Water Affordability Needs Assessment: Report to Congress

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CONTENTS

ACRONYMS

ACS	American Community Survey
AR	Affordability Ratio
AWWA	American Water Works Association
C&W	Cardoso and Wichman (2022b) Dataset
CAP	Customer Assistance Program
CBG	Census Block Group
CCF	Centum Cubic Feet
CPI	Consumer Price Index
CSO	Combined Sewer Overflow
CWA	Clean Water Act
CWNS	Clean Watersheds Needs Survey
DWSD	Detroit Water and Sewer Department
eAR	Electronic Annual Report
EFAB	Environmental Financial Advisory Board
EPA	The U.S. Environmental Protection Agency
EPIC	Environmental Policy Innovation Center
FCA	Financial Capability Assessment
FCI	Financial Capability Indicator
HBI	Household Burden Indicator
HHS	U.S. Department of Health and Human Services
HM	Hours of Labor at Minimum Wage
IBT	Increasing Block Tariff
IDWS	Income Dedicated to Water Services
IIJA	Infrastructure Investment and Jobs Act of 2021
LIHEAP	Low-Income Home Energy Assistance Program

LIHWAP	Low-Income Household Water Assistance Program
LQI	Lowest Quintile Income
LQPI	Lowest Quintile Poverty Indicator
MHI	Median Household Income
NACWA	National Association of Clean Water Agencies
NEORSD	Northeast Ohio Regional Sewer District
NRDC	Natural Resources Defense Council
O&M	Operations and Maintenance
PSC	Public Service Commission
PPI	Poverty Prevalence Indicator
PSID	Panel Study of Income Dynamics
RI	Residential Indicator
SAWS	San Antonio Water System
SDWIS	Safe Drinking Water Information System
SNAP	Supplemental Nutrition Assistance Program
SRF	State Revolving Fund
SSI	Supplemental Security Income
SSCT	Small System Compliance Technologies
TANF	Temporary Assistance for Needy Families
UNC EFC	University of North Carolina Environmental Finance Center
U.S.	United States
WaterTA	Water Technical Assistance
WIPSC	Wisconsin Public Service Commission
WRAP	Detroit Water Residential Assistance Program
WSU	Washington State University

1. Executive Summary

Access to safe and affordable drinking water and wastewater services is essential for human health, and a necessity for communities to function and thrive. Yet, unaffordable water bills are a widespread and growing issue, impacting millions of households throughout the nation. Many low-income households are struggling to pay their water bills, leading to economic stress and the potential to lose access to water services or even their homes in certain instances. When households are unable to pay their water bills, service disconnections can have impacts that include public health concerns, economic instability, social inequality, and psychological and psychosocial stress. Water utilities, meanwhile, are working to meet rising costs for operations and maintenance, upgrading aging infrastructure, and protecting public health and the environment, while

The U.S. Environmental Protection Agency (EPA) has prepared this Water Affordability Needs Assessment: Report to Congress in response to the directive in the Infrastructure Investment and Jobs Act of 2021 (IIJA), Section 50108, [42 U.S.C. 300j-19a].

Water Affordability is a widespread and growing issue. EPA estimates that between 12.1 million and 19.2 million households throughout the U.S. lack access to affordable water services. Nationally, the cost of unaffordable water service bills ranges from $5.1 billion to $8.8 billion.

facing difficult decisions about raising rates – often with the possible consequence of taking on substantial financial risk. As a step toward alleviating these challenges, a national water services affordability program could help bring relief to struggling households and communities.

The goal of this Report to Congress is to provide an understanding of the impact of the water[1] affordability burden felt across the United States (U.S.) among households and utilities, as directed in the Infrastructure Investments and Jobs Act (IIJA), Section 50108. The Report summarizes decades of work; highlights utilities, academics, and associations that have been at the forefront of this research; and develops approaches to address water affordability concerns. Peer-reviewed studies are cited where available. However, there are understudied areas of water affordability where data are scarce, and peer-reviewed studies covering the nation are not available. In these instances, the best available data are cited, and are necessary to include to meet direction from Congress, in particular to establish estimates of cost of best methods to reduce the prevalence of a lack of affordable access to water services. Data analysis in this Report includes the number of households in need of assistance as defined by the IIJA, the prevalence of utilities that have a disproportionate percentage of households needing assistance in their service area which may result in systemwide fiscal sustainability challenges, and the cost to address water affordability.

In producing this Report, EPA gathered input from a wide range of interested parties, including utilities, associations, academia, nonprofits, community-based organizations, advocacy groups, and the public. These interested parties included experts who have spent decades working to address water affordability challenges across the U.S. To determine the distribution of percentage of household income required to pay for basic water services in this report, EPA evaluated income and water service rates data from households and utilities across the U.S. Rates captured both drinking water and wastewater charges. EPA estimated a range of the number of households throughout the U.S. experiencing high water burden by using two affordability threshold values, 3% and 4.5% of household income spent on drinking water and wastewater bills combined. Preliminary analysis indicates between **12.1 million** and **19.2 million** households throughout the U.S. lack affordable access to water services. This represents between 9.2% to 14.6% of total households in the U.S. Preliminary analysis also shows that **23% of community water systems** service a disproportionate percentage of households needing assistance. The estimated unaffordable portion of water service bills ranges from **$5.1 billion** to **$8.8 billion nationwide**.

There is no single, universal approach that can address water affordability at a national level. While federal resources, such as the IIJA and the American Rescue Plan Act funds, provide an increased level of funding for water utilities, the need for both capital investment and operations support still outpaces the tools at utilities' disposal. Large-scale, sustainable change requires addressing the systemic challenges in how water utilities are funded, how rates are set, and how assistance programs are established to support rate payers. It also requires continued investment in the nation's aging infrastructure. Within this context, however, a national water services affordability

[1] "Water services" and "water affordability" refer to both drinking water and wastewater throughout this report.

program can serve as a critical tool for alleviating some of the financial stress faced by households and utilities around the country.

This Report provides recommendations based on feedback provided by interested parties, analysis and published literature in Section 9 to reduce unaffordable access to water services. These recommendations fall into three broad categories:

Establishing a Federal Water Assistance Program

Increasing Education, Outreach and Knowledge Around Solutions to Address Affordability

Increasing Ways to Reduce Water Infrastructure Capital and Operating Costs.

These potential options to address water affordability include funding for a federal low-income water assistance program. EPA estimates the range of cost to fund the pilot program authorized in IIJA Section 50109 to be between **$115 million and $185 million** per year. A permanent federal assistance program can bring relief to communities and utilities across the U.S., where efforts to close the affordability gap are falling short.

2. Background and Statement of Purpose

The costs of drinking water and wastewater services[2] have increased significantly across the U.S. in recent decades (Cardoso & Wichman, 2022; Patterson & Doyle, 2021; Patterson et al., 2023; Teodoro & Thiele, 2024). Utilities face rising capital and operating costs due to multiple factors including aging infrastructure, treatment standards, inflation, supply chain disruptions, deferred maintenance, and delayed rate increases. Continued investment in capital programs is required to ensure that water utilities continue to protect health, safety, and the environment. Existing, aging infrastructure needs to be upgraded to maintain dependable performance. System adjustments must be made to account for changing population levels that affect a utility's rate base size, and to respond to pressures from climate change. These are important actions for drinking water and wastewater service providers; however, the costs associated with these actions can pose an increased burden on U.S. households through their water bills.

The ability of households to pay their water bills has critical implications on the well-being of communities across the nation (Sarango et al., 2023; Gaber et al., 2021; Kimutai et al., 2023). Without affordable access to safe drinking water and wastewater services, households may struggle to meet basic needs for daily activities like drinking water, cooking, cleaning, bathing, and flushing toilets. Households with long-term water burden can face financial hardships, which can

[2] "Water services" and "water affordability" refer to both drinking water and wastewater throughout this report.

lead to water shutoffs, disconnections, or even loss of home. Communities can be impacted by unaffordable water in the following ways:

- *Public health.* Lack of access to safe water and sanitation can create obstacles to maintain hygiene and prevent the spread of diseases.
- *Economic instability*. Strained household budgets add to existing financial stress and can even force people to decide which necessities to pay for and which to sacrifice.
- *Social inequality.* High water rates disproportionately impact low-income households and rural and underserved communities.
- *Psychological and psychosocial stress.* Water insecurity and inadequate sanitation contribute to poorer mental health and have been linked to increased depression and anxiety.

In many communities across the U.S., local efforts to close the water affordability gap are falling short. Utilities are burdened with the decision to either increase rates to reliably provide clean and safe water or take on substantial financial risk. Increased rates lead to water affordability challenges for many households. Consequently, utilities are reluctant to raise rates, but failure to raise additional revenue or identify alternative funding sources can put utilities on an unsustainable financial path – leading to failing infrastructure, non-compliance and impaired reliability. Many utilities have revised rate structures to buffer the impact of rate increases to their low-income customers.

2.1 Water Affordability Landscape

Water utilities face significant financial challenges, including aging water infrastructure replacement or rehabilitation, adapting to growing or shrinking populations, climate and environmental challenges, necessary cybersecurity measures, and requirements to protect public health and the environment. Wastewater utilities must make capital investments to protect water quality, conduct necessary infrastructure upgrades, replace and repair existing treatment plant infrastructure, install collection and conveyance systems, install green infrastructure, and invest in combined sewer overflow (CSO) facilities. Drinking water utilities face financial burdens such as treatment plant and pipe replacement, treatment plant upgrades, storage tank replacement, and repair and replacement of other key assets.

Together, EPA estimates the cost to fund utility needs for both clean water and drinking water projects nationwide over the next 20 years will be approximately $1.25 trillion, as reported in EPA's *2022 Clean Watersheds Needs Survey (CWNS) Report to Congress* (EPA, 2024b) and EPA's *7th Drinking Water Infrastructure Needs Survey and Assessment* (EPA, 2023b). This total may underestimate the true nationwide need for the next 20 years of capital investments in clean water and drinking water infrastructure. Most of the projected needs that utilities submitted to the CWNS describe projects that will be completed within 5 to 10 years. The true 20-year planning horizon will likely need to address much more about water infrastructure to protect public health and the environment. Figure 1 shows the change in clean water infrastructure need from 2008 to 2022. Figure 2 shows how drinking water needs have increased over the past 20 years across several categories, including water distribution/transmission, treatment, source, and storage.

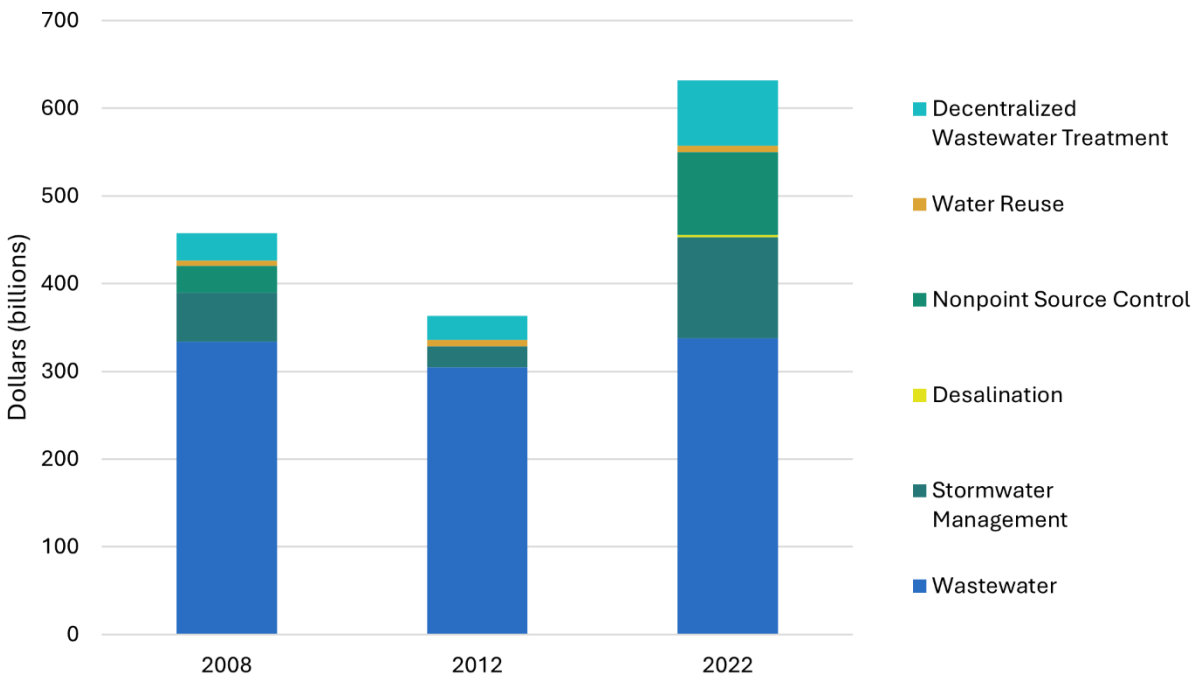


Figure 1: Total Reported Clean Water Infrastructure Needs Nationwide by Category, 2008-2022 (January 2022 Dollars in Billions)

Note: Some needs categories were aggregated for this figure as follows: wastewater refers to secondary wastewater treatment, advanced wastewater treatment, conveyance system repair and replacement, and CSO corrections. The 2012 CWNS indicated that reduced budgets, American Recovery and Reinvestment Act funding, inadequate documentation, a change in CWNS required documentation, and lack of participation in some needs categories were associated with the largest portions of the decrease in infrastructure needs from the 2008 survey to the 2012 survey. Between the 2012 and 2022 surveys, two infrastructure categories were added in the 2022 total needs, the number of planned water quality projects addressing aging infrastructure and climate change adaptation increased, and an improved online portal simplified data collection and led to robust participation. Territories were included in the 2022 CWNS. Projects on Tribal lands and Alaska Native Villages were not included in the CWNS; these needs are documented in a separate survey by the Indian Health Service.

Source: 2022 EPA Clean Watersheds Needs Survey Report to Congress

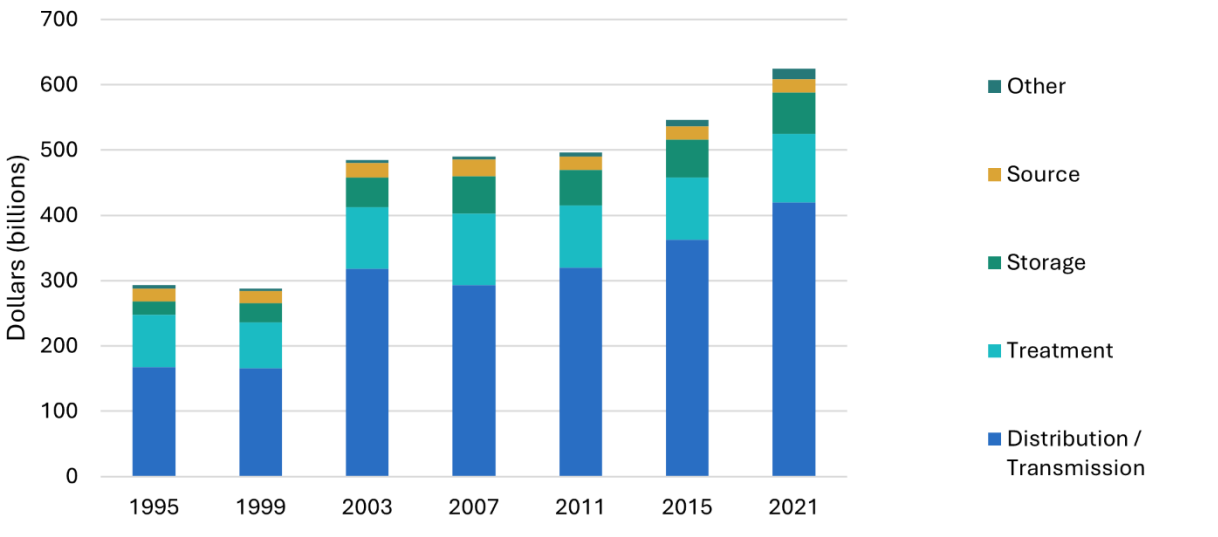


Figure 2: Total State 20-Year Drinking Water Infrastructure Need by Project Category (January 2021 Dollars in Billions)

Note: The assessments differed in scope (small community water systems, American Indian and Alaskan Native Village systems, and not-for-profit non-community water systems were not included in data collection every survey cycle, but where data was not collected the total need for the state was calculated using previously collected data for those categories, converted to that Assessment's year). Puerto Rico and DC were included in the 7th Drinking Water Infrastructure Needs Survey and Assessment. The 7th Drinking Water Infrastructure Needs Survey and Assessment includes capital investment needs of water systems serving American Indian and Alaska Native Village water systems.

Source: 7th Drinking Water Infrastructure Needs Survey and Assessment (2024)

In addition to the increased need for water infrastructure upgrades and improvements, utilities also face increases in capital and operating costs. A recent analysis from Standard and Poor's (S&P) showed an 8% increase in capital and operating costs faced by water and wastewater utilities year-over-year (D'Silva et al., 2023). While federal resources, such as the IIJA and American Rescue Plan funds, are providing increased levels of funding, the need for both capital investment and operations and maintenance (O&M) still outpaces the tools at utilities' disposal. Some utilities are taking resourceful steps to increase efficiencies and reduce costs, including regionalization and partnership with nearby utilities, and outsourcing operational functions like billing. Utilities are also working to address water affordability and efficiency at the household level by changing rate structures, introducing Customer Assistance Programs (CAPs), encouraging use of low water use appliances and strategies, and at the utility level through leak detection and repair programs (EPA, 2021a). Because projected capital and operational costs for water utilities have increased, utilities often need to raise rates to account for the current and future needs. Doing so has increased consumer spending on water bills. A recent report from the National Association of Clean Water Agencies (NACWA) predicted wastewater service rates would increase 4% per year from 2022 through 2026 across the country (NACWA, 2021). The American Water Works Association (AWWA) recently published a study that found rate increases in drinking water and wastewater bills at an average combined monthly price of $79.39 in 2017 to $95.02 in 2023 at 6,200 gallons per month (Teodoro & Thiele, 2024).

The way in which utilities implement rate increases has a significant impact on water affordability. Rate structures affect the burden that water utilities place on low-income customers. For example, Teodoro and Thiele (2024) found water rate structures became more regressive between 2017 and 2023, with utilities collecting less revenue through volumetric charges and more revenue through fixed charges. The study found that this shift in rate structures contributed to worsening water affordability concerns over the six-year period. More information on the impact of rate structures on water affordability can be found in Section 4.6 - Prior Work Evaluating Policy Implications of Water Affordability Study Findings.

To offset the impact to low-income households, some utilities are adopting more equitable rate structures that can help buffer rate increases. Some water affordability rate structures utilize a pricing system for water services designed to make water more accessible to low-income households by implementing tiered rates where the cost per unit of water decreases for lower consumption levels, often including a "lifeline rate" for essential water usage at a significantly lower price, aiming to ensure basic water needs are affordable even for those with limited income. These rate structure approaches can include income-based rate structures, inclining block rates and tax based rates. The AWWA M1 Manual helps utilities design, evaluate and restructure water rates, fees, and charges as well as provide valuable information on affordability programs and the business case for low-income discounts (AWWA, 2016).

Utilities sometimes prefer higher fixed charges because these provide reliable revenue even during times of variable demand, such as decreased seasonal demand or a water-use restricted drought. Significant work has been done to analyze the impact of various rate structures and to create tools that assist utilities in developing more equitable and reliable pricing models. The Natural Resources Defense Council (NRDC) Water Affordability Advocacy Toolkit indicates utilities can implement complementary strategies to lessen revenue variability sometimes associated with lower fixed charges (Levine et al., 2022). Additionally, the NRDC Water Affordability Business Case Tool allows utilities to model the impact of different discount program structures for low-income households (Levine & Osann, 2023).

Figure 3 compares the Consumer Price Index (CPI) of water, sewer, and trash collection services against the CPI of all items for urban consumers from 1998 to 2024. Water, sewer, and trash collection services in U.S. cities nearly tripled in price over this 26-year period. Prices in this category have increased at more than twice the rate of overall consumer prices. While aggregate prices tend to cool during periods of economic recession, water, sewer, and trash collection services show near continual increase.

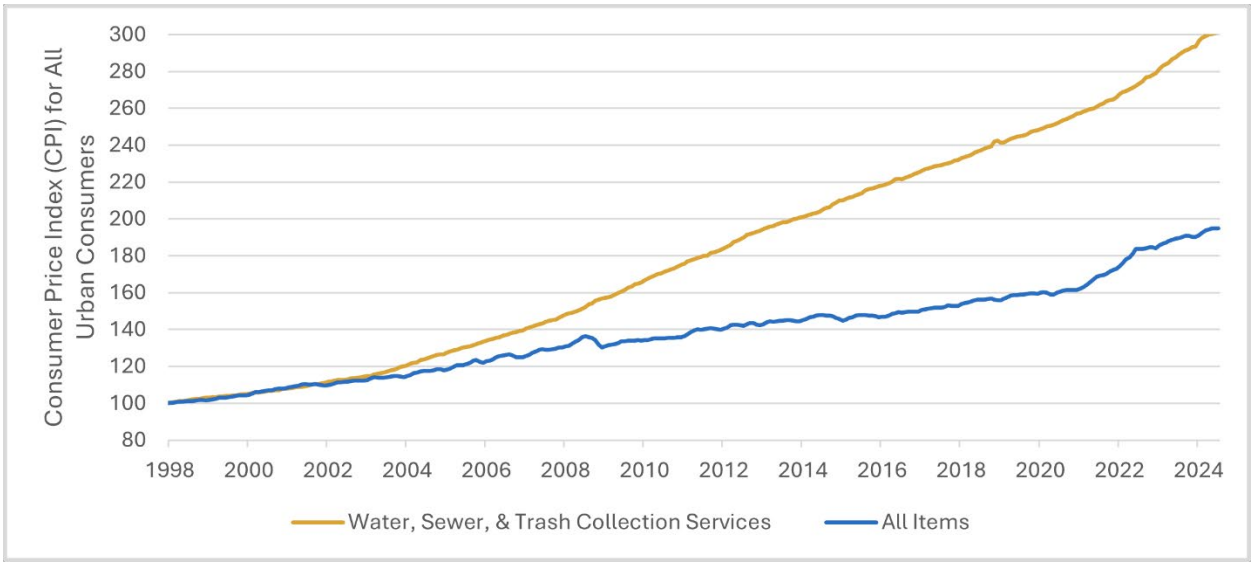


Figure 3: Consumer Price Index for Water, Sewer, and Trash Collection vs. All Items for Urban Consumers, 1998 - 2024

Source: U.S. Bureau of Labor Statistics, 2024a; U.S. Bureau of Labor Statistics, 2024b

2.2 The Impact of Unaffordable Water on Households

Water affordability is a complex issue that affects many people, including lower-income households, senior citizens on fixed incomes, and those who experience short-term disability or job loss. Many low-income households across the U.S. struggle to pay their water bills. Results of a recent survey by the U.S. Department of Health and Human Services (HHS) show that roughly 20% of households had outstanding arrearages or were in debt to their water utility. This percentage can be even higher in some communities; for example, 32% of households in Tribal communities had outstanding balances (HHS, 2024). Duke University found that up to a third of households work more than a day each month to afford water bills (Patterson & Doyle, 2021).

When the cost of water services increases, households face difficult choices that can lead to broader economic impacts. High water bills can force families to cut back on other essential expenses, such as food, healthcare, and education. This can result in health impacts such as underutilization of healthcare and medications, food insecurity, and decline in mental health (Sarango et al., 2023; Gaber et al., 2021; Kimutai et al., 2023). Additionally, access to affordable water is crucial for maintaining public health. Unpaid bills can lead to water disconnections and residential shutoffs, which can force households to rely on unsafe water sources or to forgo essential hygiene practices, a challenge highlighted during engagement sessions for interested parties held by EPA in 2024. Further compounding the impacts of higher water costs, session participants indicated that some low-income households have high water usage due to high home occupancy, old or inefficient appliances and fixtures, and leaky plumbing.

The impacts of unaffordable water fall disproportionately on a subset of the population in a community. Older populations on fixed incomes may struggle with rising rates, putting financial

pressure on their household budgets (Patterson & Doyle, 2021). Communities predominately composed of racial and ethnic minority populations often have a greater burden of inequitable access to clean water infrastructure than other communities. This can lead to water contamination, health crises, and other water equity issues (Hansen & Hammer, 2022). The disproportionate impact to specific residents within a community based on race and age was stated by numerous community advocacy groups during the engagement sessions for interested parties held by EPA in 2024. They emphasized the impact to multigenerational households, minority residents, and elderly customers, as well as unique challenges for those that pay for water and wastewater service indirectly through rent. The relationship between renters and water bills is a complex issue. Advocacy groups have explored this relationship and put forward solutions (Levine et al., 2022). Pathways to provide assistance to renters are explored in Section 9 - EPA Recommendations.

2.3 Water Affordability Challenges Faced by Utilities

Water utilities across the U.S. also face significant water affordability challenges. These costs are driven in part by rising operational costs, the need for substantial investments in maintenance, and upgrades of existing, aging infrastructure. Utilities face the balancing act of funding routine O&M costs and longer-term capital expenditures to replace or upgrade infrastructure. O&M cost increases are often driven by labor and supply costs and the increased maintenance needs of aging plant and pipeline infrastructure. Capital expenditures are often driven by the need to replace or upgrade infrastructure due to age, increased demand from population or industrial growth, and the need for resiliency to climate change.

Another driver of capital expenditures is the need to protect public health and the environment. Some utilities have met these challenges by using innovative funding and financing approaches. During the engagement sessions for interested parties held by EPA in 2024, participants noted that some water utilities, such as mobile home parks, some condos, and those not affiliated with the local municipality, are often unable to access funding programs or generate additional revenue. A federal water assistance program, discussed in Section 9.1 - Establishing a Permanent Federal Water Assistance Program, could help households struggling with unaffordable water, and in turn help utilities to have reliable capital to implement necessary improvements. Water assistance can mitigate rate increases for households, so low-income households feel less of this financial impact. Water assistance to households also helps ensure utilities are receiving adequate bill payments to support necessary infrastructure. Additionally, water assistance can help utilities more equitably implement true cost pricing.

Many cities and utilities have deferred rate increases for various reasons. Deferring rate increases can cause these utilities to need to raise rates significantly in a few short years (“rate shock”), leaving customers with less time to adjust to higher bills than slower rate increases over time. Not implementing necessary rate increases can also cause deferred maintenance, resulting in higher future capital costs.

Customer arrearages further exacerbate financial pressures for water sector utilities. The *2022 Low-Income Household Water Assistance Program (LIHWAP) Survey* showed that very large

utilities, which serve populations of over 100,000 customers, had an average arrearage balance of approximately $15 million per utility. When too many customer accounts fall behind in paying their bills, some utilities find rates and fees inadequate to cover infrastructure needs and treatment costs. The LIHWAP Survey also found that utilities of all sizes faced challenges in setting rates that are affordable for customers while covering necessary costs needed to meet sound financial metrics (HHS, 2024).

2.4 Utility-Led Customer Assistance Programs

Some utilities have developed CAPs that focus on individual customers' ability to pay for drinking water and wastewater services. CAPs can help households that are unable to pay a bill by restoring services, preventing disconnections, and making bills more affordable. Some programs may also offer installment plans to help customers spread out past due balances over time.

> The San Antonio Water System (SAWS) is one example of a successful utility-led CAP. This robust program shifts the burden of access away from customers and connects them with assistance in 14 different areas, including reduced meter fees and discounted monthly bills. Read more about the SAWS CAP in the case study in Appendix A.

Some utilities have designed CAPs that fit their own needs and those of their local communities. These programs use tools such as bill discounts, special rate structures, and other tactics to support customers who are facing challenges in paying their water bills. EPA has developed a compendium of drinking water and wastewater CAPs, which describes examples of these programs throughout the country (EPA, 2016). Many large cities offer CAPs, as well as some small cities and towns. There is extensive, detailed literature documenting key considerations that utilities should account for when developing and implementing CAPs, including lessons learned and tips for success (AWWA, 2022; Cromwell et al., 2010; Levine et al., 2022; UNC EFC, 2017; Ward et al., 2024).

While these programs have been successful in assisting households, there are limitations. Large utilities with bigger rate bases are more likely to have CAPs, yet funding to support them is still limited. For many smaller utilities, developing and implementing a CAP is out of reach given limited staffing and financial resources. In some areas, legal and policy barriers limit the ability of utilities to offer bill discounts or free services to some customers (UNC EFC, 2017).

2.5 Federal Assistance Efforts

During the COVID-19 pandemic, Congress recognized the vital importance of having access to clean, safe water and sanitation to limit the spread of infectious disease. In response, the federal government established the LIHWAP, which provided funds to states, territories, and Tribes to support low-income households with water bills. Grant recipients used LIHWAP funding to pay utilities to reduce arrearages and rates charged to recipient households. The program has

concluded and served a total of 1.7 million households nationwide (Office of Community Services (OCS), 2024b). Specific LIHWAP program information, including information on allocation of funding, is available at the HHS website.

The ability of low-income households to access other essential resources are already supported by federal programs, such as Temporary Assistance for Needy Families (TANF), Supplemental Nutrition Assistance Program (SNAP), and Low-Income Home Energy Assistance Program (LIHEAP). In FY2023, SNAP provided food benefits to approximately 42.1 million low-income individuals to supplement their grocery budgets (U.S. Department of Agriculture, 2024). LIHEAP received FY2024 appropriations of $4.025 billion and supported an estimated 5.1 million households in FY2023 (OCS, n.d.). LIHWAP was established as a temporary program and has since ended. However, the need to address water affordability, especially for low-income households, remains.

The San Carlos Apache Nation is an example of a community that benefited significantly from LIHWAP. Residents face major challenges, with an unemployment rate of 65%. In 2021, the Tribe was granted $310,510 through LIHWAP, which enabled them to restore service for households whose drinking water and wastewater services had been disconnected due to nonpayment. Many families applied, and program funds were used to pay for water bills and to empty septic tanks. Read more about the San Carlos Apache Nation's experience with LIHWAP in the case study in Appendix A.

2.6 Summary

Water affordability is a growing problem across the country. In many areas, the cost of drinking water and wastewater services has more than doubled since 2000. The estimated need for water infrastructure investments will be over $1.2 trillion over 20 years, which will further increase service costs and require further rate increases. This can disproportionately affect low-income households and communities of color.

3. Defining Water Affordability

There is no single approach to defining or measuring water affordability. Each approach applies a unique lens that explores the different elements of a community, such as demographics, socioeconomic characteristics, and financial capacity constraints. The literature on water affordability definitions and metrics is expansive and represents different viewpoints among interested parties. During EPA's water affordability listening sessions for interested parties held in Spring 2024, participants stressed the importance of looking holistically at affordability challenges and recognizing how needs may vary across communities. Interested parties also emphasized the need to explore both qualitative and quantitative approaches to defining what it means to have access to affordable drinking water and wastewater services.

Both qualitative definitions and quantitative measurements of water affordability can be useful in evaluating the water burden faced by different communities. Qualitative definitions provide context about the economic tradeoffs between basic water services and other essential expenditures. They help frame water affordability as a piece in the larger picture of household and community affordability challenges. Quantitative affordability metrics can help utilities and other interested parties understand the financial capability of households and communities to pay for necessary infrastructure, O&M costs, and improvements, which, in turn, enable utilities to set appropriate rates and support programs to assist customers regardless of ability to pay. In addition to allowing for evaluations of water affordability, these various metrics each tell a different story about the water burden faced by those within a community. The following section describes some of the

most common water affordability definitions and metrics, including comparisons across different approaches.

3.1 Qualitative Definitions of Water Affordability

One widely used qualitative definition of water affordability is the ability of a household to pay for basic water services necessary for drinking, cooking, cleaning, and sanitation without experiencing undue hardship (Patterson & Doyle, 2021; Raucher et al., 2019). The United Nations definition of water affordability further characterizes "undue hardship" by describing water affordability as "essential water and sanitation services available at a price that does not prevent access, nor interfere with other essential expenditures such as food, healthcare, housing, clothing, and education" (United Nations Human Rights Council, 2015). Legal definitions of "undue hardship" refer to the imposition of "significant difficulty or expense" as a result of a lack of adequate accommodation (Cornell Law School, 2024). These definitions also note that while people may successfully pay water bills, they may still be facing undue hardship related to other categories of necessary spending. Therefore, simply examining the rates of customer nonpayment may provide an incomplete view of undue hardship.

The water affordability field is rapidly evolving and expanding to meet growing challenges faced by households throughout the country. Advocacy groups, policymakers, and the academic community continue to refine qualitative definitions of affordability to better characterize water burden and develop tools for addressing the challenge. The NRDC Water Affordability Advocacy Toolkit was developed to provide tools for state and local policymakers to better understand water affordability challenges in their communities. It defines an affordable bill as one that "has a reasonable likelihood of being sustainably paid, as defined by a prescribed 'bill burden' that does not unreasonably impinge on a customer's income" (Levine & Osann, 2023). The Aspen Institute stresses that "no person should be denied essential water services based on ability to pay" and recognizes that the push for water affordability should not be interpreted as free utility services but should rather focus on a commitment from all levels of government to ensure these services are affordable to the entire community (The Aspen Institute & Nicholas Institute for Environmental Policy Solutions, 2022). The U.S. Water Alliance adopts a similar definition, while also emphasizing that affordability means "the costs of water systems are distributed equitably across society" and that it is essential for households to be able to "pay for water and wastewater services without having to forgo or cut back on other necessary expenses like housing, food, medication, transportation, or other utility services" (U.S. Water Alliance, 2023). Other definitions expand water affordability to better capture stormwater, and the needs of decentralized systems (e.g., septic systems) (Maxcy-Brown et al., 2024).

3.2 Quantitative Measures of Water Affordability

Researchers have proposed various metrics to measure and evaluate water affordability. These metrics do not define water affordability, but rather, each metric provides a unique perspective into the overall picture of water affordability within a given community or a single household. Because the financial health of utilities is largely dependent on the economic health of their local

community, utilities rely on metrics that determine the financial ability of households to pay increased water rates within the utility's service area. Other metrics look at water affordability at the household level by determining the financial burden of water bills on individual households or a representative household within the community. This section describes approaches that have been used at both the community level and the household level to quantitatively evaluate water affordability.

Most water affordability metrics compare the cost of a water bill at a given consumption level to a measure of household income. Affordability metrics that have been used in the academic literature look at the amount spent on drinking water and wastewater bills as a percentage of total household income, disposable income, or in terms of hours spent working at minimum wage. Some previous studies have explored affordability using a community-level summary of income. Two common summary statistics used to examine affordability at the community level include the Median Household Income (MHI) and the upper limit of the Lowest Quintile Income (LQI). The individual household level is the most granular level of water affordability measurement.

Aggregate Community-Level Measures

- Median Household Income (MHI) is the midpoint of the distribution of community income or the 50th percentile. Half of the households in the community earn more than the median income, and half of the households earn less than the median income.
- Upper Lowest Quintile Income (LQI) is the upper value of the lowest quintile of income or the 20th percentile. Approximately 20% of households earn less than the upper LQI.

Household-Level Measure

- Estimates of individual household incomes allow researchers to show the full distribution of the percent of income spent on drinking water and wastewater services across the community.

Figure 4 compares community-level summaries of income to the use of individual household-level incomes and highlights the extent to which low-income households are represented in each metric. The teal circles denote which households fall within the grouping (e.g., the two lowest earning households are the lowest quintile of a community of 10 homes). The gold homes denote which household's income would be characterized as a representative household in an affordability calculation. As shown in the graphic, MHI captures information at the community-level, but is not sufficient to describe the water burden for lower-income households because half of the households in the community have incomes below the median. Studies that examine affordability for lower-income households at the community level commonly use the upper LQI as the representative income (Teodoro, 2018; Teodoro, 2019; Teodoro & Saywitz, 2020). While this community-level value provides more information on lower-income households in the community than the MHI, it still is not sufficient to understand the burden for the lowest fifth of households. For this reason, several recent studies have advocated for measuring affordability at the household level (Patterson et al., 2023; Cardoso & Wichman, 2022a).

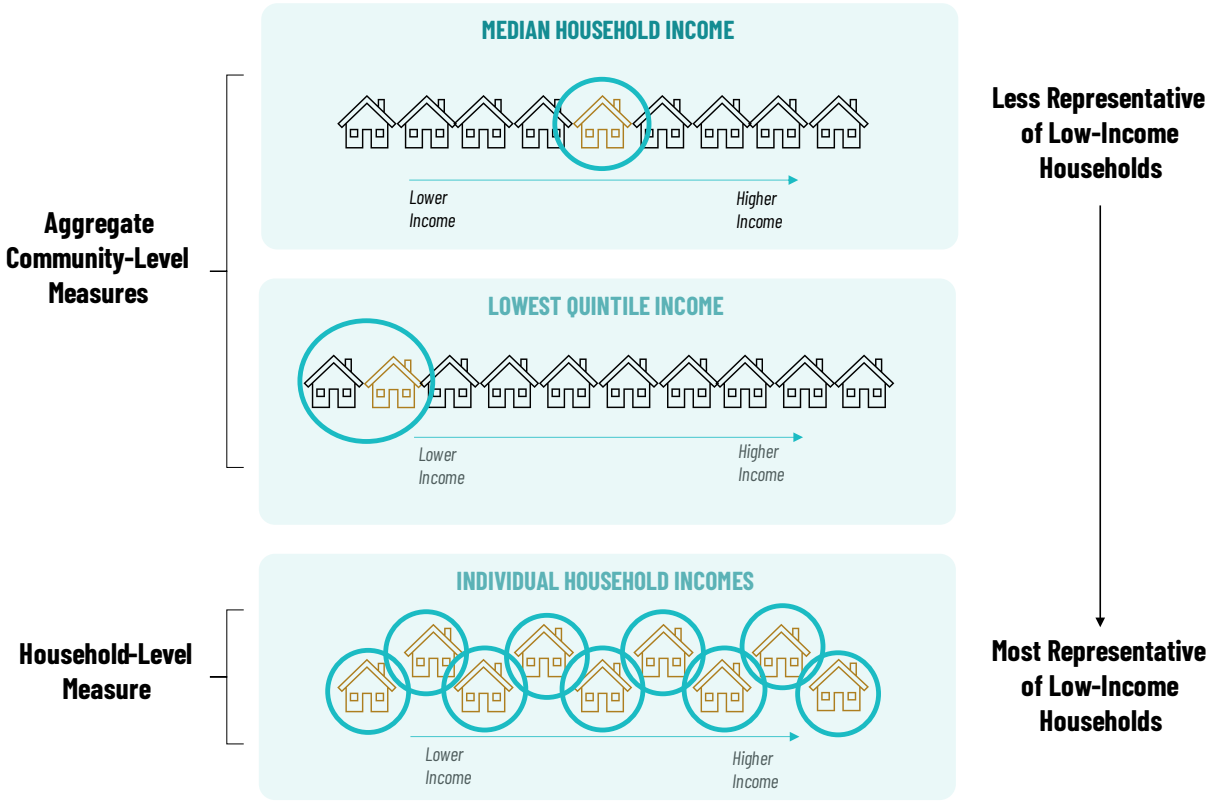


Figure 4: Comparison of MHI, LQI, and Individual Household Income Metrics

3.2.1 Approaches That Measure Affordability in Terms of the Financial Strength of a Community

Utilities, agencies, and other interested parties use several metrics to determine the financial strength of the community. These metrics help utilities gauge the financial impact of rate increases needed to implement necessary infrastructure maintenance and upgrades based on a summary statistic of income within a community. Metrics that use average or median household incomes to indicate the financial capacity of a community do not ensure that rates are affordable for every household in the community (Patterson & Doyle, 2021).

The Poverty Prevalence Indicator (PPI) measures the percentage of households below 200% of the Census Bureau's Federal Poverty Thresholds. This metric is based entirely on U.S. Census Bureau income and household data, but it does not consider the cost of water bills, and therefore measures only the degree to which poverty is prevalent in the community (Raucher et al., 2019). It furthermore does not account for cost of living, which varies between each city, state, and region. When a utility services a community with high poverty levels, there is an increased challenge for households to afford a utility's services, which affects the utility's revenue potential (Patterson & Doyle, 2021).

The MHI metric reflects the annual cost of water services as a percentage of a community's MHI (U.S. EPA, 1997; U.S. EPA, 2024a). It provides a simple measurement of water affordability at the

community level and can be calculated for the entire utility's service population or for separate regions or neighborhoods within the service area. However, MHI does not capture income disparities within a community at the household level and thus cannot inform an understanding of the rising affordability problems for low-income households. Like PPI, the MHI metric does not account for variations in cost of living between cities, states, and regions.

EPA's *Clean Water Act (CWA) Financial Capability Assessment Guidance* (U.S. EPA, 2024a) includes three metrics for evaluating community-level affordability for the cost of wastewater services: the Residential Indicator (RI), the Financial Capability Indicator (FCI), and the Lowest Quintile Poverty Indicator (LQPI). This guidance was developed to evaluate a utility's financial capability to comply with CWA standards, rather than to evaluate household-level affordability for wastewater services. The RI reflects the compliance costs per household as a percentage of MHI for the service area of the utility. The FCI measures a community's ability to implement CWA controls, and incorporates data on debt, socioeconomic, and financial conditions. The FCI is a composite of six variables that measure a community's financial management, socioeconomic condition, and debt burden. These variables are assigned a numeric score and then aggregated and compared to national benchmarks. While the RI and FCI do not account for variability in income distribution across service areas, the LQPI measures the 20th percentile of household income and is more representative of the financial capabilities of lower-income households within the community.

3.2.2 Approaches That Measure Water Burden at the Household Level

Several recent research papers have analyzed water affordability at the individual household level using the full distribution of household income in a given location (Patterson & Doyle, 2021; Cardoso & Wichman, 2022a; Patterson et al., 2023). These papers show the distribution of water burden experienced by households both across and within communities. A common way to measure water burden is through the Income Dedicated to Water Services (IDWS) metric, which is the percentage of income that households spend on drinking water and wastewater bills. Utilities and governments can use this metric to understand the extent of affordability challenges across households within a given community. When combined with threshold value of the percent of income spent on water that is deemed affordable, an estimate of the percentage of households within a service area that need water assistance can be developed as well as an estimated cost to alleviate this water burden for the community.

Several prior approaches have combined multiple metrics to develop a more comprehensive picture of affordability challenges. Teodoro (2018, 2019) and Teodoro and Saywitz (2020) used two complementary affordability metrics: the Affordability Ratio (AR) and Hours of Labor at Minimum Wage (HM). The AR metric calculates the ratio of the price of basic water services to the household's disposable income. The metric assesses water affordability for a household while accounting for the household's other essential needs, such as food, housing, and healthcare; and demonstrates the economic tradeoffs that customers face due to the cost of basic drinking water and wastewater services. While this metric may provide deeper insights into the burden faced by households than the IDWS metric, there are additional data requirements and empirical challenges. In addition to estimating household drinking water and wastewater costs, calculating the AR requires an estimate of both household income and the cost of other essential expenditures

from consumption surveys.[3] The HM metric represents the number of hours a customer would need to work at minimum wage to earn the amount necessary to pay for basic drinking water and wastewater services. HM shows a simple estimate of the impact of water service costs on a single-earning minimum wage household but does not account for essential non-water expenditures. AR and HM can be calculated for an individual household or a representative household. Individual household-level metrics provide a greater understanding of distribution of water burden across the community and allow a greater focus on basic water needs of low-income households rather than average water consumption among median income customers.

In a recently published article, Skerker et al. (2024) suggest three metrics based on water bill delinquency - the frequency, duration, and severity of delinquency - as alternatives to affordability ratios. Using detailed bill data, the authors find that Census blocks with similar affordability ratios may have different delinquency metrics.

3.2.3 Affordability Thresholds and Prior Applications

Most water affordability metrics use a threshold value to assess whether water costs are expected to be manageable on the community-level or for an individual household. Some of these thresholds, such as the Household Burden Indicator (HBI) and PPI, use a range of values to define levels of affordability. Other metrics use a singular cutoff value. For example, 4.5% of MHI is commonly used as a threshold value for evaluating the financial capability of a utility (Cardoso & Wichman, 2022; Berahzer et al., 2023[4]; Mack & Wrase, 2017). Likewise, Teodoro (2018) suggests it is unreasonable for low-income households when their monthly drinking water and wastewater bills exceed 10% of their disposable income (using the AR metric) and/or require more than eight hours of work at the local minimum wage (the HM metric). Appendix C shows the affordability threshold values recommended for the metrics previously discussed in this section. While these thresholds are benchmarks to consider when evaluating affordability, it is important to remember that every community and every household faces unique challenges, and these thresholds may not be appropriate for every situation. For example, communities that have high housing and essential goods costs might struggle to pay water utility bills, as the average household budget is stretched to meet the higher cost of living. Additional analysis on water affordability should evaluate additional socioeconomic metrics and their impact on household water burden.

Other programs and studies have used a variety of affordability metrics, thresholds, and other criteria or indicators to determine eligibility and assess costs associated with assistance programs. For example, to participate in the LIHWAP program, LIHWAP grantees (states, Tribes, or territories) were required to establish eligibility thresholds for households to qualify for benefits. These thresholds were based on total household income (at or below 150% of the federal poverty guidelines, at or below 60% of the state MHI, or measured with another lower poverty threshold) as

[3] In addition to the added data requirements, estimating essential expenditures from self-reported consumption surveys is challenging for two reasons: 1) self-reported data may be biased, and 2) estimating the cost of goods that are truly essential is difficult because households with a greater ability to pay will have greater expenditures in essential goods categories.

[4] Berahzer et al. 2023 is not a peer-reviewed study. The authors are leading economists and experts in the water affordability space. Many of the authors have published peer-reviewed studies.

well as other eligibility criteria required by grantees (OCS, 2023a). LIHWAP allowed for categorical eligibility based on enrollment in other means-tested programs, such as TANF, SNAP, Supplemental Security Income (SSI), and LIHEAP (OCS, 2023a).

The *Low-Income Water Customer Assistance Program Assessment Study* used a multiple threshold approach to evaluate the cost of drinking water and wastewater services as a percent of household income. The study considered six income ranges from <$10,000 to $74,999. Four different thresholds were used to evaluate the cost of bill assistance at each income range. Two fixed thresholds for bill assistance were considered: 4.5% and 3%. Additionally, two variable thresholds were evaluated. The first was a 3% to 8% threshold that increases as income decreases, reflecting that lower income households pay a higher percentage of their income for water services under typical rate structures. The second reflects a progressive threshold ranging from 2% for the lowest income range to 4.5% for the highest (Berahzer et al., 2023), which reflects the fact that lower-income households have less disposable income.

States also have the flexibility to design their own affordability criteria and disadvantaged community definitions in their State Revolving Fund (SRF) Programs. The Clean Water and Drinking Water SRFs were established to assist water utilities with financing infrastructure improvements by providing below-market interest rates and extended loan terms. These criteria and definitions inform the SRF Programs' distribution of additional subsidies to projects in eligible communities. States have broad discretion in developing their affordability criteria and disadvantaged community definitions. Many states use the MHI metric to create their definitions, although each state's methodologies, thresholds, and definitions vary (U.S. EPA, 2024a; U.S. EPA, 2022). The SRF affordability criteria and disadvantaged community definitions are community-level metrics that are not intended to be applied on a household-level.

3.3 EPA's Approach for This Report

The IIJA language directing this Report requires EPA to estimate the prevalence of water utility providers that contain a "disproportionate percentage" of "qualifying households with need." Elsewhere, the IIJA language calls for an estimate of the "prevalence of a lack of affordable access to water services." (See language in Appendix B.) EPA determined that the best approach to meet these requirements is to examine affordability of drinking water and wastewater bills using individual household incomes, as shown in Figure 4. Instead of measuring affordability at the community level, EPA evaluated the distribution of the water burden experienced by households within a community. An estimated water bill for basic use was compared to an estimate of the individual household incomes using the IDWS approach discussed previously (Patterson & Doyle, 2021; Cardoso & Wichman, 2022a; Patterson et al., 2023). This approach most accurately captures the impact of water burden on low-income households.

EPA conducted a thorough literature review of multiple affordability threshold values. EPA selected two thresholds, 3% and 4.5% of household income spent on drinking water and wastewater bills, to estimate a range of the number of households throughout the U.S. experiencing high water burden. The 4.5% threshold is widely used in literature (Cardoso & Wichman, 2022a; Berahzer et al., 2023; Heminger et al., 2023; Mack & Wrase, 2017). Use of the 4.5% threshold is largely consistent with

the HM metric, which suggests a threshold of one day (8 hours), or 4.6% of work hours in a month, assuming a 40-hour work week. The use of a percentage of income metric is also comparable to affordability metrics for other essential services, such as spending on electricity (Brown et al., 2020a; Brown et al., 2020b). In order to generate a range of households throughout the U.S. experiencing high water burden, EPA also selected a 3% threshold, which is the lowest fixed threshold used in the Low-Income Water Customer Assistance Program Assessment report (Berahzer et al., 2023).

EPA selected these threshold values for the purposes of generating an estimated range of household-level water burden for this Report only. During the listening sessions for interested parties held in Spring 2024, participants emphasized the importance of using a multi-pronged approach that can reflect the unique circumstances of different communities. Each community faces unique challenges and there is not a single metric or approach that will be correct for every community. EPA's affordability analysis using this methodology is detailed in Section 5 of this Report.

4. Water Affordability Literature: Summary and Major Findings

The issue of water affordability is not new; decades of research have been conducted to define the scope and extent of water burden in the U.S. and to develop strategies to mitigate its impacts. These studies provide a picture of the national water affordability challenge as well as estimates of the financial burden of water costs across diverse geographic and socioeconomic groups. Several studies have been completed at a national level using data from utilities across multiple states, at an individual state level, and at a local level. This section summarizes the findings of some of these studies and outlines several established approaches to assessing the lack of access to affordable water. This summary of existing literature serves as a foundation for the data analysis presented in Section 5 and helps identify avenues for additional research which the report explores further in Section 7.

4.1 Water Affordability Study Methods and Limitations

Most water affordability studies seek to assess the cost of essential water services in relation to the incomes of the households responsible for paying for those water services. These analyses require water rates data, census data, and the ability to match these two data sources geographically. In addition, researchers must calculate water bills at a particular quantity of water that represents the basic water needs of the household. This relies on key assumptions about household size and daily water use per household member.

Water Rates Data

Drinking water and wastewater rates and services charges are used to calculate the total cost of water services at a specific quantity of water usage for a given household. The primary challenge in evaluating water affordability on a national level is the absence of a comprehensive national database of water rates. Researchers must gather water rates data by searching utility websites or directly contacting utilities. Some databases of drinking water and wastewater rates have been developed including the University of North Carolina Environmental Finance Center (UNC EFC) Utility Rates Dashboards (UNC EFC, n.d.) and the Duke Water Affordability Dashboard (Patterson, 2022). These databases do not include every state or every utility within each state and must be frequently updated as utilities change their rates. Data on water rates are difficult to gather from smaller utilities because there are significantly more of these utilities, and they may be less likely to publish rates online. Even when water rates data are available, utilities may use different rate structures, formats, and terminologies, making it difficult to compare rates across utilities and combine them into one dataset.

Previous studies have used different samples of rates in their analyses. Teodoro (2018) selected utilities from the 25 most populous U.S. cities and Patterson et al. (2023) used rate data from the largest utilities in every state. Teodoro (2019) collected a random sample of water rates from small to large utilities (omitting very small utilities). Patterson and Doyle (2021) selected 1,791 utilities from four states with a variety of population demographics and climates (California, North Carolina, Pennsylvania, and Texas) based on the availability of their statewide service area boundaries. Some studies include drinking water, wastewater, and limited stormwater rates (Patterson & Doyle, 2021), while others use only drinking water and wastewater rates (Teodoro, 2018; Teodoro, 2019; Teodoro & Saywitz, 2020; El-Khattabi et al., 2023; Teodoro & Thiele, 2024). See Appendix E for a description of the utilities represented in the data analysis for the studies discussed here.

Census Data

Detailed geo-located census data at the household level is confidential and not available to the public. Publicly available census data provide tract- or block group-level averages of socioeconomic variables as well as the estimated counts of households that have yearly income within each of 16 income brackets. Aggregate community-level summary statistics of income or estimates of household-level income can be generated from publicly available census data. To estimate income at the household level, researchers can approximate the income distribution for each census tract or block group using the counts of households within each income bracket. Previous approaches include assigning all households in the income bracket to the median value of that bracket (Cardoso & Wichman, 2022a; Berahzer et al., 2023) or randomly generating incomes within the bracket according to a probability density function (Patterson et al., 2023).

Matching Census Data to Water Rates Data

Census boundaries frequently do not align with utility service area boundaries; therefore, matching household-level data to the utility that supplies water is challenging and prone to errors. Several previous studies have used the address of the water utility headquarters to match rates to counties (Cardoso & Wichman 2022a) or cities (Teodoro, 2018; Teodoro, 2019; Teodoro & Saywitz, 2020).

However, this method assumes that every household in the geographical unit faces the same rates, which will not be true when there are multiple utilities located within a geography. Greater geographical specificity of the utility locations and the household locations will minimize errors in matching. There have been some recent efforts to map utility service areas nationwide; for example, the Environmental Policy Innovation Center (EPIC) and EPA have developed datasets of service area boundaries (EPIC, n.d.; U.S. EPA, 2024d). Service area boundary datasets allow researchers to match households from census data more accurately to the utility that supplies water (e.g., Patterson et al., 2023). However, even with accurate service area boundaries, this matching will still be an approximation when utility service areas span multiple census geographies or vice versa. In these cases, an apportionment method is used to generate a weighted average of census data using the proportion of overlap with service areas (e.g., Berahzer et al., 2023; Patterson et al., 2023).

Calculating Drinking Water and Wastewater Bills

Monthly drinking water and wastewater bills are calculated from rate data for a specific quantity that is assumed to be sufficient to meet the basic needs of the household. This will depend critically on the assumptions of the daily water needs per person and the size of the household.

- **Daily Per-Person Water Usage.** Water affordability studies generally seek to evaluate the cost of water used for basic health and cleanliness needs, including drinking water consumption, food preparation, personal hygiene (bathing, handwashing, oral care), sanitation (flushing toilets), and basic cleaning (washing clothes, dishes, etc.). Focusing on a basic hygienic use value implicitly assumes that there are no major leaks within the household. The selection of a per-person water use value has a significant impact on the resulting estimates of a household's total water bill. Patterson et al. (2023) found that the number of households with unaffordable water services was 1.7 times greater when a household of the average size consumes approximately 100 gallons per person per day compared to approximately 50 gallons. Similarly, Cardoso and Wichman (2022a) found that the percent of households with unaffordable bills rose from 8.4% to 14.2% when the assumed water usage increased from 40 gallons per person per day to 75 gallons per person per day, respectively. Appendix D includes information on basic water usage volumes used throughout the literature.
- **Household Size.** The number of people in a household determines the amount of water needed to meet the household's basic needs. Most affordability studies assume that water use scales linearly with the number of household members, thus the per-person value is multiplied by the household size to estimate daily household water needs. Census data with household-level incomes and household sizes, however, is not publicly available, and therefore, researchers rely on a measure of average household size. Patterson et al. (2023) assume all households are the same size, approximately the national average, when calculating water usage. Teodoro (2018, 2019) and Teodoro and Saywitz (2020) calculate water usage for a four-person household, and Cardoso and Wichman (2022a) use the average household size at the census block group (CBG) level to estimate water usage.

Previous water affordability studies have been conducted with water rates and census data from different states and years and using different methods, assumptions about water use, and affordability threshold values. As a result, comparing findings between studies is difficult. Despite the differences in data sources and methods used, the literature shows that water affordability is a significant and growing issue across the U.S., especially for low-income households. While there is much work that remains to be done to create a comprehensive picture of water affordability across the U.S., the following sections outline several key insights from affordability studies that have been completed to date.

4.2 Prior Research Assessing Water Affordability Challenges for Low-Income Households

Studies Measuring Water Affordability Using Household-Level Incomes

Multiple studies have assessed the extent and prevalence of affordability challenges across the U.S. using the full distribution of household-level income. The results are not directly comparable, as each study used different utilities, rate data years, affordability thresholds, and methods. However, the results are generally consistent, with estimates ranging from 5.8% to 17.1% of households experiencing a high water cost burden within the utilities evaluated in the studies, with one study suggesting this range could be as high as 26% based on sensitivity analyses (Patterson et al., 2023). Some of the key findings are highlighted below:

- Patterson and Doyle (2021) found that for the median utility, 16.4% of households spent more than 4% of their income on water services, while 7.7% of households spent more than 7% of their income on water services.
- Cardoso and Wichman (2022a) found that 10% of households face water affordability concerns (pay more than 4.5% of income on water), with households in the lowest income decile paying an average of 6.8% of their annual income on drinking water and wastewater services.
- Patterson et al. (2023) found that 17.1% of households have unaffordable water services (defined as spending more than one day of labor each month paying for services or 4.6% of income). The study also found that this number could vary between 5% and 26% of households, depending on the volume of water used to estimate bills and the level of financial burden determined to be acceptable (Patterson et al., 2023).
- The Low-Income Water Customer Assistance Program Assessment found that between 7.5 to 21.3 million U.S. households (approximately 5.8% to 16.6% of households) are water burdened, as defined by exceeding one of four affordability thresholds described in Section 3.2.3 Affordability Thresholds and Prior Applications. Furthermore, this study estimated that between $2.4 and $7.9 billion in annual water bill assistance would be needed to address the water burden nationwide (Berahzer et al., 2023).

Studies Measuring Water Affordability Using Community-Level LQI

Four studies conducted between 2018 and 2024 (Teodoro, 2018; Teodoro, 2019; Teodoro and Saywitz, 2020; Teodoro and Thiel, 2024), evaluated the impact of water affordability challenges on low-income households at the 20th income percentile, the upper LQI. All four studies compared

drinking water and wastewater bills against the 20th percentile household income using the AR and HM metrics described in Section 3. By assessing the cost of water services in terms of minimum wage hours and as a percentage of disposable income, these studies highlight the impact of water burden on low-income households and provide a view of trends in affordability over a six-year period.

Teodoro (2018) found that in 11 of the largest 25 U.S. cities, a four-person household at the 20th income percentile would pay more than 10% of its disposable income on drinking water and wastewater services. The study also found that in 17 of the 25 largest cities, that same four-person household would need to work more than 8 hours at minimum wage to afford their monthly drinking water and wastewater bill. While the study alone cannot be used to determine which utilities have a water affordability challenge, it does highlight that low-income household affordability cannot be understood by simply evaluating a utility's overall affordability using MHI-based metrics (Teodoro, 2018).

Using a random sample of utilities serving populations of 3,300 and higher, Teodoro (2019) found that low-income households must spend an average of 9.7% of their disposable income and/or work 9.5 hours at minimum wage to pay for basic monthly drinking water and wastewater services, with considerable variation across utilities. The study was repeated by Teodoro and Saywitz (2020) using the same methodology with additional rate data included, serving a combined population of almost 44 million. Results showed that low-income households must spend an average of 12.4% of their disposable income and/or work 10.1 hours at minimum wage to pay for basic monthly drinking water and wastewater services. The authors found that between 2017 and 2019, affordability challenges increased in larger utilities (Teodoro & Saywitz, 2020). Teodoro and Thiele (2024) found that the average monthly household bill in 2023 was 20% higher than it was in 2017. Teodoro and Thiele (2024) also found for households at the 20th percentile income within communities included in this dataset, 19.4% had AR values (AR as described in Section 3.2 representing drinking water and wastewater costs as a ratio of disposable income) greater than 20.0, and 9% had AR values greater than 60.0.

Studies Measuring Water Affordability Using Community-Level MHI

Patterson and Doyle (2021) and Cardoso and Wichman (2022a) compared the results from their household-level income analysis to one using community-level MHI. Patterson and Doyle (2021) showed that 34.2% of utilities included in the study served a community where a low-income household must work more than 8 hours at minimum wage for 4,000 gallons per month of water usage. However, only 1.2% of utilities served a community where more than a day of labor was required for median households to pay that same bill. The financial burden for the median household was typically less than half a day of labor, which increased to 0.5–1.4 days of labor for low-income households, and to 0.8–1.6 days of labor for a single minimum-wage earner (Patterson & Doyle, 2021). Similarly, Cardoso and Wichman (2022a) show that 10% of households have unaffordable water bills while only 0.8% of communities are water burdened when assessing affordability using the community-level MHI.

Most recently, the 2024 LIHWAP Water Utility Affordability Survey report evaluated household-level burden by calculating monthly drinking water and wastewater costs first as a percentage of MHI,

and then as a percentage of income at 75% of the HHS federal poverty guidelines. Based on median household income, the average water burden was 2.7%, with a minimum of less than 1% and a maximum of 15.2%. For households at 75% of the poverty guidelines, the average water burden was 7.3%, with a minimum of 1.8% and a maximum of 40.2% (OCS, 2024a).

4.3 Prior State and Local Level Research on the Extent and Prevalence of Water Affordability Challenges

In addition to the national studies summarized in the previous section, several state-level water affordability assessment reports have been conducted by states, a university, or a nonprofit company. Key findings from state-specific water affordability assessment reports[5] are discussed below:

- The *2023 California Drinking Water Needs Assessment*, which includes a drinking water affordability assessment of community water systems within the state, found that 3% of utilities assessed had a high affordability burden, 12% had medium affordability burden, and 45% had a low affordability burden. High, medium, and low affordability burdens are as defined by the 2023 report (Abhold et al., 2023).[6] A 2024 update of the assessment showed that 3% of utilities had a high affordability burden and 10% had a medium affordability burden. The remaining utilities did not exceed an affordability indicator threshold (Abhold et al., 2024).
- The *Michigan Statewide Water Affordability Assessment Report* released in 2022 found the average cost of water across Michigan rose 188% from 1980 to 2018, after adjusting for inflation. For Michigan's 20th percentile income households, water costs increased over 443% over the 1980 to 2018 period (Read et al., 2022). The 2024 update to the Michigan Statewide Assessment found that 6.07% of households in the state paid combined drinking water and wastewater bills over 5% of household income. This percentage of households varied significantly by county, from 1.43% to 10.66%. The report also found that for those that have a high water burden, 70.8% to 78.1% live below the HHS poverty guidelines and most live below 200% of the poverty guidelines (Read et al., 2024).
- The *2023 Northern Arizona Water Affordability* study found that when measuring water affordability using the household burden indicator, the average score in Northern Arizona is 2.34%, and 3.02% for Tribal households. This means that on average, low-income households must dedicate over 2% of their income to pay monthly water costs. The study

[5] While these state-level water affordability assessment reports were not obtained from peer-reviewed sources, EPA is including them in this report as they provide valuable insight into trends in water affordability at the state-level.

[6] Affordability burden for the 2023 CA Drinking Water Needs Assessment is determined using three affordability indicators: 1. %MHI (residential customer charges for six centum cubic feet (CCF) of water per month that meet or exceed 1.5% of the MHI within a service area), 2. "Extreme Water Bill" ("drinking water customer charges that meet or exceed 150% and 200% of statewide average drinking water customer charges at the six CCF level of consumption"), 3. "Household Socioeconomic Burden" (percent of households that make less than 80% of the Housing and Urban Development Area Median Family Income and pay more than half their income to housing costs). A "low affordability burden" mean the utility exceeds one affordability indicator threshold. A "medium affordability burden" means the household exceeds two affordability indicator thresholds. A "high affordability burden" means the utility exceeds three affordability indicator thresholds (Abhold et al., 2023).

found that, on average, households in the study area are able to pay for 4,000 gallons of monthly water consumption by performing 3.6 hours of labor at minimum wage (Heminger et al., 2023).

- A 2023 nonprofit report on Connecticut households, *Mapping Household Cost Burdens*, assessed the drinking water burden for communities in the state, and found that 37 population tracts, containing over 47,000 households, exceeded the 2% affordability threshold of income dedicated to drinking water services. By 2025, it is estimated that this number may increase to about 50 tracts, assuming an annual 5% increase in rates (Sears & Badger, 2023).

4.4 Prior Work Evaluating Regional Trends

Teodoro (2019) found that drinking water and wastewater bills are, on average, more affordable in the Western U.S. than in other regions. Patterson et al. (2023) found that the Southwest, Mid-South, and Great Plains regions generally had less expensive water services and a lower pervasiveness of unaffordability when compared to Eastern regions. The study showed regional concentrations of unaffordability challenges in the Eastern U.S., particularly within West Virginia, Ohio, and Indiana. Both the cost of water services and pervasiveness of unaffordability were more sensitive to the volume of water used in the Eastern U.S. than in the Western regions (Patterson et al., 2023). This study attributes these findings to both steeper increases in water services costs at higher water usages combined with the relatively high poverty in these same regions.

Patterson et al. (2023) also found that while bills were comparable in the Southeast, Midwest, and Southwest regions, unaffordability in the Southeast and Midwest was higher as a result of lower household incomes in those regions. Both the Pacific Northwest and Mid-Atlantic regions had higher median monthly bills; however, the distribution of water burden differed between those two regions. Many communities in the Mid-Atlantic region had higher bills than other regions, whereas the Pacific Northwest only had a handful of communities with very high water bills. As a result, the Mid-Atlantic region generally experienced higher levels of unaffordability than the Pacific Northwest (Patterson et al., 2023).

Cardoso and Wichman (2022a) found evidence that water affordability concerns are prevalent in the Southwest and Southeast regions. However, this study also found significant concerns within many states and within urban areas across the United States. The authors concluded that affordability concerns are inherently a local issue dictated by the distribution of income within a community (Cardoso & Wichman, 2022a).

4.5 Key Findings on Socioeconomic Trends and Other Factors Impacting Water Affordability

In addition to evaluating the prevalence of water affordability challenges across the U.S., researchers have explored trends that impact water affordability, including socioeconomic characteristics of the community and characteristics of the utility.

Local Income Distribution. Results from multiple studies showed that water affordability challenges increase as income distribution becomes more unequal (Teodoro, 2019; Patterson et al., 2023). The *LIHWAP Water Utility Affordability Survey Report* found that the percentage of the population under 150% of the Federal poverty guidelines was not a significant predictor of drinking water and wastewater rates. This report indicated that rates are set at the level needed to support the utilities' operational costs, and these rates may be unaffordable for low-income households (OCS, 2024a). Furthermore, Patterson and Doyle (2021) argued that widespread poverty is a major contributor to utility financial capability challenges.

Utility Size[7]. Results from multiple studies showed that affordability improves significantly as utility size increases (Teodoro, 2019; Patterson et al., 2023). Another study showed that larger utility service populations are associated with lower bills (El-Khattabi et al., 2023). Similarly, the *2023 California Drinking Water Needs Assessment* found that small community water systems included in the assessment charged an average of $71.31 for 6 CCF (equivalent to 4,488 gallons), while medium and large community water systems included in the assessment charged an average of $45.28 and $41.14, respectively, for 6 CCF in 2021 (Abhold et al., 2023).

Utility Ownership. El-Khattabi et al. (2023) showed that municipally owned utilities often have lower water bills than for-profit utilities. The study also found that higher rates are charged by utilities that use purchased water as a main source (El-Khattabi et al., 2023).

Race and Ethnicity. A 2022 study found that the number of households facing affordability concerns is positively correlated with the proportion of Black or African American residents and negatively correlated with the proportion of Hispanic or Latino residents within a CBG, even after conditioning on prices and poverty levels (Cardoso & Wichman, 2022a).

4.6 Prior Work Evaluating Policy Implications of Water Affordability Study Findings

A key area of the water affordability literature focuses on applying the findings on water burden to develop recommendations for addressing these challenges throughout the United States. Researchers have investigated how current pricing models impact affordability, modeled the potential impacts of policy interventions, and highlighted other considerations for the design of policies.

Rate Structures. Water affordability is not only impacted by levels of water rates but also by the structure of those rates. Water utilities typically price water using a volumetric charge and may also include a fixed service charge that does not depend on the quantity consumed. The volumetric charge may be uniform or, more commonly, tiered and increasing with use, also known as an increasing block tariff (IBT). El-Khattabi et al. (2023) showed that utilities that price water using IBTs have lower rates at a modest level of water usage (4,000 gallons per month).

[7] Non-community water systems generally do not have water rates. As such, they are not typically included in water rates affordability analyses.

Cardoso and Wichman (2022a) found that rate structures that included a fixed service charge fee were positively correlated with the proportion of households with unaffordable water. Teodoro and Thiele (2024) found water rate structures became more regressive between 2017 and 2023, with utilities collecting less revenue through volumetric charges and more revenue through fixed charges.

Self-Funded Customer Assistance Program Benefit Types. Cardoso and Wichman (2022a) simulated the effects of different self-funded assistance programs on the total income share that households allocate to water services. The simulations evaluated two different benefit types (50% rate discount vs. uniform lump-sum rebates) and two different funding mechanisms (uniform water rate increase vs. a local income tax on non-eligible households). The results showed that lump-sum rebates to low-income households funded through local income taxes achieve affordability targets with fewer unintended consequences than policies that operate through lower water rates, as these policies may reduce incentives for water conservation (Cardoso & Wichman, 2022a).

Variation in Rates Across Utilities. El-Khattabi et al. (2023) highlighted the significant variation in rates among utilities within the same metropolitan statistical area and stressed the importance of accounting for this variability in rates between utilities when designing low-income water affordability or assistance programs.

Utilities with High Levels of Poverty. Patterson and Doyle (2021) stated that widespread poverty affects both the prevalence of water unaffordability experienced at the household level as well as the financial capabilities of the utility. The authors argued that CAPs may be insufficient to address these financial capability challenges, and that utilities should pursue a variety of solutions to reduce utility costs, such as increasing economies of scale, improving revenue collection, or hiring locally to stimulate the local economy (Patterson & Doyle, 2021).

4.7 Summary

The water affordability literature reveals many considerations for understanding the scale of water burden across the U.S., from comparing the data and methods used in various studies to factoring in regional and socioeconomic trends and policy implications. The existing research shows that an estimated 5.8% to 17.1% of households in the U.S. face water affordability challenges. Multiple factors contribute to these challenges, including local income distribution, rate structure, utility size, and race. Although estimates vary across regions and socioeconomic factors, several studies showed an increasing prevalence of water affordability issues, revealing significant concerns across many areas of the United States.

5. Water Affordability Analysis

IIJA Section 50108 requires EPA to characterize the extent and prevalence of water affordability challenges faced by households and utilities across the U.S. It requires EPA to examine the "prevalence of a lack of affordable access to water services" throughout the U.S., and to estimate the prevalence of water utilities servicing a "disproportionate percentage" of "qualifying households with need." IIJA Section 50108 is available for reference in Appendix B: Infrastructure Investment and Jobs Act Sections 50108 and 50109. Responsive to the IIJA requirements, EPA's Water Affordability Analysis found the following:

- **Between 12.1 million and 19.2 million U.S. households experience high water burden**. EPA evaluated the distribution of percentage of household income required to pay for basic water services using income and water service rates data from households and utilities across the U.S. EPA then compared the percentage of household income spent on drinking water and wastewater bills against two affordability threshold values, 3% and 4.5%, as discussed in Section 3.3 – EPA's Approach for This Report, to determine the number of households experiencing a high water burden.
- **The total annual cost of unaffordable water service bills is between $5.1 billion and $8.8 billion**. EPA calculated the total dollar amount of water service costs exceeding each selected affordability threshold value to estimate the total national costs of households experiencing high water burden. This represents between 9.2% to 14.6% of total households in the U.S. The cost of unaffordable water service bills only includes the

amount of each bill exceeding an affordability threshold amount, not the entire bill. See Section 5.1.1 and Figure 5 for more details on this calculation.

- **Approximately 10,340 community water systems throughout the U.S. service a disproportionate number of households experiencing high water burden.** EPA evaluated the number of "qualifying households" using the IIJA definition that compared household income to federal poverty guidelines. EPA then calculated the percentage of qualifying households as compared to total households within the drinking water service area boundaries of each utility. EPA considered utilities to have a disproportionate percentage of qualifying households when the percentage of qualifying households exceeded 40% or approximately the 75th percentile of utilities across the U.S.

5.1 Analysis of the Prevalence of Households Lacking Access to Affordable Water Services and Estimated National Costs

EPA's water affordability rates analysis evaluated the distribution of percentage of household income required to pay for basic water services throughout the U.S. Results show that between 12.1 million households (9.2% of all households in the U.S.) and 19.2 million households (14.6% of all households in the U.S.) are estimated to have unaffordable bills. The analysis also showed that more than 75% of households in the lowest quintile of income have unaffordable water bills at the 3% income threshold, and more than 50% of these households have unaffordable water bills at the 4.5% income threshold. This section presents EPA's Water Affordability Analysis data sources, methodology, findings, and data limitations.

5.1.1 Data Sources and Methods

The water rates affordability data analysis conducted in this report combined two primary sources of existing residential drinking water and wastewater rate data: the Duke Nicholas Institute for Energy, Environment & Sustainability Water Affordability Data Dashboard (Duke) and the Cardoso and Wichman (2022b) publication dataset (C&W). Water rate data was also included from the Wisconsin Public Service Commission (WIPSC).

- **Duke:** Data and code for merging drinking water and wastewater rates to CBGs are publicly available from a repository (Patterson, 2022). Combined drinking water and wastewater rates were available at intervals of 1,000 gallons. Rate data in the Duke dataset were matched to the CBG using the percentage of overlap between the CBG and the service area boundaries. That is, a weighted average of utility rates was calculated per CBG using the percentage of overlap of the CBG within each utility boundary. Please note, the data in this repository includes limited stormwater rates. However, stormwater was not included in this analysis due to lack of consistent availability.
- **C&W:** The Cardoso and Wichman (2022b) dataset used in their paper (Cardoso and Wichman, 2022a) is available by subscription. This dataset combined drinking water and wastewater rate data from the UNC EFC dashboard (accessed in July 2017) and the 2016 American Water Works Association (AWWA) Water and Wastewater Rate Survey. Combined drinking water and wastewater rates were available at intervals of 5 CCF (centum cubic feet) or intervals of 0, 3740, 7480, and 11220 gallons. Drinking water and wastewater rate

data were matched to the county level using the county of the utility headquarters. Every household in the county was assumed to face the same rates, equal to the average rates in the county.

- **WIPSC:** State-level water rate data from the Wisconsin Public Service Commission and via University of North Carolina Environmental Finance Center from the year 2020 at intervals of 1,000 gallons are available from the state dashboard webpage (UNC EFC, n.d.). These rates do not include wastewater rates; therefore, average wastewater rates from 2020 (estimated from the Duke data) were added to the reported water bills. Rates were matched to the census tract level using the city name of the water utility.

When combining these three sources of data, rates were matched to CBGs covering 59% of the U.S. population. It is important to note that this does not imply that the underlying rates data had the same coverage. Because rates were aggregated at county level in the C&W data, the census tract level for the WIPSC data, and the CBG level in the Duke data, the coverage of rate data for the households actually subject to those rates is much smaller and potentially different. As discussed previously, primary limitations of conducting a national water affordability study include the shortage of rate data, the lack of a nationally representative sample of rates, and the difficulty in precisely matching rates geographically to census data. When combining the Duke, C&W, and WIPSC datasets, there were no data for the states of Montana, North Dakota, Oklahoma, Tennessee, Vermont, West Virginia, the District of Columbia, or any U.S. territories. To estimate the total number of households in need of water assistance nationwide, rate data were extrapolated for the counties that did not have data using a regional average. Eight regions were defined for the continental U.S. following Patterson et al. (2023), as well as two regions for Hawaii and Alaska.

Drinking water and wastewater rates were adjusted to 2024 dollars using the water and sewer and trash collection services CPI available from the St. Louis Federal Reserve Economic Data (U.S. Bureau of Labor Statistics, 2024b). The drinking water and wastewater rate data were matched to census data from the 2022 5-year American Community Survey (ACS) at the CBG level (U.S Census Bureau, 2024a). Income data from the ACS were adjusted to 2024 dollars using the CPI for all items (U.S. Bureau of Labor Statistics, 2024a). If data were available for a given CBG from both the WIPSC and the C&W datasets, the WIPSC dataset was chosen because the WIPSC data are more recent, available at more refined values, and matched to a smaller geographic area. If data were available for a CBG from both the Duke and C&W datasets, the data from Duke were chosen for that block group. The Duke data were assumed to be the most accurate for several reasons: 1) Rate data in the Duke dataset were matched to the CBG using service area boundaries, 2) the Duke dataset is the most recent, and 3) the combined rates from the Duke data are available at granular intervals of 1,000 gallons, which reduced errors from linearly interpolating rates at other consumption values.

Monthly water use was calculated using a hygienic value of 50 gallons per person per day, multiplied by 30 days per month, and multiplied by the household size. Following Cardoso and Wichman (2022a), the monthly water use was estimated using the average size household of that CBG. That is, every household within the CBG was estimated to have the same size household, which is equal to the average household size of the CBG. Monthly total bills were then estimated using the combined drinking water and wastewater data at the household's estimated monthly hygienic need. Drinking water and wastewater rates were linearly interpolated for consumption

values between the known quantities from each dataset (intervals of 5 CCF for C&W or intervals of 1,000 gallons in Duke and WIPSC). EPA's analysis assumes that renters who may not pay drinking water and wastewater bills directly must pay the full cost of these bills indirectly through their rent payments.

The distribution of household income in the CBG was estimated using the counts of households in each income bracket from the census data. Following Patterson and Doyle (2021) and Patterson et al. (2023), household incomes were randomly generated in each income bracket according to these counts and assuming that incomes were uniformly distributed within each income bracket. Following Cardoso and Wichman (2022a), the assumed minimum possible income was set to $5,000 per year for households in the lowest income bracket, and the maximum possible income was set to $300,000 per year for households in the highest income bracket. Estimates of the percent of household income dedicated to drinking water and wastewater services were generated by dividing the estimated monthly water payments for hygienic household needs by the estimated monthly household income. For households paying more than the affordable threshold, EPA calculated the difference between the monthly amount and the assumed level of affordable water bills.

Households were defined as qualifying for assistance if their income was less than the greater of 60% of state MHI and 150% of the Federal Poverty guidelines. Estimates of the total number of qualifying households in need of assistance were generated by summing up the counts of qualifying households with unaffordable bills in each CBG across the nation and adjusting for the growth of households nationwide between the 2022 5-year ACS and 2024 estimates from the Census Bureau (U.S. Census Bureau, 2024a; U.S. Census Bureau, 2024c). However, not every household within the CBG is connected to utilities, and some may instead use well water or decentralized wastewater treatment. This is more common in rural areas. The percent of households connected to piped water was last surveyed in the 1990 Census. EPA used estimates of the percentage of households connected to piped water that have been extrapolated to 2020 using geographical characteristics and trends in population growth per CBG (U.S. EPA, 2020). To adjust for well water use, estimates of the total number of qualifying households with need and the total cost of a water assistance program per CBG were multiplied by the share of households that are connected to piped water.

EPA calculated the annual cost of the unaffordable portion of water service bills for qualifying households nationwide. The affordable portion of water service bills was calculated by multiplying monthly household incomes by each affordability threshold percentage (3% and 4.5%). EPA calculated the total dollar amount of monthly water service costs exceeding each selected affordability threshold value and summed these to estimate a range for the annual cost of the unaffordable portion of water service bills for qualifying households nationwide. Figure 5 shows this process for an example household (Household A). In this example, Household A's water bill represents 10% of its household income. Using the 3% affordability threshold, the maximum affordable water services bill for Household A would be $30. The amount of the bill that exceeds the affordability threshold, or $70, represents the unaffordable portion of the water services bill. Using the same method and considering a 4.5% affordability threshold, $45 of the bill is affordable to Household A and $55 is unaffordable.

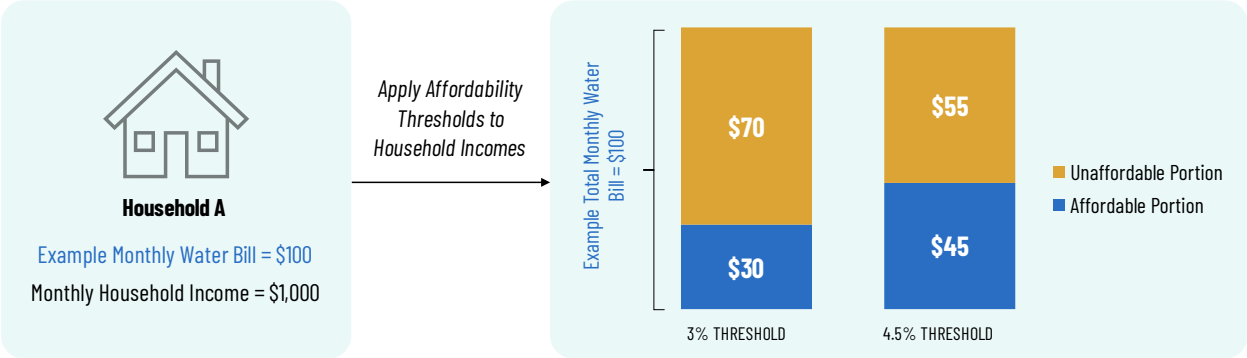


Figure 5. EPA's approach to calculating the unaffordable portion of water service bills

Note: The monthly water bill and monthly household income were chosen only for ease of calculations and are not meant to represent any particular household.

The summation of the unaffordable portion of water service bills (shown in orange in Figure 5) across the U.S. represents the total national assistance need for qualifying households that currently have unaffordable water bills.

5.1.2 Summary of Findings

As summarized above, EPA replicated approaches from similar studies to evaluate water affordability. The section below walks through the detailed analysis and findings used to calculate the affordability cost and extent of households impacted across the country. The Figure summaries provide detailed descriptions of the approach used and findings.

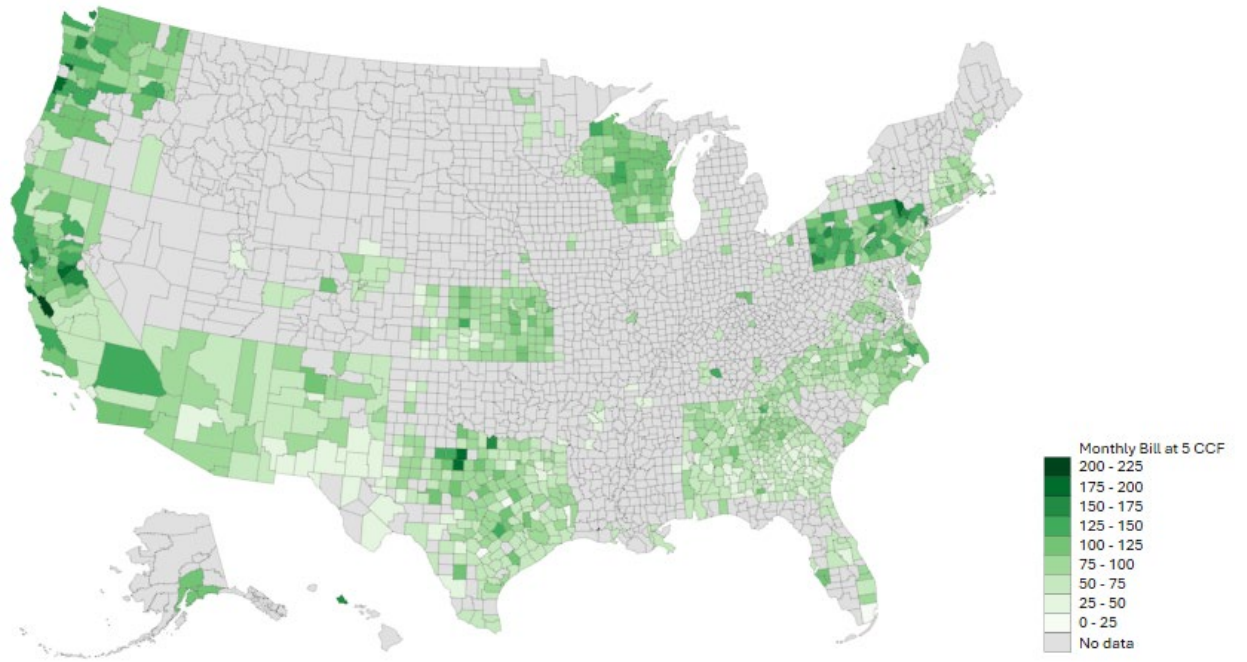


Figure 6: Average Monthly Drinking Water and Wastewater Bills for Consumption at 5 CCF (in dollars)

Figure 6 shows the average monthly drinking water and wastewater bills (in dollars) for consumption at 5 CCF (3,740 gallons) using the combined sample of rates from the Duke, C&W, and WIPSC datasets. This consumption value is approximately equal to the monthly hygienic use for a household that consumes 50 gallons per person per day and has 2.5 members, which is approximately the national average household size in 2022 (U.S. Census Bureau, 2024a). Rates are matched to CBGs for approximately 59% of the population; however, there are significant geographical data gaps. Rate data are particularly limited in the Great Plains region.

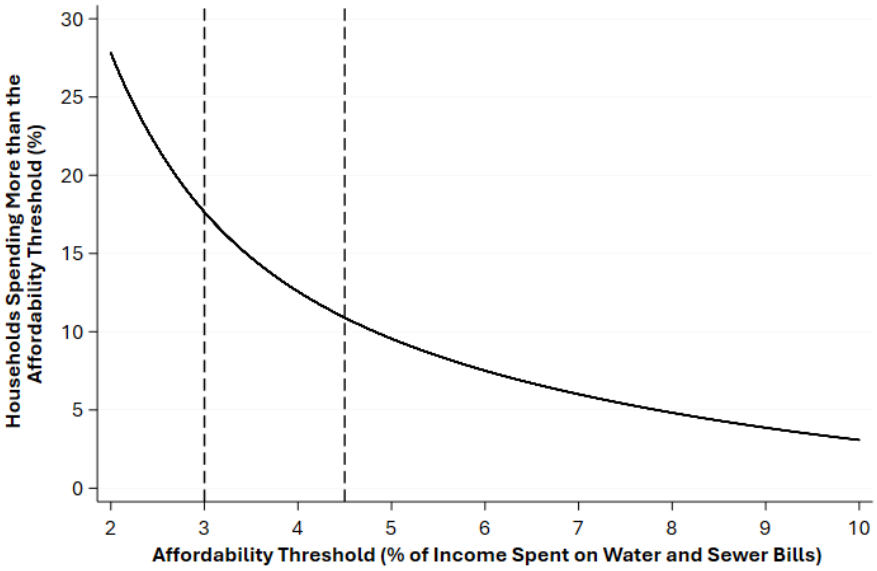


Figure 7: Households Served by Water Utilities Spending More than the Affordability Threshold on Water Bills (All Households)

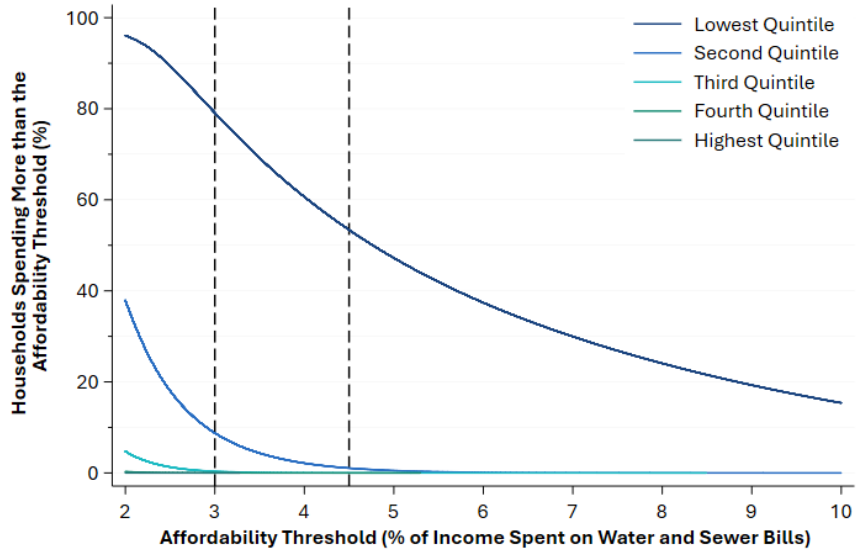


Figure 8: Households Served by Water Utilities Spending More than the Affordability Threshold on Water Bills (by Income Quintile)

Figures 7 and 8 show the percentage of households served by water utilities that spend more than the affordability threshold on the y-axis and the percent of income spent on drinking water and wastewater bills on the x-axis. Figure 7 shows all customers, and Figure 8 shows the results separately by quintile of income. Approximately 11% of households that are supplied by water utilities have unaffordable bills at the 4.5% threshold. At the 3% threshold, this percentage increases to 18% of households supplied by water utilities.

Figure 8 demonstrates that water unaffordability is primarily an issue for households in the lowest quintile of income. More than 75% of households that are supplied by water utilities in the lowest quintile of income have unaffordable water bills at the 3% income threshold, and more than 50% of these households have unaffordable water bills at the 4.5% income threshold. Income thresholds used in this analysis are discussed in detail in Section 3.2.3. Furthermore, approximately 15% of households that are supplied by water utilities in the lowest quintile of income spend more than 10% of their income on drinking water and wastewater services.

Affordability Metric	Affordability Cutoff 3%	Affordability Cutoff 4.5%
Total Qualifying Households with Unaffordable Water (in Millions)	19.21	12.10
Average Yearly Cost of the Unaffordable Portion of Water Service Bills per Household (in dollars)	456.75	421.09
Total Yearly Cost of the Unaffordable Portion of Water Service Bills Nationwide (in Billions of dollars)	8.84	5.13

Table 1: Estimates of the Number of Households with Unaffordable Water and Yearly Assistance Costs

Table 1 shows the estimated number of qualifying households with unaffordable bills, the average yearly household assistance costs for these households, and the total yearly assistance costs. At the 4.5% threshold, 12.1 million qualifying households (9.2% of all households in the U.S.) are estimated to have unaffordable bills. This number increases to 19.2 million qualifying households (14.6% of all households in the U.S.) at the 3% affordability threshold. The second row of Table 1 is an estimate of the average yearly amount of assistance that would be needed for water bills to be affordable for qualifying households that currently have unaffordable water bills. The third row of Table 1 is a nationwide sum of the yearly assistance costs for qualifying households with unaffordable bills. At a 4.5% affordability threshold, the yearly total assistance costs are estimated at $5.1 billion. This total increases to $8.8 billion at the 3% affordability threshold.

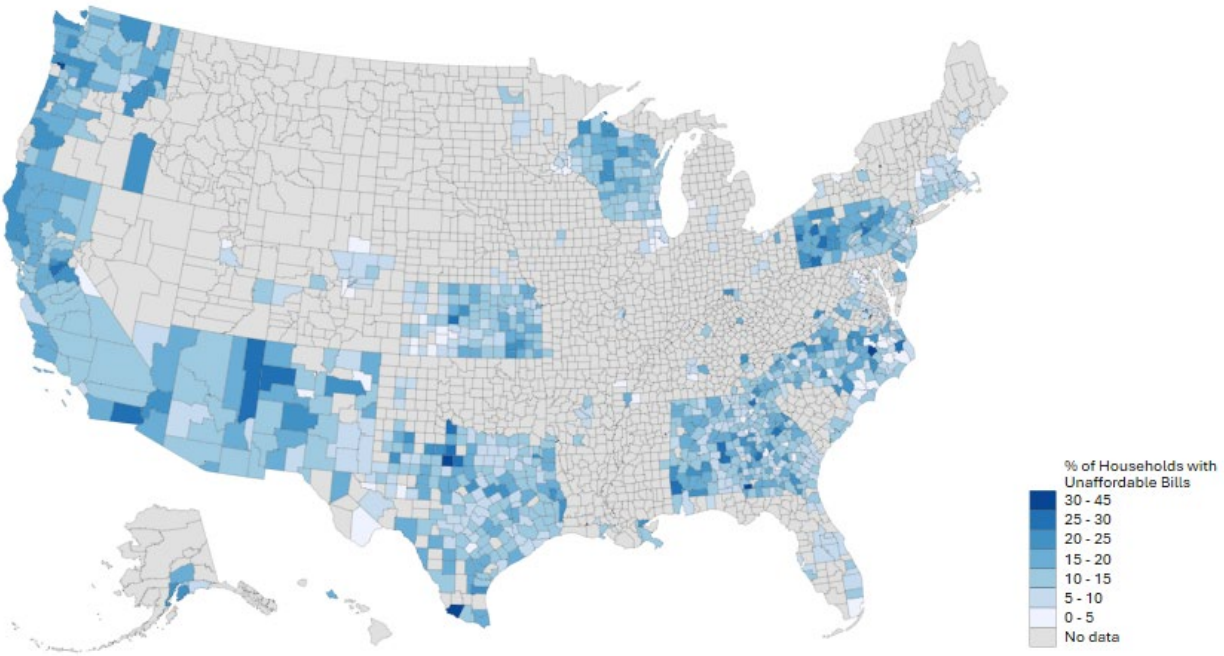


Figure 9: Estimated Percent of Households with Unaffordable Bills at the 4.5% Threshold (Counties with Rate Data)

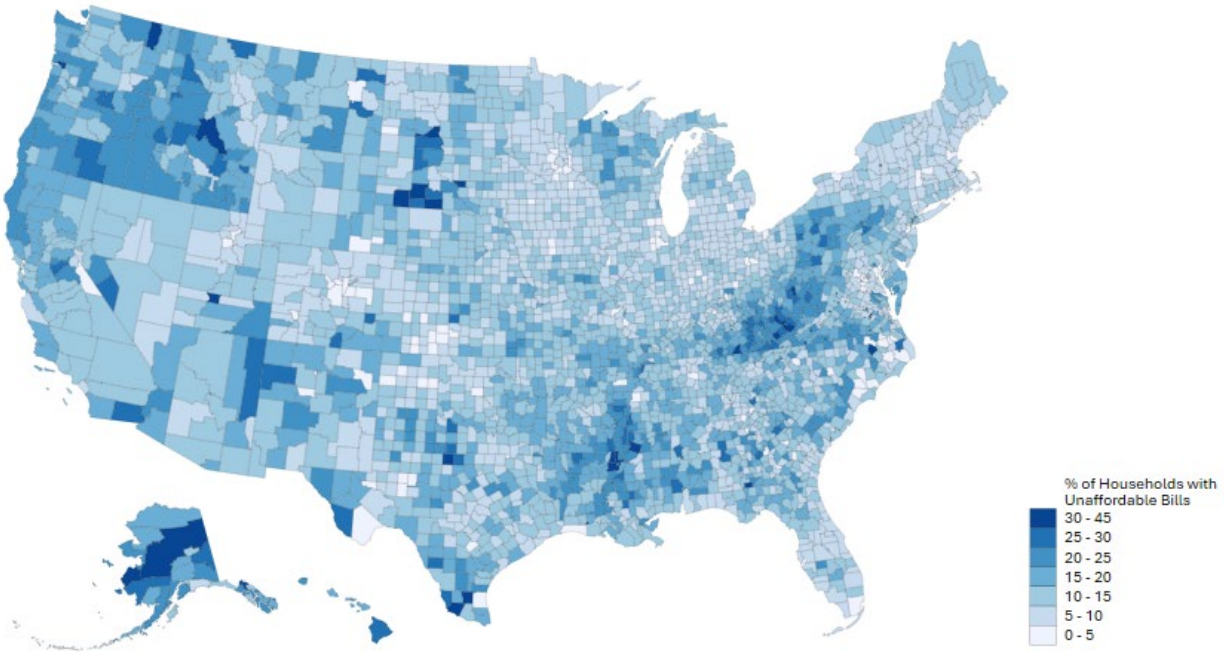


Figure 10: Estimated Percent of Households with Unaffordable Bills at the 4.5% Threshold (All Counties)

Figures 9 and 10 show the estimated percent of households with unaffordable bills at the 4.5% threshold for counties with available rate data (Figure 9) and extrapolated for all counties in the U.S. (Figure 10). For counties with no rate data available, the average rates at 0, 5, 10, and 15 CCF of the region were imputed and used to calculate household-level water bills. That is, all households in the counties with missing data were assumed to face the same drinking water and wastewater rates, equal to the regional average rates. Figure 10 shows significant variation in the percentage of households with unaffordable bills even for counties with imputed rate data. This is due to the variation in average household size and the income distribution within each CBG and highlights the importance of considering the socioeconomic characteristics of the population in an affordability analysis.

In-Depth Analysis: California-Specific Analysis

Water bills are not uniform across the U.S. Some states have much higher needs and any national program should be built to reflect that disparate need. California is one state with acknowledged affordability issues (California State Water Resources Control Board, 2021). To examine household burdens in a high-cost state and to demonstrate how EPA could use more detail in a future report, EPA focused on California, which collects a large amount of data on water systems as part of their Electronic Annual Report (eAR) survey (California State Water Resources Control Board, 2024b). The survey asks systems for a wealth of detailed data, including on rate structures, and then automatically calculates the rates for 6, 9, 12, and 24 CCF.

EPA used the distribution of California household incomes generated in the qualifying household analysis described in Section 5.2 and assigned these households water costs for 50 gallons per person per day. Household size was determined by intersecting the service area boundaries with the 2022 5-year ACS data; one average household size was used for each system.

The results of this analysis are shown in Table 2 below. The total needs (costs of water bills over 4.5% of household income) for qualifying households with need are $859 million. The average need per qualifying household is lowest for the largest systems sizes and generally increases as system size decreases.

Population Served	Number of Households	Number of Qualifying Households	Number Qualifying Households with Need	Total Annual Need	Annual Need per Qualifying Household with Need
>100,000	6,459,019	1,866,485	312,382	$ 406,939,863	$ 1,302.70
10,001-100,000	3,893,940	1,155,710	239,883	$ 359,678,605	$ 1,499.39
3,301-10,000	357,672	126,965	31,380	$ 54,299,402	$ 1,730.38
501-3,300	204,278	76,764	18,559	$ 30,955,042	$ 1,667.93
<=500	59,828	21,948	5,610	$ 9,822,090	$ 1,750.82

Table 2: California Analysis

Please see Appendix F for details.

5.1.3 Discussion of Data Limitations

Drinking Water and Wastewater Rate Data

The primary limitation of this analysis is the minimal availability of drinking water and wastewater rate data. There have been several recent efforts to collect comprehensive rate data (UNC EFC, n.d.; Patterson, 2022; California State Water Resources Control Board, 2024b). Despite these efforts, developing a census of rates remains elusive because gathering rate data from the numerous small and very small utilities is challenging, and rate data must be updated frequently as utilities change their rates. Therefore, current sources of rate data likely underrepresent small and very small utilities because of the difficulty in obtaining rate data for these utilities. Teodoro (2019) omitted utilities serving fewer than 3,300 people from the randomized sample of rates collected, and Patterson and Doyle (2021) note that medium and smaller utilities are underrepresented in their sample of rates due to missing data for these utilities. These utilities may also have higher rates because smaller utilities are less able to take advantage of economies of scale, making certain costs associated with providing drinking water and wastewater services comparatively more expensive. Furthermore, small and very small utilities may be more common in rural and Tribal areas that have disproportionally more qualifying households in need. The rate data in this Report are not geographically representative of the U.S., which may result in variability due to the aforementioned underrepresentation of small and very small utilities, the inclusion of specific areas where affordability issues may be more severe, or other variations between data used and the U.S. as a whole. A nationally representative survey of drinking water and wastewater rates would allow researchers to estimate household income dedicated to water services with greater confidence. EPA intends to conduct further research on drinking water and wastewater affordability using a nationally representative survey of rates.

Additionally, this analysis does not cover decentralized wastewater treatment systems (e.g., septic systems), private drinking water wells, or stormwater costs. These costs are not typically represented on utility bills and are not consistently represented in the national data used for this analysis. Further research on these systems, funding needs, and household affordability impacts related to stormwater, private drinking wells, and decentralized systems will be an area of focus for EPA in subsequent studies

Census Data

EPA was able to estimate the income dedicated to water services using the full distribution of household income. However, the average household size per CBG was applied to every household within the CBG, because data on the variation in household size within each income bin are not publicly available. The percentage of income spent on water services by low-income households in a CBG could be underestimated if average household size decreases with income and overestimated if average household size increases with income in that CBG. On a national level, average household size increases with income (U.S. Census Bureau, 2024b). Census data with household by income size cross-tabulations or individual-level census data would allow researchers to develop a more accurate estimate of both the number of households that would qualify for water assistance and the number of those households with unaffordable drinking water and wastewater bills. In future research on water affordability, EPA intends to develop a dataset

with more detailed census information that is better suited to answering these questions than the publicly available ACS data.

Matching Census Data to Rate Data

Limited geographical refinement of the drinking water and wastewater rate data used in this report restricted EPA's ability to precisely match rate data to CBGs. The C&W data was averaged and matched at the county level, the WIPSC data was averaged and matched at the census tract level, and the Duke data was averaged and matched at the CBG level. Furthermore, rates were imputed using the regional average for CBGs with no rate data. Higher levels of geographical aggregation may obscure the affordability challenges of households that are served by utilities with disproportionally higher rates. Ideally, all rate data should be matched to the exact population of the service area. However, in the absence of geo-located census data, the most accurate method would use service area boundaries to match census data at the CBG level to the utility. Recent efforts to map water utility service area boundaries for drinking water utilities by EPA (U.S. EPA, 2024d) make this approach for matching water rates to census geographies feasible. Wastewater utility service area boundaries have not been completed at the time of this analysis. EPA plans to use nationwide service area boundary datasets for both wastewater and drinking water utilities to more precisely match rates to census data in future research on water affordability.

Poverty Guidelines

Following the IIJA language, one indicator in qualifying household analysis is household income less than 150% of HHS poverty guidelines (See Appendix A for full IIJA language). The poverty guidelines are updated annually.[8] These guidelines are used mainly for determining eligibility for assistance programs and are based on household/family size. The guidelines are the same for all states except Alaska and Hawaii, which have individual state guidelines. In this study, we used a combination of the poverty guidelines (150%) and state MHI (60%) in our qualifying household analysis. The Census Bureau also provides poverty thresholds, which are updated each year. These thresholds are used mainly for statistical purposes and are based on family size and age, but do not vary geographically.

Another difference between the guidelines and thresholds is how the standards are applied. HHS does not set a definition of income for the poverty guidelines. However, programs applying the guidelines choose to include or exclude different categories of income such as non-wage income or cash assistance; these programs may also allow deductions for children or specific expenses (U.S. Government Accountability Office, 2017). The Census Bureau uses a specific definition of income when calculating the prevalence of poverty using the thresholds (U.S. Census Bureau, 2023a).

Caution is warranted when comparing poverty estimates from different sources, such as the studies in the literature that include poverty measures. Further, the calculation of poverty in the analyses in this study by necessity used ACS data to calculate income, which is different from the

[8] HHS notes that 'the poverty guidelines are sometimes loosely referred to as the "federal poverty level," but that phrase is ambiguous and should be avoided, especially in situations (e.g., legislative or administrative) where precision is important.' (https://aspe.hhs.gov/topics/poverty-economic-mobility/poverty-guidelines)

Census definition of family income used when calculating U.S. poverty rates. The ACS calculates household income from the sum of the responses to questions asking about eight specific categories of income (e.g., wage and tax income, retirement and pension income, etc.) (U.S. Census Bureau, 2023a; U.S. Census Bureau, 2024a). Some of this income data can be negative. For example, self-employment income is reported net after expenses. If these categories are negative, total household income can also be negative. The income measures in the ACS will not correspond to the income used for program eligibility for LIHWAP. [9] The results in the household level analysis in this report assume positive household income and therefore may differ from results using other income measures.

5.1.4 Comparison to other cost-relevant affordability analyses

This report estimates that between 12.1 million and 19.2 million qualifying households may face unaffordable water bills. The total cost of these unaffordable rates nationwide was estimated to be between $5.1 billion and $8.8 billion per year, excluding administrative costs. The average costs per participating household are estimated to be between $421 and $457 per year based on the analysis in this report. These topline numbers align with other estimates that have been developed independently, which relied on different methods and rate data. This section compares results from two recent independent estimates to EPA's findings.

The *Low-Income Water Customer Assistance Program Assessment Report* estimated that 7.5 million to 21.3 million households in the U.S. are water burdened, with a total annual need for water bill assistance between $2.4 billion and $7.9 billion. Like EPA's analysis, this estimate does not include costs associated with private wells and/or septic systems (Berahzer et al., 2023). Cost estimates are reflected in 2022 dollars. These estimates are similar to EPA's estimates[10].

The Washington State University (WSU) Calculator for Nationwide CAPs estimates that approximately 13.5 million to 28 million households in the U.S. are water burdened, with an annual water affordability need ranging from $6.6 billion to $13.7 billion. Table 3 shows the total number of households that would benefit from an assistance program and the annual cost of the program at three different eligibility thresholds based on household income as a percentage of the federal poverty threshold (Kraabel, Randriamaro, & Cook, n.d.). The upper range of the WSU estimates are higher than EPA's estimates for several reasons. The upper estimates use a cutoff of 200% of the federal poverty threshold, while EPA's analysis used a threshold of 150% of the federal poverty guidelines. The WSU Calculator for Nationwide CAPs assumes all income eligible households pay a water provider, even those on private wells. The total cost values also include administrative costs of 18.5% (covering administrative costs to sub-recipients, administrative costs to states, and

[9] As noted earlier in this report, LIHWAP eligibility thresholds were based on total household income (at or below 150% of the federal poverty guidelines, at or below 60% of the state MHI, or measured with another lower poverty threshold) as well as other eligibility criteria required by grantees (OCS, 2023a). LIHWAP allowed for categorical eligibility based on enrollment in other means-tested programs, such as TANF, SNAP, Supplemental Security Income (SSI), and LIHEAP (OCS, 2023a).

[10] Berahzer et al. 2023 is not a peer-reviewed study. The authors are leading economists and experts in the water affordability space. Many of the authors have published peer-reviewed studies. EPA's analysis uses two of the four affordability thresholds used in Berahzer et al. 2023, which could influence the two estimates to be similar. However, Berahzer et al. 2023 applies two additional thresholds, aggregates analysis to different geographies, and uses a different sample of water rates.

outreach and eligibility determinations); whereas EPA's estimates do not include administrative costs.

Assistance Metrics	At or Below 100% Federal Poverty Threshold	At or Below 138% Federal Poverty Threshold	At or Below 200% Federal Poverty Threshold
Annual Cost of Program	$6,590,000,000	$8,740,000,000	$13,709,000,000
Total Number of Households that would Benefit	13,478,000	17,858,000	27,967,000

Table 3. WSU Water Affordability Needs Assessment Model Results by Eligibility Requirement Threshold (% poverty threshold).

Note: Results assume 80% of eligible households participate; 4,500 gallons per month of water usage; and 25% essential use covered, including fixed charges.

Source: Washington State University Water and Sewer Customer Assistance Programs, Nationwide Program Estimator

5.2 Evaluation of Prevalence of Utilities Serving a Disproportionate Percentage of Qualifying Households

EPA calculated the national number of qualifying households using the 2022 ACS 5-year data (U.S Census Bureau, 2024). The ACS provides data tables of the number of households in each of 16 "bins" of annual household income ranges within a CBG. For example, the number of households with annual household income less than $10,000, from $10,000 to $15,000, and so forth, with the highest bin at greater than $200,000 in annual income. EPA then randomly assigned incomes within each bin for every household in that CBG to generate a full distribution of household income.

Using the IIJA qualifying household definitions of having income lower than the greater of 60% of state MHI or 150% of the HHS poverty guidelines, EPA calculated the share of qualifying households among all households in the census geographies. All households were assumed to be the average household size for the census geography when comparing against the poverty guidelines, which vary with household size.

Next, EPA merged census data geographically to utilities using a drinking water utility service area boundary dataset (U.S. EPA, 2024d). A weighted average of the census data was generated based on the proportion of overlap of the CBG with the service area boundary. This allowed EPA to estimate the share of qualifying households and the average household size in each utility's service area. This approach assumes that all households are evenly spread out within the CBG. Another data limitation is that service area boundaries are imprecise and may overlap. Therefore, for each utility, EPA divided the Safe Drinking Water Information System (SDWIS) service population by the estimated household size to calculate the number of households in each service area. EPA then multiplied the estimated number of households by the estimated share of qualifying households in each service area to develop an estimate of the number of qualifying households served by each utility.

The results are presented in Table 4 below by SDWIS population size category. The overall national estimate for the number of qualifying households in U.S. community water system service areas is estimated to be over 36 million households. The highest share of qualifying households is in the next-to-smallest population size category, although the number of households declines by size category. Table 4 also presents the number of utilities with more than 40% of households in their service area being qualifying households. This threshold was determined by EPA to represent water providers servicing a disproportionate percentage of qualifying households. This threshold is approximately equal to the 75th percentile of the distribution of the percentage of qualifying households served by utilities across the U.S.

IIJA Water Service Provider Classification (Population Served)	Average % Qualifying Households Served	Total Number of Qualifying Households Served	Total Number of Utilities	Number of Utilities Servicing more than 40% Qualifying Households
Large (>100,000)	30%	17,368,350	448	65
Medium (10,001-100,000)	30%	12,704,451	3,944	742
Rural (3,301-10,000)	31%	3,404,782	4,893	1,111
Rural (501-3,300)	33%	2,320,929	12,720	3,318
Rural (<=500)	30%	495,194	22,327	5,104
Totals	**31%**	**36,293,709**	**44,332**	**10,340**

Table 4: Number of Qualifying Households and Number of Utilities Servicing a Disproportionate Percentage of Qualifying Households by Utility Size

Note: Analysis was done by CBG. Appendix F includes a comparison of the analysis at the CBG level and at the census tract level.

EPA further examined the percentage of qualifying households served by Tribal utilities (identified as those utilities in SDWIS with Tribal primacy, serving a Tribal area, or having Native American ownership). These utilities have an average percentage of qualifying households of 45% with a median of 44.9%.

6. Arrearages, Disconnections, and Tax Liens

6.1 Impact of Arrearages to Households

Arrearages and water service disconnections can cause catastrophic disruptions to households and communities, including psychological stress (Kimutai et al., 2023) and threats to public health. Arrearages can lead to late fees and other penalties, wage garnishment through debt collection processes, impacts to an individual's credit score, and water service disconnections (Levine et al., 2022). Families need safe drinking water and wastewater access to prepare food, shower, and flush toilets. Shutoffs can pose a threat to public health and human dignity, disrupting people's ability to care for themselves and their dependents. Households that struggle to pay their water bills will often sacrifice other essential needs to maintain access to water services (Levine et al., 2022). Tax liens are also a threat sometimes linked to arrearages that can have potentially devastating impacts on homeownership rates, which have been shown to have greater impacts on communities of color (Montag, 2019).

While there is no comprehensive national source of water service disconnections and arrears, available data show that arrearages affect a large number of customers. For example, the 2023 LIHWAP survey found that, on average, 20% of households were in debt to their water utility. For Tribal communities, this debt figure increases to 32% of households. Average household debt per utility was $285, and $502 among Tribally owned utilities (OCS, 2024a).

Findings from the WIPSC's survey of drinking water utilities were largely consistent, showing the average percent of customer accounts in arrears varied from 11% to almost 20% and the average

debt per customer ranged from $110 to $255, with an inverse trend in utility size (Wisconsin PSC, n.d.). Table 5 shows the percentage of households with arrears and the average amount owed for customers in arrears. These data are specific to the state of Wisconsin, and further analysis is needed for other states.

Arrearage Metric	Very Large	Large	Medium	Small	Very Small
Number of Utilities	2	73	100	271	90
Total Estimated Population Served	841,815	2,098,049	747,175	567,050	26,262
Average % of Customer Accounts with Arrears	11.0%	13.7%	15.7%	19.6%	19.6%
Average Amount Owed Per Customer with Arrears	$109	$114	$215	$137	$254

Table 5. Wisconsin Drinking Water Utilities Arrearage Data for 2023 Quarter 4 PSC by EPA Water Utility Size Category

Another source of state-specific arrearage data comes from the California Water Boards' 2020 surveys, conducted to evaluate the financial impacts and household water debt during the COVID-19 pandemic. The Boards' estimated household water services debt across California totaled $1 billion as of January 2021, with approximately 1.6 million households or 12% of households in the state in arrears (California State Water Resources Control Board, 2021). The average household debt was approximately $500, and over 155,000 households had more than $1,000 in water debt (California State Water Resources Control Board, n.d.).

While arrearage data from Wisconsin and California provide a detailed look into the situation in those states, it should be noted that a wide range of factors can impact arrearages, including state laws. Additionally, utilities with CAPs may report lower levels and lower incidence of arrearages because they are providing assistance before a customer gets into arrears.

Data provided to EPA by the Water Agency Leaders Alliance further highlights the broad variation in arrearages between different utilities. Information from 30 water utilities in May 2024 indicates a wide range of arrearages, with about half of utilities reporting arrearages averaging more than $500 per customer, and nearly one-third (mostly large cities with large low-income populations) reporting arrearages averaging more than $1,000 per customer.

6.2 Impact of Arrearages to Utilities' Capital Budget Planning

Arrearages, or delinquent accounts, can result in significant financial impact to a utility. Utilities rely on rate payer revenue for their operating budget. Delinquent accounts negate a portion of this planned budget, forcing utilities to make up the difference elsewhere or defer necessary repairs and improvements. Additionally, rising numbers of arrearages can harm a utility's bond rating and

access to external lenders. Past due arrearages can affect cash on hand, debt service coverage, and the financial flexibility of the utility. Arrearages are a reoccurring issue, impacting a utility's budget on an ongoing basis.

Data from the Wisconsin PSC's annual survey of drinking water utilities provides a look into the impact of arrearages for utilities in that state. Data indicate that at the end of 2023, arrearages averaged 4.7% of annual operating revenue for the 74 smallest utilities (who serve populations less than 500) and 2.1% to 2.6% of operating revenue for the remaining 400-450 utilities that serve larger populations (Wisconsin PSC, n.d.).

The Detroit Water and Sewer Department (DWSD) is one example of a utility facing affordability challenges. As explored in a case study in Appendix A, 55% of DWSD's residential accounts are 30 days past due, and 35% of accounts are 60 days past due – with approximately 700 shutoff notices distributed per month.

Arrearages can account for hundreds of millions of dollars in some cities. For example, Milwaukee Water Works, Wisconsin's largest water utility, had $4.2 million of accounts in arrears, equal to 4.0% of its annual operating revenue, at the end of 2023 (Wisconsin PSC, n.d.). In New York City, delinquent payments reached $1.2 billion dollars from nearly 200,000 accounts during the COVID-19 pandemic (New York City Official Website, 2024). The LIHWAP survey found that an average of $15 million is owed to each very large utility (serving populations over 100,000) across the U.S. (OCS, 2024a). Arrearages at this level can seriously impact the operations and capital improvements of a utility. More analysis and detailed study of the scale of arrears across the country is recommended to better understand the financial hardship this imposes on utilities.

6.3 Disconnections Data Discussion

Disconnections present an immediate and significant impact to households, restricting access to safe drinking water, impacting hygiene and sanitation, and causing stress and anxiety. While data on the national prevalence of disconnections are limited, estimated disconnection rates from previous studies average around 2% to 5% of households evaluated. Some key findings are highlighted below:

- HHS's 2022 LIHWAP survey found that between 3.2% and 5.3% of households on average experienced disconnections at some point during the 2022 calendar year (OCS, 2024a).

- Results of a 2024 University of Southern California practicum[11] found that disconnections impacted 2.6% of households between 2012 and 2018. The report was prepared for EPA's National Center for Environmental Economics and explores disconnection data for the following seven U.S. cities: Chicago, Detroit, Grand Rapids, Milwaukee, Minneapolis, Seattle, and Washington D.C. Findings showed that most cities reported comparable levels of shutoff rates over time. Data showed a positive correlation between shutoff rates and Black or African American populations, poverty rates, and vacancy rates. Data also showed a negative correlation between shutoff rates and White, Asian, and Hispanic or Latino populations as well as MHI and education level (Gundersen et al., 2024).

Different states, cities, and utilities have different policies and laws on disconnections. For example, Wisconsin law requires utilities to add delinquent water bill amounts to the property tax roll as a tax lien every November. As a result, most water utilities in Wisconsin reported no disconnections in 2023, and of those that reported disconnections, only about 1% of customer accounts had been disconnected at the end of FY 2023. However, between 2% and 7% of Wisconsin customers on average had their delinquent billing amounts added to the property tax roll (Wisconsin PSC, n.d.).

[11] While the 2024 University of Southern California practicum was not obtained from a peer-reviewed source, the report uses a clear and transparent methodology.

7. Additional Recommended Analyses

The data analysis approach for this report addressed the immediate goal of estimating the number of qualifying households with need as described in IIJA 50108, estimating the number of utilities that service a disproportionate number of those households, and providing a national estimate of the total cost for addressing the water affordability challenges. To complete the analysis within a timeframe that reflects the urgency this challenge demands, EPA relied heavily on existing data and methodologies. There is still much work that needs to be done to fully characterize water affordability challenges and to reduce uncertainty of the estimates. In particular, a nationally representative sample of drinking water and wastewater rates and associated rate structures would allow EPA to estimate the prevalence of unaffordability challenges in greater detail, including specific trends analyses. EPA is preparing additional water affordability products to follow this report, including more detailed water affordability analyses, as well as addressing some of the gaps identified in the section below.

During the listening sessions for interested parties hosted by EPA in Spring 2024, participants stressed the importance of exploring numerous perspectives of water affordability and recommended that EPA conduct expanded analyses to explore potential contributors to water affordability challenges. Some of these areas include:

Analysis of water affordability challenges in Racially Ethnically Concentrated Area of Poverty (R/ECAPs) when compared to Non-R/ECAPs.
Analysis of water affordability challenges in Tribal areas compared to non-Tribal areas, as well as an evaluation of unique considerations faced by Tribes.
Evaluating future costs associated with climate change, drought conditions, water availability, aging infrastructure, and regulatory compliance to protect public health and the environment.
Evaluating federal and state compliance data with data on arrearages.
Evaluating the microeconomic impacts of rising water costs (e.g., impacts to local economies from decreased discretionary spending).
Conduct and make public a representative sample of water and wastewater rates and associated rate structures to estimate the prevalence of unaffordability challenges in greater detail, including specific trends analyses
Evaluating the impact of deferred maintenance on rates by analyzing data on age of system, water loss, and main breaks, and how rates coincide with nonpayment and other types of affordability data.
Analyzing the effectiveness and impact of disconnection moratoriums in states that discontinued water shut-offs during COVID-19, including evaluating the impacts, such as revenue impacts on utilities.
Perform a comparative analysis on non-U.S. countries to see if there are case studies or lessons learned on how to tackle growing water affordability challenges.

Two important areas requiring additional analyses and studies are decentralized wastewater systems and private drinking water wells. The 2022 CWNS includes estimates for decentralized costs. In 2022, 82% of the U.S. population was served by centralized wastewater treatment (U.S. EPA, 2024b). This means that 18% of the U.S. in 2022 either used a decentralized system or was unsewered. Further analysis is warranted to evaluate O&M costs for septic systems. This could involve comparing routine O&M costs to what a household might face if they did not maintain their septic system for a long period of time or if a situation occurs that compromises their septic system (e.g., root intrusion). Similarly, more research is recommended on the safety and cost of private drinking water wells. In 2021, EPA estimated that approximately 23 million households across the U.S. use private drinking water wells (U.S. EPA, 2024e). More analysis is needed to understand the scale and impact of these wells in the context of the broader water affordability issue.

These analyses may be beyond the scope of EPA's more comprehensive rates analysis and other affordability work products that EPA plans to produce in the next year. However, these are important areas for future research, and further reflect that water affordability is a multifaceted issue that has broad implications throughout the country.

8. Approach for Engaging Interested Parties

In preparation for this Report and as directed in Section 50108 of the IIJA, EPA gathered input from a diverse group of experts in the water affordability field. In March and April 2024, EPA hosted two series of targeted listening sessions for interested parties, each series consisting of three sessions. One series focused on gaining perspectives from water associations and utilities, while the other focused on feedback from nonprofit and advocacy communities. EPA invited participants from water utilities and associations, including rural advocacy associations, as well as select nonprofits, non-governmental organizations, and community-based organizations, to participate in these sessions. EPA provided the interested parties with background on this Report, solicited feedback on proposed data sources and EPA's data analysis approach, enlisted assistance in case study development and review, and discussed recommendations for addressing affordability challenges nationwide.

In June 2024, EPA hosted a broader-scale public listening session to hear from communities, utilities, and advocacy groups who were not previously involved in the report's development to share their experiences, perspectives, and ideas regarding water affordability challenges and recommendations.

Tribes have unique considerations, different challenges, and different opportunities for water affordability compared to the states. There is one Tribal case study included in the report: San Carlos. Although limited information was presented on this topic during the listening sessions, EPA acknowledges this is an important area for future coordination.

EPA obtained a wealth of information and recommendations from these sessions. Many of these recommendations are discussed in Section 7 - Additional Recommended Analyses. Some recommendations for areas of further analysis were beyond the scope of this report. However, EPA recommends these as areas for further study. Key themes of the sessions are outlined in this section.

8.1 The Impact of Water Affordability and Unique Considerations

Interested parties emphasized that water affordability challenges are not uniform, but rather different across communities, and different groups within each community face unique challenges. Some of these considerations include:

Low-Income Customers. It is important to consider the impact of water affordability challenges on low-income customers, including the need to address residential shutoffs. Session participants indicated that some low-income households have high water usage due to high occupancy, old or inefficient appliances and fixtures, and leaky plumbing. There are examples of successful utility conservation programs that have targeted lower-income households for conservation improvements to drive down the total usage and thus the total cost.

Renters. Session participants shared that in many urban areas, the challenge of affordability is embedded in the lowest income residents renting multi-family housing. It can be difficult or even impossible to know how much of the actual cost of their water bill gets passed on to renters. Utilities and community-based groups shared the challenge of developing assistance programs that meet the need of renters and provide relief directly to those residents who often need it most.

Disproportionately Impacted Communities. Several participants expressed that any new government program must be designed to address consumers that have been disproportionately impacted. For example, low-income communities and minority populations live disproportionately near contaminated water resources and are more impacted by high drinking water and wastewater service rates.

Areas Impacted by Irrigation Needs. Several interested parties shared that there are some cities with reduced access to water due to large scale irrigation and other competing water use demands. Water scarcity issues and the impact on affordability is outside the scope of this Report, but merits additional research.

Public Trust. Interested parties recommended that EPA support additional community engagement to help build trust in public water. Challenges with public trust in water utilities was cited as a reason some households were purchasing bottled water and could lead to non-bill payment. Interested parties shared that in some areas there was a loss of trust in water utilities during the COVID-19 pandemic that resulted in non-payments.

8.2 Water Affordability Challenges Faced by Utilities

Interested parties emphasized several affordability challenges that utilities face. Utilities must fund the effective, safe, and efficient management of water utilities, even if customers are unable to pay enough to cover the cost of service. Interested parties stressed the need to ensure that utilities are able to adequately perform infrastructure maintenance and needed improvements while maintaining affordability for low-income customers. Other challenges include:

Costs Associated with Regulatory Requirements. Compliance costs associated with current and future requirements (both federal and state) essential to protecting public health and the environment will result in utilities needing to raise rates, in some cases. Very small water utilities, such as mobile home parks, some condos, and those not affiliated with the local municipality, are sometimes unable to access funding programs to come into compliance with regulations. For example, some states restrict certain utilities that would otherwise be eligible for federal funding.

Impact of State and Local Laws. Restrictions in state and local laws, capacity issues in staffing, and other obstacles can create challenges for utilities in developing their own customer assistance programs.

Political Barriers. Some utilities must seek rate change approval by governing authorities, such as local city councils, and thus can experience political challenges regarding water affordability policy making.

Projected Increases in Rates. Future costs associated with climate change impacts and adaptation responses and aging infrastructure will impact rates, and thus affordability.

Challenges with Funding and Financing. Several participants shared that utilities have difficulties setting affordable rates while keeping up with the costs of system maintenance. Assessing funding needed for capital improvements and O&M can pose several challenges, including competition for limited grant funds and the risk of high debt burden if too many customers are unable to pay.

Affordable Rate Setting. Two representatives from public utilities stressed that setting rates that are affordable for ratepayers has become more difficult for utilities. The challenge is that setting affordable rates for communities is often outpaced by rising capital and O&M costs. Additionally, unprecedented rate increases are challenging for cities to plan for and ultimately places the burden on water customers.

Infrastructure Updates. An attendee expressed the desire to upgrade aging infrastructure without needing to increase rates for customers. Infrastructure loans are inaccessible without the ability to increase water rates to make up for the costs of the upgrades.

Consolidation Challenges for Small Utilities. The push toward consolidation is one challenge, as small communities lack a clear entity to consolidate into, and intent to consolidate can be an obstacle to accessing financing.

Impact of Customer Nonpayment. Interested parties also provided feedback on how utilities use debt. Debt is not undertaken due to customer nonpayment; it is undertaken to complete needed capital activities, or sometimes O&M activities. Revenues from water bills are then collected to cover the debt repayment and ongoing costs. High levels of customer nonpayment cause cash flow issues, affect bond ratings, and impact utilities' ability to raise capital, jeopardizing both existing and future commitments. Additionally, customer nonpayment can cause other problems, such as unacceptable levels of service and unaffordable rates.

8.3 Defining Affordability

Interested parties generally agreed that it is important to calculate affordability at the individual household level as opposed to community and/or national levels. They referenced the limitations of using median household income as a household affordability metric and stressed that there is movement across the sector to find alternatives that account for cost of living and other socioeconomic factors.

Interested parties noted the importance of using a multi-pronged approach that can reflect the unique circumstances of different communities and include qualitative definitions as well as quantitative ones. From the household perspective, this could be whether the ratepayer is able to pay their water bill without sacrificing the ability to pay for other basic household necessities. From a utility perspective, this could be whether the customers are able to afford what the utility needs to charge to sustain itself.

8.4 Recommendations for Addressing Affordability Challenges Nationwide

Interested parties emphasized the need for a sustainable long-term federal customer assistance program, while stressing the importance of using multiple pathways to achieve affordability. This approach combines complementary strategies, such as water conservation, efficiency, assistance with plumbing repairs, education, paying off arrearages, capping customer costs, and rate discounts. Other key recommendations from interested parties on successful implementation of a permanent federal water assistance program include the following:

Limit Administrative Barriers. Many utilities were unable to participate in LIHWAP because billing systems could not separate out the trash portion of bills from water service or accounting and/or programming changes were made. Utilities need to have the flexibility to include trash and water services in one bill, and/or there must be technical assistance for small utilities that have capacity challenges in altering their billing system to be able to participate in the program.

Consider Unique Needs of Renters. A future federal assistance program should consider renters, as it can be difficult to assess affordability burden among renters whose landlord pays the utility bills. Flexibilities to ensure equitable distribution of funds, including to those who may not have their water bill in their name, should be included in a future federal assistance program.

Direct Payment to Utilities. Direct payment to utilities and guidance to administer assistance to their customers can incentivize smaller utilities to participate, given that there is guaranteed payment.

Categorical Eligibility. Categorical eligibility can be a helpful tool to reduce burden on households and utilities in enrolling customers in an assistance program if they are already enrolled in an analogous program elsewhere. Assistance could be automatically provided to categorically eligible households, without requiring the household to complete additional paperwork. A future federal assistance program could also offer blanket approval for extremely poor communities. This would especially help small utilities, that typically lack staff capacity to register and approve individual household applications for financial assistance.

Marketing and Promotion. Particularly in rural areas and small communities, households can face significant obstacles in accessing information and navigating assistance programs. It is important that future federal assistance programs include a budget for communications and marketing to promote enrollment. Interested parties stressed that states should be required to have a communications strategy to promote the program and saw value in establishing national community outreach guidance for consistency across states.

Partnership with Local Authorities. One successful tactic used to implement LIHWAP was reaching out to local government authorities through direct advocacy and education to get them to sign up and participate in the program.

O&M Costs. Operations and maintenance expenses are frequently not eligible under various funding pathways, such as State Revolving Funds. Direct assistance to utilities to help cover O&M costs would ameliorate rising cost issues.

Disconnection Moratoriums. Interested parties had varying opinions on the use of disconnection moratoriums. Some interested parties indicated that in some cases, disconnections are the primary motivator for households struggling with affordability to sign up for assistance programs. Other interested parties recommended disconnection moratoriums to ensure that the lowest-income households are treated with dignity and respect and referenced the public health risks due to house condemnations. One participant recommended an analysis of the effectiveness of disconnection moratoriums during the COVID-19 pandemic, assessing their economic impacts on communities and water utilities.

9. Recommendations

There is no single approach to addressing water affordability at a national level. Large scale, sustainable change requires addressing the systemic challenges in how water utilities are funded, how rates are set, and how assistance programs are established, particularly to support rate payers facing affordability challenges. Developing solutions to address those challenges will require all levels of government, community advocates, utilities, and other interested parties to work together on long-term approaches. This Section describes potential ways for EPA and its partners to help address water affordability concerns.

IIJA directed EPA to provide recommendations to address affordability. These recommendations were identified during the affordability analysis and from discussions during the engagement sessions for interested parties. They are also found in literature focused on addressing water affordability.

The recommendations fall into three broad categories:

Establishing a Permanent Federal Water Assistance Program

Increasing Education, Outreach and Knowledge Around Solutions to Address Affordability

Increasing Ways to Reduce Water Infrastructure Capital and Operating Costs

9.1 Establishing a Permanent Federal Water Assistance Program

Recommendation 1: Establish a Federal Water Assistance Program

Establishing a long-term federal water assistance program could meaningfully help to reduce affordability challenges for households and utilities. EPA's analysis suggests that a nationwide affordability pilot program could be an important step to establishing and fine-tuning strategies to provide sustainable, sufficient ratepayer assistance. In addition, a water assistance program could help ameliorate the cost of meeting requirements to protect human health and the environment. Assistance provided to households could help utilities to have reliable capital to implement necessary improvements and mitigate potential rate increases to households in need.

Congress could establish a Federal Assistance Program based on the needs, research, and input from interested parties described throughout this report. A pilot program, as described in IIJA Section 50109, could fund up to eight pilots in five water utility categories. Four of these categories represent the various utility sizes that have unique challenges and approaches to establishing and providing customer assistance. The fifth grant category in this pilot is specifically for utilities that service a disadvantaged community, according to the state affordability criteria or disadvantaged community definition, and would provide an understanding of the scope, scale and successful approaches needed in the most stressed communities. See Appendix G Pilot Program Suggested Funding Level for pilot category classifications.

EPA's analysis determined a funding level for the pilot program described in IIJA Section 50109 (found in Appendix B) is a range from $115 million to $185 million per year based on the percentage of qualifying households with need and the estimated national water burden cost of $5.1 to $8.8 billion as discussed in Section 5 – Water Affordability Analysis. Additional assumptions include a variable enrollment rate based on pilot category and that the maximum of 40 pilots would be awarded. The range is generated from different assumptions of enrollment rate. See Appendix G for details.

Recommendation 2: Evaluate Best Practices and Creative Program Structures to Increase Assistance to all Socioeconomic Groups

A key component of a federal water assistance program is to ensure that the most vulnerable households are provided the support they most need. Feedback from interested parties stressed the importance of designing a federal program that served all households facing challenges. Interested parties discussed challenges to assist renters, elderly households on fixed incomes, multi-generational households with high water use, and challenges of enrollment for non-English speaking homes. For example, it is a hurdle for utilities to reach certain residents in their service area, such as renters that do not have a water bill in their name. Renters may pay a separate bill to their landlord, who then passes the payment on to the utility, or their water fees can be estimated and included in their reoccurring rent payment. For example, the Seattle Water Department has a program where they provide water assistance to renters by coordinating with the energy utility and applying the assistance to the eligible customer's energy account. The Northeast Ohio Regional Sewer District (NEORSD) added renters as eligible. NEORSD determines renter eligibility based on preferred criteria, such as income and household size, and collects proof of residence. Assistance

funds are provided to the water account. A permanent federal program could build from these models and explore other ways to provide assistance to all low-income households. Examples of these types of approaches include categorical eligibility, auto-enrollment, and/or direct payment to utilities, further discussed in the recommendations from interested parties in Section 8.4. Additionally, LIHWAP allowed for 15% administrative costs and up to 10% of the award funding to go towards outreach, intake, and eligibility determination activities for the program (OCS, 2023b). This type of flexibility would also aid assistance to all low-income households. This recommendation is also consistent with the requirements of Executive Order 14058, Transforming Federal Customer Experience and Service Delivery to Rebuild Trust in Government, for government agencies to improve service delivery when providing benefits (The White House, 2021).

Recommendation 3: Evaluate the Need for a Federal Household Water Efficiency and Plumbing Repair Grant Program

While a permanent federal assistance program could provide financial relief to households in need, such a program may not solve underlying problems related to high water use caused by leaks or inefficient plumbing products. A household that may receive financial relief will continue to be burdened by high water bills they cannot afford until the household addresses the root problem causing high water use. Some water utilities have developed programs that provide direct installation of efficient fixtures or minor plumbing repairs to homeowners needing assistance on their water bills (EPA, 2021). However, these programs are typically funded out of operating budgets or by coordinating with third party funders. EPA could work with interested parties to evaluate the potential benefits of a household water efficiency and plumbing repair grant program to tackle national affordability needs.

9.2 Increasing Education, Outreach and Knowledge Around Solutions to Address Affordability

Recommendation 4: Promote Tools, Resources, and Best Practices on Water Affordability

As described in detail throughout this Report, many organizations, academics, advocates, and associations have been working on water affordability challenges for decades. Yet, there is still a lack of knowledge to the tools and resources that are available to help communities and utilities in need. Recommendation 4 is for EPA to work in partnership with these interested parties and communities to promote water affordability tools and resources. EPA heard this recommendation on increased education from interested parties as part of a comprehensive affordability strategy. This could include:

- Webinars on best practices to tackle water affordability at the local, state, and federal levels
- Workshops establishing and funding assistance programs
- Encouraging and supporting an evaluation of true cost pricing, rates, rate structures, and approaches to help low-income residents where possible and how the best approach might vary across systems, e.g. large urban areas vs smaller areas
- Promoting success stories of cost-sharing partnerships amongst utilities
- Promoting best practices on water efficiency measures to reduce costs

- Encouraging states to support asset management practices and utilities to engage in intentional asset management planning
- Supporting states that are undertaking initiatives, as required by SDWA Section 1420(c)(2)(f), that promote asset management through their capacity development strategy and through the provision of technical assistance to develop and implement asset management plans
- Promoting partnerships, regionalization, and consolidation and encouraging states to exercise their mandatory assessment authority anticipated after the proposed Water System Restructuring Assessment Rule (WSRAR) goes final to identify feasible and affordable long-term solutions for chronically non-compliant water systems

Recommendation 5: Increase Awareness and Best Practices of Successful Funding Approaches for Utility Supported Customer Assistance Programs (CAPs)

Utility-supported CAPs play a critical role in ensuring that low-income households have access to affordable water services. Many local utilities understand the unique challenges of their customers and are able to tailor CAPs to the specific needs of the communities they serve. It is important to understand which approaches have been successful in terms of funding CAPs and increasing household utilization rates. Increasing awareness of successful utility-supported CAPs can help to increase the effectiveness of these program and encourage knowledge sharing between utilities. Beyond CAPs, where applicable by state and local law, alternative rate structures should be considered to ease burdens across utilities. EPA could develop additional resources and tools to support the development of utility-led CAPs. This includes an update of the 2016 EPA CAP compendium, searchable resource library of best practices, case studies and funding strategies. EPA can also encourage the use of existing resources and innovative approaches to restructuring rates and develop community focused tools to support their implementation.

9.3 Increasing Ways to Reduce Water Infrastructure Capital and Operating Costs

Recommendation 6: Promote the Use of Low-Cost Federal Funding and Financing for Water Infrastructure and Water Technical Assistance to Address Affordability Issues

The Clean Water and Drinking Water State Revolving Funds are important programs for investing in the nation's water infrastructure. They are designed to generate significant and sustainable water quality and public health benefits across the country and improve affordability in communities that are facing challenges across the U.S.

Through the federally capitalized SRF programs, states provide below-market interest rate loans and other financing assistance for infrastructure improvements and other water quality projects. States manage their SRF programs and are required to establish specific eligibility criteria and special funding mechanisms, including loan forgiveness and other grant-like options, for economically disadvantaged communities and those that meet each state's affordability criteria. Since 2021, EPA has invested more than $500 million in EPA Water Technical Assistance (WaterTA), which connects communities to experts who help assess and implement solutions for their drinking water, sewage, and stormwater needs. This program has allowed underserved communities across the country access this low-cost federal funding and reduce their overall project costs.[12]

Martin County Water and Sanitation Districts is an example of a utility that struggles with affordability challenges driven by both widespread poverty and aging infrastructure. The District estimates that a significant volume of water is lost from leaks in its distribution pipelines, meaning that a large portion of its operating costs to produce that water are wasted. This highlights the need for a multi-facetted approach to address water affordability, which includes continued investment in infrastructure. Read more about Martin County in the case study in Appendix A.

Interested parties recommended a continued focus from the SRF programs and WaterTA on ways to expand assistance to economically disadvantaged communities. This recommendation includes:

- Strengthening marketing of and communications about the SRF and other financial assistance programs to increase awareness of funding and financing options like the SRFs to communities facing affordability challenges.

[12] In addition to the SRF and WaterTA programs, continued investment in water workforce development and retention can help to address utility operating costs. For example, EPA's Innovative Water Workforce Development Grant Program awarded $3.8 million in total funding to 10 grant recipients (in 2023) and over $20 million in total funding to 13 grant recipients (in 2024). These workforce development grantees are nationwide, and the funding is helping to increase public awareness of job opportunities in the drinking water and wastewater utility sector and will help address the workforce needs of drinking water and wastewater utilities (U.S. EPA, 2024c).

- Providing substantial and effective technical assistance to the most underserved and economically stressed communities to prepare for, apply for, receive, and invest low-cost federal funding and financing to address their critical water infrastructure needs.
- Promoting technical assistance and SRF funding to help communities consider regionalization or consolidation options that could help to reduce financial burden on communities and customers.
- Promoting appropriate and cost-effective technology and capital projects that address local water service needs and are innately less burdensome on local ratepayers. For example, large-scale water use efficiency measures as an alternative to a more expensive new water supply and treatment project.
- Pursuing ways to implement the provision of the Clean Water SRF program that provides additional subsidization, through rate structures or other mechanisms, to directly benefit ratepayers that would experience a financial hardship because of an increase in rates necessary to fund capital infrastructure projects. This includes examination of the feasibility of EFAB's expected recommendations on options to utilize this provision.

Recommendation 7: Incorporate, Where Appropriate, Recommendations from the Environmental Financial Advisory Board (EFAB) on Water Affordability

EPA has recently charged the Environmental Financial Advisory Board (EFAB) with evaluating approaches to support communities facing water affordability challenges. This includes recommendations relevant to capital projects, CAP barriers, rate structure/design, and SRF subsidies. The charge tasks EFAB to develop new and innovative financing approaches, assess government strategies for implementing public-private partnerships, and develop innovative investment models and market-based approaches that increase the long-term resiliency of infrastructure. Recommendations stemming from the EFAB Water Affordability workgroup will help establish a path of wholistically addressing water affordability and provide a roadmap of recommended approaches. It is recommended that EPA evaluate and, where appropriate, pursue these recommendations.

Recommendation 8: Continued Research and Understanding of Water Affordability

Continued research is crucial to better understand water affordability challenges across the U.S., identify disparities in affordable access to water services, and guide the development of policies and programs to promote equitable access. Ongoing research is also necessary to anticipate future challenges and innovate new solutions in the face of changing environmental and economic conditions. Household-level analysis on the impacts of high water bills, rapid increases in rates ("rate shock"), shutoffs, and customer assistance programs are also areas for further analysis. Section 7 - Additional Recommended Analyses discusses recommendations for completing additional analyses to fill data gaps associated with the water affordability analysis conducted for this report. EPA plans to continue to address these data gaps over the next year and will continue to develop tools, studies and resources to help address water affordability challenges.

Appendix A: Case Studies

The following case studies are examples of utilities, and the communities they serve, that are struggling with the challenges of water affordability. They demonstrate factors that exacerbate affordability concerns, like economic decline and high poverty rates. Some utilities have successfully implemented their own CAPs to provide relief to customers, but many are limited by barriers including staffing, financial resources, and legal and policy limitations. For some, federal assistance programs have provided critical relief for struggling utilities and households. These case studies are a series of snapshots of water affordability challenges across the U.S.

Detroit, MI. Detroit's history of economic challenges has compounded its struggles with household water services affordability, with 55% of residential accounts over 30 days past due. Detroit Water and Sewerage Department (DWSD) has risen to the challenge by launching multiple CAPs, including a Lifeline Program that has 25,000 customers enrolled

Martin County, KY. In rural Kentucky, residents face challenges including high unemployment, water quality issues, and increasing water rates. Failing and aging water infrastructure contributes to the Water District's financial struggles, as does high levels of customer nonpayment. Martin County is not able to support its own CAP due to its small population size and high percentage of low-income customers. This case highlights the need for a multi-faceted approach to address water affordability, which includes continued investment in infrastructure.

San Antonio, TX. The San Antonio Water Systems (SAWS) runs a robust CAP, which shifts the burden of access away from customers and connects them with assistance in 14 different areas, including reduced meter fees and discounted monthly bills. The program is highly utilized by low-income customers, in part due to a streamlined single application that SAWS staff review to determine eligibility for multiple programs at once

San Carlos Apache Tribe. The San Carlos Apache Tribe community faces water affordability challenges, an unemployment rate of 65%, and high poverty levels. LIHWAP funds were used to restore service for households whose water and wastewater services had been disconnected due to nonpayment. Funds were also used to pay water bills, empty septic tanks, and provide bottled water to Tribal members after a water main break and pump failure. After the end of the LIHWAP program, the Tribe continues to face significant need for assistance in accessing water services.

Detroit, MI: Ongoing Challenges from a History of Economic Decline

Detroit, a city in Michigan with a rich industrial history, has faced significant economic challenges over the past decades. Once a hub for the automotive industry, the city experienced severe economic downturn, leading to a decline in population and an increase in poverty rates. Its peak population of 1.8 million in the 1950s shrank to 670,000 by the 2020 Census. The economic crisis peaked in 2013 when the city filed for bankruptcy, becoming the largest municipality in the U.S. to file. Currently, over half of the city's households are considered low-income, with 56% earning less than 200% of the federal poverty guidelines, almost double the level for the U.S. as a whole.

This history of economic decline has profoundly impacted water affordability in the city. Although the Detroit Water and Sewerage Department's (DWSD) standard water rates are generally low in comparison to other water utilities, Detroit's high levels of poverty create challenges with balancing the costs of providing safe and clean drinking water and wastewater services while maintaining rates at a level its customers can afford. Some of the key challenges include:

- **Suburban Migration** – Over the past-half century, the population of the city decreased as residents moved to the surrounding suburbs. New water infrastructure was built to accommodate this suburban growth, rather than reinvest in the city's existing infrastructure. DWSD was left with fewer customers, decreased water revenue, and excess water supply capacity. Residents remaining in Detroit were left to shoulder the expense of maintaining aging water and sewer pipeline infrastructure that was designed to supply a population nearly twice the city's current size.
- **Customer Arrearages** – As of May 2024, 55% of DWSD's residential accounts are 30 days past due, and 35% of accounts are 60 days past due. It is estimated that approximately 700 shutoff notices are sent out per month, of which approximately 100 will be disconnected each month. This is typical of most water utilities, as customers frequently make arrangements to avoid disconnection following a shutoff notice. Understanding that water shutoffs can exacerbate affordability issues, DWSD focuses on conducting outreach and education on available assistance options.
- **Aging Infrastructure** – Critical infrastructure upgrades and repairs need to be completed for the 100-year-old water system. Population loss and the resulting limitation on rate increases caused by customer arrearages have had significant impacts on the utility's ability to generate sufficient revenue for maintenance projects.

Customer Assistance Programs and the Need for Funding

In March of 2015, the city launched the Water Residential Assistance Program (WRAP), a regional assistance program which provided a $25 discount on monthly water bills for low-income customers. WRAP was funded using 0.5% of the water utility revenue. While WRAP helped to return water service to many customers, the cycle of delinquency on water accounts that often led to water service shutoffs continued.

In response to this ongoing need, DWSD launched its Lifeline Plan in 2022. The Lifeline Plan, an income-based water affordability program, erases a customer's past due balances and provides a tiered structure for fixed monthly bill amounts based on income. This benefit provides for up to 1,125 gallons of water usage per household member each month. In addition, the Lifeline Plan provides plumbing assistance of up to $2,000 to fix leaks and improve equipment efficiency based on results from water audits. DWSD currently has about 25,000 customers enrolled in the Lifeline Program and anticipates an additional 3,000 customers will join. The current funding amount is $17.5 million, with a total anticipated need of $26.55 million. Moving forward, additional funding sources will need to be identified.

For additional information on Detroit's Lifeline Program, visit: https://detroitmi.gov/departments/water-and-sewerage-department/dwsd-customer-service/dwsd-here-help-water-assistance-programs/lifeline-plan

Martin County, KY

Martin County is located in far eastern rural Kentucky. The county's economy was historically reliant on the coal industry. As coal use declined, poverty and unemployment rose. As of June 2024, Martin County has the highest unemployment in Kentucky, at 10.7%, which is more than double the state average of 5% and the U.S. average of 4.3% (Workforce Intelligence Branch, Kentucky Center for Statistics, & Kentucky Education and Labor Cabinet, 2024).

The County's median household income is 60% of the national level median household income. In 2022, 36% of Martin County was below the federal poverty threshold, compared to about 11.5% for the U.S. as a whole (U.S. Census Bureau, 2023b).

For decades, the County's Water District and its residents have struggled with loss of water pressure, water quality issues, and increasing water rates. Both water and sewer rates are high on an absolute basis compared to other utilities and are especially high for a low-income population. A 2019 report by the Appalachian Citizens' Law Center & Martin County Concerned Citizens found that water was unaffordable for over 45.8% of Martin County residents, with a 41.5% increase in water service cost since the previous year (Cromer & Draper, 2019).

Nearly 50% of households in Martin County have a combined water and sewer bill that is more than 4.5% of their income.

The water affordability crisis in Martin County has not improved in recent years. According to the Martin County Water and Sanitation District website, the estimated monthly water and sewer bill for 5,000 gallons of water usage is $157.93 (Martin County Water and Sanitation Districts, 2024). This represents 4.2% of income for households at the County's median level of income and a remarkable 14.4% of income for households at the County's 20th percentile of income. Nearly 50% of households have a combined water and sewer bill that is more than 4.5% of their income, which is an affordability level that is typically considered stressful. Having more than 40% of households facing potentially unaffordable bills is a very high level of financial risk for a utility and its service area population to manage. An additional rate increase is expected next year.

Failing and aging drinking water infrastructure is the main contributor to these financial challenges. The Water District estimates that a significant volume of treated water is lost from leaks in its distribution pipelines before the water reaches customers. This means that a large portion of its operating costs to produce that water are wasted. The contractor that operates the Water District's system has exceeded its contracted limit of repairs. The resulting cost overruns will lead to additional rate increases, causing even greater stress on the system and the community.

Despite receiving a grant in 2017 for repairs and improvements to its raw water intake and water treatment plant, the intake pump still does not function correctly due to contracting issues and other delays. As a result, the District rents a duplicate diesel pump that costs $30,000/month to rent and operate. Other key issues for the District include:

- **Arrearages and Disconnections** – The Water District struggles with a high level of arrearages and disconnections as a result of customer nonpayment. In 2023, there were 349 residential water disconnections for nonpayment – about one in ten households. Despite the high disconnection rate, the District is still projecting that they will have to write off approximately $45,000 of unpaid customer debt in 2024. This amount is less than the roughly $60,000–$70,000 of late charge fees received by the District each year. While this amount is a relatively small portion of the District's overall $2.5 million of annual water customer revenue, unpaid customer debt is a problem that has increased steadily over time.
- **Wastewater system** – The Martin County Sanitation District operates two wastewater treatment plants. One was constructed in the late 1980's and struggles with compliance challenges due to its aging infrastructure. A second plant was funded in 2015, however, only about 20% of homes within the service area were required to connect to it. In total, about 870 households are connected to the District's sewer system, compared to the approximately 3,500 households that are connected to the drinking water system. This results in high operation and maintenance costs for the limited population served. That high cost is passed along to the rate payers, which include some of the poorest households in the County.
- **Workforce Challenges** – The District struggles with water workforce turnover. As a small utility, the District is unable to compete with the wages that larger utilities can pay. This turnover results in high costs to train new employees, and lack of consistent knowledge contributes to the community's mistrust of the water utility.

While the District's primary goal is to obtain funding to fully repair its aging infrastructure and fix the leaks in its distribution system, Martin County also recommended two main changes:

- **Federal Customer Assistance for Low-Income Residents** – Martin County is not able to support a local Customer Assistance Program because of its small population size and high percentage of low-income customers. In the absence of more permanent support, a member of the community group, Martin County Concerned Citizens, draws from her background in social work to help connect members of the community with resources for assistance, including LIHEAP for assistance with energy bills and SNAP for assistance with food. However, there is no available program for water assistance. A permanent federal customer assistance program would assist both the community members facing growing arrearages and disconnection and reduce the District's associated customer debt due to nonpayment.
- **Change in Grants** – Funds for ongoing O&M assistance, contractor oversight for infrastructure project grants, and workforce development and retention are needed, especially in the form of grants to small, disadvantaged communities.

San Antonio Water System (SAWS): SAWS Uplift – Helping Neighbors in Need

The San Antonio Water System (SAWS) serves 2 million people in Bexar County, Texas, as well as parts of surrounding counties. The population includes more than 511,300 water customers and 457,600 wastewater customers. Approximately 16% of the population of Bexar County, and 19% of San Antonio, have incomes below the poverty threshold. SAWS has established a robust and highly utilized Customer Assistance Program (CAP) to help low-income customers afford their water service bills. The CAP, referred to as SAWS Uplift – Helping Neighbors in Need, currently consists of 14 touch points which cover a broad range of assistance areas. The program's name reflects the intentional terminology shift from "customers" to "neighbors" as a sign of SAWS's connection and commitment to the communities they serve.

The SAWS Uplift program provides assistance to eligible households in a variety of areas including plumbing services, emergency assistance, reduced meter fees, and discounted monthly bills. One of the innovative programs, Plumbers to People, provides free plumbing services for residential customers to repair plumbing fixtures to decrease their water usage. Another initiative, the Uplift Assistance Program, was recently changed from a monthly discount on water bills to a discounted rate structure with no monthly charges for the first 2,000 gallons of water. The full list of programs and initiatives are shown in the table on the next page.

The SAWS Uplift program uses a streamlined, single application process. SAWS staff review the application to determine the programs for which each applicant qualifies. This shifts the burden of navigating multiple programs, eligibility criteria, and applications away from the residents. Additionally, some applicant information is pre-populated, and SAWS uses a third-party to automatically verify income information. SAWS continues to identify ways to streamline the application process and reduce barriers to accessing assistance. For example, it is exploring ways to automatically enroll households that qualify for other assistance programs, such as the Supplemental Nutrition Assistance Program (SNAP).

The majority of the 14 programs receive funding through a city-approved fee included as a line item on SAWS's water bills. However, Project Agua, which provides emergency payment assistance, is entirely funded through donations. SAWS is proud that the largest portion of donations come from SAWS's employees themselves.

The SAWS team attributes much of their program's success to transitioning CAP implementation into the Community Outreach Department. Working through an external affairs approach, SAWS first determined the total number of potentially eligible customers and identified their needs. This allowed the team to tailor engagement opportunities, better connect with the community, and ultimately increase the number of participants in the program.

SAWS actively conducts outreach in communities, rather than primarily relying on more passive outreach techniques like flyers or advertisements.

This approach has been an important component for SAWS in reaching their neighbors, sustaining the program over time, and making it a success. Additional information on the SAWS Uplift Program can be found here: https://uplift.saws.org/helping-neighbors-in-need/.

SAWS Uplift Programs and Initiatives

Program/Initiative Name	Description
Uplift Assistance Program	Discounted rate structure with no monthly charges for the first 2,000 gallons of water.
WaterSmart	Provides access to an online tool to help save water (e.g., monthly water reports, water use history, customized water saving tips).
Courtesy Hold	Prevents water service from being shut off while the Uplift application is being processed.
Reduced Meter Service Fee	Lowers the fee for sending a technician to a household to disconnect water service because of a non-payment.
SAWS Payment Arrangements	Payment plan for past due account balance.
Reduced Deposit	Reduces the security deposit amount for new qualifying customers.
Agency Referrals	Helps make connections with local agencies to provide various types of assistance (e.g., CPS Energy electric and gas utility, Food Bank, etc.).
Leak Adjustments	Removes charges for "lost" water when a leak is repaired and fixed by a licensed plumber.
Senior Citizen Billing	Waives late payments penalties for customers aged 60+.
Domestic Violence Deposit Waiver	Allows victims to open a new service account without paying a security deposit.
Project Agua	Provides emergency payment assistance up to two times per year.
Plumbers to People	Helps residential customers repair leaking plumbing fixtures in their household.
Laterals to People	Helps residential customers repair sewer lateral from outside household to the property line.
Disability Billing/Disabled Veterans initiative	Provides payment extension to residential customers who receive disability income.

San Carlos Apache Tribe: Impact of HHS LIHWAP Funds

The San Carlos Apache Indian Reservation encompasses 1.8 million acres in Gila, Graham, and Pinal Counties in Southeastern Arizona. The Reservation is home to approximately 16,600 Tribal members, 7,000 of whom are under 18 years old. With an unemployment rate of approximately 65%, both jobs and housing are scarce. The majority of families on the reservation receive benefits through assistance programs for low-income households including Temporary Assistance for Needy Families (TANF), Supplemental Nutrition Assistance Program (SNAP), and Medicaid.

The vast area and rural setting of the Reservation present challenges to the access of drinking water and wastewater services. Approximately one-third of the estimated 2,510 occupied housing units on the Reservation are served by the centralized water and sewer systems operated by the Water Distribution and Wastewater Treatment Facilities Program (WDWTFP). The remaining two-thirds of the housing units have decentralized water and sewer systems, or no water or sewer infrastructure at all.

In 2021, the Tribe applied for the Low-Income Household Water Assistance Program (LIHWAP) through the U.S. Department of Health and Human Services (HHS). They were granted $310,510 in FY2021 and implementation began in January 2022. The Tribe's assistance program was managed and operated by the Tribal Social Services Department.

The Tribe's initial goal was to use LIHWAP funds to restore service for households whose drinking water and wastewater services had been disconnected due to nonpayment. While the Tribe did not implement water shutoffs during COVID-19, some households had already been disconnected to drinking water and wastewater services for many years and continued to have no access to public drinking water. By the end of 2021, the total arrearage balance for households on the Reservation was approximately $250,000. As COVID-19 programs ended, the San Carlos Water Company informed families that they needed to pay outstanding water bills to avoid disconnection.

Fortunately, LIHWAP funds were available to help households that needed assistance paying their water bills and arrearage balances. households that needed assistance paying their water bills and arrearage balances. everyone on the reservation. San Carlos Water mailed the applications to their customers. The Tribe also advertised the LIHWAP in the local Apache Messenger Newspaper, which has a circulation of about 5,000 copies.

The need was significant, and families came in droves to apply. LIHWAP funds were used to pay for water bills and to empty septic tanks. An overwhelming number of applications were also submitted requesting repairs to water lines, sewer lines, and plumbing fixtures. While these repairs were not eligible under LIHWAP, the Tribal Social Services Department worked to refer families to other resources.

"LIHWAP monies were put to good use and it helped children, elders and families. Then the LIHWAP monies were gone and everyone to this day asks about water bottles."

- Director, Tribal Social Services, San Carlos Apache Tribe

During the period when LIHWAP was available, the Tribe experienced a water main break in the 7 Mile Wash District of the Reservation and pump failure at three locations. While the Tribe worked to repair the equipment, families were left without drinking water. The Tribe coordinated with HHS and received approval to use LIHWAP funds to purchase cases of bottled water. The need was so great that bottled water was backordered at the local supermarket, Bashas', and it had to be ordered from Phoenix, AZ.

The Tribe considers LIHWAP to be a success in restoring access to water services for Tribal members, including providing bottled water, paying arrearages, and reducing rates to prevent disconnection of water services. HHS's Annual LIHWAP Dashboard reports that the program assisted approximately 2,000 households in the San Carlos Apache Indian Reservation.

Beginning October 1, 2023, the Tribe entered the closeout phase for their LIHWAP and could no longer accept additional applications. The need for assistance accessing drinking water services remains.

Appendix B: Infrastructure Investment and Jobs Act Sections 50108 and 50109

SEC. 50108. [42 U.S.C. 300j-19a note] NEEDS ASSESSMENT FOR NATIONWIDE

RURAL AND URBAN LOW-INCOME COMMUNITY WATER ASSISTANCE.

(a) DEFINITIONS.—In this section and section 50109:

(1) COMMUNITY WATER SYSTEM. The term "community water system'' has the meaning given the term in section 1401 of the Safe Drinking Water Act (42 U.S.C. 300f).

(2) LARGE WATER SERVICE PROVIDER.—The term "large water service provider'' means a community water system, treatment works, or municipal separate storm sewer system that serves more than 100,000 people.

(3) MEDIUM WATER SERVICE PROVIDER.—The term "medium water service provider'' means a community water system, treatment works, or municipal separate storm sewer system that serves more than 10,000 people and not more than 100,000 people.

(4) NEED.—The term "need'', with respect to a qualifying household, means the expenditure of a disproportionate amount of household income on access to public drinking water or wastewater services.

(5) QUALIFYING HOUSEHOLD.—The term "qualifying household'' means a household that—

(A) includes an individual who is—

(i) the holder of an account for drinking water or wastewater service that is provided to that household by a large water service provider, a medium water service provider, or a rural water service provider; or

(ii) separately billed by a landlord that holds an account with a large water service provider, a medium water service provider, or a rural water service provider for the cost of drinking water or wastewater service provided to that household by the respective large water service provider, medium water service provider, or rural water service provider; and

(B) is determined—

(i) by a large water service provider, a medium water service provider, or a rural water service provider to be eligible for assistance through a low-income ratepayer assistance program;

(ii) by the Governor of the State in which the household is located to be low-income, based on the affordability criteria established by the State under section 1452(d)(3) of the Safe Drinking Water Act (42 U.S.C. 300j-12(d)(3));

(iii) by the Administrator to experience drinking water and wastewater service costs that exceed the metrics of affordability established in the most recent guidance of the Administrator entitled "Financial Capability

Assessment Guidance''; or

(iv) in the case of a household serviced by a rural water service provider, by the State in which the household is located to have an annual income that does not exceed the greater of—

(I) an amount equal to 150 percent of the poverty level of that State; and

(II) an amount equal to 60 percent of the State median income for that State.

(6) RURAL WATER SERVICE PROVIDER.—The term "rural water service provider'' means a community water system, treatment works, or municipal separate storm sewer system

that serves not more than 10,000 people.

(7) TREATMENT WORKS.—The term "treatment works'' has the meaning given the term in section 212 of the Federal Water Pollution Control Act (33 U.S.C. 1292).

(b) STUDY; REPORT.—

(1) IN GENERAL.—The Administrator shall conduct, and submit to Congress a report describing the results of, a study that examines the prevalence throughout the United States of municipalities, public entities, or Tribal governments that—

(A) are serviced by rural water service providers, medium water service providers, or large water service providers that service a disproportionate percentage, as determined by the Administrator, of qualifying households with need; or

(B) as determined by the Administrator, have taken on an unsustainable level of debt due to customer nonpayment for the services provided by a large water service

provider, a medium water service provider, or a rural water service provider.

(2) AFFORDABILITY INCLUSIONS.—The report under paragraph (1) shall include—

(A) a definition of the term "affordable access to water services'';

(B) a description of the criteria used in defining "affordable access to water services'' under subparagraph (A);

(C) a definition of the term "lack of affordable access to water services'';

(D) a description of the methodology and criteria used in defining "lack of affordable access to water services'' under subparagraph (C);

(E) a determination of the prevalence of a lack of affordable access to water services, as defined under subparagraph (C);

(F) the methodology and criteria used to determine the prevalence of a lack of affordable access to water services under subparagraph (E);

(G) any additional information with respect to the affordable access to water services, as defined under subparagraph(A), provided by rural water service providers, medium water service providers, and large water service providers;

(H) with respect to the development of the report, a consultation with all relevant stakeholders, including rural advocacy associations;

(I) recommendations of the Administrator regarding the best methods to reduce the prevalence of a lack of affordable access to water services, as defined under subparagraph (C); and

(J) a description of the cost of each method described in subparagraph (I).

(3) AGREEMENTS.—The Administrator may enter into an agreement with another Federal agency to carry out the study under paragraph (1).

SEC. 50109. RURAL AND LOW-INCOME WATER ASSISTANCE PILOT PROGRAM.

(a) DEFINITIONS.—In this section:

(1) ELIGIBLE ENTITY.—The term "eligible entity'' means—

(A) a municipality, Tribal government, or other entity that—

(i) owns or operates a community water system, treatment works, or municipal separate storm sewer system; or

(ii) as determined by the Administrator, has taken on an unsustainable level of debt due to customer nonpayment for the services provided by a community water system, treatment works, or municipal separate storm sewer system; and

(B) a State exercising primary enforcement responsibility over a rural water service provider under the Safe Drinking Water Act (42 U.S.C. 300f et seq.) or the Federal

Water Pollution Control Act (33 U.S.C. 1251 et seq.), as applicable.

(2) PILOT PROGRAM.—The term "pilot program'' means the pilot program established by the Administrator under subsection (b)(1).

(3) WATER SERVICES NEEDS ASSESSMENT.—The term "water services needs assessment'' means the report required under section 50108(b)(1).

(b) ESTABLISHMENT.—

(1) IN GENERAL.—Not later than 2 years after the date of enactment of this Act, the Administrator shall establish a pilot program to award grants to eligible entities to develop

and implement programs to assist qualifying households with need in maintaining access to drinking water and wastewater treatment.

(2) REQUIREMENT.—In establishing the pilot program, the Administrator shall ensure that data from the water services needs assessment directly contributes to the structure of the

pilot program by informing the types of assistance and criteria used for priority consideration with the demonstrated need from the study conducted under section 50108(b)(1) and the water services needs assessment.

(3) USE OF FUNDS LIMITATIONS.—A grant under the pilot program—

(A) shall not be used to replace funds for any existing similar program; but

(B) may be used to supplement or enhance an existing program, including a program that receives assistance from other Federal grants.

(4) TERM.—The term of a grant awarded under the pilot program shall be subject to the availability of appropriations.

(5) TYPES OF ASSISTANCE.—In establishing the pilot program, the Administrator may include provisions for—

(A) direct financial assistance;

(B) a lifeline rate;

(C) bill discounting;

(D) special hardship provisions;

(E) a percentage-of-income payment plan; or

(F) debt relief for the eligible entity or the community water system owned by the eligible entity for debt that is due to customer nonpayment for the services provided by the eligible entity or the community water system that is determined by the Administrator to be in the interest of public health.

(6) REQUIREMENT.—The Administrator shall award not more than 40 grants under the pilot program, of which—

(A) not more than 8 shall be to eligible entities that own, operate, or exercise primary enforcement responsibility over a rural water service provider under the Safe Drinking Water Act (42 U.S.C. 300f et seq.) or the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.), as applicable;

(B) not more than 8 shall be to eligible entities that own or operate a medium water service provider;

(C) not more than 8 shall be to eligible entities that own or operate a large water service provider that serves not more than 500,000 people;

(D) not more than 8 shall be to eligible entities that own or operate a large water service provider that serves more than 500,000 people; and

(E) not more than 8 shall be to eligible entities that own or operate a community water system, treatment works, or municipal separate storm sewer system that

services a disadvantaged community (consistent with the affordability criteria established by the applicable State under section 1452(d)(3) of the Safe Drinking Water Act (42 U.S.C. 300j-12(d)(3)) or section 603(i)(2) of the Federal Water Pollution Control Act (33 U.S.C. 1383(i)(2)), as applicable).

(7) CRITERIA.—In addition to any priority criteria established by the Administrator in response to the findings in the water services needs assessment, in awarding grants under the pilot program, the Administrator shall give priority consideration to eligible entities that—

(A) serve a disproportionate percentage, as determined by the Administrator, of qualifying households with need, as identified in the water services needs assessment;

(B) are subject to State or Federal enforcement actions relating to compliance with the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.) or the Safe Drinking Water Act (42 U.S.C. 300f et seq.); or

(C) maintain or participate in an existing community assistance program with objectives similar to the objectives of the pilot program, as determined by the Administrator.

(8) REPORTING REQUIREMENTS.—

(A) IN GENERAL.—In addition to any other applicable Federal or agency-specific grant reporting requirements, as a condition of receiving a grant under the pilot program, an eligible entity (or a State, on behalf of an eligible entity) shall submit to the Administrator an annual report that summarizes, in a manner determined by the Administrator, the use of grant funds by the eligible entity, including—

(i) key features of the assistance provided by the eligible entity;

(ii) sources of funding used to supplement Federal funds; and

(iii) eligibility criteria.

(B) PUBLICATION.—The Administrator shall publish each report submitted under subparagraph (A).

(c) TECHNICAL ASSISTANCE.—The Administrator shall provide technical assistance to each eligible entity, and each State, on behalf of an eligible entity, that receives a grant under the pilot program to support implementation of the program.

(d) REPORT.—Not later than 2 years after the date on which grant funds are first disbursed to an eligible entity (or a State, on behalf of an eligible entity) under the program, and every year

thereafter for the duration of the terms of the grants, the Administrator shall submit to Congress a report on the results of the pilot program.

Appendix C: Affordability Metrics Used in Prior Work

Name	Abbreviation	Source	Calculation	Threshold
State Revolving Fund Affordability Criteria and Disadvantaged Community Definitions		CWA and SDWA; State defined	Varies by state. Can be found in DW and CW Intended Use Plans.	Varies by state
Percentage of Lowest Quintile Income or Household Burden Indicator	% LQI or HBI	Raucher et al., 2019	Drinking water, wastewater, and stormwater as a percentage of the community LQI upper limit.	Score determined based on matrix combined with PPI, HBI categories include < 7%, 7% – 10%, and >10%
Poverty Prevalence Indicator	PPI	Raucher et al., 2019	Percent of Households below 200% of the Federal Poverty Limit.	Score determined based on matrix combined with HBI, PPI categories include <20%, 20% - 35%, and >=35%
Income Dedicated to Water Services	IDWS	Patterson & Doyle, 2021	Percent of households in a utility spending x% of income on water services. Measures the prevalence of different financial burdens in the community.	Does not require an affordability threshold
Teodoro Affordability Ratio	AR	Teodoro, 2018	Drinking water and wastewater as a percentage of discretionary income for households at 20th percentile income.	Drinking water and wastewater bill > 10% suggested as relatively high impact
Teodoro Hours of Labor at Minimum Wage	HM	Teodoro, 2018	Hours worked at minimum wage to equal a drinking water and wastewater bill.	8 hours suggested as relatively high impact

Name	Abbreviation	Source	Calculation	Threshold
EPA Expanded Financial Capability Assessment Matrix	Revised FCA	U.S. EPA, 2024	Combines RI and FCI score with LQPI to determine overall impact level.	Matrix of combined scores rates community's overall impact as low, medium, or high
EPA Residential Indicator	RI	U.S. EPA, 1997	Household wastewater and CWA compliance costs as a percentage of MHI.	<1% = Low impact 1% to 2% = Mid-range impact >2% = High Impact
EPA Financial Capability Indicator	FCI	U.S. EPA, 1997	Six financial capability indicators (FCIs) related to debt, socioeconomic, and financial conditions.	< 1.5 =Weak 1.5 – 2.5 = Mid-range >2.5 = Strong
EPA Drinking Water Small System Compliance Technologies – EPA performs this analysis at a national level for three categories of small water systems in accordance with the Safe Drinking Water Act	SSCT	U.S. EPA, 1998 63 FR 42032 88 FR 18638	Comparison of national level estimated household costs of new compliance technology plus existing baseline household cost of drinking water to an affordability threshold value.	2.5% MHI

Appendix D: Water Hygienic Use Values Used in National Affordability Studies

Source	Quantity	Notes
Teodoro, 2018	50 gallons per person per day	Assumes a 4-person household yielding 6,200 gallons per month
Teodoro, 2019	50 gallons per person per day	Assumes a 4-person household yielding 6,200 gallons per month
Teodoro & Saywitz, 2020	50 gallons per person per day	Assumes a 4-person household yielding 6,200 gallons per month
Teodoro & Thiele, 2024	50 gallons per person per day	Assumes a 4-person household yielding 6,200 gallons per month
Patterson & Doyle, 2021	Bills and affordability metrics were calculated for no water use to 16,000 gallons per month at increments of 1000 gallons per month	N/A
Cardoso & Wichman, 2022a	50 gallons per person per day	Sensitivity analysis of 40, 60, and 75 gallons
Patterson, Bryson, & Doyle, 2023	6,000 gallons per month	Assumes 83 gallons per person per day, and a 2.4 person household
El-Khattabi, Gmoser-Daskalakis, & Pierce, 2023	4,000 gallons per month	
LIHWAP Water Utility Affordability Survey Report, 2024	10,000 gallons per month	

Appendix E: Utilities Included in National Affordability Studies

Source	Description of Communities Included in Study	Timeframe of Rates Data Collection	Estimated Population Served by Utilities in Study*
Teodoro, 2018	25 most populous U.S. cities (in 2017)	Spring 2017	Not provided
Teodoro, 2019	329 utilities, selected via stratified sampling based on: 1. Ownership type (public vs. private) and 2. Population served (EPA service population categories excluding utilities serving less than 3,300 persons)	May to July 2017	Not provided
Teodoro & Saywitz, 2020	399 utilities, selected through the stratified sampling method used in Teodoro 2019, and included the same utilities sampled in 2019 plus additional utilities	May to July 2019	44 million
Teodoro & Thiele, 2024	399 utilities, selected from the same utilities included in the Teodoro and Saywitz 2020 study	Both 2021 rates and 2023 rates	44 million
Patterson & Doyle, 2021	1791 utilities located in four states—California, North Carolina, Pennsylvania, and Texas Overall, 44% of the utilities in this study were large or very large, 25% were medium, and 32% were small or very small.	2020 rates data	71.9 million
Cardoso & Wichman, 2022a	1545 utilities	UNC EFC Data, as of July 2017, and the 2016 AWWA Water and Wastewater Rate Survey	145 million

Source	Description of Communities Included in Study	Timeframe of Rates Data Collection	Estimated Population Served by Utilities in Study*
Patterson, Bryson, & Doyle, 2023	787 of the largest drinking water providers located within each state of the United States.	2021	160.9 million
El-Khattabi, Gmoser-Daskalakis, & Pierce, 2023	1,558 utilities located in four states - Arizona, Georgia, New Hampshire and Wisconsin	UNC EFC Data, as of 2021	Not provided
LIHWAP Water Utility Affordability Survey Report, 2024	A random selection of 200 observations that matches the EPA's national distribution of utility sizes	Duke University provided rate information for internal analysis. Rate years were not provided.	Not provided

* *Population Served estimates as reported in the study, when available*

Appendix F: Supplemental Technical Information for EPA's Analysis

By Tract

Population Categories	% Qualifying Households (%)	# Qualifying Households	Total # Utiliities	# Utilities w/ > 40% Qualifying Households
>100,000	30	17,297,152	448	61
10,001-100,000	30	12,584,177	3,944	641
3,301-10,000	31	3,370,038	4,894	984
501-3,300	32	2,284,528	12,725	2,896
<=500	30	481,994	22,330	4,291
Totals	**-**	**36,017,890**	**44,341**	**8,873**

By Block Group

Population Categories	% Qualifying Households (%)	# Qualifying Households	Total # Utilities	# Utilities w/ >40% Qualifying Households
>100,000	30	17,368,350	448	65
10,001-100,000	30	12,704,451	3,944	742
3,301-10,000	31	3,404,782	4,893	1,111
501-3,300	33	2,320,929	12,720	3,318
<=500	30	495,194	22,327	5,104
Totals	**-**	**36,293,709**	**44,332**	**10,340**

Comparison of Analysis of Utilities Servicing a Disproportionate Percentage of Qualifying Household Using Census Tract-Level Data vs. CBG Data

Technical Notes and Assumptions for State-specific California Analysis

The 2022 eAR data has entries for 2,826 community water systems but 810 utilities—mostly utilities service fewer than 500 people—either report not having rates or having rates of zero dollars. These utilities were dropped from this analysis. Also dropped were utilities with no service area boundary in the dataset.

Household rates were determined from the survey data using a linear interpolation method similar to that used in Section 5.1.1 except the imputation was performed with the calculated rates at 6, 9, 12, and 24 CCF. In a future analysis, EPA plans to use the detailed rate structure data. If a utility indicated that wastewater charges were an additional bill component, those charges were added to the household bill. If wastewater charges were not in the eAR bill data, an average value from a 2018 survey of wastewater charges was applied, inflated using the CPI for water and sewer (California State Water Resources Board, 2024a).

The eAR presented the calculated rates at 6, 9, 12, and 24 CCF to respondents and requested that utilities verify the data, however, some rates still appeared to be unlikely or impossibly high (including over $1,000,000 million a month). EPA therefore coded any of the four CCF rates or the wastewater rates in the eAR data above their respective 90th percentile value to that value ($154.36 for 6 CCF of water use and $89.56 for wastewater).

Many of the smallest utilities are omitted from the analysis because they do not report rates in the eAR survey or report zero rates. The overall need could be underestimated because of these missing utilities. Some customers, for example mobile home park residents, pay for water use indirectly.

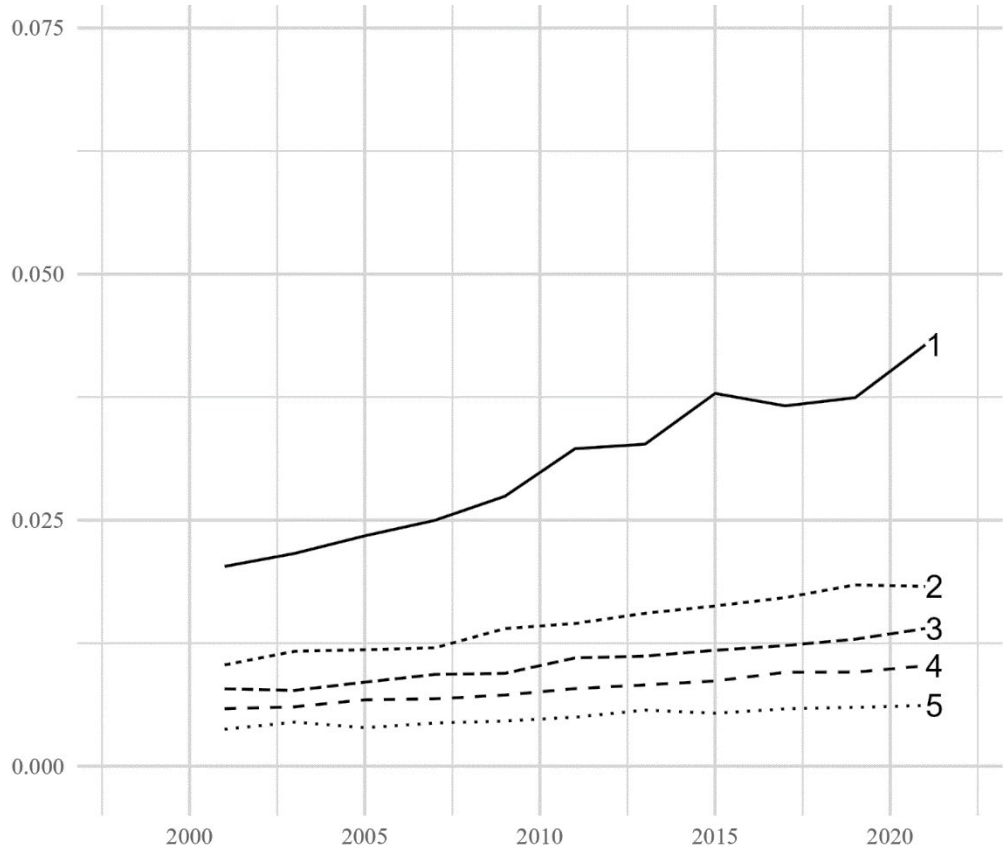
Panel Study of Income Dynamics Data

EPA has identified several national surveys that collect data on household income and spending on water services. EPA did not use these data sets for the primary analysis because the surveys ask about spending on water services, but they do not include prices (rates) or usage amounts. Therefore, reported spending will include water use beyond basic needs for households that are not facing affordability challenges. Further, data confidentiality restrictions prevent linking the data geographically to utilities and thus rates. Nevertheless, EPA believes these data can help illuminate the need for water assistance, particularly for low-income households that may be more likely to consume hygienic quantities of water. These data are also able to show trends in affordability over time, similar to the CPI trends presented in Figure 3 in Section 2.1.

One of these surveys is the Panel Study of Income Dynamics (PSID), which has asked the households in the panel about spending on water services every other year since 2001. EPA cleaned the data to drop zero and negative values and smoothed the income data across years. EPA then calculated the percentage of household income spent on water services for each sample household. The graph below shows the results aggregated for each income quintile in the survey. These data largely agree with the primary analysis conducted in 5.1.1. The average household in the lowest quintile of income spends approximately 4.5% of their income on water and wastewater, which implies that many of these households spend above that threshold. Furthermore, the percentage of income spent on water and wastewater services has steadily increased over time for

households in the first (lowest) quintile of income while the percent of income spent on water has been increasing more slowly for higher quintiles.

EPA identified other surveys that present similar data including the American Community Survey public use microdata and the American Housing Survey. These surveys use different concepts of income (see Section 5.3) and different sampling schemes. Generating comparable results is therefore difficult. EPA intends to further examine these survey data in order to better describe water affordability nationally.



Percentage of Stable Household Income Spent on Annual Water/Sewer Expenditures, Avg. Ratio Within Income Quintiles

Note: The x-axis depicts survey year while the y-axis depicts mean affordability ratio. Annual water/sewer expenditures were manually calculated from PSID responses. Stable household income is the average pre-tax income from the previous survey wave and the current survey wave to control for transitory shocks. EPA furthermore dropped all observations with business asset losses (no negative pre- tax income). Labels indicate quintile.

Source: PSID Data, 1999 – 2021

Appendix G: IIJA 50109 Pilot Program Estimated Funding Level

Key Assumptions to Generate 50109 Pilot Estimate

Selection of Utilities. IIJA Section 50109 directs EPA to make no more than 40 grants. For the estimation, EPA assumed the maximum of 40 grants would be awarded.

Range of Need. The higher cost range of estimated need was utilized for the pilot estimate.

Qualifying Households Rate. For this estimation, the national rate of qualifying households was assumed within each pilot area because the locations of the pilot communities cannot be assumed. This is likely a conservative estimate considering the pilot communities will be purposefully selected. However, the enrollment rate (discussed below) is optimistic, which could offset this assumption.

Enrollment Rate. The enrollment rate among eligible households was assumed based on size of the utility. The lower range of the funding estimate assumes an 80% enrollment rate for rural utilities to a 25% for utilities serving more than 500,000 people. The Disadvantaged Community category was assumed to have 80% enrollment. The upper range of the funding estimate assumes a 90% enrollment rate for smaller utilities to 50% for utilities serving more than 500,000 people. The disadvantaged community category was assumed to have 90% enrollment. The pilot is likely to necessitate significant people power to engage eligible households. Eligible households need to understand the program exists and may need to provide documentation to verify eligibility. The assumed enrollment rates varied by size are optimistic and much higher than real-world CAP enrollment rates. Particularly for large or very large utilities, even a small percentage of their eligible population would represent a significant number of people who would require people power to get them enrolled.

Size of Utilities. The pilot categories are stipulated in IIJA by type of utility. For rural, medium, and 100,001-500,000 utilities, the average population served within each category was assumed, based on a SDWIS data pull of community water systems in all states in April 2024. The >500,000 category assumed the median population served since there is no upper bound. Large outliers would likely push the average population served for the very large category higher than functional for this purpose. The disadvantaged community category was assumed to have 3 rural, 2 medium, and 3 large utilities. About a third of states prioritize water utility size in their disadvantaged community criteria (U.S. EPA, 2022), which was the rationale for assuming 3 rural utilities within the Disadvantaged Community category.

Population Served	IIJA Size Definition Classification	IIJA 50109 Pilot	Assumed Population for Estimate
0 – 10,000	Rural	8	1,189
10,001-100,000	Medium	8	28,928
100,001 -500,000	Large	8	190,737
>500,000	Large	8	822,600
Disadvantaged Community (size unspecified)	–	8	79,204

Administrative Costs. There is a 20% administrative cost (15% grantee, 5% agency) included in the estimation for the pilot.

Inflation. There is a 4% inflation estimate included in the estimation for the pilot. This percentage is higher than the annual inflation rate to reflect the average increase of water and wastewater bills.

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