

2019 REPORT CARD FOR KENTUCKY'S



INFRASTRUCTURE

INFRASTRUCTUREREPORTCARD.ORG/KENTUCKY

ASCE
KENTUCKY SECTION

TABLE OF CONTENTS

	Page No.
Executive Summary.....	2
Solution to Raise the Grades.....	3
About ASCE Kentucky.....	4
Kentucky Infrastructure Report Card Steering Committee.....	5
Kentucky Infrastructure Report Card Committee Chairs.....	6
Acknowledgements.....	7
Grading Criteria.....	8
Grading Scale.....	9
Kentucky Grades Summary.....	10
➤ Aviation.....	11
➤ Bridges.....	18
➤ Dams.....	23
➤ Drinking Water.....	30
➤ Energy.....	40
➤ Hazardous Waste.....	47
➤ Levees.....	54
➤ Roads.....	59
➤ Solid Waste.....	66
➤ Wastewater.....	72



EXECUTIVE SUMMARY

Kentucky's infrastructure is everywhere around you and you use it every day. The interconnected system of roads and bridges, drinking water, sewer systems, dams and levees, aviation, solid waste, and energy are all critical to our success. We have become accustomed to these systems quietly supporting our ability to work and play. However, in 2019, our infrastructure networks are aging and struggling to perform as necessary.

Infrastructure deteriorates as it ages, and it must be repaired or replaced when it exceeds its useful life. The effects of time, weather, and increased use from a growing population are impacting the quality of the infrastructure in our state. Looking ahead, there are opportunities for Kentucky to invest not only in the infrastructure in need of repair and replacement, but to also to plan strategically for the future. Through smart investment and collaborative coordination, Kentucky has the opportunity meaningfully improve critical infrastructure networks, including water, wastewater, roads, rail, airports and freight, to ensure both local and state-wide economies can grow. Strategic investments and proper planning will also provide safe and healthy environments for our children, neighbors and communities.

The good news is that Kentucky's civil engineers, government agencies, private interest groups, and the public are committed to building and maintaining Kentucky's infrastructure to keep our residents and visitors safe, the environment healthy, and to help support our economy. The Kentucky Section of the American Society of Civil Engineers has created this simple tool to give residence, businesses, and policy-makers a snapshot at the current condition of our state's infrastructure systems—both the good and the not-so-good. In addition, this report provides recommendations on things our Commonwealth can do to make sure our infrastructure is there for us in the days, weeks, and years ahead. Working together, we can implement a pro-active and collaborative approach to infrastructure planning and funding that promotes smart investments to avoid costly, catastrophic failures.

We hope this report provides the information needed to make every Kentucky citizen an informed Kentucky citizen.

GET INVOLVED



FIND

Find your elected officials



KNOW

Check the [KY Legislative Tracking Center](#) to find legislation that you care about (hint...infrastructure)



DISCUSS

Now that you know your elected officials are, **EMAIL THEM** and **VISIT THEIR OFFICES** to share Kentucky's grades and solutions



BE SOCIAL

Use the hashtag **#ASCEKYReportCard** to show your support of Kentucky's infrastructure



SOLUTION TO RAISE THE GRADES

- 1) We need a big picture approach to infrastructure investment; one that anticipates the challenges of tomorrow while addressing the problems of today. As we determine where limited funding should be spent, it's important to approach investment knowing our networks are interconnected. It does less good to pave a road if the pipelines underground are in need of replacement. Providing flood protection by building levees in one neighborhood but leaving the adjacent neighborhood unprotected will ultimately cause harm during the next major rain event. Investing in our infrastructure requires proper planning, forward thinking, and most importantly, adequate investment for all our systems.
- 2) We must invest in Kentucky's multimodal freight network to prepare for the future. Louisville and Northern Kentucky are global logistics hubs for major companies, including Amazon, UPS, Fed Ex and DHL. However, the edge our state has in the distribution and logistics industry is not guaranteed. We need to proactively invest in our multimodal transportation network to retain our competitive advantage in the years ahead. Such investment includes providing adequate funding for our roadways, rail, and inland waterways, as well as providing robust investment for intermodal connections and bottlenecks in the network.
- 3) Rural communities require significant funding to address dilapidated infrastructure systems. Much like residents of cities, our rural population relies on infrastructure systems that were built 50 to 100 years ago. However, unlike our larger metropolitan communities, rural towns lack the population density to pay into the cost of repairing and replacing systems. Rural communities are frequently plagued by unsafe drinking water, pothole-riddled roads, and live near unsafe hazardous waste sites. Funding to repair and replace these systems will be instrumental to providing our rural citizens access to jobs and healthcare.



ABOUT ASCE KENTUCKY

Established in 1936, the ASCE Kentucky Section has five active Branches covering all of the Commonwealth of Kentucky. Civil Engineers in Kentucky join ASCE to develop leadership skills, enhance their knowledge of the latest technology and engineering practices, and to network with other civil engineering professionals. The ASCE Kentucky Section promotes the profession by offering annual scholarships to deserving students pursuing a career in Civil Engineering. The Section also hosts an annual Civil Engineering Conference to advance the knowledge of its members and to honor outstanding individuals and projects. ASCE Members advocate for infrastructure and environmental stewardship which will lead to a better quality of life for all Kentuckians.



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Washington, DC

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Louisville, KY

Mary Jo Gediman
Words Fresh, Inc.
Louisville, KY

Angela Goodrich
Strand Associates, Inc
Lexington, KY

Paul G. Maron, PE
Strand Associates, Inc.
Louisville, KY

Thomas D. Rockaway, PhD., PE
University of Louisville
Louisville, KY



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Karen Scott, PE
Inspired Strategies LLC
Louisville, KY

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Nancy Albright, PE
Kentucky Transportation Cabinet
Frankfort, KY

Dams

Colette R. Easter, PE
Louisville Metropolitan Sewer District
Louisville, KY

Jon Keeling, PE
Stantec
Lexington, KY

Drinking Water

Greg Heitzman, PE
Blue Water Kentucky, Inc.
Louisville, KY

Energy

Sheila Medina,
University of Kentucky
Lexington, KY

Hazardous Waste

Darrell Herron, PE
Stantec
Lexington, KY

Levees

Josh Dickerson, PE
Louisville Metropolitan Sewer District
Louisville, KY

Colette R. Easter, PE
Louisville Metropolitan Sewer District
Louisville, KY

Roads

Nancy Albright, PE
Kentucky Transportation Cabinet
Frankfort, KY

Solid Waste

Darrell Herron, PE
Stantec
Lexington, KY

Wastewater

Vicki Coombs, PE
Louisville Metropolitan Sewer District
Louisville, KY

Dakotah DeRoche, PE
Burgess & Niple, Inc.
Louisville, KY



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GRADING 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 multihazard threats and incidents? How able is it to quickly recover and reconstitute critical services with minimum consequences for public safety and health, the economy, and national security?

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



GRADING SCALE

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

- A - 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 resilient to withstand most disasters and severe weather events.
- B - 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.
- C - 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.
- D - 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.
- F - 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.

KENTUCKY GRADES SUMMARY

KENTUCKY GRADES

Aviation



C+

Bridges



C-

Dams



D+

Drinking
Water



C+

Energy



B-

Haz Waste



D

Levees



D+

Roads



D+

Solid Waste



B-

Wastewater



C-

GPA





AVIATION



SUMMARY

Kentucky airports have a total economic impact of nearly \$15 billion annually. When airports are kept in working order, aviation has a positive impact on a broad array of services for our Commonwealth, including military, healthcare, and transportation of goods and services, just to name a few. There are funding sources in place to support infrastructure facilities within the state; however, significant needs exist, including a consolidated rental car facility at CVG, the final portion of a five-phase taxiway project at LEX, and continued modernization of airfield elements at SDF. While the state has made recent airfield improvements and needed terminal upgrades at several of its primary facilities, we are confronted with aging facilities and cannot fully realize new economic opportunities without needed infrastructure improvements.

CAPACITY

There are currently 55 public-use airports in the state, a decrease from the nearly 60 reported in 2011. The five airports that closed were all visual-approach facilities with no control tower, with one facility being a private use airport. Of the 55 remaining airport facilities in the state, five are identified as commercial service airports, and the remaining are categorized as "general aviation" (GA) airports.

The size classification of an airport is important because it is directly tied to funding. A Nonhub is an airport with less than 0.05 percent of the nation's total number of passengers. A Small Hub airport is one with at least 0.05 percent but less than 0.25 percent. A Medium Hub airport is one with at least 0.25 percent but less than 1 percent. And, a Large Hub airport has at least 1 percent of the nation's total number of passengers.

According to Federal Aviation Administration (FAA) airport classifications, there are no Large Hub airports in the state of Kentucky. The Cincinnati/Northern Kentucky International Airport (CVG), located in northern Kentucky, is the largest airport in the state and is considered to be a Medium Hub, enplaning nearly 3.8 million passengers annually according to recently released data from the FAA. Louisville International Airport at Standiford Field (SDF) is considered a Small Hub airport, located in Louisville, with approximately 1.7 million annual enplanements. Both CVG and SDF are experiencing tremendous growth, with CVG reporting a 16 percent calendar year-over-year increase and SDF up over 3 percent from last year's enplanement figures, with more recent activity approaching nearly 10 percent. Additionally, both facilities boast a strong cargo component with CVG hosting DHL and Amazon's Prime Air, and SDF as the home to the all-points domestic hub for United Parcel Service (UPS). The only other Small Hub airport in the state is Blue Grass Airport (LEX), located in Lexington, with nearly 650,000 enplanements annually. The last of the primary airports in the state include Barkley Regional Airport (PAH) in Paducah and Owensboro-Daviess County Airport (OWB) in Owensboro, both with a Nonhub status. PAH enplanes approximately 21,000 annually, while OWB enplanes nearly 20,000 passengers each year.

The remaining 50 public-use airports in the state are classified as General Aviation airports. The GA classification applies to an airport with fewer than 2,500 annual passengers and is not used for commercial aviation. This airport type is the largest single group of airports in the system.



Kentucky

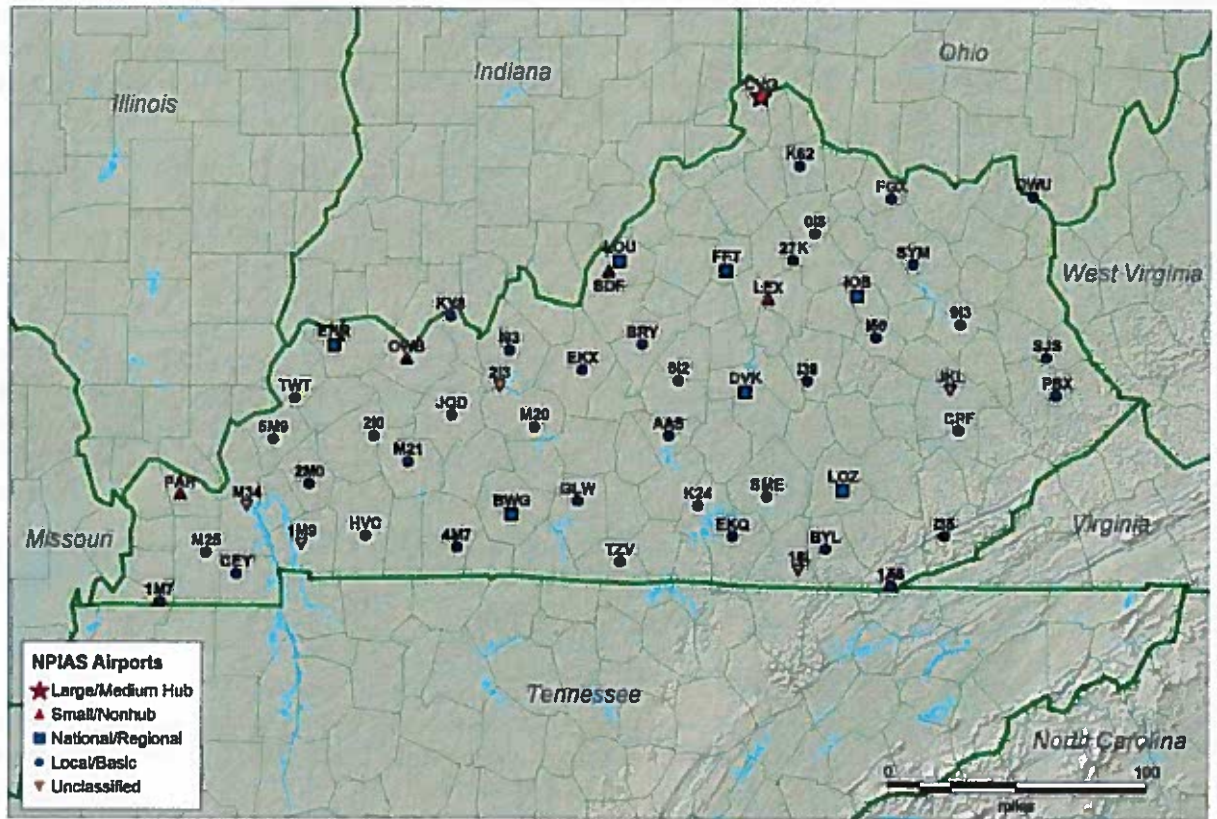


Figure 1. Public-Use Airports in the Commonwealth of Kentucky, National Plan of Integrated Airport Systems (2017-2021)

CONDITION

Of the 55 public-use airports in the state, all are equipped with hard-paved surfaces for their runways and associated taxiways. Most of these surfaces are paved with asphalt; however, for airport facilities with higher use and the need to support larger aircraft, such as CVG and SDF, the runways and taxiways are concrete. Since concrete is a longer lasting material than asphalt, airport facilities such as OWB and LEX have also utilized concrete with some of their newer runway facilities.

Airports must perform a detailed inspection of airfield pavements at least once per year as part of the Pavement Management Program (PMP). All public-use airports in Kentucky have a PMP. If a pavement condition index (PCI) survey is performed under certain ASTM conditions, the frequency of the detailed inspection may be extended to three years. Less comprehensive routine daily, weekly, and monthly maintenance inspections of runways and taxiways are required for standard operations.



AVIATION



ECONOMIC IMPACT

Kentucky airports have a total economic impact of nearly \$15 billion annually, yielding nearly 115,000 jobs. CVG and SDF airports account for more than 83 percent, or approximately \$12.5 billion, of the total economic impact annually. All airports in the state play a role in generating economic activity for their surrounding areas.

Both CVG and SDF have seen a dramatic increase in the construction of warehouses and other commercial buildings in close proximity to their airports. These are known as warehouse or "end-of-the-runway" service logistics. SDF, with its connection to UPS and Worldport®, has seen a number of businesses locate to the Louisville area to be close to the Worldport® facility.

Comparably, CVG has seen a similar attraction from businesses with the DHL facility located on the airfield in northern Kentucky, as well as recent plans for Amazon to build a primary hub on the south side of the airfield. Amazon's plans are to construct three million square feet of buildings and lease more than 900 acres for 50+ years. This \$1.4 billion investment will support a fleet of 100+ Amazon Prime cargo planes and bring more than 2,700 jobs to CVG.

In all, Kentucky's airports have a quantifiable economic impact on the surrounding areas. Some other benefits derived from airports include search and rescue, medical transportation/evacuation, and military training.

OPERATION & MAINTENANCE

The primary commercial service airports in Kentucky utilize federal entitlement dollars generated from the FAA's Airport Improvement Program (AIP) to assist with pavement remediation among other eligible uses, while the remaining airports seek discretionary funding through the state to support their needs.

Maintenance of existing infrastructure at each of the airports is certainly of concern, but another issue involves flight delays in the national airspace system (NAS). Since each airport feeds to other destinations, the ability for another airport to efficiently accept and turnaround aircraft is important to the NAS. Therefore, while the condition of paved surfaces is one of many vital components, the ability for aircraft to arrive and depart during inclement weather, and the navigational systems needed to support such activity, are also crucial. Forty-three of the 55 public-use airports in Kentucky support some level of navigational system to sustain other than visual approaches at the various airports. An example of this includes the localizer and the glideslope—both ground-based systems that use radar to assist aircraft in landing during inclement weather. Beyond these traditional systems, the implantation of capabilities identified under the FAA's NextGEN program are key to the full optimization of airports in Kentucky and throughout the country.



AVIATION



Figure 2. Replacing a concrete panel in Runway 17R-35L at SDF.

FUNDING

Over the last several years, Kentucky's aviation system has remained stable despite the challenge of Congress not reauthorizing long-term legislation for the Airport Improvement Program (AIP). The recent passage of the FAA Reauthorization Act of 2018 should enhance this position going forward.

The Passenger Facility Charge (PFC) Program allows the collection of PFC fees up to \$4.50 for every enplaned passenger at the five commercial service airports in Kentucky. These fees are identified by the individual airport to fund FAA-approved projects that enhance safety, security, or capacity; reduce noise; or increase air carrier competition. Increasing the PFC cap would help Kentucky airports access additional capital to support and improve the state's aviation infrastructure.

Another source of aviation infrastructure funding is a state jet fuel tax that was implemented in 2000 and went into effect in Kentucky in 2003. The tax was put into place to help support capital infrastructure needs at public airports across the state; however, that tax has since been capped within the state, reducing the amount of available funds. With an increase in the fuel tax cap on air carrier/transport companies, the jet fuel tax funding would be available to support aviation facilities in the Commonwealth.



AVIATION



FUTURE NEED

Investment Needs

Though Kentucky has recently made necessary improvements and upgrades, millions of dollars are still needed to continue keeping our airports competitive in the twenty-first century.

As air passenger traffic increases across the country, and as cargo operations continue to grow at CVG and SDF in particular, we are confronted with aging facilities. Our local communities cannot fully realize new economic opportunities without the infrastructure improvements needed to support both commercial air service and cargo-related activities.

Nationwide, airports have more than \$100 billion in improvements to make in the next five years. In Kentucky, funding for airports would improve the passenger experience and enhance our facilities, including runways, taxiways, terminals, gates, and other projects.

At CVG, a consolidated rental car facility is needed to streamline passenger movements in and out of the airport; it will also improve air quality.

At LEX, this means funding to complete the final portion of a five-phase taxiway project that will enhance the safety and efficiency of the airport for the airlines, as well as general aviation operators.

At SDF, continued modernization of vital airfield elements is a priority, including the need to transform and reconstruct the older portion of the taxiway network.

Such infrastructure investments lead directly to new jobs at our airports and have larger impacts on the economies beyond our gates. In Louisville, SDF and Bowman Field were shown in 2014 to support more than 69,900 jobs and generated in excess of \$8.1 billion in total economic activity. At LEX, its last study points to approximately \$370 million in economic output and nearly 3,500 jobs. Finally, CVG's most recent impact study shows over \$4.4 billion in economic output, as well as more than 31,100 direct and indirect jobs.

With over \$790 million in infrastructure needs in the next five years, work at Kentucky's airports could realistically create more than 18,000 jobs. In addition, the traveling public in Kentucky and across the United States would benefit from shorter security lines, more airline competition, lower fares, and twenty-first century facilities.

Legislative Needs

At the federal level, there is a need to have Congress approve long-term legislation for the Airport Improvement Program. The previous extensions represent a discontinuous cycle of funding for those airports eligible for AIP entitlement funding. This irregularity leads to gaps in potential discretionary funding for the remaining general aviation airports in the state. Congress must focus on approving legislation to return stability to the AIP program and funding throughout the NAS.

At the state level, the consideration of an increase to the cap on the jet fuel tax would improve the funding position of many of the general aviation facilities.



AVIATION



PUBLIC SAFETY & RESILIENCE

The Transportation Security Administration (TSA), a component of the Department of Homeland Security, is responsible for security in the nation's commercial service airports. Each commercial service airport is required to maintain both police and fire service for the facility. The size of the units is based on the number and size of aircraft that use each facility. GA airports are not subject to the same requirements.

In the case of a catastrophic event, be it man-made, weather-related, etc., airports are critical to coordinating efforts for relief, including manpower and supplies. Each commercial service airport in the Commonwealth is required to maintain an emergency plan. These are primarily targeted to aircraft incidents, but they may also be tailored to include natural disasters or other catastrophic events.

Other measures aimed at keeping the public safe in and around airports include maintaining fences around facilities to prevent pedestrians from accessing the airfield and facilities, as well as maintaining wildlife mitigation plans to diminish the risk of wildlife strikes on or near airports.

INNOVATION

CVG's Delta hub was drastically cut in 2000, reducing the number of daily passenger flights and leaving the facility with two empty terminals. But the airport turned the cutback into an economic win by demolishing those two terminals and building significant upgrades to Terminal 3. With commitments to elevating the passenger experience, CVG was named the highest ranking U.S. airport on 2017's [World's Best Airport list from SkyTrax](#). In addition, the facility started Launching Point in 2016, a new, strategic five-year plan focused on innovations for the future, including technology and air service.

Similarly at SDF, enriching the customer's experience is a top priority. Earlier this year, SDF completed the installation of Bluetooth technology that enables the blind and visually impaired to navigate the terminal with their smart phone from the front curb to the airline gate. SDF also just launched a \$100 million project to add innovative customer amenities within the terminal facility, which may even include solar energy solutions.

In other innovations in Kentucky airports, airfield lighting has been updated to utilize LED light fixtures, which are energy efficient and reduce the energy footprint for the Commonwealth's airports.

RECOMMENDATIONS TO RAISE THE GRADE

The following recommendations are supported by ASCE:

- Increasing the Passenger Facility Charge (PFC) cap would help Kentucky airports access additional capital to support and improve the state's aviation infrastructure.
- Implement NextGen system.
- Consider increasing the fuel tax cap on air carrier/transport companies, allowing the jet fuel tax to support aviation facilities within the Commonwealth.



AVIATION



- Continue to improve the facilities at existing airports and consider opportunities to expand air service to areas that can sustain such development.
- Continue to coordinate the Six-Year Highway Plan with the Six-Year Aviation Plan to allow more efficient transportation of people, goods, and services.

DEFINITIONS/KEY TERMS

Large Hub – commercial, publicly owned airports with 1% or more of annual passenger boardings

Medium Hub – commercial, publicly owned airports with at least .25% but less than 1% of annual passenger boardings

Small Hub – commercial, publicly owned airports with at least .05% but less than .25% of annual passenger boardings

Nonhub – commercial, publicly owned airports with more than 10,000 but less than .05% of annual passenger boardings

Nonhub, nonprimary – commercial, publicly owned airports with at least 2,500 and no more than 10,000 annual passenger boardings

AIP – FAA's Airport Improvement Program

CVG – Cincinnati/Northern Kentucky International Airport (CVG)

FAA – Federal Aviation Administration

GA – General Aviation

LEX – Blue Grass Airport

NAS – National Airspace System

OWB – Owensboro-Daviess County Airport

PAH – Barkley Regional Airport

PFC – Passenger Facility Charge

SDF – Louisville International Airport

TSA – Transportation Security Administration

SOURCES

1. Passenger Facility Charge (PFC) Program. Retrieved June 2018 from Federal Aviation Administration: <https://www.faa.gov/airports/pfc/>
2. Airport Categories. Retrieved June 2018 from Federal Aviation Administration: https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/



BRIDGES



SUMMARY

The overall condition of Kentucky's bridges has steadily improved in recent years, in part thanks to the prioritization of investments in transportation infrastructure by the Transportation Cabinet, through the Strategic Highway Investment Formula For Tomorrow evaluation and scoring system. In 2011, nearly 9.25 percent of all bridges in Kentucky were structurally deficient; by 2017, 7.77 percent were structurally deficient, a reduction of 180 bridges. However, looking ahead, 2,857 bridges have been identified as needing repair, which the state estimates will cost \$1.8 billion. This does not include the needed repairs and additional capacity needed on the I-75 bridge between Kentucky and Ohio, nor does it include a new I-69 bridge over the Ohio River between Kentucky and Indiana.

INTRODUCTION

Kentuckians were reminded of the importance of bridges in everyday life in September of 2011, when the Sherman Minton Bridge, connecting Kentucky to Indiana, was closed suddenly after inspectors found cracks in its structural beams. The bridge was closed for four months while it underwent repairs, creating huge traffic congestion on both sides of the Ohio River. The closure made national headlines and reminded many Kentuckians that bridges are a crucial part of a safe and reliable transportation network.

The Ohio River Bridges project saw the construction of two new bridges across the Ohio River and a new bridge with innovative construction techniques replaced a functionally obsolete structure connecting Milton, Kentucky, to Madison, Indiana. These bridges provide critical links between Kentucky and Indiana to alleviate traffic congestion and stimulate the economy of the entire region. In addition to these major bridge projects, the Kentucky Transportation Cabinet (KYTC) has just instituted the Bridging Kentucky program to provide funding to rehabilitate, repair, or replace more than 1,000 bridges across all of Kentucky's 120 counties. Approximately \$700 million will be invested over the next six years, which will extend the life expectancy of these structures. 2017 data shows that 7.77 percent of Kentucky's bridges were considered to be in "Poor" condition, which is down from 9.25 percent in 2011, for a reduction of 180 structurally deficient bridges across the state. However, the backlog of maintenance needs continues to grow, and more than half of the state's bridges are nearing the end of their design life.

CAPACITY & CONDITION

Bridges are a critical part of Kentucky's infrastructure, as they span a rich landscape of valleys, rivers, and other waterways in the state and play a vital role in keeping the roadways and railroads of the Commonwealth connected. Kentucky's people—and economy—depend on the state's 14,280 bridges as part of a safe and reliable transportation network.

The overall condition of Kentucky's bridges has improved in recent years. For example, the number of structurally deficient (SD) bridges in the state has steadily decreased. SD bridges are not unsafe, but they do require significant maintenance, rehabilitation, or replacement because critical load-carrying elements were found to be in poor condition due to deterioration or damage. In 2011, the Federal Highway Administration's (FHWA) National Bridge Inventory (NBI) reported that nearly 9.25 percent of all bridges in Kentucky were



BRIDGES



considered to be SD. However, in 2017 only 7.77 percent of Kentucky's bridges were SD, a reduction of 180 bridges.

FHWA changed its terminology in 2017 so that bridges previously considered "structurally deficient" are now most often considered to be in "Poor" condition. The new, simpler classification terms are: Good, Fair, or Poor condition. Bridge condition is determined based on the lowest condition rating assigned to various components of a bridge, including its deck, superstructure, and substructure. If the lowest rating is greater than or equal to seven, the bridge is classified as "Good." Bridges rated five or six are classified as "Fair." If the rating is less than or equal to four, the classification is "Poor." In 2017, Kentucky had a total of 5,361 bridges in "Good" condition (37% by count), 7,903 in "Fair" condition (57% by count), and 1,014 in "Poor" condition. Bridges in Good condition have remained between 36 and 41 percent of the inventory by count and between 38 and 43 percent by deck area since 2011. (The deck area of a bridge is the width of the roadway surface of a bridge multiplied by the length of the bridge, which provides an indication as to the size of the bridge.) Bridges classified as "Fair" have remained between 53 and 59 percent of the bridge inventory by count and 51 and 58 percent by deck area since 2011.

Ultimately, KYTC estimates that Kentuckians are crossing bridge structures that are in "Poor" condition roughly 2.4 million times per day. In addition, 7.5 percent of bridges in Kentucky have a posted load restriction on the amount of weight the bridge can hold. In some areas, posted load restriction bridges can restrict access to important service vehicles such as buses, ambulances, and garbage trucks. At present, more than 60 bridges are closed statewide due to unsafe conditions, and there are 822 bridges in the Commonwealth that aren't safe for school buses to cross.

[insert infographic here: 2.4 million trips per day taken across bridges in poor condition, out of 68.9 million trips taken across all bridges in Kentucky per day]

OPERATION & MAINTENANCE

KYTC inventories and inspects more than 14,000 bridges in accordance with the National Bridge Inspection Standards (NBIS).

Of the 14,280 bridges in Kentucky, the federal government owns 83 (7 percent of which are considered Poor); the state owns 9,019 (6 percent are deemed Poor); local governments own 5,144 (11 percent of which are Poor); and private entities own 34 (38 percent are considered Poor).

Maintenance of Kentucky's bridges is carried out by the entities that own them. For the bridges owned by the state, KYTC has recently implemented a pilot program in two of the 12 districts to expand bridge preservation practices by conducting preventive maintenance on a programmatic basis. Activities will include washing salt off bridges; cleaning, sealing, and greasing bearings; cleaning and sealing joints; cleaning and sealing pier caps; patching and sealing bridge decks; and removing drift material. The pilot program will address cost effectiveness, prioritization of treatments, construction methods, treatment selection, service intervals, etc. and determine the work that is best suited for state crews and which work is best suited for outsourcing to contractors.



BRIDGES



Who owns KY's bridges?

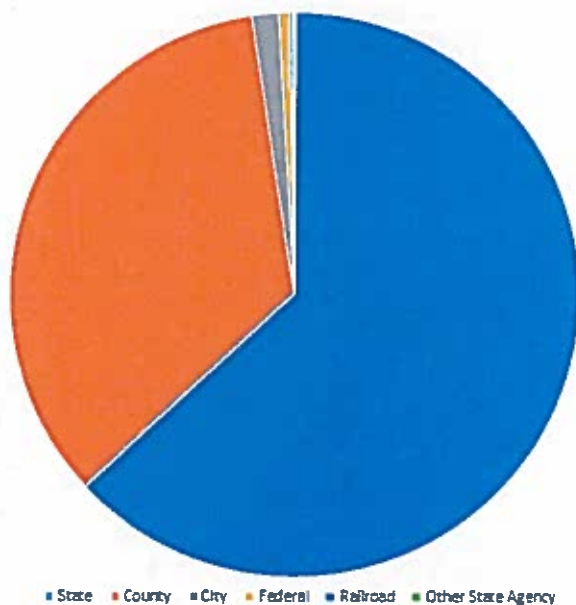


Figure 1. Kentucky's Bridges, by Owner

Who owns KY's bridges that are in poor condition?

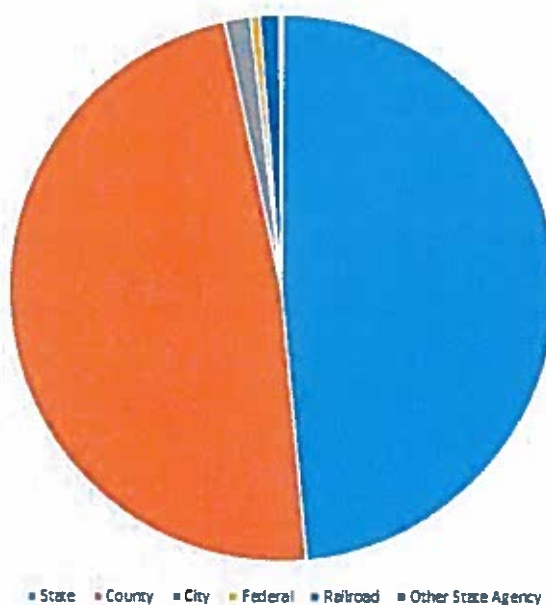


Figure 2. Kentucky Bridges in Poor Condition, by Owner

FUNDING & FUTURE NEED

Kentucky bridge maintenance activities are funded through both state and federal fuel tax sources. Federal dollars for bridge replacements and preventive maintenance are provided through multiple sub-allocations from Kentucky's allocation of the Highway Trust Fund, including the National Highway Performance Program (NHPP). These funds are to be used for bridges that are part of the National Highway System (NHS). Additional federal dollars come through the Federal Surface Transportation Block Grant Program (STP-BG), which may be used for bridges either on or off the NHS. As for state-based funding, the Commonwealth of Kentucky has two main sources, the fuels taxes on gasoline and diesel and the usage tax on vehicle purchases.

The Transportation Cabinet has recently prioritized investments in the transportation infrastructure of the state by implementing the Strategic Highway Investment Formula for Tomorrow (SHIFT), which is a formula for evaluating and scoring more than 1,100 transportation projects across the state. SHIFT is similar to a triple bottom line process in that the prioritization evaluates each project in the categories of asset management, cost-benefit analysis, economic development, congestion, and safety. This new prioritization process helped the state determine which projects should be funded with existing revenue sources over the next several years. The state has identified needed repairs on 2,857 bridges, which the state estimates will cost \$1.8 billion. This does not include the needed repairs and additional capacity needed on the I-75 bridge between Kentucky and Ohio, nor does it include a new I-69 bridge over the Ohio River between Kentucky and Indiana.



BRIDGES



Following the SHIFT process of categorizing and prioritizing needed bridge and road repairs, KYTC published the *2018 Highway Plan*, a six-year plan for major maintenance and capital improvements to both roads and bridges in Kentucky.

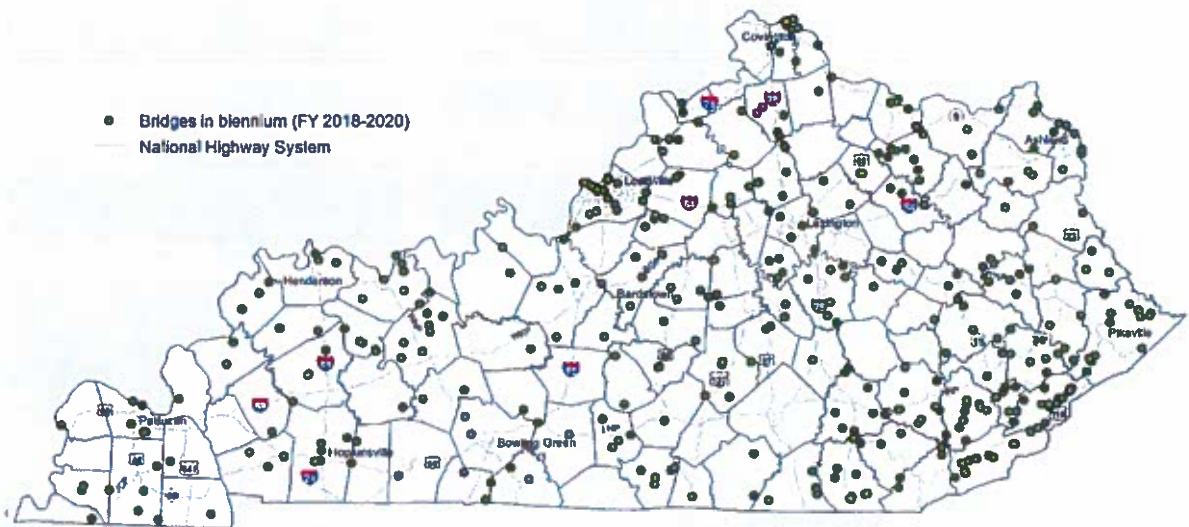


Figure 1. Bridges scheduled for replacement, maintenance, or safety repairs in FY 2018-2020

After prioritizing the list of transportation infrastructure needs and publishing the *2018 Highway Plan*, KYTC instituted the Bridging Kentucky program to provide funding for these projects. Between 2018 and 2024, approved construction projects will restore more than 1,000 state, county, and municipal bridges across all of Kentucky's 120 counties. Approximately \$700 million will be invested over the next six years. These repairs and improvements are expected to add at least 30 years of life to most of these bridges, and where a full replacement is appropriate, new construction would provide at least 75 years of useful life.

PUBLIC SAFETY & RESILIENCE

The mission of the Kentucky Transportation Cabinet is to provide a safe, efficient, environmentally sound, and fiscally responsible transportation system that delivers economic opportunity and enhances the quality of life in Kentucky. The cabinet is currently using a risk-based asset management plan to advance funding decisions focused on public safety and resilience of the infrastructure assets. As an example of its use, a 2018 Vulnerability Assessment identified hazards in Kentucky that can potentially affect the lifecycle of transportation systems, such as floods, sinkholes, landslides, and earthquakes. These hazards would result in higher maintenance costs and shorter replacement cycles as well as disruption to the traveling public. The information gathered during the assessment has been included in the risk-based asset management plan, and strategies are being developed to help mitigate the effects of extreme weather and natural hazards.



BRIDGES



INNOVATION

Kentucky is utilizing some new and innovative technologies in bridge construction and repair, which are inspired by the FHWA Every Day Counts initiative. With the Bridging Kentucky Program, KYTC is planning to use a project-bundling process, which involves awarding a single contract for several similar preservation, rehabilitation, or replacement projects in order to streamline design and construction, reduce costs, and effectively decrease the bridge project backlog.

An innovation in new bridge construction was seen when the Milton-Madison Bridge in northern Kentucky made history when its new steel truss superstructure was moved 55 feet onto its permanent, rehabilitated piers using a technique called truss sliding. The truss sliding technique allowed traffic to be maintained across this important bi-state connector with minimal closures—only a few weeks compared with the 365 days that were originally estimated.

RECOMMENDATIONS TO RAISE THE GRADE

In order to improve Kentucky's grade for Bridges, the following recommendations are supported:

- Continue to support the SHIFT formula used in the development of the six-year 2018 Highway Plan.
- Increase transportation funding through a variety of revenue sources.
- Expand bridge preservation practices statewide based on the results of the current pilot effort in two KYTC districts.
- Incentivize local governments to initiate bridge preservation practices.
- Expand the current pilot preservation program statewide to improve bridges rated as Fair.

DEFINITIONS

FHWA - Federal Highway Administration

HBRRP - Highway Bridge Replacement and Rehabilitation Program

KYTC - Kentucky Transportation Cabinet

NBI - National Bridge Inventory

NBIS - National Bridge Inspection Standards

SD - Structurally Deficient

SHIFT - Strategic Highway Investment Formula for Tomorrow

SOURCES

1. National Bridge Inventory, U.S. Department of Transportation: <https://www.fhwa.dot.gov/bridge/nbi.cfm>
2. Kentucky 2018 Highway Plan, Kentucky Transportation Cabinet: <http://transportation.ky.gov/Program-Management/Pages/2018-Highway-Plan.aspx>
3. SHIFT, Kentucky Transportation Cabinet: <https://transportation.ky.gov/SHIFT/Pages/default.aspx>
Data Miner Website, Kentucky Transportation Cabinet: <http://maps.kytc.ky.gov/bridge/>



DAMS



SUMMARY

Dams are a critical part of Kentucky's infrastructure, and many citizens of the Commonwealth enjoy the valuable benefits they provide. In recent years, the state has seen an increase in the number of high-hazard dams, meaning those that have the potential for loss of life and significant property destruction if they should fail. This is due to areas downstream of these dams being developed, creating populations at risk that did not previously exist. In addition, a majority of the Commonwealth's dam structures are now more than 50 years old. Fortunately, whereas in 2010 less than 5 percent of high-hazard dams had Emergency Action Plans (EAPs), approximately 75 percent have at least simplified draft plans today. However, necessary state funding to implement other safety programs, assistance for private dam owners, and direct funding for state-owned and operated dams for rehabilitation of aging dams has been dramatically cut. Funding is needed to rehabilitate high-hazard dams, support public and private dam owners in maintenance needs, improve emergency preparedness, increase education of dam safety for both owners and the public, update inspection methods and equipment, and hire additional staff for regulatory condition inspections.

CAPACITY & CONDITION

Dams meet a variety of needs in the Commonwealth of Kentucky, including water supply, irrigation for agricultural purposes, energy generation, pollution control, flood risk management, and the most common purpose, recreation. Resources generated from dams are a valuable part of Kentucky's economy. Most dams in the Commonwealth are constructed earthen embankments, with a purpose of holding billions of gallons of water.

There are 1,107 dams in Kentucky listed in the 2016 National Inventory of Dams (NID). The NID includes dams that are "high hazard" or "moderate hazard" potential, meaning dam failure could cause loss of human life or economic loss, respectively. The NID also includes all structures that are 25 feet or higher or store 50 acre-feet of water or more.

The Kentucky Division of Water's (KDOW) Dam Safety Program has regulatory authority over a significant number of dams throughout the state and has different qualifications for the dams they regulate. Dams found under their authority include all dams in the state with the exception of federally owned dams, dams associated with mining,* and dams that do not technically meet the KDOW definition of a dam.† As reported by KDOW, the total number of state-regulated dams in Kentucky is 954. Of these, 137 are owned by cities or towns, 72 are state owned, 553 are privately owned, and the remaining are owned by the federal government or the mining industry. In addition, there are dams that are not state-regulated, as they do not exceed the height and storage requirements to be jurisdictional under state regulatory code.

* Mining dams are regulated by the U.S. Department of Labor's Mining Safety and Health Administration and the Kentucky Division of Mine Reclamation and Enforcement.

† The Kentucky State Division of Water classifies a regulated dam as a structure that has an embankment that is a minimum of 25 feet in height, measured from the downstream toe of the dam, or has a maximum impounding capacity of 50 acre-feet or more at the top of the structure.



DAMS

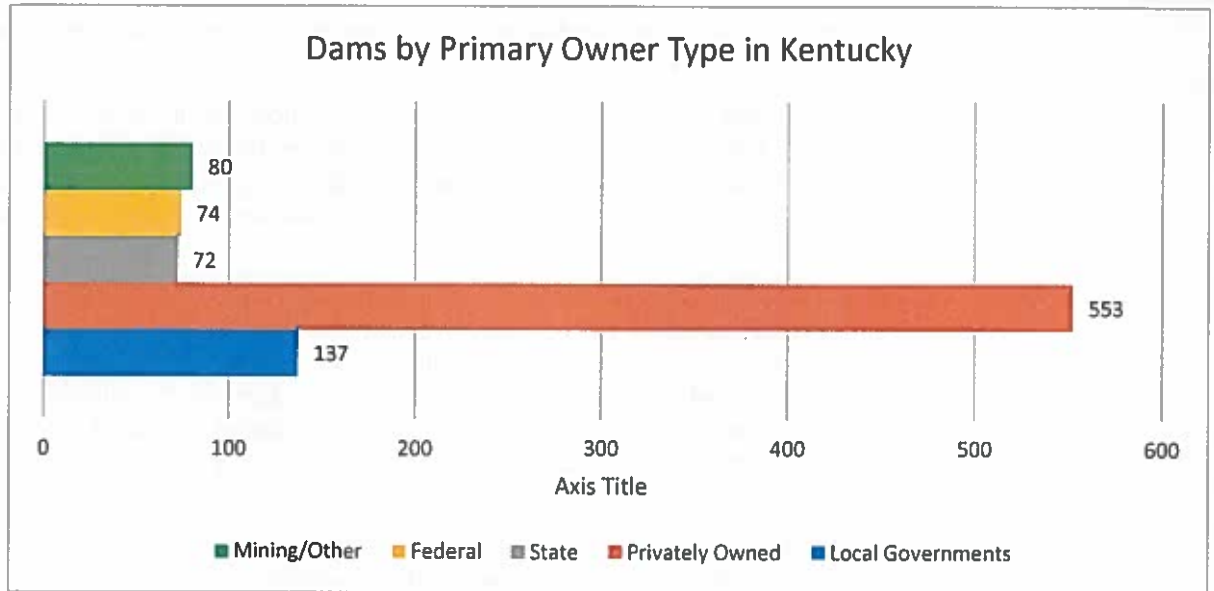


Figure 1. Dams by Owner Type.

The average age of KDOW state-regulated dams in Kentucky is 52 years, per the Dam Safety Section of the Division of Water. Dams built in this time period are now at or beyond the average design life of 50 years.

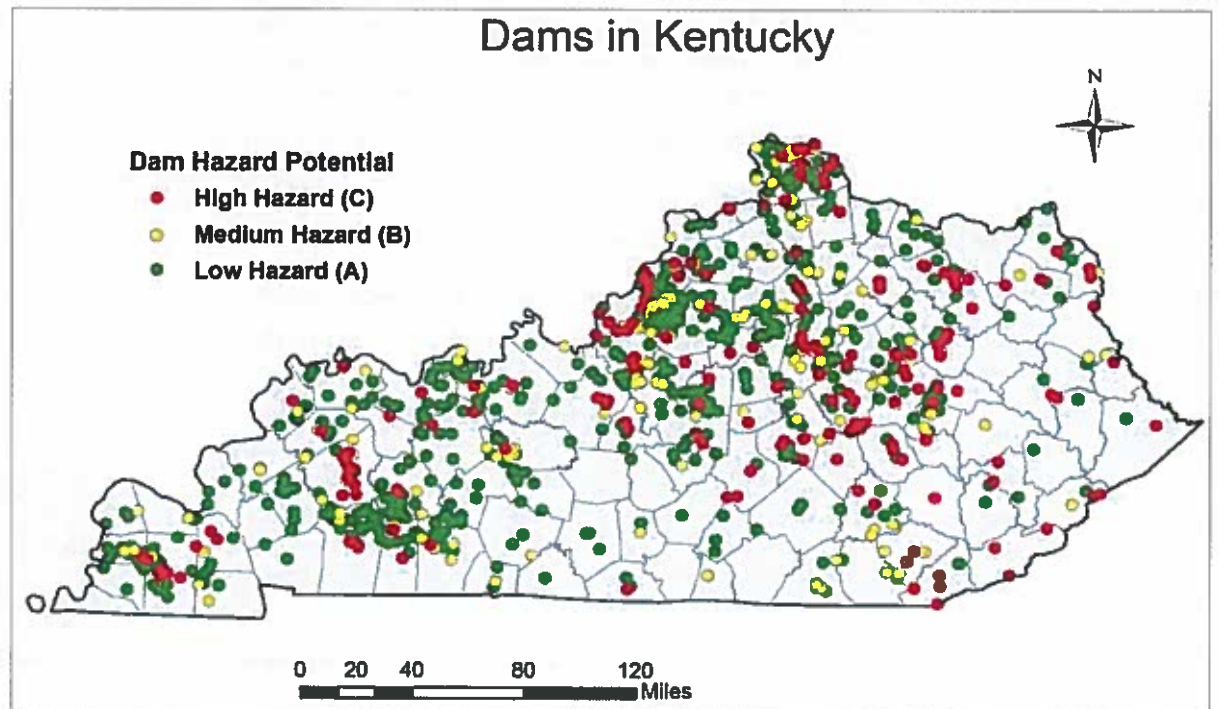


Figure 2. Dams in Kentucky provided by Kentucky Division of Water (KDOW), Dam Safety Section.



DAMS



As mentioned above, dams are classified based on their hazard potential, or the anticipated consequences in the case of failure.

A "low-hazard," or Class A, dam is defined as a structure whose failure would cause loss of the structure itself but little or no additional damage to other property. Such structures are generally located in rural or agricultural areas where failure may damage farm buildings other than residences, agricultural lands, or county roads. The majority of dams in Kentucky are classified as "low-hazard."

A "moderate-hazard," or Class B, dam is typically defined as a dam whose failure would cause significant property destruction but no loss of human life. These dams are located in predominantly rural agricultural areas where failures may damage isolated homes, main highways or major railroads, or cause interruption of use or service of relatively important public utilities. There are 133 "moderate-hazard" (also referred to as significant-hazard) state-regulated dams in Kentucky, and an additional 54 in this category that are not state-regulated, for a total of 187 overall, according to the NID.

A "high-hazard," or Class C, dam is typically defined as a dam whose potential failure or improper operation would cause loss of human life or significant property destruction to houses, industrial or commercial buildings, important public utilities, main highways, or major railroads. The number of state-regulated "high-hazard" dams in Kentucky is 177, with an additional 98 that are not state-regulated, for a total of 275 overall in this category, according to the NID. As reported by KDOW, nearly half of the state-regulated high-hazard dams, 79, are considered to have critical needs, meaning they have been assessed as being in poor or unsatisfactory condition. The non-state-regulated high-hazard dams are owned by other entities, including federal agencies and mining companies. (Many of the mining dams are listed as being regulated by the Mine Safety and Health Administration). Of all high-hazard dams in the NID, 88 are either in poor or unsatisfactory condition.

Because the potential for loss of life or significant property damage is so high, many of these high-hazard dams have an Emergency Action Plan (EAP) in place should a crisis occur. High-hazard dams are not required to have an EAP in the state of Kentucky, but as reported by KDOW, 133 out of the 177 state-regulated dams, or approximately 75 percent, have full or simplified plans in place. (This does not include mining dams). EAPs are there to help people get out of harm's way in advance of a dam failure. These plans include standard procedures such as a list of which agencies to alert, as well as flood inundation maps so officials know what needs to evacuate.

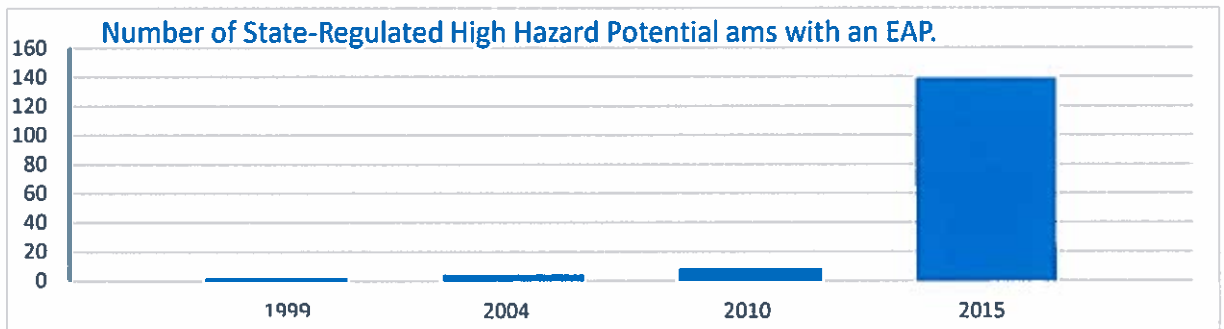


Figure 3. Number of State-Regulated High Hazard Potential Dams with an EAP.



DAMS



OPERATION & MAINTENANCE

Dam owners are responsible for the operation, maintenance, and safety of their dams, which includes financing any needed upgrades and repairs. But because of the potential downstream impact to citizens and communities surrounding Kentucky's dams, the state has regulatory authority over dam safety issues.

The state's Energy and Environment Cabinet runs Kentucky's dam safety program out of its Division of Water (KDOW). These offices are responsible for conducting regular inspections of existing dams, overseeing remediation of deficient dams, and working with local officials and dam owners on emergency preparedness. The Dam Safety Program (DSP) is also responsible for the permitting required for new dam construction. As of this writing, there are three full-time staff members in the DSP, with one vacancy at the present time.

KDOW currently has an inspection schedule of once every two years for all regulated high- and moderate-hazard dams. In the near future, state-owned, high-hazard structures will be inspected on an annual basis. Low-hazard dams are on a five-year inspection cycle. Each inspection starts with a complete file review in the office to note any identified deficiencies and to become familiar with hydrologic evaluations. The inspector then performs a field evaluation.

The Dam Safety and Floodplain Compliance Sections of the KDOW maintain a list of dam structures in an inventory database. To determine the frequency of inspection for each dam, the cabinet takes into consideration the size and type, topography, geology, soil condition, hydrology, climate, use of the reservoir, the lands lying in the floodplain downstream, and the hazard classification of the dam.

If the structure meets all the necessary requirements, a Certificate of Inspection is issued to the owner. If the dam does not meet all necessary requirements, the owner is notified of any deficiencies.

Dam Safety staff also perform periodic inspections of new dams under construction. A final inspection is performed when the construction is complete, and if the dam is constructed according to the plans and specifications, a letter is issued approving the impounding of water. The dam is then added to the inventory database.

FUNDING

The current operating budget for the Dam Safety section of the DOW is \$529,490 annually. This figure is one-third of the budget only eight years ago (see Figure 4). According to data from ASDSO, this figure is just below the national average for dam safety agency budgets (on a per dam basis).

In addition to funding for the statewide Dam Safety Program, there are separate funding streams for rehabilitation and repair of state-owned dams, provided through the State-Owned Dam Repair program of the Kentucky DOW. This funding source is replenished every year with a line item in the state budget; however, this revenue stream is only for rehabilitation or repair of state-owned dams.



DAMS

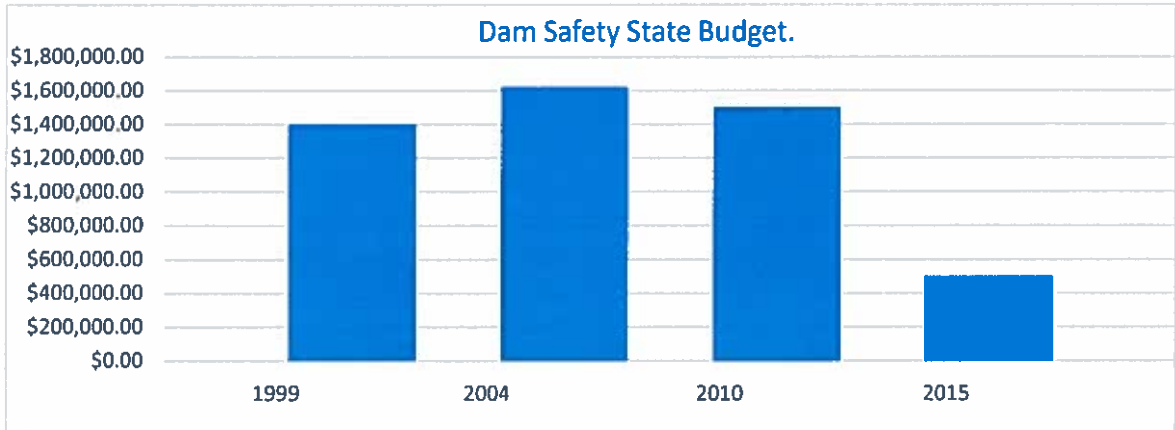


Figure 4. Budgeting for Dam Safety in Kentucky, from Kentucky Dam Safety Performance Report, 2016.

Some local dam owners have local funding streams for dam maintenance and repairs. Many large, private dam owners have self-funded operations, including EAP development.

Another potential funding stream was authorized by the creation of the High Hazard Potential Dam Rehabilitation program when The Water Infrastructure Improvements for the Nation (WIIN) Act, passed in 2016. While the program has been authorized, it has not yet been funded or implemented by FEMA. Once funds are made available, Kentucky will be able to apply for these grants for the rehabilitation of non-federal high-hazard potential dams.

FUTURE NEED

At the present time, the Dam Safety section of the Division of Water has funding limitations that hinder its ability to inspect all of the state's inventory of dams on its regular inspection schedule. In the future, in order to help prioritize projects, a risk-informed and data-driven asset management plan should be developed for the Kentucky dam inventory. This will help safety inspectors and dam owners focus on repairs and operational changes needed to reduce risks to acceptable levels.

Another initiative that will increase community safety is the creation of more emergency action plans. Though dams in Kentucky are not required to have an EAP, only 133 out of the 177 state regulated high-hazard structures have a full or simplified plan in place. It is unknown how many of the high-hazard mining dams in the state have EAPs. Dam owners of these structures in particular should develop, maintain, and exercise full EAPs with detailed inundation mapping.

Additional efforts will be needed in the near future to update applicable Kentucky Dam Safety regulations and modernize Dam Safety programmatic risks. In addition, Kentucky may consider taking enhanced enforcement actions on non-compliant dams that have critical need for rehabilitation and/or repair.



DAMS



PUBLIC SAFETY, RESILIENCE & INNOVATION

Hundreds of dams across the Commonwealth have the potential to fail with tragic consequences, and Kentuckians need to understand the risks associated with potential incidents and failures. This demands greater attention to and investment in measures that reduce risks to public safety and economic assets.

Regular inspections are the first line of defense in protecting Kentucky citizens, agriculture, and property. One of KDOW's Dam Safety Program goals is to provide routine inspections on regulated dams, and they strive to meet this goal with limited resources. Ultimately, it is the dam owner's responsibility for proper inspection, operation, and maintenance of their dam.

The next most important action to take for reducing the risks of loss of life and property damage from dam failures is to create Emergency Action Plans at all high- and moderate-hazard potential dams in the state. It is especially critical to have an EAP at the high-hazard potential dams that have been found to be unsafe or do not meet current accepted dam safety criteria.

In order to share dam safety best practices throughout the state, the Kentucky Division of Water's Dam Safety Program has been working on developing collaborative interagency forums with a progressive approach to sharing lessons learned, innovative ideas, and financial/economic needs. The Dam Safety Program routinely communicates and coordinates with multiple agencies both locally and nationwide to discuss key issues and trends in Dam Safety Best Practices. KDOW's Dam Safety Program is working to coordinate with federal agencies through initiatives like the Silver Jackets Program, which is focused on flood risk management and mitigation, and with other associations such as the Kentucky Association of Mitigation Management, as well as participating in the National Dam Safety Review Board. KDOW is working in cooperation with the Department of Homeland Security on a four-phased project to create an early-warning monitoring system in the event of a dam failure. Four dams were selected as the initial pilot for the project due to their location and existing available instrumentation available at the dam that can be used for comparison and control purposes. Best practices learned through this project may be applied to dam locations throughout the Commonwealth (and the country) where there is limited information and/or instrumentation. These tools are intended to increase warning and response time, reduce risks to lives and property, and ultimately build community resilience to flood events.

RECOMMENDATIONS TO RAISE THE GRADE

The following recommendations are supported by ASCE:

- Recommend additional funding for KDOW's Dam Safety Program to further the program's goals
- Recommend user fees on regulated dams, including fees assessed for operational permits to build new dams
- Recommend requiring Emergency Action Plans (EAPs) for all high-hazard and moderate-hazard dams in Kentucky (including mining dams regulated by the state)
- Support full appropriations for the federal High Hazard Potential Dam Rehabilitation program



DAMS



- Explore development of a central risk-based asset management plan to be housed and maintained by KDOW to identify and prioritize greatest needs for dam repair
- Similar to the state-owned dam repair fund, set up a repair fund for municipally owned dams with possible expansion to include a separate fund for repairs to privately owned dams
- Strategically plan for alternative funding avenues for qualifying dam owners to match any federal dollars that are awarded for dam maintenance and repairs
- Increase citizen awareness of the risks related to dams, and effective methods for living safely with them
- Increase outreach to dam owners and operators so they are aware of state dam safety laws, funding sources, and regulations, as well as their responsibilities and liabilities. Explore helping dam owners create operations manuals with information on the proper operation, maintenance, and inspection of their dams
- Increase education to local emergency management officials, first responders, and people who live and work in areas downstream of dams, so they understand the plans for response in an emergency situation

DEFINITIONS/KEY TERMS

DHS - Department of Homeland Security

KDOW - Kentucky Division of Water

FEMA - Federal Emergency Management Agency

EAP - Emergency Action Plan

KIA - Kentucky Infrastructure Authority

USACE - U.S. Army Corps of Engineers

WIIN - Water Infrastructure Improvements for the Nation Act

SOURCES

1. Energy and Environment Cabinet, Division of Water, Dam Safety; <http://water.ky.gov/damsafety/Pages/default.aspx>
2. Kentucky Dam Safety Performance Report, Association of State Dam Safety Officials, 2016; <https://damsafety.org/content/kentucky-program-performance-report>
3. Dams in Kentucky map: <http://epccapps.ky.gov/waterdams/DamsMap2.htm>
4. U.S. House of Representatives, Transportation & Infrastructure Committee website: <https://transportation.house.gov/wrda-2016/>
5. U.S. Army Corp of Engineers, National Inventory of Dams, http://nid.usace.army.mil/cm_apex/f?p=838:3:0::NO
6. Personal interviews with KDOW Dam Safety staff, 2018



DRINKING WATER



SUMMARY

Kentucky enacted legislation in 2000 to promote regional cooperation and water system consolidation throughout the Commonwealth. After 18 years, Kentucky has made significant progress in extending public water service to more than 97 percent of the state's population. Kentucky has deployed a robust, online Water Resource Information System and has continued to consolidate and regionalize the number of public water systems in order to serve more citizens and gain efficiencies. Kentucky has also established a Drinking Water Advisory Council, to provide input on drinking water regulations and best practices in water management, treatment, and distribution. While Kentucky has made significant progress in consolidation of water systems and service levels, several challenges have been identified, including compliance with the Safe Drinking Water Act (SDWA) Disinfection Byproducts Rule (DBPR) in some small systems; reduced state funding to the 2020 Water Program; water loss that averages 30 percent on a state-wide basis; and drinking water infrastructure needs that have increased 33 percent from 2013 to 2017, with a current estimate of \$8.2 billion over 20 years.

CONDITION AND CAPACITY

Kentucky currently has a population of 4.47 million people, who are served by 435 public water systems as of July 1, 2018. Seventy-one percent of the state's drinking water is supplied from surface water sources (rivers, streams, and lakes), while 29 percent is supplied by ground water sources. Kentucky has undergone extensive regionalization and consolidation of water systems over the past 45 years, reducing the number of its public water systems from 2,188 in 1974 to 435 in 2018, as shown in Figure 1. Consolidation has led to improvement in service levels, regulatory compliance, operating and capital efficiencies, drought tolerance, and affordable water rates.

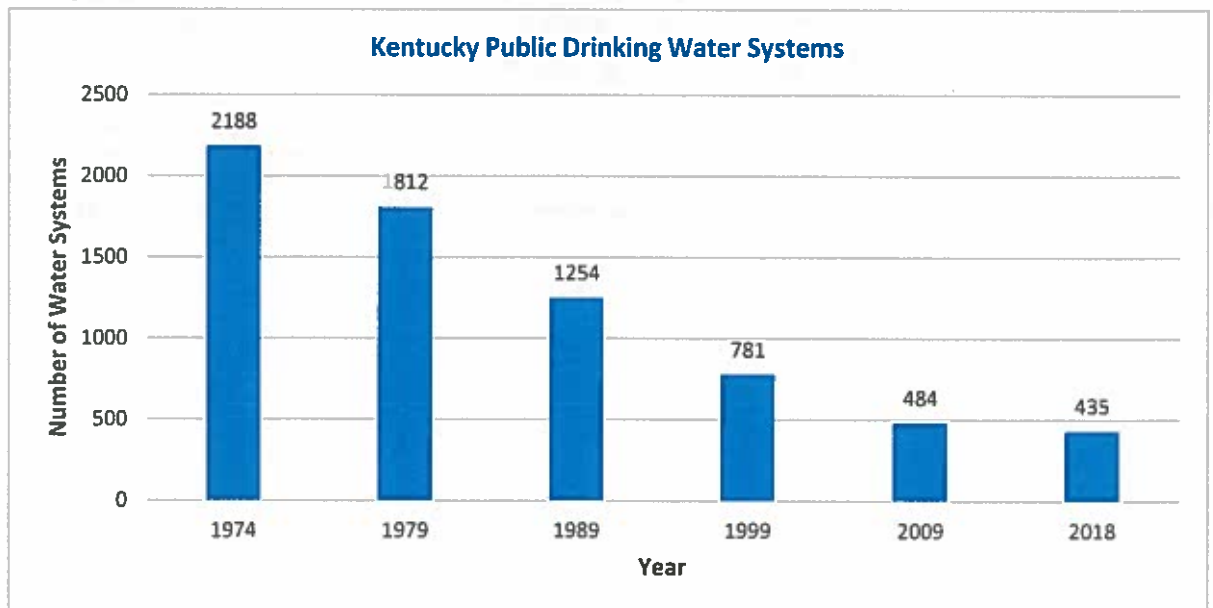


Figure 1. Kentucky Public Water Systems, 1974 to 2018.



DRINKING WATER



In 2000, Kentucky Governor Paul Patton and the Kentucky General Assembly set out an ambitious plan under Senate Bill 409 to improve water service throughout Kentucky. Senate Bill 409 established community-based planning for drinking water infrastructure statewide under the direction of the Kentucky Infrastructure Authority (KIA). KIA serves as a clearinghouse for federal and state funding of drinking water projects, including the State Revolving Fund (SRF) program, as well as state grant and loan programs authorized by the Kentucky Legislature. KIA maintains a statewide geographic information system (GIS) database, known as the Water Resources Information System (WRIS). WRIS is updated annually with information provided by water utilities to regional water management councils.

Since 2000, Kentucky has expanded water service from approximately 37,000 miles of water main to 58,783 miles in 2017. With these water line improvements, the state has increased the percentage of the population being served by a public drinking water system, from 85 percent in 2000 to more than 97 percent today. This service level is one of the highest in the United States, with fewer than 3 percent of the population (estimated at 100,000 residents) without access to a public drinking water supply. Figure 2 shows a map of the public water systems in Kentucky, and Table 1 provides a summary of Kentucky's water systems, source of water, population, and assets.

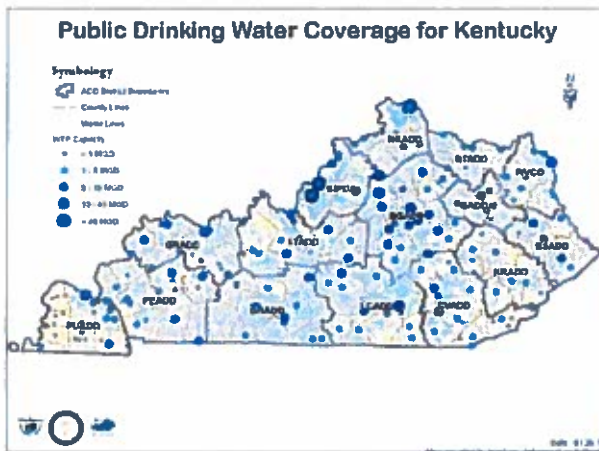


Figure 2. Kentucky's Public Drinking Water Coverage.

Public Water Systems and Source:	
435 Public Water Systems (Total)	
• 137 Surface Water (31%)	
• 172 Surface Water Purchasers (40%)	
• 101 Ground Water (23%)	
• 25 Ground Water Purchasers (6%)	
Population Served:	
• 22% serve a population over 10,000	
• 19% serve a population of 5,000 to 10,000	
• 59% serve a population of less than 5,000	
Water Assets:	
• 213 Water Treatment Plants (average age 36 years)	
• 1,842 Water Storage Tank (average age 26 years)	
• 58,783 total miles of Water Main (average age 38 years)	
• 11,697 miles of Water Main more than 50 years of age (19.9%)	

Table 1. Kentucky Public Water Systems.



DRINKING WATER



OPERATION & MAINTENANCE

The Kentucky Public Service Commission (PSC) regulates public water systems in Kentucky, with the exception of municipally owned water systems that are exempt from Kentucky PSC regulation for rates and service levels.

More than 99 percent of the water systems in Kentucky are owned by a city, county, or state authorized agency. Government-owned systems in Kentucky are exempt from property and income taxes and have access to tax-exempt debt and government grants and low-interest loans.

The three largest public water systems (Louisville Water Company, Kentucky American Water Company, and Northern Kentucky Water District) serve approximately 30 percent of the state's population and have achieved the highest level of water quality treatment under the U.S. Environmental Protection Agency's (EPA) Partnership for Safe Water.

Water rates in Kentucky are competitive when compared with national averages. The 2016 Kentucky Water Rate Survey conducted by Canon and Canon reported an average monthly water bill of \$37.66 for 5,000 gallons. Circle of Blue reports an average monthly water bill of \$35.40 for a family of four using 200 gallons per day (6,000 gallons per month) for the top 30 U.S. cities. Large urban areas typically have lower water rates than rural areas due to economies of scale and higher customer density. Some water systems in Kentucky are reluctant to raise rates to cover the full cost of service, including cost of operations, depreciation, and capital investment. Proactive investment in replacing aging water infrastructure is often not included in water rates.

Kentucky needs improvement in the area of water loss. The Kentucky WRIS reports non-revenue water loss at a statewide average of 24 percent, which is higher than both the national average of 16 percent reported in 2013 by the EPA and the 15 percent limit of unaccounted-for water loss established by the Kentucky PSC. High water loss can be attributed to water main breaks and leaks, water line flushing, storage tank overflows and inaccurate meters and is an indicator of underfunded infrastructure renewal. Figure 3 is a map of Kentucky showing non-revenue water loss by area.

Another maintenance-related challenge being experienced in Kentucky is the loss of licensed plant and distribution operators due to retirements and a competitive job market. Licensed operators are needed to assure high quality water delivery to customers.



DRINKING WATER

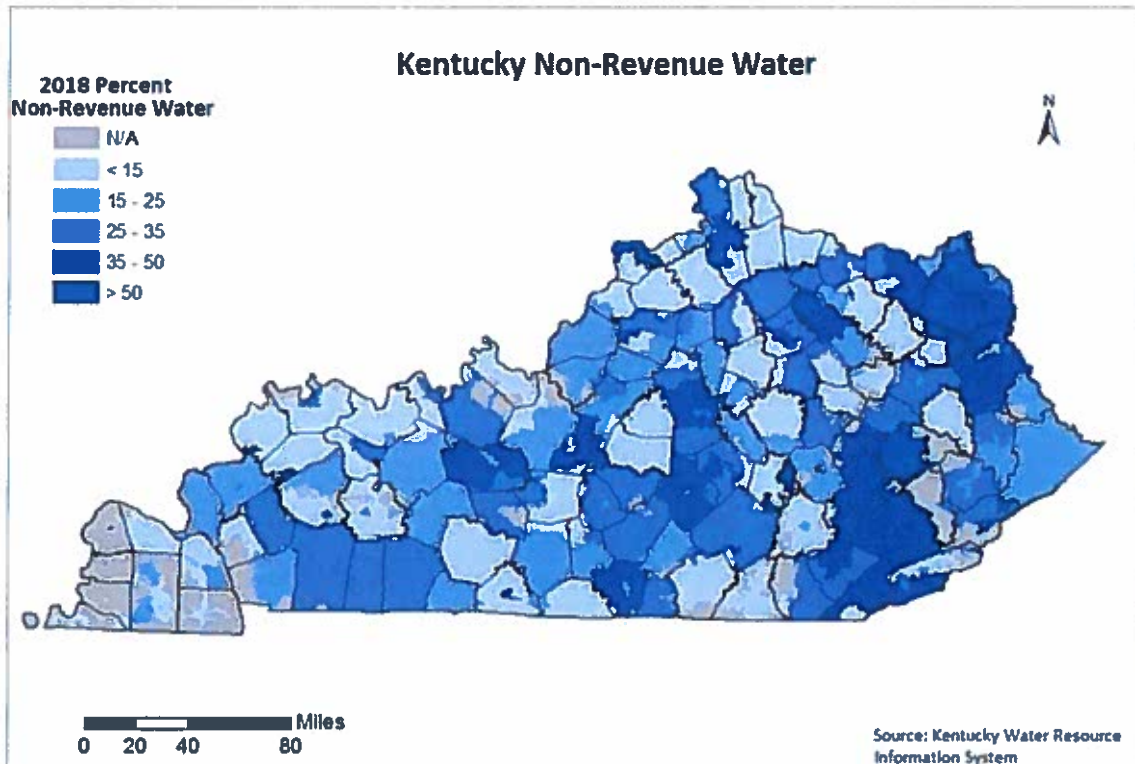


Figure 3. Kentucky Non-Revenue Water in 2018.

PUBLIC HEALTH

The Kentucky Division of Water publishes an annual Drinking Water Compliance Report, in which drinking water violations are identified in the following six categories: monitoring (MON); exceeding maximum contaminant level (MCL); reporting (RPT); public notification (PN); treatment technique (TT); and sanitary survey (SS). Figure 4 illustrates the compliance history of drinking water violations in Kentucky since 2008. In 2014, the number of total violations increased as a result of failure to comply with the 2013 Stage 2 Disinfection Byproducts Rule (DBPR) in areas of monitoring, public health, and public notification, as shown in Figure 5. The DBPR violations include consecutive system violations where water is supplied to adjacent water systems. Kentucky has focused on reducing DBPR violations, with technical assistance to small systems, and in 2017, DBPR violations dropped significantly.



DRINKING WATER

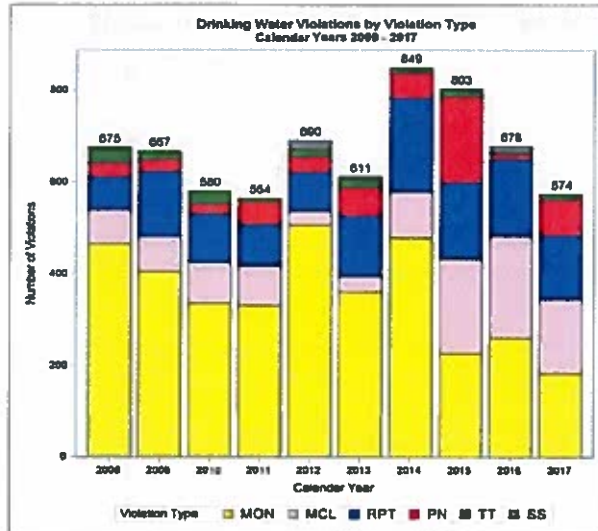


Figure 4. Kentucky Drinking Water Compliance Statistics, 2008–2017.

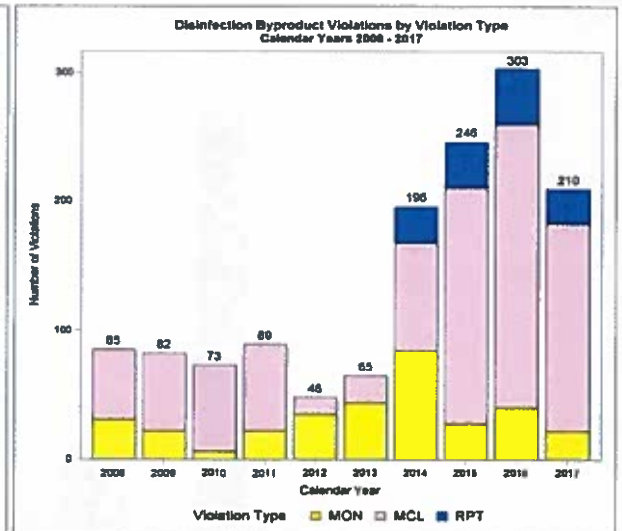


Figure 5. Kentucky Disinfection Byproduct Rule Violations, 2008–2017.

In 2016, the Kentucky Environmental Protection Cabinet chartered a Lead in Drinking Water Workgroup to evaluate the status of compliance with the EPA's Lead and Copper Rule (LCR) following the public health crisis in Flint, Michigan. The Lead Workgroup published its recommendations in March 2018. Currently, all public water systems in Kentucky comply with the EPA LCR Action Level of 15 parts per billion. In addition, as illustrated in Figure 6, sampling data since 2005 (with over 35,000 samples tested) indicate the vast majority of Kentucky public water systems will not have an issue in the future if lead action levels are reduced to 10 parts per billion.

Most Kentucky water systems do not have a reliable inventory of lead service lines due to the lack of historical service line records. Lead was used as a service line material in some Kentucky cities through 1950. In addition, rural water systems that formed after 1950 generally did not use lead as a piping material. Louisville had the largest installed inventory of 70,000 lead service lines, and through 30-year proactive replacement has reduced the number to fewer than 2,000 by 2018. This is less than 0.8 percent of all residential service lines. Louisville also initiated a proactive lead-testing program in schools in 2005 and provides a best practice approach for corrosion control treatment, replacement of lead service lines, and consumer education materials.



DRINKING WATER

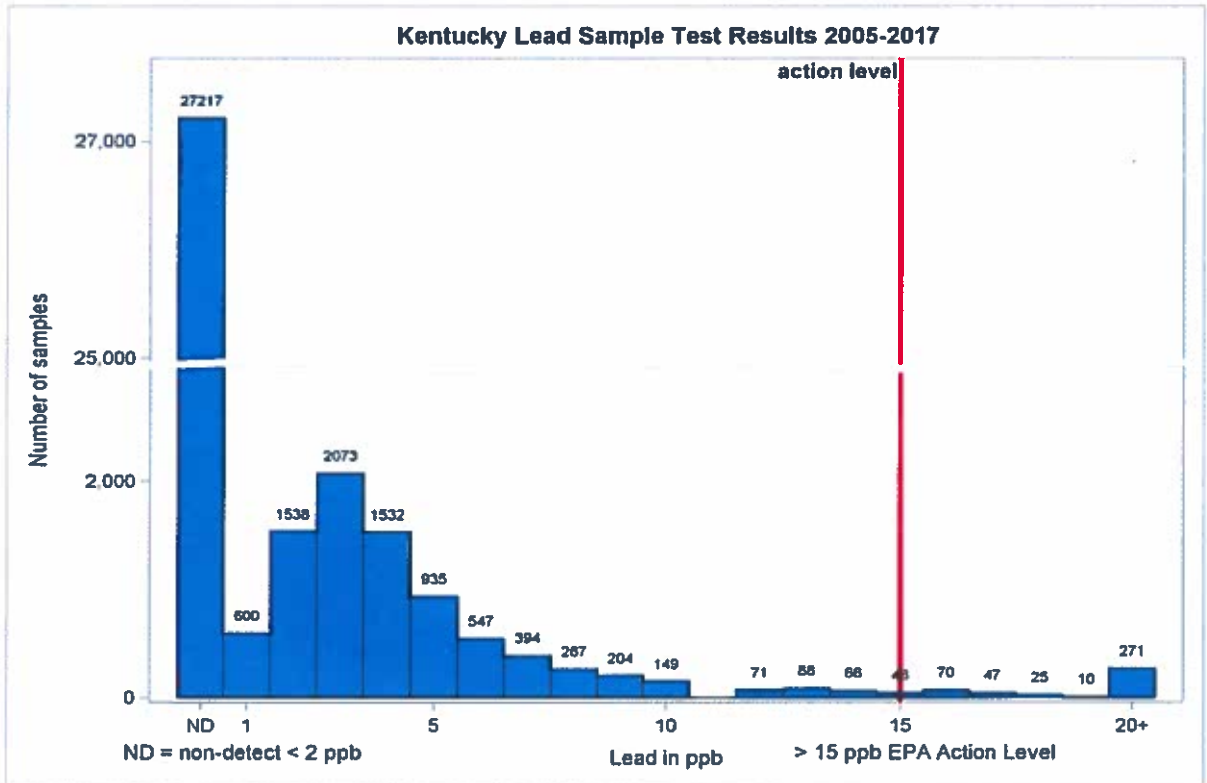


Figure 6. Kentucky Lead Sampling Results 2005 – 2017.

FUNDING

In 2000, Kentucky established 15 regional water planning and management councils. Annually, each regional council identifies drinking water system needs in their area. Projects are developed for these areas using a 20-year planning horizon, and they are prioritized on a regional basis with input from water providers and elected officials. KIA then develops a statewide priority list, and projects are selected for funding.

Since FY 2013-14, Kentucky has invested \$615.5 million in drinking water projects funded by grants and low-interest loans. Major funding sources include the State Revolving Fund (SRF) and Rural Development (RD) programs. Both SRF and RD programs provide low interest loans and some grants for water system infrastructure improvements. Table 2 provides a summary of drinking water grants and low-interest loans from federal/state agencies over the past five years (FY2014-FY2018):

Funding Source	FY Period	KY FY 2013-14 (Actual) (10/1/13 - 9/30/14)	KY FY 2014-15 (Actual) (10/1/14 - 9/30/15)	KY FY 2015-16 (Actual) (10/1/15 - 9/30/16)	KY FY 2016-17 (Actual) (10/1/16 - 9/30/17)	KY FY 2017-18 (FY Allocation) (10/1/17 - 9/30/18)	5YR TOTAL
Abandon Mine Lands (AML)	July 1 to June 30	\$ 11,664,569	\$ 19,299,430	\$ 8,435,009	\$ 11,296,456	\$ 3,713,340	\$ 54,408,804
Appalachian Regional Commission (ARC)	July 1 to June 30	\$ 1,226,500	\$ 168,000	\$ 2,575,149	\$ 1,434,338	\$ 4,820,408	\$ 10,224,395
Community Development Block Grant - Water	July 1 to June 30	\$ 1,822,000	\$ 624,000	\$ 947,000	\$ 3,271,028	\$ 2,647,846	\$ 9,311,874
KIA State Revolving Loan Fund (SRF)	July 1 to June 30	\$ 32,124,433	\$ 27,425,379	\$ 36,812,357	\$ 39,916,945	\$ 19,301,000	\$ 155,580,114
Rural Development (RD)	Oct 1 to Sept 30	\$ 76,292,000	\$ 70,135,250	\$ 41,809,000	\$ 50,792,000	\$ 146,937,000	\$ 385,965,250
	Total	\$ 123,129,502	\$ 117,652,069	\$ 90,578,515	\$ 106,710,767	\$ 177,419,594	\$ 615,490,437

Table 2. Kentucky Drinking Water Funding FY 2014-2018.



DRINKING WATER



In addition, larger water systems finance water system improvements through water rates, including debt, depreciation, and internally generated funds.

FUTURE NEED

In 2011, the EPA's Drinking Water Infrastructure Needs Survey and Assessment reported a \$6.2 billion funding need for Kentucky's drinking water infrastructure. The updated 2018 assessment reports (using 2016 survey data) an estimated 20-year funding need of \$8.2 billion for Kentucky, which represents a 32 percent increase over 2011. The most significant need in Kentucky is investment for

transmission and distribution replacement, upgrades, and extensions (\$6.3 billion), followed by treatment (\$929.7 million), and then storage (\$648.8 million). A summary of the drinking water infrastructure needs for Kentucky is identified in Table 3:

Area	\$Millions	Percent
Transmission and Distribution	\$ 6,320.70	76.8%
Treatment	\$ 929.70	11.3%
Storage	\$ 648.80	7.9%
Source	\$ 206.70	2.5%
Other	\$ 126.20	1.5%
Total	\$ 8,232.10	100.0%

Table 3. Kentucky Drinking Water Infrastructure Needs from 2016 EPA Survey, published 2018.

While the EPA Needs Assessment is more comprehensive, the Kentucky Water Resource Information System (WRIS) targets only drinking water projects that have applied for state or federal funding. A review of WRIS identifies an additional 20-year drinking water infrastructure need of \$1.9 billion. Table 4 illustrates the estimated WRIS project funding need over 20 years as of July 2018. Projects for larger municipal and for-profit systems are typically funded from water rates, including depreciation, debt, or special fees/surcharges.

Timeframe	WRIS Project Estimate (\$Million)
0-2 years	\$ 785.1
3-5 years	\$ 893.1
6-10 years	\$ 172.4
11-20 years	\$ 59.2
Total	\$ 1,909.8

Table 4. Kentucky Drinking Water Infrastructure Needs Identified in KY WRIS System.

RESILIENCE AND INNOVATION

In order to assess the Commonwealth's resilience to drought, Kentucky is updating its Water Supply Drought Risk Assessment in 2018. The most recent drought periods include 1988, 1999, 2007-08, 2010, and 2012. Kentucky has significantly reduced its drought vulnerability through additional source water capacity, treatment capacity, delivery systems, system mergers, and system interconnections. The Risk Assessment map, shown in Figure 7, illustrates the degree of vulnerability of Kentucky's public water systems to severe drought. When these droughts occur, areas of highest risk are found predominantly in southeast Kentucky, accounting for less than 1 percent of Kentucky's population.

Simultaneous to reducing drought vulnerability, the Commonwealth also has resources to respond and recover more quickly from a drought. KYWARN, a statewide Water/Wastewater Agency Response Network, provides water and wastewater utilities with a Mutual Aid Agreement and a process for sharing emergency water resources statewide when needed.



DRINKING WATER



The Kentucky MesoNet, an online weather and climate system, provides real-time weather data to assist with emergency response and resiliency efforts.

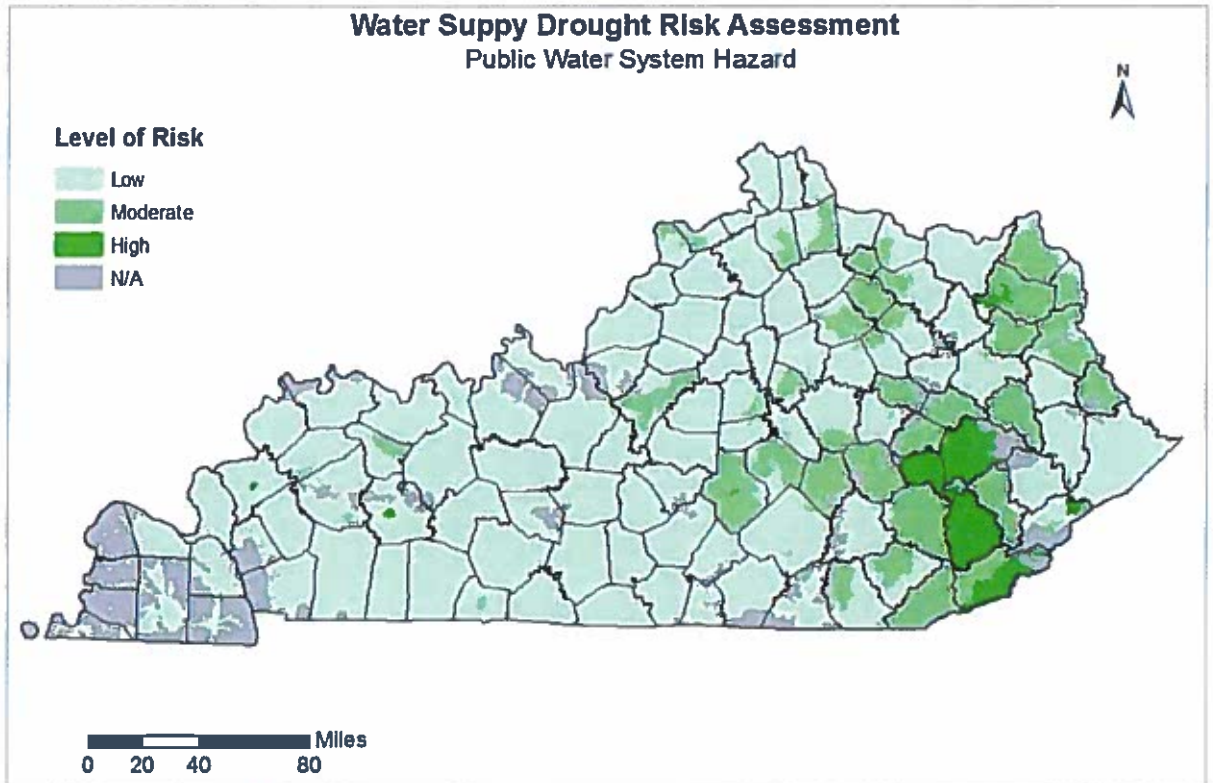


Figure 7. Kentucky Water Supply Drought Risk Assessment.

In another unique partnership with drinking water industry stakeholders (regulatory agencies, funding agencies, water utilities, and industry associations), the Kentucky Division of Water formed a Drinking Water Advisory Council, which meets quarterly to discuss regulatory compliance and industry best practices. This collaborative approach has led to proactive development of regulations and best practices for capacity development, water quality, lead corrosion control, permitting, operator certification, and design standards.

Kentucky also collaborates through industry associations, including American Council of Engineering Companies of Kentucky (ACEC-KY), Kentucky/Tennessee American Water Works Association (AWWA), Kentucky Municipal Utilities Association (KMUA), Kentucky Rural Water Association (KRWA), and the Kentucky Water and Wastewater Operators Association (KWWOA) to improve the quality, quantity, and service levels of Kentucky's drinking water supply. The University of Kentucky Water Resource Research Institute and the University of Louisville Center for Infrastructure Research also provide support for applied research and best practices.



DRINKING WATER



RECOMMENDATIONS FOR DRINKING WATER INFRASTRUCTURE

In order to continue the progress of improving Kentucky's drinking water systems, the following recommendations are supported by ASCE:

- Continue regional water planning and coordination of drinking water infrastructure,
- Maintain and enhance the Kentucky Water Resource Information System (WRIS),
- Continue updates of the 20-year drinking water infrastructure needs assessment every three to five years,
- Promote the use of cost-of-service water rate methods and full-cost pricing of water as defined in AWWA M-1 Manual on Water Rates, Fees, and Charges. Full-cost pricing will allow for water systems to build, operate, maintain, and reinvest in their water systems and provide safe, reliable drinking water supply to their community,
- Conduct a statewide assessment of water loss and promote the use of the AWWA M-36 Water Audit and Loss Control methodology to reduce water loss,
- Pursue water system mergers and regional solutions where economically beneficial,
- Continue grant and low-interest loan programs offered by federal and state funding agencies (ARC, AML, CDBG, KIA, RD, SRF),
- Pursue new sources of state and local funding for water infrastructure to bridge the funding needs gap and leverage federal and private investment in water infrastructure,
- Monitor the development of regulations for emerging contaminants (pharmaceuticals, personal care products, herbicides, and pesticides) in drinking water and identify the infrastructure improvements needed to comply with future regulations,
- Promote the use of best practices in water treatment and optimization of disinfection methods to reduce byproducts of disinfection,
- Conduct a state-wide inventory of public lead service lines and promote best practices for corrosion control, lead service line replacement, and public education on lead in drinking water,
- Develop a state-wide program for voluntary testing of lead in public schools through a partnership with the Kentucky Environmental Protection Cabinet, Department of Public Health, Department of Education, and drinking water providers,
- Develop proactive programs for recruiting and retaining plant and distribution operators.

DEFINITIONS/KEY TERMS

ACEC-KY - American Council of Engineering Companies of Kentucky

AML - Abandon Mine Lands

ARC - Appalachian Regional Commission

ASCE - American Society of Civil Engineers

AWWA - American Water Works Association

DBPR - U.S. EPA Disinfection Byproducts Rule

CDBG - Community Development Block Grant

CWS - Community Water System



DRINKING WATER



EPA – United States Environmental Protection Agency
FY – Fiscal Year
GIS – Geographic Information System
KIA – Kentucky Infrastructure Authority
KRWA – Kentucky Rural Water Association
KWWOA – Kentucky Water/Wastewater Operators Association
LCR – U.S. EPA Lead and Copper Rule
PSC – Public Service Commission
PWS – Public Water System
RD – Rural Development
SDWA – Safe Drinking Water Act
SRF – State Revolving Fund program
US – United States
WRIS – Water Resource Information System

SOURCES

1. Kentucky Division of Water, Public Water System Statistics (water.ky.gov)
2. Kentucky Water Resource Information System (www.kia.kentucky.gov/WRIS)
3. 2016 Kentucky Water Rate Survey, Canon and Canon
4. Circle of Blue 2018 Water Rate Survey (www.circleofblue.org/waterpricing/)
5. 2013 US EPA Water Loss Report (www.epa.gov)
6. 2017 Drinking Water Annual Compliance Report (www.water.ky.gov)
7. Update on Kentucky Lead Workgroup Activities, KY-TN Section AWWA Straight from the Tap, Spring 2018 (www.kytnawwa.org)
8. Kentucky State and Federal Funding for Drinking Water from KIA, AML, and RD Agencies
9. 2015 EPA Drinking Water Infrastructure Needs Survey and Assessment (www.epa.gov)
10. 2018 Kentucky Water Supply Drought Risk Assessment, Kentucky Division of Water (www.water.ky.gov)
11. KYWARN – Kentucky Water/Wastewater Agency Response Network (www.kywarn.org)
12. Kentucky MesoNet (www.kymesonet.org)
13. AWWA M-1 Manual on Water Rates, Fees and Charges (www.awwa.org)
14. AWWA M-36 Water Audit and Loss Control (www.awwa.org)



ENERGY



SUMMARY

The Commonwealth of Kentucky, with two major coal fields located within the state, has historically enjoyed the benefits of low cost electricity. The close proximity of the coal fields has kept transportation costs low, which has benefitted the state's economic development efforts. The average price of electricity as reported by the Kentucky Office of Energy Policy is 8.26 cents per kWh, which is the sixth lowest in the United States. Low energy costs have helped Kentucky attract manufacturing and other key industrial and commercial enterprises, which is an important part of the state's economy. Similar to industries across the country, in the past decade Kentucky industries have reduced output, with some companies closing or leaving the state. Total energy demand in Kentucky has still not rebounded to pre-recession levels—electricity generation dropped by one-fifth, from 2014 to 2017 alone. This reduction in electrical load has alleviated previous transmission capacity issues; however, the sharp decrease in demand for energy also presents a challenge with a subsequent decrease in funding for the infrastructure system needed to deliver energy across the state. To continue to meet the Commonwealth's energy demands and maintain low energy costs, Kentucky must continue to develop and maintain a diverse energy portfolio that includes coal, natural gas, and additional sustainable resources. Kentucky must also answer the challenge of how to fund improvements to the transmission and distribution infrastructure.

CONDITION AND CAPACITY

Energy and its transmission infrastructure are an important part of Kentucky's economy, as the largest percentage of the energy consumed in the Commonwealth is for commercial and manufacturing operations. Kentucky is able to offer low-cost electricity to energy-intensive manufacturers, which is the largest source of revenue and a leading source of employment in the state. With an abundant source of coal, Kentucky has been able to maintain the lowest industrial electricity rates east of the Mississippi River, which is critical to the state's economic growth.

Coal has been Kentucky's primary energy resource for more than two hundred years, with up to 94 percent of the state's electricity being produced from coal-fired generation as recently as 2008.

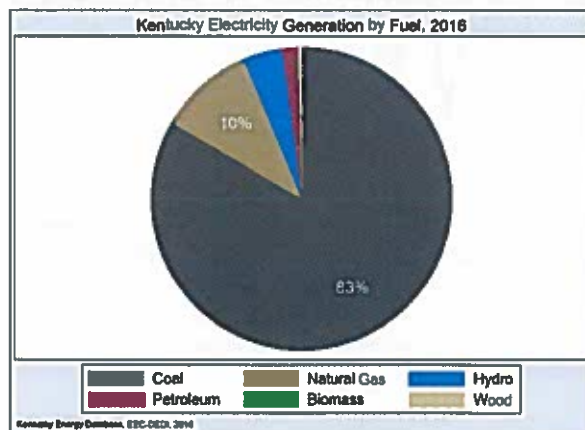


Figure 1. Kentucky Electricity Generation by Fuel, 2016.

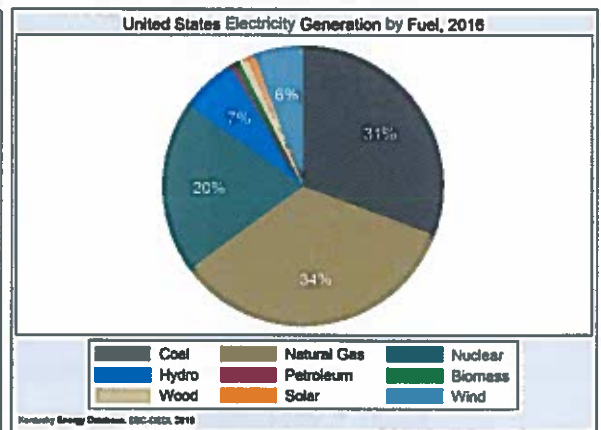


Figure 2. United States Electricity Generation by Fuel, 2016.



ENERGY



About a decade later, coal still accounts for 83 percent of Kentucky's electricity portfolio, compared with 31 percent nationwide, as illustrated in Figures 1 and 2 below. Although coal is Kentucky's primary energy source, the Commonwealth also produces small amounts of oil and enough natural gas to meet the needs for home heating and industrial requirements. Kentucky also has limited but growing renewable energy resources.

Electricity in Kentucky is supplied by 160 individual electricity-generating units at 46 power plants across the state. The average age of power plants is 38 years, with the oldest hydroelectric station being built in 1925.

The electricity-generating capacity in Kentucky, or the total amount of electricity that can be produced at any one moment, is 20 gigawatts of electricity, which is more than enough to power the homes, businesses, and industries in the state. As a result of the downturn in the economy due to the recession of 2008 and improvements in energy efficiency, energy use is down overall in Kentucky compared with previous decades; therefore, capacity is not a current concern.

Electricity usage grew rapidly in Kentucky in the late 1960s to the early 1970s and again from the late 1980s to the early 1990s, with a boom in manufacturing in the state.

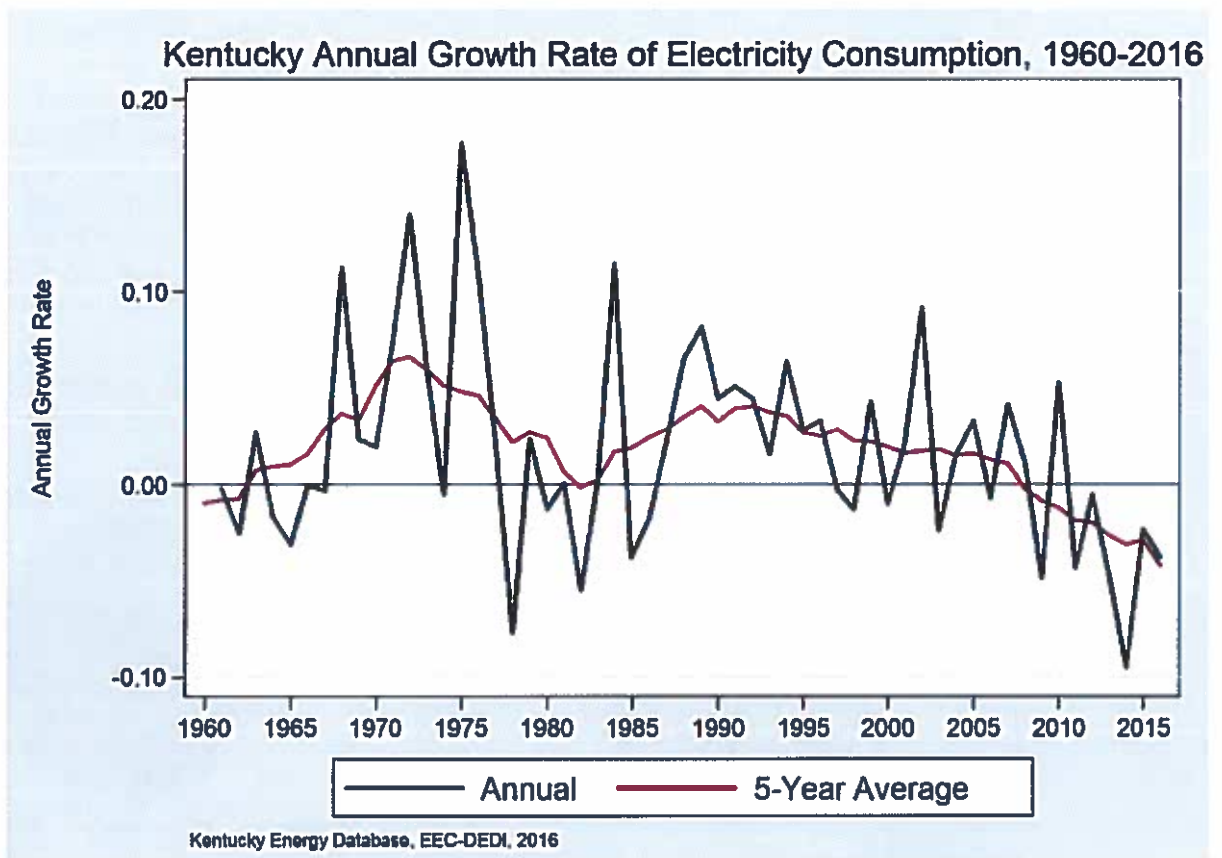


Figure 1. Kentucky annual growth rate for electricity consumption, Kentucky Energy Database, 2016



ENERGY



However, the recession of 2008 caused many in the commercial and industrial sectors to shut down or curtail output, which consequently had a significant impact on the electrical load for the state. Total electricity generation dropped by one-fifth, from nearly 90.9 million megawatt hours in 2014 to 72.1 million megawatt hours in 2017. This reduction in electrical load has alleviated the transmission capacity issues that were identified in previous report cards. Total energy demand has not rebounded to pre-recession levels, and for this reason, Kentucky has not needed to build infrastructure for additional capacity.

A combination of affordable natural gas and stricter environmental regulations—primarily mercury and air toxics—has resulted in the utilities of Kentucky transitioning away from coal to natural gas as the primary fuel for electricity generation. More than a dozen older coal-fired plants have been retired since 2014, since the cost of complying with these federal regulations, along with the reduced demand for electricity, proved not to be financially viable. Kentucky utilities have instead been building new transmission systems for natural gas since supply is abundant and prices are currently cheaper than coal.

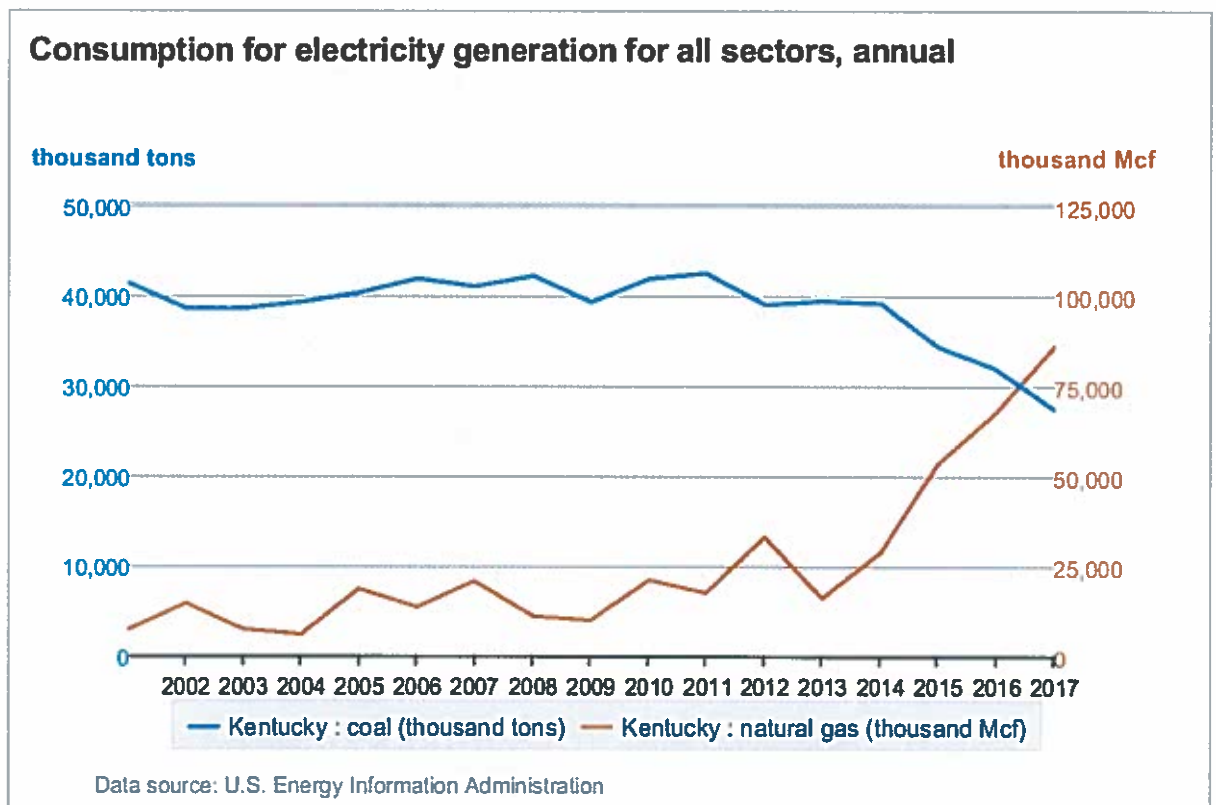


Figure 2. Consumption for electricity generation for all sectors in Kentucky.



ENERGY



OPERATION AND MAINTENANCE

The Commonwealth of Kentucky is divided into certified electric service territories, which are determined by the Kentucky Public Service Commission (PSC). Providers of electricity include three investor-owned utilities (IOUs), where ownership is made up of stockholders; two generation and transmission cooperatives, which are made up of members who generate and transmit their own power; 19 distribution cooperatives, with members who build and maintain their own distribution lines; 20 municipal utilities; and the Tennessee Valley Authority (TVA), which has a service territory along the southern border of Kentucky. The municipal utilities and TVA distributors are not subject to regulation by the PSC, but the remainder of the retail electricity market in the state is regulated by the PSC.

All transmission of electricity, natural gas, and oil is regulated by the Federal Energy Regulatory Commission (FERC). There are several regional transmission organizations (RTOs) that coordinate the movement of wholesale *electricity* throughout Kentucky:

- **PJM Interconnection**—an RTO that includes Duke Energy, AEP/Kentucky Power Company, and East Kentucky Power Cooperative as members. PJM operates the transmission systems of these utilities and dispatches energy to the eastern half of Kentucky.
- **Midcontinent ISO (MISO)**—an RTO that extends from the Canadian border to Louisiana. In Kentucky, the Big Rivers Electric Cooperative is a member of MISO, covering 22 counties in western Kentucky.
- **Tennessee Valley Authority (TVA)**—a federal agency that owns and operates one hydroelectric dam, eight combustion turbines, two coal-fired power plants, and one combined cycle gas plant to service 28 counties in western and south-central Kentucky.
- **Louisville Gas & Electric/Kentucky Utilities** serve as their own control areas, generating and dispatching their own energy and operating their own transmission assets for seven counties in north-central Kentucky as well as cities throughout the state.

With the exception of LG&E/KU and TVA, the transmission assets of energy infrastructure in Kentucky are operated by either MISO or PJM. Member utilities bid their generation into their respective market and in turn purchase their electricity needs from that same market. The regulations of both of these agencies have very tight control over any issues relating to the operation and maintenance of the transmission of energy in the state.

PUBLIC SAFETY AND RESILIENCE

Kentucky's energy infrastructure is generally resilient and able to meet the needs of the citizens of the Commonwealth. The major risks to the security of the network are associated with weather-related events, animal-caused outages, or similar catastrophic acts of nature. There is little that a utility can do to shield above-ground assets from increasing major storm events. However, identifying contingencies and preparing for failures can make the energy sector more resilient. In addition, research and deployment of advanced technologies are important to increased fiber security, another large area of vulnerability.

Another energy issue related to public safety is that of carbon emissions. In 2015, the Environmental Protection Agency (EPA) unveiled the Clean Power Plan, which aimed to lower



ENERGY



the amount of carbon dioxide emitted by power plants. However, the agency has recently introduced regulations that will modify this policy to require states to self-regulate CO₂ emissions. Depending on the strictness of the regulations imposed by Kentucky, this method of regulation could allow coal to once again fuel a substantial amount of the energy capacity in the state. It is unclear, however, if coal-generated electricity would increase since the wholesale market is now based on the price of natural gas, the lower cost fuel.

INNOVATION

Kentucky has not yet enacted requirements for renewable energy; however, there is interest from the private sector in developing sustainable energy sources such as solar, wind (not a significant resource), bioenergy, and hydroelectricity. Two utilities have constructed solar energy farms. LG&E/KU have developed a 10 megawatt solar generation facility at the E.W. Brown Generating Station, and East Kentucky Power has developed an 8.5 megawatt solar farm at its headquarters facility near Winchester, Kentucky. It was recently announced that in 2022, an 86 megawatt solar farm will be built in western Kentucky. The power from this farm will be used by the Kentucky Municipal Energy Agency and Owensboro Municipal Utilities. Solar farms had never previously gained traction in Kentucky since the cost of coal was so low. But now, costs of solar energy have come down and can compete with coal prices.

Because electricity must be used or stored as it is generated, energy storage solutions for renewable sources, such as solar and wind, will be key to wider adoption. LG&E/KU is partnering with the Electric Power Research Institute to test the viability of a new storage technology near Harrodsburg, Kentucky. In addition, with large quantities of coal still available in Kentucky, research is ongoing at the Commonwealth's universities to find new technologies that will mitigate the environmental effects associated with burning coal. These "clean coal" technologies have the promise of keeping coal at the forefront of innovations in providing energy to Kentucky. More funding for research will help Kentucky adopt more sustainable clean energy solutions.

FUNDING AND FUTURE NEED

Energy is largely paid for by the consumers who use it, which includes residential, commercial, and industrial customers. In 2016, the average price of electricity across all economic sectors was 8.26 cents per kilowatt-hour. This puts Kentucky prices at the sixth lowest in the country. Since 1970, the average price of electricity in Kentucky has been well below the national average.

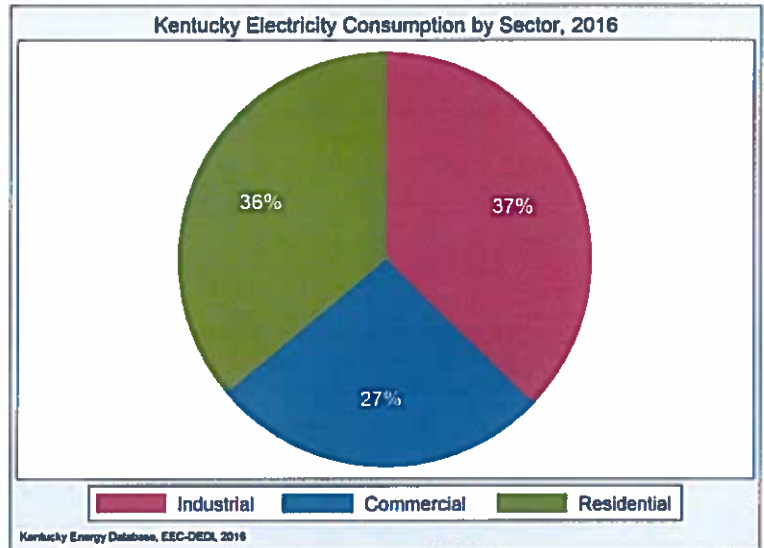
For the most part, energy infrastructure costs are also funded through the per-kilowatt-hour usage fees. While this may seem like a logical approach, a problem has surfaced in recent years when energy usage has dropped dramatically. With less energy usage, there is less income, which consequently means there is less funding for maintenance of the infrastructure system needed to deliver electricity to all customers.



ENERGY



In addition, although the energy prices in Kentucky are among the lowest in the nation, there is a trend within the industrial sector to develop onsite renewable generation. Many national corporations with businesses in Kentucky have internal sustainability goals requiring individual facilities to self-produce all power from renewable resources. Several of these facilities are building their own solar/wind farms to provide their own power; however, they are keeping the existing infrastructure in place for traditional energy sources as a backup. With the current rate structure of charging fees based on usage, these "stranded assets," as they are known, will require a new business model for funding to maintain the conventional energy infrastructure if it is required or requested.



Sector	Gigawatt Hours	1 Year Change
Total*	73,153	-3.8%
Industrial	27,267	-10%
Residential	26,425	+0.9%
Commercial	19,460	-0.6%

Figure 5. KY Electricity Consumption by Sector, 2016

RECOMMENDATIONS TO RAISE THE GRADE

The following recommendations are provided to help the Commonwealth raise the grade:

- Maintain low energy costs for customers, keeping in mind this is a key benefit for attracting new manufacturing companies to consider locating in Kentucky.
- Continue to support and promote the research and development of new energy technologies by providing funding and incentives for research projects, especially "clean coal" technologies in order to promote the abundance of coal in the Commonwealth without harming the environment.
- Support the research of energy storage solutions for renewable energy sources, such as solar and wind, in order to make wider adoption feasible.
- Support research to improve the efficiency of solar technologies which will improve the economics for the deployment of the technology.
- Continue to improve generation, transmission, and distribution infrastructure to ensure safety and reliability, while researching new business models for funding infrastructure maintenance.



ENERGY



- Maintain public safety by improving resiliency against severe weather-related events, catastrophic natural disasters, and cyber security threats.
- Support research and technologies to protect the resiliency of the grid.

KEY TERMS

EPA – Environmental Protection Agency

FERC – Federal Energy Regulatory Commission

IOU – Investor-Owned Utilities

PSC – Kentucky Public Service Commission

RTO – Regional Transmission Organization

Stranded Assets – infrastructure assets that are no longer able to earn an economic return

TVA – Tennessee Valley Authority (TVA)

RESOURCES

1. Kentucky Energy and Environment Cabinet, Office of Energy Policy: energy.ky.gov/
2. Kentucky Energy Profile, Kentucky Energy and Environment Cabinet, 6th Edition, 2017
3. Kentucky's Coal Facts, Kentucky Energy and Environment Cabinet, 17th Edition, 2017
4. A Guide to EIA Electric Power Data, U.S. Department of Energy, March 2018
5. Federal Energy Regulatory Commission website, <https://www.ferc.gov/market-oversight/mkt-electric/overview.asp>
6. Tennessee Valley Authority website: <https://www.tva.gov/About-TVA/TVA-in-Kentucky>



HAZARDOUS WASTE



SUMMARY

In Kentucky, hazardous waste is tracked from the point of generation until it is properly disposed or treated. With more than 3,000 entities generating hazardous waste in Kentucky, proper management is essential to protecting human health and the environment. There are 30 treatment, storage, and disposal facilities in the state that can accept hazardous waste, and this number appears to be sufficient for the state's needs, as there have been no new recent requests for a permitted management facility. Aside from newly generated hazardous waste needs, there are 62 environmentally damaged sites still undergoing corrective action today, and the state has 20 Superfund sites on the National Priorities List, which is on par with the national average of roughly 26 per state. In addition, there are hundreds of old or abandoned waste sites that still pose threats to the environment and public health. However, funding is not available to address cleanup of all of these sites. Kentucky has projected \$1.6 billion in remedial costs, but with an annual budget of \$450,000. It is clear that the Commonwealth is at risk of not being able to meet its statutory obligations to protect human health and the environment.

CAPACITY, OPERATIONS, AND MAINTENANCE

Many industries in Kentucky generate hazardous waste, such as hospitals, construction, and even dry cleaning. The top generators of hazardous waste in Kentucky are chemical, metal, and plastic manufacturing facilities. Hazardous wastes are defined as any liquids, solids, contained gases, or sludges that pose a serious threat to human health and the environment. The latest data on record shows that Kentucky generated 146,779 tons of this type of waste in 2016. The Environmental Protection Agency (EPA) began regulating these hazardous wastes under the Resource Conservation and Recovery Act (RCRA) in 1976. The term RCRA is often used interchangeably to refer to the law, regulations, and EPA policy and guidance. RCRA deals with newly generated materials that are currently destined for disposal or recycling.

The Comprehensive Environmental Response, Compensation, and Liability Act, also known as CERCLA or Superfund, is a related statute from 1980 that deals with cleaning up inactive and abandoned hazardous waste sites. The primary mission of the CERCLA law was to create a "Superfund" to pay for the clean-up and remediation of closed and abandoned hazardous waste sites.

Kentucky began regulating hazardous waste in 1979. The Kentucky Division of Waste Management (DWM) is the principal regulatory agency in the state, responsible for ensuring that hazardous wastes are properly managed and disposed. The Hazardous Waste Branch of the DWM is responsible for monitoring and permitting hazardous waste sites for newly generated materials, and the Superfund Branch works to ensure that historic contaminated sites are evaluated and cleaned up in a timely manner to reduce risks to human health and the environment. Usually this is accomplished by overseeing companies or individuals who have taken responsibility for cleaning up contamination found on their property; however, in cases where a responsible party cannot be found or is unable to act, the Superfund Branch may take a direct role in cleaning up a site.



HAZARDOUS WASTE



The Hazardous Waste Branch oversees the management of hazardous waste from generation to disposal, or "cradle to grave." This involves issuing permits to new facilities, corrective action (cleanup) of current sites, and registering the 3,000+ entities that generate hazardous waste in Kentucky. The branch is currently overseeing 62 facilities that were determined by the EPA to be in need of corrective action. Facilities on this list—the 2005 Government Performance and Results Act (GPRA) Corrective Action Baseline—were identified in the early 1990s as the highest priority sites where early cleanup would be appropriate. Forty-three of these sites have attained "remedy constructed" status, which means that restorative measures have been implemented to address contamination at the site.

In addition to overseeing corrective action of these existing sites, the Hazardous Waste Branch grants permits for new hazardous waste facilities. In the Commonwealth, there are 30 treatment, storage, and disposal facilities (TSDFs) that accept hazardous waste with a RCRA Part B operating permit and/or a post-closure permit. This number has increased since the time of the last ASCE Kentucky Section review when there were 14 facilities in the state; however, demand has remained flat, as there have been no new requests for a permitted management facility.

The Superfund Branch of the DWM oversees 20 sites in Kentucky that are on the National Priorities List (NPL), a list created by the EPA of the most serious threats of hazardous substances, pollutants, or contaminants throughout the United States. As seen in Figure 1, there are currently 13 sites that are in the remedial design/remedial action phase (labeled "Active"), and seven sites that have a certificate of completion (labeled "Deleted"). There are no other sites being considered for addition to this list.

Total Kentucky NPL Site	EPA ID Number	Active Vs. Deleted	Regulatory Owner
A.L. Taylor (a.k.a. Valley of the Drums)	NA	Deleted	SFB Fed. Sect.
Smith's Farm - Brooks	KYD097267413	Active	SFB Fed. Sect.
Lee's Lane	NA	Deleted	SFB Fed. Sect.
Distler Farm - Jefferson County	KYD980601975	Active/Deletion in Progress	SFB Fed. Sect.
Distler Brick Yard - West Point	KYD980602155	Active/Deletion Considered	SFB Fed. Sect.
Tri-City Disposal - Shepherdsville	KYD981028350	Active/Deletion Considered	SFB Fed. Sect.
National Southwire Aluminum	NA	Deleted	SFB Fed. Sect.
National Electric Coil - Dayhoit	KYD985069954	Active	SFB Fed. Sect.
Green River Disposal - Maceo	KYD980501076	Active	SFB Fed. Sect.
Caldwell Lace Leather - Auburn	KYD045738291	Active/Deletion Considered	SFB Fed. Sect.
Newport Dump/Landfill	NA	Deleted	SFB Fed. Sect.
General Tire Landfill	NA	Deleted	SFB State Sect.
Fort Hartford - Olaton	KYD980844625	Active	SFB State Sect.
Brantley Landfill - Island	KYD980501019	Active/Deletion Considered	SFB State Sect.
B. F. Goodrich - Calvert City (51%)	KYD006370167	Active	SFB General
Howe Valley Landfill	NA	Deleted	SFB Fed. Sect.
Red Penn Sanitation Landfill	NA	Deleted	SFB Fed. Sect.
Maxey Flats Nuclear Disposal - Hillsboro	KYD980729107	Active	SFB Maxey Flats Sect
Airco - Calvert City	KYD041981010	Active	SFB General
Paducah Gaseous Diffusion Plant - Paducah	KY8890008982	Active	HWB PGDP Sect.

Figure 1. Total Superfund Sites on National Priority List



HAZARDOUS WASTE



The Superfund Branch of the DWM is responsible for a large number of sites that essentially do not fall under other programs' regulatory authority. Because these sites are otherwise abandoned and do not have a viable responsible party, the Superfund Branch takes on financial liability. As funding dwindles, and as the number of sites, costs of remediation, and long-term oversight continue to increase, the financial capacity of the Superfund Branch to address contaminated sites has steadily declined.

In addition to the RCRA-permitted facilities and the Superfund sites, a third type of hazardous waste site is known as "Brownfields." Brownfields are abandoned, closed, or under-used industrial or commercial facilities, such as a shuttered factory in the middle of town or a closed commercial warehouse in a suburban setting. Brownfields can be located anywhere and can be quite small, such as a dry-cleaning establishment or a closed gas station. Part of the CERCLA legislation of 1980 made the purchaser of any such property liable for any hazardous substances found on the land, which is why an environmental site assessment (ESA) is a practical necessity for any potential buyer of the property. With an estimated 8,000 brownfields across the state and only 14 site assessments done in Fiscal Year 2017, the brownfield redevelopment effort will take hundreds of years to assess all brownfield sites. Some facilities such as dry cleaners are "mom and pop" type operations with little financial backing by the time they go out of business, and although they are the responsible party, they do not have funds to clean up the site. Any potential new buyer of the property does not want the liability for the site, and the Commonwealth doesn't have the funds to clean up such properties. One way to address this particular type of waste site is to create a tax on dry cleaning. Other states have set up such a tax to create a fund that will address such issues.

FUNDING & FUTURE NEED

Funding for Kentucky's hazardous waste facilities comes from several sources. Some programs are completely supported by federal funds, while others are only partially supported or not supported by federal funds at all. Currently, DWM receives funding from a total of 14 federal grants and cooperative agreements, including:

- There is grant funding from the EPA that covers approximately 65% of costs to the DWM for active oversight of 62 facilities needing corrective action. There are also site-specific grants for facilities such as The Paducah Gaseous Diffusion Plant and The Blue Grass Army Depot.
- The Five-Year Review Cooperative Agreement (FYR) provides funding from the EPA to the Superfund Program to perform five-year reviews of remedial action at National Priority List sites in Kentucky. The purpose of a five-year review is to determine whether a site's ongoing or completed remedial actions will remain protective of human health and the environment.
- Under the CERCLA Act, the EPA provides financial support to the Brownfield Redevelopment Program to address the assessment, cleanup, and redevelopment of brownfield sites. In addition, the Brownfields Assessment and Cleanup Grant (BAG) from the EPA provides funding to Kentucky communities that wish to address brownfield properties in order to protect and or improve water resources. This grant was designed to target rural areas impacted by coal mining, but it may also be used to assess approved sites throughout the Commonwealth.



HAZARDOUS WASTE



- The Leaking Underground Storage Tank (LUST) Cleanup Cooperative Agreement with the EPA provides financial assistance to the Underground Storage Tank (UST) program to oversee the cleanup of leaking underground storage tanks by responsible parties and to ensure the cleanup at sites where an owner or operator is unwilling or unable to take necessary corrective action.

In addition to federal funding sources, Kentucky has a Hazardous Waste Management Fund (HWMF) to provide the Energy and Environment Cabinet with the funds necessary to protect the health of the citizens and environment of the Commonwealth from threats associated with releases of hazardous substances, pollutants, and contaminants. The HWMF is the sole source of funding for emergency response and state-led remediation, and it is the Commonwealth's only fail-safe for contaminated sites where there is no responsible or viable party to take action, such as Superfund sites.

Presently, the annual HWMF budget allocated to the Superfund Branch for discretionary spending is approximately \$450,000. This funding level is not sufficient to address single, small-to-medium site events and large emergencies. Figure 2 illustrates an assessment by the Superfund Branch to project the state's existing, near future, and long-term potential liability costs. At even the best-case scenario, with \$1.6 billion in remedial costs, it is clear that with an annual budget of \$450,000, the HWMF can no longer meet its statutory obligations to protect human health and the environment.

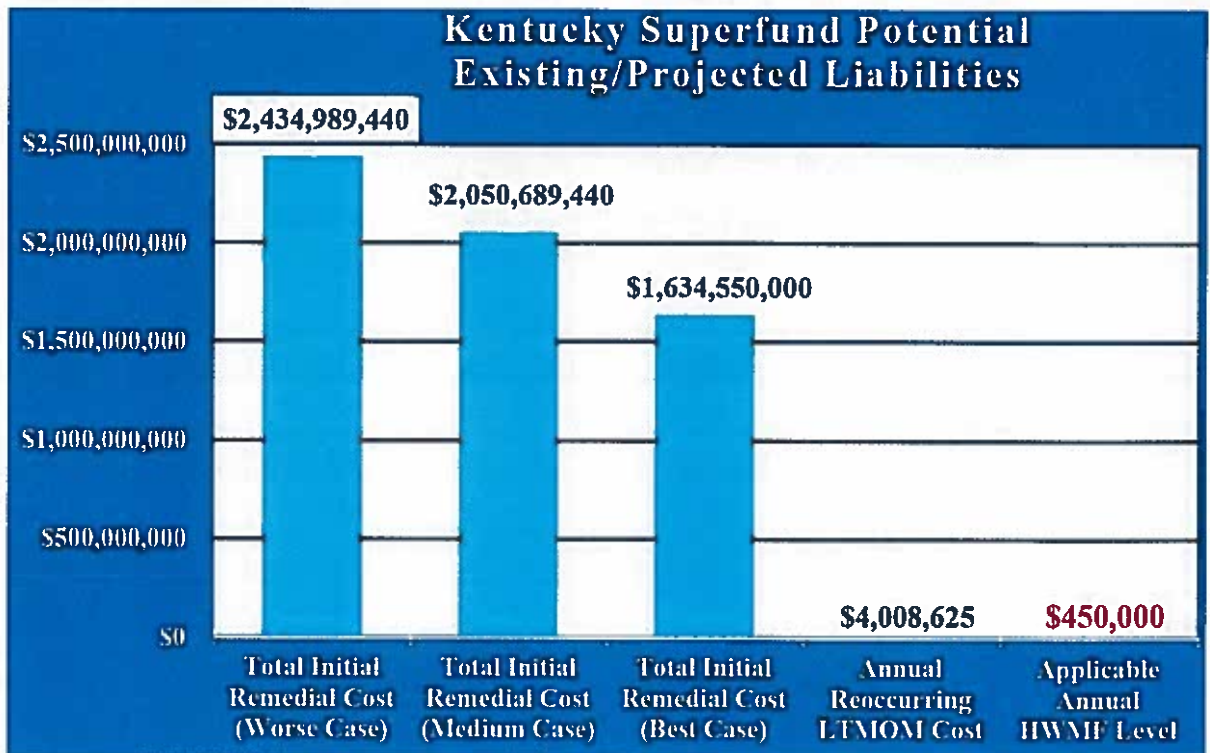


Figure 2. Kentucky Superfund Potential Liabilities



HAZARDOUS WASTE



Figure 2 is a comparison of the amount of funding available to the estimated annual program need. The amount of funding available is based on the anticipated assessment fees and fund transfers from other areas of the budget to the HWMF. The estimated annual program need is based on average expenditures for emergency responses and state-led site cleanups over the last two years. The available funding on an annual basis will not be sufficient to meet the baseline needs for the program moving forward.

The Hazardous Waste Branch of DWM receives approximately \$300,000 in permit review fees that are applied to the program costs. State general funds make up the balance of the funding needed to run the Hazardous Waste Program in Kentucky.

PUBLIC SAFETY & RESILIENCE

Public safety is the utmost priority behind all hazardous waste laws and regulations in Kentucky. Traditional hazardous waste remediation and land-use management help protect the Commonwealth's drinking water, human health, and other natural resources.

Each operating RCRA Part B TSD facility is required to have a waste minimization plan in place to reduce the waste generated at hazardous waste sites. In addition, the DWM encourages facilities to minimize hazardous waste whenever possible.

Kentucky would like to look at innovative means for risk management practices or policies on sustainability, but the state is lacking funds to carry this out. Examples of risk management actions include deciding how much of a substance a company may discharge into a river; deciding which substances may be stored at a hazardous waste disposal facility; deciding to what extent a hazardous waste site must be cleaned up; setting permit levels for discharge, storage, or transport; establishing national ambient air quality standards; and determining allowable levels of contamination in drinking water.

Risk assessment provides information on potential health or ecological risks, and risk management is the action taken based on consideration of that and other information, as follows:

- Scientific factors provide the basis for the risk assessment, including information drawn from toxicology, chemistry, epidemiology, ecology, and statistics, to name a few.
- Economic factors inform the manager on the cost of risks and the benefits of reducing them, as well as the costs of risk mitigation or remediation options and the distributional effects.
- Laws and legal decisions are factors that define the basis for risk assessments, management decisions, and, in some instances, the schedule, level, or methods for risk reduction.
- Social factors, such as income level, ethnic background, community values, land use, zoning, availability of health care, lifestyle, and psychological condition of the affected populations, may affect the susceptibility of an individual or a definable group to risks from a particular stressor.
- Technological factors include the feasibility, impacts, and range of risk management options.



HAZARDOUS WASTE



- Political factors are based on the interactions among branches of the federal government, with other federal, state, and local government entities, and even with foreign governments; these may range from practices defined by policy and political administrations through inquiries from members of Congress, special interest groups, or concerned citizens.
- Public values reflect the broad attitudes of society about environmental risks and risk management.

RECOMMENDATIONS TO RAISE THE GRADE

The Kentucky section of the American Society of Civil Engineers (ASCE) recommends the following measures be taken for the hazardous waste infrastructure of the Commonwealth:

- Continue to ensure that adequate treatment and disposal of hazardous waste is consistent with state and federal rules.
- Increase state funding to meet need for hazardous waste oversight and clean-up.
- Improve partnerships with the state's hazardous waste facilities.
- Increase funding for Superfund site remediations.
- Promote a dry cleaning fund, which exists in neighboring states, to help mitigate cost of hazardous waste cleanups that typically exceed the financial capability of facility owners.
- Renew emphasis on brownfield development; increase funding from the state to augment federal funding.
- Raise public awareness of hazardous waste issues.
- Promote recycling of hazardous waste to recover usable products, such as regeneration of spent solvents or burning for energy recovery.

DEFINITIONS

BAG – Brownfields Assessment and Cleanup Grant

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act, also known as "Superfund"

DWM – Division of Waste Management

EPA – U.S. Environmental Protection Agency

ESA – Environmental Site Assessment

FYR – Five-Year Review

HWMF – Hazardous Waste Management Fund

LUST – Leaking Underground Storage Tank

NPL – National Priorities List

RCRA – Resource Conservation and Recovery Act

TSDF – Treatment, Storage, and Disposal Facility

UST – Underground Storage Tank



HAZARDOUS WASTE



SOURCES

1. Division of Waste Management, Fiscal Year 2017 Annual Report
2. Hazardous Waste Management Fund, A Report to the General Assembly, 2014
3. ASCE Superfund Informal Briefing, 2018²
4. Energy and Environment Cabinet, Division of Waste Management, Hazardous Waste Program: <http://waste.ky.gov/HWB/Pages/default.aspx>
5. Environmental Protection Agency, List of Superfund Sites in Kentucky: <https://www.epa.gov/ky/list-superfund-sites-kentucky>



LEVEES



SUMMARY

Levee systems are an important part of Kentucky's landscape, because the rivers and waterways that provide needed transportation and water supply also have a history of devastating floods. The Commonwealth learned the importance of building flood protection after the historic flood of 1937. Since that time, Kentucky has built a network of levees across the state, now protecting more than 306,000 lives and \$46.6 billion in property. However, nearly half of the state's inventory of levees are 50 years old or more, which is beyond their expected design life. Many mechanical and electrical components of these systems were built in the 1940s and 1950s, and as such, many levee systems are deteriorating, and an increase in overall maintenance is required. In addition, two levee systems are classified as a level two or "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. Sustained actions are needed in order to mitigate these risks. Remediation of these systems will need funding, and the cost of inaction is a large threat to public safety.

CAPACITY AND CONDITION

Flood risk reduction is important in Kentucky, as the state's entire northern border is formed by the Ohio River, and its western border by the Mississippi River. Major cities that depend on the state's levee systems for protection include Covington, Louisville, Newport, and Paducah, along with many more communities and citizens throughout the state.

Most levees in Kentucky are earthen embankments designed and constructed for the purpose of containing, controlling, or diverting the flow of water to reduce the risk of flooding. Levee systems can also include concrete floodwalls, removable street closures, flood gates, and flood pump stations that work together to provide risk reduction from potentially devastating flood waters.

Figure 1 shows data from the National Levee Database (NLD), an online resource created by the U.S. Army Corps of Engineers (USACE). This database shows a total of 34 levee systems in Kentucky, consisting of 101 total miles. Five of these levees are USACE federally constructed and operated; 28 are USACE federally constructed but have been turned over to public sponsors for operations and maintenance; and one is locally constructed and locally operated/maintained. Together, all of Kentucky's levees are protecting more than 306,000 lives and \$46.6 billion in property, including hospitals, universities, major manufacturing facilities, critical utilities (electric power, water, wastewater plants, etc.), and densely populated metropolitan areas.

The average age of levees in the state is 49 years, which is nearing the end of their projected design life of 50 years. Nearly half of the state's inventory of levees, 15 of 34, were built in or before 1968, putting many of their components at the end of their life expectancy. Many parts of these systems, such as pumping stations, were constructed in the 1940s and 1950s, and 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.



LEVEES

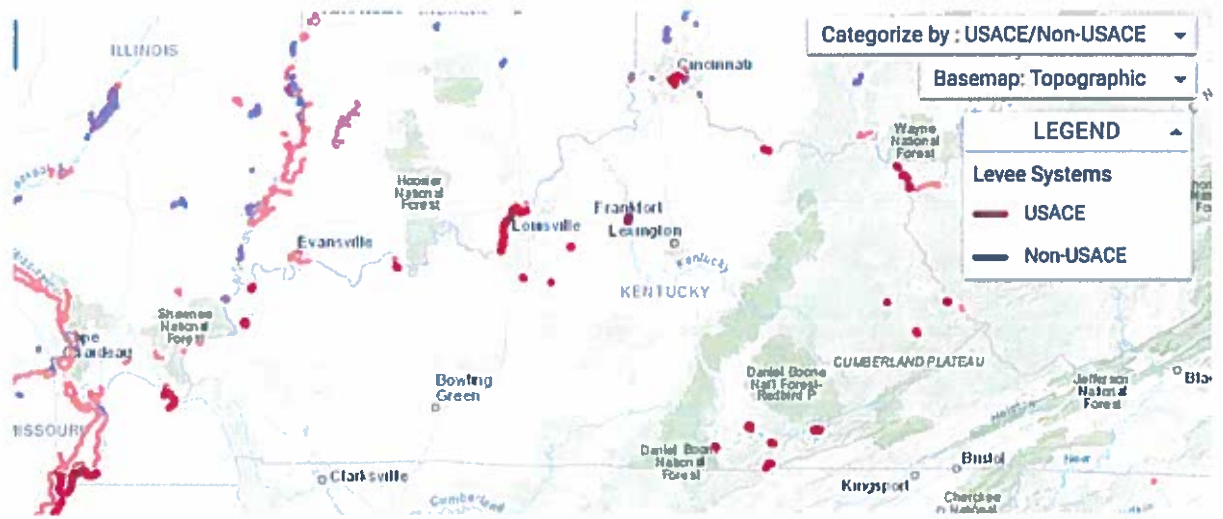


Figure 1. Levees in Kentucky, National Levee Database

Due to the risks associated with levee failure or overtopping, the USACE characterizes each levee with an action class to assess and manage the risks to people, property, and the environment. Of the 34 levees in Kentucky, 30 have been assessed, and the remaining four have not yet been screened.

The USACE Levee Safety Action Classification (LSAC) risk categories are: (1) Very High, (2) High, (3) Moderate, (4) Low, and (5) Very Low. The majority of Kentucky's levees, 24 out of 34, are rated as LSAC Level 4, which means there is relatively low risk of inundation of flood waters, and routine safety activities should be continued. Four Kentucky levees are rated as Level 3 or "Moderate," where there is a potential risk for levee failure, and actions are warranted in order to reduce the risk. Two levee systems in Kentucky are classified as Level 2 or "High," which means that urgent actions are needed in order to reduce the risk of loss of life and economic or environmental consequences. The two systems rated as "High" are:

Louisville – This levee system provides flood-risk reduction against the Ohio River for the city of Louisville and portions of Jefferson and Bullitt Counties. The levee system has a total length of 25.92 miles and consists of earthen levees, concrete walls, 16 pumping stations, over 60 removable closures, and more than 150 floodgates. This system is considered to be a "High" risk based on uncertain performance and the associated consequences of potentially high loss of life (216,825 people at risk) and extremely high property damage (projected at \$33.8 billion). This system has a limited loading history, and there is uncertainty concerning the flood wall performance at the upstream end of the segment if it were loaded to the top. Analyses show that some areas of the concrete floodwall do not meet the minimum factor-of-safety if water were within four feet of the top. However, a flood of this magnitude has a very low probability of happening, and it does not mean the floodwall would automatically fail even if water got this high. Although potential for overtopping is infrequent, evacuation effectiveness is also a concern based on the high population. This is offset, however, by the Ohio River being a slow-rising flood source with the potential for significant warning time in the case of overtopping.



LEVEES



Hickman-Obion River System – This levee system provides flood-risk protection for portions of southwest Kentucky and northwest Tennessee. (Levee systems are not confined within state lines.) This system contains 62.2 miles of levee to protect flooding from the Mississippi River. Significant investment in the levee in recent years has helped decrease but has not eliminated flooding risk. The potential exists for flood events to occur that could lead to overtopping or breach of the levee or floodwall. If such events occurred or if there were a failure of the system, the areas behind the levee would experience high damages and potential loss of life. Levee sponsors, local communities, and USACE are taking action to reduce risk associated with this levee system.

The "High" risk categorization for both of these levee systems is currently undergoing review and may be updated in the future.

There are no levee systems in Kentucky rated as Level 1 or "Very High" risk.

OPERATION 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, for example, 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 protection.

The USACE designed and built 33 of Kentucky's 34 levee systems, then in many cases turned over operations and maintenance to a local sponsor. 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 National Levee Database. 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 and levee systems and provides a rating that can help federal operators and local sponsors prioritize repairs or maintenance. As shown in Figure 2, only two of Kentucky's levee systems currently have an "acceptable" rating, two having an "unacceptable" rating, and the large majority, 29 systems, or 88%, have been named "minimally acceptable."

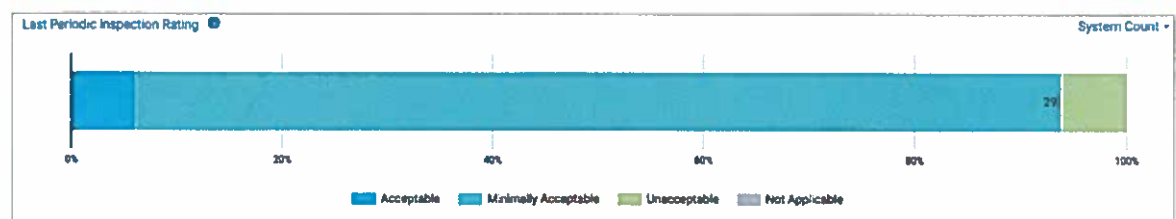


Figure 2. Inspection Ratings by USACE, NLD website



LEVEES



FUNDING AND FUTURE NEED

Funding for Kentucky's levees depends on who is responsible for their operation. Federal funding is available for the five USACE-owned and operated levees. There is one locally owned and operated levee, which is funded by the City of Frankfort. And the majority of Kentucky's levees, which are operated by public sponsors, are funded by those entities, including cities, municipalities, or other local public entities, many of which have limited budgets for repairs or maintenance.

USACE also has some programs available for local entities who may apply for funding of small projects. These programs are usually allocated to maintenance and replacement projects, with budgets of under a couple million dollars.

PUBLIC SAFETY, RESILIENCE, AND INNOVATION

USACE estimates that more than 306,000 people are protected by Kentucky's 34 levees. These systems are protecting more than 123,000 structures and \$46.6 billion in property, including hospitals, universities, major manufacturing facilities, treatment plants, power plants, and densely populated metropolitan areas. With significant flooding events along the Ohio River in 2005, 2008, 2011, 2015, and 2018, the Commonwealth's network of levee systems did their job, and no levees were breached.

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 Kentucky's citizens safe from the devastating effects floods can cause.

Flood awareness and emergency preparedness play a key role in risk management for individuals and communities living behind levees. The Federal Emergency Management Agency (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: i.e. EAPs for larger, more densely populated urban communities, such as Louisville, will require more detailed evacuation route mapping and broader emergency contact flowchart than sponsors of small communities.

RECOMMENDATIONS TO RAISE THE GRADE

The Kentucky section of the American Society of Civil Engineers (ASCE) recommends the following measures be taken for the levee infrastructure of the Commonwealth:

- Explore immediate funding for the two levee systems classified as "High Risk" by the LSAC. These levees require action to reduce the risk of loss of life and economic or environmental consequences.
- Establish a statewide levee sponsor program to encourage sharing of emergency plans, education, best practices, trainings, and inspection data, so Kentucky 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.



LEVEES



- Explore a program for nonfederal levees to require safety inspections and have EAPs in place.
- Increase public outreach to educate 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.

DEFINITIONS

EAP - Emergency Action Plan

FEMA - Federal Emergency Management Agency

LSAC - Levee Safety Action Classification

NLD - National Levee Database

USACE - U.S. Army Corps of Engineers

SOURCES

1. National Levee Database, U.S. Army Corps of Engineers:
<https://levees.sec.usace.army.mil/#/>
2. U.S. Army Corps of Engineers, Levee Portfolio Report, March 2018.
3. U.S. Army Corps of Engineers, Levee Safety Program:
<https://www.usace.army.mil/Missions/Civil-Works/Levee-Safety-Program/>



ROADS



SUMMARY

Kentuckians depend on having an efficient, safe, and well-maintained transportation network to provide easy access to work, school, medical offices, grocery stores, sporting events, and other locations. The state has recently acted to improve the roadway network by enacting a Highway Plan that will provide \$8.5 billion for over 1,400 projects across the state over the next six years. The condition of the road systems is improving; the Kentucky Transportation Cabinet's (KYTC) performance score for all roads in 2018 was 84.5, which is well above the goal of 80 and is the highest score given to date. While this is encouraging, there continues to be inadequate funding for needed construction and safety initiatives. The KYTC recently identified \$6 billion in unfunded construction projects, which would require an additional \$490 million per year to address. In addition to current needs for road maintenance and safety initiatives, the state must also plan for future growth, as traffic volume has increased by 5 percent since 2013.

CONDITION & CAPACITY

In the Commonwealth of Kentucky, there are more than 80,000 miles of public roads. About 20 percent of those are in urban areas, and 80 percent are rural.

As shown in Figure 1, about half of all public roads (40,129 miles) are maintained by individual county governments, and about one-third (27,600 miles) are maintained by the state. Another 13 percent (10,723 miles) are maintained by city/municipal governments, and the remaining 2 percent are owned and maintained by other federal, state, and local agencies.

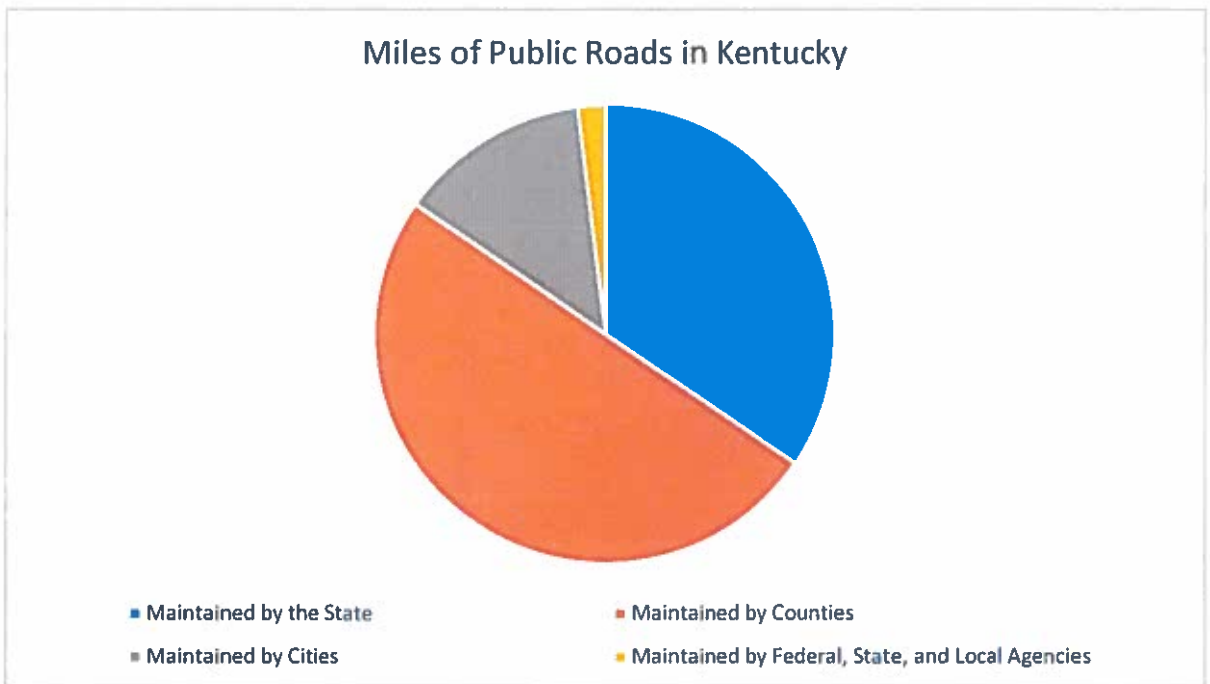


Figure 1. Maintenance of Public Roads in Kentucky.



ROADS



In order to better understand how much the roadways are being used, KYTC monitors traffic volume on all of Kentucky's roads. Data from the cabinet shows that the number of vehicle miles traveled in the Commonwealth continues to rise each year. Another data set, from a national transportation research group called TRIP, states in their report "Kentucky Transportation by the Numbers," that vehicle travel in the state totaled 49.5 billion miles in 2016, which is an increase of 5 percent since 2013.

In addition to monitoring traffic volume, KYTC also assesses the condition of Kentucky's roads each year by surveying roadside conditions and assigning a target performance level score, on a scale of 1 to 100. The statewide maintenance rating program looks at various key categories to assess the overall state of Kentucky's roadside conditions. In addition to roadway items such as potholes, this score also addresses items like shoulder drop-offs, signage, striping, guardrails, and trees within the right of way. The performance score for all roads in 2018 was 84.5, which is well above the goal of 80 and is the highest score given to date. Figure 2 shows a general trend of improvement in overall road conditions since 2007. While on the whole this score is improving, there are still subcategories of roadway classifications and conditions of individual features that score below the target of 80.

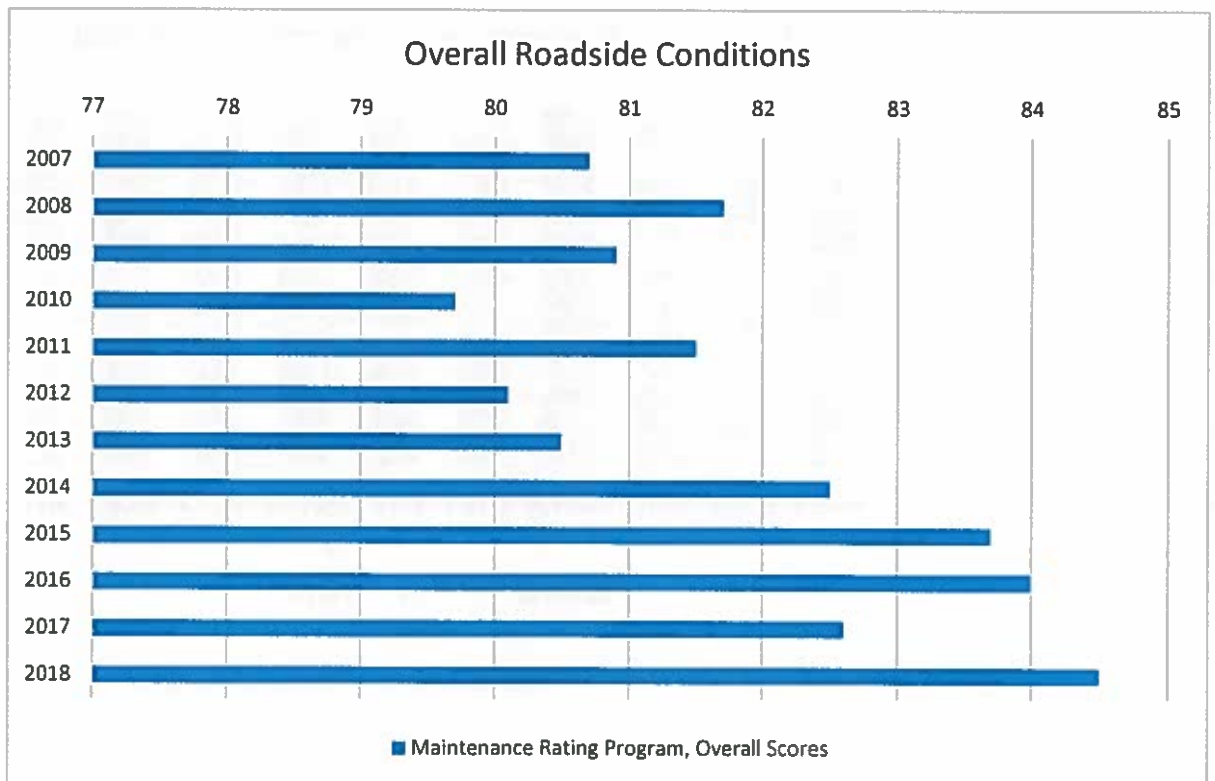


Figure 2. KYTC Maintenance Rating Program Scores, 2007-2018.



ROADS



Steady improvements have been made in the areas of pothole service and guardrail specifications. The categories of vertical clearance and shoulder drop-offs have been improving in recent years but had a slight drop in 2018. Rutting—grooves worn into the road surface by wheels—has increased on roads statewide over the last four years, reducing the scores.

Figure 3 specifically addresses the condition of Kentucky's pavements. KYTC utilizes a sliding scale that holds high-traffic roadways to a higher standard of performance, rating the roadways as good, fair, or poor depending upon the overall level of distress and the total traffic volume. A good pavement is smooth with few defects, while a poor condition pavement is characterized by a rough ride and moderate to severe distresses.

It should be noted that the assessment system changed in 2015, which had an impact on ratings. At that time, the Operations and Pavement Management Branch of KYTC implemented a new methodology based on improved data sources to more accurately assess the distinction between fair and good pavement. As a result, the percentage of fair pavement increased and the percentage of good pavement decreased beginning in 2015.

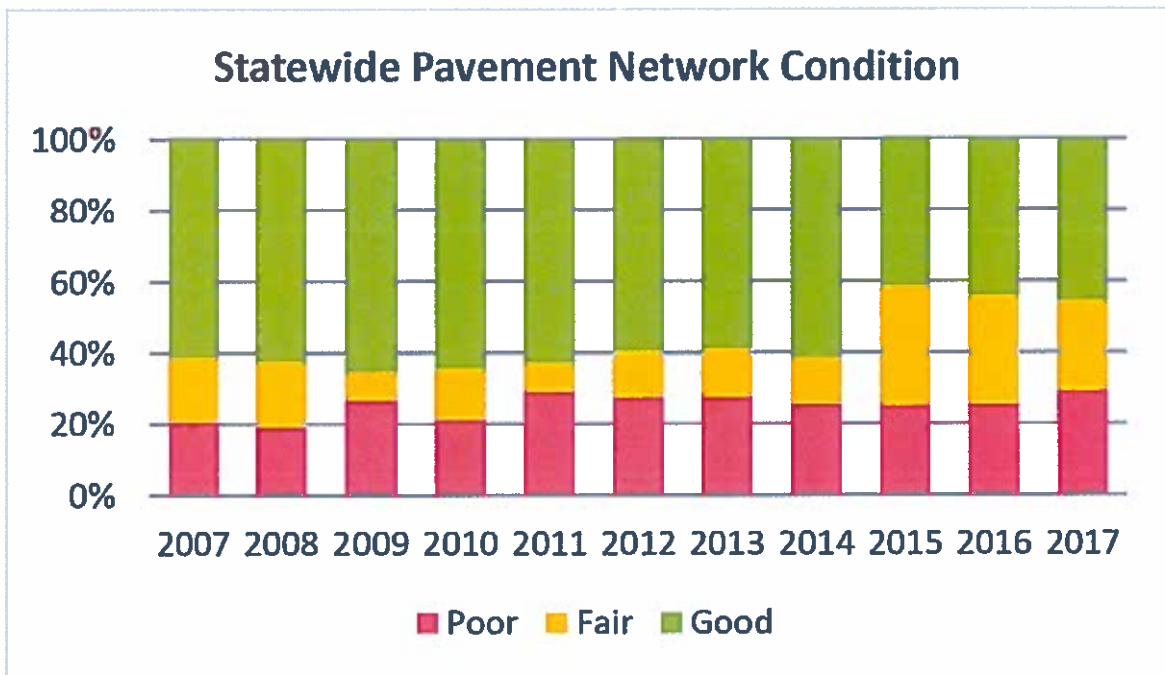


Figure 3. Statewide Pavement Network Condition, Pavement Condition Report, 2017



ROADS



FUNDING

Kentucky roads are largely paid for by those who use them, as about half the funding for roads infrastructure comes from motor fuels taxes. In addition to a federal motor fuels tax, Kentucky assesses a state motor fuels tax of \$0.26 per gallon of gasoline and \$0.23 per gallon of diesel. Approximately 44.4 percent of the revenue from these taxes is dedicated to local agencies. In comparison, the national average for a state gas tax is \$0.3372 per gallon of gas and \$0.3551 per gallon of diesel (per the American Petroleum Institute website).

By law, the Kentucky gas tax is tied to the average wholesale price (AWP) of a gallon of gasoline. Currently, the tax is 9 percent of the AWP. When the wholesale price of gas drops, the amount collected in taxes also drops, which means less money to fund road maintenance, for example. In 2015, the Kentucky General Assembly legislatively set the floor of the tax equivalent to a wholesale price of \$2.177 per gallon to ensure a minimum amount collected to help fund transportation infrastructure.

The Kentucky legislation also recently enacted a 2018 Highway Plan, which will prioritize spending on more than 5,000 miles of pavement improvements over the next six years. More than 1,100 projects were ranked quantitatively and then reviewed qualitatively, providing a data-driven process for deciding which projects would receive funding under the plan. Because the plan focused on actual available funding and prioritized spending on asset management, there are still \$6 billion in unfunded projects. In order to fund all identified projects, an additional \$490 million in annual revenue would be needed.

As part of the Highway Plan, KYTC expanded both the available funding and the types of treatments performed on pavements. The state will spend \$324 million over the next two years on these pavement treatments. This increased investment will prevent the percentage of poor pavements from continuing to grow. However, it is not sufficient to bring the percentage of state-maintained roads in poor condition down to the target level of 8 percent of the total network.

Additional sources of revenue for roads in Kentucky come from motor vehicle usage taxes, weight distance taxes, motor vehicle license fees, motor vehicle operator license fees, and other permits and fees.

FUTURE NEED

In order to assess Kentucky's future transportation funding needs, KYTC just completed its first statewide Transportation Asset Management Plan (TAMP). This plan assesses future roadway priorities over a 10-year horizon. In addition, there is a separate Strategic Highway Safety Plan (SHSP) that lays out programs to address safety initiatives.

A state-based program for prioritizing needs, KYTC's Strategic Highway Investment Formula for Tomorrow (SHIFT), created a formula for evaluating and scoring more than 1,100 projects across the state, including measures of congestion, impact to economic development in the region, safety, cost-benefit analysis, and asset management for future need. This reflects a triple bottom line analysis to deliver the "best" projects to the Commonwealth upon analysis. These projects were included in the capital improvements portion of the six-year 2018 Highway Plan but were underfunded due to the backlog of asset management needs.



ROADS



KYTC has identified \$6 billion in unfunded construction projects and would need an additional \$490 million each year to address them. The cabinet recently increased funding for asset management to \$599 million annually, which will keep the backlog of pavement needs from growing; however, this funding will do little more than keep overall road conditions at their current level.

KYTC has a demonstrated need for pavement preservation, rehabilitation, and replacement of \$4.5 billion over the next 10 years. However, at current funding levels, only \$3.2 billion will be available.

OPERATIONS AND MAINTENANCE

The Operations and Pavement Management Branch of KYTC addresses operations and maintenance of roads in the state. This branch collects data from the 12 highway districts in order to measure the condition of KYTC assets, report system performance, and analyze maintenance budgetary needs. Programs within the branch include pavement management, operations management, and a maintenance rating program. In addition, KYTC has established a pavement preventive maintenance program that has grown each year in scope and funding to provide additional alternatives to address pavement needs. While KYTC manages and maintains approximately 35 percent of Kentucky's roadways, a large percentage of the network is maintained by individual county governments and city or municipal governments.

Regular operations and maintenance programs are funded through the legislatively approved state maintenance budget, which is part of the approved transportation budget. When the cabinet experiences any shortfall in maintenance funding due to extreme weather response or other emergencies, funds are diverted from construction funding to meet these extraordinary circumstances, which may slow progress on those needed construction projects.

During the winter months, roads and highways are maintained in a timely fashion, largely due to KYTC adopting a policy several years ago of pretreating roadways to reduce the initial impact of winter storms. Many local agencies followed suit and adopted similar policies. KYTC has had a long-standing policy to have a one-hour turnaround on treating interstates once a storm has started, and the cabinet has a tiered system in place to treat the rest of the network in order of priority.

One area that is a particular challenge to the operations and maintenance of Kentucky roadways is that of staffing. KYTC is struggling to maintain professional, paraprofessional, and skilled staffing sufficient to perform the duties needed. Contracting work has increased over the last several years, which is expected to continue.

PUBLIC SAFETY

In the area of public safety, Kentucky adopted the Federal Highway Administration's (FHWA) "Toward Zero Deaths" safety strategy in 2010, with the goal of reducing highway deaths each year until the number of fatalities reaches zero. This strategy is being implemented using a data-driven approach that targets specific areas for improvements using proven countermeasures. Kentucky's fatality rate in 2017 was 1.59 deaths per 100 million vehicle-miles traveled (VMT). This rate has ranged from a low of 1.36 fatalities/100 million VMT in



ROADS



2013 to a high of 1.70 fatalities/100 million VMT in 2016. Nationally, the fatality rate per 100 million VMT decreased by 2.5 percent from 1.19 in 2016 to 1.16 in 2017.

KYTC is also focused on reducing crashes due to roadway departure, which is defined as a non-intersection crash that happens after a vehicle crosses an edge line or center line of the road. These crashes account for 70 percent of all fatal crashes in Kentucky, compared with 53 percent nationally. KYTC has been focused on reducing roadway departure crashes by evaluating roadway segments for various risk factors and funding projects on those segments with the highest risks. Risks include horizontal curves, embankments, and other geometric considerations. In these areas, KYTC works to eliminate fatalities and injuries by removing fixed objects near the edge of pavement, installing barriers, improving signs and pavement markings, installing high-friction surface treatments, and improving recovery areas for errant vehicles.

RESILIENCE & INNOVATION

KYTC is supporting several innovative technologies that are helping with the resilience of the state's transportation network. New surveying tools, such as Light Detection and Ranging (LiDAR), Ground Penetrating Radar (GPR), and digital terrain models for construction will provide better data to allow for increased precision of road mapping with decreased expenditures of time and money. In addition, KYTC is exploring the use of e-tickets for construction materials, which can help reduce trucking costs, optimize construction delivery times, and reduce paperwork.

KYTC was also an early partner with the Waze Connected Citizens program to exchange traffic and roadway information with a global navigation app. This communication has been extended to include GPS-equipped snow trucks.

Kentucky also participates in another innovative national program, the Federal Highway Administration's Every Day Counts. To enhance roadway safety, KYTC has been working on Automated Signal Traffic Controllers and proactively applying High Friction Surface Treatment using calcined bauxite for problem curves where there have been eight or more wet-weather crashes over a five-year period.

In an effort to make Kentucky's transportation system more resilient, KYTC recently completed a vulnerability assessment that identified the most likely extreme weather to be experienced by the state. That information was then applied to existing pavements, and the biggest threats were mapped. This is an important first step in developing a response plan to extreme weather events.

RECOMMENDATIONS TO RAISE THE GRADE

- Support the submitted TAMP, SHSP, and the SHIFT formula used in the development of the six-year 2018 Highway Plan. Each of these efforts by KYTC is in the interest of operating the network efficiently and should be given time to become effective.
- Increase transportation funding through a variety of revenue sources.
- Continue to research and evaluate new sources of funding, particularly as new technology and higher efficiency have an impact on previous funding models.



ROADS



DEFINITIONS/KEY TERMS

AWP – Average Wholesale Price

FHWA – The Federal Highway Administration

KYTC – Kentucky Transportation Cabinet

SHIFT – Strategic Highway Investment Formula for Tomorrow

SHSP – Strategic Highway Safety Plan

TAMP – Transportation Asset Management Plan

SOURCES

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2. Kentucky Transportation Cabinet, Maintenance Rating Program:
[https://transportation.ky.gov/Maintenance/Pages/Maintenance-Rating-Program-\(MRP\).aspx](https://transportation.ky.gov/Maintenance/Pages/Maintenance-Rating-Program-(MRP).aspx)
3. Kentucky Transportation Cabinet, 2018 Recommended Highway Plan:
<https://transportation.ky.gov/Program-Management/Highway%20Plan/2018RecHighwayPlanAll.pdf>
4. "Kentucky Transportation by the Numbers,":
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SOLID WASTE



SUMMARY

In 2017, Kentucky residents generated 7.2 million tons of municipal solid waste (MSW), which is an average of 5.5 pounds of waste per person, per day. This is above the national average by about 25 percent. Of the waste generated, about 38 percent is recycled; Kentuckians are doing better than the national average in this area. For the remaining waste that is not recycled, Kentucky has 50 permitted solid waste facilities, which processed 4.7 million tons of waste in 2017. Since the time of the last Kentucky Infrastructure Report Card in 2011, the Commonwealth has increased its number of solid waste facilities. In 2011, there were 29, which included contained and construction demolition debris landfills together as one facility, and there were no residual landfills, which accept waste from specific industrial categories. In 2018, Kentucky had 50 solid waste facilities, including 29 contained landfills, eight sites that are greater than one acre for construction/demolition debris, and 13 residual facilities. This has increased the available capacity in the Commonwealth's landfills. However, as the total population has increased, so has Kentucky's waste generation, and more work is needed to maintain or improve capacity to meet future needs. Underfunding of programs at the Division of Waste Management is a major impediment to further progress in Kentucky.

CONDITION AND CAPACITY

In Kentucky, the Solid Waste Branch (SWB), within the Division of Waste Management (DWM), is responsible for the solid (non-hazardous) waste program. The DWM Recycling and Local Assistance Branch coordinates with each county to ensure that solid waste is managed through an integrated system of waste collection, reduction, and recycling.

All 120 Kentucky counties offer a system of universal waste collection, which means that collection service is available to households either through curbside collection, drop-off collection centers, or transfer stations. By state law, waste haulers are required to report annually the number of households serviced and the monthly cost of service. Currently, 86 percent of Kentuckians participate in an approved waste collection program. This rate has remained consistent since 2006.

As the total population in Kentucky has increased, so has its waste generation. In 2017, Kentucky residents generated 7.2 million tons of municipal solid waste (MSW). Of this, 61.6 percent was sent to landfills, and 38.4 percent was recycled. This represents a slightly higher rate of recycling when compared with the national rate of 34.7 percent for recycling and composting as of 2015. Figure 1 shows that while the majority of solid waste generated in Kentucky is sent to Kentucky landfills, the recycling effort in the Commonwealth continues to grow.



SOLID WASTE

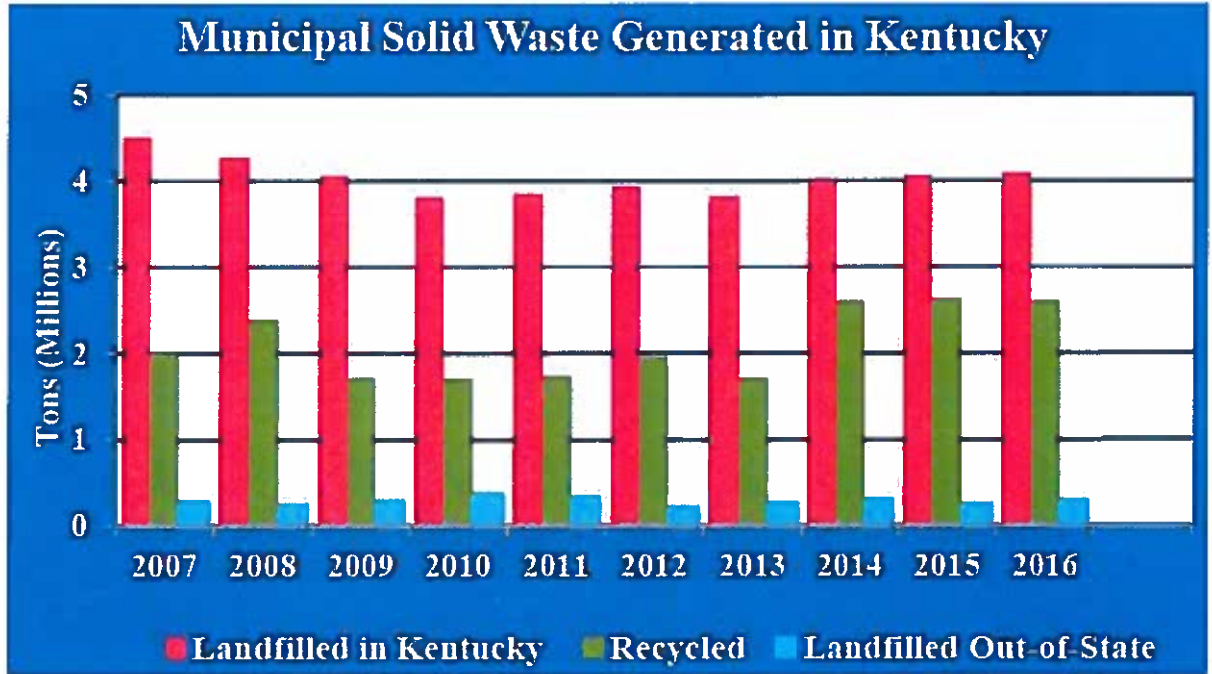


Figure 1. Municipal Solid Waste Generated in Kentucky, Division of Waste Management.

In the U.S., the national average of MSW is approximately 4.44 pounds per person, per day. At roughly 5.5 pounds per person, per day, Kentucky is generating more waste per person than the average U.S. citizen. After seeing steady declines in this number over the last decade, this rate has continued to see small increases year after year since 2014.

To dispose of this waste, there are 50 permitted landfills in Kentucky. Though the Commonwealth does not differentiate between classes (some states define landfills as either Class I or Class II), landfills in Kentucky are generally categorized by what type of waste is disposed there: (1) residual, (2) construction/demolition debris (CDD), (3) special waste, and (4) contained landfills. A contained landfill is one that has a bottom liner to keep trash and any liquids from leaching into the ground. Of the 50 landfills in Kentucky, 29 are contained (26 have operating permits and three have not yet been constructed), eight are greater than one acre CDD units, and 13 are residual landfills.

The total remaining airspace capacity of the 50 permitted landfills is approximately 313 million cubic yards based on 2017 annual surveys. This meets the requirement of a minimum of 20 years of solid waste disposal capacity. There are currently at least four contained landfills that are at or near capacity; these are located in eastern and central Kentucky.

All of the permitted landfills are owned by private entities, publicly traded companies, or municipalities.

There are 11 material recovery facilities (MRF) in Kentucky. MRFs are specialized plants that receive, separate, and prepare recyclable materials for marketing to end-user manufacturers.



SOLID WASTE



Though some states burn a portion of municipal solid waste for creating energy, there is no MSW being burned in Kentucky, although several landfills in the Commonwealth use landfill gas for energy conversion.

OPERATION & MAINTENANCE

The Kentucky DWM permits and regulates landfills. The Solid Waste Branch is responsible for reviewing technical applications and reports for all types of landfills, including residential garbage, construction debris, industrial waste, sludge, and special waste such as coal ash. This branch also issues or denies construction and operation permits and is also responsible for closures of abandoned historic landfills. All Kentucky permitted landfills have closure and monitoring requirements.

The permitted landfills in Kentucky are operated by private entities, publicly traded companies, or municipalities which are all self-funded by waste collection and disposal fees. The average cost per month for household curbside MSW collection was \$15.79 in 2016.

All landfill operators in the Commonwealth have plans for addressing future capacity. Each of Kentucky's 120 counties is required to file five-year solid waste management plans with the DWM. These plans require capacity assurance letters from landfills and waste projections for 20 years.

Landfills often include specific areas for sorting waste and containing leachate, any liquid that passes through the waste and drains from the landfill. The permitted landfills in Kentucky collect leachate in tanks or lagoons with liner systems, if required. The leachate is sometimes recirculated in contained landfills. Leachates are typically treated by disposal either with an on-site or off-site wastewater treatment plant.

The Closure Section of DWM oversees the Historic Landfills Program, in which "orphan" landfills can be monitored and closed. An orphan landfill is one that may not have been officially closed but stopped accepting waste before 1992, when the EPA put more stringent policies and penalties in place. The current total number of landfills identified in this program is 669 with 16 currently active projects and one project completed last year. With very limited sources of funding for this program, there are limitations to monitoring and closing these sites, which have the potential for causing adverse effects on human health and the environment due to exposure to unknown toxins that can seep into the soil and groundwater.

FUNDING

Because permitted Kentucky landfills are either privately owned or publicly owned, they are self-funded through waste collection fees. Landfills charge a tipping fee, which is the charge levied upon a given quantity of waste when it is emptied or "tipped" out of the truck. Kentucky's average tipping fee is approximately \$39.91/ton. Based on 4,705,072 tons of MSW sent to landfills in Kentucky in 2017, the total tipping fees would be approximately \$188 million. All of this revenue goes directly to the operations and maintenance of the individual landfills.

In order to encourage citizens to reduce, reuse, and recycle solid waste, Kentucky offers annual grants for the following programs:



SOLID WASTE



- Litter Abatement
- Illegal Open Dump Remediation
- Waste Tire Collection
- Crumb Rubber Landscaping
- Rubber-Modified Asphalt Chip Sealing
- Recycling Infrastructure
- Household Hazardous Waste Collection
- Composting

In Fiscal Year 2017, 73 entities were awarded grants totaling more than \$4.6 million. Forty-five recycling grants were awarded to cities, counties, and universities. These grants help fund the establishment or expansion of recycling operations.

FUTURE NEED

With nearly 700 orphan landfills in Kentucky, funding is needed for additional field staff to inspect and monitor sites that have been repaired by the Closure Section of DWM. With current funding, the Commonwealth is only able to address a small number of projects in the Historic Landfills Program each year.

Kentucky has a Recycling Grant Program with a goal of building recycling infrastructure, often in areas where few opportunities exist for citizens to recycle their waste. This program assists cities, counties, and universities in funding the establishment or expansion of recycling operations, with an emphasis on regional cooperative efforts. Even with this funding source in place, there is typically little financial incentive for individuals or small businesses to recycle solid waste materials. Additional seed capital funds or some type of financial incentive is needed to encourage individuals and small businesses to recycle since a large amount of total solid waste comes from these areas.

Another opportunity that needs funding in order to be realized is the exploration of a waste management system that recognizes MSW as more of a resource to be utilized than simply waste to be disposed of. For example, waste can be used for energy production, where old landfills may be mined as a source of metals, glass, and plastics for recycling. Additional funding for a program of this type is needed in order to explore innovative ways of handling solid waste.

PUBLIC SAFETY & RESILIENCE

The primary mission of Kentucky's Division of Waste Management is to protect human health and the environment. The Commonwealth currently has statutes and regulations in place to oversee municipal solid waste landfills, and these regulations are in place to address common landfill problems, such as location restrictions, liner requirements, leachate collection removal systems, groundwater monitoring requirements, and closure and post-closure care.

With the majority of Kentucky's electricity coming from coal-fired plants, the CCR produced during this process is an ongoing concern for the Commonwealth. A significant portion of CCR is beneficially reused in various industrial processes, including cement and concrete



SOLID WASTE



manufacturing, wallboard production, cosmetics, and roofing shingles. CCRs that are not used in industrial processes are presently disposed of in landfills. A new "CCR rule" from the EPA has resulted in utilities closing some coal ash slurry ponds, which should yield positive environmental results for the citizens of the Commonwealth. In the future, new CCR will be disposed of in existing or new CCR-specific units. The Commonwealth of Kentucky had an initial program of deference to the federal CCR rule that was overturned in a lawsuit. Kentucky is now in the process of establishing a new state permitting process for the construction of any new CCR units. This process needs to be expedited to address future, safe disposal needs.

Kentucky does not have stated policies on sustainability; however, all landfill operators in the Commonwealth are required to submit five-year plans for addressing future capacity, as well as waste projections for 20 years.

DWM also conducts annual solid waste workshops and offers an abundance of training.

INNOVATION

Kentucky has some innovative programs to repurpose waste, including a fairly sophisticated and healthy waste tire program. A \$1 per tire fee has generated about \$2.7 million per year, which has been used to fund several programs, including the Crumb Rubber and the Rubber Modified Asphalt recycling grants. The fee was increased to \$2 per tire starting July 1, 2018. With DWM estimates of about 3.7 million waste passenger and small truck tires being generated annually in Kentucky, this has the potential to provide funding for even more innovative programs, assuming that the increased fee is made available to the Waste Tire Trust Fund. The division's goal is to diversify markets and continue to find new innovations.

The Recycling and Local Assistance (RLA) Branch of the DWM recently expanded their recycling program to also offer grants for composting. During the 2016-17 grant cycle, a successful pilot project was funded in Franklin County, and five new composting grants were awarded in Fiscal Year 2017-18. There is an enormous opportunity to achieve higher landfill diversion rates with more comprehensive composting. It is expected that this grant will increase in popularity over the next few years. Depending on the availability of funds, RLA plans to expand and include more grantees in future grant cycles.

Nationally, 12.8 percent of solid waste was combusted with energy recovery in 2015. This is an area that Kentucky needs to explore in partnership with private and municipal utilities.

Residential glass recycling remains problematic due to the cross-contamination of materials in curbside collection, which greatly diminishes its market value. However, Kentucky is seeing some small-scale success in local re-use of pulverized glass in roadbeds, landscaping mulch, and decorative art projects. KDWM continues to look for ways to divert waste from landfills and find new uses for old materials.

RECOMMENDATIONS TO RAISE THE GRADE

- Increase funding for the Historic Landfills Program by raising user fees so that more of these sites can be monitored and closed sooner rather than later, which would reduce the health and safety impacts to communities and the environment.



SOLID WASTE



- Increase funding for recycling and developing additional markets for recyclable materials. Kentucky should make recycling economically advantageous to all citizens.
- Increase funding for additional personnel in the Solid Waste Branch of the Kentucky Division of Waste Management to address an increasing workload, including CCR Rule-related permitting.
- Encourage Energy recovery with utility companies through solid waste combustion.
- Continue the effort to establish a state permitting process for new coal combustion residual (CCR) landfills.

DEFINITIONS

CCR – Coal Combustion Residuals

DWM – Division of Waste Management

MRF – Material Recovery Facility

MSW – Municipal Solid Waste

RLA – Recycling and Local Assistance

SWB – Solid Waste Branch

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WASTEWATER

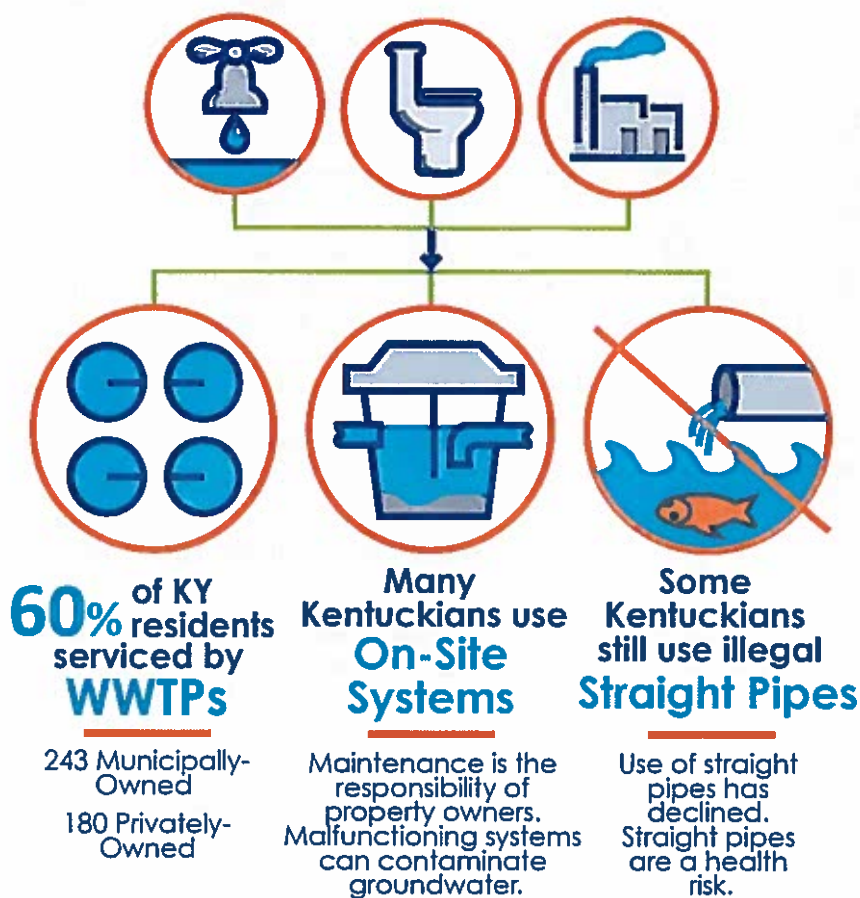


SUMMARY

Nearly 20 years ago, the governor of Kentucky issued an Executive Order to provide water and wastewater service to every Kentuckian by the year 2020. In response, a strategic plan for wastewater was developed in early 2000, which provided recommendations to be carried out over the next 20 years. Many of the original recommendations have already been implemented, and it is important to recognize the improvements that have been made over the past two decades.

However, the Commonwealth of Kentucky is faced with treatment facilities that are an average of 36 years old, as well as aging pipelines that send wastewater to the treatment plants. Some of these pipes are more than 70 years old, and many of them are large-diameter pipes that have the greatest impact on a community when they fail. Meanwhile, 40 percent of Kentuckians rely on septic tanks or other private systems, the condition of which is generally unknown. The 2012 Clean Watersheds Needs Survey (CWNS) indicated \$6.2 billion in needs for wastewater projects in Kentucky. Aging wastewater infrastructure and a lack of funding needed to implement all necessary improvements are of concern.

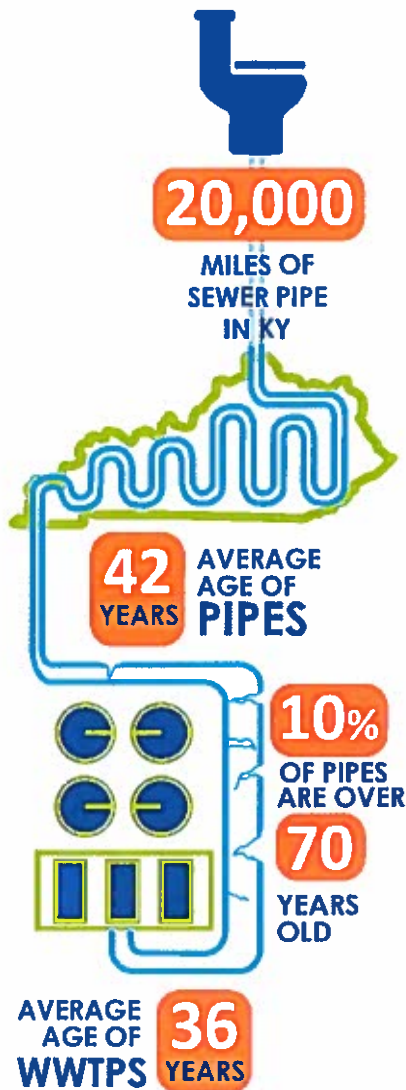
CONDITION AND CAPACITY



Sixty percent of Kentucky's 4.4 million residents are serviced by wastewater treatment plants (WWTPs). This is a 5 percent increase in the number of Kentuckians served since the 2011 Kentucky Infrastructure Report Card. Kentucky's municipal treatment plants have a combined capacity of 690 million gallons per day. Based on 2012 flow data, these plants have an average of 40 percent available capacity.



WASTEWATER



Water and wastewater infrastructure can be expected to provide useful service for 20 to 100 years. Some of these oldest pipes include large-diameter sewers that are susceptible to collapse and cave-ins due to their deteriorated condition. Failure of these large-diameter pipes often results in a greater impact to the community. The collapsed sewer pipes damage other utilities in the vicinity, causing disruption of service to customers and potential health hazards by releasing wastewater into the community. Piping and storage systems should be expected to last 75 to 100 years, or longer, if properly maintained, and many of these systems in Kentucky are reaching the end of their design life.

In 17 Kentucky communities, the sewer collection system conveys rainwater runoff, domestic sewage, and industrial wastewater all in one pipe and transports it to a WWTP for treatment. During dry weather conditions, this combined sewer system conveys only the domestic sewage and industrial wastewater to treatment facilities. However, during heavy rain events, the additional volume of storm runoff flow mixes with the sewage and wastewater, exceeding capacity, and causing untreated sewage to overflow into receiving waters of streams, rivers, or other bodies of water, which is called a "combined sewer overflow."

These combined sewer overflow (CSO) discharges have been identified as a significant threat to the water quality of much of the country's receiving waters. Removing stormwater from the sanitary system is recommended because it frees up capacity in sewers and saves money on pumping and treating stormwater. At the time of the 2011 report card, there were 17 combined sewer systems (CSSs) in Kentucky, but two of them have since completely separated their wastewater and stormwater systems. Many communities find it not feasible to separate their combined systems.

The remaining 15 CSSs have been working to reduce the number of overflows through targeted separation and flow equalization. These communities use tools such as Long Term Control Plans (LTCP) and Capacity, Management, Operation and Maintenance Programs (CMOMs) to comply with their consent decrees. Combined, these 15 communities have more than 342 overflow points. The EPA's 2008 Clean Water Needs Survey indicated that \$312 million would be required to correct CSO-related problems in Kentucky. As communities began developing the actual projects required to comply with consent decrees/orders, the costs jumped to \$945 million by 2012. Communities now report only \$65.5 million remaining



WASTEWATER



in costs to reduce the overflows to regulated standards. Kentucky's CSS communities have done significant work to their sewer systems to reduce overflows. Since 2003, Kentucky has eliminated 72 CSOs and reduced annual overflow volume from 5.84 billion gallons to 3.10 billion gallons.

Raw sewage releases from sanitary pipes are called sanitary sewer overflows (SSOs). Communities in Kentucky have been working to reduce SSOs by adding additional storage and conveyance capacity and by fixing inflow and infiltration into infrastructure. However, SSOs are still happening and communities should continue to address this concern.

The 40 percent of Kentuckians not serviced by public WWTPs and collection systems are households with septic tanks, other permitted onsite systems or, in some rural areas, straight pipes to a receiving stream. A "straight pipe" is defined as a pipe draining household sewage and wastewater straight into creeks, streams, or other waterways. Though the number of straight pipes has been reduced in recent years, use of them continues, which is both illegal and a risk to public health.

OPERATION & MAINTENANCE

Routine maintenance is important to maintain the serviceability of the state's sewer infrastructure, and each WWTP is responsible for its own operations and maintenance. As the age of infrastructure increases, utilities must plan and pay for costly repairs. In general, there have been improvements to O&M practices that have often been driven by the consent decrees and agreements and through State Revolving Fund (SRF) requirements. Many communities are left with tight budgets for operations and maintenance needs and a decrease in skilled personnel.

To effectively manage budgets and ensure the right investments are made at the right time, many public WWTPs track the condition of their assets through organized asset management programs. This type of system helps municipalities assign priority to projects based on criticality and condition. This type of management is encouraged to allow communities to plan projects instead of dealing with problems on an emergency basis.

In addition to the financial resources required for proper O&M, municipalities are struggling to maintain the skilled workforce required to operate and maintain systems that are increasing in complexity. Electricians, mechanics, plumbers, and heavy equipment operators are all currently in short supply as the economy expands.

The shortage of the skilled workforce is predicted to be a long-term concern for utilities. A significant number of experienced workers hired from 1985 to 1995 are now eligible to retire. In addition, now that the economy has recovered from the 2008 recession, many utilities are losing younger talent to market competition. As an example, the Kentucky Division of Water has lost a significant number of experienced employees over the past five years. Wages are not competitive for engineers and scientists due to a robust economy. The once attractive pension system is no longer available for newer employees. As a result, retaining and attracting talent (engineers, scientists, and those in information technology and trades) is quickly becoming a top issue facing the water and wastewater industries in Kentucky.



WASTEWATER



FUNDING

The 2012 Clean Watersheds Needs Survey (CWNS) indicated \$6.2 billion in needs for wastewater projects in Kentucky. Communities have to generate the funds to pay for these needs.

Across the Commonwealth, the average sewer rate per 4,000 gallons is \$34.12. This rate is 1 percent of the median household income, which is half the suggested percentage established by the EPA's affordability index. The average time since the most recent sewer rate adjustment is 4.1 years. Many municipalities are struggling to pay for their capital projects and higher O&M costs due to increases in the cost of fuel, labor, and other resources, yet they are not raising their rates. This hesitancy can be attributed to a number of factors, including political pressure not to raise rates and concerns about affordability, even though increased user fees are considered to be the best way to appropriate costs.

Over the past 20 years, residential water consumption has declined, resulting in decreased revenue for wastewater utilities. The result of declining consumption essentially means water/wastewater rates will need to rise much faster than inflation to maintain the same level of service.

In addition to revenue shortages over the last seven years, many municipal budgets have been tied to the efforts to reduce overflows. Although this is an important step in repairing our sewers and making our waterways safe, it has pulled money away from other types of necessary sewer projects.



Failures of large-diameter sewers create huge impacts. This cave-in closed several lanes of a busy intersection. Communities need to be able to fund preventive maintenance projects to address aging infrastructure.

The coal severance tax has historically been one of the largest pools of economic development resources in the region. Coal production provided a coal severance tax to partially fund sewer extensions and other infrastructure projects. In 2012, coal tax receipts were \$298 million, but in 2016, due to decreased coal production, receipts dropped to \$120 million, a significant decrease in funds for infrastructure projects. Many communities previously used this funding for elimination of straight pipes; however, with this source of



WASTEWATER



funding at a steep decline, the straight pipe initiative is only being focused on in three Kentucky counties.

An additional source of funding for wastewater projects in Kentucky is the Clean Water State Revolving Fund (CWSRF). The CWSRF is a 20-year loan program for planning, design, and construction of wastewater infrastructure projects, stormwater projects, and nonpoint source projects. Since 2011, yearly project commitment dollars have averaged \$78 million. In 2018, the CWSRF received the highest funding in nearly a decade. The fund has successfully sustained its ability to fund necessary wastewater projects.

In addition, the Water Infrastructure Finance and Innovation Act (WIFIA) program provides long-term, low-cost supplemental loans for regionally and nationally significant projects. To date, Kentucky has not had significant participation in this program.

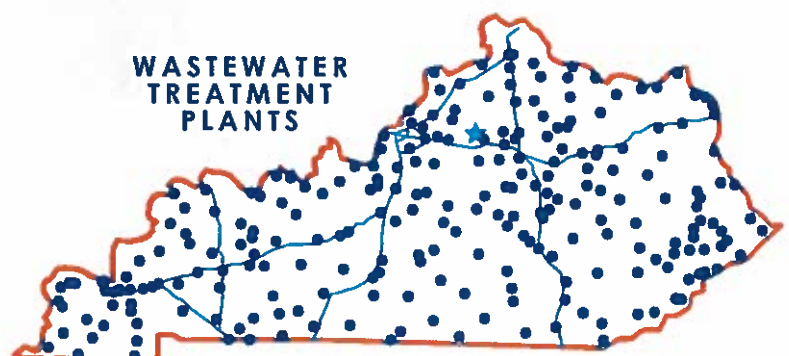
These funding sources could be an attractive alternative for utilities to avoid the rising cost of capital in the open market.

FUTURE NEED

In 2016, the Kentucky Assembly created House Joint Resolution (HJR) 56, which directed the Division of Water to collect data on all 180 small, privately operated wastewater treatment plants. With a presence in nearly every county, most of these smaller plants are older than their design life and are approaching critical service junctures, with significant infrastructure investments needed to continue service. The Energy and Environment Cabinet has offered recommendations for oversight of these systems, which includes facilitating regionalization or consolidation and improving system operation and oversight. These recommendations are in need of funding in order to be implemented.

The Kentucky Infrastructure Authority's (KIA) Report on Community Needs reported a needs increase of 3.1 percent overall, with a shift in priorities from CSO corrections to increased investments in treatment plants and collection systems. This would include fixing pipes to prevent leaks, extensions to new systems, and construction of interceptor projects.

The Kentucky Wastewater Management Plan, published by KIA in February 2015, states there are 18 new sewage treatment plants proposed in the next ten years. In addition, the plan states there are 473 miles of sewer line rehabilitation needed and 387 miles of interceptor lines needed in the next 10 years. The estimated funding need for projects in the first five years is \$1.7 billion, and the estimated funding need for projects from Year 6 to Year 10 is \$359 million.





WASTEWATER



Using today's average daily flows, most of Kentucky's municipal treatment plants have available capacity. But, 32 plants are nearing capacity. However, this does not take into account projected growth for communities. An important consideration that municipalities should consider is the need of industrial users. For example, the bourbon industry has created a boom of development in some locations in large and small communities which initiated the need for construction of new sewers and upsizing of existing sewers, pump stations, and treatment. Smaller municipalities with a limited customer base may struggle to pay for the cost of this growth.

Another challenge for municipal plants is the anticipated future regulatory requirements to meet advanced treatment levels, related to the removal of pharmaceutical pollution and nutrients.

PUBLIC SAFETY

The Kentucky Division of Water (DOW) has entered into 15 communities mandating elimination or management of CSOs and in some cases, the elimination of SSOs. In addition, two utilities, Metropolitan Sewer District, MSD, in Louisville and Sanitation District 1, SD1 in northern Kentucky, entered into joint federal and Kentucky consent decrees for the same purpose. Reducing raw sewage overflows into waterways will increase water quality and public safety.

Construction of a 20 million-gallon CSO storage tank along the Ohio River. Once completed, the tank will be hidden underground and used to protect the river by preventing combined sewer overflows.



In 2018, Kentucky passed House Bill 513 to address a declining compliance rate for small, privately owned sewer systems. The bill requires privately owned treatment systems to operate with improved management practices, including having an asset management plan in place, holding insurance on their facilities, conducting structural analysis of structures if needed, and other features that better protect the public from mismanagement. It also allows public agencies to enter into operations and management agreements with other entities, and it allows the agency to acquire or lease property outside of their municipal or jurisdictional boundaries. While this is a positive step to enhance public safety for Kentuckians, these measures only apply to systems receiving a new or renewed operating permit. Because permit



WASTEWATER



renewals are only required every five years, there will continue to be many of these privately owned systems not operating under these improved practices for several years.

RESILIENCE

Awareness of weather patterns has increased in recent years with greater understanding of the effects of climate change. Changes are difficult to quantify in Kentucky, but storms have both increased in severity and in the number of lightning strikes, resulting in more frequent flooding and disruptions to power. More treatment facilities and pump stations are adding back-up generators and portable generators in preparation for backing up power sources.

Kentucky adopted KYWARN (23), a national mutual aid model for water and wastewater utilities to assist each other during natural or man-made disasters. The emergency assistance can be in the form of equipment, supplies, and manpower to help utilities during a disaster or emergency. KYWARN also coordinates with local emergency management authorities, the Kentucky Emergency Management Agency, and FEMA for emergency assistance. Over 70 water/wastewater utilities participate in KYWARN, and 24 have executed mutual aid agreements.

KIA has added a Sustainable Infrastructure Initiative as part of their funding strategy. The goal is to reduce the funding gap between projected investment needs and the current spending levels at federal and local levels. The goal is achieved through strong infrastructure planning and management practices such as Asset Management, Water and Energy Efficiency, Infrastructure Financing, Price of Water Service, and Alternative Technologies and Assessment.

CWSRF also requires borrowers to fund a repair and replacement reserve account equal to 5 percent of their loan over 20 years. The borrower's ability to repay its loans has a direct effect on the resilience of the CWSRF.

INNOVATION

In Kentucky, gray water and other process-reuse alternatives have been considered, but the economic benefit is difficult to achieve due to the relatively low cost of abundant water resources in most of the state.

Louisville's MSD is in the process of issuing a Request for Proposals for a Solids Handling Project for all WQTCs. The proposal will have a self-imposed requirement to include sustainability in any suggested alternatives.

The Northern Kentucky Sanitation District No. 1 implemented innovative energy management plans in 2014 for each of their wastewater plants. These efforts included replacement of a blower with a more efficient model, automating chemical feed systems, and downsizing pumps to a capacity that is needed. These innovations have saved the district approximately \$200,000 per year by controlling and reducing chemical and energy use.

Kentucky is working to provide knowledge and tools to ensure that the investments made in our wastewater infrastructure will move us toward a more sustainable footing.



WASTEWATER



RECOMMENDATIONS TO RAISE THE GRADE

The following recommendations are supported by ASCE in order to raise the grade of Kentucky's wastewater infrastructure:

- Communities should continue to educate their users about the value of wastewater services to protect the water resources of the Commonwealth.
- Utilities should strive for full cost pricing of their wastewater services in order to support the operations, maintenance, and capital costs of the infrastructure. This may require raising rates for some utilities.
- State regulatory agencies should encourage a statewide effort to remove straight pipes and repair failing septic systems.
- Wastewater industry, regulatory agencies, and utilities should implement innovative recruitment and job training strategies to develop a sustained, skilled workforce. Programs would develop talent needed in both administration and operational level staff.
- Continue advocacy and funding for renewing aging wastewater infrastructure through the Clean Water State Revolving Fund (CWSRF) loan program, Water Infrastructure Finance Innovation Act (WIFIA), and other viable funding sources at the federal, state, and local levels.
- Communities should educate themselves on potential funding sources and their requirements and begin planning for the funding in the conceptual phases of projects. Development districts, industry associations, or other advocacy groups could be their champions of this education.
- Promote and support funding of applied research and development in areas of innovative wastewater technology, sustainability, security, water quality, and infrastructure resiliency.

DEFINITIONS/KEY TERMS

CMOM – Capacity, Management, Operations, and Maintenance

CSO – Combined Sewer Overflow

CSS – Combined Sewer Systems

CWNS – Clean Watersheds Needs Survey

CWSRF – Clean Water State Revolving Fund

DOW – Kentucky Division of Water

LTCP- Long Term Control Plan

SORP – Sewer Overflow Response Protocols

SRF – State Revolving Fund

SSO – Sanitary Sewer Overflow

WQTC- Water Quality Treatment Center

WWTP – Wastewater Treatment Plant



WASTEWATER



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