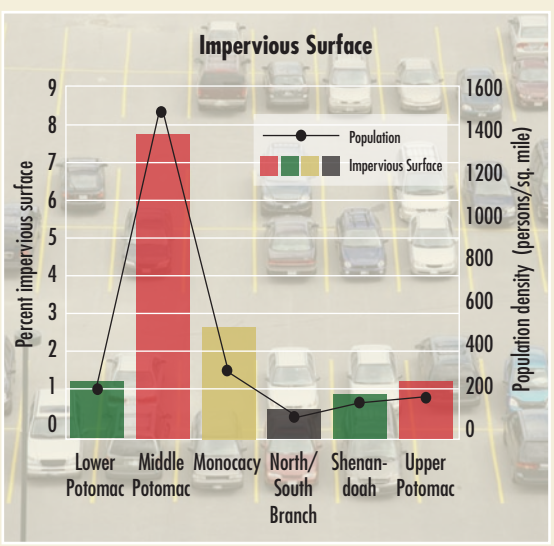


Source: Chesapeake Bay Program

Forest Cover Decreases

Tree canopy is important to the health of the watershed, and is particularly vulnerable to the stresses of development. Sadly, the Potomac watershed is losing forests as they are converted to urban uses. An example of how population growth fuels forest loss is shown in the Pohick Creek watershed in Fairfax County, Virginia (*top*). Fairfax County, Virginia, lost almost 26% of its forest area between 1986 and 1999. If current trends continue between 2000 and 2030, models predict that developed land in the greater Washington, DC, area will increase by 80%, while farm, forest, and wetlands will decline 17.5% (*middle*).

Riparian—or streamside—buffers promote bank stability, control water temperature, and limit the entrance of sediment, pollutants, and nutrients into streams. *From 1990 to 1997, developing suburban Maryland counties experienced the greatest loss of forest in the buffer zone, greater than that in either urban or rural counties. This pattern is particularly disturbing because forest buffers are so difficult to reclaim, once lost.*

Paved Surfaces Increase

As the Potomac watershed develops, its land area is converted to paved, or impervious surfaces like roads and rooftops. These hard surfaces prevent rain from soaking into the ground and instead deliver the water at increased velocity and temperature, along with accumulated pollutants, into nearby streams. Impervious areas also affect stream habitats by decreasing natural infiltration, changing natural hydrology, and increasing erosion rates within stream channels, which smothers aquatic life. As shown in a recent study in Montgomery County, Maryland, the more impervious surface, the poorer the health of stream life; and the more tree cover, the better the health of stream life.

Percent impervious area and population density are highly correlated, with the Middle Potomac sub-watershed containing both the greatest percent impervious area and the greatest population density (*bottom*). According to the Council of Governments, impervious cover in the Washington, DC, area grew from 12.2% to 17.8% from 1986 to 2000. Consider that it took more than 200 years to cover the forests and fields with the 12.2%, and in 14 years we have watched percentage of impervious surface increase by almost 50%.

For every 8% increase in population, a wasteful 41% increase in impervious surface is generated. *Although we cannot do much to control the increase in population in the coming years, we can attempt to minimize the increase in impervious area by developing wisely and efficiently.*

Sewer Overflows Continue

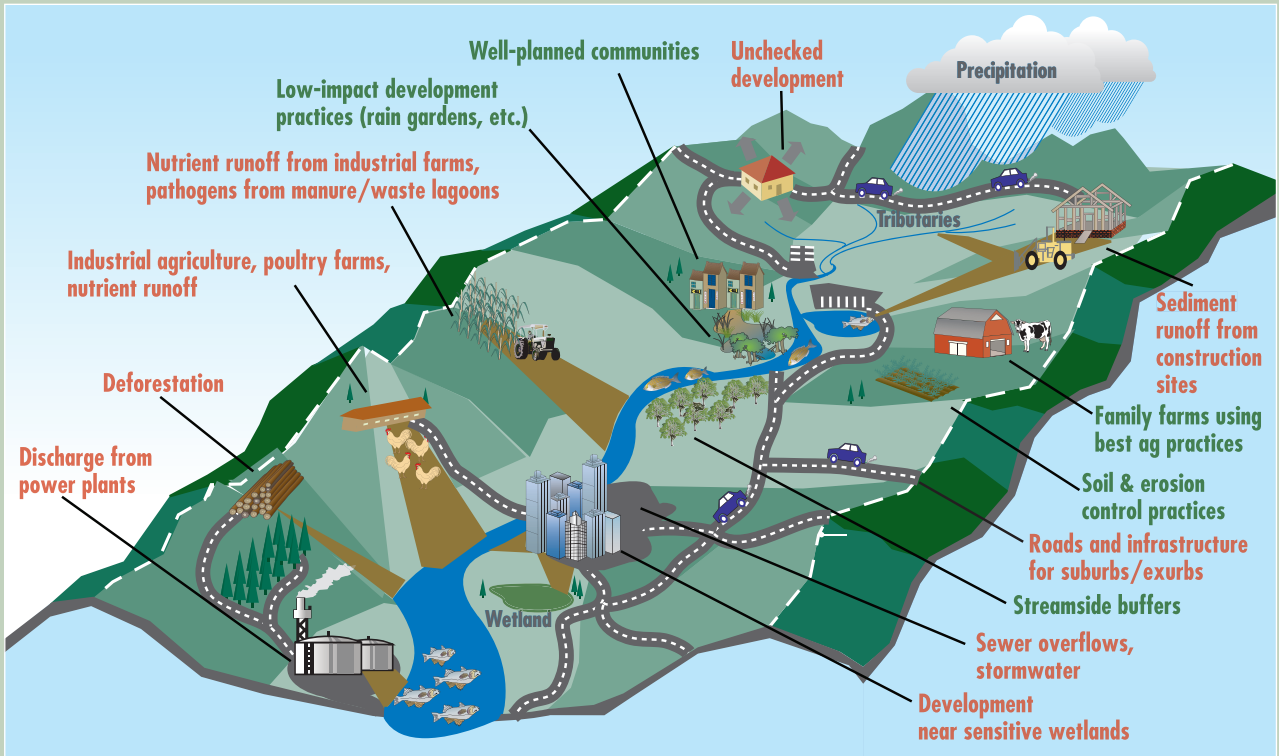
Stormwater is one of the major pollution sources for all of the urban areas in the Potomac watershed. The larger population centers in the Potomac watershed, including Washington, DC, are served by combined sewers—pipes that carry both stormwater runoff and sewage. Although combined sewers function well in dry weather, heavy rains overwhelm the system. When this happens, the excess flow, which is a mixture of stormwater and raw sewage, is discharged to the receiving water body. These discharges can harm human health by increasing bacteria levels, and can damage ecosystem health by lowering dissolved oxygen.

The combined sewer system in Washington, DC—operated by the Water and Sewer Authority—includes 53 combined sewer overflow (CSO) outfalls in the Potomac watershed: 10 of which discharge to the main stem, 15 to the Anacostia River, and 28 to Rock Creek and its tributaries. To reduce CSOs and improve water quality, WASA is developing a long-term control plan that will increase and improve capacity over the next 40 years. If fully implemented and funded, the plan would add storage tunnels to capture overflows, and is predicted to reduce CSOs by 98% in the Anacostia River, and 96% overall.

Low-impact development (LID) techniques such as porous pavement and vegetated rooftops offer effective and cost-efficient treatment of stormwater at its source, in a way that mimics natural hydrological processes. The use of LID techniques in our urban and suburban areas will be required to help address stormwater issues. For more information on LID, go to www.potomac.org.

Watershed Model

This model shows some of the many positive (green) and negative (red) factors that affect water quality in the Potomac and its tributaries.



Source: www.epa.gov/OWOW/win/what.html, adapted from The Source Water Protection Primer (Pollution Probe, 2004. www.pollutionprobe.org/Publications/Primers.htm)

Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols/), University of Maryland Center for Environmental Science.

Urban Stream Syndrome

Middle & Lower Potomac–Washington, DC, area

Stormwater pollution, increased flooding and loss of sensitive species

Many of the streams that flow into the Middle and Lower Potomac display characteristics of "urban stream syndrome." As described by Walsh et al., many urbanizing watersheds "suffer" from increased flash floods; elevated concentrations of nutrients and contaminants; altered stream morphology, including incised channels that cut off vegetation from its water source and sedimentation from eroded streambanks; and reduced diversity, with an influx of more tolerant species to counter the loss of more sensitive species.

Many of the ills of the Potomac watershed can be traced to the consequences of using urban streams as wastewater conduits. The streams are clogged by sediment from poor land development practices and inundated with pollutants carried down from the hard paved surfaces of our streets, roofs, and parking lots. Although a strong forest buffer lessens the effects of runoff, the solution is to use more porous, penetrable surfaces.

Walsh et al, *J. N. Am. Benthol. Soc.*, 2005, 24(3):706–723.

Playing "Chicken" with Rural Water Quality

South Branch, Shenandoah

Nutrient pollution from industrial farming, loss of forest cover, lack of buffer

Production of beef cattle, chickens, and turkeys has increased in the Potomac watershed, with dramatic increases in chicken and turkey farming in the Potomac headwaters in West Virginia and Rockingham County, Virginia. The increase in poultry production translates into an increase in manure, and a corresponding increase in fecal bacteria, phosphorous, and nitrogen. In addition, poultry waste also contains significant quantities of estrogens, testosterone, progesterone, and trace metals.

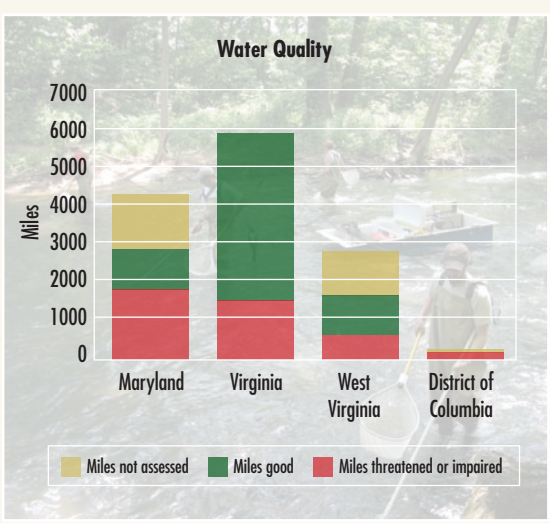
While the Shenandoah Valley dominates agricultural activity in Virginia, the Shenandoah River watershed is lacking in forested buffers compared to other watersheds in the state. The lack of forested buffers allows greater loads of nutrients and other contaminants from farms and developed areas to enter the waterways. Of the "impaired" stream miles in Virginia, 39% are in the Shenandoah Valley. Additionally, the Valley has seen a decrease in forest cover of more than 16,000 acres between 1992 and 2002, ending a 75-year increase in forest cover.

Because agriculture in the Shenandoah Valley extends into the headwaters, and because the region is the worst in Virginia for the percentage of streams having little or no streamside forests, many of the streams in the region rank high for pollution from runoff. Wider use of forest buffers is critical to protecting water quality.

National Water Quality Inventory

The Clean Water Act requires the national water quality inventory. First, each state defines the "designated use" of each stream, river, lake, and estuary within its jurisdiction. Designated uses include aquatic life support, fish consumption, shellfish harvesting, swimming, and provision of drinking water, and a water body may be assigned more than one use. States then develop a different set of water quality standards for each designated use designed to protect that use.

The results of the 2002 National Water Quality Inventory are a useful tool for painting a picture of the overall health of the surface waters in a given state. For example, according to the most recent inventory, in 2002, of the approximately 10,000 stream miles assessed in the watershed, more than 3,800 miles were deemed "threatened" or "impaired."



Source: EPA

Photo: Woody Bousquet

Pollution from Stormwater Exceeds Caps

Sediment. Excessive sediment in our waters can limit the growth of submerged aquatic vegetation (SAV), and affect the populations of all the fish, shellfish, and birds that depend on SAV as a source of food or shelter. The Potomac River delivers the largest amount of sediment to the Chesapeake Bay each year. The good news is that USGS's flow-adjusted calculations suggest that sediment concentrations have decreased in the Potomac between 1985 and 2005.

The Chesapeake Bay Program has set sediment load caps for each of the sub-watersheds of the Bay watershed. The cap for the Potomac watershed is 1494 million tons per year. The load has exceeded this cap in at least 13 of the 25 years between 1981 and 2005.

Overall, the USGS model shows a large reduction in sediment load in the last 20 years, with reductions in agricultural loads more than compensating for the increase in urban loads. The changes in sediment loads mirror changes in land use, with agricultural land uses decreasing by about 350,000 acres, and urban land uses increasing by about 300,000 acres.

Nutrients. Excessive nutrients in the Chesapeake Bay can both limit the growth of SAV (which many other organisms depend on for food and shelter) and cause low oxygen conditions, creating dead zones in the Bay. Of all the major rivers in the Chesapeake Bay watershed, the Potomac also has the highest level of nitrogen, and the third highest level of phosphorus.

Nitrogen. Although the nitrogen load has exceeded its cap (35.78 million pounds per year) in at least 16 of the 25 years between 1981 and 2005, the model shows a large reduction in nitrogen load in the last 20 years. The reductions in point sources and agricultural loads more than compensate for slight increases in urban and septic system loads.

Phosphorus. The phosphorus load has exceeded its cap (3.48 million pounds per year) in at least 10 of the 25 years between 1981 and 2005. There has been a large reduction in phosphorus load in the last 20 years, with reductions in point sources and agricultural loads more than compensating for the increase in the urban load.

Although there have been reductions in nutrient and sediment pollution, these pollutants still exceed their caps and levels are not decreasing enough to significantly improve water quality.

Fish Kills/Intersex Fish

Shenandoah and the South Branch

In the past 5 years, massive fish kills have afflicted two tributaries of the Potomac River: the Shenandoah and the South Branch.

The Shenandoah experienced fish kills every year since 2004. The fish kills tend to begin in March or April of each year, and last for several months. The fish kills primarily affect smallmouth bass, redbreast sunfish, and rock bass. Though the kills appear to occur at low rates, they span so many miles and so many months that they may have a significant effect on the fish population. In 2004, a fish kill in the North Fork killed 80% of smallmouth bass and redbreast sunfish, while in 2005 a fish kill in the South Fork killed 80% of the same species in that river. Anglers have observed a change in the populations of these species. The only good news is that the kills seem to be affecting mostly adult fish and are not having a significant impact on spawning, so that the population has a chance of recovering in future years.

Scientists are still struggling to determine the cause of the recent fish kills—and also the cause of the intersex fish that were discovered during the fish kills. Possible causes include pollution from agriculture and wastewater treatment plants (among other sources), disease, parasites, spawning stress (including increasing water temperatures as a consequence of development), sediment chemistry, and population dynamics.

Watershed Rates a D+, River Health has Reached a Plateau

Hot, polluted runoff from our parking lots, roads, and roofs; soil erosion from construction sites; toxins and pathogens from industrial farms; and untreated, unhealthy stormwater overwhelm and alter the Potomac River system.

The health of the river has reached a plateau, after improvements in the wake of the Clean Water Act. In the ensuing three decades, the growing pains of a burgeoning population have been felt throughout the region because of land conversion and development, and poor land use practices that lead to pollution runoff from agricultural and developed areas.

We grade the river at D+, with notable disturbing trends of loss of forest cover and inefficient increases in paved surfaces amidst improvements in nutrient runoff and CSO prevention. We offer some solutions:

- Protect existing forest land and replant strategic areas, such as buffers and greenways.
- Mandate use of low-impact development (LID) techniques in new and rebuilt construction.
- Require states to fully fund cost-share programs and best practice implementation and hold agricultural interests responsible for mitigating impacts.
- Update the Clean Water Act to respond to new sources of pollution such as phthalates from plastics and endocrine disruptors from personal care and pharmaceutical products.

Legislators must endorse strong legislation; municipalities and governments, particularly at the county level, must actively implement and enforce the solutions.

On a positive note, efforts to reform how communities deal with stormwater have taken hold in the watershed. For example, Montgomery County, Maryland, has a revised "road code" and stronger forest protection measures on the table. Protection of forests and traditional agricultural lands from development are also gaining strength, but still need more support from local elected officials and citizens.

In the past, and even now, we have treated our waterways as waste- and stormwater conduits. Water is not a waste product, but a resource. As individuals and communities who care about the health of our lands and waters, we must urge our elected officials to enact strong stormwater and land use policies that include LID techniques. Water-wise development must be embraced as we enter an age of scarce water resources, increased development, and more stress on our river systems.

The steps we take—or fail to take—today will have a profound impact on the future of the river. We ask you to contact elected officials to learn what they are doing to support LID and other best management practices; learn more about progressive water policies in your region; and urge elected officials to support these policies.

Acknowledgements

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Since 1993, Potomac Conservancy has protected the health, beauty, and enjoyment of the Potomac and its tributaries.

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