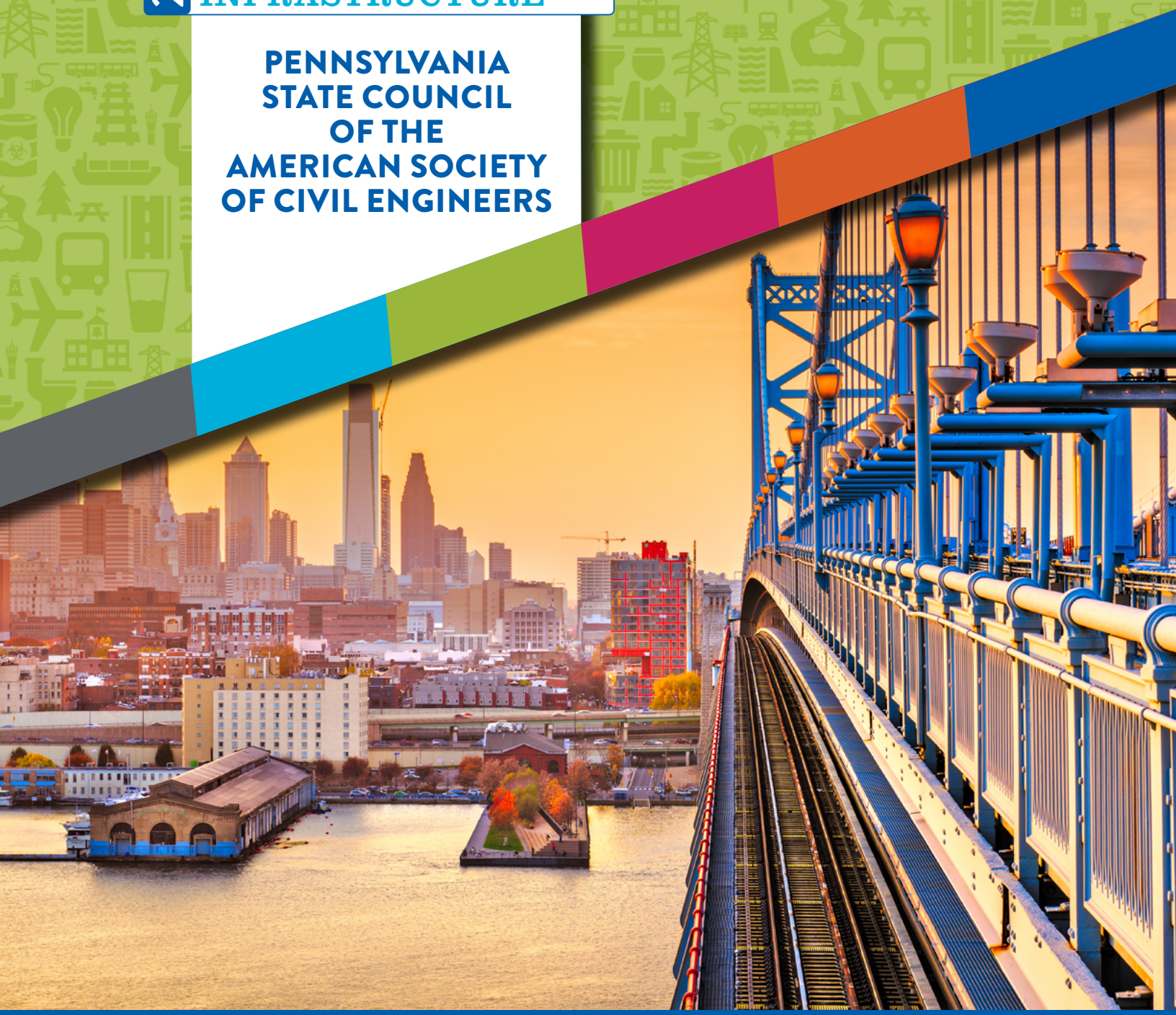
2022 REPORT CARD FOR PENNSYLVANIA'S INFRASTRUCTURE

PENNSYLVANIA STATE COUNCIL OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS



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2022 Pennsylvania Report Card Executive Summary

Members of the American Society of Civil Engineers volunteered this year to produce the *2022 Report Card on Pennsylvania's Infrastructure.* This report serves to educate the public on the status of the Commonwealth's infrastructure. Residents, in conjunction with elected officials, can therefore better prioritize limited funding among competing, connected needs to improve the condition, capacity, operations, maintenance, safety, and resilience of infrastructure.

Overall, Pennsylvania's infrastructure gets a 'C-', the same as the 2018 report card. Progress is real, but challenges remain. Pennsylvania has some of the oldest infrastructure in the country. Substantial maintenance backlogs have accrued in several areas as recent investment runs into new challenges such as inflation and resiliency to withstand climate change.

Since the previous report card, legislative support for infrastructure, public agency planning, and a moderate economy for the first two years caused tangible improvements in the status of several pieces of infrastructure. Aviation raised to a 'B-': upgrades included the implementation of Pittsburgh International Airport's Terminal Modernization Program, the expansion of cargo

facilities, and a focus on resiliency projects including a micro-grid at PIT and a solar field at Northeast Philadelphia Airport (PNE). Roads is up to 'C-': the passage of Act 89 in 2013 resulted in the completion of nearly 3,800 roadway improvement projects, with nearly 3,100 additional efforts outlined in the PennDOT 12-Year Program as of May 2022.

Progress is real, but challenges remain. Pennsylvania has some of the oldest infrastructure in the country. Substantial maintenance backlogs have accrued in several areas as recent investment runs into new challenges such as inflation and resiliency to withstand climate change.

The COVID-19 pandemic spurred a wave of Pennsylvanians to visit public parks, whether they green spaces within walking distance managed by city department, a rail-trail maintained by a metropolitan commission, or a state park of historic origin and regional importance. However, Pennsylvania parks were downgraded to 'C+'. An approximately $1.4 billion backlog of infrastructure projects exists for Pennsylvania's 300,000 acres of state-owned land, plus 1,000 miles of trails. A similar sum of necessary projects is counted in the state's 6,000 local parks. Pennsylvania's state budget has increased funding for that need in state lands, but local public land is reeling.

The pandemic shook up how people use infrastructure, how it is managed, and what funding was available. Federal funding surged to meet immediate public health needs and can now be used to fund critical needs. The 2021 Bipartisan Infrastructure Law plans to send $3.2 billion over five years to Pennsylvania for maintenance projects in transit. Roads became more deadly in the Commonwealth and nationwide, raising awareness and urgency to use engineering for safety-focused re-design of public space.

About The Report Card for Pennsylvania's Infrastructure

While you may not think about infrastructure every day, civil engineers do because we have pledged to build it, maintain it, and keep the public safe. As an organization of civil engineers who live and work in Pennsylvania, we want to share what its condition is and what can be done to improve it.

Methodology

The purpose of the Report Card for Pennsylvania's Infrastructure is to inform the public and decision makers of the current condition of our state's infrastructure in a concise and easily accessible format of a school report card. Each of the categories of infrastructure covered in the Report Card is assessed using rigorous grading criteria and recent data to provide a comprehensive assessment of the area's infrastructure. ASCE has used the following criteria to discuss and grade the state of the infrastructure:

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 for 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?

GRADING SCALE

EXCEPTIONAL: FIT FOR THE FUTURE

The infrastructure in the system or network is generally in excellent condition, typically new or recently rehabilitated, and meets capacity needs for the future. A few elements show signs of general deterioration that require attention. Facilities meet modern standards for functionality and are resilient to withstand most disasters and severe weather events.

GOOD: ADEQUATE FOR NOW

The infrastructure in the system or network is in good to excellent condition; some elements show signs of general deterioration that require attention. A few elements exhibit significant deficiencies. Safe and reliable with minimal capacity issues and minimal risk.

MEDIOCRE: REQUIRES ATTENTION

The infrastructure in the system or network is in fair to good condition; it shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies in conditions and functionality, with increasing vulnerability to risk.

POOR: AT RISK

The infrastructure is in poor to fair condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration. Condition and capacity are of significant concern with strong risk of failure.

FAILING/CRITICAL: UNFIT FOR PURPOSE

The infrastructure in the system is in unacceptable condition with widespread advanced signs of deterioration. Many of the components of the system exhibit signs of imminent failure.

INCOMPLETE

The infrastructure in the system or network does not have sufficient data to provide a grade.

2022 Report Card for Pennsylvania's Infrastructure

G.P.A. C

AVIATION B-	PUBLIC PARKS C+
BRIDGES D+	RAIL C
DAMS C	ROADS C-
DRINKING WATER D	SOLID WASTE C+
ENERGY C	STORMWATER D
HAZARDOUS WASTE B-	TRANSIT D
LEVEES C	WASTEWATER D-
PORTS C+	

Recommendations to Raise the Grade

As Pennsylvania residents learn about infrastructure needs and decision-makers work to address them, ASCE members in Pennsylvania offer suggestions to start raising the grade:

1. **Plan and fund infrastructure systems for flexible schedules and distributed supply chains.**
   The COVID-19 pandemic featured a permanent move toward hybrid work environments and flexible working hours, such that roads, bridges, and transit systems need to be planned and offer high-quality service all-day and all-week, beyond rush hours. Supply chain systems carrying goods for purchase and manufacturing experience load unpredictably, so ports, inland waterways, rail, roads, and bridges require capacity and resilience so demand or supply shocks don't imperial the whole network. These changes require funding available for capital and operations expenses, short- and long-term rethinking.

2. **Implement federal funding and reconsider methods of state and local budgeting.**
   Even with large-scale federal investments in infrastructure – the 2021 Bipartisan Infrastructure Law, the Inflation Reduction Act, Chips and Science Act – large funding gaps remain in Pennsylvania's systems. A wise path forward effectively implements formula funding and aggressively pursues competitive grants from Washington while revaluating the ways Pennsylvania generates revenue. The Transportation Revenue Options Commission (TROC) and Drive Smart Act are necessary to identify all funding options for the future in transportation with less congestion, zero traffic deaths, and net greenhouse gases.

3. **Workforce challenges must be addressed as a significant limiting factor on infrastructure improvements.**
   A surge of retirements at state and local government agencies is draining institutional knowledge right when project development and implementation are crucial to the best use of an historic funding surge. Agencies are struggling to retain younger engineers and other technical experts as they advance, especially minority staff. Planning projects and obtaining funds is one challenge. The workforce crisis hitting construction and skilled labor hampers implementation.

4. **Infrastructure is for people: efforts must become resilient, sustainable, and equitable.**
   ASCE supports and expects civil engineers to be committed to sustainable development. An engineer should plan and implement the "right" projects according to economic, environmental, and social effects. At every stage, engineers and decision-makers must engage residents and community groups with an aim to include the needs from users of all systems. Project planning should include life-cycle cost assessments to account for tomorrow's maintenance and resilience expense – in addition to today's construction cost – and the social benefits or costs of disruptive changes to the built environment.

FAIRMOUNT WATER WORKS HISTORICAL LANDMARK AND BOATHOUSE ROW, PHILADELPHIA

Aviation

B-

EXECUTIVE SUMMARY

Airports in Pennsylvania generate over $10 billion in annual payroll and over $23 billion in economic activity. The COVID-19 pandemic hampered long-term infrastructure plans with significant reductions in usage fees, but activity has bounced back. Enplanements at Pittsburgh are now 65% of pre-COVID level and 85% of that benchmark in Philadelphia. Allegheny County Airport now sees more customers than before the pandemic. Pennsylvania's capital budget program sees requests for key projects three to four times the amount of funding available. Positives over the last four years include implementation of Pittsburgh International Airport's (PIT) Terminal Modernization Program, the expansion/planned expansion of cargo facilities, and a focus on resiliency projects including a micro-grid at PIT and a solar field at Northeast Philadelphia Airport (PNE).

BACKGROUND

Pennsylvania ranks 16th in the country in the number of public-use aviation facilities with 121 airports, heliports and seaplane bases with an annual economic impact of over $23.6 billion to the Commonwealth. Of these 121 facilities, 107 are considered general aviation without commercial airline service, typically servicing private and corporate aircraft. The aviation industry also supports more than 300,000 jobs making it one of the largest employment sectors in Pennsylvania.

According to the FAA CY 2021 Report, Philadelphia International Airport (PHL) ranks Number 16 in cargo airports in North America by tonnage with PIT ranking Number 39 and Lehigh Valley International (ABE) ranked at Number 51. The Pennsylvania Bureau of Aviation is a funding regulatory agency only; they do not own the airports. As a result, there is little asset management data collected across the state.

CONDITION & CAPACITY

Airport infrastructure within the Commonwealth can be covered primarily in the following categories: buildings and airside pavement.

Building Condition

Cargo Facilities: PHL has begun executing their $1.2 billion Cargo Expansion strategy, announced in June 2021, with the intention of expanding their cargo space from 600,000 square feet to 1.4 million square feet and their air cargo facility footprint by 136 acres. Over $90 million has already been invested into the development of sites within the airport for this expansion, with additional future work planned.

Expansion of cargo facilities has been a major focus at PIT. A cargo expansion was opened in 2017 to accommodate Boeing 777 aircraft and an additional cargo space (approx. 80,000 sf) for storage and production is set to begin construction in Spring 2022. Additionally, Amazon began flying cargo into and out of PIT in 2021. ABE has grown their Air Cargo capabilities greatly in the past several years with their FedEx and Amazon facilities, and Harrisburg International has also moved into the top 75 in the country and is planning a major expansion of their air cargo facilities in the coming years with a multi-phased growth plan.

Terminal Condition & Capacity: PIT is currently working through their Terminal Modernization Program (TMP) which will include a new terminal with increased capacity, a new parking garage, rental car building, parking lots, and access roadways. PHL has made no significant improvements to its terminal facilities in recent years. A focus has been placed on enhancing the guest experience within the terminal facilities through the installation of security wait time display boards, art installations, and other small changes within the terminals. A new Terminal was completed in Williamsport in 2019 and major Terminal Improvements are underway that the Lehigh Valley International and Arnold Palmer Regional Airports.

Airside Pavement

PHL has seen a number of airfield construction projects in recent years that have rehabilitated existing pavement in deteriorating condition – including numerous taxiways and a terminal apron. Continued work is planned to rehabilitate existing pavement throughout the airfield to increase its usable life and ensure the safe and efficient operation of aircraft.

In early 2022, PennDOT kicked-off a Statewide Airport Pavement Management System Plan update for the majority of General Aviation airports across the state. As part of this project, airfield pavements at these airports will be surveyed and Pavement Condition Index (PCI) numbers updated to inform cost-effective decisions about maintenance and rehabilitation of pavement infrastructure. This information will be used for Airport and Statewide Funding Planning.

Airport activity is typically tracked through the collection of passenger boarding and cargo data. This data is used to help determine federal funding for each airport for the next fiscal year and can provide insight into anticipating the needs of the airport.

Between 2018 and 2019, overall enplanements (defined as the number of passengers boarding an aircraft) increased by almost 5%.

City	Airport Name	CY 19 Enplanements	CY 18 Enplanements	% Change
Philadelphia	Philadelphia International	16,006,389	15,292,670	4.67%
Pittsburgh	Pittsburgh International	4,715,947	4,670,033	0.98%
Harrisburg	Harrisburg International	746,369	636,756	17.21%
Allentown	Lehigh Valley International	434,007	376,468	15.28%
Avoca	Wilkes-Barre/Scranton International	288,973	258,628	11.73%
Latrobe	Arnold Palmer Regional	158,253	151,410	4.52%
State College	University Park	193,534	153,571	26.02%
Erie	Erie International/Tom Ridge Field	106,720	95,342	11.93%
Williamsport	Williamsport Regional	20,442	22,547	-9.34%
Johnstown	John Murtha Johnstown-Cambria County	6,309	4,381	44.01%
	Summary	**22,676,943**	**21,661,806**	**4.69%**

In early 2020 the COVID pandemic hit the United States causing a drastic decrease in travel including air travel. Overall enplanements decreased by over 60% between 2019 and 2020, a direct result of the pandemic's impact on the transportation sector.

City	Airport Name	CY 20 Enplanements	CY 19 Enplanements	% Change
Philadelphia	Philadelphia International	5,753,239	16,006,389	-64.06%
Pittsburgh	Pittsburgh International	1742406	4715947	-63.05%
Harrisburg	Harrisburg International	312258	746369	-58.16%
Allentown	Lehigh Valley International	187530	434007	-56.79%
Avoca	Wilkes-Barre/Scranton International	107622	288973	-62.76%
Latrobe	Arnold Palmer Regional	62470	158253	-60.53%
State College	University Park	74731	193534	-61.39%
Erie	Erie International/Tom Ridge Field	42790	106720	-59.90%
Williamsport	Williamsport Regional	20442	22547	-9.34%
Johnstown	John Murtha Johnstown-Cambria County	3149	6309	-50.09%
	Summary	**8,306,637**	**22,679,048**	**-63.37%**

It is estimated that traffic is now back to approx. 85% of pre-pandemic levels at PIT and the number of flights at Allegheny County Airport (AGC) has exceeded pre-pandemic levels and the airport is rapidly growing. Enplanements at PHL are back to above 65% of pre-pandemic levels and are continuing to rise.

OPERATIONS AND MAINTENANCE

Airports within the state that serve scheduled and unscheduled air carrier aircraft with more than 30 seats or serve scheduled air carrier operations in aircraft with between 10 to 30 seats, undergo an annual Part 139 Airport Certification process. During this process, the FAA inspects the operating conditions of the airfield to ensure safe condition. If all requirements from the process are met, an Airport Operating Certificate is issued to the airport. When conditions are not deemed in compliance with Part 139 requirements, sanctions are imposed until the conditions can be remediated. This annual process for all commercial facilities, as well as GA facilities who meet the criteria to undergo the process, ensures safe operating conditions for the airport facility.

Aging infrastructure and the effects of climate change highlight the need for effective maintenance programs at airports across the state. While larger facilities like PHL have their own dedicated maintenance teams to complete smaller routine maintenance, smaller airports throughout the state may need to rely on grant funding in order to complete required maintenance of pavements, markings, and utilities throughout the airfield. Funding shortfalls may not only prevent required maintenance from being carried out quickly and effectively, but they may also not allow for preventative maintenance (e.g., seal coating, crack sealing, mill and overlays) which help to extend the useful life of pavements and reduce the need for more frequent pavement rehabilitations.

FUNDING

Federal, state and local sources of revenue and financing are used to maintain, improve and operate airports in Pennsylvania. Pennsylvania is a Block Grant State, meaning all Federal Funding for the Commercial-Service Airports and any other Airports owned by the Commercial Service operators is managed by the FAA Harrisburg Airports District Office. For all other non-hub and general aviation Airports, Federal Funding is managed by the PennDOT Bureau of Aviation. Pennsylvania received roughly $73.8 million in FY 2019 and $106.5 in FY 2020 in AIP and Supplemental Discretionary Funding. The Pennsylvania Block Grant Funding typically ranges from $16 million to $18 million annually.

Airports also raise funds by charging passenger facility charges (PFCs) up to the current Federal cap of $4.50 per passenger. These fees can be used to make facility improvements but have a restrictive limit on funding commercial service airports.

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Other sources of infrastructure funding come from the Federal Aviation Administration (FAA) and their Airport Improvement Program (AIP) including:

- Entitlement Funding – Commercial Services Airports with greater than 10,000 annual enplaned passengers receive a minimum of $1,000,000 annually. Commercial Services Airports with less than 10,000 enplaned passengers and all general aviation airports receive $150,000 annually.
- State Apportionment Funding – Each State receives a certain amount of funding from the AIP that the FAA can use to fund projects in that State based on each State's population and area.
- Discretionary Funding – All public airports complete for Discretionary Funding.

PennDOT's Bureau of Aviation (BOA) has three additional sources for aviation funding:

- Aviation Development Grant Funding – Derived from the aviation fuel tax. ADG Funding is utilized by the BOA to provide 5% of project costs for AIP-Funded Projects, or ½ of the non-Federal Share. The remaining Funding is used to fund projects at non-NPIAS Public-Use Airports and to fund projects that are not Federally-eligible at NPIAS Airports.

  Prior to COVID, the annual amount available from this type of funding was around $7.5 million. However, since COVID, that amount has dropped to $5 million or less. This has caused the BOA to have to cut back on the number of non-NPIAS Airport Projects it is able to fund.

- Capital Budget Grant Funding – Authorized by the state Legislature from the General Fund. This funding is available for all publicly-owned Airports in the Commonwealth and for privately-owned Airports who are working with a public transportation or government agency. This Funding can be used for non-Federally eligible projects such as fuel farms and for low-priority rated projects such as hangars.

  PennDOT Capital Budget Funding provides $10 million annually for Airports. The Airport Sponsors must have line items in a capital budget bill in order to be eligible for this funding. In 2021, the BOA received $34 million in Capital Budget Release requests and was only able to fund roughly one-third of the requests.

- Multi-Modal Funding – Via Act 89 of 2013, a minimum of $6 million is annually set aside for Aviation. This Act was signed into law in 2013 and is still the current level of funding provided to Aviation. Multi-Modal Funding is used by the BOA to fill in areas where funding may

be lacking, and it is also used for funding hangar and other building projects.

The PA Department of Economic Development (DCED) also receives Multi-Modal Funding in an amount typically over $40 million annually, and Airports are eligible for receipt of this funding. However, since the Program was developed, there have been very few Airport Development Projects that were funded through the PA DCED Multi-Modal Funding Program.

The lack of funding for PA Airports is most critical in two areas, the State Capital Budget Program and the Aviation Development Program. The Capital Budget Program typically sees requests that are 3 to 4 times the amount of funding available, and that is anticipated to worsen. This will affect the future ability for Airports to construct hangars, which are lacking throughout the State. The Aviation Development Program is at the point now where the BOA will only be able to provide the State Share of Federally-funded projects, which is a critical component, but the lack of funds in this program will mean that non-NPIAS Airports will not have any funding available for maintenance or growth at their facilities.

FUTURE NEED

The PHL Capacity Enhancement Program and the PIT Terminal Modernization Program address short-term future needs via large, multi-year capital investments. Through the realization of these programs, the capacity and safety needs of the two largest airports in Pennsylvania will be addressed.

A number of the other commercial service airports, including Lehigh Valley International Airport and Arnold Palmer Regional, have recently invested in terminal replacements and expansions as well as safety and capacity projects (in various stages of completion) to address airfield shortfalls.

The availability of aircraft hangars continues to be a major issue within Pennsylvania, particularly in the Philadelphia and Pittsburgh Regions. While Pennsylvania has a rather robust funding program for hangars with Capital Budget and Multi-Modal Funding available, there is still a major lack of hangar space. Many airports in the areas between Philadelphia and Pittsburgh have constructed new hangars in the past few years, including Bedford County, Hazleton Regional, Wilkes-Barre/Scranton, Lancaster and New Garden. However, hangar construction has not kept up with demand. A major barrier to hangar development is a lack of available space at the metropolitan Airports, and the dramatic increase in costs over the past 2 years. The lack of hangar space is one of the major issues the aviation industry in PA must addressed

PUBLIC SAFETY

Pennsylvania airports have an excellent safety record, no accidents have been caused by unsafe infrastructure condition at an airport. PHL has made significant improvements to passenger safety through numerous pedestrian safety enhancements in the landside portion of the airport facility. These enhancements include the installation of in-road LED warning lights at crosswalks in the arrivals zone, construction of new raised crosswalks, and improvements associated with ADA compliant curb ramps.

In response to the COVID-19 pandemic, health and safety programs were implemented at Pennsylvania airports to protect passengers and airport employees. Measures included: mask mandates, reconfigured seating, decals signs and announcements encouraging social distancing, protective shields in high traffic areas, and enhanced cleaning and disinfection procedures.

RESILIENCE

The need for resilient airports will continue to rise as the demand for transportation services the occurrence of severe weather events increases. Severe weather can cause accelerated deterioration and damage to infrastructure and can cause disruptions to daily operations if utility services are impacted. PHL has developed a robust system for snow and ice removal, which in 2020 earned them the Balchen-Post Honorable Mention Award for Excellence in Snow and Ice Control from the Northeast Chapter of the American Association of Airport Executives. PHL begins their annual preparation for snow and ice as early as August each year, at which time the Pavements and Grounds team and Operations Department discuss changes from the previous year and begin implementing their training program for the teams who will operate their fleet of over 50 trucks. A portion of the funds PIT received as part of a federal program to assist facility operations through the COVID-19 pandemic was designated for new snow removal equipment.

In 2020, PIT broke ground on a first-of-its-kind electrical microgrid that will completely power the airport facility and be fueled by natural gas wells drilled on-site and nearly 10,000 solar panels. Similarly, PNE, has announced plans to develop a 10.25 acre parcel within its site as a solar field, utilizing solar photovoltaic technology to generate electricity for airport buildings and contribute to renewable energy production. The City of Philadelphia Division of Aviation (owner/operator of both PNE and PHL) have begun implementation of their Airport Sustainability Management Plan and Climate Adaptation and Resiliency Plan to place a greater emphasis on sustainability and conservation goals. PHL has been recognized by the Airports Council International's Airport Carbon Accreditation program as a "Level 1" accredited airport, signifying a significant milestone in their pursuit of reduced carbon emissions, air pollution, and energy consumption.

INNOVATION

New technologies and innovations are impacting every aspect of aviation, from air traffic control to facility/ground maintenance, to the aircraft themselves. The Next Generation Air Transportation System (NextGen) is the FAA's ongoing program to modernize the United States National Airspace System. As of 2020, the foundational technology of NextGen is in place to allow for the integration of essential systems that improve communications, navigation, automated traffic flow decisions, etc. These systems are progressively becoming the standard for air traffic control at airports across the country. Full implementation and benefits of NexGen are anticipated to be achieved in the 2035 timeframe.

In 2020, PIT, in partnership with Carnegie Robotics, introduced four autonomous floor scrubbers that utilize UV technology to keep airport surfaces clean and are exploring additional ways to incorporate robotics to increase operational efficiency.

Unmanned Aerial Vehicles (UAV), also known as drones, are quickly becoming invaluable tools airports can use for a variety of tasks including: inspections of existing conditions or construction progress, wildlife monitoring and dispersal, quick visuals of an accident or incident on the airfield, collection of visuals for marketing purposes, etc. Prototypes of electric small commuter and cargo aircraft are currently being tested; however, FAA certification is not anticipated for at least another 5 years. Electrification is an advancement that will impact every transportation sector including aviation.

Advancements in security screening of passengers and cargo will speed travel and delivery once infrastructure can accommodate these new technologies. Automated and connected vehicles will alter the way many passengers use commercial service airports, changing landside facility capacity demands and parking revenue streams.

These technology disrupters can and will drive improvements to aviation including service, resiliency, safety and security, and operational costs. Like many advancements, the cost and timing of adoption will be a challenge within current regulatory and funding structures.

Aviation

RECOMMENDATIONS TO RAISE THE GRADE

- Increase emphasis on public health in facility design and operation.
- Explore third-party funding such as privatization, public-private partnerships, and other available funding mechanisms to avoid budget difficulties. This will also help to maintain funding consistency through potentially changing government focus across various political cycles.
- Improve the consistency and predictability of funding to general aviation from the State Legislature through Capital Budget Grant Funding or other means.
- Adopt the system updates recommended through the NextGen program
- Incorporate sustainability and resiliency into each aviation project to encourage innovation while ensuring new and existing infrastructure is protected from more frequently occurring severe weather events.
- Invest in innovative ideas for the development of safer cyber-physical systems, such as the control of the automatic vehicles, and unmanned aircraft.

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Aviation

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Bridges

D+

THE UNDERSIDE OF THE PARKWAY EAST, STATE ROUTE 376. BRIDGE OVER COMMERCIAL STREET IN FRICK PARK LOCATED IN PITTSBURGH

EXECUTIVE SUMMARY

Pennsylvania has the ninth largest bridge inventory in the nation, coupled with an average bridge age nearly a decade older than some other states. Despite a 4.5% decrease in the number of poor condition bridges, Pennsylvania contains the second highest number of poor condition bridges among states: 25% more than the next state. The 2021 Bipartisan infrastructure Law will provide $13 billion in transportation funding over five years to help offset these. However, even that elevated level falls well short of the $18 billion annual need. Pittsburgh's 2022 Fern Hollow Bridge collapse represents a vivid example of the extreme consequences of aging infrastructure.

FIGURE 1 – FERN HOLLOW BRIDGE COLLAPSE ON JANUARY 28, 2022

CONDITION & CAPACITY

Pennsylvania ranks ninth in the nation with 23,166 highway bridges,[1] The state is second worst with 13.8% (3,198) classified in poor condition, nearly double the 7.3 % national average. These statistics exclude Pennsylvania's 285 closed bridges, up 14% from 2018. Still, the portion of poor condition bridges decreased substantially in the same time period by 4.5%, down from 18.3% in 2018 (4,173). Of Pennsylvania's state and locally owned bridges, 32.4% are in good condition, 54.8% are in fair condition, and 12.8% are in poor condition.[2]

FIGURE 2 – NUMBER OF BRIDGES IN NEED OF REPAIR (LEFT) AND NUMBER OF BRIDGES IN POOR CONDITION (RIGHT)

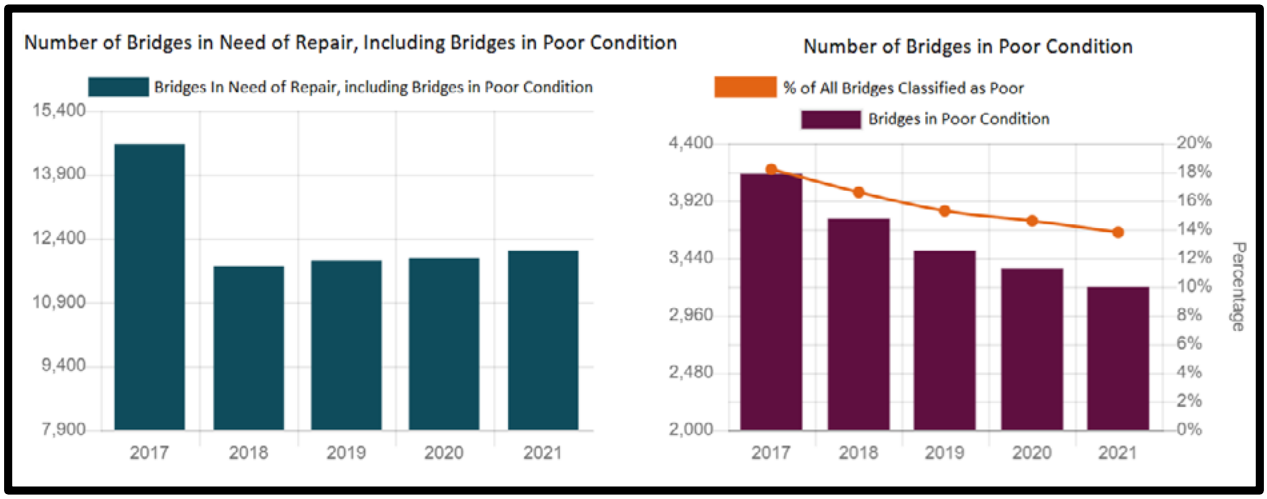
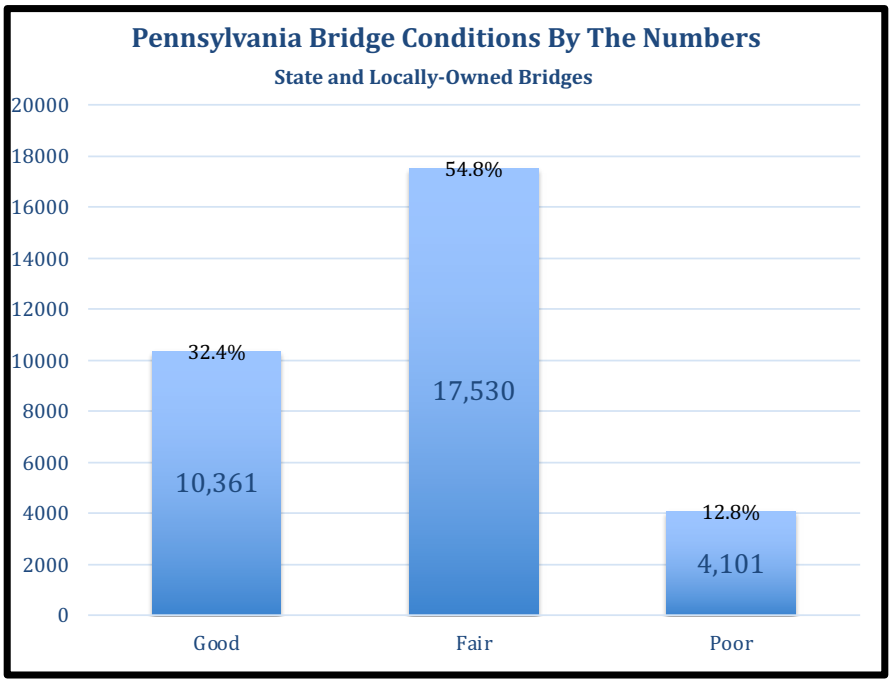


FIGURE 3 – CONDITION OF PENNSYLVANIA STATE AND LOCALLY OWNED BRIDGES



FUNDING AND FUTURE NEED

Averaging 53 years old, Pennsylvania bridges exceed the National average of 45 years. Over 12.6 million vehicles traverse poor condition bridges, including some Philadelphia area bridges exceeding 200,000 crossings daily. While the number of bridges in Pennsylvania needing repair[3] has decreased from a 2017 peak of 14,624 to 12,112 in 2021, experts estimate repairing all bridges would cost $18.15 billion.

Commonwealth bridges undergo biennial inspections and receive condition ratings based on the observed

condition of the bridge. If any key bridge components exhibit severe deterioration, the entire bridge receives a poor condition classification. While not unsafe, these bridges may require higher inspection frequency until bridge rehabilitation or replacement can occur.

OPERATIONS AND MAINTENANCE

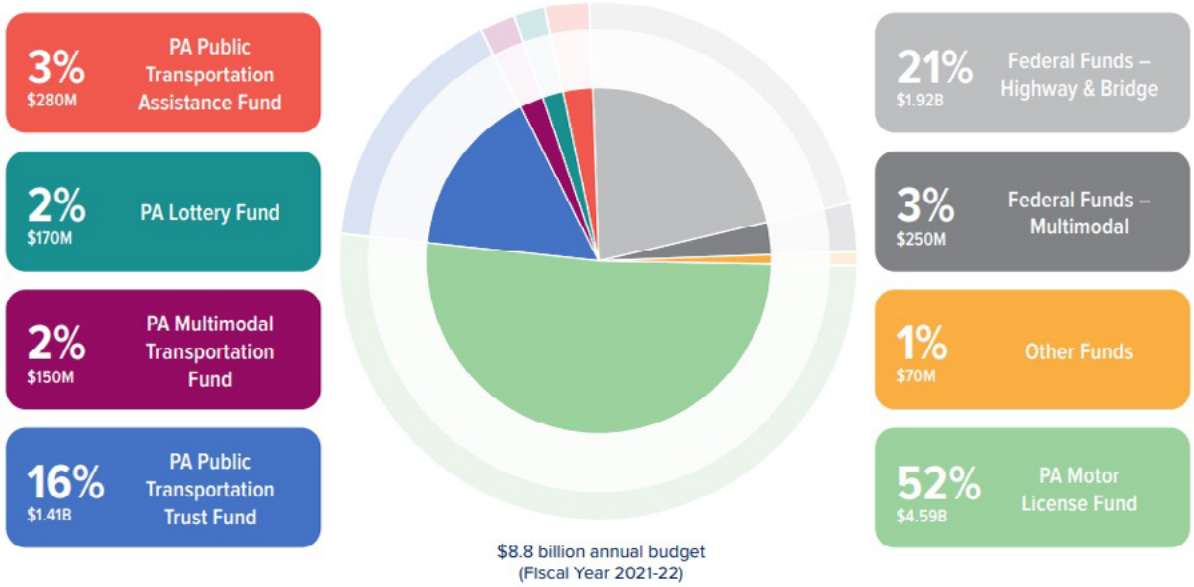
The maintenance needs of the Commonwealth's majority bridge owners, PennDOT and the Pennsylvania Turnpike Commission, are identified primarily via routine bridge inspections. Both owners have strategic maintenance programs. PennDOT has transitioned from a poor-first to Lowest Life Cycle Cost (LLCC) [4] prioritization, to strategically keep existing bridges from becoming poor and optimizing life expectancy. For example, timely deck joint repairs will prevent beams ends and substructure elements below from deteriorating, the latter representing much more intrusive, costly repairs that could hinder traffic tremendously. On the other hand, the Pennsylvania Turnpike Commission performs contracted maintenance each year utilizing unit price contracts and other preprogrammed routine maintenance items. While the state has significantly reduced the number of poor bridges through traditional and non-traditional means such as Public-Private-Partnerships (P3s), inadequate funding fails to address the ever-increasing repair deficit.

FUNDING AND FUTURE NEED

Pennsylvania bridges are funded through federal, state, local and private sources.

Considering the critical state of the nation's inadequate infrastructure funding, Congress passed the Bipartisan Infrastructure Law (BIL) in 2021. The BIL allocates $550 billion for infrastructure projects over five years, including almost $40 billion for bridges: $26.5 billion nationwide in formula funds and $12.5 billion in discretionary grant funds This represents significant investment towards addressing the backlog of existing bridge repairs estimated at $125 billion nationwide. Pennsylvania will receive almost at least $13 billion of bridge and road money over five years, with additions possible by willing discretionary grants.

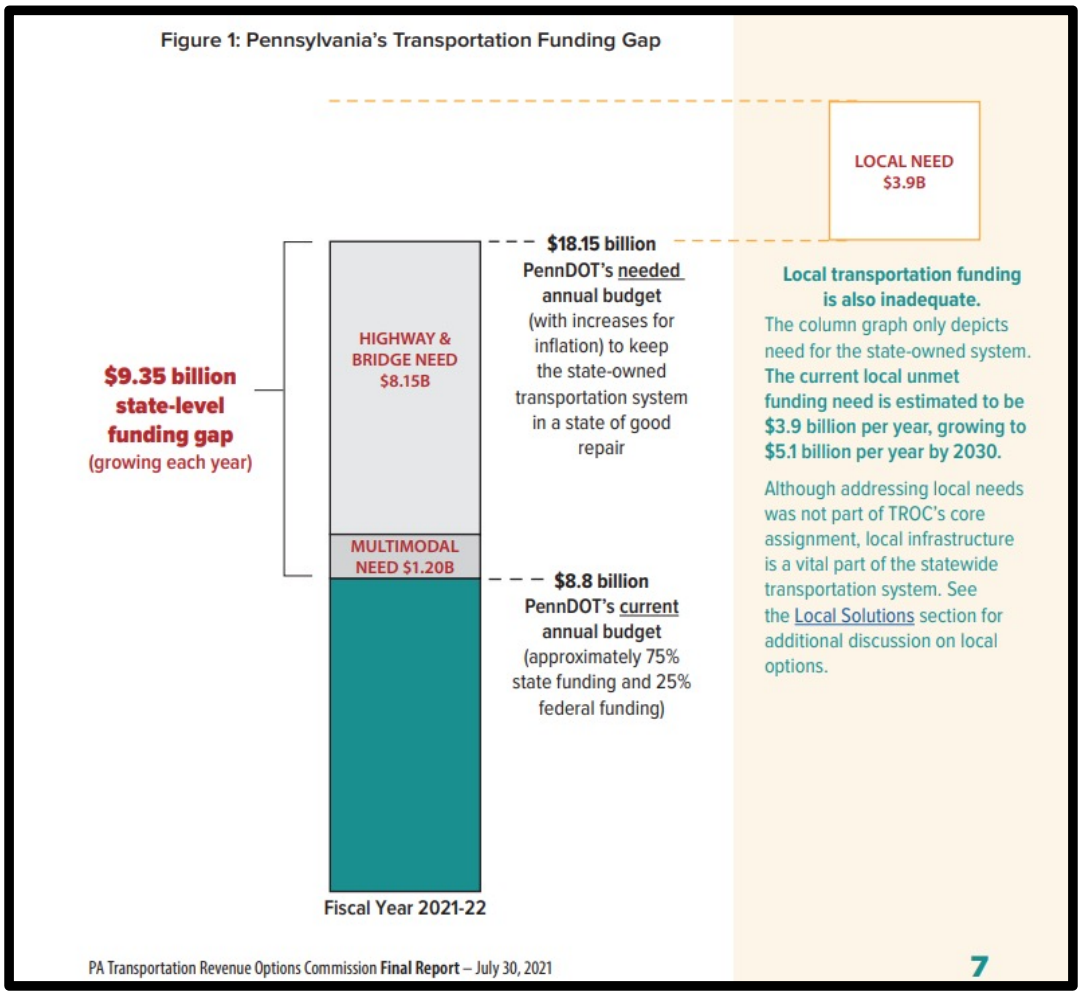
FIGURE 4 – PENNDOT FUNDING BREAKDOWN[5]



Note that the current state budget controversially diverts $500 million of infrastructure funding from Act 89's PA Motor License Fund to the Pennsylvania State Police, a recent $175 million decrease. In addition, 2022 is the last year of Act 44's annual $450 million payments from the Pennsylvania Turnpike Commission to PennDOT and will decrease to $50 million through 2057. To adequately address the state's transportation needs, annual funding needs to be increased to $18 billion.

The $10 billion funding gap has forced PennDOT to steadily reduce its construction program from $2.5 billion in 2015 to $1.6 billion in 2020, the lowest since 2006. Although the construction program increased to $2.1 billion for 2021, it falls short of the $2.5 billion average between 2014 and 2020. The decline in annual lettings[6] directly translates to inadequate bridge preservation, causing noticeable impacts to thousands of private-sector jobs supported by PennDOT engineering, construction, maintenance, and services. Thus, PennDOT established the Pathways program to help identify, evaluate, and implement reliable, future-focused solutions. The first Pathways initiative is the Major Bridge Public-Private Partnership (P3), raising revenue through tolling to support nine significant projects. However, a court order has paused this proposal. Local transportation funding remains inadequate, with estimated annual unmet needs at $3.9B expected to reach $5.1B by 2030.

FIGURE 5 – PENNSYLVANIA'S TRANSPORTATION FUNDING GAP



Governor Wolf established the "Transportation Revenue Options Commission" (TROC) to develop a comprehensive proposal for improving funding mechanisms. The July 2021 report highlighted the erosion of the Gas Tax as a reliable revenue source and recommended shifting towards a User-Pays model like Mileage-Based User Fee (MBUF) [7] as a long-term solution. To transition, TROC recommended a three-phased approach including a mix of Road User charges, Tolling, Funding Redirection, Fees and Taxes. TROC considered loss of purchase power due to inflation, which has undoubtedly impacted the State's ability to maintain infrastructure. However, 2022 supply chain issues have induced higher than expected inflation, which will undoubtedly limit current and future funding.

PUBLIC SAFETY

Pennsylvania continuously maintains Federal government requirements that all new bridges conform to their Bridge Design Specifications, further supplemented by PennDOT's own specifications. Additionally, PennDOT's Publication 238 Bridge Inspection Safety Manual has been extensively updated to include scour evaluation criteria.

With respect to bridge inspection, Pennsylvania exceeds national safety standards. PennDOT validates its inspection program through its robust Quality Assurance program, where random bridges are independently re-inspected to ensure the consistent bridge condition evaluations. PennDOT conducts approximately 18,000 inspections annually on state-owned highway bridges and oversees the inspection of approximately 6,600 locally owned bridges. Some agencies perform all inspections internally, utilizing their own bridge management system.

Pennsylvania bridges are load rated with current inspection condition data to determine safe load carrying capacity. Bridges which cannot carry the state legal load are repaired, weight restricted, or closed. Additionally, bridges in poor condition can have their load carrying capacity reduced due to their physical condition, regardless of their calculated capacity. Currently, Pennsylvania has 1,784 weight restricted bridges and 285 closed bridges, often impacting the timeliness of emergency response services.

RESILIENCE

Resilience is the ability to plan for, withstand, and recover from natural or manmade hazards to provide critical services. PennDOT has initiated a multi-phased effort to better anticipate the consequences of extreme weather events and strategies to improve transportation system resiliency.

Pennsylvania's primary natural hazard is flooding. Frequency and magnitude of extreme flood events have increased between the 1950s and 2010s, recently damaging bridges and causing road restrictions. This hazard directly illustrates the demands for evaluating Pennsylvania's bridges ability to resist scour [8]. In September 2020, PennDOT released a report presenting a three-bridge pilot analysis to develop procedures to assess potential vulnerabilities and risks related to severe hydraulic changes. This report recommends a resilient design checklist to assist in the evaluation of bridge vulnerability.

PennDOT monitors scour critical bridges via increased inspection frequency and immediately following severe flooding. This program identifies scour critical bridges which may be subject to damage during high water events. PennDOT continuously evaluates inspection techniques for bridges subject to scour and incorporates these methods into bridge inspector training.

As freight movement demands increase, PennDOT has prioritized roadway widening and bridge replacement projects to improve traffic capacity. PennDOT prioritizes efforts to replace and rehabilitate fracture critical bridges generally vulnerable to hazards. Continuous evaluation of in-service bridges and consideration of resiliency in preliminary design will prolong the life of infrastructure.

INNOVATION

In 2012, PennDOT established the State Transportation Innovation Council to promote new implementation of well-researched, documented technologies and innovations to Pennsylvania. Selected innovations are developed for deployment and promoted to standard engineering practice.

Link slabs [9] are being piloted in PennDOT District 1-0 with the first installation occurring in Mercer County in 2020. Link slabs can be utilized in existing multi-span, non-continuous bridges to eliminate deck joints which require periodic maintenance and typically leak onto the structure below. Existing joints are removed and the joint slab is poured utilizing ultra-high performance concrete (UHPC) with mild reinforcement and a bond breaker to allow adequate movement of adjacent spans.

UHPC is being studied as a bridge deck overlay due to low permeability, resistance to freeze-thaw damage, abrasion resistance, low shrinkage, high strength and stiffness, and bond strength. The use of UHPC overlays reduces the ingress of contaminants into the deck, lowers rutting potential, reduces overlay thickness, and lowers overlay cracking potential. Typical UHPC mixes are self-consolidating [10] while other overlays lack such workability.

PennDOT is leading Digital Delivery Directive 2025 which reimagines project delivery from typical 2D format. PennDOT targets 2025 to begin 3D digital delivery utilizing models throughout the planning, design, construction, and asset management. The project remains in the development phase, working on pilot projects to establish uniform delivery standards.

Bridges

RECOMMENDATIONS TO RAISE THE GRADE

- Decrease reliability on declining gas tax revenue and develop legislation to implement the recommendations for alternate funding sources outlined in the TROC Proposal and the Drive Smart Act.
- To address local level funding shortcomings, promote more counties to enact the Fee for Local Use by implementing a $5 fee on vehicle registrations. Only 24 PA counties of 67 currently participate.
- Publicly advocate for the need and the benefits of investing in infrastructure. Properly educate the public to appropriately support elected officials to enact legislation that addresses funding shortfalls.
- Prioritize bridge maintenance and preservation funding. Continue transition from poor-first to LLCC to prevent bridges from becoming poor and increase bridge service life.
- Dedicate funding for research, innovation, and construction techniques such as accelerated bridge construction and prefabricated bridge elements to enhance durability, sustainability, resiliency to climate change and extend life expectancy.

Bridges

SOURCES

(1) 2022 ARTBA data for bridges exceeding 20 feet, consistent with 2018 PA Report Card.

(2) 2022 PennDOT data for state and locally owned bridges, including bridges less than 20 feet

(3) Includes bridge replacements, widening/rehabilitation, deck rehabilitation/ replacement, and other structural work

(4) Lowest Life Cycle Cost (LLCC): LLCC is a process designed to maximize the life of an asset at the lowest cost through a risk-based prioritization of preservation, rehabilitation, and reconstruction

(5) Source: PA Transportation Revenue Options Commission July 2021 Report

(6) Letting: Project Advertised for Contractor Bidding

(7) Mileage-Based User Fee (MBUS): Charging of road users based on the distance they drive (rather than via fuel taxes collected at the pump).

(8) Scour: Erosion of soil surrounding a bridge foundation, critically during high flow water events, potentially compromising bridge stability.

(9) Link slab: portion of the deck that extends across the joint of two adjacent simple spans

(10) Self-consolidating: highly flowable, non-segregating concrete that spreads into place, filling formwork, and surrounding reinforcement without any mechanical consolidation, such as traditional vibration of plastic concrete

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Bridges

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Dams

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THE KINZUA DAM, ON THE ALLEGHENY RIVER IN WARREN COUNTY, PENNSYLVANIA

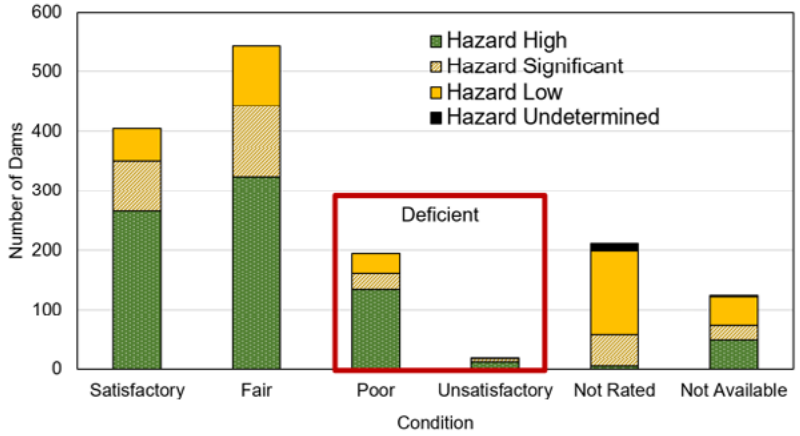
EXECUTIVE SUMMARY

Dams in Pennsylvania manage flood risk, provide fish and wildlife habitats, recreational opportunities, and drinking water supply. Of the 1,498 dams in Pennsylvania, over half (54%) are classified as high-hazard, likely causing death and economic damage under failure. The average age of Pennsylvania dams is 76 years old, nearly 20 years older than the national average and well beyond the typical 50-year design life. The high average age of Pennsylvania dams makes incorporating resiliency and innovation into the redesign cost-prohibitive, especially for the 61% of owners who are private citizens or organizations. Raising the grade on Pennsylvania dams requires increased funding, perhaps the establishment of a loan or grant program to financially assist owners with repairs, abandonment, and removal projects. Supporting modernization of current federal assistance programs through the passage of the 21st Century Dams Act would also serve to benefit Pennsylvanians.

CONDITION AND CAPACITY

The overall conditions of dams in Pennsylvania have not changed significantly since previous report cards.[1] Currently, there are 788 high-hazard dams and 314 significant-hazard dams in the state. Pennsylvania accounts for about 1.7% of all dams in the United States, yet the state has 5.2% and 3.1% of the high-hazard and significant-hazard dams respectively. Of the high and significant-hazard potential dams, 179 are considered in deficient condition (poor or unsatisfactory), and 443 are in fair condition. Many smaller, low-hazard potential dams that are managed by the Pennsylvania Department of Environmental Protection (PADEP) Division of Dam Safety are excluded from the National Inventory of Dams (NID) and do not have condition assessments available. PADEP estimates there are an additional 1,850 low-hazard dams, most of which are owned by private citizens or organizations, excluded from the reported total of 1,498 dams in the NID.

2021 CONDITION ASSESSMENT RATING AND HAZARD POTENTIAL OF PENNSYLVANIA DAMS

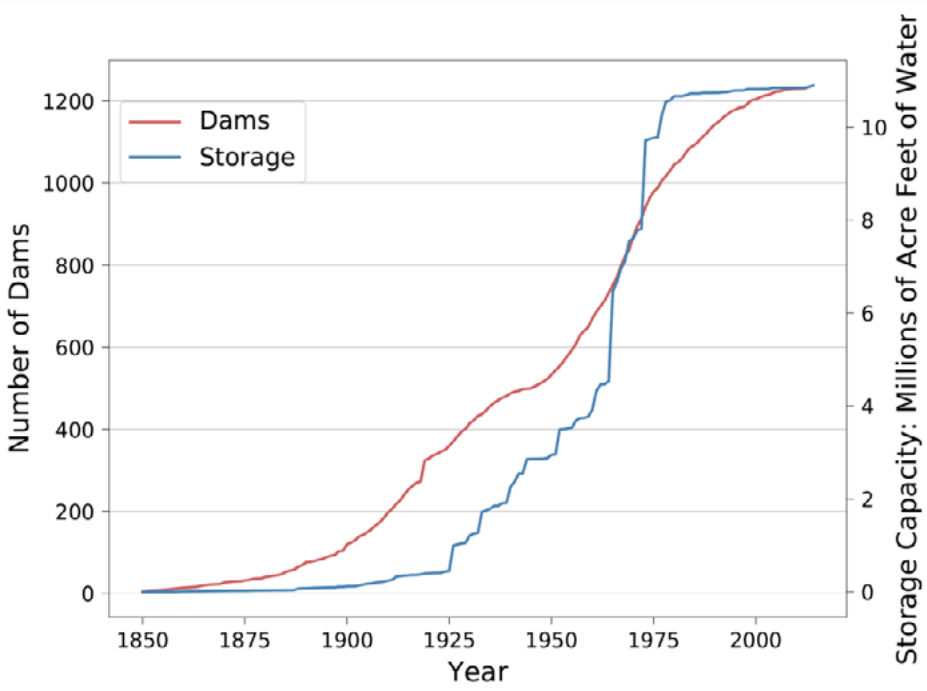


Pennsylvania is home to some of the oldest dams in the country. About 100 of the existing dams were built before 1900. The historic Johnstown Flood of 1889 also set off a dam construction phase leading to another 220 dams completed between 1900 and 1920 that are still in use today. The average age of Pennsylvania dams is 76 years old, nearly 20 years older than the national average (57 years old), and well beyond the typical 50-year design life. Dam age can increase repair and maintenance costs because with age major rehabilitation is often necessary to meet modern design criteria and current dam safety requirements.

OPERATIONS & MAINTENANCE

A 2019 study for Probable Maximum Precipitation (PMP) events was recently commissioned by PADEP provides methods and data to estimate the maximum amount of rainfall theoretically possible for a given dam. This is a significant improvement to outdated federal guidance dating to the 1950s. This tool, if voluntarily adopted, may strengthen operations and maintenance capacity for a variety of owners throughout the state. Private ownership accounts for 61% of Pennsylvania dams, including 391 high-hazard dams across the state (50% of statewide high hazard dams). State and federally owned dams have different ways of accessing funding for repairs and maintenance that are not always available to local and private owners.

MOST OF PENNSYLVANIA'S DAMS WERE BUILT IN THE MID-20TH CENTURY. DAMS ACROSS THE STATE CAN COLLECTIVELY HOLD ABOUT 11-MILLION-ACRE FEET OF WATER



PUBLIC SAFETY

PADEP oversees the inspection program for regulated dams (both publicly- and privately-owned) across the state. Inspections can reveal potential safety issues or maintenance problems before they become serious enough to risk a potential failure. Early discovery of issues can help reduce repair costs and limit risk to the public. Depending on recent assessments from safety officers and dam hazard ratings, dams are usually inspected every 1, 2, or 5 years. For the Pennsylvania dams listed for yearly inspection, 56 (7%) have not been inspected since before 2020. Over

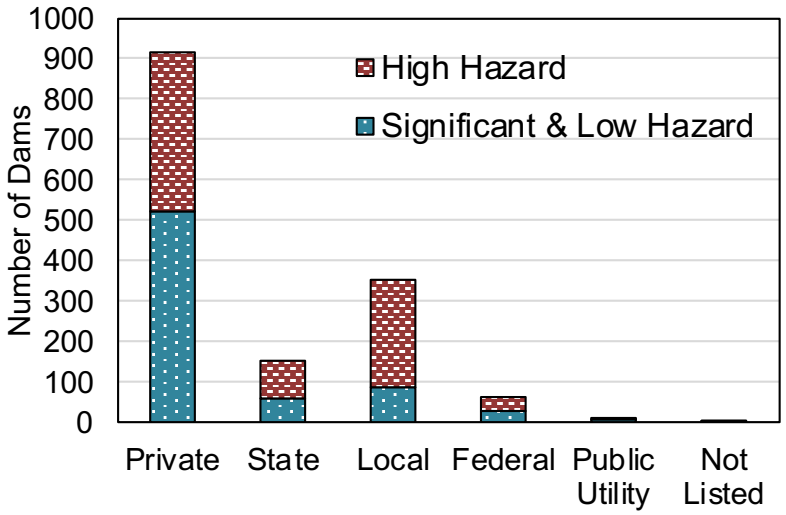
41% of dams prioritized for biannual inspection are out of compliance with this target. For those slated for inspection every 5 years, 15% have not been inspected since before 2015. Finding and retaining qualified staff continues to impact inspection frequency. Ensuring inspection compliance and rigor could be supported through increased staffing and salary support to the PADEP Division of Dam Safety. High and significant-hazard dams require an emergency action plan (EAP). Most high and significant-hazard dams have prepared and submitted an EAP (88%).

Low hazard dams can still present a danger to human life and health. Small dams that span the width of a river, known as run-of-river dams, can create a dangerous situation called a "hydraulic roller" or "drowning machine." Hydraulic rollers happen when flow going over a dam creates a current that moves upstream in the direction of the dam. This current can combine with trapped debris and air to create a current even the strongest swimmers cannot escape. Hydraulic rollers are especially dangerous to swimmers and paddlers and can look like tranquil water. Dock Street Dam in Harrisburg is only 6 feet high but has killed an estimated 29 people since its construction in 1913. Small dams like Dock Street Dam are often categorized as low-hazard because dam safety regulations often focus on downstream hazards due to failure. Investments in dam safety should consider not only the hazard potential of dam failure, but also other dam-related safety concerns. Passing the 21st Century Dams Act could support efforts to strengthen dam safety by incentivizing spending associated with maintenance of qualifying hydropower dams, increase funding for the National Dam Safety Program, and fund dam removal projects.

FUNDING & FUTURE NEED

Dam repair costs vary significantly, and costs have been rising in recent years alongside increased materials and labor demands. The PADEP Division of Dam Safety estimates that very minor repairs have a starting cost of $100,000 while major repairs can cost upwards of $10 million dollars per project. Estimates from multiple sources specified recent engineering design and construction costs on dam repairs in the state averaged about $7 million dollars per project. Since 2018, several large dams across the state have had major financial investments. For example, in 2020 Governor Wolf committed $23.8 million for a multi-year $43.5 million plan to repair 10 hazardous dams operated by the Pennsylvania Fish and Boat Commission. Additionally, the federal infrastructure bill has committed approximately $857 million to repair the Montgomery Locks and Dam in Beaver County, PA. Built in the 1930s, this system is commercially vital to the flow of river commerce across the region. The project transports between 15 and 20 million tons of commodities annually, yet it has a 50% chance of failure by 2028; thus, it is in critical need of immediate repair.

HALF OF PENNSYLVANIA'S HIGH-HAZARD POTENTIAL DAMS ARE OWNED BY PRIVATE CITIZENS OR ORGANIZATION



These recent investments will benefit individual dams, but leave many other high- and significant-hazard dams still in need of funding to improve deficiencies. The Association of State Dam Safety Officials estimated that Pennsylvania needs approximately $1.3 billion dollars to repair its non-federal high-hazard dams. In 2018, Pennsylvania passed the Private Dam Financial Assurance Program Act (PDFAP Act) to provide financial assurance assistance to owners of regulated private dams. This program intends to help private owners by restructuring the bond requirements from the PADEP into a group fund. The legislation also included a loan program to assist in repair costs for private owners that will be initiated when the fund reaches $1.5 million dollars. Unfortunately, based on the current fund growth rate, it will take many more years for this loan program to reach the minimum. Seeding this existing loan fund through state or federal support would allow for much-needed access to low-interest loans for private dam owners to prioritize maintenance and repairs of deficient dams.

RESILIENCY & INNOVATION

In many areas of Pennsylvania, extreme precipitation has increased in both frequency and magnitude, and this trend is expected to continue. These extreme events have caused increased flooding, which can overwhelm existing infrastructure, and threaten public safety. The PA Department of Conservation and Natural Resources (DCNR) has identified several dam-related actions in their Climate Change Adaptation Plan to address flooding including increasing the size of spillways or armoring earthen dam embankments, removing dams that are no longer serving the intended purpose, and prioritizing dam rehabilitation in collaboration with the PADEP based on the potential for failure. Warmer temperatures in lakes and reservoirs are also expected to result in warmer water downstream from dams, threatening aquatic species and promoting algae. To address these impacts, DCNR suggests that low-level water releases may need to be installed at many dams to introduce cooler water from deeper within reservoirs into downstream flow, since 75% of DCNR dams have spillways with uncontrolled release.

Priority projects identified for Pennsylvania Fish and Boat Commission investment:

Cloe Lake, Jefferson County

Fords Lake, Lackawanna County

Harris Pond, Luzerne County

Hemlock Lake, Indiana County

High Point Lake, Somerset County

Hunters Lake, Sullivan County

Kahle Lake, Venango County

Rose Valley Lake, Lycoming County

Stevens Lake, Wyoming County

Virgin Run Lake, Fayette County

Dams

C

RECOMMENDATIONS TO RAISE THE GRADE

- Ensure all remaining high-hazard and significant-hazard dams complete emergency action plans by 2025.
- Support dam policy modernization through the passage of the 21st Century Dams Act.
- Increase state funding to the PADEP Division of Dam Safety to ensure adequate staffing for technical expertise, support, and inspections.
- Increase funding to the PDFAP Act loan program to speed up program initiation and funding available to private dam owners.
- Continue to support funding for rehabilitation of publicly owned dam infrastructure.

SOURCES

Unless otherwise noted, all figures and statistics reported in this chapter were generated using the US Army Corps of Engineers National Inventory of Dams, 2021 update.

[1] In 2018, the calculation for deficient dams included all dams not categorized as satisfactory. Under this definition, 66% of high-hazard dams in Pennsylvania would currently be considered deficient which is in line with numbers reported from the 2014 Report Card. Current standards define deficiency as poor or unsatisfactory condition thus those are the numbers reported within.

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Dams

QUICK DEFINITIONS

Hazard classifications were developed by the Interagency Committee on Dam Safety (ICODS) as part of the National Dam Safety Program.

High Hazard: Dams where failure or misoperation will probably cause loss of human life and may also cause economic loss, environmental damage, and disruption of lifeline facilities.

Significant Hazard: Dams where failure or misoperation is not expected to cause loss of human life but will cause economic loss, environmental damage, and disruption of lifeline facilities.

Low Hazard: Dams where failure or misoperation is not expected to cause loss of human life and economic or environmental damages would be low and generally limited to the owner.

Deficient Condition: Dams are considered deficient when an issue is present that could cause a dam failure; thus, the dam would not meet the applicable minimum regulatory condition.

Drinking Water

D

EXECUTIVE SUMMARY

Most of Pennsylvania's public drinking water systems are struggling to fund projects to meet their replacement goals as well as new regulations. That's despite recent investment in main replacement and improvement in identifying vulnerability to failures for prioritization of repairs. Over the next 10 years, Pennsylvania's public water systems are projected to have a $10.2 billion funding gap, a number only very slightly offset with recent federal actions to provide infrastructure funding. In addition, there remain substantial amounts of lead service lines posing risk to public health, particularly for underserved communities. Emerging contaminants such as perfluoroalkyl and polyfluoroalkyl substances (PFAS) pose growing public health threat. To conquer these issues, water utilities need to adopt full-cost pricing and find technologies that enable more efficient operation and emergency response.

BACKGROUND

A majority of Pennsylvanians get their drinking water from public water systems. Only 12% of the population is reliant on individual, private wells for water service. Pennsylvania's Department of Environmental Protection (DEP) regulates nearly 8,400 PWS serving over 11 million people. The quality of the water and the infrastructure of these systems is regulated, but the financial burden of maintaining that infrastructure and the safety and quality of the water lies with the operating entity, and these entities must submit regular reports to DEP and to the public.

CONDITION AND CAPACITY

Thankfully, water is plentiful in Pennsylvania and our challenges do not resemble western states where drought is of primary concern. Regarding the physical condition and capacity of Pennsylvania PWS, the primary concern continues to be main breaks, which disrupt water supply, can cause damage to property and facilities in the vicinity of the break, and result in costly repairs. For example, one break that typifies those in small community systems involved a 70-year old main in Elizabeth Borough that broke at 1:30 AM on May 6, 2022 and turned a street into a fast moving stream, impacted at least 20 people in different homes and apartments, impacted several small businesses, and closed the road during the morning commute. This was the second time within three years that this line had broken. Main breaks can be more catastrophic, such as a break on a 48-inch main in Kingsessing (Philadelphia) that resulted in 8 million gallons of water lost, home/apartment evacuations and school closures, and even a rescue operation for one resident from a basement apartment.

Water mains in Pennsylvania cities are increasing in average age, with the rate of repair/replacement lagging substantially behind the rate required to maintain pipes at their recommended service life. Using Philadelphia as an example, the average annual break rate is 776 main breaks per year over the last 15 years, more frequent in cold-weather months (one three-day period in January had 111 reports of leaks in city-owned and private service lines). Recent replacement efforts have decreased the average water main age from 78 years in 2015 to approximately 76 years as of 2021 reporting, but the city remains behind on its goals for mains replacement.

In addition to leakage and structural concerns, the physical condition of water pipes can pose water quality concerns. Many Pennsylvania PWS implement flushing programs to remove mineral deposits and sediment accumulated inside pipes to improve water line capacity and water quality (taste, odor, and discoloration). These programs include notification of affected consumers of pending and ongoing flushing operations and many have online alerts that can be regularly monitored. Effective flushing programs often rely on closing valves to maximize pipeline scour and control the influx of clean water to the system; unfortunately, many of the valves in older water systems can be difficult to locate due to improvements on the surface (i.e. paving, regrading) or have become inoperable due to disuse and corrosion. Implementing asset management programs that include valve location, exercising, and renewal to better enhance flushing efforts can improve water quality, increase the potential service life of the water mains, and minimize the impact of main breaks and other repair events.

Water mains in Pennsylvania cities are increasing in average age, with the rate of repair/replacement lagging substantially behind the rate required to maintain pipes at their recommended service life. Using Philadelphia as an example, the average annual break rate is 776 main breaks per year over the last 15 years, more frequent in cold-weather months (one three-day period in January had 111 reports of leaks in city-owned and private service lines).

FUNDING AND FUTURE NEED

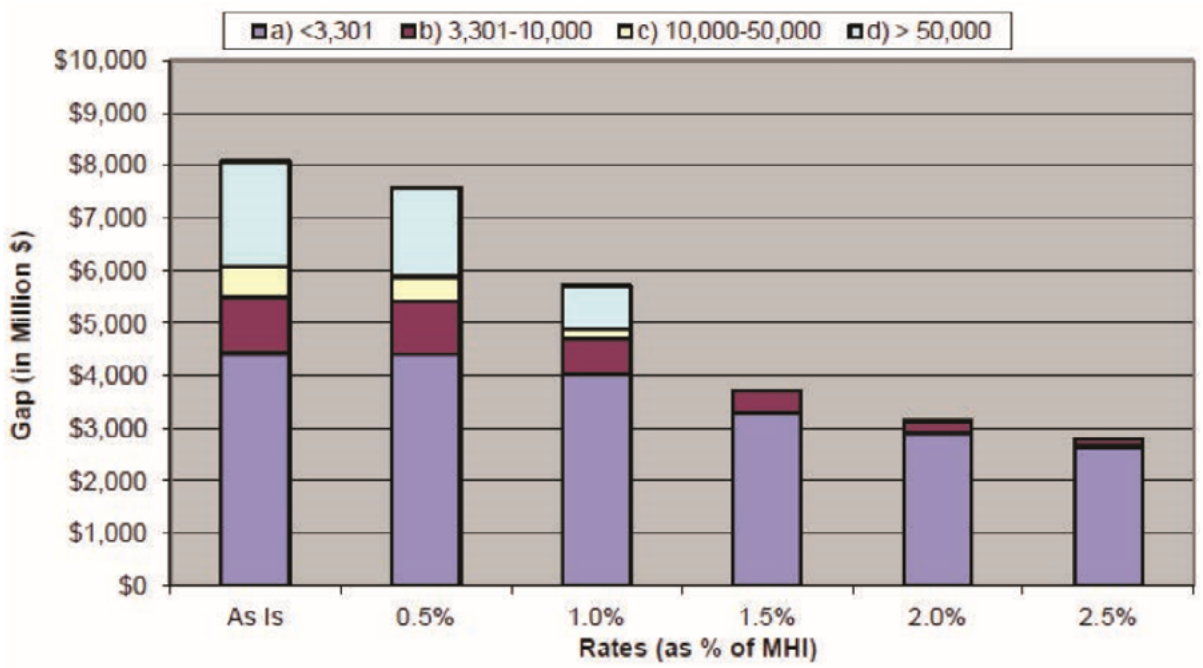
Pennsylvania PWS depend on a combination of federal and state funding, as well as user fees, to meet demands from aging drinking water infrastructure, a growing population, and new regulatory requirements. Beyond user fees, the main supplemental funding source is the Federal Drinking Water State Revolving Fund (DWSRF), which is managed by the Pennsylvania Infrastructure Investment Authority (PENNVEST). According to DEP's 2015 Water and Wastewater Gap Study, PENNVEST is expected to provide $800 million over the next 10 years in grants and loans for public and private water and wastewater systems. Total available subsidy value increases to $900 million when including other funding sources (U.S. Dept. of Agriculture Loans & Grants, U.S. Dept. of Housing and Urban Development Community Development Block Grants (HUD CDBG), and Appalachian Region Commission Grants). In December 2021, USEPA announced that Pennsylvania will receive $240.4 million in DWSRF funding in 2022 under the Bipartisan Infrastructure Law with an emphasis on supporting underserved communities – this will be administered under the DWSRF. Additionally, there are various sources of grants and loans available through USEPA, the Pennsylvania Department of Community and Economic Development (DCED), and the Small Business Administration that are directed towards smaller utilities.

Still, there remains a gap in funding between what would be required to fund adequate main renewal programs given the age of distribution infrastructure and what is

available. The drinking water gap over the next 10 years in Pennsylvania is $10.2 billion. An estimate of average utility rates performed by RentCafe indicates statewide average water rates are slightly lower in Pennsylvania ($31/month) than the national average ($39 per month). These rates do not reflect the long-term costs of maintaining and repairing the infrastructure; often they are just a reflection of short-term construction and service costs. Figure 1 below demonstrates that if rates, on a statewide average basis were allowed to rise to 1.5% of median household income (MHI), the funding gap could be met by many of the PWS. However, Pennsylvania has more than 2,200 community drinking water systems, many of which are small water systems serving fewer than 3,300 consumers. Addressing the gap is most difficult for small systems, due to high cost and low MHI. Many small systems will not be able to meet their needs through increasing user rates without state and federal funding assistance.

FIGURE 1. DRINKING WATER FACILITIES – GAP VS RATES

Total Gap for Facilities Serving Populations



In recent years, some PWS have been turning to partnerships with private or public entities to alleviate debt crises. These are advantageous when the public entity does not have the budget for long-term maintenance and replacement and can not enact the steep rate hikes required to gain capital. The partnership enables lesser rate increases due to a combination of private investment and operational efficiency and scale. The inevitable rate increase often creates public scrutiny and potential legal battles, such as in the 2019 agreement between the Delaware County Regional Water Authority (DELCORA) and Aqua Pennsylvania that has been bitterly opposed by Delaware County. Care must be taken by all parties to detail the benefits and ramifications to the public served by these partnerships during the negotiation and agreement.

PUBLIC SAFETY

One emerging concern nationally as well as in Pennsylvania is a class of chemicals known as perfluoroalkyl and polyfluoroalkyl substances (PFAS), otherwise known as "forever chemicals" and used frequently in industrial applications including for commonplace items such as non-stick pans, cosmetics, carpets, fire-fighting foams, paints, clothing, and even fast-food wrappers. These substances are highly persistent, difficult to break down, and bioaccumulate in living organisms over time. Only a handful of Pennsylvania water utilities exceeded the previous EPA health advisory for PFAS, but a new advisory has been set in June 2022 for four PFAS chemicals. StateImpact Pennsylvania reports that roughly one-third of 412 Pennsylvania drinking water systems tested for PFAS in 2021 detected the presence of the chemicals above the new EPA health advisory.

Under the Lead and Copper Rule, DEP is working with water systems to reduce lead levels that may be caused by the distribution system and household plumbing fixtures by requiring treatment to address the corrosiveness of the water. Currently 91.4% of the population served by community water systems and 86.6% of all children at day-care and school facilities that have their own water supply are protected by optimized corrosion control. There remain hundreds of thousands of residential lead pipes still in use in Pennsylvania, with actions to date largely focused on public education about the dangers of lead pipes and financial incentives (and assistance) to encourage replacement. In 2018, Governor Wolf signed Act 120 into law enabling financial and legal mechanisms for Pennsylvania's private water utilities to replace residential-owned lead service lines with costs recovered through water tariffs rather than the individual residents. The Bipartisan Infrastructure Law will direct funding specifically for lead service replacement.

In March 2020, the Pittsburgh Water and Sewer Authority (PWSA) agreed to remove thousands of lead water pipes by 2026 in an agreement negotiated by community groups (Pittsburgh United, Our Water Campaign) represented by lawyers from the Natural Resources Defense Council (NRDC) and the Pennsylvania Utility Law Project.

RESILIENCY AND INNOVATION

The federal America's Water Infrastructure Act (AWIA) of 2018 bolstered existing federal and state requirements for water system security. While original requirements were intended to protect physical security, they were broad enough to also imply cyber-security. Under AWIA, PWS serving a population greater than 3,300 were required to conduct and update a Risk Assessment and Emergency Response Plan and submit certification of completion to EPA. These plans determine what threats exist and what mitigation measures are available or desired for implementation and apply to both physical security and cyber-security. A 2017 Governor's report discusses the formation of emergency response plans but does not include a discussion on capital improvements required. Additional sources of funding for construction of these measures (Emergency Standby Power Generators, Emergency Interconnects between PWS, etc.) should be considered by the State legislature.

In 2021, the Pennsylvania Public Utility Commission issued two cybersecurity advisories, the Ransom Threats Cybersecurity Advisory (May 24, 2021) and Public Water Company Cybersecurity Advisory (February 25, 2021). These were in response to national incidents that victimized pipeline and water utility operators and strongly recommended all utilities to conduct both physical and cybersecurity risk assessments on their critical infrastructure using SCADA and cybersecurity standards from the National Institute of Standards and Technology (NIST) and to timely report incidents through appropriate channels. Recommendations including updates to hardware and software, use of multiple-factor authentication and strong passwords, and routine audits. Resources for cyber-security are available from the cybersecurity and Infrastructure Security Agency (CISA) and from USEPA, though audit and implementation of security measures represent another addition to the budget for water utilities.

Drinking Water

RECOMMENDATIONS TO RAISE THE GRADE

- Increase available funding and assistance for emergency response including physical measures (emergency interconnects, standby power, etc.) as well as cyber security measures and practices.
- Implement the use of infrastructure asset management programs on a larger scale. Effective asset management programs can save money by identifying non-performing assets, timing the renewal and maintenance of infrastructure/assets so that their useful life is maximized, minimizing expensive catastrophic failures, and establishing long-range financial planning.
- Implement reasonable increases in what customers pay for water services to reflect the real cost of service, based on full life cycle costs. User fees should be evaluated for increases greater than 1.5% MHI in communities that can tolerate higher rates based on income, since there is still a projected funding gap even with rates set at 1.5% MHI.
- Provide more state and federal grant funding to subsidize the projected funding gap that cannot be met with reasonable rate increases and for communities with below average income levels, in order to protect the environment and human health and safety.
- Evaluate consolidation of smaller PWS into regionalized systems to spread the capital and operating costs across a larger customer base, streamlining management and increase cost-effectiveness for customers.

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Drinking Water

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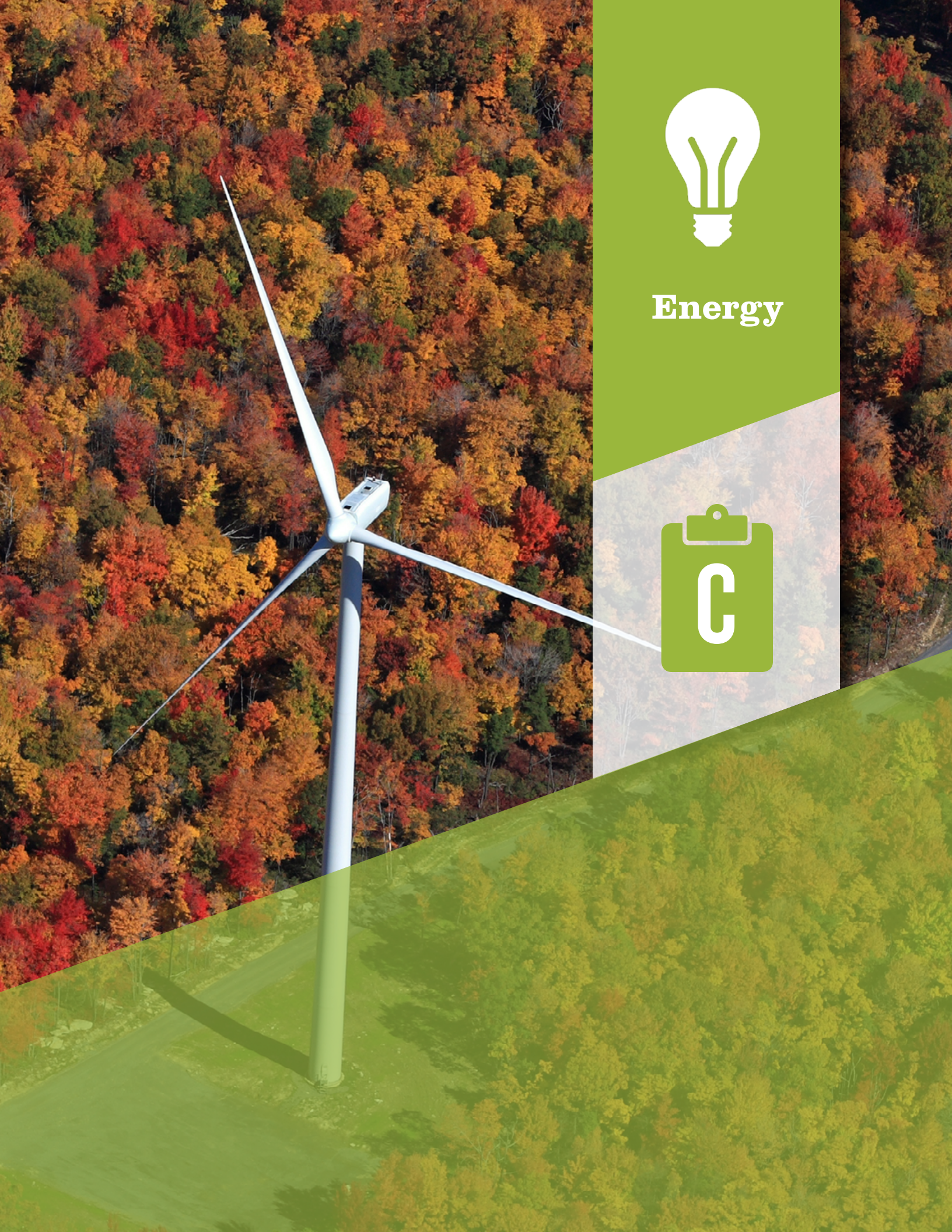

Energy

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EXECUTIVE SUMMARY

Pennsylvania benefits from a large fuels production industry focused on natural gas, as well as a robust portfolio of power generation facilities that makes the state America's largest electricity exporter. The multi-state electricity grid operated by PJM Interconnect serves all of Pennsylvania, and that regional power grid has a 30% generation capacity buffer to meet electricity demand. Some local utilities in Pennsylvania, however, have seen the reliability of their distribution systems worsen, with local blackouts nearly tripling in number over the past 25 years. Achieving a reliable and decarbonized power grid in Pennsylvania would require as much as $100 billion in investment in generation, transmission, and end-use electrification over the next 25 years. Electrifying Pennsylvania transportation alone could double electricity consumption in the state and connecting the state's most significant industrial carbon emitters to a network of sequestration pipelines could involve a $2 billion investment in addition to the costs of capturing CO2 from nearly 300 power plants and industrial facilities.

CAPACITY AND CONDITION

Fuels Production and Delivery

Pennsylvania's emergence as a major producer of natural gas has brought with it extensive investment in new production, compression, and gas transmission capacity over the past decade. Pennsylvania has around 200,000 natural gas wells (both conventional and "fracked" wells) and around 100,000 miles of natural gas pipeline. As natural gas prices have declined and concerns about safety and environmental impact have risen, several high-profile pipeline projects in Pennsylvania have been canceled. Many of these projects would have increased natural gas export capacity from Pennsylvania to other states or to global markets.

Pennsylvania has lost capacity in coal and refined petroleum products. Coal mining in Pennsylvania has been steadily declining over the past decade. In 2020, Pennsylvania hit its lowest level of coal production in over a century. In 2019, the Philadelphia Energy Solutions refinery near Philadelphia closed following a destructive fire.

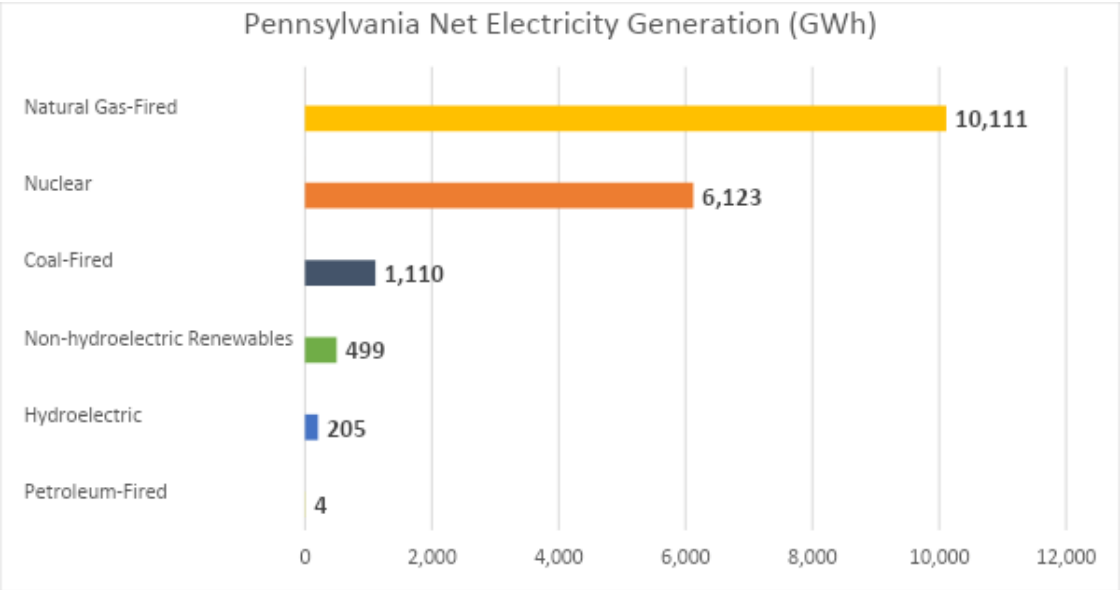
Electric Power Generation

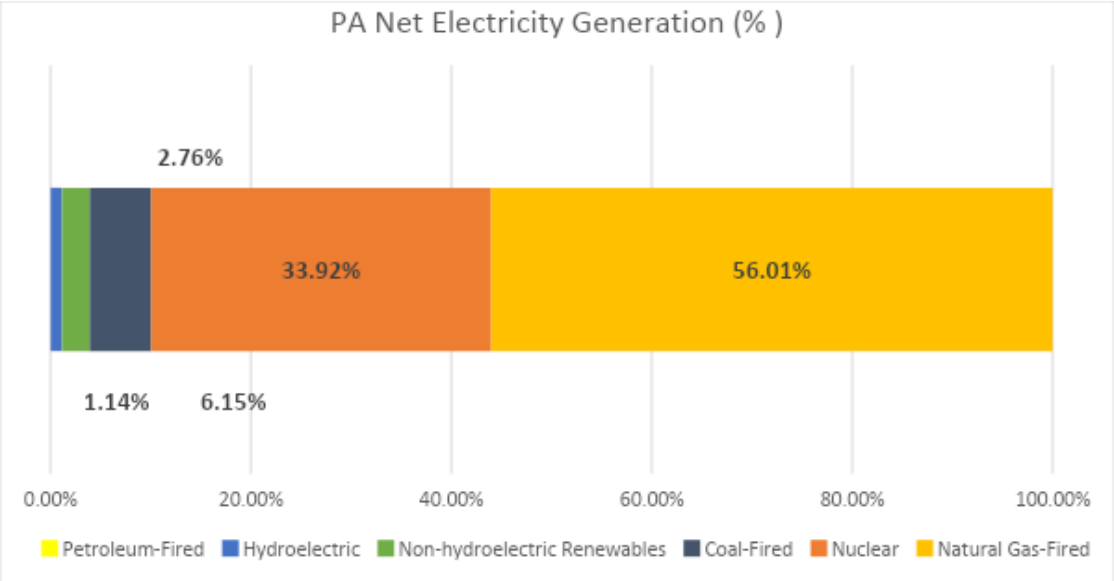
According to data from the U.S. Energy Information Administration, Pennsylvania is the third-largest producer of electricity in the country. Pennsylvania benefits from a diverse power generation fuel and technology blend. Pennsylvania's electric generation regularly exceeds the Commonwealth's consumption resulting in the export of more electricity outside its borders than any other state.

Pennsylvania has seen major shifts in the technologies and fuels used for power generation. In 2010, coal provided 48% of the state's net electricity generation, and natural gas accounted for only 15%. By 2020, coal had declined to 10% of the Commonwealth's electricity production while natural gas boomed to 52% of net

generation within Pennsylvania. This shift is due to a combination of economic factors (cheap natural gas out-competing coal in the electricity market) and regulatory factors that have increased the cost of coal generation. Natural gas generation has accounted for nearly all the generating capacity added to Pennsylvania's profile since 2019. Solar is on the rise with the number of small-scale solar photovoltaic (PV) installations in Pennsylvania doubling since 2015. Over 300 megawatts of renewable energy projects, many of which are solar, are scheduled to be constructed within the next year.

Pennsylvania should continue to have sufficient capacity to meet its electric needs for the foreseeable future. PJM's "reserve margin," which measures the surplus electric generation capacity in the region, is over 30%. Meanwhile, electricity demand over the next decade is projected to increase by 2%, even incorporating growth in vehicle electrification. The Commonwealth continues to rely on natural gas for generation; distributed and renewable generation are still a growing part of in-state capacity.





Pennsylvania's energy sector is affected by a number of state and federal policy initiatives. At the state level, Pennsylvania's existing Alternative Energy Portfolio Standard (AEPS) has encouraged new construction in wind and solar energy, and a recent refinement to the AEPS requiring qualifying solar resources to be built in-state has boosted the Commonwealth's solar energy market. With the AEPS renewable energy targets expiring in 2021, a regulatory mechanism to encourage additional investment in renewable energy in Pennsylvania is unclear.

Pennsylvania is also in the process of joining the Regional Greenhouse Gas Initiative (RGGI), a voluntary carbon management program for electric generating units. Eleven other states, including several in the PJM footprint, currently participate in RGGI. Participation in RGGI would likely have significant implications for Pennsylvania's power generation fleet. RGGI would likely further economically challenge the coal energy sector in Pennsylvania while encouraging low-carbon sources like nuclear, wind and solar.

OPERATIONS AND MAINTENANCE

Pennsylvania's electrical transmission and distribution (T&D) systems are part of the PJM Interconnection, a regional transmission organization (RTO) that coordinates the movement of electricity through a region that extends to 13 states and the District of Columbia. Eleven electric distribution companies of varying sizes serve customers in the state, under regulation by the Pennsylvania Public Utility Commission (PUC).

TABLE 1: PENNSYLVANIA ELECTRIC DISTRIBUTION COMPANIES (EDCS)

PA PUC Regulated Electric Utilities	Parent Co.	PA Customers
Citizens Electric of Lewisburg	C&T Enterprises [1]	7,000
Duquesne Light Company	DQE Holdings [2]	600,000
Metropolitan Edison Company	First Energy	560,000
Pennsylvania Electric Company	First Energy	600,000
PECO Energy Company	Exelon	1,600,000
Pennsylvania Power Company	First Energy	160,000
Pike County Light & Power Company	Corning Natural Gas Corp.	5,000
PPL Electric Utilities	PPL Corporation	1,400,000
UGI Utilities	UGI Corporation	700,000
Wellsboro Electric Company	C&T Enterprises 1	6,000
West Penn Power	First Energy	720,000

1. Owned 50/50 by Claverack and Tri-County Rural Electric Cooperatives of Wysox and Mansfield, PA
2. Owned by Epsom Investment Pte. Ltd., Three Rivers Utility Holdings, LLC, and AIA Energy North America

Much of the T&D infrastructure in Pennsylvania was constructed in the 1950s and 1960s, with some dating back to the 1920s, and upgrades are needed to maintain reliable operations as well as adapt to new power generation sources like wind, solar and natural gas, that are located in different places than legacy coal and nuclear plants.

FUNDING & FUTURE NEED

Much of Pennsylvania's energy infrastructure and supplies are owned and operated by private entities. Investments in new infrastructure and the maintenance of existing assets are driven by both business opportunities and regulatory requirements. The recently-passed Infrastructure Investment and Jobs Act (IIJA) is slated to establish 60 new programs that will provide funding support for energy infrastructure in multiple areas affecting Pennsylvania energy. The Inflation Reduction Act (IRA) provides other programs to support clean energy. As of this writing, Pennsylvania can expect $171 million to support electric vehicle charging and $75 million to support hardening infrastructure against extreme weather events and cyber-attacks.

Additionally, Pennsylvania will be well positioned for additional funding through IIJA and IRA:

- As one of the largest steel-producing states and the sixth-largest manufacturing state, Pennsylvania's industry represents a major market for cleanly-produced hydrogen;
- Pennsylvania could store up to 300 years of the state's carbon dioxide production, with investments in facilities for carbon capture and storage performance validation;
- Supporting electrified transportation through a share of the $2.5 billion in grant funds allocated to electric vehicle charging through IIJA;
- Approximately $3.3 billion in nuclear energy production tax credits as the second-largest nuclear power supplier in the U.S.;
- Capture of critical minerals from industrial wastes and abandoned mines to enhance security in national materials supply chains.
- $3.5 billion available for weatherization and other energy efficiency improvements.

Even with these opportunities, achieving a clean and resilient energy system in Pennsylvania will require additional funding in power generation and transmission, carbon capture and sequestration and clean fuels. Achieving a reliable and decarbonized power grid in Pennsylvania would require as much as $100 billion in investment in generation, transmission, and end-use electrification over the next 25 years. Electrifying Pennsylvania transportation alone could double electricity consumption in the state, and connecting the state's most significant industrial carbon emitters to a network of sequestration pipelines could involve a $2 billion investment in addition to the costs of capturing CO2 from nearly 300 power plants and industrial facilities. The 45Q tax credit of $60-$85/metric ton for carbon capture activities would apply to only 50 of these Pennsylvania facilities.

PUBLIC SAFETY AND RESILIENCE

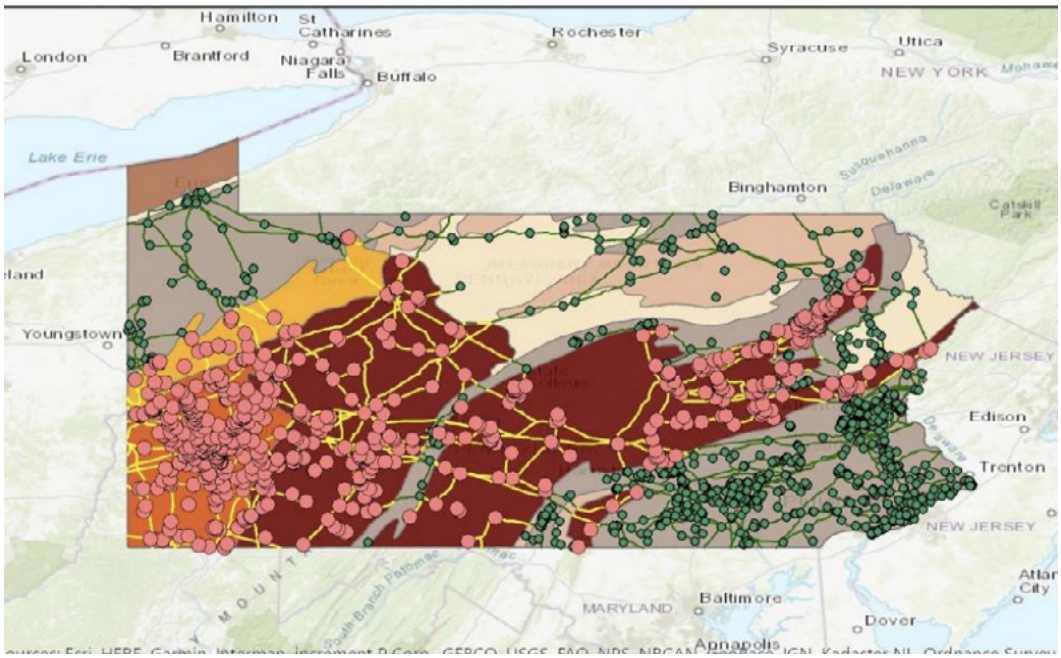
The Pennsylvania PUC monitors and regulates the state's EDCs and publishes reliability performance metrics. The PUC reported the following 3-year average performance compliance data for Pennsylvania's 11 EDCs in 2020:

- 6 EDCs failed to meet the rolling 3-year CAIDI (Customer Average Interruption Duration) performance standard. For these utilities, customers are experiencing longer blackouts on average than they have in the past.
- 3 EDCs failed to meet the rolling 3-year SAIFI (System Average Interruption Frequency) performance standard. Customers of these utilities are experiencing more frequent blackouts than they have in the past.
- 3 EDCs failed to meet the rolling 3-year SAIDI (System Average Interruption Duration) performance standard. These utilities are taking longer to restore service following blackouts than they have in the past.

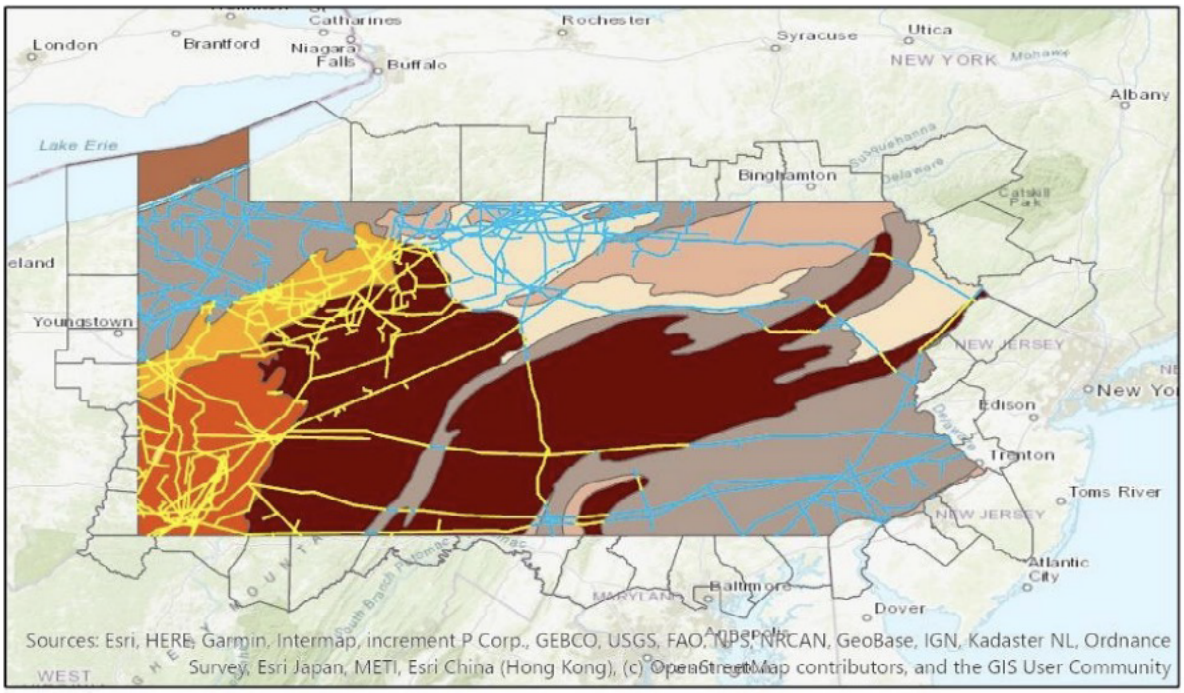
Trees and equipment failures were the top two outage causes, not including major storm events, which have been more common in the past several years. PUC acknowledged an average of 27 major events each year from 2018-2020, compared to an average of 12 each year from 2015-2017.

The resilience of the T&D infrastructure in Pennsylvania must continue to improve in the face of increased risks from severe weather events and newer challenges, including the increased prevalence of cyber-attacks. Of particular concern for the reliability of electricity and natural gas infrastructure in Pennsylvania are floods and landslides, both of which can follow extreme precipitation events. The 2020 Climate Impacts Assessment report from the Pennsylvania Department of Environmental Protection highlighted the extent of energy infrastructure in Pennsylvania that sits in identified flood zones. In Southwestern Pennsylvania, landslides following extreme precipitation events pose a further risk to multiple energy infrastructures including electric transmission lines and substations. Even underground natural gas pipelines can be affected by the forces created by large landslides. Placing precise numbers on many of these risks is not possible since much of the data required to assess these risks is not in the public domain. Continued evaluation is necessary on the part of infrastructure asset owners and regulators in Pennsylvania to ensure robust operation of critical energy systems in the face of extreme weather.

[Note: The following three figures are taken from the 2020 PA climate impacts assessment and could be used to demonstrate the potential exposure of PA energy infrastructure to extreme weather hazards]



Electric power substations in identified landslide hazard areas (red dots) and electric transmission lines whose support towers are in identified landslide hazard areas (yellow lines). Green dots and green lines indicates substations and transmission lines that lie outside of identified landslide hazard areas.



Natural gas pipelines in identified landslide hazard areas (yellow lines). Blue lines indicate natural gas pipelines that lie outside of identified landslide hazard areas.

	Proportion in Flood Zone	Proportion in Landslide Hazard Zone
Electric Power Plants (% of capacity)	3.40%	N/A
Electric Transmission (% of line-miles)	5.29%	49.25%
Electric Substations	6.16%	41.16%
Natural Gas Pipelines (% of pipe-miles)	5.00%	49.64%
Natural Gas Compressor Stations	5.79%	N/A
Natural Gas Processing Plants	0.00%	N/A
Petroleum Refineries	50.00%	N/A
Petroleum Product Pipelines (% of pipe-miles)	7.65%	N/A
Railroads (% of rail-miles)	36.47%	55.29%

Exposure to Flood and Landslide Hazard Zones for Selected Energy and Transportation Infrastructure

INNOVATION

Distributed energy resources (DERs) are a key component to grid reliability and flexibility and demonstrate the importance of end uses in infrastructure policy. DERs are a mechanism to produce and distribute energy closer to the point of consumption rather than relying on complex regional infrastructure. The set of DER technologies includes:

- Small-scale solar photovoltaics;
- Batteries, including those in electric vehicles;
- Energy efficiency (e.g., green roofs, residential and facilities insulation retrofits);
- Demand response to reduce usage and decrease stress on the grid (e.g. text messages to ratepayers asking them to conserve during moments of dangerously high usage.).

DERs can reduce costs and increase resilience for individual consumers.DERs can also reduce systems costs through avoided transmission and distribution infrastructure investments. DERs can also promote a more robust power grid. Grid-interactive buildings, advanced inverters, and virtual power plants that allow third parties to aggregate and control multiple sources such as distributed batteries are just a few of the technologies that can increase awareness of and two-way-communication with behind-the-meter resources for grid operators.

While there is tremendous potential for DERs to complement the existing electric power grid, equitable planning and investment are essential to success. Access to and participation in DERs programs should be prioritized in the communities most impacted by high relative utility costs (low-income households pay a higher share of their income in utility bills than wealthier households) as well as those most likely to be impacted by climate change through flooding and severe storms that can damage large energy infrastructure.

The Conowingo dam crosses the Susquehanna River in Pennsylvania.

Energy

RECOMMENDATIONS TO RAISE THE GRADE

- PJM and its member utilites should be given incentives to broaden investments in power grid monitoring infrastructure. This will help to increase grid resilience and allow for the flexibility to accommodate the integration of additional renewable resources.
- Continued efforts to coordinate the planning and operations of electricity and natural gas transmission systems can support greater grid reliability during the wintertime, when both gas and electricity demand are high.
- Pennsylvania should extend and expand its Alternative Energy Portfolio Standard or implement other measures to support renewable energy development.
- More granular data on risk and resilience for Pennsylvania's energy infrastructure should be made available.
- Efforts to promote electrification in vehicles and buildings can reduce multiple sources of air pollution, support Pennsylvania energy innovation, and enable a cleaner and more robust electricity grid.
- The current 45Q tax credit could be expanded to include smaller gas-fired and coal-fired power plants as well as smaller steel and other manufacturing facilities.
- Expand efforts in weatherization, energy efficiency and DERs to reduce the energy burden of low-income Pennsylvanians.

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Hazardous Waste

B-

EXECUTIVE SUMMARY

There was an estimated 345,000 tons of hazardous materials managed in Pennsylvania during 2019, the latest year for which data were available. This is a 19% decrease from the previous 2017 biennial reporting year, with four fewer sites Superfund National Priority List than the 2018 report card – a 4% decrease of the Commonwealth total. Voluntary cleanups under 1995's Act 2 included 314 successful cleanups in the FY 2020-21, with another 1,753 site cleanups in progress. Despite increased state funding and new opportunities from federal legislation, disproportionate hazardous waste impacts persist within low-income and minority communities.

BACKGROUND

The Pennsylvania Department of Environmental Protection's (PADEP's) mission is to protect Pennsylvania's air, land, and water from pollution and to provide for the health and safety of its citizens through a cleaner environment.

PADEP is responsible for numerous programs including hazardous waste management and brownfield redevelopment (remediation and reutilization of blighted properties). Funding from both the Commonwealth General Fund and the Federal government is provided to ensure resources are in place to keep the programs afloat and to provide staffing to support the mission put forth by PADEP. The Infrastructure Investment and Jobs Act, signed in November 2021 by President Biden, will provide hundreds of millions of dollars for Pennsylvania through a variety of programs.

CONDITION AND CAPACITY

The current condition and capacity of Pennsylvania's hazardous waste infrastructure is average with respect to the rest of the nation. The condition of hazardous waste infrastructure can be measured by evaluating the number of federally recognized contaminated sites (Superfund sites), quantifying the success of the Commonwealth's voluntary cleanup program (Act 2), assessing the trend of hazardous waste management and handling in recent years, trends in the reclamation of mine sites, and strategies for dealing with emerging contaminants (Perfluoroalkyl and Polyfluoroalkyl Substances – PFAS). Each of these are discussed in more detail below.

Superfund - The U.S. Environmental Protection Agency's Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) program, commonly referred to as Superfund, is designed to address highly contaminated abandoned sites. Pennsylvania currently has 90 Federal National Priority List (NPL) sites, the third highest number in the nation behind New Jersey (114) and California (97). This is four less than the 2018 reporting year. The national average is 27 NPL sites per state. The relatively high number of NPL sites is largely an artifact of the Commonwealth's rich industrial history. NPL sites are addressed through a sequential process of site studies to determine the extent of contamination and options, implementing remedial actions, and removal from the

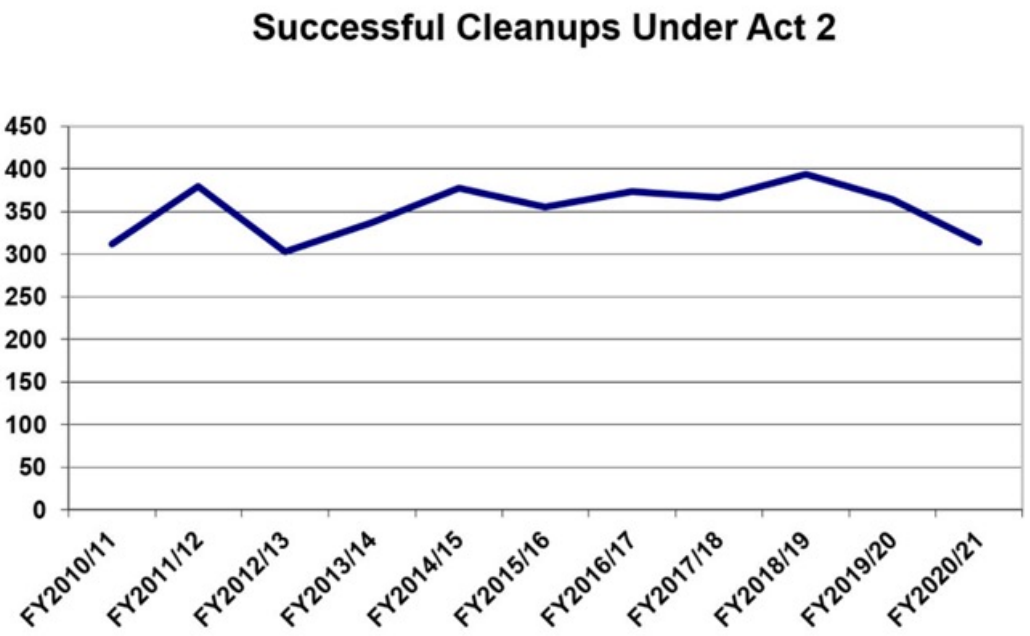
NPL (also known as "delisting"). PA has reached remedial construction completion on 99 NPL sites since 1986. Two sites have reached remedial construction completion over the last 4 years.

Hazardous Sites Cleanup - The Hazardous Sites Cleanup Fund (HSCF), a special fund established under Section 901 of the Hazardous Sites Cleanup Act (HSCA) (35 P.S. §6020.901), provides the funding for PADEP to carry out several activities to address releases and threatened releases of hazardous substances to the environment. These activities include investigation, cleanup and monitoring at contaminated sites, implementation of Pennsylvania's Land Recycling Program, and participation in the federal Resource Conservation and Recovery Act of 1976 (RCRA) Hazardous Waste Program and in the federal Superfund Program (coordinated with the EPA).

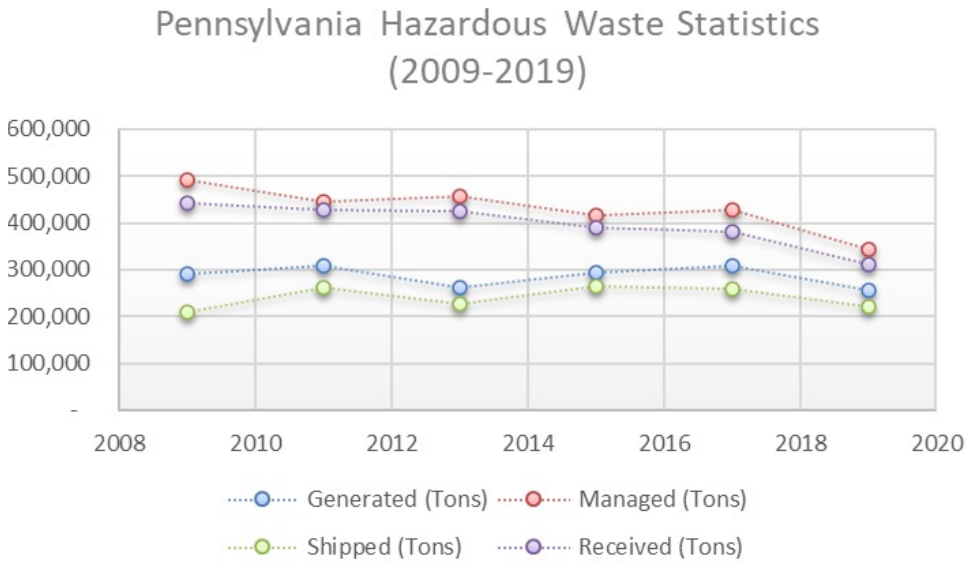
During the 2020-21 fiscal year (FY), PADEP performed investigations of groundwater and soil contamination, replaced contaminated water supplies, removed and disposed of toxic wastes, implemented groundwater treatment actions, and conducted other response actions. PADEP has addressed threats posed by toxic chlorinated solvents, toxic heavy metals, flammable materials, corrosive substances and radiological materials.

- 87 PADEP Investigations, Cleanups, and Monitoring Funded under HSCA
- 46 Cleanup Activities by Responsible Parties (RPs)
- 8 Federal Military Formerly Used Defense Sites (FUDS)

Act 2 Land Recycling (Voluntary Cleanup) Program - Pennsylvania's Land Recycling Program (Voluntary Cleanup) aims to reduce land consumption and encourages the transformation of abandoned and idle properties into economic opportunities. Since its inception in 1995, the program has resulted in 7,807 site cleanups. This includes 314 successful cleanups in the FY 2020-21, with another 1,753 site cleanups in progress.



Resource Conservation and Recovery Act (RCRA) - Whereas the Superfund program manages legacy hazardous waste sites, RCRA provides instructions for current hazardous waste generation. Under RCRA, hazardous waste is managed from the moment it is generated to its final disposal. As indicated in the figure below, the annual quantity of hazardous waste generated in Pennsylvania has declined by approximately 12% over the past 10 years (2009-2019). The 2021 biennial report is due out later in 2022.



Hazardous waste is treated and disposed of at treatment, storage and disposal facilities (TSDFs). The Commonwealth's environmental performance can be assessed in terms of the volumes managed at these permitted TSDFs and also how much hazardous waste is imported from other states or exported into the Commonwealth. Over the past decade, an annual average of 430,000 tons of hazardous waste were managed in Pennsylvania TSDFs. Pennsylvania exported 221,000 tons of hazardous waste and imported 312,000 tons of waste for management in 2019, which constitutes reductions of 15% and 18%, respectively as compared to the 2017 reporting year (most recent data available).

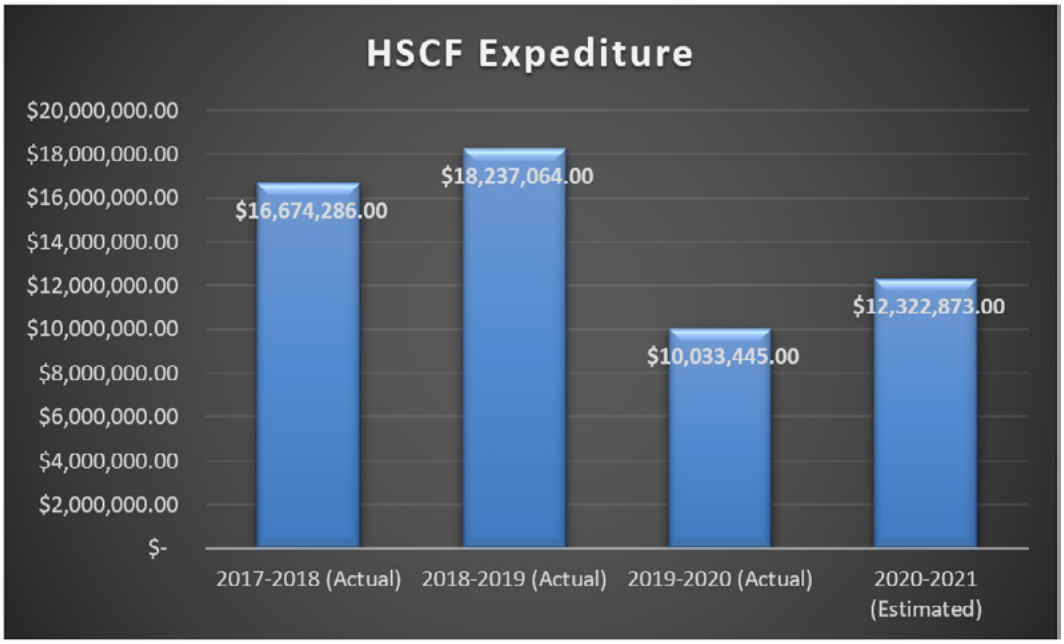
FUNDING AND FUTURE NEEDS

PADEP Budget - On February 28, 2022, PADEP leadership presented the 2022-23 proposed budget for the PADEP to the House Appropriations Committee. The budget request includes $211,387,000 from the General Fund and a total spending authorization of $1.557 billion. The proposal includes approximately $652million of special fund authorizations as well as $554million in Federal spending authority. These are all significant increases from the 2018 PARC reporting year.

The Infrastructure Investment and Jobs Act (IIJA), signed in November 2021 by President Biden, will provide hundreds of millions of dollars for Pennsylvania through a variety of programs. The IIJA will assist in addressing the following:

Oil and Gas Well Plugging	Pennsylvania qualifies for $25 million in funding in the first year and could possibly qualify for more than $300 million in additional funding over a multi-year period under a formula grant, $40 million in performance grants, and $30 million in matching grants.
Abandoned Mine Land	The IIJA will invest an additional $244.9 million over the next 15 years to address abandoned mine land cleanup.
Emerging Contaminants (per-and polyfluoroalkyl substances – [PFAs])	Additional resources are available from the IIJA for replacement and improvements to treatment systems to help protect against emerging contaminants. PADEP awaits final guidance from the federal government on some of these programs.

Hazardous Sites Cleanup Fund - HSCF provides funding for the Bureau of Environmental Cleanup and Brownfields, which develops and manages the commonwealth's Site Remediation, Land Recycling (Brownfields) and Storage Tanks Programs. The PADEP issues an HSCF annual report. The annual HSCF Expenditures since the 2018 PARC reporting year are as follows:



Contaminated Site Funding Opportunities - The Commonwealth provides various funding programs and other incentives with the mission to assist business, communities, and municipalities with environmental cleanups of contaminated sites. The Industrial Site Reuse Program (ISRP) is one of these programs. The ISRP provides grants and loans up to $200,000 for environmental assessments; grants and loans up to $1 million for remediation. The ISRP issued $5.6 million in cleanup grants in 2021.

The Superfund Program involves a state and federal partnership. The EPA has primary responsibility. EPA is obligated to consider and apply laws, standards and technical comments, and community concerns when making cleanup decisions. Pennsylvania finances 10% of a funded remedial action with the federal government contributing the remaining 90%. The commonwealth is responsible for 100% of the operation and maintenance costs after the remedial action is complete.

PADEP Personnel - As of July 1, 2021, there are 234 total full-time equivalent positions on the HSCF complement that may be filled, 28 are vacant.

PUBLIC SAFETY, INNOVATION, AND RESILIENCE

The standard hazardous waste infrastructure and investment opportunities discussed in this report generally fit this core mission. The following sections discuss emerging issues and impacts that fall outside the standard hazardous waste infrastructure and investment vehicles.

Emerging Contaminants - PFAS are man-made chemicals, are resistant to heat, water and oil, and persist in the environment and the human body. PFAS are not found naturally in the environment. They can be found in air, soil, and water (both groundwater and surface water). They have been used to make cookware, carpets, clothing, fabrics for furniture, paper packaging for food, and other materials that are resistant to water, grease, or stains. They are also used in firefighting foams and in several industrial processes.

PADEP reports that more than 400 samples were taken from drinking water and background sites from around the state to identify the prevalence of PFAS chemicals already present in groundwater resources. Toxicological research was conducted by Drexel University on the health impacts of the chemicals and factored into the limits PADEP is proposing. PADEP's Policy Office and Safe Drinking Water Program then drafted a new Pennsylvania-specific limit for perfluorooctane sulfonic acid (PFOS) (18 parts per trillion – ppt) and perfluorooctanoic acid (PFOA) (14 ppt), which are stricter limits compared to the EPA's lifetime Health Advisory Level (HAL) of 70 ppt for PFOS and PFOA combined. It is noted that EPA released new threshold soil limits in June 2022:

- Interim updated Health Advisory for PFOA = 0.004 parts per trillion (ppt)
- Interim updated Health Advisory for PFOS = 0.02 ppt
- Final Health Advisory for GenX chemicals = 10 ppt
- Final Health Advisory for PFBS = 2,000 ppt

EPA has also recently (September 2022) issued designation to list PFOA and PFOS as a CECLA Hazardous Substance.

PADEP leadership stated in its 2022 budgetary address that "Setting a drinking water MCL and taking other actions to protect Pennsylvanians from PFAS chemicals is an investment that will pay dividends for generations to come."

Climate Change - Pennsylvania established its first statewide policy on climate change in the Pennsylvania Climate Change Act of 2008 (Act 70). The Act requires the PADEP to compile an annual greenhouse gas (GHG) inventory, develop a voluntary GHG registry, and develop a climate action plan (CAP) and impacts assessment and update them every three years.

Governor Tom Wolf issued an executive order in 2019 that established a Pennsylvania climate goal of a 26% reduction in net GHG emissions statewide by 2025 and an 80% reduction by 2050, from 2005 levels. This 2021 Climate Action Plan presents GHG reduction strategies that could realize the executive order's emission reduction goals.

Indirectly related to emission reduction is the reuse of brownfield, hazardous waste, and superfund sites for on-site distributed solar. On-site, distributed solar photovoltaics play an important part in the decarbonization of the electrical grid. Siting solar projects in underutilized settings such as brownfields as a two-fold benefit:

1. Balance carbon sequestration and GHG emission reduction opportunities.
2. Bring otherwise valuable brownfield properties back into productive reuse for the community.

Resilience - While the 2021 Climate Change Action Plan report includes discussion on the benefits of brownfields with regard to carbon sequestration via reuse of existing infrastructure, it lacks a discussion on the need to incorporate climate resilient innovative features into redevelopment of these "climate vulnerable" properties. These resilient features can be resource intensive and may increase development costs; therefore, careful consideration of long-term goals, best practices, and financing opportunities to meet both a community's revitalization and its resiliency requirements are necessary.

Environmental Justice (EJ) – On March 12, 2022, the PADEP released its draft Environmental Justice Policy for public comment. The purpose of the policy is described as follows: Minority and low-income communities have been disproportionately impacted by environmental hazards in their communities and have not had had equitable opportunities to participate in decisions that may adversely affect their environment. DEP seeks to ensure that all Pennsylvanians are equipped with the proper resources and opportunities to meaningfully participate in decision-making processes and ensure that DEP integrates EJ guidelines in its policies and programs. This policy also provides guidelines for an EJ framework that advances EJ and equity more broadly within DEP [inclusive of the Hazardous Sites Cleanup Act].

Hazardous Waste

RECOMMENDATIONS TO RAISE THE GRADE

- Assess overall PADEP funding (inclusive of the Infrastructure Investment and Jobs Act) to determine if current environmental protection appropriations are allocated to maximize the ability of PADEP to achieve its intended mission objectives.
- Address staff shortages in the PADEP Hazardous Sites Cleanup Fund.
- Focus on Superfund and RCRA Corrective Action sites located near historically disadvantaged, low-income communities, as these communities have been disproportionally harmed by exposure to contamination from these sites.
- Accelerate and increase investment in PFAS research aimed at characterization, treatment, and analysis of these compounds, as well as understanding health impacts. Continue to drive that research to establish a protective and scientifically sound regulatory framework for managing PFAS in the environment.
- Add discussion in the PADEP Climate Change Action Plan to address long-term goals, best practices, and financing opportunities associated with brownfields and/or contaminated sites that are in "climate vulnerable/flood prone" areas.

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Levees

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EXECUTIVE SUMMARY

Pennsylvania remains one of the states at highest risk for structural damage from flooding of both natural and manmade disasters. Levee systems throughout the state seek to help mitigate this risk, but they are older than advisable: 58 years old is the average age of 204 levees covering approximately 155 miles. Nine levee systems are categorized as moderate risk and one system has been identified as low risk. Recent analysis identifies Pennsylvania as the state with the second largest risk and total for structural damage costs due to flooding ($1.22 billion). Increased state funding and broader eligibility for existing programs could provide localities with necessary specialized expertise to plan, design, and construct levee rehabilitations for existing needs and future challenges from climate change.

BACKGROUND

A levee is a man-made embankment, built to provide flood protection from temporary high water. Flood levees are typically linear structures constructed adjacent to a river for the purpose of preventing water from overflowing the river channel and spreading into the floodplain. More complex systems can also include pump stations, roadway gates, and relief wells which help protect levees from damaging seepage during floods.

CONDITION AND CAPACITY

According to the U.S. Army Corps of Engineers (USACE) National Inventory of Levees, the average age of the approximately 155 miles of levee systems in Pennsylvania is 58 years old. This is in line with the national average and is over the 50-year typical design life of a levee system. The national inventory identifies 204 levee systems within Pennsylvania representing covering those 155 miles.

Levees vary widely in terms of how large of an area they protect and what types of structures and people reside behind the levee system. As shown in Table 1, major levee systems across the state protect tens of thousands of people and structures according to the Federal Emergency Management Agency (FEMA).

TABLE 1: SIZE AND SCALE OF IMPACTED AREA BEHIND SEVERAL LEVEE SYSTEMS ACROSS THE STATE

Levee System	Number in Impacted Area behind Levee System				
	People living	Miles of Roadway & Rail	Structures	Critical Facilities	Source
Athens Levee System	688	4	183	3	[1]
Bloomsburg Levee System & Expansion	450	2.6	95	3	[2]
Danville Levee Systems	1,824	3.8	628	3	[3]
Duryea Levee System	1,221	6.7	597	2	[4]
Kingston to Exeter Levee System	28,000	131.5	10,590	39	[5]
Plymouth Levee System	1,590	2	522	5	[6]
Sayre Levee System	80	0.6	61	0	[7]
Sunbury Levee System	7,470	13.3	2,970	23	[8]
Wilkes-Barre Mill Creek Levee System	870	3.4	360	0	[9]
Wilkes-Barre--Hanover Levee System	25,282	64.8	5,620	18	[10]

In partnership with USACE, risk assessments have been completed on approximately 55% of the levees in the state (113 of 204). Most of the levees with risk assessments have been categorized as low risk (103 levee systems). Nine levee systems are categorized as moderate risk and one system has been identified as low risk. Risk relates both to the levee's condition and to the potential consequences for the population living behind the levee. There remain nearly 45% of all levee systems across the state without active risk assessments according to the National Levee Database.

Across Pennsylvania, 11 levee systems (5.5%) are accredited by FEMA. A FEMA-accredited levee is certified by a registered professional engineer, meets the National Flood Insurance Program minimum design, operation, and maintenance requirements, and reduces the flood hazard posed by a base (1-percent-annual-chance) flood.

OPERATION AND MAINTENANCE (O&M)

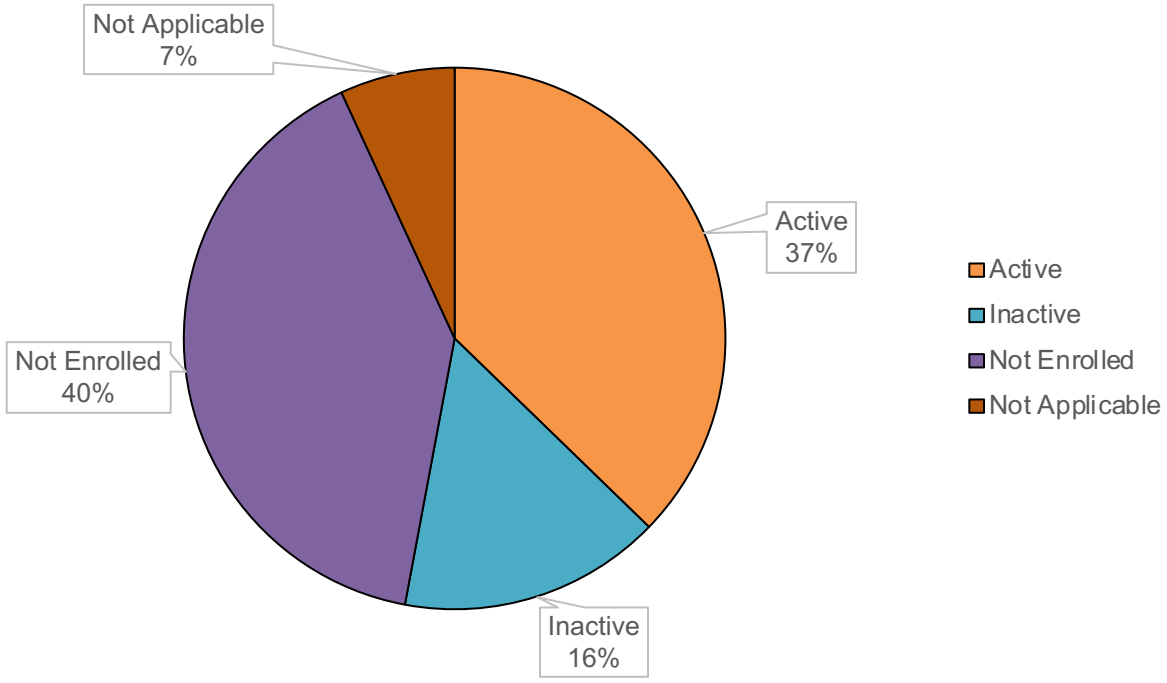
Levees and associated features such as pump stations deteriorate over time due to erosion, corrosion, weathering, scour, settlement, deformation, and degradation. Regular maintenance and periodic rehabilitation are needed to ensure that they retain their design level of protection and function. These can become expensive as a levee system ages. PA levee systems span three primary authorization categories based on construction and operation and maintenance responsibilities (Table 2, Figure 1).

TABLE 2: SUMMARY OF AUTHORIZATION CATEGORIES FOR PA LEVEE SYSTEMS

Authorization Category	Number of Levee systems (Percentage)
USACE Federally constructed and operated	17 (8.3%)
USACE Federally constructed, turned over to public sponsor for O&M	29 (14.2%)
Locally constructed, O&M	158 (77.5%)

The national USACE Rehabilitation Program provides funding for repairs to levees operated and maintained by a non-federal levee sponsors. According to the National Inventory of Levees, 75 levee systems in PA are active in this program, 32 are inactive, and 95 are not enrolled (Figure 2).

FIGURE 2: REHABILITATION PROGRAM STATUS OF PA LEVEES



FUNDING AND FUTURE NEEDS

Since the maintenance/operation responsibilities for most systems are borne by municipalities or counties, comprehensive data on the extent of needs and estimated costs of such needs is not readily available. Funding and rehabilitation decisions for these locally-owned levees are handled by each municipality independently thus there is no centralized information on state-level costs.

Capital funding for flood control projects in Pennsylvania comes primarily from four sources:

- Federal legislative appropriations administered by the USACE;
- State legislative appropriations administered by the Departments of Environmental Protection (PADEP) and Department of General Services (DGS);

- Pennsylvania Act 13 grants; and
- Local matches from municipalities, counties, or authorities.

In 2019 Governor Wolf committed over $4.5 billion to the Restore Pennsylvania plan for infrastructure projects across nearly all infrastructure sectors, including for repair and rehabilitation of levee projects for flooding mitigation. Recent specific allocations include $10 million to York County for the Codorus Greenway enhancement project which includes expanding the capacity of the levee system.

Outside of state funding, the USACE Baltimore District, which is the USACE regional office for 43 of Pennsylvania's 67 counties, has recently received over $11 million in supplemental funding, from a combination of the Infrastructure Investment and Jobs Act and the 2022 Disaster Relief Supplemental Appropriations Act, to complete mitigation work associated with the Wyoming Valley levee project.

Act 13 uses a portion of oil and gas well impact fees to provide grants up to $500,000 with a minimum 15% match from local sponsors. In general, rehabilitation or major repairs of a flood protection system easily exceed the $500,000 grant limit. At these funding levels, it is difficult to provide needed improvements efficiently.

Many municipalities lack the specialized expertise needed to plan, fund, design, obtain permits, acquire right-of-way, and administer construction contracts for major levee rehabilitations. Such projects could occur more quickly and efficiently if assistance were available through a state agency such as the PADEP. Adding to future flood risks are changing weather patterns and uncertainty in flood-frequency estimation.

Definitions: What is Act 13 and how does it relate to levees?

Act 13 is commonly known as the "Impact Fee" Act. It was signed into law in 2012 and amends Title 58 of the Pennsylvania Consolidated Statues. This Act imposes fees on unconventional oil and gas well producers. The fees generated are then distributed to counties and municipalities across the state in a variety of ways. Related to Levees, Act 13 provides grants up to $500,000 with a minimum 15% match from local sponsors for rehabilitation or major repairs.

Unlike some parts of the country, statistics show flood magnitudes growing in eastern Pennsylvania while diminishing slightly in the western side of the state. New analysis from the First Street Foundation identifies Pennsylvania as the state with the second largest risk and total for structural damage costs due to flooding ($1.22 billion). Moreover, the 2018 Commonwealth of Pennsylvania State Hazard Mitigation Plan Update indicates that flood risks are expected to increase as heavy precipitation events and maximum streamflow trends both are likely to increase, particularly in the eastern portion of the state, under a warming climate.

PUBLIC SAFETY & RESILIENCE

Levees provide a vital public service all across the state of Pennsylvania. The buildings, people, and assets protected by levee systems throughout the state include over 130,000 people, 45,000 buildings, and $22.5 billion dollars of property value. Even well-maintained levees can overtop or breach under severe flooding events. Several severe flooding events in the last five years have showcased both the importance of levees and the precarity of our flood risk across the state. Most recently, the remnants of Hurricane Ida caused hundreds of millions of dollars in damage resulting in a state and federal disaster declaration in 2021. More than $265 million in federal assistance was approved including $88.2 million in individual assistance and $95 million for policyholders of flood insurance from

the National Flood Insurance Program. Between 1975 and 2021 Pennsylvania policyholders have received well over $1.8 billion in total flood claim payments. The claim totals have been steadily increasing over time and have had several large spikes due to major events including Tropical Storm Lee (2011) and Hurricane Ida (2021).

Emergency managers need accurate and early flood forecasting to protect citizens. Early warning depends on data collection and analysis performed by the National Oceanic and Atmospheric Administration, the U.S. Geologic Survey, and the USACE. It is imperative that these services continue to receive predictable, adequate funding that grows as climate change risks complicate predictions and analyses. PADEP publishes guidelines for levee-specific Emergency Action Plans (EAPs), but there is no requirement to keep them updated.

INNOVATION

Many approaches could be taken to address flood risk in addition to or in place of levees. Measures such as watershed-wide stormwater management, floodplain protection/restoration, buyout/relocation of properties with high flood insurance risk, enlargement of bridge openings, ice jam mitigation structures, raising of flood prone structures/mechanical/electrical systems, and smart growth strategies to encourage relocation out of the floodplain should all be considered comprehensively. While some municipalities are working to implement some of these innovations, comprehensive approaches are not widely considered for a variety of reasons including lack of resources, expertise, time, and authorities.

Levees

RECOMMENDATIONS TO RAISE THE GRADE

- Increase the cap on Act 13 grant funding for levee engineering studies, improvements, upgrades, and non-routine maintenance.
- Encourage new and rehabilitation levee projects to consider design standards for levees that go beyond the 100-year level of current design in light of future rainfall trends.
- Mandate comprehensive review by local governments and Metropolitan Planning Organizations of risks from water damage events that prioritize reduced systemic risk and provide an accountable roadmap to permanently safer residents, businesses, and property.
- Provide new state-level technical assistance and funding for these after-action re-thinks.
- Strongly encourage and consider financial incentives for all levee owners to create emergency action plans and update them as climate data and development change risk profiles.
- Provide state-wide or federal expertise to assist local communities in preparing and updating those EAPs.

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Levees

Risk Info Sheets:

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Ports

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EXECUTIVE SUMMARY

Conditions at Pennsylvania's two main ports – Erie and Philadelphia – move over 100 million tons of goods, the ninth-highest figure among U.S. states. PhilaPort has identified approximately $59.5 million of repairs necessary in the short term to address serious or critical issues for its landside operations, waterfront structures, and in-water work. Growth projections at both ports require an investment need on the order of $300 million for increased capacity. Performance of the two ports is difficult to further ascertain because public data are limited regarding their facilities condition and spending for operations and maintenance.

BACKGROUND

With over 100 million tons of goods moving through Pennsylvania's ports, Pennsylvania ranks ninthh in the country for volume of goods that move through ports, providing an annual economic benefit of nearly $50 billion to the Commonwealth. With completion of the Delaware River Channel Dredging/Deepening effort and $300 million in major infrastructure capacity investments committed, the Commonwealth has demonstrated its commitment to be competitive in the global and regional economy. This momentum will need to continue to address condition as numerous facilities have aged past their useful life and are in need of significant infrastructure improvements in order to prevent Pennsylvania facilities from becoming obsolete, which will result in cargo finding another route into the country.

The Erie Port currently handles about 600,000 ton of product annually. The majority of the commodities are sand, salt and aggregate. This port's storage capacity is adequate given the needs of the region and the adjoining navigation channels. There is additional property available for future expansion, if needed. As part of its Master Plan, the Port has identified deficiencies in their utility access and shoreline conditions and is moving to program and fund improvements.

The completed Delaware River Federal Navigation Channel deepening, from 40 feet to 45 feet, from Philadelphia to the mouth of the Delaware Bay stands to help Philadelphia's ports remain competitive in the global economy. With the deeper channel and the potential for larger vessels, the facilities servicing those vessels must enhance their infrastructure to service these vessels and increase their throughput to stay competitive.

Condition

Each port agency has aging infrastructure at their facilities. While Erie's 300-ton stiff leg crane was recently rehabilitated, their mobile cranes need to be replaced. Port Erie also has aging dock walls in need of rehabilitation and needs shore power upgrades; it could also benefit from additional covered warehouse space. PhilaPort also has infrastructure issues. With many of their piers and warehouses being built circa 1920, the Port is faced with considerable maintenance and repair needs in order to keep the facilities safe and suitable for cargo handling. Improvements are continuing to be made, and conditions are being improved, but this is an ongoing process.

Each agency has been actively monitoring its facilities and preparing asset management plans to develop a planned approach to future replacement and maintenance cycles.

Capacity

The Erie Port has adequate existing storage capacity given the needs of the region and the adjoining navigation channels. There is additional property available for future expansion, if needed. As part of its Master Plan completed in 2018, the Port has performed a preliminary investigation of its properties and identified deficiencies in their utility access and shoreline conditions. These are being addressed as budgets and grant funding opportunities, mainly from the Commonwealth, permit.

PhilaPort has worked with the US Army Corps of Engineers (USACE) to complete the deepening of the Delaware River Federal Navigation Channel, from 40 feet to 45 feet, from Philadelphia to the mouth of the Delaware Bay. With the deeper channel and the potential for larger vessels, the facilities servicing those vessels must enhance their infrastructure to service these vessels and increase their throughput to stay competitive. PhilaPort continues to address these issues within its existing budget, dependent primarily on user fees and rentals from operators, with funds designated to assist with improvements to items such as Ship-to Shore cranes and mooring equipment, as well as landside improvements to warehousing. The funding will also contribute to keeping PhilaPort's automobile business competitive by the addition of a new vehicle processing center and paving. In several instances the port facilities themselves are operating at capacity but identification and establishment of additional landside support areas, such as parking/storage for automobiles coming off ships and waiting for distribution to markets via trains/trucks, has become a constraint.

Operations and Maintenance

Each port agency has aging infrastructure at their facilities. While Erie's 300-ton stiff leg crane was recently rehabilitated, their mobile cranes are in need of replacement. Port Erie also has aging dock walls in need of rehabilitation and is in need of shore power upgrades; it could also benefit from additional covered warehouse space.

PhilaPort also has infrastructure issues. With many of their piers and warehouses being built circa 1920, the Port is faced with considerable maintenance and repair needs in order to keep the facilities safe and suitable for cargo handling.

In each agency's situation current budgets are primarily geared toward ongoing upkeep and maintenance of existing facilities, which are old and in need of modernization. Outside funding from the Commonwealth has been made available to help with this, and increased user and rental fees have been implemented to raise maintenance budgets to the extent possible. Recent major upgrades on facilities needed to stay competitive in the shipping market and to accommodate newer machinery and methods has helped to reduce maintenance and upkeep burdens to some extent.

Most of the piers and other waterfront structures are in constant need of maintenance repairs, and oftentimes emergency repairs and reconstruction are necessary due to their age and to their exposure to extreme conditions. Over the next 10 years, it is estimated that $124 million is needed to address these high priority items at their sites to maintain current operations. This estimate reflects known maintenance needs. Due to aging of the assets, it can be expected that the needs will increase with each passing year. Although PhilaPort received an infusion of funds to expand and improve their cargo facilities, this money will not be used towards regular maintenance and repairs. Dredging of their facilities that are still serviced by vessels is a continual need, as well.

Funding

Erie has continued to utilize Its own usage-based funds to make its necessary investments. According to their Master Plan, most of their financial resources are allocated to operation and maintenance activities, as capital funds are generally limited. Maintenance budget levels are on the order of $15 million annually over the past several years.

PhilaPort has continued to receive major funding from the Commonwealth to expand and improve cargo operations through the Ports' busiest areas. However, by comparison, PhilaPort spends an average of $20 million annually for facility maintenance and repairs. It routinely applies for grants to supplement its capital funding.

Future Needs

For each agency, most of the piers and other waterfront structures are old and in constant need of maintenance repairs. Frequently, emergency repairs and reconstruction are necessary due to the age of these facilities and their exposure to extreme conditions. Due to aging of the assets, it can be expected that the needs will increase in each successive year.

Erie's needs include rehabilitation to dock structures, upgraded shore power, new mobile harbor cranes, and covered warehousing. Its Master Plan also mentions the need to update utility infrastructure, as well as deficient seawall and shoreline stabilization infrastructure. A cost for these items has not been identified.

PhilaPort has identified approximately $59.5 million of repairs that will be needed in the short term to address serious or critical issues for its landside operations, waterfront structures and in-water work.

Shipyard industry aerial view of large ship for repairs in large floating dock on the river Delaware

PhilaPort currently has adequate capacity at most of its facilities; however, expansion is required for container operations at Packer Avenue Marine Terminal and the automobile import business. Growth projections in both markets are requiring them to increase their capacity to handle additional cargo and will benefit from the $300 million in funds.

Public Safety

Port facilities are fairly secure in that they require anyone entering their facilities to have a Transportation Workers Identification Credentials (TWIC) card in their possession. TWIC is required by the Maritime Transportation Security Act for workers who need access to secure areas of the nation's maritime facilities and vessels. TSA conducts a security threat assessment (background check) to determine a person's eligibility and issues the credential. U.S. citizens and immigrants in certain immigration categories may apply for the credential. Most mariners licensed by the U.S. Coast Guard also require a credential.

Resilience and Innovation

As part of its Master Development and Facility Plan, Erie Port has recently taken steps to develop a more complete asset Management System so that they can more effectively manage their assets and plan for the future. They have created an electronic property database that includes all parcels and associated data from Erie County tax records. The database includes web links connected to the Erie County web site and the subject parcel for current data.

To protect against future storm events, PhilaPort is building its new facilities at or above the 100-year flood plain. In addition, new designs implement features to limit flooding exposure to substations and electric equipment. PhilaPort conducts a comprehensive facilities assessment on a five-year cycle that serves as the foundation of their asset management plan. PhilaPort is committed to sustainability and environmental stewardship and have plans to be more innovative in their approach to their operations at each of their facilities. One of their strategic planning goals is to expand green port initiatives. As part of this goal, PhilaPort works to reduce reliance on fossil fuels; establish green building standards for capital projects; and seek additional funding for sustainability projects.

In addition, PhilaPort is converting their port cranes from diesel to electric at its terminals. It has completed a baseline air emissions survey for the ship-to-shore cranes at Packer Avenue Marine Terminal (PAMT) as well as a similar baseline for the yard container handling equipment at PAMT. Clean dredge material for the channel deepening project has been used for beach replenishment at Broadkill Beach in Delaware.

Ports

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RECOMMENDATIONS TO RAISE THE GRADE

- Additional Commonwealth funding is necessary to add to the $300 million Port Development Plan investment to maintain a competitive advantage for PhilaPort as well as ongoing investment in upgrades and modernization of facilities at the Port of Erie.
- PhilaPort should also pursue additional rounds of local, state, federal grants to continue infrastructure investment, which should include localized ongoing dredging at various piers.
- Port of Erie should update and add additional fields to its asset management plan to include infrastructure condition assessment information, needs and cost in order to help it prioritize future projects and help secure funding.
- Both port agencies should continue to work with railroads that serve them to enhance and expand abilities for landside distribution and delivery. While there are existing connections to rail lines, the involved railroads have been reducing their available trackage to cut maintenance costs and market the real estate formerly used for yards and staging areas to reduce land inventory and increase capital. This has often worked in cross-purposes to the ability to bring additional train service for port service and functions and has added to the burden of port operators to locate and identify potential landside storage and laydown areas.

SOURCES

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Public Parks

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PRESQUE ISLE STATE PARK ON LAKE ERIE AT ERIE, PENNSYLVANIA

EXECUTIVE SUMMARY

Parks in Pennsylvania are undervalued in civic decision making, despite their vital importance. An approximately $1.4 billion backlog of infrastructure projects exists for Pennsylvania's 300,000 acres of state-owned land, plus 1,000 miles of trails. A similar sum of necessary projects are counted in the state's 6,000 local parks. Pennsylvania's state budget has increased funding for that need in state lands, but local public land is reeling. The parks and recreation portion of Philadelphia's general fund dropped 13% from 2018 to 2021. In that same time, the operating budget for Pittsburgh parks dropped 19%. Local government must increase funding with new, dedicated sources and significantly increase data for planning and asset management.

BACKGROUND

Parks are often an overlooked part of our infrastructure. Pennsylvania parks provide not only natural resilience by treating stormwater runoff before entering waterways, buffering floods by absorbing floodwater into wetlands and planting, and combating heat island effects by providing shade and cooling, they also provide spaces to connect with nature, gather with others, and join us to our communities.

To conduct our research, sources included publicly available data from the Pennsylvania Department of Conservation and Natural Resources (DCNR), the cities of Philadelphia, Pittsburgh, Allentown, and Erie, the Counties of Bedford, Lackawanna, Lycoming, and Venango, and a questionnaire sent to the 67 Counties.

CONDITION AND CAPACITY

Pennsylvania has over 6,000 local parks, 300,000 acres of State-owned land, and 1,000 miles of rails to trails according to DCNR.

Over the last two years, the COVID-19 Pandemic has put a spotlight on society's shift towards healthy living and increased outdoor activities. This has led to higher demand for parks and recreational facilities. According to the Pennsylvania Environmental Council, trail usage hit 100 to 200 percent of capacity in March of 2020. DCNR's studies across the Commonwealth's major cities and rural areas determined that park facilities, playgrounds, trail systems and regional parks were a high priority for residents.

To accommodate the increased demand by residents, Philadelphia and Pittsburgh are investing in providing more facilities across their cities and focusing on their equitable distribution. All eight cities and counties studied have created comprehensive or action plans detailing the actionable upgrades to their facilities as well as future visioning. However, visioned projects have either not been constructed, or have not been fully documented. It is expected that due to lack of funding, the rate of project completion to planned time frames is mismatched.

FUNDING AND FUTURE NEEDS

According to the Pennsylvania State Data Center, the most recent Census showed the State's population grew by 2.4% from 2010 to 2020. The fastest growth occurred in the southeastern part of the state, where counties increased in population between 2.5% and 5%. Funding sources vary across the Commonwealth, including taxes, licenses & permits, service charges, fines, intergovernmental revenue, trust funds, and revenue sources. Revenue sources range from fees for local sports leagues, to fees associated with Marcellus shale, and timber reserves.

Operating budgets for DCNR parks and heritage land increased by approximately 34% and 38% in the last four years. This budget increase is insufficient to address DCNR's $1.4 billion backlog of projects and maintenance. But, local parks funding over the past four years has decreased. Examples of this include: Philadelphia's Parks & Recreation portion of the general fund was reduced by about 13% between 2018 and 2021. Pittsburgh's park's operating budget was reduced by 19%.

Ways to improve funding include standard practices, such as increasing taxes, permitting fees, and sustainable, eco-conscious timber harvesting through the state. But it may be imperative to think more creatively. Municipalities could investigate increased programming, public private partnerships (although being mindful not to turn free public spaces into places of commerce), and crowd sourcing and other fundraising initiatives. Other ways to find funding for parks and recreation facilities could be to more creatively associate parks with other community needs. This could include providing green space that includes stormwater management, function as a form of resiliency, or any other "infrastructure" related connection. Park and recreation facilities could also be used in combination with local health facilities to promote wellness and rehabilitation. Finally, more funding for parks could be included in community redevelopment, as several studies have shown a connection between parks and public spaces and increased growth for local communities and commerce.

Ways to improve funding include standard practices, such as increasing taxes, permitting fees, and sustainable, eco-conscious timber harvesting through the state. But it may be imperative to think more creatively.

OPERATIONS AND MAINTENANCE

According to DCNR, Pennsylvania's state parks and forests have more than $1 billion backlog of infrastructure maintenance needs, as well as more than 6,000 community parks that have an equal maintenance backlog. Due to the pandemic, Philadelphia's Parks and Recreation budget saw a $12 million cut. According to the Trust for Public Land, only 15 cities out of 100 spent less per capita on park maintenance than Philadelphia did. However, Philadelphia is trying to recover those funds by including a partial restoration of what was reduced in the 2022 budget. It was found that many smaller parks departments within the state reviewed did not disclose the amount of money that was budgeted or spent for park maintenance and operations, making it difficult to determine how much funding is being used for operations and maintenance of their facilities.

PUBLIC SAFETY AND RESILIENCE

Of the parks departments reviewed, most had stormwater management and natural resource plans folded into their parks and recreations facilities. Allentown and Lycoming County are using similar tactics by placing green spaces, trails, and parks near their rivers to mitigate flood damage to residential and commercial property.

The Pittsburgh Parks Conservancy, a non-profit organization, is funding park renovations and upgrades across the city, which incorporates stormwater management features. Philadelphia has a strong stormwater management program because of strict regulations set out by the Philadelphia Water Department, to decrease the amount of stormwater entering the combined city sewer system during rainstorms. The Philadelphia Parks and Recreation Department has an urban forestry program called TreePhilly which plans to increase the urban tree canopy in all neighborhoods of the city to 30% by 2025, which will assist in the City's overall goal. (Currently, Philadelphia has a lower urban tree canopy than any other major city in the Northeast.)

Generally, there is a lack of information regarding park specific safety concerns and incidences. However, according to a 2018 Fall Lion poll, 52% of Pennsylvanians said they can safely walk to a public park, while a 2019 Spring Lion poll saw 69% of Pennsylvanians say they can safely access a trail within 15 minutes of their homes.

INNOVATION

On a statewide level, DCNR recognized the inequity in access to recreation and using a mapping data tool developed by the Trust for Public Land. The study found that 53% of residents have access to outdoor recreation within a 10-minute walk from their homes statewide. In general, urban residents have higher levels of access, 94% of people in Philadelphia are within a 10-minute walk, while just 28% of residents in Derry Township in Dauphin County are within a similar distance to a park. Inequity is not just proximity to parks, the study also found that parks serving nonwhite communities were half the size of parks that serve majority white neighborhoods. This data will be used to plan for future facility expansion to ensure every Pennsylvanian has access to recreation areas.

Cooks Forest State Park

Public Parks

RECOMMENDATIONS TO RAISE THE GRADE

- Municipalities should create and track more in-depth data and metrics of their parks and recreational facilities which should be accessible to the public. This includes collecting demographic information, accessibility information, both physical and proximity, projected costs for future needs and the deficits to reach those projects, and other cost, need, and programing metrics that can be tracked and monitored. Using metrics can help to correlate the cost/benefits of parks and recreational facilities to the specific community, economy, and environment.
- To increase funding and revenue municipalities could investigate increased programming, public private partnerships, crowd sourcing, and other fundraising initiatives. Pittsburgh and Philadelphia already have also partnered with non-profits like the Pittsburgh Parks Conservancy and Friends on FDR Park respectively which allow for the acquisition of funding sources not available to the government.
- Combining parks with stormwater management and resiliency infrastructure and economic growth opportunities could provide additional grant and revenue sources. The State government could incentivize local parks agencies to include stormwater green and resilient infrastructure into park upgrades by helping to fund these projects that meet these requirements.
- Local governments can use parks to engage communities; public events, concerts, rallies, volunteerism, and other measures will highlight the importance of parks, park maintenance, and funding.
- The State should market Pennsylvania outdoor tourism to attract PA residents and out-of-state visitors to the many parks and forests throughout the state. Between 2015 and 2019, State revenue from outdoor recreation increased by 2% which contributed $12 billion to the State economy. Reinvesting this into the parks will create more opportunities for people to enjoy the PA outdoors.
- State and local governments should invest in ADA accessibility upgrades and inclusive park equipment and facilities to ensure every person in the community can have access to public spaces.

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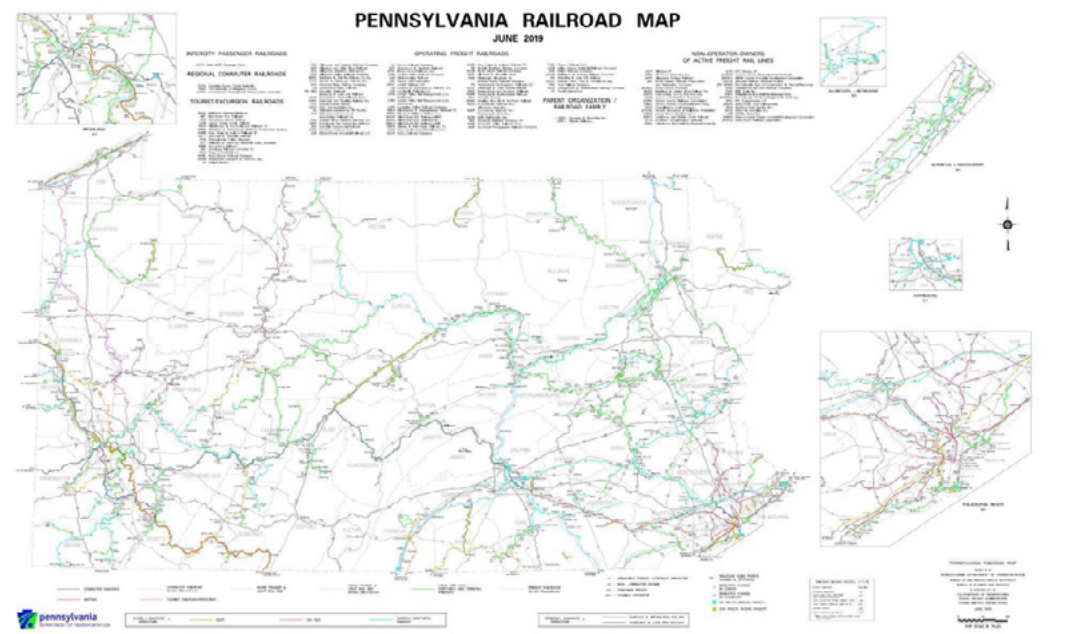
Rail

RAILROAD TRACKS IN THE RURAL COUNTRYSIDE OF LANCASTER COUNTY

EXECUTIVE SUMMARY

Pennsylvania's rail network is as diverse as the commonwealth itself, ranging from intercity passenger service to transcontinental freight rail systems, to small, short line railroads serving rural areas of the states. The 6,700-mile state network features three Class I operators (CSX, Norfolk Southern, Canadian National), two Class II companies, and 32 Class III operators. In general, Class I infrastructure is in good to excellent condition. Amtrak service will expand with the recently announced agreement to use Norfolk Southern track to open a passenger rail line in Western Pennsylvania. The 2020 Pennsylvania State Rail Plan reports $6.9 billion of investments in capital projects between 2021 and 2045. This includes $.57 billion for 132 passenger rail projects and $1.2 billion for 323 freight rail projects, the latter of which are mostly Class III railroad infrastructure needs. The bipartisan infrastructure law will help expand and improve passenger rail services in the Keystone state, while keeping the freight network modern and safe.



BACKGROUND

Rail transportation has been a key transportation mode for 175 years in Pennsylvania supporting industrial production and energy movement. Higher utilization of rail provides congestion mitigation benefits and quicker movement of goods, air quality improvements, and enhancement of transportation safety. The Commonwealth's 64 freight railroads operate on 6,716 miles of track across the state, ranking it the fourth largest rail network by mileage in the U.S.

Passenger

Passenger rail services in Pennsylvania are primarily provided by two operators: Amtrak and the Southeastern Pennsylvania Transportation Authority (SEPTA). Amtrak provides intercity passenger rail services across the commonwealth and throughout the United States, while SEPTA provides commuter rail services throughout the Philadelphia metropolitan region with 280 route miles served by 13 rail lines. Amtrak's Keystone Service, supported by PennDOT, runs between New York City and Harrisburg by way of Philadelphia. The Pennsylvanian Service runs between New York City and Pittsburgh by way of Philadelphia.

AMTRAK RAIL SYSTEM IN PENNSYLVANIA (PSRP, 2020)

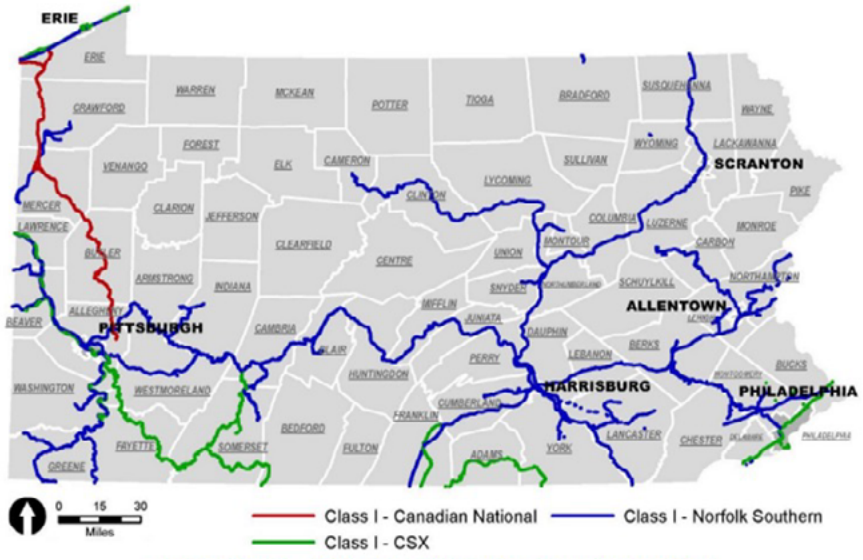
SEPTA's Regional Rail offers 13 lines with 155 stations serving Philadelphia, Bucks, Chester, Delaware, and Montgomery Counties, as well as service to Newark, DE, and both Trenton and West Trenton, NJ.

SEPTA REGIONAL RAIL SYSTEM (PSRP, 2020)

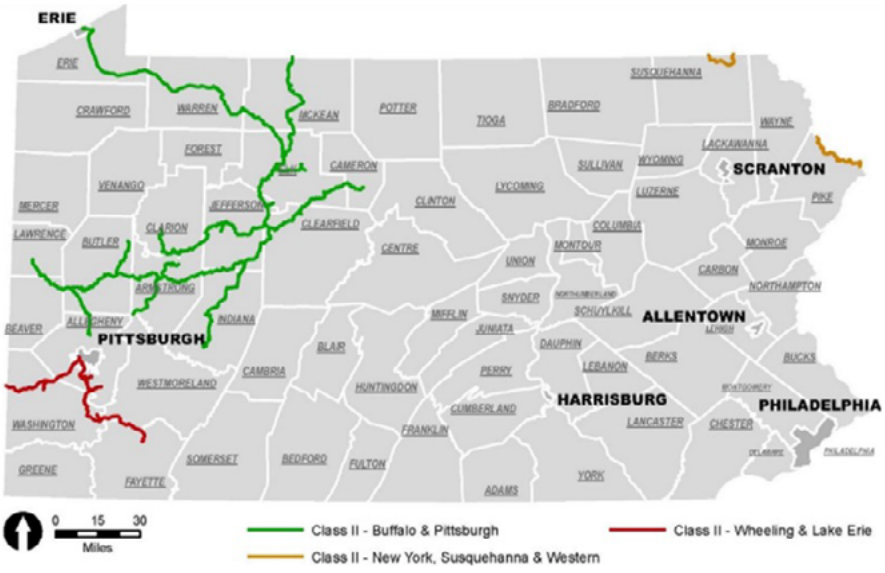
Freight

Pennsylvania is one of the nation's leaders in freight assessment, planning, and investment spurring from the Commonwealth's industrial heritage. The 6,700-mile state network features three Class I operators (CSX, Norfolk Southern, Canadian National), two Class II companies, and 32 Class III operators.

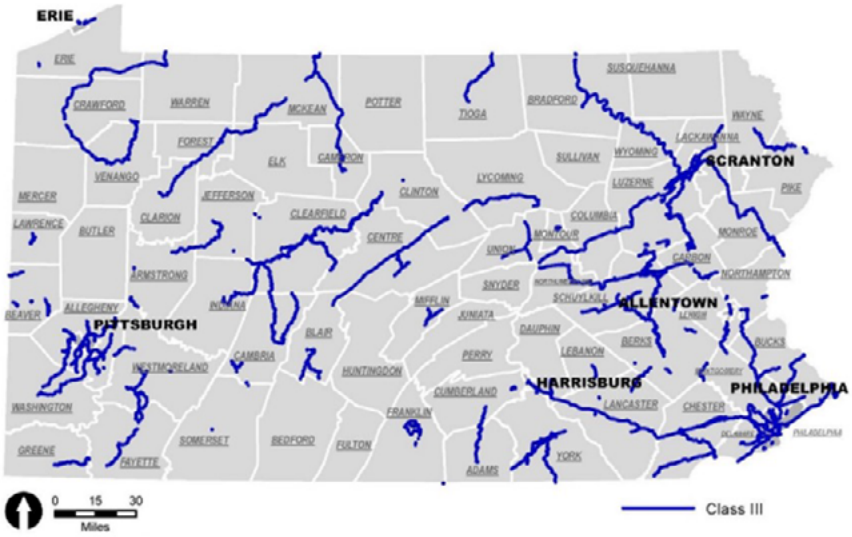
CLASS I FREIGHT RAIL LINES IN PENNSYLVANIA



CLASS II FREIGHT RAIL LINES IN PENNSYLVANIA



CLASS III FREIGHT RAIL LINES IN PENNSYLVANIA



CONDITION

Passenger

The passenger rail operators in Pennsylvania are investing to modernize their facilities and make them more accessible. In 2022, as part of PennDOT's investment in the Amtrak Keystone Corridor between Harrisburg and Philadelphia, PennDOT and local collaborators officially opened a new Middletown train station on West Emaus Street at West Main Street. The $49.5 million project is expected to promote transit-oriented development in downtown Middletown.

SEPTA completed several station reconstruction projects in FY19-20 aimed at improving accessibility for all passengers. Levittown Station, Arrott Transportation Center, and Secane Station were all made fully accessible through the installation of elevators, new curb ramps, better lighting, added pedestrian tunnels, and more.

In June of 2021, SEPTA completed the $27.5 million 5th Street/Independence Hall Station Reconstruction project. The station has been fully renovated, with improvements including mitigation of long-standing water infiltration issues, installation of new platforms, LED lighting, and more.

Freight

According to PennDOT's Rail Service Investment Program (RSIP) there are approximately "323 freight projects totaling $1.2 billion from Class I, Class II, and Class III operators" across the commonwealth. These projects are scheduled from 2021-2045 as described in the Pennsylvania State Rail Plan 2020, or PSRP 2020. This is an increase from the 301 projects that the 2015 PSRP had projected. The state plans to spend much less on freight than passenger rail because the private operators finance a large portion of improvements to their networks.

The public benefits from these private railways, so public money is needed. Many of the proposed projects increase rail capacity either through new track segments, upgraded weight limits, reconstructed bridges, and overpasses to accommodate double-stacking, or other facility and system improvements that improve integration and operations, further supporting the commonwealth's economy." These projects are broken down into several categories as described in the table below.

FREIGHT RAIL PROJECTS BY IMPROVEMENTS TYPE, 2021-2045

Project Type	Number of Projects	Total Estimated Cost (in Millions of Dollars)
Accelerated Maintenance	129	$434,338
Access Existing or New Customers	62	$196,877
Improve Civil Works	20	$190,669
Improve Terminal	47	$154,451
Improve Track	37	$148,240
Rolling Stock	5	$33,997
Grade Crossing	23	$6,111
Grand Total	**323**	**$1,164,683**

CAPACITY

Passenger

In 2019, Amtrak intercity service served approximately 6.7 million riders in Pennsylvania via approximately 120 daily trains with 24 different stations on the 11 service lines that utilize tracks in the Commonwealth. Figure 2-2 shows the upward trend in Amtrak boardings and alightings. All stations are projected to have an increase in ridership between FY 2019 and FY 2025. The increase in ridership is linked to adding a 14th weekday round trip on the Keystone in FY 2023 and a second roundtrip on the Pennsylvanian anticipated to begin in FY 2024, based on the Amtrak Five Year Service Line Plan. Total growth for all Pennsylvania Amtrak stations is projected to grow 21% from FY 2019 to FY 2025.

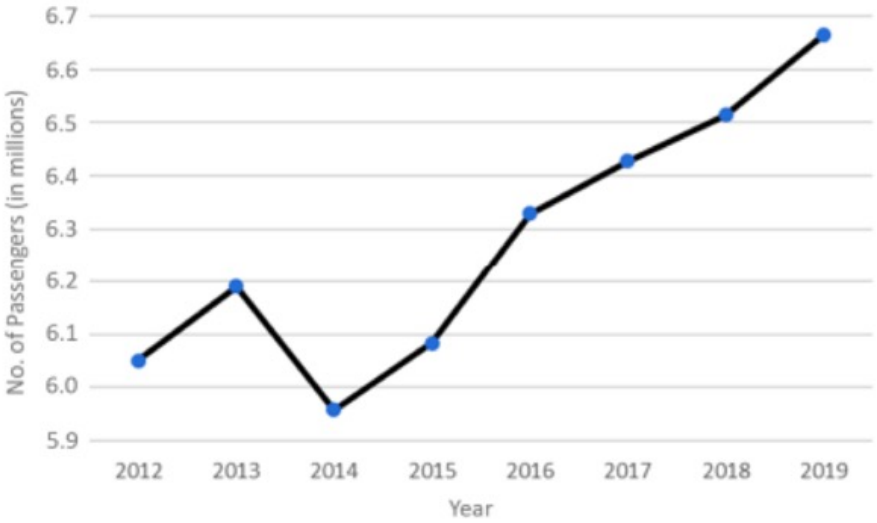


Figure 2-2: Amtrak passengers in Pennsylvania, boardings and alightings, FFY 2012–2019 (RPA, 2020)

AMTRAK PASSENGERS IN PA, BOARDINGS AND ALIGHTINGS, FFY 2012-2019 (2020 PSRP, 2021)

Amtrak Service	Annual Ridership (in Thousands)
Northeast Regional	8,940.7
Acela Express	3,577.5
Keystone	1,576.0
Silver Star	390.0
Lake Shore Limited	357.7
Silver Meteor	353.5
Palmetto	345.3
Crescent	295.2
Carolinian	244.8
Pennsylvanian	215.1
Capitol Limited	209.6
Cardinal	108.9
Vermonter	99.3

Source: (2020 PSRP, 2021)

On June 27, 2022, the Governor announced that the Pennsylvania Department of Transportation (PennDOT) and Norfolk Southern Corporation (NS) reached an agreement to expand passenger rail access in western Pennsylvania. The milestone follows a February 2022 announcement that the parties would jointly examine opportunities to eliminate chokepoints and improve Pennsylvania's rail system to better permit freight and passenger trains to operate together. To support these expanded passenger operations, the Commonwealth will invest more than $200 million in infrastructure and safety improvements that will be constructed and maintained by NS. The future improvements and construction include upgraded rail lines, passenger platforms, sidings, and necessary communications signals infrastructure

In 2019, SEPTA operated a fleet of 396 vehicles on 13 lines over 223 route miles with 155 stations across the Philadelphia metropolitan area. SEPTA Regional Rail serves Bucks, Chester, Delaware, Montgomery, and Philadelphia. In 2019, SEPTA commuter rail service served more than 34 million passengers via 155 stations, a decrease of 0.5% from FY 2018. For FY 2021, SEPTA annual ridership was 106 million or 53% below FY 2020 and 64% below 2019.

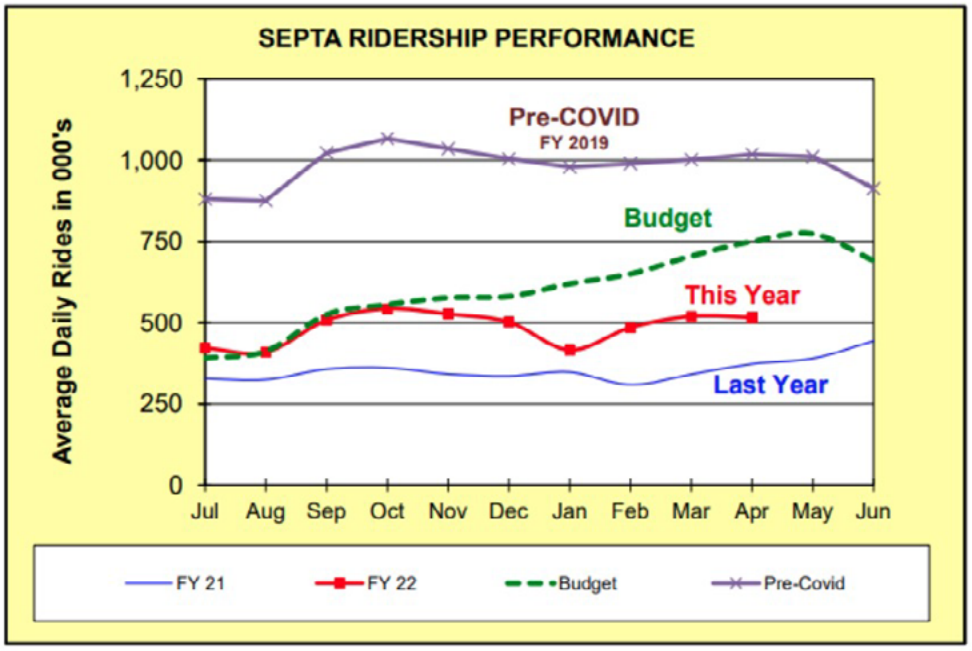
The COVID-19 global pandemic impacted service, work schedules, and travel patterns. SEPTA lost 59% of its riders from 2019 to 2021 as the pandemic hit. For the first three months of 2022, ridership was at approximately 48% of what it was in the year leading up to the COVID-19 outbreak. On the revenue side, SEPTA saw $22.7 million in passenger revenue, 24% below budget, but a 65% increase over what it was in March 2021. Federal COVID-19 relief funding supplementing SEPTA's revenue expires in fiscal 2024. By then, SEPTA hopes to have back 80% of its pre-pandemic ridership.

The Delaware Valley Regional Planning Commission (DVRPC) projected average weekday ridership from 2020 to 2045 for SEPTA Regional Rail network is projected to grow 7.3% from 2020 to 2045 in person-trips and 5.2% in passenger miles.

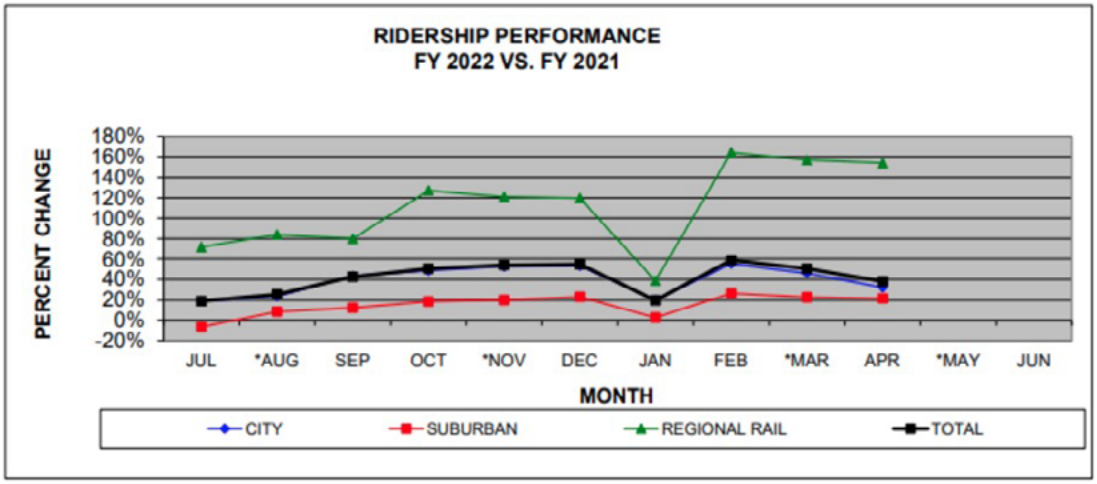
Table 2-3: SEPTA Branch Ridership, FY 2019

	Passengers	
Branch	**Daily**	**Annual**
Paoli/Thorndale	21,284	6,170,950
Lansdale/Doylestown	17,306	4,970,220
West Trenton	12,031	3,394,380
Manayunk/Norristown	11,486	3,289,470
Media/Elwyn	11,202	3,016,230
Trenton	11,132	3,253,550
Wilmington/Newark	8,917	2,498,350
Warminster	7,667	2,294,350
Airport	4,686	1,518,250
Fox Chase	4,550	1,247,750
Chestnut Hill West	4,463	1,282,680
Chestnut Hill East	3,874	1,124,380
Cynwyd	505	130,410
Total	**119,103**	**34,190,970**

Source: (2020 PSRP, 2021)



Source: SEPTA Revenue and Ridership Report (April 2022)



Source: SEPTA Revenue and Ridership Report (April 2022)

Freight

The Pennsylvania freight rail network carried an estimated 193.6 million tons of freight in 2017. Inbound and outbound traffic accounted for 25% and 23%, respectively, of the Commonwealth's freight rail tonnage. According to the Pennsylvania State Rail Plan 2020, the majority of the major rail corridors in Pennsylvania are operating below capacity conditions, with the notable exception of the passenger rail Northeast Corridor.

Pennsylvania's core or strategic rail lines include some of the highest volume routes in the nation, such as the Norfolk Southern main line connecting Philadelphia, Harrisburg, and Pittsburgh – extending ultimately to Chicago. The State Rail Plan provided an extensive Level of Service (LOS) Analysis. See the tables below for clarification of the grading system, and how Pennsylvania's Freight Infrastructure is performing and is expected to perform now and far into the future.

LOS GRADES AND VOLUME-TO-CAPACITY RATIOS

LOS Grade	Volume/ Capacity Ratio	Description
A	0.0 to 0.2	**Below Capacity.** Low to moderate train flows with capacity to accommodate maintenance and recover from incidents
B	0.2 to 0.4	
C	0.4 to 0.7	
D	0.7 to 0.8	**Near Capacity.** Heavy train flow with moderate capacity to accommodate maintenance and recover from incidents
E	0.8 to 1.0	**At Capacity.** Very heavy train flow with limited capacity to accommodate maintenance and recover from incidents
F	> 1.00	**Above Capacity.** Unstable flows; service breakdown conditions

LOS GRADES FOR BASE AND FORECAST YEAR SCENARIOS

Corridor	Length (miles)	2020 State Rail Plan Update LOS[1]			
		2017	2045 Baseline	2045 LGS	2045 HGS
Main Line	407	C	C	C	C
Erie	44	C	C	C	D
Northeast Corridor	48	D	D	D	E
Southeast	49	B	B	B	B
Southwest	125	C	C	C	C
Crescent (Harrisburg)	134	E	D	C	E
Keystone Corridor	105	C	C	C	C
Crescent (Lehigh)	54	B	B	B	B
Crescent (Sunbury)	181	B	B	B	B
Crescent (Lurgan)	67	C	C	C	C

FUNDING & FUTURE NEED

The 2020 Pennsylvania State Rail Plan reports $6.9 billion of investments in capital projects between 2021 and 2045. This includes $.57 billion for 132 passenger rail projects and $1.2 billion for 323 freight rail projects.

Passenger

In FY23, SEPTA's proposed budget projects over $316 million in operating revenue, coupled with almost $1.3 billion in operating subsidies from the federal, state, and local levels. It projects operating expenses to total over $1.6 billion. As with transit rail and bus systems, SEPTA's regional rail future rests on some combination of attracting riders back to its system, greater recurring subsidies for operations, and service adjustments to manage its budget.

Amtrak and PennDOT are also investing in passenger rail infrastructure, in part thanks to support from the bipartisan infrastructure law, which had not been passed when the 2020 Pennsylvania State Rail Plan was developed. Funding from the law will help actualize some of the needs identified in the state plan.

Pennsylvania is in a critical planning phase of a large passenger rail expansion. One such step I the recently-announced deal to run passenger train service in Western Pennsylvania on Norfolk Southern-owned track. Strategies such as this can increase passenger usage on active freight rail lines and are less expensive in the near and medium term.

Freight

Class I railroads invest in their own infrastructure projects, while Class II and Class III railroads sometimes need public sources of funding or financing. In order to meet the demand for funds on freight projects, PennDOT has identified several sources of funding through State and Federal funding methods.

ESTIMATED STATE FUNDING DEDICATED TO FREIGHT RAIL CAPITAL PROJECTS, 2021-2045 (IN MILLIONS OF YOE DOLLARS)

Funding Source	2021	2022	2023	2024	Total
Marcellus Shale Rail Freight	$1.0	$1.0	$1.0	$1.0	$4.0
RTAP/ Capital Budget Rail Freight	$30.0	$30.0	$30.0	$30.0	$120.0
Total	**$31.0**	**$31.0**	**$31.0**	**$31.0**	**$124.0**

FREIGHT RAIL

Penn DOT's Rail Freight Assistance Program (RFAP) grants have ranged in size from $250,000 to nearly $4 million. These grants have been used for new construction of private facilities to spur economic development to improve capacity. Recent examples include a $1.4 million award to the Redevelopment Authority of Berks County to replace approximately 1,600 feet of track and construct a ½-mile siding to the Boyertown Foundry including rehabilitation of the 4th Ave bridge. Buffalo & Pittsburgh Railroad received $1.8 million to replace approximately 5.5 miles of worn rail on curves to improve rail conditions and safety.

PennDOT is also beginning to utilize other funding programs to complement their (RFAP) and capital budget programs, including Congestion Mitigation Air Quality (CMAQ), and various grants through the Federal Railroad Administration (FRA). Table below shows the number of jobs that have been created as a result of PennDOT grants over the past four years that have been applied towards freight rail projects, typically for Class II and III rail lines.

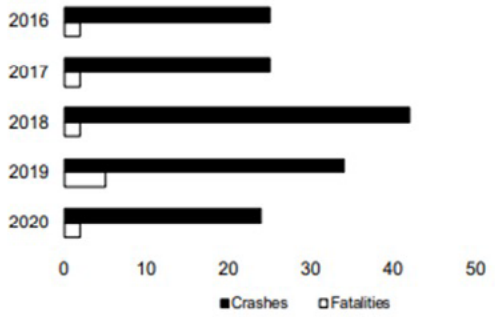
Fiscal Year	Grant Type	State Investment	Total Project Cost	Number of Projects Funded	Number of Jobs Created
2018	RFAP	$9,327,765	$13,325,378	18	158
2018	CB	$14,268,437	$20,383,481	9	99
Total		$23,596,202	$33,708,859	27	257
2019	RFAP	$9,990,783	$14,272,547	14	30
2019	CB	$30,000,000	$42,857,143	12	360
Total		$39,990,783	$57,129,690	26	390
2020	RFAP	$5,590,901	$7,987,001	17	46
2020	CB	$25,719,757	$36,742,510	9	158
Total		$31,310,658	$44,729,511	26	204
2021	RFAP	$6,936,179	$9,908,829	17	111
2021	CB	$26,314,055	$37,591,512	8	97
Total		$33,250,234	$47,500,341	25	208

PUBLIC SAFETY

According to the PSRP, "in general rail accidents, deaths, and injuries in Pennsylvania have decreased over the past decade." But, "the number of accidents, injuries, and incidents at highway-rail grade crossings (public and private) increased between 2009 and 2018." According to the most recent Pennsylvania Crash Facts & Statistics Report crashes between trains and other vehicles have been on the decline since 2016.

Crashes Between Trains and Other Vehicles—Five-Year Trends

Motor vehicle/train crashes make up a very small percentage of total crashes. In the last five years, only 13 fatalities have occurred in this type of crash. In 2020, two fatalities occurred.



Year	Crashes	Fatalities
2016	25	2
2017	25	2
2018	42	2
2019	34	5
2020	24	2

All Crashes

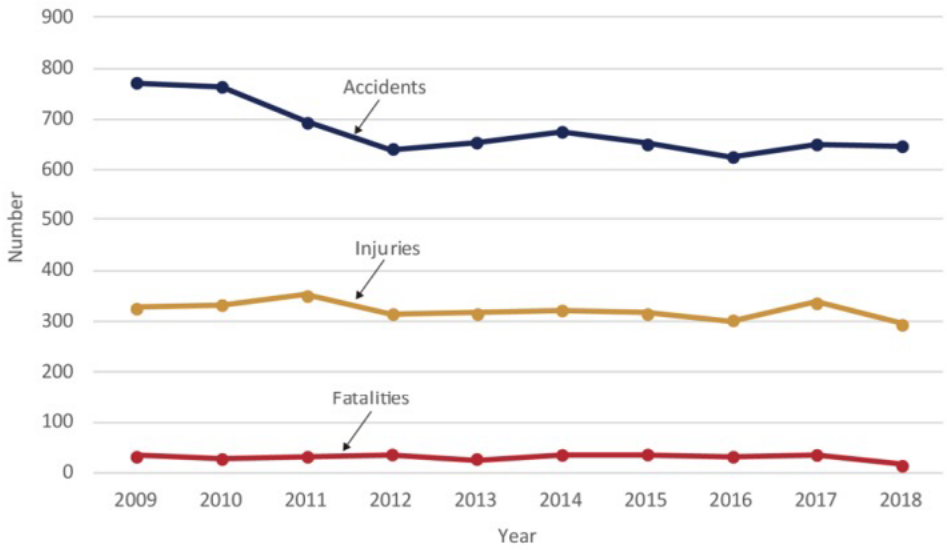
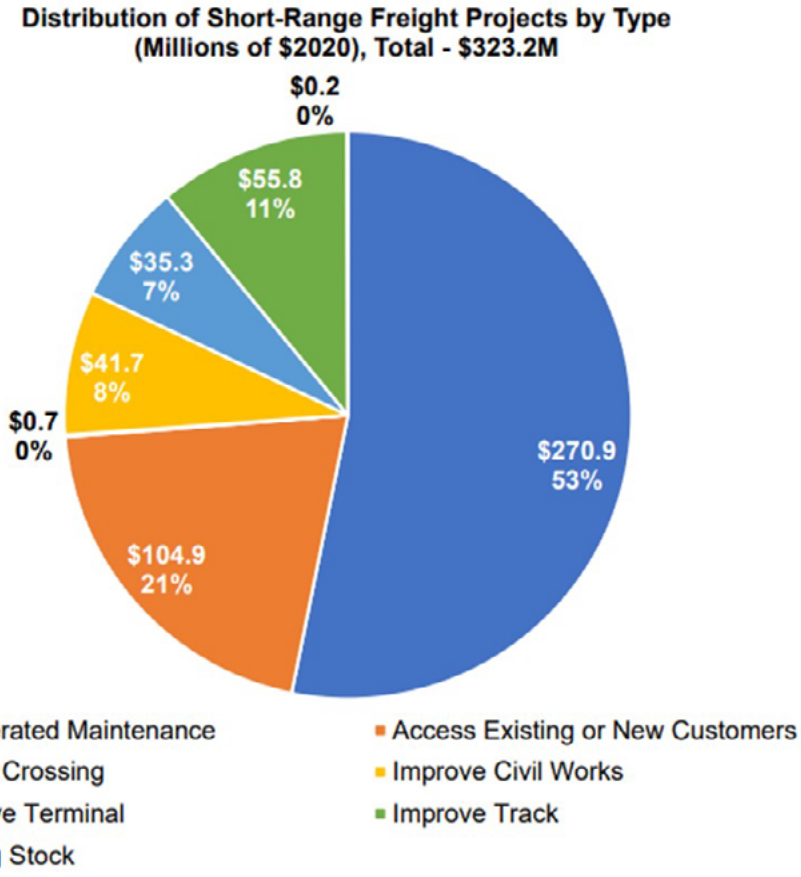


Figure 2-9: Rail accidents, fatalities, and injuries in Pennsylvania (2009–2018)

Source: Pennsylvannia State Rail Plan 2020 (March 2021)

Despite the concern for highway-rail or grade crossings, PennDOT has only devoted 0.1% of Short-Range funds on projects improving the safety designs of these junctions. The 2021 Bipartisan Infrastructure Law introduced a new Railroad Crossing Elimination Program offering more than $500 million in competitive grants to improve safety or eliminate at-grade crossings. That, and the existing Rail-Highway Crossing Program, offers additional funding opportunities to reduce these avoidable tragedies.

2021-2045 (IN MILLIONS OF 2020 DOLLARS)



Derailments and collisions risk significant public harm. There are 75 oil trains and numerous chemical trains that pass through the Commonwealth every week. Train travel times of day, as well as speed through urbanized areas are carefully coordinated and controlled. In general, private railroads do not provide public information on these trips.

RESILIENCY

Railroads must ensure that key personnel follow all state and local protocols to limit the possibility of hurting the supply chain. Freight train capacity is limited by the same issues that the trucking industry faces – the limited availability of container chassis trailers, limited terminal working hours, and limited trucker shift working hours.

INNOVATION

Track signal light fixtures are being upgraded to LED to save energy and to be more visible to both railroad personnel and to the general public. GPS technology has been used and continues to be more fully integrated with complex logic computer tracking systems to monitor train operations. Trains are becoming more and more automated such that in the future, only one human will be needed to safely operate the train.

Rail

RECOMMENDATIONS TO RAISE THE GRADE

- Frame passenger rail planning efforts on the differing visions and trade-offs of the near- and long-term future: the more affordable investment plans of recent State Rail Plans using mostly existing track or the more expensive and higher potential of passenger rail using new track corridors that deliver high-speed rail at better-than-driving convenience.
- Aggressively pursue new competitive funding opportunities from the Bipartisan Infrastructure Law to further fund capital projects in pre-COVID investment plans with a special focus on safety and connecting rail service improvements with adjacent land-use changes.
- Create state-level and local incentives for residential and commercial development to cluster in denser, transit-oriented communities near passenger rail stations. This includes reforming zoning and building codes to support the redevelopment of high-potential land that is currently underutilized.
- Implement recommended changes that result from the suggested passenger rail study when it relates to shared common tracks. Include municipalities, metropolitan planning organizations, and resident groups to more equitably increase the throughput of both freight and passenger rail in their communities.
- Work with railroad owners, operators, and labor organizations to ensure that the correct number of human operators are staffed at all times to provide continuous network safety. This includes monitoring and addressing security concerns from physical and cyberattacks.

DEFINITIONS

Class I Railroad - A carrier earning revenue greater than $250 million.

Class II Railroad - A carrier earning revenue between $20 million and $250 million

Class III Railroad - A carrier earning revenue less than $20 million.

Consists - A makeup or arrangement of cars contents.

PTC - Positive Traction Control

FRI - Freight Rail Innovation Institute - This program focuses on innovation, lead by Carnegie Mellon University, the Genesee and Wyoming (largest short line and owner of other short lines within Pennsylvania), and Wabtec - a technology company focused on developing large scale batteries for locomotives to drastically reduce the carbon footprint. This partnership is a strong source of pride, as most, if not all, partners are from within the Commonwealth and highlight the Western PA/ Greater Pittsburgh Region.

Level of Service (LOS) - A performance matrix that looks at the current level of utilization for a given type infrastructure and grades it on a scale or A to F.

PennDOT - Pennsylvania Department of Transportation

Rail

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Roads

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COLUMBIA, PENNSYLVANIA BESIDE THE SUSQUEHANNA RIVER

EXECUTIVE SUMMARY

The passage of Act 89 in 2013 resulted in the implementation and completion of nearly 3800 roadway improvement projects, with nearly 3,100 additional efforts underway and in the PennDOT 12-Year Program as of May 2022. Despite this major undertaking, there remains an $8 billion shortfall of unmet needs. Pennsylvania ranks 45th of the 50 states in terms of congestion delays, imperiling key freight routes amid a supply-chain crisis. With the passage of the federal Bipartisan Infrastructure Law, the Commonwealth is slated to receive $11 billion for targeted for roadway projects. While vying for that money, decision-makers must prioritize safety projects – complete streets, road diets, traffic-calming retrofits – and use fix-it-first approach. Engineers have the ability and responsibility to utilize road design to reduce Pennsylvania's 1,129 traffic deaths to zero.

CONDITION & CAPACITY

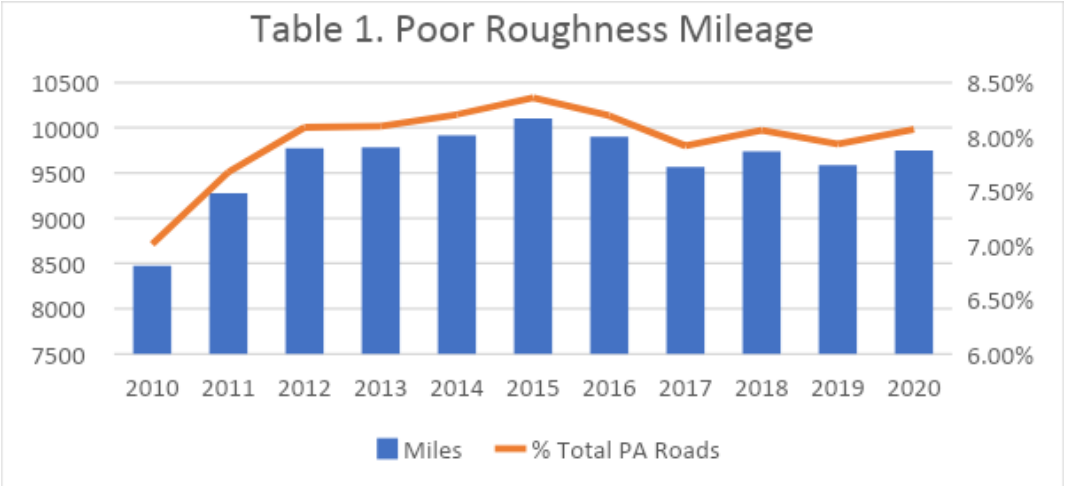
There are approximately 121,000 miles of public roads in the Commonwealth, with a third of this total being the responsibility of the Department of Transportation (PennDOT). Over 48,000 miles (40%) are in urban areas. Roughly 28,000 miles (30%) are eligible for federal funding for improvements.

PennDOT must prioritize alternative modes of transportation to alleviate congestion caused by vehicles. Significant further investments are necessary in transit, as well as improved infrastructure for people walking, riding bikes, and piloting scooters. Residents often observe that trains are slower and more expensive than driving. The vast majority of road users do not feel comfortable using bicycles for essential, functional trips like school runs or errands. They feel the danger of sharing space with motorists, regardless of paint markings. The massive potential of electric, cargo bikes and public transit on dedicated lanes is a reflection of the current dearth of safe, accessible infrastructure in communities (inadequate sidewalks, wide roads running through community neighborhoods, or lack of bike/shared paths). PennDOT and local road authorities can and should focus their engineering investment on what actually reduces traffic congestion: attracting motorists out of cars by changing the design of roads such that every resident feels comfortable riding to the grocery store and travelers with choices will opt for the bus becuase its faster than driving and parking

The use of the gas tax as a primary source of funding through Act 89 continues to see obstacles as more turn to fuel-efficient and hybrid/electric vehicles. Anecdotal information on the number of alternative fuel vehicles in the Commonwealth indicates that just over 10% of the total number of vehicles registered are alternative fuel types. This number continues to grow with the recent increases in gasoline prices, particularly with operators of large fleets.

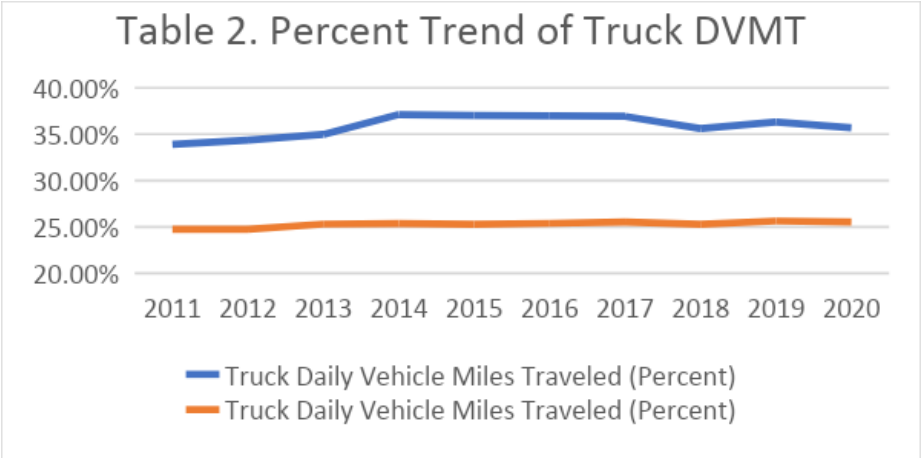
In 2021, PennDOT has been able to keep the overall International Roughness Index (IRI) on National Highway System roadways steady. The most marked increase in IRI measures occurred on no-NHS roads.

Poor roughness mileage has remained generally steady over the past decade, accounting for slightly less than 10% of the state's total roadway miles, as shown in Table 1 below:



Often the roadway surfaces that have a poor roughness rating require frequent maintenance activity to address conditions such as "washboard" (uneven, shoved or rutted paving), potholes, and pavement joint deterioration. These areas must be constantly addressed, with the associated disruption of traffic and delays, until the ultimate solution of new pavement can be designed and constructed. With the current funding backlog, this is often a lengthy process, therefore requiring ongoing maintenance efforts until reconstruction or major restoration can be scheduled.

Truck traffic showed minor fluctuations on both interstate and non-interstate PA roadways, displayed in Table 2 below:



Despite this, Pennsylvania has multiple top choke points for truck traffic – Philadelphia has 5 of the top 100 truck choke points in the United States. Harrisburg has one, and Pittsburgh has two on that list. PennDOT has prioritized its investment program to the improvement of existing facilities, and the agency should pursue novel solutions within existing right of way. Adding capacity does not alleviate chokepoints if you're only adding a general-purpose vehicle lane. Wireless communications between vehicles enable bus priority at traffic control devices, and this or other ITS could be explored for freight.

Compared to vehicle miles traveled in 2018, total rural daily vehicle miles traveled (DVMT) has decreased by 11%

in 2020, and DVMT for total urban miles decreased by 19% in 2020. While much of this is related to restrictions imposed by COVID, such as increased remote working and reduced commuter, vacation and pleasure travel, there have been slight upticks in DVMT since mid-2021. Pennsylvanians are driving more despite telework, and transportation planning must shift to serve all-day, all-week use. This is coupled with a rise in home delivery of goods associated with online purchasing which has resulted in more trucks on the roadway system.

OPERATIONS AND MAINTENANCE (O&M)

There are over 121,000 total linear miles of roadways in Pennsylvania. These are owned, operated, and maintained by various agencies including PennDOT, the Pennsylvania Turnpike Commission (PTC), and Local Municipalities.

PennDOT has several ongoing and routine maintenance activities that it carries out on state roadway, including surface treatment, shoulder cutting, shoulder grading, pipe replacement and cleaning, mechanized patching, manual patching, joint and crack sealing, winter operations, vegetation management, line (pavement markings) painting, bridge maintenance and cleaning, and signing.

PTC and Local Municipalities also perform many of these same activities on their roadways. Agencies utilize in-house staff as well as contracted companies to perform these maintenance tasks. The costs of these activities continueto increase given recent inflation and higher material and production costs.

PennDOT publishes a yearly Transportation Systems Management and Operations Performance Report that quantifies and evaluates the effectiveness of the various maintenance programs.Continuous prioritization is needed to maintain the most miles of roadway efficiently with the available monies. To aid in the future maintenance of roadways, new projects should look at both resiliency and life cycle costs while planning and designing for those roadway improvements.

Amish Country

The pandemic has impacted travel patterns with reductions in vehicle trips and transit use which reduced revenues that are critical to fund transportation projects. With a reduction in revenues, transportation agencies had to adjust funding for capital programs and operational and maintenance activities to account for these immediate revenue shortfalls.

FUNDING

Since its enactment in 2013, Act 89 has helped improve investment in the Commonwealth's infrastructure. It has generated approximately $2.3 billion per year in funding for all modes of transportation. Act 89 has helped PennDOT to complete nearly 4,000 projects totaling more than $10 billion in value. However, the PTC made the final $450 million payment to PennDOT for transit systems around the state in mid-21. Starting in fiscal year 2022, the payments decreased to $50 million per year for over two decades, which will shift the burden to the Commonwealth's general fund.

There were still unmet funding needs even with Act 89 investment. As reported from the Transportation Revenue Options Commission Report Final Report , the need to fund transportation improvements has grown to a funding gap of $9.35 billion annually for state-owned highways, bridges, and multimodal facilities There are similar unmet needs at the local level with an estimated $3.9 billion funding need annually growing to nearly $5.1 billion by 2030. This continued growth in unmet funding needs is an on-going challenge for PennDOT, County and Local transportation agencies to maintain and operate the Commonwealth's transportation infrastructure that continues to age.

A total of 25 counties had passed an ordinance, allowed for under Act 89, to charge a $5 vehicle registration to fund local transportation projects. Each of the five counties in southeastern Pennsylvnia (Bucks, Chester, Delaware, Montgomery and Philadelphia) have collected between $2.2 – $4 million annually per county to be used to fund projects on local county roads and bridges.

Funding for the operations and maintenance of the roadways is primarily from the Motor License Fund which is made up of Liquid Fuels Tax and License and Fees monies. Funding for the operation and maintenance of the roadways at the local municipal level is from both local taxation and fees and the Liquid Fuels fund. The Liquid Fuels fund originates from the Motor License Fund and is distributed to local municipalities in proportion to the eligible roadway mileage in each municipality. At every level of the operations and maintenance responsibilities, the funding of maintaining the existing roadways and operating them efficiently is in direct conflict with the funding available for roadway improvements that add capacity.

The pandemic has impacted travel patterns with reductions in vehicle trips and transit use which reduced revenues that are critical to fund transportation projects. With a reduction in revenues, transportation agencies had to adjust funding for capital programs and operational and maintenance activities to account for these immediate revenue shortfalls.

At the federal level, the Infrastructure Investment and Jobs Act, also known as the Bipartisan Infrastructure Law, was signed into law on November 15, 2021. Of the $1.2 trillion identified, $110 billion was designated for roads, bridges, and other major projects across the U.S. Pennsylvania will receive $17.8 billion of this to improve roads, bridges, public transportation, and other needs, with $11.3 billion targeted for roadway projects.

With the long-term federal funding in-place, Pennsylvania will continue to advance the strategic funding proposal from the PA Transportation Revenue Options Commission to help toward the unmet funding needs of the PA transportation system in the future.

FUTURE NEED

Roadways will continue to age beyond their design service life and deteriorate, thus the previously-mentioned gap between needs and resources will continue to widen. Given improved fuel economy and the increasing popularity of alternative fuel vehicles, reliance on any fuel-based taxes for continued revenue must be reconsidered.

There are several methods being evaluated and implemented on trial bases in several jurisdictions that would allow road user charges for all vehicles regardless of the energy source used for their power. One of these is a Vehicle Miles Traveled (VMT) tax. This will account for reduced fuel consumption as vehicle fuel economy improves, as well as covcer the increasing number of alternative-fuel vehicles. Pennsylvania has not yet taken any action in this area but is considering this as well as other methods as part of the alternative funding proposals developed by PennDOT in its Transportation Revenue Options Commission (TROC) report as well as by the State Legislature, with both the PennDOT Pathways and Drive Smart initiatives that it has put forth.

PennDOT should apply life-cycle cost analysis methods, which maximize the financial sustainability of investments from its limited budget. The expanded use of cost-benefit analysis principles in the evaluation and prioritization of projects would permit the ability to address needs on a more objective basis. These methods reflect the benefits of fixing existing roads, adding safer, multi-modal, changes, and the threats of Climate Change.

PUBLIC SAFETY

1,129 residents lost their lives on Pennsylvania roadways in 2020, the latest year for which NHTSA has performed a full analysis. That number included 1,060 drivers, 143 pedestrians, and

20 bicyclists. The total represented an almost 7% jump from 2019, despite significantly less road use because of COVID-19. This is a troubling trend, as NHTSA's early estimates of 2021 nationwide data suggest the Commonwealth's road deaths were more numerous than the year before. Pedestrian deaths and fatal crashes involving large trucks both rose 13% in America last year. Fatalities on local urban roads jumped 20% and 15% on larger urban roads. Rural interstates – frequently two-lanes with no shoulder or sidewalk – featured 15% more deaths across America in 2021, compared to 2020.

Engineers share in the responsibility to reduce these numbers of deaths, and the much more frequent major injuries, with roadway reconfigurations that create Complete Streets. These changes help to reduce motorist speeds, enhance pedestrian comfort, and physically separate bike people riding bikes from motor vehicles.

Roundabouts, especially in rural and exurban areas, is one all-star of safety-first engineering. In 2021, PennDOT released data for 26 roundabouts on state routes at intersections that were previously signal-controlled. These data show that the fatalities were reduced by 100 percent, and serious injuries by 81 percent. In addition, PennDOT requires state-funded projects to conduct feasibility studies at intersections before any improvement work.

The target for Pennsylvania engineers is zero: zero deaths on public roads in the Commonwealth by 2050. Two campaigns – Toward Zero Deaths and Vision Zero – are in use across Pennsylvania with that goal. Vision Zero has been adopted by cities like Harrisburg and Philadelphia and re-frames road engineering by removing user fault/blame and focusing on the system: everyone makes mistakes, and it's our job to design streets so that no error is deadly.

Greater political will, increased enforcement, additional capital funding, and urgency from decision-makers are necessary for serious progress on eliminating traffic violence. Philadelphia adopted Vision Zero, but its 2021 safety report notes an upward trend in traffic deaths since the adoption – and before the large danger increases from the COVID-19 years. As the report notes, more aggressive traffic calming engineering is necessary that force motorists to go slower in fewer vehicle lanes.

Projects with primarily safety benefits historically receive much less funding than capacity projects in budgets that add lanes or expand intersections and interchanges. That must change to make the Commonwealth's streets safer.

Investing a higher percentage of capital dollars in safety projects has a large ROI: when Philly began Vision Zero, half of all its traffic deaths and injuries happened on only 12 percent of the city's streets.

RESILIENCE AND INNOVATION

As Pennsylvania's roadways and pedestrian paths/sidewalks continue to age, transportation demand continues to grow, and climate change continues to pose a threat to the built environment, it is increasingly important to develop new innovations to build resiliency into roadway infrastructure. Throughout the state, advances in design, construction, maintenance, and management technologies are being employed in order to improve resiliency. These tools include new software to guide design and construction, new building materials that utilize previously discarded waste, and new project delivery options to reduce cost and increase efficiencies.

In an effort to reduce costs and extend roadway longevity, the use of non-traditional materials has continued to grow throughout Pennsylvania.

- PennDOT has identified measures to enhance and improve roadway surfaces and simultaneously increase resiliency on aging roadways, through the use foamed glass aggregates (FGAs) (which use recycled materials and glass) and hot pour mastics (HPMs) (whch can be applied during all seasons, and require shorter timeframes), thus reducing impacts to the travelling public.
- Cashless tolling systems, primarily for the Pennsylvania Turnpike (implemented as a temporary measure in response to the pandemic in 2020, but part of the Turnpike's long-range plan), which will help move traffic and reduce travel delays, and potentially be able to be used by PennDOT if tolled facilities are considered in the future.
- The expansion of PennDOT's ability to remotely manage and observe traffic, through regional Traffic Management Centers (TMC) will also permit better use of roadway capacity through technology (TMC's have been established in several PennDOT Districts to date and more are planned).
- Measures such as variable speed limit signage and hard-shoulder running will enhance safety and help the efficient movement of traffic.

Over the past three years, emergency repair needs were shown to have dramatic increases, mainly related to severe weather events which caused large-scale damage. Severe flooding related to unusual weather events in both 2020 and 2021 caused $120 million in road and bridge damages, an amount that was over four times greater than the allocated budget for emergency repairs in the same year. The combination of severe weather events with older infrastructure has resulted in these repairs increasing frequency.

As the wellbeing of Pennsylvania's roadway infrastructure continues to be challenged, investing in and research of new innovations are crucial to a more resilient future. As the largest collection of impervious surface area under state control, roads create the most significant dangers to public safety and health from stormwater. In cost-benefit analyses, this environmental damage should be considered, in addition to the future needs of operating and maintaining the roads.

Reducing waste, improving efficiencies, minimizing costs, and mitigating future negative impacts to the roadway network all work in tandem in building better infrastructure. The use of the tools discussed above along with many others that are currently in development is an integral part in improving the state's transportation network for years to come.

Roads

RECOMMENDATIONS TO RAISE THE GRADE

- Establish predictable, stable and equitable dedicated transportation funding which will enable PennDOT to address the growing backlog of unmet improvement needs.
- Leverage/match federal funding effectively and efficicently, with a primary focus on calming traffic and increasing comfort for roadway design for people walking, biking, and accessing transit.
- Repurpose existing roadways to prioritize freight and transit vehicles, the latter of which must attract motorists to ride for traffic congestion to lessen and forge resilient supply chains.
- Restructure existing planning and funding schemes to increase by orders of magnitude the state investments in storm preparedness, recovery, and asset rebuilding with the latest, most resilient ASCE design standards.
- Utilize innovative and creative project delivery strategies and methods to maximize the benefit of transportation funding.
- Pilot and fully implement large-scale user fees for passenger and freight vehicles that provides a solid foundation to replace the gas tax within this decade.
- Require the use of life-cycle cost analyses and methods to properly evaluate and determine the total cost of planned projects as well as in the evaluation and prioritization of projects.

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Solid Waste

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EXECUTIVE SUMMARY

Pennsylvania residents generate less municipal solid waste than the American average: 4.0 and 3.8 pounds per day in 2019 and 2020 respectively, compared to the national mark of 4.9. In total, the state's 43 active municipal waste have adequate capacity, but remaining life differs greatly by location. The Greater Lebanon Refuse Authority reports less than 4 years remaining while the McKean County Landfill has 190 years' worth. Acts 68 and 90 added a fee of $0.25 per ton and $4 per ton fee to benefit land conservation programs, the first among states to divert mandatory tipping fees. Despite that innovation, flexibility is limited at the local level. The state modify Act 101 to permit county and/or local governments to establish various methods for generating revenue to sustain their solid waste management, recycling, and education programs.

BACKGROUND

Pennsylvania's solid waste consists of household trash as well as waste generated by residential, commercial or institutional sources. Solid waste is collected and most often disposed of in a landfill or recycled.

In Pennsylvania, solid waste management operates largely on a local level and wastes are categorized as municipal solid waste (MSW) and residual waste. MSW, commonly referred to as garbage or trash, includes everyday items used in homes, businesses, and institutions. . Non-hazardous industrial wastes include waste produced by industrial, mining and agricultural operations, and are considered residual solid waste.

CAPACITY

The Pennsylvania Department of Environmental Protection (PADEP) is the primary regulatory agency with jurisdiction over how solid waste is handled, managed, disposed, or recycled in Pennsylvania. According to the PADEP, there are 43 active municipal waste landfills, and 6 waste-to-energy (WTE) facilities in the Commonwealth. (Figure 1).

Over 900 facilities in Pennsylvania have permits to process, beneficially use, or dispose residual wastes, which include the following:

FIGURE 1: PENNSYLVANIA WASTE FACILITIES

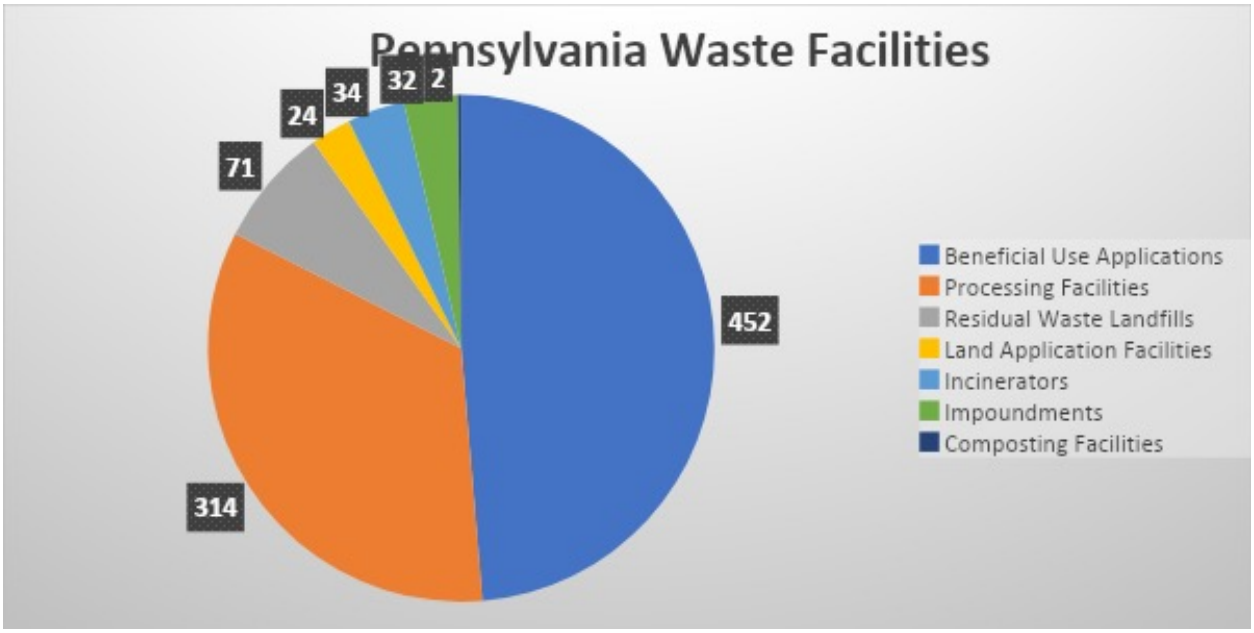
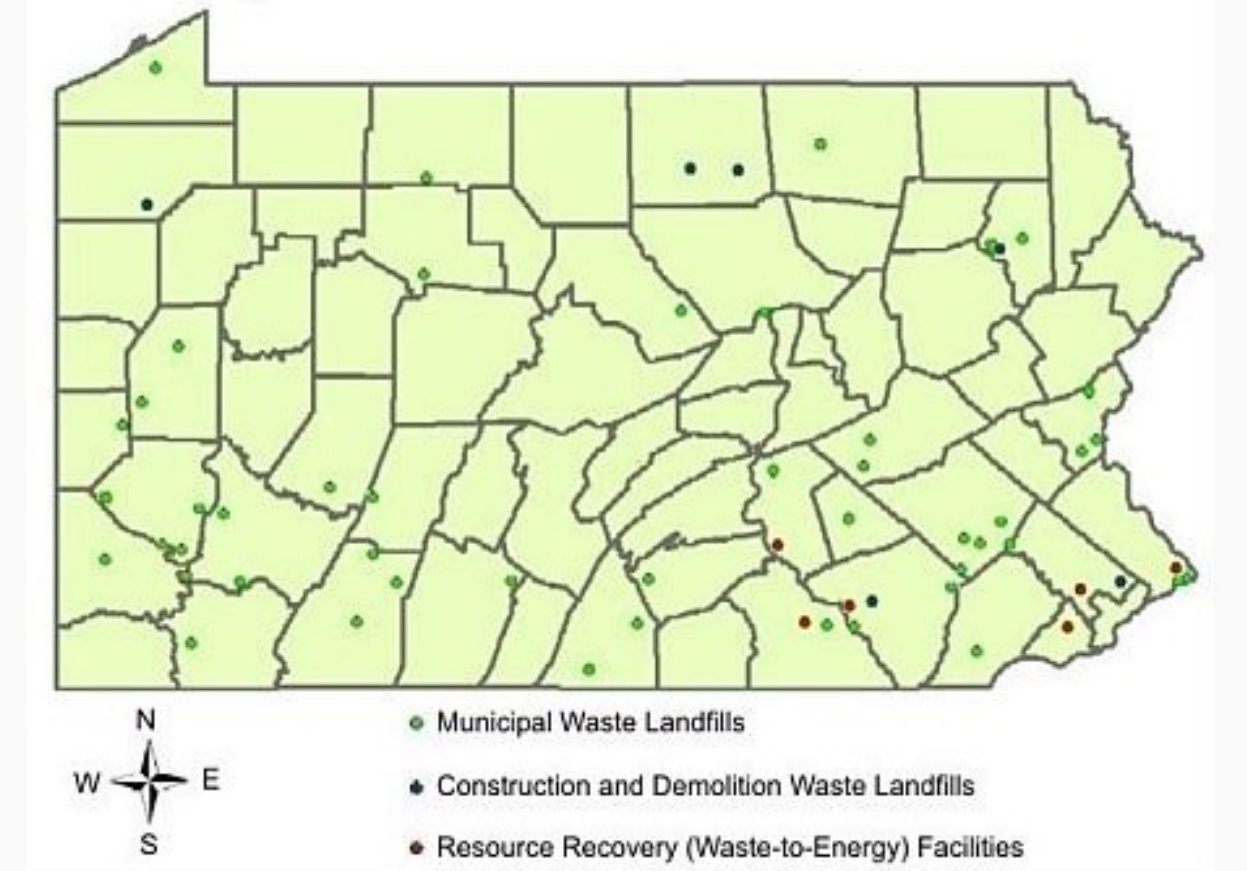


FIGURE 2: MUNICIPAL WASTE LANDFILLS AND RESOURCE RECOVERY FACILITIES



A summary of the statistics of waste disposal tonnage within the US and Pennsylvania and indicating the per capita waste disposal for PA residents is presented in Table 1 below.

TABLE 1: SOLID WASTE DISPOSAL QUANTITIES IN PENNSYLVANIA (2019 and 2020)

	2019			2020		
	Municipal	Residual	Total*	Municipal	Residual	Total*
Total Million Tons	15.3	4.5	24.1	14.2	4.0	22.4
PA Million Tons	9.3	3.3	15.5	9.1	2.8	14.6
PA lbs/ person/day	4.0	NA	NA	3.8	NA	NA
PA Population was estimated at 12.8 million in 2019 and 13.0 million in 2020 based on the 2020 U.S. Census						

**Total waste includes municipal waste, residual waste and "additional wastes." "Additional wastes" include residual, sewage sludge, processed medical/infectious, construction, ash residue, and asbestos wastes.*

In 2018[1], the reported national average of solid waste generated per person per day was 4.9 pounds, compared to Pennsylvania which reported 4.0 pounds in 2019 and 3.8 pounds in 2020. The total amount of MSW disposed of in Pennsylvania accounts for approximately 8% of the nation's MSW.

The total tonnage in Table 1 includes waste imported from outside of Pennsylvania and waste from in-state sources. Based on the data above, approximately 35% of disposal in Pennsylvania MSW landfills comes from out of state.

Municipal waste disposal facilities and transporters are required to comply with county plans that specify which facilities are approved to receive waste. These plans require permits, which set maximum daily waste accepted at landfills, ensure safe transport of solid waste and ensure transportation capacity needs are met.

Table 2 presents the existing MSW Landfill capacity as of 2020 broken down by region.

TABLE 2: MUNICIPAL SOLID WASTE LANDFILL CAPACITY (2020)

Landfill	County	Ave. Daily Volume of Waste Accepted (tons)	Total Capacity Remaining (tons)	Estimated Remaining Life (years)
NORTHEAST REGION				
Alliance Sanitary Landfill, Inc.	Lackawanna	1,881	23,067,811	39.6
Environmental & Recycling Services, Inc.	Lackawanna	1,350	N/A	4.8
Keystone Sanitary Landfill	Lackawanna	4,935	6,797,574	4.44
Bethlehem Landfill Co.	Northampton	1,170	1,757,232	4.89
Chrin Brothers Landfill	Northampton	558	2,999,073	17.6
Grand Central Sanitary Landfill	Northampton	2,119	4,070,366	6.3
Blythe Recycling and Demolitions Site (BRADS)	Schuylkill	1,500	10,847,000	23.2
Commonwealth Environmental Systems Landfill	Schuylkill	2,461	8,205,557	13
Northeast Region Remaining Capacity and Life			**57,744,613**	**14.2**
NORTH CENTRAL REGION				
Northern Tier Solid Waste (101201)	Bradford	19.62	101,181.7	17.25
Northern Tier Solid Waste (101243)	Bradford	327.65	7,218,778	71.3
Camp Hope Run Landfill	Clearfield	5,000	28,200,000	21
Clinton County Solid Waste Authority	Clinton	945	11,081,715	37.8
Lycoming County Landfill	Lycoming	883	4,531,594	16.6
North Central Region Remaining Capacity and Life			**51,133,268.70**	**32.8**
NORTHWEST REGION				
Northwest Sanitary Landfill	Butler	442	278,182	2.42
Seneca Landfill	Butler	2,204	19,656,503	30.9
Greentree Landfill, LLC	Elk	1,790.2	23,906,372.7	50.3
Lake View Landfill	Erie	674	8,065,170	45.9
Evergreen Landfill	Indiana	366.34	4,635,753.2	48.3
McKean County Landfill	McKean	551	23,402,296	190
Northwast Region Remaining Capacity and Life			**79,944,277**	**61.3**
SOUTHEAST REGION				
Fairless Landfill	Bucks	11,725	23,299,080	6.4
Southeastern Chester County Refuse Authority (SECCRA)	Chester	409	2,150,562	17.1
Southeast Region Remaining Capacity and Life			**25,449,642**	**11.8**

SOUTH CENTRAL REGION				
Sandy Run Landfill	Bedford	342	2,204,731	25
Conestoga Landfill	Berks	3,711	11,163,098	9.8
Pioneer Crossing Landfill	Berks	1,222.64	2,116,582.9	5.5
Western Berks Community Landfill & Recycling Center	Berks	814	1,098,566	4.37
Cumberland County Landfill	Cumberland	1,891	3,450,720	5.9
Blue Ridge Landfill Co.	Franklin	2,307	10,694,160	14.8
Mountain View Reclamation	Franklin	1,169	8,738,696	24.4
Lanchester Landfill	Chester	919.71	3,265,177.7	11.5
LCSWMA Frey Farm Landfill	Lancaster	1,397.4	6,830,207	16.5
Greater Lebanon Refuse Authority	Lebanon	423	502,962	3.9
Modern Landfill	York	3,154	4,018,275	4.15
South Central Region Remaining Capacity and Life			**54,083,176**	**11.4**
SOUTHWEST REGION				
Monroeville Landfill	Allegheny	1,314.74	6,589,749.8	16.3
Imperial Landfill	Allegheny	1,930	12,247,955.6	23.2
Kelly Run Landfill	Allegheny	615.22	641,697.7	4.0
Joseph J. Brunner Landfill	Beaver	250	1,755,824	24.5
Laurel Highlands Landfill	Cambria	500.03	18,099,518.4	139.8
Chestnut Valley Landfill	Fayette	602	1,271,231	8.1
Mostoller Landfill	Somerset	795.05	4,666,190.7	22.6
Southern Alleghenies Landfill	Somerset	347.45	5,216,482	57.7
Arden Landfill	Washington	1,201.06	21,814,255.2	54.1
South Hills Landfill	Washington	546.65	7,505,467.9	52.4
Greenridge Reclamation, LLC	Westmoreland	1,173.1	1,281,671	4.2
Westmoreland Sanitary Landfill	Westmoreland	905.91	22,310,465.8	78.9
Valley Landfill	Westmoreland	1,104.60	5,183,957.2	17.8
Southwest Region Remaining Capacity and Life			**108,584,466.3**	**38.7**
TOTAL PENNSYLVANIA REMAINING CAPACITY AND LIFE			**376,939,442**	**28.9**

Landfill	County	Total Capacity Remaining (tons)	Estimated Remaining Life (months)
NORTH CENTRAL REGION			
Shawville Landfill	Clearfield	7,911,398.3	15,942
White Pines Landfill	Columbia	498,116	129
Pheonix Landfill	Tioga	11,309,840.6	819
Pine Hill Landfill	Tioga	513,237	374
North Central Region Remaining Capacity and Life		**20,232,591.9**	**4,316**
NORTHWEST REGION			
New Castle Power Landfill	Lawrence	**1,848,594**	**437**
SOUTHEAST REGION			
Aqua Foxcroft Landfill	Montgomery	131,551	2,113
Aqua Neshaminy Falls Landfill	Montgomery	5,011	108
Aqua Pickering Creek Landfill	Montgomery	105,599	1,010
North Central Region Remaining Capacity and Life		**20,232,591.9**	**4,316**
SOUTHWAST REGION			
Max Yukno Landfill	Westmoreland	**200,436**	**20.7**
TOTAL PENNSYLVANIA REMAINING CAPACITY AND LIFE		**22,523,783**	**2,095**

Alex Paris is a residual waste landfill that is no longer accepting waste, according to PADEP.

Per the PADEP, the majority of the residual landfill capacity is within the northern portion of Pennsylvania.

According to the Waste Business Journal's 2019 Waste Market Overview & Outlook, the estimated remaining landfill capacity in the U.S. is approximately 20 years and is expected to reduce to 17 years by 2022. Landfill capacity in the Northeast is also expected to reduce to 10 years by 2022. Therefore, Pennsylvania is above the national average for landfill capacity. However, reduced landfill capacities in the U.S. and northeast will likely lead to more solid waste being transported to Pennsylvania for disposal.

Based on the information provided in Tables 2 and 3, sufficient disposal capacity for waste generated in Pennsylvania over the next 10 years appears to currently be available. However, landfill capacities in the Southeast, South Central and Northwest regions of Pennsylvania are less than the national estimated remaining landfill capacity and are nearing 10 years.

OPERATIONS AND MAINTENANCE

States play a leading role in ensuring federal regulations are met for operating and maintaining MSW. In absence of an approved state program, the federal requirements must be met by waste facilities. Regulations address common problems associated with landfills, including location restrictions, liner requirements, leachate collection and removal systems, groundwater monitoring, and closure and post-closure care expectations. In 2020, to sustainably manage the nation's solid waste, the EPA announced its National Recycling Goal, which set a 10-year benchmark to increase the recycling rate for all materials by 50%. To achieve this goal, operational improvements include reducing the percentage of the wrong materials such as food and other contaminants entering the recycling stream. Clean recyclables improve the efficiency of processing materials into new products or energy. The EPA notes that clear, consistent public education and outreach are critically important to achieving this goal.

CONDITION AND PUBLIC SAFETY

Solid waste facilities are regulated by PADEP permits to help ensure safe operations. The PADEP is also responsible for continued monitoring of all closed MSW landfills prior to the receipt of their final closure certification. This includes reviewing the ground water monitoring plan, summaries of the inspections completed, details on the leachate generation and landfill gas production if applicable. The PADEP also reviews the land use landfill benefits and financial bond liabilities and insurance coverage on an annual basis. The PADEP's Solid Waste Program which includes comprehensive permitting and inspections of facilities. Over 1,400 violations have been identified since 2018. Facilities that are determined to be noncompliant with their permits are subject to penalties including fines or potentially forced closure. Due to regulatory monitoring and reporting, most disposal sites are in good conditions; however, exceptions do exist. Some examples of recent regulatory studies and enforcement are as follows:

- PADEP issued civil penalties in 2015 against a major waste disposal company for odor control and leachate storage violations at three of its disposal landfills and mandated that two of them cease operations by 2017 and 2019, respectively. Both landfills have been closed and waste previously disposed of at these landfills has been directed to alternative locations leading to longer waste transportation routes and an increase in disposal costs.
- In April 2019, the Pennsylvania Department of Health conducted a study on a landfill and determined that short-term exposure to the air around the landfill could be an issue for children, pregnant women, and the elderly.
- PADEP is also responsible for identifying illegal dump or waste storage sites and has issued fines against property owners for improper disposal of waste and illegal tipping. In late 2020 PADEP reached an agreement with a waste disposal company to provide landfill space and a property owner to transport illegally dumped material.
- In October 2020, PADEP also imposed fines against an MSW landfill related to improper leachate disposal and for leachate water containing contaminants associated with fracking.

The solid waste disposal industry remains the 6th deadliest occupation in the United States (as a whole) though total collection worker fatalities continue to decline. Fatalities associated with the industry have been trending downward from 57 in 2018 to 43 in 2019 to 38 in 2020. In Pennsylvania there were 8 fatalities in 2019 and 9 fatalities in 2020. Most of the fatalities were associated with machinery or vehicle movement.

Transportation of solid waste is also regulated with inspections by the PADEP and the Pennsylvania State Police. Solid waste transporters continue to have fewer instances of noncompliance as compared to other commercial transporters. In Pennsylvania, all vehicles transporting municipal or residual waste to processing and disposal facilities are required to have valid waste transporter authorization to ensure safety. The number of waste haulers across the state has increased to nearly 5,000 and is expected to keep increasing; however, the number of inspections has not been able to keep pace with this increase.

Funding needs to continue to protect the public from the results of illegal dumping and to support safe handling, transportation, disposal, and recycling practices.

As per peer reviewed published research landfills and specifically landfill leachate has been identified as a source of PFAS contamination. In April 20198, the PADEP announced a plan to sample public water supplies that have elevated potential for contamination, based on proximity to common sources of PFAS including landfills. Sampling of the water continued through 2020 and first quarter 2021. Results of the sampling are available on the PADEP website. A ruling to establish a state-wide MCL for PFOA and PFAS is currently in progress.

FUNDING

Publicly operated solid waste management programs have trouble remaining financially sustainable. As a result, solid waste is typically transported by private haulers and disposed at private facilities with state municipal and county staff oversight.

Tipping fees are waste disposal fees paid by waste haulers to dispose of MSW at landfills. The fees are typically used to pay labor to operators and drivers related to MSW transport and disposal. The revenue generated from tipping fees are also used for grants for local recycling planning and environmental protection programs, and subsidize state programs for recycling market development, public education, technical assurance, and grants administration. Similarly, recycling fees are also imposed and are financed by Act 101.

Based on a nationwide study in 2020, four-year trends in average tipping fees increased 3.5% annually from 2016 through 2018. Between 2019 and 2020 the nationwide average fee decreased 2.6% to $55.36 *(+/- 29.62)*. The average fee in the Northeastern region, however, went up to $68.69 *(+/- 20.46)*. Fees in Pennsylvania are higher than most of the country but consistent with the Northeastern U.S. As of 2020, the state average tip fees in Pennsylvania were $73.45 *(+/- 15.23)*.

Acts 68 and 90 added a fee of $0.25 per ton and $4 per ton fee to benefit the environmental stewardship fund. Pennsylvania is the only state to use its state-imposed tipping fees to finance land conservation programs.

As of September 2021, 65 landfill gas energy projects exist in Pennsylvania, 51 of which were in the operational or constructed phases. Most projects generate electricity from landfill gas, while the remainder process landfill gas into a fuel for commercial use, displacing fossil fuel consumption like oil and natural gas. This serves as a source of income for the landfill. Pennsylvania has six waste -to-energy facilities converting MSW into electricity. The energy produced is sold to the grid to generate the funds to operate the disposal site.

As per ACT 101 Pennsylvania has funds reserved specifically for composting. The PADEP keeps track of all registered composting facilities. There are numerous composting facilities within the state, however, a majority of them are located within farms and are not allowed to accept waste outside of material generated within the facility. There are fewer facilities collecting and generating compost from municipalities and townships, primarily leaf composting. PADEP is also responsible for reviewing recycling and composting ordinances as well as reviewing and providing grants to ensure compliance with Act 101.

Food waste consists of a large portion of waste within the MSW facilities (between 10-20%), a significant percentage of agricultural waste and yard waste is also compostable. Encouraging municipalities and smaller facilities to group together to generate compost can significantly reduce the amount of material that needs to be landfilled thus extending the lifespan of landfills and reducing costs. Further education and outreach efforts to communities about composting process and benefits would also be beneficial.

Funding sources to enable local governments to sustain recycling and solid waste programs are still needed especially in rural areas.

RESILIENCE

There are numerous publicly and privately-operated transport, recycling and disposal facilities across the state, which prevents the system from being significantly impacted as a result of one entity's individual performance or collapse. While some vulnerabilities still exist, PADEP regulations on the design of facilities, monitoring and reporting procedures provide for accountability that engineering practices and environmental controls are upheld.

At present, 440 of Pennsylvania's 2,700 municipalities are mandated to recycle and provide curbside collection programs. These municipalities collect leaf waste and at least three materials from a menu of eight materials - steel/tin and aluminum cans, plastics, clear and colored glass, office paper, newspaper and corrugated cardboard from residents. They also provide recycling education and enforce their recycling ordinances.

Pennsylvania has over 1,900 municipalities with access to recycling programs. These programs serve an estimated 94 percent of the state's population (more than 11.6 million residents). Of the communities not required to recycle, 617 have curbside programs and 873 have access to drop-off programs.

INNOVATION

Pennsylvania has six municipal Waste to Energy (WTE) facilities located in the southeast region. Combined, the facilities are capable of processing up to 10,000 tons of waste per day and generating 250 megawatts of electricity. However, WTE facilities can produce Nitrogen Oxides (NOx) which are the main ingredient in ground level ozone or smog which can cause respiratory inflammation. There are proven controls available for NOx like Selective Catalytic Reduction and less expensive options like Selective Non-Catalytic Reduction and the use of Low-NOx Burners and Over-Fire Air. To date these technologies are not installed at PA's WTE plants.

Pennsylvania currently supports 38 landfill methane projects, with eight candidate projects identified. The methane is either mixed directly into the natural gas supply or used to generate electricity on-site. Pennsylvania has the third highest number of landfill methane projects of any state.

Single-stream recycling encourages people to recycle because it is convenient. All recyclables can be placed in one bin, which is collected and sorted at the recycling facility. This process diverts approximately 45% more material to recycling facilities than multi-stream recycling (in which residents are required to sort their recyclables by type) and reduces the burden on municipal waste landfills. Currently, 70 recycling facilities prepare material for resale in Pennsylvania; however, only one quarter of them support single-stream recycling.

In Pennsylvania, approximately 9.5% of organic material, such as yard trimmings, manure, and food waste, are diverted to composting facilities, which is on par with the national average. Pennsylvania also has the most yard trimming composting facilities in the nation. The State's composting legislation has not been updated since 1991, and no grants, loans, or diversion mandates promote further composting. However, PADEP did provide grants to provide assistance to registered nonprofit organizations such as food banks for the proper management and operation of food to reduce waste under the Food Recovery Infrastructure Grant Program.

Philadelphia passed legislation prohibiting retail establishments from providing single-use plastic bags and paper bags that do not meet certain requirements in December 2019, with full enforcement beginning in April 2022. The plastic bag ban will help reduce single-use plastic waste and improve the environmental quality and cleanliness of the city.

Solid Waste

RECOMMENDATIONS TO RAISE THE GRADE

- Legislation should be considered to modify Act 101 to permit county and/or local governments to establish various methods for generating revenue to sustain their solid waste management, recycling and education programs.
- Pass state legislation that would promote, enhance, or facilitate the development of resource recovery facilities, including those for single-stream recycling, composting, reuse, and energy recovery.
- Improve waste education programs on topics such composting and recycling (with focus on preventing contamination) and reduction of waste generation.
- Continue inspections of solid waste generators, transporters and disposal facilities.
- Continue and improve data collection and publication so data is readily available for planning purposes.
- Evaluate landfills for potential emerging contaminants (PFAS, PFOA, etc.).

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Stormwater

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EXECUTIVE SUMMARY

While Pennsylvania's stormwater infrastructure is generally performing adequately for lower-intensity events, more intense, frequent, and longer duration storms overwhelm the aging network. Over 65 utilities across the Commonwealth provide much needed dedicated funding to address local stormwater needs, representing $1.3 billion for wastewater and stormwater infrastructure over the next five years. But approximately $2 billion in stormwater assets have reached the end of their useful life and a total need exists of $6.7 billion in stormwater funding over the next three to five years. The Commonwealth lacks an easily accessible and accurate database of all publicly and privately owned stormwater assets, a tool that is desperately needed to for successful operation and maintenance programs and life-cycle assessments. As noted in the previous two Pennsylvania report cards, the Commonwealth's primary tool for guidance and regulation for the design of stormwater assets is over 15 years and has still not been updated to reflect changes in science and technology.

BACKGROUND

Stormwater infrastructure is comprised of a system of inlets, conveyance pipes and channels, and structures that convey rainwater from impervious and pervious surfaces, agricultural areas, and other surfaces to streams, ditches, rivers, lakes, and bays. Stormwater management analyzes how much and how quickly stormwater runoff enters these receiving water bodies and the quality of the runoff. Municipalities, government agencies, private businesses and homeowner associations own and maintain stormwater management facilities within the Commonwealth.

As watersheds are urbanized, much of the vegetation is replaced by impervious surfaces, reducing the amount of infiltration to groundwater that can occur. Thus, more stormwater runoff is generated - runoff that must be collected by extensive drainage systems that include curbs, storm sewers, and ditches to carry stormwater runoff directly to streams. More simply, in a developed watershed, much more water arrives at a stream more quickly, resulting in an increased likelihood of more frequent and severe flooding. Frequent flooding causes problems for residents and the local government which must clean up sand and sediment deposited after a flood.

Programming at the State, County and Municipal levels has consistently trended towards a reactive rather than proactive approach. Owners of stormwater management facilities often consider their existence a nuisance rather than an asset. With some exceptions, Capital Improvement projects tend to be focused on short term fixes rather than long-term planning.

The National Pollution Discharge Elimination System (NPDES) Phase II Program sets procedures that must be followed for stormwater. There are two programs that pertain to stormwater: Earth Disturbance permits and Municipal Separate Storm Sewer Systems (MS4) permits. Construction projects that disturb more than 1.00 acre of soil require a permit that reviews the approach to handling stormwater. Typically, County

Conservation Districts or the Pennsylvania Department of Environmental Protection (PADEP) perform these reviews and issue NPDES permit approval.

An MS4 is a stormwater system that is not combined with sanitary sewers. In Pennsylvania there are 1,059 municipalities with MS4 regulations. According to the Pennsylvania Department of Environmental Protection (PADEP), MS4s must apply for NPDES permit coverage or a waiver if they are in an urbanized area as determined by the latest Decennial Census by the U.S. Census Bureau, or if they are designated as needing a permit by the PADEP. Additionally, MS4s that discharge to impaired surface waters or within the Chesapeake Bay Watershed must prepare a Pollution Reduction Plan (PRP).

Significant funding is necessary for Pennsylvania to meet water quality commitments while ensuring stormwater infrastructure is maintained and improved in a way to sustain public safety and protect property values.

CONDITIONS & CAPACITY

The responsibility for enacting and enforcing stormwater management is placed largely on individual municipalities in Pennsylvania. Although public and private entities within Pennsylvania have been designing and building stormwater management assets for over 160 years, there is currently no statewide assessment of existing conditions and capacity. In recent years, larger public utilities such as the Philadelphia Water Department have begun to create inventories and assess their stormwater management assets.

While a decentralized stormwater management approach allows for local innovation and tailoring, it also led to different issues: 1) inconsistency of stormwater control measures (SCMs) including nomenclatures 2) inconsistency of regulations, and 3) difficulty for data/inventory sharing. These issues have resulted in challenges for fulfilling stormwater regulatory obligations, which especially hurt small and mid-sized communities.

FUNDING AND FUTURE NEED

Significant funding is necessary for Pennsylvania to meet water quality commitments while ensuring stormwater infrastructure is maintained and improved in a way to sustain public safety and protect property values.

According to the 2020 Pennsylvania Integrated Water Quality Monitoring and Assessment Report, 30% of Pennsylvania's rivers and streams do not meet water quality standards for water supply, aquatic life, recreation, or fish consumption. This results in roughly $2.41 billion in funding needed for MS4 permit holders to achieve compliance in the current permit term.

Similarly, Pennsylvania has committed, as part of the Chesapeake Bay Agreement, to implement its recently revised Phase III Watershed Implementation Plan (WIP). An additional $2.6 billion in funding is necessary for Plan implementation to achieve the Commonwealth's pollution reduction commitments by 2025. Adding onto this approximately $2 billion in stormwater assets that have reached the end of their useful life, there is a total need for roughly $6.7 billion in stormwater funding over the next three to five years.

Fortunately, infrastructure owners throughout the state are making some progress to improve stormwater systems. For example, con regional stormwater utilities are reducing costs by approximately 30% to 70% as compared to each municipality managing stormwater on their own. These 65 utilities, with residential stormwater user fees ranging from $20 - $190 per year, provide a dedicated sources of funding for stormwater-related capital improvements. In addition, the Commonwealth has dedicated $250 million in American Rescue Plan

Act (ARPA) funds towards MS4 and WIP compliance, while the federal Infrastructure Investment and Jobs Act (IIJA) is anticipated to bring approximately $400 million of wastewater and stormwater funding to Pennsylvania by 2026. Combining new funding with existing sources is anticipated to result in 1.3 billion for wastewater and stormwater in PA over the next five years. However, a significant gap remains.

According to the Pennsylvania Department of Conservation and Natural Resources (DCNR), potential funding sources for stormwater projects include:

- DCNR Community Conservation Partnership Program grants
- Commonwealth Finance Authority
- PADEP's Growing Greener Watershed Grants
- PA Infrastructure Investment Authority's (PENNVEST) Green Initiatives
- US EPA's Green Infrastructure Funding Opportunities
- National Fish and Wildlife Federation's Chesapeake Bay Stewardship Program
- Chesapeake Bay Trust's Green Streets, Green Jobs, Green Towns

PUBLIC SAFETY AND RESILIENCE

Storms overburden Pennsylvania's stormwater infrastructure. For example, in 2021, Hurricane Ida created historic levels of flooding in Philadelphia and significant floods in other areas of the state, resulting in the loss of lives and over $100 million in damages to property. Meanwhile, frequent stormwater infrastructure failures can potentially cause public health challenges. For example, multiple reports have noted that over the past 5 years the city of Harrisburg's combined sewer systems conveyed an annual average of roughly 900 million gallons of untreated water into its waterways because of overflows. Looking forward, a critical component of the design and construction of resilient stormwater management systems include designing for changing rainfall patterns. Precipitation estimates are the backbone of all stormwater design and planning efforts in the Commonwealth. We have been systematically tracking the weather in this country since around 1850. For about 100 years of the record (1895 to 2000) the rate of change in annual rainfall was less than 1/3 an inch per decade. Since the turn of this century, it has been changing at about seven times that rate. When rainfall patterns were changing slowly (stationary), no adjustments for future conditions were needed. Now that a 20-year trend clearly shows a significant increase in the mean annual rainfall depth is occurring (see below), applying an adjustment to predict the rainfall event depths and intensities for the design life of a structure is needed. Infrastructure with a design life of 40 years needs to be designed in 2022 for the

rainfall pattern anticipated in 2062. Adjusting design storm depths and intensities based on both observed and predicted changes in rainfall is needed to protect the investment in new infrastructure and for retrofitting existing infrastructure to help reduce current and future flood damage.

The National Oceanographic and Atmospheric Administration's (NOAA) Atlas 14 is the most common rainfall data used for infrastructure design. Pennsylvania data in that dataset is over 20 years old. The graph of measured historic rainfall shows that mean annual precipitation has been increasing for the 20 years that the NOAA Atlas 14 Pennsylvania data is missing. Although funding has been provided by a group of transportation departments that includes the Pennsylvania Department of Transportation to update NOAA Atlas 14, the design of infrastructure needs to include consideration of current rainfall increases and future rainfall changes now to assure that the structures being designed meet design requirements.

The bipartisan PRECIP Act would require the National Oceanic and Atmospheric Administration (NOAA) to update precipitation frequency estimates every five years, and study best practices and research needs for estimating precipitation levels. This is critical to the civil engineering community which relies on the most complete, up to date data available for designing and building critical infrastructure which can withstand the increasingly harsh effects of climate change.

Incorporating new technologies into local stormwater programs would increase the capacity for the monitoring of stormwater management assets and the assessment of their performance with regards to the capture of stormwater runoff.

INNOVATION

Significant technological advancements in stormwater management have been made in recent years that allow for the collection of stormwater metrics and the tracking of stormwater infrastructure assets by municipalities and private property owners. Incorporating new technologies into local stormwater programs would increase the capacity for the monitoring of stormwater management assets and the assessment of their performance with regards to the capture of stormwater runoff.

Additionally, advancements in asset management technology and monitoring have made capturing inventory information a much less time-intensive procedure. To continue to make improvements to the Commonwealth's infrastructure, local municipalities and should consider upgrading their asset management technology.

Stormwater

RECOMMENDATIONS TO RAISE THE GRADE

- Create a statewide system that inventories the size, condition, capacity, and capital needs of all public and privately-owned stormwater assets that is easily accessible.
- Innovative approaches such as P3 legislation that implement stormwater projects for the public good on private property in exchange for credits to user fees to further improvements in stormwater planning and financing.
- Regulators, designers, and residents alike must think with resilience in mind. Changing weather patterns are resulting in increased frequency and intensity of rainfall events. Support for the bipartisan PRECIP Act would ensure that stormwater planning, and design are conducted with the most accurate data.
- It has been over 15 years since the Commonwealth published its initial Best Management Practices Manual. Since that time, science, technology, and weather patterns have changed greatly. The Commonwealth must stay on the leading edge of stormwater innovations and thought leadership and release an update to the manual.

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Transit

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TURNTABLE AND ROUNDHOUSE IN SCRANTON, PENNSYLVANIA

EXECUTIVE SUMMARY

Transit service and its supporting infrastructure is crucial for Pennsylvanians in dense cities, suburban clusters, and rural areas. In 2020 – a historically low year for transit ridership across the country – passengers rode over 1 billion miles in Southeastern Pennsylvania Transportation Authority (SEPTA) vehicles and 219 million miles on the Pittsburgh Regional Transit (PRT) Authority network. Unfortunately, transit infrastructure has been underfunded for decades. SEPTA reports $4.6 billion of unfunded capital needs, while the Port Authority of Allegheny County requires $175 million for capital improvements to its light rail network alone. Transit operators and the state have been investing in vehicle replacements, in part thanks to Act 89 funding. Meanwhile, the federal bipartisan infrastructure law will provide Pennsylvania transit with $3.2 billion over five years, including $615 million in 2022 alone, to help address deferred maintenance. However, additional dedicated funding for capital and operations efforts is necessary to attain states of good repair and better attract riders with greater service levels.

BACKGROUND

Transit includes light rail, buses, subways, elevated trains, trolleys, and trackless trolleys; modes of travel that efficiently move large groups of people at one time and fits into a larger multi-modal picture that includes pedestrians and bicycles. It also includes 44 systems offering shared-ride services in all counties, and all counties with rural transportation for persons with disabilities.

Source: 2021 Pennsylvania Transportation Performance Report (PennDot STC, 2021)

CAPACITY

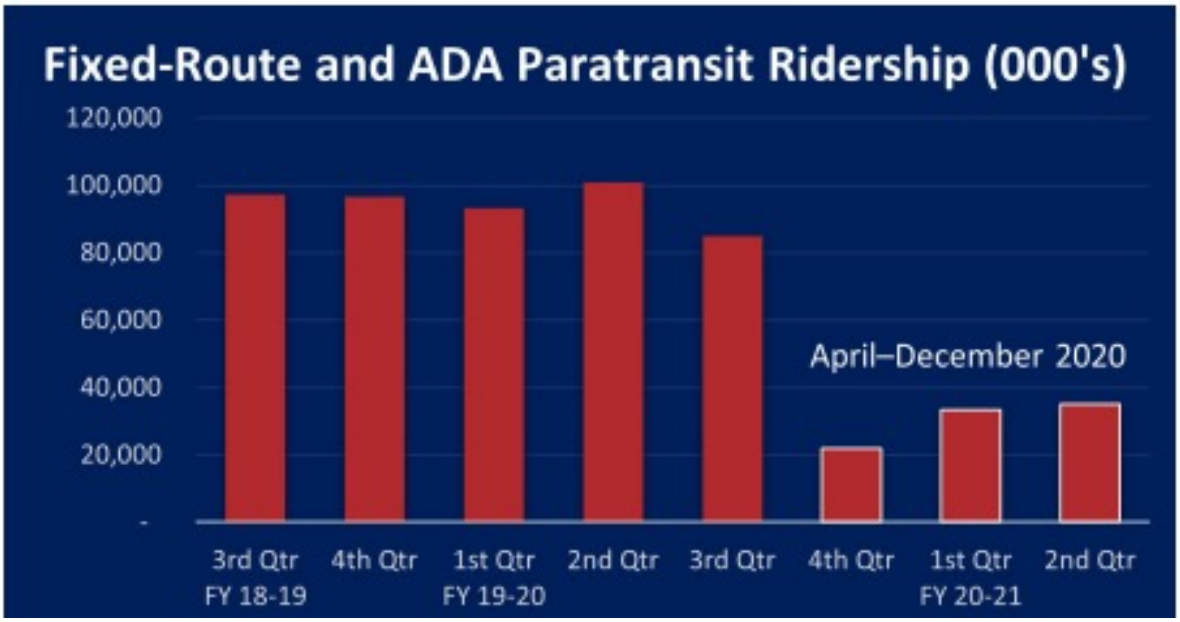
Pennsylvania is comprised of 67 counties, each with unique transit needs and systems. PennDOT oversees operating and capital investments for 32 fixed route (scheduled local bus, light rail and commuter rail) systems, 43 community transportation systems, passenger rail service between Pittsburgh and Philadelphia, and 13 intercity bus routes provided by two intercity bus companies. Pennsylvania fixed route transit systems provided 141.9 million trips in FY 20-21. In addition, Lottery funds allowed senior citizens to take more than 1.6 million trips on community transportation curb-to-curb service at reduced fares. Persons with disabilities also used community transportation curb-to-curb service at reduced fares and took more than 230,000 trips.

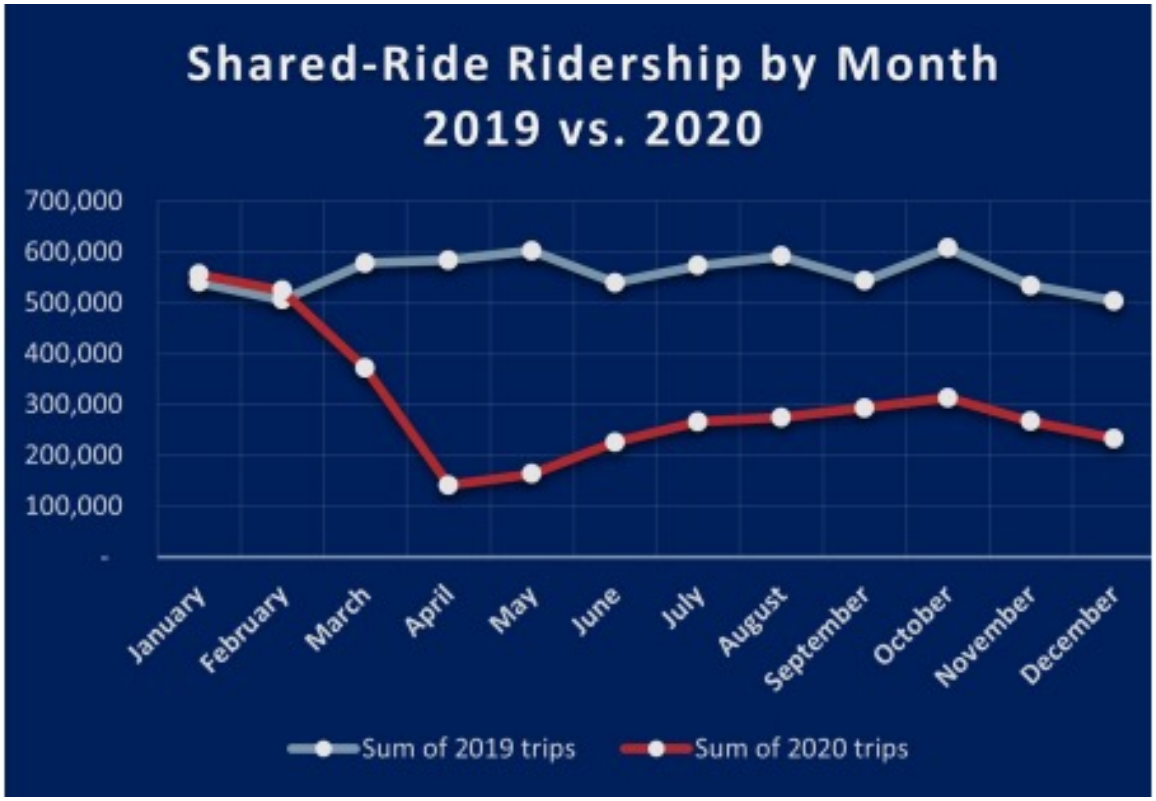
SEPTA and PRT have been identified in the National Transit Database's Top 50 Reporting Agencies for 2020 Report, which highlights the service population, as well as the operation characteristics of various transportation modes. Some of these key metrics can be found in Table 1.

TABLE 1. SEPTA & PRT KEY CAPACITY METRICS

	SEPTA (Philadelphia Metro)	**PRT (Pittsburgh Metro)**
Service Area Total Square Miles	1,981 Square Miles	775 Square Miles
Service Area Population	3,432,361	1,415,244
Available Modes of Transport	Commuter rail demand responsive, heavy rail, bus, streetcar rail, trolleybus	Demand responsive, inclined plane, light rail, bus
Annual Passenger Miles Traveled (PMT)	1,092,751,808	219,073,451
Vehicles Operated Maximum Service	Vehicles Operated in Max. Service: 2,406 Vehicles	Vehicles Operated in Max. Service: 930 Vehicles
Available Vehicles Maximum Service	Available for Max. Service: 2,929	Available for Max. Service: 1,117
System Wide Fixed Guideway Directional Route Miles (across all modes)	637.7 miles	92.9 miles

In recent years, however, the COVID-19 Pandemic has greatly affected ridership. Table 2 depicts the rapid decline in fixed route transit ridership in Pennsylvania, while Table 3 depicts the decline of shared ride ridership across the state.





This data is consistent with national transit ridership loss, which saw ridership drop 73% between April 2019 and April 2020. As the Commonwealth continues to recover from the numerous effects of the pandemic, transit agencies will have to learn and adapt to new ridership needs given the parameters of new working conditions, many of which have shifted dramatically for the years to come.

TABLE 1

Total Act 44 Passenger Trip Statistics (Includes Senior Citizens)

Agency	2018-19	2019-20	Percent Change 18-19 to 19-20	2020-21	Percent Change 19-20 to 20-21
SEPTA	292,342,374	223,067,983	-23.7%	105,603,593	-52.7%
PAAC (Allegheny)	62,990,158	50,961,821	-19.1%	21,913,736	-57.0%
AMTRAN (Blair)	567,624	466,503	-17.8%	320,151	-31.4%
ATA (North Central)	425,898	361,545	-15.1%	253,399	-29.9%
BCTA (Beaver)	780,983	592,612	-24.1%	339,635	-42.7%
BMC (Mount Carmel)	32,821	33,520	2.1%	31,565	-5.8%
BTA (Butler)	187,529	173,724	-7.4%	141,819	-18.4%
CamTran (Cambria)	1,167,144	1,039,684	-10.9%	727,418	-30.0%
CAT (Cumberland, Dauphin)	2,025,283	1,757,612	-13.2%	981,539	-44.2%
CATA (Centre)	6,428,507	5,068,448	-21.2%	684,446	-86.5%
CATA (Crawford, Venango)	280,495	243,087	-13.3%	179,628	-26.1%
CCCT (Carbon)	10,520	7,505	-28.7%	5,748	-23.4%
COLT/LT (Lebanon)	316,024	250,592	-20.7%	179,196	-28.5%
COLTS (Lackawanna)	1,028,256	817,374	-20.5%	427,003	-47.8%
CPTA (York, Adams)	1,605,137	1,335,363	-16.8%	886,026	-33.6%
EMTA (Bradford, Sullivan, Tioga)	103,995	90,716	-12.8%	51,692	-43.0%
EMTA (Erie)	2,517,463	1,933,371	-23.2%	769,695	-60.2%
FACT (Fayette)	140,772	107,762	-23.4%	65,496	-39.2%
HPT (Hazleton)	200,671	169,639	-15.5%	130,183	-23.3%
IndiGo (Indiana)	406,304	285,667	-29.7%	118,555	-58.5%
LANTA (Lehigh, Northampton)	4,497,481	3,862,712	-14.1%	2,672,391	-30.8%
LCTA (Luzerne)	1,165,199	1,007,814	-13.5%	770,617	-23.5%
MCRCOG (Mercer)	88,617	68,801	-22.4%	45,161	-34.4%
MCTA (Monroe)	256,101	239,600	-6.4%	145,353	-39.3%
Mid County (Armstrong)	43,021	36,580	-15.0%	23,708	-35.2%
MMVTA (Mid Mon Valley)	288,328	238,545	-17.3%	153,820	-35.5%
NCATA (Lawrence)	577,092	478,126	-17.1%	307,934	-35.6%
PART (Pottstown)	247,557	182,086	-26.4%	133,932	-26.4%
SCTA (Berks, Lancaster)	4,450,830	3,888,302	-12.6%	2,822,706	-27.4%
STS (Schuylkill)	189,211	169,210	-10.6%	121,639	-28.1%
TAWC (Warren)	67,225	61,828	-8.0%	50,547	-18.2%
WCTA (Washington)	116,104	89,997	-22.5%	55,155	-38.7%
WCTA (Westmoreland)	421,732	305,200	-27.6%	122,636	-59.8%
Williamsport RVT (Clinton, Lycoming)	1,314,850	970,360	-26.2%	637,533	-34.3%
TOTAL	**387,281,306**	**300,363,689**	**-22.4%**	**141,873,655**	**-52.8%**

Source: 2020-21 Public Transportation Annual Performance Report (PennDOT, 2021)

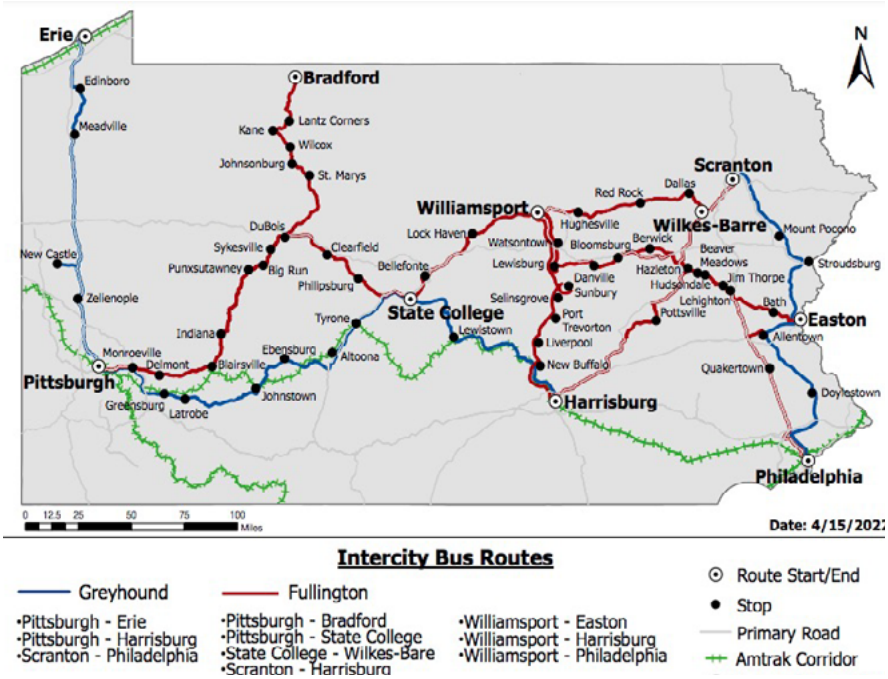
CONDITION

Transit systems capabilities are limited by the condition of the assets they manage. If not routinely maintained and replaced, an aging transit infrastructure can present challenges to agencies and the civilians who rely on them. In general, the useful life of a heavy-duty large bus is 12 years and rail cars is 30 years. Figure 2 outlines the average age of transit vehicles for agencies in Pennsylvania that report more than 2 million boardings per year.

FIGURE 2. AVERAGE AGE OF TRANSIT VEHICLES

	Average Age (Years)		
Transit Agency	Bus	Rail Cars	Vanpool
PRT (Pittsburgh)	5.9	28.6 Light Rail	-
SEPTA (Philadelphia)	7.3	Commuter Rail: 31.1 yrs	
Heavy Rail: 27.8 yrs			
Street Car Rail: 43.1 yrs	-		
EMTA (Erie)	12.6	-	-
LANTA (Lehigh and Northampton)	5.5	-	-
RRTA (Lancaster)	7.3	-	-
CAT (Cumberland Dauphin-Harrisburg)	7.1	-	-
BARTA (Berks)	8.9	-	-
CATA (Centre Area)	9.5	-	6.7
LCTA (Scranton and Wilkes Barre)	5.4		

In general, most agencies are in compliance with the standard. However, in addition to monitoring the useful life of these assets, it is also imperative for agencies to monitor potential improvements to safety and efficiency in these vehicles. For this reason, PennDOT organized a program to offer assistance to Pennsylvania transit agencies to help purchase new fixed route buses. In the Fiscal Year 2019-2020, PennDOT invested $92 million to purchase 172 new buses, which included 48 CNG Buses, 2 Electric Buses, 57 Hybrid Diesel Buses, 60 Diesel Buses, and 5 gasoline buses. In the Fiscal Year 2020-2022, PennDOT invested $72.2 million to purchase 330 new buses, which included 28 CNG Buses, 6 Electric Buses, 7 Hybrid Diesel Buses, 51 Diesel Buses, 226 gasoline buses, and 12 propane buses.



Local transit agencies and municipalities are investing to improve system condition. For example, PennDOT led extensive coordination with the Borough of Middletown, Capital Area Transit, and the Harrisburg International Airport to maximize multimodal connectivity, complement the Borough's downtown streetscape improvements, and align with the airport's master plan. The landmark station and parking project provides a pedestrian overpass to the ADA-accessible platform and elevator, on-site parking, and designated bus loading zones to improve multimodal connectivity.

Additionally, a $450 million order of 525 hybrid diesel-electric buses to SEPTA was completed in May 2021. The delivery of these buses allowed the Authority to retire many of its aging diesel buses with new vehicles that have significantly reduced environmental impacts. SEPTA's bus fleet is now over 90% hybrid vehicles.

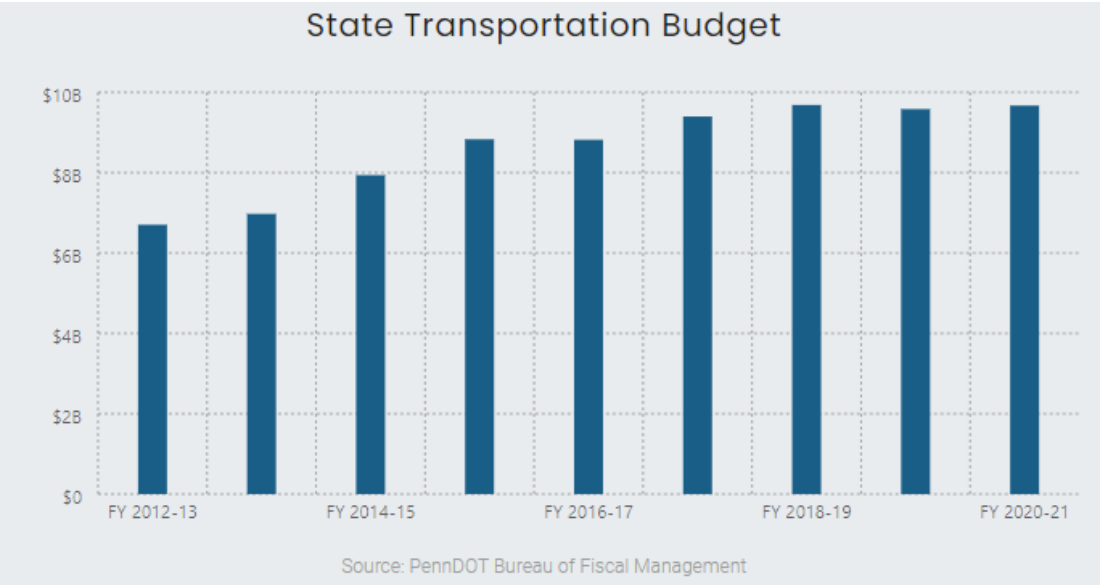
OPERATION & MAINTENANCE

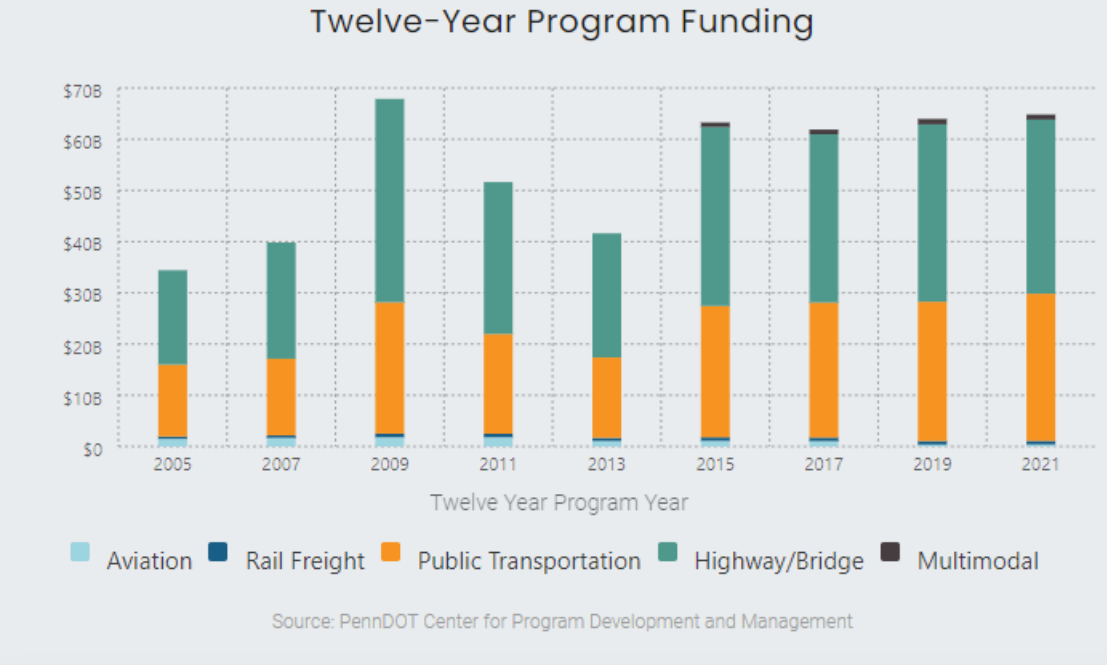
Although total ridership experienced historic low levels, the pandemic emphasized the necessity for public transportation as a life-line service, enabling many people to maintain access to employment and other life-sustaining functions. Some bus operators and other employees even served in additional capacities, engaging in friendly check-ins or delivering meals to elderly or disabled passengers who were riding less frequently.

For transit agencies, supply chain issues have impacted vehicle procurement. While heavy-duty fixed-route transit buses are still available, production delays and a shortage of semiconductor chips have significantly increased the build time for shared-ride vehicles. This has led to a substantial manufacturing backlog for new shared-ride vehicles, and transit agencies have had to wait months longer than usual to receive cutaway vehicle orders. It is anticipated that this shortage of vehicle manufacturing capacity will persist for some time. Meanwhile, transit construction projects have experienced delays in the delivery of materials, especially with steel and manufactured products. Finally, substantial increases in the costs of construction materials, as well as shorter vendor pricing windows, make procurement and project delivery in general more complex and costly for transit agencies

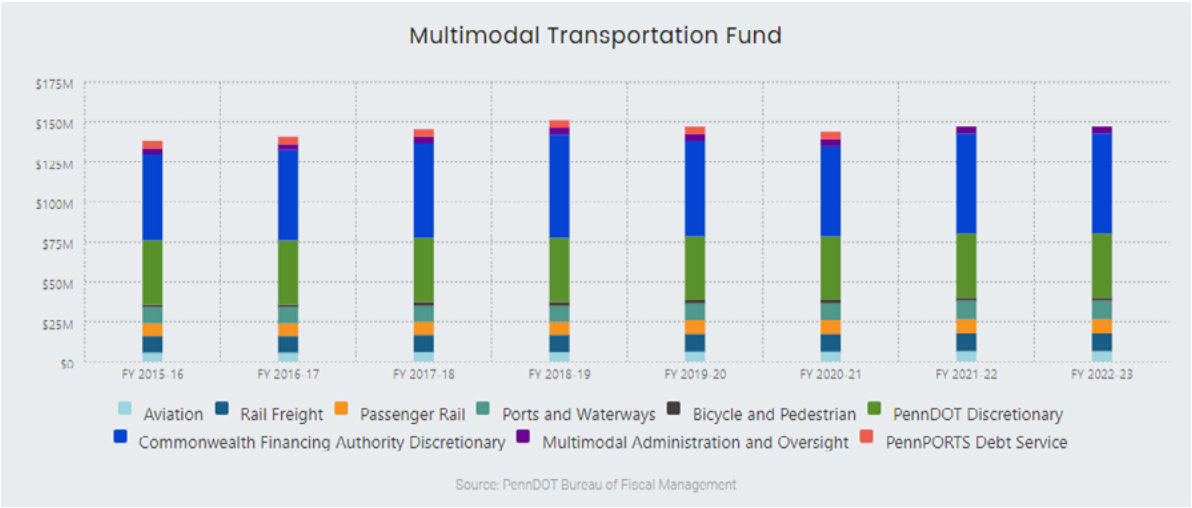
FUNDING AND FUTURE NEED

Transit funding comes through federal, state, local funding, and through ticket sales. Pennsylvania's state funding for transportation is 11% of the 2022-2023 State Budget. It has continuously grown since 2012, a direct result of Act 89.





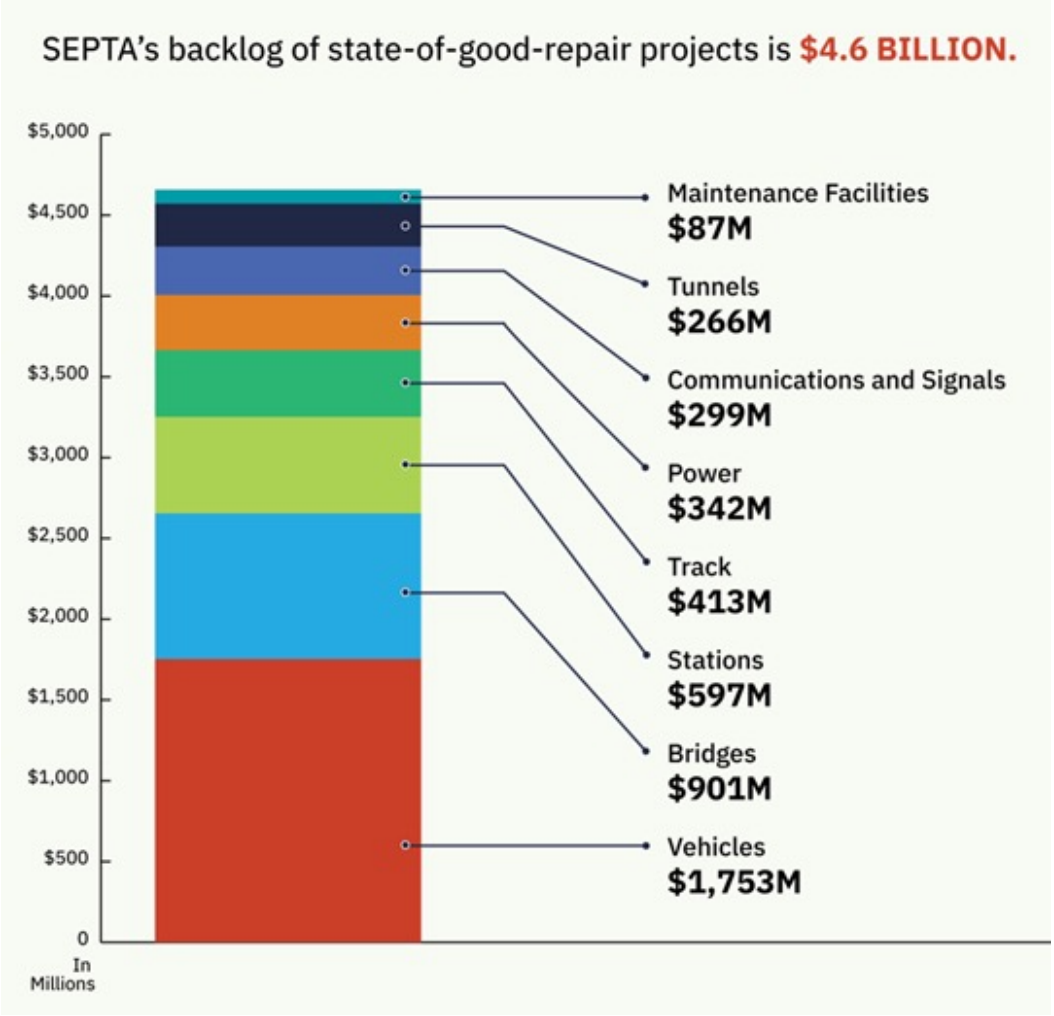
When Act 89 was established in 2013, the multimodal fund and local use funds were created to provide funding to capital projects supporting the improvement of all transportation modes. Funding for transit projects is provided through the State's Liquid Fuels Program. The liquid fuels tax has been the largest revenue contributor to the state transportation fund since it was established in 1984.



Act 44, approved in 2007, expanded the PA Turnpike's Commission (PTC) mandate from one focused entirely on improvements to the Turnpike to one that also provides annual funding contributions for broader Pennsylvania transportation needs, including transit. A financial shift in 2022 will relieve the PTC of these payments but place an additional burden on Pennsylvania's budget. Beginning on July 1, 2022, the PTC's required annual contribution to PennDOT will be reduced from $450 million to $50 million. Current law stipulates motor vehicle sales tax revenues will be earmarked to replace that reduced funding with a floor of $450 million from the state's General Fund. While this is good news for the state's transit budget, there is no new revenue to replace the investments from the General Fund.

The federal gas tax has not been increased since 1993 and remains inadequate to fully fund the Highway Trust Fund (HTF), which supports federal highway, bridge and transit spending. The long-term solvency of the HTF and the ability of federal funds to support Pennsylvania's infrastructure remain uncertain. While this continues to be a long-term problem, Congress solved the problem in the short term with passage of the Bipartisan Infrastructure Law (BIL) in late 2021. The BIL will provide Pennsylvania transit with $3.2 billion over five years, including $615 million in 2022 alone.

Federal funding is sorely needed but won't fully close the funding gap for transit. SEPTA alone reports a $4.6 billion in funding needs.



PRT has identified over $175 million in capital needs for its light rail network alone. The fleet must be maintained and has capital needs such as service and garage facilities.

Although many smaller transit operators throughout the state provide bus service, similar needs have been identified for vehicle replacement, storage and maintenance facility upgrades, and expanding the number of transit centers. Act 89 increased funding of transit assistance, which has helped authorities catch up on capital needs, but in the future more funding will be needed to maintain and expand capacity.

PUBLIC SAFETY

Transit as a travel mode is a safer means of transportation than typical automobile traffic. The chances of being in an automobile traffic accident than a transit traffic accident are 10 to 1. Still, there are attitudes and preconceptions that prevent more widespread use of transit (both in and outside Pennsylvania) and many of these have been exacerbated since the onset of the COVID-19 epidemic. Despite the frame of these larger setbacks, multiple Pennsylvania agencies are making efforts to improve transit infrastructure and safety for the traveling public.

LCTA is in the process of building a 200,000-square-foot facility to house transit operations, administration, and maintenance, greatly expanding the Authority's capacity. In order to make its facilities more accessible and improve pedestrian accommodations, the PRT is spending $4.5 million dollars to add ADA facilities and passenger amenities, and $21 million on a parking deck that will double capacity at the Ross Township Park-N-Ride.

Since 2018, the SEPTA has completed three station reconstructions, totaling $105 million total. In addition to improving its facilities, SEPTA has been particularly responsive to public concern about crime and the need for policing on and near its trains, buses, and facilities. In the city of Philadelphia, it has spent $3.6 million on social service specialists to work in conjunction with police officers.

RESILIENCE

Pennsylvania transit agencies have been making strides to be more resilient to extreme weather events. An example of this includes the PATCO placing employees at other regional command centers in advance of extreme storms. SEPTA is also looking across modes to address extreme weather events such as deploying buses during region-wide power outages when their rail services are unavailable. PRT in Pittsburgh recently completed its long-range plan, NEXTransit, with policy goals of decarbonizing its fleet, implementing a sustainability plan to be more responsive to climate change and its local effects (primarily flooding and landslides), and utilizing energy-efficient designs in its new and retrofitted facilities. Like PRT, SEPTA's infrastructure program also includes several projects to harden its infrastructure and provide flood mitigation.

INNOVATION

The Fixed Route Intelligent Transit System (FRITS) program, launched in 2018, is a statewide technology implementation project that will provide 32 of Pennsylvania's 34 fixed-route transit agencies with cutting-edge technology solutions The program allows all participating transit agencies to collect and report information consistently, standardizing the data elements PennDOT receives and housing the data in a statewide repository. This reporting platform allows transit agencies to evaluate data and make informed decisions to improve service, and provides unprecedented reporting capabilities for PennDOT, which greatly reduces the burden on agencies to provide data and reports to PennDOT. For transit users, this new software will allow riders to track the location of their bus, and it paves the way for app based payment methods. As of FY 2020-21, PennDOT has implemented FRITS in 11 of the planned 32 agencies.

Transit

RECOMMENDATIONS TO RAISE THE GRADE

- Create a Dedicated Source of Funding for Operations and Capital Spending – This allows for the increase of service levels, ensures state of good repair programs are maintained, and allowing capital programs to move forward.
- Improve Station Accessibility and Transit Equity for all passengers - Through ADA improvements, first/last mile initiatives, improved wayfinding and signage, and improved lighting.
- Continue Creating Incentives and Improvements to User Experience to Attract Ridership – This can be done through optimization of transit frequencies, technology enhancements, partnerships with employers providing employees with transit passes, free parking at stations, reduced fares for off peak hours.
- Deploy new approaches for public safety – Provide apps or portals to report incidents in real time and provide additional law enforcement presence.
- Modernize the System – This includes infrastructure improvements and fleet replacement for Rail, Trolley, Subway and Buses including options to reduce the carbon footprint and increase use of electric vehicles.

DEFINITIONS

1) Community Systems - Community Systems typically coordinate shared-ride services and can be found in all counties.

2) Rural Systems – Pennsylvania is comprised of 17 rural systems which support areas with a population of 50,000 people or more.

3) Urban Systems – Systems servicing areas of 50,000 people or more.

4) PRT – Pittsburgh Regional Transit, formerly PAAC – Port Authority of Allegheny County

5) SEPTA – Southeastern Pennsylvania Transportation Authority

6) EMTA – Erie Metropolitan Transit Authority

7) LANTA - Lehigh and Northampton Transportation Authority

8) RRTA – Red Road Transit Authority

9) CAT – Capital Area Transit, also known as Cumberland Dauphin-Harrisburg Transit Authority

10) BARTA – Berks Area Regional Transportation Authority

11) CATA – Centre Area Transportation Authority

12) LCTA – Luzerne County Transportation Authority

13) PATCO – Port Authority Transportation Corporation

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Wastewater

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EXECUTIVE SUMMARY

Aging wastewater management systems discharge billions of gallons of raw sewage into Pennsylvania's surface water each year. The average age of most sewer systems is approaching 75 years with many pipes over 100 years old. 26% of the state is served by on-lot systems with nearly one-quarter failure rate. Two-thirds of the state's Sewage Facility Plans are over 20 years old. The Commonwealth has a funding gap of $8.4 billion over the next 10 years to repair existing systems, upgrade existing systems to meet regulatory requirements, control Combined Sewer Overflows (CSOs), address illicit Sanitary Sewer Overflows, and construct new or expand existing systems to meet increasing demand. Available funding over that time is estimated to be $900 million, only about one-tenth of the required annual investment.

BACKGROUND

One of the most vital, though possibly most frequently overlooked, systems of our society is the sanitary handling of wastewater. While treatment of wastewater may seem paramount, collection and conveyance are equally important to protect water quality and safeguard human health.

Wastewater infrastructure includes the network of sewer pipes that collect and carry household, business, and industrial effluents to wastewater treatment facilities, both on-site or centralized facilities. Within these treatment systems, wastewater undergoes processes to remove harmful constituents and reduce pollution to regulatory limits before being discharged into nearby waterbodies.

Pennsylvania has an enormous inventory of wastewater infrastructure. There are more than 10,000 sanitary sewer systems that operate under the National Pollution Discharge Elimination System (NPDES) in Pennsylvania. As time passes, more and more of these systems are becoming private. At last count, according to the Pennsylvania Department of Environmental Protection (PADEP), approximately 2,200 are publicly owned.

Pennsylvania is facing the threat of infrastructure reaching the end of its useful life. Unfortunately, this is often not realized until failure occurs, and when failure occurs, the environment and public health are exposed to great danger.

CONDITION & CAPACITY

The sheer number of NPDES facilities exerts substantial effort on PADEP staff when it comes to regulating these facilities. In 2019, 748 Inspections were conducted on major treatment plants (flows exceeding 1 Million Gallons per Day (MGD)), resulting in 297 violations. In 2021, 846 inspections resulted in 303 violations. Within the past five years 150 Consent Orders have been issued by PADEP for wastewater system permit violations.

According to the most recent 2015 study conducted by the Center for Rural Pennsylvania, more than 1.6 million homes, or approximately 26% of the state is served by on-lot disposal systems (OLDS). On-lot disposal systems include septic tanks and cesspools. No documented statewide data is available on the percentage of these OLDS that are failing to function as intended, nor remediation costs for homeowners. National failure rates for OLDS are reported

at 10% annually by the United States Environmental Protection Agency (EPA) due to the frequent occurrence of unsuitable soil conditions. PADEP's report from 2021 shows that OLDS failures are associated with degrading the quality of 202 miles of streams and 3,192 lake-acres. Contamination of groundwater and surface water by failing substandard septic systems is a considerable risk. PADEP's Bureau of Clean Water Management oversees the licensing for Sewage Enforcement Officers (SEO's), but since 2011 no longer compensates the SEO's or municipalities that employ them for training. Regulations or technical requirements to increase the effectiveness of OLDS have not been updated since 1983.

The Pennsylvania Sewage Facilities Act (Act 537) requires that all municipalities develop and implement plans that provide for the identification and resolution of existing sewage disposal problems, provide for the sewage disposal needs of new development and provide for the future sewage disposal needs of the municipality. These plans are required to consider growth for 10–20-year periods and are to be updated to stay current and relevant. However, as of 2021, of the 2,575 Act 537 Plans in existence, 64% are at least 20-years old and over 38% are more than 40-years old. For many years municipalities were able to apply for grants through PADEP to cover 50% of the costs to develop or update Act 537 Plans. Unfortunately, this assistance was eliminated in 2014. Consequently, the high cost of updating Act 537 Plans serves as a significant deterrent to municipalities.

The average age of sanitary sewers varies by community with industrial age cities having pipes dating back to the turn of the 19th Century. Philadelphia has reported the average age of its sewers to be 100 years old. Sewers in communities developed post-WWII are now approaching 75 years old. The rate of pipe replacement remains below that of which is required to meet a sewer pipe's life cycle, putting public health at risk, increasing the likelihood of more expensive costs in the event of complete failure. The good news is that more systems are conducting annual repair and replacement programs and are increasingly implementing less costly trenchless technology repairs.

Pennsylvania retains its title as having the most CSO's of any state in the country. CSO's convey both storm and sanitary sewer flows, resulting in untreated human and industrial waste as well as other pollutants entering into the environment. The 1,680 CSO systems across 39 counties account for some of the highest occurrences of overflows in the country. Such occurrences significantly impair water quality, impact public health and wildlife. Estimating the volume of CSO discharge is difficult given the quantity, frequency and impact are unique for each CSO system. Since the previous Pennsylvania Report Card, there is moderate progress and significant momentum to reduce CSO's. Examples from two of the state's largest metropolitan areas illustrate these improvements:

- 60 % of the City of Philadelphia is served by CSO systems. To meet state and federal regulations, the City created their Green City, Clean Waters Program: a 25-year plan to reduce the volume of stormwater entering combined sewers using green infrastructure and expanding stormwater treatment capacity with traditional (grey) infrastructure improvements. These grey improvements include a 100 MGD outflow bypass with preliminary treatment for CSO discharges. The program, which officially began in 2011, has reduced untreated CSO outflows by approximately half and the goal at the completion of the program is an 85% reduction. The green infrastructure improvements add aesthetic and sustainability components to the city as well.
- The Allegheny County Sanitary Authority (ALCOSAN), which serves 83 municipalities including the City of Pittsburgh, is beginning major grey facility improvements that are estimated to ultimately cost $2 billion. These improvements include three large tunnels to store CSO's during wet weather and to release them to an expanded treatment plant during dry weather. ALCOSAN also encourages its municipalities to utilize green improvements as well conventional inflow and infiltration reduction repairs to further reduce the ultimate load on the grey infrastructure projects that are now under design and construction.

FUNDING AND FUTURE NEED

Wastewater infrastructure may be funded by local user fees and taxes, state-specific grants or discretionary set-asides, and federal grants or financing mechanisms. Funding and financing differ through the simple fact that infrastructure financing, like any loan or bond, requires repayment over a 30- to 50-year period. According to the Congressional Research Service, the federal government's share of capital investment has fallen from 63% in 1977 to less than 9% in 2017. State and local entities shoulder the majority of capital project costs and O&M expenses, with the most common source of funding for Pennsylvania's aging wastewater infrastructure being user fees.

Based on results of the water and wastewater gap study carried out in 2015, Pennsylvania's total wastewater funding gap between revenues and need modeled out to the year 2025 was estimated at $8.4 billion. Based on data from the 2015 study, the state would have only $900 million in state and federal funds to meet the needs of both the water and wastewater utilities.

Most user fees paid by customers today do not reflect the long-term costs of maintaining and repairing wastewater infrastructure; often they are just a reflection of short-term capital improvement costs and operational costs. This results in frequent sharp spikes in rates reflecting costs of replacement for emergency repairs. Some public and private systems incorporate asset management programs as a tool to prioritize infrastructure improvement and optimize the operation of their systems. This results in proactive infrastructure improvement as opposed to emergency repairs, which greatly reduces long-term costs.

While sewer ratepayers are the primary source of funds for operation, maintenance and some capital improvements; federal and state funding are also major sources for capital improvements to Pennsylvania's aging wastewater infrastructure. The main source of federal funding is the Federal Clean Water State Revolving Fund (CWSRF), which is managed by the Pennsylvania Infrastructure Investment Authority (PENNVEST). During the fiscal year 2019-2020, PENNVEST financed a total of $470 million that included $174 million for wastewater projects. Additionally, PENNVEST, in cooperation with the Pennsylvania Housing Finance Agency, provides up to $25,000 in low-cost financing to improve, replace, or repair individual on-lot sewage disposal systems or to connect, for the first time, to a public sewer to meet public health and environmental safety standards.

Other sources for wastewater infrastructure in Pennsylvania include:

- United States Department of Agriculture, Rural Development (USDA RD),
- US EPA's Water Infrastructure Finance and Innovation program; Department of Community and Economic Development (DCED),
- Public Works Program and Economic Adjustment Assistance Program of the Economic Development Administration Department of Commerce,
- National Rural Water Association Revolving Loan Fund, and
- Section 219 program of the US Army Corps of Engineers.

Based on results of the water and wastewater gap study carried out in 2015, Pennsylvania's total wastewater funding gap between revenues and need modeled out to the year 2025 was estimated at $8.4 billion. Based on data from the 2015 study, the state would have only $900 million in state and federal funds to meet the needs of both the water and wastewater utilities.

As per the 2015 study, even if user fees were increased to 1.5% of median household income (HMI) the wastewater funding gap would only be reduced to $4.2 billion over 10 years. The 1.5% of MHI value was chosen as an affordability standard based on data from several national financial assistance programs collected over 50 years and is considered a reliable indicator of what the affordable ceiling should be for the customers of a wastewater system. However low-income ratepayers may require assistance to pay rates at 1.5% MHI.

OPERATIONS AND MAINTENANCE

Wastewater systems in Pennsylvania have several systems in place to assist in their effective operations and maintenance (O&M). These include regulations for the certification of operators, both plant and line technicians. The Pennsylvania Water Environmental Association and the Pennsylvania Water Pollution Control Operators Association offer excellent training programs to assist in certification and O&M training.

Obstacles to improved O&M effectiveness in PA are similar to those nationwide. These include the aging of O&M staff as well as labor shortages due to difficulty in recruiting the next generation of staff. Funding shortages are to most difficult obstacle and these have been addressed in detail in a sperate section of this report. These obstacles, while they affect systems of all sizes, are particularly difficult to overcome by small systems.

One recommendation in overcoming these obstacles is the implementation and promotion of O&M apprentice programs in the recruiting of new staff. Another recommendation is the regionalization of smaller systems into larger entities that are more capable of recruiting and training new staff. Regionalization can also maximize the benefits of grant/loan funding by spreading increased operational costs over a greater number of customers. A regulatory requirement to implement owner-controlled asset management programs by all utilities receiving outside funding would also be desirable. As asset management programs become more prevalent, limited funding can be focused to the best advantage.

Public Safety

Inadequate collection, conveyance, and treatment of wastewater can have dire consequences on human health and the environment. The release of raw sewage into the environment has the potential to impair our drinking water, spread disease, and degrade waterways. PADEP's 2020 Integrated Water Quality Monitoring and Assessment Report found 25,468 miles of streams in Pennsylvania, approximately 30% of the total have impaired water quality for one or more uses including water supply, aquatic life, recreation or fish consumption. In Pittsburgh for example, sewer overflows into the city's rivers effect nearly half of the 140-day boating season (May 15-October 1), making the rivers unacceptable for recreational contact.

RESILIENCE AND INNOVATION

As an increasing number of utilities are installed below ground in urban areas, it is vital to identify the location of utilities prior to construction. The discovery of unforeseen underground utility lines during construction can not only lead to catastrophic damages, but also affect project costs and schedules. Subsurface Utility Engineering (SUE) has emerged as a means to reduce unexpected utility conflicts. SUE is an engineering process that utilizes data processing and site characterization technologies to accurately locate and depict underground utilities in the preliminary stages of a project. The American Society of Civil Engineers (ASCE) has developed a National Consensus Standard titled ASCE 38-21, Standard Guideline for Investigating and Documenting Existing Utilities. This National Consensus Standard (NCS) follows the legal procedures for adoption as not only an ASCE standard, but also as an American National Standard Institute (ANSI) standard. Adoption of Standard 38 as part of Pennsylvania's One-Call law, will aid in reducing costs to sewer systems by reducing utility conflicts in underground construction work.

Climate change poses a significant challenge to wastewater systems throughout Pennsylvania. Per the

USEPA, precipitation from extremely heavy storms has increased 70% in the Northeast United States since 1958. These storms intensify flooding and can overwhelm sewers and treatment plants, resulting in the release of untreated sewage into the environment. Significant steps are needed to increase the resiliency of our wastewater systems from flooding risks especially as annual precipitation and the frequency of heavy downpours are anticipated to continue to rise.

Besides renewing and expanding sewer capacities, communities with CSO systems are also deploying green infrastructure to reduce the impact of stormwater on these systems. In 2021 alone the City of Philadelphia completed "greening" 489 acres with 259 public projects and partnered in the 'greening" of an additional 684 acres through 425 private projects, with a goal of achieving 10,000 greened acres by 2036. The EPA has highlighted the City of Lancaster's Green Infrastructure Plan as a national model. The 25-year $140 million plan is expected to save the city $25 million annually and prevent over 1 billion gallons of CSO discharges from polluting the Conestoga River.

Pennsylvania has made great strides in the innovative disposal of biosolids (e.g. wastewater treatment sludge) and resource recovery using biogas (e.g. fuel produced from sludge). Instead of disposing of the nutrient rich biosolids in valuable landfill space, land application has increased. This has benefitted farmers by allowing them to save money on commercial fertilizers and improving the quality and structure of the soil. Land application of biosolids has also been used to aid reclamation at mining sites and forestry. However, emerging concerns about the possible presence of Per- and Polyfluoroalkyl Substances (PFAS) in biosolids and its impact on human health and safety, may reverse these gains in beneficial reuse of biosolids. Research is ongoing on identifying the frequency and concentration of PFAS in biosolids and how best to address their presence and ultimate removal/destruction.

The American Biogas Council ranks Pennsylvania ninth among US states for methane production potential from biogas sources. There are 181 operational biogas systems in the state (81 of 181 being wastewater plants) with the potential for more than 492 more (220 being wastewater plants). If the potential were fully realized, enough electricity could be generated to meet the needs of 356,000 homes, while reducing greenhouse gas emissions by the equivalent of 20.6 trillion tons of carbon dioxide.

Wastewater

RECOMMENDATIONS TO RAISE THE GRADE

- Implement the use of infrastructure Asset Management programs on a larger scale. Through Asset Management, detailed inventories of system components, operations and maintenance tasks, and long-range financial planning can be developed. Effective Asset Management programs can save money by timing the replacement of infrastructure/assets so that their useful life is maximized, and expensive catastrophic failures are minimized.
- Implement reasonable increases in what customers pay for wastewater services to reflect the real cost of service, based on full life cycle costs. User fees should be evaluated for increases greater than 1.5% MHI in communities that can tolerate higher rates based on income, since there is still a projected funding gap even with rates set at 1.5% MHI. Rate affordability is an issue that must be addressed, and consideration of rate subsidy needs to at least be a subject of discussion in order to help close the funding gap.
- Provide more state and federal grant funding to subsidize the projected funding gap that cannot be met with reasonable rate increases and for communities with below average income levels, in order to protect the environment and human health and safety.
- The issue of On Lot Disposal Systems need to be addressed by improving regulations to include new technologies. More stringent enforcement of OLDS regulations is required to protect the environment. Municipal and private sewer systems should consider the implementation of area-wide assessment programs to begin the process of eliminating OLDS where economically feasible supported by adequate zoning laws in lieu of relying on OLDS limitation to control development density.
- Evaluate consolidation of smaller wastewater systems into regionalized systems to spread the capital and operating costs across a larger customer base, streamlining management and increase cost-effectiveness for customers.
- Increase funding for PADEP to maintain a level of inspections adequate to protect human health and the environment, provide funding for the training of SEO's and increase grants for Act 537 Plan updates.
- Adopt ASCE C-I 38-02, Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data as part of Pennsylvania's One-Call law (Act 50) to aid in reducing costs to sewer systems by reducing utility conflicts in unground construction work.

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