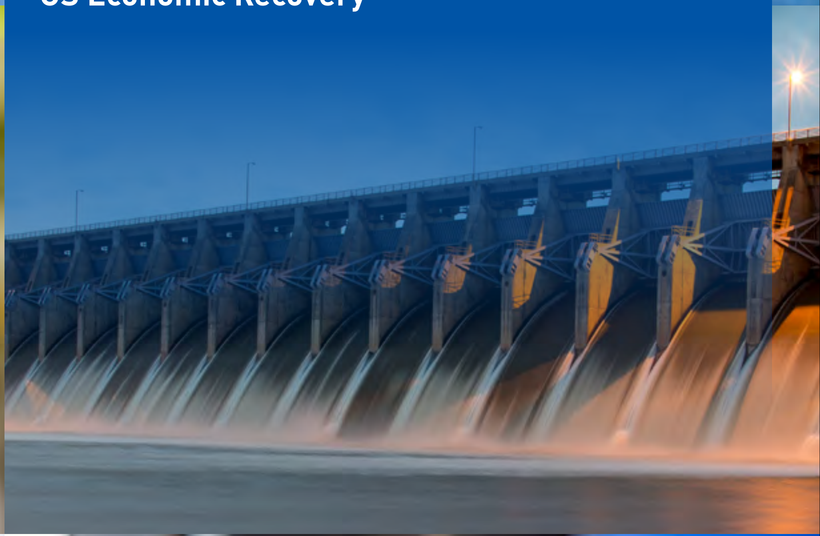
Value of Water Campaign

ASCE American Society of Civil Engineers

The Economic Benefits of Investing in Water Infrastructure

How a Failure to Act Would Affect the US Economic Recovery



About this Report

The American Society of Civil Engineers (ASCE) partnered with the Value of Water Campaign to commission this study. It is part of ASCE's Failure to Act series, which began in 2011. It is one of five studies in the series that ASCE will release in 2020. Subsequent studies will address electricity, surface transportation, ocean ports, inland waterways, and airports. This study also builds on the Value of Water Campaign's 2017 study *The Economic Benefits of Investing in Water Infrastructure*.

About the American Society of Civil Engineers

The American Society of Civil Engineers represents more than 150,000 members of the civil engineering profession in 177 countries. Founded in 1852, ASCE is the nation's oldest engineering society. ASCE stands at the forefront of a profession that plans, designs, constructs, and operates society's economic and social engine—the built environment—while protecting and restoring the natural environment.

To learn more: www.asce.org

About the Value of Water Campaign

The Value of Water Campaign educates and inspires the nation about how water is essential, invaluable, and in need of investment. Spearheaded by top leaders in the water industry, and coordinated by the US Water Alliance, the Value of Water Campaign is building public and political will for investment in the United States' water and wastewater infrastructure through best-in-class communication tools, high-impact events, media activities, and robust research and publications.

To learn more: www.thevalueofwater.org

About EBP

EBP—formally Economic Development Research (EDR) Group—is a firm dedicated to advancing the state-of-the-art in economic evaluation and analysis to support planning and policy in the areas of transportation, energy resources, urban development, and economic growth strategy. Since its founding in 1996, EBP has helped state and local governments make infrastructure investment and economic development decisions that support broad-based job creation, income generation, and overall prosperity. ASCE and the Value of Water Campaign contracted with EBP to conduct this study.

To learn more: www.ebp-us.com/en

About Downstream Strategies

Downstream Strategies offers environmental consulting services that combine sound interdisciplinary skills with a core belief in the importance of protecting the environment and linking economic development with natural resource stewardship. Within the water program, the company performs economic and policy analyses, provides expert testimony and litigation support, and conducts field monitoring.

To learn more: www.downstreamstrategies.com

The Economic Benefits of Investing in Water Infrastructure

How a Failure to Act Would Affect the US Economic Recovery

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Introduction

The American Society of Civil Engineers (ASCE) and the Value of Water Campaign release this report at a time when the COVID-19 public health crisis is causing economic disruption at an unprecedented speed and scale in the United States. Workers are losing jobs by the millions as consumer confidence, retail sales, and gross domestic product plummet. It is clear that the nation's economic recovery will be long and difficult. In the coming months and years, public officials at every level of government will consider policies and investments to jumpstart economic recovery. Investment in the nation's aging water infrastructure—composed of drinking water, wastewater, and stormwater systems—can spark a new era of job creation and economic growth while protecting public health and improving the quality of life for families across the United States.

Water is essential to every aspect of household and community life and the economy. Dozens of industries, like mining, manufacturing, and health care, rely directly on water and wastewater services to function. If they lost access to clean water supplies, the economic impact would be acute. Meanwhile, the COVID-19 pandemic has shown that the public health benefits from safe drinking water and wastewater treatment are immeasurable. Much of the nation's vast water infrastructure is buried underground or out-of-sight, but it is hard to overstate how vital these systems are for people's health and the economy.

Like so much else in the US economy, water utilities have been affected by the effects of the COVID-19 pandemic. Tourism and convention activities have canceled, sports arenas have closed, hotels and schools have emptied, and many restaurants and bars have been operating at less than maximum capacity—all of which translates to reductions in water consumption and rate revenues. It is uncertain when full economic activity will return. The American Water Works Association (AWWA) and the Association of Metropolitan Water Agencies (AMWA) estimate that drinking water utilities will experience a negative aggregate financial impact of $13.9 billion—or 16.9 percent—by 2021, due to revenue losses and increased operational costs during the pandemic.[1] The National Association of Clean Water Agencies (NACWA) estimates that the resulting financial impact on wastewater utilities will be even higher, around $16.8 billion, including a 20 percent drop in sewer revenues.[2]

The financial challenges water utilities face as a result of the COVID-19 pandemic are layered onto chronic, long-term, and insufficient investment in the nation's water infrastructure. Billions of dollars are needed each year to renew and replace outdated pipes, pumps, storage facilities, and treatment plants that ensure clean water delivers to homes and businesses across the nation, carry away and safely treat sewage and stormwater, and return treated water to rivers, streams, and other water bodies. Local, state, and federal funding is meeting **a fraction** of the current need. If this trend continues, the nation's water systems will become less reliable, breaks and failures will become more common, vulnerabilities to disruptions will compound, and the nation's public health and the economy will be at risk.

This report details the cost to the nation's economy if current investment trends in the nation's water infrastructure continue, and it explores the massive economic benefits people would realize from fully funding the nation's water infrastructure needs. The report is organized in the following manner:

- **The US Water Infrastructure Investment Gap** section summarizes the mismatch between the current spending levels and funding needs.
- **The Costs of Inaction** section analyzes the impact on gross domestic product (GDP), businesses, households, and public health if current investment trends in water infrastructure continue for the next 20 years.
- **The Economic Benefits** section describes the economic gains that could be realized over the next 20 years if the water infrastructure investment gap were closed and spending needs fully funded.

The United States is entering what may be the deepest economic contraction since the Great Depression.[3] As such, the policy and investment decisions that public officials make will have enormous consequences on the pace of economic recovery. This analysis presents two very different futures. If **current underinvestment in water continues**, businesses will become less competitive, household costs will increase, GDP will shrink, and public health may be at greater risk. If **the United States acts boldly and closes the water infrastructure investment gap**, we will boost economic recovery, create jobs, fuel business activity across a wide range of sectors, improve public health, and protect the environment.

ASCE created the Infrastructure Report Card to assign grades for the nation's infrastructure based on condition, safety, capacity, and other factors. The most recent report card assigned drinking water and wastewater infrastructure a D and D+, respectively. Closing the investment gap would be equivalent to the nation's water infrastructure achieving at least a "B" letter grade, reaching a state of good repair and posing a minimal risk, or an "A" letter grade, a standard of resilience and capacity that is fit for the future.

D

Drinking water infrastructure grade
according to ASCE's most recent Infrastructure Report Card

D+

Wastewater infrastructure grade
according to ASCE's most recent Infrastructure Report Card

Study Methodology

ASCE and the Value of Water Campaign worked with an economic research team that included EBP, Downstream Strategies, and the Interindustry Forecasting Project at the University of Maryland (INFORUM) to develop this analysis. The researchers relied on a model called the Long-term Interindustry Forecasting Tool (LIFT), housed at University of Maryland's INFORUM Group. LIFT is a dynamic interindustry-macro (IM) model that uses macroeconomic data to examine how changes in one industry will affect other industries and the entire economy.

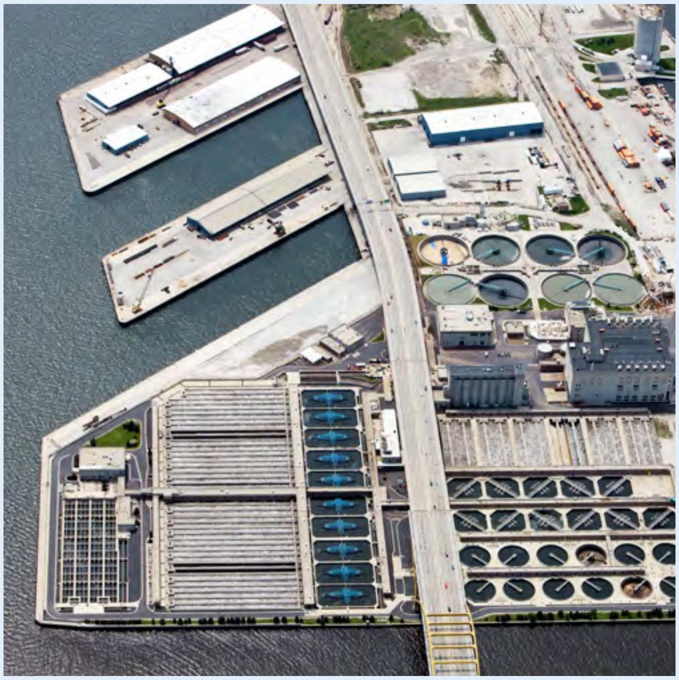
This study estimated the capital and operations and maintenance (O&M) needs of water utilities and generated 10-year and 20-year economic projections for the potential consequences of two future scenarios: the first, continuing delay and underinvestment in water infrastructure and the second, increasing investment in water infrastructure at levels that would close the chronic investment gap. The focus of this report is on the pipes, treatment plants, pumping stations, and other infrastructure that make up the nation's drinking water, wastewater, and stormwater systems. This report does not address drinking water supply infrastructure beyond treatment plants and distribution systems, such as source water structures like dams and levees.

The economic analysis included two types of infrastructure needs:

1. **Building new infrastructure to service increasing populations and expanded economic activity**
2. **Maintaining or rehabilitating existing infrastructure that needs repair or replacement**

The report includes projections for both 10-year (2029) and 20-year (2039) time horizons. It bases the economic modeling on the 2019 national economy and uses 2019 dollars, so as not to reflect the economic impacts of the COVID-19 pandemic. The study's projections also do not reflect the financial impacts from climate change, though climate change is expected to increase both the cost and the urgency of water infrastructure investments.

The full methodology can be found in this report's technical appendix, also available on the Value of Water Campaign website.



What Is US Water Infrastructure?

The vast majority of US homes and businesses receive drinking water, wastewater, and stormwater services through a network of treatment plants, pumps, pipes, storage facilities, and other assets operated by both public and investor-owned utilities. In this study, we refer to these structures and facilities as "water infrastructure."

Every day, more than 50,000 drinking water systems distribute 39 billion gallons of potable water—drinking water—to US homes, industries, and other businesses.[4] US Environmental Protection Agency (EPA) and state agencies under the Safe Drinking Water Act, which requires EPA to establish standards for contaminants that could cause negative health effects, regulate these systems. Most people living in the United States receive drinking water from a water utility, either public or investor-owned. Surface water systems, including rivers and lakes, serve approximately two-thirds of US residents, and groundwater systems serve one-third. Over 13 million households rely on private wells for drinking water, which EPA does not regulate.[5]

In addition, approximately 15,000 wastewater utilities serve 75 percent of the US population.[6] These systems collect and treat approximately 32 billion gallons of wastewater daily before returning it to the environment.[7] Some of these systems also manage stormwater services. EPA and state agencies under the Clean Water Act, which sets ambient water quality standards for wastewater that flows out of a treatment plant, sewer, or industrial outfall, regulate wastewater systems. Over the last few decades, the reuse of wastewater through advanced treatment has become more common.[8] Public wastewater systems do not serve about 19 percent of US households, which instead depend on septic tanks.

Large portions of US water and wastewater systems were built over a century ago. As pipes, plants, and pumps reach the end of their expected lifespan, they need to be upgraded, replaced, or fortified. In addition, many systems are not equipped to meet the new demands they face today with growing populations, increased treatment requirements, and the impacts of climate change.

While the majority of people living in the United States have access to high-quality drinking water and wastewater services, more than two million do not have access to adequate drinking water and sanitation. A report from the US Water Alliance and Dig Deep found that Native Americans are 19 times more likely than white households to lack indoor plumbing. This study analyzed data from the American Community Survey and other Census Bureau data sources and then described the water and sanitation crisis in six diverse hot spot communities across the United States.[9]

While not included in this analysis, dams are an important water infrastructure and critical for storage and supply, particularly in water-scarce regions. Capital investment in and operation and maintenance of dams can constitute a significant portion of a utility's annual budget, along with other storage facilities, like tanks, and the pipes, pumps, and treatment plants in drinking water, stormwater, and wastewater systems.

The US Water Infrastructure Gap

To secure the nation's water future, the first step is to assess where it stands today—the current condition, level of investment, and need of the systems that bring water to and from homes and businesses. What follows is a summary of the current state of the nation's water infrastructure. The analysis found that:

1. **The nation's water infrastructure is aging and deteriorating.**
2. **The nation is chronically underinvesting in water infrastructure.**
3. **Federal investment is lagging, placing added pressure on local and state governments.**
4. **New challenges and a growing demand are shaping infrastructure needs.**

The US needs to invest a total of **$109 billion per year** in water infrastructure over the next 20 years in 2019 dollars to close the water infrastructure gap.

The nation's water infrastructure is **aging and deteriorating.**

Cities across the United States constructed water systems at different times. In general, investment in new water infrastructure surged both after World War II and with the federal construction grants program that followed the passage of the Clean Water Act in 1972. Drinking water and wastewater pipes, pumps, and other components last anywhere between 15 and 100 years, depending on the component type, material, and other conditions. AWWA estimates that most of the nation's existing drinking water pipes need to be repaired or replaced before 2040, necessitating a "replacement era" that will dramatically increase costs to utilities and their customers.[10]

The implications of the nation's aging water infrastructure are becoming clear. **Between 2012 and 2018, the rate of water main breaks increased by 27 percent, reaching an estimated 250,000 to 300,000 per year.**[11] This is equivalent to a water main break every two minutes. As these systems age, leaks increase. **Drinking water systems currently lose at least six billion gallons of treated water per day, or 2.1 trillion gallons per year.**[12] The drinking water sector refers to these losses as "non-revenue water loss." Treating and pumping this water is inefficient and costly. The US lost an estimated $7.6 billion of treated water in 2019 due to leaks.

On average, **a water main breaks every two minutes somewhere in the US,** totalling an estimated 250,000 to 300,000 breaks per year.

Wastewater systems face a similar challenge. In the 1970s and 1980s, the federal construction grant program enabled communities across the country to build or expand their wastewater systems—from the pipes and pumps that convey wastewater from homes and businesses to the treatment plants that process wastewater flows and safely return water to the environment. Many of these facilities need comprehensive upgrades or replacement now.

This challenge is even more acute for combined stormwater and sewer systems. These systems were designed to convey both stormwater and sewage to a treatment plant. But some storms can flood these systems, causing overflows into lakes and rivers. Combined sewer systems were constructed using models and population projections that are now outdated.[13] As the frequency and intensity of storm events increase with climate change, combined sewer overflows are likely to increase.[14] To date, combined sewer overflows have resulted in more than $32 billion in compliance costs for the nearly 60 consent decrees issued to municipalities nationwide.[15]

Figure 1

The Useful Lives of Water Infrastructure Components[16]

Component	Useful Life (years)
Reservoirs and dams	**50–80**
Drinking water treatment plants (concrete structures)	**60–70**
Wastewater treatment plants (concrete structures)	**50**
Drinking water and wastewater treatment plant structures (mechanical and electrical)	**15–25**
Drinking water trunk mains	**65–95**
Drinking water pumping stations (concrete structures)	**60–70**
Drinking water pumping stations (mechanical and electrical)	**25**
Drinking water distribution	**60–95**
Wastewater collection	**80–100**
Force mains	**25**
Wastewater pumping stations (concrete structures)	**50**
Wastewater pumping stations (mechanical and electrical)	**15**
Interceptors	**90–100**

The nation is **chronically underinvesting** in water infrastructure.

There is a growing need for capital investment in the distribution lines, conveyance systems, treatment plants, and storage tanks that keep US water systems working. Investment in these systems, however, has not kept pace with the need. In 2019, the total capital spending on water infrastructure at the local, state, and federal levels was approximately $48 billion, while investment needs totaled $129 billion, creating **an $81 billion gap.**[17] The United States is drastically underinvesting in critical water infrastructure—only meeting 37 percent of the nation's total water infrastructure capital needs in 2019.

If funding needs and infrastructure investment trends continue, the annual gap will grow to $136 billion by 2039. Over 20 years, the cumulative water and wastewater capital investment need will soar to $3.27 trillion, and the cumulative capital investment gap will total $2.2 trillion—nearly $6,000 for every adult and child expected to be living in the United States in 2039.

Operation and maintenance (O&M) costs are also growing and outpacing available funding. Operating and maintaining water infrastructure become costlier as the system components near or exceed their expected lifespans.[18] The limited amount of federal and state funding assistance utilities receive today is primarily used to help fund capital projects, so local utilities primarily cover O&M costs out of their own revenue streams. These costs will rise as systems continue to age, placing smaller or less affluent communities at a relative disadvantage. While utilities historically have been able to fund O&M without major concerns, there is a growing gap between O&M needs and available funding. In 2019, 90 percent of the nation's $104 billion O&M funding need was met, leaving an annual O&M funding gap of $10.5 billion. **If trends continue, the country will face a single-year O&M shortfall of $18 billion in 2039,** and the cumulative gap in O&M funding for the 20-year 2019-2039 period will be $287 billion. Based on current practices, sustainable funding for O&M will become a more pressing issue compounded by age and other factors if it does not address the funding gap.




Figure 2

Water Infrastructure Capital Spending Gap[19;20;21]
($ million)

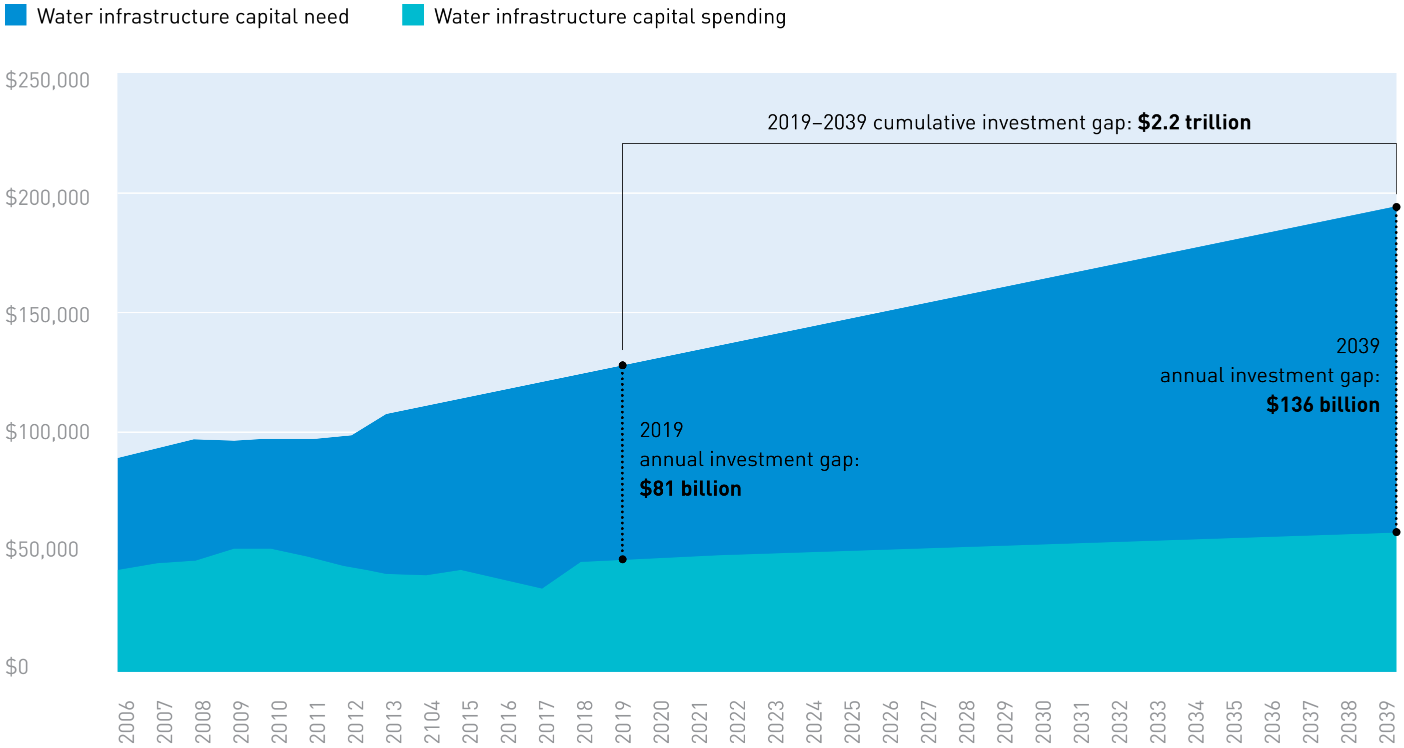
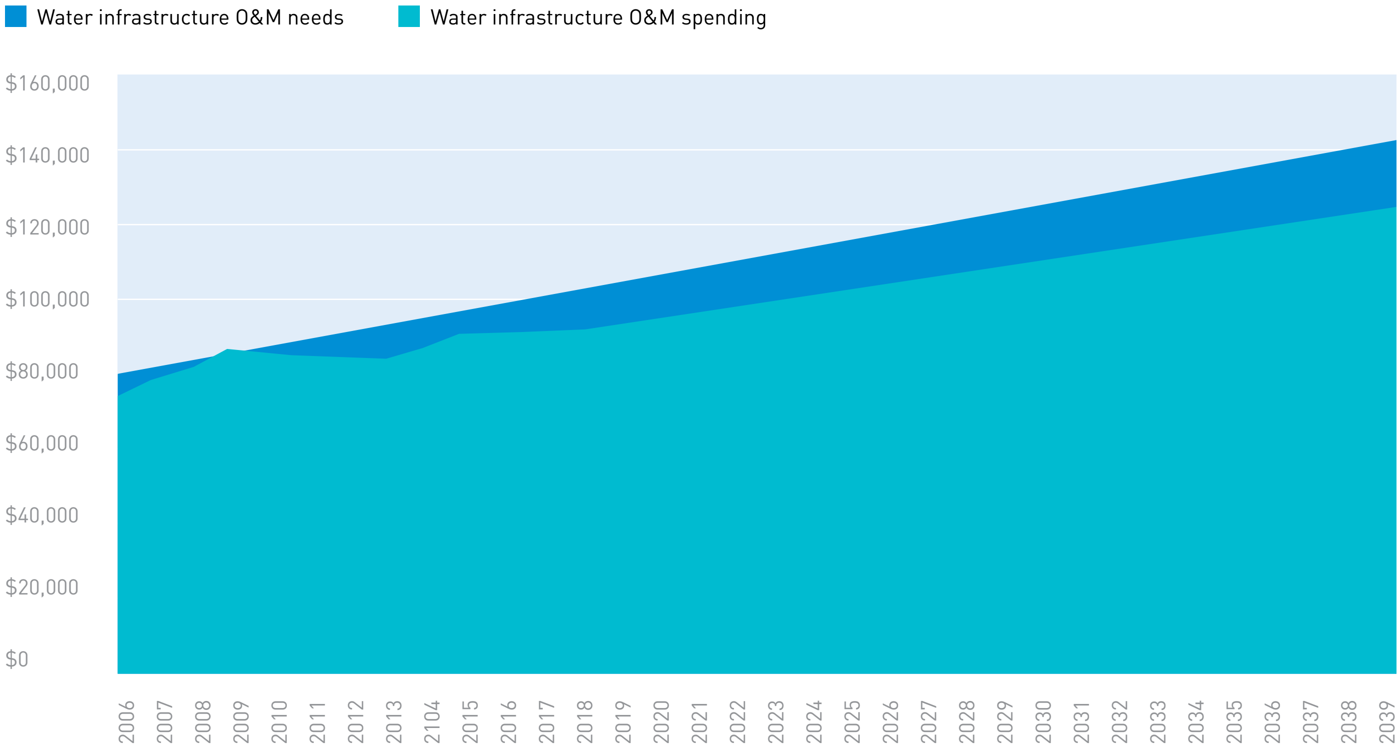


Figure 3

Water Infrastructure O&M Spending Gap[22]
($ million)



Federal investment is lagging, **placing added pressure on local and state governments.**

Despite the growing need for water infrastructure, the federal government's share of capital and O&M investment has fallen from 31 percent in 1977 to a mere four percent in 2017. In 1977, the federal government invested 63 percent of all capital spending on water infrastructure. Forty years later, federal spending on capital water infrastructure accounts for less than ten percent.[23] This is a far lower percentage than the federal government's share of total 2016 public spending on other infrastructure sectors like transportation. As federal support for water infrastructure needs has declined, local and state spending has provided a much greater share. Across the country, water rates are climbing to meet the costs of upgrading, expanding, and replacing water infrastructure. As costs, however, continue to rise, many communities will struggle to cover them through local rates and fees.

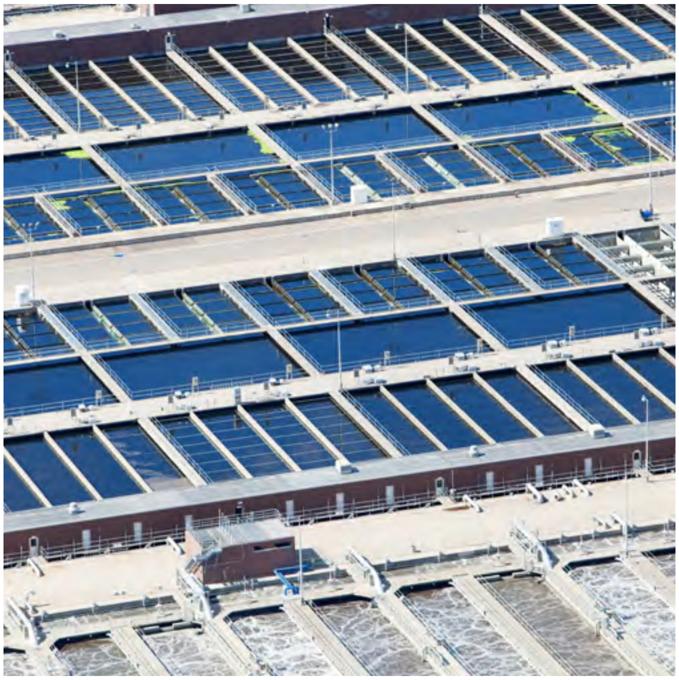


Figure 4

Federal vs. State and Local Spending on Water Capital and O&M Investment: 1975–2017[24]

($ billion, 2017 value)

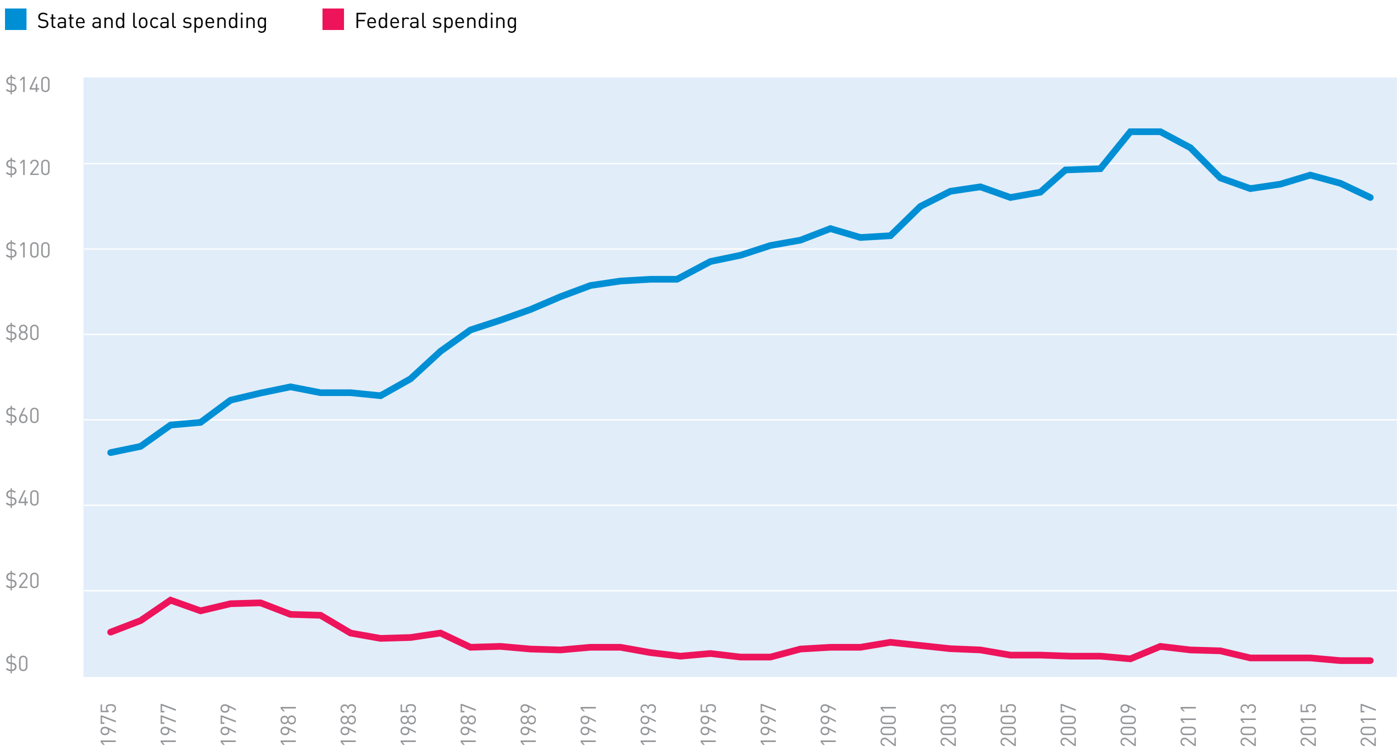
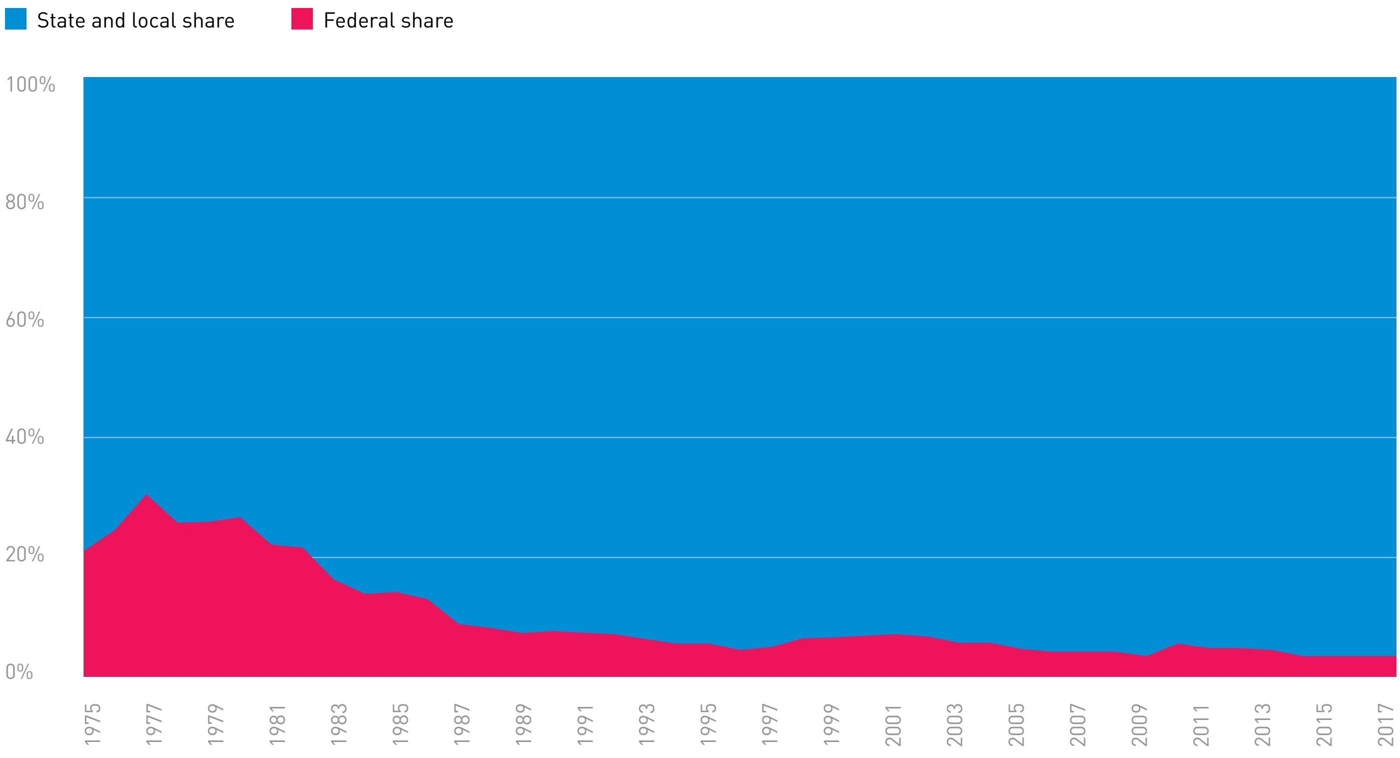


Figure 5

Federal vs. State and Local Share of Water Capital and O&M Investment: 1975–2017[25]



New challenges and a growing demand are shaping infrastructure needs.

Water utilities face a variety of constraints and challenges that were not anticipated when most water infrastructure was designed and built. There are an estimated six to 10 million lead service lines in communities across the country. Lead-related health crises like in Flint, Michigan, have increased public attention and a call to remove and replace lead service lines. Fully removing lead service lines is a complex process and can be expensive, costing between $5,000 and $7,500 per service line.[26] Microconstituents pose another growing challenge. Advances in instrumentation and analytics have allowed scientists to detect and study microconstituents like per- and polyfluoroalkyl substances (PFAS) that were previously unknown. As the health effects of these and other constituents become more fully understood, new regulations or treatment requirements could be imposed. Regulation of wastewater effluent has become more stringent, with many utilities facing the need to build new, more advanced treatment systems.

Finally, most of the nation's water infrastructure was not designed for a changing climate. Water systems are vulnerable to impacts from declining surface water flows and aquifer recharge, sea-level rise, salt-water intrusion, flooding, drought, and wildfire.[27;28;29] Many wastewater systems are in low-lying areas near water sources and especially prone to increased flooding as the impacts of climate change accelerate.[30] The country's water infrastructure needs to be repaired, replaced, and *reimagined* for a new era so it can meet changing conditions. Water infrastructure resilient to these changes is essential for communities to grow and thrive.

For some water systems, one of the biggest stressors is population growth. Managing demand through conservation, water recycling, and addressing non-revenue water loss (leaks) can reduce the need for building new capacity.[31] Although per capita residential water demand decreased over the last two decades due to the widespread adoption of in-home, water-efficient appliances,[32] many utilities still need to develop new water supplies or construct new storage facilities to meet and effectively manage future demand. Many of the nation's fastest-growing communities are in water-scarce regions like the Southwest, elevating the need to identify and develop new supplies.

There Is No Industry Without Water

Water is the essential ingredient that fuels industry. Thermoelectric power and irrigation are the largest users of freshwater resources in the United States.[33] The most water-intensive industry is paint manufacturing, which requires 123 gallons of water per dollar output. Other water-intensive industries include alkalis and chlorine manufacturing (38 gallons per dollar output), paper mills (36 gallons per dollar output), and wineries (34 gallons per dollar output). Most people do not associate a gallon of paint or a glass of wine with their water supplies, but virtually all consumer products rely on water to varying degrees.

Many manufacturing industries get their water supplies through a combination of direct withdrawal from water-bodies and purchase from water utilities. They use water both to produce goods and to dilute the waste products generated in manufacturing processes. Many common consumer products include a variety of components, each of which requires water for production. Smartphones, for example, are made of many smaller components. In aggregate, producing and assembling all these components requires roughly 3,000 gallons of water per phone.[34]

Reliable water service has an enormous effect on industry in indirect ways as well. For example, a disruption in the water supply to the food processing industry would not only reduce productivity in that industry, but it may also lead to a decrease in purchases of industrial machinery and trucking services. Over time, workers in food processing, trucking, and machinery sectors may face wage reductions or lose their jobs. They would then make fewer household purchases of groceries, furniture, cars, clothing, restaurant meals, and other goods and services, amplifying the economic impact of the water supply disruption.

Figure 6

The 10 most water-intensive industrial sectors (excluding agriculture, mining, and electric power generation) in terms of direct water use per dollar output[35]

#1
Paint and coating manufacturing:
123
gallons per $ output

#2
Alkalis and chlorine manufacturing:
38
gallons per $ output

#3
Paperboard mills:
36
gallons per $ output

#4
Wineries:
34
gallons per $ output

#5
Pesticide and other agricultural chemical manufacturing:
30
gallons per $ output

#6
Synthetic dye and pigment manufacturing:
27
gallons per $ output

#7
Adhesive manufacturing:
21
gallons per $ output

#8
Industrial gas manufacturing:
21
gallons per $ output

#9
Distilleries:
14
gallons per $ output

#10
Poultry processing:
14
gallons per $ output

The Cost of Inaction

The current state of water infrastructure is precarious: systems are aging, and current levels of investment are insufficient. This section of the report analyzes what the future will be if these trends continue. This analysis generated 10- and 20-year economic projections, using 2019 baseline data, and addressed key questions: What would the economy look like? What would the effects be on households, public health, and other sectors? Four key findings emerged:

- **Service disruptions would cost water-reliant businesses $250 billion by 2039.**
- **Underinvestment would lead to a cumulative $2.9 trillion decline in the gross domestic product by 2039.**
- **Costs incurred by US households due to water and wastewater failures would be seven times higher in 20 years than they are today.**
- **Failing water infrastructure would result in $7.7 billion in cumulative healthcare costs to households over the next 20 years.**

If the water infrastructure gap is not addressed, deteriorating water infrastructure would cost water-reliant industries **$250 billion in 2039**.

Service disruptions will cost water-reliant businesses **$250 billion by 2039.**

The costs resulting from deteriorating water infrastructure would be particularly burdensome for water-reliant industries. We estimate that water service disruptions led to a $51 billion economic loss for the 11 most water-reliant industries in 2019. These industries include those that people rely on every day—education, health services, retail, construction, manufacturing, and more. Disruptions in water and wastewater service increase the price of goods and services and result in production delays, sales losses, and other effects. If the current trajectory continues, we estimate that service disruptions would cost these water-reliant businesses **$111 billion by 2029, growing to $250 billion by 2039.**

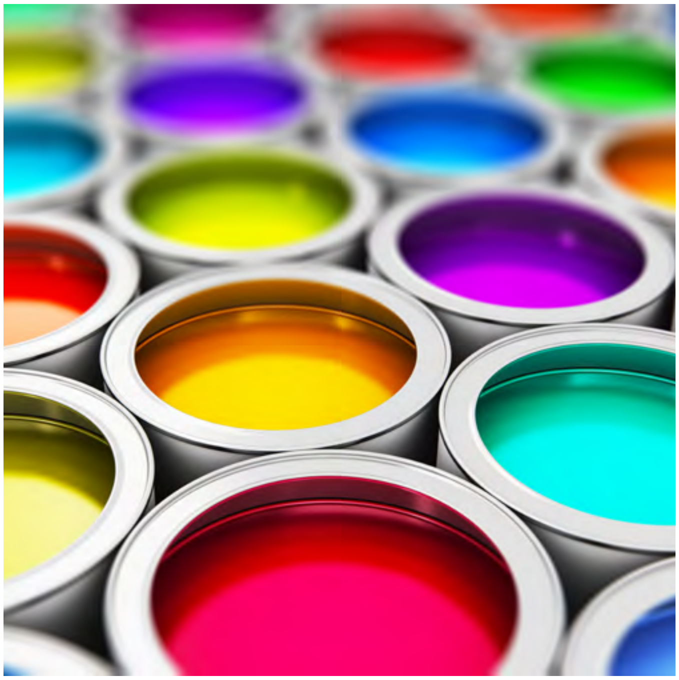
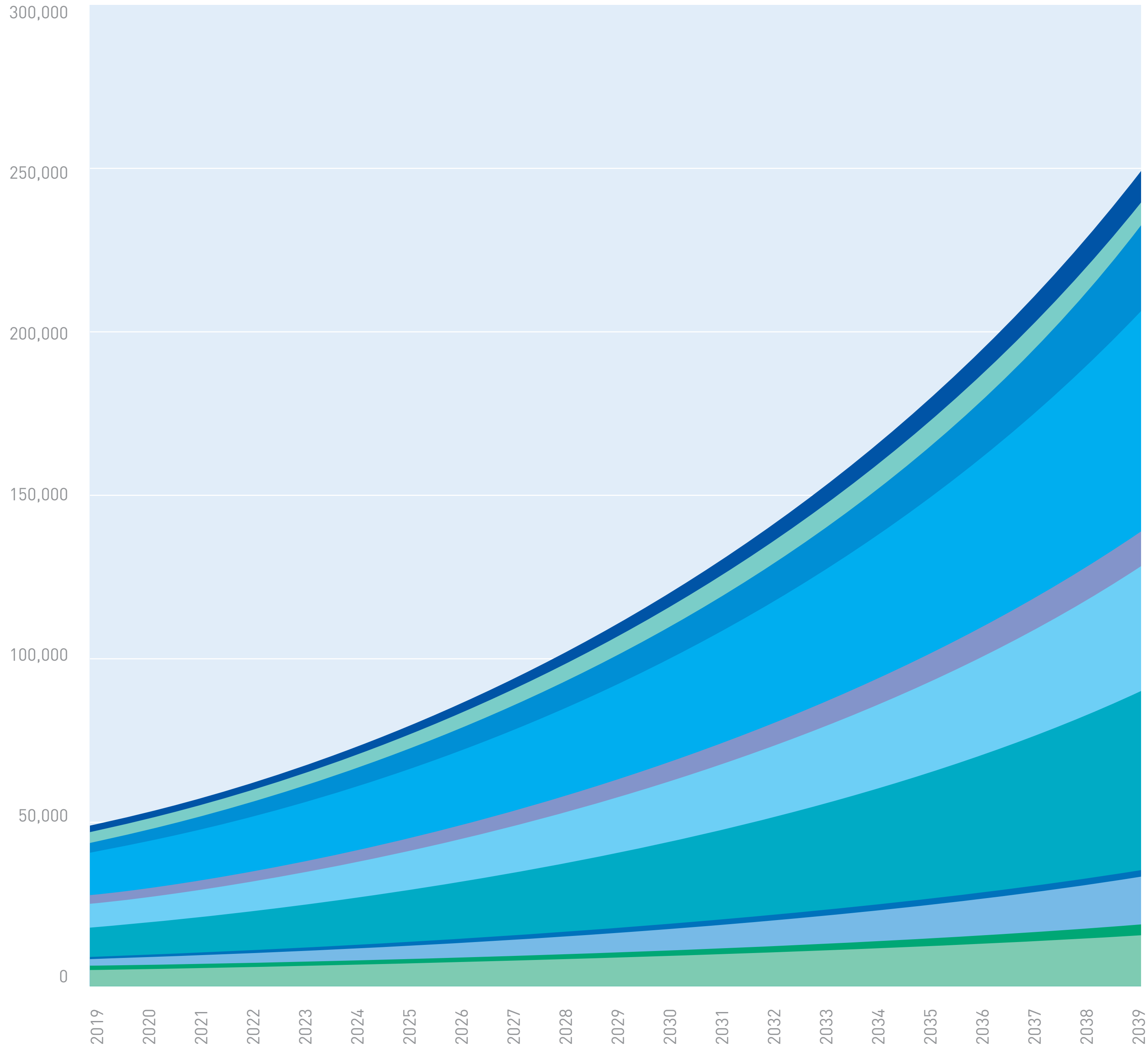


Figure 7

Annual Losses from Water Service Disruptions on Water-Reliant Businesses[36;37]
($ million, 2019 value)

- Retail trade
- Natural resources and mining
- Professional and business services
- Manufacturing
- Leisure and hospitality
- Financial activities
- Education and health services
- Other services (except public administration)
- Information
- Construction
- Utilities



Underinvestment will lead to a **$2.9 trillion decline** in the gross domestic product (GDP) by 2039.

As water infrastructure deteriorates and ruptures, street flooding, shutdowns, and damage from storms would increase. These interruptions would increase production costs for businesses, and prices for consumers would climb. This would lead to a reduction in domestic and possibly foreign demand for manufactured products, which would reduce global competitiveness and produce a domino effect across almost every indicator of economic wellbeing in the United States. By 2039, the cumulative impact on the gross domestic product (GDP) is estimated to be a decline of 1.2 percent, translating to a loss of $2.9 trillion. **Moreover, more than $732 billion in business sales (output) would be lost over the next 10 years. By 2039, that number will exceed $4.5 trillion.**

Output is the gross production of US industries. Generally, output is made up of business sales and budget expenditures of public agencies and nonprofit businesses, along with unsold inventory produced, and the value of breakage and theft.

Gross Domestic Product (GDP) is output minus the cost of goods and services purchased from vendors (known as intermediary goods and services).

As production volumes decline, workers would see reductions in wages and disposable income. **By 2039, 636,000 jobs would be lost annually**. It is important to note that the number of jobs is not always the best indicator of industry health. In some sectors, employment levels do not directly correlate to production volumes, and they may require just as many employees for lower production. Even so, they will lose jobs, ultimately harming workers, industries, and the US economy.

Due to higher costs resulting from unreliable water services, US manufacturing is expected to lose about 89,000 jobs over the next 20 years, about half of them concentrated in fabricated metal industries, machinery, computer and electronics, and motor vehicles. Health care, construction, accommodations, and food services will lose jobs as disposable household income and disposable spending decline. These impacts would radiate through the economy, affecting both low- and high-wage jobs.

As water systems continue to age, water loss will accelerate. Leaks and pipe breaks will be more frequent, wasting more treated water. Leaking pipes lost the equivalent of $7.6 billion worth of treated water in 2019, and this loss is projected to more than double over the next 20 years, reaching $16.7 billion in 2039.




Figure 8

Aggregated Output Impacts by Industry Sector[38]
($ billion, 2019 value)

Sector	2020–2029	2030–2039	2020–2039
Manufacturing	-$227	-$1,089	-$1,316
Finance, insurance and real estate	-$60	-$372	-$432
Professional services	-$83	-$493	-$576
Health care	-$47	-$241	-$288
Other services	-$43	-$224	-$267
Information	-$131	-$631	-$762
Logistics	-$19	-$86	-$106
Retail trade	-$20	-$103	-$122
Mining, utilities, agriculture	-$13	-$70	-$83
Construction	-$15	-$73	-$88
Transportation services (excluding truck transportation)	-$22	-$102	-$125
Accommodation, food, and drinking places	-$38	-$222	-$260
Entertainment	-$4	-$21	-$25
Educational services	-$5	-$27	-$32
Social assistance	-$3	-$18	-$21
Total	**-$732**	**-$3,771**	**-$4,503**

Figure 9

Potential Employment Impacts Due to Failing Water and Wastewater Infrastructure, 2029 and 2039[39]

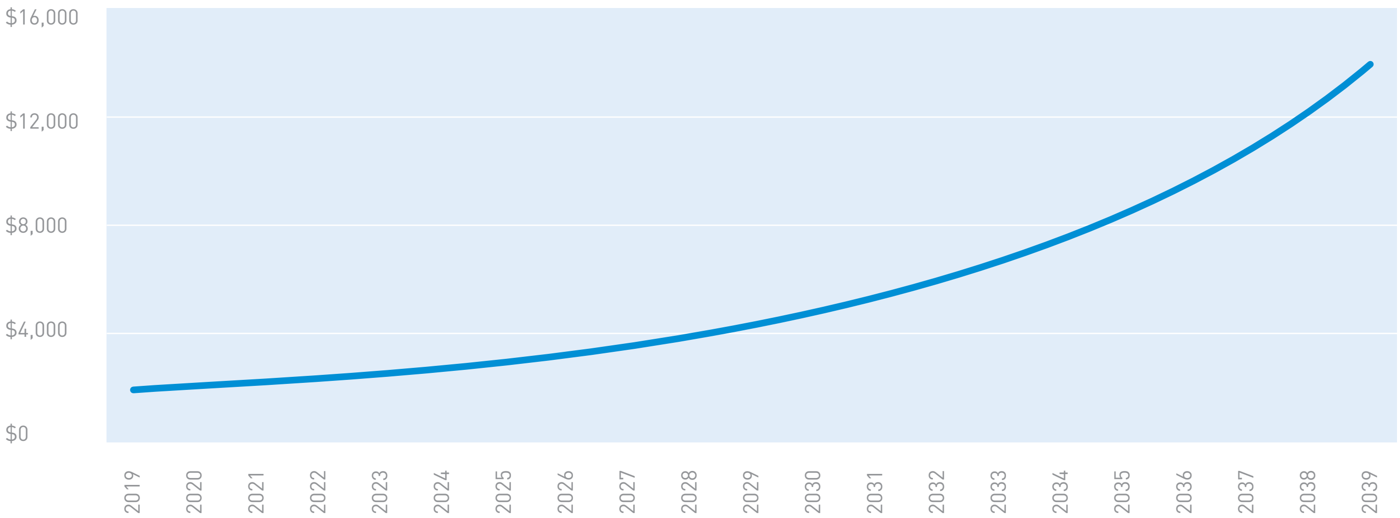
Sector	2029	2039
Professional services	-39,000	-106,000
Manufacturing	-47,000	-89,000
Other services	-38,000	-80,000
Logistics	-34,000	-79,000
Construction	-30,000	-63,000
Health care	-26,000	-56,000
Finance, insurance, and real estate	-24,000	-50,000
Retail trade	-25,000	-31,000
Transportation services (excluding truck transportation)	-11,000	-26,000
Information	-10,000	-19,000
Mining, utilities, agriculture	-8,000	-18,000
Accommodation, food, and drinking places	-16,000	-13,000
Educational services	-10,000	-3,000
Social assistance	-11,000	-3,000
Entertainment	-4,000	-1,000
Total	**-333,000**	**-637,000**

Water and wastewater infrastructure failures cost US households $2 billion in 2019. **In 2039, increasing service disruptions would cost households $14 billion.**

Water and wastewater service disruptions to US households can result in large, unexpected personal costs to individuals and families. In 2019, service disruptions and flooding (due to sewer overflows and stormwater drainage problems) cost households an estimated $2 billion. During drinking water outages, household residents need to find alternative water supplies and, in extreme situations, must relocate either temporarily or permanently. Increased climate-related flooding in some areas of the country will increase the cost burden on households from repeated cleanup, rehabilitation, and structural repair. **As infrastructure ages and the rate of infrastructure failures increases, household costs would more than double in 10 years to $4.3 billion, climbing to almost $14 billion by 2039.**

Figure 9

Annual Household Costs from Water-Service Disruptions[40;41;42]
($ million, 2019 value)

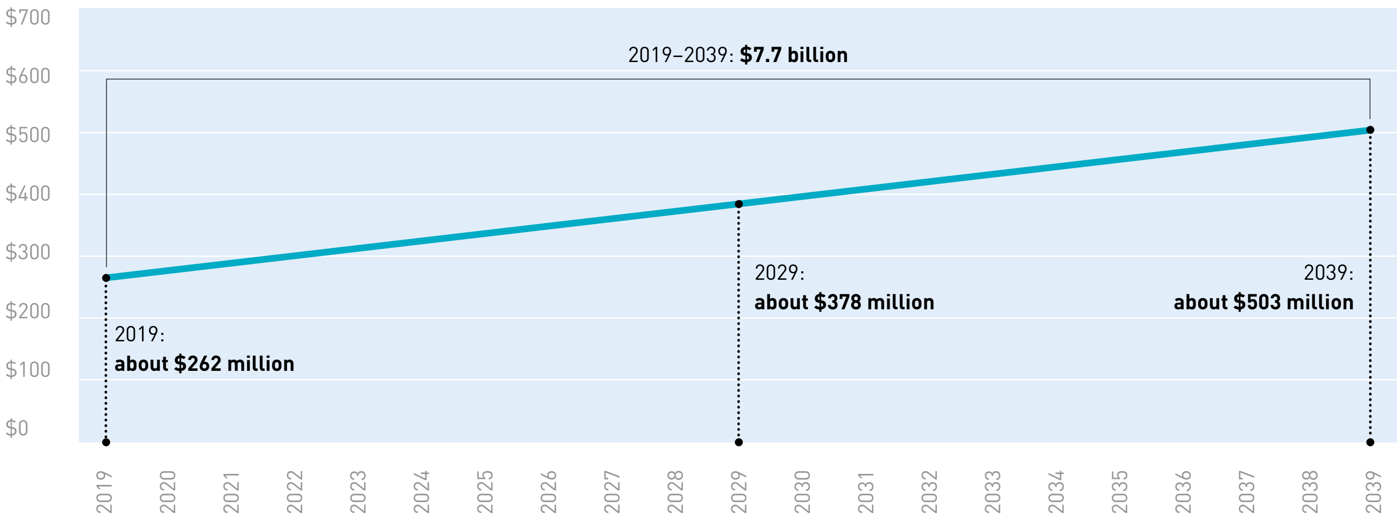


Failing water infrastructure could result in **$7.7 billion in cumulative health-care costs** to households over the next 20 years.

Households must also manage the health and medical costs that can arise when water systems fail. Sewer overflows can expose people to contaminated water, which can cause bacterial infections (e.g., giardia, cryptosporidium). Deteriorating drinking water systems can leach heavy metals into water supplies, which can lead to serious health problems, especially for children and other vulnerable populations. Without adequate investment in water systems, people could see higher incidences of illness, hospitalizations, and lost working days. US households spent an estimated $262 million on health-care costs due to water service disruptions in 2019. If trends continue, US households could spend $378 million in 2029 and $503 million in 2039. **Over the next 20 years, failing to invest in the nation's water infrastructure could lead to medical costs that exceed $7.7 billion in cumulative medical costs to US households.**

Figure 10

Annual Health Costs from Water-Service Disruptions[43;44;45]
($ million, 2019 value)






The Economic Benefits

The cost of failing to invest in water infrastructure is tremendous. But if the United States proactively invests in water infrastructure and closes the water infrastructure investment gap, the benefits to the economy, trade, and public health will be enormous.

As in the previous section, the INFORUM model was used to generate economic projections using 2019 baseline data. These projections assume that the years, starting in and following 2020, meet 100 percent of capital and O&M water infrastructure needs. It should be noted that 2019 met only 37 percent of capital investment needs. Closing the gap would require spending $2.2 trillion above the baseline projections over the next 20 years.

The study projected the impacts of a 100 percent investment scenario on employment, wages, business sales, and exports. The LIFT model is dynamic, with the ability to show how changes in one industry ripple across the entire economy. As a result, the numbers shown here are dramatically different from earlier studies that used static economic multiplier models. In assessing the benefits of closing the water infrastructure investment gap, three key findings emerged:

- **Business sales would increase, and the US GDP would grow by $4.5 trillion.**
- **The US trade balance would dramatically improve, making exports more competitive.**
- **Investment would create 800,000 jobs, and disposable income would rise by over $2,000 per household.**

The economic gains from more reliable and efficient water systems would increase business sales (gross output) to **$5.6 trillion.**

Business sales would increase, and **the US GDP would grow by $4.5 trillion.**

Under current investment levels, the nation will spend $1.067 trillion on water infrastructure over the next 20 years, but the total need over this time frame is over $3 trillion. To close the gap, the United States would need to increase its investment in water infrastructure by $2.2 trillion over the next 20 years, or roughly $109 billion per year.

Closing the investment gap would improve the condition and performance of water systems, leading to supply-side and demand-side benefits to the economy. Improved reliability and water quality would increase productivity and efficiency in other sectors and lead to higher capital investment and O&M spending. Over the next 20 years, the national economy would stand to gain **$4.5 trillion in GDP.** The economic gains from more reliable and efficient water systems would build over time; most would accrue in the second decade as households and businesses reap the benefits of improved water reliability. **By 2039, business sales (gross output) would exceed $5.6 trillion.**

Figure 11

Effects on Total US Economy due to Improved Water Delivery and Wastewater Treatment Infrastructure Systems, 2020–2039[46]
($ billion, 2019 value)

Year	Business Sales (Output)	GDP	Household Disposable Income	Jobs
Increases in the Year 2029	$204	$180	$125	444,000
Increases in the Year 2039	$670	$461	$315	798,000
Cumulative Increases 2020-2039	$5,613	$4,480	$2,833	N/A

The US trade balance would dramatically improve, **making exports more competitive.**

As capital infrastructure projects move forward and industrial productivity rises, US businesses would gain **$225 billion in export value.** Four commodities and service industries would see an increased export value of $10 billion or more above the projected baseline: wholesale trade, motor vehicles, aerospace products and parts, and other chemicals.

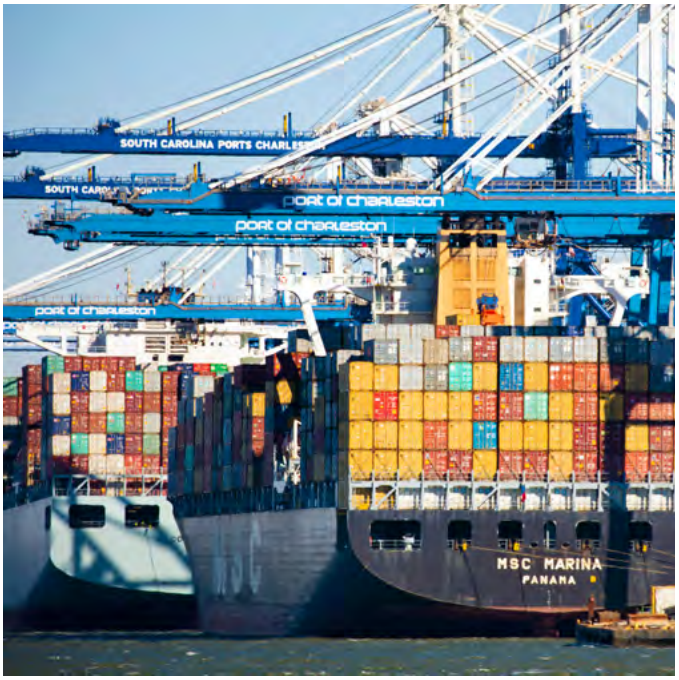


Figure 12

Value of US Exports Generated by 10 Leading Commodities and Services[47]
($ billion, 2019 value)

Commodity/Service	2020–2029	2030–2039	2020–2039
Wholesale trade	$2.2	$18.0	$20.3
Motor vehicles	$6.5	$13.5	$20.0
Other chemicals	$1.3	$12.0	$13.3
Aerospace products and parts	$0.8	$11.5	$12.3
Royalties	$1.0	$8.5	$9.5
Architectural, engineering, and related services	$0.8	$7.8	$8.7
Software	$0.8	$7.6	$8.4
Resin, synthetic rubber, and fibers	$2.5	$4.7	$7.1
Other financial investment activities	$0.7	$6.2	$7.0
Scientific research and development services	$0.7	$6.1	$6.8

Investment would create 800,000 jobs, and **disposable income would rise by $2,000 per household.**

Full funding of water infrastructure needs would create nearly 800,000 new jobs by 2039. Of these new jobs, 61 percent would be in construction and professional services stimulated by the boost in infrastructure spending. Increased reliability and water quality would also increase productivity and efficiency in other sectors like manufacturing, leading to job gains. And wages would rise: US workers would earn more than **$2.8 trillion** in additional disposable household income over 20 years, leading to an increase of over $2,000 per household.

More reliable water services would also help US households avoid up to $7.7 billion in cumulative medical costs over 20 years, $2.6 trillion in cumulative losses incurred from service disruptions and overflows, and $1.4 trillion in cumulative disposable income loss.

While this model cannot generate public health predictions, wages and disposable income are part of a web of interrelated factors that affect health over a lifetime.[48] People with lower incomes tend to have a higher risk of heart disease, diabetes, stroke, and other chronic disorders.[49] Other studies have shown that as jobs, wages, and other indicators of economic prosperity improve, so does public health.[50] The model shows that investing in water infrastructure has a positive effect on the economic conditions of people at many income levels. Adequate investment in water infrastructure protects public health directly by maintaining safe water quality and indirectly by creating economic conditions that enable people to thrive.

Direct, Indirect, and Induced Impacts

Both visions for the future evaluated in this study account for direct, indirect, and induced impacts on the economy.

- **Direct impacts** include the economic implications for companies directly involved in designing, engineering, and constructing water infrastructure.
- **Indirect impacts** include the additional economic implications created by the actions of firms directly involved in water infrastructure. Business to business purchases of goods and services, like machinery for construction of a water infrastructure project, is an indirect impact.
- **Induced impacts** include the purchases in retail, medical, leisure, and other sectors dependent on the income earned by workers in all sectors of the economy that are affected by infrastructure investments. The implications of water infrastructure investment ripple through the US economy through induced impacts.

Figure 13

Potential Employment Impacts Due to Improved Water and Wastewater Infrastructure, 2029 and 2039[51]

Sector	2029	2039
Construction	377,000	442,000
Manufacturing	(17,000)	58,000
Professional services	3,000	52,000
Health care	(6,000)	8,000
Logistics	12,000	38,000
Other services	9,000	37,000
Finance, insurance, and real estate	10,000	31,000
Retail trade	11,000	30,000
Transportation services (excluding truck transportation)	5,000	20,000
Information	7,000	15,000
Accommodation, food, and drinking places	8,000	12,000
Mining, utilities, agriculture	(5,000)	11,000
Educational services	5,000	6,000
Entertainment	(1,000)	4,000
Social assistance	7,000	4,000
Total	**444,000**	**798,000**

Figure 14

Estimated Direct and Multiplier Effects for Scenario Outcomes in 2029 and 2039[52;53]
($ billion, 2019 value)

Failure to Act Scenario 2039				
	Jobs	**Disposable Income**	**GDP**	**Output**
Direct	-240,000	-$67	-$140	-$179
Indirect	-144,000	-$40	-$96	-$144
Induced	-252,000	-$69	-$133	-$193
Total	**-636,000**	**-$175**	**-$369**	**-$516**
100 Percent Scenario 2039				
	Jobs	**Disposable Income**	**GDP**	**Output**
Direct	330,000	$140	$189	$264
Indirect	167,000	$70	$111	$172
Induced	301,000	$104	$162	$233
Total	**798,000**	**$315**	**$461**	**$670**

Conclusion

Water and wastewater infrastructure are interwoven into every aspect of the US economy. Reliable water service is an enabling force for economic growth and prosperity. Unreliable water service and deteriorating infrastructure, on the other hand, will put the nation's communities and economy at risk.

As the United States confronts a widening gap between capital and O&M spending and investment needs, it faces two possible directions. If chronic underinvestment in the water infrastructure continues, the overall economy will suffer; by 2039, GDP will decline by $2.9 trillion. Families would pay for deferred maintenance—costs incurred by households would be seven times higher in 2040 than they are today. Inaction is a threat to a safe and secure water future. The COVID-19 pandemic only intensifies the need to act and invest across all levels of government. Failing to act now will lead the country into a prolonged era of economic and public health vulnerability.

Conversely, if the United States closes the spending gap, the national economy will stand to gain **$4.5 trillion in GDP by 2039.** All can rise to the challenge. In the 20th century, large investments in water infrastructure spurred economic growth and led to tremendous gains in public health, setting the stage for generations of prosperity. Leaders at all levels must step up and explore policy and funding solutions that will move the nation in the right direction. Local, state, and federal action to increase investment in these critical systems today will lead to a resilient, efficient, and reliable water future and protect the public health of generations to come.

This report, along with the technical appendix, can be found at **TheValueofWater.org/resources.**

Please note: Columns may not total due to rounding. Losses and increases reflect impacts in a given year against total national export projections.

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