

2020



REPORT CARD FOR
MISSISSIPPI'S
INFRASTRUCTURE

THINK IT. GROW IT. INVEST IN IT.
THAT'S THE MISSISSIPPI WAY.
Let's invest in Mississippi's infrastructure now.



Mississippi Section of the American Society of Civil Engineers
[INFRASTRUCTUREREPORTCARD.ORG/MISSISSIPPI](https://infrastructurereportcard.org/mississippi)



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EXECUTIVE SUMMARY

Mississippi's infrastructure systems play a critical role in the state's economic prosperity and help preserve – and can enhance – the quality of life for all Mississippians. However, over the past 15 years, our infrastructure systems have faced numerous, unprecedented challenges in the form of hurricanes, tornadoes, droughts, and floods. Yet, every time Mississippians are faced with a challenge, they rise to meet it. Our infrastructure systems have helped us meet these challenges; now it's our time to help our infrastructure systems. To continue to raise, retain, and attract the best and brightest, Mississippi must invest in strategic infrastructure efforts. After all, we want Mississippi to continue its long-standing tradition of hospitality, good Lord willing, even if the creek *does* rise.

This is why local engineers with the Mississippi Section of the American Society of Civil Engineers (ASCE) have conducted an exhaustive evaluation of Mississippi's infrastructure, based on publicly available data, reports, analyses, and conversations with state and local agencies. The *2020 Report Card for Mississippi's Infrastructure* was developed as a public service to citizens and policymakers to inform them of the infrastructure needs in 12 different categories in the state.

Mississippi's ASCE report card committee of engineering experts assessed the overall GPA as a D+.

The group found that when there is investment in Mississippi's infrastructure, there are more jobs which means more economic growth. However, Mississippi faces challenges due to aging infrastructure, lack of routine maintenance, inconsistent data collection, and limited funding. These issues impact residents' quality of life and pose threats to nearby businesses. Fortunately, though, Mississippi is seeing that where the private sector has made investments – in the energy grid and parts of the freight system like ports and rail – economically productive and community capacity building results can be seen.

Given the analysis of this report, the committee makes the following recommendations to raise the grade:

1. Ensure that infrastructure investment is strategically focused on efforts that maximize good-paying jobs, promote the state's economic competitiveness, and enhance usability so that all Mississippians continue to proudly call our state home.
2. Design, operate, maintain, and expand infrastructure in accordance with federal leadership by using consensus-based codes, specifications, and standards that reduce the potential loss of jobs, economic opportunity, and critical natural resources. Under President Trump's Administration, FEMA and other federal agencies have begun to pivot toward mitigation measures to ensure better use of taxpayer dollars, which is a strategy Mississippi should also employ.
3. Develop a comprehensive education campaign on the true costs and savings associated with investment in critical infrastructure and disseminate around the state through publicly accessible channels and platforms such as Mississippi Public Broadcasting and social media forums.
4. Establish a grant program for 21st century technical career training in the drinking water and wastewater sectors that retains Mississippi's talent and mainstreams tools for data-driven decision-making, such as asset management software, life-cycle cost analysis, and affordable rate structuring.
5. Mississippi's highways and scenic back roads are the state's critical arteries to our homes, businesses, and outdoor recreation, so users must contribute a fair share to aid in maintenance and fill the gap that isn't covered by state spending.

2020



REPORT CARD FOR
MISSISSIPPI'S
INFRASTRUCTURE

2020 REPORT CARD FOR MISSISSIPPI'S INFRASTRUCTURE



 AVIATION  C

 LEVEES  D

 BRIDGES  D-

 PORTS  B-

 DAMS  D

 RAIL  B-

 DRINKING
WATER  D

 ROADS  D-

 ENERGY  C

 SOLID WASTE  C

 INLAND
WATERWAYS  D

 WASTEWATER  D



ABOUT THE INFRASTRUCTURE REPORT CARD

GRADING CRITERIA

ASCE-MS's 2020 Report Card Committee is a group of dedicated civil and environmental engineers from Mississippi, who volunteered their time to collect and analyze data, prepare, review, and revise each section, and develop the final Report Card. The committee worked with ASCE's Committee on America's Infrastructure and ASCE Infrastructure Initiative staff to provide Mississippi with a snapshot of the state of our infrastructure, as it relates to us at home, and on a national basis.



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

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

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

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

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

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

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

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

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



GRADING SCALE



EXCEPTIONAL: FIT FOR THE FUTURE

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



GOOD: ADEQUATE FOR NOW

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



MEDIOCRE: REQUIRES ATTENTION

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



POOR: AT RISK

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



FAILING/CRITICAL: UNFIT FOR PURPOSE

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



AVIATION



BIG PASSENGER AIRPLANE TAKING OFF AND FLYING FROM AN AIRPORT.
SOURCE: BIGSTOCKPHOTO.COM



AVIATION GRADE: C

EXECUTIVE SUMMARY

Mississippi's aviation system is critical to the state's economy; the industry employs over 20,000 people with a total payroll of \$721 million and a total economic output of \$2.5 billion. There are 73 public use airports in the National Plan of Integrated Airport Systems (NPIAS), 68 of which are non-primary and five are primary. Of the five primary airports, two - Jackson and Gulfport - have performed runway overlay projects over the last five years. Aviation infrastructure in Mississippi is heavily dependent on support from the federal government. The state experienced a 34% decline in passengers from 2007 to 2017, which impacts the amount of funding for aviation infrastructure the state receives from passengers and the federal government. As popular airports experience less demand, the life of the existing infrastructure is extended which leaves no significant operation and maintenance (O&M) needs unmet. However, O&M is not eligible for federal funding and, as a result, is deferred in more rural and low-income communities.

INTRODUCTION

Mississippi has 73 public-use airports within the National Plan of Integrated Airport Systems (NPIAS). There are eight commercial service airports in the state that accommodate nearly one million passengers annually, half of which are federally subsidized through the Essential Air Service (EAS) Program. These EAS airports include Greenville Mid-Delta, Hattiesburg-Laurel Regional, Key Field (Meridian), and Tupelo Regional. The largest airport in the state is Jackson–Medgar Wiley Evers International Airport and it is the only Small-Hub airport in the state. According to NPIAS, “hub” is a term used by Federal Aviation Authority (FAA) indicating the extent to which the airport is trafficked for commercial services. In 2018, the Jackson-Medgar Wiley Evers International Airport secured new low-cost carriers (Frontier, Sun Country, and Allegiant) which is helping the airport recover some of the leakage of passengers to New Orleans and Memphis. The remaining 68 airports are considered general aviation facilities, supporting localized air service rather than commercial needs. According to a 2014 Mississippi Department of Transportation (MDOT) Aeronautics Division report, Mississippi’s aviation system employs over 20,000 people with a total payroll of more than \$720 million and an economic output of over \$2.5 billion.

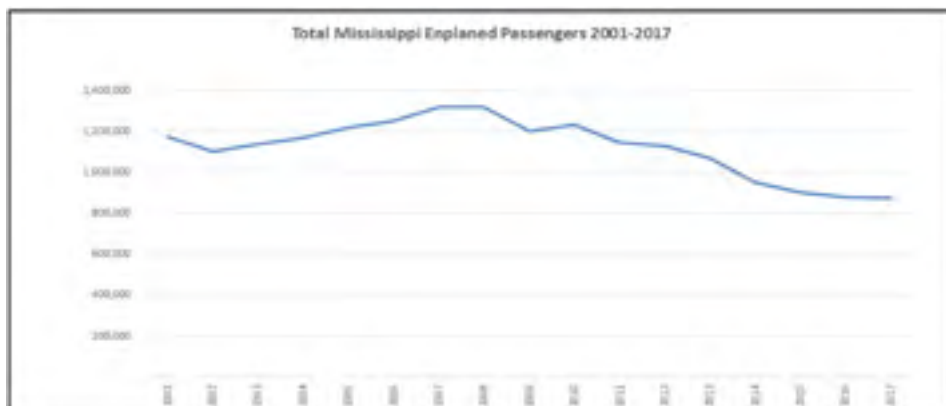
CONDITION

In Mississippi, there is currently no statewide database that contains information about the condition of the airports. In other states, however, the aviation division of transportation agencies have conducted statewide pavement condition index (PCI) surveys to quantify runway pavement of the airport system. This process standardizes the results across every airport and allows state and federal aviation officials to efficiently allocate funding to airports based on need and activity. While Jackson and Gulfport have recently received runway pavement rehabilitation projects, many other smaller airports are struggling to maintain their infrastructure due to inadequate funding. Lack of funding has led to pavement conditions deteriorating, navigation equipment outages, and outdated passenger and pilot facilities.

CAPACITY

The lack of low-cost carriers and direct routes to other areas of the country has resulted in a significant amount of passenger leakage to both New Orleans and Memphis, reducing enplanements. Figure 1 depicts NPIAS data for total enplaned passengers from 2001 to 2017 and illustrates an approximate 34% decline in passengers across the highest and lowest spread – from 1,320,096 in 2007 to 874,226 in 2017. While many commercial service airports and general aviation airports in the state have multiple runways, given the existing commercial traffic demand and the fact that none meet the current capacity requirements of 130,000 annual operations, the facilities have excess capacity.

FIGURE 1- HISTORICAL ENPLANEMENTS





OPERATION & MAINTENANCE

All of Mississippi's general aviation airports are inspected by MDOT which frequently notes maintenance items on the generalized inspection reports, such as navigation equipment outages, runway light deficiencies, excessive grass or tree heights, or pavement deterioration and debris on the airfield. The majority of the general aviation airports in Mississippi do not have full-time maintenance staff, so the maintenance regimen is more reactive than proactive.

FUNDING AND FUTURE NEED

Mississippi airports' operation and maintenance (O&M) costs remain challenging for the aviation industry in the state. Not all O&M costs are eligible for federal funding through the FAA Airport Improvement Program (AIP) and specific state grant programs. Some of these O&M costs can be offset by aeronautical revenues, but airports are generally not financially independent and rely on the local government for support. Furthermore, airport infrastructure projects are generally funded through a mixture of local, state, and federal funding streams and/or grants.

Local funds include bonds, loans, airport revenue from landing fees, fuel sales or hangar rent, or general city funds. The majority of Mississippi airports are only guaranteed \$150,000 per year in non-primary entitlement through the AIP if the airport has nine or more aircraft stored at the airport. General aviation airports can save this money for a period of four years for a larger \$600,000 project, but in many cases, that funding is still not enough to fund a major runway or taxiway rehabilitation. Airports are eligible to compete for a larger amount of discretionary funds through the FAA AIP but must compete against other airports in the state and in the southern region. If the AIP was not continued by the federal government, Mississippi would lose their primary funding source for aviation improvement.

The Passenger Facility Charge (PFC) is an available source of income for commercial services airports. The PFC is regulated through the FAA, but the authorized amount for Mississippi airports has been decreasing over the last few years as total enplaned passengers have decreased as shown in Figure 1. This decrease is limiting the funding of airports in the state.

Considering funding from the state, until the most recent 2018 omnibus bill, the FAA AIP funding remained flat for the last 17 years. This stagnation resulted in a backlog of needed but unfunded projects. The new supplemental discretionary funding announced in the 2018 omnibus resulted in three projects in Mississippi being funded for a total amount of \$18 million. Additionally, MDOT has a multimodal grant program that provides the MS airport system with \$3.4 million annually and generally funds revenue producing projects such as terminals, hangars, fuel farms, or the local match required for a federal grant.

Overall, the current NPIAS five-year plan shows a demand of \$350 million in capital improvements and large maintenance projects needed for Mississippi's airports. The NPIAS needs do not figure in normal O&M. Over the last five years, Mississippi airports have received \$35 million per year on average. However, the rising costs of construction has resulted in a greater dependence on state and federal funding for needed projects, so if these cost and funding trends continue it will result in an estimated shortfall of \$175 million over the next five years.



PUBLIC SAFETY

The Safety and Standards Branch of the Southern Region Airports Division of the FAA is primarily responsible for ensuring the safety and certifications, operations, and safe practices of airports in Mississippi. The FAA sets design standards to ensure safe aircraft operations. The design standards include airfield geometry, pavement strength, wayfinding signage, lighting, navigational aids, stabilized safety areas, and clear approaches. All airports that receive federal funds are required to meet standards as a condition of each grant. Standards for Aircraft Rescue and Firefighting (ARFF) are also required to be followed at all commercial service airports.

Wildlife strikes are one of the most difficult aspects of Mississippi aviation safety to control. These strikes are a threat to human safety. The FAA conducted a study to characterize reported strikes with civil aircraft in Mississippi from 1990 to 2010. This study summarized 381 reported strikes (366 birds, 14 mammals, and 1 reptile) compromising over 42 species and show collisions between wildlife and aircraft have been increasing. Airports in Mississippi are exposed to migratory birds traveling along the Mississippi and Atlantic Flyways. Mississippi airports with the most reported strikes are among the state's largest and busiest: Jackson-Medgar Wiley Evers International (Jackson, MS), Gulfport Biloxi Regional (Biloxi, MS), and Golden Triangle Regional (Columbus, MS). Fortunately, none of these strikes have caused major human injury or property loss in Mississippi. Each commercial service airport is required to have a wildlife hazard management plan created by a certified airport wildlife biologist. Each plan is designed specifically for the airport and the airports are required to employ mitigation approaches outlined in the plan.

INNOVATION

Mississippi is becoming more innovative in its aviation systems. The state is incrementally implementing satellite-based navigation systems to help improve the process of tracking and planning air travel. Many general aviation airports now support RNAV GPS approaches. This system is being adopted throughout the country and is changing the way air travel can be monitored. In addition to using new aviation technology, Mississippi schools are supplying the industry with professionals. Delta State University in Cleveland, Mississippi offers a Bachelor and Master of Commercial Aviation. Other institutions offer technology programs which include Unmanned Aviation Systems (UAS) and aircraft maintenance. As UAS becomes more popular in the nation, rules and regulations must be established. Mississippi State University is the state's leading researcher on this issue and directs the FAA's UAS Center of Excellence. This center is designed to safely and efficiently integrate UAS regulations into the aviation system such as the Golden Triangle Regional Airport (Columbus) and Trent Lott International Airport (Moss Point) which houses UAS production and testing facilities.

RESILIENCE

Mississippi's commercial airports are required to conduct emergency preparedness training and have on-site fire and emergency response units. However, Mississippi's 68 general aviation airports depend largely on their local first responders to address emergency needs. With additional funding, training, and planning Mississippi's aviation industry, infrastructure, and assets could be leveraged to comprehensively build the state's resilience before, during, and after disasters.

For example, while southern Mississippi's airports face the continued threat of hurricanes and tropical storms coming from the Gulf of Mexico airports such as Jackson and Meridian are further inland and share their facilities with National Guard installations making them the ideal locations for staging hurricane relief operations.



AVIATION



RECOMMENDATIONS TO RAISE THE GRADE

- **Mississippi should adopt a statewide pavement condition index to allow airports to be systematically graded and prioritized for funding in order to efficiently address the most dangerous and deteriorated areas.**
- **Funding for operations and maintenance is one of the largest hurdles facing Mississippi's airports. A possible solution for bridging the funding gap would be to explore third-party funding including public- private partnerships.**
- **Finally, PFCs should be increased to support the increased costs of construction, operations and maintenance. While this is a federal issue, Mississippi should support changes to federal law to increase the current cap on PFC's or better yet, eliminate the cap altogether.**
- **More funding for training and planning should be set aside for Mississippi's aviation industry, infrastructure, and assets to comprehensively build the state's resilience in light of increasingly frequent and severe disasters.**



AVIATION



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BRIDGES



BRIDGES

GRADE: D-

EXECUTIVE SUMMARY

Mississippi has 17,072 bridges. More than 400 timber pile bridges have been closed to the public since 2018, when the federal government determined these structures had been insufficiently inspected and posed a risk to the traveling public. A total of 3,127 of Mississippi's bridges are weight-restricted; some are posted for a four-ton load, approximately the average weight of a pick-up truck. To address safety concerns, the Mississippi Legislature convened a special session in August 2018 and voted to provide approximately \$100 million annually for bridge maintenance and rehabilitation. While this additional funding is helpful, it does not come close to addressing the \$1.6 billion funding gap for bridges in the state or reversing the years of underinvestment.



CONDITION AND CAPACITY

The 17,072 bridges in Mississippi are either owned by the state, counties, towns, cities, the federal government, other agencies, or private owners. In 2018, 1,603 bridges (9.4%) were structurally deficient. This compares unfavorably with the 7.6% of bridges nationwide that were identified as structurally deficient the same year. While not unsafe, structurally deficient bridges signal the need for significant maintenance, rehabilitation, or replacement. Under current funding structures, Mississippi lacks resources for the necessary renovations to bring every bridge up to a “good condition” rating. Despite the lack of funds, there have been improvements made to the current condition of Mississippi’s bridges. According to an analysis by the American Road & Transportation Builders Association, the state identified needed repairs on 7,397 bridges in 2018, a slight improvement from the 7,506 bridges that needed repairs in 2014.

Another way to understand the condition of Mississippi’s bridges is to consider the percentage of bridges in good, fair, and poor condition. Table 1 shows the breakdown in condition across the state. Fair bridges require attention and funding in order to avoid falling into poor condition. A “poor” classification is roughly equivalent with a structurally deficient classification previously mentioned. In 2018, 63% of bridges were in good condition, 28% were in fair condition, and 9% were in poor condition.

TABLE 1: MISSISSIPPI BRIDGE CONDITIONS

AMOUNT AND CLASSIFICATIONS			
All	Good	Fair	Poor
17,071	10,711	4,757	1,603
PERCENTAGES			
All	Good	Fair	Poor
100%	65%	28%	9%

The age of a bridge can also impact the condition of the structure. According to Federal Highway Administration (FHWA), 4,682 bridges (27.4%) were built in Mississippi before 1970, meaning they are 60 years or older and have surpassed their original design life. While bridge design life can be extended through regular maintenance, adequate funding is required. Table 2 below shows the number of bridges, their age, and their percentage of the total bridges.

TABLE 2: MISSISSIPPI BRIDGE AGES

MISSISSIPPI BRIDGE AGES				
Age	<20 Years	20 to <40 Years	40 to <60 Years	≥60 Years
Number	3,832	6,021	5,019	2,200
Percentage	22.4	35.3	29.4	12.9



PUBLIC SAFETY

Pile-timber bridges are a significant safety concern across the state. In 2018, FHWA determined that these structures had been improperly inspected for several years and posed a safety risk to the traveling public. As a result, Governor Phil Bryant declared a state of emergency and ordered the closure of 83 bridges in the state. The number was later updated to 455 bridges, and closures impacted almost every county in the state. Closed bridges affect emergency vehicle routes and delay residents that are traveling to their jobs and schools.

Pile-timber bridges aside, 3,127 of Mississippi's bridges are weight-restricted, 18.3% of the state's total bridges. In fact, in some areas there are posted for a four ton load or less, the average weight of a pick-up truck.

FUNDING

In 1987, the Mississippi Legislature passed a \$1.6 billion long-range highway bill to build roads and bridges. While one of the largest highway bills of the time, the legislation did not consider the need for future maintenance and rising construction costs. MDOT reports that between 1989 and 2017, the construction cost index increased over 300%. Meanwhile, the state's fuel tax that funds most of the state's road work, has remained at \$0.18 per gallon, on par with the national gas tax of \$0.184 per gallon (unraised since 1993).

According to Mississippi Economic Council's Blueprint Mississippi, prior to the 2018 special legislative session an estimated \$375 million a year is needed to repair and maintain bridges and roads. To help address the funding shortfall, the Mississippi Legislature passed a \$180 million bond bill in 2015. Close to \$85 million was spent to fix 13 bridges between Clarksdale and Marks and \$36 million for 13 bridges in Tallahatchie County. Lawmakers again agreed to borrow \$50 million for the state's local bridge repair program that began July 1, 2018. While bonding can help provide funding for bridges and roads, loans must be repaid. Additionally, as evidenced by the large number of bridge closures since 2018, existing funding is insufficient for current bridge needs. Additional revenue is needed. Some states have utilized a gas tax increase or other similar fees to help increase available funding for bridge repairs and replacements.

Recently, the State Legislature identified several new limited revenue sources to help pay for necessary surface transportation infrastructure repairs. Spurred by the bridge closures, the Mississippi State Legislature convened a special session and passed the Mississippi Infrastructure Modernization Act of 2018. This legislation diverts a portion of the tax assessed for online purchases to cities and counties to pay for needed infrastructure improvements, including bridge repairs. Furthermore, the legislation imposes fees on electric and hybrid vehicles. By fiscal year 2022, the legislation will provide more than \$100 million annually for bridge and road infrastructure. Finally, the Mississippi Infrastructure Modernization Act creates an emergency fund for MDOT to use when paying for emergency repairs on bridges. The Special Session also authorized \$250 million in bonds for necessary bridge repairs.

FUTURE NEED

While the additional revenue for bridges and transportation is helpful, it will not close the funding gap. Mississippi's \$0.18 per gallon gasoline tax has not been raised since 1987, and in the subsequent years' inflation has eroded the tax's purchasing power. The American Road and Transportation Builders' Association estimates \$1.6 billion is needed for bridge repairs throughout the state.



Legislators in Mississippi have proposed several partial solutions to address the surface transportation funding gap. In addition to introducing legislation to raise the gas tax, lawmakers have suggested reallocating budgets in favor of bridge maintenance, borrowing money from the federal government and other entities, and tax increases on tobacco and incomes.

OPERATION & MAINTENANCE

Maintenance in Mississippi is primarily reactive. According to MDOT's Annual Report in 2019, \$408.6 million was spent on road and bridge contracts and awarded 172 bridge repair and replacement projects. The agency spent nearly \$3.8 million on routine bridge maintenance and \$306,884 on bridge repairs due to accidental vehicle impacts. Because of the high cost of bridge maintenance and the lack of funding, MDOT is shifting its resources from new projects to 10 to 15-year maintenance items.

INNOVATION

Mississippi is capitalizing on innovative bridge research, including bridge scour monitoring and optimization of Mississippi aggregates for concrete bridge decks. Bridge scour and other hydraulic processes make up around 60% of bridge failures. MDOT continues to research tools that can measure the depth of scour from the deck of the bridge. These tools also analyze the application of probabilistic framework to quantify bridge scour uncertainties. Another focus of research and implementation has prioritized aggregates used in the concrete of bridge decks. MDOT has recently begun placing more stringent upper and lower limits on aggregate gradations used in the design of concrete bridge decks in order to produce more durable surfaces using locally sourced Mississippi gravel aggregates.

RESILIENCE

As bridges across the state are replaced, a no rise analysis is conducted to ensure the new bridge will not have a negative impact on water levels around the structure. As storms become more intense and bring more rain year after year, the average precipitation changes causing more water to flow through rivers and creeks. As such, generally when new bridges are built they are higher than the bridge they are replacing to take into account the changing water levels due to changing weather patterns. While this method represents an incremental rise in the bridge heights, it does not explicitly incorporate future climate trends.



RECOMMENDATIONS TO RAISE THE GRADE

Mississippi's bridges can greatly benefit from improvements. Some recommendations to see improvements and raise the state's grade for bridge infrastructure include:

- Increase annual funding for bridge repair and replacement. The simplest method to do this would be to increase the gas and diesel user fees across the state. Research shows that every sitting governor for a state that has increased the gas and diesel user fees have been reelected if they run, regardless of political affiliation. Additional sources of income include continuing to utilize revenue from internet taxes and lotteries for repairs, replacements, and routine maintenance of bridges.
- To prevent future funding problems, any legislative language regarding increasing the gas and diesel user fees should also include language that would automatically index for inflation over time.
- MDOT should consider a prioritization method to determine how to split funding between operation and maintenance and new construction across the state.
- Extra efforts should be made to educate the public regarding how they are impacted by deteriorating or closed bridges and the continued failure to act on infrastructure investment.





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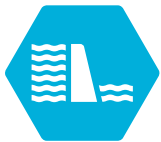
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AERIAL VIEW OF ABERDEEN LOCK AND DAM ON THE TOMBIGBEE RIVER
NEAR ABERDEEN, MONROE COUNTY, MISSISSIPPI, USA.



DAMS



DAMS
GRADE: D

EXECUTIVE SUMMARY

Mississippi's dams provide flood control, navigation, water supply, recreation, and other benefits to the state's population. The National Inventory of Dams (NID) records 6,081 known dams in Mississippi that are owned by a variety of federal, state, or municipal agencies, as well as private owners. 381 of these dams are high hazard potential, a classification not reflective of condition, but rather indicates that should the dam fail, loss of life and significant economic damage is expected. 130 of Mississippi's high hazard potential dams need repair and more than 90% depend on the scarce financial resources of local governments or private owners. To best prepare downstream communities for possible failure, all high hazard potential dams should have emergency action plans (EAPs). However, in Mississippi, just 71% have EAPs on record. Also of concern is that 36% of state-owned dams are in poor or unsatisfactory condition. Approximately \$1.21 billion dollars is needed to repair Mississippi's non-federally owned dams.

INTRODUCTION

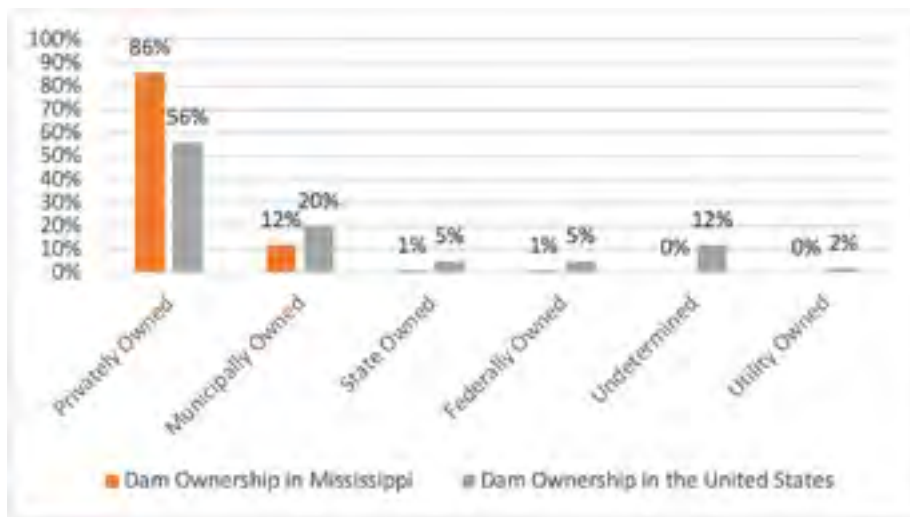
Dams are used for irrigation, flood control, navigation, water supply, fire protection, fish and wildlife habitat, debris control, and tailings associated with mining activity. In Mississippi, 85% of the state's dams are relied upon for recreational purposes. The Mississippi Department of Environmental Quality (MDEQ) regulates the state's dams. However, not all dams, namely those less than 8 feet in height, that impound less than 25 acre-feet of water, or do not retain a continuous flow of water are regulated.

Mississippi classifies its regulated dams as either a high, significant, or low hazard. If a low hazard dam fails, it would result in damage to agricultural land, farm buildings (excluding residences), or minor roads. If a significant hazard dam fails, it would pose no threat to human life, but may cause significant damage to main roads, minor railroads, and/or cause interruption of use or service of public utilities. If a high hazard dam fails, it may cause loss of life, serious damage to residential, industrial, or commercial buildings; or damage to, or disruption of, important public utilities or transportation facilities such as major highways or railroads.

CONDITION AND CAPACITY

There are currently 6,081 dams in Mississippi and 5,868 are state regulated. A breakdown of dam ownership in the United States and Mississippi, by owner category, is shown in Figure 1.

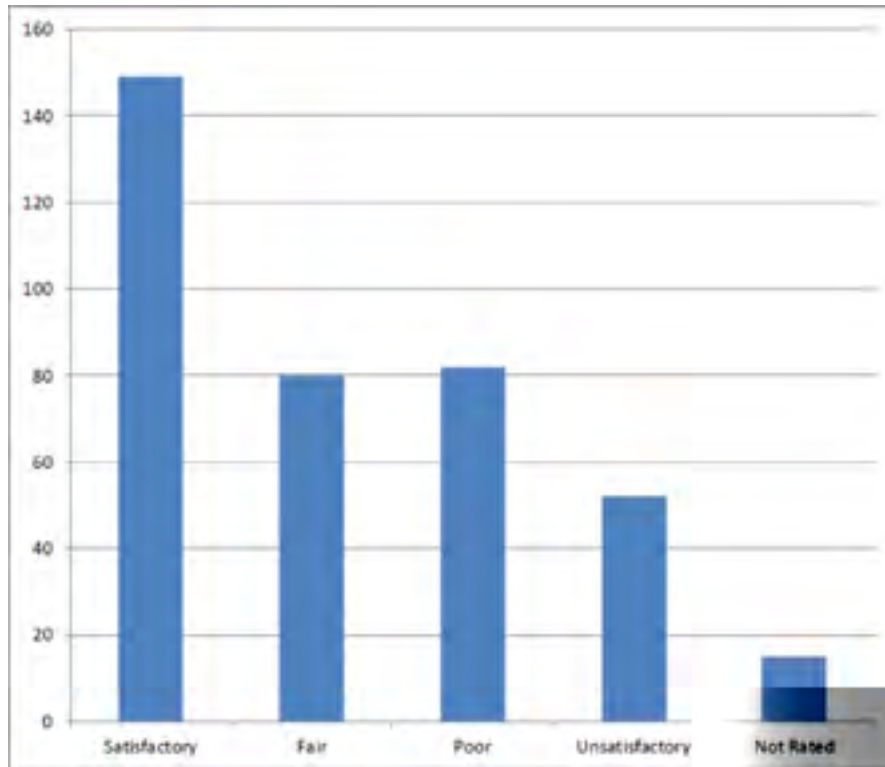
FIGURE 1: DAM OWNERSHIP IN MISSISSIPPI



Dams may be classified as high hazard, significant hazard, low hazard, or undetermined. There are 381 high hazard dams, 73 significant hazard dams, 3,586 low hazard dams, and 2,041 dams that remain undetermined. The Mississippi Department of Environmental Quality (MDEQ) Dam Safety Division has been working since 2017 to reclassify both significant/low hazard and unclassified/undetermined dams. Since 2017, MDEQ has increased the number of structures carrying high-hazard classification from 256 structures to 381 structures. These additional 125 dams will be required to undergo formal review, perform annual inspections, and put together Emergency Action Plans (EAPs) for the first time. Hazard classification is defined in the public safety section below.

The Association of State Dam Safety Officials' 2018 Dam Safety Performance Report for Mississippi collected information about the condition of state-regulated high hazard potential dams. Figure 2 shows that approximately 39.1% are rated as satisfactory, 21% are fair, 21.3% are poor, and 13.9% are in unsatisfactory condition; 4.7% are not rated, likely due to incomplete data.

FIGURE 2: 2018 CONDITION RATING OF STATE-REGULATED HIGH HAZARD POTENTIAL DAMS



Source: Association of State Dam Safety Officials – Dam Safety Performance Report: Mississippi (2018)

Of the dams in Mississippi with a known age, the average age is 45 years. However, only 2,019 dams have a known age, which means that the ages of the remaining 4,062 dams are unknown. Historically, dams were designed for a 50 to 100-year lifespan. This means that it is probable that many of those 4,062 dams with unknown ages have exceeded their design lifespan.

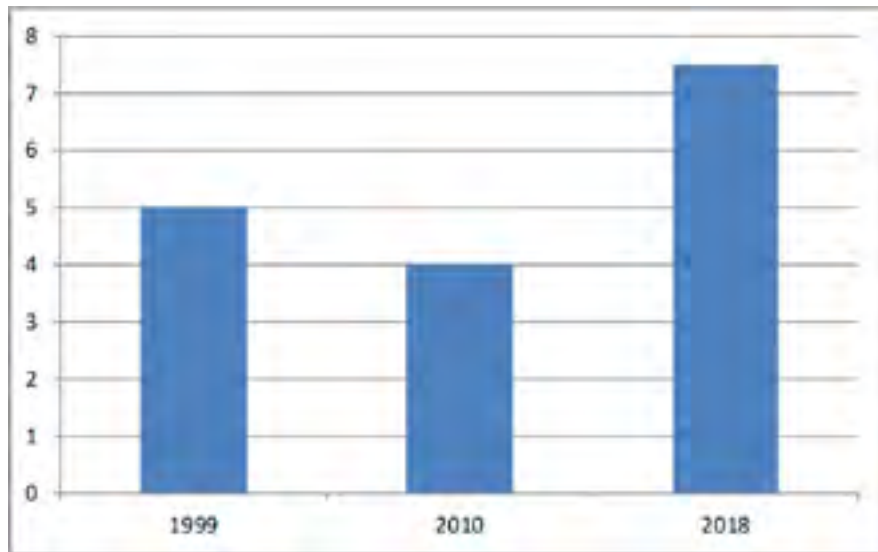
OPERATION & MAINTENANCE

The Dam Safety Division of MDEQ regulates all the dams in the state except for five owned and operated by the U.S. Army Corp of Engineers (USACE) and one owned and operated by the Bureau of Indian Affairs. However, MDEQ oversees all dam inspections in the state, even for the six over which it does not have regulatory authority.

Although the MDEQ oversees regulation of dams and maintenance of inspection records, it is the responsibility of dam owners to maintain their dams, have them inspected as needed, and submit their inspection reports to MDEQ. These inspections involve a periodic visual inspection to spot any developing problems. Informal inspections require that personnel conducting the inspection be knowledgeable about the dam and its accessories. An informal inspection must be performed every 60 days for high and significant hazard dams as well as after significant storm events. In addition to having their dams inspected periodically, owners must also ensure that the EAP for their dams are updated at regular intervals and distributed to downstream stakeholders.

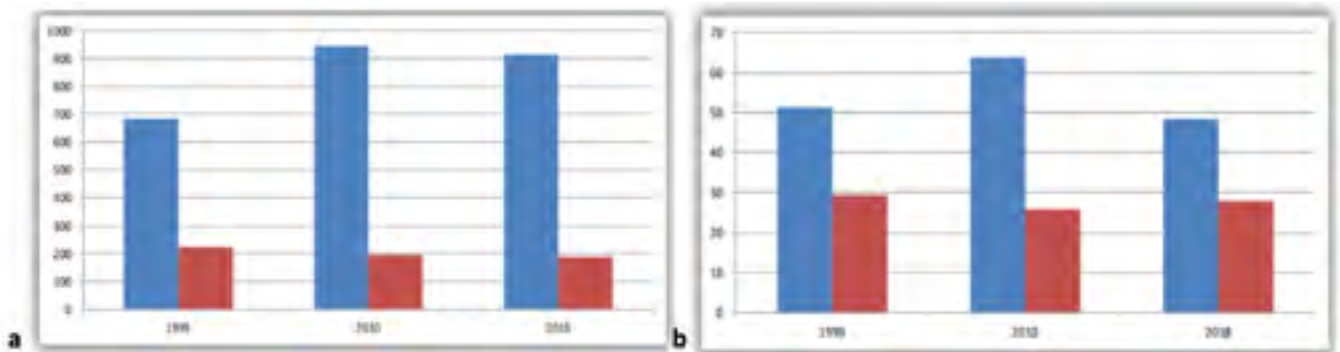
According to the Association of State Dam Safety Officials' Dam Safety Performance Report for Mississippi, Figures 3 and 4 show the total personnel, personnel per dam (4a), and personnel per high hazard dams (4b), respectively. Although the Dam Safety Division of MDEQ has an overall increase in staffing (Figure 3), staffing is much lower than the national average full time equivalent (FTE) personnel per state-regulated dams (overall) and state-regulated high hazard potential dams. Additionally, further challenges are present regarding MDEQ's regulation and inspection of dams. For instance, private owners, many of whom do not acquire permits nor notify the Dam Safety Division, continue to construct new dams. This increases the difficulty for the Dam Safety Division to maintain updated records of all the dams in the state, potentially contributing to the large number of unclassified dams. Also of concern are insufficient/inadequate inspection reports, which are due to inspections being performed by unqualified persons on behalf of the owner. According to Mississippi law, only high hazard and significant hazard dams must be inspected by a professional engineer.

FIGURE 3: TOTAL STAFF (FTE) FOR DAM SAFETY



Source: Association of State Dam Safety Officials – Dam Safety Performance Report: Mississippi (2018)

FIGURE 4: (A) STATE-REGULATED DAMS PER FTE (BLUE) AND NATIONAL AVERAGE (RED); (B) STATE-REGULATED HIGH HAZARD POTENTIAL DAMS PER FTE (BLUE) AND NATIONAL AVERAGE (RED)



Source: Association of State Dam Safety Officials – Dam Safety Performance Report: Mississippi (2018)



PUBLIC SAFETY

MDEQ regulations require an EAP to be developed for all High Hazard Dams. A well-prepared and maintained EAP can greatly reduce the potential risk of loss of life in the event of a dam breach. Between 2010 and 2018, MDEQ's efforts have increased the number of high hazard dams with documented EAPs from 141 to 270, or upwards of 70%. However, this coverage remains below that of the national average of more than 80% according to the Association of State Dam Safety Officials' Dam Safety Performance Report for Mississippi and is an overall reduction over prior years due to the reclassification of 125 dams as high hazard.

To date, Mississippi has not experienced a dam failure resulting in loss of life; however, in 2004 the Big Bay Lake Dam, located in Lamar County, failed resulting in the destruction of 48 homes. Of the 381 high hazard dams, only 270 (71%) have an Emergency Action Plan.

FUNDING

Funding is necessary for inspection and regulation of dams as well as the repair and maintenance of dams. The funding available for maintenance and repair will differ according to whether a dam is federally owned, state-owned, municipally owned, or privately-owned. The funding available for specific dams even within the same classification can differ depending on which federal agency, municipality, or person owns the dam.

The funding for federally-owned dams in Mississippi depends on the budget available to the federal agency that owns and is tasked with the dam's maintenance and repair. There are 43 federally owned dams in Mississippi. Of these dams, one is owned by the Bureau of Indian Affairs (BIA), two by the Department of the Navy, 13 by the Forest Service, three by the Fish and Wildlife Service, and 24 by the USACE.

Funding is generally insufficient for the repair of federally owned dams. One case that exemplifies this is an issue faced by the BIA. Although Congress authorized the Water Infrastructure Improvement Act in 2016, through which \$35 million per year would be appropriated for dams owned by the BIA, Congress has not yet appropriated these funds. The BIA is therefore only able to meet the most critical needs regarding its dams. For this reason, the Lake Pushmataha dam, which should have a risk of failure no greater than 0.01%, has a 5% risk of failure. This lack of funding is also observed in dams owned by the Fish and Wildlife Service, which is only able to cover routine yearly maintenance and utility bills with its funding. Another consequence is an inability for the dam owner to perform repairs that prevent deteriorating conditions and could lead to a proactive approach to operation and maintenance of its dams. While these funding challenges and their consequences are significant, of the 43 federally owned dams, only one has been judged to be in poor condition. The rest of the dams are currently in an acceptable condition but are expected to need additional maintenance funding in the near future.

Funding for state-owned dams can come from different sources. However, the primary four funding sources are the Land and Water Conservation Fund, the Natural Resources Conservation Service (NRCS), bonds, and the budget of the state agency responsible for the specific dams. Of the 62 state-owned dams in Mississippi, only one is currently on record as needing repair.



The majority of funding for municipally owned dams comes from local taxes and is limited by the municipality's budgets. Of the 665 municipally owned dams, 85 dams are currently in need of repair. However, municipalities have limited resources and may be swayed by the public's opinion to support other immediate funding requests, leaving dams farther down the priority and funding list. As dams are often out of sight and out of mind until significant flooding or failure occurs, it is often too late to catalyze more funding for rehabilitation by the time the public advocates for it. Consequently, it is important to increase the public's knowledge of dams, where they are located, the purposes they serve, the risk they pose, and their need for increased funding.

The majority of the dams in Mississippi are privately owned, and the responsibility for maintaining and repairing these dams falls on the owners. This means that the funding needs for most of Mississippi's dams are primarily associated with private entities which do not have the same financial resources as federal and state-owned dams. Currently, of the 5,297 privately-owned dams in the state, 76 need repairs.

FUTURE NEED

According to a report published by the Association of State Dam Officials in 2019, the total cost to rehabilitate the state's non-federally owned dams is approximately \$1.21 billion, which is the same need estimated in 2012. The cost to rehabilitate Mississippi's federally owned dams is approximately \$200 million. There are 381 high hazard dams in the state, and 130 of these need repairs. It is roughly estimated that the total cost to repair these 130 high hazard dams would be \$16 million. Since there is only one federally owned high hazard dam that needs repair and only one state-owned high hazard dam that needs repair, it is evident that the majority of those in need of repair are local government and privately-owned.

INNOVATION

The Dam Safety Division of MDEQ has established standards for the design of dams according to their hazard level classifications. MDEQ has also established a list of inspection criteria for owners who are responsible for having their dams inspected. Regarding inspection and regulation, however, there has been an innovative change on the part of the Dam Safety Division of MDEQ in the last three years in prioritizing dams according to their risk. This prioritization ranking is based on the hazard ranking of the dam as well as the population at risk downstream. Because of this, MDEQ is able to better determine which dams should be given first priority in repair.



RECOMMENDATIONS TO RAISE THE GRADE

Mississippi's dams will benefit from additional improvements. These improvements include:

- Support MDEQ's continued efforts to classify/reclassify the dams under their purview so all dams in Mississippi have a hazard designation. Currently 2,041 dams are unclassified.
- Strengthen permitting language and fines for dam owners who construct dams without acquiring proper permits and/or coordinating with MDEQ's Dam Safety Division prior to construction.
- Expand the Dam Safety Regulations, Title II, Part 7, Chapter 3 to require owners of high and significant hazard dams to have their dams inspected by a registered professional engineer. The dam inspection reports submitted to MDEQ accompanying the dam inspection should be written and sealed by a registered professional engineer.
- Require all high hazard dams to have, and exercise on a routine basis, their EAPs.
- Request that Congress fully appropriate the \$35 million authorized in the Water Infrastructure Improvement Act of 2016 for the rehabilitation and repair of dams under the Bureau of Indian Affairs.
- Expand MDEQ Dam Safety Division's information and educational outreach programs to increase dam owners' and the public's knowledge of dams, where they are located, the purposed they serve, their funding needs, and the risk they pose.
- Create and fund a Dam Rehabilitation State Revolving Loan Fund which would allow municipal and private dam owners to receive low-interest loans for dam rehabilitation purposes.
- Increase the number of FTEs in MDEQ's Dam Safety Division to reduce the number of state-regulated dams per FTE. Currently, each FTE is responsible for inspecting a much larger percentage of dams than the national average.
- Require all MDEQ personnel inspecting dams to be registered professional engineers.



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DRINKING WATER



DRINKING WATER

GRADE: D

EXECUTIVE SUMMARY

Drinking water infrastructure in Mississippi includes water treatment plants, groundwater wells, storage tanks, and transmission lines that store and provide quality drinking water to consumers across the state. In 2015, the United States Environmental Protection Agency (EPA) estimated that Mississippi needs \$4.8 billion over the next 20 years to fund safe drinking water infrastructure for the people of Mississippi. Much of the state's current drinking water infrastructure is beyond or nearing the end of its design life, with older systems losing as much as 30-50% of their treated water to leaks and breaks. Adequate funding and prioritization of drinking water infrastructure improvements are needed to ensure Mississippians continue to enjoy quality drinking water for years to come.



CONDITION & CAPACITY

According to the Mississippi Department of Health's (MSDH) Bureau of Public Water Supply, the state has 1,170 public water systems that must comply with the Federal Safe Drinking Water Act (SDWA). The condition and capacity of Mississippi's drinking water infrastructure influences the systems' ability to treat, store, and deliver potable drinking water at adequate pressure to the state's population. In Mississippi, the percent difference of billable water to treated water (non-revenue water or water losses) averages approximately 15%; older systems lose as much as 50% of the water treated. The high leakage rates and water main breaks are mostly due to the aging pipes of legacy water systems in the state. Some pipes were laid as early as the 1920s, while other water systems consist of pipes that were laid from the 1940s to 1980s. Many of these networks have aged past their useful life span.

The state of Mississippi has sufficient groundwater resources to supply the state's rural population. According to the U.S. Geological Survey (USGS) the state of Mississippi pumps 3.39 billion gallons of groundwater every day and uses 10%, or 339 million gallons per day, for public water supply; the balance is used in agricultural applications. Groundwater makes up 88% of the public water supply for the 2,840,000 people who are served by these systems. However, 446,000 people do not rely on public water supplies and have private wells for their drinking water. Of these residents that rely on wells, some were installed as early as the 1940s. Because the useful life span of a well is between 25 and 40 years, many of these structures are well past their design life.

OPERATION & MAINTENANCE

Because drinking water infrastructure includes water treatment plants, groundwater wells, storage tanks, and transmission lines, appropriate operation and maintenance (O&M) of the systems includes coordination, oversight, funding, and training for municipal and/or county-level personnel in technical, managerial, and financial capacities.

Through the Environmental Protection Agency's (EPA) Capitalization Grant set-asides, MSDH has funds for local organizations such as Communities Unlimited, Inc., Mississippi Rural Water Association, and the Mississippi State University Extension Service to provide a comprehensive suite of training programs. The training programs aim to improve technical capacity, water board management and coordination skills, water treatment plant operator abilities, and asset management competencies. Overall, as the programs train personnel that are responsible for O&M, more systems are expected to achieve or remain in compliance with the SDWA.

However, various O&M challenges continue and compound at many different drinking water systems throughout the state. Failures from leaky, aging, and broken transmission lines diminish the service and quality. Insufficient funds from rate payers result in infrequent maintenance schedules and a lack of resources to perform routine O&M. Long-term patterns of reactive maintenance increase costs and make future planning for routine infrastructure upgrades difficult.

Some cities are making concerted efforts to change. For example, the City of Starkville is cutting against the grain of a typical reactive approach to O&M and has made the decision to increase rates, without adding long-term debt, in order to invest an additional \$1 million annually into water and sewer infrastructure. With positive outcomes, Starkville can become a best practice for other municipalities.



FUNDING

Drinking water infrastructure in Mississippi is funded through a combination of user fees and federal and state loans and grants.

The typical water bill for a rural water association system ranges from \$25-\$35 monthly. That source of revenue equates to \$300-\$420 per year per service connection for the utility. Depending on the drinking water treatment process, much of the revenue pays for normal operations to produce potable water, some reactive maintenance, and administrative costs.

MSDH administers two common financing mechanisms – the Emergency Loan Program and the State Revolving Loan Fund program—as well as EPA’s Capitalization Grant set asides. The United States Department of Agriculture’s (USDA) Office of Rural Development provides some grants and low interest long-term loans for capital investments to public entities, non-profit utilities, and Tribes. Finally, the Mississippi Development Authority manages the Community Development Block Grant program.

Most municipalities, water districts and/or associations apply to the state and federal grants programs during each funding cycle. These no-risk funding options are the preference for many water providers. Although many qualify for grant money, there are typically insufficient funds to accommodate all needs.

Further options are the self-bonded or loan mechanisms. Loans require the utility to take on risk in assuming some level of debt to complete a project. Taking on debt as a utility is not inherently a bad idea but requires the payoff of the debt to be appropriately built into the customers’ increasing service fees. Oftentimes, the loan source expects repayment over a 20 or 30-year period. Finally, some utilities have been sufficiently managed whereby they can self-fund the project internally.

FUTURE NEED

In EPA’s 2015 Drinking Water Infrastructure Needs Survey and Assessment Sixth Report to Congress, EPA estimated that Mississippi needs \$4.8 billion to finance drinking water infrastructure projects over the next 20 years to continue to provide safe drinking water to the public. This equates to approximately \$241 million needed annually for drinking water infrastructure improvement funding in Mississippi. Currently, estimates for funding mechanisms total around \$100 million in consistently available funding for water infrastructure needs, which leaves a shortfall of over \$140 million dollars according to EPA’s estimates.

Mississippi currently has a population growth rate of 0.30%, which ranks 40th in the nation for growth percentage. Overall, water consumption appears fairly constant with a slight downward trend in areas that are constructing new homes due to the implementation of improved technologies such as water-saving appliances like faucet aerators.

Water systems in Mississippi continue to struggle with maintenance issues due to the need for workforce training, system-wide effects of aged pipes, and/or the inability to fund improvements. Rates have remained low in Mississippi due to the federal support, and a possible source of revenue would be to increase those rates so that they more adequately reflect the full cost of service for delivery and treatment, including operation, maintenance and capital needs.



PUBLIC SAFETY

According to the EPA, 138 public water systems in Mississippi reported violations in FY2018, though there may be additional violations that went unreported. This number is down from 1,012 violations in FY2012, as a result of increased federal funding after the Deepwater Horizon oil spill. Additionally, according to MSDH, there were 800 reported boil water alerts across the state in FY2016 and 542 in FY2017 due to loss in pressure in the water distribution systems. Typically, boil water alerts are issued when the pressure within a distribution system drops below 20 psi, indicating that water outside of the system can enter into the piping network and introduce bacteria. If the low pressure persists, businesses and schools who depend on a continuous supply of clean water are forced to close.

INNOVATION AND RESILIENCE

Mississippi has sufficient water resources due to the coupling of large amounts of rainfall and the rate at which the groundwater is recharged. Delivery of the resource, however, is becoming increasingly complex due to more frequent and severe extreme weather events – flooding, severe storms, hurricanes. Because water is not influenced by man-made state boundaries, weather events and / or actions throughout the Mississippi River watershed may impact the quality and provision of this critical resource for Mississippians. As such, elected officials up and down the river have developed a partnership called the Mississippi River Cities and Towns Initiative that collaborates on opportunities to build jobs, bring investment to the region, and improve the resilience of the infrastructure and communities in states along the Mississippi River – a national resources to our country



RECOMMENDATIONS TO RAISE THE GRADE

- **A balanced approach to capital reinvestment and routine O&M on new infrastructure would benefit Mississippi’s drinking water infrastructure and its consumers.**
- **Water production systems and distribution lines are increasingly in need of repair, replacement and upgrading due to age.**
- **Funding requirements should be implemented, and regulations imposed that require a balanced budget for water utilities, in addition to some percent of annual reinvestment to be used in a proactive and sustainable manner.**
- **Cost-effective methods are important to judiciously steward limited resources and maximize the rate of return for drinking water infrastructure investment.**
- **Newer materials that are safe, reliable, sustainable, and resilient should be integrated into drinking water infrastructure.**

FIND OUT MORE

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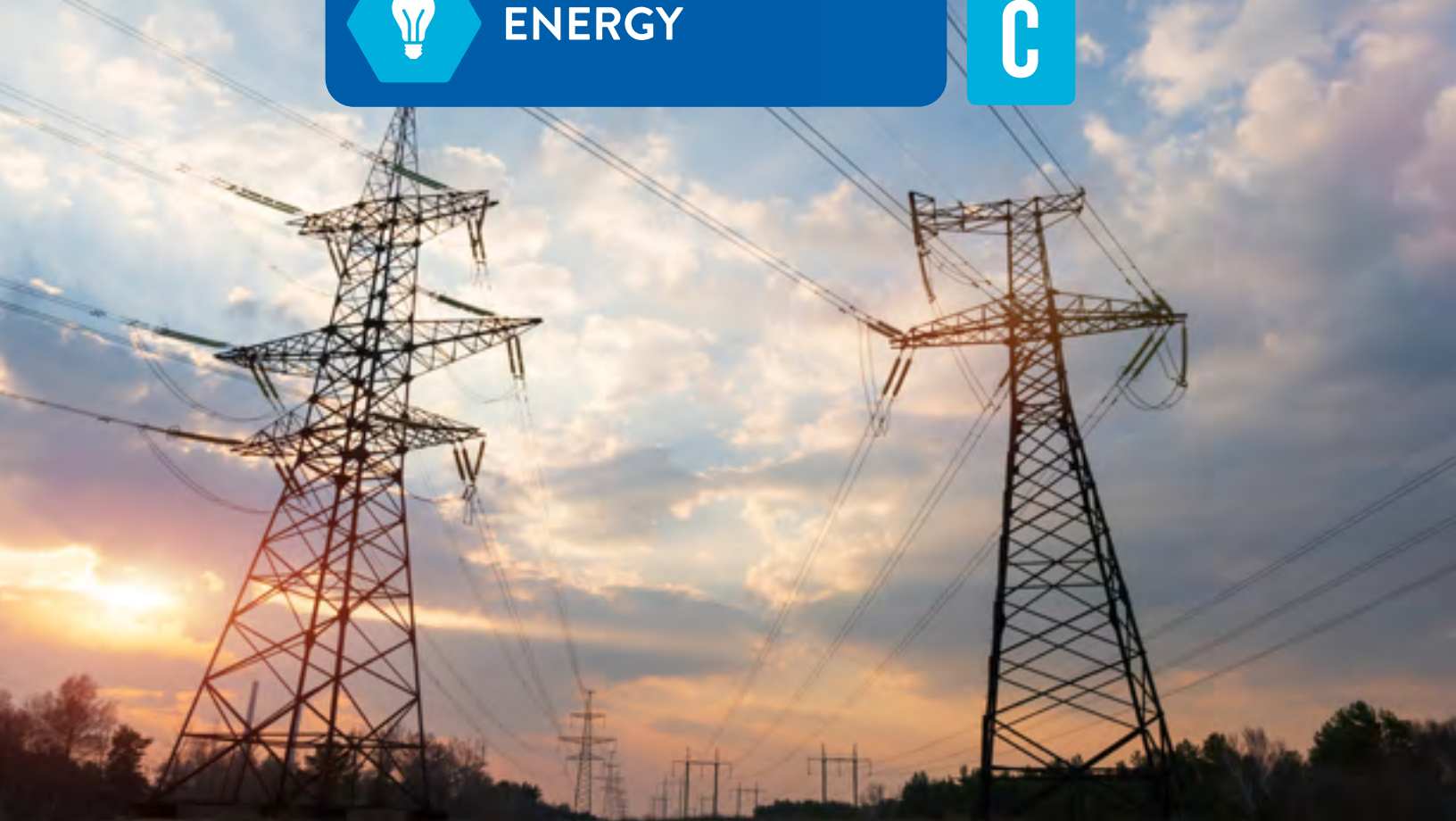
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ENERGY



ENERGY GRADE: C

EXECUTIVE SUMMARY

Mississippi's energy infrastructure, approximately 75% of which is privately owned and 25% of which is cooperatively owned, is closely related to the state's economic development goals. The energy infrastructure portfolio includes nearly 14,000 miles of natural gas pipelines, four major gas storage facilities, 31 natural gas-fired power plants, and more than 4,000 miles of high and low voltage transmission lines. The pipelines have proven to be reliable with few long-term maintenance challenges. The transmission and distribution lines, however, experience periodic disruptions. On average, households experience more than 19 hours of electrical outages per year, most often the result of weather and falling trees. Potentially exacerbating reliability challenges: Mississippi's electric cooperatives serve an average number of 8.1 consumers per mile of line, compared to the national average of 32 for investor-owned utilities and 41 for municipal-operated systems. This may increase vulnerability and result in longer outages when extreme weather-related events occur throughout the state.



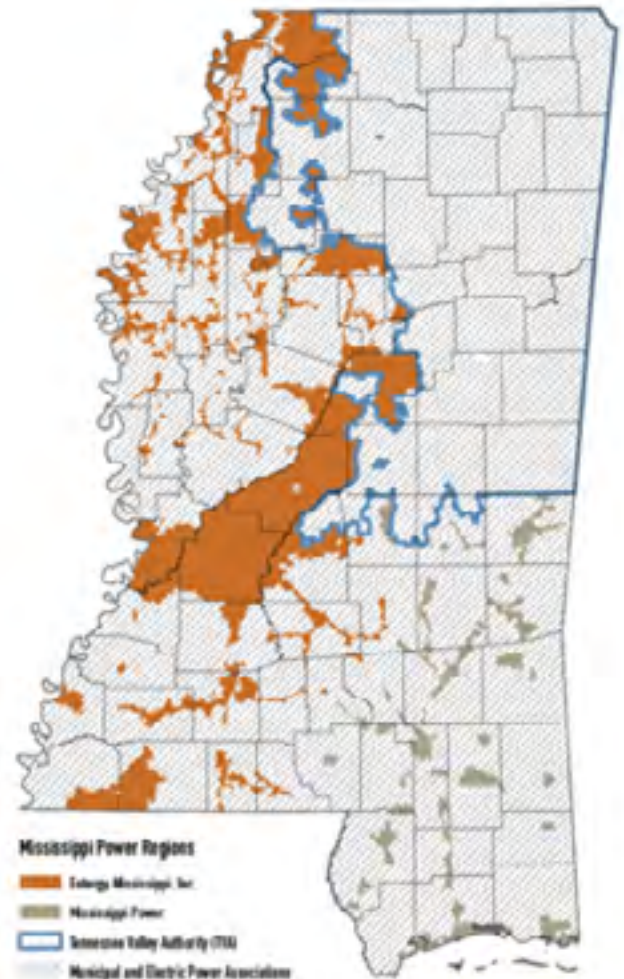
INTRODUCTION

In 2017, according to U.S. Energy Information Administration (EIA), Mississippi's total energy needs were met by coal (4%), natural gas (44%), nuclear (6%), petroleum (40%), and renewable resources (6%). The state was ranked 13th in the U.S. for total energy consumed per capita (394 million Btu) and 29th for total overall energy consumption (1,176 trillion Btu). The primary energy consumers include commercial (13%), industrial (34%), residential (15%), and transportation sectors (38%). In 2017, with more than 700 billion Btu of raw energy, namely oil, natural gas, and coal, coming from outside of the state, Mississippi was a raw energy importer. However, a portion of these raw energy sources are converted into electricity within one of the 43 electric power plants. The state's electricity mix includes natural gas (59%), coal (19%), nuclear (19%), and renewables (3%). When consumer-related forms of energy like electric power and transportation fuel are considered, Mississippi becomes a net energy exporter with excesses of approximately 14 million MWhr of electricity and 46 million barrels of petroleum. The primary focus of this chapter will be infrastructure directly related to the provision of the state's electrical needs.

CONDITION AND CAPACITY

The majority of Mississippi's energy infrastructure belongs to three leading companies: Entergy (32%), Mississippi Power Company (13%), and the Tennessee Valley Authority (TVA) (30%). The remainder (25%) is the responsibility of the Electric Cooperatives of Mississippi, rural municipalities and local utilities throughout the state. Altogether, these electric utilities are responsible for the condition, capacity, operation, and maintenance of the state's energy infrastructure, including responding to outages. Figure 1 depicts the state's electricity providers and their regions of service as set forth by Mississippi's Public Service Commission (PSC).

Due to the state's dependence on natural gas as its primary resource for producing electricity, Mississippians also rely on its associated infrastructure. According to the U.S. Department of Energy's (DOE) State of Mississippi Energy Sector Risk Profile, the energy infrastructure portfolio includes nearly 14,000 miles of natural gas pipelines, four major gas storage facilities, 31 natural gas-fired power plants, and more than 4,000 miles of high and low voltage transmission lines. The pipelines have proven to be reliable with few long-term maintenance challenges. The transmission lines, however, experience periodic disruptions, most commonly due to faulty equipment, operator errors, or natural disasters. While each of these disruption scenarios have a similar rate of occurrence, natural disasters have the overall largest impact affecting more than 1.5 million Mississippians between 1992 and 2009. When considering electricity distribution, weather and falling trees lead as the annual cause of outages for 81,888 Mississippians. On average, these households experience more than 19 hours of electrical outages per year.





In addition to natural gas, renewable energy is helping the condition and capacity of Mississippi energy portfolio. In 2016, a solar farm was built in Sumrall on nearly 600 acres with about 220,000 panels. It can produce enough energy to supply power to around 8,000 homes. Renewable energy provides 2%-3% of the state's power and is projected to grow to 5% in 2021.

OPERATION & MAINTENANCE

Currently, Mississippi's electric cooperatives energize a total of 94,200 miles of lines throughout a service area which covers 85% of the state's physical area. They serve an average number of 8.1 consumers per mile of line, compared to the national average of 32 for investor-owned utilities and 41 for municipal-operated systems.

Mississippi Power, a subsidiary of Southern Company, owns and operates six electric generating plants providing over 3.5 million kW to Mississippi customers. Additionally, Mississippi Power operates four individual solar facilities producing 158,000 kW. Mississippi Power maintains more than 2,100 miles of transmission lines in the state.

Energy Mississippi provides power to approximately 449,000 customers in 45 counties. The company also owns and operates Mississippi's only nuclear power reactor – Grand Gulf Nuclear Station – which generates 1,443MW.

In 2018, the TVA provided 5 billion kW hours of electricity to 343,000 customers and 9 billion kW hours of electricity to 86,000 commercial and industrial customers. The TVA operates and maintains 2,124 miles of transmission lines across the state. Additionally, TVA has five combustion turbine sites in northeastern Mississippi producing 3.5 million kW per year and operates two solar facilities producing 53 kW per year.

PUBLIC SAFETY

According to the National Oceanic and Atmospheric Administration (NOAA), Mississippi's most common natural hazards are thunderstorms, lightning events, and flooding. When the most frequent hazards are coupled with those that have the highest economic impacts to Mississippians' property – hurricanes and tornados – it becomes apparent that projections of more frequent and severe extreme weather events should be incorporated into energy sector. This kind of adaptive planning may help prevent impacts to public safety from downed lines and debris. Currently Mississippi's electric companies and utility associations operate and maintain the state's energy portfolio in a proactive way that includes debris/obstruction removal and tree trimming to prevent widespread power outages.

Considering the public safety implications of Mississippi's energy transmission (gas pipelines) includes an awareness of periodic oil spills that damage natural habitats, potentially causing animals to permanently flee the environment. It can also kill organisms found in affected water bodies. Spills are decreasing, however, according to the International Tanker Owners Pollution Federation. In the 1970s there were 24.5 large (greater than 700 tons) oil spills, while in the past decade oil spills have decreased to 1.7 per year.

Furthermore, gas pipeline leaks release powerful greenhouse gases into the environment that contribute greatly to climate change. This makes the long-term effects of pipeline leaks particularly troubling. There are nearly two dozen interstate natural gas pipelines that pass-through Mississippi. To avoid putting Mississippians at an increased risk of pipeline leaks, improved materials and construction practices are put in place to help ensure that risks are minimized, providing safety for the public.

FUNDING

In 2013, Governor Phil Bryant signed landmark legislation into law resulting in a plan called Energy Works: Mississippi’s Energy Roadmap. Consequently, State Bill 2564: The Energy Infrastructure Revolving Loan Fund was signed into law. The law provides funding from state bonds to municipalities or counties in Mississippi to finance energy infrastructure or infrastructure improvements (e.g., gas lines, and transmission lines) needed to support economic development.

More broadly, the focus of the state’s energy future closely couples funding for research and design, economic development, and infrastructure investment that accommodates a broader mix energy options.

Aside from state-level funding, Mississippi’s energy industry also meets its financial needs through the sustained funding source of user fees. Table 1 synthesizes information from a 2019 report by the U.S. Energy Information Administration (EIA) to show the differences, based upon user types, in the cost of electricity (cents/kWh) between Mississippi and the average across the country. Residential and industrial customers pay less than the national average whereas commercial users pay slightly more (10.58 cents/kWh in Mississippi vs 10.53 cents/kWh nationally).

TABLE 1: U.S. ENERGY INFORMATION ADMINISTRATION’S (EIA) REPORT OF MISSISSIPPI’S AVERAGE COST FOR ELECTRICITY IN COMPARISON TO THE U.S. AVERAGES

User Type	Mississippi Average (cents/kWh)	United States Average (cents/kWh)
Residential	11.94	13.32
Commercial	10.58	10.53
Industrial	6.08	6.71

The Electric Division of PSC regulates the rates investor-owned electric utilities (Entergy and Mississippi Power Company) can charge. However, the PSC has limited authority over municipal and cooperative electricity providers

FUTURE NEED

Energy infrastructure in Mississippi is continuously being developed to meet the state’s demands. The state is working diligently in expanding its energy capacity through energy conservation and efficiency. For instance, there is ongoing research to enhance renewable energy resources, improve energy transmission and distribution, and eliminate cyber security threats. The future need of Mississippi’s energy sector is not expected to outpace the sector’s ability to handle the demand due to the state’s slow population growth rate.



INNOVATION

In 2012, the state of Mississippi received a \$725,000 grant from the U.S. DOE to support energy efficiency improvements at the state's public universities. The grant is being used to create an energy efficient retrofit strategy for the state's Institutions of Higher Learning (IHL) facilities, with the ultimate goal of reducing energy consumption at Mississippi's public university facilities by 20% by the end of 2020. In addition to the initiative from IHL, there are several organic initiatives in public and private institutions to implement energy efficient solutions for the expected long-term benefits associated with those solutions.

RESILIENCE

Mississippi has diverse and abundant electric power generation assets, as well as reliable transmission and distribution capacity that makes the state a dependable energy state.

In the face of increasing frequency and severity of extreme weather events or man-made disasters, this mixed portfolio and ample supply makes the state satisfactorily resilient. Recovery after outages can be quicker with mid-scale, mixed energy portfolios.

The U.S. Energy Information Administration (EIA) noted that Mississippi has a substantial energy infrastructure. The state has many natural gas, crude oil, and refined product pipelines. Mississippi's larger ports, located on the Gulf of Mexico and the Mississippi River, handle coal, crude oil, petroleum coke and refined petroleum products.¹ Although it is not as rich in crude oil and natural gas resources as some of its neighboring states, Mississippi has major energy infrastructure with the biggest U.S. nuclear power reactor and large petroleum refinery, natural gas natural gas processing plant, and liquefied natural gas terminal located along the state's Gulf of Mexico coastline.

In 2017, the energy produced in Mississippi was as follows (EIA):

- Crude Oil – 103 trillion Btu
- Nuclear Electric Power – 75 trillion Btu
- Other Renewal Energy – 60 trillion Btu
- Natural Gas – Marketed – 40 Trillion Btu
- Coal – 34 trillion Btu
- Biofuels – 8 trillion Btu

EIA also noted that the 1,443-megawatt Grand Gulf Nuclear Power Station in Port Gibson was the single-largest nuclear power reactor in the nation and the 5th largest in the world. In 2018, Grand Gulf generated approximately 10% of the State's electricity.

The Pascagoula oil refinery is the 9th largest refinery in the nation and has a capacity of approximately 350,000 barrels per calendar day. Additionally, natural gas accounted for nearly four-fifths of Mississippi's electrical net generation in 2018 and was the fuel used at 9 of the 10 largest power plants in the State.



ENERGY



RECOMMENDATIONS TO RAISE THE GRADE

- **Mississippi should continue providing funding to the Energy Infrastructure Revolving Loan Fund.**
- **Mississippi should adopt a Renewable Portfolio Standard to diversify Mississippi's energy mix, promote its economic development, and reduce emissions. The standard should require utilities to sell a specified percentage or amount of renewable electricity and should include investor-owned utilities as well as municipalities.**
- **The state should promote and increase public awareness with regard to energy conservation. Mississippi's energy conservation can be improved by educating the public regarding utility's environmental footprint and possible energy alternatives, such as sustainable transportation and renewable electricity.**
- **Both privately-owned and cooperatively owned utility companies should provide incentives for consumers to deploy energy-saving and harnessing technologies which focus on conserving the state's energy and promoting renewable energy usage.**
- **Mississippi should provide incentives for publicly-owned facilities – such as universities, POTW, water treatment plants, etc – to install energy-saving and harnessing technologies.**
- **The state, through IHL and other means, should continue to support and promote a strong clean energy economy by helping provide funding for research and development opportunities.**
- **To avoid putting Mississippians at an increased risk of pipeline leaks, improved materials and construction practices should be put in place to help ensure that risks are minimized.**



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INLAND WATERWAYS



A CARGO FLOAT PASSES THE BRIDGES OVER THE MISSISSIPPI AT VICKSBURG IN THE USA.



INLAND WATERWAYS

GRADE: D

EXECUTIVE SUMMARY

Mississippi has 870 miles of inland waterways, including the Tennessee Tombigbee Waterway, Yazoo River, Mississippi River, Pearl River, and the Gulf Intracoastal Waterway. The top two cargo passage lock and dams in the state, the John C. Stennis and the Whitten Lock and Dam, are located on the Tennessee-Tombigbee Waterway. Over the next 20 years, approximately \$4.9 billion will be the needed investment for Mississippi inland waterways, or nearly \$250 million annually. Adequate reinvestment and modernization of the state's inland waterways is critical; nearly 2,000 vessels pass through the state's locks every year, carrying over 4.3 million tons of domestic and foreign commodities, including coal, petroleum products, paper, concrete, steel, grain, and farm products.



CONDITION AND CAPACITY

The inland waterway system for Mississippi has been in operation since the Water and Power Act of 1920. Today, the majority of inland waterways are the domain of the federal government. These waterways include the Tennessee-Tombigbee Waterway on the eastern border of Mississippi, flowing into Alabama; the Mississippi River along the state's western border; the Yazoo River and its associated backwaters; and the Pearl River that runs through the lower half of the state, emptying into the Mississippi Sound.

Along these waterways, important infrastructure includes levees and dams that control flood waters as well as locks to maintain the surface elevation of water for boat traffic.

The Mississippi River has many lock and dam systems upstream; however, there are no systems downstream. As the Mississippi ports continue to expand, the inland waterway capacity must also increase to avoid exceeding their maximum capacity. The inland waterway system in Mississippi is 870 miles long and is maintained by the US Army Corps of Engineers (USACE). The top two cargo passage lock and dams in the state are located on the Tennessee-Tombigbee Waterway; the John C. Stennis and the Whitten Lock and Dam which are located at mile 334.7 and 411.9, respectively.

According to a 2016 report from the USACE's Navigation and Civil Works Decision Support Center, these facilities reported the passage of nearly 2,000 vessels through the state's locks, carrying over 4.3 million tons of domestic and foreign commodities including coal, petroleum products, paper, concrete, steel, grain, and farm products, to name a few. However, the barges encounter delays along Mississippi's inland waterways with the Whitten Lock and Dam yielding the highest percentage of delays with upwards of 16% per year. This estimate was calculated before a 2019 flood created sandbars on the Tennessee Tombigbee in Northern Mississippi and the canal temporarily closed, before partially reopening for traffic.

OPERATION & MAINTENANCE AND PUBLIC SAFETY

Inland waterway operation and maintenance (O&M) efforts include dredging, clearing and snagging of the waterways which is critical for keeping them navigable. Furthermore, O&M for the aging infrastructure is vital to ensure the systems function properly, meet their full design life, and guarantee public safety.

Public safety is an important factor for Mississippi's inland waterways because the potential impact of failure could cause extensive damage. For instance, the Great Flood of 1927 catalyzed the failure of dams and locks along the Mississippi River that resulted in catastrophic flooding, property damage and loss of life. Much of the damage occurred in low-lying farmland areas which impacted households and the agricultural sector, not to mention catalyzed a mass migration of displaced persons out of the state.

Potential dam or lock failures would yield significant economic and livelihood impacts from disrupted movement of millions of tons of agricultural goods along the river. Currently, however, as local and global trade demands (e.g. transportation and agriculture) increase, so too will the demand for dredging for the ever-growing size of cargo ships. This means a balanced approach to inland waterway dredging that does not neglect environmental and public safety concerns is necessary. Furthermore, changing the sediment supply to an area can create conditions for land loss, bank erosion, scour, and flooding which may impact public and/or private property. Accommodating these needs requires adequate funding, technical capacity, and planning to meet current needs, ensure public safety, and prepare for increasingly frequent extreme weather events.



FUNDING AND FUTURE NEED

Inland waterway in Mississippi are mainly funded by the federal government Inland Waterways Trust Fund (IWTF). The year to year O&M expenses for these thoroughfares come from general appropriations as well as from the Harbor Maintenance Trust Fund (HMTF), a separate funding account from the IWTF that is based on an ad valorem tax applied to waterborne imports and domestic traffic. In FY2017, the federal government invested \$127 million into the O&M of Mississippi's inland waterway infrastructure; in FY2018, \$85 million was spent, and approximately \$92 million was spent during FY2019.

Additionally, other sources of funding include self-generated revenue, private sector investments, resources from local governments, and state funding from the Mississippi Development Authority or the Mississippi Department of Transportation. Due to the highly competitive nature of IWTF and limited statewide funding, the total funds needed for Mississippi inland waterways are not regularly met. Specifically, over the next 20 years, approximately \$4.9 billion will be the needed investment for Mississippi inland waterways. This translates to a nearly \$250 million need annually. Additional funding is needed to fully clear the flood-deposited sediment; by one USACE estimate, an additional \$100 million is needed to return the canal to its original depth and width.

While the navigation locks are aging, and rehabilitation is needed, regular dredging is also required to maintain channels. As such, Mississippi should begin working to attain the funds necessary for reinvestment and modernization of the current inland waterways situated throughout the state. Whether the funds come from the federal government or the state of Mississippi, reinvestment will be necessary to maintain the quality of life, agricultural abundance and transportation industry which all benefit from the waterways.

INNOVATION

The USACE's formal vision for the future of the Inland Marine Transportation System is a world-class maintenance management system to help sustain the vast aging infrastructure of navigation locks and dams. A key pillar of this plan includes standardization of component designs such that they can be readily shared across the hundreds of miter gate structures, spillway gates, and other infrastructure components. The Corps' Navigation Research and Development program, based at its Engineer Research and Development Center (ERDC), also has several efforts underway to help improve the safety and efficiencies of marine transportation along the inland waterways. For example, the Smart Gate application uses structural health monitoring technologies to provide real-time awareness to lock operators concerning damage detection, fatigue cracking, barge impacts, and other risks to overall structural integrity of these vital infrastructure assets. Finally, the River Information Services (RIS) initiative seeks to leverage modern information technologies to improve real-time domain awareness for marine operators and the public at large. Communication protocols such as the Automatic Identification System (AIS) are being used in a variety of applications to avoid collisions, address hazardous navigable conditions, and improve operational logistics.

RESILIENCE

The resiliency of these inland waterways is affected by factors such as tidal extremes, climate changes, extreme weather events, adjacent land use changes, operations of the structures, and species that live within the waterways, among others. The federal government identifies vulnerabilities and determines efforts that contribute to greater resilience. These efforts include providing the infrastructure with layers of operational capability, increasing target hardness, and improving the quality and capacity of the intermodal connectors. Intermodal connectors are just as important as the waterways and can often be a limiting factor to capacity. When connectors are in poor condition it may reduce service reliability, negatively impact response speed during and after a service interruption, and increased shipping cost. To increase the resilience of the waterway system intermodal connectors should be properly designed and in sufficient condition to service the needs of the waterways.



**INLAND
WATERWAYS**



RECOMMENDATIONS TO RAISE THE GRADE

- **The system's overall dependability can be greatly enhanced by better coordination (project planning, O&M practices, and spending) between USACE, state agencies, and stakeholders to avoid disturbances, duplication, and congestion.**
- **One of the keys to maintain and improve infrastructure of the Marine Transportation System is to coordinate appropriately how funds are allocated to each project through use of both state and federal collaboration on inland waterway projects.**
- **Rehabilitation of the largest state waterway, the Tennessee-Tombigbee Waterway Locks and Dams should be considered to reduce delays and increase design life.**
- **Developing reserve and surge capacity in the Marine Transportation Systems while coordinating with industry on response and recovery operations could prove beneficial with respect to resilience and reduced capacity from intermodal connectors.**
- **Actions should be taken to ensure enough funds are available and distributed to meet dredging needs.**



FIND OUT MORE

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ON MAY 17, 2011, FLOOD WATERS FLOWING OVER A LEVEE IN THE MISSISSIPPI DELTA CAUSED SIGNIFICANT DAMAGE TO HOMES, FARMS, WILDLIFE AND CROPS. (FILE PHOTO BY MSU EXTENSION SERVICE/SCOTT COREY)



LEVEES



LEVEES

GRADE: D

EXECUTIVE SUMMARY

Mississippi is home to over 900 miles of concrete and earthen levees that protect more than 300,000 people and \$21.8 billion in property. Of the state's 114 individual levee systems, 25 were constructed by U.S. Army Corps of Engineers (USACE) and are regularly inspected. Of these 25, 14 levee systems are rated unacceptable, meaning the condition of the system may prevent it from performing as intended or a serious deficiency has gone unaddressed. Little to no information is available about the conditions of non-USACE levees. The lack of publicly available information regarding Mississippi's locally owned levees poses a challenge when assessing the overall condition, funding, and safety of levees in the state.



INTRODUCTION

After the Great Flood of 1927, USACE was authorized by Congress to control the Mississippi River with a system of levees. This also led to the Mississippi Rivers and Tributaries Act (MR&T). Established in 1928, the MR&T was installed in Mississippi, Louisiana, Tennessee, Arkansas, Kentucky, Missouri, and Illinois in order to organize and fund a comprehensive and unified system of public works. The intention is that this would provide enhanced protection from floods and an efficient navigation channel. This system added supplemental techniques to the flood control system through four major features: levees and floodwalls, channel improvement and stabilization, tributary basin improvement, and floodways. This system also authorized higher levee grades and stronger levee sections to be made. Nationally, the most cited failure causes for levees include under-seepage, hydraulic piping, and overtopping. Aging and poorly maintained levees contribute to a higher probability of levee failure. Exceptional events such as extreme water flow rates and water surface elevation associated with severe flooding events also lead to levee failures.

CONDITION AND CAPACITY

Mississippi has 978 miles of levees. The average age of these levees is 61 years. On USACE-owed levees, the agency conducts routine inspections approximately every year and more thorough, periodic inspections approximately every 5 years. Once inspected, levees are assigned one of the following conditions: acceptable (A), minimally acceptable (M), or unacceptable (U). If an inspected levee is deemed acceptable, this means the system is in satisfactory condition with no deficiencies. The minimally acceptable levee condition demonstrates that one or more items have a minor deficiency that need to be corrected, but an engineering determination concludes that the items would not prevent the segment or system from performing as intended during the next flood event. An unacceptable levee condition rating means that one or more items that make up the levee system is predicted to prevent the system from performing as intended, or that a serious deficiency noted in past inspections has not been corrected within the established timeframe.

According to the National Levee Database (NLD), 0 levee systems are currently rated acceptable, 11 levee systems are rated minimally acceptable and 14 levee systems are rated unacceptable. Only USACE constructed levees are currently rated. No information is publicly available on the condition of locally constructed levees.

OPERATION & MAINTENANCE

Of the 114 Mississippi levee systems in the NLD, 89 are locally operated and maintained, 23 are USACE federally operated and maintained, and 2 are maintained by public sponsors. In FY 2020, USACE received \$8.7 million for Mississippi River levees operation and maintenance. Additional federal funding and USACE assistance are available after major floods. This money is spread across levees in seven states all along the Mississippi River, including Mississippi. No O&M funding information is publicly available for levees that are not federally operated and maintained.

PUBLIC SAFETY

Levees play a critical role in protecting many Mississippi communities from dangerous flooding. About 4 million Over 300,000 people and more than \$21.8 billion in property are protected from flooding by these levees. The two high -risk USACE-constructed levees in the Mississippi protect 206,000 people, \$7.2 billion in property value, and 81,000 individual structures. The MR&T created a flood risk management plan designed to control the project design flood in 1956 based of the largest maximum possible flood discharge data from the National Weather Service.



In addition to the condition inspections discussed above, levees in the NLD are also assigned one of the following risk levels, based on the “likelihood of inundation due to that should a breach and/or system malfunction in combination with occur, the incident would cause loss of life, economic, or environmental consequences” (NLD): very high risk, high risk, moderate risk, low risk, and very low risk. In other words, these risk characterizations are not indicative of condition, but instead reflect the potential damage to life and property, should a failure occur. Twenty four (24) of the 25 USACE constructed levees, or 96%, have been screened. Two of these have been rated high risk, 3 have been rated moderate risk, and the remaining 19 have been rated low risk. Since this rating system reflects the risks due to potential failure, the large number of low risk levees intuitively represents a lack of development that would be impacted. No project levee built by the MR&T has ever failed; however, ensuring proper review and inspection is necessary to ensure that this record continues. No locally constructed levees have been assessed by the USACE and, as a result, no information is available about their risk levels.

FUNDING

To date, over \$15.5 billion has been invested across the MR&T system for planning, construction, and operation and maintenance since 1928. \$1 trillion in flood damages are projected to have been prevented since 1928. An estimated \$234 billion in flood damages were prevented in 2011. There is an estimated 67 to 1 return on each dollar invested in MR&T.

Twenty-three of Mississippi’s 114 levee systems are constructed, owned, and maintained by USACE at the federal level. The funding for these levees comes from USACE’s budget. In FY 2020, Congress appropriated \$7.4 billion to USACE, with \$8.7 million in O&M funding and \$16.3 million in construction funding for levees along the Mississippi River, which includes Mississippi’s USACE levees. Based on the lack of acceptable-rated levee systems in Mississippi, it is clear that more funding for O&M is needed. Additionally, \$15 million was appropriated to the National Levee Safety Program in FY2020 to assist in inventorying levees across the country for the National Levee Database. This is more than triple the budget in FY 2019. In 2019, USACE was able to assess 88% of its Mississippi levees. With the increase in inventory funding, no investment gap is expected for assessment.

Ninety-one out of 114 levee systems in Mississippi are constructed, owned, and maintained by localities and public sponsors. Little information is publicly available on funding for these systems; however, we can assume they have limited budget. In Mississippi’s FY 2020 Budget Recommendation Report, no funding was specifically allocated to levees.

FUTURE NEED

The Engineering Research and Development Center (ERDC) in Vicksburg, MS completes a very thorough and well-engineered approach to considering the impacts of past, present and future weather events in order to assess the robustness of the levees systems. Continued funding for this type of research will be necessary to ensure that risks to agricultural and personal assets are minimized due to inadequate funding structures.

More O&M funding is needed in the future in order to bring the levees up to acceptable condition and prevent excessive flooding and damage. Additionally, localities need increased funding to create an assessment framework and inventory their levee systems.



RESILIENCE

No levee built in the MR&T has ever failed, despite at least eight major floods in the last 90 years. The resilience of Mississippi's levees system is a direct function of their design, and construction, and continued maintenance to the extent that funding has been allocated to do so.

Furthermore, where state and federal funding is limited, ecosystem restoration work performed by non-profit organizations has an increasingly important role to play. Nonprofits like Ducks Unlimited and the National Fish and Wildlife Foundation work with communities and agency partners to not only restore floodplain habitat and Mississippi River aquatic ecosystems but these efforts also improve some of the original hydrological connectivity of these areas, enabling them to better accommodate and withstand flood events. As more of the natural ecosystems adjacent to levees are able to accommodate flood events, less pressure is put on the levee infrastructure itself.

As climate change continues to progress, extreme weather events do as well. Mississippi precipitation is increasing at a rate of 0.57 inches per decade, and, as more rainfall leads to more flooding, the levees will need to continue to be improved in order to maintain their resilience. Currently, the Mississippi Levee Board is sponsoring efforts to enlarge levees to increase safety and resilience as flooding becomes worse. However, this project focuses on only 69 miles of Mississippi's 900 miles of levees.

INNOVATION

In its efforts to widen levees along the Mississippi River, the Mississippi Levee Board has implemented "avoid and minimize" design techniques to reduce the amount of borrow material needed, including relief wells and dredged berms. Relief wells allow seep water to discharge through a controlled mechanism under the levee without displacing material. Dredged berms, when near enough to the river and containing suitable material, are being excavated and used to raise the levees. Dredged berms decrease the environmental impacts of these kinds of projects. By making use of local resources and not bringing outside materials to build up the levees, the environmental impacts are minimal and the carbon footprint is smaller. This project is scheduled for completion in 2031.



LEVEES



RECOMMENDATIONS TO RAISE THE GRADE

- **Develop a mechanism to provide local governments funding assistance for O&M needs.**
- **Prioritize environmentally friendly practices, such as dredged berms, when improving and maintaining levees.**
- **Fully fund operation and maintenance budget for USACE levees.**
- **Create a state revolving fund and principal loan forgiveness program to provide localities with resources to inventory and collect data on their levee systems.**
- **Request Congress fully fund the national levee safety program at its authorized level of \$79 million.**
- **Invest in innovative technologies to minimize the probability of catastrophic failure along the levees.**



FIND OUT MORE

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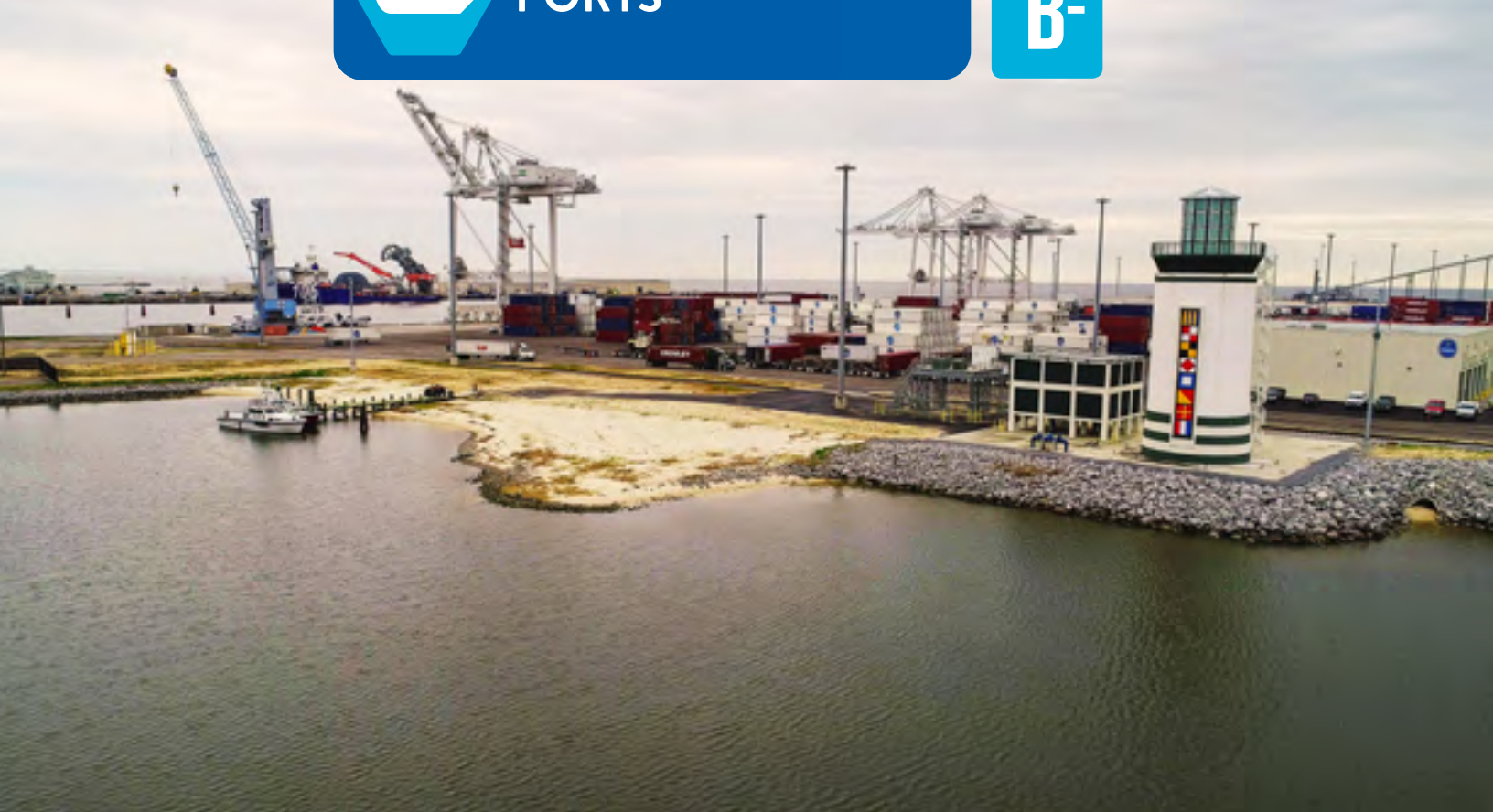
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PORTS



PORTS GRADE: B-

EXECUTIVE SUMMARY

Mississippi's ports are critical to the state's economic wellbeing. A 2016 study conducted by the Mississippi Department of Transportation (MDOT) noted that Mississippi's ports support over 125,700 jobs and nearly \$5.4 billion in income while generating nearly \$17 billion in economic stimulus annually. There are sixteen coastal and inland ports in Mississippi; the three largest are: the Port of Gulfport, the Port of Pascagoula, and Port Bienville. These ports serve as the United States' ingress and egress points for millions of tons of goods every year. Two of these ports are considered deep-draft while the third is shallow-draft. The three largest Mississippi ports are investing in their infrastructure, but none are capable of receiving larger draft Post-Panamax ships. These ships are becoming increasingly common; if Mississippi wishes to capture the market they represent, public discussion must take place on increasing the dredging depths to accommodate larger vessels.



CONDITION AND CAPACITY

The three major coastal ports handle a high volume of business and anticipate continued growth in the coming years. Due to rebuilding efforts and new investments following Hurricane Katrina, all three ports are in good condition and have enough capacity to meet their current needs. However, there is a growing demand for the Mississippi coastal ports resulting in expansion or planning for expansion in the coming years. All three ports currently meet the demands of Panamax size vessels (4800 TEUs), but not Post-Panamax vessels (12,000 TEUs). Post-Panamax ships do not fit into original canal locks.

With its \$570 million, 84-acre addition Restoration Project, the Port of Gulfport has made noteworthy progress toward its largest expansion ever. This Restoration Project is leading the way for new economic opportunities for the port, businesses, and the local community. Due to its location, the port has easy access to open ocean waters via a short 18-mile ship channel that is currently maintained at 36 ft. The U.S. Department of Transportation Maritime Administration has designated the Port of Gulfport as one of seventeen Strategic Seaports in the United States. The port is the second-largest importer of green fruit in the U.S. and the third busiest container port on the Gulf of Mexico.

The Port of Pascagoula is Mississippi's largest port by volume and ranks nationally in the top 20 in foreign cargo volume. It is a deep-water port and maintains two shipping channels: one is 42 ft and the other is 38 ft. The Port of Pascagoula is in a prime location - a 2-hours pilotage to major shipping lanes - and has weather protected rail operations, a flexible labor force, and extremely competitive rates. This port includes two harbors with public and private terminals and proximity to three industrial parks. It is expanding its Pascagoula River Harbor and establishing a more efficient rail link to improve its intermodal transit capabilities.

Port Bienville has 600 ft. available dock space with three primary berths, 12-ft. channel depth, and two new warehouses with a total capacity of 110,000 sq. ft. equipped to handle container, bulk or break-bulk shipments. A railroad expansion project was recently completed to link the port to the Industrial Park which facilitated expansion of other businesses' operations and encouraged new businesses to move into the area. The Port of Gulfport has recently worked with the U.S. Army Corps of Engineers (USACE) to increase the channel depth to allow deeper draft vessels access to the port. This change, along with the Restoration Project, resulted in a tonnage increase from 1.7 to 2.7 million between 2014 and 2017.

OPERATION & MAINTENANCE

The MDOT is the agency authorized for port operations. Operational issues include the flow of traffic and goods as well as streamlined logistics to ensure the proper parts are in motion. Mississippi is working diligently to expand and modernize the coastal ports through the use of machinery in the operation and maintenance. These duties typically fall under the port authority, port commission, or a particular governing committee. The coastal ports have routine preventative maintenance and periodic inspection programs where repairs are identified, budgeted, and scheduled. The Mississippi State Port Authority at Gulfport funds its operating budget through its own revenue streams, including wharfage, leases, and harbor fees. Little information is publicly available on the operation and maintenance budgets of the other two ports, but we can reasonably assume they may be funded through the same means.

PUBLIC SAFETY

Public safety along the Mississippi Gulf Coast is a team effort across stakeholder groups managing ports and waterways infrastructure. As the Gulf Coast ports are an economic hub welcoming national and international traffic, the area is at risk of terrorism. The ports rely on the U.S. Coast Guard, the Department of Homeland Security, and the Transportation Security Administration to protect the ports and ensure the quality of imported goods. All three ports underwent major restoration work after Hurricane Katrina in 2005, during which they experienced nearly \$100 million in damages.



FUNDING

The major source of capital for port infrastructure in Mississippi comes through self-generating revenue and local governments. Other funding sources include Federal grants and programs, private sector investment, and state funding from the Mississippi Development Authority (MDA) and MDOT. However, funding from MDOT is limited and only includes funding from the Multi-Modal Transportation Improvement Program (MTIP).

In fiscal year 2019, 38% of the \$10 million from MTIP has been allocated to the state's ports. This was the largest percentage allocated for one type of infrastructure. This funding, which is outside the normal port operating budget, is earmarked for capital improvements or rebuilding. In February 2020, the Department of Transportation provided the Port of Gulfport with a grant for \$15.8 billion dollars for improving highway access.

All three ports had serious funding needs identified in their 2000 Capital Improvement Plans, adding up to approximately \$51 million. However, after Hurricane Katrina in 2005, these needs greatly increased and funding options also increased with federal aid as a result of the disaster.

FUTURE NEED

The future of Mississippi's ports will be one of improvement, operations and maintenance. There is currently no obvious funding gap. Increasing capacity will continually be necessary, as the economy grows. Whether exporting or importing, the ports will continue serving as a vital infrastructural asset to Mississippi's and the United States' economic health.

Currently, the Mississippi ports are not capable of receiving larger draft Post-Panamax ships. These ships are becoming increasingly common; however, there has been no public discussion of increasing the dredging depths that the ports are authorized for. The Port of Pascagoula is working to expand its size and capacity and has expanded its channel width from 450 to 550 ft. The dredge material from this project was used to replenish Round Island, a rapidly disappearing island in the Mississippi Sound, which provides protection for both marine life and the port during flood events or hurricanes. This width expansion is a reaction to the increasing ship size; however, if Mississippi wishes to capture the portion of the market that uses these ships, it must consider authorizing the ports to dredge more deeply in addition to expanding horizontally.

RESILIENCE AND INNOVATION

Ports are inherently susceptible to natural disasters and coastal degradation. Hurricane Katrina, one of the worst natural disasters in U.S. history, hit the Mississippi Gulf Coast in August 2005. Following this disaster, all three coastal ports compiled their lessons learned into hazard mitigation plans, disaster recovery plans, port security plans, resiliency plans, and staff disaster training. For example, following Hurricane Katrina, the Port of Gulfport rebuilt at a significantly higher elevation. Furthermore, Port Bienville's business office and the records therein were completely destroyed, so their mitigation plans now outline better measures to protect their records.

The Port of Gulfport is also expanding to interact with its community through a groundbreaking \$10 million partnership between Mississippi State Port Authority and University of Southern Mississippi's School of Ocean Science and Technology on a Marine Research Center. This project will not only beautify the port's north end entrance but will significantly grow the city and state's blue economy. This increases social resilience by providing transparency on the port's infrastructure and reassures members of the community about the value and stability of the port's economic benefits to the community, both through imports/exports and job creation.

Lastly, with little intermodal connectivity between the three ports, all are seeking to build resilience by adding Class I rail connectors. These connectors include a north/south rail for the Port of Gulfport and a Port Bienville rail connector linking the CSX and Norfolk Southern mainlines in Hancock County.



RECOMMENDATIONS TO RAISE THE GRADE

- **Increase federal and state grant money to further expand the ports and fund the necessary projects laid out in the Capital Improvements Plans.**
- **Increase the USACE budget and the Harbor Maintenance Trust Fund for operation and maintenance of the navigable waterways for dredging to allow ports to maintain the water depth of channels and berth areas.**
- **Expand the local workforce along the Gulf Coast by providing educational opportunities and encouraging the hiring of local citizens.**
- **Promote tourism to its coastal ports. This is currently being done at the Port of Gulfport and is making considerable economic impact.**
- **Determine innovative methods for funding, planning, permitting, engineering, and constructing the improvements needed in the ports to reduce project costs and expedite the completion of projects.**



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RAIL



RAIL
GRADE: B-

EXECUTIVE SUMMARY

The railway system provides over a quarter of the freight services in Mississippi. Comprised of five Class I, one Class II, and 20 Class III rail lines, the network experiences a large amount of through freight traffic and provides travel options to a modest number of passengers. Privately-owned Class I railroads provide the most service, perform adequately, and are fit for the future. The Class II/III railroads are challenged with deteriorating tracks largely due to lack of funding, although limited dollars are available through several state programs. Priority for continued grade crossing improvements—including the addition of warning devices and resurfacing—should be a feature of future railroad capital programs. Throughout the state, about 65% of these grade crossings have no active warning devices and 10% have no warning devices at all. Fortunately, projects are continuously in progress to improve track awareness for public safety that will also provide more efficient rail operations.

CONDITION AND CAPACITY

The Mississippi rail system is comprised of 2,455 miles that are divided into two main categories: Class I (major) railroads, and Class II/III (shortline) railroads. Major rail lines are privately owned and comprise the majority of the system with nearly 1,700 miles. There are roughly 700 miles of shortline railroads in the Mississippi network (note that not all shortline rails are publicly owned). The Mississippi Department of Transportation (MDOT) State Rail Plan provides a map of the rail routes and owners along with the currently out-of-service tracks. The main use of rail throughout the state is for freight purposes but passenger services are also available via two long distance trains operated by Amtrak. These trains have 10 stops throughout the state.

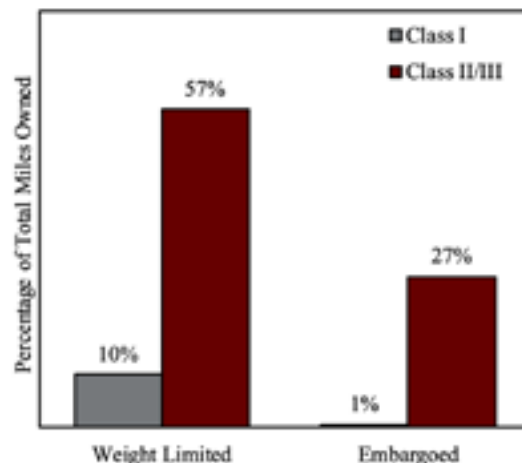
Class I Railroads

In Mississippi, five major railroads are owned and operated by Burlington Northern Santa Fe, Chessie-Seaboard Merger Transportation, Canadian National, Kansas City Southern and Norfolk Southern railways (BNSF, CSXT, CN, KCS and NS, respectively); they make up approximately two-thirds of the state's rail system. In 2017, over 113 million tons of freight valued at over \$120 billion were transported by rail. If the commodity flow stays consistent, it is projected that there will be a 48% increase in tons by the year 2040. Private rail companies ensure good rail line condition to keep this continuous commodity flow. Of the total 1,695 miles, only 162 miles are weight limited and fewer than 10 miles are embargoed. The fact that only 10% of the rails are weight limited demonstrates the railways are in good shape. The embargoed rails are purposeful stops along the railway for customer-specific or switching needs. The main need for rehabilitation in these corridors are the bridges that cannot sustain the needed 286,000-lb carload.

Class II and III Railroads

Shortline railroads provide connecting service to the major railroads. These lines are typically bought locally and regionally from the private companies when their profit margin decreases. There is one Class II rail line near Columbus that serves between the Mississippi – Alabama state line. All 13 miles of this track are limited to 263,000-lb carloads. The 20 Class III railroads vary in condition and capacity with only four tracks that can fully handle the 286,000-lb carloadings. As seen in Figure 1, over half of the total shortline rail system is weight limited while another quarter is out-of-service due to deteriorating rail lines.

FIGURE 1 – MAJOR AND SHORTLINE RAIL CONDITIONS (1)





Passenger Services

There are two long distance trains operated by Amtrak that run through Mississippi. The *Crescent* service operates between New York and New Orleans using Norfolk Southern tracks with four daily stops throughout the state while the *City of New Orleans* service operates between Chicago and New Orleans using CN tracks with six daily stops. The Jackson station was the third busiest stop along the *City of New Orleans* route in 2018. Ridership in 2017 was 101,542 and is projected to remain steady or moderately increase through the next ten years.

OPERATION & MAINTENANCE

While the major rail lines are owned, operated, and maintained by private companies, MDOT Railroad Safety Specialists conduct track, grade crossing signal system, hazardous material, and operating practices inspections under the guidance of the Federal Railroad Administration (FRA) through the FRA state participation program. One feature continuously being improved is highway-rail grade crossings. There are about 2,200 public highway-rail grade crossings in Mississippi (note that there are also private crossings that are beyond the scope of this document). About 65% of these grade crossings have no active warning devices and 10% have no warning devices at all. Crossing surfaces are also experiencing large amounts of deterioration around the tracks.

Fortunately, progress is being made. Over 60 crossing projects have recently been completed, including resurfacing, adding LED flashers, and installing signals and gates. There are 52 signal and gate projects and four crossing surface projects that are currently being implemented or are planned.

PUBLIC SAFETY

Within the past 10 years, the total railroad-related incidents in Mississippi have been reduced by half, but continuous maintenance and improvement of safety at grade crossings remain vital. The limited number of grade crossings with active warning devices is a source of avoidable accidents. Priority for continued grade crossing improvements—including the addition of warning devices and resurfacing—should be a feature of future railroad capital programs. For future purposes, the Multimodal Transportation Improvement Fund (MTIF), established in 2002 by the Mississippi Legislature, could easily include language requiring a minimum level of safety improvement at railway crossings as consideration for awarding the grant. The MTIF grant allows for 12% of MDOT's multimodal funding to be allocated for this type of improvement program, and through MDOT's administration of the project, there is a higher probability of successful implementation of safety standards.

FUNDING

While the major (Class I) railroads have annual budgets anywhere between \$70 million and \$2.5 billion with adequate funding from shipper charges, the shortline railroads struggle to make improvements with available funding. Shipper charges are generally insufficient to meet railroad maintenance and capital improvement needs. Public funding is used to sustain connecting railroad operations but the application processes can be excessive and matching or local share funding is often not available to support applications for available federal loans or grants.

Funding available for grade crossing upgrades is mostly administered by MDOT. The Highway-Rail Grade Crossing Program receives its funding through the Federal Highway Administration (FHWA) Section 130 Highway-Rail Grade Crossing Program which allows MDOT to fund 10 to 15 projects each year. The 40 grade crossing projects that are currently active are using \$9.3 million from this fund and, if funding levels are maintained, the remaining 16 improvement projects will total to \$3.7 million.



FUTURE NEED

There is limited funding for rail owners from the state of Mississippi. The MDOT Railroad Revitalization Fund provides loans to rail owners for rehabilitation costs of existing lines and facilities. These no-interest loans provide up to 75% of the improvement costs and require an annual payment of at least 10% of the loan amount. Grants are also available through the MDOT Multimodal Transportation Improvement Program (MMTIP). While these programs have value, increasing the total funds available for rail should be considered.

Other needs in the freight network include rehabilitation and expansion of port rails. There are 12 ports currently serviced by rail and one additional port is planning for future service. Two projects proposed in 2011 have been completed using HUD grants, BUILD (formally known as TIGER) funding, and the Multimodal Transportation Improvement Fund.

Amtrak operates two of 15 long distance routes through Mississippi. A principal measure of service quality used by Amtrak is on time performance (OTP). Overall OTP for long distance routes is only 43% in 2018, down 1.7 percentage points from 2017. The primary reason for delays on long distance routes is freight train interference due to dispatching of freight trains ahead of and/or in conflict with passenger trains. Amtrak has graded the two freight railroads over which Mississippi long distance trains operate—NS and CN—as F. All of the freight railroads in the United States with significant passenger operations are required to install Passenger Train Control (PTC) systems by December 31, 2020. While all freight railroads have been making progress towards this objective, significant technical and funding challenges remain. Amtrak's ridership and revenue for the long-distance trains are dependent on the freight railroad's management of infrastructure including maintenance and trackage-renewal capital investments. The long-distance passenger rail network has the weakest cost recovery ratio in the Amtrak system and requires substantial federal government subsidies.

INNOVATION

Since its 81-mile embargo in 2011, the Grenada rail line has experienced a series of improvements. In 2015, Iowa Pacific Holdings, LLC (IPH) began a 15-year operation agreement for the line. IPH inaugurated a Christmas-themed passenger event with an antique passenger train to attract tourism and provide funding for the line. A recent loan agreement has also been reached to rehabilitate the southern portion of the rail line.

In the case where out-of-service lines lead to full abandonment, rail banking is often used to preserve the corridors for any possible future rail use. The Rails to Trails Conservancy has transformed 120 miles of abandoned rails into 13 recreational trails for public use throughout the state.

RESILIENCE

Since 2018, Mississippi has experienced multiple floods throughout the state. For more than 150 days, the Yazoo River, a tributary of the Mississippi River, flooded approximately 548,000 acres. While three highways were completely inundated with water, the Class III local rails on the border of Issaquena and Warren Counties were not submerged. A few months later, in early 2020, the Jackson metro area flooded— inundating over 1,000 homes and resulting in millions of dollars of damage. While local roads flooded, the Class I railroads in the Jackson metro area remained above water. These railroads were not inundated, but flood waters were not far from overtopping the Class I lines running out of downtown Jackson.

Due to the infrastructure's height, many of Mississippi's rail systems have withstood major catastrophes in the recent past, but work still needs to be done to ensure the railroads can continue to meet the challenges they will face in the future. Overall, raising the elevation of railroads and bridges and moving lines out of flood zones where possible can help Mississippi's rail industry become more resilient and continue serving the citizens of the state.



RAIL



RECOMMENDATIONS TO RAISE THE GRADE

To raise the rail grade, the Mississippi Section of the American Society of Civil Engineers recommends the following actions:

- Increase funding availability to shortline rails.
- Lowering upfront costs and providing reasonable application processes can improve the funding of Class III railroads.
- Continue to improve grade crossings supporting the public safety of the rail system; rehabilitation is suggested for crossing surfaces in areas that are greatly deteriorating.
- Raise track elevations in flood-prone areas and over bodies of water to meet current and future weather patterns.

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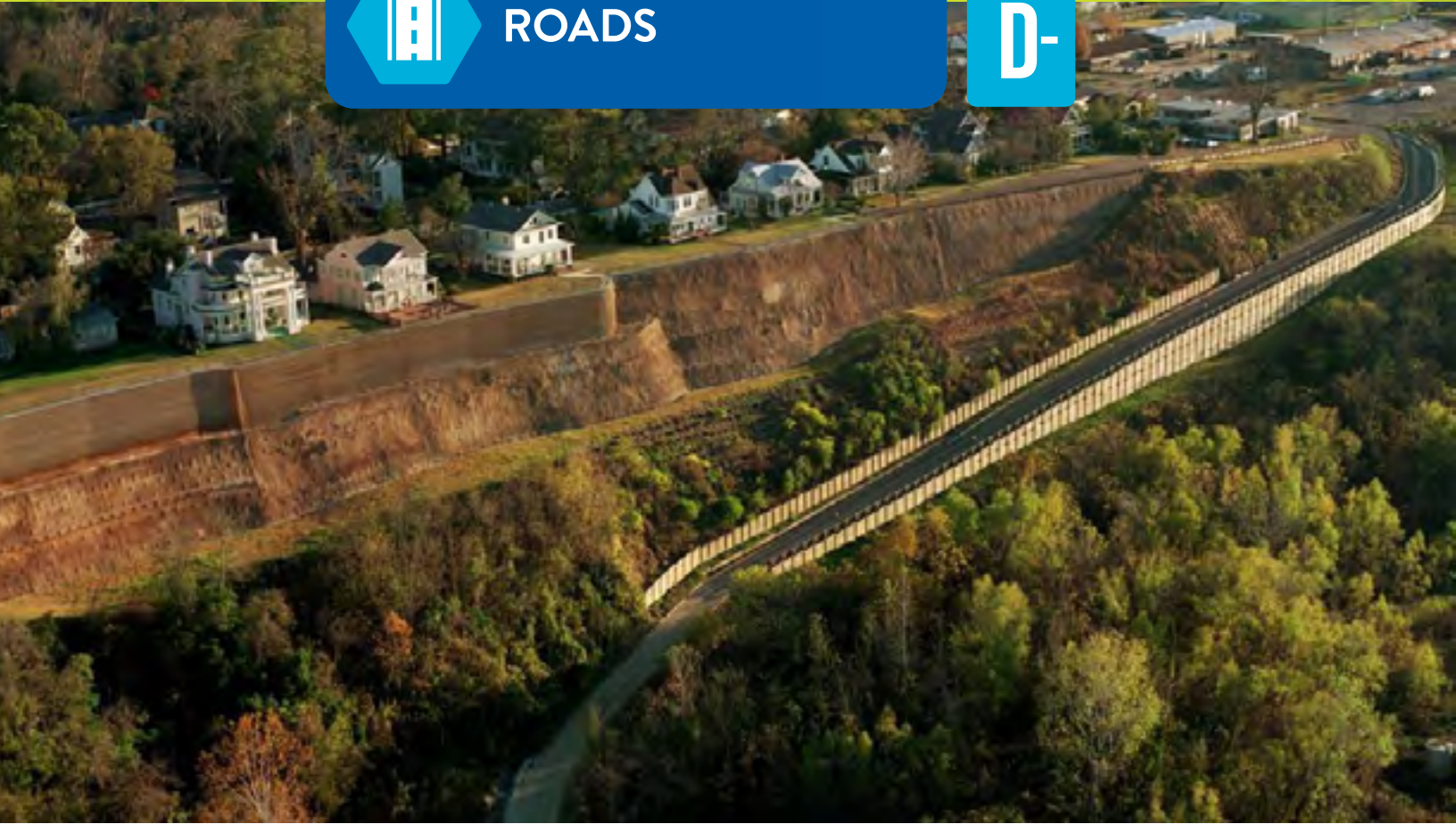
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ROADS



ROADS GRADE: D-

EXECUTIVE SUMMARY

Roadway projects in Mississippi are largely paid for with an 18.4 cents-per-gallon tax on gasoline, a rate that has not been raised for over 30 years. As a result, inflation and other factors have decreased the spending power of the state's gas tax, leading to an inability to pay for necessary rehabilitation and maintenance projects around the state. In 2018, nearly 40% major urban road miles in the state were in poor condition, double the national rate, and 25% of the rural road network was also in poor condition. The average motorist spends \$820 in extra vehicle repairs and operating costs because Mississippi roadways are in poor condition. Also of major concern: the state's fatality rate in 2018 was one the highest in the nation, with 1.63 deaths per 100 million vehicle miles travelled, compared to 1.13 nationally. Raising the gas tax and indexing it to inflation would help close the annual gap of at least \$400 million annually. Meanwhile, the state is developing innovative tools that increase the accuracy of roadway evaluation to improve the design of maintenance and rehabilitation projects, while also enhancing resource efficiency.



CONDITION AND CAPACITY

With over 77,000 miles of roads across the state of Mississippi, roadways are among the most widely used forms of transportation and have a large impact on the economic growth of the state. In 2016, Mississippi's population reached approximately 3 million residents, a 5% increase from 2000. Approximately 2 million of these individuals are licensed resident drivers. In 2016, these drivers logged a total of 42.3 billion vehicle miles traveled (VMT), a 19% increase from 2000's 35.5 billion VMT. From 2000-2016, the increase in VMT coincides with an increase in population and a 14% growth in the state's gross domestic product (GDP). In 2017, Mississippi drivers logged approximately 13,673 VMTs per capita – much higher than the 9,880 VMT per capita average of the U.S.

Overall, 43% of Mississippi's locally and state-maintained major urban roads and highways have pavements in poor condition, 21% are rated in mediocre condition, 12% are fair, and the remaining 24% are in good condition. In other words, nearly 40% Mississippi's major urban road miles are in poor condition. This is double the national rate of 20% of highway miles being in poor condition.

Most of the major urban roads that are in poor or mediocre condition are in the larger urban areas; the following percentages distinguishing the total urban roadways in poor condition of each area: Gulfport-Biloxi-Pascagoula at 41%; Hattiesburg at 51%; Jackson at 63%; and Southaven-DeSoto County at 44%. However, Mississippi's roadways are overwhelmingly rural and in slightly better condition, with 64,000 of the total 77,000 roadway miles (more than 83%) designated as rural roads. Overall, 25% of Mississippi's locally and state-maintained major rural roads and highways have pavement in poor condition, 28% are in mediocre condition, 15% are in fair condition and the remaining 32% are in good condition.

According to the Mississippi Department of Transportation's (MDOT) Five-Year Road and Bridge Plan, roads that are considered to be of the highest priority, based on public safety, highway condition, present and future traffic counts, and route connectivity, are rated in mediocre to poor condition, meaning that they show signs of deterioration, including rutting, cracking and potholes. In some cases, these roads can be resurfaced, but too often are so deteriorated that they must be reconstructed. The Road Information Program (TRIP) has calculated the total cost to motorists in Mississippi's largest urban areas due to driving on the state's deficient roads is \$2.9 billion annually. Drivers in these areas incur additional costs related to vehicle operation annually that totals: Gulfport-Biloxi-Pascagoula – \$1,267; Hattiesburg – \$1,293; Jackson – \$2,046, Southaven-DeSoto County – \$1,870. Furthermore, this value incurred by the motorist increases when considering the additional cost of hours lost to congestion: Gulfport-Biloxi-Pascagoula – 19 hours at \$411; Hattiesburg – 13 hours at \$298; Jackson – 38 hours at \$878, Southaven-DeSoto County – 43 hours at \$1,080. The national average for cost incurred by urban drivers due to unmaintained roads is approximately \$561 per year. For urban drivers in Mississippi, the cost incurred is at least three times the national average. In Jackson and DeSoto County, drivers incur indirect costs at over five times the national average. The average cost incurred by motorists due to deficient roads and congestion can be seen in Table 1.

FIGURE 1: AVERAGE INDIRECT COST INCURRED BY URBAN MOTORIST IN MISSISSIPPI



OPERATION & MAINTENANCE

Mississippi roads are funded through federal, state, and local means. Amid the variety of funding sources, the shortfall in operation and maintenance has severely impacted Mississippi’s highways. For the next 10 to 15 years, at least \$400 million is needed annually to stop deterioration and restore the highway system. Approximately 1,600 of the nearly 9,000 lane miles that are in poor condition are repaired yearly. Notably, the amount of lane miles that have been traveled by Mississippi drivers nearly doubled, overtaking roads that were designed and constructed based on a lower volume of traffic. The overuse of existing roadways magnifies the previously mentioned operation and maintenance funding deficit. This causes delays for new projects and ongoing maintenance. For instance, projects such as the US 82 bypass around Greenville and the Highway 15 bypass around Ripley in Tippah county have been postponed due to maintenance needs. These projects would have added capacity to the state’s existing roadway system by removing commercial traffic from the downtown areas and city streets.

PUBLIC SAFETY

On Mississippi’s roads, public safety is largely affected by operation and maintenance efforts. In the 2040 Multiplan, 60% of the state’s roads are listed in fair or better condition; however, these roads will soon be reaching the end of their service and design life, potentially pushing them into poor condition. This means that over the next 25 years a large portion of these roads will need rehabilitation. According to TRIP, between 2013 and 2017 there were 3,277 deaths on Mississippi highways, with 690 in 2017 alone. Road features play a part in as many as one third of these deaths.

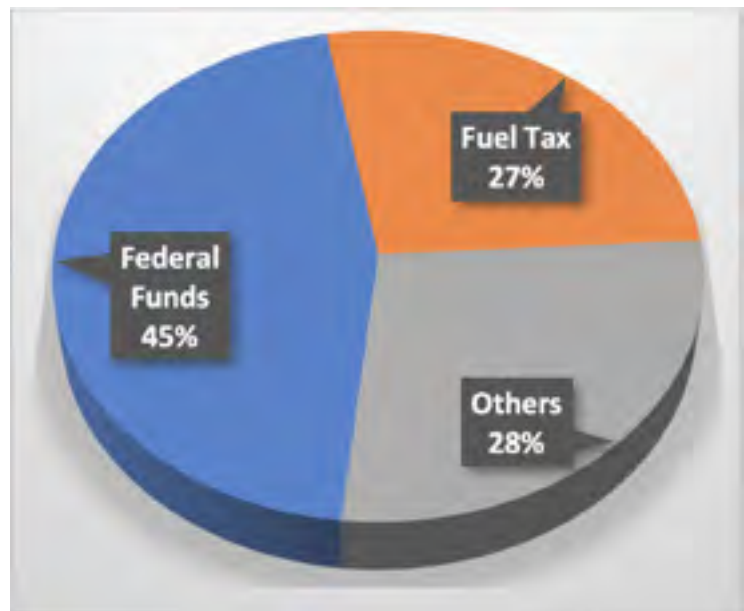
Furthermore, the previously mentioned funding gaps that halted the construction of bypasses, which would have added roadway capacity and reduced commercial traffic in downtown areas, also negatively impacts public safety because there is no relief of traffic through affected cities. The lack of funding combined with rising construction costs has caused challenges for MDOT to carry out routine maintenance and implement new projects that both serve to improve public safety.

FUNDING

Mississippi's road network, primarily operated and maintained by MDOT, is funded through federal support, the state's fuel tax, and other dedicated state taxes (such as truck and bus fees, the privilege tax, weight permits, a lubricating oil tax, and interest income). The largest contributions are from the federal funds and state fuel tax. Federal funds account for 45.5% of MDOT's total budget while the state fuel tax contributes 26.9%. Table 1 provides specific funding information about MDOT's total revenue for fiscal year (FY) 2017 - approximately \$1.2 billion. It should be noted that the figure below shows the percentages acquired from new receipts and does not account for the remaining receipts carried over from FY 2016.

TABLE 1: REVENUE ALLOCATIONS

Receipts:	
Federal Funds	\$ 514,426,182
Fuel Tax	\$ 303,842,249
Interlocal Proceeds	\$ 70,852,486
Truck & Bus Tax	\$ 68,630,971
Other Receipts	\$ 129,903,116
Tag Fees	\$ 14,244,786
Interest	\$ 5,918,004
Contractor's Tax	\$ 16,255,527
Commercial Vehicle Fees	\$ 4,579,413
Lubricating Oil Tax	\$ 856,423
Total New Receipts	\$ 1,129,509,157
<i>Remaining 2016 Funds</i>	<i>\$ 105,774,145</i>
Total Receipts Available	\$ 1,235,283,302



In 2017, MDOT dedicated roughly \$954 million of their \$1.1 billion budget – or 87% - towards road and bridge projects and repairs. In 2016, MDOT spent approximately \$225 million in pavement repairs alone. An additional \$77 million was spent on state mandated transfers, federal grant pass-throughs, state aid for local governments, and business support. Altogether, MDOT's total expenditures for FY 2017 was approximately \$1.15 billion.



FUTURE NEED

The state's roadway system will continue to be negatively impacted if strategic changes are not made. At this point, many projects that would help impact the state's economy, improve safety, and decrease additional lifetime costs for maintenance and repair for the roadways are unfunded or significantly underfunded. If the trends of the past decade continue, millions of additional dollars should be invested into the system to accommodate population growth and increasing vehicle miles traveled, both of which require expanded capacity as well as keeping a productive operation and management program. Fortunately, this can be easily accomplished through increased funding – primarily through a minimal but immediate increase in gas tax and tying the gas tax to inflation, as other states have done recently.

INNOVATION

According to the National Academies of Sciences, Engineering, and Medicine's Transportation Research Board database of projects in progress, Mississippi has a number of FHWA, MDOT, and university-led initiatives addressing topics such as performance evaluations of road slopes, traffic simulations during security-related and high hazard scenarios, optimization of traffic signal systems, and performance improvements in concrete materials in chlorine-rich environments. MDOT has an active project developing a tool to assist roadway designers in better selecting locations for taking core samples that are used to provide engineers details pavement condition information. The research incorporates ground penetrating radar (GPR) to more accurately collect data and design maintenance and rehabilitation projects in Mississippi. Such innovative O&M approaches could save time, money, and other scarce resources for the departments and municipalities responsible for the state's roadways, not to mention, setting a new precedent for more accurate roadway evaluation in the future.





ROADS



RECOMMENDATIONS TO RAISE THE GRADE

Based upon the infrastructure needs, recommendations to improve Mississippi's roadways include:

- Increasing the funding mechanisms that are currently in place, namely through raising the gas tax, tapping into the state's lottery earnings, or by reallocating federal funds.
- Using state and federal funds to make repairs in a timely fashion and test/ implement innovative ideas to halt Mississippi's deteriorating infrastructure.



ROADS



FIND OUT MORE

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SOLID WASTE



SOLID WASTE

GRADE: C

EXECUTIVE SUMMARY

Mississippi generates over 6 million tons of municipal waste per year. There are 19 permitted landfills for non-hazardous industrial and municipal solid waste and 145 commercial rubbish disposal facilities. The average person in Mississippi generates 5 pounds of solid waste per day, which is above the national average of 4.4 pounds per person per day. Fortunately, Mississippi’s landfills have on average 55 years of remaining capacity left, although some individual facilities have less than 20 years and require more immediate expansion. The Mississippi Department of Environmental Quality (MDEQ) has seen a substantial downward trend in violations and fines over the past 20 years, an indication the state is trending in the right direction for protecting public health. One area of potential improvement lies in recycling. Just 5% of the waste generated in the state of Mississippi is diverted to recycling, compared with approximately 35% of municipal solid waste nationally.



CONDITION AND CAPACITY

Municipal Solid Waste (MSW) can be defined as trash or everyday waste from many different sources. Items that are designated as recyclable are treated differently at another location.

In 2017 in Mississippi, approximately 3.3 million tons (54.38%) of total waste was disposed at commercial landfills, 1.5 million tons (24.28%) at non-commercial landfills, 1.3 million tons (21.11%) at commercial rubbish sites, and 14,000 tons (0.23%) at non-commercial rubbish sites. About 4.6 million tons of solid wastes were disposed at commercial disposal facilities and the remaining 1.5 million tons of wastes were disposed at noncommercial disposal facilities.

Most landfills are privately owned, while others are owned by public entities such as counties and cities. All of these landfills are permitted, though the responsible agency, the Mississippi Department of Environmental Quality (MDEQ), has a large backlog of renewals to be granted. Table 1 shows the types of landfills and disposal facilities in Mississippi.

TABLE 1: TYPES OF LANDFILLS AND DISPOSAL FACILITIES

Active Municipal Solid Waste Landfills	19
Commercial Class I Rubbish Disposal Facilities	82
Commercial Class II Rubbish Disposal Facilities	63
Transfer Stations	34
Land Application Sites	30
Composting Facilities	16
Solid Waste Processing Facilities	7
Industrial/Institutional/Special Waste Landfills	26
Industrial/Institutional/Special Waste Rubbish Sites	19
Waste Tire Processing Facilities	6
Commercial Waste Tire Collection Sites	5
Local Government Waste Tire Collection Sites	149
Generator Waste Tire Collection Sites	4

Out of all these facilities, there are 18 materials recovery facilities in the state. Table 2 shows the total municipal solid waste for the past few years in Mississippi for all MSW landfills across the state; these numbers include the quantity generated by in-state and out-of-state contributors.


TABLE 2: 2012-2016 ANNUAL MSW LANDFILL TOTALS AND PERCENT CHANGE

MSW (tons)	CALENDAR YEAR					Avg. Annual % Change
	2012	2013	2014	2015	2016	
Total	3,180,139	3,313,434	3,290,438	3,151,292	3,287,523	-0.75
In-State	2,517,611	2,552,346	2,639,751	2,545,645	2,712,736	0.01
Out-of-State	662,528	761,028	650,687	605,647	574,787	-3.50

MDEQ reported that there are nine processing facilities that reclaim and process recyclable materials. Approximately 5% of Mississippi's MSW is recycled, a value that is much lower than the nationwide recycling rate of over 35%.

There are 19 MSW landfills in Mississippi. In 2016, they received more than 3.2 million tons of disposed material. Table 3 shows further details regarding the amount of waste received as it impacts the landfill's life span. The data shows that MSW landfills receive nearly 18% of its waste (more than 580,000 tons/year) from out-of-state contributors. However, there is sufficient capacity for Mississippi's MSW landfills because they have an average of 55 years of remaining life. The exact value a landfill's projected life varies based on the permitted acreage and the amount of waste received per year.

TABLE 3: DISPOSAL INFORMATION ON MSW LANDFILLS FOR 2016 WITH LIFE EXPECTANCY

(I) ID	(II) County	(III) Name of Facility	(IV) Owner	(V) Permitted Acreage	(VI)	(VII)		(VIII)
					Total Waste Received tons/year	Out of State Waste Received tons/year	%	Est. Life Remaining years
1	Adams	Plantation Oaks Landfill	Waste Mgt. of MS, Inc.	80	67,622	8,233	12.17	87
2	Chickasaw	Prairie Bluff Landfill	Waste Mgt. of MS, Inc.	236	89,259	18,652	20.90	150
3	Clay	Golden Triangle Reg. Landfill	Golden Triangle Reg. SWMA	288	148,747	0	0.00	50
4	Harrison	Pecan Grove Landfill	Waste Mgt. of MS, Inc.	176	288,823	3,910	1.35	21
5	Jackson	MacLand Landfill**	MacLand Disposal Center, Inc.	49	200,884	31,173	15.52	10
6	Jefferson	Riverbend Landfill	Riverbend Env. Services, LLC	162	209,914	101,116	48.17	90
7	Kemper	Kemper Co. Landfill	Kemper Co. Landfill Company	22	51,405	7,405	14.41	12
8	Lauderdale	Pine Ridge Landfill	Waste Mgt. of MS, Inc.	75	96,140	13,772	14.32	36
9	Leflore	Leflore County Landfill	Leflore Co. B.O.S.	56	79,666	0	0.00	8
10	Madison	Canton Sanitary Landfill	City of Canton	155	44,427	0	0.00	71
11	Madison	Little Dixie Landfill	BFI Waste Sys. of MS, LLC	165	246,892	14	0.01	21
12	Pearl River	Central Landfill	TransAmerican Waste, Inc.	109	58,747	3,268	5.56	119
13	Perry	Pine Belt Reg. Landfill	Pine Belt Reg. SWMA	49	157,123	0	0.00	25
14	Pontotoc	Three Rivers Reg. Landfill	Three Rivers Reg. SWMA	207	264,557	0	0.00	50
15	Scott	Clearview Env. Control Facility	Chambers of MS, Inc.	145	418,125	272	0.07	37
16	Tippah	Northeast MS Reg. Landfill	Northeast MS Reg. SWMA	82	472,184	242,547	51.37	6
17	Tunica	Tunica Landfill	Waste Mgt. of Tunica, Inc.	203	227,302	143,076	62.95	94
18	Washington	Big River Landfill	BFI Waste Sys. of MS, LLC	148	146,108	8,558	5.86	94
19	Winston	Louisville Landfill	City of Louisville	39	20,399	0	0.00	56



OPERATION & MAINTENANCE

Typically, operation and maintenance is the responsibility of a private owner or cooperative. Owners and operators are required to cover solid waste with 6 inches of earthen material at the end of each day according to the Resource Conservation and Recovery Act (RCRA). Because excess water near solid waste disposal sites is not permitted, site drainage is required to divert water off the landfill towards a treatment system. Landfill owners are responsible for ensuring that the run-off treatment system complies with the Clean Water Act point and nonpoint source requirements.

When landfills reach capacity, they are closed with a covering of at least 24 inches of earthen material to minimize infiltration of liquid and soil erosion. Operators are also responsible for an additional thirty years of monitoring post-closure. The costs for these closure and post-closure activities can often fall upon municipalities and counties, who lack resources to meet the need. This, in turn, poses a risk, as an improperly closed landfill can threaten public health and safety.

PUBLIC SAFETY

Regulations, such as Section 1.3 of the Mississippi Nonhazardous Hazardous Solid Waste Management document, are used to control waste management to ensure that it does not affect the safety of the public's daily life. In 2017, while there were no reports registered for human health hazards, 866 complaints were made to MDEQ, and more than 2,000 inspections were conducted. These inspections resulted in the issuance of 61 non-compliance orders, totaling around \$1.2 million in fines. This is a sign of progress as MDEQ has seen a substantial downward trend in violations and fines.

FUNDING

Solid waste management infrastructure is funded by a mixture of public and private funds. Of the 19 MSW landfills, some are publicly owned and operated, while others are publicly owned but operated by private contractors. While taxes are a major mechanism for funding solid waste management, private landfills are primarily funded by disposal fees collected from waste generators. Public landfills may be funded by a combination of fees and public taxes.

The state also uses financial resources from trust funds like the Environmental Protection Trust Fund and the Mississippi Non-Hazardous Solid Waste Corrective Action Trust Program. The main priority of these programs is to provide a sustainable source of funding to prevent interruption of solid waste collection in the state. The latter program allows for landfill and site owners, to have federal assisted funding if they choose to take over closed or abandoned municipal solid waste facilities.

FUTURE NEED

Mississippi produced 2,712,736 tons of MSW and imported almost 600,000 tons from out of state in 2016. With a population of nearly 3 million in 2016, the average MSW produced per person per day was approximately 5 pounds, which is above the national average of 4.4 pounds per day.

Mississippi's 2016 population of 2,988,726 is expected to grow to 3,142,000 by 2025. With an average of 5 pounds of solid waste per person per day, the total solid waste produced for the year will increase from 2.7 million tons to an estimated 2.9 million by 2025. These numbers do not account for the estimated 500,000 to 600,000 tons of solid waste that is imported each year.



MDEQ's annual solid waste management report shows that over 30% of MSW landfills have 20 or fewer years of expected capacity. Although, half of the 19 landfills still have an expected life of 50 or more years remaining. This shows that while the majority of the locations are prepared for future growth, some landfills will require expansions of existing facilities or the construction of new sites. While Mississippi is currently prepared for future growth in most areas, it is necessary to be aware of potential factors, like debris from major storms, that could quickly reduce the current capacities.

INNOVATION

Mississippi utilizes methane gas collection at multiple landfills across the state. These facilities are capable of converting the gas to electricity or using the gas for boilers to evaporate leachate. These facilities collect up to 19.6 million square cubic feet of gas per day and have the capacity to produce up to 3.6 MW of energy. This is a great way that Mississippi utilizes a byproduct of landfills; however, this technology is only implemented in very few landfills in the state.

While Mississippi does reuse or recycle a significant amount of material, it is recommended that they continue to improve in this area. Improving the availability and convenience of recycling to a larger percentage of the population should be one of the sector's long-term goals. Improving and utilizing methane gas collection systems in more landfills should also be a priority.

RESILIENCE

The Hurricane Katrina cleanup was the largest effort in the history of the U.S. The response to Hurricane Katrina was expedient as some closed sites reopened, existing landfills expanded, and landowners offered their land to the state. The approval process of these types of actions normally takes months, but environmental officials worked quickly to accommodate the needs in the wake of this catastrophic event. Moving forward, Mississippi can learn from their not-too-distant past and streamline these approaches by putting the best practices into place.





RECOMMENDATIONS TO RAISE THE GRADE

Mississippi's solid waste infrastructure will benefit from additional improvements. These improvements include:

- Educate the public of the importance of recycling and solid waste reduction.
- Provide for effective curbside recycling, composting, or other waste diversion in all major municipalities. Set the goal to divert 10% of MSW from landfills and Type I rubbish disposal facilities within 10 years.
- Counties and municipalities should increase annual dedicated funding – especially for closure and post closure care of all public landfills – to ensure that future generations are not burdened with these costs associated with current disposal practices.
- Maintain or increase funding to the Waste Tire Management Program to help with the collection, processing, and beneficial reuse of waste tires.
- MSW landfills, and their management, should continue to incorporate emerging technologies into their comprehensive solid waste management planning. Due to the lead times and significant investments required, actively planning for and implementing new technologies will reduce future solid waste management costs.
- Expand sites where it would cost-effective to implement waste-energy systems, such as burning or biogas.
- Explore ways that Mississippi landfills, especially those in flood-prone and/or coastal areas, can be retrofitted to become more resilient
- MDEQ should provide mechanisms and guidelines to help streamline resource use in waste removal, especially by adding more fuel-efficient trucks, planning more efficient routes, and utilizing modernized methods of waste disposal.

As the state of Mississippi continues to grow, it is essential that the state continues to maintain and improve its solid waste infrastructure as it is vital to its health and function. It is highly recommended that the state focus on the listed improvements. In doing so, it is possible that Mississippi could raise the current grade of its solid waste infrastructure.



SOLID WASTE



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WASTEWATER



ROUND-BASSIN WHERE THE WASTED
WATER IS BEING FILTERED
SOURCE: BIGSTOCKPHOTO.COM



WASTEWATER GRADE: D

EXECUTIVE SUMMARY

While most wastewater treatment systems in Mississippi operate within their design capacity, over the past five years 1,180 failures were reported for onsite systems while 2,715 notices of violation were issued for wastewater treatment plants. Insufficient funds to cover routine operation and maintenance expenses result in backlogged upgrades that would improve treatment efficiency. While some utilities are raising rates to meet budget deficiencies, much of the state's wastewater infrastructure is heavily dependent on federal funding; new approaches to closing the budget gap and financing wastewater improvements, particularly O&M and efficiency upgrades, should be considered. Overall, as the state's population remains stable threats from increasing wet weather conditions, inconsistent maintenance, and a lack of rehabilitation pose extreme threats to the state's wastewater infrastructure.



INTRODUCTION

Wastewater infrastructure within the state can be categorized in two ways: wastewater treatment plants (WWTP) and onsite wastewater treatment systems (OWTS). These systems are permitted and regulated by the Mississippi Department of Environmental Quality (MDEQ) and the Mississippi Department of Health (MSDH), respectively.

Mississippi has a widely dispersed population with more than 50% of its residents living in rural areas. As such, approximately 40% of Mississippians (nearly 400,000 households) use OWTS while the remaining residents are connected to a nearby sewer system where their household's effluent is collected and transported to a WWTP.

CONDITION AND CAPACITY

Homeowners with onsite treatment systems living on more than two acres of land are exempt from the requirement of having the system approved by MSDH. However, electronic record keeping has increased over the past several years to help regulate OWTS, those installed before 2002 were not retroactively added to the electronic system. As such, it is difficult to determine an average age or condition for many of the state's OWTS. However, according to the Environmental Protection Agency (EPA), the average lifespan of a septic system, depending upon its usage and operation and maintenance (O&M) practices, is between 15 to 40 years. Coupling this information with a 2016 survey conducted by the National Association of Home Builders which indicates the median age of an owner-occupied home in the U.S. as 37 years old, may indicate that many OWTS across the state could be nearing the end of their life.

Onsite wastewater treatment system failures occur when wastewater breaks the surface of the ground or leaves the property. These failures may result from a lack of capacity and/or poor condition of the system. Between January 1, 2013 and January 1, 2018 there were 1,180 statewide evidence-based complaints of failure. Due to laws protecting access to private property MSDH only performs enforcement inspections for systems with registered complaints or formal OWTS applications. Accordingly, OWTS evaluations likely represent a conservative value of a more chronic issue of OWTS failures.

At the centralized or community scale, WWTPs also face challenges associated with aging and underperforming systems. While there is no publicly facing database that aggregates data such as the age, condition, and design/operating capacity of the state's WWTPs, for the purpose of this assessment, information was collected from a sample of county and municipal wastewater authorities. Across the state, there are 298 incorporated municipalities, and the majority own and operate WWTPs with individual discharge permits. The 6 most populous counties in Mississippi have between 100,000 and 250,000 residents that are served by a network of WWTPs that range in capacity from 150,000 gallons per day to a multi-county system of 47 million gallons per day (MGD). While most WWTPs maintain adequate capacity and do not pose concerns under dry conditions, increasingly frequent and severe wet weather events expose insufficient capacity for many WWTPs resulting in sanitary sewer overflows (SSOs). The scale of these SSOs are exacerbated as inflow and infiltration (I&I) occur in legacy wastewater collection systems that are aging and in need of extensive rehabilitation.

Over the past five years, there have been 2,715 Notices of Violation (NOVs) issued by DEQ. These enforcement actions represent one to two system failures every day over a five-year span. Specifically, a federally-guided means of enforcement – a consent decree – has been exercised by the EPA and the U.S. Department of Justice on the City of Jackson, Mississippi's capital, since 2012 due to its continued violation of the National Pollutant Discharge Elimination System (NPDES) permit under the Clean Water Act. In early 2018, it was estimated that the consent decree would cost the City at least \$800 million, without consideration of any additional fines.



OPERATION & MAINTENANCE

The state's story of operating and maintaining wastewater infrastructure is not told only by the consent decree in Jackson. Instead, there are two principles that contribute to the O&M challenges – insufficient funds and a failure to maintain consistent O&M practices. Over time, if inadequate funds are not present or as resources are taken away from the O&M budget, immediate impacts are not always seen, but the burden of routine rehabilitation and necessary upgrades grows. As this burden grows, both in WWTPs and OWTS, treatment efficiency and effectiveness are compromised.

However, many municipal WWTPs across the state are raising rates, but the funds collected are not adequate to cover the growing O&M costs or meet their budgetary shortfalls. Low- and moderate-income population areas struggle to provide the revenue necessary to support the O&M for the existing WWTPs and collection systems, let alone save for rehabilitation and upgrades. Furthermore, federal funds cannot be used to cover O&M costs. These dynamics leave owners and operators of many WWTPs struggling to meet stringent water quality standards with aging and inefficient systems – resulting in violations and expensive fines.

PUBLIC SAFETY

As Mississippi's wastewater infrastructure continues to age, it poses a threat to public safety. MDEQ monitors the water quality data from permitted treatment systems and helps resolve any issues that arise. The main public safety concern for the state's wastewater infrastructure is the potential for members of the public to interact with raw, untreated sewage, particularly SSOs. SSOs occur when the inflow exceeds the capacity of the system or infiltrates the sanitary sewers through damage, improper connections, or flooded buildings. Once the stormwater fills the sewer system, the sewage overflows through manholes and can overwhelm the treatment facilities, causing poorly-treated or untreated sewage to enter the environment.

Other threats to public safety include, in the City of Jackson, years of leaking pipes that have degraded the roadbeds causing portions of roads to cave in. In May 2018, a high school senior was killed when her vehicle hit a previously reported uncovered manhole. In May 2019, a school bus in Jackson became partially stuck – for the second time in the school year - in a pothole that had developed due to the degrading water and wastewater infrastructure under the roadbed.

FUNDING

According to the EPA's most recent overview of the nation's wastewater needs, the Clean Watersheds Needs Survey, more than \$2 billion in total funding over the next twenty years, \$100 million annually, is needed to provide adequate collection and treatment for Mississippi's wastewater.

MDEQ manages the state's primary funding program the Clean Water State Revolving Loan Fund (SRF). The program is capitalized with federal money to provide loans to public entities. Eligible loan recipients are expected to contribute a 20% match to the borrowed funds. This funding mechanism is meant to act as an infrastructure bank where low-interest loans are provided to finance infrastructure improvements and/or rehabilitation projects. Over time, as the loans are repaid with interest, the monies in the SRF are recycled or "revolve".



Many communities in Mississippi, particularly rural areas with a modest tax-base, are oftentimes hesitant to apply to the SRF program due to concerns about taking on more debt and the challenges they will face with repayment. MDEQ works with communities to mitigate this challenge by making it possible for small, low-income communities (< 3,000 households with a median household income of < \$30,000) to receive up to a 75% subsidy on their requested loan amount. Other communities taking part in SRF loans couple these funds with grant resources to minimize the amount that must be repaid with interest. Furthermore, emergency repairs, replacements, and improvements to wastewater collection and treatment facilities that cannot wait for the planning and time requirements associated with the SRF program, can apply for Mississippi's Emergency Loan Funds that come from the state's budget.

MDEQ data shows that emergency funds (approximately \$3 million) remained stable between 2014-2018, while the SRF program showed more variability over the same timeframe, levelling out between 2016-2018. During FY18, MDEQ funded four projects totaling more than \$18 million under the SRF program, while in the same year \$3 million were paid out in emergency loan funds for one project. More recently, in FY20 the EPA provided Mississippi's SRF program with nearly \$14.5 million to assist with modernizing aging wastewater infrastructure, implementing water reuse and recycling and addressing stormwater.

Most cities and towns rely on the SRF program, US Department of Agriculture, and Community Development Block Grants for funding, but those funds are becoming more competitive due to the number of municipalities applying. Additional funding can come in the form of Water Infrastructure Finance and Innovation Act (WIFIA); however, due to the size of most municipalities in the state, it may be difficult to find an area (or cluster of communities) that would meet the requirements.

FUTURE NEED

While the state's overall population is staying relatively stable, around 3 million people, new developments in some of the more populous counties (Madison, Jackson, and DeSoto) are increasing the demand for larger WWTPs. The state's WWTPs are heavily dependent upon federal funding; new approaches to closing the budget gap and financing wastewater needs, particularly O&M, should be considered. A clean water trust fund, a national infrastructure bank, and public-private partnerships are some of the approaches that can be put in place to increase funding.

INNOVATION AND RESILIENCE

As Mississippi saw with Hurricane Katrina in 2005 and the Yazoo Backwater Flood in 2019, the wastewater infrastructure in the state is not currently designed and/or sited to operate during and/or withstand natural disasters. Jackson County Utility Authority partnered with the EPA, US Army Corps of Engineers, and NOAA's National Centers for Coastal Ocean Science to identify a site for the location of their new WWTP that would "remain dry for the next 50 years." To do so, the utility considered 3-5 ft sea level rise and storm surge scenarios to determine an appropriate site and configure protective berms. Current projections estimate the utility could save millions in costs associated with flood damage.



RECOMMENDATIONS TO RAISE THE GRADE

Mississippi's wastewater infrastructure will benefit from additional improvements. These improvements include:

- Full funding for the SRF in both the state and federal budgets.
- Full funding from the State of Mississippi for SRF loan forgiveness.
- Wastewater service providers to assess their sewer rates and increase or reduce them as needed to reflect the true cost of service including O&M, debt services, and capital improvements. If not already in place, providers should consider adding additional user categories for different types of industry.
- Expanding the law to allow MSDH to approve all onsite treatment systems, removing the clause exempting homeowners living on more than two acres of land. Additionally, the State of Mississippi should increase funding to MSDH to cover the expenses incurred through the removal of this exemption.
- Creation of educational materials highlighting different funding opportunities – from multiple branches of the federal government – for wastewater infrastructure that can be applied for.
- Creation of a program incentivizing the installation of low flow fixtures, reducing wastewater generated



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WASTEWATER



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