



Ohio Section of the American Society of Civil Engineers
[INFRASTRUCTUREREPORTCARD.ORG/OHIO](https://infrastructurereportcard.org/ohio)





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ABOUT THE OHIO COUNCIL OF LOCAL SECTIONS OF ASCE

The Ohio Council was organized in 1969 to focus statewide attention on issues of interest and concern to the approximately, 3,300 ASCE Members in Ohio. There are six Local Sections in Ohio – Akron-Canton, Central Ohio, Cincinnati, Cleveland, Dayton and Toledo. Each has representation on the Ohio Council in proportion to its membership. Each Local Section has one delegate for each full one hundred assigned members, with a minimum of two delegates regardless of the number of members assigned. The Ohio Council meets twice annually, in spring and fall. The activities of the Ohio Council are financed by the Local Sections.

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EXECUTIVE SUMMARY

At its fall meeting, held October 4, 2019, the American Society of Civil Engineers (ASCE) Ohio Council of Local Sections (Ohio Council) formed a committee to develop a report card on the state of Ohio's infrastructure following the methodology used by the ASCE to assess our nation's infrastructure. Ohio last underwent a similar effort in 2009. Dr. Charles Sawyer was appointed Chairperson of the report card committee to put together a team of volunteers to develop the report. The Committee assessed the following sixteen infrastructure areas: bridges, dams, drinking water, energy, hazardous waste, inland waterways, levees, parks, ports, rail, roads, schools, solid waste, stormwater, transit and wastewater. A summary of key findings for each infrastructure category is in the accompanying brochure of this report.

ASCE gave the nation's infrastructure an overall grade of D+ (poor) in 2017, the same as in 2013. ASCE will be updating its national infrastructure grade in March 2021. The Ohio committee's overall assessment gives Ohio's infrastructure a grade of C-. While slightly better than the current national average, Ohio's infrastructure is mediocre and exhibits significant deterioration. Condition and capacity are areas of serious concern with strong risk of failure.

What does Ohio's infrastructure do? Every day it:

- Facilitates the movement of goods throughout the state and region
- Provides water for drinking and other uses
- Manages wastewater, stormwater, hazardous waste and solid waste
- Provides energy where needed
- Supports the economy
- Supports the quality of life of residents

An analysis of Ohio's infrastructure reveals a mixed performance.

Some of the state's privately owned infrastructure such as electric utilities and rails have seen increases in funding while roads, ports, inland waterways and many other types of public infrastructure are in dire need of increased funding. The majority of Ohio's bridges, dams, levees, drinking water distribution systems and ports are approaching or have exceeded their design life expectancy. Ohio's deficient dams need about \$300 million for rehabilitation. Levee systems are nearly 50 years old and in need of risk assessments given that they provide flood risk reduction for more than 151,000 people and \$27.5 billion in property. Inland waterways need approximately \$120 million to address critical maintenance over the next 15 years and funding for operation and maintenance of park land is inadequate. Protecting Ohio's water resources by managing stormwater run-off and improving water quality by sustained wastewater infrastructure improvement is of high priority. Surface water from Lake Erie and the Ohio creeks and rivers are the source of clean drinking water for many Ohioans. Ohio requires a considerable high-quality infrastructure to thrive, not only among competitive states in the U.S., but to compete among modern world economies.



Ohio roadways and bridges carry the third highest freight volume in the U.S. They also accommodate the sixth most vehicle miles travelled, making the state an essential tool in the national economy. While surface transportation, rail, ports and inland waterways are all meeting the needs of Ohioans presently, continued investment is needed to ensure that these systems can sustain increased volumes in the future, expand the local economy and ensure no sector is left behind. Such infrastructure systems are indispensable for the various industries in Ohio, particularly goods producing sectors such as manufacturing, agriculture and mining. These goods need to be safely and efficiently moved within Ohio, across the country and out of the U.S., for the nation to maintain long-term global competitiveness.

The state's transit systems need to become an immediate priority. With so many travelers coming through Ohio for tourism and to gain access to other states, local businesses cannot thrive without an adequately funded transit system. In addition, the local economy will remain stagnant without reliable methods of transportation for all.

Increased spending on Ohio's infrastructure will have both short-term and long-term benefits. In the short run, infrastructure will stimulate economic activity and create jobs within the state. In the long run, the impacts would be more significant because improvements in our infrastructure:

- Lower the cost to deliver goods
- Lower prices of manufactured goods
- Reduce the cost of materials
- Reduce dependency on imports
- Improve the health of the work force
- Create greater movement of people within the state
- Have an overall positive effect on both businesses and consumers

Continued funding of grant and low interest loan programs will be imperative as most communities have seen a significant reduction in revenue in response to the recent pandemic – a trend that will likely continue for the remainder of 2021.

RECOMMENDATIONS TO RAISE THE GRADE

Ohio's infrastructure is the foundation for thriving communities and businesses. Its roads, water systems, energy grid and other infrastructure components help drive the economy, support quality of life and ensure public health and safety for residents. Unfortunately, Ohio has been underinvesting in its infrastructure for decades.

In addition, the COVID-19 pandemic made an already difficult situation worse. A sizable portion of Ohio's infrastructure systems is supported by user-generated revenue funding. Since the onset of COVID-19, the use of Ohio roads and transit are down, use of inland waterways and drinking water are also down. Meanwhile, municipal and state budgets are becoming more and more inadequate under unparalleled demands, meaning less support is available for parks, schools and other publicly owned infrastructure, precisely at the time more investments should be made.

However, this could be an opportunity for Ohio to reimagine its future and make infrastructure investment a centerpiece of its immediate response as well as its long-term economic recovery strategy. A renewed focus on investment, leadership and planning and preparing for the future will help Ohio improve on the state of its infrastructure.

INVESTMENT

1. Ohio should consistently dedicate public funding from both the state and local levels to infrastructure investment. The state should sufficiently assess user-generated fees so that infrastructure trust funds are used only for new infrastructure projects.
2. To ensure long-term, sustainable funding for the federal surface transportation program, the user fee on gasoline and diesel fuel must be raised and tied to inflation to restore its purchasing power, fill the funding deficit and ensure reliable funding for the future.
3. The state should authorize programs that improve specific categories of deficient infrastructure, and then support that commitment by fully funding them in an expedient, prioritized manner.
4. Infrastructure owners and operators must charge—and Ohioans must be willing to pay, rates and fees that reflect the true cost of using, maintaining and improving all infrastructure, including our water, waste, transportation and energy services.

LEADERSHIP & PLANNING

Smart investment will only be possible with leadership, planning and a clear vision for Ohio's infrastructure. Leaders from all levels of government, business, labor and non-profit organizations must come together to ensure all investments are spent wisely, prioritizing projects with critical benefits to the economy, public safety and quality of life, while also planning for the costs of building, operating and maintaining the infrastructure for its entire lifespan.

To do so, Ohio must:

1. Encourage projects that receive federal funding use life cycle cost analysis and develop a plan for funding the project, including its maintenance and operation, until the end of its service life.
2. Create incentives for state and local governments as well as the private sector to invest in maintenance and to improve the efficiency and performance of existing infrastructure.
3. Develop tools to ensure that the projects most in need of investment and maintenance are prioritized, to leverage limited funding wisely.
4. Streamline the project permitting process across infrastructure sectors. This should include safeguards to protect the natural environment, provide greater clarity to regulatory requirements, bring priority projects to reality more quickly and secure cost savings.
5. Identify infrastructure projects attractive to private sector investment and public-private partnership.

PREPARING FOR THE FUTURE

1. Develop active community resilience programs for severe weather events to establish communications systems and recovery plans as well as reduce impacts on the local economy, quality of life and environment.
2. To ensure long-term utility, consider emerging technologies and shifting social and economic trends – such as autonomous vehicles, distributed power generation and storage and larger ships – when building new infrastructure, to assure long-term utility.
3. Improve land use planning at the local level to consider the function of existing and new infrastructure, the balance between the built and natural environments and population trends in communities of all sizes, now and into the future.
4. Support research and development into innovative new materials, technologies and processes to modernize and extend the life of infrastructure, expedite repairs or replacement and



ABOUT THE INFRASTRUCTURE REPORT CARD

GRADING CRITERIA

METHODOLOGY

Every four years America's civil engineers provide a comprehensive assessment of the nation's 16 major infrastructure categories in ASCE's *National Infrastructure Report Card*. Using a simple A to F school report card format, the Report Card examines current infrastructure conditions and needs, assigning grades and making recommendations to raise them. The Ohio Council of Local ASCE Sections Infrastructure Report Card Committee adopted the same simple A to F report card format, assessing relevant data and reports, consulting with technical experts and assigning a grade for each category using the following criteria:



The Report Card Sections are analyzed based on the following eight criteria:

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?

2021 REPORT CARD FOR OHIO'S INFRASTRUCTURE



 **BRIDGES** 

 **PORTS** 

 **DAMS** 

 **RAIL** 

 **DRINKING WATER** 

 **ROADS** 

 **ENERGY** 

 **SCHOOLS** 

 **HAZARDOUS WASTE** 

 **SOLID WASTE** 

 **INLAND WATERWAYS** 

 **STORMWATER** 

 **LEVEES** 

 **TRANSIT** 

 **PARKS** 

 **WASTEWATER** 

COMPARISON OF 2017 AND 2021 GRADES

OHIO		
Category	Ohio 2021	National 2017
Bridges	C+	C+
Dams	C-	D
Drinking Water	D+	D
Energy	C	D+
Hazardous Waste	D+	D+
Inland Waterways	D+	D
Levees	D	D
Parks	C-	D+
Ports	C	C+
Rail	B	B
Roads	D	D
Schools	C+	D+
Solid Waste	B-	C+
Stormwater	D+	N/A
Transit	D	D-
Wastewater	C-	D+
Overall GPA	C-	D+



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.

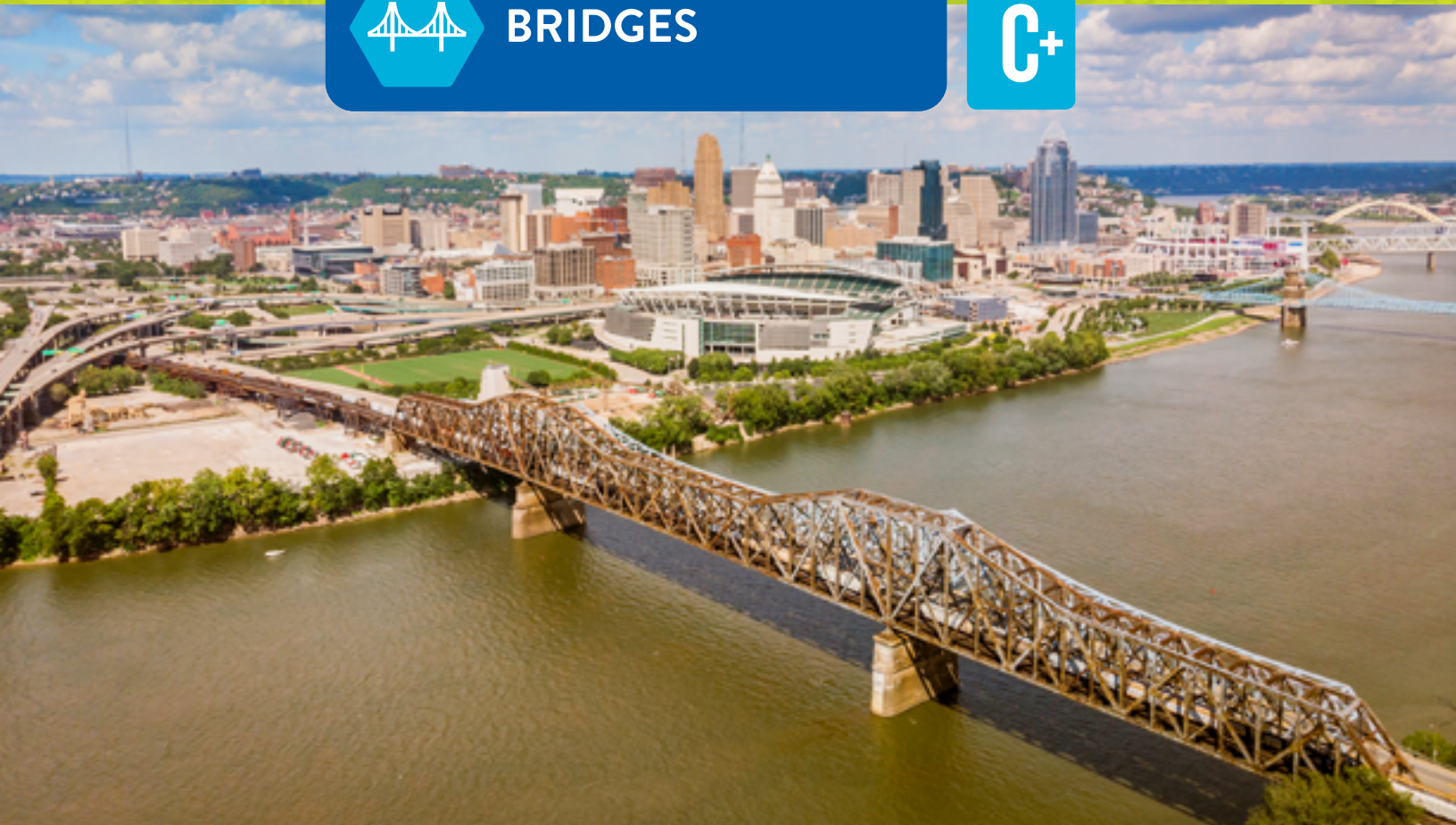


FAILING/CRITICAL: UNFIT FOR PURPOSE

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.



BRIDGES



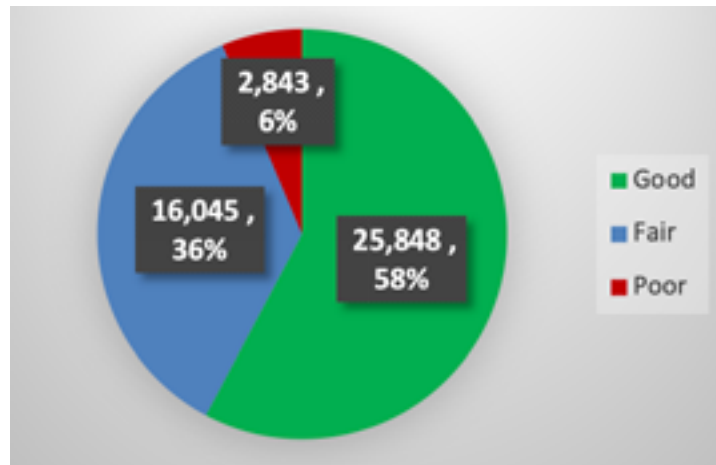
BRIDGES

GRADE: C+

EXECUTIVE SUMMARY

Ohio is home over 44,000 bridges, of which 58% are rated in good condition, 36% are in satisfactory or fair condition and 6% are in poor condition. There are 2,012 (4.5%) bridges that require a reduced load capacity and 200 that are closed altogether. Starting in 2018, the Ohio legislature enabled counties to generate additional revenues for improving their local transportation network by levying a \$5 permissive fee on vehicle registration, though increases have not been uniformly adopted across the state. In 2019, state leaders raised the state's gas tax from 28.0 cents to 38.5 cents. Overall, Ohio faces a significant funding shortfall, particularly in addressing the state's future needs. Funding has remained static and is not indexed to inflation, while the system continues to age at a faster rate than repairs or replacements occur. While funding challenges limit the number of annual repairs or replacements, an increased emphasis on system preservation has helped to hold off the growing needs of Ohio's bridges.

FIGURE 1: OHIO BRIDGE CONDITION SUMMARY



INTRODUCTION

The Ohio Revised Code (ORC) defines a bridge as any structure of 10 feet or more clear span, or 10 feet or more in diameter, situated on, above or below a highway, and requires all bridges to be inspected annually. The Federal Highway Administration (FHWA) National Bridge Inventory (NBI) defines a bridge as a structure that is 20 feet or longer and requires an inspection frequency of two years. Ohio’s 10-foot-long bridge definition and greater inspection frequency places a higher level of responsibility on bridge owners in the state; Ohio is the only state in the U.S. with this requirement. The annual bridge inspection requirement along with the significant number of bridges in the state inventory requires additional staffing and other resources to inspect, report and load rate all bridge structures. The table below supports this point by identifying the bridge distribution by length based on the ORC:

TABLE 1: OHIO BRIDGES

NUMBER	BRIDGES IN OHIO
44,736	Total number of bridges over 10-foot span
30,805	Total number of bridges over 20-foot span
13,931	Additional Ohio Bridges between 10- and 20-foot span
27,162	Total number of FHWA/NBI Bridges

State of Ohio national rankings

- Second greatest number of bridges, second only to Texas
- Fourth highest volume of interstate lane miles (6,800)
- Fifth highest traffic volume
- Third largest quantity of truck traffic on the interstate

While ODOT has invested significant resources on major bridges in the state including the I-90 George V. Voinovich Bridge (\$573.6 million), the I-480 structures over the Cuyahoga Valley (\$227.8 million) and the I-71 Jeremiah Morrow (\$88.1 million), funding remains a challenge for the replacement of the bi-level Brent Spence Bridge and adjoining roadways over the Ohio River which carry both I-71 and I-75 (\$2.6 billion), and recently suffered a major truck fire and shutdown for emergency repairs.

CONDITION AND CAPACITY

MAP-21 Rulemaking defines bridge condition general appraisal ratings in the following ranges: Good (9-7); Fair (6-5); Poor (4-0). ODOT has established a systemwide goal of having an average general appraisal rating of 6.8. This goal demonstrates ODOT's effort to judiciously use limited resources across a large infrastructure portfolio including interstate and freeway pavement, interchanges, traffic signing, safety features and other operations and maintenance commitments.

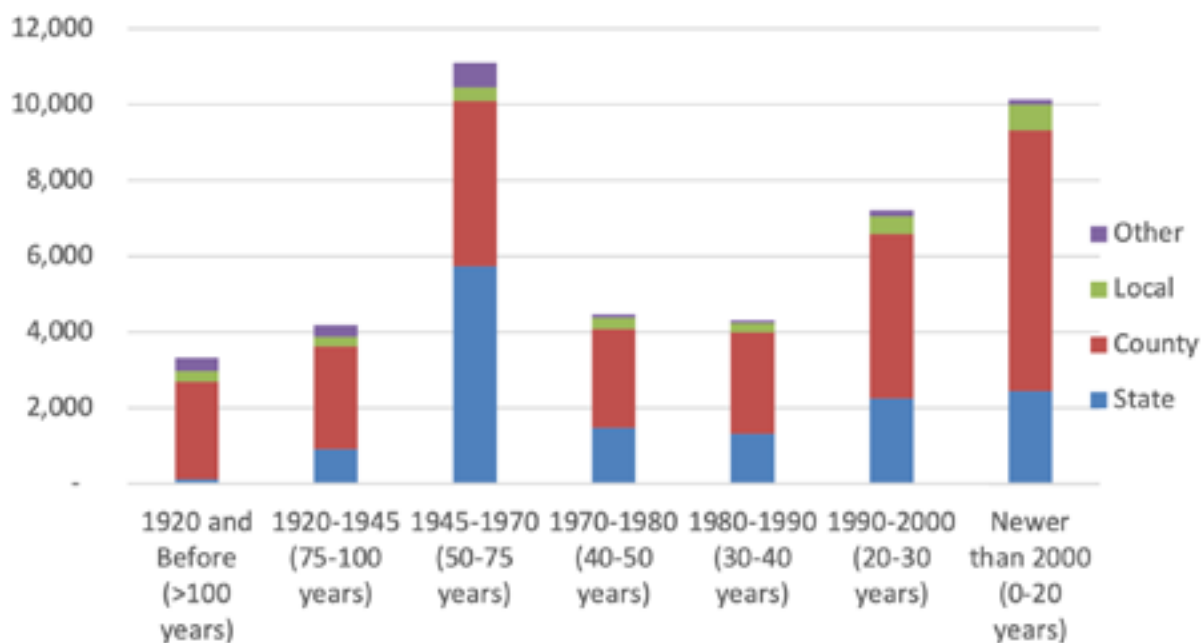
TABLE 2: BRIDGE CONDITION SUMMARY BASED ON STATEWIDE, 2020 ODOT BRIDGE INVENTORY

Owned By	CONDITION				Below 100% Legal Load	Total Deck Area (sf)	Closed to Traffic	Posted/Temp Closed
	Good	Fair	Poor	Total				
State	9,058	4,904	291	14,253	214	107,742,587	13	110
	64%	34%	2%		2%	66%		
County	14,677	9,445	2,011	26,133	1,848	33,903,347	108	1,655
	56%	36%	8%		7%	21%		
Local	1,416	896	239	2,551	377	7,437,713	51	199
	56%	35%	9%		15%	5%		
Other	697	800	302	1,799	938	14,939,587	28	48
	39%	44%	17%		52%	9%		
Total	25,848	16,045	2,843	44,736	3,377	164,023,234	200	2,012
	58%	36%	6%					

Nationally, the average bridge age is 45 years, which is just five years shy of the typical 50-year design life expectancy. The average age of a bridge in Ohio is 46 years, with 48% of ODOT bridges and 42% of all bridges in Ohio 50 years or older.

It is also recognized by owners that a bridge's service life is often longer than its design life, requiring additional repair and rehabilitation investment as the bridge continues to age. 17% of Ohio's bridges are now older than 75 years. To correct this backlog and achieve the State's system goal of bridges below a 75-year design life by 2045, over 52% of Ohio's bridges (23,078) will need major rehabilitation or replacement between 2020 and 2045. This equates to 923 bridges per year, a replacement rate 1.8 times higher than the replacement of 507 bridges per year from the last twenty years.

FIGURE 2: OHIO BRIDGE AGE DISTRIBUTION BASED ON STATEWIDE, 2020 ODOT BRIDGE INVENTORY



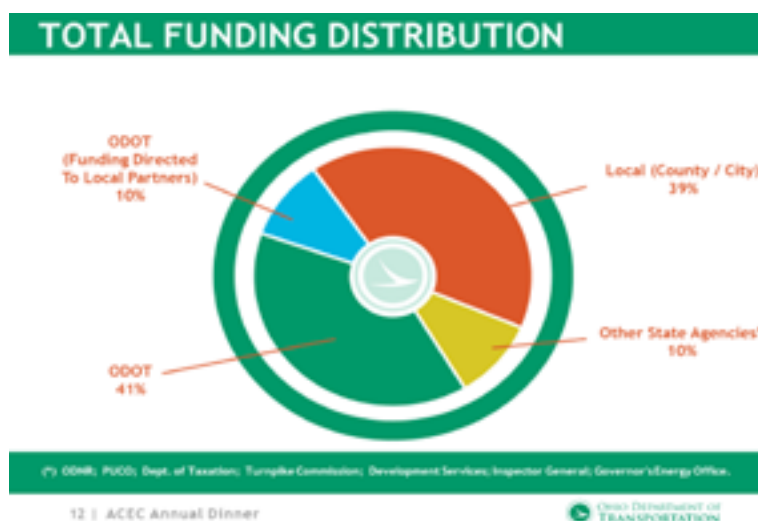
FUNDING AND FUTURE NEED

Funding for transportation projects in Ohio comes from several revenue streams. Funds are derived from taxes, both federal and state on gasoline and diesel fuels, permissive license tag fees, income tax, tolling and other sources. Per ODOT Fiscal Year (FY) 2019 Annual Report, revenue for FY19 amounted to \$3.23 billion.

The primary revenue source is gas tax revenue from gasoline and diesel fuel. The current Ohio per-gallon tax rates are 38.5 cents for gasoline and 47 cents for diesel. A federal tax of 18.4 cents for gasoline and 24.4 for diesel per gallon is also levied. In 2019, Ohio H.B. 62 increased the per-gallon gas and diesel rates 10.5 cents and 19.0 cents per gallon, respectively, for the first time since 2006. The federal per-gallon rates have not increased since 1993. According to the ODOT FY19 Division of Finance Financial and Statistical Report, the State Motor Fuel tax comprises approximately 93% of the total state revenue ODOT receives.

ODOT established a nine-member Transportation Review Advisory Council (TRAC) in 1997 with the purpose

FIGURE 3: ODOT FUNDING DISTRIBUTION- STATEWIDE (FIGURE COURTESY OF ODOT DISTRICT 12)



of assisting project selection and prioritization of major new projects. The TRAC project list is fiscally constrained and segmented into Tiers I, II and III; however only Tier I projects are fully funded through construction. Construction funding commitments are expected to decrease through 2023.

For local governments such as counties, municipalities, villages and townships, sustained annual revenue varies according to their size. Each county, however, receives the same allocation of fuel tax receipts – \$2.4 million per county in 2018 up to \$2.9 million in 2019. This growth reflects six months of the recently enacted gas and diesel tax increase. While the increased revenue from the first full year of the fuel tax increase was estimated to be just under \$4 million per county, significantly reduced travel in 2020 due to the COVID-19 pandemic caused significant declines in the expected monthly projections. In addition to fuel tax revenue, local agencies have available funding through the County Engineers Association of Ohio (\$34 million per year), Ohio Municipal Bridge Program (\$10 million per year), Ohio Bridge Partnership (\$5 million per year) and the license tag fees permitted by HB-26 (2017) and HB-22 (2019).

In 2015, the Fixing America's Surface Transportation (FAST) Act was signed into law by President Obama. The FAST Act provided \$305 billion over five years to surface transportation until 2020. It was extended one additional year until September 30, 2021. However, it did not increase funding levels nor did it address the Highway Trust Fund (HTF) shortfall. The federal gas rate per gallon has stayed at the same level since 1993. Based on inflation, that reduces the buying power of that 18.4 cents by 40% according to an ASCE 2020 issue brief. It should be noted that Ohio is considered a donor state related to gas tax receipts meaning that it receives less than it collects from the HTF. In FY19, Ohio collected \$2.06 billion in federal fuel receipts, but received only \$1.78 billion for ODOT's annual budget.

OPERATIONS AND MAINTENANCE

Bridge maintenance agencies include ODOT, the Ohio Turnpike and Infrastructure Commission, counties, municipalities, transit and park agencies. Each agency supports bridge maintenance needs through resources such as personnel, equipment and facilities. They perform operations and maintenance activities including safety item repairs, wearing surface patching, minor rehabilitations, concrete patching and sealing, expansion joint maintenance and drainage system repairs. Extensive bridge repair and rehabilitation work is most often programmed, designed and then performed by bridge contractors and managed by the agencies. Challenges faced by bridge owners include:

- Annual bridge inspections and the large number of bridges in the state result in higher inspection costs.
- The aging bridge system requires additional costs to operate and maintain. Overall, 41.6% of Ohio's bridges are over 50 years old.
- Preventative maintenance work is desired but difficult to execute due to limited staff and funding resources.
- Lower priority asset work is deferred until resources are available.

ODOT is placing an increased emphasis on system preservation and preventive maintenance programs for bridges. A long term, life cycle cost approach to preserving their bridge assets will yield cost savings and ultimately improved overall structure conditions. In FY18, ODOT statewide spent 90% of its \$2.4 billion construction budget on system preservation projects, leaving less funding for new projects and upgrades.



PUBLIC SAFETY

Bridges in Ohio are load rated with bridge inspection condition data to determine the safe load carrying capacity of each structure. Bridges which cannot carry the state required vehicle loads are posted to a safe load capacity based on condition or original bridge design loading. Currently, the State of Ohio has 3,377 (7.5%) bridges in service that cannot carry full Ohio legal loads, 2,012 (4.5%) that are posted for low load capacity and 200 that are closed.

RESILIENCE

The ASCE policy statement on infrastructure resilience focuses on the ability of the system to recover from a catastrophic event. Except for the Appalachian region in Southeast Ohio, Ohio is fortunate to have a lot of redundancy in its transportation system, with highly urbanized areas served by an extensive Interstate, freeway and urban arterial roadway network. In the event of a complete bridge closure, a suitable alternate transportation route would be available in nearly all cases to detour traffic, understanding that traffic congestion and travel delay could be significant. Agencies have focused on eliminating or reducing the number of fracture-critical bridges and this reduction in non-redundant structures increases the overall resiliency of the system.

Regarding resiliency as it pertains to climate change and weather-related impacts, ODOT has conducted an Infrastructure Resiliency Plan for the State that identifies the 10 most vulnerable bridges. One concern is an increasing number and size of storm and flood events. Regional impacts of the Fourth National Climate Assessment indicate a 60% to 100% increase in number of days exceeding 1.25" of precipitation per year, a 20% increase in total precipitation, and a 32% increase in heavy precipitation events in the 1951-2012 assessment period.

INNOVATION

ODOT has been a leader on the development of improved materials and research and has also provided counties and municipalities with research funding through Ohio's Research Initiative for Locals (ORIL) program. This program takes ideas from owners, engineers and stakeholders to fund applied research. Since 2014, the program has funded 26 projects, including six related to bridges. Other efforts have been undertaken through ODOT's Statewide Planning and Research office and in cooperation with the FHWA Every Day Counts (EDC) program and these have resulted in test projects for innovative materials and specifications.



BRIDGES



RECOMMENDATIONS TO RAISE THE GRADE

- **Counties should take advantage of HB 26 which allows counties the opportunity to increase vehicle registration revenues by imposing an additional \$5 permissive fee, until the state maximum amount is achieved.**
- **The state legislature should index the state gas tax rate to inflation. This would extend the legislation beyond a short-term fix.**
- **The federal government should raise the motor fuels tax and index it to inflation.**
- **Public private partnerships to replace bridges should be encouraged, when appropriate.**
- **Bridges in poor condition should continue to be upgraded and rehabilitated.**
- **Bridges in fair condition should continue to perform have preservation and rehabilitation projects.**
- **Legislators should provide more financial tools with funding certainty to counter the current lack of indexing, capped fees and an unknown employment environment from recessions and factors outside agency/jurisdiction control.**

SOURCES

Ohio Revised Code (ORC) section 5501.47 (B.1.c) titled-Bridge Inspections- the State of Ohio

ASCE Policy Statement 208- Bridge Safety

ASCE Policy-Statement-500—Resilient-Infrastructure

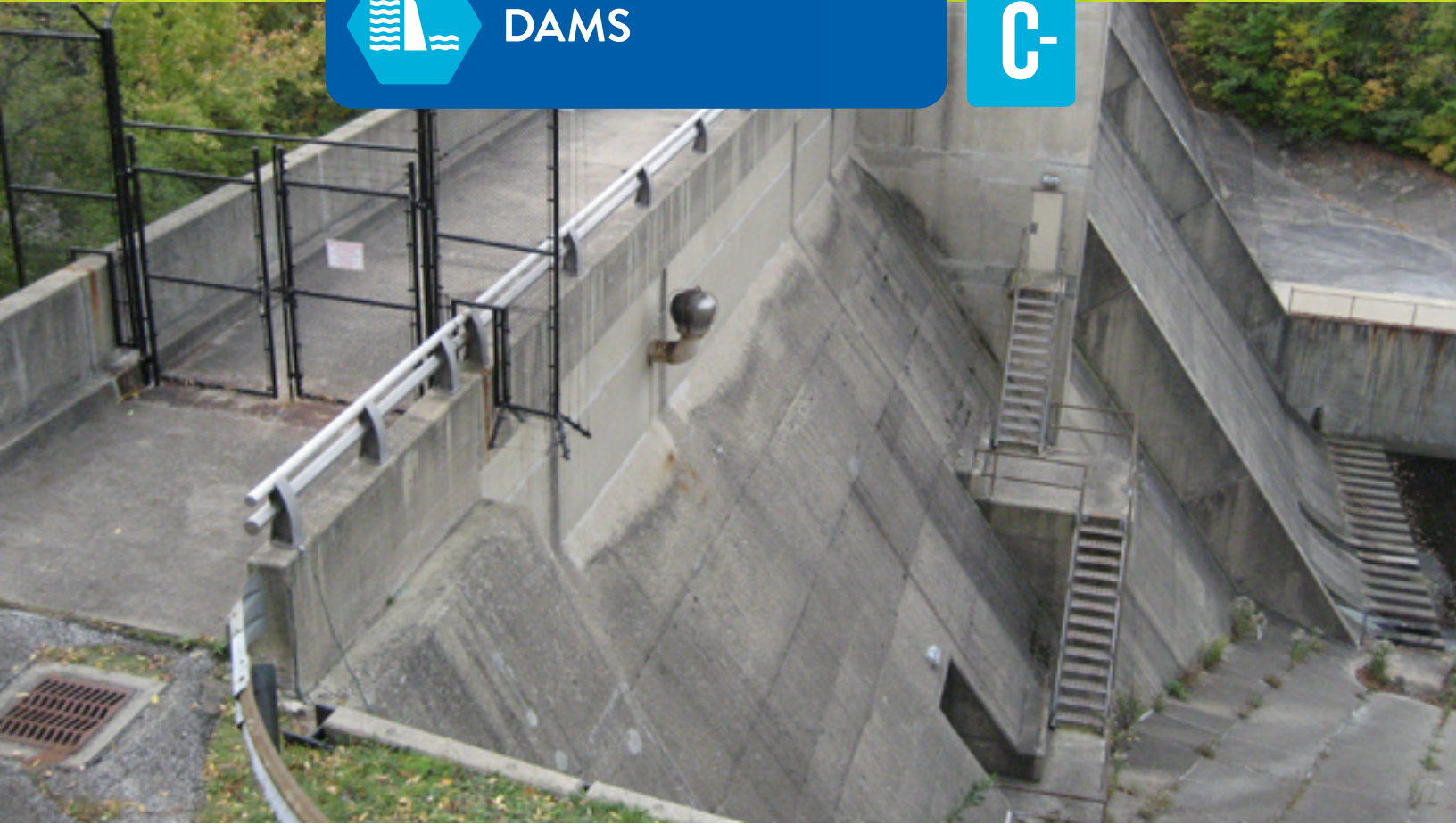
Ohio 2018-2019 Transportation Budget Bill (HB 26)

Federal Highway Administration (FHWA)

Buckeyeassets.org



DAMS

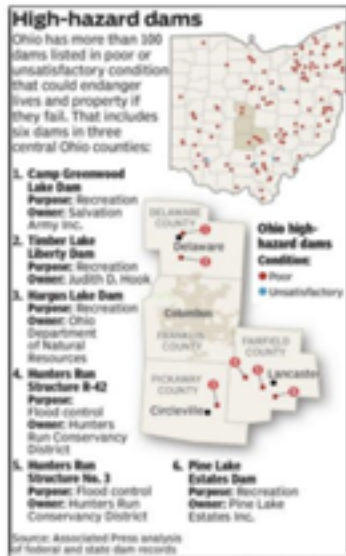


DAMS
GRADE: C-

EXECUTIVE SUMMARY

There are more than 2,500 dams in the state of Ohio, of which 1,472 are state regulated. The Ohio Department of Natural Resources (ODNR), Division of Water Resources, Dam Safety Section is responsible for inspection of Ohio's dams. Of the regulated dams, 33% are deficient. Nearly 60% of Ohio dams are privately owned. The 2019 Dam Safety Section budget was nearly \$1.8 million, representing an average of \$1,190 per regulated dam. Staff workload has increased to nearly 150 dams per full time equivalent staff member but remains under the 2019 national average of approximately 190 dams per staff member. It is estimated that the repair cost for Ohio's deficient dams is nearly \$300 million. In calendar year 2019, 23 state regulated dams were repaired of which seven state regulated high hazard potential dams were remediated (meaning construction was completed) because of hydraulic and/or structural deficiencies.

INTRODUCTION



The Columbus Dispatch

More than 100 'high-hazard' dams across Ohio need upgrades, repairs

By Doug Caruso, GateHouse Media, and Julie Carr Smyth and Dan Sewell, The Associated Press

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Hargus Lake Dam near Circleville is among the more than 100 Ohio dams in poor or unsatisfactory condition whose failure could threaten lives and property. The condition of Ohio's dams remains a concern four years after the start of the Buckeye Lake Dam restoration, and a Dispatch investigation, brought the issue to the fore.

Dams provide tremendous benefits, including water supply for drinking, irrigation and industrial uses as well as flood control, hydroelectric power, recreation and navigation. However, dams also represent one of the greatest risks to public safety, local and regional economies and the environment. Historically, dam failures have caused some of the largest disasters in the United States.

Dams in Ohio – except for federally owned dams – are subject to regulations administered through the Ohio Department of Natural Resources (ODNR) Dam Safety Program. The approximate ownership breakdown of dams in Ohio is:

- 2% federal government
- 6% state government
- 17% local government
- 75% private (such as individuals, groups or companies)

There were 1,472 state regulated dams in Ohio in 2020. Of that:

- 371 are classified as High Hazard Class I dams where failure would result in probable loss of human life or collapse of at least one residence, commercial or industrial building.
- 557 are classified as Significant Hazard Class II dams where failure would disrupt a public water supply or wastewater treatment facility, or damage major roads or the only access to critical facilities such as a hospital.
- 544 are classified as Low Hazard Class III dams where failure effects would be limited to rural buildings or local roads.

There are over 1,000 additional Class IV dams included in the ODNR inventory of Ohio dams that are exempt from the regulatory requirements affecting Class I, II and III dams because their failure would only result in property damage to rural lands and the dam itself.

An unknown number of dams for coal mining ponds are regulated by ODNR's Division of Mineral Resources Management (DMRM). At the time of this report, it could not be determined how many of these dams are permitted or their hazard class. Based on information from DMRM, it is understood that most of these dams are small (less than 20 feet in height) and are usually decommissioned (usually removed) after the mining permit has expired. Of those dams that have not been removed, jurisdiction is transferred to the Dam Safety Section.

CONDITION & CAPACITY

Like all man-made structures, dams deteriorate. Deferred maintenance accelerates deterioration and causes dams to be more susceptible to failure. As with other critical infrastructure, a significant investment is essential to maintain its benefits and assure the safety that society requires.

In 2008, ODNR prepared a condition rating for all its High Hazard Class I dams, as requested by the U.S. Army Corps of Engineers for the National Inventory of Dams. In 2019, this condition rating was applied to all High Hazard Class 1 dams. Approximately 8% of the Class I dams were not given a rating, typically because they had not been inspected recently.

Of the 342 dams rated:

- 1% were considered unsatisfactory
- 33% were considered poor
- 26% were considered fair
- 40% were considered satisfactory

The dams that were rated unsatisfactory and poor (34% of Class I dams that were surveyed) represent those with deficiencies, a slight increase from 2007 percentages for Class dams (31%). Over the years, as ODNR's data collection efforts have improved, more condition-based data about the state's dams becomes available and their growing need becomes clearer.

FUNDING AND FUTURE NEED

Sufficient funding is needed to monitor and estimate the cost to improve state regulated dams to assure dam safety. ODNR's Ohio Dam Safety Section budget increased from \$1.4 million to \$1.8 million over the last decade but associated total staff for Ohio has dropped, requiring staff to be spread thinner across the state regulated dams.

Federal funding is also needed for the rehabilitation of dams, especially high hazard dams. Unlike highways and other infrastructure, the general public doesn't directly "use" a dam. Rather, the public uses its byproducts – its drinking water, a recreational lake, its shoreline its flood protection or its low-cost energy. In many cases, the beneficiary of a dam may not even be aware of the presence of a dam or its complexity. As a result of the low public awareness of dams, the demand or "outcry" for dam rehabilitation is often limited until failure of such a facility puts the disaster into the headlines.



Ohio received funds from the Federal Emergency Management Authority's (FEMA) High Hazard Potential Dam Rehabilitation Program. In fiscal year 2019 that program was severely underfunded, having only received \$10 million of its authorization level of \$25 million. Ohio received a \$126,080 Dam Safety Assistance grant from FEMA in 2020 that helps with budget needs, but this amount has steadily decreased over the past few years. In 2020, Ohio also received \$558,000 from the High Hazard Potential Dam grant program. Sub-recipients of this grant must provide a 35% cost share for any proposed projects.

There are very few funding assistance programs specifically for dams in Ohio. Dams owned by state and local government bodies may need specific funding for repairs or rehabilitation from the legislature which has sometimes occurred in the past. Similarly, privately owned dams may rely on below-market loans through the Ohio Water Development Authority's Dam Safety Linked Deposit Program. New funding initiatives are needed.

OPERATIONS AND MAINTENANCE

To provide safe, continuing service, dams require ongoing monitoring, frequent safety inspections and rehabilitation. Aging dams often require major rehabilitation to assure their safety. Downstream development in areas below dams has increased dramatically in recent years. New findings from scientific research of dam failure mechanisms, such as major flood events or earthquakes, frequently demand repairs to dams constructed decades before such scientific research was first conceptualized.

In Ohio, ODNR has an operation maintenance and inspection manual to guide dam owners. Ohio law states manuals shall be required for all Class I, II and III dams. In addition, the owner of a dam shall prepare a written manual detailing the operation, maintenance and inspection procedures necessary for the continued safe operation and use of the dams. An emergency action plan (EAP) shall also be adopted and updated on at least an annual basis. This includes updating all emergency contact information and the owner submitting updated pages to the division and local county emergency management director.

Ohio also requires that all Class I dams have an inundation study and inundation maps. For Class II, fillable EAP forms are available to make the reporting process easy. Inundation maps are used by communities in Ohio to plan for emergency response and evacuation routes as roads may not be accessible if a dam breach should occur.

The result of dam inspections made by ODNR's Dam Safety Section is a written report, which contains a section entitled required repairs. If deficiencies are serious enough, the state has the power to enforce repairs. Ohio Revised Code 1521.062 provides enforcement authority against any deficiency, but does not stipulate how serious the deficiency must be. The threat of enforcement seems to be a successful means of getting necessary repairs made.



PUBLIC SAFETY

Dams provide great benefits for Ohio, but they also pose risks to public safety especially if they are not properly maintained. For example, were the Portage Lakes Class 1 dams to fail, about 4,000 people and approximately 2,000 critical structures in the Akron area would be affected. If a breach were to occur during a storm, up to \$500 million in damages could be expected. Fortunately, rehabilitation of the Portage Lakes dams are completed or underway.

ODNR's Division of Water Resources manages a dam safety program for dam owners and local officials. Per Ohio rules and regulations, the dam owner is responsible for ensuring that the dam is properly operated and maintained such that it does not pose a safety hazard to health, life and the environment. In Ohio, dam safety inspectors conduct about 300 inspections of dams on a five-year rotation schedule. They write reports that detail repairs and maintenance needed for the dams to meet compliance requirements of the law. All dams regulated by ODNR are required by law to have an EAP. Although significant improvement has occurred in recent years, 20% of Ohio's Class I (high hazard) dams do not have an EAP.

In Ohio, an AP study conducted in 2018 found that among the dams that are classified as high-hazard, approximately 25% needed repairs or other upgrades to be able to withstand a powerful flood. ODNR is actively pursuing funding and enforcing compliance measures to help reduce the number of dams that need repairs or upgrades.

RESILIENCE

The Department of Homeland Security's Office of Infrastructure Protection and the National Cyber Security Division manage a roadmap to improve cybersecurity for dams for voluntary use by the dam sector and industry stakeholders. This roadmap provides set of goals and objectives as well as milestones and specific efforts and activities for achieving each goal.

The cybersecurity threat for Ohio dams is real and needs immediate attention. In New York, an attack was successful against a dam. A similar incident which presents a safety hazard to health, life and the environment could happen in Ohio at any time. Some funding is becoming available for dam cybersecurity. In January 2020, the U.S. Department of the Interior's Bureau of Reclamation awarded a \$45 million, five-year indefinite delivery, indefinite-quantity contract for information technology risk management services to two private companies to support threat monitoring systems for the more than 600 dams across the western U.S. managed by the bureau.



RECOMMENDATIONS TO RAISE THE GRADE

Ohio can support ASCE's "Key Solutions" by a variety of programs currently in place. This support should include:

- **Increasing infrastructure leadership at the federal level.** There needs to be a renewed involvement at the federal level with our critical infrastructure and this should include dams. We need a national vision and strong federal leadership that can then be shared at all levels of government and private owners.
- **Promoting sustainability and resilience.** America's infrastructure must be able to meet the current and future needs of the nation while protecting and improving the environment. Both structural and non-structural methods need to be used to promote sustainability. Research and development should be funded at the federal level to develop new materials and more efficient methods for the construction and rehabilitation of the nation's infrastructure.
- **Developing federal, regional and state infrastructure plans.** Well-conceived plans are needed to prioritize infrastructure investment to focus funding and solve the most pressing problems.
- **Addressing life-cycle costs and ongoing maintenance.** Owners of infrastructure should perform life-cycle cost analysis, on-going maintenance and planned renewal to enhance the sustainability and resilience of their infrastructure.
- **Increasing and improving infrastructure investment from all stakeholders.** There must be a renewed commitment to infrastructure investment by all levels of government, owners and users of infrastructure. Significant funds will need to be invested to provide sustainable development and ongoing maintenance, and all available funding options need to be explored and debated.
- **Continuing to offer low interest loans for dam repair through the Ohio Water Development Authority.**



DAMS



RECOMMENDATIONS TO RAISE THE GRADE (CONT.)

- Promoting and supporting, and then fully funding federal legislation to provide grants to Ohio's Dam Safety programs. These grants are particularly needed to offset reductions in state budgets.
- Continuing to support dam fixes from the Dam Rehabilitation and Repair Act of 2009 to provide federal funds to correct deficiencies at non-federal publicly owned dams.
- Continuing to enforce the implementation of repairs to severely deficient dams. This includes strengthening state rules to provide greater enforcement of required repairs.
- Continue efforts to achieve 100% of Class I (high hazard) dams with an EAP.

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Protecting US Dams from Cyberattacks



DRINKING WATER



DRINKING WATER

GRADE: D+

EXECUTIVE SUMMARY

Drinking water infrastructure in Ohio is able to meet current and expected residential and commercial demands due to its sufficient source, treatment and distribution networks and accompanying facilities.

In the last decade, many large water utilities have:

- Improved their treatment systems to meet increasingly stringent regulations
- Addressed new water quality challenges
- Increased infrastructure reliability and resilience

While these investments stretch limited funds, they are made at the expense of Ohio's aging distribution networks, leading to a projected 36% increase in breaks in some areas over the next 20 years. State funding for capital projects requires organizations to develop emergency and asset management plans. Most available funding for medium and large systems is in the form of loans, for which the repayment must be reflected as debt service. Small systems serve populations less than 10,000 and tend to be more challenged for funding but have additional rural system grants and loan funding sources. Debt service and other costs of improvements and operations ultimately fall on the shoulders of users through the water rate fee structure. In the past 20 years, Ohioans have been paying water bills that have escalated at twice the rate of the Consumer Price Index.

CONDITION AND CAPACITY

There are approximately 4,800 public water systems in Ohio, delivering 1.3 billion gallons per day of clean, safe drinking water to the state's residential and commercial customers. Approximately 65 percent of the drinking water comes from surface water sources and the remainder from ground water sources. Given the state's plentiful amount of source water, there is sufficient capacity to supply Ohio's water demands for the foreseeable future.

Overall, Ohio's drinking water infrastructure has sufficient treatment and distribution capacity to serve community needs. Water demand across the state has been declining. In the past decade, systems have seen declines in urban usage while suburban areas have grown and increased water usage, causing some localized conveyance capacity issues. Increasing treatment and distribution system capacity has not been a major need in new drinking water infrastructure. Instead, recent improvements to major drinking water facilities have focused on increasing levels of treatment to enhance water quality and provide additional resilience and reliability.

Examples include:

- Cincinnati recently added UV disinfection to its Richard Miller Treatment Plant
- Toledo is upgrading their treatment plant process to include ozone
- Columbus is planning a new fourth water treatment facility to provide additional redundancy
- Greene County is planning to add membrane softening to its existing Northwest Regional Water Treatment Plant. This will provide customers drinking water that exceeds regulatory requirements for quality.

In general, improving the condition of treatment assets has been the focus of capital spending over the last 20 years rather than rehabilitation and replacement of buried distribution assets such as water mains and valves. Cleveland, Dayton and other utilities have improved the condition of treatment assets through equipment replacement at their treatment facilities. In recent years, Cleveland invested \$630 million in treatment facility improvements, while only just beginning a pipe replacement program at a funding level well below the treatment asset spending rate. Medium and small systems, such as Piqua, have replaced their treatment assets due to the poor condition of existing facilities, however, the rehabilitation and replacement of Ohio's aging distribution system water mains has lagged.

A significant amount of Ohio utility distribution system assets were installed during two periods in the last century – the early 1900s until the Great Depression and the post-war period of the 1950s and 1960s. The water main assets for the first period are at or are approaching their expected useful life (which is typically between 75 and 100 years of age). In many cities, those older assets are still crucial portions of the distribution system. These systems experience water losses greater than 35%. The water mains installed during the second period, while currently still within their useful life, will approach the end of their useful life over the next two decades. Investment in these distribution systems has not kept up with the current and near future need. A recent study completed by Montgomery County predicted that water main break rates will increase 36% over the next 20 years, doubling repair costs to current pipe rehabilitation and replacement levels. The county projected that a six-fold increase in its annual capital pipe spending will be needed just to maintain the system's average pipe age. Similarly, the City of Dayton found an eight-fold increase in its annual replacement rate will be needed to maintain the level of service of its existing distribution system.

FUNDING AND FUTURE NEED

Drinking water infrastructure projects in Ohio are funded through user fees and government loan and grant programs. The funding derived from user fees support operations, maintenance, administration and debt service for past projects. A survey of 24 Ohio utilities' average user fees resulted in a range from a high of \$55 to a low of just over \$19 a month. There is a need to generate additional funding for infrastructure restoration and to address water quality which is challenged by a general reduction in customer water use and has raised user fees considerably. From 2009 to 2016, fees increased three-fold. This is more than double the growth rate of the Consumer Price Index over the same period.

Substantial funding is made available from the state of Ohio in the form of low-interest loans. The largest program is the Water Supply Revolving Loan Account (WSRLA) with seed money provided by the U.S. Environmental Protection Agency (EPA) and a smaller portion by the Ohio EPA. The Ohio Water Development Authority (OWDA) administers the WSRLA fund along with the Fresh Water Fund, supported solely by the state of Ohio. In 2015 the WSRLA and OWDA funds made loans for water improvements totaling over \$152 million. By 2019, these agencies fulfilled loan requests for \$205 million, with nearly 60% distributed by the WSRLA.

State grants are also provided by the Ohio Public Works Commission and the Ohio Community Block Grants Program. Federal funding for smaller utilities is provided by the U.S. Department of Agriculture (USDA) Rural Development Program. There is also limited funding for rural areas provided by the U.S. Army Corps of Engineers and from the Appalachian Regional Commission. Over \$32 million in grants and loans were awarded in 2015 by the Ohio Public Works Commission and USDA for water projects. In 2019, these agencies distributed over \$25 million. Smaller systems often rely primarily on a combination of grants and loans, thus resulting in a shortfall if the utility fails to receive any one of their requested and/or expected funds. Loan principal forgiveness is being offered on more types of loans for expenditures related to harmful algal bloom treatment facilities, lead corrosion abatement and merging private water systems into the local public systems. The remainder of infrastructure investment is largely in the form of private bonds purchased by the utilities. This funding approach is mostly used by large utilities serving major metropolitan areas.

The drinking water industry is regularly challenged by new rules that require removal of constituents in the water found to have potentially negative health effects. The ability to detect and measure substances of emerging concern at lower concentrations is improving and so too are the studies assessing impacts on health. Accordingly, water treatment processes will likely need to be modified to mitigate the harm of emerging concerns, potentially costing utilities substantially and eventually being passed on to water consumers.

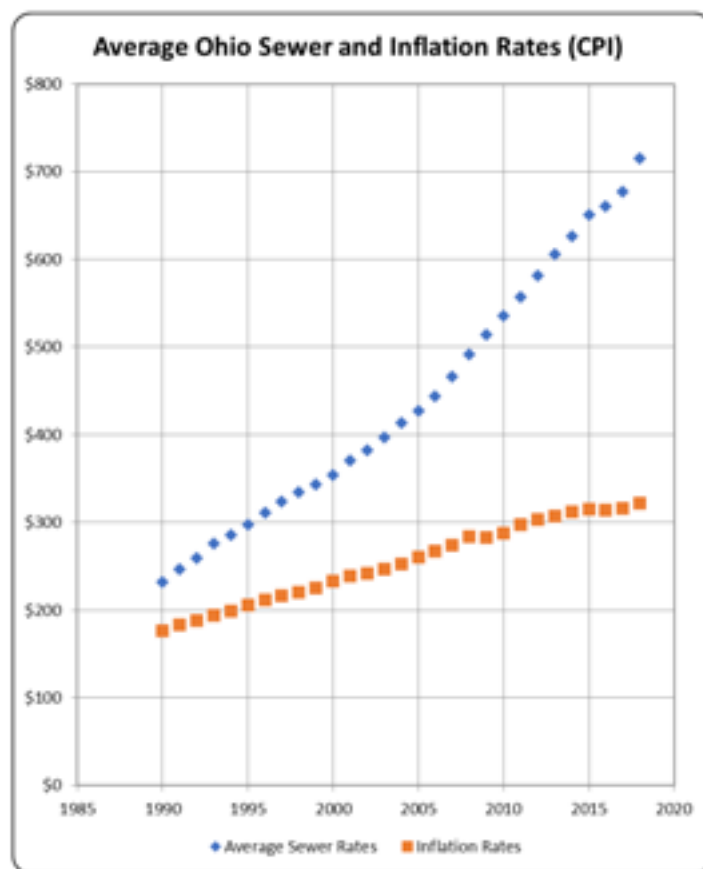
Harmful algal blooms continue to threaten the surface water intakes in Toledo, where in 2014 bloom concentrations shut down the entire water system for multiple days. The renewed national regulatory emphasis on lead removal as well as copper and arsenic control will mean elevated spending in many utilities statewide. For example, Cincinnati's capital budget for 2020 through 2025 allocates \$10 million annually for lead service line removal. With the emergence of per- and polyfluoroalkyl substances (PFAS) in 2019, the U.S. EPA has established monitoring requirements of these substances for utilities to implement.

Additionally, water utilities face the need for a massive investment to shore up existing underground infrastructure that is failing faster than it is being replaced. Little emphasis is being placed on buried assets in the distribution systems where the most money is needed to avoid the consequence of water main failure repair costs and related damages. The U.S. EPA Clean Water and Drinking Water Infrastructure Needs Assessment and Survey reports that a 20-year drinking water investment is needed for all drinking water systems in Ohio at \$13.4 billion, expressed in 2015 dollars. The largest component of this need is nearly \$9 billion for transmission and distribution system improvements. A review of state and federal funding resources reveals that in the first five years of a 20-year planning period covered in the EPA needs assessment, the combined total funding of all programs equaled \$1.5 billion, or only 11% of the total 20-year need. This spending level is less than half the rate of spending – 25% – that would need to be applied annually over



the 20-year period. Local funding is also provided by the individual utility revenue supplements, but it is usually insubstantial. The only recourse, then becomes raising water rates for consumers. Ohio utilities have raised user rates at a pace double the inflation rate over the past ten years but the needs for asset renewal outpaces the ability to raise revenue. Most water customers are also seeing dramatic increases in their wastewater user fees.

FIGURE 1: ANNUAL AVERAGE SEWER AND INFLATION RATES 1990-2018



2018 Ohio EPA Sewer and Water Rate Survey

OPERATIONS AND MAINTENANCE

Typically, operations and maintenance funds cannot be borrowed and come mainly from utility user fees, therefore the loss of the urban customer base and the use of water-efficient appliances decreases the amount of money available for drinking water utilities. Unanticipated expenses due to unplanned equipment and water main failures continue to reduce funding otherwise intended for other operations. In addition, water utilities are challenged in finding qualified employees to replace those that are leaving or retiring. The lack of operating funds reduces the number of personnel to operate water treatment facilities, perform leak detection and exercise valves.

Statewide, the Ohio EPA required water utilities to complete an asset management plan by October 1, 2018, to better manage, operate and maintain water systems in a consistent and cost-effective manner. Implementation of the plan enables utilities to develop a more achievable spending plan by identifying key assets and assessing consequences and risks of critical failures.

PUBLIC SAFETY

State and federal requirements are implemented to ensure water quality standards are met by utilities to minimize human health risks. Quality assurance is maintained by systematic sampling throughout treatment and delivery systems as well as regular inspections of facilities by regulatory agencies to confirm they are operating effectively. As new threats to water quality are identified – either man-made or natural – water regulations are implemented or revised. Funds provided for capital and operations are required to maintain water quality by adjusting processes to treat seasonal water changes and preventing the effects of harmful algal blooms, lead pipes, disinfectant byproducts and PFAS chemicals. Smaller communities with little funds often cannot afford such upgrades to include specialized treatment.

The distribution system is important to public safety for fire-fighting. As distribution systems grow older, the flow through unlined pipes is reduced and the water system's capability to protect the community during fires may be compromised.

RESILIENCE

As a matter of procedure, to respond and return to normal operation after a disaster, medium and large utilities identify the weakest links in their operation and delivery chains and assess equipment and facilities that are vital in maintaining a constant water supply to the public. Providing redundant facilities requires planning and large capital investments.

Loan funds through the Ohio EPA require the borrowing utility to have a Capability Assurance Program in place, as well as emergency and asset management plans. These documents point out deficiencies in water systems. However, smaller systems struggle to have the facilities and personnel to maintain operations during emergencies.

INNOVATIONS

The drinking water industry has been responsive to emerging health threats and has strived to improve the management of its infrastructure. There has been an emphasis on evaluating water quality from the treatment plant to the customer's tap. In the last two decades, the water industry has been implementing measures to secure water systems from intentional or unintentional contamination.

Ohio has long been a leader in advanced drinking water practices. In the 1990s, Cincinnati implemented granular activated carbon treatment to provide a barrier against organic contaminants in the Ohio River. In the last five years, Columbus installed ion exchange treatment at its largest treatment plant to provide additional protection against emerging contaminants of concern.

Information technology is helping systems achieve their goals. In addition to SCADA and real-time security tools, many Ohio water systems are managing operation of their systems through advanced metering infrastructure to capture individual customer water usage. Customers can also access the data to manage their water use. Cleveland has already replaced its meters to lower its water loss and Canton and Akron are implementing similar programs.



**DRINKING
WATER**



RECOMMENDATIONS TO RAISE THE GRADE

- **Implement asset management plans – especially with respect to distribution systems – to track assets for planned replacement and lessen emergency reactions.**
- **Expand public information programs to enhance support for increasing user rates to ensure affordability.**
- **Explore alternative funding sources for grants and low-interest loans, including adjusting user fee structures to benefit low-or-fixed income customers.**
- **Increase regionalizing and consolidation of water utilities to better control costs for smaller communities and water systems, who can't afford enhanced treatment or distribution system asset rehabilitation on their own.**



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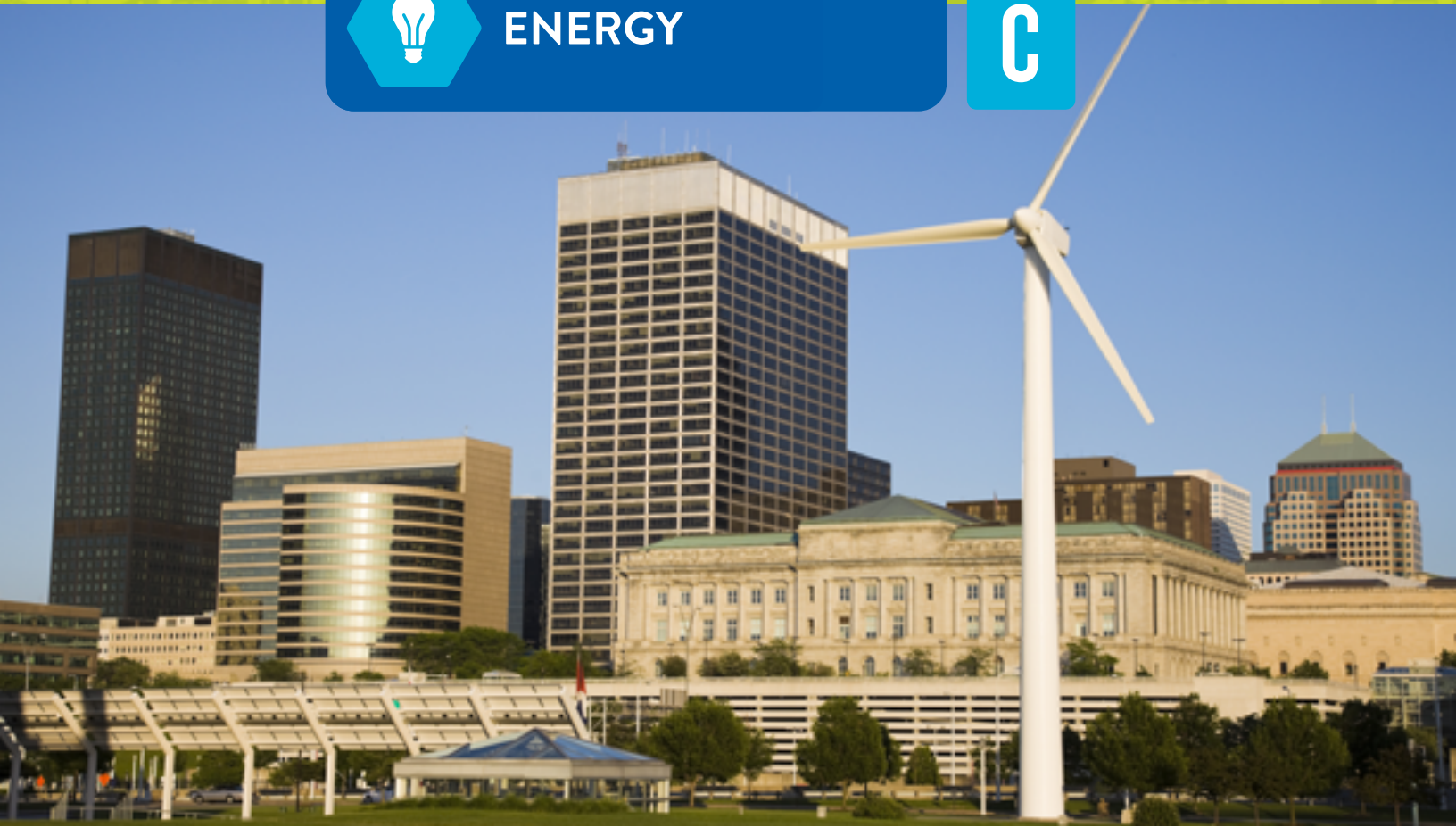
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ENERGY



ENERGY

GRADE: C

EXECUTIVE SUMMARY

Ohio's electricity consumption continues to increase faster than its modest population growth rate. This increase in usage can be attributed to more energy intensive industries and changes in service demand. At the same time, more energy efficient products are coming online. To date, the increase has been offset by improvements in electrical transmission and generation processes along with emerging technologies and a renewable portfolio standard that requires 8.5% of electricity sold in the state to be generated from renewable energy sources by 2026. Some Ohio utilities are conducting rehabilitation, replacement and/or upgrade efforts, as much of the state's existing infrastructure is approaching the end of its expected life cycle. To fund these projects, the systemwide average electricity rate is .1264 cents per kilowatt hour which is below the national average of .1319 cents per kilowatt hour. Therefore, to ensure the reliable electrical infrastructure that is expected by the state's residential, business and industrial customers, sufficient – yet affordable – rates and a favorable permitting environment are needed for the sector.

Ohio's electric distribution utilities are members of the regional transmission organization PJM Interconnection which coordinates wholesale electricity markets and manages the high-voltage electricity grid for 65 plus million people. As a result, Ohio receives electricity from a broad geographic area that is generated using both nonrenewable and renewable resources including:

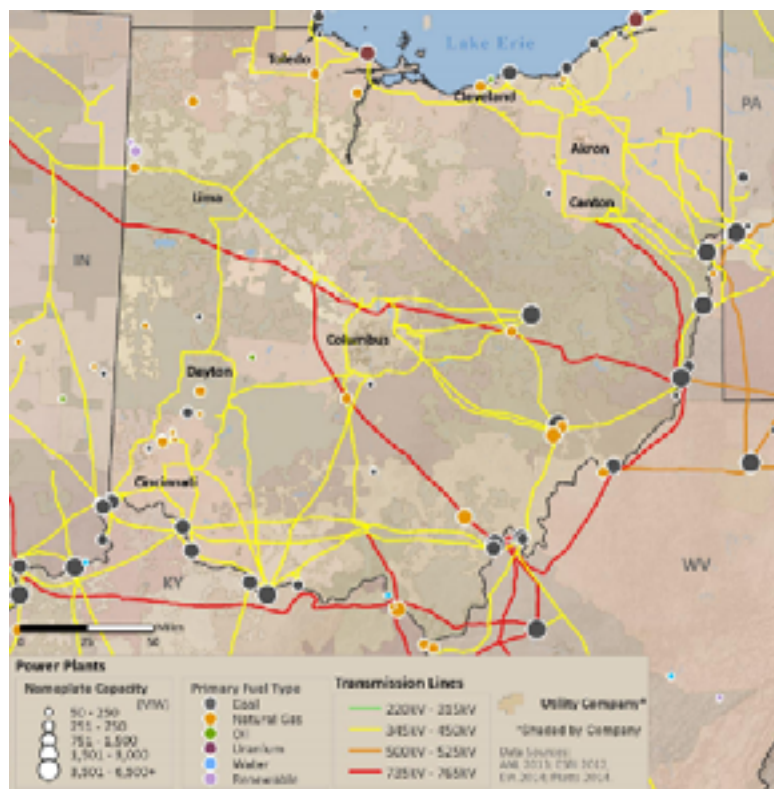
- Natural Gas – 36%
- Nuclear Power – 34%
- Coal – 24%
- Renewables – 5%

In 2019, for the first time, natural gas was used to generate more of Ohio's in-state electricity than coal. Ohio ranks among the top 10 states generating the most electricity and is among the top five states in total electricity demand.

CAPACITY

In Ohio, there is no single, publicly available source of information about the capacity of the state's energy infrastructure. For perspective, one of Ohio's major energy providers, Dayton Power and Light (DP&L), serves about 11% of the state's population in 24 of its 88 counties. DP&L's energy infrastructure capacity includes 1,690 miles of transmission lines and 17,908 miles of distribution lines. On a statewide scale, estimates show that Ohio has fewer than 8,000 miles of transmission lines and fewer than 200,000 miles of distribution lines.

FIGURE 1: OHIO MAP OF ELECTRIC POWER PLANTS AND TRANSMISSION LINES.



Source: U.S. Department of Energy



Over the last five years, the North American Electric Reliability Corporation (NERC) has become more involved in assessing the capacity of utilities. Ohio scored well against rigorous NERC capacity standards. Though Ohio's population has grown slowly in recent years, customers continue to conserve electricity by installing LED lighting and other efficiency projects. This contributes, in part, to the fact that most parts of the state have adequate capacity and little expectation for significant increases in demand.

The energy sector faces a challenge with the transmission system not being designed for the integration and extensive growth of renewables or distributed energy generation. For instance, consider Franklin County, where the rise in photovoltaic capacity has increased dramatically with a 65% average annual growth rate since 2010. Depending on where future generation capacity is installed, some transmission lines may be inadequate or absent. Furthermore, local distribution systems are not necessarily ready for potential rapid growth of electric vehicle purchases, fleet electrification and high capacity DC fast chargers.

CONDITION AND OPERATIONS & MAINTENANCE

Numerous portions of the transmission and distribution system are more than 50 years of age. However, adequate maintenance and upgrades have kept transmission towers and distribution lines in an acceptable physical condition.

The condition of a transmission or distribution line is affected by routine operation and maintenance efforts including vegetation management practices. There are NERC standards that define and support tree trimming practices along right of way corridors. Fines or settlements with payments as high as \$1 million have been made by Ohio-based utilities related to transmission line outages. Thunderstorms, windstorms and ice storms are the most common weather-related events that results in downed trees and cause localized or broad-scale electricity outages. In Ohio, from 2007 to 2014, the total annual duration of electricity outages has decreased from more than 42,000 minutes to less than 2,500 minutes. However, the total number of residents affected over that timeframe has fluctuated from more than 800,000 people in 2007 to nearly 1.5 million people in 2012, back down to little more than 530,000 people in 2014.

Proactive inspection, rehabilitation and replacement of wooden utility poles and transformers occurs throughout the system. The average service life of wooden poles is debated, but the estimated lifespan is between 30 and 50 years. One of the state's major energy providers, Ohio Edison, reported their 561,000 wooden utility poles are inspected on a routine 10-year cycle. Another utility, American Electric Power Ohio, lists dozens of projects statewide for replacing outdated transmission and distribution lines, constructing and/or expanding new systems and implementing upgrades to improve reliability.



NERC sets standards for relays, trees, system ratings, substation inspections and more. NERC auditing provides incentives for routine operations and maintenance. Thanks to advancing technologies and more real time data, asset management teams are making more informed decisions. However, there remain financial pressures that cause some utilities to reluctantly spend what is necessary for operations and maintenance.

FUNDING AND FUTURE NEED

Ohio's energy sector is funded through myriad financial resources including state and federal grants and other funding mechanisms as well as fees from local ratepayers. Transmission system funding is reported to be fully regulated by the Federal Energy Regulatory Commission with an attractive return on investment of +10%. However, not-in-my-backyard groups often resist new lines or corridors and therefore hinder projects that otherwise could be funded.

Aging infrastructure and government regulations continue to be major drivers of large expenditures for both the power plants and in the distribution system. While the national average electricity rate in the United States is .1319 cents per kilowatt hour, the average retail price of electricity in Ohio is below the national average at .1264 cents per kilowatt hour. Additionally, permitting and siting issues continue to be challenges for many planned high-voltage transmission lines. Funding of distribution system upgrades are often subject to the vision of the Public Utilities Commission of Ohio Chairman and/or advocates of residential cost control. Therefore, most utilities are poorly incentivized to invest heavily in distribution system upgrades and enhancements. However, some utilities have strong earnings performances, which allow them to continue to focus on system investments to enhance service to customers.

Moving forward, Ohio energy systems will need to evolve to serve the growing portion of renewable and intermittent generators. These new, decentralized sources include wind, solar, natural gas combined cycle and biogas electricity generators. Ohio law requires that by 2026 8.5% of electricity sold in the state must be generated from renewable energy sources. In 2018, electric distribution utilities were responsible for approximately 22 % of the overall compliance obligation while competitive retail electric service providers supported the remaining 78%.

To accommodate renewables and/or intermittent generators, a strong transmission backbone is required, especially those systems in the 100- to 1,000-megawatt generation capacity range. An additional trend for Ohio is its popularity for location of large data centers. These developments, particularly those integrating renewable energy generation, must either choose locations with available transmission capacity or work with utilities to extend transmission lines and associated substations.

PUBLIC SAFETY

Safety is an extremely high priority for workers and the public. Electricity has the potential to cause electrocution or ignite fires, but instances of these occurrences are very low in Ohio. Safety first cultures and mindsets are being developed with an emphasis on learning from events. Leading indicators are used to be even more proactive in preventing harm.

RESILIENCE

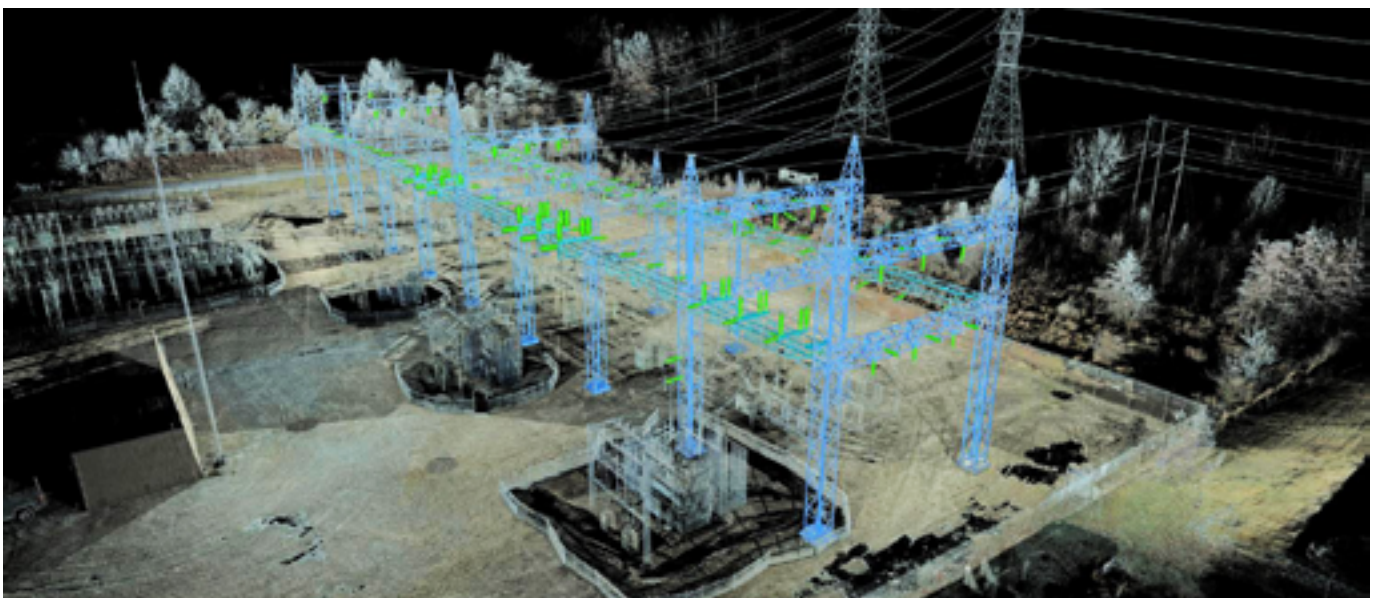
Ohio utilities have demonstrated their ability to respond to natural disasters. Utility systems across the state have working agreements to share line workers and equipment, expediting repairs after storms like tornadoes and ice storms. Similarly, agreements are in place with utilities in numerous other states to send repair workers to Ohio as needed. These measures to help Ohio's energy system resume normal operations do not only improve the sector's resilience, but also protect public safety, ensuring the power to critical sectors such as hospitals, schools, residences and other areas are restored quickly.

INNOVATIONS

Ohio utilities are beginning to make major investments and enhancements in their transmission and distribution systems using smart grid innovations. The state's previous dependence on meter readers is giving way to automated smart grid telemetry that can locate outages in an automated way, increase safety for utility personnel during and after storms and remove the responsibility for ratepayers to report outages.

As an example, DP&L opened what it called its "Smart Operations Center" in September 2020 at its MacGregor Park headquarters campus, celebrating a facility it says is the first of its kind in the nation. The \$20 million facility will use data analytics and modeling to increase the efficiency of electric operations. Bernerd Da Santos, AES executive vice president and chief operating officer, said in a release. "The new AES Smart Center will tap into the power of data and digital platforms, allowing us to monitor, remotely operate and improve the management of our power generation operations, including solar, wind, hydro, thermal and energy storage facilities."

Some Ohio utilities are innovating around dynamic line ratings instrumentation. This provides quicker and more accurate assessments of remaining capacity in transmission lines throughout a utility system. Innovations are also coming from the use of drones. Line inspections used to be very time consuming and include an element of safety risk. In recent years, drones have been employed to do rapid and closeup inspections of transmission line equipment. This has yielded major productivity benefits, along with better and safer inspections.





ENERGY



RECOMMENDATIONS TO RAISE THE GRADE

- **The Public Utility Commission of Ohio (PUCO) should encourage more reliable electrical infrastructure to withstand storms and enable rapid restoration after outage events. Standards for availability (low outages) should be as high as any other U.S. state.**
- **The Public Utility Commission of Ohio should authorize sufficient, yet affordable, rates to accomplish the tasks. PUCO should even consider performance-based regulations towards system adequacy.**
- **The permitting process for siting new utilities needs to be improved to allow expeditious construction of critical, systemwide improvements. This needs to focus on economical, efficient and safe routing.**
- **Ohio utilities must understand the cybersecurity threats to the state's electrical grid and invest in a manner that ensures a cyberattack would be unsuccessful or quickly repaired.**

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ENERGY



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HAZARDOUS WASTE



HAZARDOUS WASTE

GRADE: D+

EXECUTIVE SUMMARY

With 38 sites listed in the National Priorities List (NPL), Ohio is ranked 11th in total number of sites listed. It is ranked 4th in total number of generators (1,255 entities) of hazardous waste under the Resource Conservation and Recovery Act program. Ohio has more than 9,000 vacant and contaminated brownfield properties that have the potential to bring in millions of dollars in additional tax revenue, create jobs, and steward the environment by seizing the opportunity to redevelop them. Capital projects funding is essentially lacking in Ohio's EPA budget with approximately \$194,000 in FY 2017, \$364,000 in FY 2018, and \$0 in FY 2019. Inadequate funding of the nation's Superfund program and lack of capital funding in Ohio's EPA budget is slowing remedial action project completion and negatively impacting addition of sites to the NPL.

CONDITION AND CAPACITY

There are 50 total sites listed on the “Superfund Exposure Dashboard” for Ohio. Ohio has 38 sites listed on the NPL, giving it a rank of 11th in the total number of sites listed. Of the 38 sites listed, 35 are non-federal and three are federal sites. The total acreage occupied by superfund sites is estimated to be 11,000. The three federal sites account for approximately 75% of superfund sites in Ohio. The creation of lists of sites under the superfund program started in the 1980s. Since then, Ohio added 24 sites in the 1980s, added two in the 1990s, added seven from 2000 to 2010, and added five from 2011 to 2020.

In addition, Ohio:

- Ranks 4th in the total number of generators of hazardous waste with 1,255 generators of hazardous waste under the RCRA program
- Has 4.9% of the national total of generators
- Generates 4.6% of the national total tonnage of hazardous waste
- Accounts for 4.4% of the number of facilities that manage hazardous waste in the U.S.

Table 1 shows pertinent data regarding hazardous waste management in Ohio as of April 2020

TABLE 1: PERTINENT DATA FOR OHIO REGARDING HAZARDOUS WASTE MANAGEMENT

Number of Generators	1255
Generated Tons	1,594,454
Number of Managers	51
Managed Tons	1,628,103
Number of Shippers	1249
Shipped Tons	576,562
Number of Receivers	24
Received Tons	665,738

Table 2 shows the total number of generators and total tonnage generated from 2001 to 2017 in Ohio.

TABLE 2: GENERATORS AND TOTAL TONNAGE IN OHIO, 2001 – 2017

Location Name	2001	2003	2005	2007	2009	2011	2013	2015	2017
Ohio- # of Sites	1071	1040	1040	980	896	941	1221	1330	1255
Tot. Generation (Tons)	1,889,067	1,800,170	2,198,821	1,612,560	1,300,804	1,627,192	1,531,251	1,711,5217	1,594,454

Ohio has 9,000+ vacant and contaminated brownfield properties. The Clean Ohio brownfields program has been defunded in recent years and, as a result, has lost its effectiveness. But, this program is about to take a turn for the better; a bill that gives prospective buyers of contaminated property legal immunity was signed into law on June 16, 2020. This bill went into effect on September 14, 2020. With the bill enacted, Ohio has the potential to bring in millions of dollars in additional tax revenue, provide jobs, create new housing options and steward the environment if the opportunity is seized to redevelop the state's 9000+ vacant and contaminated brownfield properties.

The Hazard Ranking System with a range from 0 to 100 is used to determine eligibility of a site placement on the NPL. A site scoring 28.5 or greater is eligible. Ohio has:

- 15 sites scoring 30 to 39
- 7 scoring 40 to 49
- 14 scoring 50 to 59
- 1 scoring 60 to 69

Since the beginning of the superfund program, eight sites in Ohio have been deleted from the NPL and are in active use. In FY 2018, Ohio added one new site and partially deleted one. There are four sites listed as Superfund Alternative Approach (SAA) of which three are classified as Non-NPL SAA and one proposed SAA. An SAA uses the same investigation and clean-up process and standards that are used for sites listed on the NPL. There is a willing, capable Potentially Responsible Party (PRP) who will negotiate and sign an agreement with EPA to perform the investigation or do the cleanup.

There are 13 sites in Ohio that are listed or were once listed as superfund sites that are being reused, benefiting the communities and readying them for business. Eight of these have published economic data. Sites with published data account for approximately 72 individual businesses, 3,634 employees, and \$1.3 billion in annual sales revenue generated.

Table 3 shows the management methods, number of managed sites and the managed tons at hazardous waste managed facilities in Ohio.

**TABLE 3: MANAGEMENT METHODS, NUMBER OF MANAGED FACILITIES,
AND TONS MANAGED AT HAZARDOUS WASTE FACILITIES**

MANAGEMENT METHOD	# OF MNGRS	MANAGED (TONS)
* Total *	51	1,628,103
Deepwell / Underground Injection	3	1,086,032
Energy Recovery	3	92,215
Fuel Blending	8	122,326
Incineration	4	155,203
Landfill	1	39,052
Metals Recovery	5	7,560
Other Treatment	2	47
Sludge Trtmnt / Stab / Encap	2	49,539
Solvents Recovery	16	21,550
Wastewater Treatment	21	54,580

Deep well/underground injection accounts for 67% of hazardous waste managed. Recovery methods such as energy, metals and solvent recovery account for only 7.5% of management methods. Underground injection can pose a serious threat to groundwater contamination.

The Voluntary Action Program (VAP) is the Ohio EPA's cleanup program for brownfields. The number of completed cleanups in the last two years has declined drastically. In 2018, there were 18 completed VAP cleanups. In 2019 there were nine completed VAP cleanups with several pending. At the height of the Clean Ohio program, Ohio was averaging 35 completions per year.

FUNDING AND FUTURE NEED

Ohio EPA funding generally falls into five categories:

- General revenue
- Dedicated purpose (DP)
- Internal service activity
- Capital projects
- Federal

DP funding is the largest of the five categories and typically accounts for 65% to 70% of Ohio EPA's funding. It's comprised mainly of fees for permits, inspections and licenses. Funding for remediation and restoration projects typically comes from the DP. Federal funding is Ohio EPA's second largest source of income accounting for between 15% to 20% of its revenue.



The DERR is expected to allocate approximately 12.2% of Ohio EPA's funding, translating to \$26 million for FY 2020 and \$27 million for FY 2021. Approximately 57% of this budget is expected to be used for personnel services (wages, salaries, fringe benefits and more), 24% for subsidies and 12% for supplies and maintenance. The division currently has 211 employees. Capital projects funding is essentially lacking in the Ohio EPA's budget with approximately \$194,000 for FY 2017, \$364,000 in FY 2018, and \$0 in 2019. The lack of capital funding is negatively impacting the number of sites that could be added to the NPL.

EPA spending on the superfund program for the entire nation has generally declined from about \$2.2 billion from 1993 to about \$1.1 billion from 1999 to 2013. It has since then remained flat from 2013 to 2019. In general, Ohio EPA spending has also declined proportionately over this same period.

Because of inadequate funding resources, the U.S. EPA has had to prioritize its spending with the largest amount going to Region 2 that accounts for approximately 33% and New Jersey receiving over 25% of the cleanup funds. The number of Ohio sites in the NPL has remained relatively constant over the past five years while the number of remedial action project completions and construction completions generally declined due to inadequate funding and underestimation of the time it takes to remediate a site.

The funding requirement for the nation's EPA superfund program should trend upward towards \$2.2 billion – its funding level in 1993. The current \$1 billion is inadequate as can be seen from the pace in remediation and construction of projects. Even though Ohio has made efforts to invest more in its hazardous waste infrastructure, these efforts do not come close to what is needed. Ohio has simply failed to increase investment for too long and is struggling to catch up. A significant increase in funding to the DERR is needed to improve the hazardous waste environment.

The legal immunity bill recently passed could create opportunities in the future to increase the number of buyers of contaminated properties, and this could result in brownfield cleanup investment.

A Clean Ohio Revitalization fund with at least \$25 million annually should be instituted for brownfield cleanup and revitalization.

OPERATIONS AND MAINTENANCE

Listing a non-federal site on the NPL triggers the EPA to determine whether a PRP bears some or all the costs for remedial investigation and feasibility studies, remedial design, construction and operations and follow-on maintenance costs. The Ohio EPA bears the initial cost of identifying PRPs. The site response cost is determined on a site-by-site basis and depends on success in identifying PRPs as well as the actions EPA and the state decide to take based on limited funding resources available.

Operating costs of groundwater treatment systems represents a significant and growing portion of the cost to treat superfund sites in Ohio. The impact of groundwater treatment costs is being felt by the Ohio EPA and PRP lead sites because long-term operations and maintenance costs like this are usually under-estimated when budgets are prepared. Most sites that were anticipated to have dropped off by now are still under the superfund program.

There has been a serious lack of funding for brownfield redevelopment. The primary source of funding is the Jobs Ohio Revitalization Fund which comes in the form of a grant. The program can provide up to \$200,000 in grant money to fund Phase II environmental assessment work for redevelopment. However, due to the criteria geared toward job creation placed on this grant, it has not been serving its purpose as a Phase II assessment fund. Phase II assessment funds – whether under the old Clean Ohio Fund or the Jobs Ohio Revitalization Fund – have been critical to brownfield redevelopment in Ohio.

PUBLIC SAFETY

The Division of Emergency Response, Investigations and Enforcement responds to emergency incidents, and investigates conduct that may criminally violate state or federal environmental laws and regulation. This division was grossly understaffed with only 10 fulltime employees in 2016, a number that increased to 32 in 2019, and is projected to reduce to 28 for FY 2020 – FY 2021. The Division of Emergency Response, Investigations and Enforcement's funding is approximately \$4 million which is inadequate to monitor and investigate environmental activities in the state to assure public safety.

RESILIENCE

Ohio is far enough from the coasts and active faults to avoid most of the risks associated with hurricane damage or earthquakes. It is still within an active tornado zone. Ohio is among the top 10 states with the greatest number of tornados with 43 confirmed cases in 2017. Ohio has also been experiencing extreme flooding conditions over the last decade. For example, a one-time hurricane named Sandy caused \$17 million in damage in Cuyahoga County. Flooding is posing increased risks at superfund, RCRA and brownfield sites. This increase in risk is not being adequately studied by the Ohio EPA as climate change is no longer a major strategic objective within the U.S. EPA. Not understanding the increased risk due to extreme weather conditions nor implementing more resilient hazardous waste infrastructure could result in substantial damage to Ohio's economy as well as environmental and human health over the coming decades.

INNOVATIONS

Remedial cleanup methodologies currently used in many superfund, RCRA and brownfield sites are causing economic burden to the Ohio EPA, PRPs and the public. Hazardous wastes consist of a variety of substances and for many of these appropriate remedial and disposal technologies have not been developed. Innovation should focus mainly on hazardous waste reduction processes and recovery and reuse of the waste as resource materials. Deep well/underground injection which accounts for 67% of hazardous waste management in Ohio is simply unacceptable.

Funding for research provided to the Ohio EPA is inadequate. Resources provided to this sector could ignite the development of new, state- and or site-specific technologies that may address recovery and reuse of hazardous wastes among other novel outcomes.



RECOMMENDATIONS TO RAISE THE GRADE

- The IRS should also include brownfields located in Qualified Opportunity Zones within the scope of Qualified Opportunity Funds to provide incentive to invest funds in the assessment, remediation and reuse of brownfields.
- The funding made available for the nation's superfund program should be increased from \$1 billion to approach the 1993 level of \$2 billion. This would accelerate remedial action project completion and construction completions to make room for additional NPL sites as well as the starting of new construction projects.
- The use of deep well/underground injection should be reduced – its currently accounting for 67% of the management method – by at least 3% each year, replacing it with future innovative technologies for reduction, recovery and reuse of hazardous waste materials.
- The number of vacant and contaminated brownfield properties in Ohio should be reduced by about 25% in the next five years by taking advantage of the recently passed legislative bill for purchasing contaminated properties.
- The USEPA should provide adequate funding and direction to the Ohio EPA for integrating information on the potential impacts of climate change effects into risk assessments and response decisions.
- Innovation should be encouraged. This can be done through the implementation of legislation that enables and encourages research and development programs aimed at developing technologies for generating them and by providing economic incentives for waste reduction and reuse of recovery and reuse of hazardous waste. Development of these technologies should be promoted within the industry.



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INLAND WATERWAYS



INLAND WATERWAYS

GRADE: D+

EXECUTIVE SUMMARY

The Ohio River is a fully “impounded” river with a series of 19 navigation dams. It carries more commercial tonnage than any other impounded river in the world and links commercial navigation from the eastern third of the country to the Mississippi River basin and Gulf Coast.

Ohio’s inland waterway system is comprised of the 451 miles of the Ohio River and nine navigation locks and dams. Commodities passing through these locks and dams in 2018 were valued at \$5.66 billion. Ohio’s locks and dams are essential structures of inland waterways and stakeholders expect reliable availability. Operation, repair and rehabilitation must be accomplished through well-managed programs, otherwise, major disruptions in commercial navigation could result. There is an estimated need of approximately \$120 million to address critical maintenance over the next 15 years. However, a “fix as fail” approach to repairs accompanied by unreliable funding streams are likely to increase the frequency of failures and outage times in the future, which would result in economic losses to Ohio and the nation.

CONDITION AND CAPACITY

The Ohio River basin (Figure 1) is 204,430 square miles, drains portions of 15 states and contains over 2,800 miles of navigable waterways. The Ohio River's 981 miles of waterway flow from Pittsburgh, Pennsylvania to the confluence with the Mississippi River near Cairo, Illinois. One of the most remarkable aspects of the Ohio River is that it provides 365 days per year operation and is never closed for seasonal outages. Locks and dams are operated and maintained by the U.S. Army Corps of Engineers (USACE).

Ohio's inland waterway system is comprised of the 451 miles of the Ohio River forming the state's southern border and nine navigation locks and dams as shown in Figure 2. Dams form a series of "steps", called pools, to provide a minimum navigation water depth of 9 feet as shown in Figure 3. Locks serve as a "water elevator" allowing vessels to "step" up or down one pool to another.

FIGURE 1. OHIO RIVER BASIN



FIGURE 2. STATE OF OHIO NAVIGATION LOCKS AND DAMS





FIGURE 3. OHIO RIVER MAINSTEM NAVIGATION SYSTEM



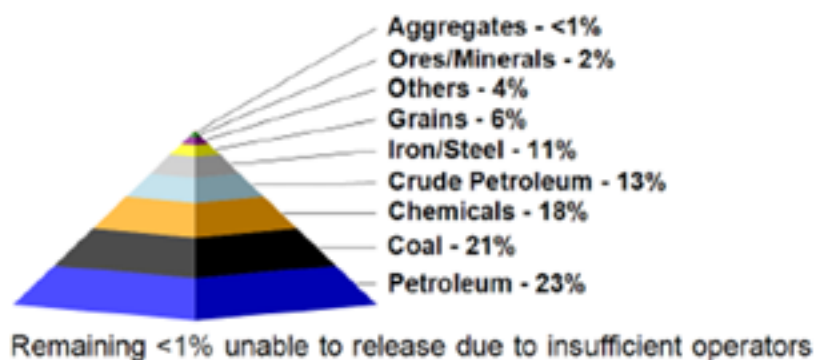
Ohio's navigation locks and dams consist of two lock chambers – a main 1,200-foot long by 110-foot wide chamber and an auxiliary 600-foot long and 110-foot wide chamber as well as a gated dam. Some locks include a non-federal hydroelectric power plant. The typical configuration of an Ohio River locks and dam is shown in Figure 4.

FIGURE 4. TYPICAL CONFIGURATION OF OHIO RIVER NAVIGATION LOCKS AND DAMS



Annual cargo capacities of main and auxiliary lock chambers are approximately 100 million tons and 50 million tons, respectively. More than 41 million tons of commodities passed through Ohio's navigation locks and dams in 2018. In comparison, commodities shipped in Ohio via air were 842,000 tons, rail more than 389 million tons and truck more than 936 million tons (2019 values). Commodities passing through Ohio's navigation locks and dams in 2018 were valued at \$5.66 billion and the value distribution is shown in Figure 5. Top ports were Cincinnati-Northern Kentucky at more than 38 million tons and Huntington Tristate at upwards of 34 million tons.

FIGURE 5. TRAFFIC COMMODITY VALUE DISTRIBUTION

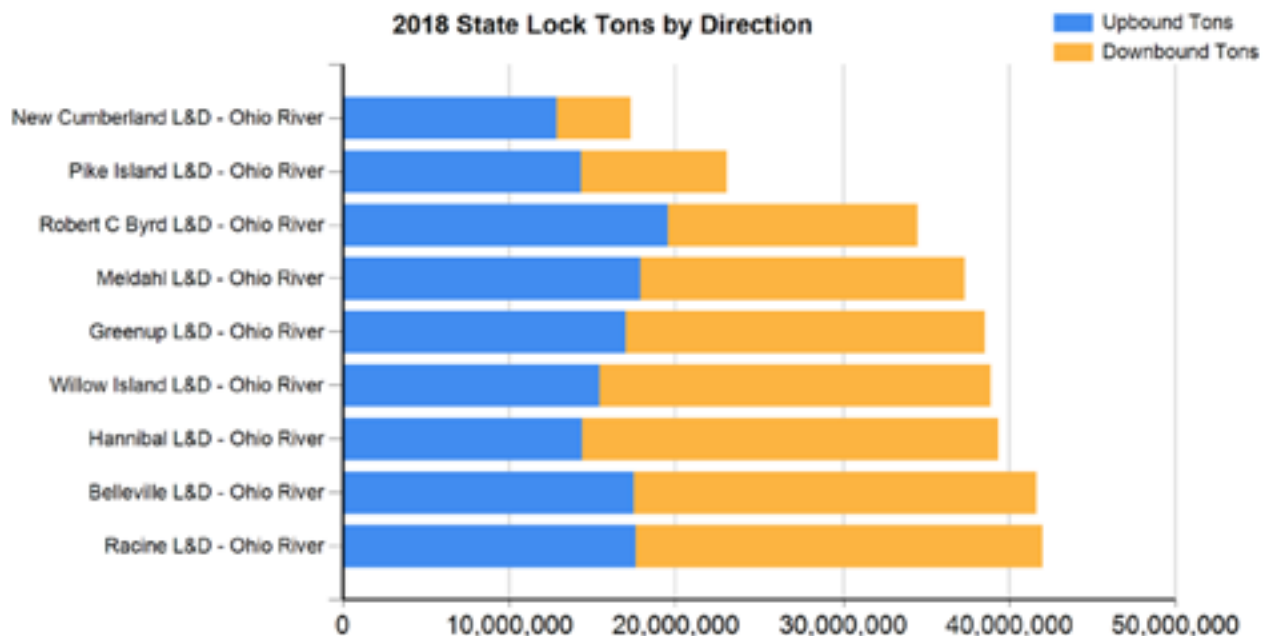




For state locks on the Ohio River, about 14% of the total tons shipped or received either originated or terminated at Harbor Maintenance Fee (HMF) locations. Of the HMF locations, about 90% of that traffic are at ports on the Lower Mississippi River.

The 2018 values for cargo tonnage passing through Ohio's locks and dams is shown in Figure 6.

FIGURE 6. CARGO TONS PER DIRECTION

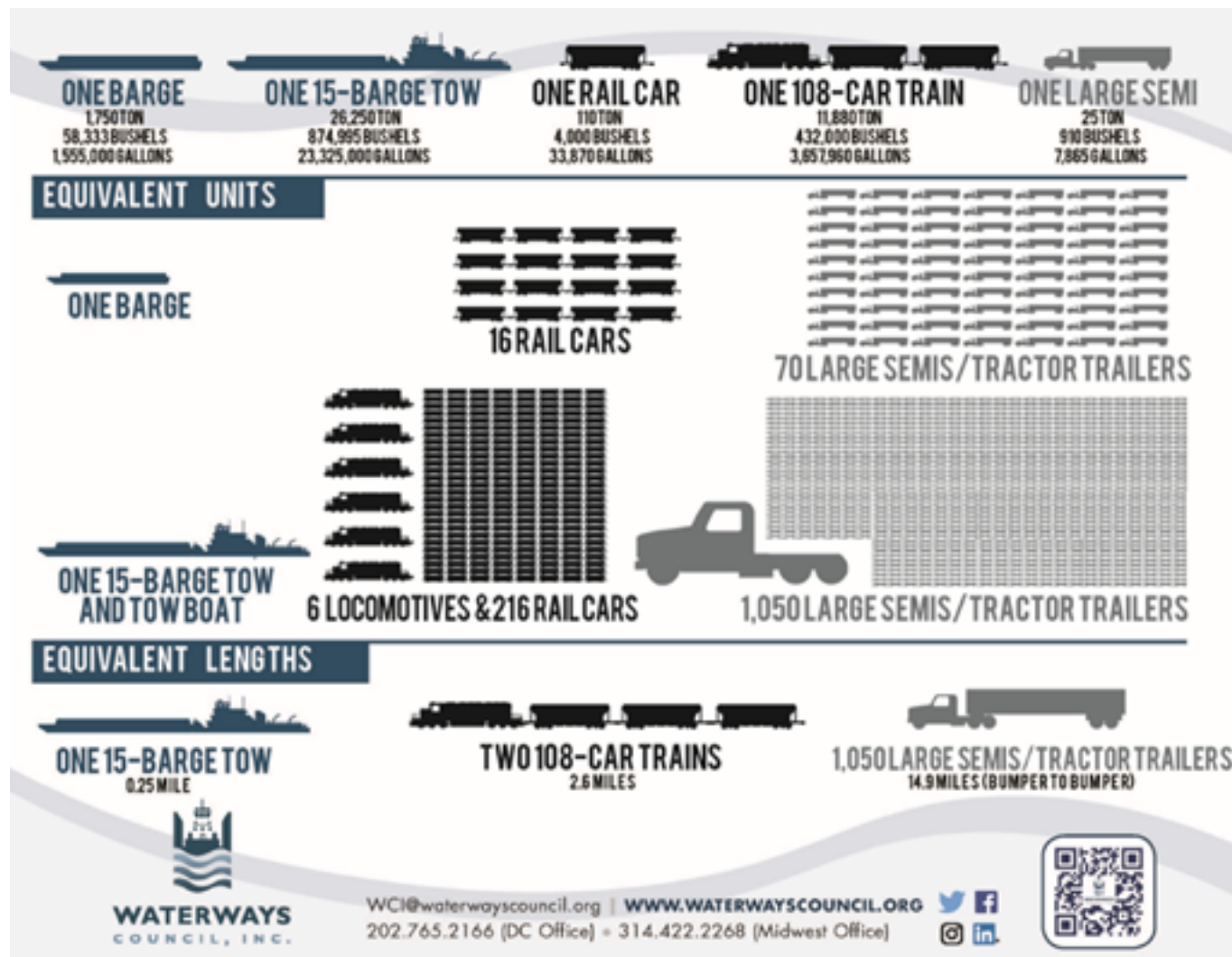


Shipping on the inland waterways provides an average transportation savings of \$10.67 per ton over the cost of shipping by alternative modes. On average, a gallon of fuel allows one ton of cargo to be shipped 59 miles by truck, 202 miles by rail and 514 miles by barge.

Bulk materials are transported on the inland waterways in barges. The term tow is used to describe several barges lashed together being pushed from behind by a towboat. The dimensions of a common Ohio River bulk material barge are 195 feet long and 35 feet wide. The typical Ohio River tow is comprised of 15 barges lashed together – three barges wide and five barges long – and pushed from behind by a towboat approximately 150 feet in length. This typical tow is 105 feet wide and 1125 feet in length. Figure 7 shows the cargo capacity comparisons of rail, truck and barge. Note that 1,050 large semis or tractor trailers or six locomotives and 216 rail cars would be required to haul the same amount of cargo of one 15-barge tow.



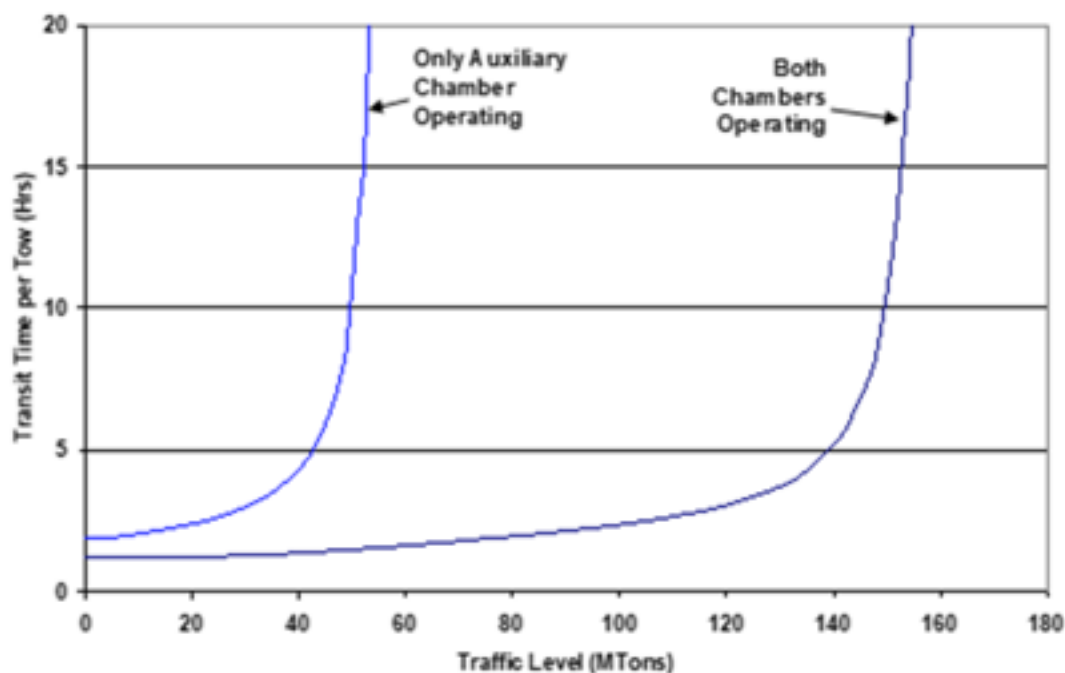
FIGURE 7 CARGO COMPARISON FOR RAIL, TRUCK, AND BARGE



When the 1,200-foot long main chamber is closed for maintenance all traffic must pass through the 600-foot long auxiliary chamber. This requires a 15-barge tow to separate into two units and each unit locked through separately, more than doubling the transit time through the lock.

As a lock chamber approaches its capacity, delays can increase exponentially. Figure 8 shows the relationship between average transit time per tow and tonnage processed for Ohio River dual chamber locks. Note that capacity is significantly decreased if the main chamber is closed.

FIGURE 8. TRANSIT TIME VERSUS TRAFFIC LEVEL



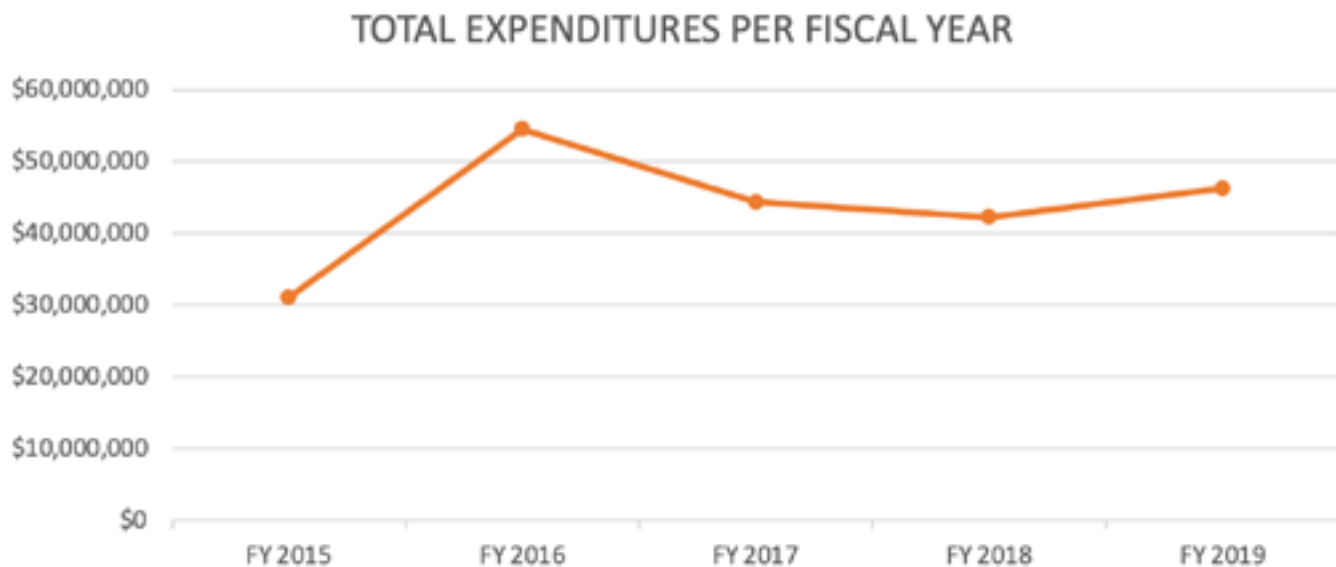
Lock gates are one of the largest and most expensive components to replace. Since repair or replacement of these gates can require extended closures of lock chambers, they can also result in the greatest delay and financial impact to the towing industry. Most of the lock gates have exceeded their 50-year design life and have induced steel fatigue from cyclic loading.

All of Ohio's navigation locks and dams have two lock chambers – a main 1200-foot long by 110-foot wide chamber and an auxiliary 600-foot long and 110-foot wide chamber. The average age of Ohio's navigation locks and dams is 51 years – Greenup is the oldest at 61 years of age and Robert C. Byrd is the newest at 27 years of age. In Ohio, lock gates have been replaced at Greenup, Meldahl and New Cumberland locks and dams. Additional lock gates are being fabricated for New Cumberland.

O&M, FUNDING & FUTURE NEED

The Inland Waterways Trust Fund (IWTF) is a fund in the U.S. Treasury that receives revenues from a 29-cent-per-gallon ad valorem tax (also known as the inland waterway user fee) on commercial barge fuel on federally designated waterways. Pursuant to the Water Resources Development Act of 1986, IWTF monies are subject to appropriation and used to finance construction and major rehabilitation projects on these waterways. IWTF funds are used to match federal appropriations from the general fund of the U.S. Treasury.

FIGURE 9. TOTAL EXPENDITURES FOR OPERATIONS AND MAINTENANCE OF OHIO'S INLAND WATERWAYS, FY 2015 - 2019



Over time it becomes more difficult to maintain this aging infrastructure. It has become apparent in recent years that major systemic infrastructure issues relating to the navigation dams will require a significant future investment strategy to assure continued reliability of the navigation system. The sheer size of many of the key components found on locks and dams – lock gates, lock valves and dam gates – make major repairs or replacement of the parts a very labor intensive and expensive operation.

In 2014, the USACE Great Lakes and Ohio River Division initiated a Lock Gate Replacement Program. This program analyzed lock gates based on their design characteristics and current operational condition, and then projected the condition forward in time based on expected cycling frequency. The resulting projected conditions and dates were used to determine suggested future replacement dates.

Around 45% of vessels locking through any of the locks on the Ohio River that border the state of Ohio would experience some amount of delay, a slightly lower percentage than the national average of 49%. This could vary significantly when looking at each lock individually and considering if there are any other factors affecting operations (maintenance, mechanical issues, traffic volume or weather) that could cause delays to potentially increase or decrease.

As the infrastructure continues to age, outages in lock service due to unscheduled mechanical breakdowns is expected to rise. Figure 10 shows the number of unscheduled lock unavailabilities and the associated hours due to mechanical breakdowns of greater than 24 hours and one week. Figure 11 shows the average delays of tows transiting the locks.



FIGURE 10. UNSCHEDULED LOCK UNAVAILABILITIES OF
OHIO'S NAVIGATION LOCKS AND DAMS, FY 2015 - 2019

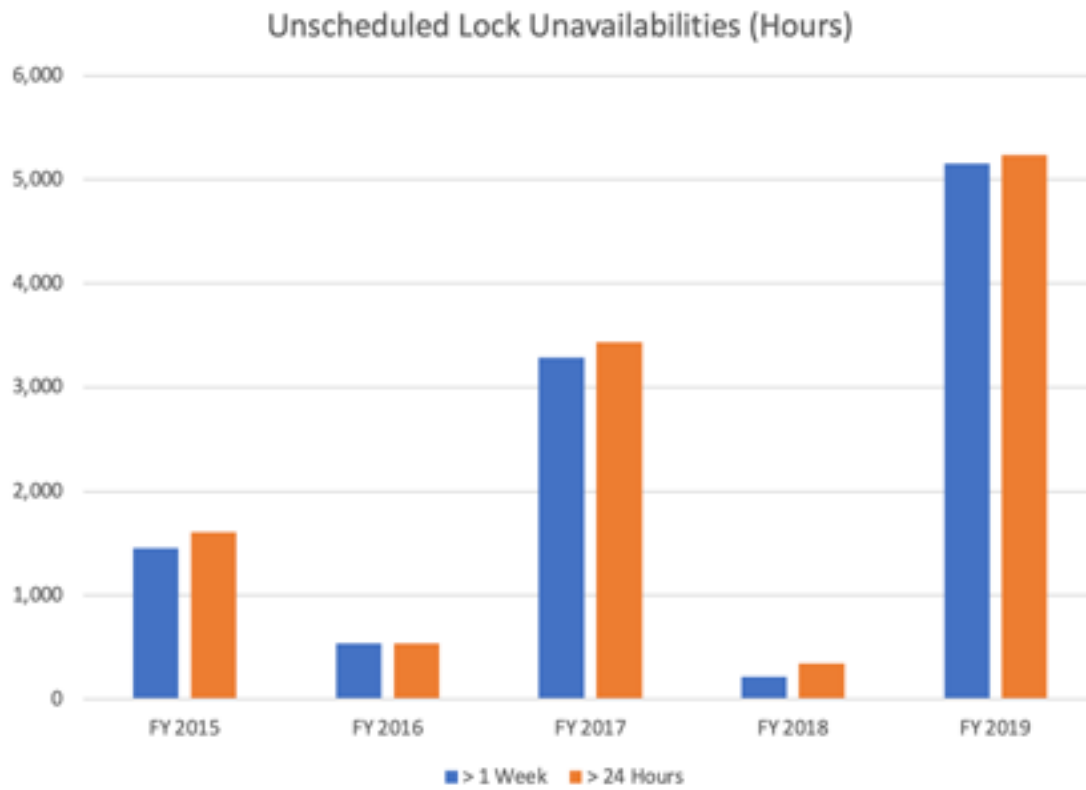
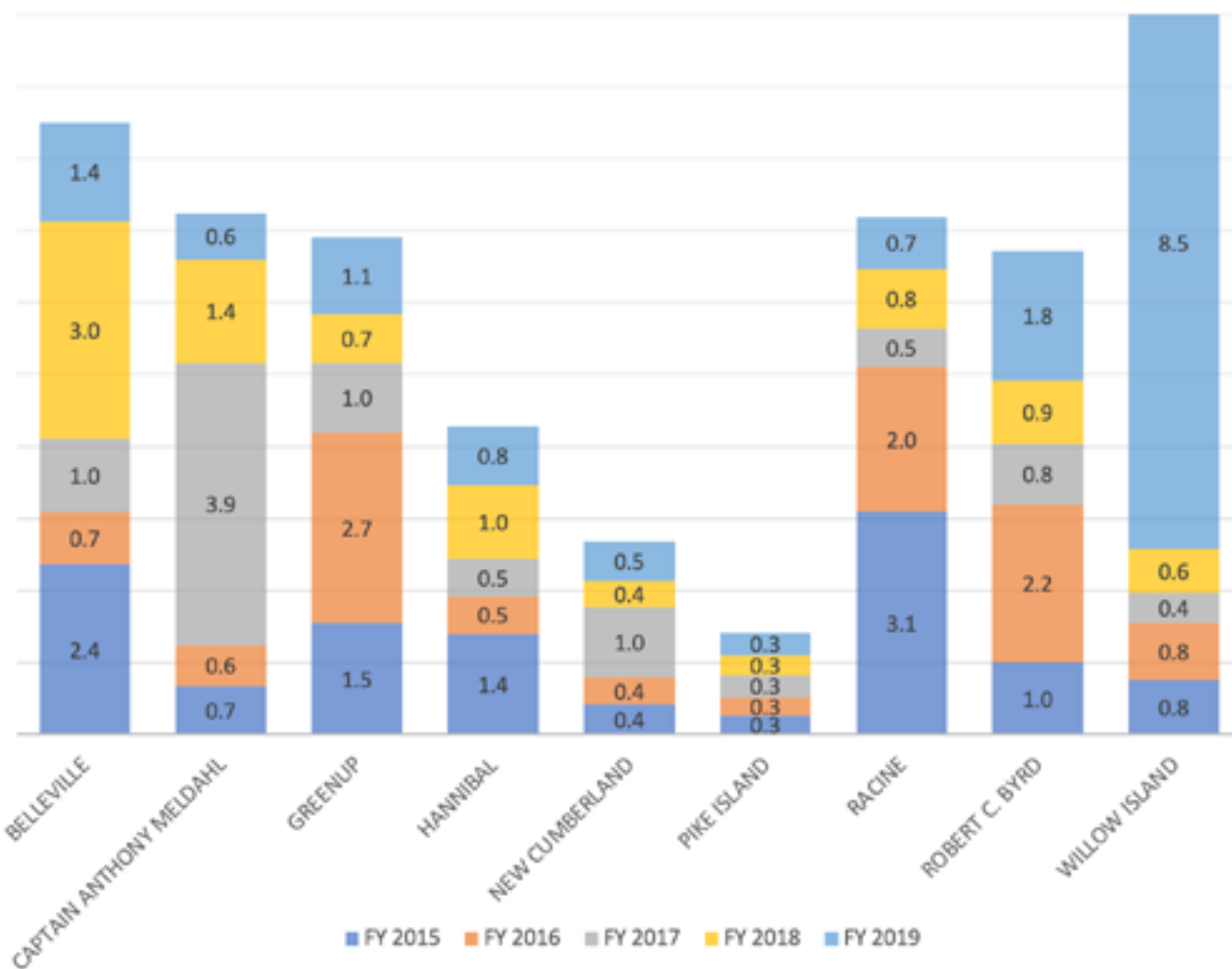


FIGURE 11. AVERAGE DELAYS OF TOWS (HOURS) OF OHIO'S NAVIGATION LOCKS AND DAMS, FY 2015 - 2019



Continuing the reliable operation of the navigation system must be managed through a pre-emptive manner since stakeholders expect 100% availability. Operation, repair and rehabilitation must be accomplished through well-managed programs, otherwise major disruptions in commercial navigation could result. Continued “fix as fail” repair strategies accompanied by unreliable funding streams will likely increase the frequency of failures and outage time in the future, which would result in increased economic losses to the nation.

The USACE Navigation Operations and Maintenance program is extremely complex with many different facets. The USACE has worked diligently to optimize its asset management program and this has enabled accurate prioritization of a large list of potential projects. This optimization and feedback from stakeholders in regards to asset management, condition assessments, budget development and addressing high priority maintenance work has led to a highly developed and defensible system of requirements in both the near- and long-term.



The backlog of critical maintenance for all 19 locks and dams on the Ohio River Mainstem Navigation System continues to grow. There is an estimated need of approximately \$120 million to address critical maintenance over the next 15 years. These estimates include items currently deteriorating, however, do not take into consideration unforeseen future breakdowns, accidents or inspections. An aggressive inspection program is one step toward addressing maintenance of this essential national infrastructure in a preemptive and protective manner. Finally, a sound, well planned and resourced investment strategy, will spell success and provide continued reliability of navigation locks and dams.

PUBLIC SAFETY

Specific threats may include natural disruptions like flooding (high water events) and droughts (low water events). High water events are more common and can cause locks to close because the water level interferes with the lock's operating machinery, or if high enough, totally submerge the lock chamber. To proactively plan for both events, the Maritime Industry, U.S. Coast Guard, USACE and state and local governments have jointly developed plans – called a Waterways Action Plan – to facilitate safe and orderly movement of traffic during evolving conditions. Ohio's inland waterways are included in the Waterways Action Plan, Mississippi River and Ohio River and Tributaries.

The navigation of dams is very dangerous, especially to the recreational boating public. Public safety initiatives including “dam conscious” are used to educate the public on the location of each dam and lock on local waterways.

RESILIENCE

Many parts of the nation's transportation system, including Ohio's ports, are vulnerable to both natural and manmade disruptions. Because of these vulnerabilities, transportation firms and government agencies have become interested in providing a system that is resilient to disruptive impacts, including the ability to prepare, resist, recover and adapt to disruptions. A resilient inland waterways system possesses robustness because of its design and can withstand severe blows, respond appropriately to threats and mitigate the consequences of threats through response and recovery operations.

INNOVATIONS

The USACE has long served as a risk management organization, addressing uncertainty and managing risk by various methodologies at all levels of the organization. In addition, the USACE released *Technologies to Extend the Life of Existing Infrastructure*, a first-of-its-kind best practices compilation on life cycle maintenance management, innovative technologies and emerging capabilities that are happening at USACE locks and dams.



**INLAND
WATERWAYS**



RECOMMENDATIONS TO RAISE THE GRADE

- **Give USACE contract authority for projects to avoid the stop-and-start of construction currently happening due to the appropriations process**
- **Fund waterways projects at the authorized levels and do so consistently, passing a Water Resources Development Act on a two-year cycle**
- **Increase the amount spent on operations and maintenance of the inland waterways each year**
- **Focus funding on reducing unscheduled lock closures at locks and dams with the highest risk of failure**
- **Utilize alternative financing and delivery methods, such as public-private partnerships, when appropriate.**
- **Develop and implement a standardized measurement for delays on the system**



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LEVEES



LEVEES

GRADE: D

EXECUTIVE SUMMARY

Levee systems are vitally important to large portions of the state of Ohio due to the flood risk it faces from multiple threats, most significantly from the Ohio River Valley and Lake Erie. Ohio's network of levees reduces flood risk for more than 151,000 people and \$27.5 billion in property. However, much of the state's levees are nearly 50 years of age or more which is beyond their design life. The mechanical and electrical components of these systems are deteriorating, requiring replacements or an increase in costly maintenance. The large majority of levee systems in Ohio have not had risk assessments performed to classify their condition, and there are no consistent standards associated with the maintenance and ongoing inspection of levees in the state.



CONDITION AND CAPACITY

Flood risk comes from all sides in Ohio, as the state's northern border lies along the shores of Lake Erie, its southern border and most of its eastern border lies along the Ohio River and it is flanked by many tributaries that flow into the Ohio River.

Most levees in Ohio are earthen embankments designed and constructed to contain, control or divert the flow of water in a way that reduces the risk of flooding. Levee systems in urban areas usually include concrete floodwalls, removable road or rail closures, flood gates and flood pump stations that work together to reduce the risk of harm from potentially devastating flood waters.

The U.S. Army Corps of Engineers (USACE) estimates that more than 151,000 people are protected by Ohio's levee systems. These systems are protecting at least 45,000 structures and \$27.5 billion in property.

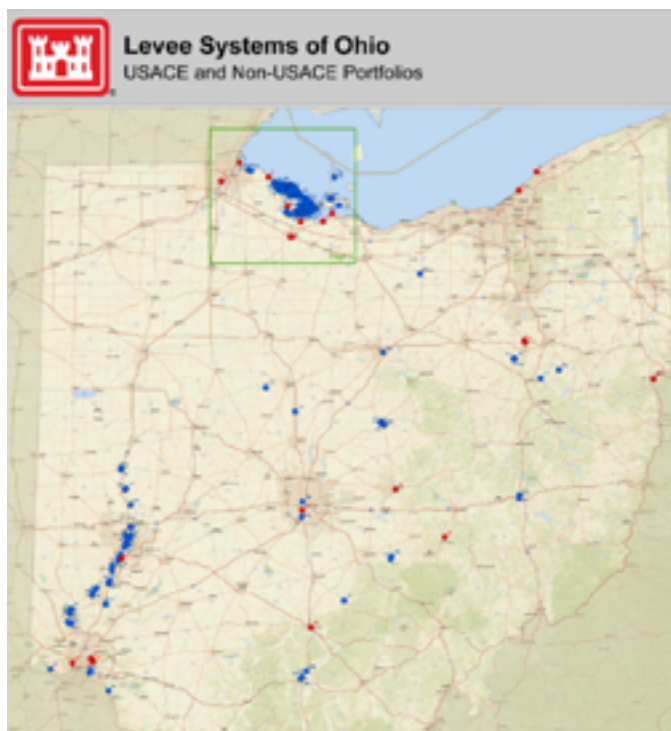
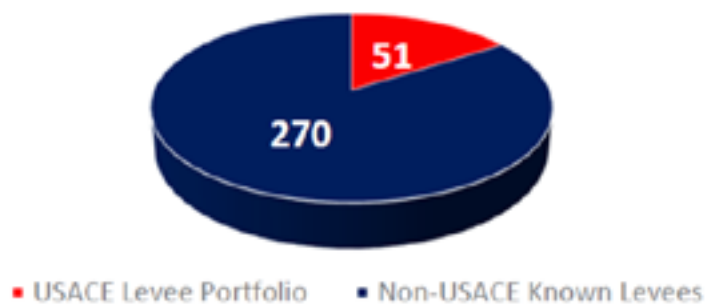


FIGURE 2

Number of Levees Miles in Ohio



Figures 1 and 2 above and Table 1 below show data aggregated from multiple sources including the USACE National Levee Database (NLD) and the Federal Emergency Management Agency's (FEMA) Mid-term Levee Inventory. These databases show that most levee systems in Ohio are not currently under the umbrella of the USACE Levee Safety Program. Therefore, much about their condition and risk characterization is unknown. At least 54% of those living behind a known levee in the state may be unaware their levee has not been screened to determine the relative flood risk to their communities. Of those living behind a levee, 7% live behind a levee system determined to have high risk, which means that inundation due to breach and/or system failure would very likely result in loss of life, large economic losses and/or devastating environmental consequences.

TABLE 1

RISK CHARACTERIZATION	PEOPLE AT RISK (PAR)	STRUCTURES AT RISK	% PAR
Not Screened	81,379	19,291	54%
Low	22,586	9,089	15%
Moderate	36,785	11,822	24%
High	11,062	4,717	7%

The average age of levees in the state is 47 years, which is nearing the end of their projected design life of 50 years. Many parts of these systems – such as pumping stations and flood gates – were constructed early in the 20th century. This means repair to the mechanical and/or electrical systems may not be possible since often replacement parts are no longer available or the parts are extremely costly. When repairs are not possible, the cost of replacing these assets is high.

OPERATIONS AND MAINTENANCE

While some levees are stationary earthen embankments that do not require operation, some portions of the systems require active mechanical operations of pumps and gates which need to be tested periodically to keep them in good working order. All levees require regular maintenance and periodic repairs, replacements or upgrades to retain their level of performance required to reduce flood risk.

The USACE designed and built 25 of Ohio's levee systems (about 61.6 miles in length), and then turned over operations and maintenance to a local sponsor for 23 of them (58.5 miles in length), maintaining ownership responsibilities for 2 systems (3.1 miles in length). The other large agency in the state responsible for design, construction and operations and maintenance for the levee system is the Miami Conservancy District which maintains 55 miles of levee in the southwest region along the Great Miami River.

A local sponsor is usually a legally constituted public entity—such as a city, town, public utility or the state itself—that will operate and maintain the levee to ensure it will function as designed to prevent or mitigate flood damages. Local sponsors are responsible for operating mechanical or electrical systems regularly to make sure they are in working order, inspecting the levees on a regular schedule and keeping records of all operations and maintenance.

Local sponsors share some of this data with USACE, who keeps detailed records of most of the levees in the United States in the NLD. The NLD was created and is maintained by the USACE as an authoritative resource for information about levees including data on inspections, flood plain management and risk assessment.

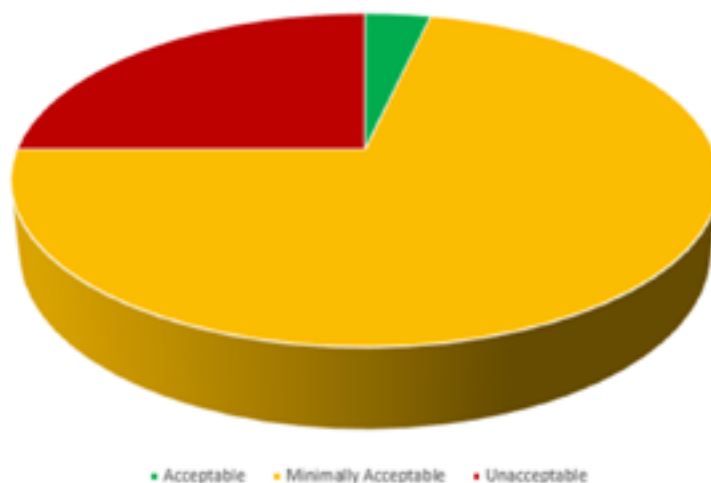
The USACE also performs periodic inspections of levees systems in their portfolio and provides inspection ratings that can help federal operators and local sponsors prioritize repairs or maintenance.

As shown in Figure 3 below:

- One Ohio levee is rated acceptable
- Seven (25%) are rated unacceptable
- 20 (71%) are rated minimally acceptable

FIGURE 3

Periodic Inspection Ratings in Ohio



FUNDING AND FUTURE NEED

Funding for Ohio's levees depends on the party responsible for their operation. Federal funding is available for the two USACE-owned and operated levees. Most Ohio levees are operated and funded by public sponsors including cities, municipalities or other local public entities. Many of these entities have limited budgets for repairs or maintenance.

USACE also has some programs available for local entities to use to fill funding gaps for small projects. These programs are usually allocated to maintenance and replacement projects, with budgets estimated at less than a couple million dollars.

PUBLIC SAFETY

The general public and property protected by levees in Ohio include hospitals, universities, major manufacturing facilities, treatment plants, power plants and densely populated metropolitan areas. During recent significant flooding events along the Ohio River, its tributaries and the Lake Erie shoreline, the state's network of levee systems functioned appropriately without any breaches or failures.

Because extreme rain events are occurring with more regularity in recent decades, flooding is a public concern and levees play an important role in keeping Ohio's citizens safe from the devastating effects floods can cause.

RESILIENCE

Flood awareness and emergency preparedness play a key role in risk management for individuals and communities living behind levees. FEMA requires that every levee within its program have an emergency action plan (EAP). The size of the community within the leveed area will dictate the complexity of the EAP. For example, EAPs for larger, more densely populated urban communities, such as Cincinnati, Columbus or Cleveland, will require more detailed evacuation route mapping and a broader emergency contact flowchart than EAPs of small communities.



LEVEES



RECOMMENDATIONS TO RAISE THE GRADE

- Continue involvement in the National Levee Safety Program established by the Water Resources Reform & Development Act of 2014, especially efforts with USACE to inventory and perform inspections & risk assessments on the levee systems in Ohio.
- Establish a statewide levee safety program to encourage sharing of emergency plans, education, best practices, trainings, and inspection data, so Ohio levee owners / operators have a central repository of information.
- Encourage all levee owners to have emergency action plans in place and be kept up-to-date.
- Explore a program for nonfederal levees to require safety inspections and have EAPs in place.
- Increase public outreach to educate communities about how important levees are to protecting lives.
- Increase citizen awareness of the risks related to levees and effective methods for living safely with them.

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PARKS



PARKS

GRADE: C-

EXECUTIVE SUMMARY

Ohio's park infrastructure is mostly in fair to good condition, total area of park land is insufficient for Ohioans, as evidenced by the state's rank of 44th out of the 50 states in acres of park land per resident. Because of funding constraints, the operation and maintenance of several of these lands is inadequate, resulting in deteriorating conditions of roads, bridges, dams and other structures. As an example, the Ohio Department of Natural Resources, ODNR, allocates approximately \$3.5 million per year for surface maintenance, resulting in a shortfall of \$6.2 million per year. On the upside, our parks are relatively resilient, considerably safe, and remarkably innovative, including the use of various funding sources.



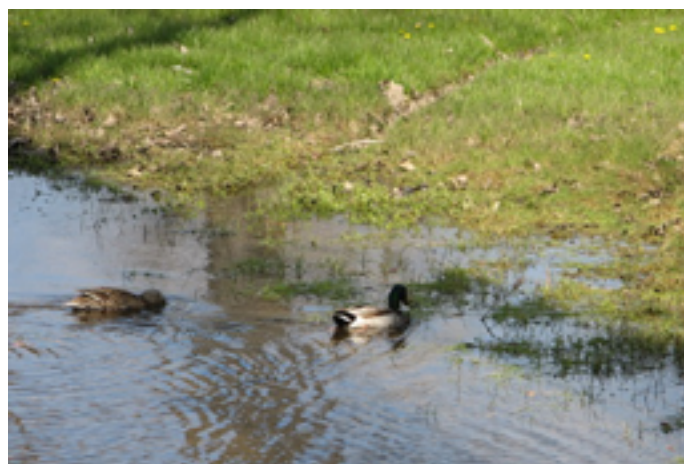
CONDITION AND CAPACITY

Ohio is home to the Cuyahoga Valley National Park (CVNP), the Wayne National Forest and:

- 75 state parks
- 23 state forests
- 136 state nature preserves
- 150 state wildlife areas

All of these are under the responsibility of ODNR. Large metropolitan areas in the state are served with Metroparks – Cleveland, Columbus, Butler County (Cincinnati), Toledo and Summit County (Akron).

The state's total area of park land is almost 1 million acres, or 0.85 acres per resident (excluding small local parks). Ohio ranks 44th in park acreage per resident within the 50 states and 34th when acreage/resident for only state and national parks are considered. Ohio's four largest cities rank, on average, in the 50th percentile of the national acreage of local parks per resident, with 70% of the residents of those cities living within a 10-minute walk from a park. Of individuals surveyed on the 2019 Ohio's Statewide Comprehensive Outdoor Recreation Plan (SCORP) Survey 22% indicated that more public outdoor recreational facilities were needed near their homes.



ODNR is responsible for:

- 640,000 acres of land
- 75 state parks
- 21 state forests
- 136 state nature preserves
- 145 designated wildlife areas
- 120,000 acres of inland waters
- 7,000 miles of streams
- 481 miles of the Ohio River
- 2.25 million acres of Lake Erie

Ohio has more than 5,000 miles of trails, including 1,367 miles for multi-use and 1,644 miles for horseback riding. The Buckeye Trail, a 1,440-mile cross-state hiking trail managed by the nonprofit Buckeye Trail Association, is an outstanding resource. Trails are less available at the municipal level. The Bailey Mountain bike system – which broke ground in the Fall of 2019 and is funded by a public-private partnership model – has the potential to become a valuable resource.

ODNR owns:

- 104.5 million square feet of pavement in roads and parking lots
- 870 centerline miles of road
- 311 bridges

In 2017, roads and parking lots exhibited an overall Pavement Condition Index rating of 70, down from 72 in 2004. Of those, 11 state parks (totaling 1 million square feet of pavement) were in serious to failed condition. Potholes are often reported within state park roads.

The National Bridge Inventory reports 32% of bridges within the state parks are in good condition, 55% in fair and 13% in poor condition. For comparison, only 6% of statewide bridges are in poor condition. Thirty one percent of the bridges within parks are over 100 years of age, 40% are currently past their design life (over 75 years old) and 54% are reaching or past their design life (over 50 years of age). CVNP has replaced four bridges deemed unsafe in the past four years.

Several aging class one dams are located within the limits of Ohio parks. One of them, CVNP's Brecksville Dam was built in 1951 and removed in August 2020. The dam had not only been aging, but was also detrimental to river ecology, fish habitat and a danger to recreational kayakers due to the hydraulic backflow generated by water passing over the bridge.

Only 27% of respondents to Ohio's SCORP survey indicated that near-home public facilities for boating, camping, sports, trail use, water recreation, wildlife viewing or winter sports were adequate and met their needs.

FUNDING AND FUTURE NEED

There is no entrance fee to CVNP or to any state park, and this is the same for most municipal and county parks. An exception is the Great Parks of Hamilton County which does assess entrance and parking fees. Although this presents funding challenges, it also makes our parks accessible to all individuals. User based fees for occupancy of campsites or cabins, use of amenities and hunting and fishing licenses are assessed to pay for their creation, upkeep and maintenance. During COVID-19, the revenues from these fees have fallen due to restrictions on keeping amenities open while maintaining social distancing.

CVNP and the Wayne National Forest are funded by the federal budget, which is insufficient and has been decreasing in recent years as shown below for 2018 through the projection for 2020. Wayne National Forest generates some revenue from logging. In a positive development, in August, 2020, the President of the United States signed the Great American Outdoors Act, a bill to fund national parks, including the more than \$51 million for overdue work at CVNP.

YEAR	2018	2019	2020 (REQUEST)
CVNP Budget (dollars)	11,052,000	10,992,000	10,586,000

The removal of the Brecksville dam – within the limits of CVNP but within the jurisdiction of ODNR – was funded in part through the Environmental Protection Agency's Great Lakes Restoration Initiative.

The Ohio Sierra Club has stated that the state's parks are also underfunded. ODNR received an appropriation of \$910 million over the Fiscal Year (FY) 2020-2021 biennium, with one third of those monies coming from general revenue funds. Of the budget, 11.9% is allocated to debt service. For many years, hunting and fishing license fees required an act of the general assembly and were not tied to inflation, resulting in less purchasing power year over year. This has been modified by H.B. 49 (2019) to allow the ODNR Director and Wildlife Council to manage these fees. The creation of the H2Ohio Fund (H.B. 166) added \$46 million to support and create wetlands and habitats throughout the state.

Some local park systems generate revenue from restaurants, concession stands, golf courses and sporting equipment rental. Some of these are adequately funded via these sources as well as programs such as:

- BUILD grants which stipulate that no more than \$100 million be awarded to each state with a maximum grant award of \$25 million
- The Ohio Environmental Protection Agency (EPA) Water Resource Restoration Sponsorship Program (\$15 million annually)
- The Ohio Public Works Commission's Clean Ohio Greenspace Conservation Fund (\$37.5 million per year D up to \$150 million per year
- Clean Ohio Trails Fund (up to \$25 million per year with a maximum project award of \$0.5 million and a total funding amount in 2019 of approximately \$6.6 million
- Federal Congestion Mitigation and Air Quality improvement grants (2020 estimated funding of \$2.499 billion)

It should be noted that some of these programs are not fully funded or utilized annually.

Future needs identified by the 2018 SCORP report include advancing the trail network, improving and adapting recreational facilities, emphasizing rivers, lakes and wetlands, increasing awareness and access to outdoor recreation opportunities, and protecting and sustaining the natural environment.

With future needs in mind, all Metroparks acquire land for habitat preservation, nature enjoyment and recreational activities. The Cleveland Metroparks even received an award from the National Association of County Park and Recreation Officials (NACPRO) for a land acquisition project.

Ohio parks are preparing for the future by responding to the trend towards park visitors using on-line resources for planning information and reservations.

OPERATION AND MAINTENANCE

In 2017, CVNP experienced a maintenance shortfall of more than \$51 million. However, it has an extensive trail maintenance program that cuts back plant growth from trails and removes potentially dangerous overhanging branches. It relies on the Trailblazers volunteer organization to monitor and report trail conditions daily. CVNP also culls deer as part of its regular maintenance program.

ODNR spends around \$244 per acre per year to manage public lands. However, a significant portion of state park maintenance is performed by "friends of" organizations. ODNR allocates approximately \$3.5 million per year for surface maintenance, resulting in a shortfall of \$6.2 million per year.

Ohio Metroparks systems typically maintain the roads and the Ohio Department of Transportation rated bridges within their properties. In addition, they maintain multiple smaller nonrated bridges such as pedestrian, bicycle and golf course bridges which are often made of timber. They do not, however, perform regular inspections of buildings, pavement, dams, storm sewers and other infrastructure assets. These assets are repaired through a reactionary approach to failures. Like other park organizations, Metroparks also rely on a combination of volunteers and staff for maintenance practices like invasive plant removal.

PUBLIC SAFETY

CVNP meets visitors with unarmed interpretive rangers, all of whom have radio access to the park's enforcement division and the surrounding municipalities. CVNP law enforcement works with the FBI and the U.S. attorney's office because a crime on park land is a federal offense. All law enforcement rangers in the park are first responders and many are emergency medical technicians; other staff have had first aid and CPR training. There are two law enforcement ranger stations in the park. These are secure facilities complete with holding cells. The joint Valley Fire District – made up of the surrounding communities and are on call 24/7 – provides technical rescue services in the park with boats and brush trucks as well as standard fire and emergency medical services equipment.

ODNR is charged with regulating and enforcing state law related to natural resources and conservation, including the issuance, enforcement and revocation of hunting, fishing and boating licenses. This involves the Natural Resources Law Enforcement program with responsibility for these activities in state parks, Ohio's waterways, on Division of Forestry lands and for state natural preserves. ODNR also operates a mine safety program, oil and gas regulation and plugging, a dam safety program and a waterways safety program.



The Cleveland Metroparks focus on visible police presence and are certified by the Commission on Accreditation for Law Enforcement Agencies. Their safety resources include a canine program, a dive team and an equestrian team. Water safety personnel are available at beaches and boating facilities in local, state and national parks.

RESILIENCE

Since business closures imposed by the state of Ohio due to the COVID-19 pandemic started in March 2020, park usage has increased by 117%. In a show of resilience, some parks adapted quickly to the COVID-19 pandemic, cordoning off playgrounds, exercise equipment and visitor centers, installing signage encouraging the public to follow CDC guidelines, restricting certain roads for pedestrian and bicycle use only to facilitate social distancing and providing portable toilets in lieu of closed restrooms. Despite being used at a much higher rate, park systems experienced reduced revenue from user fees typically generated by amenities closed due to the pandemic. Unfortunately, some municipal parks, in Medina for example, were not able to transform themselves quickly and chose instead to close to the public.

The Northeast Ohio Regional Sewer District (NEORS) considers the Cleveland Metroparks to be a stormwater asset and natural infrastructure that contributes to the area's resiliency to storms. Per an agreement, NEORS stormwater fees that the Metroparks is assessed is approved to be reinvested in the Metroparks. On the other hand, municipal parks in Geneva on the Lake and Mentor on the Lake were unprepared for high levels of Lake Erie and the significant erosion that was observed in 2019 and 2020, where parkland was lost at an alarming rate.

INNOVATIONS

Several innovative initiatives exist among Ohio parks, mostly at the county system level.

The Cleveland Metroparks has an innovative partnership with the City of Lakewood, with whom it shares an electric car fleet. Of Cincinnati's parks, 12 have "gone solar." A series of green infrastructure projects was implemented within Cullen Park, the westernmost access point to Lake Erie, as part of the Going Beyond Green Regional Sustainability Plan. The F.A. Seiberling Nature Realm, part of the Summit County Metroparks, is an innovative and very well executed concept. Lastly, the West Creek Reservation of the Cleveland Metroparks is a demonstration site for innovative urban watershed stewardship techniques. It was accomplished through an innovative partnership with NEORS and won an award from NACPRO. ODNR owns and operates the Zaleski Sawmill, allowing them to recycle downed trees into usable timber for reuse in ODNR projects. In addition, the timber can be transferred to other local parks for use at cost or sold at market rates.



RECOMMENDATIONS TO RAISE THE GRADE

- The recent passage of the Great American Outdoors Act, which would provide \$6.5 billion to the National Park Service including to Ohio parks is a major step forward. Continued advocacy to renew and fully fund this program every year is needed to ensure its success.
- Advocacy for continued funding and expansion of the Clean Ohio initiative, including the Clean Ohio Green Space Conservation Program and Clean Ohio Trails Fund is needed in addition to the new H2Ohio initiative.
- The state and local parks grant application process needs to be improved, including the addition of grant writers to staff.
- More trails need to be developed, trail access needs to be improved and trail maintenance and rehabilitation is needed. Trail connections should be approached from a network level to avoid disconnections and support multimodal, integrated, active transportation.
- Outdoor Facilities need to be rehabilitated, updated and improved, including athletic fields within state parks.
- More land should be acquired for habitat preservation, nature enjoyment and recreational activities. This can be achieved through public acquisition, bequests and public-private partnerships with land conservation groups and other non-profits such as the Trust for Public Land Ohio.
- Online marketing should be enhanced, including websites, social media and apps to expand and improve park users' experience (for example for hiking).
- Hunting, fishing and boating license fees should be raised to commensurate with inflation rates, both to catch up from prior year flat fees and to keep up with inflation on future fees.
- Specific user fees for facility amenities such as campgrounds, cabins, lodges and pools or for activities including hunting and fishing are recommended to aid funding while maintaining public access to all. These fees should be set to adequately fund the upkeep and maintenance of equipment and facilities.
- To avoid economic exclusion, programs should be created by parks at all levels – ODNR or CVNP – to provide reduced fees to low-income people and families, particularly access for children and involvement in childhood recreation programs. This reduces socio-economic disparities, addresses obesity issues and promotes safety.



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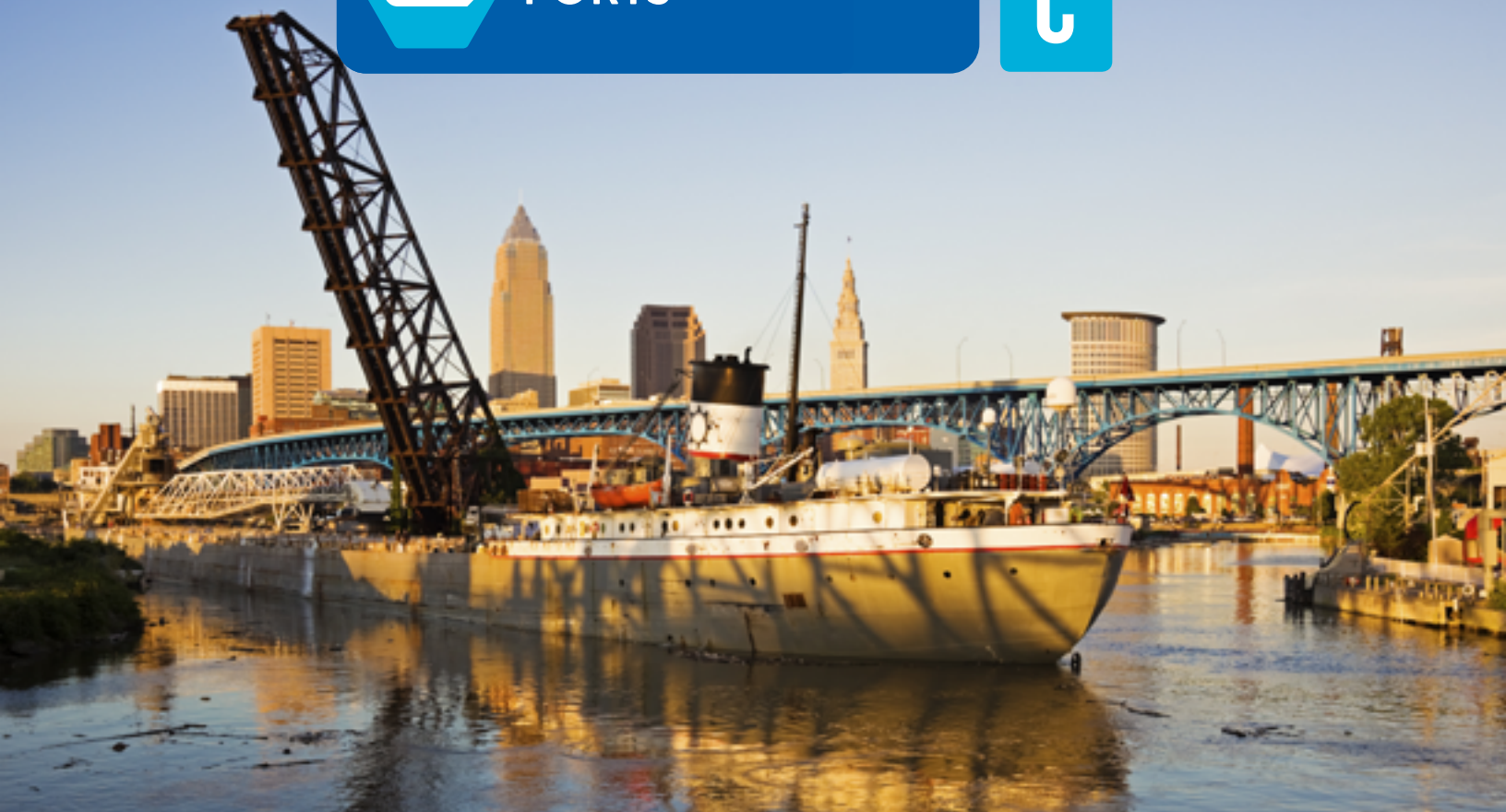
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PORTS



PORTS GRADE: C

EXECUTIVE SUMMARY

Ohio's ports:

- Include 716 miles of navigable waterways
- Are 8th in the nation for annual tonnage
- Annually move goods valued at over \$11 billion

Currently, the state's ports are aging with insufficient infrastructure to handle modern cargo in the 21st century. More importantly, ports in Ohio are undercapitalized to address future trends and infrastructure needs. Port structure in Ohio is decentralized and locally chartered, allowing ports to be responsive and adaptable to the needs of local, microeconomic drivers. However, this has led to Ohio lacking a cohesive funding approach that allows strategic investment in ports to achieve highest economic benefits from their capacity and unique attributes. The needs of public ports within Ohio outpace available funding when coupled with the increased cost of maintaining and reinvesting in aging infrastructure.

BACKGROUND

Ports are a key engine to American competitiveness and prosperity, producing over \$4.5 trillion in annual economic activity. Over 25% of the U.S. economy is linked to ports. Unlike many competitor states, Ohio benefits from direct maritime access to regional (Great Lakes, Midwest), national and global markets, providing access, speed, and lower costs to businesses. Ohio's ports on Lake Erie and the Ohio River annually generate over \$6 billion in economic activity, 33,000 jobs and \$800 million in state and local income taxes. Table 1 shows the direct statewide annual economic impact in 2018 dollars.

TABLE 1: DIRECT STATEWIDE ANNUAL ECONOMIC IMPACT (2018 DOLLARS)

JOBS	PERSONAL INCOME	BUSINESS REVENUE	LOCAL PURCHASES	TOTAL TAXES PAID
33,168	\$2.2 Billion	\$2.7 Billion	\$1.41 Billion	\$838.7 Million

CAPACITY AND CONDITION

Ohio's ports consist of 716 miles of navigable waterways, are 8th in the nation for annual tonnage and annually move goods valued at over \$11 billion. There are 12 public maritime (lake/river) ports in Ohio. Key measurables for these ports include freight volume, industrial terminals, channel depth, harbor dredging, level of congestion and load capacity. The major cargoes transported along these ports are cement, coal, grains, break bulk cargo, specialty project cargoes, iron ore, limestone, liquid bulk, salt, sand and shipping containers. Ohio ports have excess volume capacity, even while moving over 100 million tons of cargo through their docks annually.

Direct access to the Great Lakes, the Atlantic Ocean via the Saint Lawrence Seaway and the Gulf of Mexico via the Ohio/Mississippi River system is a tremendous asset; however, this is only partially leveraged because operational and competitive disadvantages exist compared to other modes of transportation as well as other state's ports. One constraint includes the inability of Ohio ports to efficiently offload cargo with modernized offloading equipment due to outdated and inefficient infrastructure. With additional investment to improve and modernize Ohio's ports, the total tonnage could grow dramatically and cargo could diversify to support the state's businesses, manufacturers and exporters.

Approximately 80% of the Great Lakes harbor structures are older than their 50-year design life. Much of the port infrastructure remaining in service today was put into service when major investments were made to the Soo Locks and the Saint Lawrence Seaway in the 1940s and 1960s. The same holds true with major investments and upgrades made in the Ohio/Mississippi River system. Limited local resources dedicated to reinvestment are routinely tapped to keep existing infrastructure in service and to support efforts to sustain navigation. This has limited the ability of ports to modernize facilities to accommodate shifting cargo trends of the 21st century.

Critical investments needed include:

- Increased dock bearing capacities
- Reconstruction of dock infrastructure
- Investments in modern cargo offloading equipment to efficiently service the docks and make more efficient intermodal transfers
- Installation of new security and communication infrastructure to more efficiently track and process cargo through terminals
- Infrastructure improvements to reduce each terminal's environmental impacts

Ports are aging and operators must frequently execute major maintenance projects with limited resources to keep existing assets in service.

Navigation channels and berths that service Ohio's ports also require routine maintenance dredging to sustain full depth navigation. Ohio restricts the placement of dredge sediment into Lake Erie. Confined disposal facilities – structures that were built in the late 20th century to receive and permanently store dredge sediment – now are at or nearing their design capacities and anticipated useful lives. This has added additional financial pressures on local ports in Ohio. Most public ports within the state have been tapped to lead and financially support local dredge material management efforts.

FUNDING AND FUTURE NEED

Ohio ports – including Toledo, Cleveland and Conneaut – have recently been successful in pursuing competitive federal programs, specifically, the U.S. Department of Transportation MARAD Port Infrastructure Development program. This \$225 million-dollar grant program is targeted at improving the safety, efficiency and/or the reliability of the movement of goods into, out of or within a port. Great Lakes and Ohio River ports were eligible to compete for funds under this program. Unlike other federal transportation infrastructure programs, this program targeted port infrastructure, which can have a difficult time competing against other transportation infrastructure projects in other federal programs. This program will bring more than \$46.5 million in federal grant dollars to Ohio to modernize and reinvest in critical port infrastructure.

Until recently, Ohio provided zero state level funding for ports. Ohio's public ports have limited means to generate operating dollars and struggle greatly to obtain capital dollars for major reinvestment programs. The State of Ohio recognized this need and created the Ohio Maritime Assistance Program (MAP) in 2019. MAP is a \$23 million grant program to fund fiscal year 2020-2021 projects that would otherwise be delayed in starting for years due to financing. The recent creation of the MAP grant program has begun to position Ohio ports to gain resources needed to compete and modernize their facilities. Projects awarded include equipment upgrades to improve terminal efficiency, dock modernization and reconstruction projects, investments in dredge material management facilities and facility upgrades required to handle modern cargoes. This program funded investments in both Lake Erie and Ohio River public ports.

Ohio's ports need long-term funding of about \$500 million for global competitiveness, \$250 million for landside maintenance and \$250 million for waterside maintenance. In short, Ohio's ports struggle to play their intended role in what should be a seamless multimodal logistics network that supports our state's manufacturers and businesses. Funding of programs at the state and federal levels, specifically identified for ports, is critical in maximizing limited local funds.



OPERATIONS AND MAINTENANCE

Limited funding resources have hampered infrastructure reinvestment in Ohio ports, contributing to the common practices of deferring major reinvestment and modernization, increasing major maintenance backlogs and spreading limited financial resources around to perform an increasingly diversified portfolio of maintenance and operations. Unforeseen repairs or crises cripple the budgets of ports because they often lack reserves dedicated to such situations.

Asset management is handled differently by each port, leading to disjointed assessment and planning efforts. The age and condition of the existing infrastructure in Ohio ports – much of which was constructed in the 1940s and 1960s – presents challenges when ports look to formally inventory their capital assets, assess their current conditions and determine their anticipated lifespans. As major reinvestment occurs within Ohio ports, asset management programs are needed to transition from reactive to proactive maintenance programs. Successful asset management programs require resources to start as well as to staff, maintain and upkeep accurate records.

PUBLIC SAFETY

Security and cargo clearance systems in Ohio ports are outdated, relying on 20th century systems and standard business practices. Ports within the state also struggle to provide facilities to meet the specifications required by U.S. Customs and Border Protection. Ports within the state have had to divert significant amounts of operating and capital resources to enhance terminal security over the past 20 years, specifically ports that handle international cargoes. Even with these investments, Ohio ports continue to lag when compared with ports nationally. Challenges with outdated security and cargo clearance systems can reduce terminal efficiency, make it more difficult to harness and act on data and increase risks for dependent supply chains.

RESILIENCE

Weather patterns across the Ohio River Valley and the Great Lakes region are showing short-term trends of more frequent heavy rainfall events. This results in increased navigation channel sediment deposition and sustained high-water conditions. Lake Erie's water elevations are at or near historic highs, breaking several record high monthly mean water levels in the middle of 2019 and early 2020. Lake level rise and variability in Ohio River conditions must be considered when upgrading or implementing new infrastructure. Ohio ports need to conduct resiliency assessments to plan for future climate-related threats.

INNOVATIONS

Maritime shipping, specifically on the Ohio River system and within the Great Lakes, is not recognized as very innovative. The industries which our infrastructure has traditionally supported include manufacturing and the movement of bulk commodities, such as agriculture products, petroleum, coal and iron ore. All are critical to Ohio's economy, but not generally seen as innovative. Ohio's ports must continue to push for innovative practices to complement these industries, such as real-time cargo position tracking and development towards autonomous transportation networks.

While the movement of traditional cargoes through Ohio ports is – and will remain – critical, investments must also continue to be made within our ports to service industries that are under served or emerging. This diversification will result in a more resilient and healthy system for both ports and the state. This could also include investment and funding to further promote the movement of



PORTS



RECOMMENDATIONS TO RAISE THE GRADE

- **Continued funding of state and federal programs with funding dedicated to of state and federal programs with funding dedicated to ports.**
- **State-level port freight planning and regional coordination amongst state port authorities to leverage and maximize assets of each port for greatest state benefit.**
- **Development of Dredged Material Management Plans for Ohio harbors and ports consistent with Ohio law and containing clearly identified and sustainable funding strategies.**
- **Provide state-level resources and support to port authorities to develop consistent and comprehensive asset inventory**

SOURCES

Ohio Department of Transportation (ODOT)

U.S. Department of Transportation Maritime Administration (MARAD)

Ohio Council of Port Authorities

American Great Lakes Ports Association

American Association of Port Authorities

Great Lakes St Lawrence Governors and Premieres

U.S. Army Corps of Engineers Detroit District



RAIL



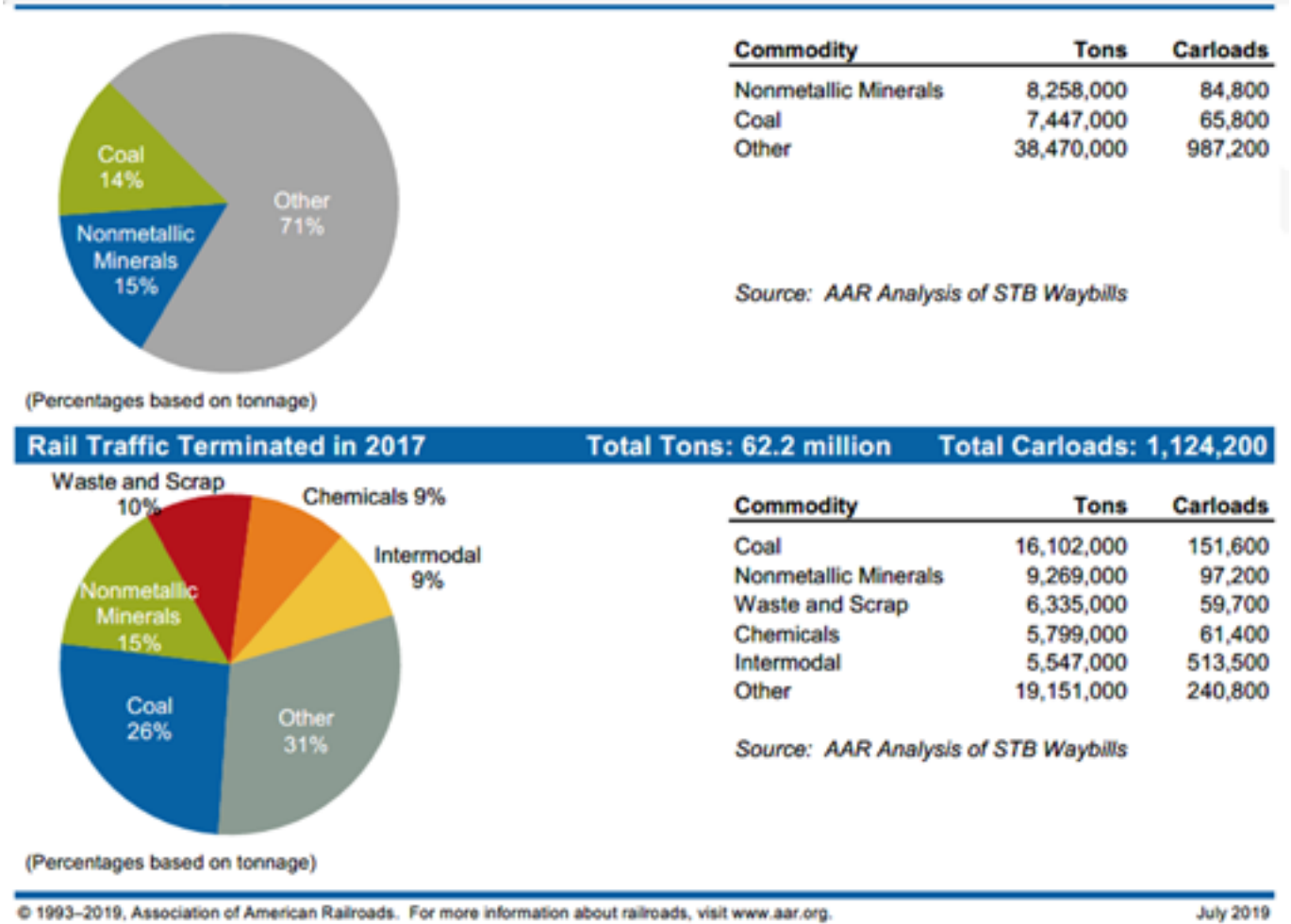
RAIL
GRADE: B

EXECUTIVE SUMMARY

Ohio has an extensive rail network that is closely integrated with the State's economy. Ohio's 38 freight railroads – consisting of three Class I, one Class II and 34 Class III railroads – carry approximately 289 million tons of freight annually. Ohio ranks 4th in the nation in the total miles of track with 5,188 miles and total number of rail/highway grade crossings with 5,737 at-grade vehicular public crossing. Ohio ranks 2nd in the nation in the number of intermodal terminal facilities with 12. There are also more than one hundred transload facilities and numerous maritime facilities along Lake Erie and the Ohio River that have rail service.

Ohio freight railroads carry approximately 289 million tons of freight annually. Ohio ranks 8th in the nation in originating tonnage with 54.2 million tons. This primarily consists of coal, farm products crushed stone, sand, gravel, intermodal, food products, metallic ores and primary metal products. Ohio ranks 7th in the nation in terminating tonnage with 62.2 million tons. This primarily consists of coal, chemicals, intermodal, crushed stone, sand, gravel, food products and metallic ores.

FIGURE 1 - OHIO’S FREIGHT RAIL NETWORK





CONDITION AND CAPACITY

Ohio's active rail line network is comprised of 5,188 miles of track primarily owned by private freight railroad companies. 569 miles of track is owned by government entities including federal, state, county, municipal or port authorities and 30 miles of track is owned by tourist railroad organizations.

Freight Rail

Ohio freight railroads are categorized into three classes based on the distance served and earnings. Ohio has three Class I/National railroads (Canadian National Railway, CSX Transportation, Inc., and Norfolk Southern Corporation), one Class II/Regional railroad (Wheeling & Lake Erie Railway Company) and 34 Class III/Local railroads. CSX Transportation and Norfolk Southern Corporation operate 59 percent of the Ohio rail network.

Most of Ohio's rail lines consist of only a single track, however there are high-density rail lines with two tracks. CSX Transportation and Norfolk Southern Corporation each have high-density east-west lines in the northern part of the state and north-south corridors linking to other parts of their systems south of Ohio.

The high-density rail lines use centralized traffic controls with dispatches at remote locations that manage train movement, controlling signals and switches. Medium-density rail lines use automatic block signaling with lineside signal systems to indicate if a section of track is occupied. On other rail lines, train crews use radios or telephones to communicate with a dispatcher before entering a section of track.

CSX Transportation and Norfolk Southern Corporation's high-density east-west rail lines can accommodate 20'-2" double stack railcars. Most other rail lines can accommodate 17'-0" boxcars. Most of Ohio's rail lines can accommodate industry standard railcars of up to 286,000 pounds in gross weight. Ohio has 13 intermodal terminal facilities, more than one hundred transload facilities and numerous maritime facilities along Lake Erie and the Ohio River also have rail service.

FIGURE 2 - OHIO'S FREIGHT RAIL NETWORK



Intermodal

Ohio ranks 2nd in the nation with 12 intermodal terminal facilities that are connected to other facilities across the nation, including ports on the east and west coasts. Ohio also has more than 100 transload facilities and numerous maritime facilities along Lake Erie and the Ohio River also have rail service.

National Gateway

CSX Transportation's National Gateway allows double-stack trains to operate between Chicago and ports on the east coast. Under an agreement, they can also operate with BNSF to ports on the west coast through CSX's Northwest Ohio Intermodal Terminal in North Baltimore.

Heartland Corridor

Norfolk Southern Corporation's Heartland Corridor allows double-stack intermodal trains to operate between Chicago and ports on the east coast.

FIGURE 3 - OHIO'S INTERMODAL TERMINAL FACILITIES



FIGURE 4 – NORFOLK SOUTHERN INTERMODAL NETWORK MAP



FIGURE 5 – CSX TRANSPORTATION INTERMODAL NETWORK MAP





Passenger Rail

Amtrak operates long-distance passenger rail service in Ohio along three routes: Capital Limited (Chicago to Washington, D.C.), Cardinal (Chicago to New York) and Lake Shore Limited (Chicago to New York/Boston). Due to scheduling of connecting trains in Chicago, these trains pass through Ohio at night. In 2017, 149,013 passengers boarded or disembarked Amtrak trains in Ohio. Of those, 56,275 did so in Cleveland and 53,528 in Toledo.

FIGURE 6 - OHIO'S PASSENGER RAIL NETWORK



FUNDING AND FUTURE NEED

Freight railroads pay for all operating expenses and most of their capital expenses through their own revenues. Local and regional railroads, whose average revenue per route mile is one-eighth that of the Class I railroads, have fewer financial resources to maintain their infrastructure in a state of good repair. Public funding to support capital projects is available only under specific circumstances. The State of Ohio, through the Ohio Rail Development Commission (ORDC), makes grant funding available to promote economic development opportunities and mitigate grade-crossing safety concerns. The ORDC funds or finances projects that build rail access to Ohio business. Projects are completed as partnerships, where the shipper funds part of the cost of rail access and ORDC funds or finances another portion of the projects. The National Gateway and Heartland Corridor are examples successful public-private partnerships.

The average ORDC grant in 2017 and 2018 was \$180,000 and the total available funds in 2018 and 2019 was approximately \$2 million. Ohio also uses a variety of federal funding resources. However, Railway-Highway Crossing (Section 130) Program funds and other federal safety programs are the only continuous federal funded programs. Ohio spends approximately \$15 million of Federal Highway Safety Funds – including Section 130 funds – annually to reduce crashes at public rail/highway grade crossings. Ohio also pursues other federal funds that are awarded on a competitive basis. ORDC has identified 62 projects to be considered for funding under future federal competitive grants.

FIGURE 8 - PROJECTS FOR FEDERAL COMPETITIVE GRANT APPLICATIONS

Category	All Projects	Projects with Cost Estimates	Cost of Projects with Estimates (\$2018)
Bridge rehabilitation – bring railroad bridges to modern standards and a state of good repair	2	2	\$2,000,000
Grade separation – grade separate rail and highway rights-of-way	8	8	\$122,444,000
Industrial access – build rail sidings or spurs to industrial locations	5	4*	\$5,130,000
Passenger rail – improve existing infrastructure or build new infrastructure to improve passenger service	5	2*	\$2,373,000
OfRail capacity – improve rail yards or rail lines to expand capacity	11	11	\$51,413,000
Rail connection – establish or improve connections between rail lines	3	3	\$3,498,000
Rail rehabilitation – bring rail lines to modern standards and a state of good repair	21	21	\$42,298,000
Road clearance – raise the level of rail overpasses to	1	1	\$12,841,000
Other – create rail bypass, new rail line, preserve right-of-way, build new bridge, improve crossing	2	2	\$32,065,000
Transload or intermodal – improve or construct new transload or intermodal terminal	8	8	\$39,434,000
Grand Total	66	62	\$313,496,000

PUBLIC SAFETY

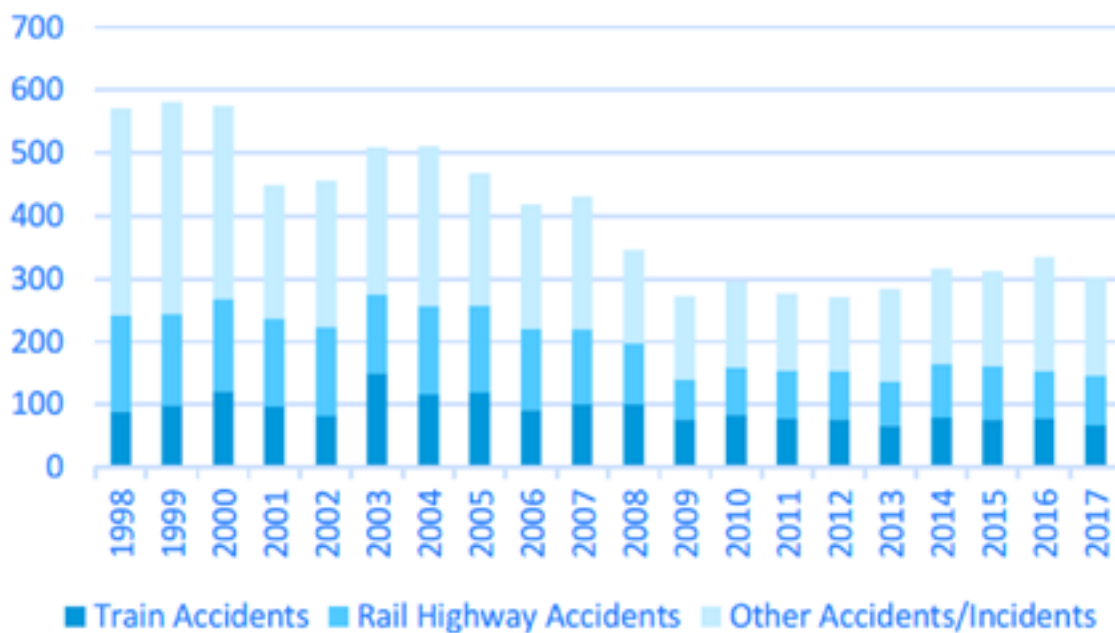
Ohio has the fourth largest number of rail/highway grade crossings in the Country. As of 2018, Ohio was home to 5,737 at-grade vehicular public crossings, of which 58% have flashing lights and gates, 10% have flashing lights and 32% have passive systems such as crossbucks.

ORDC administers approximately \$15 million annually in federal hazard elimination funds for rail/highway grade crossing safety improvement projects. These projects have resulted in a significant reduction in crashes at railroad crossing over the past two decades.

Rail safety is reported in three categories:

- Train incidents or collisions
- Train derailment
- Other equipment that causes damage to railroad equipment, track or structures

FIGURE 7 - OHIO'S RAIL SAFETY



Rail/highway incidents consist of collisions where a train collides with a highway vehicle, bicycle or pedestrian at a rail/highway grade crossing. Other incidents include work-related injuries to railroad employees or situations where trespassers, railroad employees or contractors are struck by trains.



INNOVATION

Freight Rail

Over the past decade, professionals have been working to implement Positive Train Control (PTC) technology across the entire system of Ohio Class I Railroads. PTC is a safety system that tracks the location, direction and speed of trains and can automatically stop a train to prevent four specific types of human-error incidents:

1. Train to train collisions
2. Derailments caused by excessive speed
3. Incidents that can occur if trains are routed down the incorrect track
4. Unauthorized train movements on tracks undergoing maintenance.

PTC systems consist of three main elements (locomotive, wayside and back-office systems) integrated by a wireless data communication system. CSX and Norfolk Southern Corporation have both received conditional approval for their PTC Systems.

Passenger Rail

Hyperloop is a new mode of transportation that could move freight and people quickly and safely. Passengers or cargo would be loaded into the Hyperloop pod vehicle and accelerated gradually via electric propulsion through a low-pressure tube. The pod quickly lifts above the track using magnetic levitation and glides at airline speeds for long distances. There are currently two initiatives being developed to connect Ohio with Chicago to the west and Pittsburgh to the east. The Northeast Ohio Areawide Coordinating Agency's initiative would follow a route through Cleveland, while the Mid-Ohio Regional Planning Commission's initiative would follow a route through Columbus.





RAIL



RECOMMENDATIONS TO RAISE THE GRADE

- Continue to invest in improving the safety of rail/highway crossings to reduce incidents
- Create sustainable, long-term funding mechanisms at all levels of government to support rail infrastructure investments that yield a public benefit and leverage private investment

SOURCES

State of Ohio Rail Plan, January 2019

Association of American Railroads, July 2019



ROADS



ROADS GRADE: D

EXECUTIVE SUMMARY

Located within a day's drive of 60 percent of the population of the U.S. and Canada, Ohio maintains one of the most extensive and heavily travelled roadway systems in the nation containing 122,987 miles of roadway consisting of 262,320 miles of total road lane miles and more than 40,000 bridges. This places Ohio's system 2nd in the nation for number of bridges, 3rd largest in freight volume, 4th in the nation for total interstate lane miles and 6th largest in total vehicle miles travelled. Even though Ohio's roadway network is extensive, congestion costs Ohio motorists an estimated \$4.7 billion each year in lost time and wasted fuel. In 2019, the Ohio General Assembly approved a transportation budget that included a variety of revenue enhancements including increases to the motor fuel tax and vehicle registration fees which have been estimated to generate an additional \$865 million for Ohio's roads and bridges per year. More funding is still required to eliminate or narrow the gap between funding available and funding required.



BACKGROUND

Ohio has more than 122,987 miles of roadways, of which 19,233 miles (16%) are state owned and maintained by the Ohio Department of Transportation (ODOT). There are 8,356 lane miles of interstate highway that serve the state, making it the 4th largest in the nation. Ohio is located within a day's drive of 60% of the population of the U.S. and Canada, making Ohio's roadways a vital transportation resource for the mobility of people, goods and services.

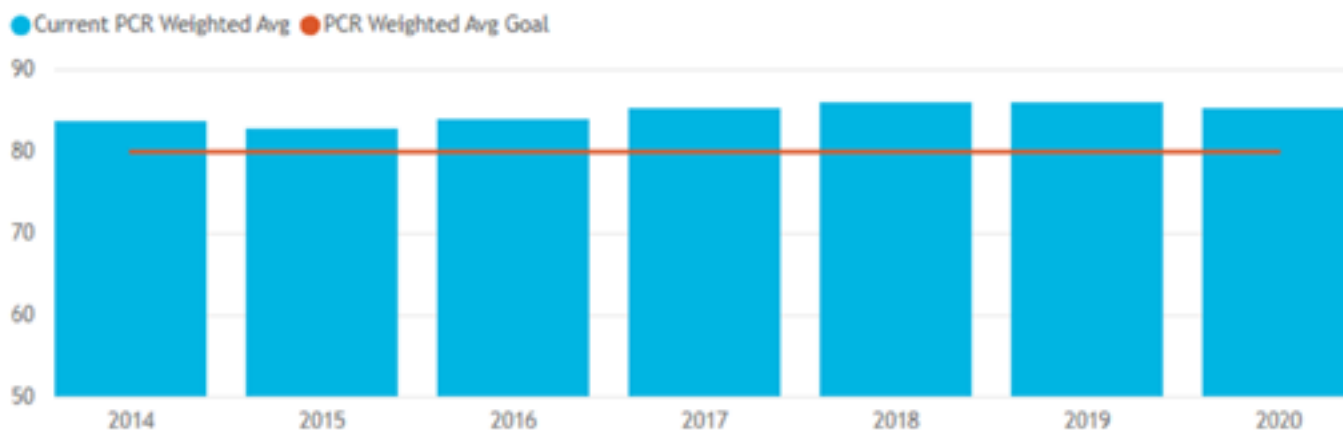
The Ohio Turnpike, owned and maintained by the Ohio Turnpike and Infrastructure Commission (OTIC), is also part of Ohio's interstate system. It is funded and operated separately from other roadways in Ohio. The Ohio Turnpike consists of 241 miles of interstate tollways in northern Ohio with revenue drawn primarily from toll collection. A \$134 million capital program was initiated in 2018 as part of a 30-year, \$1.5 billion Capital Improvement Program. In addition, in 2018 \$1.5 billion in bonds were issued for the Ohio Turnpike from 2012 to 2018 to perform infrastructure projects on non-turnpike roadways which have a significant transportation-related nexus to it. OTIC is independent of ODOT. This document, therefore, primarily focuses on ODOT. Other owners and maintainers of non-interstate roads in Ohio include the state's 88 counties, 1,309 townships and 932 incorporated municipalities.

CONDITION AND CAPACITY

Ohio's road conditions are better than the national average. Based on 2018 roadway condition data from the U.S. Department of Transportation, the percentage of roadways in poor condition in Ohio is commiserate with the national average; on the other hand, a higher percentage than the national average is rated in good condition according to the International Roughness Index (IRI).

Each year, ODOT assesses federal-aid-eligible roadways (i.e. state and local primary roads) to evaluate the severity and extent of various distress types. ODOT rates roadways based on a Pavement Condition Rating (PCR) which measures the distress level for a section of pavement on a scale of 0 to 100, with 100 being the best. As the following graphs demonstrates, while the average PCR rating of Ohio's roadways has held relatively steady over time, the percentage of roadways which are rated as poor have increased since 2014. This indicates that funding has not been received at a level that can keep pace with maintaining a good to fair condition for all Ohio roadways.

AVERAGE WEIGHTED PCR PER YEAR



Source: ODOT – Critical Success Factors – General System Pavement Conditions



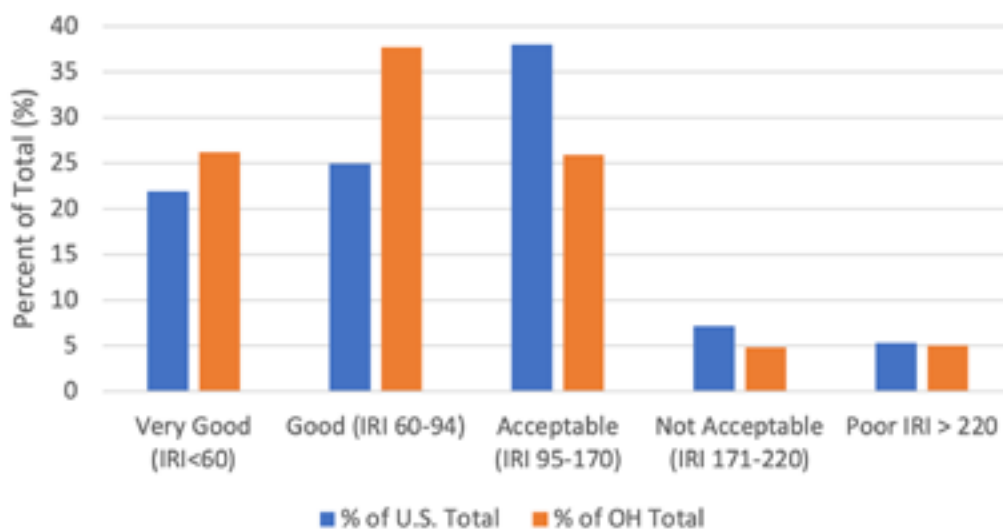
OHIO ROADWAY PCR – PAST AND PROJECTED

● Poor (PCR below 65) ● Fair (PCR between 65 and 85) ● Good Percentage (PCR above 85)



Source: ODOT – Critical Success Factors – General System Pavement Conditions

OVERALL ROAD CONDITIONS: 2018

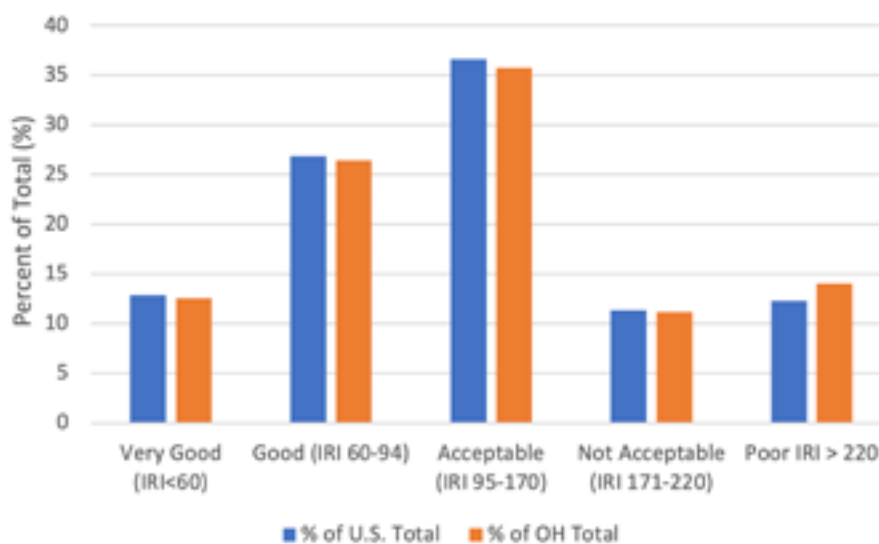


Source: Adapted from U.S. Dept. of Transportation, 2018, State Transportation Statistics

The condition of the roads outlined above are largely maintained by ODOT and do not provide a complete picture. Urban roadways – which are largely maintained by local jurisdictions – have not received the same level of investment as roadways largely maintained by ODOT. A lack of local funding for roadways has resulted in approximately 25% of Ohio's urban roadways in a poor to not acceptable condition classification, compared to less than 10% of the overall total. In addition, the conditions of Ohio's urban roadways are generally worse than the national average.



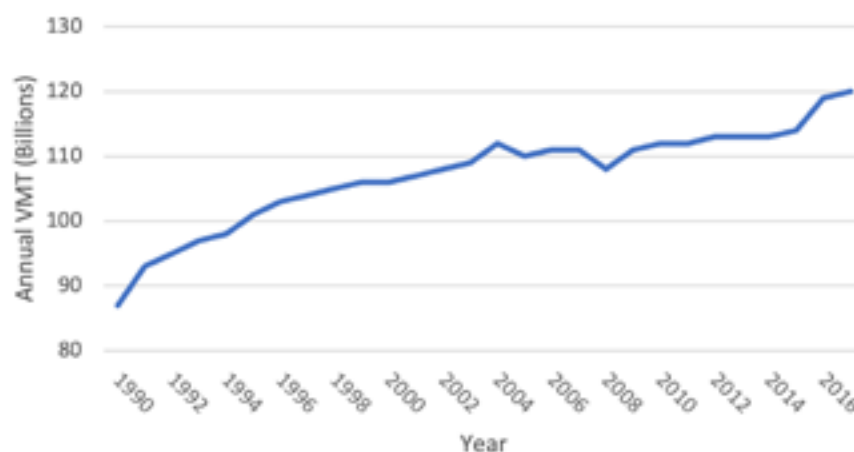
URBAN ROAD CONDITIONS: 2018



Source: Adapted from U.S. Dept. of Transportation, 2018, State Transportation Statistics

Ohio's economy relies on a great deal of personal and commercial mobility. Annual vehicle travel in Ohio increased 38% between 1990 and 2018 and increased 11% between 2008 and 2018. However, the number of lane miles that exist have held relatively steady during the same 10-year period, resulting in an increase in congestion and reduction in mobility.

ANNUAL VEHICLE MILES TRAVELLED (VMT.)



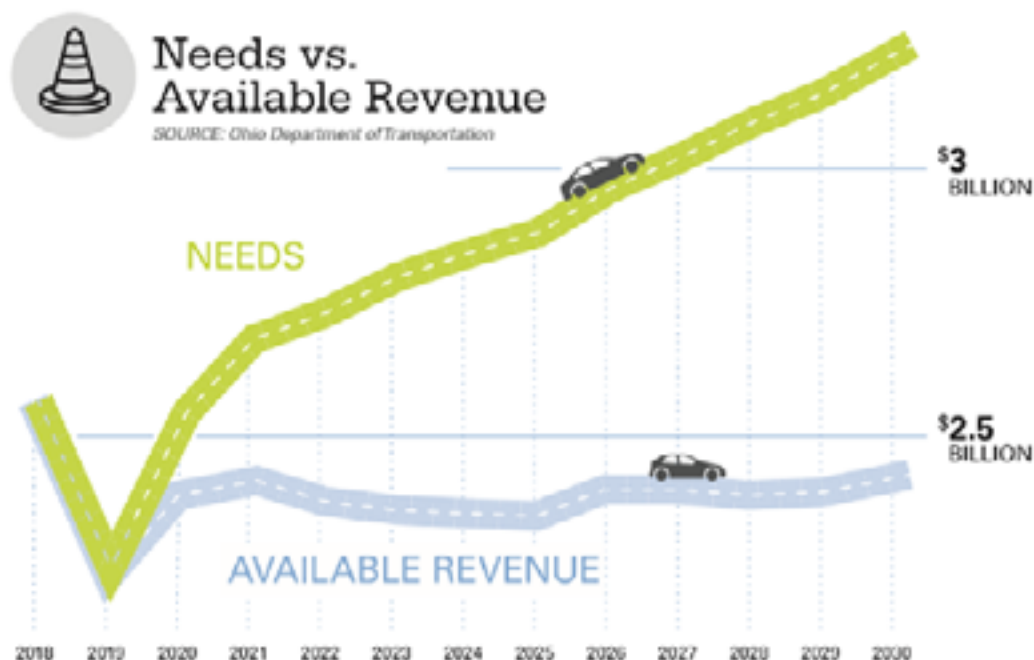
Source: Adapted from U.S. Dept. of Transportation, 2018, State Transportation Statistics

Increased traffic volumes will continue to impede travel and economic development while applying more pressure on the roadway infrastructure. This causes faster deterioration of the existing roadways while budgetary constraints are creating difficulties in maintaining the existing road mileage. In addition, traffic congestion will continue as a growing burden in Ohio's urban areas which will serve to impede economic growth and quality of life. In 2017, three metropolitan areas in Ohio (Cleveland, Columbus and Cincinnati) placed in the top 30 metropolitan areas and an additional three (Akron, Dayton and Toledo) placed in the top 75 metropolitan areas in four key metrics of congestion: travel delay, excess fuel consumed, truck congestion cost and total congestion cost. The total congestion cost in these six metropolitan areas in 2017 was estimated to be approximately \$4.7 billion.

FUNDING AND FUTURE NEED

In 2019, the Ohio General Assembly approved a transportation budget which included several revenue enhancements for roadways. Included was a fuel tax increase of 10.5 cents per gallon for gasoline and 19 cents per gallon for diesel from the previous tax amount of 28 cents per gallon. The General Assembly also levied an annual renewal fee of \$100 for hybrid vehicles and \$200 for electric vehicles. This increase in the fuel tax and fees for hybrid and electric vehicles has been estimated to generate an additional \$865 million for roads and bridges per year. The transportation budget also permitted municipalities and townships to increase license plate fees an additional \$5 to their residents. This complimented a previous \$5 increase provided to counties in 2017. Prior to these recent revenue increases, the General Assembly has not passed an increase in revenue since 2003.

Even with these needed increases, there is not adequate funding to address the gap for highways. According to the report of Governor DeWine's Advisory Committee on Transportation Infrastructure, ODOT and local governments reported needing over \$2.5 billion in 2020, and then reported a needed increase to over \$3.2 billion annually by 2030. This projected estimate catches the state up on deferred maintenance projects and begins to address future maintenance needs.



Even with the additional funding provided for in the 2019 transportation budget, funding levels are not expected to be enough to accommodate the rate of deterioration and congestion on Ohio's roads.

Additional funding is still required to:

- Provide the necessary maintenance of roadways that are seeing increased wear and tear
- To relieve current and future traffic congestion
- To improve public safety and the movement of freight

Annually, \$1.1 trillion in goods are shipped to and from sites in Ohio, primarily by truck. A well developed and highly accessible network of roads is a key factor in whether businesses decide to relocate or expand. Continued inadequate investment will result in increased maintenance costs and a reduction in Ohio's quality of life and economic competitiveness.

While recent increases in revenues due to additional motor fuel taxes and license plate fees help to decrease the gap in roadway needs versus available revenues, it will not be sufficient to meet future needs. Revenues from motor fuel taxes are anticipated to remain steady or decline over time due to a variety of factors including increases in fuel efficiency and the lack of indexing the rate of fuel taxes to inflation. In addition, advances in vehicle technology including increases in the number of alternative fuel vehicles, ride sharing and autonomous vehicle technology will continue to require new mechanisms for generating funds for road improvements.

At the federal level, motor fuel taxes which are used to support the Highway Trust Fund, the major source of federal surface transportation funding, are eroding as the federal motor fuel tax of 18.4 cents per gallon has not been increased since 1993. This tax was also not indexed for inflation and only has 60% of the purchasing power it had when first enacted. Because of this, Congress has resorted to transferring general revenues to the Highway Trust Fund since 2008. Continued general fund transfers to support highway projects are not a long-term solution to transportation funding needs.



PUBLIC SAFETY

Safe and well-maintained roadways are important to economic productivity and enhance the quality of life of Ohio's residents. Serious accidents and fatalities take an emotional and economic toll on Ohio's residents. The economic costs to Ohio include lost productivity, travel delay and medical, workplace insurance and legal costs. According to the Ohio State Highway Patrol, in 2019 there were:

- About 296,000 recorded crashes on Ohio roadways
- 1,039 traffic fatalities, of which 127 were pedestrian fatalities and 22 cyclist fatalities.
- Approximately 17,000 of those crashes were related to distracted driving
- Approximately 3,200 of those crashes were related to pedestrians
- Approximately 1,400 of those crashes were related to bicycles

The number of fatalities per million miles of vehicle miles traveled (VMT) has increased in Ohio – in 2009 the number of fatalities per million were 0.92 and in 2017 that number increased to 0.99. The fatality rate in Ohio remained below the national average from 2014 to 2017, ranging from 1.08 to 1.17 fatalities per 100 million miles of VMT.

In 2019 and 2020, Governor Mike DeWine announced major initiatives to improve the safety of Ohio's roadways. As a result of the 2019 increase of the gas user fee, ODOT announced a record \$158 million annual safety budget which included an expansion of the Local Government Transportation Safety Program which will now cover 100% of eligible costs for selected highway safety projects in 2020. In addition, the Governor identified funding to improve safety at 150 dangerous intersections in Ohio as well as an additional \$10 million for the Pedestrian Safety Improvement Program.

RESILIENCE

Ohio has been a leader in developing programs to promote resiliency in roadways. ODOT has addressed its vulnerability to climate change through the preparation of an Infrastructure Resiliency Plan. The plan identifies ODOT's vulnerabilities to climate change impacts and provides recommendations for future decision making processes. ODOT also utilizes a Transportation Asset Management (TAM) system in the planning, development, preservation and construction of Ohio's transportation system. TAM allows ODOT to make fiscally responsible resource allocation decisions.

INNOVATION

ODOT promotes innovation for local jurisdictions by providing funding for research and pilot programs through the Ohio Research Initiative for Locals program.

Ohio has also established an office, DriveOhio, which is responsible for spearheading the development of autonomous and connected vehicle technology. Ohio has invested in technology to make the state's roads and highways "autonomous ready." DriveOhio has also coordinated the establishment of Smart Corridors where technologies for autonomous vehicles are being installed to allow open-road testing of autonomous and connected vehicles.



ROADS



RECOMMENDATIONS TO RAISE THE GRADE

- Continue and enhance Governor DeWine's funding initiative to improve the safety of Ohio's roadways.
- Create sustainable, long-term funding mechanisms at all levels of government to repair, improve and expand the Ohio highway transportation system and eliminate or narrow the gap between funding available and funding required. These mechanisms should include provisions to address aspects of inflation so the purchasing power of funding does not erode over time.
- Ohio is a leader in using data-based processes to inform and assess management decisions for its diverse investment in roads and bridges. It is important that these asset management systems continue and expand to all jurisdictional levels to provide the most efficient and effective use of Ohio's transportation investment.
- Road designers and owners should make strategic decisions and prioritize investments on highway transportation projects by reviewing the total life-cycle costs of project.
- Federal policymakers should fix the funding deficiencies in the Highway Trust Fund by raising the federal motor fuel tax, creating another funding mechanism to enhance or replace the federal motor fuel tax, or studying and implementing mileage-based user fees.
- The movement of freight is a significant portion of roadway traffic in Ohio. Recognizing the larger contribution freight has on the wear and tear of Ohio's roadways, consideration should be given to a user-based fee for freight movement or additional fees for permits or truck registration related to size and weight.



ROADS



SOURCES

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SCHOOLS



SCHOOLS

GRADE: C+

EXECUTIVE SUMMARY

Ohio suffers from a lack of recent data on the quality of school infrastructure. The most recent comprehensive study was ordered in 1997, and showed a need for \$10.2 billion for repair and reconstruction of existing schools. However, since then, Ohio has remained near the national average of annual operations and maintenance, spending and total school-construction capital outlay (about 5% and 11% above national average). Meanwhile, capacity is sufficient, as Ohio's student enrollment is projected to decrease by 5-12% between 2012 and 2024. In 2019, the Ohio legislature overhauled the school allocation and sent an additional \$600 million to schools over the first two years of implementation. However, spending on school infrastructure is inadequate to combat impacts of aging facilities, some of which are over 100 years old.



In 1997, the Ohio Supreme Court declared the Ohio system of funding for public education unconstitutional. A judge ruled that the state legislature should provide a more equitable means of financing education. During litigation, the school district presented evidence of inadequate funding which had led to obsolete and poorly maintained facilities, negatively impacting the quality of education and morale. Evidence presented including a survey ordered by the state legislature showed a need for \$10.2 billion for the repair and reconstruction of existing schools. In response to the litigation, the Ohio School Facilities Commission (OSFC) was established to prepare design standards, provide planning and management services, oversee maintenance and renovation projects and provide financial support starting with the poorest districts.

In 2012, OSFC was merged with the former Office of State Architect to create a new Ohio Facilities Construction Commission (OFCC) which administrates capital projects for state agencies and state-supported universities and community colleges as well as Ohio comprehensive public K-12 school construction and renovation programs. The OFCC manages various grants for cultural and educational facilities such as the School Security Grant Program, Lead Plumbing Fixture Replacement Assistance Grant Program and Community School Classroom Facilities Grant.

CONDITION AND CAPACITY

The 2017 ASCE Infrastructure Report Card indicated a \$38 billion annual gap in the nation's investment in school facilities and a resulting 24% of public schools being classified in fair or poor condition. Lack of comprehensive data on public school infrastructure is also a major obstacle in effective investment and long-term planning in school infrastructure. Despite its efforts, Ohio suffers from a lack of recent data on the quality of school infrastructure.

The State of our Schools report published in 2016 provides a comprehensive overview of the country's school infrastructure conditions and needs. Table 1 lists key indicators of Ohio's schools condition per the National Council on School Facilities report. Considering the large variability of state-to-state spending, Ohio is near the national average of annual maintenance and operations spending and total school construction capital outlay (about 5% and 11% above national average respectively). In terms of long-term debt per student, Ohio is doing better than the national average by about 31%. Ohio's student enrollment was projected to decrease by between 5% and 12% between 2012 and 2024.

TABLE 1. KEY MEASURES OF OHIO'S SCHOOL CONDITION AND CAPACITY

MEASURE	Ohio School Data	
	per student	per GSF**
Average annual M&O* spending, FY 2011–13	\$1,088	\$6.08
Average annual M&O* spending, FY 2016–18	\$1,034	\$6.07
Total school-construction capital outlay, FY 1994–2013	\$21,683	\$121
Average capital outlay, FY 2014–18 (per SY2018–19 student)	\$783	
Long-Term local debt per student, FY2018	\$7,916	
Long-term debt - FY2018 (in \$ millions)	\$13,424	
Enrollment student per year (FY2018–19)	1,695,762	
School count (2013)	3,685	
Area of facilities in millions of GSF** (FY 2013)	288.8	
Average annual M&O expending FY2014-2017 (in \$ millions)	\$1,711	
Projected M&O* expending gap (in \$ millions)	\$69	
Latest reported construction capital outlay - FY 2017 (\$millions)	\$1,449	
Recommended construction capital outlay (in \$ millions)	\$2,433	
Average annual construction cap outlay FY1994–2013 (in \$ millions)	\$1,750	
Current replacement value of state facilities (in 2014 \$ millions)	\$60,800	

* M&O = maintenance and operations

** GSF = gross square foot

OPERATIONS & MAINTENANCE, FUNDING AND FUTURE NEED

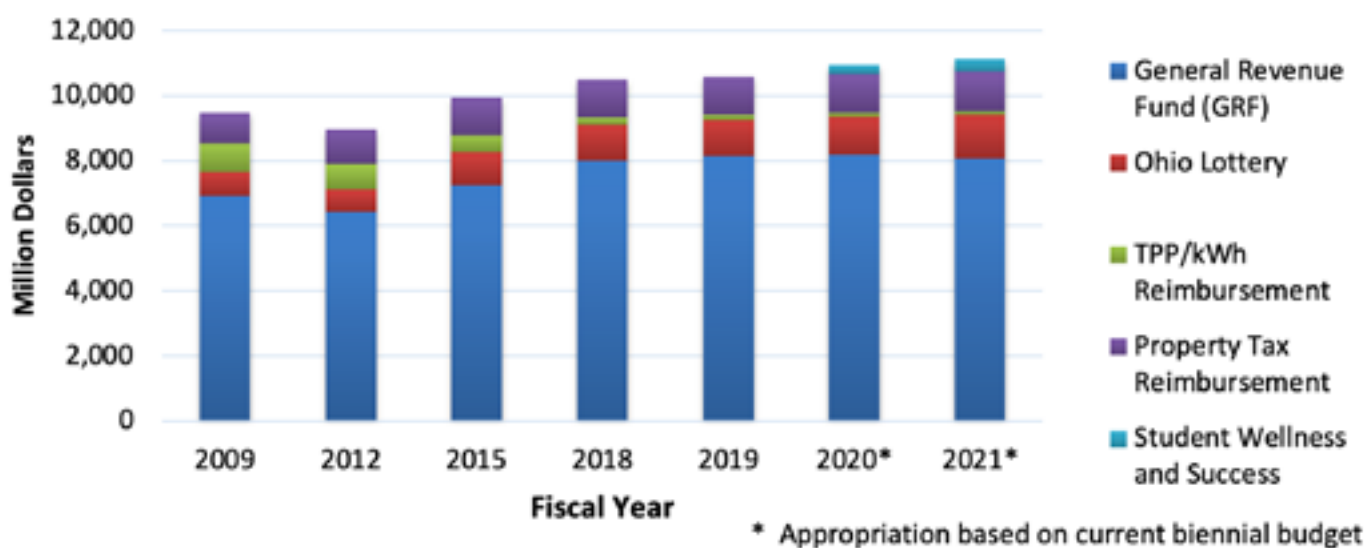
In 1825, the Ohio government established a common school system. Since these early years, property tax has been a main source of school funding. Currently, about two thirds of state property taxes fund state education. Later, sales tax and the Ohio Lottery were also considered to fund various school programs but the percentage of their contribution has changed many times over the years. A portion of funding for public schools in Ohio is provided through the federal government as well as some state funding, while the greater part is furnished from local sources in each district. The main formula for funding still relies on property taxes, but layers of financial configurations add to its complexity. Despite the progress over recent decades, a main shortcoming in school funding in Ohio has been its financing system. Efforts to overhaul the funding formula and establish a more equitable system are still ongoing.



In June 2019, H.B. 305 was introduced in the Ohio House of Representatives to overhaul the school funding system in the state. Supported by a majority of representatives, the bill aimed to create a more equitable school financing system and provide additional funding for schools in Ohio. The bill proposed phasing in the funding over six years and provide about \$660 million more in the first and second years of implementation. For comparison, the state spent around \$10.6 billion on primary and secondary education in fiscal year 2019. Though H.B. 305 aimed to resolve a major obstacle, the School Infrastructure Funding Need report published by the American Federation of Teachers in 2008, indicated a need for an additional \$9.3 billion for school infrastructure in Ohio. This report is among a few comprehensive reports providing data on the quality of infrastructure in Ohio and the nation. The required \$9.3 billion is about 45% above the national average but the data shows a significant increase from 2001, for which the funding need was reported around \$20.9 billion.

Ohio has continued to spend more on schools such that the funding for primary and secondary education has increased from about \$9.5 billion in 2009 to \$10.6 billion in 2019. Figure 1 presents an overview of school funding in Ohio in the last decade along with funding appropriations for fiscal year 2020 and 2021 per a report from the Ohio Department of Education (ODE).

FIGURE 1. OVERVIEW OF PRIMARY AND SECONDARY EDUCATION FUNDING IN OHIO



In response to the 2019-2020 COVID-19 outbreak, Ohio has announced a \$300 million cut to the state's public K-12 schools. Future cuts are likely as well and local revenue such as property tax and local income tax is expected to decrease. Federal funds such as the CARES Act have provided about \$88 million to Ohio's primary and secondary education to offset the cuts.



PUBLIC SAFETY

The OFCC School Security Grant Program has awarded 5,214 grants and has spent about \$15.7 million to enhance entrance security and emergency communication systems that provide direct communication between schools and first responders. The Lead Plumbing Fixture Replacement Assistance Grant, created in 2016, appropriates \$12 million in state funds to reimburse public and chartered nonpublic schools for sampling and assessing their drinking water and replacing deficient water facilities if needed. The Community School Classroom Facilities Grant, established in 2015, provides funding for the purchase, construction, reconstruction, renovation, remodeling or addition to classroom facilities and has provided a total of \$21 million so far.

RESILIENCE

The latest ODE Performance Audit recommends that the department institute a formal IT governance structure, process improvements and operational discipline to facilitate consistent evaluation, selection, tracking and operational oversight of all projects and initiatives. The recommendations include the design and implementation of a Disaster Recovery Strategy for ODE to ensure business continuity in the event of a disaster. Such a strategy greatly increases the resilience and resourcefulness of ODE and district schools against disasters.



RECOMMENDATIONS TO RAISE THE GRADE

- **Institute a formal technology governance structure:** This governance and management system should facilitate consistent evaluation, selection, tracking and operational oversight of all projects and initiatives and improve planning and management, especially during disasters.
- **Overhaul the current funding formula and support of new public funding streams:** Ohio has struggled to achieve an equitable and efficient funding system for decades and the need for federal and state funding sources to achieve equity is recognized now more than ever.
- **Engagement in school facilities planning:** Leaders in federal, state and local school systems need to better engage with stakeholders, taxpayers and voters to identify the gaps, priorities and needs of the education system as well as leverage all available public and private resources to modernize schools.
- **Establishment of a data and information collection system to standardize data collection and analysis at the state and local levels**
- **Modernization of schools to achieve efficient, safe and sustainable facilities**



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SOLID WASTE

B-



SOLID WASTE

GRADE: B-

EXECUTIVE SUMMARY

The diverse programs in Ohio solid waste management provide many options for the recovery, and/or disposal of solid waste. Most landfills are self-funded through waste collection fees. Disposal rates range between \$9 and \$77 per ton, with an average of approximately \$44.50 per ton. A large portion of this revenue goes directly to the operations and maintenance of the individual landfills. In 2018, Ohio received solid waste at 50 disposal facilities, yielding a combined permitted disposal capacity of over 770 M cubic yards, or, over 35 years of expected life. Residential and commercial (R/C) Solid wastes generated within Ohio totaled more than 14 M tons during 2018, equating to 6.85 pounds per person per day, greater than the 2017 national average of 4.51 pounds per person per day. Based on available data, Ohio's solid waste industry is well-performing, especially with respect to capacity, operations, public safety and resilience.



Solid waste in Ohio is comprised of many different materials including municipal solid waste (MSW), scrap tires, green wastes, industrial and residual wastes and infectious wastes. Each of these materials can be managed in separate registered facilities, licensed disposal facilities or all can be disposed at sanitary landfills. In Ohio, construction and demolition debris (C&DD) is not statutorily considered solid waste and is regulated separately; however, C&DD can be disposed of in sanitary landfills. Industrial solid waste (ISW) is generated by manufacturing or industrial operations. In Ohio, all ISW landfills are captive landfills, meaning the owning company is the only company that can use the facility.

Residual solid waste (RSW) landfills can accept solid wastes from seven specific industrial categories, including coal burning operations and cement operations. The waste streams from these industries are typically homogeneous and are generated in large quantities.

CAPACITY AND CONDITION

Residential and commercial solid wastes generated within Ohio totaled more than 14 million tons during 2018, equating to 6.85 pounds per person per day. This is greater than the 2017 national average of 4.51 pounds per person per day. Generally, waste disposal quantities are variable in Ohio and ranged between approximately 17.5 million and 21 million tons of waste disposed yearly between 2008 and 2018. During 2018, Ohio was a net importer of solid waste receiving more than 5 million tons of waste from out-of-state while exporting approximately 1.5 million tons to adjacent states. The amount of imported waste appears to be trending upward. From 2010 to 2018, imported wastes increased by 33% and exported wastes rose by 6% percent.

In 2018, Ohio received solid waste at 50 disposal facilities. The combined permitted disposal capacity of these facilities was over 770 million cubic yards, or, over 35 years of expected life. This represents a healthy permitted capacity for future disposal. Of the 50 landfills licensed in 2018, 36 are permitted as sanitary landfills and the remaining 14 are ISW or RSW landfills.

During 2018, licensed C&DD landfills totaled 40 and accepted 3.82 million tons for disposal. C&DD landfills have substantially reduced in number from 2010. Ohio promulgated new laws which upgraded requirements for C&DD facilities and increased development and operating costs. The impacts of these requirements brought about the closure of C&DD landfills which thus directed these wastes to sanitary landfills. C&DD waste volumes rose by 162% at sanitary landfills from 2010 to 2018.

During 2018, approximately 29.7% – or 4 million tons – of residential and commercial solid waste was reduced or recycled excluding unsuitable materials. The top two recovered materials by percent in 2018 were yard waste at 31% and corrugated cardboard at 19%. With regards to ISW, approximately 50.24% – or 8 million tons – was reduced or recycled. As with the residential and commercial sector, most of the ISW recycled consisted of a small number of materials. The top two materials by percent were metals at 52% and flue gas desulfurization product.

FUNDING AND FUTURE NEED

Most landfills are self-funded through waste collection fees. Disposal rates range between \$9 and \$77 per ton, with an average of approximately \$44.50 per ton. A large portion of this revenue goes directly to the operations and maintenance of the individual landfills. As part of these rates, there are several fees applied to each ton of solid waste disposed. A state fee is applied to each ton of waste disposed. Each solid waste management district applies certain fees based on the source of the waste, including in-district, out-of-district and out-of-state fees. Finally, there are health department and host community fees. These fees can amount to 30% or more of the total disposal charges.

As it relates to proper closure and maintenance of closed landfills, all landfills are required to fund financial assurance programs including funds earmarked for capping, monitoring and maintaining the facility. Ohio offers a variety of grant programs to encourage citizens to reduce, reuse and recycle solid waste. These include, but are not limited to:

- Academic Institutional Grants
- Community Recycling and Litter Prevention Grants
- Scrap Tire Recycling and Management Grants
- Recycling Market Development Grants

Even with this funding source in place, there is typically little financial incentive for individuals or small businesses to recycle solid waste materials. Funding is also needed to expand educational programs to communicate what can be reused and recycled and how citizens can lower their consumption and total waste output. This is complicated by the fact that China began turning away recycled waste from the United States in 2018. This leaves a gap in the market and creates opportunities for companies to begin to increase the amount of recycling facilities. Moving forward, decreasing recycling costs, or creating better incentives to recycle, could increase the state's diversion rates.

Funds are needed to make recyclable materials more marketable, to find innovative ways to manage MSW for a useful purpose and to create new technologies that provide alternative pathways for solid waste rather than entering a landfill. Funding mechanisms are also needed to help transition citizens, local governments and the waste industry into recognizing MSW as a resource to be utilized.

OPERATIONS AND MAINTENANCE

Solid waste in Ohio is regulated by the OEPA. The Ohio Administrative Code provides design guidance and regulates key items at these facilities including siting and location restrictions, leachate management, stormwater management, environmental monitoring (i.e. groundwater, landfill gas, etc.), and closure and post-closure care.

Disposal planning and recycling support is also provided by solid waste management districts (SWMD). Each county in Ohio is required to be in a SWMD. A SWMD is a local government agency that oversees management of solid waste, including recycling. In 2018, there were 52 SWMDs in Ohio. Of those, there are 37 single-county SWMDs and 15 multi-county SWMDs. The main purpose of the SWMD is to prepare, ratify and implement a solid waste management plan. This plan is the SWMD's strategy for achieving the recycling goals of the state solid waste management plan and meeting the solid waste disposal needs of constituents.

PUBLIC SAFETY

The primary oversight and permitting of solid waste and C&DD facilities is performed by the OEPA with secondary oversight by OEPA-approved local health departments. The onsite operations are internally and externally monitored and require routine reporting to the OEPA. Facilities that are determined to be noncompliant with the conditions outlined in their permits are subject to penalties including fines or potentially forced closure.

Each owner or operator of a solid waste transfer or sanitary landfill facility in Ohio reports to OEPA annually. Their annual report summarizes the waste accepted at the facility during the year, including how much, what types were disposed and where the waste originated. OEPA compiles this data into a facility data report.



RESILIENCE AND INNOVATION

Ohio is generally considered low risk for geological and meteorological natural hazards. The most impactful events are floods and tornados. Solid waste landfills in Ohio are designed to mitigate the impact from significant rain events and earthquakes, including detailed siting studies, subsurface investigations, stormwater management system designs and slope stability analyses.

Innovation in Ohio exists primarily in response to regulatory requirements. Landfill space is abundant and relatively low in cost as compared to other areas throughout the U.S. Ohio's vast landfill capacity and low cost creates economic difficulty for new innovative waste minimization solutions. Ohio has 32 single stream material resource recovery facilities (MRFs) for recyclables, 49 dual stream MRFs, 2 Mixed Waste Processing Facilities, 15 wood processing facilities, 12 paper processing facilities, 36 scrap yards, 8 plastic processing facilities, and 3 glass processing facilities. Ohio has no waste-to-energy (WTE) facilities.

Ohio's compost program uses the nomenclature of Class 1 for MSW derived compost, Class 2 for sewage sludge, food, and green waste compost, Class 3 for food and green waste compost and Class 4 for green waste only compost. Ohio has 28 Class 2 compost facilities, 48 Class 3 compost facilities, and 246 class 4 compost facilities. Ohio formerly had 1 Class 1 compost facility but was retired in 2015.

Many Ohio sanitary landfills operate landfill gas extraction systems to maintain compliance with the Federal Clean Air Act. While the purpose of the gas systems is to prevent migration of gas off site and reduce greenhouse gases, some of the systems also generate electricity, upgrading the gas to pipeline quality gas, or creating Renewable Natural Gas.





SOLID WASTE



RECOMMENDATIONS TO RAISE THE GRADE

- **Waste Reduction:** Improve recycling education for the public, especially as it relates to excluding unsuitable items from recycling. Additionally, more education can be provided to the public regarding the use and reuse of materials in a sustainable way throughout the lifecycle of the material.
- **Waste Reduction:** Implement local financial incentives, such as reduction in monthly household disposal costs for recycling.
- **Innovation:** Create a rapid review and testing program within the OEPA to support development of new and innovative technologies.
- **Alternative Waste Usage:** Increase funding for research and development of alternative uses of waste, including waste-to-energy and additional markets for recyclable materials such as glass.

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The authors acknowledge the assistance from the Ohio Environmental Protection Agency (OEPA) in the collection of data for this ASCE report.



STORMWATER



STORMWATER

GRADE: D+

EXECUTIVE SUMMARY

To meet the needs of Ohio's nearly 12 million residents, the state has an extensive portfolio of stormwater infrastructure built to protect public health and the environment. Unfortunately, it is aging and undersized. A leader in the nation, Ohio has approximately 109 stormwater utilities that charge an average of \$3.50 monthly, less than the national average of \$5.85. While nearly 75% of the state's stormwater infrastructure funding comes from state and local sources, state infrastructure spending ranks 41st in the nation. Ohio currently spends between \$400 to \$600 million annually on its stormwater infrastructure, but Ohio still needs at least \$600 million in annual funding to keep pace with the estimated \$1.2 billion required to manage both existing infrastructure and future needs related to predicted climate change impacts.

INTRODUCTION

The state of Ohio is approximately 44,825 square miles in size. It drains into two major drainage basins: Lake Erie and Ohio River. In addition, Ohio has

- Over 760 square miles of impervious area
- 150,000 miles of streams
- 60,000 miles of storm sewers
- 792 square miles of wetlands

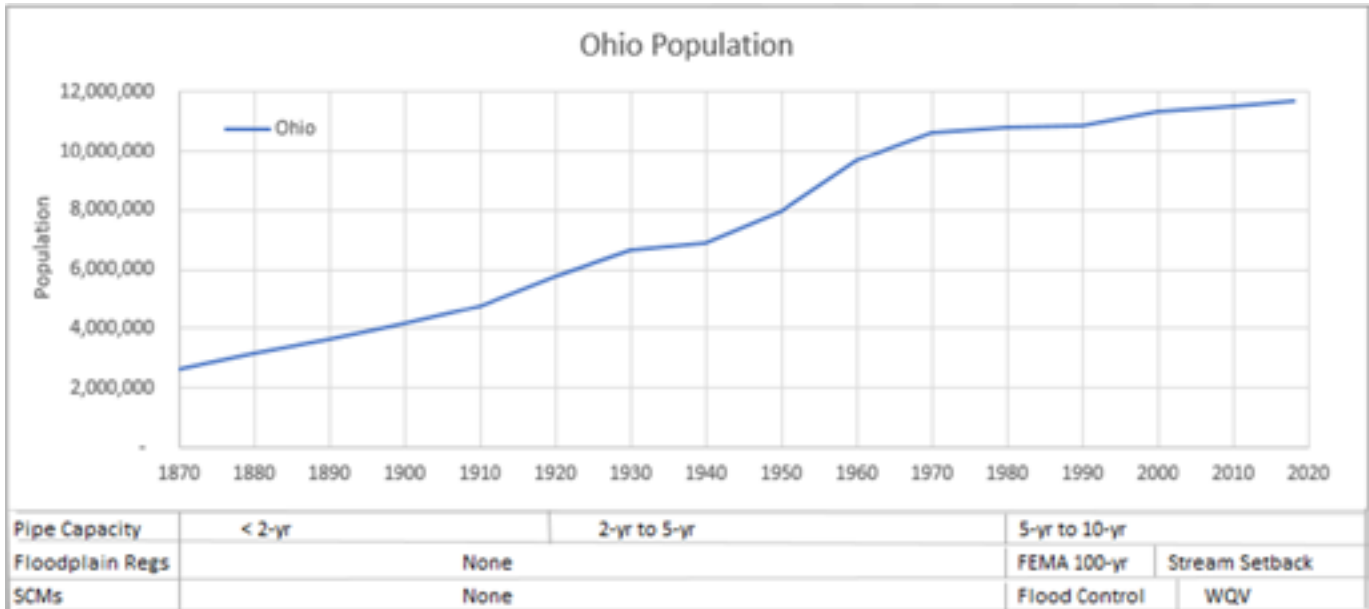
Ohio's 55 Municipal Separate Storm Sewer (MS4) regulated areas cover only 7% of the land but they include nearly 73% of the State's population and impervious area.

Stormwater originates from rain and snow melt which results in surface runoff if it does not soak into the soil, evaporate or become stored on land. If not properly managed, surface runoff can threaten non-stormwater related infrastructure like building, transportation and utilities. Impervious areas are a major cause of flash flooding, erosion and structural issues, because nearly all rainfall that lands on impervious area turns into surface runoff. As challenging as it may be to manage the current stormwater infrastructure (SWI), significantly more SWI is still needed to manage untreated impervious area constructed before today's stormwater management standards were set.

When a community's population increases, new infrastructure is built to support the increased population and it is designed to meet the standards established at that time. Stormwater infrastructure's useful life ranges between 30 and 100 years before it needs to be replaced. As can be seen in Figure 1, most of Ohio's population increase occurred prior to 1980 and most of that infrastructure still exists today. The stormwater standards prior to 1980 focused on sizing a pipe's capacity to collect site runoff from impervious area and quickly discharge it off-site. No stormwater control measures (SCMs) were required to manage the increased runoff from impervious area on-site, and no restrictions existed to prevent building within a stream's 100-year floodplain. Given today's standards are not retroactive, and accounting for new development and retrofitting, over 80-percent of Ohio's impervious area may still not have any flood control storage or water quality volume. In addition, over 200,000 structures exist in the 100-year floodplain, contributing to flooding and water quality problems. Consequently, the number and severity of both flooding and water quality problems within a watershed can generally be contributed to the percentage of developed areas that do not meet today's standards.



FIGURE 1: OHIO'S POPULATION AND GENERAL STORMWATER MANAGEMENT FROM 1870 TO 2018

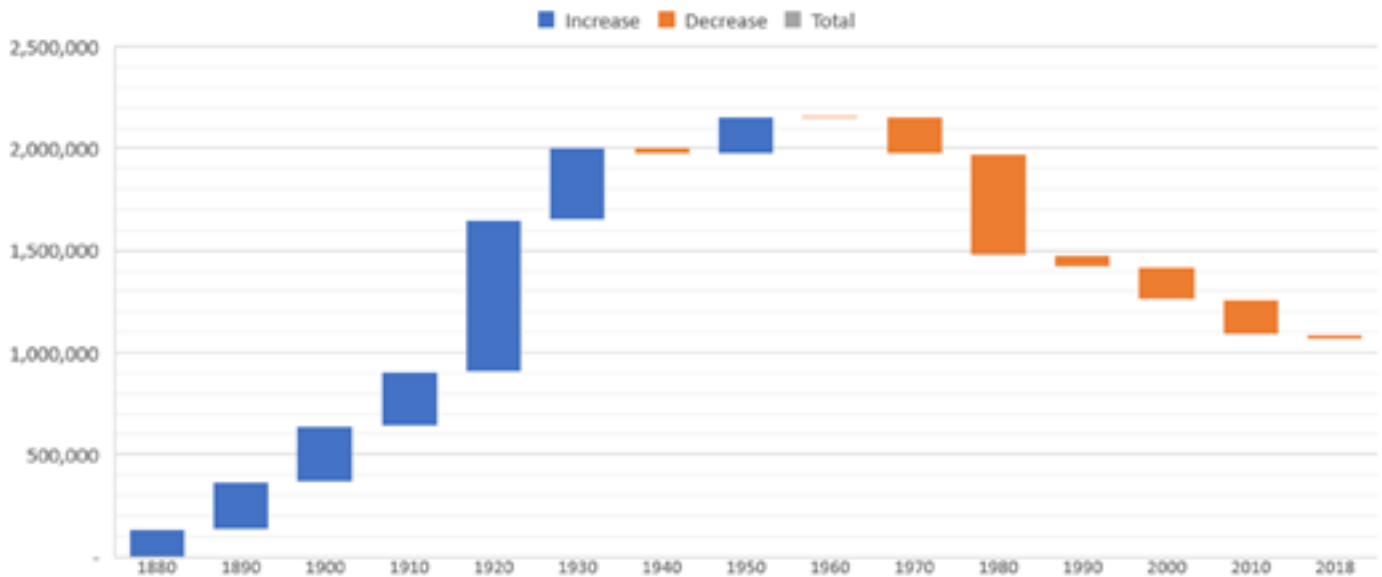


CONDITION AND CAPACITY

The capacity of Ohio's existing stormwater infrastructure hinders it from meeting today's standards. While storm sewers built today are typically sized to handle a 10-year storm without surcharging, most of Ohio's existing storm sewers were built when the design level was for a 2- to 5-year storm event. According to the Ohio Environmental Protection Agency (OEPA) 2018 Construction General Permit standards, Ohio's estimated 760 square miles of impervious area requires a water quality volume of almost 488 million cubic feet. Based upon permits approved by the OEPA, over 80% (390 million cubic feet) of water quality volume and 1.6 billion cubic feet of flood control storage may not exist to meet today's standards. Consequently, Ohio may be missing up to \$20 billion in additional SCMs to manage untreated impervious area.

Finding space for SCMs in urban areas is challenging due to space limitations. Green Infrastructure can help manage runoff from impervious areas at its source, and end-of-pipe treatment can help manage runoff before discharging to a stream.

**FIGURE 2: MAJOR OHIO CITIES WITH DECLINING POPULATIONS
(AKRON, CANTON, CINCINNATI, CLEVELAND, DAYTON, TOLEDO, YOUNGSTON)**



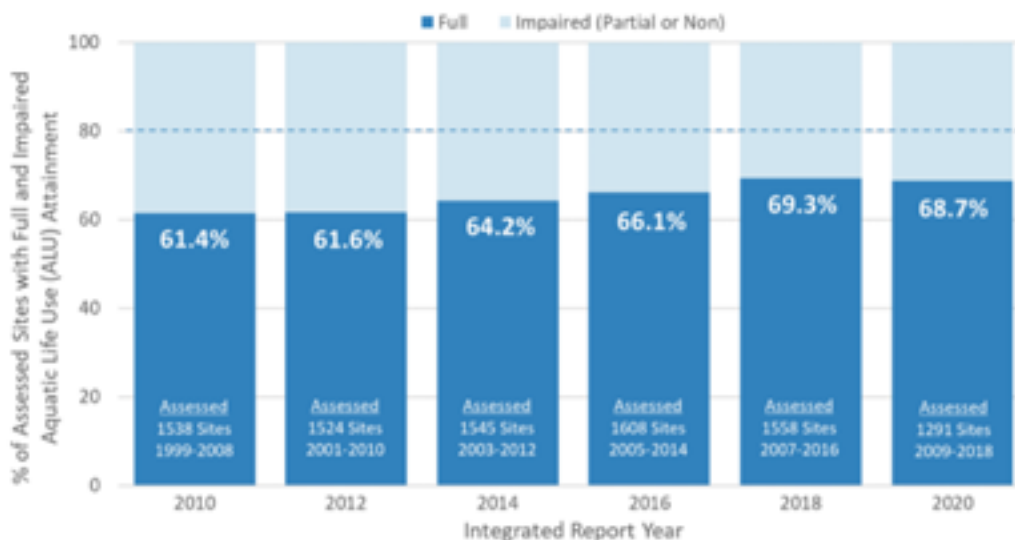
Many cities in Ohio experienced an economic and infrastructure boom over 75 years ago, and now the aging infrastructure is close to – or past – its useful life, requiring replacement. Furthermore, many of Ohio’s largest communities have lost a significant portion of their population (Figure 2) leading to a greater financial burden for today’s tax base to maintain stormwater infrastructure.

The Ohio Department of Transportation (ODOT) currently inspects and maintains over 95,000 culverts and approximately 45,000 bridges. Available condition ratings indicate both bridges and culverts are generally in good condition with an average score of 6.8, where 1 equals poor and 9 equals excellent.

According to OEPA’s 2020 Integrated Water Quality Monitoring and Assessment Report, approximately 69% of assessed wading and principal streams met full attainment for aquatic life use (Figure 3). However, on average 59% of Ohio’s waterways are impaired due to land-based practices. Not until 2003 did new development in Ohio require SCMs to include water quality volume to help collect pollutants from impervious areas. Therefore, impervious areas constructed prior to 2003 may today be contributing pollutants to Ohio’s waterways where by today’s standards that would be managed by an SCM.



FIGURE 3: STATUS AND TREND OF AQUATIC LIFE USE 80 PERCENT BY 2020 GOAL FOR WADING AND PRINCIPAL STREAM AND RIVER SITES IN OHIO



FUNDING AND FUTURE NEED

Stormwater utilities are considered the most reliable method to fund stormwater management programs since they are founded upon a specific customer base, user fees and a rate tier structure. Ohio has approximately 109 stormwater utilities, ranking the state 6th in the U.S. The average monthly fee is approximately \$3.50, which is below the national average of \$5.85.

According to a 2019 report by the Center on Budget and Policy Priorities, state and local governments account for nearly 75% of public infrastructure funding. However, state and local spending on infrastructure is at historic lows. In 2016, Ohio's capital spending of 8.5% ranked it 41st in the nation. Ohio and local spending on all infrastructure has decreased from 3% of Ohio's annual budget in the 1960s to below 2% in 2018.

Ohio's SMPs need over \$1.2 billion per year to retroactively meet current standards and become more resilient to today's more extreme storms. Compared to available local, state, and federal funding, over \$600 million in additional annual funding is needed to retroactively meet today's flooding and water quality standards.

According to the 2019 WEF Report National MS4 Needs Assessment Survey Results, over 60-percent of responses (includes Ohio MS4 permittees) noted aging infrastructure as an important challenge. Approximately 60-percent of the responses also ranked lack of funding or availability of capital as an important stormwater challenge, and an additional \$7.5 billion in annual funding is needed nationally to comply with NPDES requirements. Phase I communities, Phase II, and State responses recommended a 52 percent, 136-percent, and a 12 percent annual increase in funding to support future needs of infrastructure, respectively.

OPERATIONS AND MAINTENANCE

Stormwater systems have public and private owners that implement individual O&M programs, leading to mixed results. A proactive O&M program is a valuable part of any SMP, since it can detect and resolve small problems before becoming bigger, oftentimes more expensive problems. Knowing where flood prone areas are located and keeping them free of debris can help mitigate flooding during a storm event.

Ohio has 2,860 Private Industrial Stormwater NPDES Permits, which are regularly monitored. However, most private SWI is not on industrial property, not regulated, and more prone to sporadic O&M or failure. Some private detention basin owners simply focus on aesthetics and overlook structural or storage problems, which can lead to the basin not functioning properly and failing more frequently.

A computerized maintenance management system can help maximize the longevity of assets, increase staff efficiency, and support predictive analysis and prevent maintenance. Developing Key Performance Indicators to assess sediment and debris accumulation, structural integrity, and hydraulic performance can help identify problems and support root cause analysis and corrective actions.

PUBLIC SAFETY

Widespread flooding occurred on February 25, 2018 when the Ohio River crested 8-feet above flood stage near Cincinnati, resulting in one death, 10,449 customers without power, and \$44 million worth of damages across 18 counties. Excessive flooding also led to three reported deaths in Ohio in 2019 and two deaths in March 2020.

According to NOAA, Ohio incurred over \$14 billion in storm related damage between 1980 to 2019. FEMA reports on average, 3-inches of flooding results in \$30,000 of damage, and one foot of flooding results in \$72,000 of damage to a typical house. ODNR noted over 200,000 structures exist in the Federal Emergency Management Agency (FEMA) Special Flood Hazard Area (SFHA) but only 12 percent have flood insurance. Nearly 53 percent of the structures in the SFHA exist in the areas with stormwater permits.

According to FEMA, structures built to the minimum National Flood Insurance Program (NFIP) standards experience 80 percent less damage and avoid \$1 billion in losses each year. To encourage and reward local floodplain management, the Community Rating System (CRS) was created and reduces NFIP insurance rates when a local community adopts regulations that meet specific standards. Over 600 municipalities, and 86 counties across Ohio participate in the NFIP. However, most municipalities only get the minimum (5%) discount on insurance, when up to a 45 percent discount is available.

RESILIENCE

Many Ohio communities and agencies utilize the NOAA Atlas 14 recurrence rainfall values (published in 2004) to size SWI. Using the last 20-years of data, NOAA and NWS suggest the NOAA Atlas 14 values may be underestimating flood recurrence rainfall by up to 20 percent (See Figure 4) today and another 20-percent over the next 20-years. Consequently, Ohio's extreme rain events are becoming more frequent and severe due to climate change, and they are predicted to become worse in the future. Consequently, today's 10-year rainfall values may be closer to the NOAA Atlas 14 published 25-year values.



Table 1 lists the top 12 Ohio Counties with repetitive losses through 2018, per Ohio EMA. Ohio communities and the Ohio EMA are working together to develop County-level Local Hazard Mitigation Plans (LHMPs), so they are eligible for federal disaster assistance and mitigation funds. Belmont County noted in their 2013- 2018 LHMP a 100-year flood scenario that estimated nearly 15,000 structures at risk at a value of nearly \$2 billion in losses. Jackson County noted in their 2017 Natural Hazards Mitigation Plan that \$660 million of structures may be at risk, including 24 essential facilities (fire stations, hospitals, police stations, and schools).

FIGURE 4: NOAA/NWS HEAVY PRECIPITATION TREND

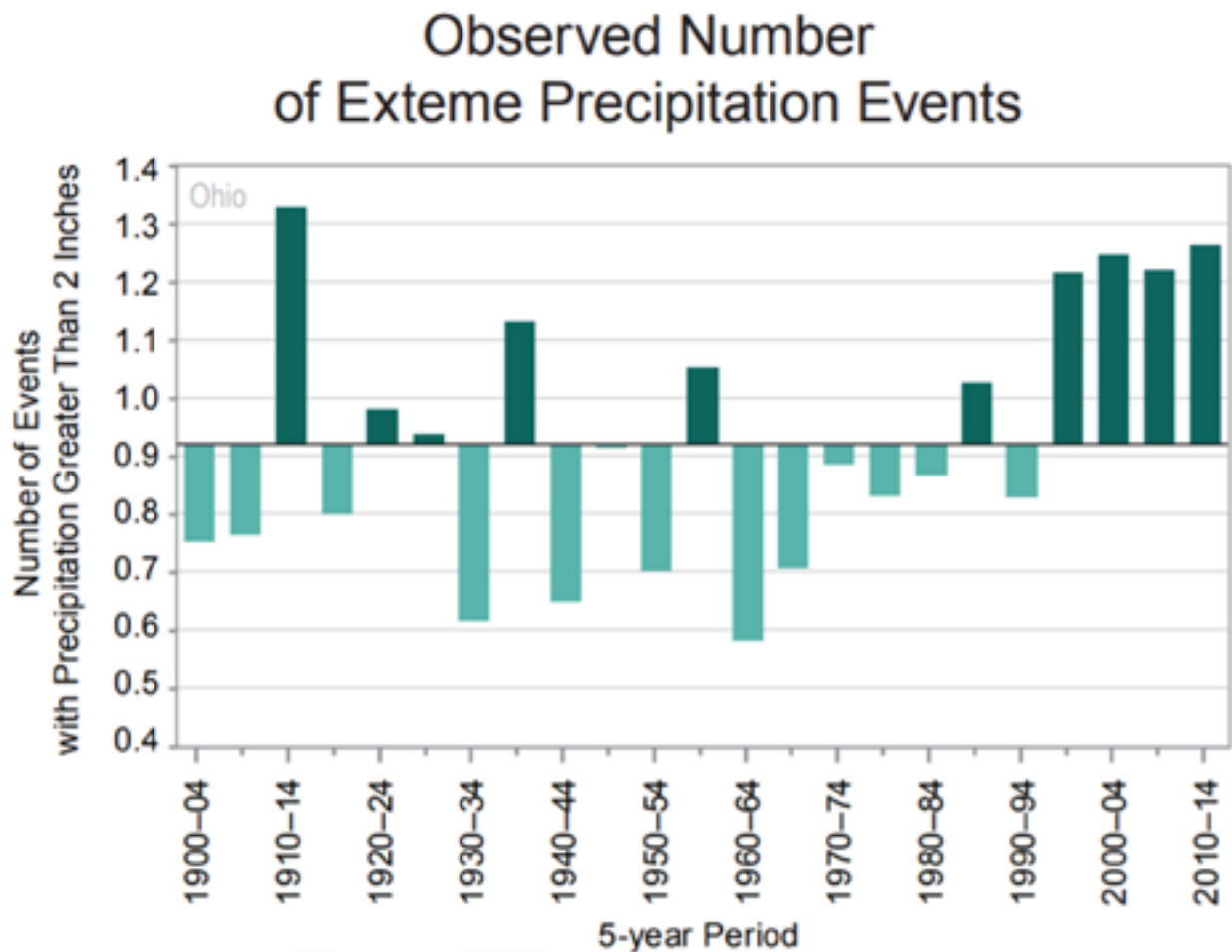




TABLE 2: TOP 12 OHIO COUNTIES WITH REPETITIVE LOSSES

RANK	COUNTY	LOSS STRUCTURES			Losses	Total Paid
		TOTAL RL/SRL STRUCTURES	REPETITIVE LOSS STRUCTURES	SEVERE REPETITIVE LOSS STRUCTURES		
1	Hancock	266	221	45	835	\$ 19,786,550
5	Cuyahoga	148	117	31	557	\$ 21,638,500
2	Washington	202	183	19	510	\$ 11,975,540
4	Hamilton	141	123	18	437	\$ 12,824,763
3	Ottawa	130	125	5	375	\$ 3,291,518
6	Erie	99	84	15	331	\$ 3,533,345
8	Lucas	80	72	8	227	\$ 2,753,382
9	Lake	78	71	7	225	\$ 3,369,267
7	Summit	89	84	5	222	\$ 5,517,466
10	Franklin	70	68	2	164	\$ 2,123,454
11	Belmont	61	59	2	146	\$ 2,604,347
12	Guernsey	57	55	2	139	\$ 4,874,974
TOTAL		1,421	1,262	159	4,168	\$ 94,293,107

INNOVATION

A Northeast Ohio SMP is utilizing various monitoring technologies (e.g., real time controls, stream monitors, trail cameras) to optimize storage at SCMs, warn communities about measured flooding, and develop time lapse videos of storm events to support O&M efforts, model calibration, and public education.

A Northeast Ohio SMP is utilizing asset management to estimate the probable annual risk associated with structural and flooding problems to support construction and O&M project prioritization.



RECOMMENDATIONS TO RAISE THE GRADE

- Upgrade existing SWI to retroactively meet today's Federal, State, and local stormwater management standards, which includes constructing new SCMs to manage site runoff from any impervious area that currently exists today.
- Develop resiliency plans to account for changes to extreme storm events due to climate change, which currently indicates rainfall intensity has increased by up to 20-percent over the last 20-years and may increase by an additional 20-percent.
- Invest in a GIS-based computerized maintenance management system that tracks the function of streams, infrastructure, and structurally or hydraulically threatened buildings, transportation, and utility assets.
- Increase local, State, and Federal Funding to advance SMPs and explore opportunities to leverage non-traditional funding sources (e.g., parks) where project goals are complimentary.
- Develop an Urgent Storm Standard Operating Procedure that includes Pre-Storm Planning, Storm Tracking, Post-Storm Field Response, Post-Storm Field Recovery phase and communication trees.
- Similar to ODOT's Transportation Information Mapping System that shows the current structural condition of culverts and bridges (See Figure 5), improve public education and information sharing by developing a state-wide website with live links to Ohio SMPs to track existing stormwater infrastructure, problems, projects, and budgets.

FIGURE 5: ODOT CULVERTS AT AN UNACCEPTABLE STRUCTURAL CONDITION (RATINGS 1 TO 4) IN SOUTHWEST OHIO





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TRANSIT



TRANSIT

GRADE: D

EXECUTIVE SUMMARY

In Ohio there are 27 urban and 34 rural transit systems serving 83 of Ohio's 88 counties. These systems provided 100.6 million rides in 2018 – a 25% decrease in the last 15 years. In 2018, 636 of 3,559 (17.9%) revenue vehicles exceeded their useful lives – a 55% increase over the 408 of 3,469 (11.8%) vehicles with this status in 2003. This coincides with the dramatic and long-term lack of state funding for transit that has decreased as follows:

- \$42.3 million in 2000
- \$18.3 million in 2005
- \$15.8 million in 2008
- \$7.3 million in 2013
- \$6.5 million in 2018

In 2018, transit received only \$6.5 million or \$0.57 per person ranking Ohio 42nd in state per capita funding. By contrast, the average state provided \$58.69 per capita – more than 100 times that of Ohio.

CONDITION AND CAPACITY

In 2018, Ohio's transit agencies were required by the Federal Transit Administration (FTA) to create Transit Asset Management Plans (TAMP). This plan inventories existing assets and sets goals for asset condition in four areas:

- Percent of revenue vehicles exceeding their useful life
- Percent of equipment exceeding their useful life
- Facilities below a 3.0 rating on a 5-point scale
- Percentage track with slow zones for rail lines

TAMP plans also include goals for each applicable category and detail each agency's inspection and condition documentation.

Given that the TAMP is a new requirement, trend data is not readily available. However, the annual ODOT Status of Public Transit report does list all the revenue vehicle types and first year of service for the state's 61 transit agencies. This provides some trend data for revenue vehicles exceeding their useful life. Data from 2003, 2007, 2013 and 2018 is shown in Table 1.

TABLE 1 – OHIO URBAN AND RURAL REVENUE VEHICLE CONDITIONS

	2003			2007		
	Revenue Vehicles	Exceed Useful Life	%	Revenue Vehicles	Exceed Useful Life	%
Urban	2933	358	12.2%	2947	456	15.5%
Rural	536	50	9.3%	505	38	7.5%
Total	3469	408	11.8%	3452	494	12.0%

	2013			2018		
	Revenue Vehicles	Exceed Useful Life	%	Revenue Vehicles	Exceed Useful Life	%
Urban	2808	407	14.5%	2971	564	19.0%
Rural	506	42	8.3%	588	72	12.2%
Total	3314	449	13.5%	3559	636	17.9%

Over the past 15 years the number of revenue vehicles exceeding their useful lives has grown steadily from 408 (11.8%) in 2003 to 636 (17.9%) in 2018. This growth in older vehicles exceeding their useful life has occurred both in the urban and rural systems and reflects the funding pressures facing transit throughout the state.

As the data above shows, the number of revenue vehicles in Ohio has grown over the last 15 years from 3,469 to 3,559, but the transit ridership has dropped 25% from 134 million in 2003 to 100.6 million in 2018. As shown in Table 2, the vast majority of ridership is concentrated in Cleveland, Cincinnati and Columbus (known locally as the 3Cs) accounting for 72% to 74% with the eight largest urban systems (the 3Cs, plus Akron, Canton, Dayton, Toledo and Youngstown) accounting for 92% to 95% of all rides.

TABLE 2 – OHIO AND URBAN TRANSIT RIDERSHIP DATA (MILLIONS)

	2003	2007	2013	2018
Ohio Total	134.0	129.9	115.1	100.6
Akron	5.8	5.3	5.4	5.1
Canton	1.8	2.2	2.7	2.5
Cincinnati	23.9	22.7	17.0	14.0
Cleveland	59.3	59.5	49.2	39.6
Columbus	15.6	14.8	18.8	19.2
Dayton	11.6	10.5	9.7	9.1
Toledo	4.3	4.6	3.5	2.6
Youngstown	1.1	1.2	1.5	1.5
8 Large Urbans	123.4	123.8	107.8	93.6
3 C's	98.8	97.0	85.0	72.8

The ridership losses shown above highlight the transit impacts of urban sprawl and the de-densifying of Ohio's largest cities. Ohio's population has been stagnant over this period with Columbus as the only urban area growing in the state. This has supported Columbus's ridership growth of 23.0%. Canton and Youngstown, areas that recently noted ridership gains, have now either leveled out or decreased in the last five years.

FUNDING AND FUTURE NEED

Transit funding in Ohio is a combination of Federal, State and local funding. It is used for both operations and capital spending. Depending on the funding source, it is often restricted to either operating or capital spending exclusively. The 61 different transit agencies are funded via a number of sources including a combination of:

- County sales tax
- County property tax
- Local income tax
- City/county general funds
- Farebox revenue
- Service contracts
- Advertising
- Donations

State-level funding for transit comes in two forms – the State of Ohio General Revenue Fund and ODOT Flex Funds, the latter of which is derived from federal gas tax funds that are designated within the ODOT budget for transit. The ODOT Office of Transit controls and allocates a portion of those funds by formula through the Urban Transit Program to agencies and allocates another portion through competitive grants known as the Ohio Transit Preservation Program.



Federal funds are allocated by formula based upon population and ridership. They are administered through the FTA and provide a base level of funding. Federal funds also are available through several competitive grant programs through both FTA and the U.S. Department of Transportation (USDOT) that provide one-time funds as well as a variation of funding for capital projects and vehicle replacement programs. For the rural transit agencies, the ODOT Office of Transit administers and distributes their federal funds and are used for both operating and capital projects. For the urban agencies federal formula funds are used to supplement operating budgets for preventative maintenance and for capital projects.

National Transit Database (NTD) time series data for operating, capital and total transit funding for 2003, 2008, 2013 and 2018 are shown in Table 3. Local and other funding sources have increased approximately 3% per year over the last 15 years, keeping up with inflation. During the same period, state funding has decreased by 30% and federal funding has fluctuated, increasing slightly over 1% per year.

TABLE 3 – NTD OHIO TRANSIT FUNDING SOURCE DATA (MILLIONS)

FUNDING SOURCE	2003	2008	2013	2018
Operating				
Local/Other	\$427.1	\$460.1	\$552.4	\$692.7
State	\$7.6	\$18.5	\$8.6	\$10.3
Federal	\$76.4	\$88.8	\$102.1	\$112.7
Total	\$511.1	\$627.4	\$663.1	\$815.7
Capital				
Local/Other	\$23.5	\$63.2	\$62.3	\$78.3
State	\$7.6	\$8.7	\$0.1	\$0.4
Federal	\$95.7	\$103.5	\$119.0	\$89.8
Total	\$126.8	\$175.4	\$181.4	\$168.5
All Funding				
Local/Other	\$450.6	\$583.3	\$614.7	\$771.0
State	\$15.2	\$27.2	\$8.7	\$10.7
Federal	\$172.1	\$192.3	\$221.1	\$202.5
Total	\$637.9	\$802.8	\$844.5	\$984.2

A review of the American Association of State Highway and Transportation Officials (AASHTO) Survey of State Funding for Public Transportation shows that Ohio's State funding for transit has decreased from \$42.3 million in 2000, \$18.3 million in 2005, \$15.8 million in 2008, \$7.3 million in 2013, and \$6.5 million in 2018. (6,7,8,9) This does differ slightly from the NTD data due to variation in fiscal year and calendar year reporting. As shown in Table 4 the trend of Ohio's decreased state funding, significantly lower state to federal funding ratio compared to other states and low ranking in funding per capita shows that Ohio has lagged other states for a number of years. The passage of House Bill 62 in 2019 had increased state GRF funding to \$70 million in State Fiscal Years 2020 and 2021, but due to COVID-19 those funds have already been reduced to \$66.8 million and \$56.0 million.

TABLE 4 – AASHTO FEDERAL AND STATE/D.C. TRANSIT FUNDING DATA

	2000	2005	2008	2013	2018
United States					
State to Federal Funding %	135%	129%	94%	161%	149%
Average State Funding per Capita	\$26.57	\$31.79	\$42.50	\$54.28	\$58.69
Ohio					
State to Federal Funding %	32.0%	10.9%	8.6%	4.3%	3.1%
State Funding per Capita	\$3.75	\$1.60	\$1.37	\$0.63	\$0.56
State Ranking	25th (est.)	30th	40th	37th	42nd

In 2015, ODOT's Statewide Transit Needs Study documented the future needs for both operating and capital funding to preserve existing services as well as additional funding for system expansion in order to increase ridership. In 2014, the unmet operating need was \$97 million with annual operating funding needed to grow to \$1.3 billion by 2025. In 2014, the capital project backlog totaled \$274 million primarily for vehicle replacement with an additional \$1.8 billion needed from 2015 to 2025 to achieve a systemwide state of good repair. The report also noted a need for an additional \$2.1 billion from 2015 to 2025 to expand vehicle fleets and operating systems to meet the anticipated additional ridership demand. With the lack of new state and federal funding since the study was published, these future funding needs have only increased.

OPERATIONS AND MAINTENANCE

Ohio's transit agencies must balance the amount of service provided to match their available operating funds. They also must maintain a greater volume of older vehicles that have exceeded their useful lives and require significantly more time and money than newer vehicles to remain in service. Those added maintenance costs take funds away from providing service. This is impacting both the urban and rural agencies as shown above by the increasing number of vehicles exceeding their useful life and decreases in system ridership.

Several systems are re-evaluating their route networks for efficiency. They are also improving their communication networks, real-time vehicle tracking capabilities and utilizing data analytics to improve services.

PUBLIC SAFETY

Ohio's public transit systems provide a much safer travel alternative to Ohio's freeway and roadway networks. According to the NTD, from 2008 to 2018 there were 3,362 injuries and 42 fatalities on Ohio's 61 transit systems. That's an average of 302 injuries and 3.8 fatalities per year. The injuries have trended lower with a high of 379 in 2008 and a low of 225 in 2018 with 2016, 2017 and 2018 – all below the 11-year average. The fatalities have fluctuated around the average with a high of 7 in 2012, a low of 1 in 2010, and 5, 4, and 2 in 2016, 2017, and 2018. This is a positive trend. In 2018, the ridership was 100.6 million rides with over 464 million passenger miles traveled for an injury rate of 0.48/million miles and fatality rate of only 0.004/million miles.



RESILIENCE

Ohio transit agencies are addressing resiliency in two ways – first as a modal alternative within the transportation network and second to provide reliable and continuous service during extreme weather events (snow, ice, wind, flooding or tornados) and manmade disasters.

The large urban agencies have been working with ODOT as well as media to communicate transit as a modal alternative during large-scale highway construction to mitigate delays. Similar efforts have also been included during large scale civic and sporting events to minimize traffic congestion on the highway and roadway networks.

Regarding weather and other disruptions, the transit agencies have been hardening their passenger and operating facilities in response threats of terrorism, adding addition emergency communications and backup electricity generators in response to power outages, and strengthening Emergency Operations Plans to provide continuity of service.

INNOVATION

Ohio's transit agencies had been lagging in the areas of technology and innovation. However, in the last five years a number of exciting initiatives are being developed and implemented. Examples include:

- Columbus won the USDOT SMART City Challenge which has resulted in the testing of an autonomous shuttle vehicle, development of transit related apps, and use transit to provide transportation to address health care disparities.
- Dayton has piloted its Ridetime program where the Greater Dayton Regional Transit Authority is the lead agency coordinating Mobility as a Service, tying transit to rideshare, bikeshare and multi-modal ticketing and payment.
- NeoRide a multi-agency consortium is implementing a mobile ticketing application and providing mobile ticket readers for transit vehicles both small urban and rural authorities funded through the ODOT Office of Transit.
- Greater Cleveland through a USDOT ATCMTD grant has upgraded its entire vehicle communication backbone to place router on all vehicles allowing for free Wifi, and greatly improved vehicle tracking and location data.
- Many agencies have pursued and won FTA grants for adding all-electric buses to their fleets.





RECOMMENDATIONS TO RAISE THE GRADE

- Implement the recommendations from the 2015 ODOT Transit Needs Study including increased and dedicated Operating and Capital funding from the State of Ohio.
- Dedicate portions of the State Sales Tax revenue to public transit and/or dedicate an expanded the State Sales Tax base to public transit.
- Explore state constitutional amendment to allow the state gas tax to fund transit.
- Explore partnerships with Health and Human Services organizations as Ohio's population ages and is less mobile.
- Incentivize investments in technology and implement policies to coordinate Mobility as a Service and Mobility on Demand in conjunction with public transit instead of competing with transit.
- Use Transit Asset Management Plans and performance metrics to document the condition of transit assets throughout the state.
- Update the ODOT Transit Needs Study to document and update the transit needs reflecting the changes from the last five years.



TRANSIT



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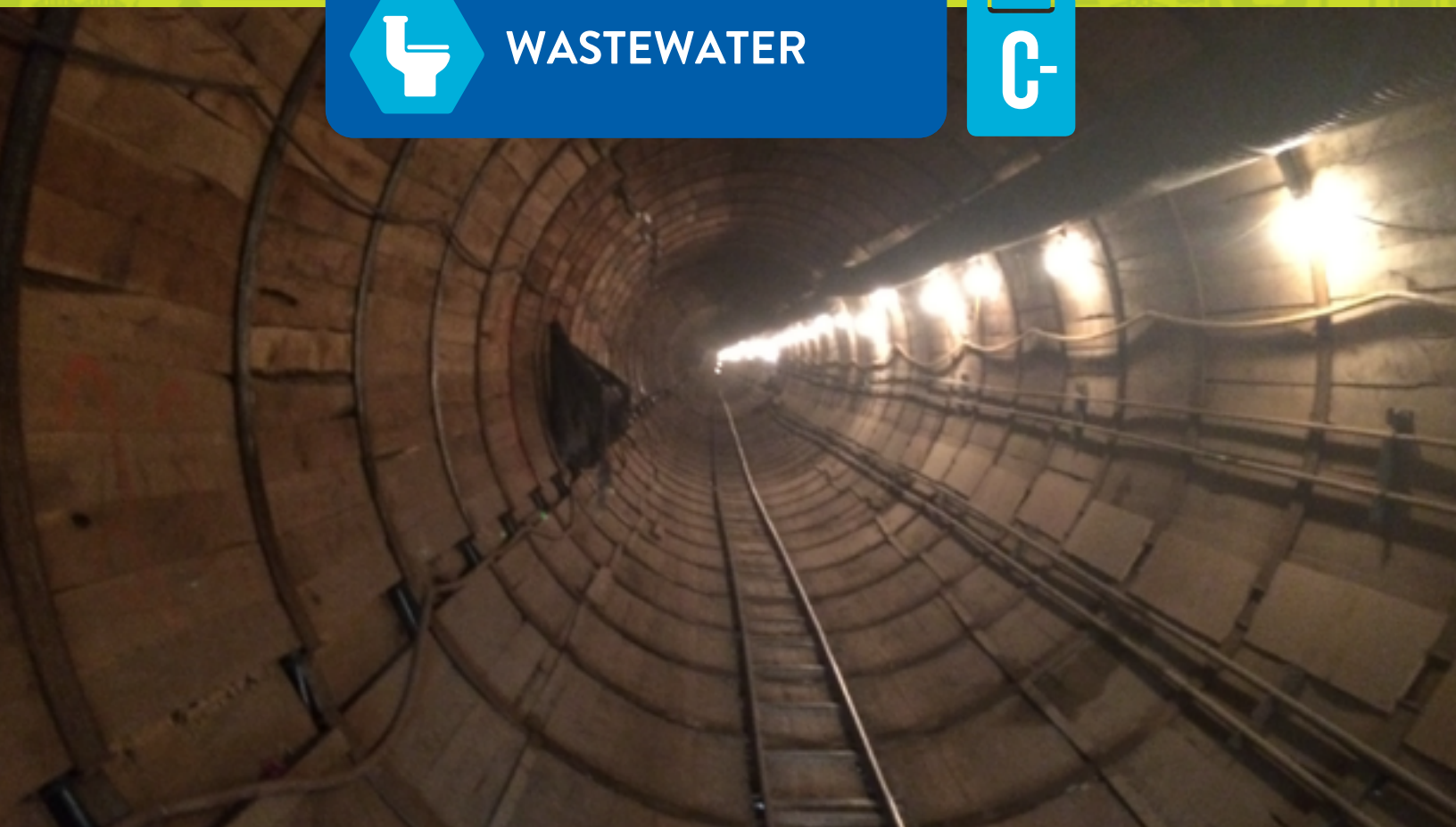
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WASTEWATER



WASTEWATER

GRADE: C-

EXECUTIVE SUMMARY

Approximately 81% of Ohio's 11.8 M residents rely on municipal wastewater collection systems and treatment plants. Much of this infrastructure is old and in need of repair, upgrade, or replacement. According to survey results published in the 2016 Clean Watersheds Needs Survey (CWNS), Ohio needs \$17.0 B to meet the water quality and human health goals of the Clean Water Act (CWA). An Ohio survey published in 2019 found annual rates have increased for a typical customer by almost 70% in the last 10 years. It is likely that this trend will continue as further emphasis on CSO reductions and elimination of SSO outfalls occur. Unfortunately, due to the limited availability of grant funds and priority given to those communities placed under formal EPA intervention, the response of most communities has been to address the immediate needs to resolve the EPA action or address current problems, rather than maintaining and upgrading assets.

BACKGROUND

The collection and treatment of wastewater improves the water quality of Ohio's streams, lakes and rivers and protects public health. Approximately 9.6 million Ohioans are served by more than 1,000 wastewater treatment plants. Many of these collection systems and treatment plants were built more than 50 years ago; they are nearing – or beyond – their design life and many do not meet current regulatory standards.

Ohio has many combined sewers which were constructed in the early 20th century and convey both wastewater and stormwater in the same pipe. During heavy rains and/or significant snow melt, the capacity of the combined sewers and treatment plants are overwhelmed, and raw sewage overflows through CSOs to lakes and streams. As of September 2017, Ohio had approximately 1,140 permitted CSOs in 72 communities ranging from small, rural villages to large metropolitan areas. About 50 of the CSO communities discharge to Lake Erie.

CAPACITY AND CONDITION

Most collection systems and treatment plants in Ohio have the capacity to collect and treat wastewater during dry weather. However, Ohio does not have the capacity to treat the combined wastewater and stormwater that is generated from combined sewers, as well as leaking sanitary sewers, during wet weather. During heavy rains and/or significant snow melt, the capacity of the combined sewers and treatment plants are overwhelmed and raw sewage overflows through CSOs to lakes and streams. These overflows cause water quality degradation and pose a risk to human health and make swimming, boating and fishing unsafe.

The impact of increased flow in combined sewers can be mitigated by:

- Installing new pipes
- Separating stormwater from wastewater
- Constructing wet weather or high-rate treatment facilities to treat surges
- Constructing storage to hold the overflow until it can be treated later

These strategies are expensive. Wet weather issues are problematic in separate sanitary sewer systems too. Infiltration and/or inflow into sanitary sewers can surcharge sanitary sewer systems and create basement backups affecting human health as well as the overflow of sanitary sewer into lakes and streams. Wet weather flows from combined and separate sewer systems that do not overflow to the environment generate additional wastewater that must be treated at plants.

The condition of treatment plants, pumping stations and pipe assets throughout Ohio are directly influenced by the age and maintenance of the infrastructure and the financial capability of the community to address improvements. Most communities do not undertake major improvements within their treatment and collection systems until they are compelled to do so in response to a significant event or series of events, such as rapid growth, changes in influent characteristics, more stringent effluent requirements, a failure in the system or EPA intervention. Operators and local staff responsible for the infrastructure recognize the importance of maintaining their systems, however, the general public and local administrations are generally unwilling to undertake the high levels of investment needed to properly maintain the integrity of their systems.

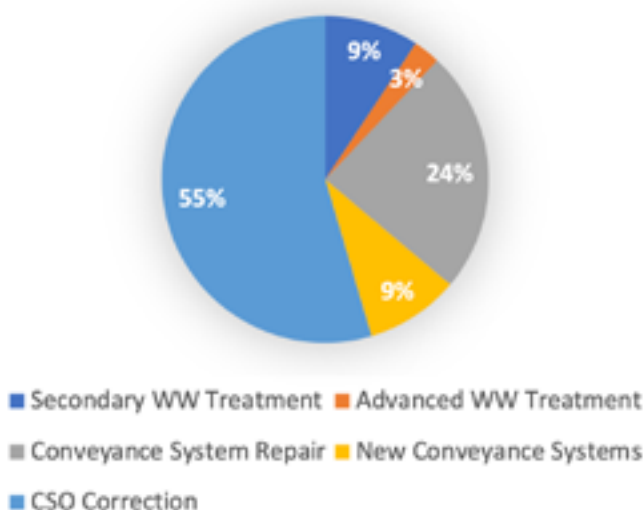
Some Ohio communities have established infrastructure that is in excess of 100 years old and remains in use while other infrastructure installed during the “baby boom” after WWII has not been updated to keep pace with newer standards or levels of material quality. Therefore, while data is scarce, estimates from experts in the field note that as much as 50% of the pipes and pumping systems within Ohio's collection systems are beyond 50 years of service.



FUNDING AND FUTURE NEED

Complying with state and federal wastewater regulations are often some of the costliest capital projects for municipalities and sewer districts. Statewide, the sources of funds vary but typically they come from sewer rates, local taxes and through the federal government. It is estimated that the state of Ohio needs almost \$17 billion to meet the water quality and public health goals of the Clean Water Act according to survey results published in 2016. Over 50% of that need was identified for CSO control followed by repair and renewal of existing sewer infrastructure at 24%.

Ohio Wastewater Needs, \$17B



A recent survey found that annual rates have increased for a typical customer by almost 70% in the last 10 years. Even though significant rate increases have been made, operation and maintenance of wastewater facilities uses most of these funds and the need for capital improvement is greater than available user fee funding. Continued rate increases will challenge many ratepayers or necessary increases may not be implemented due to political reasons. Wastewater utilities must seek other sources of funding or look to partnerships to invest in critical infrastructure.

The Water Pollution Control Loan Funding program is one of Ohio's State Revolving Funds Programs which provides low interest loans for wastewater collection and treatment. It has an annual capacity of approximately \$550 million per year. Other sources of grant and loan funding, including but not limited to Ohio Water Development Authority Loans and Ohio Public Works Commission Grants and Loans, provide an additional \$135 million per year. The limited grant funding and affordability issues cause wastewater utilities to apply for loan funding based on what they can repay, not what is needed causing existing problems to worsen. It is not anticipated that increases in the available funds will occur at a pace that will match the defined need for assistance without a major change in national policy and an influx of federal funding to support these programs. Therefore, utilities such as the Northeast Ohio Regional Sewer District (NEORSDD) have implemented a pilot program called the Member Community Infrastructure Program to provide funding to local communities to address water quality and human health issues, including constructing new or rehabilitating existing wastewater infrastructure.

Current investment needs have already been described in the condition and funding sections of this chapter. While current trends focus on CSO control and reduced treatment plant discharge loading, future wastewater infrastructure needs will mainly be determined by trends in Ohio. A comprehensive inspection program of wastewater collection systems will identify existing and potential future problems to develop prioritized long-term capital improvement plans and continued maintenance of sewer infrastructure will ensure sewers are operating within their design capacity. While many treatment plants are sized for growth and have adequate capacity to treat additional flows, many plants are unable to add customers due to current wastewater strengths and lower NPDES permit discharge limits. In addition to these challenges, wastewater plants are also unable to remove emerging contaminants, such as polyfluoroalkyl substances PFAS and other endocrine disruptors, through traditional treatment processes affecting water quality of rivers and lakes, many of these being drinking water sources.

A significant trend affecting Ohio is the overall population decline and the outward migration from portions of the state's major urban centers. For example, the Northeast Ohio Areawide Coordinating Agency estimates that through 2040 the population of Cuyahoga County – which includes Cleveland – will decrease 13% while surrounding counties will increase by 7%. This regional outward migration will cause additional stress on both rural and urban wastewater infrastructure. Rural areas will rely on inefficient septic systems or look to implement new wastewater infrastructure while these urban areas will continue to have infrastructure improvement needs but reduced revenue through population decline.

Finally, while the effects of COVID-19 on wastewater revenue is still undetermined, early estimates forecast a 20% reduction. Wastewater utilities play a large role in tracking potential COVID-19 outbreaks since the virus is being sampled at wastewater facilities.

OPERATIONS AND MAINTENANCE

Operation and maintenance (O&M) of the wastewater treatment system is a large undertaking. Typical O&M activities include inspection, cleaning and repair of collection systems and treatment facilities. Geographic information systems and asset management systems are utilized by some communities in Ohio to monitor and predict when O&M work is needed. The expansion of these efforts would greatly benefit other utilities. The benefits of these systems include using desktop analysis to proactively identify when and where O&M activities should occur and track them once completed rather than using paper maps to identify where a problem is located and not keeping track of work. However, managing and implementing O&M measures can be expensive and with underground pipes out of sight – and out of mind – in many municipalities, maintenance does not occur until problems manifest. Because federal funding cannot be used to pay for O&M, the burden falls on rate payers. The funds raised by rates are often insufficient to address both O&M and capital projects for aging wastewater systems.

PUBLIC SAFETY

Direct human exposure to high bacteria levels in lakes and streams represent a significant risk to human health. In 2017, Northeast Ohio Lake Erie beaches experienced health advisories due to high bacteria counts for 20% of the beach season. The inability of wastewater infrastructure to capture both sewage and stormwater creates CSOs and SSOs during wet weather events and causes water quality impairments to lakes and streams. It also leads to surcharging of sewers. This causes sewage basement backups and poses a direct risk to human health.

Statewide statistics for the total number of physical CSOs and SSOs and the current estimated volumes related to the overflow points do not currently exist. NEORSD is responsible for CSO control for approximately 120 permitted CSO outfalls. In 2010, NEORSD launched a 25-year, \$3 billion long-term CSO control plan, called Project Clean Lake, to reduce annual CSO volumes by 4 billion gallons to Lake Erie. Although NEORSD is not responsible for mitigating SSOs, the agency estimates that there are approximately

300 physical SSO structures in its service area and 53 of these structures have a 20% chance of overflowing each year. Combined sewers comprise more than 40% of the Metropolitan Sewer District of Greater Cincinnati (MSD) system. MSD monitors more than 200 permitted CSO and more than 70 designated SSO relief structures. NEORS, MSD and wastewater utilities across Ohio are working to reduce CSO and SSO overflows but will require significant funding and many years to accomplish.

RESILIENCE

Wastewater infrastructure must be resilient and able to protect Ohio's public health and safety as well as the environment while serving millions of daily users during normal operations and times of stress. In this regard, wastewater facilities must be designed and built in accordance with regulatory requirements and operational guidance that include:

- Design storm capacity
- Process and equipment redundancy
- Backup power
- Location of facilities outside the 100-year floodplain
- Other measures that allow operations during times of stress

Action must be taken to revise the planning and design of wastewater facilities to maintain and increase resiliency as annual precipitation and the frequency and intensity of storms continue to increase. Across Ohio, more frequent and localized high intensity storms have overwhelmed sections of wastewater systems and contributed to sewer backups and infrastructure damage. With wet weather one of the biggest issues for public utilities, climate change and resiliency must be considered and incorporated into planning and design of future and upgraded wastewater systems to better serve the needs of Ohio.

INNOVATIONS

New approaches and technologies are also being used to address CSOs. Separating combined sewers in urban areas is prohibitively expensive. Rather than separating the sewers or building treatment capacity that will be used only a few times a year, some utilities are building storage capability and high-rate treatment facilities – using new technologies – to manage and reduce CSOs. Some Ohio utilities, such as NEORS and MSD, are also using smart sewer technology and real time controls to manage and store flows in existing collection system and treatment facilities rather than constructing new infrastructure. MSD has found that the life-cycle cost of adding smart sewers technology to existing wastewater systems can be significantly less than new and upgraded infrastructure. Real time controls and smart sewers can be an expensive capital investment, but they can improve system performance and reduce long-term costs.

Continued development of GIS and asset management systems is occurring to make the software and hardware required less expensive and more user-friendly and will aid in proactively directing the community resources to the areas of most need, rather than relying on response to failures and emergencies in the field.

In wastewater treatment process, screenings and solids management has potential to pioneer new processes. A significant effort is required to educate the public on flushable wipes. These wipes may be labeled as flushable but do not break down in wastewater like toilet paper. Flushable wipes cause problems in private homeowner plumbing, public sewer pipes and wastewater treatment plant processes. A new screening technology is beginning to show prominence in treatment plants as these wipes are not removed by traditional methods.



WASTEWATER



RECOMMENDATIONS TO RAISE THE GRADE

- Continue to fund the State Revolving Loan Fund. Establish a Water Infrastructure trust fund to finance and provide substantial low interest loans and grants for utilities to invest in critical infrastructure needs and minimize impacts on wastewater rates.
- Establish a statewide infrastructure needs inventory using geographic information system and asset management principles to better assess current and future investment needs.
- Conduct hydraulic/hydrologic modeling evaluations and life cycle cost analyses of various alternatives to determine cost-effective solutions to address problems. This could include evaluating smart sewer and other innovative technologies.
- Educate the public and elected officials on the importance of regular maintenance of wastewater infrastructure and its implication on increasing rates so that the useful life of assets is prolonged and expensive problems are prevented.
- Promote public awareness regarding the complexity and rising costs of wastewater collection and treatment, the need for capital investments and the impact it has on clean water. Promote simple at-home solutions, such as the proper disposal of flushable wipes.
- Promote regional collaboration to combine systems and individual projects to find innovative solutions and partnerships that spur reinvestment which can reduce the operational and capital expense to each partner.



WASTEWATER



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