

Shenandoah Watershed Context

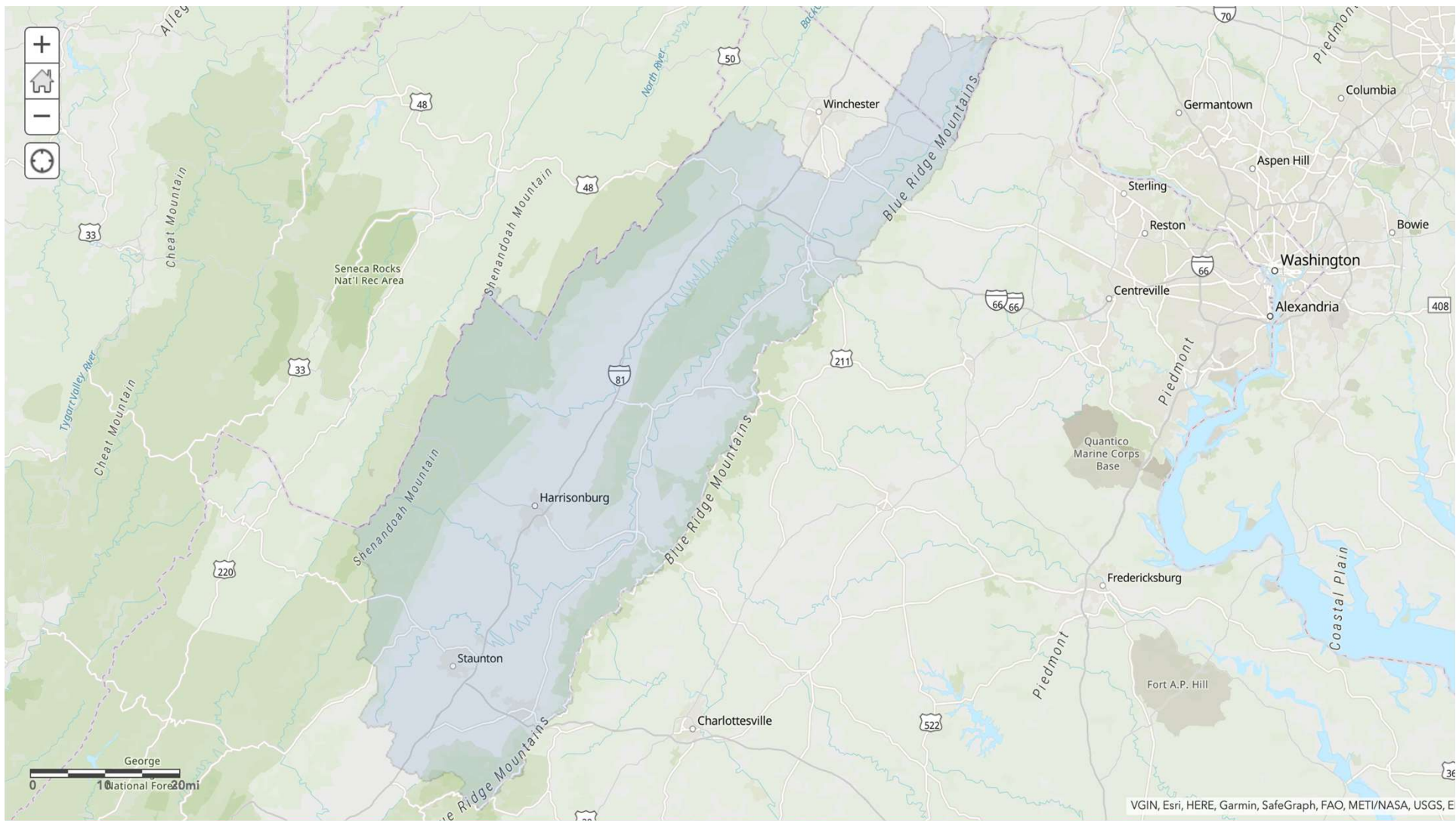
-- Mark Frondorf, Shenandoah Riverkeeper



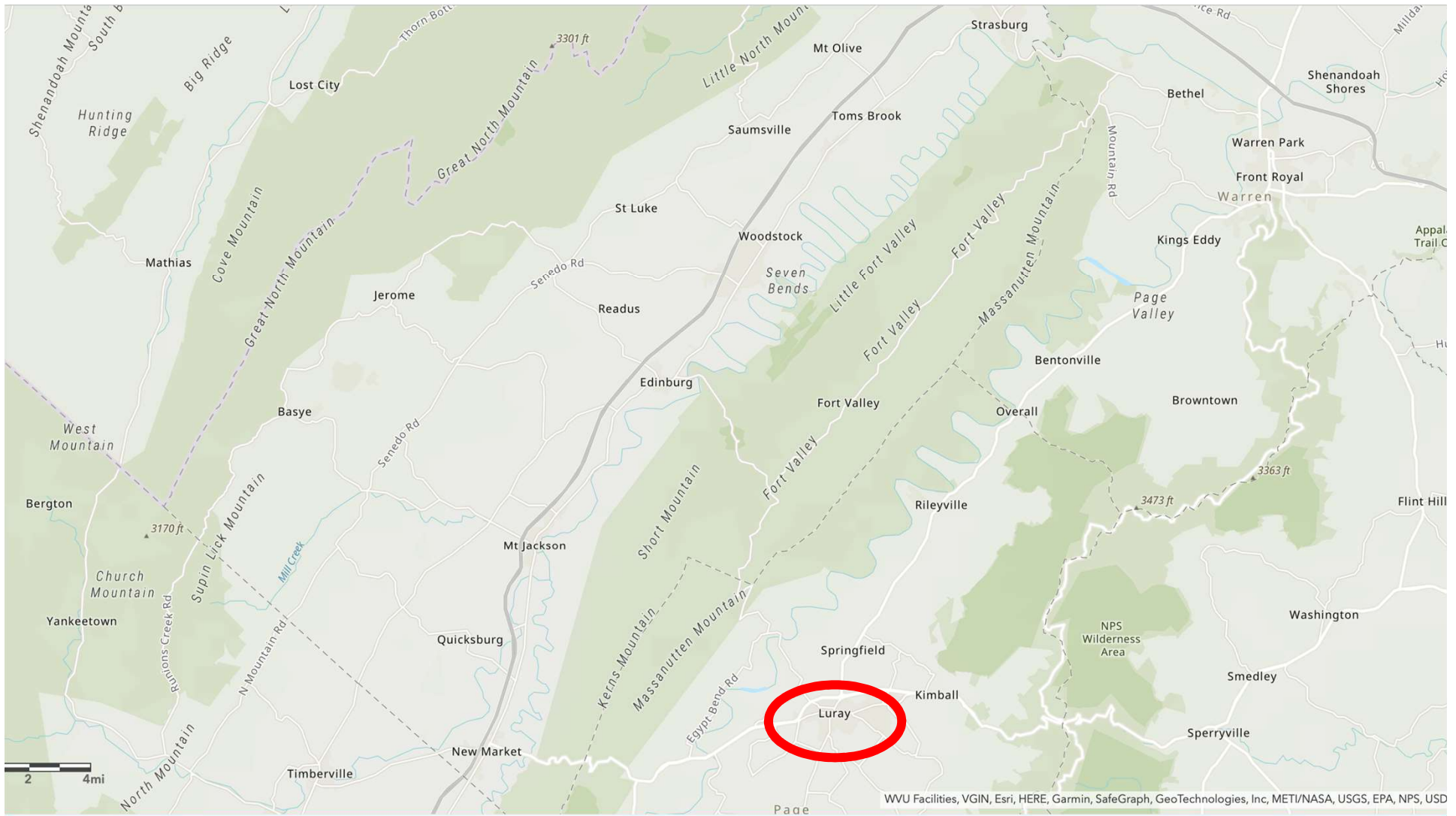
7 December 2022

mark@shenandoahriverkeeper.org

Stopping Pollution and Restoring Clean Water



VGIN, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, E



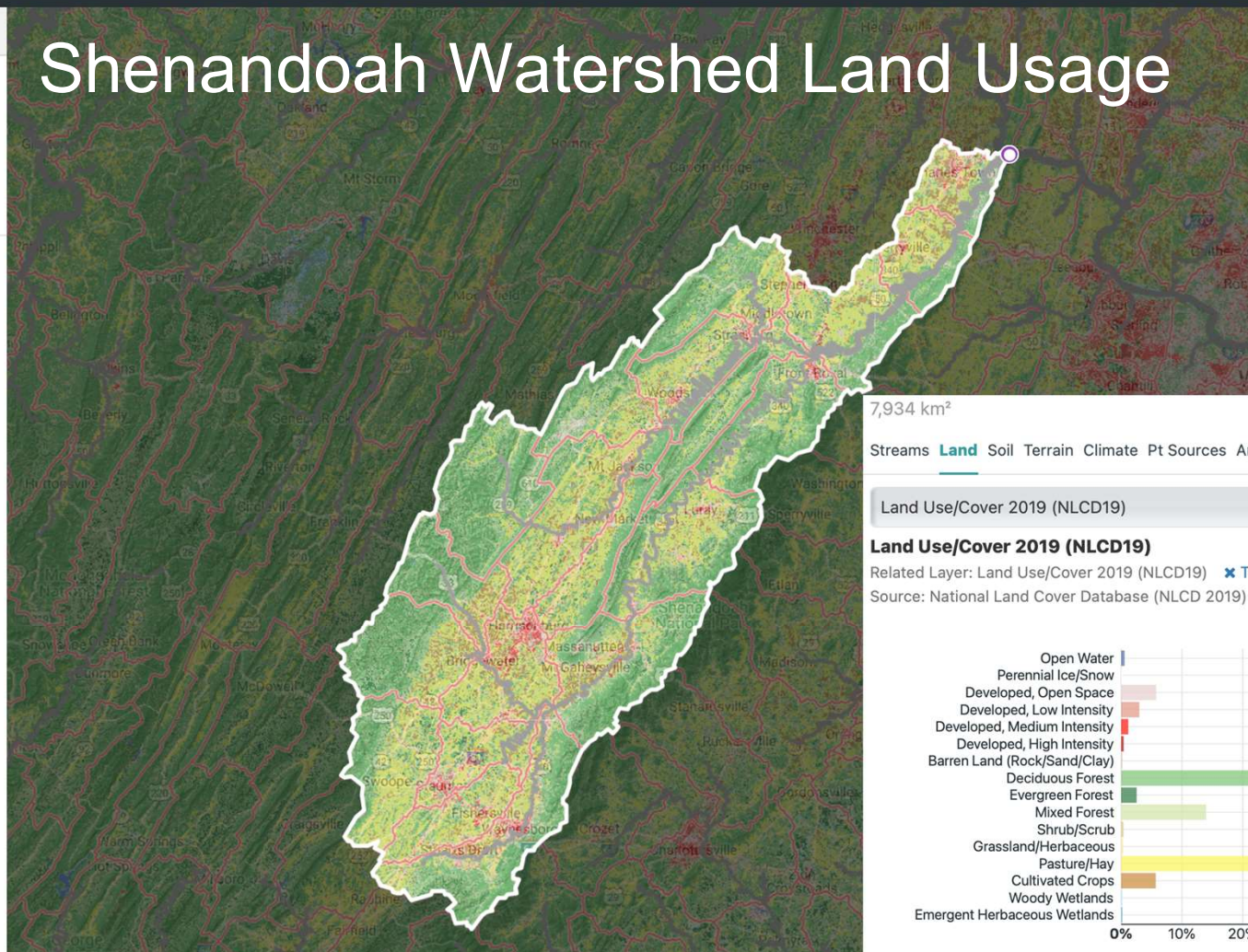
Continental US Medium Resolution

7,934 km²Streams **Land** Soil Terrain Climate Pt Sources Animals

Water Qual

Type	Area (km ²)	Coverage (%)	Active River Area (km ²)
Open Water	43.94	0.56	40.98
Perennial Ice/Snow	0.00	0.00	0.00
Developed, Open Space	454.80	5.76	93.12
Developed, Low Intensity	235.62	2.98	46.07
Developed, Medium Intensity	91.38	1.16	17.07
Developed, High Intensity	32.45	0.41	8.10
Barren Land (Rock/Sand/Clay)	6.82	0.09	1.31
Deciduous Forest	3,033.69	38.40	393.04
Evergreen Forest	200.91	2.54	34.81
Mixed Forest	1,104.45	13.98	166.29
Shrub/Scrub	30.57	0.39	3.46
Grassland/Herbaceous	27.72	0.35	3.78
Pasture/Hay	2,182.03	27.62	411.60
Cultivated Crops	449.43	5.69	87.80
Woody Wetlands	4.08	0.05	3.49
Emergent Herbaceous Wetlands	1.83	0.02	1.56

Shenandoah Watershed Land Usage



Geographic Features of the Watershed



Stopping Pollution and Restoring Clean Water

190 Century Farms in the Shenandoah Valley





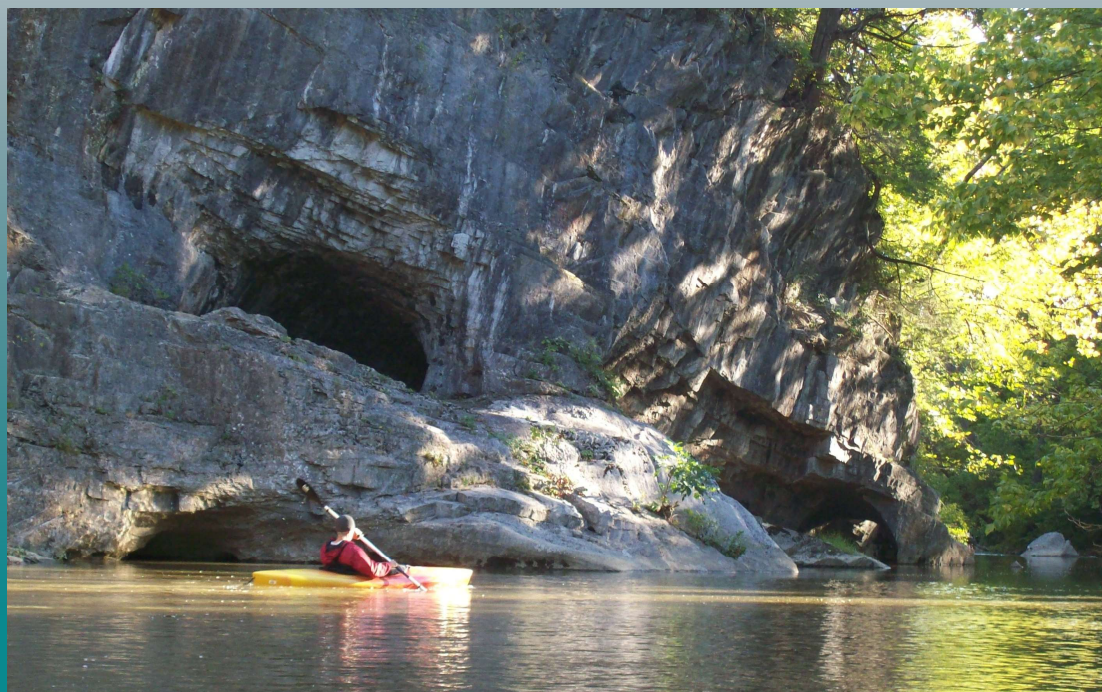
POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER®



WATERKEEPER® ALLIANCE



POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER®

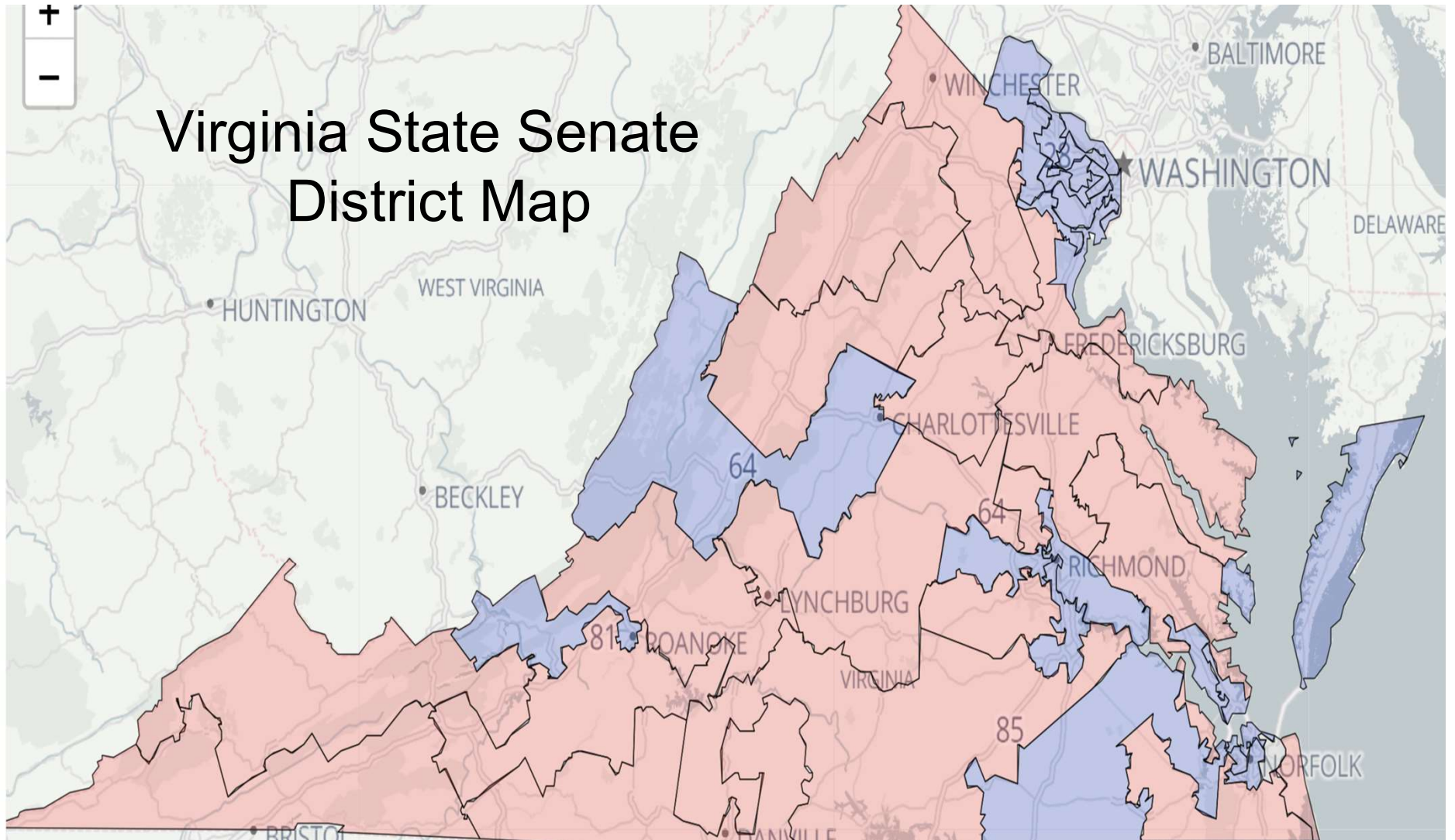


Stopping Pollution and Restoring Clean Water

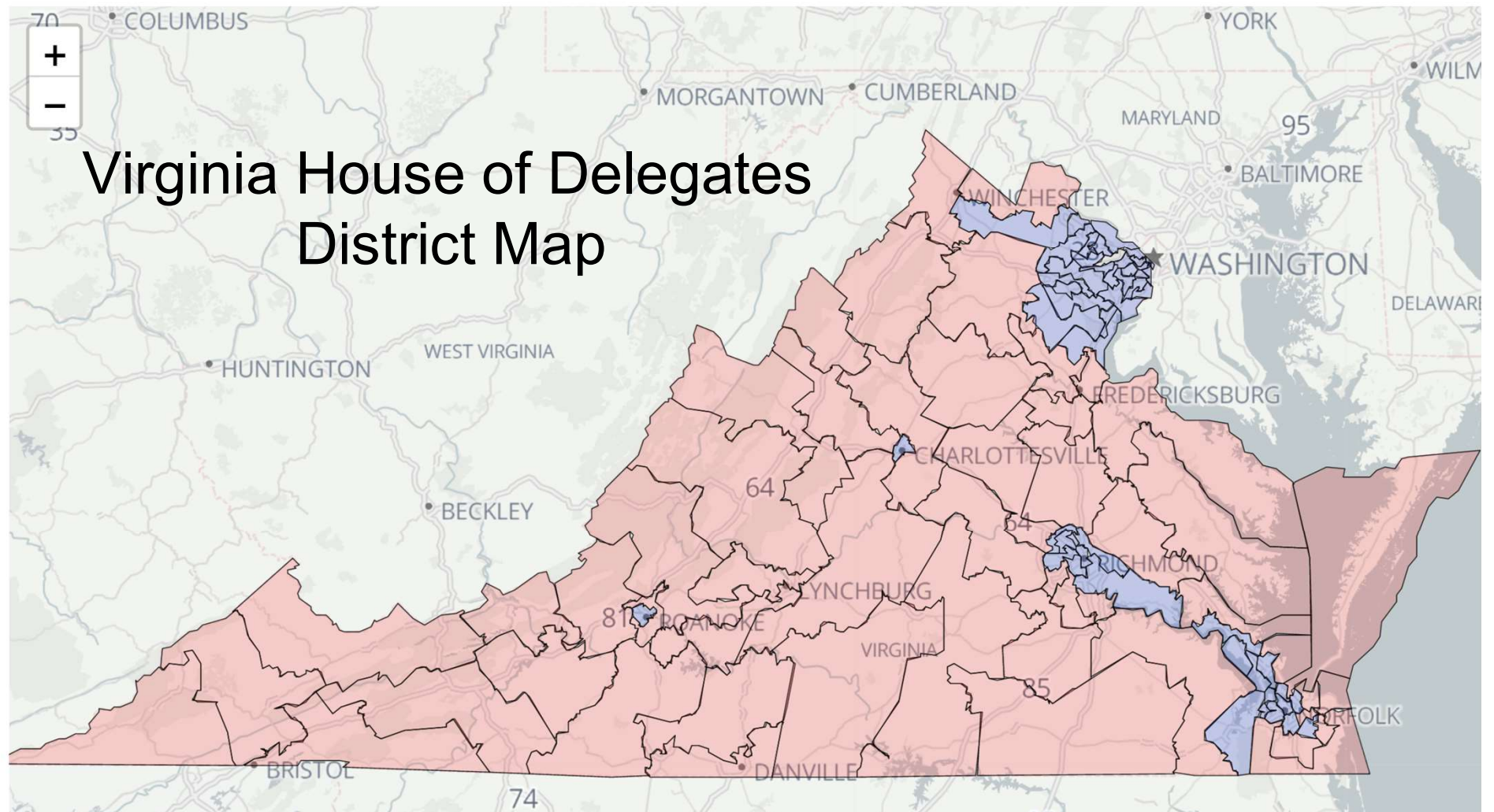


WATERKEEPER® ALLIANCE

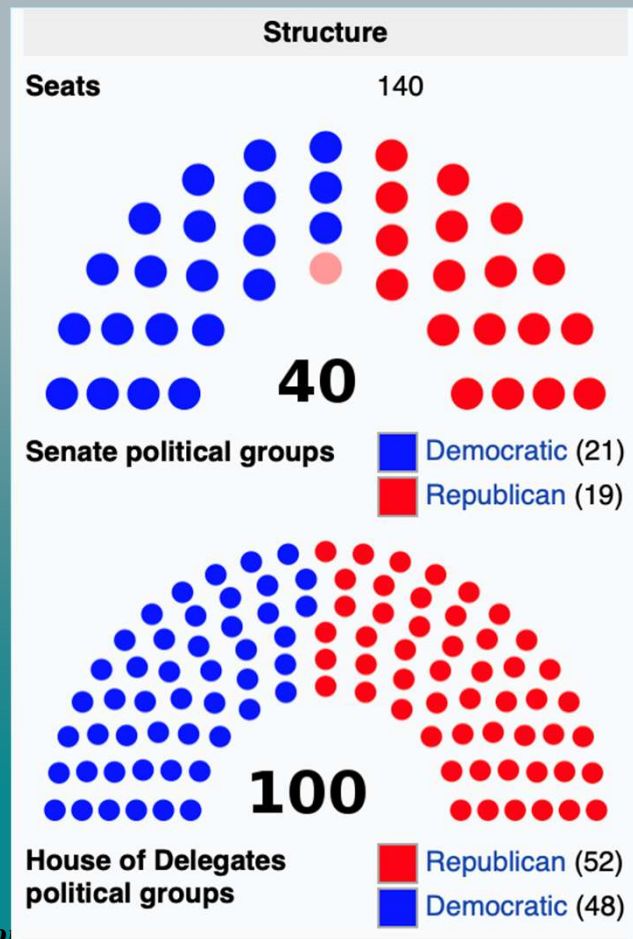
Virginia State Senate District Map



Districts



Virginia General Assembly Breakout



Table

Race and Hispanic Origin	Clarke County, Virginia	Warren County, Virginia	Shenandoah County, Virginia	Page County, Virginia	Rockingham County, Virginia	Augusta County, Virginia
Population Estimates, July 1 2021, (V2021)	14,881	40,925	44,752	23,807	84,394	77,563
PEOPLE						
Race and Hispanic Origin						
White alone, percent	90.6%	89.9%	93.1%	95.3%	93.7%	92.2%
Black or African American alone, percent (a)	4.4%	5.0%	3.0%	2.3%	2.8%	4.9%
American Indian and Alaska Native alone, percent (a)	0.8%	0.6%	0.5%	0.3%	0.6%	0.3%
Asian alone, percent (a)	1.5%	1.4%	1.2%	0.5%	1.1%	0.7%
Native Hawaiian and Other Pacific Islander alone, percent (a)	0.1%	0.1%	0.1%	Z	0.1%	Z
Two or More Races, percent	2.7%	2.9%	2.1%	1.5%	1.7%	1.9%
Hispanic or Latino, percent (b)	7.0%	6.4%	8.1%	2.5%	8.2%	3.7%
White alone, not Hispanic or Latino, percent	84.7%	84.5%	86.2%	93.3%	86.7%	89.3%

Stopping Pollution and Restoring Clean Water



Race and Hispanic Origin ▼

United States x

Rockbridge County, Virginia x

Bath County, Virginia x

Jefferson County, West Virginia x

Frederick County, Virginia x

Population Estimates, July 1 2021, (V2021)

331,893,745

22,641

4,114

58,370

93,717

PEOPLE


Race and Hispanic Origin

White alone, percent	75.8%	93.2%	93.7%	88.1%	89.8%
Black or African American alone, percent (a)	13.6%	3.5%	4.0%	6.5%	5.0%
American Indian and Alaska Native alone, percent (a)	1.3%	0.7%	0.2%	0.4%	0.5%
Asian alone, percent (a)	6.1%	0.8%	0.5%	1.7%	2.1%
Native Hawaiian and Other Pacific Islander alone, percent (a)	0.3%	Z	0.0%	0.1%	0.1%
Two or More Races, percent	2.9%	1.8%	1.6%	3.2%	2.5%
Hispanic or Latino, percent (b)	18.9%	2.2%	2.5%	6.8%	10.6%
White alone, not Hispanic or Latino, percent	59.3%	91.4%	91.6%	82.2%	80.4%

<div>Race and Hispanic Origin</div> <div></div>	<div> <div></div> <div>Rockingham County, Virginia</div> <div></div> </div>	<div> <div></div> <div>Harrisonburg city, Virginia</div> <div></div> </div>
<div> <div></div> <div>Population Estimates, July 1 2021, (V2021)</div> </div>	<div> <div></div> <div>84,394</div> </div>	<div> <div></div> <div>51,430</div> </div>
<div> <div></div> <div>PEOPLE</div> </div>		
<div>Race and Hispanic Origin</div>		
<div> <div></div> <div>White alone, percent</div> </div>	<div> <div></div> <div>93.7%</div> </div>	<div> <div></div> <div>77.2%</div> </div>
<div> <div></div> <div>Black or African American alone, percent (a)</div> </div>	<div> <div></div> <div>2.8%</div> </div>	<div> <div></div> <div>7.8%</div> </div>
<div> <div></div> <div>American Indian and Alaska Native alone, percent (a)</div> </div>	<div> <div></div> <div>0.6%</div> </div>	<div> <div></div> <div>0.1%</div> </div>
<div> <div></div> <div>Asian alone, percent (a)</div> </div>	<div> <div></div> <div>1.1%</div> </div>	<div> <div></div> <div>3.5%</div> </div>
<div> <div></div> <div>Native Hawaiian and Other Pacific Islander alone, percent (a)</div> </div>	<div> <div></div> <div>0.1%</div> </div>	<div> <div></div> <div>0.0%</div> </div>
<div> <div></div> <div>Two or More Races, percent</div> </div>	<div> <div></div> <div>1.7%</div> </div>	<div> <div></div> <div>8.4%</div> </div>
<div> <div></div> <div>Hispanic or Latino, percent (b)</div> </div>	<div> <div></div> <div>8.2%</div> </div>	<div> <div></div> <div>20.0%</div> </div>
<div> <div></div> <div>White alone, not Hispanic or Latino, percent</div> </div>	<div> <div></div> <div>86.7%</div> </div>	<div> <div></div> <div>65.3%</div> </div>

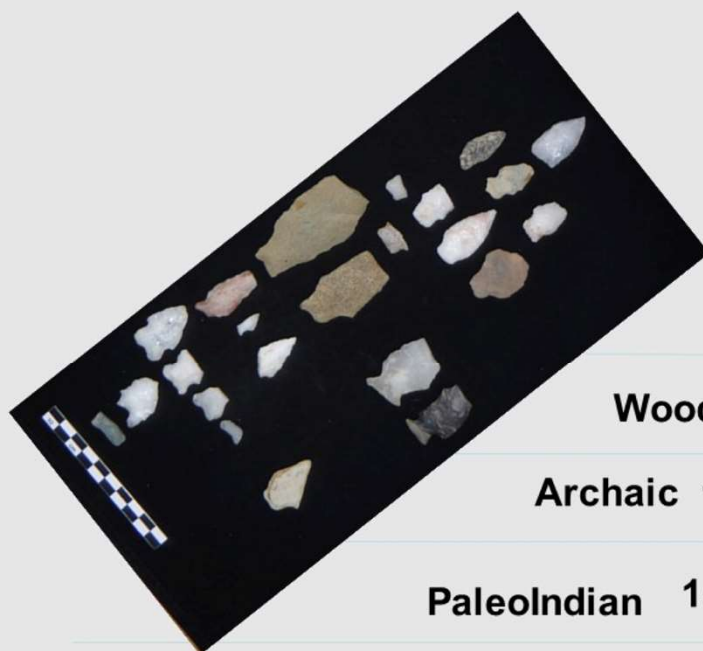
Income & Poverty	Rockingham County, Virginia	Harrisonburg city, Virginia
Population Estimates, July 1 2021, (V2021)	84,394	51,430
PEOPLE		
Income & Poverty		
Median household income (in 2020 dollars), 2016-2020	\$64,496	\$49,117
Per capita income in past 12 months (in 2020 dollars), 2016-2020	\$33,276	\$23,580
Persons in poverty, percent	8.3%	25.5%

<div> <div>Race and Hispanic Origin</div> <div>▲</div> </div>	<div> <div>Q Frederick County, Virginia</div> <div>×</div> </div>	<div> <div>Q Winchester city, Virginia</div> <div>×</div> </div>
<div> <div>i</div> <div>Population Estimates, July 1 2021, (V2021)</div> </div>	<div> <div>⚠</div> <div>93,717</div> </div>	<div> <div>⚠</div> <div>28,136</div> </div>
<div> <div>👤</div> <div>PEOPLE</div> </div>		
Race and Hispanic Origin		
<div> <div>i</div> <div>White alone, percent</div> </div>	<div> <div>⚠</div> <div>89.8%</div> </div>	<div> <div>⚠</div> <div>77.4%</div> </div>
<div> <div>i</div> <div>Black or African American alone, percent (a)</div> </div>	<div> <div>⚠</div> <div>5.0%</div> </div>	<div> <div>⚠</div> <div>10.0%</div> </div>
<div> <div>i</div> <div>American Indian and Alaska Native alone, percent (a)</div> </div>	<div> <div>⚠</div> <div>0.5%</div> </div>	<div> <div>⚠</div> <div>0.2%</div> </div>
<div> <div>i</div> <div>Asian alone, percent (a)</div> </div>	<div> <div>⚠</div> <div>2.1%</div> </div>	<div> <div>⚠</div> <div>2.1%</div> </div>
<div> <div>i</div> <div>Native Hawaiian and Other Pacific Islander alone, percent (a)</div> </div>	<div> <div>⚠</div> <div>0.1%</div> </div>	<div> <div>⚠</div> <div>0.0%</div> </div>
<div> <div>i</div> <div>Two or More Races, percent</div> </div>	<div> <div>⚠</div> <div>2.5%</div> </div>	<div> <div>⚠</div> <div>8.2%</div> </div>
<div> <div>i</div> <div>Hispanic or Latino, percent (b)</div> </div>	<div> <div>⚠</div> <div>10.6%</div> </div>	<div> <div>⚠</div> <div>17.8%</div> </div>
<div> <div>i</div> <div>White alone, not Hispanic or Latino, percent</div> </div>	<div> <div>⚠</div> <div>80.4%</div> </div>	<div> <div>⚠</div> <div>64.0%</div> </div>

Income & Poverty ▲	Q Frederick County, Virginia ✕	Q Winchester city, Virginia ✕
i Population Estimates, July 1 2021, (V2021)	⚠ 93,717	⚠ 28,136
<div>  PEOPLE </div>		
Income & Poverty		
i Median household income (in 2020 dollars), 2016-2020	\$80,011	\$61,102
i Per capita income in past 12 months (in 2020 dollars), 2016-2020	\$38,442	\$31,719
i Persons in poverty, percent	⚠ 7.4%	⚠ 15.3%

Native American Presence in the Shenandoah Valley

Archaeologically-Defined Cultural Periods for Virginia



Historic

Contact 500-300 YBP

Woodland 3,500-500 YBP

Archaic 11,000-3,500 YBP

PaleoIndian 15,000-11,000 YBP

Pre-Clovis 17,000-15,000 YBP (?)

YBP = years before present



POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER®



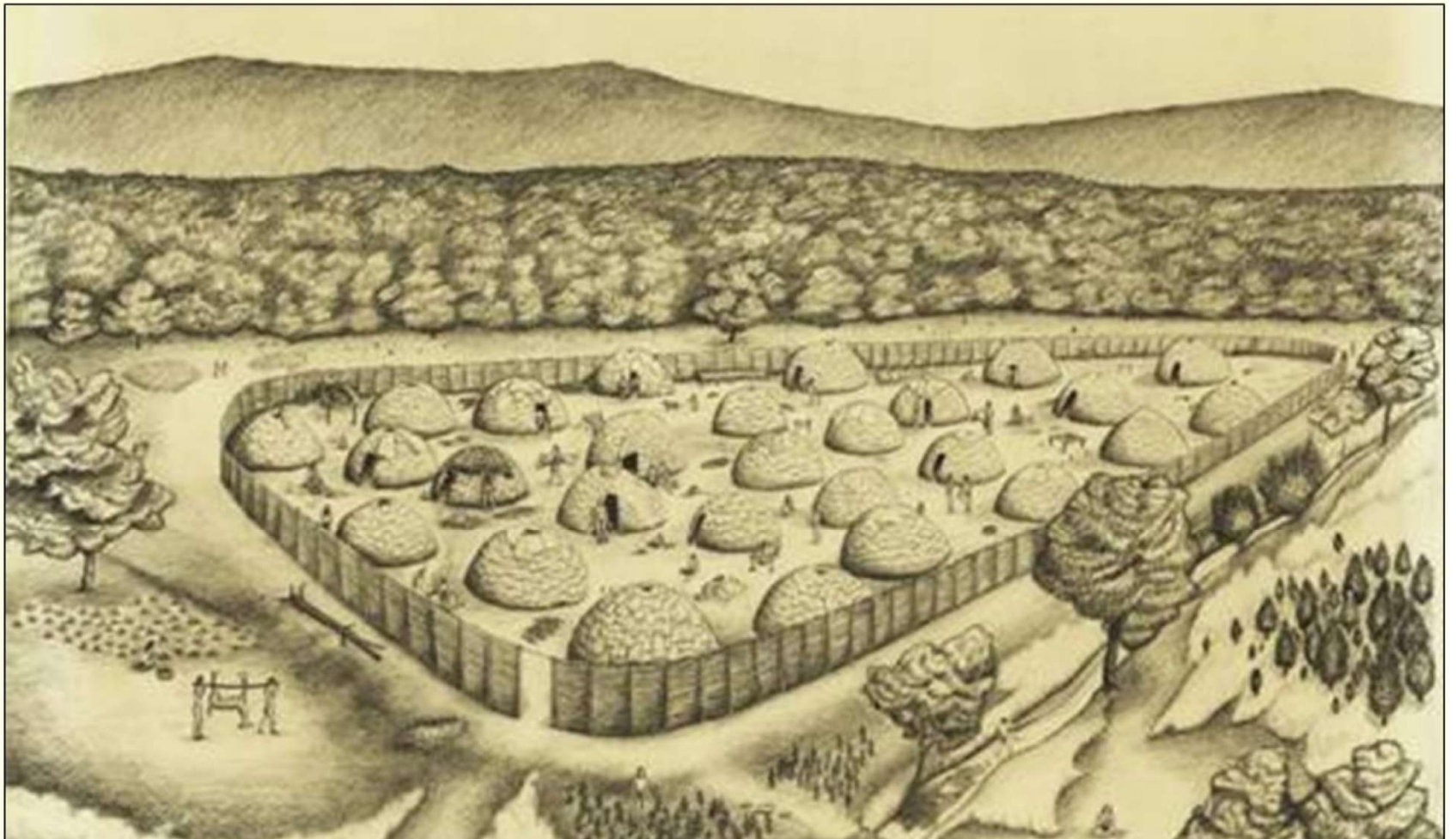
Accretional Burial Mounds

- *found on floodplains near the confluence of streams
- *community cemeteries

Indian Mound, Shumate Farm, 4 miles south of Monterey, VA. “This mound is about 130’ in circumference, is covered with rocks, with a layer of rocks around the outer edge.”



The Keyser Culture, 550-350 Years Ago (A.D. 1450-1650)



What Happened?

- The Impact of the Little Ice Age
- Epidemic Disease: Were Valley Communities Infected through Indirect Contact (trade) decades before Europeans Colonized Western Virginia
- Incursions by Non-Local Warring Tribes and Resulting Displacement
- Colonial Government Took Indigenous Lands and the Small Groups Who Stayed, Married Into or Otherwise Joined European Settlers
- Combination of Events, Plus Movement Based Upon Long-Term Relationships with Groups from Beyond the Valley

Stopping Pollution and Restoring Clean Water



POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER®

11 State Recognized Tribes of Virginia:

Cheroenaka Nottoway
Chickahominy
Eastern Chickahominy
Mattaponi
Monacan
Nansemond
Nottoway
Pamunkey
Patawomeck
Rappahannock
Upper Mattaponi



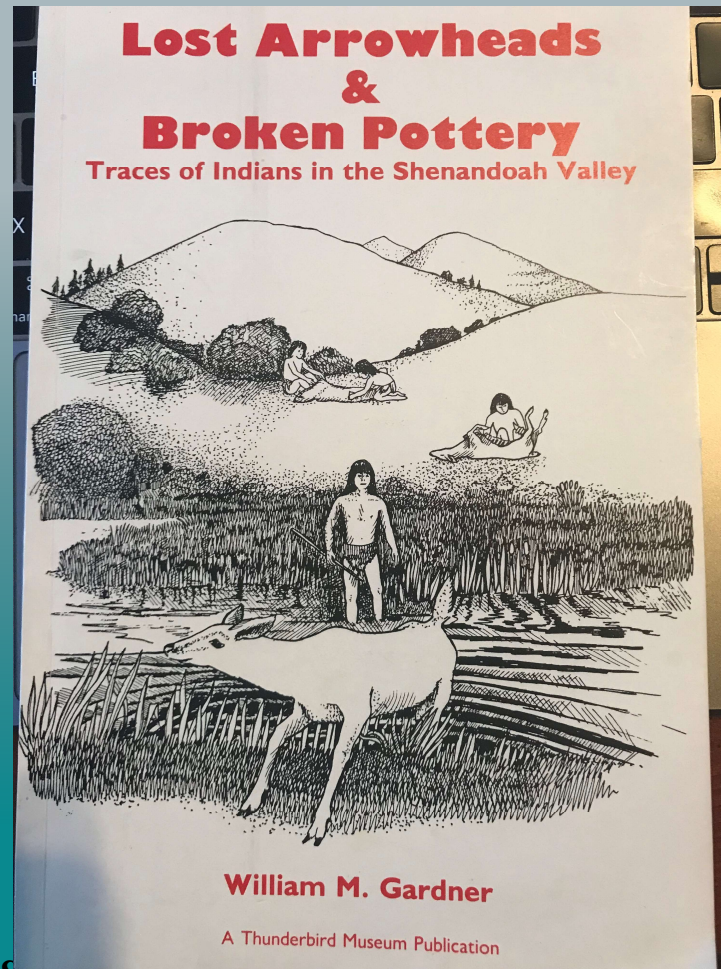
Stopping Pollution and Restoring Clean Water



WATERKEEPER® ALLIANCE



POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER®



Stopping Pollution and Restoring Clean Water



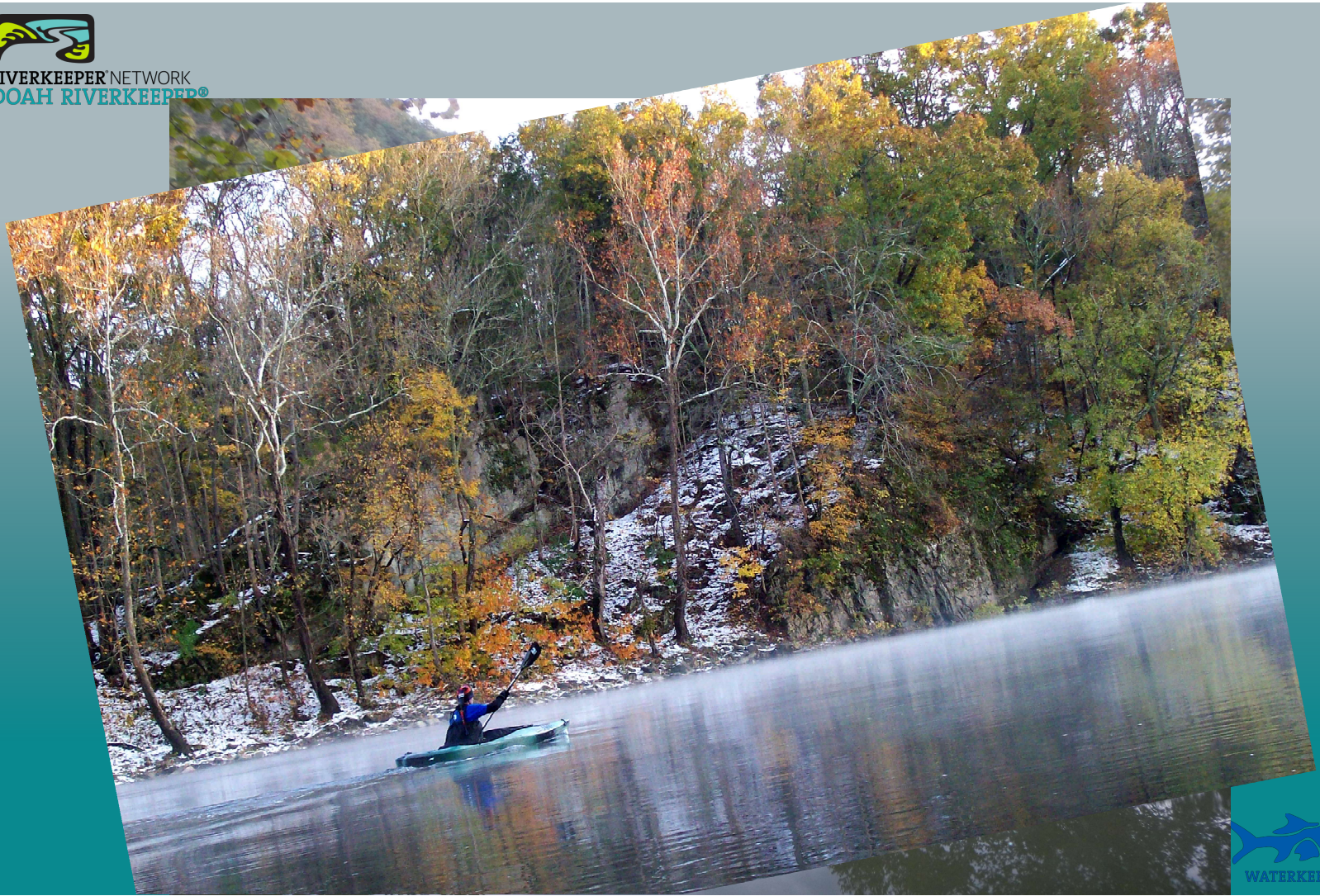


POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER®





POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER®





POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER®





POTOMAC RIVERKEEPER NETWORK
SHENANDOAH





POTOMAC RIVERKEEPER
SHENANDOAH



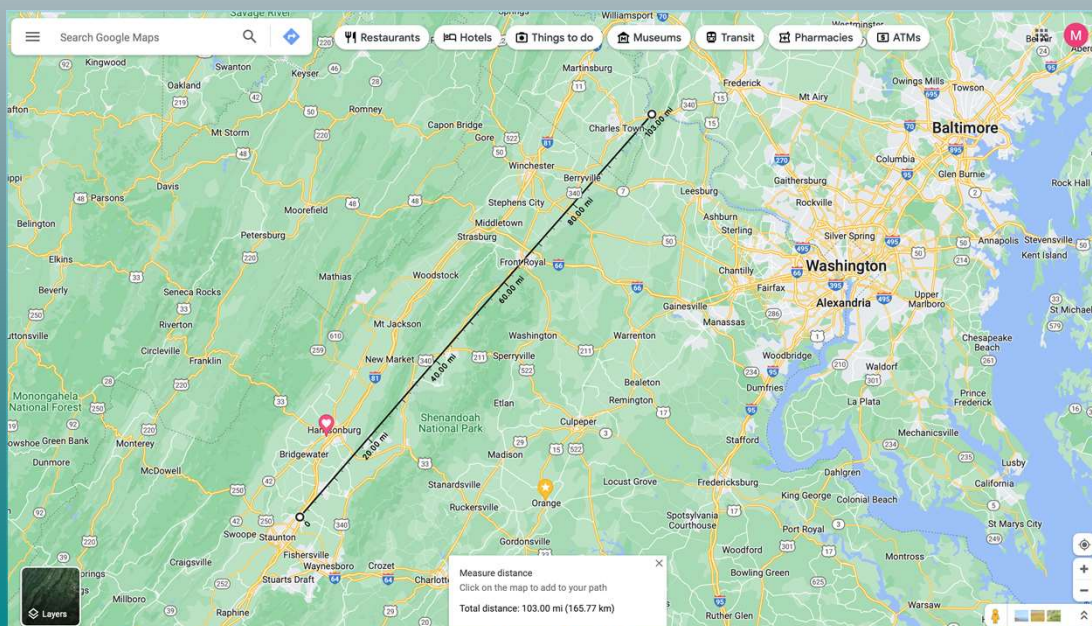
POTOMAC
SHENANDOAH





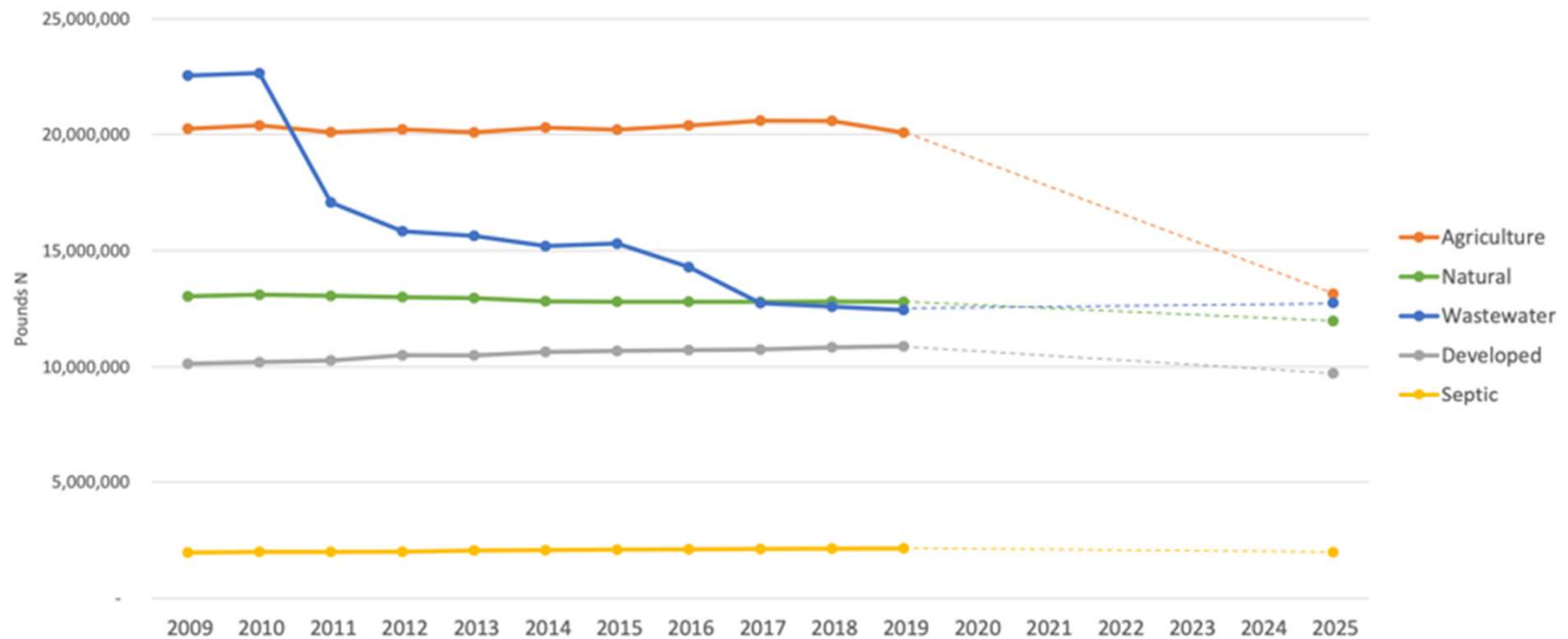
Livestock Raised Annually in the Shenandoah Valley

- 160,000,000 chickens
- 16,000,000 turkeys
- 500,000 cattle



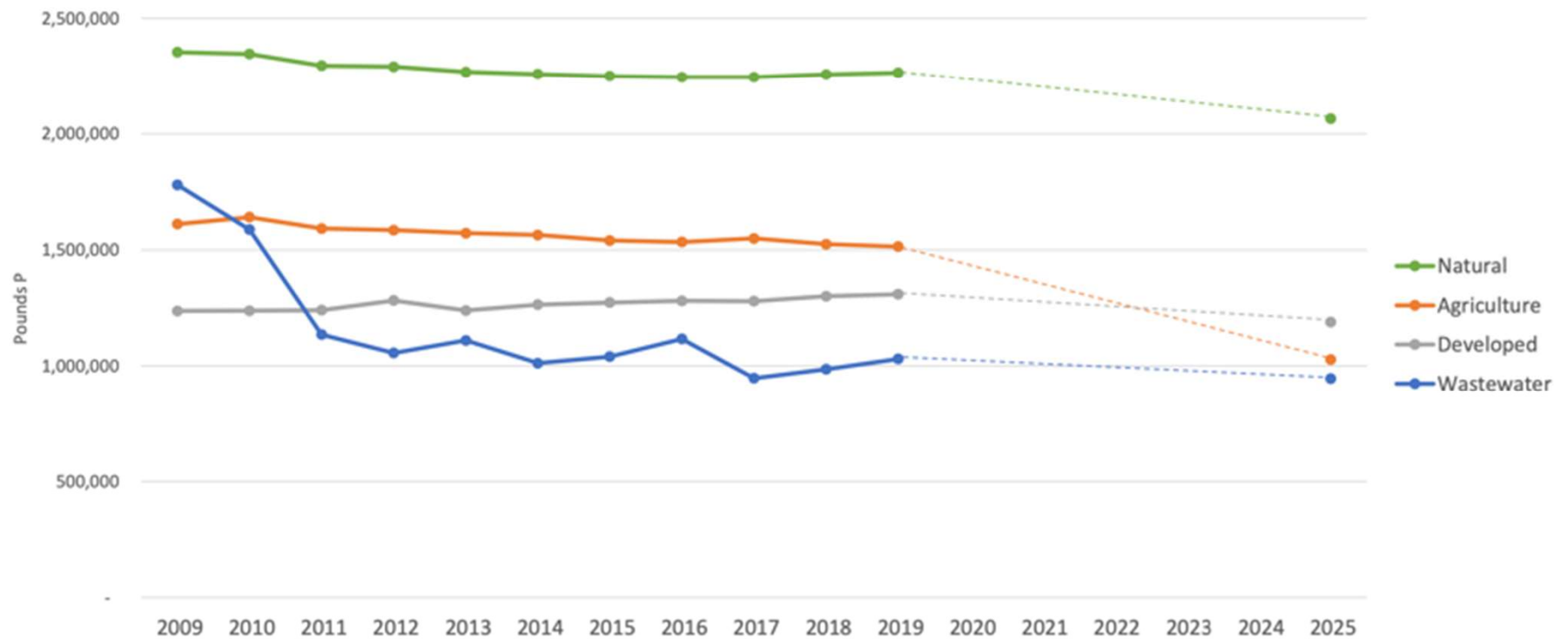
Stopping Pollution and Restoring Clean Water

Virginia Nitrogen Loads (CAST2019, Delivered)

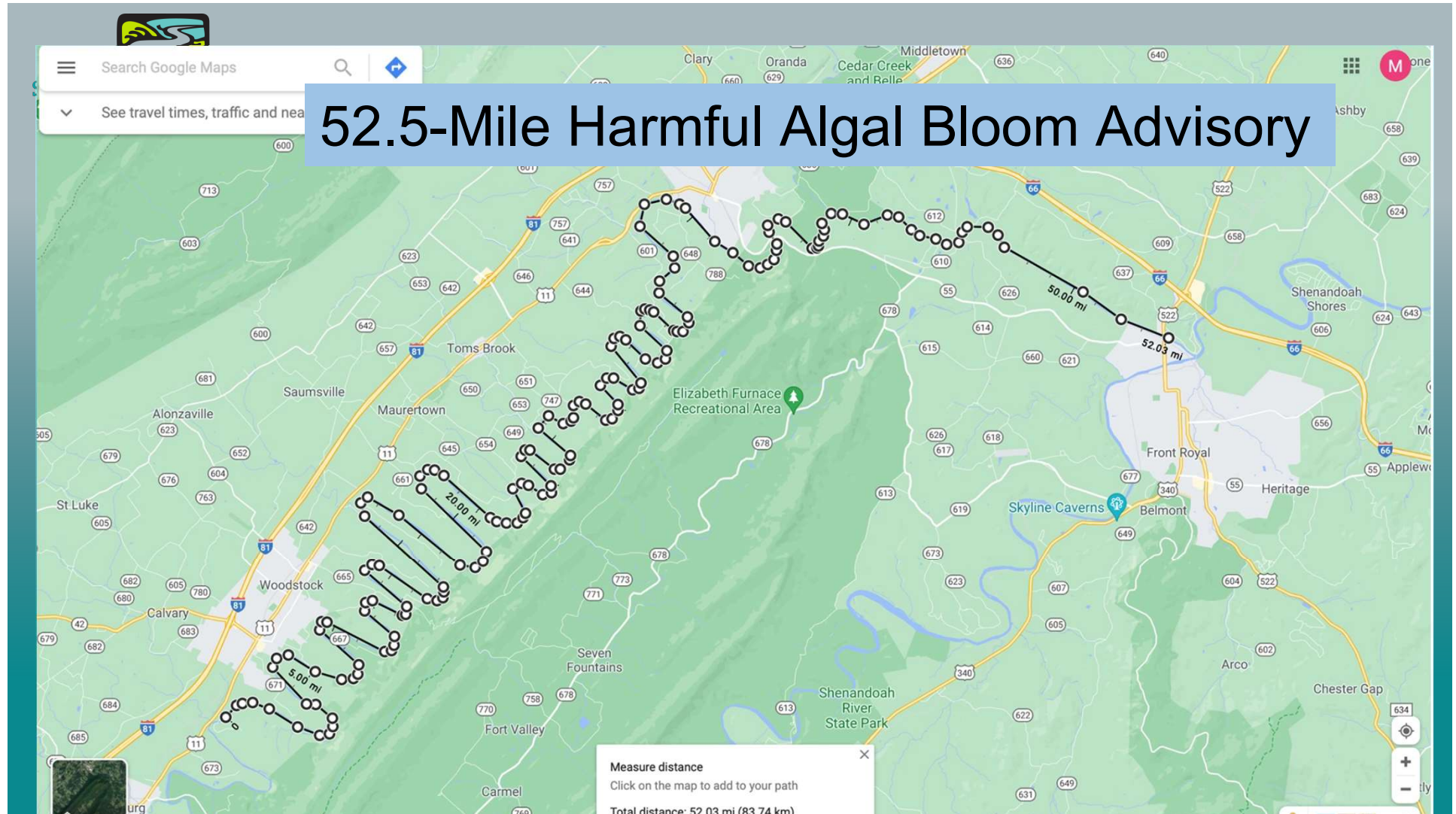


Virginia Phosphorus Loads

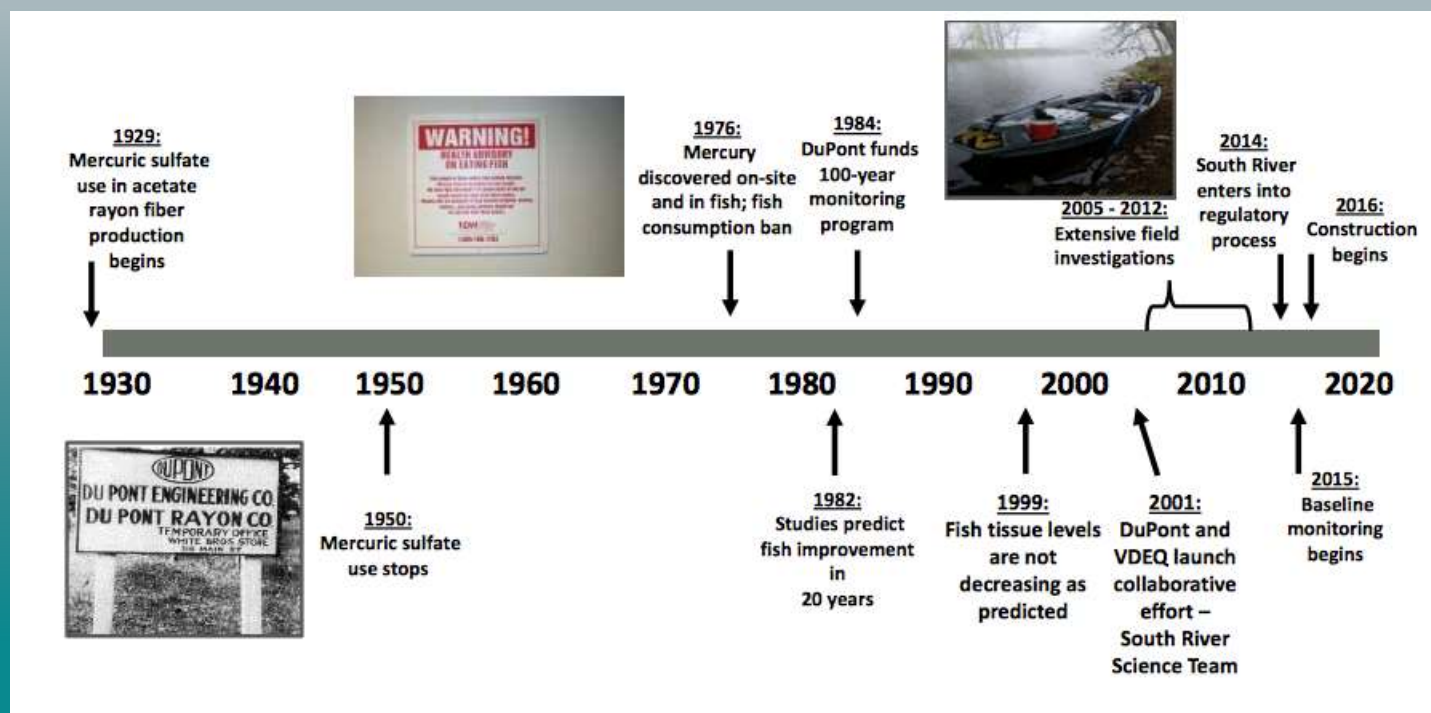
(CAST2019, Delivered)



52.5-Mile Harmful Algal Bloom Advisory



DuPont Background and History



Stopping Pollution and Restoring Clean Water



POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER®

Know Your Fish

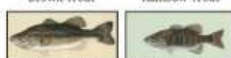
Mercury and PCBs can be passed through the food we eat. In the river, mercury and PCBs accumulate in fish. When fishing in the South River and the South Fork and Main Stem Shenandoah Rivers, keep in mind the advisories shown on the map in this brochure.

Ask Yourself:

Where did you fish?



What did you catch?



What does the advisory say?



(Not all fish are shown.)

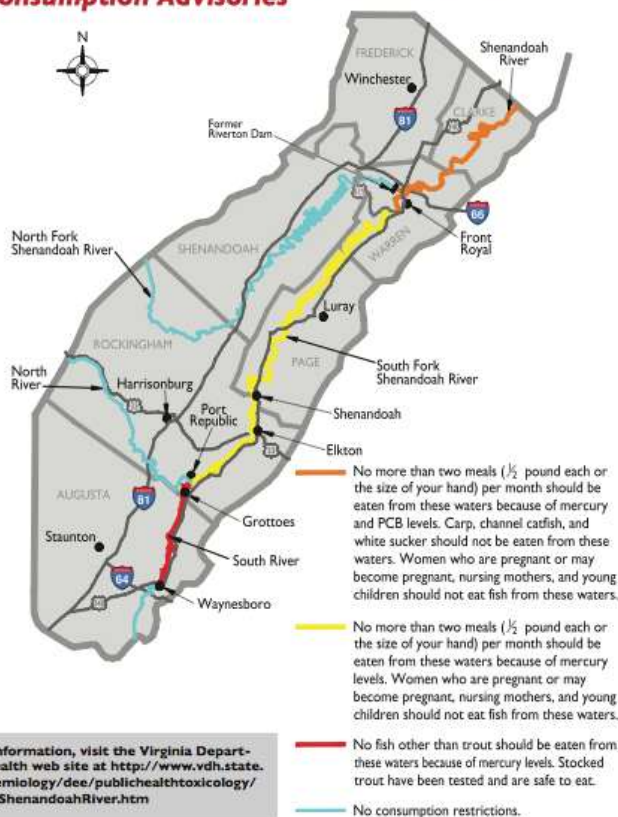
If you have questions about these advisories, call the Virginia Department of Health at (540) 332-7830.

Mercury, PCBs, and Your Health

Fish are an important part of a healthy diet and are among the healthiest sources of protein because they are low in saturated fat, the type of fat associated with clogged arteries and heart disease.

Mercury is a toxin that affects the human nervous system, particularly developing brains. Long-term exposure to PCBs may increase the risk of cancer. This is why women who are pregnant or may become pregnant, nursing mothers, and young children should not eat fish from mercury- or PCB-impacted water.

Mercury and Polychlorinated Biphenyl (PCB) Fish Consumption Advisories



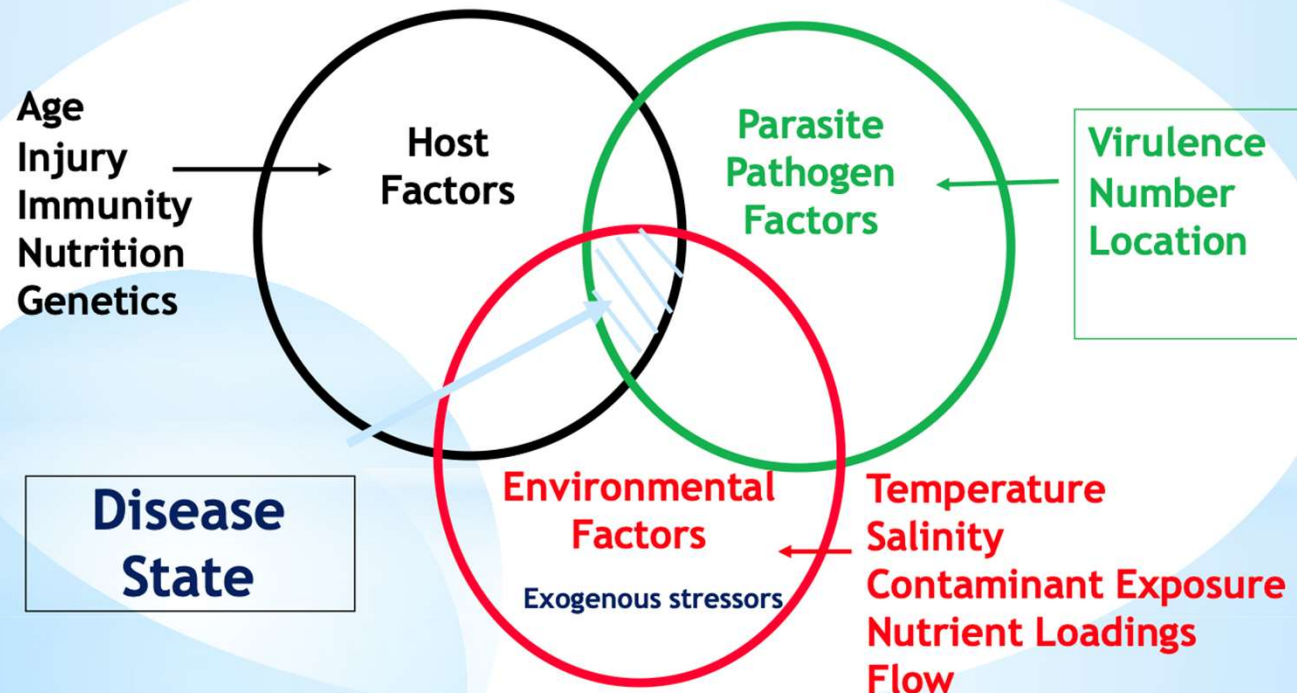
For more information, visit the Virginia Department of Health web site at <http://www.vdh.state.va.us/epidemiology/dee/publichealthtoxicology/advisories/ShenandoahRiver.htm>

Stopping Pollution and Restoring Clean Water





A Paradigm For Fish Health





POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER®

WATER QUANTITY

TOO MUCH

TOO LITTLE

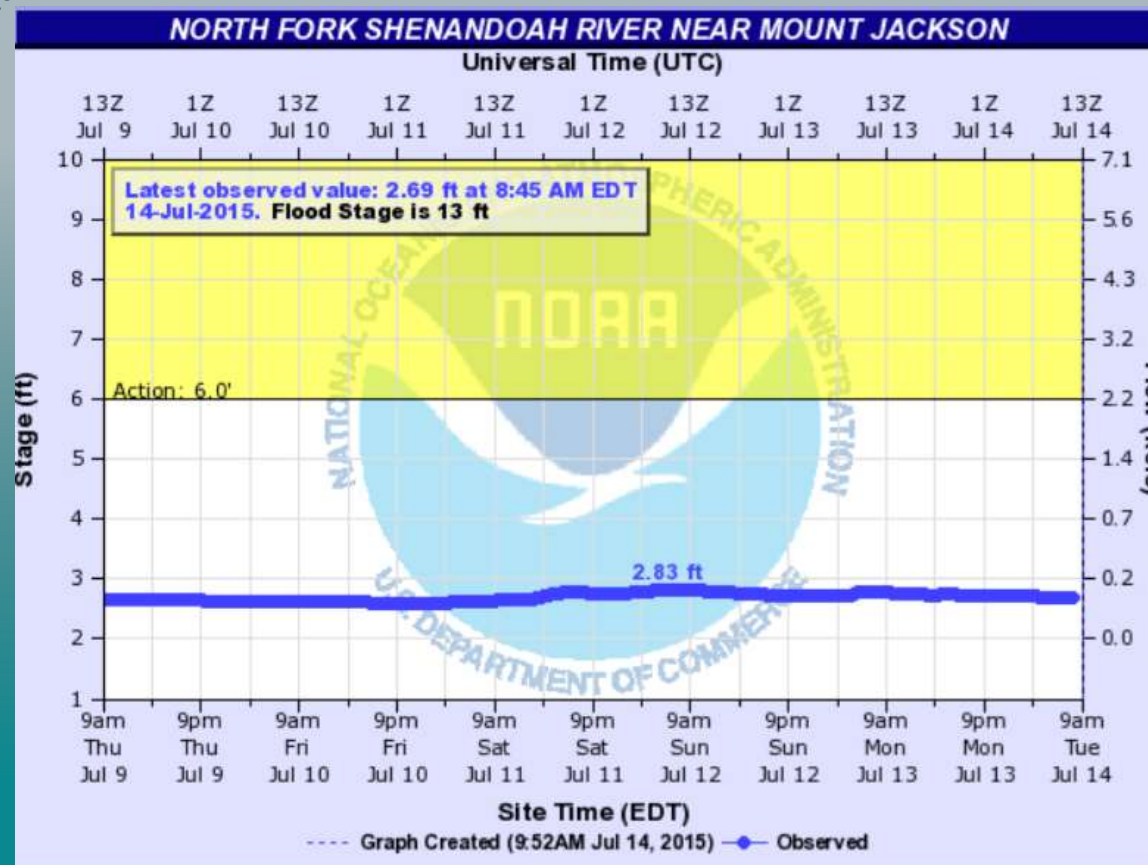
Stopping Pollution and Restoring Clean Water



WATERKEEPER® ALLIANCE



POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER®

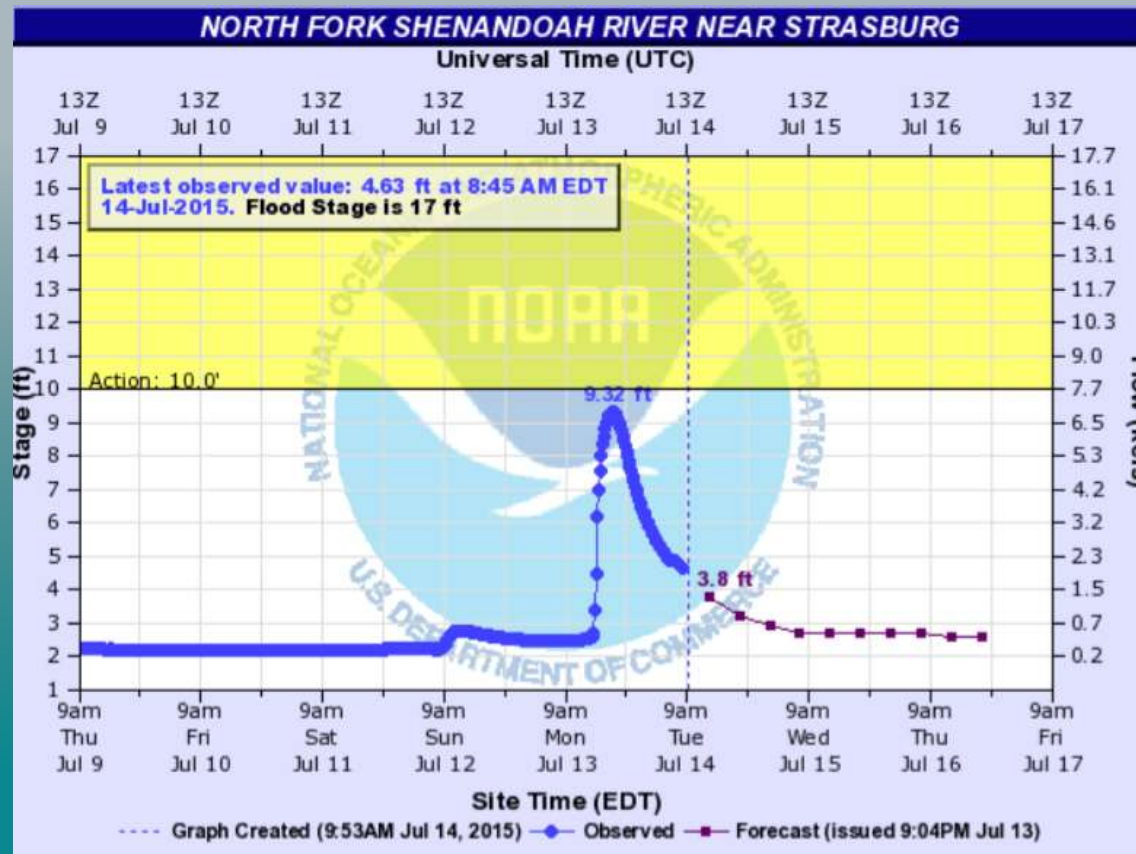


Stopping Pollution and Restoring Clean Water





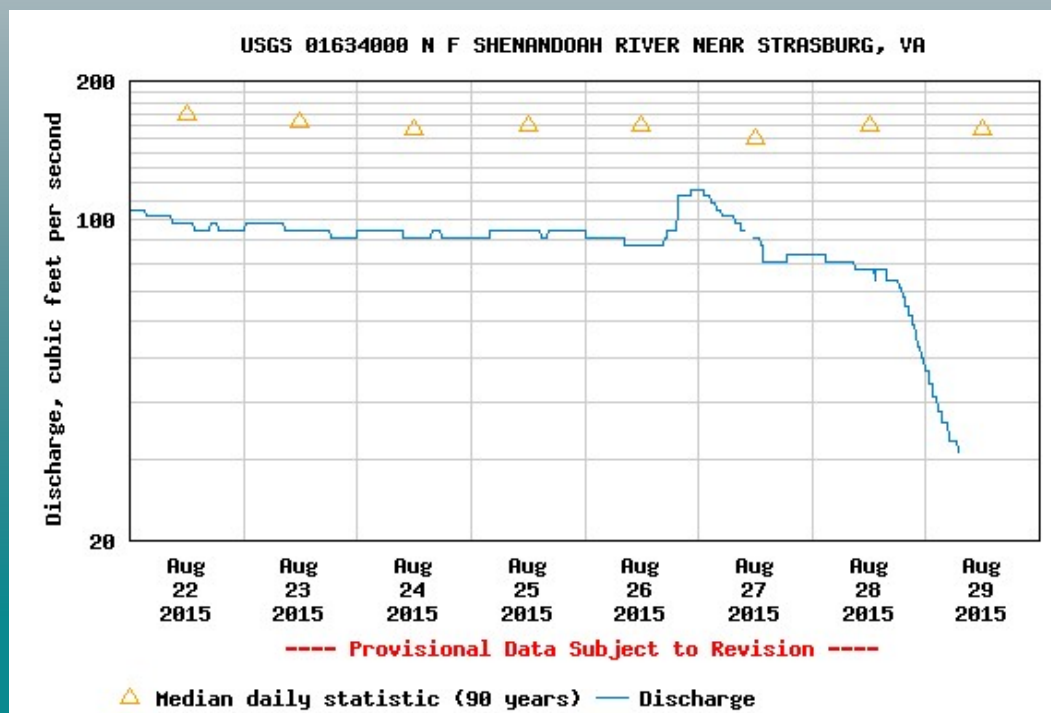
POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER®



Stopping Pollution and Restoring Clean Water

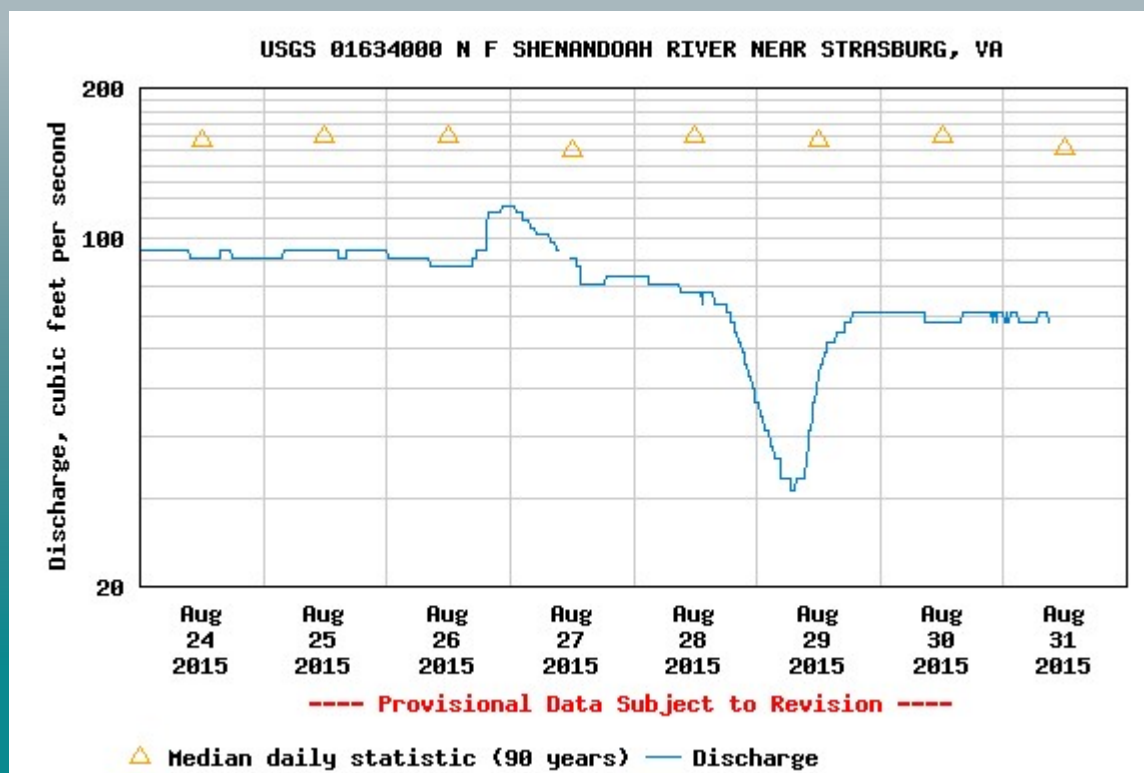


Strasburg Gauge



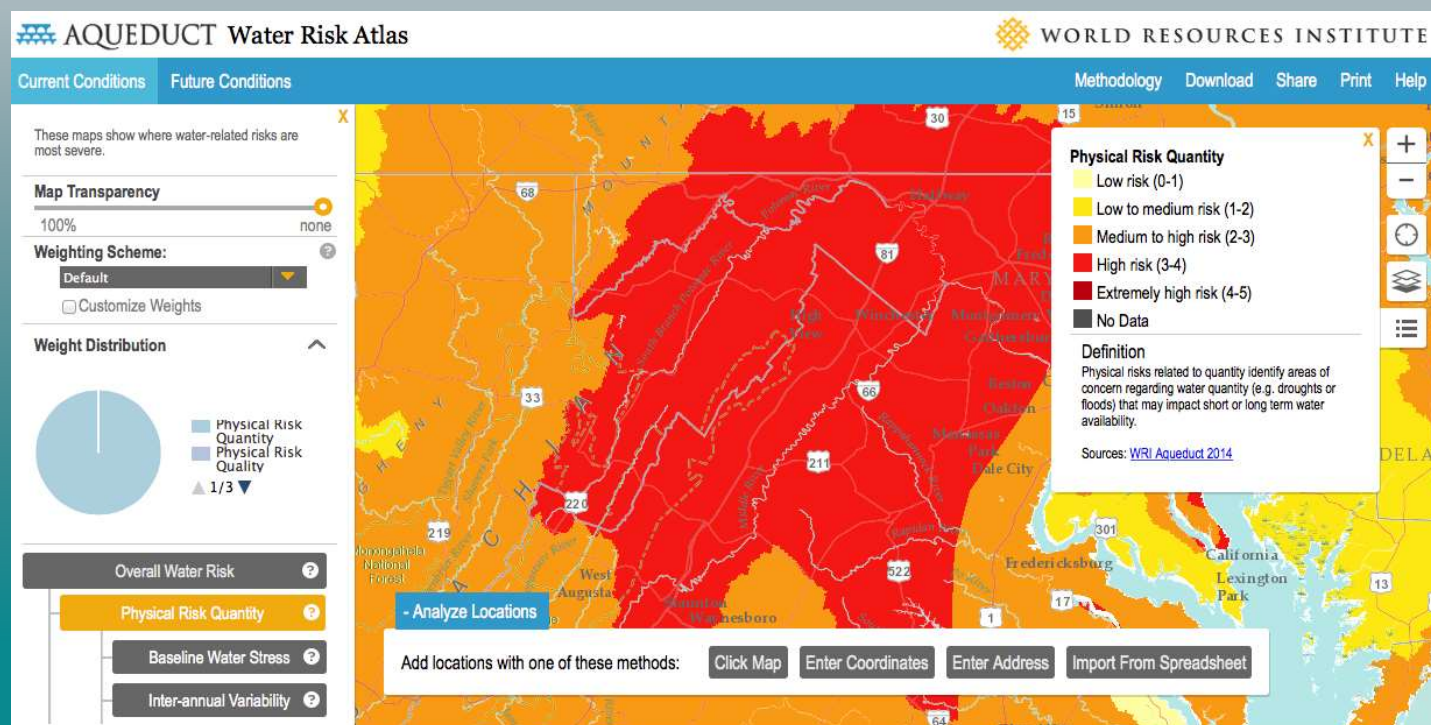
Stopping Pollution and Restoring Clean Water

Strasburg Gauge, 31 August



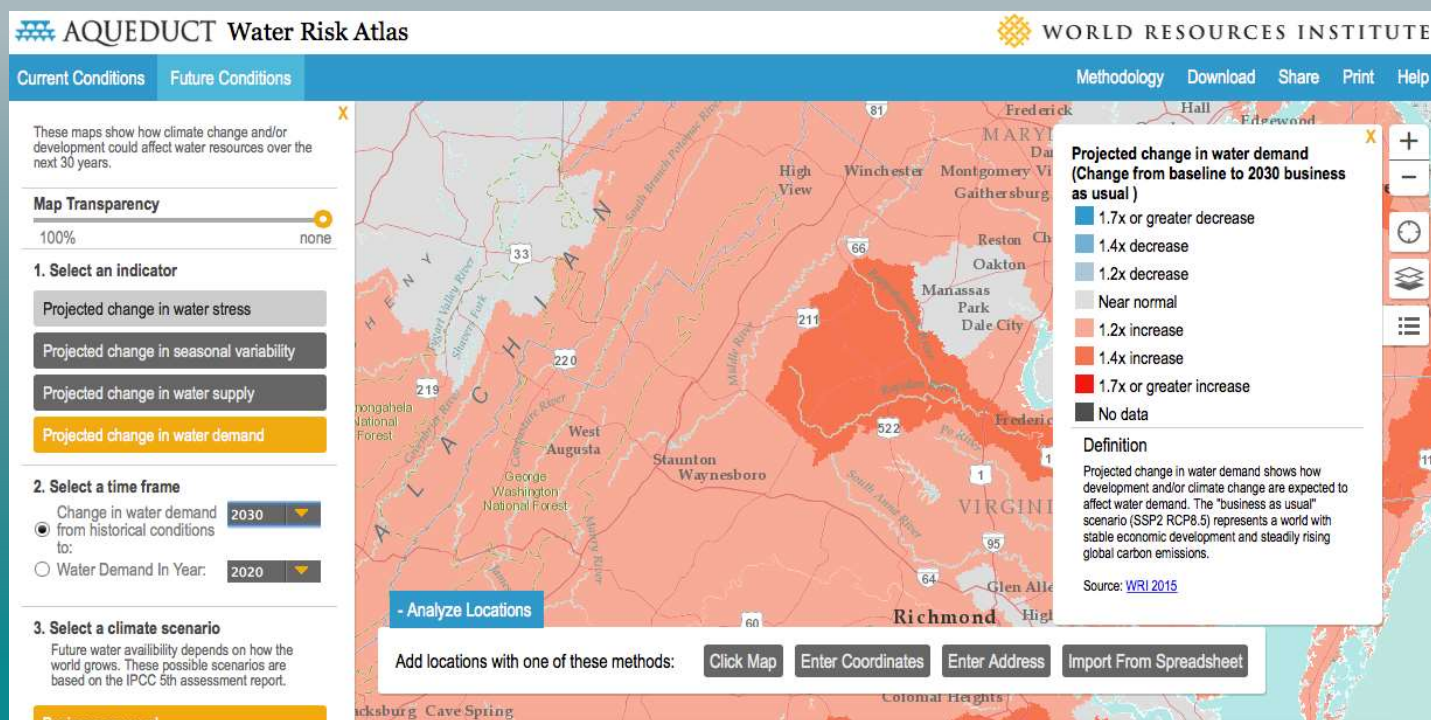
Stopping Pollution and Restoring Clean Water

Physical Risk Quantity



Stopping Pollution and Restoring Clean Water

What About in 2030?



Stopping Pollution and Restoring Clean Water



POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER®

Shenandoah Watershed Opportunities

Stopping Pollution and Restoring Clean Water



WATERKEEPER® ALLIANCE

NRDA Fund Allocations

Categories	Compensation
Improve Water Quality and Fish Habitat	\$10M
Freshwater Mussel Restoration	\$4M
Neotropical Migratory Songbird Full Life Cycle Restoration	\$2.5M
Land protection, property acquisition, and recreational and wildlife enhancements	\$18.2M
Willets Tract addition and forest restoration	\$1.3M
Recreational Fishing Improvement Projects	\$2.5M
Front Royal Fish Hatchery	DuPont

Stopping Pollution and Restoring Clean Water

Front Royal Fish Hatchery

- Needed major reconstruction
 - Pond, raceway and building upgrades
- Provide consistent production of smallmouth bass to supplement during years with poor natural reproduction
- “Bring people back to the river” through stocking programs and education

DuPont paying directly – up to
\$10M

Stopping Pollution and Restoring Clean Water



POTOMAC RIVERKEEPER
SHENANDOAH RIVER



WATERKEEPER ALLIANCE



POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER®



Stopping Pollution and Restoring Clean Water



Cattle Herd Legislation



Stopping Pollution and Restoring Clean Water

Creation of Chlorophyll A Standards

- How to translate this...



Stopping Pollution and Restoring Clean water

Creation of Chlorophyll A Standards

- Into that...

<u>Segment</u>	<u>Two-Month Median (mg/m²)</u>	<u>Seasonal Median (mg/m²)</u>
<u>Shenandoah River from its confluence of the North Fork and South Fork Shenandoah Rivers downstream to the Virginia/West Virginia state line</u>	<u>150</u>	<u>100</u>
<u>North Fork Shenandoah River from its confluence with Fort Run downstream to its confluence with the South Fork Shenandoah River</u>	<u>150</u>	<u>100</u>
<u>South Fork Shenandoah River from its confluence with the North and South Rivers downstream to its confluence with the North Fork Shenandoah River</u>	<u>150</u>	<u>100</u>

Stopping Pollution and Restoring Clean Water



POTOMAC RIVERKEEPER NETWORK
SHENANDOAH RIVERKEEPER

Summary of Proposed “Off-the-Top” WQIF Allocations

(GF \$ in millions)

	<u>FY 2023</u>
Small Herd Initiative	\$8.0
Conservation Reserve Enhancement Program Match	\$6.0
Assistance for Newly Regulated MS4 Localities	\$5.0
Shenandoah River Harmful Algal Bloom Study	\$2.5
Poultry Litter and Other Nonpoint Source Reduction	\$4.6
Virginia Conservation Assistance Program	\$4.0
Virginia Trees for Clean Water Program	\$4.0
Pay for Documented Performance for Nutrient Removal Technologies	\$3.0
Incentives for Riparian Buffers by Agricultural Producers	\$2.0
State Lands Watershed Implementation Plan	\$2.0
Conservation Application Suite	\$1.5
Water Quality Grants	\$1.0
Virginia Cooperative Extension Outreach	\$0.7
Small Farm Outreach	\$0.3
Septic Hotspot Identification and Mapping	\$0.1
Total	\$44.6



Agricultural Best Management Practice Cost-Share Program

- \$81 million for Chesapeake Bay watershed cost-share BMP
- \$15 million Soil and Water Conservation Districts to provide technical assistance to farmers
- \$11 million will bolster operations and maintenance needs.

Stopping Pollution and Restoring Clean Water

