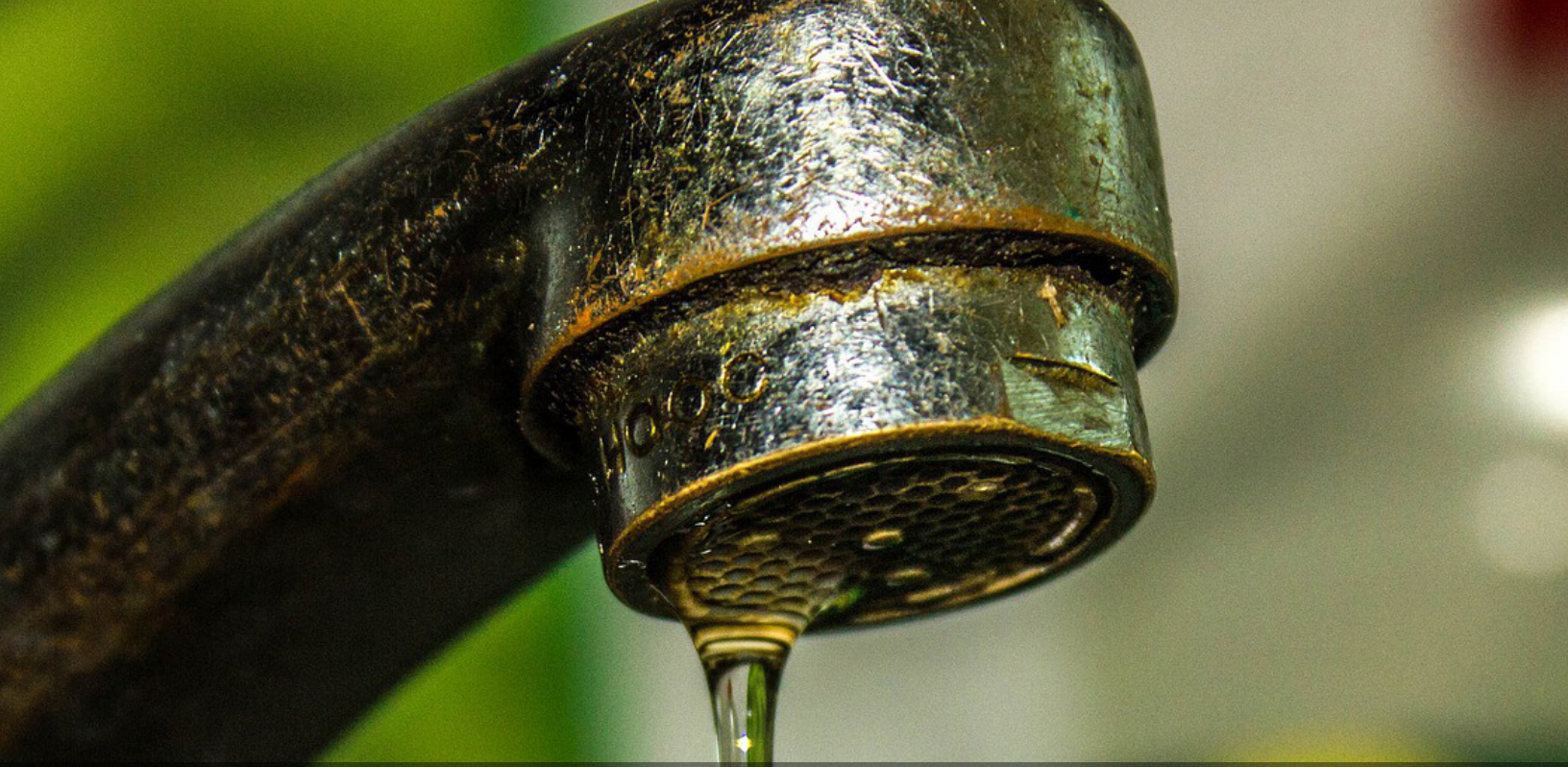

WATER SERVICE AFFORDABILITY IN MICHIGAN: A STATEWIDE ASSESSMENT

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WATER SERVICE AFFORDABILITY IN MICHIGAN: A STATEWIDE ASSESSMENT

1. INTRODUCTION

This report examines the affordability of water services (drinking water, wastewater, and stormwater) across the state of Michigan. The report contributes to the policy conversation by providing a snapshot of the current status of water affordability across the state.

Drawn from public source data, as well as interviews with the primary stakeholders, the analyses here quantify the affordability of water services across the state of Michigan at the household level and explore important issues utilities face in providing safe and affordable water services to the communities they serve. The report does not recommend specific solutions for water affordability; many groups across the state of Michigan and nationally are working on specific policy solutions. Instead, the report presents quantitative analyses, along with perspectives, insights, and personal and professional experiences with water rates, bills, and utility management gleaned from conversations with frontline community groups, water utilities, and state agency personnel. This important contextual information provides crucial considerations for policymakers when developing solutions to the identified challenges.

This report uses the terms *water* and *water service* as shorthand to refer to the entirety of water-related costs a household or utility may have, including drinking water, sewage, and stormwater costs. In recent years, some communities have added stormwater charges as separate water charges. These fees can represent additional costs to individual households that struggle to pay for their basic needs.

To progress toward making water affordable for all, it is important to have a shared definition of the term ***affordability***. In the context of this report, the term is used to discuss both household-level affordability and utility/community-level affordability.

> ***Household-level water affordability*** refers to a household's ability to pay for its water and sewer services **without undue economic hardship**, such as sacrificing other essential goods and services—e.g., health care, food, insurance—for access to water. ***Access*** to water means there is ample clean and safe water for household use and that the home has the necessary infrastructure to both receive fresh water and remove wastewater to protect human life and the environment.
>
> ***Community-level water affordability*** reflects the community's ability to afford water and sewer infrastructure, along with its continued operation and maintenance, such that the infrastructure delivers consistent, reliable water services compliant with applicable health and environmental laws and regulations.
>
> *Sources: Raucher et al., 2019; Center for Water Security and Cooperation, 2021*

Public health begins and ends with water. People must have access to safe drinking water to survive. People must have access to sanitation, or wastewater removal, to prevent disease. Furthermore, excess stormwater can cause flooding and extensive direct and indirect harm. Well-designed and maintained water infrastructure is essential for meeting and managing these basic human needs.

In many communities, inability to pay leads to water service shutoff in individual homes, resulting in a

lack of drinking water and basic sanitation at the household level. If an entire community struggles to afford water infrastructure maintenance and renewal, the community may never receive the quality, reliable water service—for delivery and collection—that it needs to thrive. The COVID-19 pandemic has substantially increased the health and societal consequences of water shutoffs while dramatically increasing the number of residents at risk of missing bill payments. This presents a large and growing risk, both to water supply sustainability and to equity.

Water industry groups have been grading the condition of water infrastructure and quantifying the investment needed to ensure sustainable water systems for years, noting the lack of federal and state investment has meant significant increases to water rates.

Although these two groups—communities and utilities—work together on occasion, the policy discussions on water affordability and water infrastructure funding often occur in separate rooms with separate outcomes. The pandemic presents a new urgency and opportunity to address these issues holistically: to prevent a return to water shutoffs as a standard, accepted practice while addressing utility financing concerns and finding a revised financing structure that allows water suppliers to maintain and replace water infrastructure and provide the safe and affordable water that all residents deserve.

Now we have the opportunity to build on the extensive work all stakeholder groups have developed over years, to chart a path forward, and to build political will to take action. When we spoke with community members, however, they expressed distrust in the process. As one interviewee noted, "Every time we think a new strategy or a new dataset is going to advance this conversation, we expose new vulnerabilities and we fail to make progress." The rationale for why we cannot solve this problem keeps changing, they said, and the current narrative is lack of funding.

BUILDING ON EXISTING WORK

This report builds on and extends the foundational efforts in recent decades of numerous community-based organizations in Flint, Detroit, and adjacent communities, as well as their partners across Michigan, to address water affordability, including water shutoffs and access to safe water in general. The recent history of water affordability in Michigan is defined by the dual crises in Flint and Detroit, along with the emerging challenges in Benton Harbor. Water affordability, as a topic separate from other poverty-related finance issues, was generally not considered in Michigan until the early 2000s.

In 2005, the Michigan Welfare Rights Organization and Michigan Legal Services commissioned economist Roger Colton to develop a Water Affordability Plan for the Detroit Water and Sewerage Department (DWSD). The plan addressed the "substantial problem" of unaffordability that had arisen in "recent years," noting, "Not only have customers been disconnected, and gone without service, but even households that pay their bills incur substantial hardships because of the unaffordability of their bills" (Colton et al., 2005). Colton's report suggested an income-based approach to water and sewer charges for Detroiters. The plan was approved by city council, but it was never implemented and remains central in the discussion of water affordability today. After the Colton report, many interested groups founded the People's Water Board Coalition in 2009, asserting that water is a human right and should be affordable and accessible to all (People's Water Board Coalition, 2016).

Water shutoffs have been occurring in Detroit since or before the early 2000s. The People's Water Board Coalition states that "more than 40,000 households… experienced water shutoffs by 2003" (People's Water Board Coalition, 2016). The 2006 DWSD budget included resources to shut off an additional 45,000 homes (MWRO, 2006). Between 2010 and 2019, of the approximately 300,000 housing units in Detroit located in structures of less than four units,[1] over 175,000

1 Detroit Water and Sewerage does not individually bill households in structures comprising four or more housing units.

households experienced at least one shutoff (Kurth, 2019). In 2013, while Detroit was under emergency management and bankruptcy proceedings, DWSD completed 16,693 shutoffs.

The next year, that number nearly doubled, and Detroit garnered international attention for the practice—including condemnation from the United Nations that noted, "Disconnection of water services because of failure to pay due to lack of means constitutes a violation of the human right to water and other international human rights" (Gottesdiener, 2014). Despite a brief (one-month) moratorium on shutoffs, during which the city proposed a 10-point plan addressing water affordability called the Blue Ribbon Affordability Plan, the shutoff policy was continued. Over 93,000 shutoffs occurred between 2015 and 2019, making it clear that the DWSD assistance plan was not sufficient. On March 9, 2020, Detroit placed a moratorium on shutoffs, one day before the governor of Michigan announced a statewide moratorium due to the COVID-19 pandemic (EO 2020-28). The Detroit moratorium has been extended to 2022 while the city works on a permanent solution (City of Detroit, 2020).

The origins of the Flint Water Crisis are different, but they began with the issue of unaffordable water and evolved to include lack of access to clean and safe water—another component of our definition of access to affordable water at the household level. Similar to Detroit, economically vulnerable Flint residents had been fighting expensive water at the household level for some time. Then, in 2014, under emergency management, the city decided to temporarily switch water supplies from DWSD to the Flint River to save money while constructing a pipeline from Lake Huron. Residents noticed an immediate change in water quality. After a year of pressure from individuals and Flint community groups about the increasing cost and poor quality of water, researchers published several studies revealing high lead levels in the water and the doubling of lead blood levels in children (Edwards, 2015; Hanna-Attisha et al., 2016). Contaminated water is also blamed for an outbreak of Legionnaires' disease that killed 12 and sickened at least 87 people between June 2014 and October 2015. The city's attempt to address detections of total coliforms and E. coli resulted in elevated levels of total trihalomethanes (TTHMs) in the water system due to over-chlorination (Masten et al., 2016). The crisis again put Michigan in the international water spotlight. In 2016, the U.S. Senate approved a bill allocating $100 million to Flint in order to replace lead pipes. Then, in 2021, a $626 million settlement was awarded to the residents affected by the crisis. Nine officials were indicted with criminal offenses, including former governor Rick Snyder (Michigan Attorney General, 2021).

The Flint and Detroit water crises, along with widespread water affordability issues in cities like Highland Park, Pontiac, and Benton Harbor, have brought much attention to the issue of water affordability in Michigan. Chief among this research was *Mapping the Water Crisis* from We the People of Detroit Community Research Collective, a visual exploration of the causes and impacts of the Detroit crisis that was published in 2016 (We the People of Detroit, 2016). That same year, the Haas Institute's report Water Equity and Security in Detroit's Water and Sewer District found, among other things, that the Water Residential Assistance Program (WRAP) was insufficient to meet Detroit residents' needs (Recchie et al., 2019). A 2018 University of Michigan survey of the greater Detroit area found that 72.8% of low-income customers reported that it was a struggle to pay their water bill and that they were willing to pay what they could afford (Rockowitz et al., 2018). Roger Colton completed a follow-up analysis in 2019 that found that low-income residents in each county reported paying, on average, 10% of their monthly household income for water services (Colton, 2019). More recently, the efforts of Detroit and Flint groups have expanded across the state, demonstrating that these concerns occur at the household level throughout Michigan. This report seeks to quantify, describe, and locate those households and the specific challenges they face.

ABOUT THIS REPORT

This assessment looks at affordability at the levels of both individual households and communities. In the household analysis, we calculate several affordability indicators using census and utility rate survey data. The data and methods used in developing the indicators are described in Section 2. These indicators, functions of water cost (reported or calculated) and income (plus or minus other expenses), allow us to explore their geographic and demographic characteristics via regression and latent class analysis. Section 3.1 describes our findings at the household level.

At the community level, we explore financial capability via funding needs and expenses surveys conducted by the EPA, American Water Works Association (AWWA), and Census of Governments for the whole state. Sections 3.2 and 3.3 describe our findings at the community and utility levels. We compiled work about the affordability of private wells and septic systems in order to provide a more complete picture across the state, from urban to suburban to rural residents. These results are explored in Section 3.4.

We also interviewed a range of relevant stakeholders, with the expectation that their experience would provide important context for the technical analyses. We believe this context, provided in Section 3.4, will be valuable to policymakers in developing meaningful and sustainable solutions to the statewide issues documented in the quantitative analyses.

SHARED STAKEHOLDER SENTIMENTS

Through the course of this work, the stakeholders we interviewed agreed on the following concepts:

All Michiganders need available and affordable, safe, and sustainable drinking water and sanitation services.

Economic stability is a necessity, and it requires appropriate supplementation from state and federal entities.

- **At the household level, economic stability provides for health, family stability, and human dignity.**
- **At the water utility level, economic stability provides for technical, managerial, and financial capacity.**

When a household is unable to pay its water bills (i.e., the water is shut off), there are impacts to the household (damage to health and dignity), the water utility (operational costs and unreliable revenue), and society (public health and collective well-being).

2. DATA AND METHODS

DATA

This section describes the data used in this report. Where possible, we have used publicly available federal data to ensure our analyses will be readily replicable and to establish the ability to monitor progress. For state and local policies designed to address the water affordability challenges outlined in this report, tracking trends in the data used here over time could provide evidence of success and reveal opportunities to improve. Below we explore each data source used in this report, its limitations, and its benefits.

IPUMS

We used data retrieved from IPUMS, an initiative to provide access to global census and survey data through time.[2] Housed at the University of Minnesota, the initiative provides researchers access to many integrated datasets drawn from the U.S. Census, the American Community Survey (ACS), and the Puerto Rican Community Survey via an online database. We accessed data from 1980 through 2018 comprising de-identified individual observations that provide household water costs, income, and demographics in the same observation. With these observations for a household, we do not need to make assumptions about household size or income in determining the ratio of water service cost to income at the household level.

There are some notable limitations of the IPUMS dataset. Foremost among these is the geographic resolution of the observations—Public Use Microdata Areas (PUMAs). To maintain the anonymity of respondents, each PUMA is a geographic area of 100,000 people. Accordingly, PUMAs are smaller in dense, urban areas and larger in sparse, rural areas.

The second limitation of this dataset is that water costs are reported by respondents, not measured directly. Therefore, we cannot be certain what respondents incorporate into the costs they report. For example, respondents may or may not include storm sewer/drainage fees.

To collect water service costs, the ACS asks the following question:

> **IN THE PAST 12 MONTHS, what was the cost of water and sewer for this house, apartment, or mobile home?** *If you have lived here less than 12 months, estimate the cost.*
>
> Past 12 months' cost -
>
> Dollars $_____.00
>
> **OR**
>
> [ ] Included in rent or condominium fee
>
> [ ] No charge

There is also ambiguity in what respondents indicate as their cost of water and sewer, especially for those who do not receive regular water service bills. For households on private wells and septic systems, for example, we assume that the most common response is no charge (24.25% of respondents in 2018), although some households may provide maintenance and operation costs. Additionally, respondents may decline to provide water costs (5.41% in 2018)[3] or report them as "Included in rent or condominium fee" (16.52%). In order to address the gaps in reported water costs

2 Originally IPUMS was an acronym standing for Integrated Public Use Microdata Series; however, because the initiative has expanded over time with other projects that either lack microdata or have conditions that limit their public use, IPUMS is now just a prefix used for project names. Regents of the University of Minnesota, IPUMS, "Mission and Purpose," **https://www.ipums.org/mission-purpose** (accessed 7/19/21).

3 These two numbers—no charge (24.25%) + decline to report water costs (5.41%)—are close to the MI Department of Environment, Great Lakes, and Energy estimate of 30% households in the state with water/sewerage provided by wells/septics (**https://www.michigan.gov/egle/0,9429,7-135-3313_3675---,00.html**). We assume that the majority of private well and septic systems users are reporting no charge, which means the IPUMS data cannot be used to account for the affordability of those systems.

and to conduct a more complete analysis of Michigan household water costs, we adjusted the 2018 IPUMS dataset to impute the water costs across the country. We ran a multiple-imputation analysis on the dataset for any household that reports water costs included in their rent or condominium fees. To estimate water costs for renters, the model used reported water costs for households and the following variables reported in the survey: metro status, number of units in the structure, number of people in the household, ownership of home, value of home, food stamp status, poverty status, and state to estimate water costs for the renters. The imputations added 691,340 weighted Michigan households to the analysis, all of which report water costs in condominium fee or rent. The remaining households, 29.66%, presumably get their water from private wells. This is reasonably close to the 30% of Michigan households that use private wells (Michigan Department of Environment, Great Lakes, and Energy, n.d.-b).

We conducted all the analyses we describe below with both the imputed and the non-imputed IPUMS datasets as a robustness check. Typically, the results did not vary significantly; however, there are a few instances of informative differences. We highlight these in the results in the following sections. Otherwise we report results for the imputed dataset because it includes approximately all the households that pay for water service in Michigan. Therefore, the results better describe the costs and affordability issues that Michigan households face. The only part of our analysis for which we do not use imputed IPUMS data is the time series graphs and charts because we only imputed the 2018 dataset.

Rate Schedule Survey

Another way to calculate household water costs and address the potential bias in self-reporting is to determine costs using water system rate schedules. To do this, we surveyed the water and sewer schedules of community water supplies in Michigan. The EPA's Safe Drinking Water Information System (SDWIS) indicates that there are 1,383 community water systems in the state as of 2020. The EPA defines community water systems as systems that provide water or sewer to at least 25 people year-round or 15 service connections. Our rate survey consisted of a sample of systems under 10,000 stratified by the number of people served for systems serving less than 500, between 501 and 3,000, and between 3,001 and 10,000. It also included all systems above 10,001. Results are weighted using the SDWIS population and service counts to account for non-random selection.

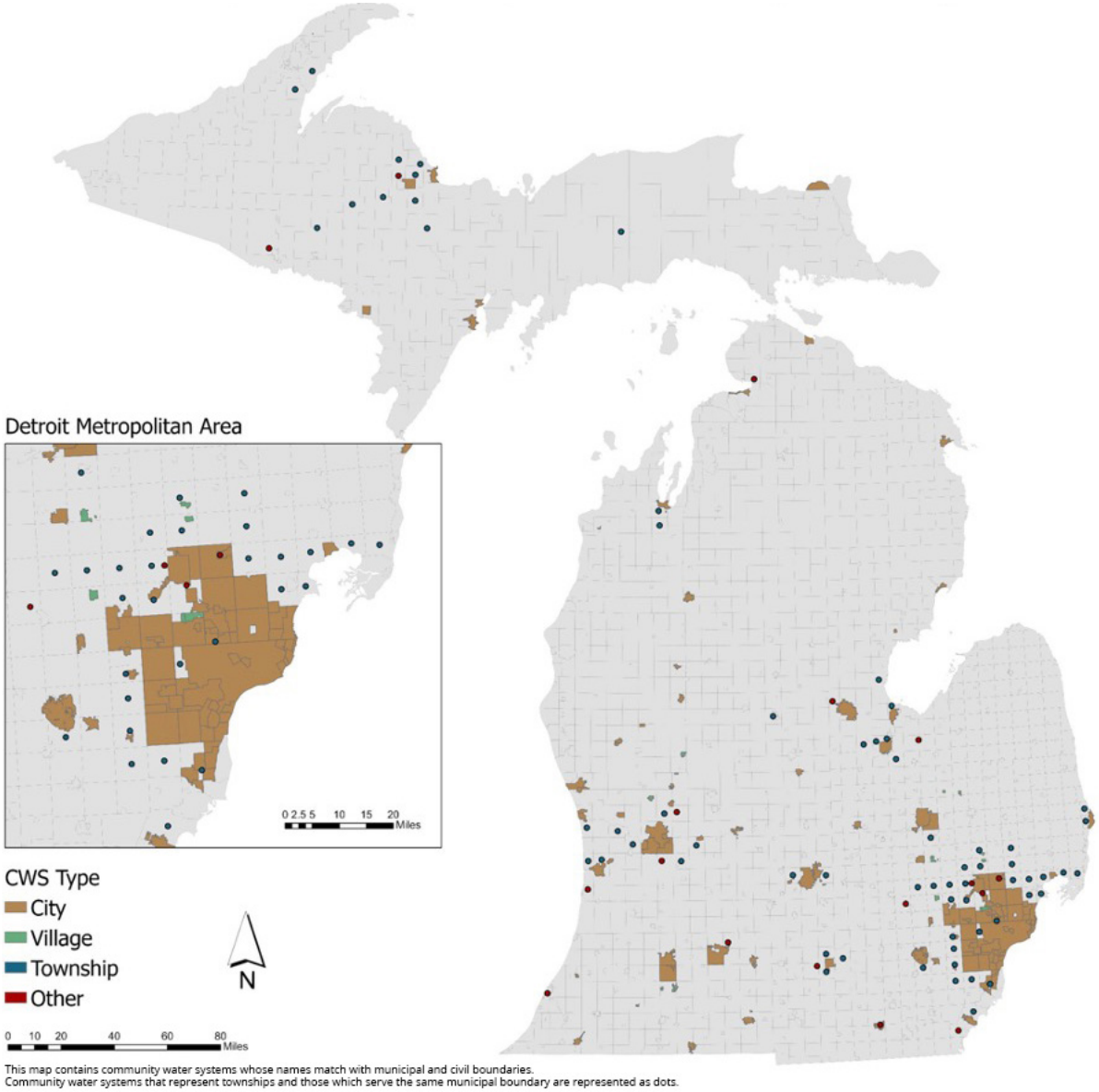
We conducted the survey by finding rates online as well as by communicating via email and telephone with select water systems.[4] We emailed and followed up three times with systems whose rates were not found online. For each community, we collected data needed to calculate water bills for a family of four with a usage of 50 gallons per person per day,[5] living in a freestanding single structure with a $^{5}/_{8}$ inch water service. In order to compare analyses across the state, we also included stormwater (drainage) charges (but not garbage collection) when these were stated explicitly in the rate schedule. We recognize that drainage charges are very significant in some communities and are included in water bills, making them an additional burden for households already challenged to pay for their basic services and possibly pushing them into arrears. The rates collected include infrastructure and flat fees that are not associated with variable water use in the home.

4 We found rates for 166 water supplies online and recorded the URLs. We emailed three water supplies, who responded with rate information. We telephoned all remaining community water supplies.

5 See Affordability Ratios for discussion on water usage.

Figure 1. Sampled Community Water Systems, 2021

Figure 1 is a map that shows all systems sampled, their location in the state, and their municipal boundaries where cities or villages are served. Municipal boundaries are not always an accurate description of utility boundaries, especially in rural areas, and for townships specifically. Township water service areas are typically much smaller than the township's geography and are therefore shown as colored dots on Figure 1. Table 1 provides the breakdown of the stratified samples.



The collection took place between February and May 2021, and we found water rate data for 265 community water systems in total. All but two of the community water systems serving >10,000 people responded, a 98.5% response rate. We found data for 65.4% of the systems sampled that serve <10,000 people, with the lowest response rate coming from systems that serve ≤500 people. Of the systems that serve ≤500 people, 29 reported not charging households separately for water—six of these were group housing facilities, and 23 included water services in rent or condo fees. The response rate for small systems suffered from inactive phone numbers/emails in the SDWIS database and little-to-no online presence. In this way, response bias was toward those systems with the resources to support web pages and operating phone lines.

Table 1. Public Community Water System Schedules Collected (Totals per 2020 SDWIS)

Population Served	Total in Michigan	Collected in Survey	Charged Customers Directly	Only Serve Water
>100,000	7	7	7	0
10,001–100,000	129	127	127	2
3,001–10,000	155	45	45	6
501–3,000	381	41	39	3
≤500	714	41	15	13

Income and Expenditures

We used publicly available data from the ACS 5-year estimates and the Consumer Expenditure Survey (CEX) collected by the U.S. Bureau of Labor Statistics to generate income and expenditure information. The ACS provides the number of households in 10 different income brackets for a given geography. We used stepwise distribution to estimate in which bracket the 20th percentile of income would fall. Using this income range, we then obtained a specific estimate of annual household income by assuming there is a uniform distribution within each income bracket. For essential expenses at the 20th percentile, we used both the CEX, which sampled roughly 1,250 Michigan households between 2017 and 2018, and the IPUMS data from 2018. Following methodology outlined by Manuel Teodoro (2018), we developed a regression model that estimated household expenditures on taxes, housing, home energy (data source: CEX), and health care and food (data source: IPUMS) for households in Michigan. We then used specific demographic information for each county to estimate expenditures at the 20th percentile income for a four-person, single-family household.

Key Stakeholder Interviews

Recognizing the limitations of our quantitative analyses, we knew that the experiences of key stakeholders would be fundamental to identifying and characterizing household- and utility-level issues. Therefore, we conducted a series of interviews designed to better understand both the overall context of water service affordability in Michigan and the specific challenges faced by households and differently sized and aged water systems.

Between November 2020 and June 2021, our team interviewed 32 individuals representing the three primary stakeholder groups in this space—frontline communities, large and small water utilities and other water sector perspectives, and state regulatory agencies and municipal governments. A list of the individuals we interviewed is included in the Appendix.

We identified interviewees by developing an initial list of individuals from the three key stakeholder groups and reaching out to them for interviews. Some of our initial interviewees were industry association representatives, e.g., AWWA or Michigan Rural Water Association (MRWA), who helped identify and introduce us to individuals at geographically and demographically diverse utilities. We asked our initial state agency and frontline community group for suggestions of additional individuals whose perspectives would broaden the study. We asked the individuals we interviewed to share their understanding of and personal experiences with water affordability, to describe what water affordability information they want, to consider where opportunities may lie, and to identify challenges Michigan policymakers need to keep in mind when tackling this issue. Section 3.4 below reflects our synthesis of what they told us. We are grateful for their time and commitment to building a sustainable future for all.

METHODS

We took several different approaches using the best available data and resources to develop a comprehensive picture of water affordability across Michigan. Some of our analyses are data driven and are reported in Sections 3.1–3.3 as maps, charts, and graphs. Other analyses relied upon interviews with key stakeholders and are reported as observations in Section 3.4. The processes we followed to conduct the analyses are described in this section.

Affordability Ratios

The billed cost of water alone is not a useful measure of affordability. It becomes significant when presented in context, such as relative to other household expenses and income. In this report, we consider multiple ways to examine the ratio, known as *water share* or *water burden*, of annual household expenditures on water services to annual income. Many researchers have calculated water burden for households across the United States (Cardoso and Wichman, 2020; Mack and Wrase; 2017 Mumm and Ciaccia, 2017), but all have relied on rate schedules to determine water cost and on American Community Survey 5-year income distributions to estimate household income. This approach requires researchers to make assumptions about water use and household size when estimating water costs and to determine a method to attach an income to a bill, whether it be a single income (Mumm and Ciaccia, 2017) or an income distribution (Cardoso and Wichman, 2020).

Affordability ratio (AR) is an indicator developed by Manuel Teodoro that builds upon water burden by incorporating other essential expenses of a household (Teodoro, 2018). AR can be used to indicate affordability at the household, community, or utility level. At the household level, the measure is calculated with individual household information:

> AR = Water and Sewer Costs ÷ (Household Income – Essential Expenses)

To calculate the affordability ratio, we used individually reported data from the 2018 American Community Survey, retrieved from IPUMS as described above, to generate annual household water and sewer expenditures as a share of household income for specific, individual households. Because we use individually reported data, we do not need to make any of the assumptions about household size or income that others have made, and the IPUMS data integrate factors such as water leaks and the impact of older appliances on household water costs.

The disadvantage of this approach is the lack, in many cases, of geographic resolution to calculate AR at the community water supply level. When household water bills and incomes are not known for a given community water supply, researchers must make assumptions about those variables. Teodoro, for example, calculates AR for a family of four at the 20th percentile (AR20) with the following formula:

> AR20 = Basic Water and Sewer Costs ÷ Disposable Income for Consumers at 20th percentile

This formula, AR20, is useful when individual bills and incomes are not available—which, due to data limitations, is often the case at the utility level. Therefore, we have used AR20 for analyses in this report as needed when data is not available. AR20 estimates costs and expenses specifically for low-income households, the segment of the community most vulnerable to water affordability challenges. AR20 can also be estimated at the census-block level, allowing for inter- and intra-utility comparison which, because of time and resource constraints, we did not complete in this current assessment.

The biggest disadvantage of the AR20 measure is that it estimates water affordability at the community level and by representing the water burden of a theoretical family of four, rather than closely matching an area's demographics. The measure does not allow us to vary water use by locality or account for how discrepancies in quality of plumbing or appliances impact water use. Lastly, AR20 does not capture affordability for households that are not connected to water systems.

In calculating AR20 for this report, we use the utility rate schedules we gathered to calculate the basic cost of water and sewer for a family of four who consumes 50 gallons per person per day.[6] We determined disposable income by subtracting expenditures such as shelter, food, taxes, and bills (Consumer Expenditure Survey) from 5-year estimated household income (American Community Survey).

Latent Class Analysis

Latent class analysis (LCA) is a statistical method to identify distinctive subgroups within populations that share common characteristics (Weller et al., 2020). This analysis returns subgroups, referred to as latent groups, or classes, that are determined by latent (unobserved) heterogeneity in samples. We used Mplus 8.4 software to conduct a latent class analysis on those households that paid more than 5% of their income for their water and sewer bills in 2018 and on households whose AR was above 10%. The analysis on both these measures produced similar class groupings.

We used the following variables to determine the latent classes: cost of water, age, poverty level, metropolitan status, race, household type, employment, and household ownership. The variables of age, race, and employment refer to the head of household as identified by the American Community Survey. We selected a model with four classes, with an entropy of .844, an Akaike information criterion (AIC) of 29589387.934, and a Bayesian information criterion (BIC) of 29590430.119. While this model had neither AIC or BIC as low, nor entropy as high, as a five-class model, we selected the four-class model for communication purposes. The five-class model had very similar subgroups as the four-class model, except that the fourth class, "Older Residents," splits into two groups whose prime distinction is race. When identifying populations of need, this additional subgroup is not as resourcefully distinctive as the other groups and is represented in the four-class model. Models with more than five classes break the population into subgroups of less than 5% of the total population and are not analytically helpful.

Water Infrastructure Needs Assessment and Affordability Forecasting

In order to estimate the statewide water and sewer infrastructure funding gap, we looked at national and statewide needs surveys as well as data from the Census of Governments, a five-year financial survey of state and local governments conducted by the U.S. Census Bureau. The U.S. EPA and AWWA needs surveys informed the 20-year water and sewer infrastructure needs estimates we developed, while the Census of Governments provided the annual infrastructure spending. We used this information to estimate the difference between investment and needs.

The U.S. EPA is required to conduct two surveys every four years, and these surveys provided data for this analysis. The EPA Drinking Water Infrastructure Needs Survey Assessment is a national survey that reports drinking water needs results at the state level. The Clean Watersheds Needs Survey looks specifically at wastewater needs, and results are available by watershed. EPA conducted each assessment every four years from 1996 to 2016. The Drinking Water Infrastructure Needs Survey Assessment has one major limitation: it only collects information on "needs" that can be financed by the Drinking Water State Revolving Fund (DWSRF), which focuses on compliance with the Safe Drinking Water Act. The 2018 assessment includes the cost of replacing a subset of lead service lines in Michigan. However, the Michigan Lead and Copper Rule, which was revised in 2018, now requires water utilities to replace all lead service lines by January 1, 2041, putting the total lead service line replacement burden on the next 20 years. The DWSRF does not cover needs related primarily to population growth or water system operation and maintenance costs, so this limitation

6 This usage is lower than the U.S. average consumption of 84 gpcd and more than minimum consumption of 27.2 needed for essential tasks such as drinking, cooking, health, and sanitation (Vanhille et al., 2017). Teodoro (2018) uses this standard when calculating AR, noting that 50 gpcd is a typical assumed minimal residential wastewater flow for purposes of sewer system design and is meant to reflect indoor, nondiscretionary water use to maintain health in a contemporary U.S. home.

can exclude important projects such as raw water dams, reservoirs, and distribution system expansion (EPA Office of Water, 2018).

The AWWA conducted a needs assessment in 2012, called Buried No Longer: Confronting America's Water Infrastructure Challenge, that specifically focused on water distribution systems. This assessment surveyed water main material type and age and estimated replacement values for mains in poor condition (AWWA, 2012).

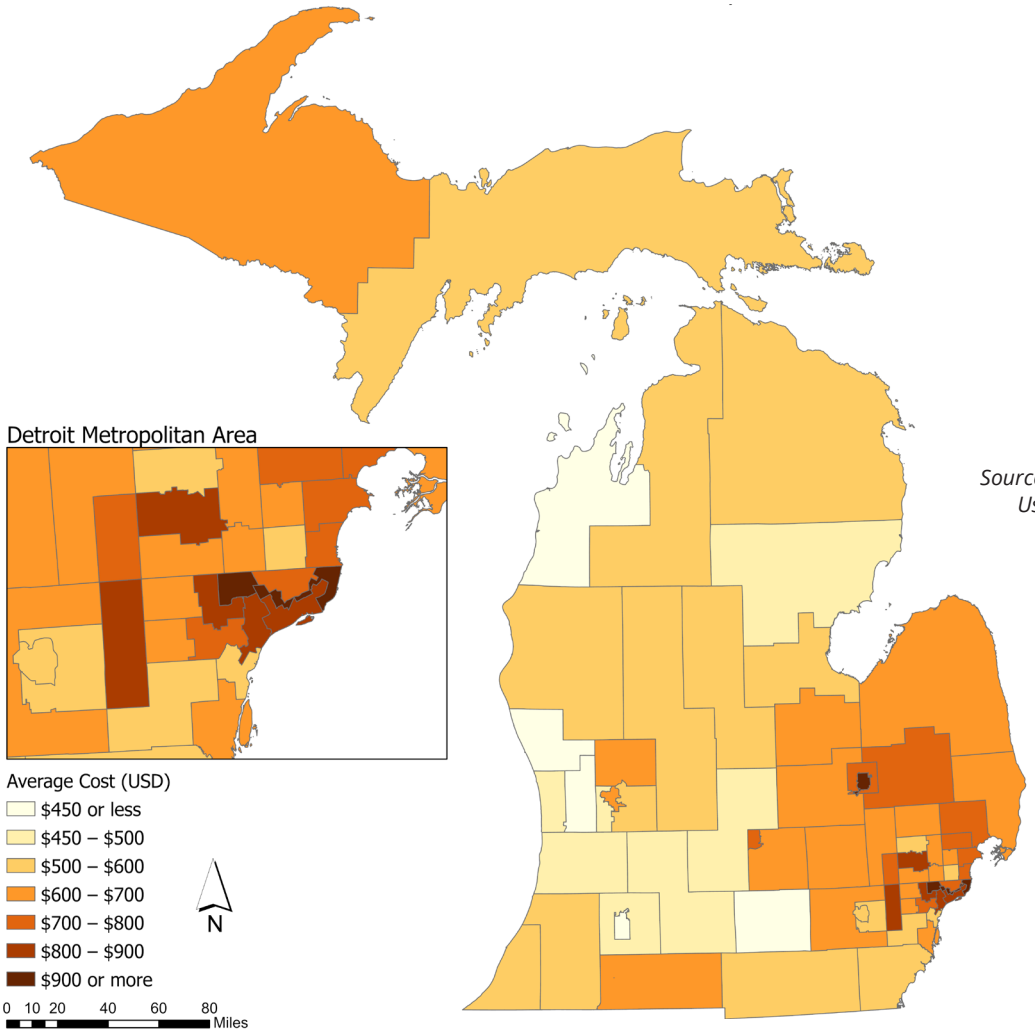
We quantify current capital spending on water and sewer infrastructure using the 2017 Census of Governments, which reports the amount of spending on capital investment for water- and sewer-related infrastructure by governments (local and state) every five years.

Table 2. Summary: Affordability Metrics and Data

Metric	Data Source	Description	Pros	Cons
Cost of Water	IPUMS	Reported water costs	Captures annual water costs of households on municipal water supplies. Accounts for household-level issues with water use such as leaks, old appliances, and household size.	Cannot provide estimates at a fine geographic level, such as most utilities. Includes discretionary water use. Relies on customers knowing their water costs.
	Rate Survey	Calculated water costs	Captures water rates at the utility level. Allows for discretionary usage to be calculated.	Requires an estimate of water usage, which limits the ability to account for leaks, old appliances, and varying household size.
Water Burden	IPUMS	Cost of water ÷ household income	A metric that is easily understandable and relies on paired water costs and household income in the IPUMS data.	Does not account for the range in cost of living in different parts of the state. Also see IPUMS reported water costs.
Affordability Ratio (AR)	IPUMS, Census of Household Spending	Cost of water ÷ (household income – household expenses)	Relies on paired water costs, household income, and some household expenses. Accounts for impact of cost of living on water affordability.	Is more complicated to calculate. Not available at finer geographic resolution. Also see IPUMS reported water costs.
Affordability Ratio 20 (AR20)	Rate Survey, ACS, Census of Household Spending	Cost of water for a family of four ÷ (20th percentile household income – household expenses)	Available at the utility level. Accounts for differences in cost of living and income.	Requires estimated water use and is only representative of affordability at the 20th percentile income. See Rate Survey calculated water costs.

3. QUANTITATIVE AND QUALITATIVE ANALYSES AND FINDINGS

Figure 2. The Annual Cost of Water and Sewer, 2018



Source: Integrated Public Use Microdata Series from the American Community Survey

3.1 Affordability at the household level

In order to understand household water affordability, we need first to understand what households are paying for water services. The average annual water bill as self-reported by Michigan households in 2018 is $603—not significantly different from the national average of $601. These data come from the University of Minnesota IPUMS U.S. Census dataset, which represents all renters and homeowners on municipal water systems.[7] In comparison, the 2021 water rate survey we conducted indicates higher average bills. Using rate schedules requires assumptions of household size and use. The average water use in Michigan is 82 gallons per capita per day (gpcd) and, using average household size, corresponds to an annual bill of $1,016 (Dieter et al., 2018). Average water use might include discretionary outdoor usage, so for the purpose of this report, we will rely on a use of 50 gpcd[8] when calculating water bills. Using the 50 gpcd assumption and an average household size, the average bill drops to $727 annually. Using

7 See Section 2 for more information on the IPUMS data.

8 See Section 2 for more information on water use estimates.

a household size of four, which represents a typical family household, and a use of 50 gpcd, the average cost is $1,002. While the rate survey averages differ greatly, they offer a good way to compare utility systems with each other.

The results from IPUMS and the rate study also differ significantly. However, these datasets are not directly comparable. The IPUMS data were collected in 2018, and the dataset imputes water bills for renters who say their water is included in their rent. It also captures any water discounts received by households, as well as a small number of households who sourced water from private wells. The rate survey occurred in early 2021 and does not account for varied household sizes or usage. It is also possible that the difference between these estimates could be due solely to rate increases over the three years. While we cannot determine a definitive average cost of water in Michigan, unique insights on water affordability are offered by using these two datasets. The IPUMS results capture household expenses more accurately than the rate study, and the rate study provides insight into utility-level prices and affordability.

Figure 2 shows the geographic distribution of the mean annual bill for water services using IPUMS data for a given Public Use Microdata Area (PUMA). Average water costs calculated from the rate survey mentioned above shows the (often large) differences in bills between municipalities that are not captured in the average water cost at the PUMA level. On a city level, there is a discrepancy between the rate study and IPUMS data, with cities identified in the IPUMS, such as Flint, Grand Rapids, and Ann Arbor, having substantially lower reported water costs than rate survey results, and Detroit reporting water costs above the average calculated using the rate study data. These differences may result from differences in water usage due to leaks or efficiency of appliances, and/or they might reflect changes in rates between 2018 and 2021. Regardless of the source of the difference, the IPUMS data is not an overestimate of water rates but rather most likely an underestimate. Figure 2 also highlights the high cost of water in Detroit, Flint, and Pontiac compared to the rest of the state. A descriptive regression shows that households in large Michigan cities, on average, have annual water bills that are $124 higher than households not in large cities, while those in poverty pay $9 more than those who are not in poverty when controlling for household ownership.

Finding: Households in large Michigan cities have annual water bills that are, on average, $124 higher than households not located in large cities, while those in poverty pay, on average, $9 more than those who are not in poverty.

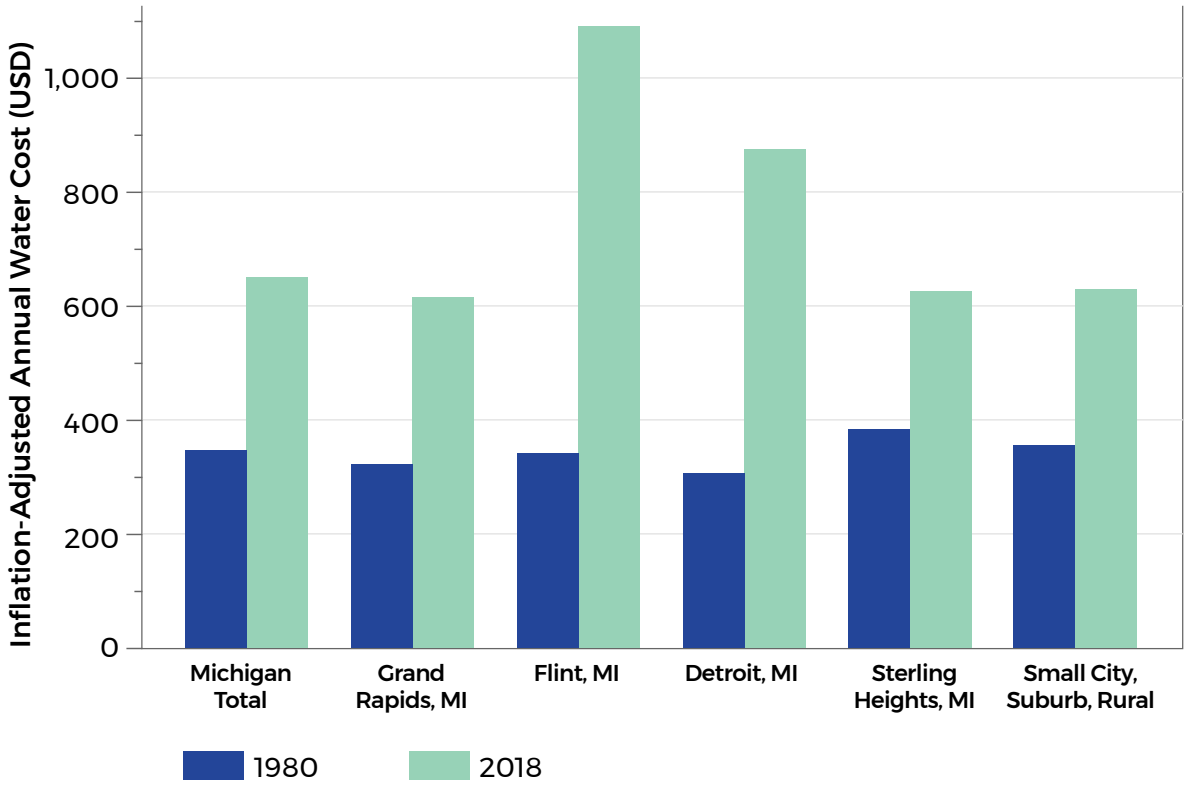
Table 3 shows the average cost of water for a family of four and confidence interval by the population served by the utility. These results are weighted by utility instead of population and help explain affordability at the utility level. To better understand the relationship between utility size and water cost alone, we ran an ordinary least squares (OLS) statistical regression model. This model indicates that the cost of water in community water systems decreases on average $7.47 dollars a year for every 100,000 people served by that

Table 3. Average Cost of Water for a Family of Four by Size of Community Water Supply

Population Served	Average	[95% confidence interval]	
>100,000	$931	-	-
10,001–100,000	$985	$979	$992
3,301–10,000	$1,051	$962	$1,114
501–3,300	$1,138	$998	$1,277
≤500	$843	$640	$1,046

Figure 3. Water Costs Have Increased Across Michigan

Average inflation-adjusted water costs have roughly doubled for the state as a whole since 1980. As the graph below shows, small cities, suburbs, and rural areas follow that average, while large urban areas (Detroit, Flint, etc.) have seen a much sharper rise. So, while water costs have increased across the state, the issue is exacerbated in urban areas.



utility. This analysis supports the conventional wisdom that larger systems tend to benefit from economies of scale in providing water services, although the magnitude may be small.

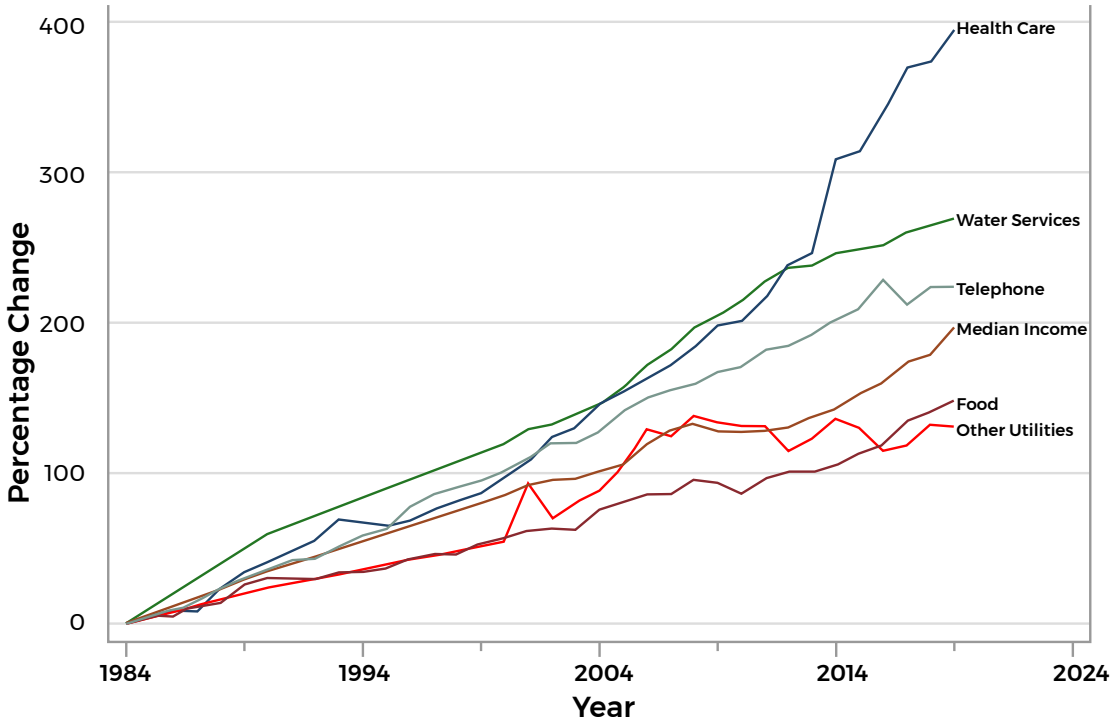
Much like the rest of the nation, Michigan has experienced rising water service costs. Figure 3 uses IPUMS data to calculate the increase in water costs over time. The average reported cost of water service in Michigan has increased 188% since 1980 when adjusted for inflation. Detroit and Flint have seen increases of 285% and 320% respectively over the same period. In 1980, the average annual cost of water was $345 in 2018 dollars, with little variation in cost among cities, extended metropolitan areas, and rural areas. While water costs across the state have risen since 1980, the biggest increases have been for those who live in cities.

Finding: The inflation-adjusted average cost of water across Michigan has increased 188% since 1980 and up to 320% in individual cities.

Water costs have risen steadily in the United States over the last 40 years. The Consumer Expenditures Survey report began to record household expenses in 1984. Using these data, we compared percentage changes in cost of many essential goods and services for the average U.S. household (Figure 4). Only health care costs have risen faster than water costs, and both of these have increased markedly more than median income. Notably, only food prices and other utilities have risen at a slower rate than median income.

Finding: The cost of water service, on average, has increased at a faster rate than all other essential goods and services except health care.

Figure 4. Percentage Change in U.S. Household Expenses Since 1984



Source: Customer Expenditure Survey

Table 4 below shows the cost of essential services in 1980 and again in 2018 for those at the 20th percentile of income in the Midwest. Again, only the cost of food and natural gas have increased at a slower rate than median income. Water costs have increased over 443% for those at the 20th percentile over that same period. Despite the marked increase in average water costs, water services are a relatively small portion of total essential household expenditures, which include shelter, transportation, food, and health care costs. Water affordability is a subset of the overall affordability of all of these essential services for economically vulnerable households. In reality, for these households, none of these services are affordable. The primary difference between water and other essential services is the existence of a national, state, or local safety net of public support that subsidizes these other essential goods and services—such as food, health care, transportation, telephone services, heat, and shelter—but rarely includes subsidized water service.

Table 4. Expenses for a Midwest Household at the 20th Percentile of Income

Essential Expenses	1986	2018	Percentage Change
Water Services	**$95**	**$421**	**443%**
Health Care	$971	$3,727	384%
Shelter	$2,042	$6,690	328%
Transportation	$1,781	$5,090	286%
Telephone Services	$335	$843	252%
Electricity	$465	$1,132	243%
Food	$2,053	$4,214	205%
Natural Gas	$301	$522	173%
Total Essential Expenses	$8,043	$22,639	281%
20th Percentile Income	$9,953	$24,000	241%

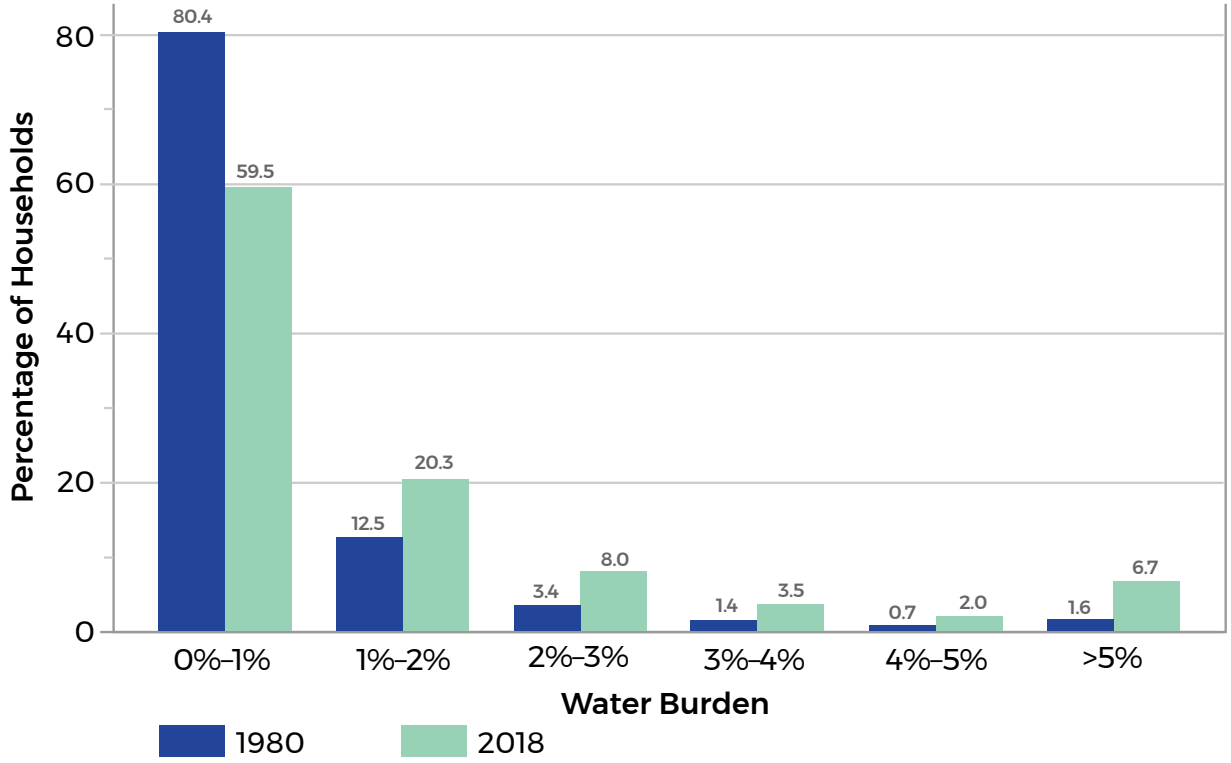
Source: Customer Expenditure Survey Midwest Region Table by Income

Finding: While water bills are the smallest of all essential services for vulnerable households, the percentage increase is the greatest for all essential expenses (443%), and there are no federal or state programs supporting residents in paying their water bills.

It is difficult to choose a specific price point, or water rate, above which water is considered unaffordable. There are many factors that determine whether a water rate is affordable. Most observers agree that it is more helpful to consider a ratio of water cost to household income, called *water burden*. There are several different ways to determine water burden and therefore different ratios, or percentages, that researchers and organizations consider unaffordable. The United Nations Department of Economic and Social Affairs defined unaffordable water service as requiring 5% or more of household income (UN, 2010). This corresponded to 6.59% of Michiganders in 2018, with a need of $78.3 million annually to avoid high-burden water bills. The Philadelphia Water Department's Income-Based Water Assistance Program (IWRAP)—a program Roger Colton initially developed for Detroit—determines water affordability by income level and poverty. According to IWRAP, households that are at between 0% and 50% of the poverty line should not have a water burden of more than 2%. Households between 50% and 100% of the poverty line should not have a water burden of more than 2.5%, and households at between 100% and 150% of the poverty line should not have a water burden over 3% (Philadelphia, Pennsylvania, Municipal Code § 19-1605). Using IWRAP eligibility, 10.28% of households in Michigan would have qualified for assistance in 2018, at a cost of $95.5 million.

The affordability ratio (AR) subtracts essential expenses from household income when calculating water burden. While not a definite determinant of affordability, an approximate threshold for AR could be 10% of income less other essential expenses (Teodoro, 2018). Using this approach, 10.75% of Michigan households in 2018 had unaffordable water, requiring $145.99 million in funding to keep all households under the 10% AR benchmark.

Figure 5. Michigan Water Costs Are Less Affordable Now Than in 1980



Finding: Between 6.59% and 10.75% of households across Michigan struggle with water bills.

While each of these measures are carefully considered and convey slightly different information, they are useful ways to assess the extent of households struggling to afford water service across geographies and demographics. This is especially true when we use them to consider change over time. Figure 5 shows the distribution of water burdens in 1980 and 2018, respectively. The percentage of households with a low water burden (less than 2%) fell from 80.4% to 59.5% while those with a water burden of more than 5% quadrupled. Also, the magnitude of increase as a percentage grew across every range.

While the cost of water services has been rising dramatically over this period, we also must consider the impact of changes in household income on this measure. Using the IPUMS data, we examined the inflation-adjusted change in cost of water and household income by income quantile. Water costs have increased among all quantiles an average of 43% while income has substantially risen over inflation only for those above the 75th percentile of income. This analysis indicates that changes in water burden are primarily driven by changes in the cost of water, especially for households whose incomes have not substantially changed in 40 years.

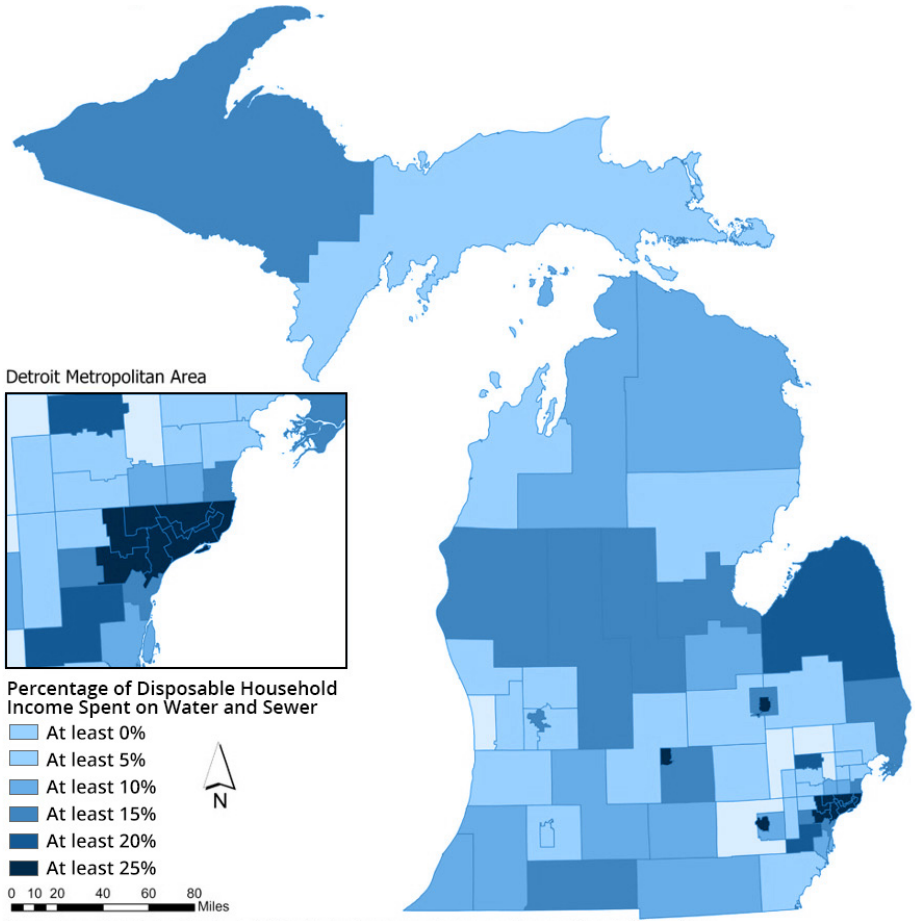
Finding: Rising water rates and stagnant incomes mean Michigan residents spent a greater percentage of their income on water in 2018 than they did in 1980.

Figure 6 is a map of the distribution of the affordability ratio for the most economically vulnerable 10% of households in each PUMA. This map highlights that water affordability is an issue, in particular, for metropolitan areas. The poorest residents in

Figure 6. Affordability Ratio of the 10% Most Vulnerable Households

This map of Michigan shows Public Use Microdata Areas (PUMAs), which are geographies of 100,000 people. The colors on the map represent the affordability ratio (percentage of household disposable income spent on water and sewer services) for the most vulnerable 10% of households in each PUMA.

As the map shows, challenges with water/sewer service affordability affect people throughout Michigan, across geography and demographics. The challenges affect households statewide—whether residents live in cities, suburbs, or rural areas—and the magnitude of the affordability problem has been increasing.



Source: Integrated Public Use Microdata Series from the American Community Survey and Census of Household Expenditures

Detroit and Flint pay upward of 25% of their income, minus other essential expenses, to water services. These cities also have the highest water costs in Michigan. The map also shows that for much of the rural part of the state, the most economically vulnerable 10% of households have an AR of 10% or more.

Finding: While households from all demographics and geographies struggle with water costs, almost all are below the poverty line and have above average water costs.

A basic analysis gives some indication of who might struggle to afford water. Using the metric of affordability ratio and water burden, between 5.5% and 8.3% of homeowners have high water burden. The same metrics show between 12.4% and 22.9% of renters have high water burden. Of all who bear a high water burden, 70.8%–78.1% live below the poverty line, and all but a small fraction (1.2%–5.6%) live below 200% of the poverty line. Geographically, between 9.1% and 10.2% of high-burden households live in non-metropolitan areas, corresponding to the percentage of Michiganders in those areas (9.45%). The latent class analysis below (Table 5) classifies households into identifiable categories that may better inform policy solutions than the statistics listed here. Classes 1–3 are common types of households that struggle financially, and Class 4 offers insight into a subset of the population that experiences very high water costs. Their high costs could be due to high water usage (such as from leaking pipes or outdoor maintenance) or may reflect costs not related to water service bills per se, such as bottled water or filtration system purchases. Notably, all classes have an average water cost above the Michigan average of $595 annually, and all but those in the "high water cost" category live below the poverty line (Table 5).

Rural Michigan: Private Wells and Septic Systems

Rural Michiganders without access to community water supplies receive their household water from private wells and their waste is treated through onsite septic systems. While this infrastructure is much less complex in scope than public water supplies, the potential cost for improvement at the household level is prohibitive. There are a number of reasons a well might become contaminated—runoff from agricultural, commercial, or industrial neighbors can introduce excessive nitrates; tetrachloroethylene, PFAS, and other long-lasting environmental contaminants can enter the aquifer; or nearby septic systems can stop working properly. The solutions include adding home filtration or other treatment

Table 5. Classes of Michigan Households With High Water Burden

Variable	Michigan Overall	Class One: Younger Singles 24% of total	Class Two: Younger Families 22% of total	Class Three: Older Residents 44% of total	Class Four: High Water Costs 10% of total
Water Cost	$595	$610	$1,088	$725	$2,462
Household Income	$76,694	$5,768	$12,833	$8,350	$27,365
Geography	Extended Metro Areas	Cities/Suburbs	Mixed	Mixed	Cities/Suburbs
Race	76% White 15% Black 9% Other	40% White 54% Black 6% Other	46% White 38% Black 16% Other	68% White 26% Black 6% Other	49% White 39% Black 12% Other
Household Type	Mixed	Single	Married/Single With Children	Married/Single	Single
Ownership	69% Owners 31% Renters	33% Owners 67% Renters	39% Owners 61% Renters	25% Owners 75% Renters	26% Owners 74% Renters
Average Age	52.54 years	33 years	40 years	66 years	58 years

that can cost as much as $1,800, for example, for installation of a household reverse osmosis system not including operation (Consumer Reports, 2021); drilling new wells which range widely from a minimum of $3,500 into the $10,000s; or, if geographically viable, connecting to a nearby public water system where connection costs can run to several thousand dollars (David deYoung, personal communication, March 26, 2021). In addition, low-income residents with private wells and septic systems are unlikely to have the resources to sample well water quality on a regular basis and may not even have access to the information they need to know if their well is contaminated and their health is at risk.

A 2017 report analyzing well and septic system viability at point of sale for Barry and Eaton Counties found that 20% of wells and 27% of septics were not operating to protect the health of household residents (Barry-Eaton District Health Department, 2017). There is no reason to believe that these findings are unique to these two counties. Therefore, it would be reasonable to extrapolate from this study that, because almost 30% of households statewide have private well water, at least 6.6% or 659,142 households are facing or avoiding an expensive fix that is necessary to safeguard their health.

Residents of mobile home parks face similar challenges if their wells become contaminated. Contaminated aquifers in small communities mean expensive one-time bills on top of regular payments. Generally, mobile home park owners do not operate water systems with cash reserves. Therefore the cost of drilling wells or updating water systems is passed directly on to residents. Residents who cannot pay for these urgent improvements cannot move their mobile home if it is over 15 years old because older homes are often restricted by local bylaws or state law that mandate exact building and internal system standards (Mueller, 2019). If residents do not believe the water is safe or if they cannot afford a special assessment for a new well, they may lose their home.

Related to the steep cost of replacing private wells is the potential cost of septic system replacement. The 21st Century Infrastructure Commission Report (2016) estimated that with 1.3 million septic systems across the state, each with an average life span of 25 years, approximately 52,000 (4%) on average should be replaced each year. This could amount to an annual investment of up to $780 million. The commission anticipated that as many as 10% of owners of failed septic systems would need some kind of financial support to replace their system (21st Century Infrastructure Commission, 2016).

Finding: Households with private wells and septic systems, and those in mobile homes, face unanticipated and catastrophic expenses when wells and/or septics fail, providing similar economic challenges as their counterparts on public water supplies.

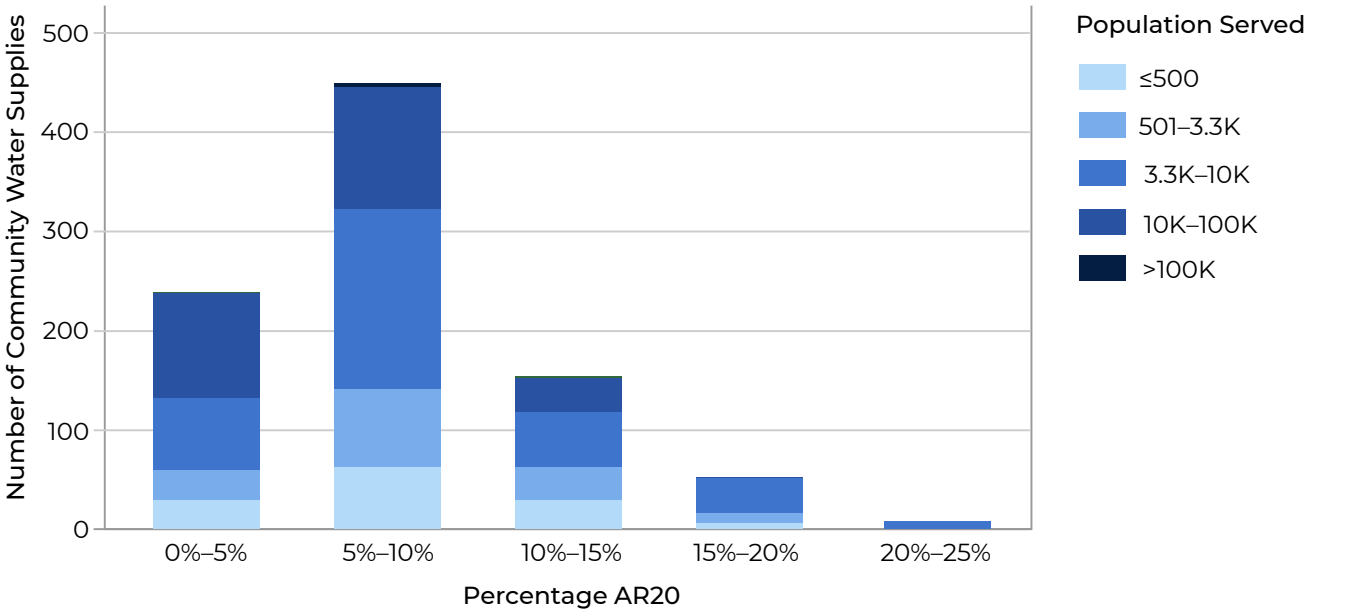
3.2 Affordability at the community level

Another perspective from which to consider water affordability is at the community level. Here, affordability pertains to the community's ability to afford water and sewer infrastructure and their operation and maintenance costs so that it delivers consistent and reliable water services compliant with applicable health and environmental laws and regulations. Quantifying water affordability at the community level requires two types of metrics: metrics that describe the ability of the community to pay for water services collectively and metrics that describe the financial capability of a utility to operate sustainably.

The community's collective ability to pay for water services is measured by indicators such as AR20 and the EPA residential indicator. These measures are calculated for a "hypothetical" household's water burden at some level of income representative of the community. Other metrics that indicate a community is challenged to provide water services are the percentage of households below the poverty level,

Figure 7. AR20 for Community Water Supplies by Population Served

Each column represents the total number of communities within an AR20 increment. The shaded colors correspond to the population served by each community water supply.



the number of water service disconnections due to non-payment, and the collection rate of water service payments. Of all these measures, AR20 is the most useful because it is comprehensive and accounts for water expenditures and essential expenses for the economically vulnerable portion of the community.

Finding: More than 200 (29.8%) community water systems have an AR20 value between 5% and 10%.

As described above, AR20 reflects household water affordability at the community water system (CWS) level for households at the 20th percentile of income for that service area. While this is not very useful in understanding trends across the state, it is very useful in understanding how utility-level variables such as size, source water, or regulatory violations impact affordability metrics. Figure 7 shows the distribution of AR20 among community water systems according to the population served. The majority of systems in Michigan have AR20 values that range from 5% to 10%. There are, however, more than 200 (29.8%) community water supplies with AR20 above the 10% affordability threshold suggested by Teodoro (2018). Systems serving 3,300–10,000 have the largest share of high AR20 values, consistent with EPA evaluations at the national scale.

Finding: On average, wealthier communities have more affordable water.

We investigated the correlation of characteristics of community water systems with cost of water for a family of four and AR20 through an ordinary least square model. The model included the following variables: CWS size, ownership, primary water source, and logged median household income. The results are remarkably similar for all dependent variables. There was no statistically significant correlation with the variables of private ownership and groundwater. The cost of water went down with an increase in population served and median income, when the analysis is controlled for cities. The cost of water and AR20 ratio increased if the community water supply served a city, and AR20 was not significantly impacted by population served. The results also reflect the fact that it is more expensive to treat surface water than groundwater.

When water costs remain consistently high, especially in low-income communities, higher water costs

become normalized. According to one interviewee, "Some folks feel like this is normal, but it's not normal to pay this much for water."

Table 6. Correlation of Water Cost With Key Community Characteristics

	(1)	(2)
	Cost of Water	**AR20**
Log of Population Served	-38.88***	-0.0498
	(6.591)	(0.0893)
Privately Owned	-432.2	-2.048
	(244.5)	(2.114)
Groundwater	-84.79	-0.458
	(45.98)	(0.788)
Surface Water	104.4*	1.619*
	(43.76)	(0.752)
City	48.67***	0.059***
	(11.41)	(0.165)
Log of Median Household Income	-91.35***	-12.43***
	(13.97)	(0.358)
Constant	2284.3***	142.9***
	(177.1)	(4.059)
Observations	233	214

Standard errors in parentheses
**p < 0.05, ** p > 0.01, *** p > 0.001*

3.3 Utility financial capability to provide safe and affordable water service

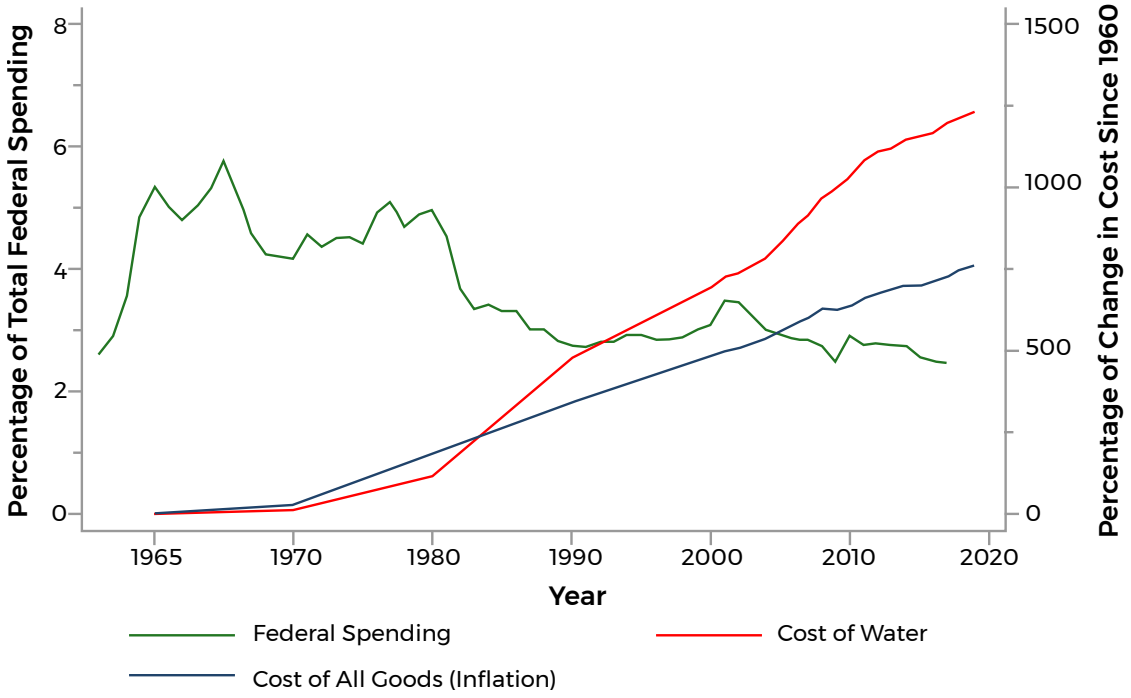
The second component of community water affordability is the utility's financial capability to provide affordable water service. Financial capability is most often measured in comprehensive financial plans or cash flow forecasts. Cash flow forecasts include annual revenues, rate adjustments, operations and maintenance expenses, capital improvement expenditures, debt service coverage, and cash fund balances. Accurate financial planning, along with comprehensive asset management, is the only way to understand the current capability and potential financial capacity of a utility. The AWWA, for example, recommends that every community forecast and account for elements such as the impact of cumulative rate increases; typical bills as a percentage of the lowest quintile income (20th percentile) and median income; outstanding debt per customer account; and capital debt to equity ratio in their cash flow forecast (AWWA, 2018).

We faced a significant quantitative barrier in considering utility financial capability. Lacking a centralized data repository of utility financial information and the time/resources to collect the necessary information from individual utilities statewide, we took a qualitative approach to our analysis. We interviewed a set of utilities around the state, reflecting a variety of community characteristics (region, community size, source water, etc.), about their financial capability and the challenges they face in providing safe and affordable water to their residents. We also examined EPA data on water and sewer infrastructure funding at the state level.

The status of water and sewer infrastructure and funding are critical to the sustainability and resiliency of our water systems. City water and sewer systems in the United States were built at each city's time of greatest population growth. Depending on the city, pipes could have been laid as early as the mid-19th century, in the early 20th century, or post-1945. However, the life cycles of pipes laid in each of these three time periods are coming to an end around the same time due to the reduced quality of each subsequent investment (WIN, 2002). Tracking at the state level of infrastructure investment, as well as investment needs, will inform policymakers and governments about the future of our water systems, their sustainability, and future affordability. One interviewee pointed out the need to include employees in asset management plans. They are a critical asset, and no water system can operate and manage its infrastructure effectively without experienced, trained operators.

Finding: There is no central repository for Michigan water utilities' financial data, which will take time and resources to compile. Without this vital resource, it will be impossible for the state to plan infrastructure renewal or understand if rates are accurately developed.

Figure 8. Cost of Water Rose Nationally as the Percentage of Federal Spending on Water Infrastructure Declined, 1960–2018



Source: Congressional Budget Office, IPUMS USA, and U.S. Bureau of Labor Statistics

The American Society of Civil Engineers estimates an $81 billion per year investment gap in water infrastructure (Quinn et al., 2017). The majority of this investment burden falls on local governments. Their report noted that the federal government's contribution to water infrastructure capital spending has fallen from 63% of total national capital spending in 1977 to just 9% of total capital spending in 2014. At that same time, per capita spending by local communities has more than doubled in real terms from $45 in 1977 to upwards of $100 per person in 2014 (Quinn et al., 2017). Figure 8 above shows that federal spending on water infrastructure peaked in the mid-1960s at 6% of the federal budget and has since fallen to less than 3%, while water costs have increased over 1,250% nationally. This decline in available federal support has the potential to reduce system reliability as utilities struggle to complete infrastructure upgrades with resources supplied primarily through local rates.

Finding: The cost of water has been rising nationally as federal spending on water infrastructure has decreased.

Table 7. 2015–2035 Estimated Shortfall in Michigan Utility Infrastructure Funding (Billions of USD)

The EPA and AWWA have completed extensive needs assessments in the last decade. The shortfall listed here sums these assessments, less the capital infrastructure spending in the Census of Governments. This estimated shortfall may be low, as utilities often do not know their 20-year needs when responding to surveys.

NEED	
EPA: Drinking Water Treatment	$4.702B
AWWA: Distribution	$22.116B
EPA: Clean Water	$2.144B
Michigan Lead Service Line Replacement Costs	$1.732B
SPENDING	
COG Data	**$10.856B**
20-YEAR SHORTFALL	**$19.838B**

Using EPA, AWWA, and Census of Governments data, we estimated the 20-year funding gap for Michigan water and sewer infrastructure. The 2012 EPA Clean Water Needs Survey returned particularly low values, which survey managers believe are due to utilities providing three- to five-year spending estimates, rather than 20-year estimates. The identified 20-year shortfall of $19.838 billion is slightly larger but in the same order

of magnitude as the estimated $800 million annual gap ($16 billion over 20 years + $1.7 billion added with 2018's revised Lead and Copper Rule) in water and sewer infrastructure needs reported in the 21st Century Infrastructure Commission Report (2016).

Finding: Addressing the Michigan water infrastructure investment gap will require $19.838 billion in the next 20 years.

Utilities face numerous challenges in maintaining affordable services for vulnerable households along with a functioning water system for everyone. Interviews with water systems across the state highlighted several factors that contribute in various ways to the growing infrastructure funding gap across the state. These are noted below, and while the following points are independent of each other, many communities are experiencing two or more of these simultaneously:

- In many communities, water rates were set under original federal water quality regulations when there were relatively abundant resources from state and federal investment, many systems were new, and there was not yet an emphasis on robust asset management. Collectively, these factors encouraged an expectation that water rates would be relatively stable, with little increase. As a result, many water utilities continue to set rates at unsustainably low levels.
- In many cases, there is a lack of political will on the part of city councils to increase water rates to close the infrastructure funding gap, with many council members fearing backlash from constituents. This has resulted in years of undercharging for water services in many communities. It is not clear whether city councils have the training they need to understand the long-term implications of these decisions (e.g., sharply increased water costs are necessary when infrastructure renewal comes due because no reserves have been set aside for replacement).
- Inadequate or delayed asset management planning enabled a growing divergence between available resources and the pace of infrastructure reinvestment.
- As risks change and new information becomes available, new regulations are enacted to protect public health under both the Safe Drinking Water Act and the Clean Water Act. However, federal and state funding structures typically do not incorporate the resources necessary to ensure local compliance with the new regulations. The assumption is that community water supplies will meet these regulatory requirements from existing budgets or rate increases, forcing them to take the entire financial burden of a much larger community or societal good.
- In some cases, water revenues were diverted for other municipal uses. In some communities with other, larger needs (e.g., public safety), there is less money available in the general fund for water infrastructure improvements.
- In some cases, water infrastructure was built for projected population growth that never materialized, or population loss has resulted in significantly oversized infrastructure with a large fixed cost that is distributed on the remaining population. Communities losing population also tend to be older, and the infrastructure is more likely to require repair and replacement, therefore increasing the financial burden that is placed on fewer households.
- All infrastructure has a relatively fixed life span, and old infrastructure breaks often in absence of a robust asset management plan, resulting in expensive, crisis-generated replacement schedules rather than logical, economically efficient, planned maintenance and replacement.
- Water infrastructure is less expensive to maintain than to replace, but if the necessary expertise is not available to ensure maintenance at the proper times, this can accelerate the degradation of water infrastructure, resulting in increasing costs for both maintenance and replacement.

Table 8. Common Contributors to Escalating Infrastructure Costs and Water Rates

		Contributing Factors to Escalating Infrastructure Costs and Water Rates				
Water System	**Population Served**	**Aged System**	**Inadequate Revenue**	**Newly Identified Public Health Risk**	**Access to Expertise**	**Other Notes**
Dearborn	98,153	X	X	X		
Detroit	713,777	X	X	X		Long-term population loss is a contributing factor.
Grand Rapids	258,416					Uses fees and rent from leasing water towers and other buildings to fund affordability programs. Although the system is older, working to address it via strong asset management planning.
Marquette City	21,000	X	X	X		
Marquette Township	2,700		X			Expanding infrastructure to serve new residents is prohibitively expensive.
Ishpeming	6,470	X	X	X		Population loss is a contributing factor and need to access technical expertise.
City of Grayling	1,981	X			X	The city helps pay for capital improvements with a city income tax.
Ada	6,523					Reduces costs by hiring a private company to run utility instead of having full-time staff.*
West Michigan Trailer Parks	~500	X		X	X	System replacement/regulation changes can present large one-time bills to residents.

*There are pros and cons to contracting private companies to manage utilites. See the challenges listed below.

- Smaller communities and those with little financial capacity lack access to relevant expertise—financial, engineering, public communications and outreach—to operate efficiently. This includes a lack of certified operators available at the salaries these communities are able to offer. Some communities are able to hire operators from the private sector, which can save resources over the short term; however, it is difficult for officials, who are not technical experts, to remain fully engaged and understand the contractor's work and potential impacts. When contracts are re-bid, institutional knowledge can be lost.
- Under-resourced communities are also challenged to access state and federal funding resources, either when needed or as a part of normal business operations. The lack of expertise means infrastructure falls into further disrepair, making it even more expensive to operate.
- Climate change has added pressures to strained wastewater systems and can affect source water quantity and quality.

Table 8 documents both specific barriers and some successful examples of approaches to address them.

In addition to the challenges individual utilities face, there are cumulative deficiencies that need to be considered on a statewide basis:

- State management and regulatory leaders need more information from water systems to be effective partners, to be prepared to address the problems as they arise.
- The sheer number of community water supplies and the lack of consistent comparable data make it difficult to gain insights from statewide data analysis, understand context to inform enforcement, and generally be efficient in overall management.
- Some communities use shutoffs as a tool to get bills paid and others add overdue water bills to the property tax bill—we need a better understanding of where and how these tools are used.
- Michigan lacks an oversight body to set or review local water rates.

Finding: The water infrastructure investment gap results from the cumulative impacts of a variety of political, historical, technical, and financial factors.

3.4 Important perspectives and context

Given the lack of comparable utility-level financial, infrastructure, and maintenance data across Michigan, we knew that the experiences of key stakeholders would be fundamental to identifying, characterizing, and expanding important household- and utility-level issues that must be understood to improve water affordability. The following section reflects the experience, expertise, and observations about water affordability we heard from the 32 individuals we interviewed for this study. Interviewees represented community groups, water utilities, and municipal and state government and, as such, provided many different perspectives on affordability that have allowed us to present a nuanced understanding of the various issues that each group faces as they grapple with access to safe and affordable water every day.

Direct quotations are provided in italics in the text below. Otherwise, comments are synthesized along with supporting information derived from secondary literature in the text. In effect, the experiences and observations the interviewees shared with us provide the context and stories around the data-driven analyses we presented in Sections 3.1 and 3.2 and the qualitative results in Section 3.3. Details about how we identified and selected these individuals and the questions we asked are provided in Section 2: Data and Methods.

Perspective: Cultural, Socioeconomic, and Technical Legacy of Disinvestment

In the years immediately following World War II (1946 through the mid-1960s), a generally positive understanding of the value of cities as the "economic engine" of the U.S. society underpinned a public policy approach that supported public investment and innovation in urban centers across the country, such as Detroit and Flint in Michigan. Since the 1970s, the approach to urban governance and finance in the United States has dramatically shifted. The racial tensions and riots of the 1960s, and subsequent white and business flight to the suburbs in the 1970s, resulted in metropolitan areas across the country whose urban centers were stripped of businesses. This reduced economic opportunity for the remaining urban residents and resulted in a declining tax base (Diamond and Sugrue, 2020). The transition of the U.S. economy from manufacturing based to a consumer-service orientation and a steady decline in federal revenue sharing completed the economic transformation of former manufacturing hubs such as Detroit, Flint, Ecorse, Hamtramck, Pontiac, and Benton Harbor. Since the 1980s, the result has been increasingly economically vulnerable urban neighborhoods where the spiral of fewer middle-class jobs, inadequate public transportation to reach suburban jobs or training opportunities for non-manufacturing positions, and rising cost of living moves them further toward and into poverty. In this situation, urban households, often living paycheck

to paycheck on the remaining lean employment opportunities, were drawn into a cycle that drove more and more households into debt on bills such as electricity, gas, and water. For context, and as we heard from several interviewees, water service lacks the more comprehensive federal, state, and utility-based assistance programs offered for electricity and gas and supplemental food programs.

A parallel cycle for water utilities emerged as mounting water service expenses went unpaid. The utilities saw a growing divergence as their operating revenue—via rates and (in some cases) taxes—declined while their real operational costs increased. Municipal departments, such as water and schools, were soon unable to function. Michigan stepped in through a sequence of emergency financial management legislation in the late 1990s and 2000s. The law allowed the legislature to remove executive authority from local governments and school systems and give it to an individual appointed by the state (Kirkpatrick and Breznau, 2016). While framed in terms of fiscal expediency, studies show that the implementation of emergency management in Michigan was disproportionately applied to Black and people of color communities. "[B]etween 2007–2013, 51.7% of Black Michigan residents had been subjected to emergency intervention, while only 2.7% of their white counterparts were similarly affected" (Kirkpatrick and Breznau, 2016).

When national interest in revitalizing urban centers began to reemerge in the 1990s and 2000s, governance and finance policies had shifted from a focus on developing public assets to private sector-focused approaches, such as tax increment financing, charter schools, outsourcing city services to private enterprise, and other public-private partnership opportunities (Diamond and Sugrue, 2020). These private sector-focused approaches favored redevelopment and gentrification, which resulted in decisions, programs, and policies that generated value for investors rather than the community. For example, some water systems no longer invested in salaried employees, whose knowledge of the system and salaries in the past benefited the community, instead shifting to consulting experts who, while less expensive in the short run, tend not to benefit the community in the same way.

As observed by some water utilities, highly trained, well-compensated professionals are needed to run water utilities. The lack of qualified operators indicates a need for better workforce development programs, including outreach to impacted communities to recruit individuals for training and certification. When insufficiently trained and certified operators are hired at lower wages, an interviewee observed, *"you will not have affordable water, or you'll have bad water…and there's a cost to bad water. And it's actually cheaper to get good water first. We all know that now. We have lots of case studies."*

Additionally, institutional knowledge and expertise is lost when contracts pass to other consultants over time, especially when contracts are always awarded to the lowest bidder. This approach fails to meet the needs of the community over the long run.

One state employee noted that for those communities that chose to outsource critical roles at the water department, everything costs more. Knowledge of the system has been lost and, because no one at the utility understands how all the moving parts come together, time and resources are expended on understanding the system, or figuring out what questions to ask, that would not otherwise be necessary.

Finding: The cultural, socioeconomic, and technical legacy of historic disinvestment in urban centers perpetuates capacity differences among communities.

Perspectives on Causes of Unaffordable Water Services

This section provides a short examination of several key perspectives encountered among the water stakeholders we interviewed. In our estimation, some of these perspectives counter or challenge others, reflecting the importance of stepping back to take the broadest possible view of the affordability

conversation. Some of these conceptions have been widely perpetuated, while being unsubstantiated, and only limit or block progress, while others are too narrowly framed to provide the complete picture. The purpose of this section is to identify these limiting perspectives and the potential barriers they present for policymakers.

Finding: There are many, often competing perspectives on the causes of unaffordable water.

Perspective: The Role of Poverty

Both community groups and utilities express that households living in poverty experience the most extreme impacts of unaffordable water. Utilities have expressed the challenges of providing safe and affordable water given the extent of poverty in some communities. Affordability is of greatest concern among the poorest 10% of the population; it affects the poorest residents most. It is also clear that poverty is distributed across the state, and therefore water affordability is an issue almost everywhere in Michigan, even if it is not yet recognized broadly. The unique situation of a given water utility and the community it serves also affects local affordability. Such characteristics can be the age and condition of the system, the community and utility's debt load, and whether the community is losing population. These other factors add to the expense of providing water and lead to higher rates for communities overall.

In conversation with a utility, we heard, *"We know what the problem is. We've studied it. The problem is poverty, and we need money."*

Finding: Unaffordable water is not only an urban phenomenon; it exists statewide.

Perspective: The Broader Narrative About Who Does and Does Not Pay Water Bills

Presumptive narratives, informed by racism, perpetuate division between urban residents and water utilities. Challenges arise when one or several narratives are elevated over others, are given "more credence," or are continually presented as the "truth." Many of these narratives include commonly referenced beliefs that do not speak to the reality of a community's lived experience.

One frequent narrative asserts that residents don't want, or lack the responsibility, to pay their water bills and that they choose to prioritize unnecessary expenditures, such as cell phones, over water bills. While it could be true that there are some residents who lack the desire or inclination to pay, the reality of non-payment is much more complex. A community group member noted that after extensive canvassing by their group, *"no one has ever said, 'I don't want to pay my water bill,' yet this narrative lives on."*

A University of Michigan study found low-income households in Southeast Michigan "value water service and are willing to pay what they can afford," and less than 2% of the residents interviewed indicated they wanted free water or were unwilling to pay for their water (Rockowitz et al., 2018). *"In general,"* noted a state employee interviewed for this report*, "people prioritize the water bill. By the time people don't pay the water bill, there are huge challenges in place."*

When the policy response is to frame challenges with water affordability as an individual failing, the policy fails the community. Residents are told they didn't work hard enough, and it's their fault they cannot earn the money they should be earning. Sometimes they are told *"This bill is not that expensive, why can't you prioritize it?*" This and other harmful narratives distract, undermine key stakeholders, and perpetuate unhelpful divisions.

From the water utility perspective, *"In our industry we are dealing with…[employees]…who have spent a large portion of their career in one community. What they know is that one community's experience,"* otherwise saying that they may not understand or they may lack empathy for circumstances in other communities where new solutions to address water affordability are necessary.

Some interviewees also identified false divides across affected populations. "*Outside of Southeast Michigan, people are convinced their conditions are different from those in Detroit. They've personalized the blame for Detroiters but for anywhere else the blame is outside themselves. For urban areas, unaffordable water is the resident's fault, while in white areas with PFAS contamination, it's the fault of the military or private companies.*"

Just as there are different water affordability challenges in different parts of the state, residents living in crisis have access to different coping strategies and safety nets. For example, the state has provided support to households with PFAS contaminated wells that includes water filters, water delivery service, or supporting hookup to nearby municipal systems, all costs that could push economically vulnerable residents over the precipice (Michigan Department of Environment, Great Lakes, and Energy, n.d.-b).

The media also plays a pivotal role in the narratives that persist and those that are not shared as widely. One interviewee pointed out that the Flint Water Crisis was a crisis of affordability long before the lead crisis that captured international media attention. At that point, however, the conversation then became very narrow and eliminated affordability from the list of challenges being addressed, allowing some to claim victory when a plan to address the lead in water was implemented.

Finding: An ongoing bias in perception informs the broader narrative about why people don't pay their bills.

Perspective: Regional Approaches to the Provision of Water Services

Regional approaches can take different forms of governance, management, and/or fiscal relationship depending on the situation and history. Southeast Michigan is even more complex. On one hand, the idea of a large regional water system makes sense from an engineering and efficiency perspective. And from the perspective of suburban communities, the creation of the Great Lakes Water Authority (GLWA) alleviated their concerns about paying Detroit for its water—that their primarily white communities had been paying a disproportionate share of the water and sewer infrastructure provided by DWSD and off-setting water costs to the primarily Black residents of Detroit. In some cases, this racialized narrative has been used to distract residents, when the white suburbs themselves mark up water rates for their customers. Others have noted that prior to GLWA, DWSD's sensitivity to this perception was manifest in undercharging the suburbs, leading to other problems, such as under-investing in infrastructure renewal (Recchie et al., 2019, and interviews). The suburban communities view GLWA as a neutral third party, working for the good of the overall system, able to set the wholesale water rates and sewer fees necessary to maintain the system, and, as such, they pay willingly.

For Detroit, however, regionalization occurred while the city was in bankruptcy and under emergency management. Numerous studies have demonstrated that emergency management has been applied unevenly across the state, chiefly to primarily Black or people of color communities (see, e.g., Breznau and Kirkpatrick, 2018; Fasenfest and Pride, 2016; Lee et al., 2016). These studies substantiate the perception of emergency management among Detroit residents: that it has brought economic, social, and cultural hardship to the community; that it has racial implications; and that the imposed solutions are more harmful than constructive. Many Detroiters view the creation of GLWA as transferring control over water, infrastructure assets, and the land it occupies to the suburbs from the city that funded and built the system that has made possible the success of the entire region.

The regional water system, GLWA, is perceived as shifting water management away from the city and possibly toward privatization, rather than securing water as a public benefit and retaining control

by the city. Therefore, from the perspective of Detroit residents, the development of GLWA only heightened racial tensions; it did not alleviate them. If regionalization is used as a tool to resolve water affordability in Michigan, it needs to be structured to provide supporting resources to all participating communities in the region based on their individual needs. It must avoid taking away a community's authority over its water.

As we heard from an interviewee, "*When regionalizing systems, we have to consider that this is taking something away from a community and giving it to someone who doesn't understand their fight and their history. There is a strategy gap here. The focus needs to be on getting the resources to support the community needs, not to take the water authority away from the community.*"

There are cases in Michigan where regional approaches, via consortia of communities, have been less controversial. Two examples from the central part of Michigan offer possible models for structural, governance, and financial relationships. Both examples involve the Lansing Board of Water and Light (LBWL). The first is the wholesale water purchase agreement with West Side Water that allowed the latter, a smaller 2,000–customer community, to avoid investing in additional water treatment facilities by selling raw water in return for purchasing treated water. The agreement kept costs down for the customers of both utilities by taking advantage of complementary excess capacity in each system (Bouma, 2018a). Similarly, LBWL joined a consortium of mid-Michigan communities that jointly purchase water treatment chemicals in bulk, allowing them to realize and share considerable savings. The consortium is voluntary, with no membership fees or time commitment, allowing even resource-constrained communities to participate and realize benefits (Bouma, 2018b). These examples illustrate how regional approaches can be mutually beneficial, providing support for all participating communities along with opportunities for each to contribute from their community strengths.

We heard numerous interviewees speak to the value of sharing resources and expenses while cautioning about the importance of maintaining political autonomy.

Finding: In the context of affordability, regional approaches can be useful. To be successful, any approach needs to account for context, history, and politics and be built upon equity.

Perspective: Rate Setting Processes and Electoral Politics

Several interviewees, across all three stakeholder categories, noted that the electoral process confounds approaches to utility management because elected municipal officials often focus on the short term (e.g., no water rate hikes) over longer-term priorities (e.g., the need for sustained investment in water system infrastructure). This is challenging because the current water rate setting process in Michigan is exemplary of the adage that "all politics are local." In the absence of a state oversight function for water rate setting, rates are set at the utility level. And, until very recently, utility asset management plans that quantify operational and replacement needs, and thereby inform rate setting, were generally not in place. In the absence of adequate information, rate setting by the public utility commission or municipal council is almost always fiscally conservative, with many communities going years without adequate rate increases to match the growing divergence between household income and water rates and underdocumented operational and infrastructure renewal needs.

As an interviewee noted, *"I've seen, numerous times, a rate plan or rate structure get turned down, a solvency plan get turned down, because a city council doesn't want to raise rates, or be viewed as the one that raised taxes, or something along those lines, because it might not get them elected next time."*

Another noted that being unable to raise rates has an impact on utility management, *"and the reason I say that goes back to the elected officials wanting to tell their constituents 'we're not going to raise your rates,' so you're not funding the reserve to the level that you need to."*

Furthermore, the lack of transparency in the process

makes it very difficult for community members to participate, advocate, and understand the community-wide impact of adopting a particular rate setting strategy. One interviewee observed that a water utility had such a lack of public engagement that they "operated like a private company."

Finding: Without appropriate information and plans, water rate setting is driven by electoral politics.

Perspective: Limitations to Utility-Level Financing

Water utilities, like local governments, face real constraints on the ways they can generate income to pay for the costs of providing water services to the community. They are limited to the revenue they can generate through the rates they charge customers for service and, if lucky, some share of general revenue (i.e., local property, business, or income taxes). Utilities also have the option to apply for loans, which sets the community up for years of financial obligation.

A considerable constraint on rate setting is the reality of what residents in a community are able to afford. As one utility manager noted, the ability of the rate payer base to pay is a relatively new but growing concern: *"[Ability to pay is] probably the part of the equation that we, as utilities, as managers, think about the least because we worry about what we need and then we hope that our customers can pay it."* The manager went on to note, *"So, when we're managing infrastructure, we do kind of have blinders on until we start seeing what the impacts of the newest rates are having on [our] customers. How many of them suddenly can't pay their bill on time, how many of them are getting shutoff notices, or they find resources or prioritize resources in some cases in order to pay that bill."*

When a utility requires more funds but rate increases are either not politically feasible or possible due to economic constraints on customers, it may seek supplemental funds from local general revenue, i.e., property taxes. That is possible, but if the support requires an increase in the local tax rate, there are additional hurdles to overcome. Since 1978, the Headlee Amendment to the Michigan Constitution has complicated local governments' ability to raise property tax rates beyond those authorized when the amendment went into effect that year. If a community wants to subsidize its water utility from general revenue and needs more resources than are currently available, a majority of local taxpayers will need to approve a tax increase. While the purpose of the Headlee Amendment is to restrain tax increases that local taxpayers do not approve, it does not stop those increases from occurring. With sufficient support from the community—a majority of the qualified electors who vote on the question—these increases can occur (Hohman, 2017). Therefore, on its own, the Headlee Amendment does not mean local tax resources are unavailable to water utilities, even though it is often portrayed in this manner. However, there is rarely political will to put tax increases on the ballot.

Some also assert that the Headlee Amendment restricts a utility's ability to offer differentiated rates to customers, such as rates that are based on income. However, as long as rates meet the criteria of being a fee for service, as defined in the precedent case Bolt v. Lansing, then the Headlee Amendment does not come into play. A fee is neither a new tax nor an increase to an existing tax. If a utility elects to differentiate the rates it charges for service, this action appears to not fall under the scope of increases prohibited by the Headlee Amendment (Leonard et al., 2020).

Finding: There are both real and perceived constraints on utility-level financing.

Perspective: Impacts of Unaffordable Water Beyond the Immediate Lack of Water

During interviews, we heard stories of people juggling and often skipping or making risky trade-offs of key expenses such as medicines, electricity, water, and taxes in order to provide for their families when their income is limited. Associated late payment penalties with most of these expenses only make the problem worse. When individuals prioritize the water bill, it

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is often at the expense of necessary medication or healthy food choices. Over time, the mental health impact from the stress and shame of struggling to support a family accumulates and impacts capacity to work and support the household. The impact of making hard decisions every month becomes a severe mental health challenge that requires resolution beyond merely examining the household budget.

A community activist noted, *"when you're forced to choose between needs rather than wants, there is a broader, emergent insecurity that comes of having to choose between paying your water bill and going to the grocery store, or paying your water bill and paying your car insurance…or your rent….Sometimes the emergent insecurity that comes out of lack of access to any of these resources is broader than the sum of the parts."*

Another interviewee said, *"I've met people who would literally be going into foreclosure or going into shutoff status with their DTE bills because they're trying to constantly pull money from other areas to keep paying their steadily increasing water bill."*

In communities where water shutoffs are used to induce payment, these trade-offs are even more risky because the shutoff does nothing to change the individual's ability to pay. Shutting off water can have immediate health impacts, including dehydration and secondary infections from improperly cleaned wounds or maintained medical equipment. Personal hygiene suffers and impacts individuals' ability to attend school or work.

One example is recorded in the oral history collection Detroit Water Stories (2019), where an interviewee recalled the impact on her household. *"The last thing you do is think about drinking water because you don't—First of all, you don't want to have to go to the bathroom, and you can't get another use out of it once you drink it. You just literally force yourself into dehydration. Then, as a parent, you make the choice of, 'Well, if water's going to get drank, I'm going to leave it for the kids to drink. I'm not going to drink any water, I'll just let the kids drink water. It's summer, it's hot, let them have the water.'"*

Without water in the house, people need to find an alternate source of water or navigate and weave together a variety of assistance programs for other expenses, both of which require a great deal of time and energy that could otherwise be used to seek or sustain employment and tend to the family's health needs. Furthermore, the transient nature of low-income populations complicates access and longevity of enrollment in assistance programs.

One community representative told us that when they go to neighborhood homes, *"we're seeing a water hose going through someone's kitchen window, and people are telling us 'I just got back from the gas station across the street [with this water],' or 'the carwash,' and 'I filled up some buckets,' or 'I'm waiting for my daughter to come because she is going to bring some tubs of water.'"*

Water is heavy and the burden of carrying water when it is not delivered from the pipes is physically demanding. Many who cannot afford water and struggle with health issues also have major challenges securing alternative water supplies.

Water shutoffs carry more than a social stigma. In some communities, the child welfare agency becomes engaged when they receive notice that a minor resides in a home without water. This can force parents to place their children with relatives or friends or, when those options are not possible, face having their children removed from the home. Both community group members and utility personnel noted that this fear of Child Protective Services can prevent people from seeking any available drinking water assistance.

Finding: Unaffordable water affects individual, household, and societal physical and mental health well beyond the immediate lack of water.

Perspective: Public Health Benefits of Affordable Water

Water affordability challenges affect more than the households that cannot pay. Community public health is threatened by water shutoffs in several direct and indirect ways. For example, the COVID-19 pandemic highlighted the importance of access to safe and abundant water for combating disease. The Michigan statewide ban on water shutoffs,

resulting from bipartisan action in the legislature, was founded on this understanding. The moratorium was intended to reduce the extent of COVID-19 spread in the community by ensuring that households could manage their personal hygiene and home sanitation. The link between clean and safe water and community health is well established, and the role of public water infrastructure in safeguarding the health of residents in Michigan is essential to the state's future.

Early results assessing the impact of shutoff moratoria due to COVID-19 across the country demonstrate the personal and public health benefits to those communities and/or states that imposed them. A study from Duke University, for example, demonstrated that policies that stopped utility disconnection during the pandemic correlated with both reduced infection and mortality rates from COVID-19 (Jowers et al., 2021). Similarly, a Cornell University team found that states with shutoff moratoria between April and December 2020 had significantly reduced growth rates of COVID-19 infections and deaths than did those without them, estimating that as many as 480,000+ infections and over 9,000 deaths nationwide would have been avoided with a national moratorium on water shutoffs (Zhang and Warner, 2021).

The interviews, research, and writing of this report occurred during the COVID-19 pandemic. The water access needs and pressures that have come to light with the pandemic magnified issues that have been affecting us all along. The current intensity of focus may wane after the pandemic eases, ending exceptional measures to ensure all residents have access to water services, such as federal and state emergency funds for arrearage forgiveness and shutoff moratoria. The pandemic provided some key experiences that could inform policy going forward—demonstrating the level of support utilities require when shutoffs are not used as a revenue securing tool.

Finding: The public health benefits of affordable water extend to the whole community.

Perspective: Precariousness of Economic Stability

In numerous interviews, we heard a variation of the observation that financially "everything is good, until it is not." Economically vulnerable households are one unexpected bill away from economic undoing, regardless of whether they have public water or a private well. For instance, mobile home parks can charge reasonable rates for water supply, until they need to drill a new well. Private wells are very inexpensive, until contamination forces the need for treatment or hooking up to the public water system—and a third of the state has self-supplied water. Older residents on fixed incomes are fine until an unexpected stay in a rehabilitation facility diverts their social security payment to a third party and their bills pile up at home. In all these cases, otherwise self-sufficient households face unpredictable incidents that result in their inability to afford their water service and other expenses. There is a gap in programs to support people who find themselves unable to pay for household water services.

Finding: Household financial situations are often precarious, no matter where those households are located.

Perspective: Affordability Challenges for Renters

On average, tenants in Michigan have a household income of $44,589, approximately half the income of homeowners, and a poverty rate of 27% compared to 8% for homeowners. While facing much lower incomes, water costs for the 40% of renters who receive bills directly are only slightly less than the average homeowner. These economic conditions predispose households that rent to severe affordability concerns, with approximately double the percentage of renters above the UN 5% benchmark compared to homeowners.

Renters also have a unique set of water affordability concerns independent of the economic ones. Utilities have long designated renters as "hard to

reach" recipients of customer assistance programs, as landlord-tenant relationships impede utilities in providing assistance to renters (Water Research Foundation, 2017). Even renters who pay utilities directly face challenges, as the GLWA noted, such as the inability to conduct plumbing repairs for leaky toilets in rented properties, which can be a large barrier to the success of the Water Residential Assistance Program (Aspen Institute, 2020). Renters who pay for water services with their rent are often excluded from receiving any form of assistance.

Outside of customer assistance, renters often suffer from poor plumbing quality, which increases bills. They also often have to pay a fee in order to change the water bill to their name. In Flint this fee is $350, which represents roughly 30% of an annual bill. Tenants whose water is included in their rent sometimes face issues with landlords improperly paying water bills. This leads to unexpected shutoffs and possible eviction. In 2016, a commercial apartment owner refused to pay delinquent water bills, jeopardizing water for several hundred Flint residents. Several Detroit residents have noted that landlords failed to remove their names from past apartments, and they started receiving water bills unexpectedly.

Finding: Renters face a unique set of barriers to receiving affordable water services.

Perspective: Water Services for Native Americans in Michigan

According to the 2018 Census, 132,264 people in Michigan identify as American Indian or Alaska Native fully or in combination with another race. A subset of these people belong to federally recognized Tribes that have treaty relationships with the U.S. federal government. U.S. EPA's Region 5 drinking water program oversees all Tribal water systems in Michigan. This means that Tribal water systems in Michigan do not automatically enjoy the added protections in which the state has adopted drinking water regulations that are stricter than the federal requirements, specifically for lead and copper and PFAS contaminants. However, some Tribes have adopted their own water quality standards that may match or be more stringent than state regulations. Households on reservations, whether living in Tribe-supplied housing or privately owned homes, are typically supplied with water at no charge, from either a community water supply or a Tribe-owned well. For these households the cost of water service is not an issue (Ettawageshik and Kiesewetter, personal communication).

Other Native Americans in Michigan can find water service costs equally challenging to afford as their non-native neighbors. For example, a Tribal member can be living within reservation boundaries but receiving water service from a non-Tribal community water supply. In this situation, the household would be responsible for paying their own water service bill. Other Native Americans, whether belonging to a federally recognized Tribe or not, who live in communities across the state and receive water from a municipal water supply, or who live in a home where water comes from a private well and waste flows to a private septic system, are also responsible for their own water costs. In these cases, similar to non-natives in this report, the socioeconomic status of the Native household is a strong indication of the ability to afford the water bill (Ettawageshik and Kiesewetter, personal communication).

Finding: Native Americans in Michigan do not report facing unique water affordability challenges.

4. RECOMMENDATIONS

This report fills in information gaps about both household water affordability across the state and the financial and management needs of water systems. It provides a better understanding of which and where households struggle with affordability across the state. It remains challenging to examine utility-level issues statewide because of the lack of collected, publicly available data. However, through conversations with many industry, utility, and state agency personnel, we were able to develop a qualitative description of the challenges utilities face.

Affordability affects people across geography and demographics, including age and race, and the impact has been steadily growing over the last 40 years. Financial situations at the household and community level are precarious and similarly challenging whether residents live in cities, the suburbs, or the countryside.

There is no one-size-fits-all or one-time fix to these water affordability challenges. The following are characteristics of a solution package that can effectively and sustainably address water and sewer affordability. This solution package must be sensitive to history and community-lived experience because poverty, race, politics, and local finance present challenges that have evolved differently in each community.

We encourage policymakers, state legislators, water utilities, and community members to work together to develop a solution package that:

1. Addresses household capacity to pay for water and sewer services. Solutions must address each of the following scenarios:
   a. Households with water service arrearages (solutions could include debt forgiveness);
   b. Households in long-term poverty (solutions could include discounted or income-based water and sewer service, support for critical plumbing repairs);
   c. Households with short-term economic challenges (solutions could include emergency funds);
   d. Households on private wells and septic systems (solutions could include grants or low-interest loans); and
   e. Focused support for households in economically vulnerable communities.
2. Prohibits water shutoffs for economically vulnerable households.
3. Addresses gaps in utility technical, managerial, engagement, and financial capacity statewide. In addition, it provides mechanisms that direct funding, expertise, and capacity to the utilities and communities with the least financial stability.
4. Addresses the lack of comparable utility-level financial data (e.g., arrearages, utility debt), infrastructure data (e.g., asset management plans, inventories), and maintenance data (e.g., water shutoffs, water main repairs) statewide.
5. Requires water utilities to implement meaningful and significant community engagement in water and sewer system planning and decision-making that includes data transparency, full participation, mutual understanding, inclusive solutions, and shared responsibility for engagement; and
6. Embraces a state role with adequate authority and resources for oversight that ensures public health protection, water quality regulation (existing and future), and appropriate water rates and provides technical, managerial, and financial support for water utilities.

At this point, a return to water shutoffs means a continuation and increase in communicable disease outbreaks, health disparities for Michigan's most vulnerable residents, and the associated economic risks at both the household and community levels. Furthermore, it means that water suppliers will continue to face increasing costs of service which will limit their ability to provide safe, sustainable, affordable water to the remaining customers.

The way forward requires negotiating multiple, competing, and often divisive narratives that are deeply rooted in the lived experience of each

community. In understanding that poverty, race, politics, and local finance present challenges that have evolved differently in each community, great care will be necessary to ensure that these unique challenges do not divert attention from attaining the collective needs identified above. And, given the current and emerging water crises across the state, the variety of challenges cannot be used as an excuse to delay or avoid a policy response to this emergency.

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Interviewees are identified in the Appendix.

Technical Advisory Group

- Manny Teodoro, *University of Wisconsin-Madison*
- Jan Beecher, *Michigan State University, Institute of Public Utilities*
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- Jim Nash / Kelsey Cook, *Oakland County, Water Resources Commissioner*
- Rich Bowman, *The Nature Conservancy*

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APPENDIX: INTERVIEWEES

NAME	ORGANIZATION
Tim Neumann	Michigan Rural Water Association
Deb Pospeich	Detroit Water and Sewerage Department
Nicole Hill	People's Water Board Coalition
Sylvia Orduño	Michigan Welfare Rights Organization
Monica Lewis-Patrick	We the People of Detroit
Eric Oswald	Michigan Department of Environment, Great Lakes, and Energy
Kelly Green	Michigan Department of Environment, Great Lakes, and Energy
James Clift	Michigan Department of Environment, Great Lakes, and Energy
Ninah Sasy	Michigan Department of Environment, Great Lakes, and Energy
Nayirrah Shariff	Flint Rising
Scott Cambensy	City of Marquette
Bonnifer Ballard	Michigan American Water Works Association
Jim Nash, Kelsey Cooke	Oakland County Water Resources Commissioner
Jon Kangas	Marquette Township
Wayne Jernberg	Grand Rapids
Dennis Brinks	Village of Sparta
Steve Ryan	Ada Township
Sue McCormick	Great Lakes Water Authority
Jim Murray, Yunus Patel, Eric Witte	City of Dearborn Department of Public Works, Water and Sewerage Division
Shay Gallagher	Village of Sparta
Steve Crider	Michigan Department of Health and Human Services
Dan Sorek	Prein & Newhof
Nick Leonard	Great Lakes Environmental Law Center
Abdul El-Sayad	Community Organizer
Peter Schwarz, Heather Holzinger	City of Midland, Water Services
Erich Podjaske	City of Grayling, Zoning/Economic Development
Emily Kutil, Nadia Gaber	We the People of Detroit