

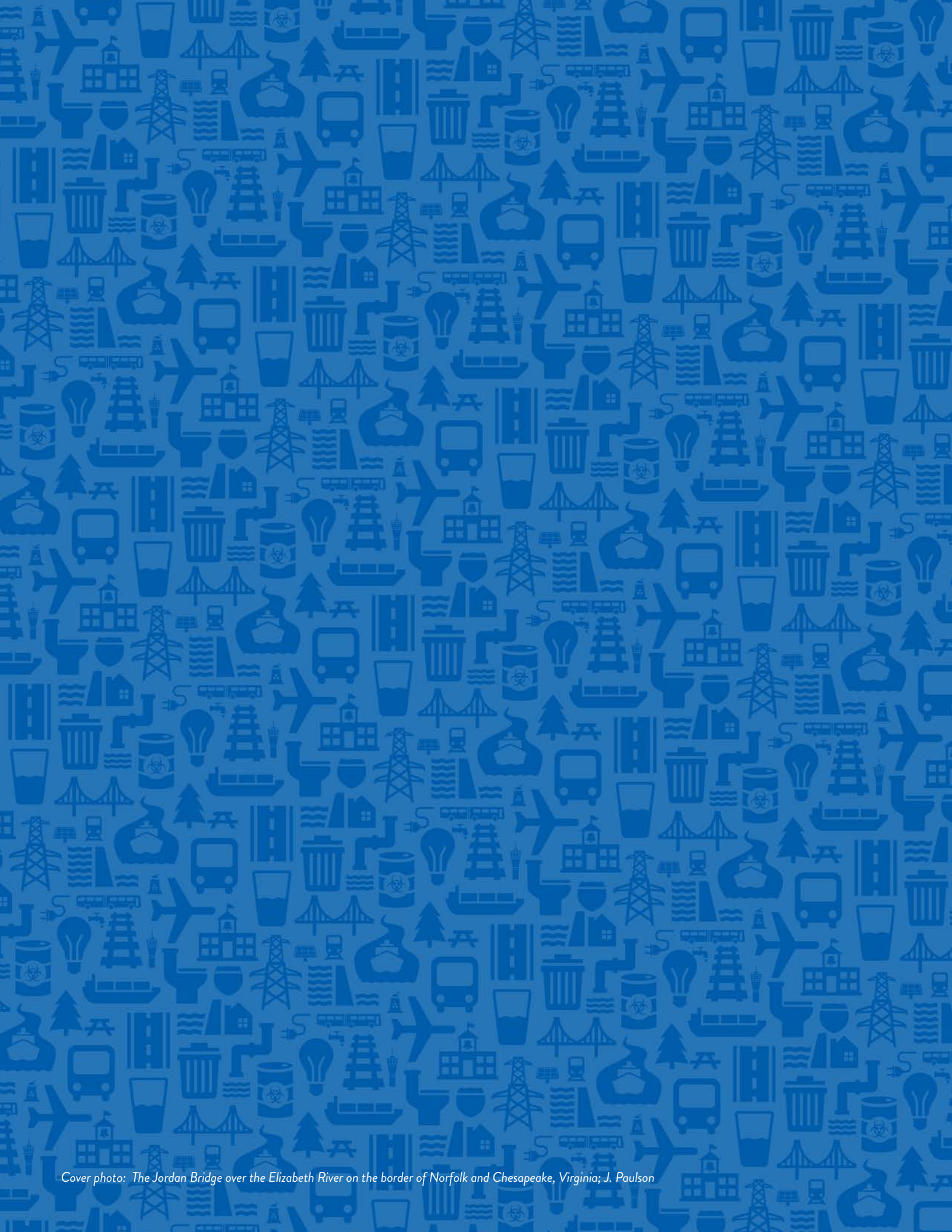


2026 REPORT CARD FOR **VIRGINIA'S** INFRASTRUCTURE



ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

[INFRASTRUCTUREREPORTCARD.ORG/VIRGINIA](https://infrastructurereportcard.org/virginia)



Cover photo: The Jordan Bridge over the Elizabeth River on the border of Norfolk and Chesapeake, Virginia; J. Paulson

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INFRASTRUCTURE REPORT CARD TEAM

BRIDGES

Hari Aamidala
Immanuel Samuel
Magyarics Michael

BROADBAND

Cole McAndrews
Tamarah Holmes
Nehemiah Aikens
Kayla Bravo
Wyatt Carter

DAMS

Caitlin Grady
Ryan Calder
Catalina Gonza

DRINKING WATER

Chrisa C. Mitchell
Jason Lee
Victor Crawford

ENERGY

Payman Dehshanien
Abby Kollar
Ryan Calder
Caitlin Grady
Cheng Xie

PUBLIC PARKS

Susan England
Allison Kennedy

RAILS

Sheila Duwadi
John Harman

ROADS

Susan Shaw
Wendy Thomas
John Harman

SCHOOLS

Mike Jelen
Cassidy Mullen
Kheira Bekkadj

STORM WATER

Lambert Logan
Nikkil Deshpande
Ivan Zapata

TRANSIT

Maaz Quorashi

WASTEWATER

McKenzie White
Victor I. Crawford





2026 REPORT CARD FOR VIRGINIA'S INFRASTRUCTURE

Executive Summary

The Commonwealth of Virginia has a growing economy supported by steady population growth. Strategic investments have strengthened the state's infrastructure, including expanding broadband access and advancing the replacement of the Long Bridge rail bottleneck in Northern Virginia. While these achievements represent meaningful progress, continued population growth is placing greater pressure on Virginia's infrastructure.

The Commonwealth has made notable progress in the condition and performance of its bridges, broadband, roads, and solid waste systems, driven in part by historic state and federal investments. The Infrastructure Investment and Jobs Act (IIJA) has helped close longstanding funding gaps across Virginia's infrastructure, providing approximately \$12.6 billion for projects statewide as of January 2025. State road and bridge funding increased from \$294 million in FY2022 to \$500 million in FY2025, enabling agencies to better maintain and improve infrastructure across Virginia's diverse landscape. These investments have accelerated critical improvements while helping position the Commonwealth to meet future infrastructure needs.

Virginia continues to face significant infrastructure challenges driven by increasingly severe weather, aging assets, and varying local capacity. In particular, more frequent extreme weather is increasing straining infrastructure systems across the Commonwealth. In recent years, Tropical Storm Ophelia produced two to four feet of storm surge, causing tidal flooding that closed roads in Norfolk, Virginia Beach, and Mathews County. In 2024, Hurricane Helene triggered flash flooding that prompted evacuations across seven counties, isolated communities, and led to more than 70 rescues, and two fatalities. Heavy rainfall has also furthered the risk of combined sewer overflows in cities such as Richmond, Lynchburg, and Alexandria, where aging systems can discharge untreated wastewater during major storms.

Virginia's diverse geography and population distribution also create unique operational and maintenance challenges. Specifically, rural communities often lack the financial and technical resources needed to maintain aging infrastructure. To address these needs, the Virginia Office of Drinking Water funds leak detection equipment through Drinking Water State Revolving Fund set-asides, while the Virginia Rural Water Association provided 764 hours of leak detection technical assistance during the reporting period. Despite these efforts, many rural systems continue to face funding shortfalls for maintaining treatment plants, pump stations, storage tanks, and pipelines.

Significant investment needs remain across other sectors. The Commonwealth's \$5 million Dam Safety grant program for 2026 is small relative to the estimated \$5.42 billion needed to rehabilitate Virginia's dams, forcing many owners to defer critical maintenance. Similarly, the 2022 Clean Watershed Needs Survey reported approximately \$45.77 billion in wastewater infrastructure needs statewide.

Recent investments have delivered measurable improvements across many sectors, but aging assets, continued population growth, increasingly frequent extreme weather, and persistent funding gaps underscore the need for sustained investment. Maintaining Virginia's economic competitiveness, public safety, and quality of life will require a long-term commitment to preserving existing infrastructure while building more resilient systems for the future.

Recommendations to Raise the Grade



Investment: Increased investment is needed to meet growing demands driven by population growth and more intense storm events. Targeted funding will help ensure that drinking water, transportation infrastructure, and energy infrastructure can continue to operate safely and reliably under increasing stress.



Resilience: Recent storms such as Tropical Storm Ophelia and Hurricane Helene have demonstrated Virginia's resilience while highlighting the need for the state to prepare for the next major storm event, including updating emergency action plans for all departments and municipalities.



Safety: Virginia faces significant safety risks, with 402 high-hazard dams and rising vehicle fatalities per 100,000 residents over the past decade. Strengthening dam inspection programs and adopting comprehensive roadway safety strategies will be essential to reducing risks and improving public safety statewide.



Capacity: Added capacity for aging water-related and wastewater infrastructure is critical, especially as population growth continues. Many wastewater and stormwater systems are past their design life cycle and need upgrades, which will help to address water quality, flooding, and erosion concerns.



Technology: Relying on improving technologies such as groundwater recharge of treated wastewater at treatment plants and artificial intelligence (AI) will help to stretch limited funding and ensure investments are made efficiently.

About The Report Card for America's Infrastructure

Every four years, America's civil engineers provide a comprehensive assessment of the nation's 18 major infrastructure categories in ASCE's *Report Card for America's Infrastructure*. Using a simple A to F school report card format, the Report Card examines current infrastructure conditions and needs, assigning grades and making recommendations to raise them.

The ASCE Committee on America's Infrastructure is made up of 52 dedicated civil engineers and infrastructure professionals from across the country, with decades of expertise in all categories, who volunteer their time to work with ASCE Infrastructure Initiatives staff to prepare the Report Card. The Committee assesses all relevant data and reports, consults with technical and industry experts, and assigns grades using the following criteria:

Methodology

CAPACITY

Does the infrastructure's capacity meet current and future demands?

CONDITION

What is the infrastructure's existing and near-future physical condition?

FUNDING

What is the current level of funding from all levels of government for the infrastructure category as compared to the estimated funding need?

FUTURE NEED

What is the cost to improve the infrastructure? Will future funding prospects address the need?

OPERATION AND MAINTENANCE

What is the owners' ability to operate and maintain the infrastructure properly? Is the infrastructure in compliance with government regulations?

PUBLIC SAFETY

To what extent is the public's safety jeopardized by the condition of the infrastructure and what could be the consequences of failure?

RESILIENCE

What is the infrastructure system's capability to prevent or protect against significant multi-hazard threats and incidents? How able is it to quickly recover and reconstitute critical services with minimum consequences to public safety and health, the economy, and national security?

INNOVATION

What new and innovative techniques, materials, technologies, and delivery methods are being implemented to improve the infrastructure?

In addition to this national Report Card, ASCE's sections and branches prepare state reports on a rolling basis. Visit [Infrastructurereportcard.org](https://www.infrastructurereportcard.org) to learn about your state's infrastructure.

About the Grades

The 2026 Report Card for Arizona's Infrastructure was written by a committee of more than 50 civil engineers across Arizona who volunteered their time to collect and analyze data, prepare and review their findings and present their conclusions. The committee worked with staff from ASCE National and ASCE's Committee on America's Infrastructure to provide a snapshot of our state's infrastructure, as it relates to us locally and on a national level. The Report Card Sections are graded based on the following eight criteria: capacity, condition, funding, future need, operation and maintenance, public safety, resilience and innovation. ASCE defines these grades as follows:



Exceptional, Fit for the Future



Good, Adequate for Now



Mediocre, Requires Attention



Poor, At Risk



Failing/Critical, Unfit for Purpose

The 2026 Report Card on Virginia's Infrastructure



Bridges
B+



Broadband
B+



Dams
C-



Drinking Water
C+



Energy
D



Public Parks
C



Rail
C+



Roads
C



Schools
D+



Solid Waste
B



Stormwater
C



Transit
C-



Wastewater
D+



**OVERALL
GPA**

Bridges



GRADE
COMPARISON

VA: B+
Nat'l: C



BRIDGES

EXECUTIVE SUMMARY

Over the last several years, Virginia has made meaningful progress on bridge conditions. Between 2020 and 2025, the total percentage of poor condition bridges dropped from 3.5% to 3.1%. In 2024 alone, the Virginia Department of Transportation (VDOT) rolled out multiple targeted initiatives for the state’s bridges, including the State of Good Repair–Bridge Program, the High-Priority Projects Program, and the Highway Construction District Grant Program. The 2026 Six Year Improvement Plan allocates \$2.3 billion for bridges, and when combined with other funding sources, total bridge funding rises to roughly \$800 million per year, a significant gap relative to bridge preservation and State of Good Repair program needs. Despite these constraints, Virginia stands out for how it approaches bridge maintenance and design, embracing innovative materials, and utilizing forward looking design practices. Those innovations are helping stretch limited dollars and improve long term performance, but sustained investment will be essential to continue progress.

BACKGROUND

Virginia is home to 21,373 bridges, as summarized in Table 1. VDOT inventories all highway bridges, regardless of length, and culverts with openings greater than or

equal to 36 square feet. Short span bridges and culverts comprise the balance of inventory.

Table 1. Virginia Highway Structures

Structure Type	Non-NBI	NBI	Total
Bridges	2,610	10,642	13,252
Culverts	4,952	3,169	8,121
Total Structures	7,562	13,811	21,373

Source: VDOT, 2025

* The National Bridge Inventory (NBI) is a Federal Highway Administration (FHWA) database containing data for public vehicular bridges longer than 20 feet. Non-NBI structures (typically under 20 feet or non-vehicular) are generally not included in federal reporting.

Virginia is one of only a few states in which most secondary roads and bridges are managed directly by the state highway department. Thus, Virginia has the third

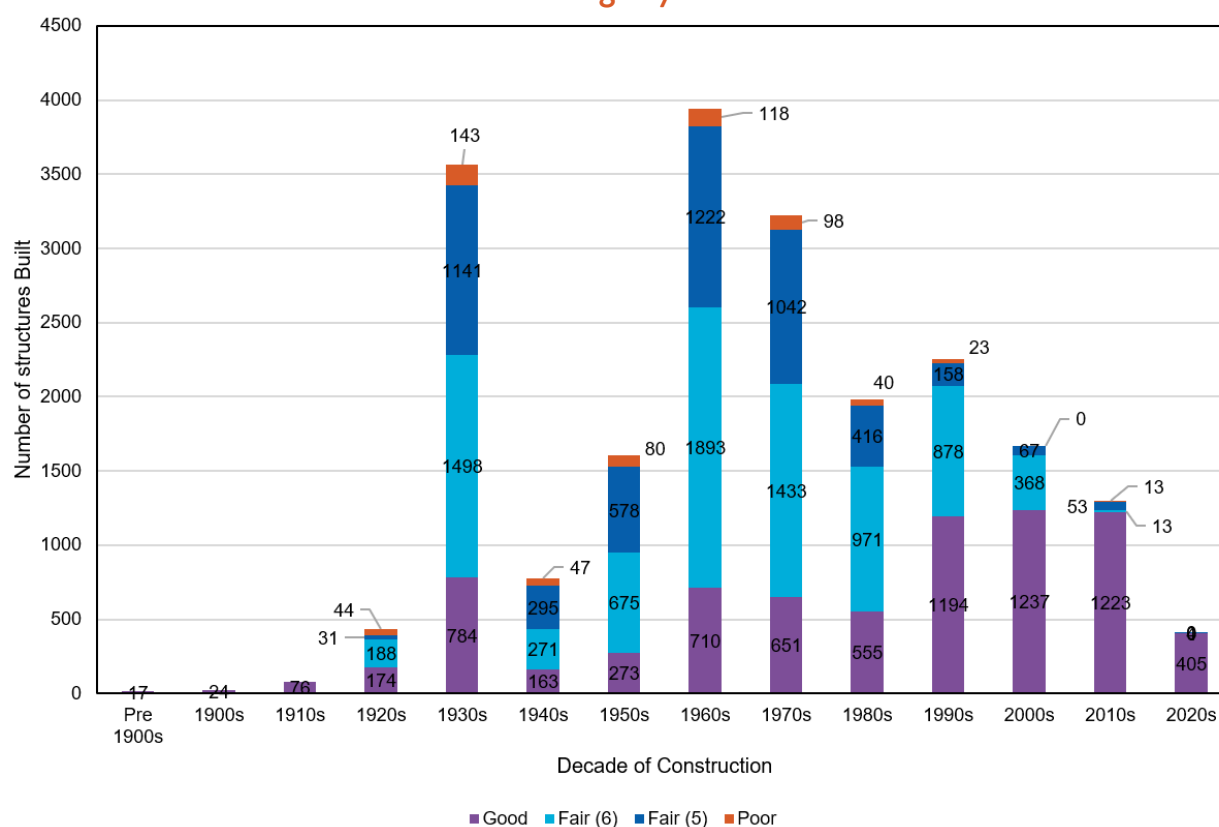
largest number of state-owned highway structures in the U.S., after Texas and North Carolina.

CONDITION

Highway agencies routinely build bridges to last 75 years or more today. However, prior to 2007 most bridges were designed for a 50-year service life. This means approximately 92% of Virginia's highway structures were designed with a service life expectancy of 50 years, and

nearly 58% of Virginia's bridges are now more than 50 years old and have either met or exceeded their expected service life. Figure 1 shows the distribution of Virginia's bridges built by decade.

Figure 1. Age Distribution of Virginia's Highway Structures Built by Decade and Condition Percentage by Count (FY2024)



Source: VDOT, 2025

**Many county structures with unknown construction dates were added to VDOT inventory during this period. Structures with unknown construction dates have been assumed to have year built in 1932.*

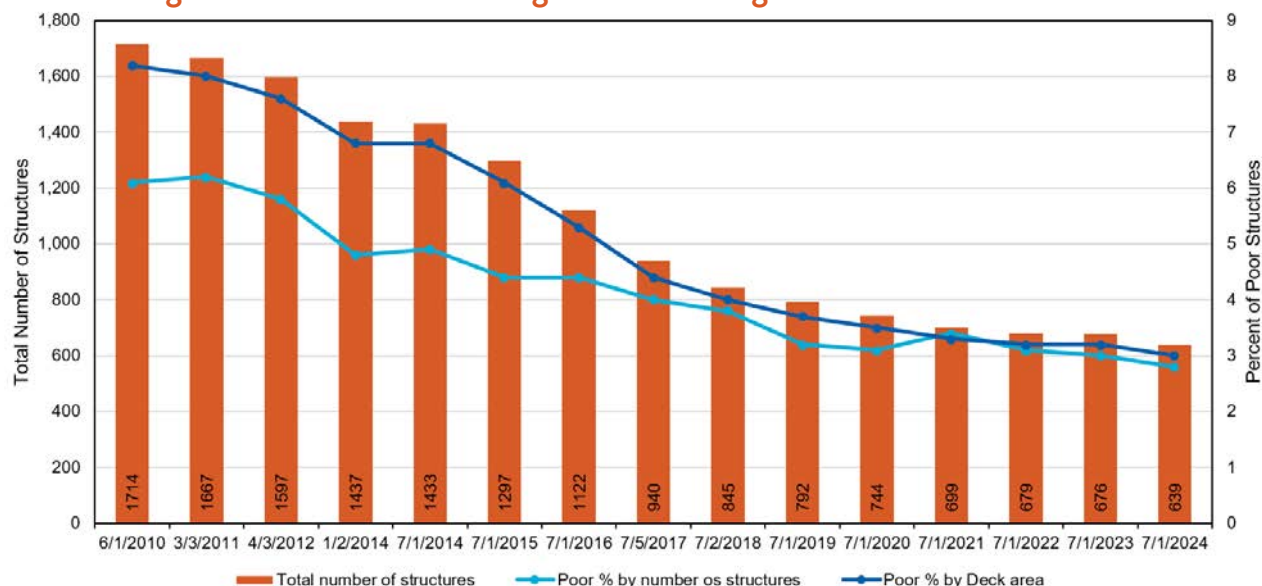
As of 2025, 661 of the 21,373 bridges in Virginia – or about 3.1% – were considered “Poor”. This marks a slight improvement from the 2022 report card, in which 698 bridges – about 3.3% - were Poor. Over the past two years VDOT's effort to improve or replace Poor bridges on all highway systems has remained steady, leading to the slight improvement.

Federal regulations require that states develop a Transportation Asset Management Plan for their highway infrastructure and report bridges that are in Good or Poor condition. Good is defined as a bridge having a lowest General Condition Rating (GCR) of 7 or better, and Poor is a bridge having any GCR of 4 or lower.

In 2024, VDOT found that the state has made steady progress in reducing the number of Poor bridges over the past fifteen years, with improvements found in

terms of total number of structures, percentage of structures by count, or percentage of cumulative deck area of structures.

Figure 2. Trend in Percentage of Poor Bridges Since 2010 (FY2024)



Source: VDOT, 2025

The average GCR is determined by calculating the average GCR of the components for each structure according to its importance factor (IF). As of the most recent assessment, the average condition rating across all highway structures (including bridges, culverts, tunnels, an ancillary structures) in the state is 6.23. This marks an improvement from the 2021 average of 6.10, indicating

significant progress in addressing and eliminating bridges previously classified as Poor. The increase in the average rating reflects ongoing rehabilitation and replacement efforts aimed at improving the overall condition of Virginia's bridges. However, despite these advances, there remains a substantial funding need to ensure continued operability and maintenance of the bridge inventory.

CAPACITY

Capacity of bridges can be understood in two ways: 1) traffic capacity and ability to not constrict flow of the traffic on the connected roadway, and 2) structural capacity to carry heavy vehicles such as trucks. The first can be inferred from how well a structure conforms to roadway geometry requirements and is captured in Section 6 of this report card (Roads). The latter is inferred from load rating and posting, and will be discussed.

Load posting is required for bridges that do not have sufficient structural capacity to safely carry legal loads. These postings restrict access for certain vehicle types, particularly heavy trucks, and can impact freight movement and emergency response. As of 2025, 1,443 bridges and culverts in Virginia were posted to restrict

loads — approximately 6.8% of the total inventory. This represents a slight increase from 2021, when 1,116 structures (5.3%) were posted.

Of the posted structures:

- 609 restrict single-unit vehicle loads to less than 20 tons (e.g., tractor trailers).
- 97 restrict loads to less than 10 tons (e.g., medium-duty pickups, ambulances).

Approximately 71% of load-restricted structures are located on secondary routes, which are typically rural and carry a smaller share of overall traffic volume. While these routes are less critical to commerce, they are important for local connectivity and emergency access.

Table 2. Postings by Highway System

Highway System	Posted
Interstate	0
Primary	315
Secondary	1,030
Urban	98
Total	1,443

Source: Virginia Department of Transportation

Although Virginia has continued to invest in bridge rehabilitation and replacement, the number of load

posted bridges has marginally increased, underscoring ongoing infrastructure needs. Structural capacity limitations remain a concern, particularly in rural areas and on routes that support agriculture, logging, and local freight. Several recent projects have targeted poor and load-restricted bridges, contributing to this improvement. Examples include bridge replacements along Route 58 in Patrick County (e.g., Lover’s Leap project), I-64 widening between Richmond and Hampton Roads (e.g., I-64 Gap Project), and I-81 bridge upgrades in Botetourt and Roanoke Counties as part of the Corridor Improvement Program. Additionally, VDOT’s State of Good Repair Program has supported replacement of numerous load-posted bridges on secondary routes in districts such as Staunton and Lynchburg, where rural freight movement is critical.

FUNDING

Virginia’s bridge funding is structured through five primary programs, each serving distinct roles in maintaining and improving the state’s transportation infrastructure. The Highway Maintenance and Operating Fund (HMOF) is the largest, supporting general maintenance and operations for highways and bridges, with a FY 2025 allocation of \$2.87 billion, though it faces an \$829 million deficit that will be covered by transfers, including \$319 million in federal funds and \$510 million in state construction fund. The State of Good Repair (SGR) Program is specifically designed to address poor and fair bridges on the cusp of becoming poor (bridges with a minimum general condition rating of 5), receiving \$225 million in FY 2025 for eligible bridges. The Robert O. Norris Special Structures Fund targets high-cost, unique structures such as major river crossings, with a statutory allocation of \$80 million annually. Recent legislative amendments have supplemented this with one-time funding, including a \$400 million deposit for the Norris Bridge replacement and the potential for revenue bonds up to \$200 million per year to accelerate repairs. The High Priority Projects Program allocated \$209.9 million in FY 2025 to projects that score highly under Virginia’s SMART SCALE prioritization system. This program is primarily focused on highway projects without bridges, although bridges are occasionally included in SMART SCALE projects.

Federal funding, primarily through the Infrastructure Investment and Jobs Act (IIJA) between FY 21-26 plays a significant role. Under the Bridge Formula Program (BFP), Virginia is allocated approximately \$578 million over five years, averaging \$115–116 million annually, with at least 15% earmarked for bridges that are not on the federal aid system, which are usually local rural and urban bridges. The IIJA also introduced the PROTECT Program, which aims to enhance the resilience of transportation infrastructure against climate hazards and natural disasters. Up to \$38 million per year may be used to make bridge projects more resilient to extreme weather and other repetitive events.

Additionally, some bridge projects are funded through public-private partnerships, which, while impactful, do not provide a consistent funding stream. VDOT’s overall FY2024 budget stands at \$8.67 billion, sourced from the Commonwealth Transportation Fund, federal contributions, local and regional sources, tolls, bonds, and other mechanisms. In summary, Virginia’s bridge funding landscape is diverse, combining state, federal, and special programs, with allocations subject to legislative changes and evolving infrastructure needs.

Special structures, including 6 tunnels, 9 movable bridges, and 10 large, fixed-span structures, continue to be funded from the Statewide Special Structure

Fund established in 2019 (Robert O. Norris Bridge and Statewide Special Structure Fund per §33.2-1532). Projects to protect and rehabilitate special structures are identified and reviewed in coordination with

VDOT's Structure & Bridge Division and in some cases are programmed separately through Commonwealth Transportation Board (CTB) action when state special-structure funds are used.

FUTURE NEED

Maintaining Virginia's bridge inventory in a long term state of good repair will require sustained, predictable investment focused primarily on preservation. The 2019 Maintenance and Operations Comprehensive Review determined that bridge preservation—including rehabilitation, repair, and treatments that slow deterioration—is five to six times more cost effective than full replacement. The study concluded that at least \$384 million annually (2019 dollars) is needed to sustain acceptable bridge conditions over a 50-year period, assuming a balanced approach between preservation and replacement.

While Virginia allocates approximately \$800 million per year for bridges through its Six-Year Improvement Program, this total includes capacity and capital improvement projects. Only about \$225 million annually is directed toward state of good repair (SGR) needs. This creates a clear funding gap relative to the identified \$384 million annual SGR need, indicating that current investment levels in preservation are insufficient to maintain long-term system performance.

Critically, the study recommended that approximately 75% of overall bridge funding be dedicated to preservation activities, with the remaining 25% targeted toward replacing poor bridges. Failure to maintain this allocation risks accelerating deterioration, increasing lifecycle costs, and shifting more assets into higher cost replacement needs. Delaying preservation interventions

could add an estimated \$122 million annually (2019 dollars) to lifecycle bridge costs statewide.

Virginia oversees approximately 21,327 highway structures, including 19,694 VDOT owned bridges, of which 58% are 50 years or older and have exceeded their original design life. While 96.9% of bridges are currently rated "Good" or "Fair," the aging profile of the inventory significantly increases future funding pressure. Even short term reductions or instability in preservation funding threaten this performance level and could reverse recent gains.

Recent and programmed bridge investments—including allocations within the Six Year Improvement Program (SYIP), high priority bridge funding, and special structure investments—have increased total bridge spending. However, not all programmed funds are available for routine preservation activities, and much of the funding is episodic or project specific. As a result, maintaining the identified state of good repair threshold remains highly dependent on sustaining annual preservation funding at or above identified minimum levels, adjusted for inflation and rising construction costs.

Absent consistent funding aligned with preservation first strategies, Virginia faces increasing risk of asset degradation, higher long term costs, and growth in the number of load posted and poor condition bridges despite ongoing capital investment.

OPERATION AND MAINTENANCE

Virginia funds bridge maintenance primarily through the Highway Maintenance and Operations Fund (HMOF), supported by statewide motor fuels taxes, other state revenues, and regional supplemental funding in Northern Virginia and Hampton Roads. By statute, maintenance of the existing transportation system is the Commonwealth's highest funding priority. Federal apportioned funds from the Federal Highway

Administration also support bridge operations and maintenance activities.

Inspection, monitoring, and data driven condition assessment remain central to Virginia's bridge management approach. In FY2024, VDOT inspected 9,842 bridges at a cost of \$45.4 million, ensuring compliance with federal requirements and supporting

proactive lifecycle decision making. These inspection efforts inform preservation programming, risk prioritization, and cost effective intervention timing.

VDOT's bridge management strategy emphasizes early intervention, proactive rehabilitation, and targeted replacement, supported by condition data and performance analytics. Continued deployment of innovative materials, construction methods, and monitoring technologies will be essential to extending service life and controlling long term costs as the inventory continues to age.

PUBLIC SAFETY

Public safety is a central concern for Virginia's bridge management, with over 21,000 bridges statewide. As of 2025, 3.1% are classified as structurally deficient slight improvement since 2021. While these bridges are not immediately unsafe, they require significant maintenance or replacement to ensure continued safety. Inspections occur at least biennially under NBIS standards, and VDOT has adopted advanced technologies like drones, LiDAR, and remote sensing to improve inspection accuracy, though some localities still rely on manual methods due to resource constraints.

As of September 2025, 1,443 bridges are load-posted,

RESILIENCE

VDOT recognizes the growing importance of resilience in transportation infrastructure, particularly in Virginia's coastal regions that face increasing risks from sea-level rise, stronger storm surges, and more frequent extreme weather events. To ensure the continued safety and reliability of the transportation network, VDOT has designated hurricane evacuation routes and ensured that bridge and roadway structures in coastal areas are designed to withstand the significant impacts of flooding, high winds, and storm surge.

VDOT provides detailed engineering and design guidance addressing climate change adaptation and coastal storm resilience, emphasizing not only traditional durability—such as using corrosion-resistant materials and redundant structural systems—but also long-term adaptability through the integration of new environmental data and projections. This includes consideration of sea-level

The Six Year Improvement Program (SYIP) remains the primary mechanism for advancing state of good repair projects from identified needs into design and construction. Programmed bridge projects are documented within the SYIP and detailed annually in VDOT's State of the Structures and Bridges Report. While the SYIP has enabled meaningful progress in addressing structurally deficient bridges, its long term effectiveness depends on stable funding levels and continued emphasis on preservation focused investments.

restricting access for emergency vehicles, school buses, and freight, which poses safety and logistical challenges. Funding limitations slow the pace of rehabilitation and replacement. Extreme weather events have exposed vulnerabilities, prompting VDOT to integrate climate adaptation strategies into bridge design, though retrofitting older structures remains difficult.

VDOT provides public access to bridge condition data, but public understanding of safety terminology is limited. Key challenges include aging infrastructure, restricted access due to load-posting, and climate-related risks.

rise scenarios, increased rainfall intensity, changes in groundwater elevation, and temperature fluctuations that can accelerate material degradation

VDOT's work builds on prior efforts to extend the service life of structures through more durable materials and improved detailing, while expanding the scope to incorporate environmental and climate resilience criteria into the planning, design, and maintenance phases. VDOT's approach aligns with national best practices and federal guidance, including FHWA's Transportation System Resilience Framework, ensuring consistency with evolving climate models and risk-based asset management.

Furthermore, VDOT's Transportation Resilience Improvement Plan (TRIP) complements these structural guidelines by identifying vulnerable corridors, developing mitigation strategies, and prioritizing investments in areas

critical for emergency response and economic continuity. Through data-driven decision-making, VDOT is enhancing the resilience of bridges, culverts, and evacuation routes to protect communities, reduce recovery costs, and sustain mobility during and after major storm events.

VDOT's resilience strategy thus represents a proactive, science-based approach to modern infrastructure design—one that recognizes resilience not as a singular event but as an ongoing commitment to safety, reliability, and adaptability in the face of a changing climate.



Photo: The Robert O Norris bridge spanning the Rappahannock River in Virginia: Wirestock Creators

INNOVATION

VDOT has invested millions of dollars per year over several decades to enhance the state of the practice in highway transportation. Since 1948, VDOT has accomplished this through the Virginia Transportation Research Council, a partnership of VDOT and the University of Virginia. Research relevant to bridges includes innovative materials and advanced design techniques to improve durability, structural efficiency, construction quality, and economy. VDOT has been an industry leader in implementing innovations, including:

- High performance concrete – VDOT has been using Very-High Performance Concrete (VHPC) in bridge deck overlays to provide significant durability, control against cracking, and low permeability to protect against corrosive road salts. VDOT is also developing Ultra-High-Performance Concrete (UHPC) which will provide even more durability and less maintenance than VHPC. Both high-performance concretes also use fibers to improve serviceability and ductility. VDOT is also investigating on Self-consolidating concrete for prestressed concrete superstructures.
- Corrosion-resistant reinforcement and prestressing – every interstate and high-volume primary bridge requires corrosion-resistant reinforcement in its bridge deck. All coastal structures require stainless or carbon-fiber composite prestressing in piles to resist corrosion.
- Elimination of deck joints at piers and abutments – VDOT has been using integral and semi-integral designs and retrofitting existing simple-span structures to eliminate deck joints to extend service life.
- Elastomeric concrete deck joints – VDOT has conducted proof-of-concept implementation of elastomeric concrete to provide flexible deck joints that resist cracking. This technology has been implemented in many cases with deck joint elimination.
- Use of induction coating removal (ICR) plus laser ablation coating removal (LACR) to remove existing coatings from painted structural steel.
- Repair of shear keys for prestressed concrete slab and box beams with dog bone technique.



RECOMMENDATIONS TO RAISE THE GRADE

- Prioritize the replacement, load rating updates, or strengthening of load-posted bridges along essential freight and emergency corridors.
- Enhance the precision of element-level bridge inspections through investment in advanced inspection technologies.
- Align preservation-first strategies with funding requirements, particularly for high-priority and specialized structures.
- Incorporate climate resilience and adaptation measures into bridge design, while continuing to innovate in materials and engineering approaches.
- Advance public education initiatives and improve data transparency.

SOURCES

Smart Scale, "How it Works," 2025.

VDOT, "Manual of the Structure and Bridge Division," 2025.

VDOT, "Virginia Transportation Resilience Improvement Plan (VTRIP) Technical Memo," 2024.

VDOT, "State of the Structures and Bridges, Fiscal Year 2024," 2024.

VDOT, "VDOT Dashboard", 2025.

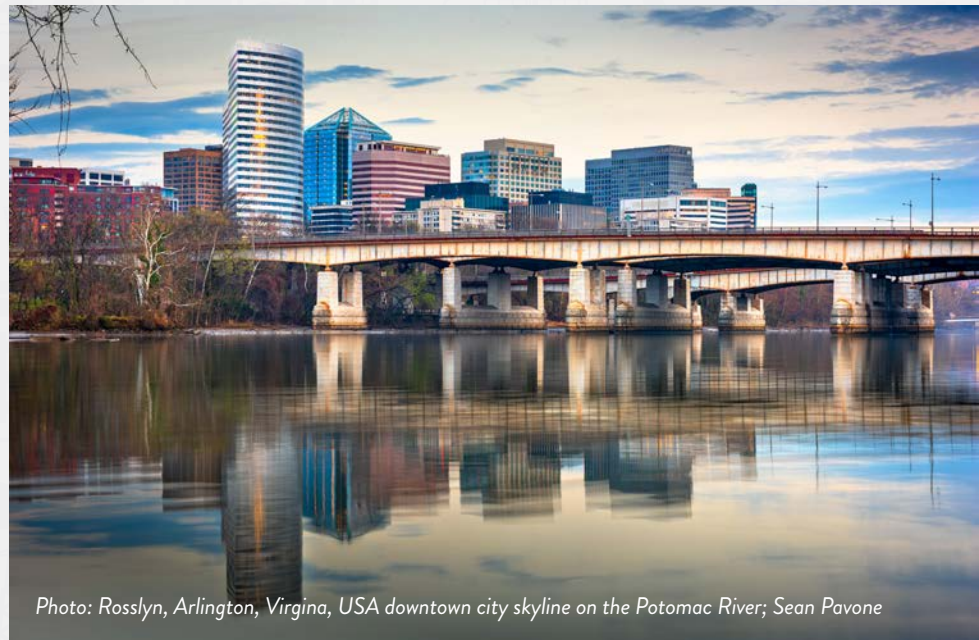


Photo: Rosslyn, Arlington, Virginia, USA downtown city skyline on the Potomac River; Sean Pavone

Broadband



GRADE
COMPARISON

VA: B+

Nat'l: C+

Photo: Construction site with a fiber optic cable roll for digital broadband internet communication; manfredxy



BROADBAND

EXECUTIVE SUMMARY

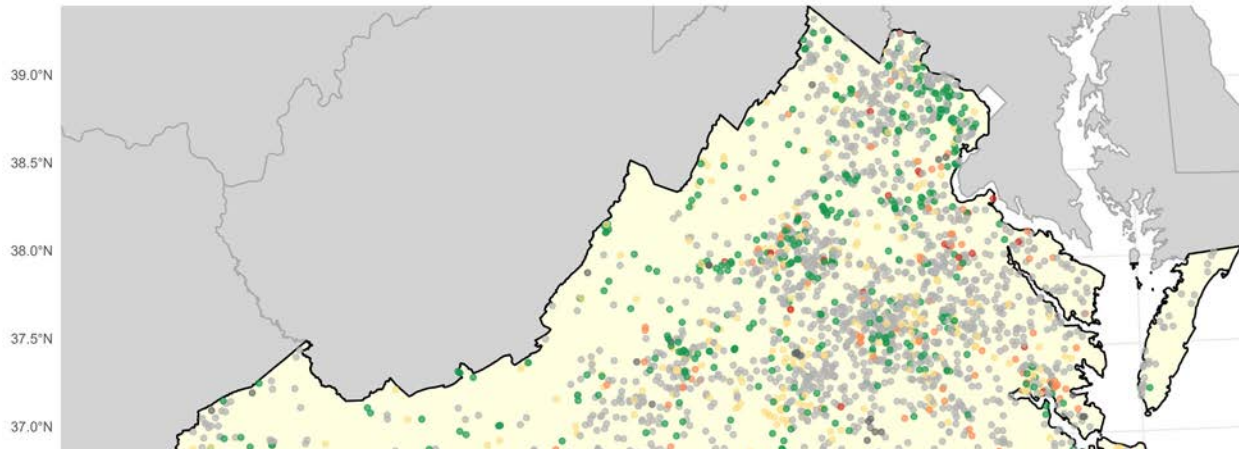
Broadband has become fundamental for Virginians, whether it be for education, work, healthcare, or even civic participation. Internet service providers (ISPs) design, construct, and maintain broadband networks to bring high-speed internet to Virginia households, businesses, and community anchor institutions (CAIs). However, many areas of rural Virginia still lack access to broadband infrastructure, as it remains challenging to build in relatively remote locations. In response, the Virginia Office of Broadband (“Office of Broadband”) has made it a priority to utilize a combination of federal and state dollars to fund broadband infrastructure deployment to unserved locations in the Commonwealth and achieve the goal of universal broadband access in Virginia. As of 2026, the Commonwealth has awarded funding to extend broadband infrastructure to more than 400,000 locations. The Office of Broadband expects Virginia to achieve universal broadband by 2030, using the Commonwealth’s \$1.48 billion allocation from the Broadband Equity Access and Deployment program.

BACKGROUND

The Virginia Office of Broadband (hereafter “Office of Broadband”), housed within the Department of Housing and Community Development (DHCD), administers several programs that deploy broadband infrastructure to unserved locations across the Commonwealth. Virginia began state support for the extension of broadband infrastructure in 2017 with the launch of VATI administered by DHCD. Small-scale investments in broadband infrastructure existed prior

to VATI through the Tobacco Region Revitalization Commission (TRRC) and the Appalachian Regional Commission (ARC) and Community Development Block Grant (CDBG) programs. Federal support for the extension of broadband infrastructure in Virginia occurred through programs administered by the Federal Communications Commission (FCC) and U.S. Department of Agriculture. The following map illustrates VATI rounds by funding year.

Figure 1: VATI Rounds by Funding Year



Source: DHCD VATI

Since 2017, the Commonwealth has funded the construction of broadband service to reach over 400,000 locations, primarily through VATI. Of these funded locations, more than 221,000 homes, businesses and community anchors have been completed as of April 2026, with the remaining locations currently

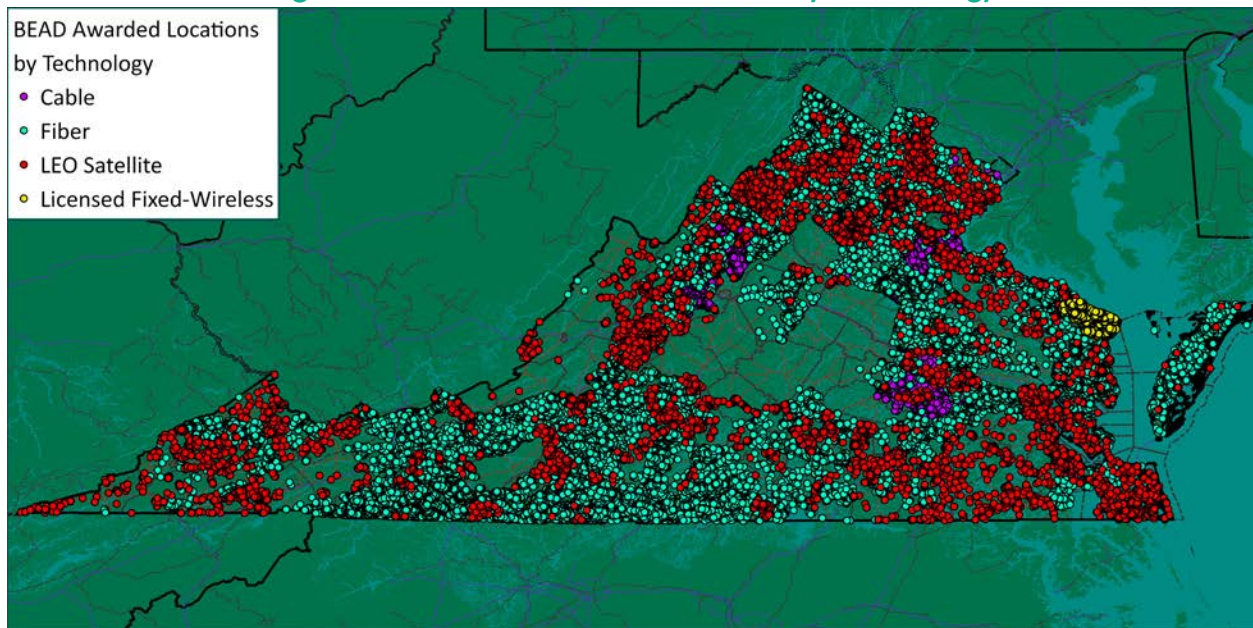
under construction. Through the BEAD program, 85,000 locations will obtain access to broadband service. The Commonwealth intends to reach remaining unserved households and achieve universal service in the Commonwealth by the end of 2030.

CAPACITY & CONDITION

Through the many initiatives that the Virginia Office of Broadband administers, the Office partners with municipal governments and the ISPs selected through their competitive application process. In line with Virginia's technology-neutral approach, these ISPs leverage a range of technologies, including fiber, cable, fixed wireless, and satellite services to connect Virginians. Virginia's BEAD Final Proposal, (approved by the National

Telecommunications and Information Administration (NTIA) on November 18th, 2025) will utilize a diverse mix of technologies to provide broadband coverage for all remaining locations across the Commonwealth previously without access, ensuring that households and businesses in every region have access to reliable, high-speed broadband service.

Figure 2: BEAD Awarded Locations by Technology

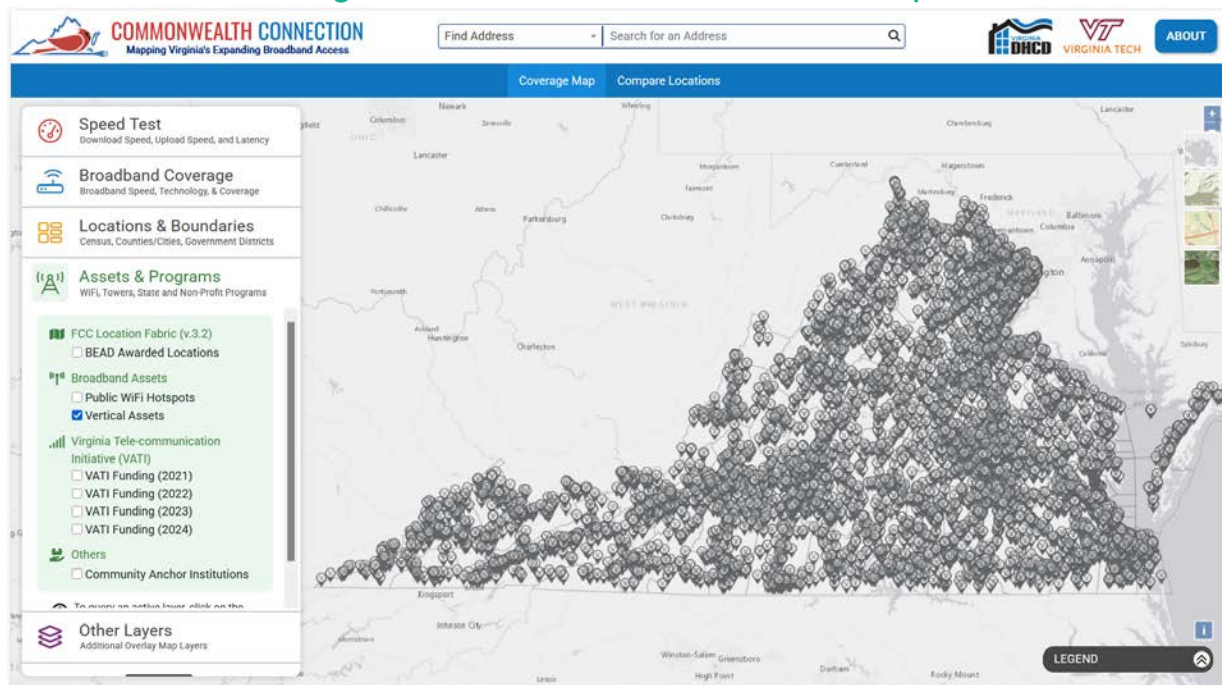


Source: DHCD BEAD

Virginia's vertical broadband infrastructure, including towers and repeaters, was first cataloged in 2009, with ongoing updates through the Commonwealth

Connection platform launched in 2021. These assets are mapped on the Commonwealth Connection and categorized by asset type.

Figure 3: Commonwealth Connection Map



Source: Commonwealth Connection

In addition to towers and repeaters, utility and telephone poles are a critical component of Virginia's broadband and electrical infrastructure. However, many of these poles—particularly in rural areas—are aging and in need of replacement or reinforcement. Wood utility poles typically have a service life of 30 to 50 years, and a significant number across the Commonwealth are approaching or exceeding that lifespan. As a result, upgrades are often required to support modern broadband technologies.

Delays associated with pole make-ready work have affected broadband deployment timelines, especially in rural communities. To mitigate these challenges and improve long-term infrastructure resilience, some ISPs are pursuing partial or fully underground deployments where feasible. While legacy infrastructure such as copper wiring and traditional telephone lines remains in some areas, it is increasingly being phased out or supplemented due to limitations in speed and reliability.

Despite these infrastructure-related challenges, Virginia has made substantial progress in expanding broadband access. Today, over 90% of Virginians have access to reliable high-speed internet—one of the highest connectivity rates in the nation—reflecting sustained investment in both modern infrastructure and strategic deployment.

While infrastructure readiness is essential to expanding

broadband access, ensuring that service is affordable is equally critical to achieving meaningful connectivity. Accordingly, although the Commonwealth's broadband investments have primarily focused on extending service to unserved areas, affordability remains a central consideration—particularly for projects funded through VATI. In the FY22 VATI funding round, the average cost of the lowest monthly broadband plan across all awarded projects was \$57.73. This figure does not reflect discounted plans available to eligible low-income households, such as Comcast's Internet Essentials or Cox's Connect2Compete. Seven projects were awarded Capital Project Funds (CPF). Across these projects, the average cost of the lowest monthly broadband plan was \$62.83, with prices ranging from \$44.95 to \$90 per month prior to the application of any benefits or discounts. These figures do not account for additional low-income offerings or subsidies that may further reduce costs for eligible households.

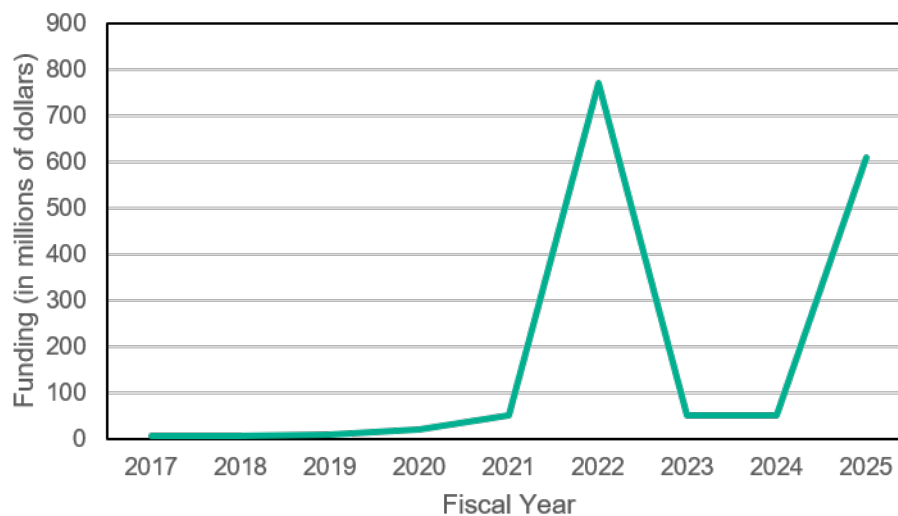
Virginia is also leveraging the BEAD program to advance its goal of providing high-speed internet access to every home, business, and community organization. Under BEAD requirements, all participating ISPs must offer a Low-Cost Service Option to eligible customers and maintain that offering throughout the federal period of performance.

FUNDING AND FUTURE NEED

Broadband infrastructure is financed through a variety of funding sources in the Commonwealth of Virginia. DHCD manages several state programs that make awards to supplement the deployment of broadband infrastructure to unserved locations across the Commonwealth. ISPs leverage funding from these state programs as subsidies for broadband deployment in areas where such infrastructure deployment would otherwise be formidable. The Office of Broadband has managed both state and federal funds through VATI and the Line Extension Customer Assistance Program, which provides

funds to cover the last mile of deployment, and will be administering \$545 million in federal funds through the BEAD program. Funds remaining from Virginia's BEAD allocation, expected to be in excess of \$800 million, will be used for non-deployment programs. Guidance on what expenditures are eligible for non-deployment funds has not yet been released by the Department of Commerce. The chart below demonstrates total funding by fiscal year since the inception of VATI.

Figure 4: Funding for Broadband Infrastructure Expansion in Virginia



Source: Virginia Office of Broadband

Table 1 details 15 programs that supported broadband deployment efforts in Virginia between FY17 and FY26. The listed programs are administered by various entities, both at the state and federal levels. A few of the programs listed are no longer active in Virginia.

Since statewide broadband deployment efforts began in 2017 through VATI the Commonwealth has greatly increased investment for broadband deployment. In 2017, Virginia announced \$944,849 in VATI grants. Virginia made its most significant investment in expanding broadband infrastructure in FY22, when the Commonwealth awarded more than \$722 million in VATI awards with funds from the American Rescue Plan Act (ARPA) and Capital Project Fund that the Commonwealth earmarked for broadband expansion. Most recently in 2024, Virginia awarded more than \$41 million in state general funds for VATI grants. In addition to VATI, DHCD is also responsible for administering federal BEAD program funding. In the Commonwealth's BEAD Final Proposal submitted in early September, and approved in November, Virginia awarded \$545 million in

grant awards for broadband deployment efforts. Several of the programs listed in Table 1, including Middle Mile, BEAD, TBCP, and ReConnect were included in the 2021 Infrastructure Investment and Jobs Act (IIJA), which provided \$65 billion in broadband investments across the country over five years—the largest federal investment in broadband in U.S. history.

With the BEAD Program addressing most of the remaining unserved locations in the Commonwealth, Virginia is now positioned to lead the nation in achieving universal broadband access. However, some homes and businesses may be unaccounted for in existing deployment efforts, primarily due to new home construction in areas without broadband access and inaccuracies in federal location-level mapping may leave. The Office of Broadband is developing guidelines for a final round of VATI with remaining allocated general funds to identify and serve any remaining locations. In the future, it is expected that new construction will be connected to nearby broadband infrastructure, a reality made possible by the statewide infrastructure deployment.

Table 1: Broadband Funding Programs in Virginia

Program	Administering Entity	Description	Active in Virginia	Funding
GO Virginia	State - DHCD	Supports extension of “middle mile” broadband projects in partnership with the private sector.	FY19 – present	State - \$5M
Line Extension Customer Assistance Program (LECAP)	State – DHCD	Supports extension of existing broadband networks to low- and moderate-income households where distance exceeds the internet service provider’s standard for connection drop length.	FY22 – present	State - \$10M ^a
Last Mile Broadband Program	State – Tobacco Commission	Supports deployment of broadband services to southern and southwest Virginia.	FY17 – FY20	State - \$140M
Utility Leverage Unserved Area Certification Program	State – SCC, DHCD ^b	Allows Virginia’s investor-owned utilities to leverage utility-owned fiber for network expansion in unserved areas of the Commonwealth.	FY21 - present	N/A
Virginia Telecommunication Initiative (VATI)	State – DHCD	Uses state and other funds to fund public-private partnerships providing targeted financial assistance to extend broadband service to areas currently unserved by a provider.	FY17 - present	State/Federal - \$976.6M (including federal pandemic relief funding)
Appalachian Regional Commission	Federal – DHCD	Similar to VATI, uses federal funds, run through state application processes to extend broadband service to areas currently unserved by a provider.	FY22 - present	State - \$26.9Ma
Broadband Equity, Access, and Deployment (BEAD)	Federal – NTIA ^c , DHCD	Provides funding to states to enable greater broadband access in unserved areas, underserved areas, and community institutions. Requires 25% match (e.g., from the internet service provider, locality, utility, state, etc.) and low-cost options.	Expected FY26	Federal - \$1.48Ba
Connect America Fund II (CAF II)	Federal – FCC	Supports bringing broadband to eligible rural areas in the U.S. through a federal auction-based program.	FY19 - present	Federal - \$109M
Connecting Minority Communities Pilot Program (CMC)	Federal - NTIA	Provides funding to help colleges and institutions that serve minority and tribal communities.	FY22 - present	Federal - \$9.7M
Coronavirus Aid, Recovery, and Economic Security (CARES) Act	Federal – U.S. Treasury	Provided funding to address short-term broadband needs during the COVID-19 pandemic. Funding utilized for connectivity (access), affordability, and adoption programs.	FY20 - FY21	State - \$30Ma
Enabling Middle Mile Broadband Infrastructure Program (“Middle Mile”)	Federal - NTIA	Provides funding to expand “middle mile” infrastructure to reduce the cost of connecting unserved and underserved areas.	FY24 - present	State - \$16.4M
Enhanced - Alternative Connect America Model (E-ACAM)	Federal – FCC	Provides funding to broadband providers, usually legacy phone companies, to extend broadband access throughout locations in their legacy footprints.	FY24 - present	Federal - \$180.1M
Rural Digital Opportunity Fund (RDOF)	Federal - FCC	Supports bringing high speed fixed broadband service to rural homes and small businesses that lack it through a federal auction-based program.	FY21 - present	Federal - \$159M
Tribal Broadband Connectivity Program (TBCP)	Federal – NTIA	Supports tribal governments bringing high-speed internet to tribal lands, including telehealth, distance learning, affordability, and digital inclusion initiatives.	FY21 - present	Federal - \$1.5M
USDA ReConnect	Federal - USDA	Offers loans, grants, and loan-grant combinations to facilitate broadband deployment in areas of rural America that currently do not have sufficient access to broadband.	FY20 - present	Federal - \$83.1M (grants and loans)

^a Funding is federal funding that is passthrough the state.

^b DHCD certified areas are unserved.

^c Funds were provided by the National Telecommunications and Information Administration.

OPERATION AND MAINTENANCE

The Office of Broadband coordinates the awarding and compliance of state and federal dollars to deploy broadband infrastructure across the Commonwealth. Virginia has a broad array of ISPs operating across many service territories. National carriers such as Verizon, Cox, and Comcast have significant service territories, while local and regional providers include local ISPs, electric and telephone cooperatives, and licensed and unlicensed fixed wireless providers. The Office of Broadband works in tandem with these ISPs and Virginia's localities to expand broadband infrastructure to areas that are currently unserved or underserved across the state.

Broadband infrastructure projects can be shaped by federal environmental and permitting requirements, including those tied to National Forest and National Parks easements, railroad easements, and Tribal land access. For these projects, ISPs are required to submit a series of documents with project applications detailing specific information on how the ISP will comply with mandatory requirements during project implementation. These requirements can slow deployment timelines but also ensure that projects respect environmental protections and sovereign land rights. Easement access policies sometimes require lengthy negotiations, which directly affect project costs and completion timelines. Together, these regulations set the boundaries within which broadband expansion can occur, requiring careful coordination between municipal governments, ISPs, as well as The Office of Broadband.

ISPs are responsible for the maintenance and upkeep of current and future network infrastructure. The Commonwealth emphasizes scalability of networks for broadband deployment projects, requiring ISPs to provide information during the application process on system maintenance and the scalability of their networks, such as how speeds can be upgraded and how more subscribers can be added to a network.

Ensuring a sufficient workforce for both the construction and maintenance of broadband networks is paramount to the Commonwealth's efforts to deploy broadband infrastructure. There are a range of workforce development programs currently in development across the Commonwealth, including those led by state and municipal government, higher education institutions, and those coordinated by the private sector. For careers in broadband deployment, Southside Virginia Community College offers the Fiber Technician Program, a three-week course designed to train those interested in becoming fiber technicians with the skills and knowledge required to install, splice, test, and maintain "Fiber to the Home" and "Fiber to the Building" systems. Workforce development programs such as the Fiber Technician Program provide individuals with valuable education and experience as they begin their professional careers.

PUBLIC SAFETY, RESILIENCE, AND INNOVATION

Severe weather has had an impact on Virginia's ability to expand and maintain broadband infrastructure. In September of 2024, former Hurricane Helene passed through Southwest Virginia as a Tropical Storm, causing extensive damage to broadband infrastructure across the region due to flooding, wind damage, and debris. According to the Federal Communications Commission's "Status Report for Areas Impacted by Hurricane Helene," 27 Virginia localities were included in the storm's "disaster area." Severe weather events like this are becoming both more frequent, and more severe, resulting in the Commonwealth being forced to incorporate this reality into strategic planning moving forward.

Virginia's Cybersecurity Planning Committee (VCPC) is charged with developing and adopting the Commonwealth's cybersecurity plan, obtaining input from a wide variety of stakeholders, and building the necessary consensus to ensure this plan can advance cybersecurity across the Commonwealth. The committee's 16 members are appointed by the Governor, serve four-year terms, and at least half are required to have professional experience relating to cybersecurity or information technology. Currently, the committee is in the midst of creating a cohesive planning network that builds and implements cybersecurity preparedness initiatives using federal, state, local and tribal, private sector and faith-

based community resources. For more information visit the VCPC's website here: <https://www.vita.virginia.gov/security/cybersecurity-grants/vcpc/>.

Broadband projects that receive federal funding, such as through the Capital Project Fund, must complete an environmental review process that embeds sustainability considerations. This review requires grantees to provide detailed project descriptions, including scope, location, and number of passings. Grantees must also categorize and aggregate project areas to make environmental impacts more manageable. During the review, projects are evaluated for potential effects on air quality, wildlife, flora, wetlands, floodplain management, and a myriad of other relevant environmental areas. These steps ensure sustainability is accounted for in the design and construction phase of broadband projects. Any projects

funded by the BEAD Program will be required to comply with the National Environmental Policy Act (NEPA).

Sustainability principles have been applied in the management of existing broadband infrastructure. Grantees and their subcontractors evaluate network assets with long-term resilience in mind. This includes designing systems that can withstand environmental risks such as flooding and extreme weather events. As a result, sustainability is not just a front-end requirement but also factors in ongoing infrastructure management. The Office of Broadband guides cost-effective management of broadband infrastructure through the analysis of the long-term sustainability of networks during each of its programs' respective application phases. This analysis is conducted through the review of design plans, project scalability, and resiliency plans of the planned build.



Photo: Telecommunications infrastructure supporting cellular networks with antennas mounted on a steel truss tower; marekusz



RECOMMENDATIONS TO RAISE THE GRADE

- Reach universal access to broadband by 2030.
- Use remaining BEAD non-deployment funding to supplement broadband infrastructure through eligible programs.
- Improve broadband affordability and digital skills across the Commonwealth.
- Facilitate make ready and permitting processes to expedite deployment of infrastructure to reach universal connectivity.

DEFINITIONS

BROADBAND INFRASTRUCTURE: Defined as access to broadband infrastructure with speeds in excess of 100 Mbps download and 20 Mbps upload.

PASSING: Any structure that can receive broadband service. Multi-unit structures may be counted as more than one passing, provided individual connections and accounts are planned at that structure.

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Dams



Photo: Buck Dam on the New River in Virginia; HokjeTim

GRADE
COMPARISON

VA: C-
Nat'l: D+



DAMS

EXECUTIVE SUMMARY

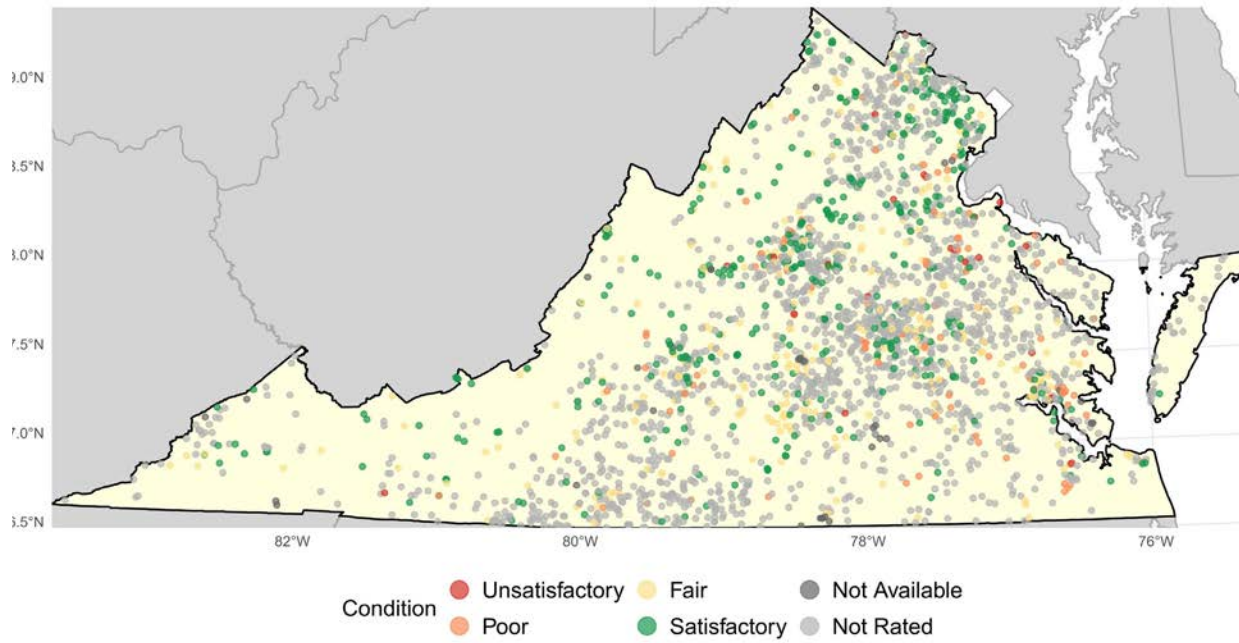
Virginia's dam system includes about 2,712 dams, most of them small and privately owned. A substantial share of dams lacks clear documentation, including missing ownership, purpose, hazard classification, and condition, which makes it harder to manage risk, understand accountability, and prioritize maintenance. However, the share of dams with undetermined hazard potential improved from 70% in 2022 to 65% in 2026. Condition data is limited, with roughly 68% of dams lacking a condition rating, and about 14% of rated dams in poor or unsatisfactory condition. Inspection activity has declined since 2022, with fewer than half of high-hazard-potential dams inspected since 2022 and only about 13% of all dams inspected since that time. Funding remains the dominant constraint: a \$5 million grant for 2026 is insufficient relative to an estimated \$5.42 billion rehabilitation need for the Commonwealth, resulting in deferred maintenance and rehabilitation, allowing deterioration to continue.

CAPACITY AND CONDITION

Virginia's rivers are influenced by approximately 2,712 dams distributed across the Commonwealth (Figure 1). At least 56% are privately owned and 11% are owned by local governments, with the rest owned by State and Federal government and/or by multiple listed owners. The large majority (92.6%) of dams are less than 50 ft tall (Table 1), and the majority (at least 52.2%) are used at least partially for recreation (Table 2). 17% of dams have more than one listed purpose, and 22.6% of dams have no available information on the primary

purpose of the dam. It should be noted that the data presented throughout this section refers to the publicly available data in the National Inventory of Dams. The Virginia Commonwealth keeps Virginia's Dam Safety Inventory System (DSIS) which contains alternative inclusion criteria. As of April 15th, 2026, there are 3,753 dams in the DSIS. We present NID data based on 2,712 records.

Figure 1: Dams across Virginia by condition rating.



Created by authors using data from NID.

Table 1: Virginia dams by height

Height	Number	Percentage
Less than 25 feet	1264	46.6%
25-50 feet	1247	46%
51-100 feet	159	5.9%
Greater than 100 feet	38	1.4%
Undetermined	4	0.1%

Source: NID

Table 2: Virginia dams by purpose

Purpose	Number	Percentage*
Debris control	6	0.2%
Fire protection, stock, or small fish pond	33	1.2%
Fish and wildlife pond	103	3.8%
Flood risk reduction	304	11.2%
Hydroelectric	55	2%
Irrigation	308	11.4%
Navigation	5	0.2%
Recreation	1417	52.2%
Tailings	16	0.6%
Water Supply	177	6.5%
Other	185	6.8%
Undetermined	612	22.6%
* Sum exceeds 100% because 452 dams have multiple listed purposes		

Source: NID

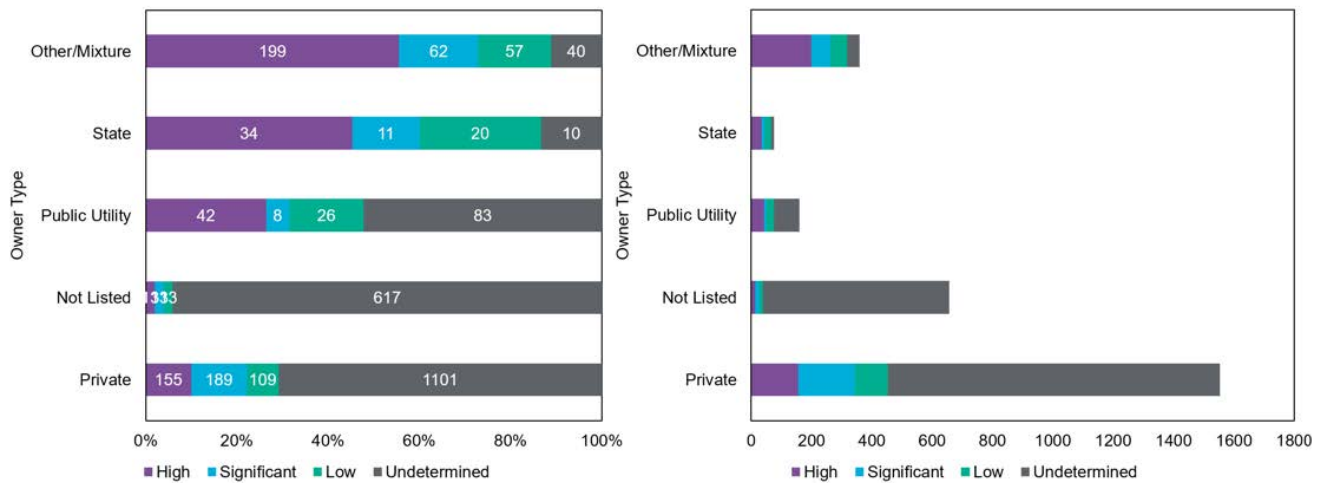
The NID classifies dams by *hazard potential* (magnitude of damage or consequences in the event of a dam failure) and *condition rating* (physical and operational status of the dam) (Table 3). The 2022 version of this Report Card reported that hazard potential of dams was generally increasing given increased development in the vicinity of formerly rural dams but that the true distribution is uncertain given the large number of dams with missing hazard classification. The fraction of dams with “undetermined” hazard declined slightly from 70% in 2022 to 65% in 2025, and the fraction of dams classified as “significant” or “high” hazard increased from 20% to 23% compared to the fraction of dams classified as “low” hazard, which increased from 10% to

12%. Of the 440 high-hazard-potential dams (HHP) with condition information, 52 dams (1.2%) are older than 50 years, 166 (38%) are used for recreation, and 140 (32%) for flood reduction purposes.

While the distribution of formal hazard ratings remains fairly stable, the high fraction of dams with undetermined hazard rating limits the prioritization of dam inspections and other allocations of resources. Figure 2 shows the breakdown of hazard potential by their ownership. Likewise, 68% of dams also lack a reported condition rating. Of the 32% of dams that have a reported condition rating, 14% are “poor” or “unsatisfactory”.

Figure 2: Dams hazard potential by ownership.

Y axis in both panels indicates ownership category. Panel A showcases hazard type by percentage, Panel B showcases hazard type by count.



Created by authors using data from NID.

Table 3: Virginia dams by condition rating and hazard assessment.

Hazard	Condition					
	Unsatisfactory	Poor	Fair	Satisfactory	Not Available	Not Rated
High	8	44	143	191	15	39
Significant	4	13	55	69	10	32
Low	7	34	47	115	11	102
Undetermined	4	10	47	30	0	1682

Created by authors using data from NID.

FUNDING AND FUTURE NEED

Funding for dams in Virginia comes from competitive grants, state appropriations, and the financial capacity of individual owners. The primary state mechanism for providing financial assistance is the Virginia Dam Safety, Flood Prevention and Protection Assistance Fund (DSFPPAF), which is administered by the Virginia Resources Authority (VRA) on behalf of the Department of Conservation and Recreation (DCR). The DSFPPAF is financed through multiple sources, state appropriations, flood insurance premium assessments, recycled loan repayments, and investment

income, creating a stable, non-reverting pool to help dam owners meet regulatory requirements. There also exist related but smaller funding mechanisms including the Resilient Virginia Revolving Loan Fund (RVRF) and the Small Dam Repair Fund for Soil and Water Conservation District Dams. However, the sufficiency of the current funding levels remains a central point of concern for assessing the status of Virginia dams.

The 2026 DSFPPAF grant round announced \$5 million in grants to match funds committed by dam owners and lowered the required match from 50% to 10-30% of the

total relative to 2021. However, this figure is eclipsed by the estimated \$5.42 billion needed for statewide rehabilitation. Previous assessments recommended funding the DSFPPAF on the order of \$250 million over five years to bring high-hazard dams up to an adequate condition as well as other programs and investments to improve data availability given the significant gaps. The FY2023 budget appropriated \$10 million of state funds plus \$10 million from the American Rescue Plan Act to recapitalize the DSFPPAF. Between FY2025 and FY2026, the Fund was replenished with approximately \$6.4 million, and \$3 million was allocated for small dam repairs through Soil and Water Conservation Districts. Annual commitments since 2023 range between \$2.9 million to \$9.6 million. Evaluating these numbers, the current average rate of appropriation covers less than

0.1% of the identified need. This mismatch between available capital and necessary expenditure creates a significant risk profile, as maintenance and rehabilitation work is frequently deferred, leading to rising costs due to inflation and structural deterioration.

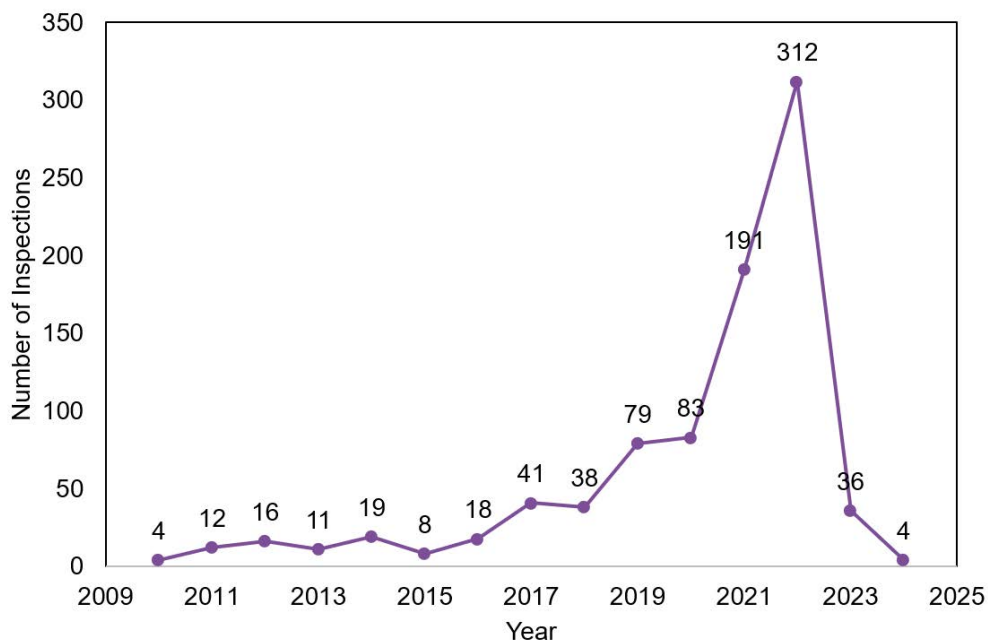
In addition to state appropriations, some dams are eligible to tap into federal resources for dam maintenance and rehabilitation. Unfortunately, several of these large projects funded by the Infrastructure Investment and Jobs Act have been canceled, for example, a \$24 million project to fund improvements to the Lake Meade Dam was cancelled in 2025. This serves as a stark reminder that meeting infrastructure goals requires consistent and reliable funding.

OPERATION AND MAINTENANCE

Available data suggest that Virginia's dams are aging and that the average time since last inspection is increasing. Of the 6% of dams with age data, 81% are more than 50 years old (up from 76% in 2022), with an average age of 77.4 years. In 2022, there had been a recent uptick in inspections (Figure 3), with less than 50% of high-hazard dams having been inspected annually since 2017. Since 2022, inspections have declined

substantially, with less than 50% of HHP dams having been inspected at all since 2022. Of the 34% of dams with recorded inspections, only 38% (i.e., 13% of all dams) have been inspected since 2022, and 4% (i.e., 1% of all dams) have been inspected since 2023. Here, too, the large amount of incomplete data in the NID makes definitive conclusions about the overall condition of Virginia's dams difficult to ascertain with certainty.

Figure 3: Number of dam inspections in Virginia since 2010.



Created by authors using data from NID.

The private sector owns most dams in Virginia, approximately 56% of the total inventory. This includes individual farmers, homeowner associations (HOAs), and private utilities. Private owners play a critical role in the Commonwealth's public safety landscape. They are legally responsible for important aspects of dam operation and maintenance including inspections, emergency action plans for high-hazard structures, mapping inundation zones and more. Most private dam owners do not have a dedicated revenue stream to fund these requirements. HOAs, for example, must fund dam repairs through member dues, which can lead to special assessments in the tens of thousands of dollars

PUBLIC SAFETY

On May 11, 2025, the Virginia Department of Wildlife Resources (DWR) issued emergency declarations for the “imminent failure” of the Gardy’s Millpond Dam, following the Virginia Department of Transportation’s discovery of a breach in the dam the day before. The dam had last been inspected in September 2024 and is classified as a “low hazard” dam. The DWR performed emergency stabilization of the dam, including placing sandbags around the eroded portion. While it did not result in a full dam failure or any significant economic impact, this example reminds us that even dams with recent inspections can have significant and quickly emergent changes in status that impact public safety.

The continued rapid development of Northern Virginia, the Tidewater region, and other growth corridors has led to “hazard crawl.” This occurs when new residential or commercial construction is built within the inundation zone of an existing low-hazard or significant-hazard dam. This development can then trigger a reclassification of the dam to “High Hazard,” forcing the owner to comply with much more extensive safety standards despite the dam itself not having changed. This is of particular concern for many private

per household for major repairs. This “revenue gap” is a large driver of the backlog in dam maintenance. To mitigate this, the state legislature has expanded the eligibility of the DSFPPAF to include private entities. In 2025, several private owners received grants for inundation zone analysis and rehabilitation plans. Moving forward, it is important to recognize that many smaller owners including both private sector owners and smaller local municipalities often struggle to secure the 10% to 30% match required for state grants thus creating a difficult environment to access the currently available pools of funding for maintenance and rehabilitation.

owners who have no clear revenue streams for dam maintenance as discussed above or who may not have technical expertise to manage more extensive safety protocols. In terms of staffing, Virginia has grown its dam safety workforce and budget significantly since 2001, but staff remain responsible for more high-hazard dams per person than the national average, suggesting the program may still be under-resourced relative to the size of its inventory.

Risk is concentrated in the 427 high-hazard-potential dams, where failure would likely cause loss of life and severe economic disruption. The Commonwealth has strengthened resilience through risk-informed oversight, expanding dam break inundation zone (DBIZ) mapping via tools like VFRIS and enforcing robust Emergency Action Plan (EAP) requirements (including periodic updates and exercises) as a prerequisite for operation and maintenance certificates. However, large compliance costs persist and additional expenses for mapping and EAP development can strain local budgets and smaller owners, as discussed in the Funding section. Overall, 91% of high hazard dams have an EAP prepared.

Table 4: Virginia High Hazard Dams by condition and EAP status.

Condition	EAP Status	
	No EAP	EAP Prepared
Unsatisfactory	2	6
Poor	7	37
Fair	5	138
Satisfactory	3	188
Not Available	0	15
Not Rated	21	18

Created by authors using data from NID.

Another significant public-safety risk is the incomplete accounting of Virginia’s dams in commonly used state and public-facing databases, which creates blind spots for both regulators and emergency managers. When a dam lacks a hazard classification, it is harder to ensure it is being managed in the best interest of the public’s safety. The inventory shows 39 high-hazard dams listed as “Not Rated,” and 13 additional high-hazard dams with condition “Not Available,” meaning dozens of dams with the greatest life-safety consequences lack complete, decision-ready condition information. More broadly, 1,683 dams with “Undetermined” hazard are also “Not Rated,” and across

all hazard classes there are 1,856 dams marked “Not Rated” plus 35 with condition “Not Available,” leaving a substantial share of the statewide portfolio without clear condition or risk signals for planning and prioritization. As hazard crawl continues in fast-growing regions, an unmapped or poorly documented structure can shift from “low consequence” to “life-safety threat” before localities, responders, and downstream residents have reliable inundation-zone information. Increased resources are imperative to modernize and complete the inventory of dams in the Commonwealth, which is critical for public safety and resilience.

RESILIENCE AND INNOVATION

Innovation is increasingly visible in how Virginia plans, funds, and modernizes dam-related infrastructure. The Dam Safety Program leverages digital systems such as the Dam Safety Inventory System (DSIS) and updated VFRIS datasets to streamline permitting, inspections, and prioritization with limited staffing capacity, while a revised general permit program for low-hazard dams (introduced in 2026) is designed to reduce administrative burden and refocus engineering resources on higher-risk structures. On sustainability and resilience practice, some parts of the Commonwealth, like the City of Richmond, are voluntarily adopting frameworks like Envision, to embed climate robustness, ecological outcomes, and life-cycle value into project delivery.

As many dams reach the end of their design life, they often become obsolete, no longer serving their original purpose for hydropower, milling, or water supply. These

aging structures pose a public safety hazard and degrade the river ecosystem by trapping sediment and blocking fish migration. To date, American Rivers estimates that 60 dam removals have been documented in Virginia. Since 2021, 13 removals have occurred, including high-hazard dams like the College Lake Dam in Lynchburg Virginia.

Proactive measures, such as the introduction of a revised general permit program for low-hazard dams in 2026 show that the state is attempting to reduce administrative friction. Continued support for dam removal when appropriate also highlights the Commonwealth’s values around resilience and innovation. However, the physical reality of aging embankments, undersized spillways, and increasingly unpredictable rainfall regimes due to climate change pose significant remaining challenges for the resilience and innovation of Virginia Dams.



RECOMMENDATIONS TO RAISE THE GRADE

- Increase by at least one order of magnitude annual appropriations for the DSFPPAF from approximately \$5 million per year to \$50 million per year.
- Undertake a concerted effort to bring the database of dams in the Commonwealth up to date and eliminate the large number of key entries that are unknown.
- Provide funding for additional state dam safety staff to improve the dam inspection program and to support enforcement action for deficient dams. At minimum, two additional engineering staff are necessary to match other states with similar dam safety needs.
- Implement a statewide awareness campaign to educate individuals on the location and condition of dams in their area and become more “dam aware.”
- Update probabilistic maximum precipitation estimation approaches, consistent with the 2024 National Academies guidance, to more accurately capture extreme changes in rainfall behavior and provide the engineering community with improved data for dam design and the development of resilience measures.



Photo: Small dam with running water fall in Accotink park in Fairfax, Virginia; Andriy Blokhin



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Drinking Water



GRADE
COMPARISON

VA: C+

Nat'l: C-

Photo: View of the Charlottesville Reservoir from Moorman's River Overlook, on Skyline Drive, in Shenandoah National Park, Virginia; Jon Bilous



DRINKING WATER

EXECUTIVE SUMMARY

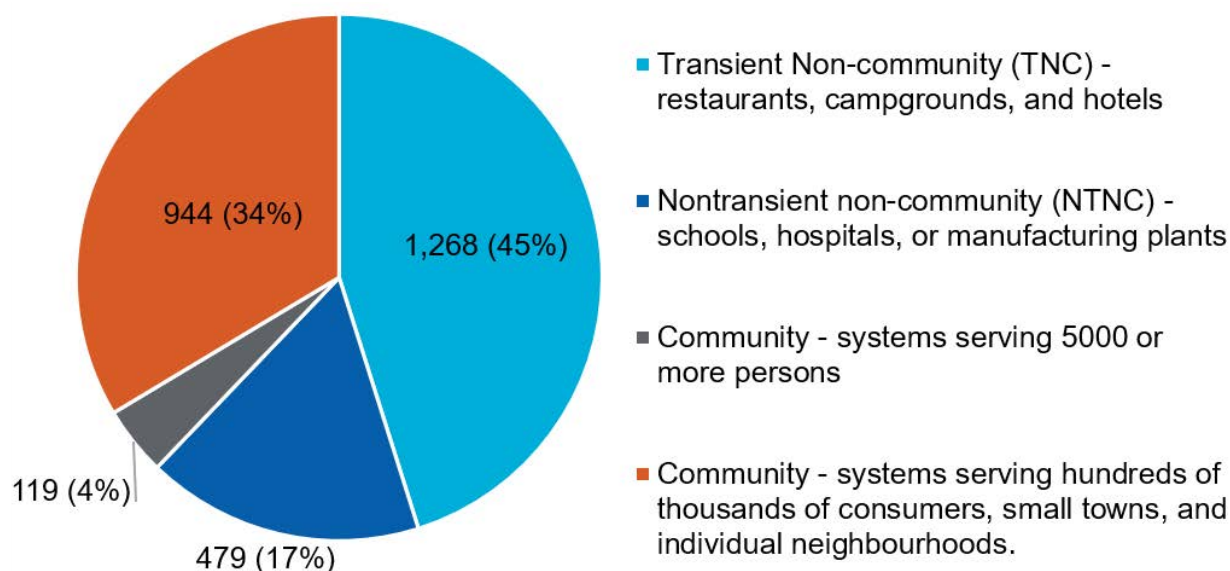
The main source of drinking water for municipal systems in Virginia is 1,780 groundwater wells. Other sources include 170 surface water intakes on lakes, reservoirs, rivers and streams. The Commonwealth has over 2,800 community and non-community waterworks. While statewide population growth is not broadly straining drinking water infrastructure, rapid growth in some localities—particularly near Richmond—is increasing maintenance demands and affecting service reliability. Additionally, funding remains a significant challenge. Average customer rates are well-below the level typically needed to support long-term capital investment, forcing many systems to rely on municipal subsidies and state or federal grant and loan programs. While recent federal investments through the IIJA and related drinking water programs have provided important support, particularly for emerging contaminants and disadvantaged communities, aging infrastructure, affordability constraints, and a shrinking licensed operator workforce creates years-long risks for Virginia’s drinking water systems.

CONDITION AND CAPACITY

The Virginia Department of Health, Office of Drinking Water (ODW) staff direct programs, tools, and activities that support Virginia’s waterworks strategy efforts. These systems collectively serve approximately 7.8 million consumers – almost 75% of the total population

of Virginia (8.89 million people). Virginia has 1,063 community waterworks, 1,268 transient non-community waterworks, and 497 non-transient non-community waterworks (Figure 1).

Figure 1. Waterworks Systems in Virginia, Virginia Department of Health, Drinking Water Viewer (DWV)



The main source of drinking water for municipal systems in Virginia is 1,780 groundwater wells. Other sources include 170 surface water intakes on lakes, reservoirs, rivers and streams. Virginia’s overall population is not increasing at a rate that is causing statewide infrastructure strain; however, some localities such as New Kent and Goochland Counties near Richmond are experiencing 20% growth year-over-year which is causing infrastructure strain leading to increased maintenance and less reliable service quality.

Between October 1, 2022, and September 30, 2025, the Office of Drinking Water (ODW) identified 29 community and non transient, non community (NTNC) water systems as “new.” Of the systems classified as “new,” 14 had at least one violation. The number of new systems with violations increased slightly in 2024, when 10 newly identified water systems had violations. At the same time, the total number of new systems decreased to 34 in 2024. In the most recent year (October 1,

2024, through September 30, 2025), only three new systems were identified, just one of those had a violation. New water systems often have early violations under the Revised Total Coliform Rule. These issues are frequently linked to limited staffing, funding, or technical capacity, and existing systems needing repairs or upgrades. New systems may also struggle with proper sampling procedures and techniques when they first begin operating. None of the new systems are listed on EPA’s Enforcement Targeting Tool (ETT). The ETT is designed to focus enforcement efforts on water systems with serious health based violations or a pattern of ongoing noncompliance across multiple drinking water rules.

Two million residents, or 22% of Virginia’s population, rely on well water. There has not been a significant increase in the number of applications for new wells since 2020 (Table 1). Nine to twelve percent of the total wells constructed each year are to replace an existing water supply well.

Table 1. New Well Applications

Year	No. of Applications	Class IV Applications (Industrial, geothermal, and irrigation wells)
2020	10,282	1237
2021	11,395	1273
2022	10,499	1179
2023	9,964	996
2024	10,079	941
2025	9,907	845

Source: Private Well Program Coordinator, Office of Environmental Health Services, Virginia Department of Health

Virginia's largest water provider is Fairfax Water, providing 170 million gallons of water per day (MGD), serving over 2.2 million people. The plant capacity is 345 MGD. What is not distributed by Fairfax Water is sold to other water authorities including Prince William Water and several city systems.

Due to the size of Fairfax Water, each major asset is managed by an individual plan, for example electrical systems, storage tanks, pipes, etc., and GIS Tracking of pipes, pumps, valves, and corrosion protection equipment. Fairfax Water, using a program to identify older leaking pipes for replacement has reduced their water which is lost due to leakage, unbilled or unauthorized consumption, or metering inaccuracies, to 6.9%. Most of Fairfax Water piping was installed in the last 40 years but 23% of their system is iron piping installed in the 1950's and 1960's which is failing more frequently.

The city of Danville has 337 miles of water mains serving approximately 18,000 customers. Water mains were

installed in 1900-1920 and then in 1950-1960, with an average 20 water main breaks per year over the past 5 years. The water mains installed in the 1950s and 1960s are showing the most concern.

The City's water tanks, water treatment plant, reservoirs, and pumping stations are in very good shape. There is one surface water intake from the Dan River. The water treatment plant was built in 1902 with several additions and upgrades over the past 120 years. The water treatment plant's treatment capacity is 18 MGD and treats approximately 6 MGD. Danville Utilities also supply water to Yanceyville, NC (350,000 gpd) and Pittsylvania County, VA (550,000 gpd).

The City's 2022 master plan prioritized water main projects over the next 10 years to work on replacing 150 miles of cast iron over the next 20-30 years. The City is using their GIS system and 10-year master plan for an asset management system that will be able to track the maintenance history of all our assets and infrastructure.

OPERATION AND MAINTENANCE

Most waterworks are small and privately owned; however, county and municipal governments operate the waterworks that serve most of the population.

ODW continues to fund applications for leak detection equipment under the set-asides from the Drinking Water State Revolving Fund (DWSRF). The Virginia Rural Water Association (VRWA) provides leak

detection services through ODW referral and direct contact from waterworks. VRWA reported delivery of 764 hours of leak detection technical assistance service to several waterworks in Virginia during the reporting period.

Maintenance includes the repair of plants, pump stations, storage tanks and pipelines.

Asset management plans are more common for waterworks that serve populations of 5,000 or more. Maintenance at smaller waterworks is typically focused on reactive work, but shifts towards proactive work for waterworks serving populations of 5,000 or more.

Licensed operators are aging out faster than they are being replaced, leaving large gaps in the water workforce. Also, licensed operators take advantage to increase pay by jumping between localities, exacerbating the challenge of retaining qualified staff (Table 2).

Table 2: Number of Operators by Class as of September 30, 2025

Class License	Number of 2024 Licensees	Number of 2025 Licensees	Net Gain (Loss)
6	210	191	(19)
5	267	266	(1)
4	321	302	(19)
3	356	343	(13)
2	334	318	(16)
1	767	760	(7)
Total	2,255	2,180	(75)

Source: Commonwealth of Virginia, Capacity Development Annual Implementation Report, October 1, 2024, through September 30, 2025

FUNDING AND FUTURE NEED

The average billing rate should be 1% of the customer base's median household income, which in Virginia would be approximately \$75.82 per month but is much lower, around \$45/month. Therefore, waterworks rarely cover expenditures and long-term capital improvement with rates alone. These projects are subsidized by other parts of the municipal budget and/or through grant/loan programs.

The DWSRF program provides financial assistance to help water systems and states achieve the health protection objectives of the Safe Water Drinking Act. This federal revolving fund provides loans and other authorized assistance to water systems for eligible infrastructure projects. The DWSRF program requires 20% state matching dollars. Loan repayments and interest flow back into the dedicated revolving fund. Virginia received its first DWSRF loan offer in June 1998.

The Infrastructure Investment and Jobs Act (IIJA) of 2021 allocated an additional \$11.7 billion over five years to the nationwide DWSRF program. In 2025, \$945 million funding allotments were added to the IIJA for

the Emerging Contaminants in Small or Disadvantaged Communities grant program. This program funds the reduction of per- and polyfluoroalkyl substances (PFAS) and other contaminants, specifically focusing on underserved, small, and disadvantaged communities. December 21, 2024, the states of Florida, Georgia, North Carolina, South Carolina, Tennessee, and Virginia were awarded addition DWSRF through the Hurricane Helene, Milton, and Hawaii Wildfires Special Appropriation (SA-HMW) funding.

From July 1, 2024, through June 30, 2025, ODW received applications for the FY 2025 DWSRF, FY2025 IIJA and SA-HMW funding. EPA's awards for the FY2025 BIL/IIJA grants were provided on August 28, 2025.

ODW closed 83 State Revolving Fund construction projects totaling \$70.1 million during this reporting period. As of June 30, 2025, Virginia's program has completed funding/financing agreements for 574 projects, which total \$617,943,291 (Table 3).

Table 3. DWSRF Annual Funding/Financial Agreements

Year	State Fiscal Year	# of Binding Commitments	Amount
1	1998	1	\$4,000,000
2	1999	3	\$8,000,000
3	2000	15	\$15,114,517
4	2001	20	\$24,584,781
5	2002	30	\$33,827,968
6	2003	19	\$19,875,065
7	2004	16	\$11,667,041
8	2005	17	\$10,654,508
9	2006	17	\$16,833,000
10	2007	15	\$12,124,046
11	2008	12	\$6,193,126
12	2009	18	\$13,707,176
13	2010	17	\$13,503,089
14	2011	16	\$15,496,322
15	2012	16	\$18,330,972
16	2013	15	\$26,077,006
17	2014	19	\$28,182,614
18	2015	20	\$16,262,052
19	2016	24	\$16,912,070
20	2017	20	\$17,435,147
21	2018	23	\$26,938,449
22	2019	34	\$19,256,987
23	2020	20	\$12,142,839
24	2021	16	\$87,052,223
25	2022	12	\$10,960,861
26	2023	14	\$20,584,189
27	2024	25	\$22,018,981
28	2025	83	\$70,070,019
	Grand Total	574	\$617,943,291

Source: Virginia Drinking Water State Revolving Fund Program (DWSRF) State Fiscal Year 2025

Overall, O&M and capital improvement projects are drastically underfunded in Virginia. Virginia's population is growing slowly with certain localities experiencing rapid growth. Increasing population and water consumption are outpacing rate increases, challenging infrastructure upgrades. Virginia received almost \$600,000,000 in requests for DWSRF in the past year, while only being able to fund about \$100,000,000 worth of projects.

Earmarks known as "Community Grants, (CG)" or "Congressionally Directed Spending, (CDS)" grants are projects proposed by members of Congress for projects

in areas served by their constituents. Earmarks taken from the Drinking Water State Revolving Fund reduce the amount of remaining DWSRF funding that comes to state for drinking water programs. DWSRF earmarks have been increasing. Earmark dollars are permanently removed from the DWSRF pool – losing years' worth of added revenues for other projects. To make up for earmark funds taken from the DWSRF allocation, Virginia has also allocated an additional \$25 million in FY 2025 for drinking water projects

PUBLIC SAFETY

Virginia laid the foundation for safe drinking water practices on May 24, 1610, when the first sanitation law was written and enforced in Jamestown, VA. The Virginia Department of Health was created in 1908, and ODW was established in 2003 to "protect public health and ensure that all Virginians have a safe and adequate supply of drinking water. Most waterworks are in compliance with the Safe Drinking Water Act and Virginia Waterworks Regulations.

In April 2024 EPA announced the final National Primary Drinking Water Regulation establishing legally enforceable Maximum Contaminant Levels for six PFAS in drinking water. ODW is offering no-cost PFAS sampling and analysis for the required two sampling rounds to community and non-transient noncommunity public water systems that rely on groundwater and serve populations of 10,000 or fewer.

ODW routinely reviews water quality data submitted by waterworks and issues Notices of Alleged Violation (NOAVs) for samples that do not meet the standards, for monitoring and reporting infractions, lacking a properly licensed operator, recordkeeping failures, and other conditions that deviate from standards established by the Safe Drinking Water Act and state regulations. These notifications describe recommendations for a course of action for waterworks to follow to return to compliance and include any applicable public notice requirements. During October 1, 2024, through September 30, 2025, reporting period, ODW issued 1,411 NOAVs (1,241 Federal violations and 170 State violations) and 59 warning letters. Additionally, the

State Health Commissioner entered into five consent orders that involved community waterworks.

Virginia's smaller waterworks have a larger proportion of violations because they lack the customer base necessary to fund capital expenditures and technical expertise needed to resolve problems. Larger waterworks benefit from economies of scale that can reduce the cost per customer for operating and maintaining the system and implementing upgrades.

During October 1, 2024, through September 30, 2025, source water assessments were completed for 488 eligible systems, refining the process for determining whether these systems maintain a Strategy In Place (SIP) and meet the definitions of Substantial Implementation (SI) under both the 2014 and 2021 criteria. Of the 488 systems contacted, 185 provided responses, with 80 systems confirming they have a SIP in place, including 49 "yes, coastal plain construction" (YCPC) systems that automatically meet SIP requirements due to construction classifications.

There have been two major incidents in the last few years that have presented challenges to public health. Wilderness community experienced a 10-day "Do Not Use" notice in August 2024 for an unknown substance detected in the water, which was discovered to be burnt mineral oil from a raw water pump.

The City of Richmond experienced a multi-day Boil Water Advisory in January 2025 due to an electrical failure during a winter storm. The Emergency Services Coordinator participated in the Virginia Emergency

Support Team activation in January for a winter weather event with cascading impacts causing the City of Richmond to go under a Boil Water Advisory (BWA) that cascaded to affect eastern Henrico County and parts of Hanover County. In April of 2025, the City of Richmond released an After-Action Assessment report with 30 recommendations. To date, 19 recommendations have been completed, and the remaining recommendations

are in progress. The recommendations included additional training for mechanical and electrical staff during storm events that have risks of power outages, developing an emergency staffing plan for Department of Public Utilities facilities in cases of emergency situations, and raising as many critical electrical systems above the plant basements as practical.

RESILIENCE AND INNOVATION

Utilities recognize the need to conserve their source of water, so they are working to reduce water loss as much as possible.

The Hampton Roads Sanitation District's (HRSD) Sustainable Water Initiative for Tomorrow (SWIFT) is pumping highly treated waste water that has been through additional rounds of advanced water treatment to meet drinking water quality standards into the Potomac Aquifer, the primary source of groundwater throughout eastern Virginia. HRSD recently surpassed 1 billion gallons of treated wastewater injected into the

Potomac Aquifer. By 2030, officials hope to add 50 million gallons per day.

Loudoun Water in northern Virginia is developing the Potomac Water Supply Program to convert former rock quarries into raw water storage facilities. The first will be the Milestone Reservoir (Picture 1) which will provide 1 billion gallons of raw water storage. Potomac River water will be stored during high winter flow to supply the Trap Rock Water Treatment Facility (TRWTF) during periods of low flow in summer months or water supply emergencies. The project is expected to be completed in 2028.

Milestone Reservoir, Loudoun Water



Many localities have strong emergency response plans that aid an effective response to natural disasters. However, utilities in the Commonwealth are overall not prepared for extreme weather events. Hurricane Helene revealed many vulnerabilities in Virginia's drinking water infrastructure.

Winter weather and flooding in January and February 2026 created many disruptions to water utilities in Virginia. In addition, the collapse of the Potomac Interceptor in January 2026, resulting in an estimate 240 million gallons discharge of raw sewage into the

Potomac River, demonstrated the need for backup water storage for emergencies, such as the use of quarries by Loudoun Water. While severe weather impacts many regions in Virginia, planning for critical infrastructure cyber threats continued with the private sector, Virginia Department of Emergency Management (VDEM), and various state agencies including ODW.

No innovative financing approaches or other changes at the municipal level have been used in Virginia at this time for increased drinking water funding.



Photo: The Carvins Cove reservoir and Allegheny mountains from the Appalachian Trail near Roanoke, Virginia; Sean Board



RECOMMENDATIONS TO RAISE THE GRADE

- Continue ODW development of TMF competencies for waterworks owners and operators by offering and sponsoring on-going training opportunities.
- Offer more funding and incentives to incorporate cyber security, Asset Management Programs, into smaller waterworks.
- Consider resilience regarding flooding and cold weather in planning processes for asset rehab/replacements
- Offer incentives to smaller waterworks to combine their staff and assets with other nearby waterworks, i.e. economies of scale.
- Increase Utility fees to cover full cost of service including operation, maintenance and capital needs.
- Fully fund Future DWSRFs. FY 2027 will be the first year without the supplemental advanced appropriations provided in the Infrastructure Investment and Jobs Act.

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Energy



**GRADE
COMPARISON**

**VA: D
Nat'l: D+**



ENERGY

EXECUTIVE SUMMARY

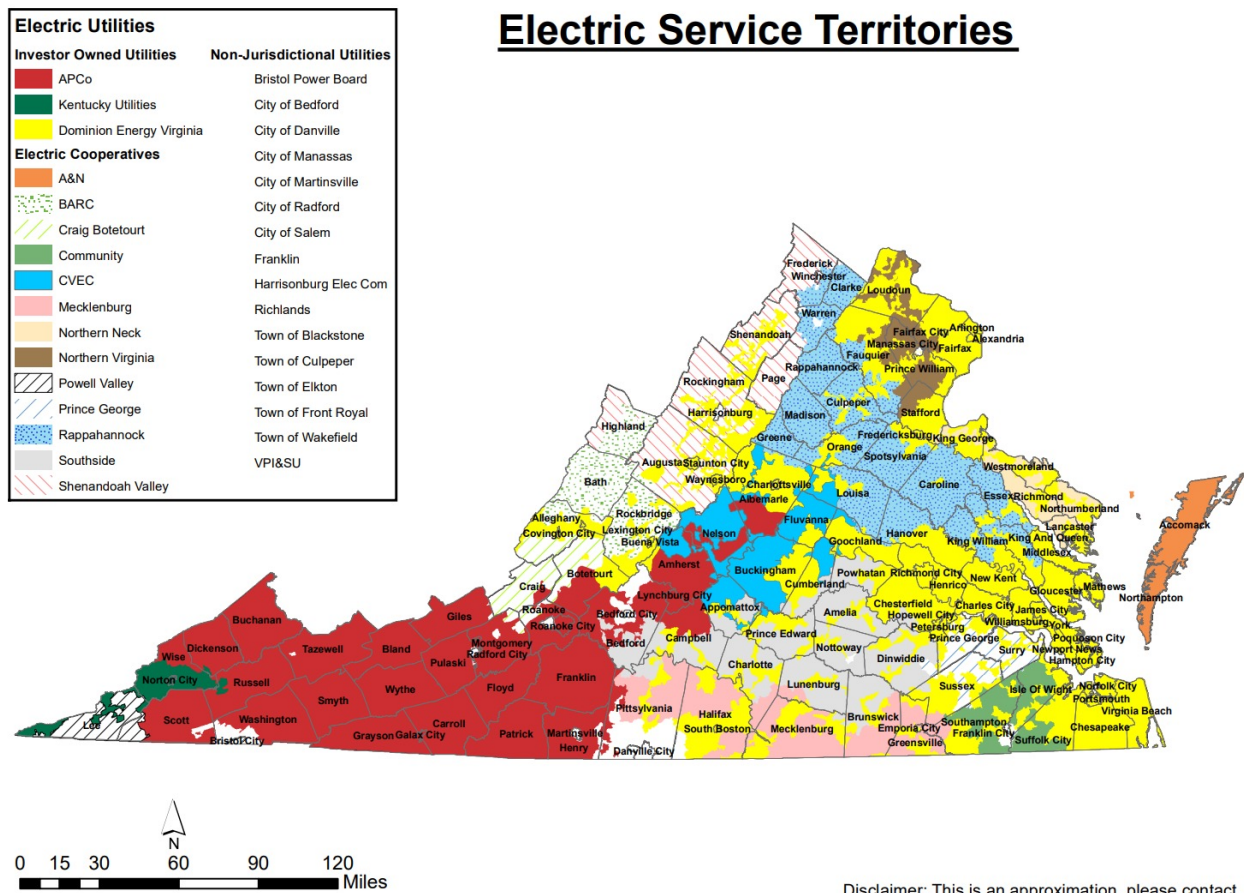
Virginia is a net energy consumer, meaning The Commonwealth consumes more energy (electric and non-electric) than it produces. In 2023, Virginia was the nation's largest net importer of electricity among all states. With the addition of a growing data center presence and other projected demands due to increased electrification, the state is on the verge of an electricity reliability crisis. However, the state shows promise in its operation and maintenance, federal and state funding streams, and efforts to improve the resilience of the grid to combat increasingly frequent extreme weather events. The Commonwealth also boasts strong energy innovation programs, especially in new nuclear technologies. There is an urgent need to address Virginia's capacity challenges to ensure a reliable future, which could be addressed with new grid technologies such as distributed energy resources, virtual power plants, energy storage systems, grid enhancing technologies, and modernized pricing models.

BACKGROUND

Virginia is a part of the Pennsylvania-Maryland-New Jersey (PJM) interconnection which balances electrical generation and demand across much of the Mid-Atlantic United States. Virginia's two largest utilities are investor-owned: Dominion Energy serves ~90 million customers in Virginia and Appalachian Power serves

~14 million customers in Virginia. The remaining ~35 million are served by diverse electrical cooperatives and municipally-owned utilities. A map of Virginia's electric utilities is provided in Figure 1.

Figure 1. Electric utility service areas in Virginia as of 2020.



Source: State Corporation Commission, 2020
Created by: Division of Public Utility Regulation, 2020

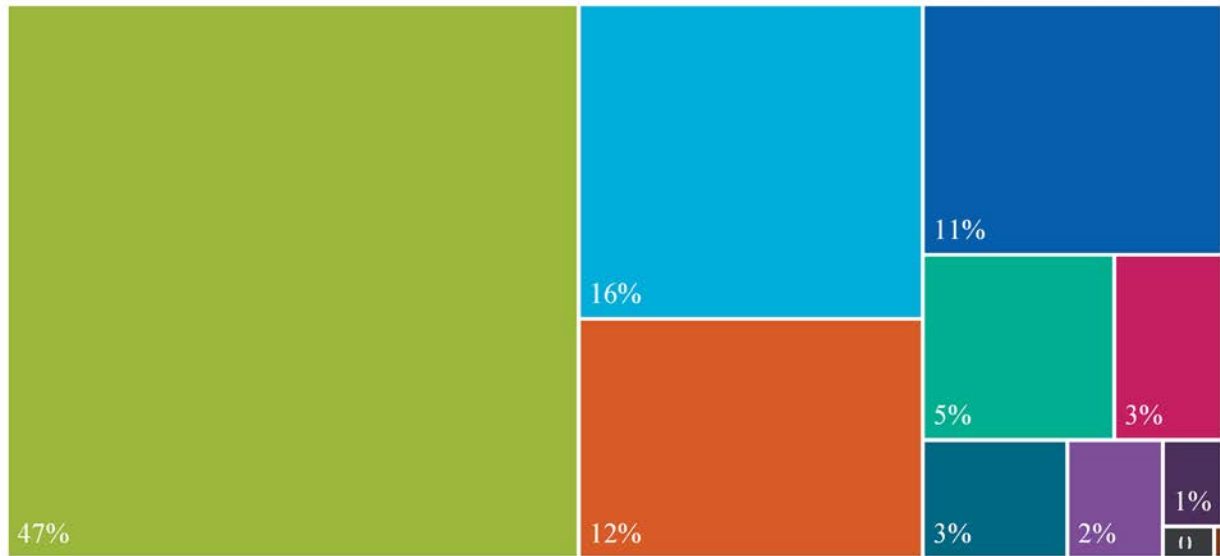
Disclaimer: This is an approximation, please contact the Division of Public Utility Regulation for official electric territory maps.

Source: State Corporation Commission

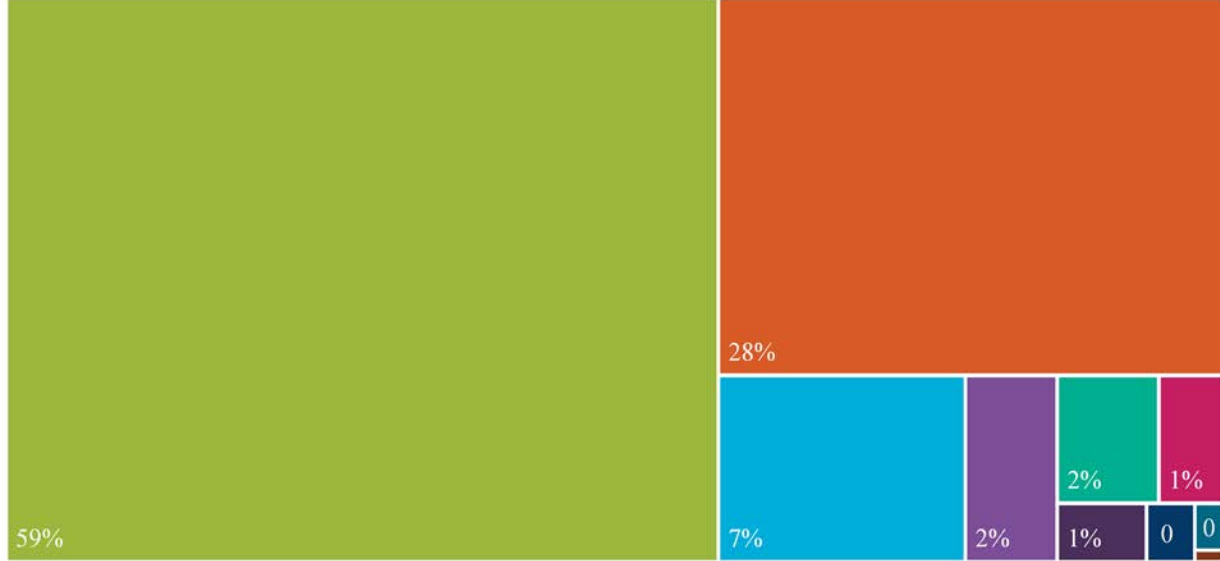
Across the 50 states, Virginia is the 10th largest consumer of electricity (and 15th on a per-capita basis), owing primarily to large commercial (including data centers) and industrial sectors. The commercial sector accounts for 56% of demand in Virginia compared to 35% nationally. Virginia has an electrical generation mix dominated by natural gas (55% of generation), and nuclear (32%), with renewables including solar and wind accounting for 12% of generation as of 2023. While hydroelectric power accounts for a very small fraction of electrical generation, the Bath County Pumped Storage Station is the United States' largest, with an installed capacity of over 3,000 MW, or roughly 12% of Virginia's total installed capacity. In-state generation accounts for 64% of demand (89.5 of 138 TWh in 2023) requiring

Virginia to import 36% of its electricity, making Virginia the highest per capita net energy importer of any state in the U.S. Figure 2 shows installed capacity (a) and generation totals by energy source along with imports (b). This generation mix has evolved over time, most notably with a decrease in reliance from coal and petroleum and an increase in natural gas and solar capacity for in-state electricity generation. Virginia consumes nearly eight times more natural gas than it produces, relying primarily on Appalachian supplies delivered through interstate pipelines. Demand within the Dominion Energy delivery zone is expected to increase by 5.5% annually for the next decade, doubling by 2039, increasing stress on generation and transmission systems.

Figure 2. 2024 total electric industry power (a) capacity and (b) generation by primary source. Hydroelectric refers to conventional hydropower, excluding pumped storage.



a) Installed capacity (total of 29,147MW)



b) Generation (total of 104,237,942 MWh)

- Natural gas
- Nuclear
- Solar
- Wood
- Coal
- Hydroelectric
- Other biomass
- Other
- Petroleum
- Wind
- Pumped storage
- Battery

Source: EIA, figure created by authors

CAPACITY

Virginia's energy capacity is poor due to high and quickly increasing energy demand, slow generation and transmission additions, and reliance on electricity imports. Data centers consume a large portion of Virginia's energy: approximately one-quarter of Dominion Virginia's total electric load and more than 65% of NOVEC's energy sales go to data centers, and this is expected to grow. State-wide energy demand from data centers could increase by 183% (i.e., by 2.8x) relative to 2023 demand by 2040. In the Dominion delivery zone, planned capacity additions will not come online until the late 2030s, and transmission expansion timelines exceed 7–10 years, while 50% growth in data center energy demand may be materialized within the next five years. Current reliability margins may not be sustained without accelerated growth of build-out or demand constraints. Additionally, Northern Virginia's exceptional concentration of data centers presents grid congestion challenges that are largely unique to the region, where sudden, large-scale load swings can destabilize local transmission in ways that distributed commercial demand does not, offering a cautionary lesson for other states as data center development accelerates nationally.

Build-out of generation and transmission projects in Virginia has been slowed through formal legal, regulatory, and local-government actions driven by interlocking economic, environmental, and health concerns around the energy needs of data centers. In Northern Virginia, residents and county officials have filed objections and intervened in State Corporation Commission proceedings opposing Dominion Energy's proposed high-voltage transmission lines intended to serve growing data-center load, citing potential health impacts from proximity to high-voltage lines, degradation of residential property values, and safety concerns near schools and neighborhoods. In Loudoun County, local governments adopted resolutions opposing overhead transmission corridors, arguing that routing decisions unfairly shift

infrastructure burdens onto residential communities while the benefits accrue to large commercial users such as data centers. Similar opposition has emerged around generation projects, including natural-gas facilities and large renewable installations, where communities have raised concerns about air quality, noise, land use, and cumulative health effects, leading to zoning disputes, permit delays, and project redesigns.

The State Corporation Commission (SCC)'s current rate schedule does not allow utilities to recoup all the generation and transmission expenses required for data center growth directly from data center enterprises, instead distributing those costs across all ratepayers. Currently, large power users such as data centers pay for electricity primarily through standard demand and energy charges, while many network transmission upgrades and generation investments required to maintain system reliability are recovered through base rates shared by all customers. Dominion Energy therefore projects rate increases for all residential customers even as much of the underlying load growth is driven by large commercial users, including data centers.

A new rate class approved by the SCC for large loads, including data centers, that would recover most of the distribution, transmission, and generation costs associated with the additional demand will not take effect until 2027. Capacity additions in Virginia by Dominion include approximately 2.6 GW of offshore wind under construction with additional offshore leases (2.1–4.0 GW potential) and 3,636 MW of petitioned solar projects, which are mostly approved, plus a 30 MW battery pilot (28.34 MW approved) and existing pumped storage; however, project timing and rapid load growth (6.3% avg peak growth) create near-term adequacy pressure. While Dominion is investing in new capacity, Appalachian Power Company lags behind, with only 5 MW of their new generation investments going to Virginia.

CONDITION

The condition of Virginia’s energy infrastructure requires attention. Virginia has mixed reliability performance when comparing its metrics to that of the national average in 2023 and 2024 shown in Table 1: in 2023, the state performed better in two of the three metrics and in 2024 it performed better in only one of the three metrics. It should be noted that these represent self-reported information by utilities and as such, may not fully reflect actual system performance in either direction. Both the national average and Virginia metrics worsened from 2023 to 2024, but the average SAIDI for Dominion Virginia has remained steady when comparing three-year averages. While Dominion showed a 99.98% power availability in 2024, this excluded major storm events, which are primary causes for outages, and therefore overstates day-to-day system reliability as experienced by customers. Virginia also faces tensions

between increasing energy demand and retirements of older generating units. On July 10, 2024, 60 data centers in Northern Virginia, using approximately 1,500 MW of power, dropped off the grid due to a failed surge protector on Dominion’s Ox-Possum line which almost resulted in a widespread blackout event, indicating the sensitivity of the grid to these new large loads. Virginia also saw the retirement of approximately 1,800 MW of generation in 2023. Tree contact with overhead distribution lines remains a leading cause of outages in Virginia; while Dominion has been undergrounding outage-prone lines, a significant share of the distribution network remains exposed to vegetation-related faults, particularly in suburban and rural areas. Therefore, the worsening reliability metrics, increasing demand, and retirements indicate a deteriorating condition that is reflective of today’s current energy struggles.

Table 1. Virginia and national average reliability metrics

	SAIDI (mins/customer/year)	SAIFI (interruptions/customer/year)	CAIDI (mins/interruption)
2023 VA	292.8	1.655	176.9
2023 US	366.6	1.348	271.8
2024 VA	962.1	2.238	429.9
2024 US	662.6	1.531	432.7

Sourced from SAIDI = System Average Interruption Duration Index (average total yearly interruption period per customer).

SAIFI = System Average Interruption Frequency Index (average yearly number of interruptions across customers).

CAIDI = Customer Average Interruption Duration Index (average restoration time).

A lower SAIDI, SAIFI, and CAIDI indicate better reliability.

Bold = VA worse than US average.

FUNDING

State and Regional Funding. On the state government level, Virginia Energy secured \$405 million in grant funding in 2025, increasing its active project portfolio to more than \$830 million. In 2023, the Virginia Air Pollution Control Board voted to repeal the Regional Greenhouse Gas Initiative (RGGI) regulation, effectively suspending Virginia’s participation in RGGI, an interstate compact then consisting of the states of Connecticut, Delaware, Maine, Maryland,

Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. RGGI requires utilities to purchase carbon offsets, with revenues reinvested in climate resiliency and energy programs. Between 2008 and 2024, RGGI generated \$8.3 billion in revenues across participating states; between 2021 and 2023, Virginia received approximately \$827.7 million from the program. While a state court ruled this withdrawal unlawful, the decision is stayed

pending appeal. Virginia's withdrawal from RGGI represents a loss of at least \$2 billion through 2030. As of spring 2026, the Virginia legislature has passed a bill to rejoin RGGI, with formal re-entry expected by summer 2026, suggesting the lapse in funding availability may be temporary.

Federal Funding. Virginia has benefited from federal investment programs, though some funding has been rescinded. For example, a federal decision canceled \$156 million in funding for the "Solar for All" program in Virginia, which had been part of the state's investment portfolio. Nevertheless, the Virginia Department of Energy reported that they are still implementing the remaining federal grant projects totaling over \$500 million. These span multiple programs, including programs to deploy battery storage at large data center loads, grid resilience and smart grid grants for Dominion Energy and Rappahannock Electric Cooperative, formula grants for weatherization, mine land reclamation, and workforce training. Much of this funding was made possible through the Infrastructure Investment and Jobs Act of 2021 (IIJA).

Nevertheless, the cycle of Virginia's RGGI withdrawal and anticipated re-entry, alongside the federal

cancellation of the Solar for All program, illustrates the degree to which energy funding streams at both the state and federal level can be affected by shifts in policy priorities, creating challenges for utilities and program administrators that rely on stable, long-term revenue projections for infrastructure planning.

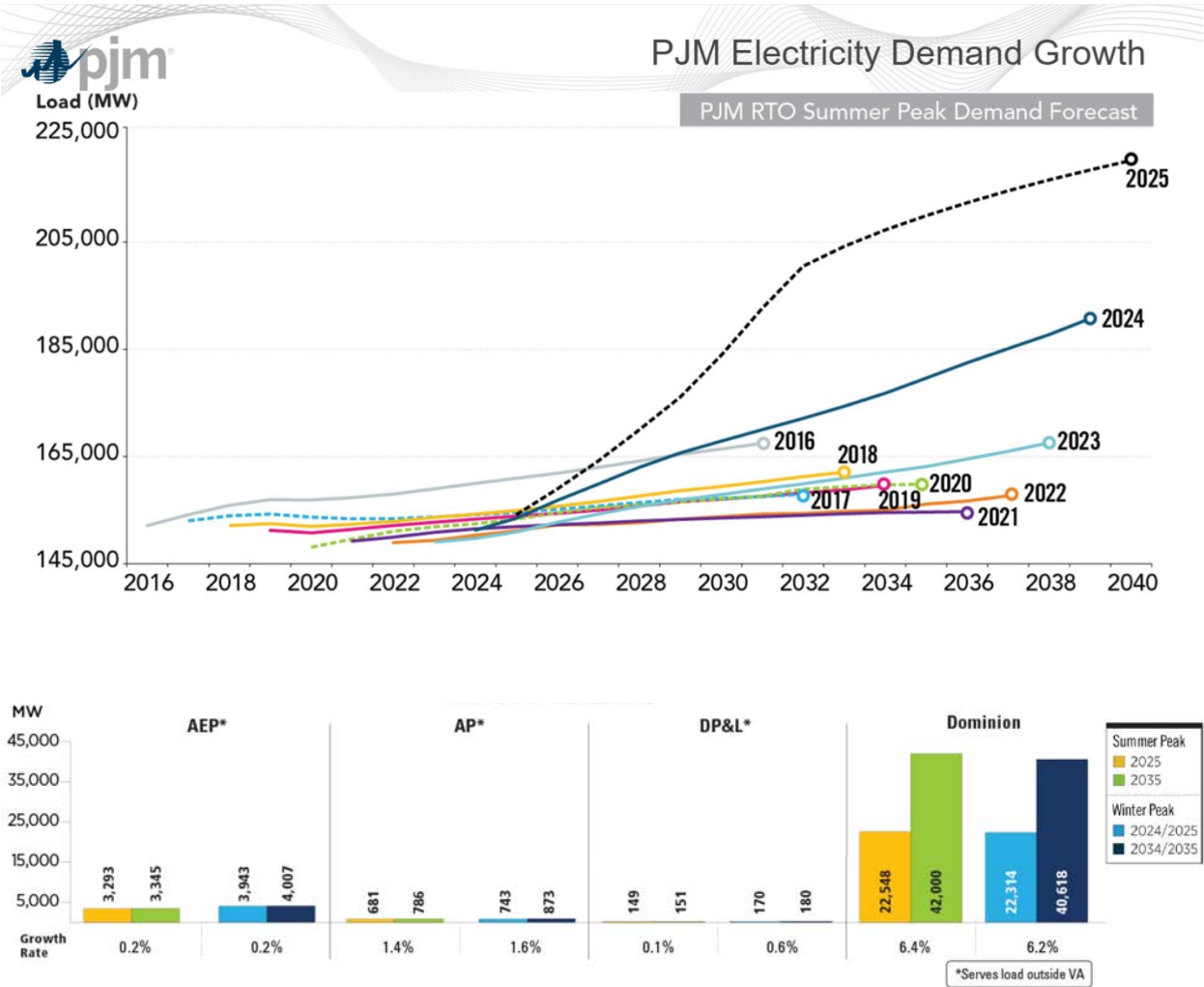
Utility Funding. On the utility level, investment in transmission expansion includes the 2023 Regional Transmission Expansion Plan (RTEP) project and \$2.1 billion invested in transmission in 2024 by Dominion Energy Virginia. The RTEP program is currently active and moving through the normal State Corporation Commission approval process, while no public document is found indicating the cancellation of the \$2.1 billion transmission upgrade plan. Furthermore, Dominion's \$50 billion capital plan (2025–2029) for its entire service territory includes \$27 billion for regulated grid investments and \$15 billion for generation modernization, and the sale of gas subsidiaries reduced \$21 billion in debt improved balance sheet flexibility. Considering this is a long-term plan, many projects may still be in development, permitting, or financing phases, yet no cancellation has been found against Dominion's funding.

FUTURE NEED

Virginia has established a mandatory renewable portfolio standard under the Virginia Clean Economy Act, requiring 100% renewable energy by 2045 for Dominion Energy and 2050 for Appalachian Power. Against this backdrop, the state is projected to face considerable challenges and demands on its energy system. PJM's summer and winter peak loads are expected to increase by less than 1% to over 6% annually in the next decade. In fact, PJM's 2038 forecast for summer peak demand has increased from 2023 to 2025 shown in Figure 4, highlighting the rapid, unexpected growth in the area. More locally, Appalachian Power is projecting a need of almost 6,000 MW of capacity by 2035. One of the main drivers of this demand growth is the rise in data centers: Virginia is forecasted to remain the state

with the largest data center electricity consumption in 2030, with data centers potentially accounting for 41–59% of the state's total electricity by that year, up from approximately 25% today. If completion rates of new generation do not accelerate, it is possible that PJM's reserve margins become inadequate, and the Dominion zone is projected to see the largest absolute increase in summer peak demand of any PJM zone between 2026 and 2030. Virginia needs to bolster its generation capacity or demand management to minimize the risk of demand outpacing supply. This is especially concerning as the state is predicted to have solar and natural gas supply chain issues. Therefore, Virginia must act quickly to secure a reliable energy sector for the future.

Figure 4. PJM RTO summer peak demand forecast for all of PJM region (top) and Virginia (bottom).



Source: PJM 2024 Virginia State Infrastructure Report (PJM, 2025)

OPERATION AND MAINTENANCE

Virginia’s energy infrastructure is actively maintained through a range of vegetation management, inspection, and workforce programs that broadly align with national utility practice. Utilities complete vegetation clearing to reduce the chances of outages due to fallen power lines. In 2024, Dominion Virginia increased funds towards tree trimming and vegetation management, and the Rappahannock Electric Cooperative completed significant maintenance using drones for pole inspections, removing hazardous

trees, and adding animal guards on transformers. The strong workforce presence in the Transmission, Distribution, and Storage (TDS) and Energy Efficiency sectors support the consistent system upkeep and reliability across Virginia’s energy infrastructure. However, the rising operations and maintenance costs reported by Dominion Virginia driven by labor, storm restoration, and transmission modernization expenditures could become an additional burden on the utility if they continue to rise in future years.

PUBLIC SAFETY

Virginia's energy sector demonstrates strong safety performance across several key indicators, from mining operations to utility worker safety and emergency response. While Virginia is home to one of the major coal exporting ports in the nation, the state boasts strong mining safety, including zero mining fatalities, more than 500 miners completing safety and regulatory compliance training, and 100% of required inspections completed during the most recent state reporting cycle. The state is also investing \$11 million in Abandoned Mine Land Economic Revitalization (AMLER). Robust worker safety extends beyond miner safety to the larger energy sector: Dominion Energy achieved a 0.42 OSHA recordable injury rate in 2024 across its entire service area, approximately 75% below the U.S. utility industry average, marking one of its safest operational years on record. For electricity customers, Dominion has an effective response to emergencies; for example, Dominion was able to restore service to 446,000 customers within two weeks during 2024's Hurricane Helene in their South Carolina service area.

Virginia's natural gas pipeline network is subject to a layered oversight structure: the Virginia SCC's Division of Public Utility Regulation conducts annual inspections of intrastate pipeline operations, maintenance, and construction activities, while the Pipeline and Hazardous

Materials Safety Administration (PHMSA) retains jurisdiction over interstate transmission pipelines. In 2023, PHMSA's Gas Mega Rule Part 2 took effect, imposing strengthened integrity management, corrosion control, and inspection requirements on gas transmission operators nationally. Despite this oversight, a 30-inch natural gas pipeline ruptured in Fauquier County, Virginia in March 2023 due to hydrogen-induced cracking in pipe manufactured in 1957, with no injuries reported, illustrating the risks posed by older pipeline infrastructure in the state.

On cybersecurity, the electric utility sector faces mounting threats: cyberattacks on energy companies in the U.S. and Canada increased by 71% between 2021 and 2022, and the energy industry ranked as the fourth most targeted sector in 2024. Utilities operating in PJM, including Dominion, are subject to mandatory NERC CIP standards, which govern physical and cyber protections for bulk electric system assets, including access controls, incident response planning, and supply chain risk management. Dominion's capital expenditure plan includes dedicated cybersecurity investment, and as grid modernization accelerates, including smart meter deployment and DER integration already underway in Virginia, ensuring cybersecurity requirements scale with these additions will be critical.

RESILIENCE

Virginia has prioritized making its energy infrastructure more resilient to combat increasingly frequent severe weather events, however, as is true throughout the country, significant improvements are needed to safeguard the entire network from wind, rain, snow and ice, extreme heat, and more. Virginia's resilience outlook is shaped by several significant system-level developments, including Dominion Energy's planned \$43.4 billion capital investment in Virginia to harden substations, enhance transmission redundancy, and expand distributed restoration capabilities, alongside PJM's approval of over \$7 billion in RTEP transmission upgrades in Virginia over 2023 and 2024 and the enhancement of natural gas deliverability and redundancy that will further reinforce bulk power system reliability. Aside from overhead power line upgrades, utilities have undergrounded many vulnerable transmission and distribution lines, including 70% of NOVEC's power lines, more than 2,000 miles

of tap lines in Dominion Virginia, and Dominion Virginia is planning to move a total of 4,000 miles of distribution lines underground. Despite these advancements, statewide resilience is increasingly challenged by growing exposure to severe weather and cyber/physical threats, consistent with national reliability risk trends. Virginia recorded increasing major severe-weather outages: three in 2022 and four in 2023. This vulnerability was especially evident in 2025, when Virginia experienced 13 major outage events (over 1000 impacted customers) affecting approximately 467,000 customers by the end of July, shown in Table 2. These outages were mostly due to severe weather-related incidents underscoring the need for continued investment in adaptive and hardened energy infrastructure. Virginia's 2024 CAIDI of 429.9 minutes (approximately 7 hours average restoration time per interruption, Table 1) reflects baseline statewide performance.

Table 2. Major outages (>1000 impacted customers) reported by the end of July 2025, data gathered from the local news reports.

	Date (2025)	Location	Cause of Outage	Impacted Customer	Source
1	Jan 10	Arlington, VA	Transmission line issue	6,599	(Fields, 2025)
2	Feb 16	Richmond, VA	Severe Storms	110,000	(WTVR CBS 6 Web Staff, 2025a)
3	Mar 05	VA Statewide	High winds, cold front	20,000	(12 On Your Side Newsroom, 2025)
					(National Weather Service, n.d.)
4	Mar 27	Arlington, VA	Pending Investigation	2,433	(ARLnow.com, 2025a)
5	Apr 04	Arlington, VA	Transformer	7,400	(ARLnow.com, 2025b)
6	Apr 15	Falls Church, VA	High winds	1,650	(ARLnow.com, 2025c)
7	May 16	Alexandria, VA	Severe Storms	14,250	(Belmore, 2025a)
8	June 19	DMV areas	Thunderstorms	114,000	(Anderson, 2025)
9	June 20	Washington, DC	Thunderstorms	100,000	(Wells et al., 2025)
10	Jul 01	Alexandria, VA	Thunderstorms	2,800	(Belmore, 2025b)
11	Jul 09	Fairfax, VA	Thunderstorms	10,000	(Woolsey, 2025)
12	Jul 20	Central Virginia	Thunderstorms	8,540	(WTVR CBS 6 Web Staff, 2025b)
13	July 27	Henrico, VA	Thunderstorms	20,000	(12 On Your Side Digital Team, 2025)
	July 27	Chesterfield, VA	Thunderstorms	14,000	
	July 27	Midlothian, VA	Thunderstorms	2,500	
	July 27	Richmond, VA	Thunderstorms	12,000	
	July 27	Fan District, VA	Thunderstorms	1,000	
	July 27	Hanover, VA	Thunderstorms	20,000	
Total numbers of customer outage				467,172	

INNOVATION

Virginia is an energy innovation hub. Virginia is a leader in nuclear energy, including the nation's first installation of a 12-module small modular reactor (SMR) simulator, creation of the Virginia Power Innovation Program investing in microreactor and next-generation materials research, and the development of the world's first 400 MW commercial fusion power plant in Chesterfield County. In addition to nuclear energy, the Virginia Clean Energy Innovation Bank continues to finance

early-stage clean energy technologies, including fusion, SMRs, hydrogen, and grid-scale storage pilots, reinforcing Virginia's leadership in emerging energy systems. Aside from generation and storage, over 3.9 million smart meters have been deployed by Dominion in 2024 and 50 thousand advanced meters by NOVEC, enabling faster outage detection, real-time diagnostics, and targeted restoration following major events.

Energy



RECOMMENDATIONS TO RAISE THE GRADE

- The state should conduct a comprehensive, statewide assessment of future data center growth, including implications for generation, transmission, and resiliency, and expedite reforms to the ratepayer schedule to ensure that data center enterprises bear the costs of electricity system upgrades.
- To meet rising demand, the state should modernize and streamline permitting and interconnection processes to add clean supply, distributed energy resources (DERs), storage, and grid-enhancing technologies (GETs) and expand the use of Virtual Power Plants (VPPs), behind-the-meter resources, and decentralized energy systems to increase available capacity without relying solely on new large-scale generation or long-lead-time transmission upgrades.
- Virginia should adopt or adapt proven national best practices for DER incentives and resilience programs, such as battery-storage deployment grants, microgrid incentives for critical facilities, and industrial DER programs that have been successful in states like Massachusetts and Texas.
- Policymakers should clarify long-term energy direction by aligning regulatory frameworks, including addressing distinctions between the Virginia Clean Economy Act (VCEA) and the All-of-the-Above Energy Plan, to provide consistency for investment, innovation, and local energy planning.
- The Commonwealth should strengthen collaboration between utilities, counties, and behind-the-meter participants to support advanced load management, integrated planning, and rapid deployment of customer-sited storage and flexible demand resources.

Energy



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Public Parks



GRADE
COMPARISON

VA: C

Nat'l: C-



PUBLIC PARKS

EXECUTIVE SUMMARY

The Commonwealth of Virginia is home to a strong network of public park infrastructure, with over 17% of Virginia’s land area publicly managed by federal, state, and local governments, and nonprofits. Park districts across the Commonwealth are developing policies with dynamic, forward-thinking best practices to ensure parks serve users into the future. Despite these positive trends, Virginia parks continue to struggle with the demands of deferred and ongoing maintenance. A 2025 audit of Virginia State Parks found that deferred maintenance exceeds \$350 million, a \$90 million increase since previous reporting in 2021. Virginia is rich in natural resources, and its park agencies must continue to fight for needed funding to keep its resources safe and available to the public.

CONDITION AND CAPACITY

Virginia’s publicly managed lands are diverse, including seashores, trails, scenic mountain drives, and historic monuments. As of June 2024, about 17% (4.32 million acres) of Virginia’s land was publicly managed. 54% of

Virginia’s protected land is managed by the federal government, 33% is managed by state government, 8% is managed by nonprofits, and over 3% is managed by local governments.

Table 1: Virginia Land Conservation Statistics

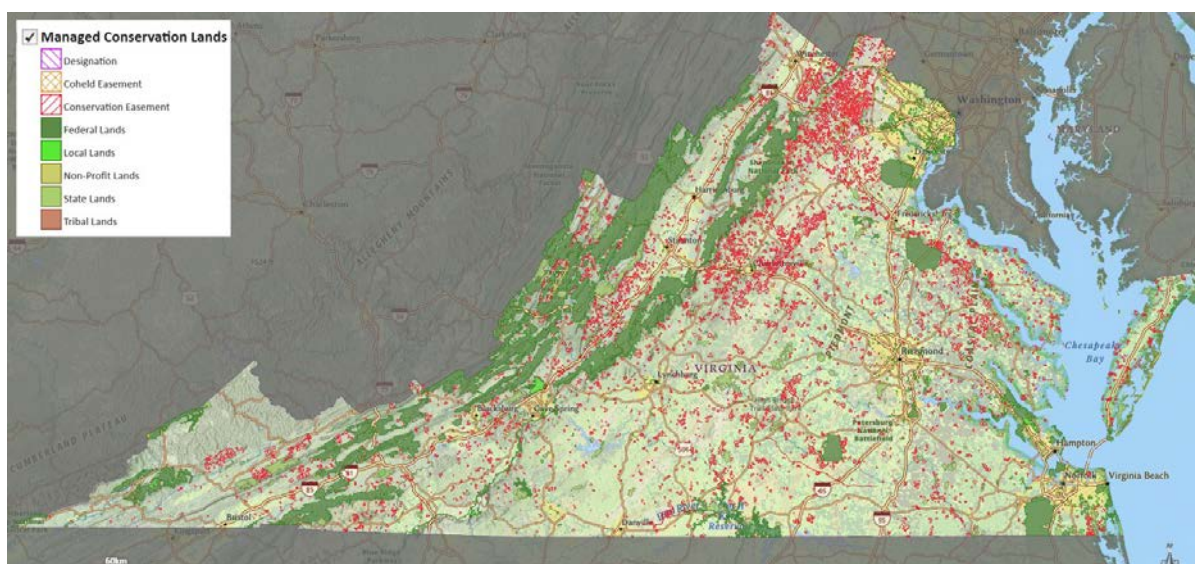
GROUP	Easements (acres)	Fee-Simple (acres)	Total Conserved (acres)	Total Conserved (%)
Federal	14,693	2,339,669	2,354,361	54%
State	1,005,923	452,040	1,457,963	34%
Local	50,135	110,464	160,599	4%
Non-Profit	258,339	106,351	364,690	8%
Tribal	0	2,321	2,321	0%
Total	1,329,090	3,010,845	4,339,935	100%

Source: Virginia DCR

The National Park Service manages 22 sites in Virginia, welcoming over 21 million visitors per year. This includes a section of the Appalachian Trail, a National Scenic Trail which runs from Georgia to Maine and passes through the state, and one World Heritage Site (Monticello/The University of Virginia). According to the National Park Service Visitor Spending Effects Report, National Park visitors spent \$1.5 billion while visiting National Park Service lands in Virginia. In addition to federally managed lands, Virginia's open space infrastructure includes 127,000 acres of State Parks, 74,969 acres of State Forests, and five recreational reservoirs managed by the U.S. Army Corps of Engineers.

In 2024, Virginia State Parks contributed \$531.74 million to the state's economy and supported approximately 4,491 jobs. The parks also generated \$40.2 million in state and local tax revenue, meaning roughly \$1.29 in taxes were generated for every dollar spent on the park system. The Virginia Outdoors Plan was updated in 2024 and will guide planning and investment efforts for the 2025-2030 period. State Parks are generally distributed evenly across the Commonwealth, with a few gaps in service along the southern border at the central and easternmost portions, and in northern Virginia between highways 64 and 66.

Figure 1: Map from Virginia State Parks

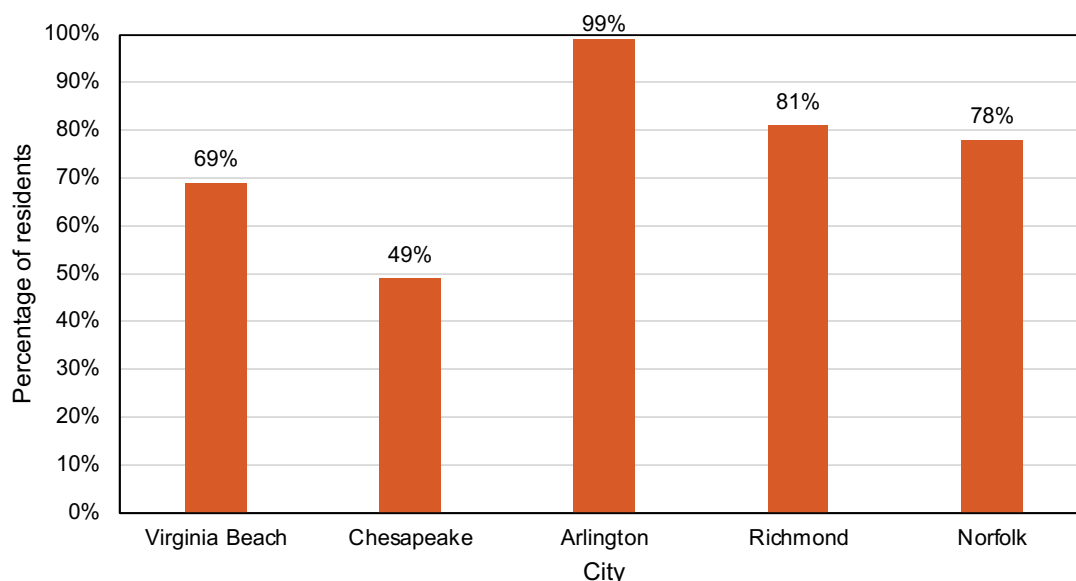


Source: Virginia DCR

Virginia contains diverse ecosystems and a mix of historic and modern development. Park infrastructure is subject to historic preservation restrictions, conditions of coastal degradation and restoration, or mountainous sections of

national parks, depending upon its location within the state. Table 2 provides an overview of the percentage of residents within a 10-minute walk of a park in the most populous cities and counties in the Commonwealth.

Figure 2: Residents living within a 10-minute walk of a park



The largest city in Virginia, Virginia Beach, has 382 parks, roughly 12% of its land area. The Trust for Public Land (TPL) awarded Virginia Beach a ParkScore of 60th in the Country. Chesapeake is ranked 36th in the country by TPL, with 159 parks totaling 32% of its land area. Arlington, the third largest city in Virginia, tops the list for park accessibility, even though only 11% of the city's land area is dedicated to parks. Despite this, TPL's ParkScore ranks Arlington 7th in the country, with 99% of its population living within a 10-minute walk of a park. The fourth and fifth largest cities in Virginia, Richmond and Norfolk, have ParkScores of 16 and 50, respectively. The number of parks and percentage of city land dedicated to parks are similar for these two as well, but the biggest difference is in the dollars per capita dedicated to parks in each of these cities.

Virginia's state parks include 2,800 built assets and facilities, which include roads, bridges, visitor centers, restrooms, campgrounds, and recreation facilities. Roads and bridges in parks across the Commonwealth are aging, with ongoing rehabilitation and maintenance. Negative effects of this aging infrastructure include surface deterioration and drainage and erosion issues. The Virginia Department of Transportation estimates that over 58% of all bridges in the Commonwealth are more than 50 years old, indicating an increased need for replacement and structural upgrades. Wear and tear on the built assets and facilities at parks across the state are accelerated by heavy use, which exceeds eight million annual visitors to state parks alone.

OPERATION AND MAINTENANCE

Staffing numbers are difficult to standardize and track across park systems due to variation in resources and services provided and given staff size fluctuation with seasonal workers. Rural municipal park systems have different needs than large metropolitan park systems, and different needs again when compared to state or national park systems. The National Recreation and Park Association (NRPA)

provides a benchmark recommendation of 8-9 full time equivalent (FTE) staff per 10,000 residents. This number aligns with estimates provided by many municipal park districts in Virginia, including Prince William County, while smaller park districts and larger park districts which employ a large seasonal workforce, such as Fairfax County, fall below this number.

The Virginia State Parks program manages over 75,000 acres of parks statewide but lacks consistency in performing ongoing maintenance. Moreover, heavy reliance on hourly staff affects maintenance capacity. On March 26, 2025, the Office of the State Inspector General (OSIG) published a report on the Virginia State Parks system. Deferred maintenance was found to exceed \$350 million, a \$90 million increase since previous reporting in 2021. Inconsistency in the manner of reporting and tracking maintenance needs was pinpointed as a contributing factor to this ongoing backlog. The Virginia Department of Conservation and Recreation (DCR) responded to the findings of the audit by introducing several changes, including implementation of a new asset tracking system and the development of online dashboards and mapping system for internal staff use.

During the 2025 legislative session, the Commonwealth authorized an appropriation of \$20 million (FY 2025) toward addressing deferred maintenance across state parks. This investment underscores recognition at the state level that maintenance issues — if left unaddressed

— pose risks to visitor safety, park integrity, and long-term usability.

For the Fiscal Year (FY) 2026 budget, the City of Richmond has allocated \$6.5 million in new funding specifically for park maintenance. Expected intervals for The City of Virginia Beach offers an online form which enables anyone to request maintenance services for any site which falls under The Park & Landscape Services Division's purview. The City of Virginia Beach also regularly reports metrics related to maintenance schedules and responsiveness. The City of Fairfax uses an app and web page for citizens to report any maintenance concerns. Finally, the City of Alexandria has published a publicly available Park Maintenance Plan that defines service levels across five asset classifications and emphasizes proactive upkeep. The plan prioritizes routine inspections to identify safety or maintenance needs, timely repairs to address issues before they escalate, and ongoing maintenance to keep parks safe, clean, and functional. It also incorporates systematic data collection to inform decision-making, prioritize investments, and support the long-term condition of park assets.

FUNDING AND FUTURE NEED

In 2025, parks funding in Virginia experienced a mix of substantial challenges and meaningful progress. Virginia State Parks identified significant shortfalls in 2025, from the deferred maintenance shortfall discussed in the "Operation and Maintenance" section of this chapter to an overall shortfall for State Park funding needs. The shortfall continues the trend noted in a 2021 report by the Virginia Department of Conservation and Recreation. This report noted that Virginia State Parks total identified funding need is nearly \$159 million. Against this need, the current general fund appropriation of nearly \$22 million and the five-year average annual revenue of nearly \$26 million leave an acknowledged funding shortfall of over \$111 million.

The Virginia Outdoors Plan, updated in January 2025, fulfills the requirements of eligibility for funding with federal Land and Water Conservation Fund (LWCF) monies. During FY 2024, the Commonwealth of Virginia received \$7.2 million in LWCF funding. Virginia has received almost \$126 million total under the program

since its initiation in 1965, funding more than 450 projects across the state.

Virginia's city parks programs are typically financed through a mix of general fund monies, income from user fees, and donations from private citizens and "friends of" groups. TPL gathered data related to parks spending per capita from the 100 most populous cities in the United States for their 2026 ParkScore Report. City agencies managing parks spent an average of \$151 per capita on parks. The highest expenditure per capita in the state on the list was Arlington, listed with the 10th highest expenditure nationally at \$287. Richmond came in at 19th with \$251, and Virginia Beach was listed 32nd with \$178 per capita, followed by Chesapeake in 33rd and \$181 per capita (additional funding sources were considered in the TPL ranking, whereas this comparison looks only at money spent by each City per capita). The City of Norfolk also made the top 100, coming in at 82nd with a per capita expenditure of \$88.



Photo: Yorktown Battlefield, Colonial National Historical Park in Virginia; Zack Frank

RESILIENCE

The resilience of parks refers to their robustness in the face of present-day stressors. These stressors may include environmental, cultural, funding, or other factors. Many park districts in the Commonwealth have officially adopted resilience plans, such as the City of Alexandria’s Flood Resilience Plan, Fairfax County’s Resilient Fairfax plan, and the City of Hampton’s Natural Infrastructure Resiliency Plan. These plans share similar general goals to increase local stormwater infiltration rates to stage and treat stormwater/storm surges, and to support equitable access to open space infrastructure.

Arlington County introduced two new programs related to resilience, the Emerging Uses Program (EUP) and the Natural Resiliency Program (NRP), in its FY 2023-2032 rollout. The EUP focuses on adapting to the changing needs of its citizens and providing new recreational opportunities. The NRP provides funding for projects which increase stormwater capacity at existing parks. There are also regional and statewide plans and policies on resilience, including the Virginia Coastal Resilience Master Plan and the Plan RVA Resilience Program. Virginia Department of Environmental Quality Coastal Zone Management reports on coastal “edge” resilience. These plans are taking inventory of built projects and providing data-based information to evaluate built interventions in terms of resilience in the built environment.

Data related to park closures can highlight how public safety and maintenance concerns sometimes force parks to restrict access. An immediate illustration of closure due to environmental damage comes from the aftermath of Hurricane Helene in late 2024. According to the DCR, nine state parks and four natural-area preserves were closed or partially closed due to significant damage caused by the storm. For instance:

- New River Trail State Park was closed until further notice, with campgrounds shuttered through February 28, 2025.
- At Claytor Lake State Park, all boat ramps were closed due to excessive debris, preventing boating or watercraft launches.
- Trails, launch sites, campgrounds and picnic areas at other parks (e.g. Grayson Highlands State Park, Hungry Mother State Park, Powhatan State Park) were also closed or restricted, in some cases “until further notice.”

These closures reflect how environmental hazards (e.g., storm damage, debris, flooding) can directly compromise public safety and necessitate protective action, sometimes for extended periods.

PUBLIC SAFETY

Public safety in Virginia’s public parks is managed at scale by the Virginia DCR, which oversees Virginia State parkland spanning thousands of acres. According to the DCR, the state park system includes 44 state parks (plus some undeveloped parks) together managing more than 75,800 acres, with more than 700 miles of trails, 1,716 campsites, 36 lakes and ponds, 11 swimming beaches, and hundreds of cabins, picnic shelters, visitor centers and recreational facilities. This breadth of facilities and natural terrain means that maintaining public safety is a large and ongoing operational undertaking.

DCR law enforcement rangers are sworn officers with authority similar to sheriffs for enforcing state laws. Rangers operate 24/7, with both preventive patrol and reactive capabilities. According to the most recent reports, the public-safety staff respond annually to “approximately 100 incidents involving ‘search and rescue’” in state parks and natural area preserves. DCR operates under a community policing model, combining law enforcement with education and outreach. Rangers receive training in mental health response, crisis intervention, search and rescue, and wildfire management, along with law enforcement.

A review of recent years shows upward trends in water-related incidents in Virginia, underscoring that safety pressures are evolving. According to the Virginia Department of Health (VDH), between 2020 and 2024 a total of 473 Virginians died by drowning — on average nearly one fatality every four days. Over that same 5-year period, 58% of drownings occurred in natural bodies of water — settings commonly associated with state and local parks. Non-fatal drownings and water-injury events have also remained notable: VDH records indicate 1,477 emergency-department visits for non-fatal drowning during 2020–2024, and 81 inpatient hospitalizations.

Boating incidents, another important risk for parks with water access, have also shifted in recent years. According to the Virginia Department of Wildlife Resources (DWR), the number of “reportable” boating incidents statewide rose markedly in 2024: there were 89 incidents, 46 injuries and 17 fatalities — a substantial increase from the prior year (2023: 59 incidents, 39 injuries, 8 fatalities). Many of the fatal incidents involved paddle-craft (canoes, kayaks, etc.), and in 94 % of those fatalities, individuals were not wearing life jackets. The DWR identified failure to maintain a proper lookout as the leading contributing factor in many of the 2024 incidents.



Photo: Wishing well Luray Caverns, Virginia; vm2002

Virginia State Parks prioritize professionalized law enforcement, alongside community-oriented policing, training and outreach. Technology investments focus on communication and response rather than highly visible surveillance infrastructure. Compared to some urban park systems, the model leans more toward education, presence, and partnerships than heavy physical security interventions. Statewide, official policies regarding public safety design strategies such as Crime Prevention Through Environmental Design (CPTED) are limited. While there is not much official documentation of public safety policies for park lighting, line-of-sight management, and surveillance technology, these

strategies are employed at many local and regional parks across the state.

According to DCR, park attendance exceeded 8 million visitors in 2023, up from 7.4 million in 2022. With so many visitors, the likelihood of emergencies, accidents, or resource stresses increase. The combination of significant visitor volume, diverse recreational activities (hiking, swimming, boating, camping), and natural hazards demands that park authorities maintain robust safety infrastructure: trained enforcement and rescue staff, regular patrols, clear safety signage and procedures, and public-awareness efforts about water and wilderness risks.

INNOVATION

Innovation in Virginia's public parks has accelerated in recent years as agencies modernize how natural resources and visitor services are managed. At the state level, the Virginia DCR has expanded the use of digital park-management tools, such as GIS-based asset inventories, real-time trail mapping, and online reservation systems for campsites, cabins, and events. Many state parks now use remote-sensing tools and digital monitoring platforms to track trail conditions, manage invasive species, and assess erosion, allowing staff to make faster, data-driven decisions about maintenance and habitat protection.

Local parks and open space agencies across Virginia have also implemented creative innovations that integrate technology with community engagement. Several counties and city park systems have introduced QR-code-based interpretive signage that links visitors to historical narratives, wildlife information, and accessibility features. Cities including Arlington and Alexandria have launched mobile apps to connect citizen reporting to relevant city offices and empower citizens to engage with the city to improve public spaces.

Environmental innovation is another defining feature of Virginia's park system. State and local managers have increasingly invested in nature-based stormwater and shoreline-protection solutions, such as living shorelines, wetland restoration, and regenerative stormwater conveyance systems that stabilize slopes, filter runoff, and protect waterways. These projects reduce long-

term maintenance costs while improving climate resilience. Several localities have also integrated solar lighting, green roofs, energy-efficient visitor centers, and environmentally friendly trail materials to reduce environmental footprints and extend facility life cycles.

Virginia's parks have expanded social and programmatic innovation through partnerships, accessibility improvements, and new models of community stewardship. Expanded collaborations with nonprofits, conservation groups, universities, and tribal nations have led to co-managed open spaces, community science programs, and culturally informed land stewardship. Inclusive-design efforts—such as ADA-accessible trails, adaptive-recreation equipment, sensory-friendly park spaces, and multilingual wayfinding—have helped broaden access to diverse user groups.

For its numerous innovative projects and policies, Virginia Beach Parks & Recreation was awarded the 2023 National Gold Medal for excellence in parks and recreation management by the American Academy for Park and Recreation Administration, in partnership with the NRPA. In 2025, NRPA awarded its 2025 Innovation in Park Design award to Henrico County Recreation and Parks for its Taylor Farm Park. Together, these initiatives demonstrate how Virginia's state and local parks are integrating technology, environmental design, and community partnerships to create more resilient, accessible, and forward-looking public spaces.

Public Parks



RECOMMENDATIONS TO RAISE THE GRADE

- Secure significant dedicated annual funding to address the deferred maintenance shortfall. This may take the form of tax allocation, lottery proceeds, and/or federal grant funding. Consider establishment of a Natural Resources Trust Fund to manage dedicated funding.
- Standardize and digitize maintenance reporting within individual park districts through a single software tool to promote system-wide transparency and communication.
- Expand use of technology such as smart codes and easy-to-use online reporting to empower the public to track and prioritize maintenance and safety issues at parks.
- Encourage statewide adoption of policies that promote community resilience; in the form of strategies to design with nature, for healthy watersheds, and for equitable benefit of communities.

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Public Parks



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Rail



Photo: Railroad tunnel in Virginia at Point of Rocks; Wirestock Creators

GRADE
COMPARISON

VA: C+

Nat'l: B-



RAIL

EXECUTIVE SUMMARY

Virginia's rail system consists of approximately 3,460 miles of track and 1,471 bridges operated by two Class I and nine Class III (short line) railroads. Passenger rail services are operated by Amtrak (intercity) and the Virginia Railway Express (commuter). Passenger and freight rail services operate in shared tracks, with efforts underway to separate tracks along key segments. Virginia's freight rails moved 132 million tons in 2017 and are forecasted to move 211 million tons in 2045, a 60% increase. Virginia has introduced several rail initiatives based on factors driving changes in the rail industry to include freight movement, population characteristics, transportation technology, the natural environment, and operational challenges. Despite a one-time influx of federal funding from the Infrastructure Investment and Jobs Act, sustained funding will be needed to meet the goals stated in Virginia's 2045 Vision.

BACKGROUND

Rail Governance

Several agencies are responsible for rail governance in Virginia. Their responsibilities in dealing with freight and passenger rail system is indicated in Table 1:

- Virginia Department of Rail and Public Transportation (DRPT)
- Virginia State Corporation Commission's (SCC's) Division of Utility and Railroad Safety
- Virginia Passenger Rail Authority (VPRA)
- Virginia Department of Transportation (VDOT)



Photo: Emporia Virginia Train depot and railroad tracks in rural south-eastern Virginia; Joseph Sohm

Table 1: Rail Governance Structure

Agencies	Responsibilities
Virginia Department of Rail and Public Transportation (DRPT)	Rail planning (Virginia Statewide Rail Plan (VSRP)), project development, policy setting, administering federal and state grants, distribution of funds to public transportation providers, local and regional government entities, freight railroads, and distribution of funds to VPRA.
Virginia State Corporation Commission's (SCC) Division of Utility & Railroad Safety	Enforcement of state and federal safety statutes, and safety inspections in conjunction with the Federal Railroad Administration.
Virginia Passenger Rail Authority (VPRA)	Passenger & commuter rail services
Virginia Department of Transportation (VDOT)	Administration of the Virginia Highway Safety Improvement Program, which focuses on highway-rail crossing safety.

Freight Rail Service

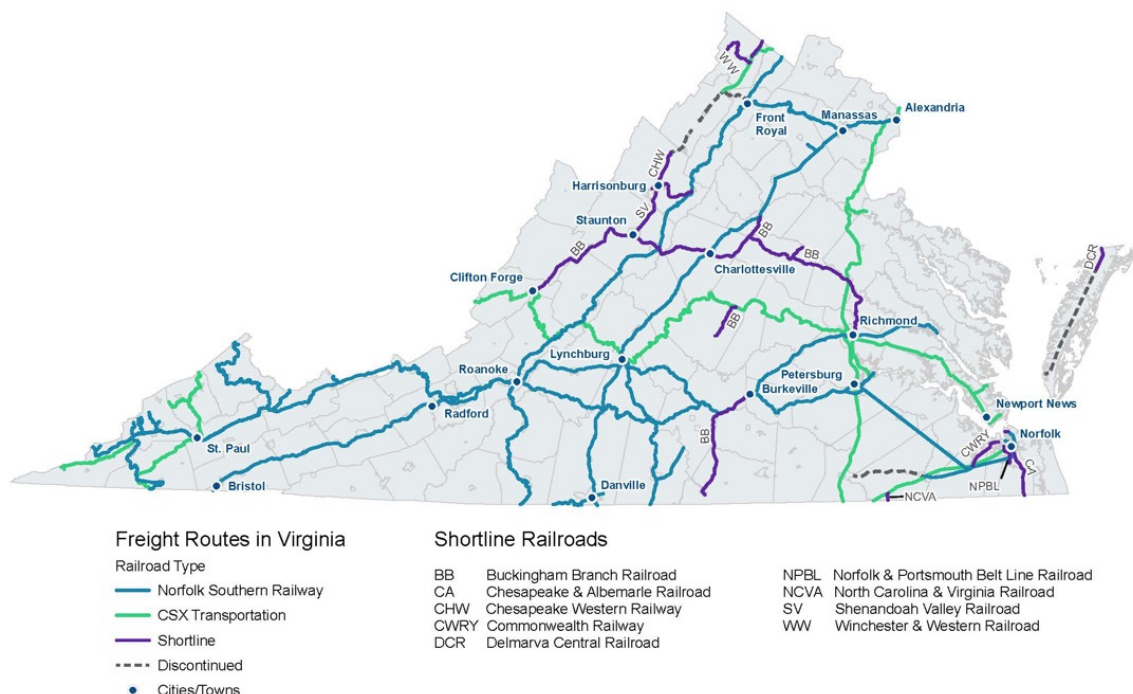
Virginia's freight rail system consists of approximately 3,086 miles of track operated by two Class I railroads and 454 miles of track operated by 9 Class III (Short Line) railroads, as shown in Figure 1.

Class I Railroads are those that have an annual carrier operating revenue of \$943.9 million or more. The two Virginia Class I freight railroads operating in Virginia include:

1. CSX Transportation (CSXT) operating 1,016 miles of tracks
2. Norfolk Southern Railway (NS) operating 1,990 miles of tracks.

Class III Railroads have annual operating revenues of less than \$42.4 million. These local railroads operate as either line-haul carriers or switching and terminal carriers and are also referred to as short line railroads.

Figure 1: Virginia's Freight Rail Network



Source: DRPT FY2024 Annual Report

Passenger Rail Service

Passenger rail service encompasses both intercity and commuter rail, see Figure 2. These passenger services operate on rail lines owned by freight rail companies under negotiated service agreements.

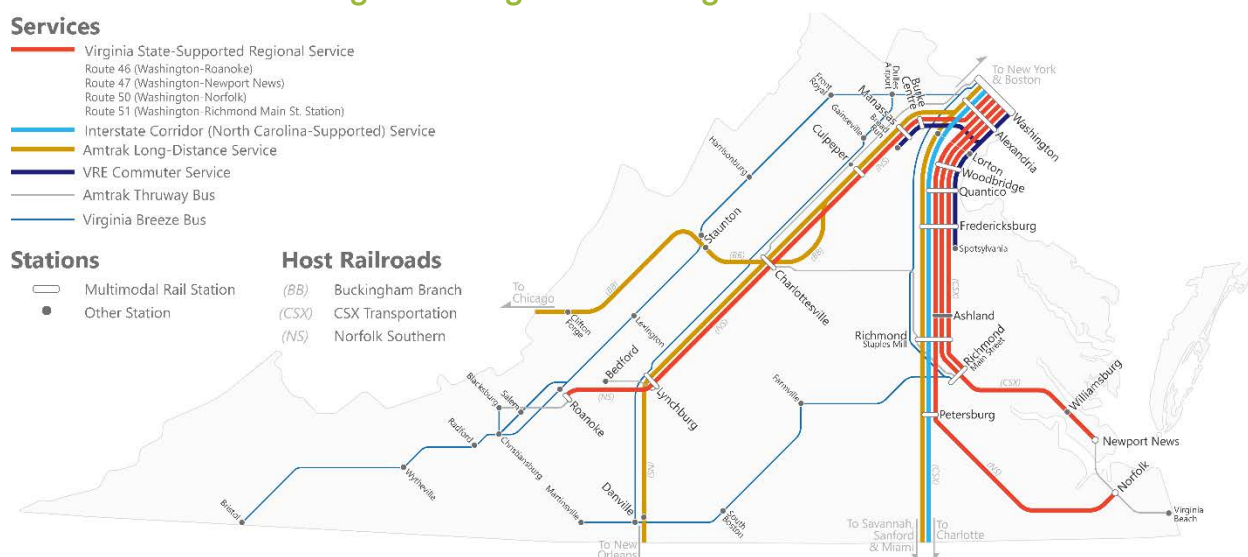
The intercity passenger rail service through Amtrak includes:

- Virginia regional service serving four routes from Washington, D.C., to Richmond, Norfolk, Newport News, and Roanoke.

- Interstate corridor and long-distance trains operating through Virginia linking New York with Miami, Savannah, Charlotte, New Orleans, and Chicago.
- Long-distance auto trains operating between Lorton, VA, and Sanford, FL.

The Virginia Railway Express (VRE) provides commuter rail services on two routes from Washington, D.C., to Broad Run (the Manassas Line) and to Spotsylvania (the Fredericksburg Line).

Figure 2: Virginia's Passenger Rail Network



Source: DRPT FY2024 Annual Report

Highway-Rail Crossings

Highway-rail crossings represent critical elements as it relates to mobility and safety concerns. Virginia has approximately 1,841 public at-grade highway-rail crossings, and approximately 1,359 grade-separated crossings. In addition, there are approximately 2,561 private crossings in the state.

Railroad Bridges

Virginia has approximately 1,471 railroad bridges per the National Railroad Bridge Inventory. A breakdown of these bridges categorized by their owners, and by their predominant design types are shown in Tables 2 & 3. A vast majority, 60.4%, are listed as of 'unknown' design type.

Table 2: Railroad Bridges in the Commonwealth of Virginia by Owners

Owners	# of RR Bridges Owned
CSXT	305
NS	1015
Short Line Railroads	150
Amtrak	1
TOTAL	1471

Source: USDOT - BTS Database

Table 3: Railroad Bridges in the Commonwealth of Virginia by Design/ Material Type

Design Type	# of RR Bridges
Concrete	89
Steel	484
Wood	3
Other (Brick, Masonry, etc.)	7
Unknown	888
TOTAL	1471

Source: USDOT - BTS Database

CONDITION AND CAPACITY

According to the most recent summary issued by the Association of American Railroads (AAR), among U.S. states Virginia ranked 19th in total rail miles (3,086 miles); 19th in rail tons originated (27.8 million); and 10th in rail tons terminated (60.2 million).

However, since the majority of railroad infrastructure (bridges, tunnels and tracks) is privately owned, access to information on condition and capacity is limited. Without this access, it becomes difficult to assess condition and

capacity of these infrastructures and provide an accurate trendline to make meaningful determination.

The total historic and forecasted tonnage moved by rail in Virginia was nearly 132 million tons in 2017 and forecasted to 211 million tons in 2045, a 60.5% increase with breakdown shown on Table 4. Major commodity by tonnage moving through these rail networks include coal, 49%, followed by chemicals or allied products, 11%, as shown on Table 5.

Table 4: Total Historic and Forecasted Tonnage Moved by Rail in Virginia

Total Historic and Forecasted Tonnage Moved by Rail in Virginia							
Direction	2017		2045		Change		
	Amount (millions)	Percent	Amount (millions)	Percent	Amount (millions)	Percent	Compound Annual Growth Rate
Outbound	13	10.1%	24	11.5%	11	83.3%	2.2%
Inbound	48	36.2%	80	37.9%	32	68.0%	1.9%
Intrastate	15	11.2%	21	10.1%	6	43.9%	1.3%
Through	56	42.5%	86	40.5%	30	53.2%	1.5%
Total	132	100.0%	211	100%	79	60.5%	1.7%

Source: 2022 Virginia Statewide Rail Plan

Table 5: Major Commodities Moved by Rail in Virginia (by Tonnage and Units), 2017

Source: 2022 Virginia Statewide Rail Plan

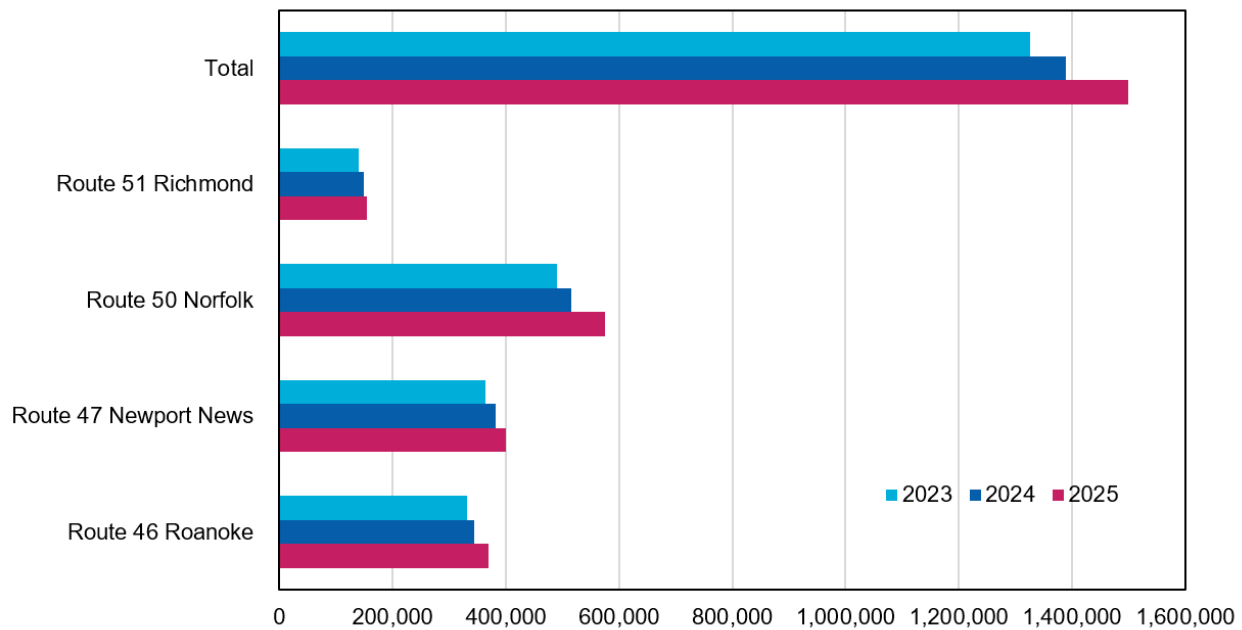
Major commodities Moved by Rail in Virginia by Tonnage, 2017		
Commodity	Tons	
	Amount (millions)	Percent
Coal	643	49%
Chemicals or Allied Products	14	11%
Misc. Mixed Shipments	9	7%
Farm Products	8	6%
Nonmetallic Minerals	7	6%

Major commodities Moved by Rail in Virginia by Rail Units, 2017		
Commodity	Units (Carloads)	
	Amount (thousands)	Percent
Misc. Mixed Shipments	749	34%
Coal	569	26%
Chemicals or Allied Products	170	8%
Food or Kindred Products	103	5%
Pulp, Paper or Allied Products	96	4%

In calendar year 2025, Amtrak recorded 1.45 million passengers in Virginia, the highest since the Commonwealth launched its state-supported service in 2009. The ridership also went up by 45% from the

pre-COVID pandemic record of 953,008 in 2019. The increase was seen in all four Amtrak Virginia regional service corridors as shown in Figure 3.

Figure 3: Amtrak Ridership in Virginia 2023 - 2025



Source: Virginia Passenger Rail Authority

Virginia has introduced several initiatives to address capacity, conditions, and services and push towards its 2045 vision. Transforming Rail in Virginia (TRV), managed by the Virginia Passenger Rail Authority (VPRA) is expected to expand service, improve reliability, and create a pathway to ultimately separate passenger and freight operations along the Interstate 95/ 85 corridor between Washington, D.C. and Richmond, Virginia, and continuing to Ridgeway, North Carolina through other programs. The largest project associated with this agreement is the Long Bridge Project, Figure 4, a \$2.6 billion effort to construct a new double-track bridge over the Potomac River between Arlington and Washington, D.C. The new bridge, which will run adjacent to an existing bridge that is over 117 years old, is intended to double the capacity along this corridor and is scheduled for completion in 2030.

Other initiatives include the Southeast High Speed Rail Corridor through six states and D.C.; and the Western Rail Initiative extending passenger train service west of Roanoke to New River Valley for the first time since 1979.

Virginia Railway Express (VRE) is working on expansion, asset management, new installation, and replacement and rehabilitation effort with a total expenditures cost of

\$1,020.4 million. The types of work involve pedestrian grade crossings improvements, station improvements to increase passenger safety and capacity, modifications of stations to accommodate longer car trains, and the additions of tracks.

Figure 4: The Long Bridge Project



Source: FRA

Rail Improvements at Ports - Driven by the Port of Virginia's connectivity to markets outside, Virginia has made growth in intermodal rail traffic a priority. Investments are being targeted to rehabilitate existing rail connections between principal railroad lines and port properties thus enabling more inbound and outbound port traffic to be hauled by rails.

CSX Transportation, and Norfolk Southern Railway are making their own capital investments on maintenance and upgrading of their rail infrastructure addressing capacity enhancement, safety and facility efficiency. CSX reports approximately \$61.5 million of their 2021 investment was made in Virginia.

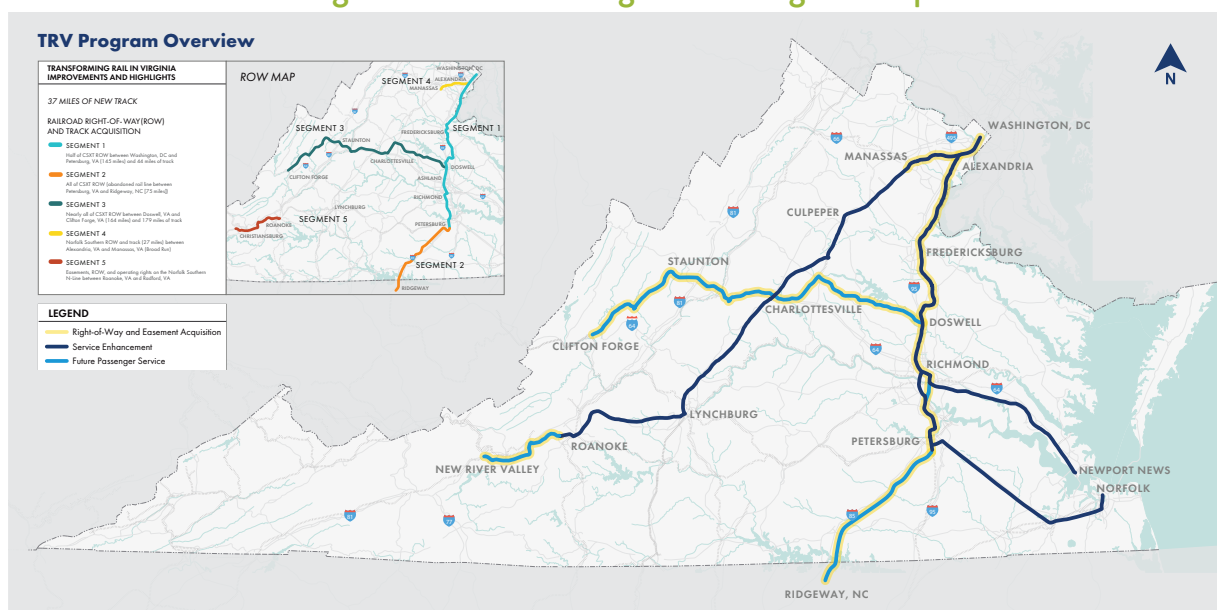
FUNDING AND FUTURE NEED

Rail program in Virginia is supported through a combination of federal, state and private railroad funds. Its 2022 Virginia Statewide Rail Plan identifies approximately \$6.4 billion in total investments which include \$536 million for freight, \$5,772 million for passenger rails, and \$73.5 million for rail crossing projects. Much more funding is

still needed to fully implement all projects identified to complete its 2045 vision.

Figure 5 shows the current and future routes, focusing on increasing rail services to a larger population within the State.

Figure 5: Transforming Rail in Virginia Map



Source: 2022 Virginia Statewide Railroad Plan, DRPT

Through the state's Commonwealth Rail Fund \$1.2 billion has been allocated for freight and VPRA supported programs from fiscal years 2022-2027, see Table 6. The Commonwealth Rail Fund (CFR) provides 93% to the Virginia Passenger Rail Authority (VPRA) to oversee state support of Amtrak, and 7% to DRPT for freight rail improvements through Freight Rail Enhancement to Increase Goods and Highway throughput (FREIGHT) grants, rail planning, technical assistance, and administration.

Virginia has focused its available resources on high-priority "transformational" projects to maximize ridership and port efficiency. The state originally committed around \$4 billion of its own funds to launch the Transforming Rail in Virginia (TRV) program to be completed in four phases. The program has since been scaled to around \$6 billion in scope, with funding leveraged through federal, and local sources alongside CSX and Amtrak. Grants have been secured through Federal-State partnership for Intercity Passenger Rail Grant Program.

Furthermore, the FRA awarded the VPRA a federal grant \$729 million to support Phase 2 of the TRV initiative. Additionally, the FRA awarded \$25 million through its BUILD grant program to VRE also funding specific portion of the TRV. The Commonwealth Transportation Board earmarked \$232 million for TRV in the fiscal year 2026. As of FY2026, projects under the first 2 phases have been fully funded, and awaiting additional funds for phases 3 & 4 projects.

While major corridors are moving forward, several elements of Virginia’s long-term rail vision lack dedicated funding, including the Commonwealth Corridor, a proposed east-west passenger route that could take until 2040 to complete without additional federal funding, and station modernization needed to support future service growth.

Major projects in Virginia that have paved the way for its current program have relied heavily on funding from past and ongoing Federal programs. From 2009 to 2022 seven

Virginia rail projects received \$176 million in federal grants from programs such as the Consolidated Rail Infrastructure and Safety Improvements (CRISI) Rebuilding American Infrastructure with Sustainability and Equity (RAISE) American Recovery and Reinvestment Act (ARRA) State of Good Repair, INFRA, and High Speed Intercity Passenger Rail programs.

The Infrastructure Investment and Jobs Act (IIJA) (P.L. 117-58) has had a significant impact on rails, where funding has gone to improve existing rail services and/or extend services to new areas. Of the \$66 billion authorized for rails under the IIJA from FY22-26, Virginia has received over \$1.3 billion as of early 2026, including the CRISI and RAISE grants mentioned above.

Since 2014, funding across all rail programs in the Commonwealth has increased by 103%, and the last five years, DRPT has invested nearly \$170 million per year for rail improvements.

Table 6: Commonwealth Rail Funds

FY2022 - FY2027 State Program Funds	Budget Amount (Millions)
Freight Rail Enhancement to Increase Good and Highway Throughput (FREIGHT)	\$121.00
Rail Industrial Access (RIA)	\$17.25
Shortline Railway Preservation	\$660.20
Virginia Passenger Rail Authority	\$973.00
Total	\$1,171.45

Source – DRPT Annual Reports

Capital investments by CSXT system-wide during 2024 across its network totaled \$2.5 billion for infrastructure, and of this amount \$63.8M or 2.6% was spent in Virginia.

Much of CSX’s 2024 Virginia capital spending has gone towards the larger, \$3.7 billion dollar “Transforming Rail in Virginia” initiative.

OPERATION & MAINTENANCE

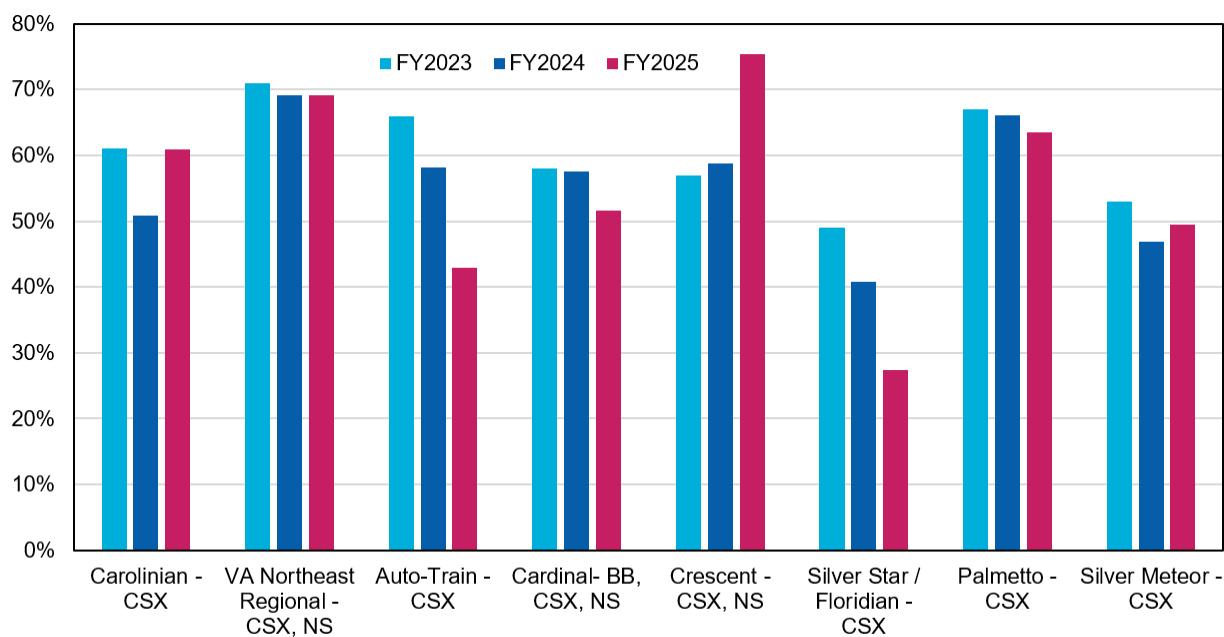
Operations and maintenance are primarily handled by the owners of the infrastructure, and for freight rails this would be the private rail companies.

CSXT's capital investments in Virginia in general involved maintenance and upgrading of existing track and bridges, adding new track capacity, and improvements to network and facility efficiency. NS's investments in Virginia included track and bridge work, installation of safety devices, improvements to yards, terminals, introduction of new technology, etc. Nationwide, these companies reinvest nearly 10% of their operating revenues back into their rail networks annually.

While Amtrak's total ridership saw increases in its state-supported (Carolinian, and Amtrak) services and long-distance trains (Auto Train, Cardinal, Crescent,

Floridian, Palmetto, & Silver Meteor) from 2.2 million in 2023, 2.3 million in 2024, and 2.4 million in 2025, it's on-time performance lagged in many areas, affecting its operations and services. Delays were attributed to many reasons including sharing of tracks by both freight and passenger services. Figure 6 shows Amtrak's on-time performance and owners of the tracks they operate on for fiscal years 2023, 2024, and 2025. An on-time performance standard entered into effect in 2021 where penalties can be assessed against host freight railroads if poor on-time performance is found to be the result of interference by freight trains; despite this, delays still continue. Construction of parallel lines separating freight and passenger rail networks may alleviate this situation as more become available.

Figure 6: Amtrak Customer On-Time Performance, 2023-2025



Source: Amtrak State Fact Sheets

On-time performance has not only impacted passenger service; companies that ship by rail are also experiencing operational difficulties due to escalating railroad delays and deteriorating services.

The need for a trained workforce has become a critical concern. As of early 2026, the rail industry in

Virginia faced high labor demand, driven by both the Transforming Rail in Virginia expansion and a broader regional labor shortage. Railroad industry projections point to a significant need for both entry-level and specialized technical roles. The DRPT is currently evaluating these long-term labor needs as part of its new 2026 Statewide Rail Plan.

PUBLIC SAFETY

Safety of the traveling public is a high priority at all government levels, federal, state and local. Virginia's rail safety is heavily monitored and enforced by VDOT and DRPT. However, even with measures in place, train incidents continue to occur. Train incident type, location, and causes in Virginia over a nine-year time period is detailed in Table 7. Train incident type "Other" includes

any death, injury, or occupational illness of a railroad employee that is not the result of a "train incident" or "highway-rail incident", and was the dominant type of rail incident in the state. Additionally, most rail incidents occurred on yard tracks as opposed to mainline tracks, and the majority of incidents were due to human errors.

Table 7: Train Accident Types, Locations & Causes

Train Incident Type/Locations/Causes in Virginia (2013-2022)	
Train Incident Type	15% train incidents (not at grade-crossings)
	20% highway-rail
	65% other
Train Incident Location	40% main line tracks
	60% yard tracks
Train Incident Causes	12% misc.
	16% equipment
	32% track
	40% human

Source: data from 2022 Virginia Statewide Rail Plan



Virginia has implemented warning devices at around 75% of its highway-rail at-grade crossings, as shown in Table 8, and both Class I railroads have fully implemented Positive Train Control (PTC) technologies on their networks, a system designed to automatically stop or slow a train before accidents can occur. Additionally, defect and clearance detectors; automatic track inspection technology, and automatic railroad crossing mechanisms are being used on tracks throughout Virginia.

In 2024 Virginia ranked 21st in the nation for highway-rail crossing collisions. The primary cause, 87%, occurred because vehicles failed to stop, stopped on tracks, or attempted to drive around lowered gates. Over 95% of incidents happened at crossings already equipped with warning devices.

Table 8: Types of Warning Devices at Virginia Public At-Grade Crossings

Types of Warning Devices Installed at Virginia Public At-Grade Crossings	
Warning Equipment Type	Number of Crossings
Quad Gates	13
Gates	1175
Flashing Lights	184
Bells	4
Special Warning	5
Stop Signs	32
Cross Bucks	375
Other	2
None	51

Source: FRA Crossing Inventory Data Query

RESILIENCE AND INNOVATION

Virginia has addressed resiliency and redundancy by separating passenger and freight traffic, expanding physical track capacity, and updating design standards to manage extreme events. In addition to providing these layers of redundancy on its rail network, Virginia is shifting toward “multi-hazard” protection incorporating climate-adaptive designs to account for sea-level rise, rainfall intensity, and water salinity, and nature-based measures restoring wetlands to act as flood buffers for rail right-of-way.

Flood resiliency effort is focusing on three primary “hotspot” regions where historical data and future sea-level rise projections intersect with critical national rail arteries. These include the Northern Virginia/DC Gateway, Hampton Roads & Tidewater Region, and the Appalachian & Riverine Corridors.

Additionally, both CSXT and Norfolk Southern have been quick to respond to rail disruptions. When the CSX coal train derailed on October 2025 in New Kent County, two locomotives and 53 coal cars left the tracks, spilling diesel fuel and coal into wetlands near the Chickahominy River. This incident caused a major disruption by completely closing the CSX rail line between Richmond and Newport News for several days.

The CSX maintenance forces worked around the clock to resume service. The rail line was reconnected within roughly one week, restoring passenger and freight service while remediation continued. As resiliency measure the responders deployed floating booms and turbidity curtains to contain 7,000 gallons of diesel and 4,000 tons of coal, preventing widespread contamination of the river. In general, railroad companies tend to prioritize resiliency to incidents or disruptions in order to prevent loss of freight revenue.

Hurricane Helene on September 2024 presented significant challenges with riverine flooding. Heavy rainfall led to track washouts along several Norfolk Southern and CSXT routes in the Appalachian region. In anticipation of the storm, rail operators implemented curfews and staged repair crews in key areas like Roanoke, allowing for rapid inspections once water receded. While some mountain routes were temporarily severed, freight was successfully diverted to alternate North-South corridors, although at the cost of increased transit time.

Freight railroads are continuing to integrate predictive analytics, automation, AI and advanced inspection systems to enhance safety, efficiency and sustainability.

Rail



RECOMMENDATIONS TO RAISE THE GRADE

- Continue developing and implementing focused programs such as the Transforming Rail in Virginia initiative, and the Western Rail Initiative expanding and extending rail services throughout the state to relieve congestion and provide mobility options.
- Improve information availability on inspection and condition data of the built infrastructure as rail provides critical transport, carrying passengers and freight, whose failure impacts the public, public safety, and the economy.
- Continue efforts to advance community connections by expanding the rail network and increasing service frequency to serve a broader population, and make passenger rail more competitive with other modes of travel.
- Further efforts to improve safety within the rail network through research and implementation of innovative technologies.
- Advance initiatives on design and operation of the built railway infrastructure addressing resiliency and redundancy, especially in terms of multi-hazard threats and incidents of high probability of occurrence within the Commonwealth.

Rail



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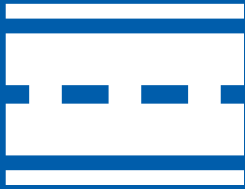
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Roads



GRADE
COMPARISON

VA: C
Nat'l: D+



ROADS

EXECUTIVE SUMMARY

Virginia's roadway network includes approximately 164,000 lane-miles, with about 75% maintained by the Virginia Department of Transportation (VDOT) and the remaining 25% by local governments. While the Commonwealth has established a diversified transportation revenue stream, long-term funding pressures persist due to rising construction costs, evolving travel patterns, improving fuel efficiency, and growing maintenance needs. Recurring maintenance shortfalls have required the transfer of construction funds to operations and maintenance, highlighting structural funding challenges. Although Virginia continues to perform well in national rankings, increasing urban congestion, rising maintenance costs, and below-average roadway safety metrics continue to strain the system. Ensuring long-term sustainability will require additional and more diversified revenue sources, along with stronger partnerships among federal, regional, and local stakeholders. Improving roadway safety will also require continued investment in safer roadway infrastructure, programs that encourage safer driving behaviors, post-crash care, and modern vehicle safety technologies.

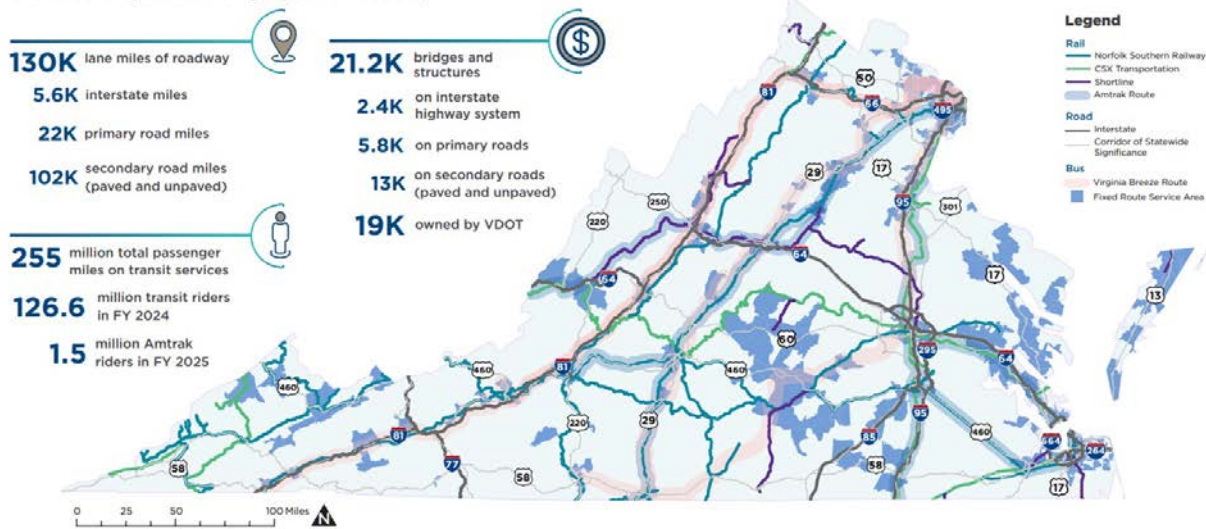
CONDITION AND CAPACITY

VDOT is responsible for the third-largest state-maintained highway system in the country, maintaining approximately 130,000 lane miles of roadway. Localities maintain over 30,500 lane miles of roadway, with approximately 5,600 interstate miles, 22,000 primary road miles, and 102,000 secondary road miles.



Photo: Woodbridge, Virginia; Kristina Blokhin

Figure 1: VDOT Corridors of Statewide Significance

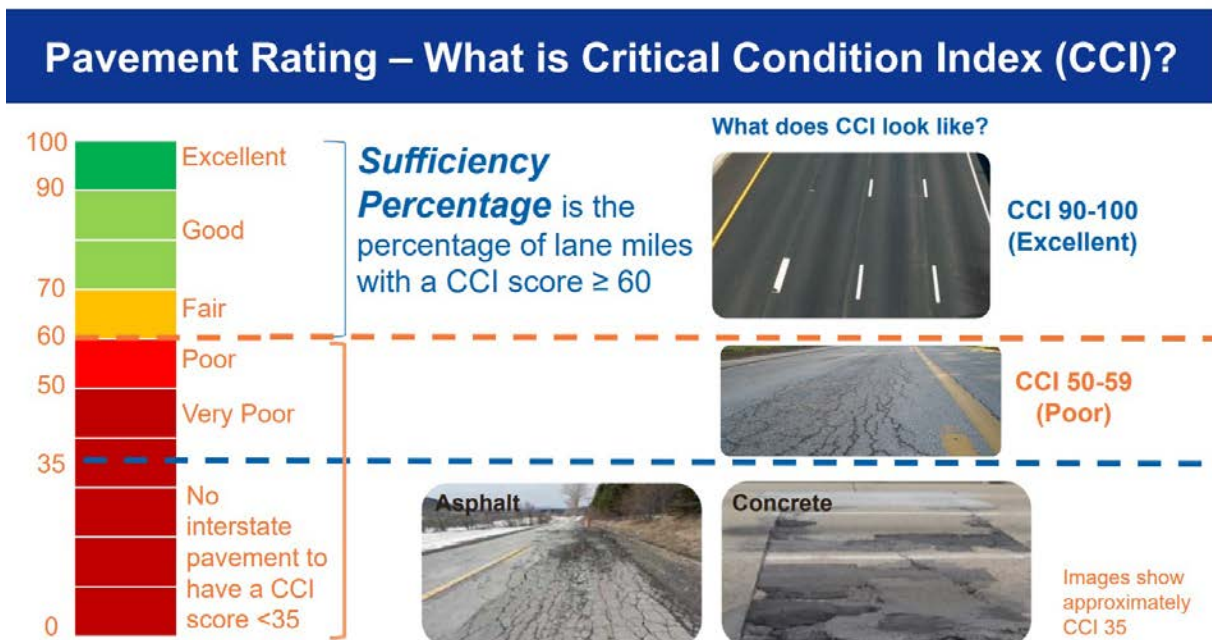


Source: VDOT Office of Intermodal Planning

VDOT measures pavement condition across three roadway categories: interstates, primary roads (generally carrying more traffic volumes and serving as major arterial and collector roadways), and secondary roadways (local roadways) using a Critical Condition Index (CCI), on a scale of 0 to 100, with 100 representing a pavement with no visible distress. Conditions are measured annually for all interstate and primary roadways and for 20% of the

secondary roadways (i.e. once every 5 years). The CCI is comprised of two Pavement Condition Indices, the Load-related Distress Rating which considers fatigue cracking, patching, rutting, etc.; and the Non-load-related Distress Rating which considers transverse and longitudinal cracking, longitudinal joint separation, bleeding, etc., conditions generally associated with weathering of the pavement surface.

Figure 2: Critical Condition Index for Pavement Ratings

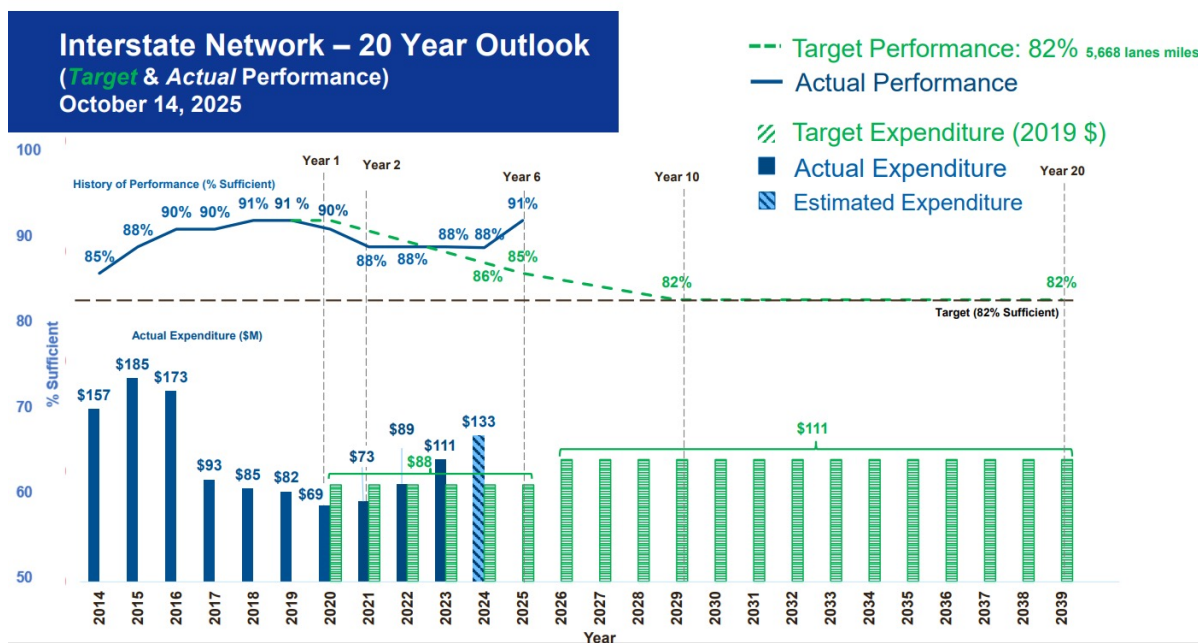


Source: VDOT April 21, 2026 Commonwealth Transportation Board Workshop

As of October 2025, investments for interstate pavements have resulted in 91% of interstate lane-miles being assessed in fair, good, or excellent condition, with 9% in poor condition. For the primary network, 82% of roadways that carry over 3,500 Annual Average Daily Traffic (AADT) are in fair, good, or excellent condition, and 75% of the primary network is in fair, good, or

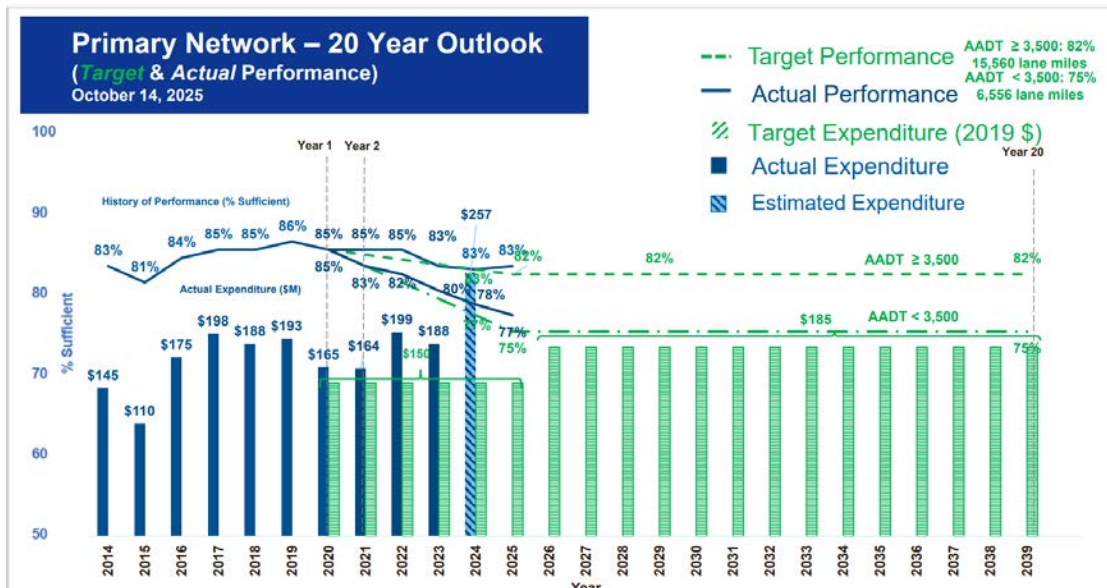
excellent condition. The percentage of secondary roads that carry more than 3,500 AADT and are in fair, good, or excellent condition has improved from 60% in 2020 to 82% in 2024. While this is good news there remains over 40,000 lane miles of VDOT's roadways in poor, very poor, or worse condition.

Figure 3: Interstate Network, Annual Expenditures and Performance Ratings



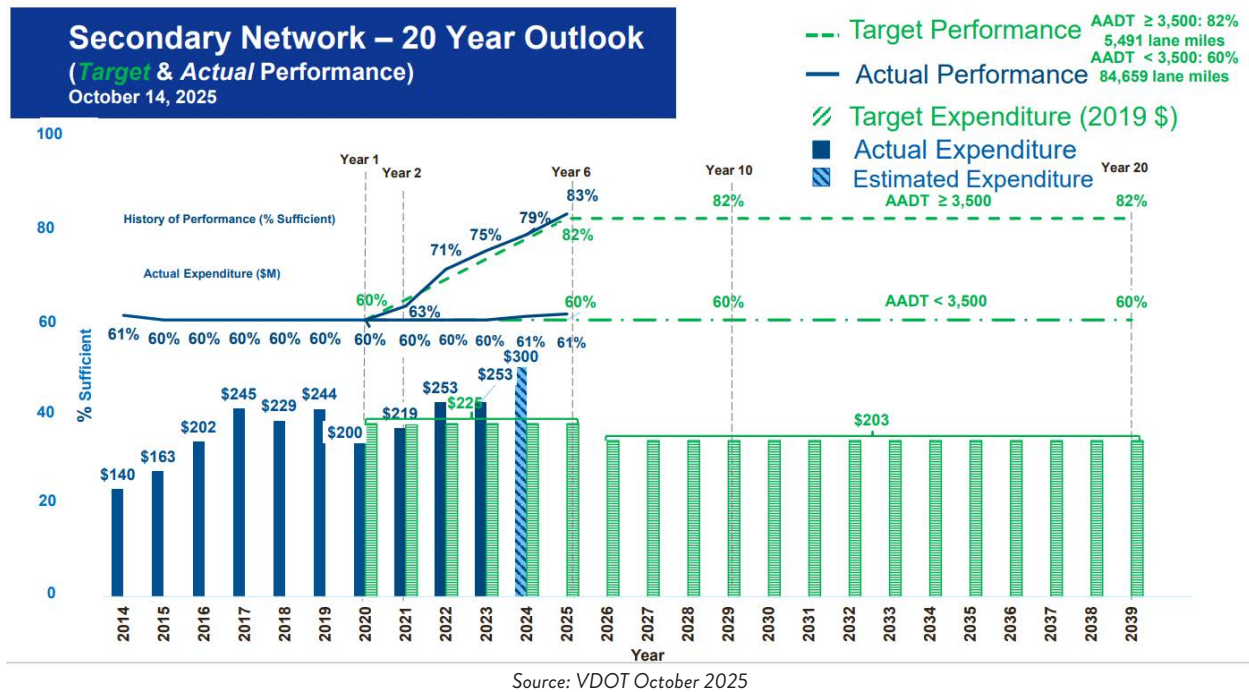
Source: VDOT October 2025

Figure 4: Primary Network, Annual Expenditures and Performance Ratings



Source: VDOT October 2025

Figure 5: Secondary Network, Annual Expenditures and Performance Ratings



Vehicle Miles Traveled (VMT) statewide in 2024 was slightly above 2019 levels, indicating a full rebound from pandemic lows. VDOT reports show that most interstate corridors and primary routes now carry volumes comparable to or higher than pre-pandemic figures, especially in Northern Virginia and Hampton Roads. Traffic data indicates congestion is worsening, particularly in Northern Virginia, Richmond, Hampton Roads, and along Interstate 81. Urban commuters in Virginia now spend an average of 39 hours per year stuck in traffic, up from about 8.5 hours in earlier reports, showing a sharp increase in gridlock over time.

Urban regions such as Northern Virginia, Richmond, and Hampton Roads experienced the highest traffic volumes and operational challenges in 2024. Incident clearance times on interstates in these areas averaged under 90 minutes, meeting VDOT's statewide target, but congestion during peak hours remained a significant

issue. In contrast, rural districts such as Bristol, Staunton, and Culpeper faced fewer congestion-related problems but had unique operational challenges tied to incident response and roadway geometry. Rural areas reported longer clearance times for major incidents due to limited resources and greater distances between service providers.

Overall, urban areas focused on congestion mitigation and technology-driven solutions, while rural areas prioritized safety and incident management efficiency. Both settings benefited from Transportation Systems Management and Operations (TSMO) strategies, but their application differed; urban districts leveraged advanced Intelligent Transportation Systems (ITS) tools to optimize flow, whereas rural districts concentrated on systemic safety countermeasures and resource coordination.

FUNDING & FUTURE NEED

Virginia has taken significant steps in recent years to increase and diversify investment in the Commonwealth's transportation network, although funding challenges remain as VDOT works to sustain and modernize one of the nation's largest state-maintained highway systems. The primary source of state funding is the Commonwealth Transportation Fund (CTF), which derives revenue from 11 state sources:

- Retail sales and use tax
- Motor vehicle sales and use tax
- Statewide motor fuels tax
- Aviation fuels tax
- Road tax
- International registration plan
- Registration fees
- State insurance premium tax
- Recordation tax
- Vehicle rental tax
- Highway use fee

In FY 2026, the CTF is projected at \$9.0 billion from state, federal, regional, and other sources, of which approximately \$8.0 billion supports the Commonwealth's transportation modes, highway maintenance, operations, and construction programs.

Virginia's FY 2026 motor fuels tax, 31.7 cents per gallon for gasoline and 32.7 cents per gallon for diesel, is indexed to inflation and scheduled to rise annually. While this indexing mechanism preserves revenue growth, improved vehicle fuel efficiency and increased adoption of hybrid and electric vehicles continue to erode long-term gas tax sustainability. To address this, the Commonwealth in 2020 established a highway use fee on fuel-efficient and electric vehicles and launched the Mileage Choice Program, a voluntary per-mile road usage charge pilot. These steps position Virginia as one of the early adopters of alternative funding mechanisms for a future less reliant on per-gallon fuel taxes. In FY 2026, the highway use fee is estimated to generate \$96 million in revenue, up from \$83.9 million in FY 2025.

Virginia has introduced targeted programs to address regional infrastructure challenges and priorities. Virginia has made extensive use of regionally generated

revenues to support needs in Northern Virginia, Hampton Roads, and Central Virginia. Regional revenues generate approximately \$1.1 billion annually for priority projects. Of note, regional funding in Hampton Roads is supporting construction of the \$3.9 billion Hampton Roads Bridge Tunnel Expansion. Similarly, the I-81 Corridor Improvement Program is supported by a dedicated regional fuels tax and a share of funding from the Commonwealth's Interstate Operations and Enhancement Program (IOEP). The program is projected to support \$3.5 billion in capital and operational improvements through FY 2031.

Also of note, the Special Structures Program, created in 2017, provides dedicated funding for large and complex bridges and tunnels that fall outside the scope of routine maintenance and have especially high reconstruction costs. These represent some of the Commonwealth's most expensive and technically complex infrastructure needs. This program will advance the \$724 million reconstruction of the Robert O. Norris Bridge eight years ahead of the previous timeline.

Federal support through the Infrastructure Investment and Jobs Act (IIJA) has provided a critical boost, underpinned by the federal motor-fuels tax and the federal General Fund. Virginia has received approximately \$7 billion in highway formula funds and more than \$500 million in bridge repair funds over the five-year period of the IIJA ending in October 2026. Year over year, federal formula funding provided to Virginia has been approximately 33% greater under the IIJA than the previous highway funding bill. Virginia has also made extensive use of federal financing programs and tools to maximize the impact of these dollars, including Grant Anticipation Revenue Vehicle (GARVEE) bonds; soft match through toll credits, which allow states to count past toll facility investments as the non-federal match on a project and effectively enable federal funds to cover 100% of eligible project costs; and Transportation Infrastructure Finance and Innovation Act (TIFIA) loans. These mechanisms have allowed the Commonwealth to accelerate major projects, stretch limited state dollars, and complement IIJA resources.

Table 1. Detailed Sources of Transportation Funds

Line item	Amount
CTF Funding Programs prior to Distribution	\$187,654,497
CTF Transfer to HMOF	\$2,704,920,560
TTF Transfer to Construction Fund	\$1,377,387,979
TTF Transfer to Priority Transportation Fund (PTF)	\$272,878,751
Other HMOF Revenues	\$53,678,105
Other Construction Fund Revenues	\$1,168,251,151
Interstate 81 Corridor Improvement Fund & Financing	\$452,092,464
Fuel Tax Revenue for Highway Construction District Grant Program	\$129,945,878
Federal Fund	\$1,539,446,727
Priority Transportation Fund (PTF)	\$15,628,568
General Funds	\$7,000,000
GARVEE Bonds	\$100,000,000
Subtotal	\$8,008,884,680
Pass through revenues	
Central Virginia Transportation Authority Fund	\$248,400,000
Northern Virginia Transportation Authority Fund	\$416,800,000
Hampton Roads Transportation Fund	\$287,400,000
Hampton Roads Regional Transit Fund	\$37,100,000
TOTAL	\$8,998,584,680

Source: VDOT FY 2026 Commonwealth Transportation Fund Budget (Revised June 2026)

In Virginia, local governments play a significant role in transportation funding, though their tools vary. Cities, towns and counties that maintain their own street networks receive state maintenance payments, although these payments have been insufficient to keep pace with local maintenance needs. Many localities issue local bonds, establish special service districts, dedicate general funds, and/or leverage developer proffers to fund roadway construction and improvements independently or to complement the Commonwealth's statewide transportation revenues.

A defining feature of Virginia's approach to maximizing transportation investments is SMART SCALE, the statewide project prioritization process adopted in 2014. SMART SCALE requires that candidate

projects be scored based on safety, congestion mitigation, accessibility, environmental quality, economic development, and land use to ensure limited transportation dollars are directed toward the highest-value projects. Importantly, SMART SCALE's benefit-cost methodology incentivizes local governments to leverage their own transportation revenues to improve competitiveness for scarce statewide construction funds.

Despite these reforms, maintenance funding has been a persistent issue. Rising construction costs and an expanding roadway network, combined with inflationary pressures, have reduced the buying power of transportation dollars. While the Commonwealth's 2020 transportation revenue package stabilized maintenance allocations by dedicating new sales and fuels tax revenues,

funding has often been insufficient to fully address pavement rehabilitation, bridge preservation, and routine system upkeep. Consequently, in accordance with state law, funds dedicated for construction purposes have been required to be transferred to meet maintenance needs (a process called “crossover”) since FY 2022. The FY

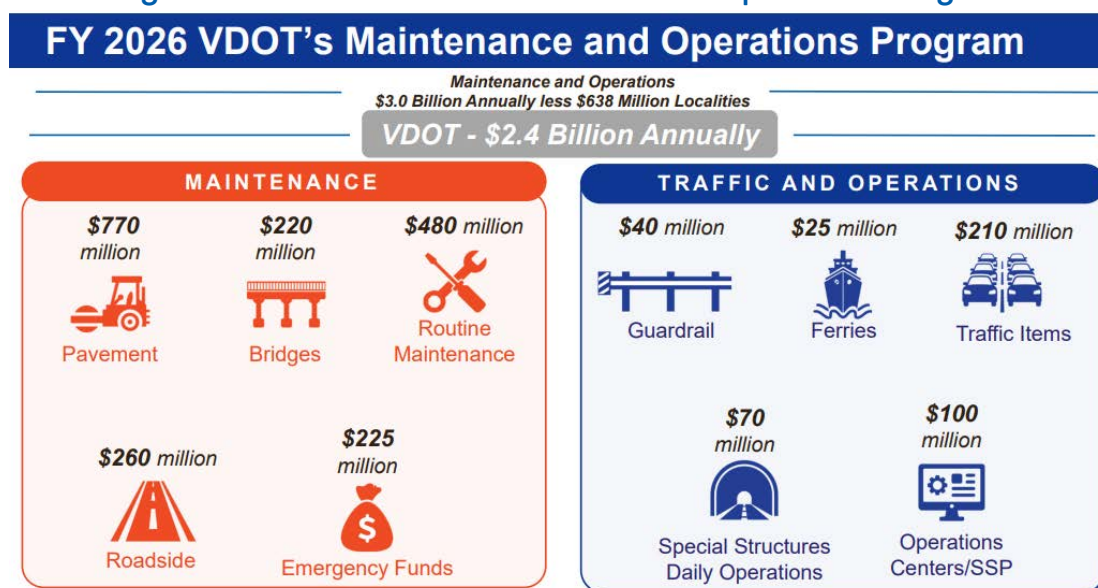
2026 crossover was \$677.4 million in state funds and \$284 million in federal funds, with the FY 2027 deficit projected to be a total of \$653.7 million. Recurring crossover transfers reflect persistent maintenance funding shortfalls and reduce the Commonwealth’s ability to expand or modernize infrastructure.

OPERATION AND MAINTENANCE

VDOT maintains about 75% of all roads in Virginia with an annual operations and maintenance budget of \$2.4 billion split into two categories: \$445 million supporting traffic and operations; and \$1.955 billion for maintenance programs that include pavement, bridges, routine maintenance, roadside maintenance, and emergency funds (snow removal, storm response). In addition to these funds, another \$400 million annually is distributed

across the Commonwealth for the State of Good Repair program for pavements and bridges maintenance needs as identified within each of the nine VDOT districts. Increasing pressures on maintenance and operations budgets come from increasing inventory (1,656 lane miles added since 2019, representing a 1.27% increase), rising construction costs, increasing vehicle-miles traveled, and the increasing age of existing infrastructure.

Figure 6: VDOT 2026 Maintenance and Operations Program



Source: VDOT Commonwealth Transportation Board Workshop, April 21, 2026

PUBLIC SAFETY

Traffic crashes impose a tremendous economic cost to Virginia. In 2024 alone, fatal and serious traffic crashes in Virginia resulted in an estimated \$35 billion in combined economic costs and lost quality of life—\$8.7 billion in direct economic impact and \$26.3 billion attributed to trauma, pain, and lost lifespan. Virginia saw a troubling 9% rise in traffic fatalities between 2015 and 2025, with 833 deaths in 2025, with the lowest number of fatalities in 2014 at

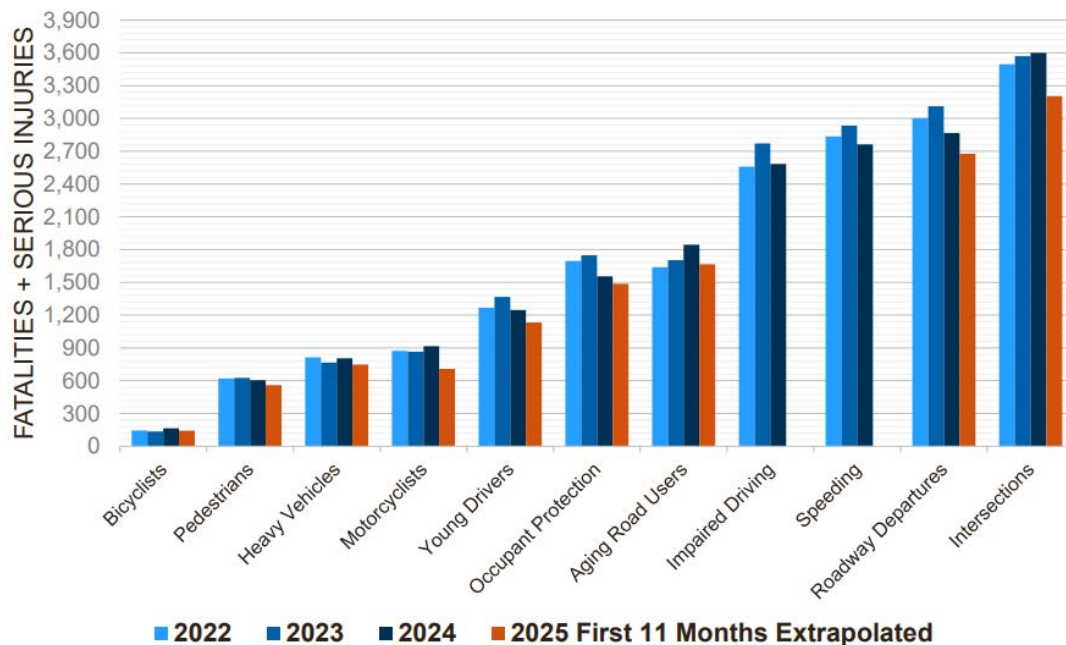
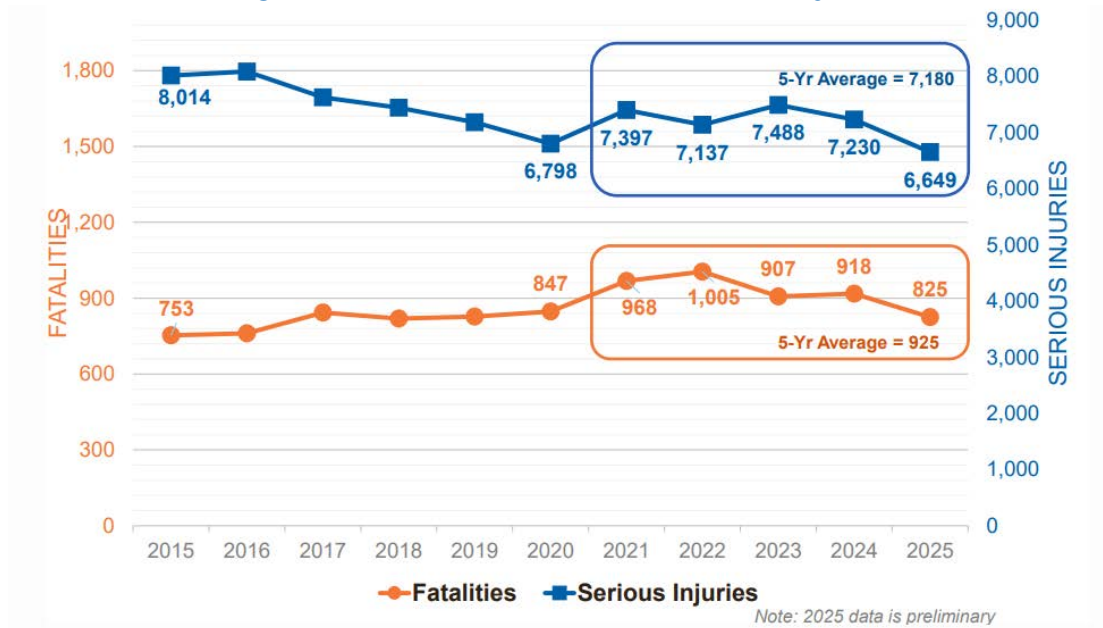
753 fatalities. While there was a decline between 2022 and 2025, the long-term trend highlights persistent safety concerns. From 2020 to 2024, there were a total of 4,465 traffic fatalities that included 669 pedestrians (14%), 75 bicyclists (2%), which are both lower than the 2023 national averages of 18% and 3%, respectively. Based on data from the US Department of Transportation’s Fatality Analysis Reporting System, Virginia’s fatality rate for 2024

was 10.41 deaths per 100,000 people and was lower than the national average of 11.54. Crash rates per 100 million vehicle miles traveled (VMT) show that the rural fatality rate has been above 1.7 per 100 million VMT from 2021 to 2024, about twice the national average.

In VDOT's Strategic Highway Safety Plan the top focus areas identified are intersections, roadway departures,

speeding, impairment (distracted, drunk, drowsy, drugged), aging road users, unbelted drivers, young drivers, motorcyclists, heavy vehicles (trucks), pedestrians, and bicyclists. Fatal and serious injury traffic accident trends across these focus areas show an overall decline between 2022 and 2025 across each of the categories.

Figure 8 Annual Fatalities and Serious Injuries



Source: VDOT Safety Overview, CTB Meeting March 18, 2026

The top two focus areas; roadway departures and intersections, represent about 34% of all fatal and serious injury traffic accidents and have led to increased focus on infrastructure changes that can improve safety and reduce these types of traffic accidents. Adopted strategies include increasing roadway departure initiatives (such as constructing rumble strips), improving the road edge, and delineating curves. In addition, in 2024, VDOT designed and/or installed flashing yellow arrows at 106 signalized intersections and constructed improved pedestrian crossings at 134 intersections.

Crashes resulting in fatalities and/or serious injuries usually involve more than one factor. For example, of

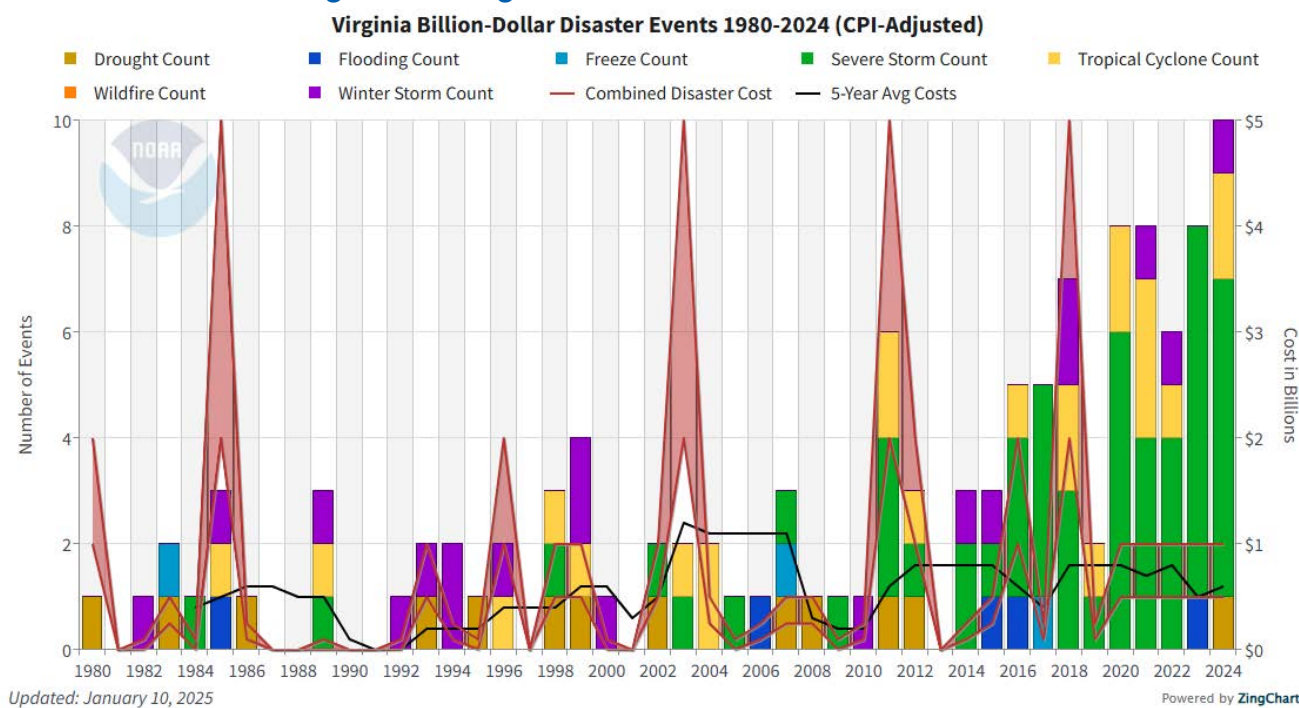
15,461 crashes involving fatalities or serious injuries involving a roadway departure, 44% (6,870) involved a speeding driver, and of those speeding drivers, 40% (2,782) were impaired. This has resulted in a multi-pronged approach to address public safety, as noted in VDOT's Strategic Highway Safety Plan, and a supplemental report Vulnerable Road User Safety Assessment. VDOT has implemented several innovative strategies such as roadway reconfiguration projects across the Commonwealth, especially in urban areas. For example, in the Richmond area, 68 miles of bike lanes have been created and have resulted in a reduction in injuries to bicyclists and pedestrians.

RESILIENCE

From 1980-2024, there were 116 confirmed weather/climate disaster events with losses exceeding \$1 billion each in Virginia. These events included 13 drought events, 5 flooding events, 3 freeze events, 53 severe storm events, 23 tropical cyclone events, and 19 winter storm events. The 1980–2024 annual average is 2.6 events (CPI-adjusted); the annual average for the most recent

5 years (2020–2024) is 8.0 events (CPI-adjusted). In the past 5 years, the number of severe storm events have increased significantly, increasing flooding risk to Virginia's roadway infrastructure. Of the 116 weather events, 81 were flood-related disaster events (floods, severe storms, tropical cyclones).

Figure 10: Virginia Billion-Dollar Disaster Events



According to the Virginia Department of Conservation and Recreation, flooding is the most common and costly natural disaster in Virginia. Approximately 2.3 million acres in Virginia are designated as Special Flood Hazard Areas, accounting for about 9% of the state's land. In addition to the increased number of severe storms, Virginia's low-lying coastal road infrastructure also faces increased flooding threats due to sea level rise.

According to the National Oceanic and Atmospheric Administration, Virginia's tidewater region has the highest annual sea level rise on the East coast averaging over 5 mm per year (Yorktown, Norfolk) and is projected to rise 1.64 feet by the year 2050. There are over 6,000 lane-miles of roadway located within FEMA Flood Hazard Zones, as shown in the table below.

Table 2. Summary of Road Miles within FEMA Flood Hazard Zones

Category	Total Road Length (miles)	1% Annual Chance Flood Hazard, all A and V zones (miles)	0.2% Annual Chance Flood Hazard (miles)	Area of Minimal Flood Hazard (miles)
All Coastal Roads	62,312	3,083	1,498	57,730
Urban Roads	17,359	1,229	854	15,277
Suburban Roads	22,590	595	235	21,761
Rural Roads	22,363	1,259	409	20,692

Source: Coastal Virginia Transportation Infrastructure Inundation Study Annual Update by Virginia Institute for Marine Science

In November 2022, VDOT released its first-ever Resilience Plan, establishing a multi-layered framework to embed resilience within transportation planning, design, operations, maintenance, and asset management. The plan includes six primary objectives:

- **Promote data-driven decisions** via risk-based assessments of flood, rockfall, and extreme weather vulnerabilities.
- **Engage and partner with stakeholders** through strategic outreach and coordination.
- **Identify and prioritize at-risk infrastructure** using objective vulnerability criteria.
- **Adopt diverse resilience measures**—from adaptive engineering to natural and administrative solutions.
- **Evaluate feasibility and cost-effectiveness** and integrating resilience within funding and investment processes.
- **Incorporate resilience into current funding policies.**

INNOVATION

Virginia continues to advance a range of innovation-related initiatives, including project delivery, infrastructure improvement, and materials development. Since 2015, the Innovation and Technology Transportation Fund (ITTF) has provided funds for pilot programs pertaining to high-tech infrastructure improvements for projects

or programs that reduce congestion, improve mobility and safety, provide up-to-date travel data, or facilitate emergency response. As of August 31, 2025, ITTF supports 60 projects totaling \$156.2 million, and in 2025 identified 4 new projects totaling \$21.7 million.

Figure 9: I-95 Variable Speed Limit (VSL) System



Source: Virginia Department of Transportation

Urban corridors saw increased deployment of Transportation Systems Management and Operations (TSMO) strategies, including adaptive signal control, ramp metering, and real-time traveler information systems. These measures helped reduce secondary crashes and improve reliability, particularly on heavily traveled interstates like I-95 and I-64. The I-95 Variable Speed Limit (VSL) System deployed along a 15-mile stretch of I-95 northbound (Figure 6), saw 86 fewer crashes and a 13.8% drop in average travel times compared with 2021 data before implementation.

Urban districts also reported strong integration of connected vehicle technologies and expanded use of dynamic message signs to manage recurring congestion and special events.

Another example of ITTF-supported projects include Arlington County's Dynamic Parking Pricing system, which is a data-driven, variable-pricing parking system designed to reduce negative effects associated with searching for parking spaces. Infrastructure

improvements also include tunnel safety upgrades, a statewide Transportation Data Hub for analytics, and integrated mobility platforms such as the Regional Multi-Modal Mobility Program Dynamic Incentivization, Commuter Parking Information System, and the Animal Detection Warning System study on U.S. Route 460 to mitigate elk collisions.

Four new efforts identified in 2025 include a project to provide data to VDOT's Richmond Travel Operations Center for an 8-mile segment of I-95 to enable shorter incident response times, decrease congestion caused by incidents, increase safety on the corridor, and allow communicating real-time data to travelers. In addition to this project, two traffic signal control projects are planned (17 signals in Christiansburg, queue length detection at I-581/Route 220 interchange), and a "digital twin" will create a virtual version of data from multiple sources (i.e. traffic signals, parking, street assets) so that the City of Alexandria can test scenarios for better decision making to reduce congestion, improve multi-modal throughput, and improve safety.



RECOMMENDATIONS TO RAISE THE GRADE

- Increase investment in safer infrastructure, enhanced driver behavior programs, post-crash care, and modern vehicle safety systems to improve roadway safety and reduce fatal and serious injury crashes.
- Adapt revenue framework as fuel efficiency improves and travel patterns evolve.
- Strengthen partnerships at the federal, regional, and local levels, as fuel efficiency improves, construction costs rise, and travel patterns evolve.
- Supplement traditional revenue sources with innovative funding tools to better balance future construction priorities with maintenance and operational needs.
- Incorporate resilience into current funding policies.

SOURCES

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Schools



GRADE
COMPARISON

VA: D+
Nat'l: D+



SCHOOLS

EXECUTIVE SUMMARY

Virginia's school infrastructure needs major modernization. Aging facilities and chronic underinvestment are widening gaps in safety, reliability, educational adequacy, and resilience. More than half of Virginia's school buildings are over 50 years old, and many still rely on HVAC, electrical, and plumbing systems beyond their expected life, leading to frequent failures, emergency repairs, and disrupted instruction. Northern Virginia divisions manage overcrowding and continued use of modular classrooms, while Southwest and Southside communities maintain oversized, aging campuses they cannot afford to modernize. Urban and coastal divisions contend with roof leaks, drainage failures, and recurrent flooding. Statewide estimates show an annual maintenance and operations shortfall of \$1.11 billion and capital investment gap of \$2.62 billion. Raising the grade will require a permanent state construction program, consistent statewide facility data, and broader implementation of resilient, high performance design.

BACKGROUND

Virginia's public education system includes more than 2,150 K-12 schools serving roughly 1.26 million students across 132 school divisions, alongside licensed early childhood providers and charter schools. The Commonwealth shares responsibility for K-12 school facility oversight with local governments, but localities provide most capital

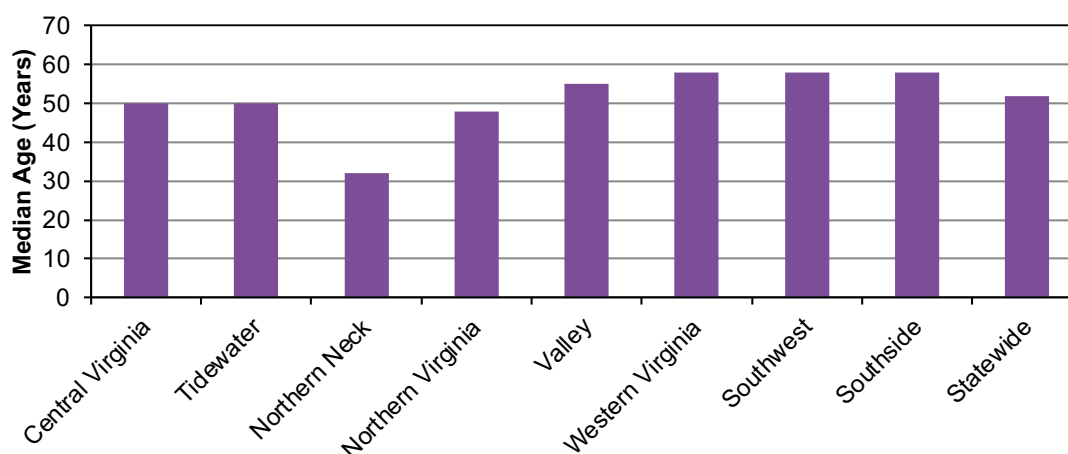
funding, which creates uneven modernization cycles and longstanding disparities in building age, safety, reliability, indoor environmental quality, and instructional quality. These facility conditions affect instructional delivery, day-to-day operations, and long-term educational opportunity across the Commonwealth.

CONDITION

Virginia's school infrastructure reflects decades of underinvestment, aging systems, and regional imbalance. The 2021 *Needs and Conditions of Virginia School Buildings* report found that more than half of Virginia school buildings are over 50 years old and often depend on HVAC, electrical, and plumbing systems that are beyond their expected lives and were not designed to

meet current expectations for ventilation, temperature control, electrical capacity, and energy efficiency. The continued reliance on this 2021 assessment also reflects a broader deficiency: Virginia lacks a recurring statewide process for collecting and reporting comparable school-facility condition data, limiting effective prioritization, planning, and accountability.

Figure 1: Median School Building Age by Region

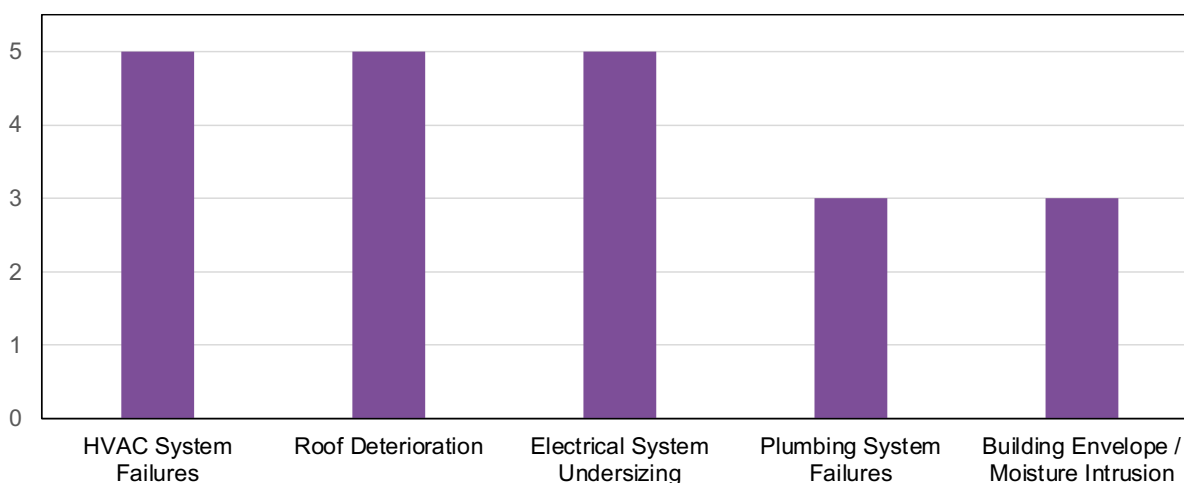


Source: ASCE Virginia Section analysis of statewide school facility condition data

Regional differences in building age contribute to unequal learning environments and operating burdens. While some divisions maintain newer or recently modernized facilities, others rely heavily on schools more than 50 years old, requiring more extensive modernization and imposing higher maintenance and operating costs. Aging HVAC, electrical, and plumbing systems remain one of the Commonwealth's most serious school infrastructure challenges. Media reports and division incident logs document repeated HVAC failures during extreme heat and cold in large and small divisions across the Commonwealth, forcing relocations,

temporary closures, and contingency staffing. Recent statewide facilities data from the 21st Century School Fund show persistent underinvestment in mechanical and building systems, helping explain why these failures and emergency repairs remain common. Many schools still rely on legacy pneumatic controls, outdated air handlers, or incompatible components that complicate repairs, while electrical panels in mid-century buildings often lack capacity for modern ventilation systems, filtration needs, and current IT equipment. Plumbing failures and roof leaks also cause water damage, disrupt operations, and increase deferred maintenance costs.

Figure 2: Severity of Most Common Systems



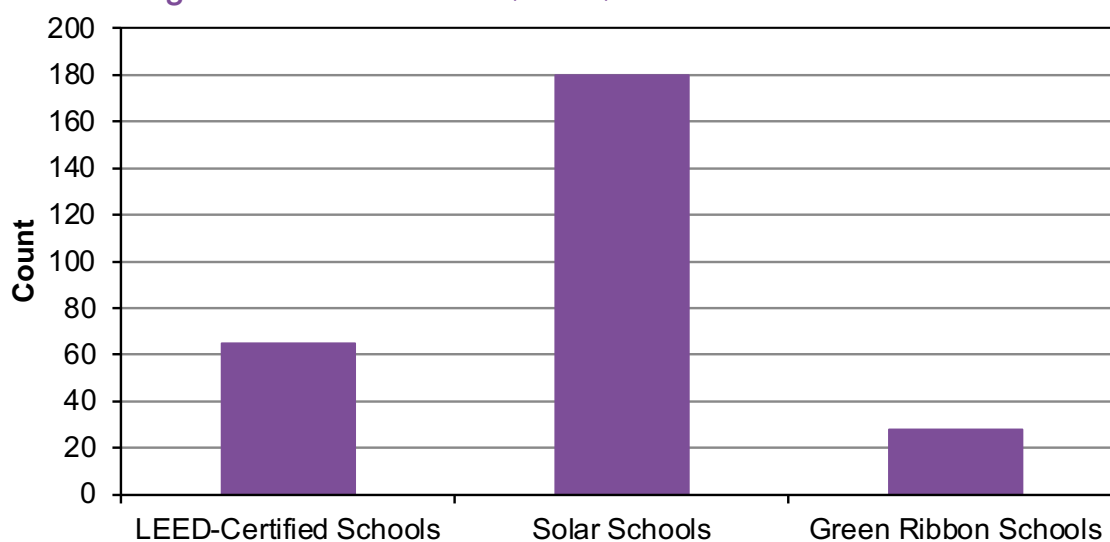
Source: ASCE Virginia Section analysis of statewide school facility condition and systems data.

Substandard conditions extend to the building envelope and site. Many mid-century buildings have single-pane windows, limited insulation, and deteriorated flashing that allow moisture intrusion and undermine energy performance. Roof systems in older schools often require full replacement rather than spot repairs, while stormwater drainage issues and deteriorated paving and lighting create standing water, erosion, access problems, and safety concerns for students.

Virginia has several notable but isolated examples of sustainable school design. LEED-certified schools feature high-efficiency HVAC, improved ventilation, enhanced daylighting, and more efficient envelopes, while solar

schools reduce long-term energy costs and support instruction in sustainability. Green Ribbon Schools provide additional examples of environmental and health leadership. These projects demonstrate what Virginia divisions can achieve, but they are not representative of the statewide school portfolio and remain concentrated in divisions with greater fiscal and planning capacity. For example, Fairfax County Public Schools received the U.S. Department of Education Green Ribbon Schools District Sustainability Award in 2017, and Centreville Elementary School was recognized as a Green Ribbon School for its efforts to reduce environmental impact, improve health and wellness, and integrate environmental education.

Figure 3: LEED-Certified, Solar, and Green Ribbon Schools



Sources: ASCE Virginia Section analysis of Center for Green Schools, Generation180, and US Department of Education Green Ribbon school data

Early childhood providers in repurposed spaces often work around constrained HVAC systems, outdated restrooms, limited secure entries, and insufficient outdoor learning areas, which can reduce program

quality and hinder expansion. Charter schools face similar limitations, and without dependable capital access they may depend on operating funds for improvements, which constrains modernization and enrollment stability.

CAPACITY

Capacity challenges differ sharply by region and often interact with condition.

Southwest and Southside divisions face a different capacity challenge because many operate oversized campuses built for larger historical populations.

Capacity is also shaped by the adequacy of interior core spaces. Many schools built for smaller student populations

have undersized cafeterias, corridors, restrooms, gyms, and layouts that do not support current instructional models. Extended lunch waves reduce instructional time, and many older schools lack modern media centers, maker spaces, or flexible learning environments.

Virginia educates more military-connected students than any other state, with more than 78,000 attending

public schools across the Commonwealth. Divisions near major installations manage frequent midyear transitions, and MIC3 reports show mobility rates that require flexible seating, counseling space, registrar capacity, and orientation processes throughout the year. Without buffer capacity, mobility can strain classrooms, counseling teams, special education supports, and testing schedules.

Early childhood capacity is also constrained by facilities. The Shovel Ready Virginia Task Force identifies facility

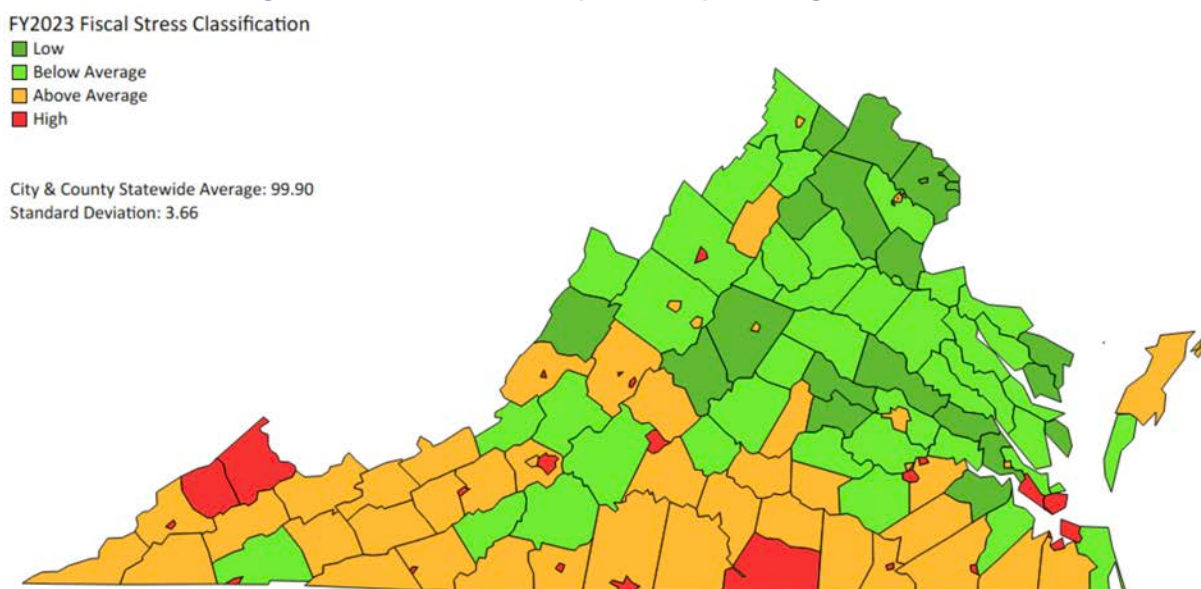
availability as one of the largest barriers to expanding early childhood education. In survey responses and case examples, providers described deferring playground improvements because of lease terms and operating in buildings where mechanical systems were controlled by landlords, all of which limit seat expansion even when funding is available. Charter schools face similar constraints when they rely on leased buildings that rarely support laboratories, specialized instructional areas, or long-term stability.

FUNDING

Funding remains one of the strongest drivers of Virginia's school infrastructure grade. Localities carry most responsibility for K–12 capital funding, but fiscal capacity varies significantly across divisions. Wealthier divisions

are better positioned to replace schools or undertake major renovations, while many fiscally stressed divisions struggle to address even basic needs, widening disparities in indoor conditions, reliability, capacity, and safety.

Figure 4: Fiscal Stress by Locality in Virginia (2023)



Source: Virginia Commission on Local Government, Fiscal Stress Report (FY2023).

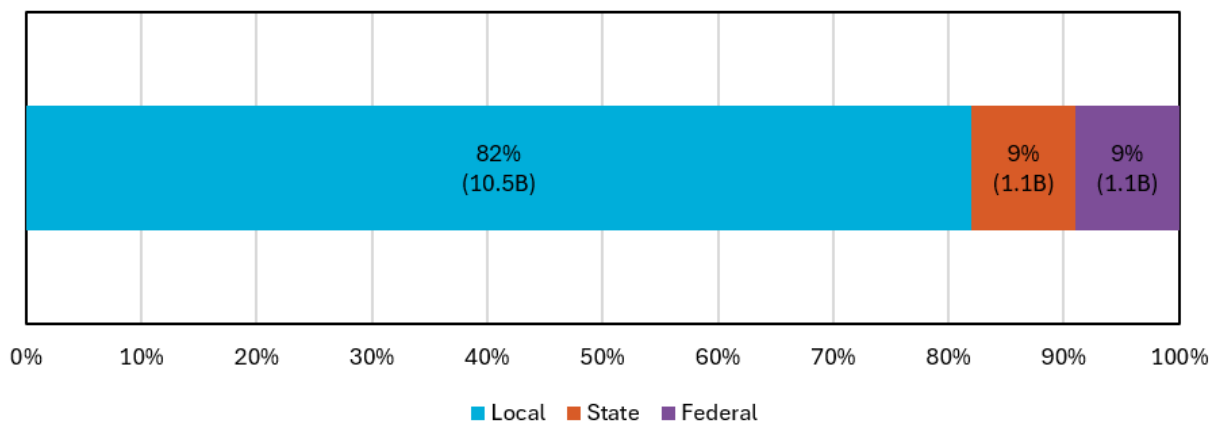
The School Construction Assistance Program (SCAP) has expanded state involvement in school modernization, but available funding still falls far short of need. Recent SCAP rounds received significantly more eligible applications than awards, especially from rural and high-poverty communities. One-time appropriations in HB 6001 provide important but temporary support, but without a permanent construction program long-range modernization remains inconsistent and divisions with limited planning capacity struggle to compete for grant rounds.

Recent statewide facilities data from the 21st Century School Fund's 2025 Virginia profile reinforce the scale of this problem. From fiscal years 2014 to 2023, local education agencies in Virginia funded 82.4% of school construction and capital equipment outlay with local funds, while the state funded about 8.9% and federal sources about 8.7%. Over the same period, divisions would have needed to invest about \$3.90 billion annually to meet modern facility standards, compared with an actual annual average of about \$1.28 billion, leaving an

annual investment gap of about \$2.62 billion. Funding barriers are also acute for early childhood providers and charter schools. The *Shovel Ready Virginia Task Force* identifies limited credit access, scarce licensed-ready sites, and high renovation costs as major barriers

for early childhood facilities. Charter schools face similar structural barriers because they generally lack bonding authority or dedicated state capital tools, which leaves many operating in spaces unsuited for modern instruction and long-term program development.

Figure 5: Revenue for PK–12 Facility Capital Outlay by Source, FY2014–2023



Source: 21st Century School Fund, Public Education Infrastructure Profile 2025: Virginia.

FUTURE NEED

Virginia’s future needs are extensive and driven by the cumulative effects of age, deferred maintenance, enrollment pressures, and climate risk. Major modernization priorities include HVAC and ventilation replacement, electrical modernization for modern loads, plumbing replacement and leak mitigation, roof renewal and envelope improvements, accessibility upgrades, and safety and security modernization. Many buildings require full renovation or replacement rather than piecemeal repair because modern ventilation, technology, and instructional requirements cannot be met through isolated upgrades alone.

Future needs also differ by region. Northern Virginia divisions need new schools and expansions to keep pace with sustained enrollment growth, while Southwest and Southside divisions need resources to right-size oversized campuses, reduce operating costs, and replace aging infrastructure. In climate-exposed areas such as

Hampton Roads, modernization needs include elevating equipment, improving drainage, reinforcing building envelopes, and deploying humidity-controlled HVAC systems that can withstand recurrent flooding and extreme weather.

Divisions serving military families need facilities with flexible seating, scheduling, and support spaces to handle frequent in-year transitions. Reliable mechanical systems and adaptable spaces help stabilize students experiencing repeated relocations.

Virginia also lacks a uniform facility-condition assessment system, leading to inconsistent reporting on building age, system condition, and maintenance backlogs. A recent federal grant provided the Virginia Department of Education with \$5 million for small rural districts to perform assessments, but one-time funding still requires sustained follow-through from the Commonwealth.



Photo: Structured Vision

OPERATION AND MAINTENANCE

Operations and maintenance pressures reinforce the problems described under condition, funding, and future need. Divisions maintain aging buildings with funding levels that are often well below best practice benchmarks, especially in pre-1970 schools with widespread deficiencies in HVAC, plumbing, roofing, and building envelopes. HVAC failures have forced relocations or closures in some cases, creating unpredictable learning environments and straining staff capacity.

Technicians often work with obsolete equipment and mismatched replacement parts, which leads to outages and costly emergency repairs. Older controls and mechanical systems frequently cannot support modern ventilation or humidity management, increasing operational instability and complicating preventive maintenance. As a result, many divisions rely on triage, prioritizing the most critical systems, using on call contractors where they can, and deferring non urgent work to keep schools operational.

Divisions manage O&M shortfalls by concentrating staff on the most critical systems, using contracted maintenance services, and sequencing work to align with limited shutdown windows. Larger divisions have adopted centralized work-order systems, preventive maintenance schedules, and on-call service contracts to

stretch limited in-house capacity, while smaller divisions often rely on multi-role custodial and maintenance staff who cover several buildings. To attract and retain O&M personnel, divisions report using modest pay adjustments, certification stipends, and targeted recruitment for licensed trades, but competition with private-sector employers still leaves many districts with vacancies.

Recent statewide estimates show that Virginia school divisions would need to spend about \$2.92 billion annually on maintenance and operations to meet modern standards, compared with an actual annual average of about \$1.82 billion for fiscal years 2019–2023, leaving a maintenance and operations gap of roughly \$1.11 billion, or \$877 per student. Utilities alone accounted for about \$800 million in 2023, about 44% of statewide O&M spending, which further limits what divisions can devote to preventive maintenance and repairs.

Early childhood providers operating in leased or shared facilities often lack control over the building systems making preventive maintenance difficult and leaving ventilation, restroom, storage, and outdoor-area issues unresolved. Charter schools face comparable conditions when they must use operating funds to maintain aging commercial spaces because they do not have access to local capital budgets or bond financing.

PUBLIC SAFETY

Virginia's school facilities pose ongoing public safety concerns, especially in older buildings and constrained sites. Many schools lack secure vestibules, controlled circulation, and modern access-control systems, even though the RD451 School Security Equipment Grant Program funds upgrades to surveillance, communications, and access control. In many cases, older floor plans and entry configurations limit how effectively divisions can apply these improvements without major renovations, so facility modernization and security upgrades must often be planned together rather than as separate efforts

Failing building systems also create direct safety risks. HVAC breakdowns, roof leaks, and electrical outages degrade indoor air quality, interrupt communications, reduce visibility, and force unplanned relocations or closures. On many campuses, divisions still need to

improve lighting, sidewalks, ADA-accessible routes, and bus and parent drop-off areas to support safe daily circulation for students, staff, and families.

Divisions with large military-connected student populations regularly update emergency contacts, health plans, and student services because students move in and out during the year. Early childhood programs that operate in repurposed facilities often lack secure entries, age-appropriate egress routes, and clear sightlines, and charter schools in older commercial properties face similar limitations when they do not have access to capital financing tools. Overall, divisions have taken steps to upgrade security equipment, but many schools still operate in buildings and on sites that fall short of modern public safety expectations.

RESILIENCE

Virginia's schools must support uninterrupted learning even as environmental risks such as flooding and extreme temperatures intensify. Coastal divisions regularly face flooding that affects parking lots, sidewalks, bus loops, and building entrances, while stormwater failures and

tidal surges expose mechanical rooms to moisture and disrupt school operations. Some divisions experience multiple high-impact flooding events each year; others see fewer events but still face significant disruptions from extreme weather.

Figure 6: Coastal Flooding Impact Severity in Hampton Roads



Source: ASCE Virginia Section analysis based on reported flooding impacts in Hampton Roads school divisions and related media and state reports.

To strengthen resilience, divisions need to modernize both sites and building systems. Priority measures include improving drainage, elevating critical equipment, reinforcing building envelopes, and installing humidity-controlled HVAC systems that can maintain safe indoor conditions under stress. High-performance schools already demonstrate elements of this approach by combining modern HVAC, efficient envelopes, and on-site solar generation to improve comfort, reduce energy costs, and provide limited support during outages. Some divisions are also beginning to integrate resilience into long range capital planning and to coordinate facility

upgrades with local hazard mitigation and emergency operations plans.

However, divisions have not deployed these resilience strategies consistently across the Commonwealth. Many schools in flood-prone and heat-exposed areas still operate with vulnerable sites, low-performing envelopes, and aging mechanical systems including mechanical rooms that are at or below grade. As a result, resilience remains a developing strength rather than a fully realized feature of Virginia's school facility portfolio.

INNOVATION

Virginia shows uneven innovation in school infrastructure. Some divisions have created flexible classrooms, CTE and STEAM labs, outdoor learning areas, and maker spaces that support current instructional models. For example, Fairfax County Public Schools have incorporated collaborative learning environments and innovation labs in several new and renovated schools, while Loudoun County Public Schools have expanded career and technical education facilities to support high-demand workforce pathways. LEED-certified, solar, and Green Ribbon buildings can also improve indoor environmental quality, reduce operating costs, and strengthen long-term building performance.

These projects demonstrate that Virginia knows how to plan and deliver innovative school facilities, but they remain concentrated in divisions with stronger fiscal capacity and planning resources. Many high-need divisions still rely on outdated buildings with limited flexibility, aging systems, and few opportunities

to integrate modern instructional space or high-performance features. Innovation therefore appears in pockets rather than at a scale that can materially raise school facility conditions statewide.

Early childhood providers and charter schools also pursue innovative approaches where they can, including co-located family services, outdoor classrooms, and creative reuse of space. However, reliance on leased facilities and limited access to capital constrain how far these innovations can go and how long they last.

Overall, Virginia's efforts in school facility innovation are promising but fragmented and depend heavily on local fiscal strength instead of a consistent statewide modernization strategy. To become a statewide strength rather than a set of isolated examples, innovation must be paired with predictable capital funding, broader access to high-performance design, and modernization strategies that reach fiscally stressed divisions as well as early childhood and charter providers.

Schools



RECOMMENDATIONS TO RAISE THE GRADE

- **Establish a permanent, formula-driven state school construction program.**
Create a recurring, needs-based capital program separate from existing grant rounds, with higher match rates for fiscally stressed divisions and a formula that prioritizes comprehensive modernization or replacement of pre-1970 K-12 buildings identified in the *Needs and Conditions* report.
- **Expand and stabilize the School Construction Assistance Program.**
Provide predictable annual funding for competitive SCAP grants and pair the program with technical assistance so that applications from divisions with limited planning capacity reflect actual need.
- **Invest in early childhood and charter facilities.**
Offer capital grants, financing tools, and credit enhancements for early childhood providers and charter schools because facility barriers limit access, quality, and long-term stability.
- **Build statewide facility data systems and update them on a recurring cycle.**
Implement a uniform facility-condition assessment process and reporting cycle, including funding for divisions that do not have resources to assess actual building conditions.
- **Integrate military-connected mobility into facility planning.**
Include MIC3 commitments, mobility patterns, and year-round support-space needs in school sites, capacity planning, and modernization decisions.
- **Advance safety-focused modernization.**
Prioritize secure entries, circulation improvements, ADA routes, drop-off upgrades, and reliable mechanical systems that directly improve day-to-day safety and continuity.
- **Increase resilience investments in climate-exposed divisions.**
Support drainage upgrades, equipment elevation, envelope improvements, and humidity-controlled HVAC in flood-prone and heat-exposed areas.
- **Scale sustainable, high-performance design statewide.**
Expand the use of efficient HVAC, high-performance envelopes, solar generation, and related strategies that improve indoor environmental quality and reduce long-term operating costs and help schools manage the Commonwealth's documented capital and maintenance gaps more effectively over time.

Schools



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Solid Waste



GRADE
COMPARISON

VA: B
Nat'l: C+



SOLID WASTE

EXECUTIVE SUMMARY

Virginia's municipal solid waste (MSW) system provides reliable, compliant service through a mature regulatory framework, stable funding, and a professional mix of public and private operators. A statewide network of more than 200 permitted facilities supports waste management activities and provides generally sufficient near-term disposal and processing capacity. Since 2022, targeted capital investments have improved operational reliability and regional system performance, while compliance trends have improved through fewer violations and more timely corrective actions. However, Virginia's per-capita MSW generation rate remains high at approximately 6.65 pounds per person per day, well above the U.S. average of about 4.9 pounds per person per day. Statewide diversion rates have declined, increasing pressure on disposal capacity while organics diversion infrastructure remains underdeveloped. Therefore, future priorities must include reducing waste generation, expanding markets for recyclable and organic materials, strengthening resilience to extreme events, and improving data collection and reporting to measure progress.

BACKGROUND

Municipal solid waste (MSW) management is a nexus for development and implementation of environmental sustainability related programs, policies, goals and objectives, as well as the necessary and associated technologies and infrastructure - the corresponding Solid Waste 'space' lives at the intersection of climate change mitigation, energy, economic growth, as well as public health and safety, and even social justice. In Virginia, MSW management includes collection, transfer, diversion/recycling, energy recovery, and

disposal of residential, commercial, and institutional waste streams, overseen primarily by the Virginia Department of Environmental Quality (VDEQ). It is noteworthy that VDEQ recently released a Draft Solid Waste Management Plan (SWMP), its first comprehensive update in decades, establishing a 20-year forward-looking vision focused on waste diversion and circular economy development, all of which reflects a progressive vision of the waste sector and changing perspective of waste materials as valuable resources.

Fairfax County Energy-from-Waste Facility, Virginia's largest WTE facility and the region's primary MSW disposal pathway.



SPSA Regional Landfill, Suffolk, Virginia



CAPACITY

A diversified, statewide network of more than 200 permitted facilities supports Virginia's MSW system, providing generally sufficient near-term disposal and processing capacity. Emerging regional constraints tied to population growth, declining diversion rates, and facility siting limitations underscore the need for proactive capacity planning and regional cooperation.

In 2023, Virginia handled approximately 22.6 million tons of solid waste, including both in-state-generated and imported waste, of which MSW accounted for roughly two-thirds of the total stream. The MSW fraction comprised approximately 36% organics, 17%

plastics, and 16% paper, indicating substantial potential for waste diversion efforts such as composting, recycling and advanced mixed waste processing. According to VDEQ's Annual Recycling Summary Report, Virginia's per-capita MSW generation rate is approximately 6.65 pounds per person per day, up from approximately 6.50 pounds per person per day reported for 2020, and significantly higher than the U.S. average of approximately 4.9 pounds per person per day reported by EPA for 2018 (Figure 1). Figure 1 shows that total MSW tonnage and per-capita generation increased from 2018 to 2023 while recycled tonnage declined, resulting in steadily rising disposal volumes.

Figure 1. Municipal Solid Waste Generation, Diversion, and Disposal Trends in Virginia (2018–2023)

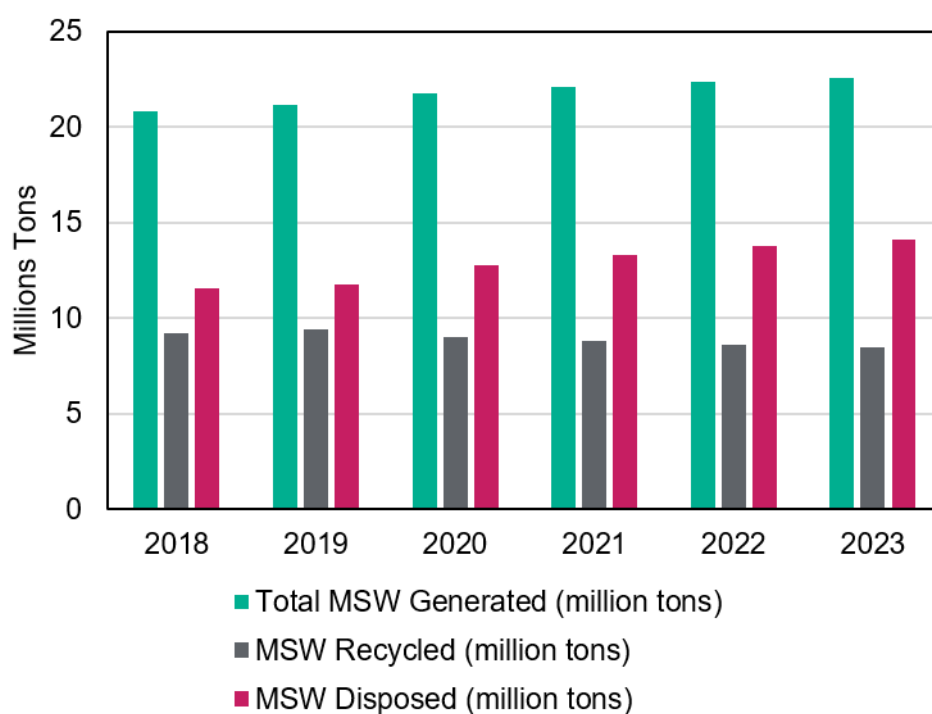
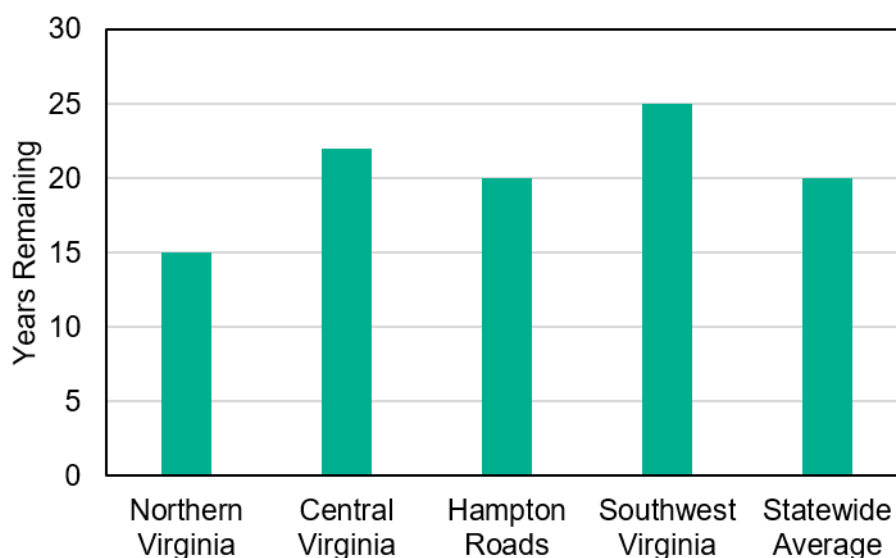


Figure 2 shows that statewide average remaining landfill capacity is approximately 20 years, but capacity is unevenly distributed, with Northern Virginia facing tighter constraints than other regions. VDEQ has identified 14 facilities with less than 10 years of remaining permitted capacity, concentrated in urbanized areas where land availability, permitting complexity, and community

opposition constrain new or expanded sites. Northern Virginia presents the most acute challenge - the region generates a disproportionate share of the Commonwealth's MSW. Recent capital upgrades improved reliability and emissions performance, but limited WTE expansion and constrained landfill siting continue to drive long-distance hauling, adding cost and sustainability risk.

Figure 2. Remaining Permitted MSW Landfill Capacity by Region



Capacity is further influenced by Virginia’s waste diversion performance. Although statewide recycling rates remain above the national average (Virginia’s rate peaked at 46.1% in 2018 before declining to 42.5% by 2023, compared to the national average of approximately 32%), recent declines following market disruptions have reduced the volume of material diverted from disposal, effectively increasing demand for landfill and WTE capacity. For example, VDEQ’s recent recycling summaries show lower

paper and plastics recovery and higher residuals after China’s National Sword policy changes, which banned the import of most foreign plastic and unsorted paper waste. Organics, which comprise a significant portion of the MSW stream, remain largely unmanaged through dedicated diversion infrastructure, outside of yard waste programs and a limited number of composting and anaerobic digestion facilities, representing a long-term opportunity for enhanced waste diversion.

CONDITION

The physical condition of Virginia’s MSW infrastructure is generally good, reflecting sustained maintenance and periodic capital investment.

Conditions vary by facility age, design era, and ownership structure. Older landfills and transfer facilities exhibit routine wear, but operators generally maintain them in compliance with applicable permit requirements. No evidence of widespread structural deterioration threatening public health or environmental protection has emerged; where deficiencies arise, operators typically address them through targeted capital improvements.

Recent investments continue modernization of major facilities and their environmental-control systems. The Fairfax County Energy-from-Waste facility completed a major low-NOx emissions-control upgrade in 2022.

SPSA completed a \$25 million renewable natural gas facility at its regional landfill in 2023. Prince William County reports capturing approximately 90% of available landfill methane, while the Rappahannock Regional Solid Waste Management Board installed its landfill-gas collection system ahead of regulatory deadlines. These examples demonstrate strong asset stewardship at several of Virginia’s larger regional facilities.

Material recovery facilities (MRFs), which sort and process recyclable materials collected from households and businesses, represent a more variable segment of the system from a condition standpoint. Many MRFs face aging equipment, increased downtime, and higher maintenance costs. These challenges directly affect processing efficiency and may contribute to declining diversion performance.

Virginia Recycling and Materials Processing



FUNDING

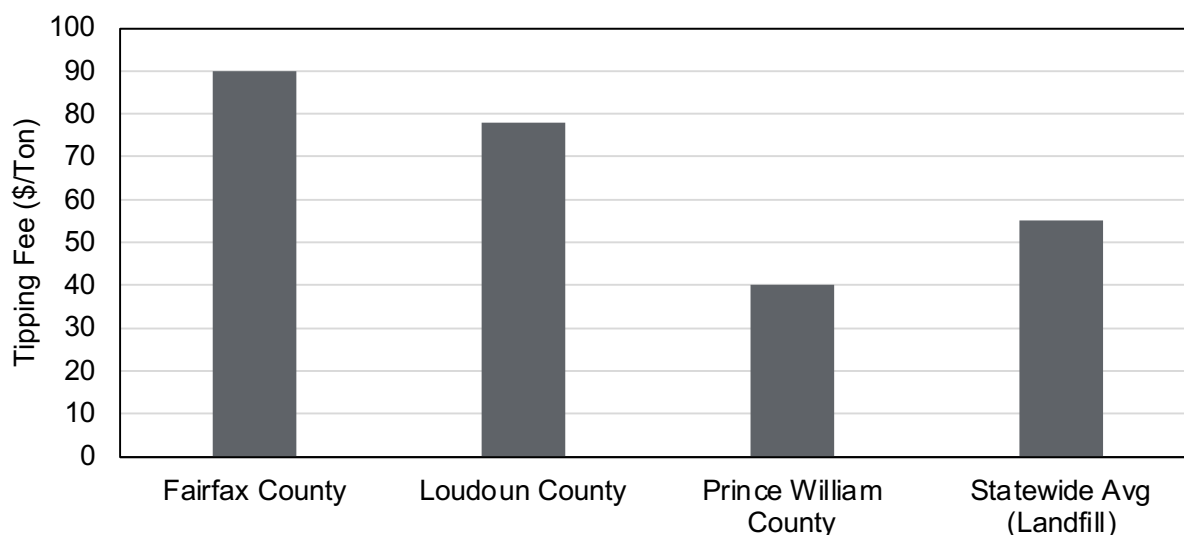
Virginia's MSW system relies upon a mixture of funding mechanisms including enterprise-based funding, including user fees, tipping fees, and contractual service arrangements, as well as general tax revenues in some localities. This framework adequately supports disposal operations and regulatory compliance but is less effective at sustaining recycling and diversion programs as commodity markets fluctuate and processing costs rise, with many local MSW management systems relying on cross-subsidies from disposal revenues. Tipping fees vary significantly by region, facility type, and disposal technology; statewide rates generally range from \$30 to \$90 per ton, with the highest concentrated in Northern Virginia.

Recent examples illustrate this regional variability. Fairfax County's waste-to-energy facility established a tipping fee of \$90 per ton for MSW disposal in Fiscal Year 2026, reflecting the capital-intensive nature of WTE operations and the limited availability of alternative disposal capacity in the region. Prince William County implemented a \$40 per ton tipping fee for commercial disposal at its MSW landfill in 2024, while Loudoun

County increased disposal fees to \$78 per ton effective July 2025. Outside Northern Virginia, tipping fees are lower: the Augusta Regional Landfill increased its fee to \$52 per ton in July 2024, and Greene County, a largely rural jurisdiction, charges \$54 to \$70 per ton for commercial MSW. Volume-based user charges, also known as Pay As You Throw (PAYT) programs, are used by some localities to allocate costs directly to waste generators and incentivize diversion. Figure 3 compares tipping fees across selected Virginia jurisdictions against the statewide landfill average, illustrating both regional cost variability and the premium associated with Northern Virginia's disposal constraints.

Alternative revenues, including recovered material sales at MRFs, electricity and steam sales from WTE facilities, and landfill gas-to-energy proceeds from local and regional solid waste facilities, help offset some costs but remain limited in scale. Virginia has explored extended producer responsibility contributions and grant funding to support recycling infrastructure, but neither approach has reached a scale sufficient to materially alter system funding dynamics.

Figure 3. Example MSW disposal tipping fees in selected Northern Virginia jurisdictions and the statewide landfill average



FUTURE NEED

Sustained population growth, elevated per-capita waste generation, and capacity constraints in high-growth regions shape Virginia's long-range MSW needs. Near-term permitted capacity remains adequate, but long-term needs present meaningful planning challenges.

A primary future need is reducing per-capita MSW generation, which remains significantly higher than the national average despite above-average recycling performance. Some localities have demonstrated what is achievable: the Central Virginia Waste Management Authority reported a recycling rate of 58.6% in 2024, well above both the state and national averages. Without reductions in generation or substantial increases in diversion, continued growth in waste volumes will accelerate the consumption of permitted disposal capacity and intensify pressure on existing infrastructure. Addressing this trend will require sustained public education, commercial sector engagement, and policies that promote waste reduction and diversion.

Commercial and multi-family sectors now generate greater waste quantities than single-family households in many Virginia communities yet expanding recycling and diversion in these sectors is constrained by the Dillon Rule, which limits local government authority and

requires state General Assembly action to enable even basic waste management policy changes at the local level. Without targeted state legislation, recycling gains in commercial and dense residential sectors are likely to stagnate.

Expanding recycling and organics diversion capacity is equally critical. Virginia has strong end markets for recovered paper, with eight mills across the state and region accepting various grades, but regional markets for plastics, glass, and organics remain limited. Glass recycling facilities are located outside the Commonwealth, increasing transportation costs and discouraging processing investment. Organics represent a substantial share of the MSW stream yet remain largely unserved by composting or anaerobic digestion infrastructure - developing these pathways could reduce volumes and tonnage otherwise disposed, mitigate greenhouse gas emissions, and extend lifespans of facilities which receive waste and/or residual by products of waste processing.

Improved data collection and reporting represent a persistent and consequential gap. The Commonwealth does not yet comprehensively or consistently report recycling and diversion outcomes across all facility types, particularly from non-permitted facilities, which

limits its ability to assess system performance and make evidence-based investments. Aligning Virginia's reporting framework with federal EPA data standards would improve interstate comparability and strengthen the Commonwealth's basis for accessing federal

program funding. State and federal agencies collecting and reporting better, more consistent data would enable more accurate capacity planning, targeted investment, and effective policy evaluation.

OPERATION AND MAINTENANCE

The Commonwealth benefits from a robust and mature regulatory framework and owner/operator ability to comply with regulatory requirements to both develop, operate and maintain infrastructure pursuant to state and federal standards. Notices of Violation (NOV) from the VDEQ and other agencies are rare and typically resolved in a collaborative manner protective of both environmental and public health and safety. The operational framework is typically supported by experienced public agencies and owners/ operators that generally meet and often exceed minimum standards and regulatory expectations. The Virginia Solid Waste Management Regulations (VSWMR) govern day-to-day operation and maintenance across landfills, transfer stations, MRFs, and WTE facilities, setting performance standards that protect public health and the environment throughout each facility's life cycle.

Several Virginia facilities demonstrate performance well beyond minimum regulatory requirements. The Covanta Fairfax Energy-from-Waste facility operates significantly below federal standards and holds OSHA Voluntary Protection Program Star certification. SPSA's Regional Landfill holds E3 certification under Virginia's Environmental Excellence Program, the highest recognition available, and completed a voluntary \$25 million renewable natural gas facility in 2023. Prince William County expanded landfill gas capture to approximately 90% of available methane, earning national recognition from the National Association of Counties. The Rappahannock Regional Solid Waste Management Board installed its landfill gas collection

system ahead of regulatory deadlines. Statewide, Virginia's 42.5% recycling rate substantially exceeds the state-mandated 25% minimum.

Owner-operators generally demonstrate the technical and financial capacity to maintain compliance with applicable permits. VDEQ inspections verify adherence to waste handling, leachate management, environmental monitoring, and equipment maintenance requirements.

Operational requirements vary by facility type, but regardless of the technologies involved in a MSW system, they all rely on established maintenance practices and long-term asset management plans; minimize and/or abate nuisance impacts such as odor and traffic, as well as rely upon preventive and/or corrective maintenance and periodic capital reinvestment to meet reliability standards.

MRFs present ongoing challenges—contaminated and heterogeneous waste streams drive higher equipment downtime, maintenance costs, and reduced sorting efficiency. Continued investment in equipment, maintenance programs, and workforce training will continue to be a necessary effort.

Post-closure care obligations form an integral part of Virginia's MSW operational framework. Financial assurance requirements ensure operators set aside sufficient funds to maintain closed landfills, manage leachate and gas systems, and monitor environmental conditions for decades after closure, sustaining environmental protection beyond active facility life.

PUBLIC SAFETY

MSW infrastructure protects public health through safe, continuous collection, processing, and disposal of waste, functions that in Virginia operate within a regulatory framework prioritizing public and worker safety with a strong compliance record.

Virginia's Solid Waste Management Regulations (9VAC 20-81), administered by VDEQ, establish stringent requirements for facility siting, design, operation, monitoring, covering liner systems, leachate collection, groundwater protection, gas control, and post-closure care, to prevent contaminant releases, minimize exposure pathways, and safeguard workers and the public. VDEQ verifies compliance through regular inspections and enforces corrective measures when deficiencies arise.

Available data indicate relatively few incidents in which public safety has been compromised by MSW

infrastructure performance. Isolated nuisance impacts such as odors, noise, or traffic occur periodically but are typically resolved through permit conditions and operational adjustments.

Worker safety is an important ongoing consideration. Collection, transfer, and sorting operations are labor-intensive and involve heavy equipment and potentially hazardous materials. Continued emphasis on training, equipment maintenance, and operational controls is necessary to reduce occupational risk.

When transportation networks, fuel supply, or power are disrupted, waste collection and disposal can be compromised. Prolonged service interruptions create direct public health risks, making cross-sector coordination an important element of solid waste system planning in Virginia.

RESILIENCE

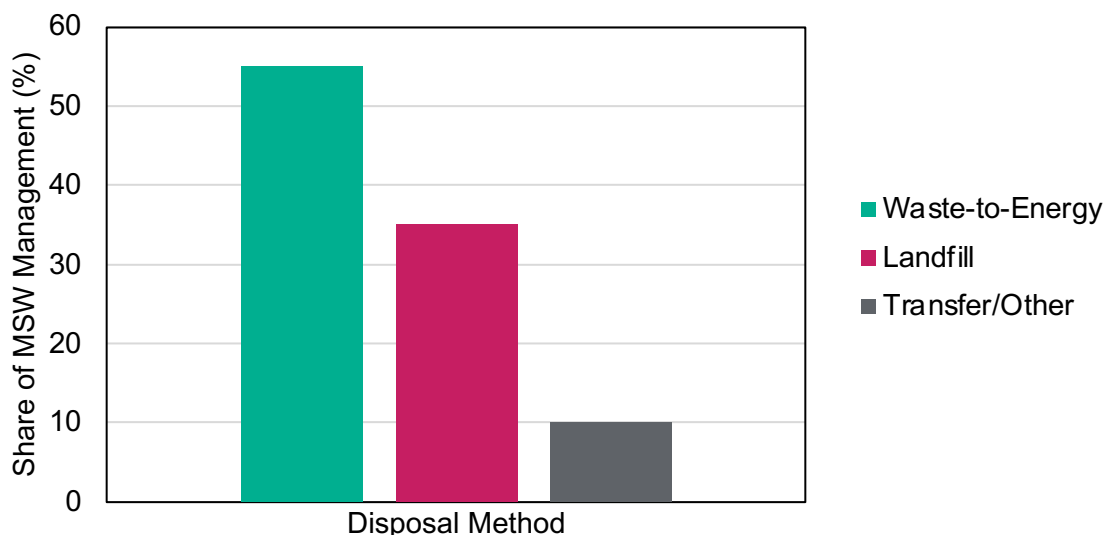
The resilience of Virginia's MSW system rests on the physical robustness of individual facilities and the ability of operators and regulators to sustain service continuity during and after disruptive events, which is adequate but uneven across regions. Virginia's solid waste management infrastructure faces vulnerability to severe weather events, particularly in coastal regions. MSW facilities are designed with multiple hazard protections, and VDEQ requires contingency planning as part of routine permitting to ensure operational continuity and public health protection during unanticipated events.

A noted gap is the reduction in available disposal and processing capacity following high-severity storms and other catastrophic events, when large volumes of vegetative debris and construction and demolition debris are generated simultaneously with disruptions to normal operations, particularly in coastal regions.

Contingency planning and emergency response measures are standard VDEQ permit conditions for solid waste facilities. Inter-jurisdictional cooperation agreements are also in place across multiple Virginia regions, providing an established layer of operational resilience.

When transportation networks, fuel supply, or power are disrupted, waste collection and disposal can be compromised. Prolonged service interruptions create direct public health risks, making cross-sector coordination an important element of solid waste system planning in Virginia. Limited redundancy in high-growth regions amplifies these vulnerabilities, particularly where disposal capacity is concentrated and alternatives are constrained. Figure 4 illustrates the regional distribution of disposal capacity and the inter-jurisdictional cooperation agreements that provide an established foundation for mutual aid and operational continuity.

Figure 4. Regional MSW Disposal Capacity and Inter-Jurisdictional Cooperation in Virginia



While Virginia’s MSW system has demonstrated the ability to recover from routine disruptions, enhancing resilience will require proactive planning for extreme events. This includes developing dedicated capacity for storm-related debris management, building on existing

inter-jurisdictional coordination, and integrating solid waste planning into broader emergency management and infrastructure resilience efforts. Strengthening these capabilities will support faster recovery and reduce community impacts following disruptive events.

INNOVATION

Municipal solid waste (MSW) management is a nexus for development and implementation of environmental sustainability related programs, policies, goals and objectives, as well as the necessary and associated technologies and infrastructure - the corresponding Solid Waste ‘space’ lives at the intersection of climate change mitigation, energy, economic growth, as well as public health and safety, and even social justice. This both provides opportunity for and requires innovation.

By shifting the paradigm from looking at MSW as merely requiring cost effective disposal to viewing it as a potentially valuable asset for resource recovery, communities have been able to create renewable energy, reduce their carbon footprint by cutting greenhouse gas (GHG) emissions, reduce reliance on virgin resources during manufacturing processes – all while creating jobs and continuing to protect public health and the environment.

Virginia’s MSW sector has made measurable progress in emissions control, materials recovery, and energy capture, but innovation has been uneven. The system has concentrated on incremental improvements to established technologies rather than wholesale transformation, delivering operational gains without yet resolving structural challenges related to per-capita waste reduction, market volatility for recovered materials, and waste composition shifts.

Innovation in recycling and materials recovery has proven more challenging. MRFs face increasing contamination, more complex packaging materials, and higher processing costs. Advanced optical sorting, robotics, and AI-assisted systems show promise, but deployment has been uneven due to high capital costs and uncertain return on investment. Innovation in recycling infrastructure has not kept pace with changes in the waste stream, representing a gap that must be addressed to improve diversion outcomes.

Solid Waste



RECOMMENDATIONS TO RAISE THE GRADE

- **Expand end markets and strengthen source separation for recyclables and organics.** Virginia should develop in-state and regional markets for recyclable materials, with emphasis on plastics, glass, and the organic fraction of waste (OFW), through targeted incentives, extended producer responsibility (EPR) programs for plastics and packaging, and coordinated regional planning among solid waste authorities. Robust source separation is a prerequisite for viable end markets.
- **Reduce per-capita waste generation and advance circular economy practices.** State and local governments should expand public education, and commercial sector engagement to encourage waste reduction and reuse, while investing in circular economy infrastructure that shifts toward value recovery through MRFs, WTE, landfill gas-to-energy (LFGTE), renewable natural gas (RNG), and advanced waste processing.
- **Invest in diversion and advanced processing infrastructure using flexible delivery models.** Policymakers should support financing mechanisms and progressive design-build and design-build-operate (PDB/PDBO) delivery approaches to manage cost, risk, and performance uncertainty. Regional cooperation can help smaller jurisdictions achieve economies of scale in composting, organics processing, and advanced MRF technology.
- **Strengthen resilience planning and integrate climate considerations into MSW policy.** Solid waste planning should be explicitly linked to coastal and urban resilience frameworks, with dedicated capacity for storm debris management and expanded inter-jurisdictional cooperation built on existing mutual aid agreements.

Investment decisions should incorporate full lifecycle cost accounting, including the avoided costs of virgin material use and the monetized environmental and public health benefits of diversion, weighted alongside carbon footprint reduction and waste diversion goals.

- **Align funding structures with diversion and resource recovery goals.** Virginia should diversify funding mechanisms to support recycling and diversion alongside disposal, including surcharges dedicated to recycling investment, state-equivalent Renewable Energy Certificates (RECs) or tax incentives, EPR program revenues, and public-private partnerships.
- **Strengthen data collection, transparency, and cross-jurisdictional reporting.** Virginia should establish a comprehensive, standardized data reporting framework that captures recycling and diversion outcomes from all facility types, including non-permitted facilities, and aligns with federal EPA reporting standards to enable accurate benchmarking. The Commonwealth should work with VDEQ and relevant state agencies to close existing data gaps and create a publicly accessible dashboard tracking waste generation, diversion rates, facility capacity, and disposal trends. Enhanced data collection at both the state and federal levels will underpin evidence-based capacity planning, more effective targeting of infrastructure investment, and stronger accountability for progress toward Virginia's waste diversion goals.

Solid Waste



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Stormwater



GRADE
COMPARISON

VA: C
Nat'l: D

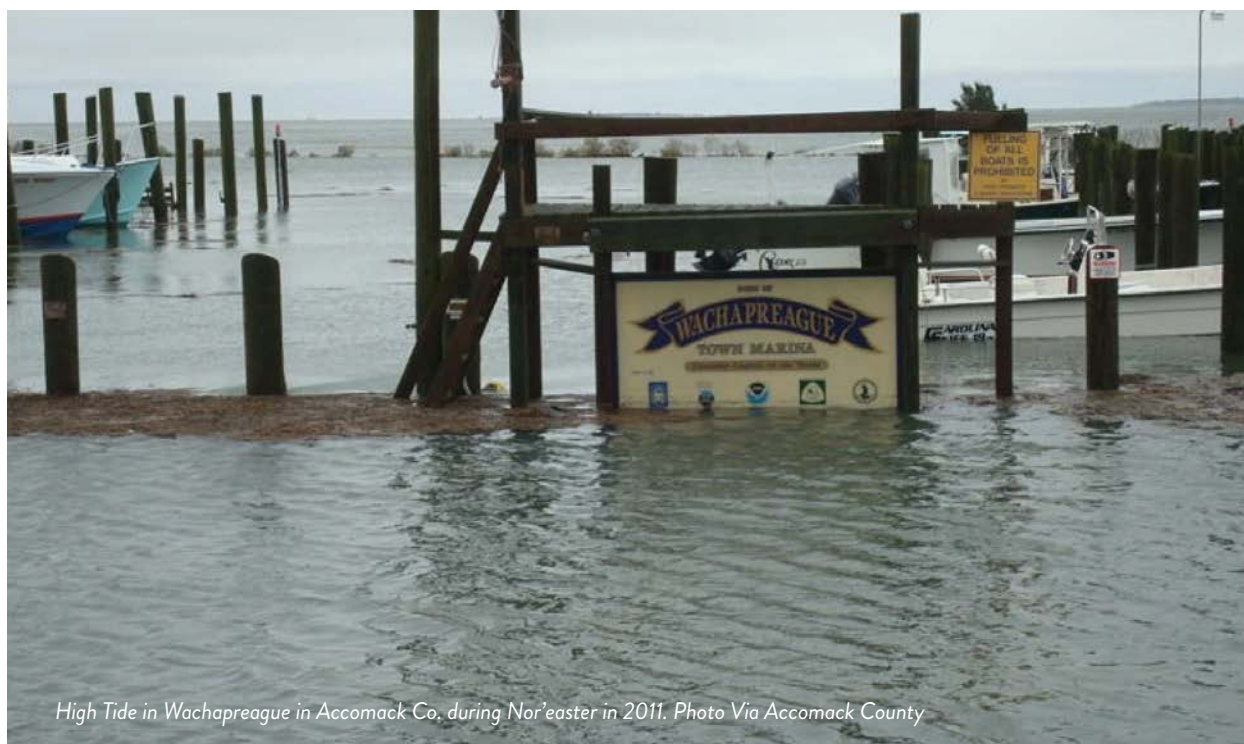
Photo: Rural road flooded in Grayson County, VA from Hurricane Helene; HokieTim



STORMWATER

EXECUTIVE SUMMARY

Virginia's stormwater program continues to advance across all major performance criteria despite rising costs driven by aging infrastructure, regulatory expansion, and climate pressures. System capacity and condition assessments have improved with strengthened Municipal Separate Storm Sewer System (MS4) oversight and expanded asset tracking that enables better identification and prioritization of system needs. There has also been a broader adoption of stormwater utilities, user-based fees, and increased state and federal funding that support continued capital improvements and resilience initiatives like those in Arlington County and the Hampton Roads Area. While significant funding gaps and aging assets remain, Virginia has demonstrated measurable progress in program maturity, financial structure, and data-driven management.



High Tide in Wachapreague in Accomack Co. during Nor'easter in 2011. Photo Via Accomack County

BACKGROUND

Stormwater systems including the pipes, drains, ditches, ponds, and green spaces help manage rainwater to reduce flooding, keep roads safe, protect homes and businesses, and preserve water quality in the receiving streams, rivers, and estuaries. With land development, more paved

areas create more runoff which puts pressure on existing systems that were often designed using outdated rainfall data. Managing stormwater has grown into a complex and resource intensive responsibility that supports public safety, the environment, and infrastructure resiliency.



CAPACITY

Virginia's stormwater infrastructure is under significant strain, with many systems operating beyond their original design limits due to aging components, increased urbanization, more intense rainfall patterns, and sea level rise. While theoretical capacity is based on historical design standards (e.g., "10-year" storm), actual capacity is frequently lower due to maintenance backlogs in addition to the above-noted contributing factors.

Over the last several years Virginia has witnessed a wide

range of flood types from coastal and river flooding to flash floods induced by tropical storm remnants and intense thunderstorms. These events have prompted evacuations; emergency declarations at state and federal levels; and resulted in costly damages and the loss of lives. Some notable flooding events throughout the state include:

Floods Swept Through Buchanan Co. in July 2022.
Photo by Bedford Co. Operations Command

Date	Location	Description
July '22	Buchanan Co.	Flash floods, 4"-6" rain in 12 hrs., 1 fatality, drinking water loss
Sept. '23	Hpt. Roads & E. Shore	T.S. Ophelia, 2'-4' storm surge, 3"-5" rain in 12-18 hrs.
Sept. '24	New River Valley	Hurricane Helene, over 70 rescues, 2 fatalities
July '25	Petersburg Area	Flash flood, 2"-3" per hr.

While most major flooding events resulted from extreme rainfall linked to storms, several localized urban incidents were clearly worsened by inadequate drainage systems, including outdated or undercapacity storm drains, unmaintained outfalls, and aging infrastructure.

Virginia ranks high nationally in stormwater utility development, with more than 80 local utilities supported by a strong regulatory framework and active municipal participation. There is also well established regional coordination through the Virginia Municipal Stormwater Association (VAMSA) and Planning District Commissions (PDCs), which assist localities with best practices, funding strategies, and collaborative planning. The Virginia Erosion and Stormwater Management Program (VESMP) integrates stormwater and erosion control oversight, improving regulatory efficiency and environmental outcomes.

There are 11 large Phase I MS4s and approximately 90 small Phase II MS4s that include traditional municipalities and non-traditional entities like universities and transportation departments that must

monitor, maintain, and upgrade systems to reduce pollution to the maximum extent practicable. Annual MS4 reporting requirements include inspection logs, operations and maintenance schedules, pollution reduction measures, Total Maximum Daily Load (TMDL) progress, monitoring data, and training records. All permittees must meet TMDL reduction targets by June 30, 2028.

Combined sewer overflow (CSO) in older cities face capacity challenges where events are tracked through a combination of regulatory reporting, monitoring systems, and public notification:

- Richmond averages 37 overflow events with 115 million gallons discharged annually.
- Alexandria's four CSO outfalls overflow during most heavy rain events.
- Lynchburg has reduced its CSO points from 132 to 17 under its Long-Term Control Plan.

CONDITION

Recent assessments indicate that Virginia's stormwater infrastructure remains in a vulnerable condition as it is characterized by aging systems facing significant environmental strain. Evaluation occurs through a combination of independent engineering reports and state-mandated inspections like those required by the MS4 Program where storm sewer inventories are used to identify outfalls and track illicit discharge detection and elimination (IDDE). Much of the existing network, including corrugated metal and reinforced concrete pipes, has reached or exceeded its 50- to 100-year design life. The MS4 Program has transformed local stormwater management from drainage focused maintenance to pollution control which drives regulatory compliance, dedicated funding, asset tracking, planned water-quality investments, and required public education and transparency.

Effective July 1, 2025, all new development must use the Virginia Stormwater Management Handbook and the Virginia Runoff Reduction Method (VRRM) version 4.1. Also pending is the NOAA Atlas 15 update which represents a major leap forward in modernizing precipitation estimates. These updates to design criteria

are essential for infrastructure and resilience planning at a time of increasing climate variability.

Approximately 2,300 miles of streams in Virginia are listed as impaired in DEQ's 2024 Integrated Water Quality Report, primarily due to pollutants that harm aquatic life and other designated uses. Urban stormwater runoff is cited as a source for roughly 35-45% of stream impairments in urbanized watersheds. Agriculture remains the largest source overall, but in MS4 areas, stormwater is often the dominant contributor.

The overall health of Virginia's receiving waters (streams, rivers, and estuaries) varies widely, but the 2024 Integrated Report estimates about 65-70% of assessed stream miles do not meet one or more designated uses (e.g., aquatic life, recreation, fish consumption, etc.). Nutrient and sediment load in Chesapeake Bay tributaries remain a major challenge despite progress under the Bay TMDL program. Urban streams are often impaired for bacteria and benthic community health due to stormwater runoff. Mountain headwaters are generally in better condition despite localized impairments from mining and legacy pollutants.

Compared to previous DEQ Integrated Reports, the 2024 report does not indicate a major statewide improvement in stream condition, but it does reflect a clear shift in emphasis:

- Urban stormwater is playing a larger documented role than in earlier cycles.

FUNDING

Virginia funds stormwater management through a layered system of local fees, state grants and loans, and federal assistance, with an increasing emphasis on user-pay models to address aging infrastructure and Chesapeake Bay pollution reduction requirements.

Local funding is primarily generated through Stormwater Utility Fees, now used by most major jurisdictions. Fees are typically based on impervious surface area using an Equivalent Residential Unit (ERU) model, ensuring costs align with runoff generation. The use of stormwater utilities has expanded steadily since the 1990s, increasing from fewer than ten utilities statewide to approximately thirty today, with the most significant growth occurring over the past 15 years.

State programs that provide critical capital support include:

- Stormwater Local Assistance Fund (SLAF) grants up to 50% of costs for projects like stream restoration, pond retrofits, and new BMPs.
- Virginia Clean Water Revolving Loan Fund (VCWRLF) offers low-interest loans for water quality improvement projects.
- Flood resilience and safety programs, such as the Community Flood Preparedness Fund (\$99M in awards announced in January 2026), Resilience Virginia Revolving Loan Fund (situational and

- Agricultural impacts remain significant, but their relative share is slowly declining.
- Biological impairments persist despite nutrient reductions.

targeted), and Dam Safety Assistance Fund (\$5M in matching grants as of December 31, 2025).

- Cost-share and results-based programs that support small-scale projects and innovative nonpoint source pollution reductions.

Federal funding supplements state and local efforts through:

- Infrastructure Investment and Jobs Act (IIJA) funding delivered via state revolving loan funds, including significant grant and loan-forgiveness components.
- USDA rural water and stormwater programs.
- FEMA resilience and flood mitigation grants, particularly for high-risk and underserved communities. As of March 25, 2026, approximately \$1B available nationwide through the Building Resilient Infrastructure and Communities (BRIC) program.

Over the past 15 years, stormwater funding in Virginia has increased markedly, shifting from limited and inconsistent support to sustained state investment following creation of the SLAF in 2014 and related Chesapeake Bay compliance programs. Federal support expanded further after 2021, when the IIJA and enhanced FEMA mitigation programs delivered historically high levels of funding to the Commonwealth.

FUTURE NEED

Updated UVA Weldon Cooper Center projections estimate Virginia's population will reach approximately 9.3 million by 2030, an increase of about 400,000 residents since 2020. Roughly 90 percent of that growth will be concentrated in Northern Virginia, the Richmond region, and Hampton Roads. Northern Virginia alone will account for nearly half of the net statewide growth

which will significantly increase demand on urban infrastructure. At the same time, reported stormwater capital needs in the EPA's Clean Watersheds Needs Survey (CWNS) increased dramatically from \$80 million in 2012 to \$30.2 billion in 2022. Contributors to this increase include:

- Expanded regulatory requirements (MS4 permits, Chesapeake Bay TMDL)
- Improved data collection and reporting
- Urban growth and stricter development standards
- Increased focus on climate resilience and flooding

While stormwater funding has risen in recent years, Virginia faces a multibillion dollar funding gap because documented stormwater needs far exceed available

annual grant funding leaving the state heavily reliant on loan-based financing and local capital resources to address the shortfall. The size of the gap underscores the importance of:

- Project prioritization
- Improving State Revolving Fund (SRF) financing affordability
- Stacking grant and loan funding sources

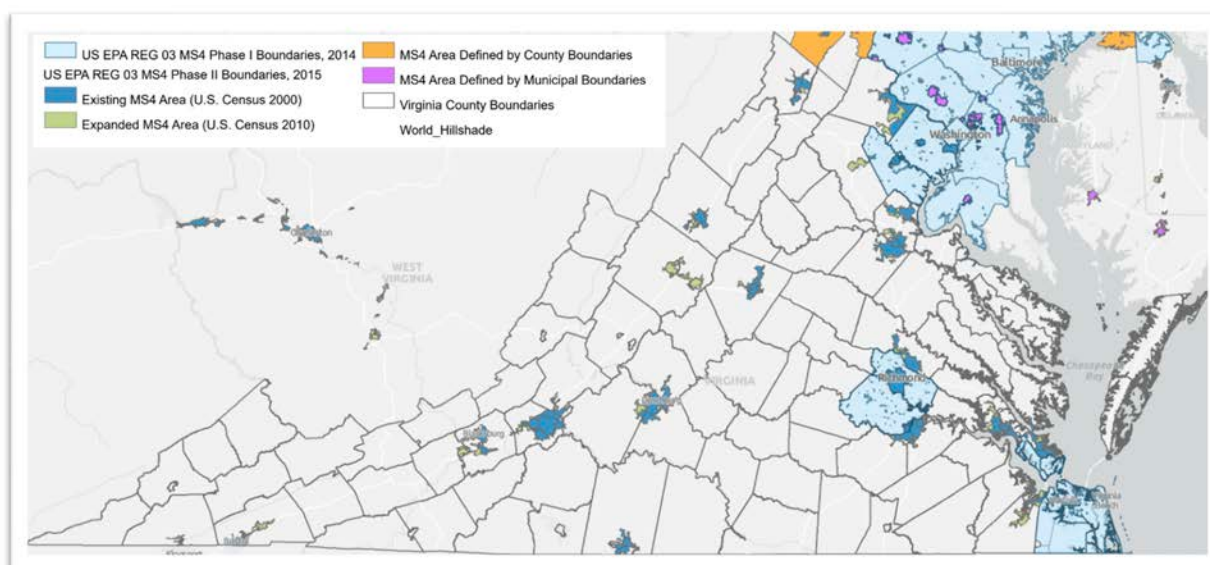
OPERATION & MAINTENANCE

Designated MS4 permit holders are responsible for operation and maintenance (O&M) of stormwater infrastructure, with VDOT maintaining systems in state rights-of-way and private owners responsible for private facilities. Most systems are located within drainage easements and public rights-of-way where routine inspections, cleaning, and repairs are conducted using a mix of in-house staff and contractor support. Typically, preventive maintenance is prioritized in flood-prone or impaired areas while critical repairs are addressed promptly. As infrastructure inventories and regulatory requirements grow, many MS4 permittees face increasing demands on staffing and funding which is driving a shift toward more data driven maintenance and prioritization approaches.

Staffing typically includes engineers, inspectors, and maintenance crews that directly support permit

compliance. Staffing constraints are common, especially in smaller localities that rely heavily on cross-trained public works staff. MS4 reporting also tracks staff training and certifications as evidence of program capability and compliance. Ongoing training and certification programs support compliance, workforce retention, and adaptation to evolving technical standards.

Approximately 85% of Virginia lies outside MS4 coverage as shown on the following map. However, runoff from rural and agricultural lands can significantly impact downstream MS4 systems and receiving waters. These areas are managed primarily through voluntary and incentive based nonpoint source programs which provide funding and technical assistance for BMP implementation. Strengthening coordination between MS4 permittees and these rural programs presents an opportunity to better address cross jurisdictional water quality impacts.

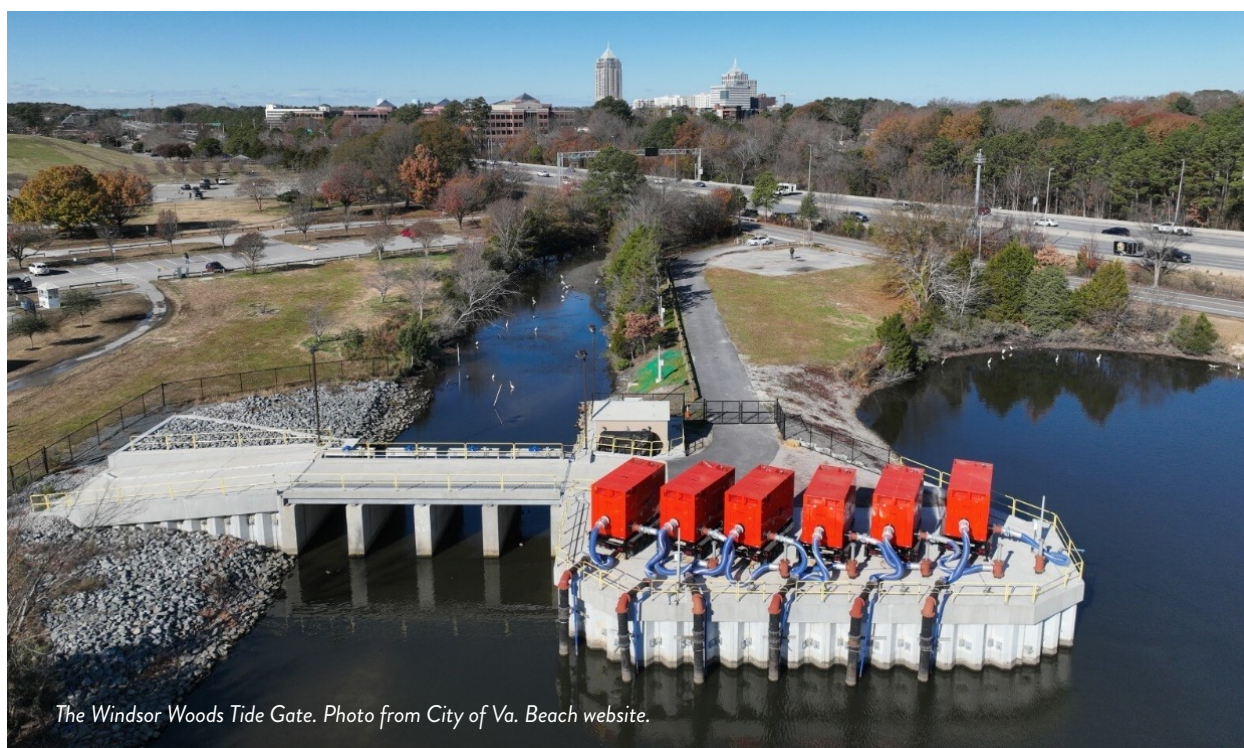


Source: DEQ Environmental Data Mapper

PUBLIC SAFETY

Public safety as it relates to stormwater is most effective when it combines regulatory compliance, engineering best practice, risk communication, and long-term resilience planning. Because Virginia already has a robust statutory and technical framework, the most effective approach is to fully use and integrate that framework. On a statewide basis, the updated Virginia Stormwater Management Handbook (VSMH) incorporates enhanced stormwater facility safety features, such as flattened side slopes, safety benches, and controlled access, to reduce drowning and injury risks associated with stormwater detention facilities.

At the local level, jurisdictions across Virginia are increasingly implementing targeted measures to reduce flood-related risk to the public. For example, Arlington County has deployed real-time rainfall and stream monitoring systems that support emergency response and public notification in flood-prone areas. In coastal areas, Virginia Beach and other cities have invested in roadway flood mitigation through pump stations, tide gates, and elevation improvements to reduce the frequency and severity of flooded streets. These efforts directly address one of the most significant public safety hazards during storm events, vehicles entering flooded roadways.



When stormwater management is implemented with public safety as a core objective, it not only achieves regulatory compliance but also strengthens community resilience, protects critical infrastructure, and reduces the risk of injury and loss during storm events.

Virginia has experienced nearly 20 federally declared flooding disasters in the past 20 years with more than half occurring in just the last decade. The State has received nearly \$1 billion in FEMA disaster assistance since 2003, with over \$600 million tied to climate and

flood driven disasters since 2011 alone.

Flooding whether from hurricanes, tropical remnants, or winter storms is a persistent and escalating driver of federal emergency funding which is supplemental, not comprehensive as state, regional, and local governments must consistently provide matching funds and long-term maintenance. The scale and frequency of federal disaster funding underscore the financial and public safety importance of proactive stormwater, flood mitigation, and infrastructure resilience investment.

RESILIENCE

Much of the state's infrastructure was designed based on historical conditions and lacks the redundancy, adaptability, and durability needed to withstand future hazards. However, local jurisdictions are increasingly advancing resilience through both large-scale projects and planning initiatives.

In Norfolk, the Coastal Storm Risk Management Project that was developed in partnership with the U.S. Army Corps of Engineers includes floodwalls, surge barriers, and nature-based features designed to reduce storm surge and tidal flooding impacts. Nearby, Hampton has advanced the "Resilient Hampton" initiative, which integrates flood resilience into capital improvement planning, land use decisions, and neighborhood-level interventions.

In Northern Virginia, Alexandria is investing significantly in stormwater infrastructure upgrades, particularly within the Hooffs Run watershed, to address repeated flooding through increased conveyance capacity and system redundancy. Likewise, Richmond is incorporating flood mitigation into long-term redevelopment planning, such as in the Shockoe Bottom area, where drainage improvements and flood protection measures are being evaluated alongside urban revitalization.

While progress has been made, resilience is not yet uniformly integrated across all sectors or geographies. Broader adoption, stable funding, and clear performance metrics will be necessary to ensure resilience strategies are implemented consistently and equitably across Virginia.



INNOVATION

Virginia is making steady progress in modernizing its infrastructure by utilizing innovative practices and technologies, with several examples emerging at the local and regional level.

Agencies such as the VDOT and local governments are deploying smart sensors, flood monitoring systems, and traffic cameras to monitor roadway and drainage conditions in real time. These tools support faster emergency response, improve maintenance planning, and reduce the likelihood of system failure during storm events.

Local governments, including Loudoun County, are integrating GIS-based asset management systems with capital planning processes, allowing for improved tracking of stormwater infrastructure performance and more informed decision making. Increasingly, these geospatial tools are being paired with design technologies such as Building Information Modeling (BIM) to enhance coordination across disciplines and reduce lifecycle costs.

Virginia jurisdictions are also advancing innovation through pilot projects and applied research. Partnerships with institutions such as Virginia Tech are supporting the testing of permeable pavements, advanced stormwater control measures, and alternative materials designed to improve durability and water quality performance. These pilots allow communities to evaluate effectiveness before scaling solutions statewide.

In addition, the Hampton Roads region is demonstrating a more integrated approach to watershed-scale planning and resilience, coordinating across multiple jurisdictions to address shared flood risks. The recently published

“Regional Resilient Design Guidelines for Hampton Roads” encourages localities to consider amending stormwater related policies to incorporate sea level rise and increased rainfall. This type of regional collaboration represents a shift toward more comprehensive and systems-based infrastructure planning.

Alternative delivery methods, including design-build (DB) and public-private partnerships (P3s) are actively being used to address growing stormwater and flood resilience demands. DB is the dominant approach being used on projects like the Virginia Beach Flood Protection Program and Roanoke’s Lick Run stream restoration efforts, both projects are publicly funded and controlled. Broader adoption of P3s specific to stormwater remains limited within Virginia compared to other states. A successful P3 example is the 2007 Prince William Environmental Bank (PWEB) which uses private capital and repayment through mitigation credit sales to fund stream restoration. PWEB remains active and continues to deliver projects across County parklands under that original P3 framework.

Despite these advancements, innovation is not uniformly applied across all jurisdictions. Ensuring that successful pilot programs transition into standard practice will require sustained investment, clear performance benchmarks, and continued collaboration between state agencies, local governments, and research institutions.

The data is clear; stormwater infrastructure is no longer a secondary utility. Strategic investment now can reduce disaster costs, improve water quality, and protect lives while failure to act will continue to compound risk and expense.



RECOMMENDATIONS TO RAISE THE GRADE

To improve the performance and long-term sustainability of stormwater infrastructure, decisionmakers should focus on the following priorities:

Close the Funding Gap

- Scale grant funding to better align with the documented \$30.2B stormwater need, particularly for disadvantaged and high-risk communities.
- Preserve and expand dedicated revenues for resilience and water quality programs.

Mandate Asset Management

- Require comprehensive inventories, condition assessments, and lifecycle cost planning for stormwater assets, similar to drinking water and wastewater systems.

Modernize Design Standards

- Accelerate adoption of updated rainfall data (e.g., NOAA Atlas 15) and require climate adjusted design criteria for all publicly funded projects.

Prioritize Risk Based Investment

- Direct funding to projects that measurably reduce flood risk, CSO frequency, and pollutant loads, not just regulatory minimums.

Integrate Stormwater into Resilience Planning

- Treat stormwater systems as critical infrastructure for public safety, transportation continuity, and economic stability.



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Transit



GRADE
COMPARISON

VA: C-
Nat'l: D

Photo: Metrorail commuter train station escalator; Joseph Sohm



TRANSIT

EXECUTIVE SUMMARY

Virginia's transit agencies were significantly impacted by the COVID-19 pandemic, and ridership continues to rebound toward pre-pandemic levels, totaling 145 million trips in 2025 compared with 172 million in 2019. The Commonwealth has 41 transit agencies providing bus, rail, paratransit, ferry, and other services, but more than 1.1 million Virginians lack access to fixed-route transit. Transit asset conditions have improved since 2022, although 16% of inventoried assets have met or exceeded their useful life benchmark, and agencies continue to report funding shortages for state of good repair and future expansions. Virginia has made progress through investments such as the completion of the Silver Line, Potomac Yard Metro Station, Richmond Highway Bus Rapid Transit, and planned Alexandria Bus Rapid Transit improvements. However, safety targets remain unmet, workforce shortages challenge operations and maintenance, and flooding, hurricanes, and extreme heat threaten infrastructure. Continued investment in service coverage, state of good repair, safety, resilience, and innovation is essential.

CONDITION AND CAPACITY

Virginia's transit agencies provided 145 million trips in Fiscal Year (FY) 2025 (between July 2024 and June 2025), showing a 38% increase from FY 2023, and a 14% increase from FY 2024 (Figure 2). Virginia has 41 transit agencies, including WMATA, 82 human service providers (For seniors, individuals with disabilities, and people with low income not served by traditional transit), 16 transportation demand management agencies, 15 metropolitan planning organizations, one intercity passenger rail operator, and one intercity bus operator (See table 1 for all agencies). The modes of public transport in Virginia includes light rail, Federal Transit Administration (FTA) regulated commuter rail, frequent

heavy rail, paratransit, ferryboat, and bus services. In 2024 around 49%, and 46% of ridership in Virginia was coming from bus and heavy rail modes respectively. The transit coverage of Virginia is shown in figure 1, more than 1 million Virginians lack access to transit potential to improve. All VDOT standards are designed to meet Americans with Disabilities Act, so does the new projects. DRPT is a Title II ADA agency, meaning it must ensure that its program, services, and activities are accessible to qualified individuals with disabilities.

Virginia adopts a Transit Asset Management Plan; the approach uses the condition of assets to guide the

optimal prioritization of funding (Through the Making Efficient and Responsible Investments in Transit (MERIT) Program) to keep transit networks in a state of good repair. 16% of all inventoried assets have met or exceeded their Useful Life Benchmark (ULB); the asset inventory includes:

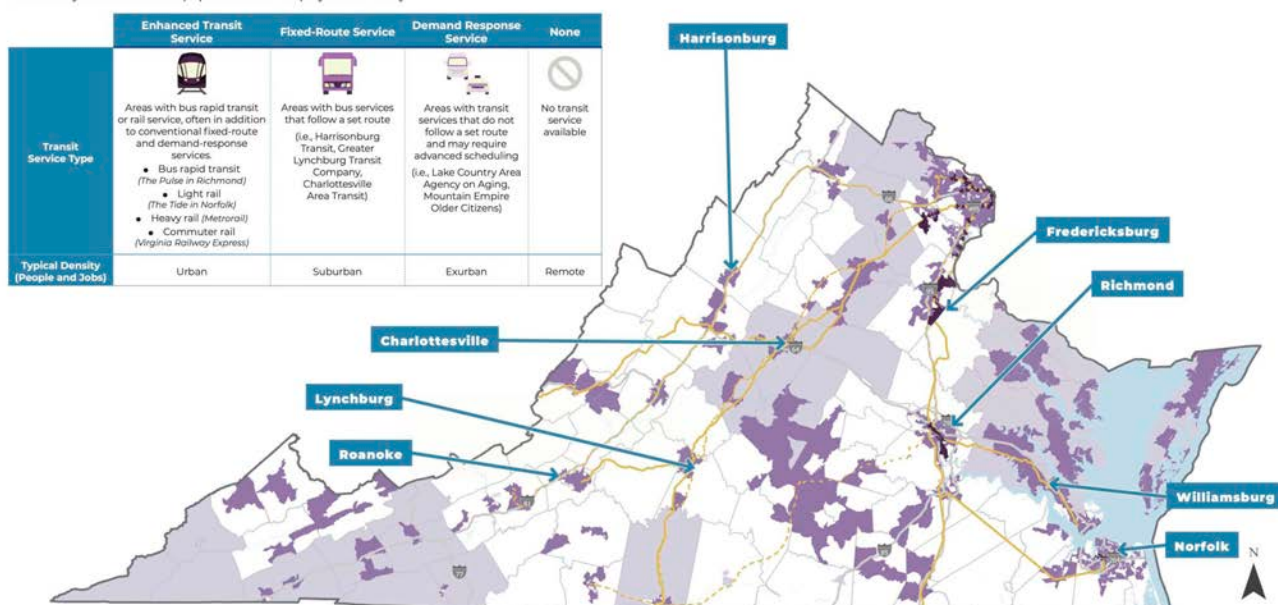
- 1,326 revenue vehicles of which 14% have met or exceeded their ULB (See Table 2)

- 167 service vehicles/equipment, of which 40% has met or exceeded its ULB
- 49 facilities including seven passenger facilities. Of these facilities, two fall adequate level category according to Transit Economic Requirements Model.

Overall, transit asset conditions have improved since 2022, with all vehicle classes except minivans showing a decrease in the percentage of assets exceeding their ULB.

Figure 1: Transit Service Coverage

Summarizing transit service coverage helps to identify and communicate the availability of transit service within Virginia. Three classifications of transit service coverage are defined primarily by the types of transit service available within a given area. This information is supplemented by other community features such as population and employment density.



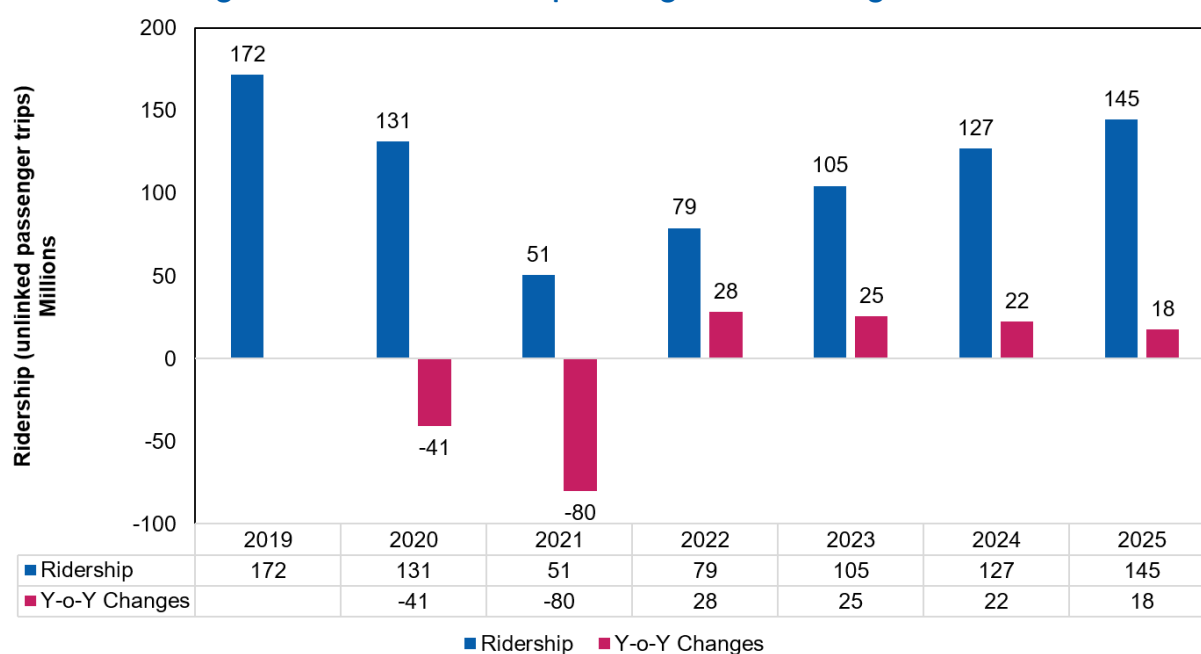
Source: wtopnews

Table 1: Fiscal Year 2024 Ridership by Public Transit Provider

Public Transit Provider	Fiscal Year 2024 Ridership	Public Transit Provider	Fiscal Year 2024 Ridership
Four County Transit	124,617	Pulaski Area transit	28,456
JAUNT	228,961	McAfee Knob	3,571
Bay Transit	131,277	RADAR/UHSTS	62,335
Lake Area Bus	12,090	Danville transit	257,650
BRITE	212,642	STAR transit	101,901
Mountain Empire Transit	130,896	Mountain Lynx transit	177,659
Charlottesville Area Transit	1,353,059	Altavista Community transit System	15,318
RideSmart	3,047	Farmville area bus	96,178
Bristol Virginia Transit	42,876	Blacksburg transit	3,791,431
Arlington Regional Transit	2,458,738	FXBGo! (Fredericksburg Regional)	332,441
City of Harrisonburg (Public Transport.)	1,877,126	Blackstone area bus system	28,882
DASH (Alexandria Transit Company)	5,351,634	Greater Lynchburg	585,759
Petersburg Area Transit	471,466	Graham	33,235
CUE (Fairfax City)	982,981	Greater Richmond Transit Company)	10,839,638
Radford transit	90,833	PONY Express	6,423
Fairfax Connector (Fairfax County)	8,716,249	Valley Metro (GRTC Roanoke)	1,383,180
Suffolk transit	77,888	Virginia regional	192,243
Virginia Railway Express	1,589,693	Greensville-Emporia Transit	11,791
WinTran	181,306	Williamsburg Area Transit Authority	1,051,426
OmniRide	1,949,355	Hampton Roads Transit	8,575,405
Loudoun County transit	648,606	WMATA	72,365,626

Source: DRPT Data Portal

Figure 2: Transit Ridership in Virginia (Including WMATA)



Source: DRPT Open Data Portal

Table 2: Virginia's Transit Asset Condition- excluding WMATA

Asset Class	# of Vehicles	ULB (years)	FFY25 Target	# At or Beyond ULB	% Beyond ULB	Avg. Age (years)
Revenue						
AB – Articulated Bus	14	14	5%	2	13%	6.8
BU – Bus	501	14	15%	107	21%	8.6
CU – Cutaway	621	10	10%	45	8%	5.7
MV – Minivan	42	8	20%	12	34%	6.1
BR – Over-the-Road Bus	54	14	15%	7	13%	7.2
VN – Van	35	8	20%	4	14%	—
Non-Revenue						
*AO – Automobiles	171	8	30%	111	65%	—
*TX – Trucks and other rubber tire vehicles	26	14	30%	6	23%	—

Source: DRPT's 2026-2029 TAM Kick Off Slides

More than 1.1 million people in the Commonwealth are in need of fixed-route transit- bus, van, and rail service operating according to a regular schedule along a predetermined route, and around 570,000 jobs lacked access to fixed-route transit. Virginia's transit system

continues to experience the effects of the COVID-19 pandemic, which brought ridership to record lows. The Commonwealth saw 172 million ridership in 2019, and ridership hasn't crossed this level since. Virginia expects to recover to pre-pandemic levels soon.

WMATA, which operates in the Northern Virginia suburbs of Washington, accounts for half of the transit rides that take place in the Commonwealth. WMATA's services include Metrorail, Metrobus, and MetroAccess, which is a shared-ride paratransit service. Of the 127 million rides that occurred in Virginia in FY 2024, WMATA accounted for 72 million (trips originating or ending in Virginia). Of this, Metrorail accounted for 58.6 million, Metrobus 13.6 provided million), and MetroAccess provided 170,000. While Metrorail provides the bulk of WMATA's public transit trips, Metrobus on its own provides more trips than any other public transportation system in Virginia. WMATA's asset condition report indicates that while recent investments have improved some infrastructure

and reduced the backlog of critical repairs, a significant portion of assets remain in fair to poor condition, requiring sustained funding and maintenance to achieve a full state of good repair.

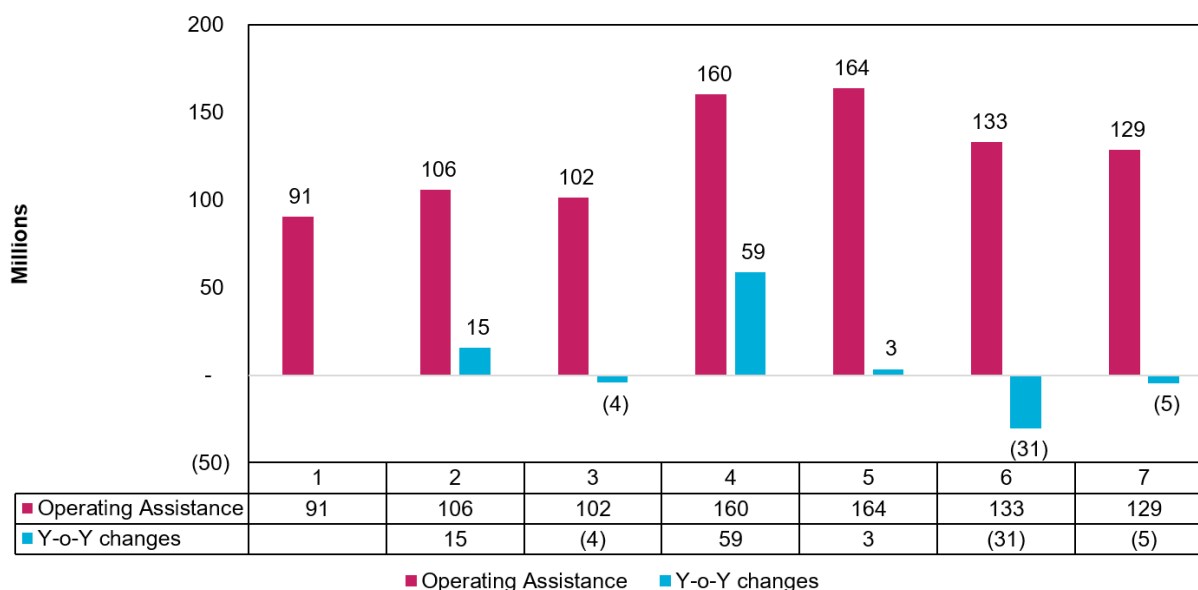
Despite challenges from evolving markets and workforce fluctuations, Virginia's economy shows overall stability, with metropolitan areas continuing to drive population and employment growth across diverse industries. Recently completed and planned projects in Virginia are intended to increase capacity. Among these are the completion of WMATA's Silver Line, Potomac Yard Metro Station, Richmond Highway Bus Rapid Transit line in Fairfax County, Newport News Transportation Center, and Alexandria Bus Rapid Transit Network (3 network).

OPERATION AND MAINTENANCE; FUNDING AND FUTURE NEED

DRPT's MERIT Program provides funding for operating expenses for all transit agencies throughout Virginia to improve the quality and efficiency of public transportation services (See figure 4). The Transit Ridership Incentive Program (TRIP) is a statewide grants program to achieve regional accessibility of urban areas with more than 100,000 population, and to reduce barriers to transit use for low-income riders, public

safety, and passenger amenities. The program receives 6% of the Commonwealth Transit fund, to fund projects which address the program goals; including projects such as Subsidized SmartTrip Cards, Fare Equipment upgrades, Zero Fare projects, transit vehicles security cameras, ferry and bus stop/shelter improvements, Silver Line service, etc.

Figure 3: DRPT Annual Allocation through MERIT for Operating Expenses



Source: DRPT Data Portal

Virginia is the only state in the country that has an entirely separate agency dedicated to supporting rail and public transportation. DRPT provides state funds for rail programs and public transportation operating, capital, and additional programs. Funding primarily comes from Transportation trust funds, with some contributions from toll revenue, CPR bonds, federal funding, and local funds.

In the past decade, Virginia's overall operating budget has grown 7% annually, with a total appropriation of \$49.6 billion in FY 2016 increasing to \$92.8 billion in FY 2025. The Virginia Department of Transportation (VDOT) received a total appropriation of \$8.6 billion (9.3% of total state appropriations) in FY 2025. In FY 2025, VDOT's budget was \$8.9 billion. Virginia DRPT received \$1.1 billion in appropriations in FY 2025 from state funding.

DRPT also distributes some federal funds to transit agencies. The DRPT's six-year improvement program for FY 2024-FY 2029 totals \$6.4 billion. In FY 2025, DRPT maintained full staff, a low turnover rate, and minimized spending on administrative costs. The Mass Transit Fund (All of which is provided to DRPT), and Rail Fund (7% goes to DRPT) provide funds to DRPT. The breakdown is as follows and listed in table 3:

1. Public Transit Operating Assistance through MERIT Operating program
2. Public Transit Capital Assistance- Addresses state of good repair, small enhancements, and major expansions.

These include projects such as support equipment (radios, vehicles, etc.), replacing WinTran's maintenance facility, expanding VRE's Manassas Park Station parking garage, replacing bus/transit shelters, etc.

3. WMATA Dedicated (46.5 % of the Mass Transit Fund, i.e., 241.5 million in FY 2024; Virginia's contribution to WMATA is \$415 million in FY 2024 (\$50 million via PRIIA match, \$210.5 million from Mass Transit Fund, and \$154.5 million from WMATA dedicated capital)
4. Transit Ridership Incentive Program (TRIP) (Statewide grants program to achieve regional accessibility of urban areas with more than 100,000 population, and to reduce barriers to transit use for low-income riders, public safety, and passenger amenities)
5. Special Commuter & other Programs (2.5% of Mass Transit Fund).

The Commonwealth also faces O&M challenges in the form of workforce shortages. The shift to low- and no-emission vehicles is creating a critical shortage of automotive technicians, bus mechanics, and electricians. The Zero Emission Transportation Workforce Readiness Study by DRPT highlights some challenges for the workforce in transit sector: educational capacity, skilled craft shortages, and need for collaboration with original equipment manufacturers.

Table 3: DRPT Transit Investment Category FY-2025

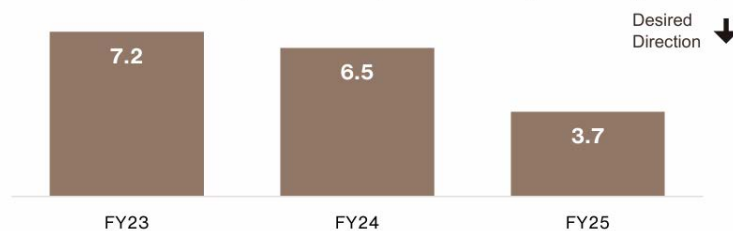
Transit Investment Category	Amount (in Million USD)	% of Total
WMATA Assistance	\$330.2	33.6%
Capital Assistance	\$253.1	25.7%
Operating Assistance	\$156.5	15.9%
WMATA Dedicated	\$154.5	15.7%
TRIP	\$37.2	3.8%
VRE Assistance	\$16.3	1.7%
Human Service Transportation	\$10.8	1.1%
Special Programs	\$10.0	1.0%
Commuter Assistance	\$8.2	0.8%
Planning, Regulation & Safety	\$6.4	0.7%
Total:	\$983.2	100%

Source: DRPT CTB Final Annual Budget Document

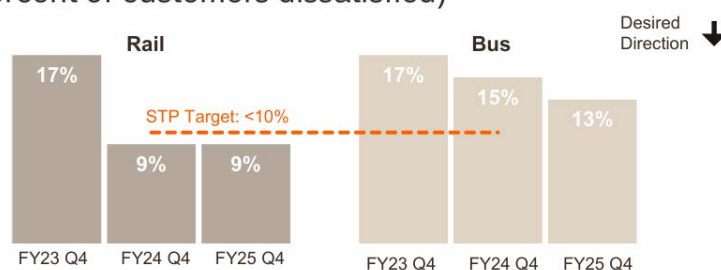
PUBLIC SAFETY

Figure 4. WMATA Crime Rate and Perception of Safety

Part 1 Crime Rate (# crimes per million passenger trips)



**Perceptions of Safety From Crime / Harassment
(percent of customers dissatisfied)**



Source: Service Excellence Report FY2025

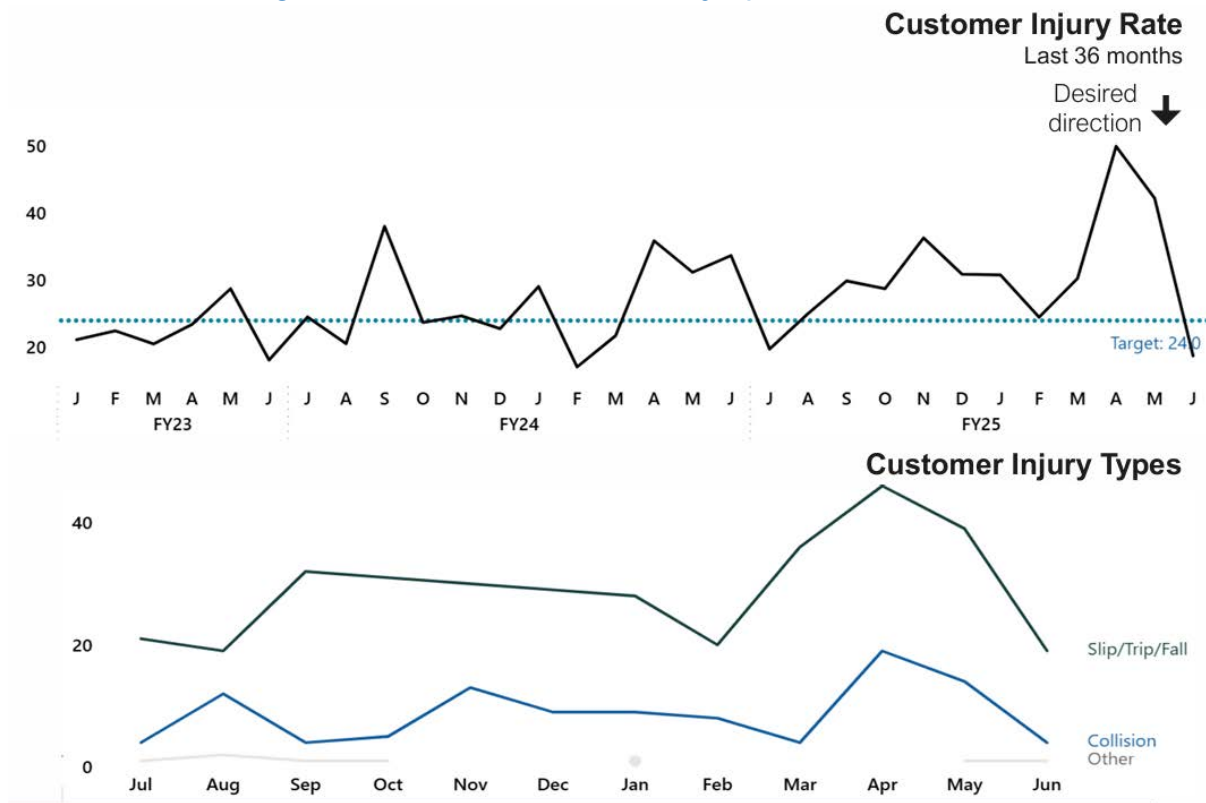
Public transit is among the safest modes of transportation. Keeping it safe requires a lot of effort from the service provider, law enforcement agencies, and the public. Safety on WMATA is important for the Commonwealth as more than 50% of the transit trips in were associated with WMATA in 2024. Some of the key safety highlights of WMATA system are as follows (these stats are system-wide; Virginia-specific stats are not available):

- Customer injury rate of 30.9 injuries per 10 million revenue miles in FY25 which is 15% higher than FY 24: missing the target of no more than 24. 463

injuries in FY2025 of which 57% bus, 40% rail, and 3 % Metro Access.

- WMATA Employee injury rate improved in FY25 (6.2 injuries per 200,000 employee hours) compared to FY 24, although it missed its target of 6.0 injuries per 200,00 employee.
- Efforts to Address Safety Resulted in 50% decrease in crime rate since 2025
- The WMATA met or exceeded 6 out of 10 targets in safety and security objectives as laid out in their Strategic Transformation Plan.

Figure 5. WMATA Customer Injury Rate FY2025



Source: Service Excellence Report FY2025

Apart from WMATA there are 41 transit agencies in Virginia who are responsible for the remaining 44 % ridership (FY 2024 comparison). DRPT assists 15 small transit agencies with a comprehensive statewide Public Transportation Agency Safety Plan (PTASP). Usually the number of fatalities/ injuries, and the rate (E.g., per 100,000 vehicle revenue miles) are tracked, and compared against the target; each small transit agency works with its local Metropolitan Planning Organizations (MPO). There was limited availability of data for individual agencies to comment on the safety performance targets. The national transit database shows 183, 289, and 235 injuries for 2023, 2024, and 2025. In compliance with federal law, DRPT has been designated as the State Safety Oversight agency to oversee the state's public transportation safety. DRPT conducts

audits and inspections, reviews accidents and incidents, investigates hazards, and tracks progress in correcting safety and security gaps. It also reviews and approves rail safety, security, and emergency preparedness.

These trends point to actions that require continued support from the public, sponsors, and stakeholders, including visible staffing on platforms and trains, camera-supported case clearance, fare-gate retrofits, increased enforcement, support for individuals experiencing mental health or other crises, proactive rider engagement, and data-driven policing strategies. Safety remains a concern in metropolitan areas. WMATA is investing in programs to improve rider security. DRPT programs also support and fund these efforts across the Commonwealth, for other transit agencies.

RESILIENCE AND INNOVATION

Major hazards for Virginia include sea level rise, storm surge, and inland/riverine flooding. VDOT's Virginia Transportation Resilience Improvement Plan (VTRIP), and the Virginia Transportation Plan (VTrans) for the Commonwealth are based on guiding principles to ensure safety, security, and resilience to provide a transportation system that is safe for all users. Data is shared among all the modes of transportation for accurate planning, and

incorporation on a bigger scheme as part of the VTrans. The Commonwealth of Virginia Hazard Mitigation Plan (COVA HMP) regularly updates to assess major threat to life and property in state (see figure the overall hazard ranking in Virginia). VDOT's analysis of this ranking has informed its decision to prioritize resources towards the most critical threats for all modes of transportation (Roads, Rails, Transit, etc.).

Table 4: Hazard Ranking for Virginia

Threat Level	Hazard
High	Flood, Hurricane, Winter Weather
Medium – High	Extreme Heat, Non-Tornadic Wind, Tornado
Medium	Drought, Extreme Cold
Medium – Low	Earthquake, Pandemic, Wildfire
Low	Erosion, Impoundment Failure, Karst (Sinkholes), Landslide
Negligible	Land Subsidence, Space Weather

Source: VDOT Transportation Resilience Improvement Plan 2022

All endeavors undertaken by DRPT are informed by a wide range of studies, research, data collection, and analytics. SMART SCALE is a funding program that competitively assesses projects based on an objective, outcome-based method, thereby introducing more transparency and accountability when it comes to spending taxpayer dollars. The DRPT's open data portal transferred a variety of data projects, metrics, and performance measures into visuals, which helps public, or public agency understand the current and past trends without reading lengthy reports. Some of the innovative

initiatives by DRPT are the intercity bus study, the modernization of transit fleets, web grants, etc.

WMATA's next generation of trains will replace the oldest trains in our current fleet. It will feature enhanced security, improved ventilation and airflow, energy-efficient heated flooring, and lighter exteriors made of aluminum. Easy to see information screens, separate space for wheelchairs, and bicycles/ baby strollers. These Hitachi's 8000-series trains are projected to be delivered for pilot runs in 2027.



RECOMMENDATIONS TO RAISE THE GRADE

To raise infrastructure grades, Virginia should:

- **Expand Service Coverage and Frequency.** Increase access to high-frequency transit, especially in underserved areas. Provide flexibility to transit agencies for transit fiscal cliff as Covid-19 funding is depleted and fare collection remains below pre-pandemic levels.
- **Secure Sustainable Funding:** Identify ways to maximize funding for operations, maintenance, and capital improvement projects. Explore ways to stimulate growth in funding, including through tolls and grant programs.
- **Accelerate Capital Investments.** Prioritize modernization and state-of-good repair projects; more funding and emphasis for DRPT's Transit Asset Management plan.
- **Improve Public Safety and Rider Confidence:** Ensure proper funding through DRPT for safety related transit programs to transit agencies. Continue constructing new infrastructure to be Americans with Disabilities Act compliant.
- **Foster Innovation and Resilience:** Resources shall be prioritized towards assets with high threat levels (As per COVA HMP) to ensure safe infrastructure.

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Wastewater



Photo: Wastewater treatment facility located; 24K-Production

GRADE
COMPARISON

VA: D+
Nat'l: D+



WASTEWATER

EXECUTIVE SUMMARY

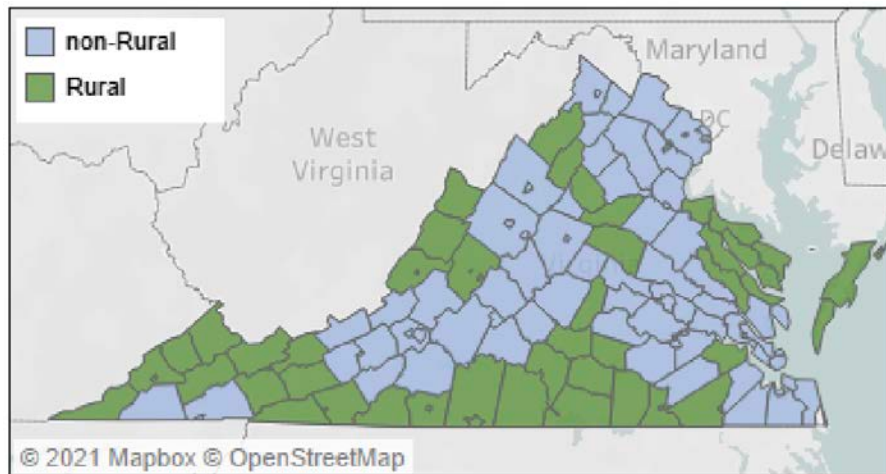
Virginia is served by approximately 584 municipal wastewater treatment facilities concentrated in urban areas, while an estimated 1.1 million rural households rely on on-site septic systems. Much of this wastewater infrastructure is nearing or exceeding its design life and is increasingly in need of repair or replacement. With a population exceeding 8.8 million and continued growth anticipated, existing systems face mounting capacity and performance pressures. Municipalities are working to comply with the Virginia State Mandate, including addressing the Commonwealth's three remaining combined storm and wastewater collection systems, which discharge untreated sewage into waterways during heavy rainfall events. These challenges are compounded by an aging wastewater workforce and difficulties recruiting and retaining well-trained operators. Funding constraints remain a critical barrier to routine maintenance, workforce development, and capital investments needed to modernize infrastructure. Although Virginia is advancing innovative wastewater treatment approaches, increasing storm frequency and severity continue to heighten infrastructure risk statewide.

CONDITION & CAPACITY

Virginia's population of over 8.8 million people are serviced by approximately 584 municipal wastewater treatment facilities. According to the 2020 Census, more than 10,000 occupied homes in Virginia did not have complete plumbing facilities. Approximately 1.1 million households in rural Virginia are serviced by on-site septic systems. These systems support and provide services to areas where centralized treatment plants are unrealistic due to cost or geography. Organizations

such as the Virginia Rural Water Association provide technical guidance and funding assistance. However, Virginia's rural communities are spread across nearly 88% of the Commonwealth and face a variety of challenges. In addition, it is often more challenging to address infrastructure in rural localities, which are susceptible to extreme flooding events which can lead to sewer overflows and septic tank collapses.

Figure 1. Virginia Rural Districts.

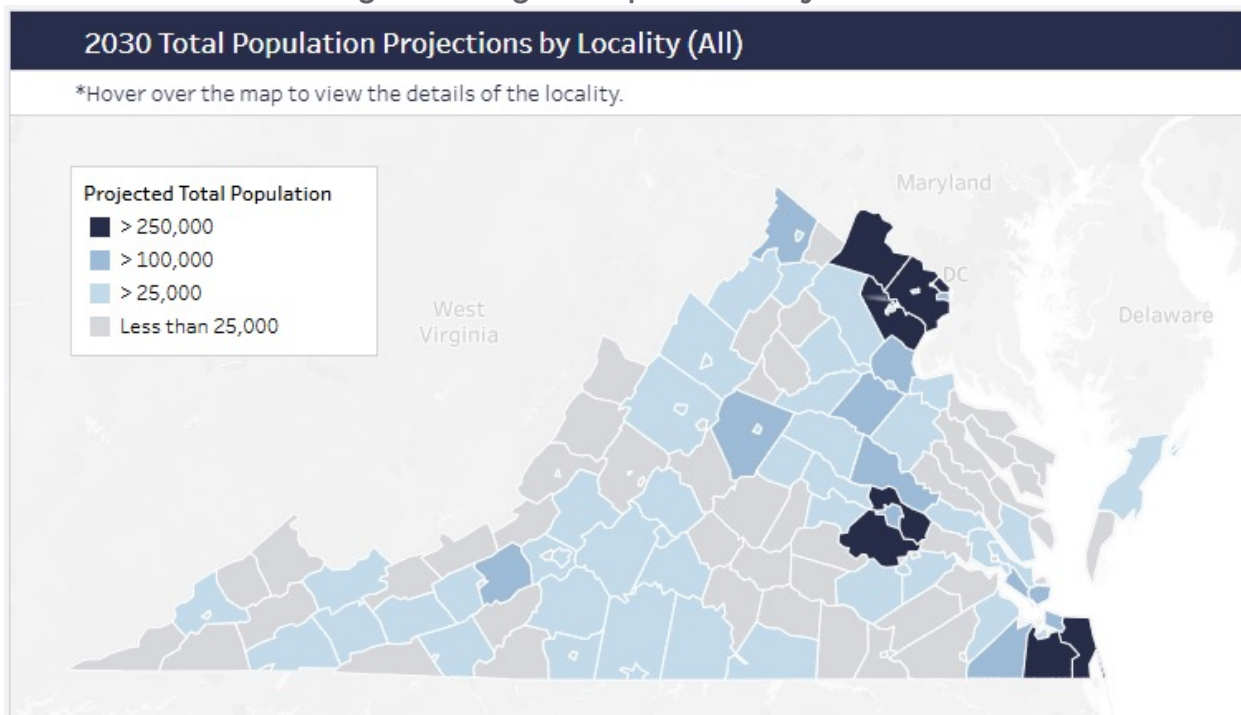


Source: Virginia Rural Health Plan

In the more urban areas of Virginia, centralized water treatment is provided in 584 municipal wastewater treatment facilities across the Commonwealth: 474 “minor” municipal facilities [with design capacities $\geq$ 1,000 gallons per day, but $<$ 1 million gallons per day (MGD)], and 110 “major” municipal facilities (with design capacities $\geq$ 1 MGD). Sewer flows continue to increase as population has increased by over 300,000 since the

2020 census report and as of 2025. Over the next ten years, Virginia is estimated to see a population growth of 9% primarily concentrated in the urban centers of the Commonwealth. While many municipal facilities have significant capacity, with the Commonwealth capacity exceeding 600 MGD, rain and wet weather complicate treatment during and after storm events.

Figure 2. Virginia Population Projections.



Source: Weldon Cooper Cetner for Public Services

The U.S. Environmental Protection Agency (EPA) indicates that the design life for sewage collection systems is 80 to 100 years, 50 years for force mains, and 50 years for concrete structures in pump stations and treatment facilities. These estimates decrease in cases of corrosion, inundation, and damage to pipes from construction projects and accidents. As conveyance systems age, sewer pipes and the joints that connect them may begin to fail, allowing groundwater and stormwater to leak into the system. This infiltration and inflow (I/I) compounds the existing capacity issues and ultimately may lead to sanitary sewer overflows (SSOs) during rain events. Estimating the age of Virginia's sewer infrastructure is difficult due to the wide range that exists. In historical, coastal cities like Norfolk and Portsmouth, existing clay pipes from up to 125 years ago are still in service and cities like Richmond with its combined sanitary sewer have an average pipe age over 100 years. In addition, there have been significant

improvements in repair technology where outright replacement is no longer always needed. In Norfolk, the Hampton Roads Sanitation District did over 9 miles of sewer improvement which included replacement, Cured-In-Place-Pipe (CIPP) lining, and manhole rehabilitation.

The Virginia Department of Environmental Quality (VDEQ) maintains a pollution response and preparedness web platform that shows approximately 500 SSO events reported in 2022 which is down significantly from the 1,000 reported in 2019. SSOs also track instances of overflows from combined sewer systems (CSS) where stormwater and wastewater are conveyed through the same pipe network. As storm frequencies increase and intensify, and impervious area increases, this puts more stress on wastewater facilities during peak events and leads to more discharge events. However, Virginia cities with CSSs are making significant upgrades to their systems to outright eliminate the overflow outlets.

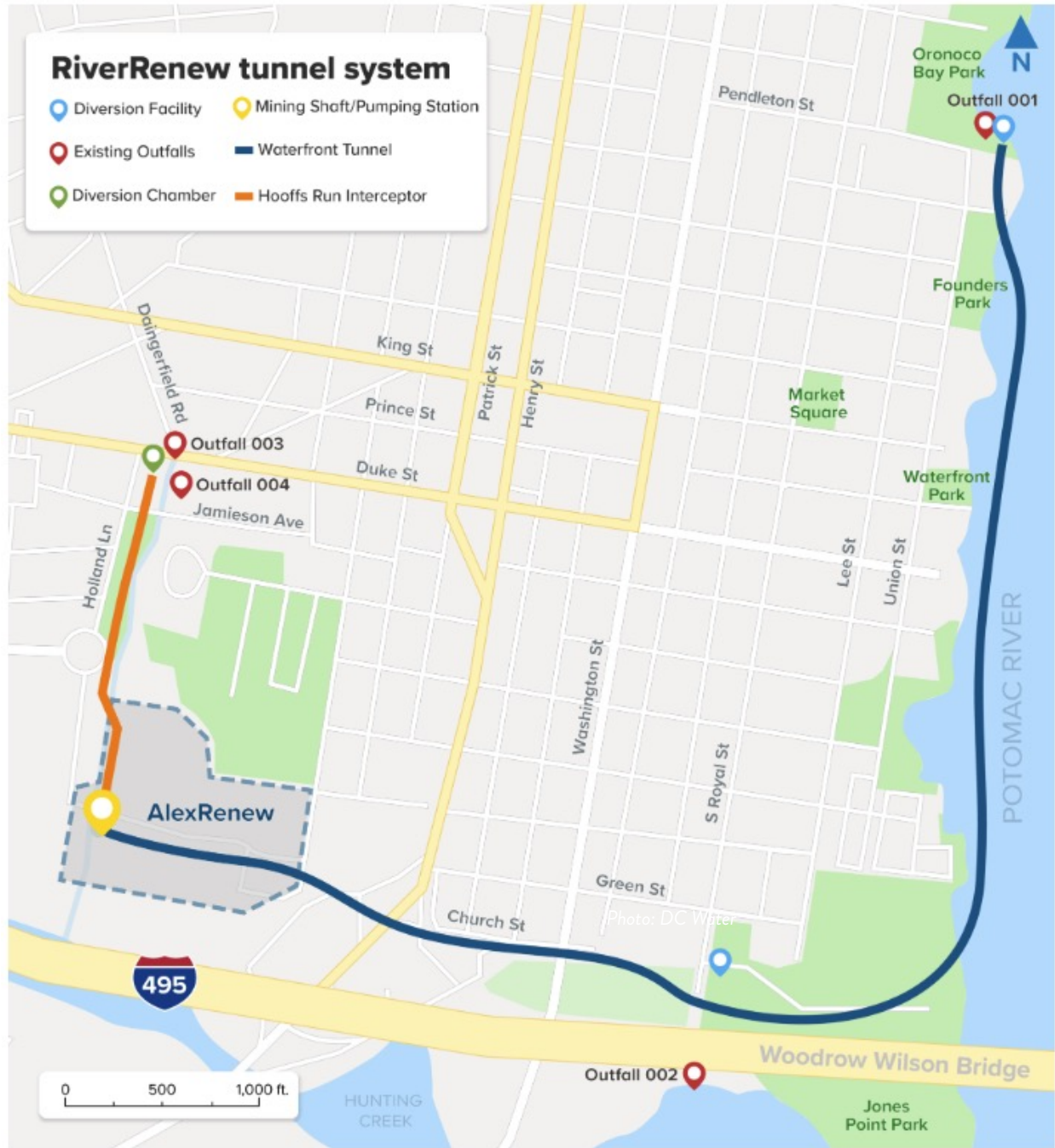
PUBLIC SAFETY

Virginia's wastewater story includes its struggle with safeguarding residents against possible safety concerns with CSSs and their associated overflows (CSO). In heavy rain events, residents of Richmond, Lynchburg, and Alexandria must not only protect against flooding from the storms, but also from sanitary sewer discharges due to over-capacity conveyance lines.

Work to reduce CSO discharges is ongoing and continuous. In 2017, the Virginia General Assembly passed a law requiring the remediation of outfalls that discharge sewage mixed with rainfall into public waterways to reduce raw sewage discharges by July 1, 2026. All cities within the law have hit major milestones and shown continued commitment to decreasing the hazards associated with CSOs. The City of Alexandria and Alexandria Renew Enterprises (AlexRenew) are

committed to meeting this mandate, completing major projects such as their RiverRenew project which includes a 2.2-mile-long Waterfront Tunnel and the Hoofts Run Interceptor in 2026. These projects are expected to prevent over 120 million gallons of combined sewage from entering the Potomac River annually. The City of Richmond has earmarked \$117 million in a long-standing commitment to their overflow control program but with the caveat that long term solutions are incredibly costly and unlikely to be implemented soon. However, with the upcoming completion of all projects outline in their Interim Plan under the Consent Order and Acts of Assembly in 2027, approximately 180 million gallons annually are reduced. The City of Lynchburg is projected to have closed 115 of their 132 CSO outfalls with a 93% reduction in discharge to the James River by November 2026.

Figure 3. RiverRenew projected new tunnel system.

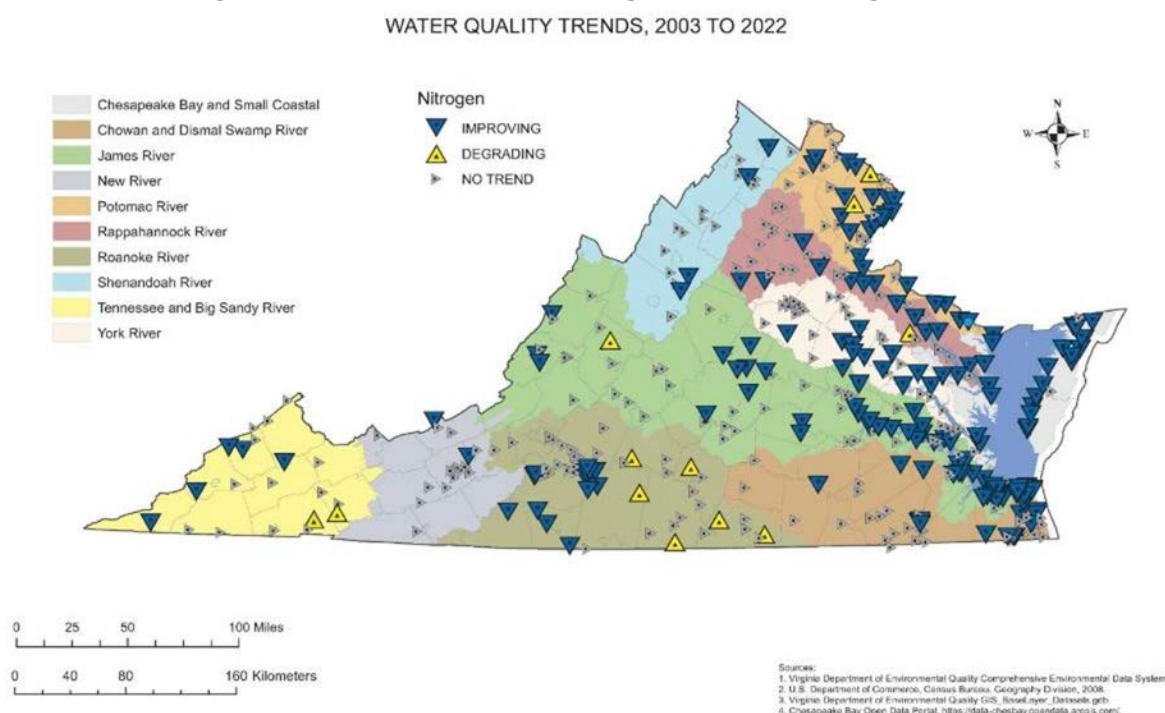


Source: RiverRenew Feature News

Across the Commonwealth, Virginia DEQ tracks water quality standards and when waterways fail to meet these standards, Total Maximum Daily Loads (TMDLs) are developed to determine and limit the total amount of pollution a waterbody can receive. When these limits

are exceeded, the waterbody is considered impaired and a TMDL Action Plan is developed and permitted. As of 2025, DEQ is monitoring 4,503 miles of impaired rivers and streams, 3,138 acres of impaired lakes and reservoirs, and 1,005 square miles of impaired estuaries.

Figure 4. Statewide total nitrogen trends through 2022.



Source: Virginia's 2024 305(b)/303(d) Water Quality Assessment Integrated Report

OPERATION AND MAINTENANCE

The wastewater sector depends on a well-trained workforce to conduct operation and maintenance (O&M) which ensures a functioning system, a maximized lifespan of the system, and ensures permit compliance. As Virginia's existing workforce ages, a shortage in trained personnel is among the top concerns reported in the American Water Works Association's (AWWA) 2025 State of the Water Industry Report. This is reflected from larger municipalities all the way to smaller counties, with a warning of overall reliability and safety concerns. As staffing becomes an issue, maintenance begins to become reactive instead of proactive. Many municipalities prioritize based on risk levels and the acceptable level of downtime, for example per the city of Danville if a pump has 80% out of service time, it will be prioritized. Proactive work is managed only when risk levels are lower. These risk levels are tracked and managed through increasingly more common asset management programs which allow for more consistent maintenance schedules.

As the workforce shrinks, wastewater sectors are addressing the missing gap amidst a combination of budget cuts, wastewater authority consolidations, and an increase in technology like automation. The US Bureau of Labor Statistics is projecting a 6% decrease in job availability in the wastewater sector. The DEQ has released updated cybersecurity training and assessments in response to the amended Article 4 of the Water Control Law in 2024 to match the overall trend of increased remote automation. Per the Virginia Department of Health, the overall number of licensed operators continues to decline. This reflects overall trends leading back towards an industry struggle in hiring and retention. To encourage continuing education for O&M activities, many professional organizations (such as the American Water Works Association) and regulatory bodies (such as the Department of Health, Office of Drinking Water) offer scholarships to offset education costs and preparatory course to support exam preparation.

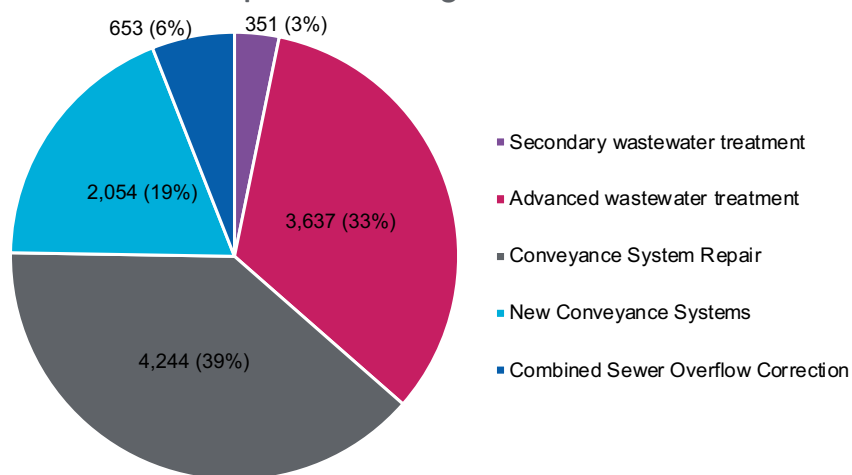
FUNDING AND FUTURE NEED

As infrastructure ages and population grows, many localities are looking to upgrade facilities and conveyance systems. However, these projects are typically very large and require extensive planning in order to maintain

services throughout construction. Per the latest Clean Watershed Needs Survey presented to Congress in 2022, Virginia reported an overall need of \$45.77 billion.

Categories	Funding Needs
Secondary wastewater treatment	351
Advanced wastewater treatment	3,637
Conveyance System Repair	4,244
New Conveyance Systems	2,054
Combined Sewer Overflow Correction	653
TOTAL	10,939

Figure 5: Virginia's documented funding needs in millions by category, reported to congress – 2022.



Source: Clean Watershed Needs Survey.

In smaller localities, up to 80% of annual expenditures are ear-marked for O&M. Inflation and lingering supply chain issues following the COVID-19 pandemic have led to a 43.3% increase in construction costs. With limited Capital Improvement Project budgets, prioritization has led to outdated infrastructure remaining long past its serviceable lifetime. Pipes, pumps, and treatment plants are fixed reactively as they break instead of proactively to reduce discharges. On the other end of the spectrum, larger municipalities like the City of Richmond have significant needs to address CSOs. However, 20.9% of residents are below the poverty line and already pay

some of the highest sewer rates in the Commonwealth.

For many utilities, funding remains the top priority and concern for wastewater professionals. For municipal utilities, rate increases remain the most common funding method, with over 44% of utilities planning or enacting either a one-time price hike at an average of 5.4% or an average annual increase of 3.0%. However, only 41% of utilities indicate confidence that this hike would cover all the improvements anticipated. In addition, most locality funding is supplemented through state funding and programs such as the Virginia Clean Water Revolving

Loan Fund (VCWRLF). The VCWRLF provides financial assistance for publicly owned collection and treatment facilities with below-market interest rates and extended loan terms based on project lifespan. This fund, which is administered by DEQ, received an influx via the Infrastructure and Investment Jobs Act which allowed additional funds being distributed for large-scale projects, for example a loan of \$186 million to assist AlexRenew in their RiverRenew project. For privately

owned systems, alternative programs such as the Septic and Well Assistance Program (SWAP) provide funding for low-income residents for maintenance and replacement of onsite sewage system and components. SWAP is administered by the Office of Environmental Health Services and received one-time funding through the American Rescue Plan Act. The fund was incredibly well received, with all \$11.5 million allocated funds committed by September 2, 2022.

RESILIENCE AND INNOVATION

2024 brought extreme flooding and hurricane impacts to portions of Virginia far outside a storm's usual path. Hurricane Helene caused millions in damage after it made landfall and made its way up the east coast. Southwest Virginia experienced extreme flooding as waters reached an excess of 31 feet.

Along the eastern shore and throughout the Middle

Peninsula, many communities rely on septic systems. However, their systems are aging, unmaintained, and failing. The Virginia Institute of Marine Science estimates that 6% of the Chesapeake Bay's watershed's total nitrogen pollution comes from failing septic systems. These problems are being compounded as a vast majority of these systems were not designed for the extended inundation from flooding.

Figure 6: Sanitary sewer overflow following tropical storm Ophelia.



Source: photo courtesy of McKenzie White

As new problems arise, creative and innovative solutions across Virginia rise to the challenge. The Hampton Roads Sanitation District (HRSD) broke ground on the full-service James River Sustainable Water Initiative for Tomorrow (SWIFT) facility in 2022. As part of their SWIFT initiative, HRSD has been treating wastewater to drinking water standards and pumping this treated water into the ground to fight land subsidence and recharge the Potomac Aquifer. As of 2025, HRSD has surpassed 1 billion gallons of water returned to the aquifer.

State lawmakers support innovation and resilience in Virginia through regulatory initiatives such as DEQ monitoring of biosolids applied as fertilizer.

Lawmakers also strive to incorporate new and emerging technologies and getting ahead of the curve for new pollutants like regulating the levels of per- and polyfluoroalkyl substances (PFAS) in use of distributing biosolids. Localities like the City of Richmond have been using real-time visualization to help prioritize critical infrastructure to reduce CSO into the James River while many rural communities rely on information provided by agencies like the Virginia Department of Health about specialized projects like septic system enhancements. As new challenges arise, Virginia continues to meet them through a combination of new technologies and support at the regulatory level.



Photo: Scientist in yellow protective suit conducts water quality test in dirty sewer tunnel. Environmentalist working on pollution control and wastewater management; FOTO Eak

Wastewater



RECOMMENDATIONS TO RAISE THE GRADE

- Direct additional state resources to rehabilitating aging collection infrastructure.
- Continue DEQ's assessment of impaired Virginia waterways and establishing necessary Total Maximum Daily Limits.
- Expand resources for utilities to recruit and retain operations.
- Advance continued support for the state's revolving fund.
- Fully fund and expand grant programs focused on addressing septic tank rehabilitation in rural Virginia.
- Implement asset management programs to better target maintenance and capital needs and better track risk levels.
- Utility fees should cover full cost of service, including considerations for increased operation, maintenance, and capital needs.

Wastewater



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