

Socio-Demographic Correlates of Household Water Consumption in Detroit: Implications for Human Health



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BACKGROUND AND SIGNIFICANCE

Unaffordable water is a growing crisis in the United States, with disproportionate impacts on low income, predominantly people of color, communities with aging infrastructure. Residents of Detroit, Michigan are among those who have been disproportionately impacted (Environmental Protection Agency, 2024). In 2013, after Detroit's Emergency Manager Kevin Orr declared bankruptcy, the Detroit Water and Sewerage Department (DWSD) increased their practice of shutting off water in order to collect on overdue water bills (Mapping the Water Crisis, 2016; Helderop et al., 2023). In 2014, approximately 27,000 Detroit households who were unable to pay were disconnected from their water (United Nations, 2014). These shut offs were so numerous that it caught the attention of the United Nations, who visited the city in 2014 in response and noted that, "it is contrary to human rights to disconnect water from people who simply do not have the means to pay their bills" (United Nations, 2014). As of 2020, approximately 140,000 Detroit households had their water shut off (Helderop et al., 2023). Per the EPA's 2024 Water Affordability Needs Assessment Report, "55% of DWSD's residential accounts are 30 days past due, and 35% of accounts are 60 days past due – with approximately 700 shutoff notices distributed per month" (Environmental Protection Agency, 2024).

The shutoffs in Detroit disproportionately impact Black Americans. According to the ACLU, 95% of water shutoffs that occurred in the city from January 2017 to July 2018 were in Census tracts that had a majority-Black population (ACLU of Michigan, 2020). Tracts in which less than 50% of the population is Black experienced 64% fewer shutoffs per 1,000 people relative to tracts with a majority-Black population (ACLU of Michigan, 2020).

These inequities in water access and affordability are linked to water rate structures. For example, Detroit water bills include charges for both household water used and for sewage and storm water management for Detroit's regional wastewater system. That system manages sewage and storm water for approximately three million people in 77 municipalities in Southeast Michigan (see Box: Detroit's Regional Wastewater System and Payment Structure). A

1999 ruling by federal oversight Judge John Fiekens resulted in an 83%/17% split, in which Detroit residents pay 83% of the construction cost for Combined Sewer Overflow systems (CSOs) while suburban customers pay just 17%, even if those systems exclusively serve suburban customers (Recchie et al., 2019). The average monthly water bill for Detroit residents is \$87.54: Of that amount, 75% (\$65.35) goes to support sewage disposal and service and drainage services (DWSD, 2026).

In addition to the inequitable distribution of water treatment charges, there are also differences in the charges for water use that create structural disadvantages for Detroit residents. Currently, the Great Lakes Water Authority (GLWA) manages suburban customers of the DWSD system, and

Detroit's Regional Wastewater Treatment System and Unequal Payment Structure

Detroit's regional wastewater system manages sewage and stormwater for approximately three million people in 77 municipalities in Southeast Michigan. The system's only wastewater treatment facility, the largest single-site treatment facility in North America, is located in Southwest Detroit (Great Lakes Water Authority Masterplan 2020 (www.glwater.org/wp-content/uploads/2020/12/Full_WWMP_Report_Final_June-2020.pdf)). It processes approximately 650 million gallons of wastewater per day, on average.

Emissions from the Wastewater Treatment facility in Southwest Detroit include a number of chemicals with human health impacts, including arsenic, cadmium, chromium, lead, mercury and a number of other chemicals classified as PFAS/PFOAs (www.glwater.org/wp-content/uploads/2022/01/2021_LocLimRep_Rev.pdf).

The regional wastewater system's large scale and centralized nature lead to infrastructure flooding in the City of Detroit, where the combined sewer system can overflow into the Detroit River and Rouge River. DWSD has constructed a series of Combined Sewer Overflow (CSO) facilities to mitigate the impact of overflows and associated environmental fines and penalties (i.e., EPA Clean Water Act).

In the mid-1970's, the Detroit Water and Sewerage Department (DWSD) was found to be in violation of the Clean Water Act due to sewer overflows from Detroit's combined wastewater and stormwater system. In 1977, Judge John Fiekens was appointed as federal oversight judge over DWSD to address this issue. In 1999, Judge Fiekens ruled that the residents of the City of Detroit would pay 83% of the construction cost for CSO systems, while suburban customers across the remaining municipalities served by the system would cover the remaining 17%. This division remains in place today, requiring Detroit residents to pay over four fifths of those infrastructure costs, even when those combined overflow systems exclusively serve suburban structures (Richie et al, 2019).

parts of the DWSD system within Detroit's municipal boundaries, while DWSD manages other parts of that system. Under this system, GLWA charges wholesale rates to the suburbs of Southeast Michigan, while Detroit customers pay retail rates under a two-tiered water usage system (Great Lakes Water Authority, 2018; Recchie et al 2019; DWSD, 2026). According to GLWA, this "will help ensure all communities are responsible for their own bills and creates a stronger level of confidence in the system's revenue projections." The inequitable rate structure is compounded by actions taken by some of the suburban municipalities, who have formed associations, such as the Southeastern Oakland County Water Authority, to negotiate even more favorable water rates from GLWA (see Mapping the Water Crisis, pages 8-9, for additional detail). As the median household income in the Detroit Metro Area is \$76,403

compared to \$39,209 in the City of Detroit, decisions which charge retail rates to Detroit residents while charging wholesale rates for those in suburban areas are compounded, fostering inequitable access to affordable water (Detroit Future City, 2021; Great Lakes Water Authority, 2018). The heightened rates for water usage combined with the lower household incomes of Detroit residents increase vulnerability to adverse economic and health impacts. A study of households in the United States by Medwid and Mack (2021) found that households earning less than \$50,000 per year were four times more likely to cut back spending on essential goods to pay their water bill when compared with those with an annual income over \$100,000. Similarly, they were eleven times more likely to say that they could not afford essential goods when their water bill increased, again compared with those who made over \$100,000 (Medwid & Mack, 2021). These findings crystallize the challenges for Detroit residents, where half of residents have household incomes below \$37,000 (United States Census Bureau, 2023).

The United Nations declares that access to water and sanitation is a fundamental human right, and that “physical presence is not the same as access” (United Nations, n.d.). Essentially, while water service might exist in an area, the human right to water is compromised when water costs prohibit accessibility. While definitions of water affordability are debated, it is frequently measured as a ratio of the cost of water relative to household income (Goddard et al., 2022). This ratio does not take into account other factors, such as the number of persons in the household, other household expenses, or medical conditions that may require the use of more water (Goddard et al., 2022).

There are quantifiable impacts of unaffordable water. These include the imposition of late fees, interest on past due balances, shut offs, fees for reconnecting water services, and legal bills as residents seek to address challenges. For homes already struggling to pay their water bills, these additional costs add further economic hardship.

Households facing challenges to accessing affordable water face associated health challenges. Access to affordable and potable water is fundamental to human health. It reduces the risk of infectious disease such as COVID-19 (Staddon et al, 2020; Zhang, Warner and Grant, 2022), diarrhea, respiratory infections, malnutrition, schistosomiasis, malaria, soil-transmitted helminth infections and trachoma (Prüss-Ustün et al, 2019), as well as infant, child and maternal mortality (Cheng et al 2012). A Detroit-based study by Plum and colleagues (2017) found an association between water shutoffs and water-associated illnesses. Study participants

who lived on a block in which someone's water had been shut off were 1.55 times more likely to be diagnosed with a water-associated illness compared to those living on a block without water shut offs (Plum et al., 2017). This study was retrospective and did not assess causal links, only associations, so must be interpreted with caution. However its findings are consistent with other studies linking insufficient access to clean water to increased burden of infectious diseases, short-term health outcomes, like headaches and diarrhea (Asher, 2018; Rosinger, 2018; Prüss-Ustün et al, 2019), and long-term health outcomes, such as risk of metabolic diseases, kidney failure and hepatitis (O'Neill, 2023, Johnson et al 2022). Globally, as well as in Detroit, studies have documented associations between water insecurity, psychosocial stress and mental health (Gaber et al, 2021; Kimutai et al., 2023).

Water shut offs themselves can lead to health issues. They can lead to localized lead and/or other heavy metal contamination of the water in the household, especially for homes with lead service lines (EGLE, 2026). Lead and heavy metals are associated with adverse health outcomes, with children and pregnant women being particularly vulnerable to adverse health impacts. Among children, even low levels of lead in drinking water can result in behavior and learning problems, lower IQ and hyperactivity, slowed growth, hearing impairment and anemia: higher levels can cause seizures, coma and even death (EPA, 2026). Lead can be stored in the bones, along with calcium. When women who have experienced lead exposure over their lifetime become pregnant, lead is released from the bones as maternal calcium is used to help form the bones of the fetus: This is particularly true for women who do not have enough dietary calcium during pregnancy. Lead can also cross the placental barrier exposing the fetus to lead in utero, leading to serious adverse health impacts for the mother and developing fetus (EPA, 2026).

Lead is also harmful to healthy adult women and men. It has been linked to cardiovascular effects, including increased blood pressure and hypertension, decreased kidney function, and reproductive problems (in both women and men) (EPA, 2026).

The economic stressors noted above can also lead to housing instability, with its own set of adverse health outcomes. Mapping the Water Crisis illustrated associations between water bill debt, residential tax foreclosures and auctions of tax-foreclosed homes in Detroit, showing how this phenomenon impacted Detroit's neighborhood geography in uneven ways (Mapping the Water Crisis, 2016). Due to effective advocacy by WPD in drawing attention to this issue, DWSD discontinued its prior practice of automatically adding water bill debt to property taxes, a

practice that contributed to both economic and psychosocial stress. Even with this change, a recent study conducted by Sarango and colleagues (2023) linked unaffordable water to housing instability as one of several pathways impacting health outcomes in the United States. Adults experiencing housing instability have increased risk of congestive heart failure (Novin et al 2025), more severe COVID 19 (Benfer et al 2019), kidney failure (Novick et al 2022), and poorer overall physical health (Bhat et al 2022) compared with those with more stable housing. The largest causes of death for those experiencing housing instability are stress related, including heart disease and respiratory disease. Adults 65 and older are among the fastest growing group facing housing instability: Within this group, such instability is linked to cognitive decline, cardiovascular risk, stress and social isolation (Kim and Schwartz, 2024).

Housing instability also has long term impacts for infants and children. Those who experience housing instability as infants experience heightened risk of depression, anxiety, and poorer overall health in adolescence (Pierce et al 2024), and are more likely to experience delays in accessing medical care and medications, and increased use of emergency visits for several years following an episode of childhood housing instability (Ma, Gee, Tissel, 2008). Infants and children who experience homelessness and housing instability are more likely to have frequent adverse childhood experiences, asthma, longer neonatal care periods, and more frequent use of emergency department services, with these effects persisting for up to 6 years following the homeless incidence (Clark et al 2019).

Economic stressors associated with water affordability can also compound health issues. For example, women who experience eviction during pregnancy are more likely to give birth prematurely, to have low birth weight infants, and infants with impaired neurodevelopment (e.g., impaired cognitive, social or emotional functioning), especially when eviction occurs in the 2nd or 3rd trimester (Ramphal et al 2023). These impacts can persist into adulthood.

Thus both the direct effects of water unaffordability on water usage/restrictions and indirect effects through, for example, implications for economic and housing instability, have implications for health. The overarching objective of this study was to understand the impacts of water unaffordability for the health of Detroit residents, with a particular focus on residents of communities in which water rates consume disproportionate proportions of household incomes.

STUDY AIMS

The aims of this study were collaboratively developed by a team from Michigan State University, the University of Michigan, and We the People of Detroit, a Detroit-based community organization focused on co-conducting research to establish water affordability policy and end water shutoffs. We aimed to address three questions related to affordability, water usage, and health, as follows:

Aim 1: In what ways do householders respond to water affordability challenges? These may include, but not be limited to, reductions in water use to reduce the cost of water. We are particularly interested in potential links to human health. Because those with chronic conditions or those taking medications that require additional water intake (e.g. thiazides commonly prescribed to treat high blood pressure, which require increased fluid intake, Kassarie, 2023), we specifically examined associations between these conditions.

Aim 2: In what ways is household size associated with water affordability challenges? Recognizing that larger households with more residents may consume more water, we examine implications for water costs relative to household income. We also examine whether these burdens may particularly fall to households with children aged 18 and under. Larger households with more members may consume more water, raising water costs relative to household income: Those households may include households that have consolidated or “doubled up” in response to economic stressors (including but not limited to water affordability). We examined whether larger households may be more likely to experience water unaffordability, and also asked about the extent to which they may be more likely to restrict water use to reduce costs.

Aim 3: In what ways is the experience of water unaffordability, the threat of water shut offs, and/or actual water shut offs linked to psychosocial stressors described by Detroit residents? We examine residents’ descriptions of the implications of these added stressors for their health and well-being. Links between psychosocial stress and physical health outcomes are well established (Luo et al, 2022): Understanding the ways that water unaffordability may compound existing stressors and their association with health outcomes can help understand the cascading effects of unaffordable water.

RESEARCH METHODS

Quantitative and qualitative data were gathered from residents of Detroit communities that experience overlapping impacts of aging infrastructure, flooding, air and soil pollution, and relatively high rates of water shutoffs in recent years. Quantitative data were derived from

survey data collected by a team from Stanford University (Khalid Osman, PI) with a primary focus on water quality. Surveys were conducted with 48 households in Southwest (zip codes 48209, 48216) and East (zip codes 48217, 48215, 48224) Detroit. We report results from a subset of items from the above study, focused specifically on water affordability and health and including: residents' self-reported household income, water bill costs, number and age of household members, behaviors related to water use (e.g. frequency with which they limit water consumption), and health conditions among household members.

Qualitative data were derived from four focus groups. Focus group participants were aged 18 and over, and resided in the same East Side and Southwest Detroit zip codes described above. Two focus groups were conducted in English (n=24): One with predominantly Black residents on Detroit's East side and one with predominantly Black residents of Southwest Detroit. Two focus groups were conducted in Spanish (n=13), both with predominantly Latinx residents of Southwest Detroit. Focus groups were facilitated by English speaking and Spanish speaking Detroit residents, respectively, who were provided training in focus group facilitation by members of the academic research team. Focus groups were tape recorded, transcribed and themed by members of the research team. Participants were asked about the affordability of their water and its relationship to their health and invited to share their experiences with affordability programs. Prior to attending focus groups, participants were screened using the flowchart in Appendix A to determine eligibility.

Qualitative data was coded using a two stage inductive coding process, with data first coded into the following categories: affordability, health, experience with affordability programs, strategies for dealing with water shutoffs, and proposed solutions. Codes were then applied to relevant lines of the transcript, staying as close to the words used by the participants as possible. In the second stage of coding, we examined these codes in relation to the three primary research questions for this study.

RESULTS

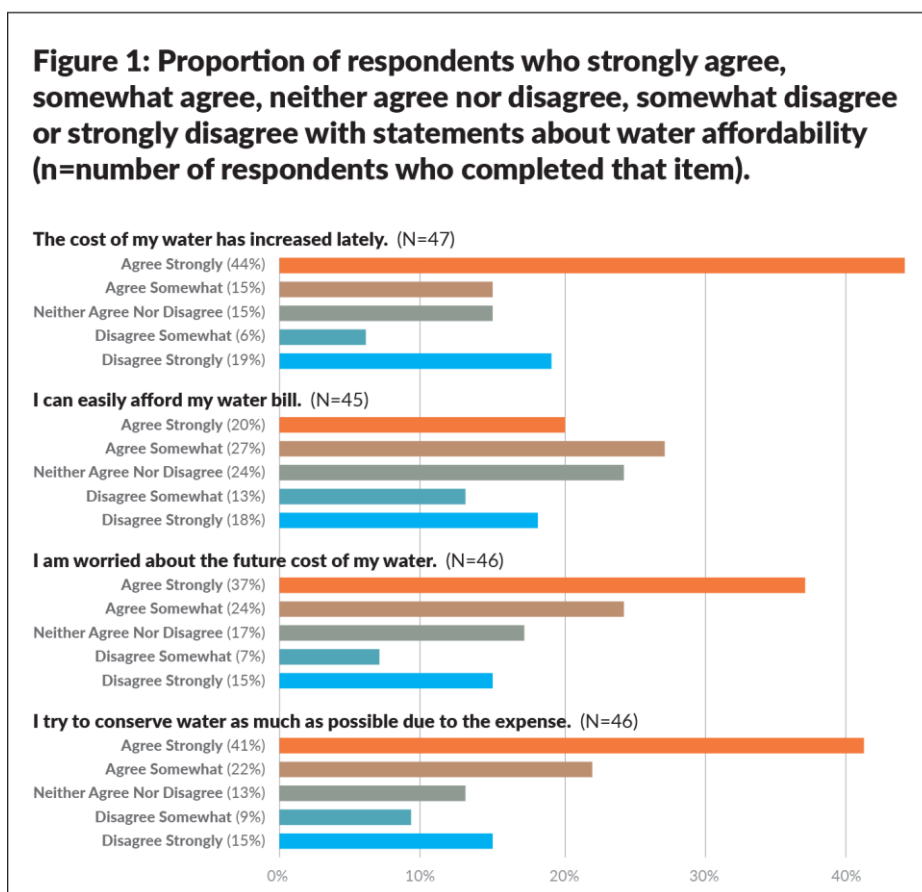
Quantitative and qualitative results are presented below, organized by each of the three guiding research questions. In addition to our central research questions regarding water affordability, we also report several additional themes that emerged, including concerns about water quality and health, lack of transparency in how costs are calculated or determined, and descriptions of participants' interactions with representatives of DWSD. Finally, we include focus group participants' suggestions or potential solutions to the challenges described. We

close with recommendations for addressing water affordability, water quality and health.

Aim 1: In what ways do householders respond to water affordability challenges, including, but not limited to, household reductions in water use to reduce the cost of water? What are potential links to human health?

Affordability: Results from survey questions asking about water affordability are shown in Figure 1. Over half (54%) of participants indicated that they agreed somewhat or agreed strongly that the cost of water had increased lately, and roughly the same proportion (55%) agreed or agreed strongly that they worried about the future cost of water. Nearly two thirds (62%) of respondents indicated that they try to conserve water as much as possible due to the expense.

Nine (19%) of the 48 survey respondents indicated that members of their household always or very frequently restricted water used for showering or bathing, while 13 (27%) indicated that household members restricted water usage always or frequently when washing or cooking food.



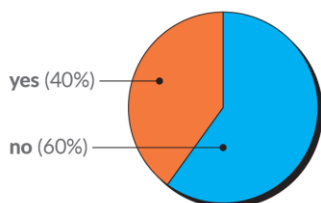
Of the 48 survey respondents, 73% (n=35) reported paying water bills monthly; 2% (n=1) reported paying quarterly, 10% (n=5) indicated they paid water bills as part of their rent, 2% (n=1) reported that they paid all of their utilities together, and four either preferred not to answer or indicated “don’t know.” Nineteen percent (n=9%) reported that they were currently participating in a program to help them pay their water bills. The mean water bill for those

participating in a program was \$35.18/month, with payments ranging from \$18 to \$61/month. By comparison, among those not in a program who reported their monthly water bill (n=26), the mean payment was \$89.52/month, with a range of \$30 to \$300/month.

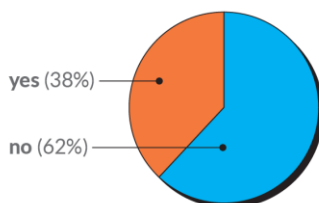
We used guidelines from the Environmental Protection Agency to calculate water affordability, or the percentage of household income paid for water and sewerage (<https://www.epa.gov/waterfinancecenter/water-affordability-needs-assessment>), for 42 survey respondents who provided information on both water bills and household income. We used two cut off points to assess water affordability: 3% and 4.5% of household income for water bills, respectively.

Figure 2: Percentage of respondents whose water is unaffordable, calculated using EPA reference points of above 3% or above 4.5% of household income.

Percentage that pay more than 3% of household income for water bills



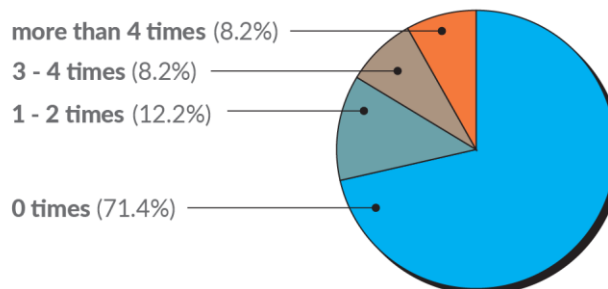
Percentage that pay more than 4.5% of household income for water bills



As shown in Figure 2, depending on the affordability cut point used, between 38 - 40% of survey participants reported water bills considered unaffordable based on their household income.

As an additional indicator of water affordability, survey participants were asked if they had paid a late fee on their water bill in the past year. As shown in Figure 3, 70% (n=33) indicated that they had not; 12% (n=6) reported that they had paid a late fee on their water bill 1-2 times in the past year; 8% (n=4) indicated 3-4 times; and 8% (n=4) indicated that they had paid late fees more than 4 times in the past year.

Figure 3: Percentage of Detroit survey respondents who had paid a late fee for water in the previous year.



Of those respondents who completed a question about water debt (n=32), 56% (n=18)

indicated no water debt, while 44% (n=14) reported some water debt. Among those in the latter category, the mean water debt was \$1,273, with debt ranging from \$80 to \$11,200.

Ten percent (n=5) of survey respondents indicated that they had lost water service in the past year. Of those, three indicated that it had been due to an infrastructure problem (e.g. a burst pipe). Most reported fairly brief shut offs: three were less than one day; one more than one day but less than a week; and one more than a week but less than one month without water.

Excerpts from the focus groups provide additional insights into residents' experiences of water affordability. Several focus group participants expressed concern about DWSD's use of estimates for water bills, rather than metered water use. For example, this excerpt from an East side focus group:

"These estimated bills, the house -- most of this house is vacant. They're [DWSD] like, 'Oh, we do estimated bills, 5,000 gallons.' Well, nobody's there. How am I paying-- how is it 5,000 gallons?"

The high cost of sewerage fees as part of the water bills was mentioned across all four of the focus groups conducted for this study. For example, a participant in one of the Southwest focus groups noted that while their water usage bill was just \$6, their overall bill was closer to \$70, due to sewerage fees and other miscellaneous charges. Similarly, another participant shared:

"el agua no es tan cara, pero el drenaje es carísimo" [the water isn't too expensive, but the sewerage is very expensive].

Similarly, several participants in Eastside focus groups noted that the sewerage fees bundled with their water bills were much higher than the water usage bill per se, and noted that the sewerage charges remained high no matter, *"what provisions you may have made mechanically to reduce the level of sewage."*

Finally, participants also described their perception that costs for maintenance and repair of infrastructure were passed along to the residents, as in the following example: *"[the] bill goes up every time a water main bursts."*

Together these comments reflect a sense of frustration about high water bills and the inability to reduce those costs despite the efforts of household members to conserve or reduce the amount of water used.

Strategies for reducing unaffordable water bills: Survey respondents described a number of actions they took as part of efforts to reduce water costs. One in five (19%) of survey respondents indicated that household members “always” or “very frequently” conserved water by restricting water use when showering or bathing, and over one in four (28%) indicated that they “always” or “very frequently” restricted the amount of water used for washing or cooking food.

Several focus group participants described making tradeoffs between paying water and sewerage bills and other household expenses, including for example, paying the water bill or the electric bill, or as in the following example, car insurance:

“My son, he went on to pay the \$400 [water bill]... he didn’t have the money to pay the car insurance.”

Others described seeking assistance from family and friends in order to avoid threatened water shut offs:

“Luego, me ayudaron a pagar el bill, fueron mis hermanas que me ayudaron.” [Then, they helped me pay the bill, it was my sisters who helped me].

An elder described a particularly stressful situation in which she was told her water would be shut off on a Friday afternoon due to an error in her water payment. She was able to convince the DWSD employee who was sent to her home to shut off her water to allow her the weekend to pay. Over the weekend, she sought assistance from neighbors, who loaned her the money to pay the bill. This experience was particularly stressful, as she was caring for an infant in her home, and was aware that having no water in a household could be grounds for removal of children and placing them in foster care.

Other participants described actions taken by their neighbors to cope with water shut offs, including using hoses to bring water to neighboring homes where water service had been disconnected. One focus group participant described discovering that an elderly neighbor was connecting to her outside tap:

“I was in bed one night, and I heard my water running, so I was thinking, what if the pipes busted? I got my clothes on, I’m going to go and look for this water... and then it stopped. I said, ‘What was that?’ Never thinking, ‘Go outside, go around the house’, and didn’t know my old elderly neighbor had her water shut off. What happened, my car was

not in the driveway, it was in the shop, and so she didn't know I was home. She had been using my water while I was gone, because she didn't have no water."

Other focus group participants who had experienced a shutoff said that they would purchase water from the store, or had to find a way to pay their bill to get the water turned back on.

The implications of these and other experiences with threatened or actual water shutoffs for health and well-being are examined in greater detail in Aim 3, below.

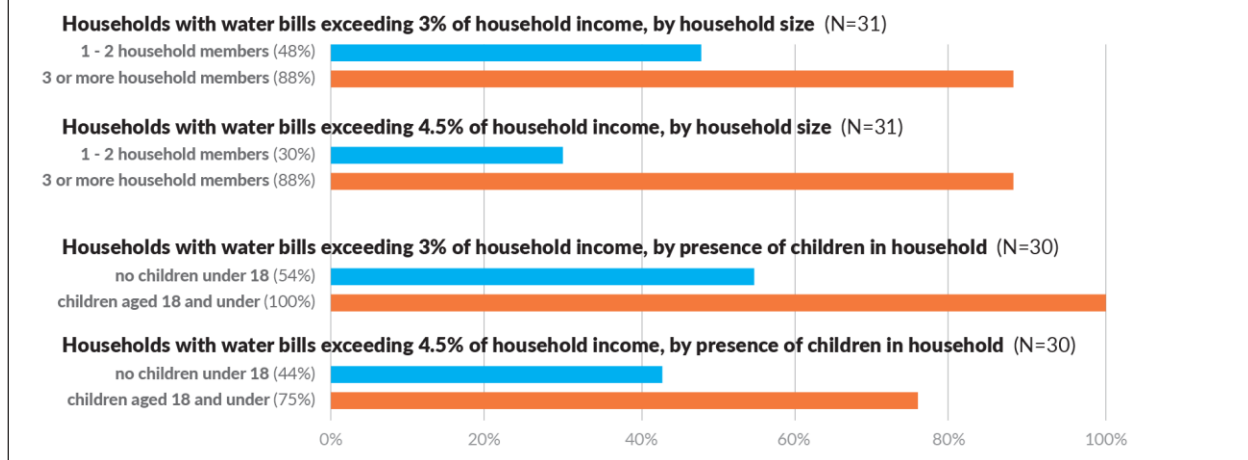
Aim 2: In what ways is household size associated with water affordability challenges, recognizing that larger households with more residents may consume more water, raising water costs relative to household income?

As shown in Figure 2, between 38-40% of households who completed the survey reported water payments that were unaffordable, using EPA guidelines for determining affordability. In this section, we ask whether household size and/or the presence of minor children (18 or under) in the household are associated with water affordability.

The average household size reported by survey respondents was 2.5 persons per household: 34% (n=15) reported one person in the household; 39% (n=17) reported two household members; 14% (n=8) reported three household members; and 5% each reported 4 and 5 household members. Just 4% (n=2) reported more than five members of the household.

Figure 4 shows results from analyses comparing the proportion of households where water exceeds the affordability thresholds of 3% and 4.5%, by household size and by whether there were children 18 and under in the household. These calculations were possible for only a subset of surveys that had complete data for number of household residents, age of household residents, amount of water bills and total household income.

Figure 4: Proportion of households with unaffordable water, by size of household (n=31) and by whether children under 18 are present in the household (n=30).



** Some percentages add to more than 100% due to rounding.

These results indicate that households with more than 2 members were more likely than smaller households to experience water unaffordability, using either the 3% or the 4.5% water affordability cut off. Seven of eight (88%) of households with more than two members spent 3% or more of their household income on their water bills, compared with just under half (48%) of 1-2 member households. Similarly, when using the 4.5% affordability cut point, again 7 of 8 (88%) of households with more than 2 members spent more than 4.5% of their income on water, compared with just 30% of households with fewer members.

Figure 4 also compares households made up of only adult members with households with members aged 18 and under. Households with children aged 18 and under were more likely to experience water unaffordability. Those with children in the household were nearly twice as likely to pay more than 3% or 4.5%, respectively, of their income for water, compared to households without children.

Aim 3: In what ways are the experience of water unaffordability, the threat of water shut offs, and/or actual water shut offs linked to psychosocial stressors and/or physical health challenges described by Detroit residents? How do residents describe the implications of those added stressors for their health and well-being?

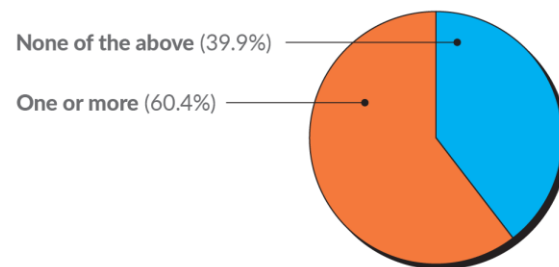
The household survey included a series of items asking respondents about any chronic conditions, health symptoms that they attributed to water in their households, and infectious

diseases they had experienced in the previous year.

About one third (31%, n=15) of survey respondents described one or more health related symptoms or conditions that they attributed to their water, including hair loss (n=6, 13%), skin irritation (n=9, 19%), diarrhea (n=2, 4%), vomiting (n=1, 2%), headache or dizziness (n=6, 13%), and/or persistent coughing (n=2, 4%). Sixty percent (n=30) indicated that they were unsure as to whether their water had contributed to any health problems.

Because adequate hydration is critical for individuals with some chronic conditions, the survey also asked about multiple chronic conditions currently experienced by members of the household. Altogether, three out of every five (60.4%) survey respondents indicated that one or more household members had at least one of the chronic conditions included in the survey (Figure 5).

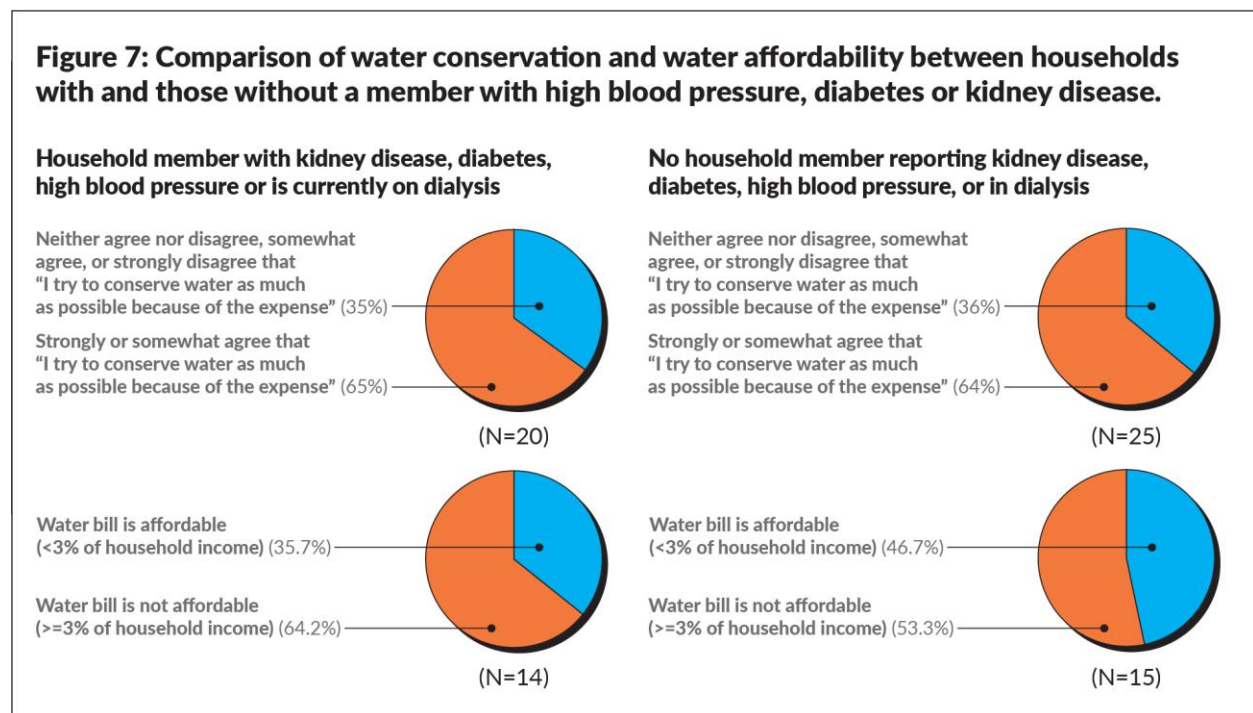
Figure 5: Proportion of survey households reporting that one or more member of the household reported at least one chronic condition (high blood pressure, heart disease, asthma, digestive problems, diabetes, kidney disease or was on dialysis for kidney disease (n=48).



As shown in Figure 6, nearly half (48%) reported high blood pressure, a condition for which some medications can make it more challenging to regulate body heat, contributing to increased risk of heat exhaustion or heat stroke during hot weather (Hospersa, Dillon, McLachland et al, 2024) and necessitating adequate hydration. One in four survey respondents indicated that at least one member of their household had diabetes. Six households (13%) reported a member with kidney disease and three (6%) reported a household member was currently on dialysis: Kidney disease and dialysis both require adequate hydration to prevent

further loss of kidney function.

As shown in Figure 7, even in households in which one or more member had a medical condition for which adequate water intake is important (high blood pressure, diabetes, kidney disease), two thirds (65%) indicated that they “strongly agreed” or “somewhat agreed” that they try to conserve water whenever possible. This result was comparable to self-reported water conservation in households without any member with a chronic condition requiring adequate water.



Households with at least one member with a chronic condition requiring adequate hydration were more likely to pay more than 3% of their household income for water, compared with those without a chronic condition: 64% compared to 53% (Figure 7). In other words, households with at least one member with a chronic condition were substantially more likely to experience economic hardship associated with water affordability.

Adequate access to water can impact the ability to avoid infectious disease, as well as manage chronic conditions. As shown in Figure 8, nearly two thirds (62.5%) of survey respondents indicated that they had experienced an infectious condition or foodborne illness in the previous

year.

Figure 9 provides additional detail on specific infectious or foodborne illnesses, and also includes comparative data from national sources indicating the proportion of U.S. residents experiencing that condition *Note that these numbers generally do not offer direct comparisons due to differences in question wording or data collection method (e.g. anyone in the household experienced the condition*

Figure 8: Proportion of survey respondents who reported that they had experienced an infectious or foodborne illness in the previous year.

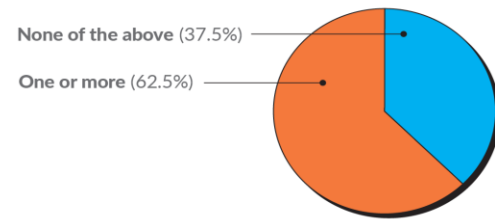
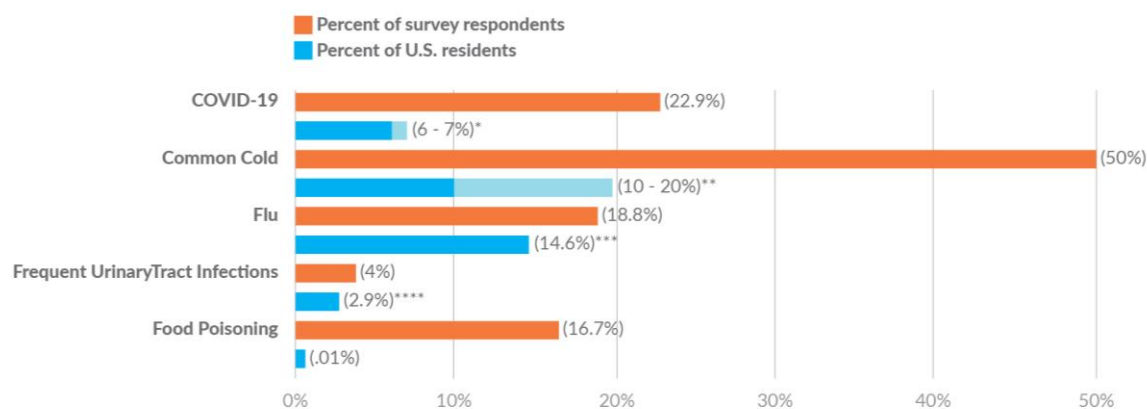


Figure 9: Proportion of survey respondents who reported each of 5 infectious or foodborne illnesses in the previous year, compared with national data for U.S. residents.



*CDC COVID-19 Surveillance, COVID-NET, and Statistical Modeling Estimates (<https://theworlddata.com/covid-statistics-in-the-us>). Accessed July 13, 2026

**20% of U.S. adults experience respiratory infections each year (CDC); About 50% of those are due to the "common cold" (NIAID)

***CDC 2024–2025 Influenza Season Summary (<https://www.cdc.gov/flu-burden/php/data-vis-vac/2024-2025-prevented.html>). Accessed July 13, 2026.

****Approximately 2.9% of U.S. women experience two or more UTIs per year (<https://theworlddata.com/urinary-tract-infections-in-us>). Accessed July 13, 2026.

versus the number of people in a population; survey item asking about the "common cold" versus CDC reports on "respiratory conditions" more broadly). Specific wording in the figure is included to facilitate visibility of those differences.

Additional Study Results

Water Quality. While the primary purpose of this study was to examine water affordability and its potential implications for health, both survey respondents and focus group participants described concerns about the *quality* of the water coming into their homes and its implications for health. Half (50%) of survey respondents indicated that they did not trust that the water coming into their households was safe, and as reported above (under results for Aim 1),

approximately one in three (31%) indicated that they thought their water had contributed to one or more health problems or symptoms for members of their households. In addition, while respondents were not asked explicitly whether they purchased bottled water due to concerns about the quality of their tap water, it is not uncommon for those who are concerned about the quality of their tap water to purchase bottled water as an alternative. Of the thirty-five survey respondents who completed a question about bottled water, 40% (n=14) indicated that they spent more than \$10 per week on bottled water; 26% (n=9) reported spending \$6-10 per week, and 34% (n=12) reported spending \$5 or less.

Participants in the focus groups offered a number of insights to expand on the quantitative results described above, with many describing their concerns about the quality of water provided:

"I had my water tested because, as [another participant] said, anything happens, our water comes out brown. We just went through a little series of water testing because we've been learning that we've been paying these high water bills and we've been getting water that has sediment and other stuff in it so our safety is at stake."

Other health related concerns that participants described included psychosocial stress associated with payment of water bills:

"I'm going to pay the water bill, but do you want me to pay the water bill that's on the bill or the water bill they was telling me that they have for set aside [for the LifeLine program]? You know what I'm saying?... It's stressful."

Such dilemmas are stressful in part because failure to pay water bills that are in arrears as well as failure to pay an agreed upon amount for those enrolled in the LifeLine program can each result in sanctions. Thus the stakes can be high for making a mistake or misunderstanding payments to be made.

One focus group participant, who attended with a neighbor, described the neighbor's experience of being told that her water was going to be turned off:

"She [neighbor] was having a nervous breakdown, and I was having a nervous breakdown with her. She said, 'Wait, wait, wait. Don't cut it off yet, let me fill my tub up.' She filled her sinks and her tubs up so she could have water."

Other links to health outcomes described by focus group participants included anecdotes about

wounds worsening after being washed with tap water, kidney damage after drinking tap water, and dizziness after bathing. While anecdotal, these descriptions convey the degree of uncertainty about the quality of household water, and concerns about potential links to health outcomes.

Participants also described inverse associations between access to water and health, as in the example of a focus group participant who described her husband's illness and subsequent loss of employment related to that illness. Because they were not able to pay their water bills due to the loss of household income, their water had been shut off. Thus, water shut offs can *result from* health challenges, in addition to *contributing to* them.

Interactions with DWSD. Study participants described their interactions with DWSD service providers, ranging from communications about results from water quality testing to those related to billing or enrollment in the DWSD Lifeline program, the first income-based affordability plan offered by the City, announced in June 2022 (DWSD, 2022). Although this was not one of the research questions initially posed for this study, the frequency with which interactions with DWSD staff were mentioned in the context of the focus groups drove our decision to include discussion in this report.

Several participants described interactions with affordability programs offered by DWSD, intended to assist residents who were experiencing difficulty paying their water bills, or paying past bills, such as the Lifeline program rolled out in 2022. Several expressed gratitude for the programs, stating that they are a *"ray of sunshine to break down some of the utility bills."* Others described confusion related to the parameters or expectations of the affordability plans, as in the following excerpt.

"I think they need to make the bill more understandable... it makes me think that I'm in trouble because I'm only paying this little amount and my bill is so high... When you pay more, what happens? They kick you off."

Despite the program's intent to provide support for households struggling with water affordability, even the payment plans developed under the Lifeline program at times felt beyond the reach of households experiencing pressures related to payment of their water bill:

"Your bill may be, say, 150, whatever, but they want you to pay 90 something dollars. That's not in my budget."

Others described inflexibility or lack of understanding on the part of DWSD frontline workers, as with a resident who indicated they had been told they would be removed from the Lifeline program for being “*off a penny*.” Perceived ambiguity, inflexibility and the high costs of being considered out of compliance with Lifeline or other affordability program demands contributed to experiences of distress described by focus group participants.

Additional challenges surfaced for Spanish speaking Detroit residents. Many in the Spanish-speaking focus groups were either unaware of the affordability programs, or described reluctance - sometimes fear - to enroll due to prior experiences with other utility affordability programs or with DWSD staff. For example, one Latina participant in the Spanish speaking focus group described her decision to spend a day in the waiting room at DWSD to explore whether her own experience of feeling dismissed was limited to herself or experienced more broadly:

“un día sentarme ahí y ver cómo atienden a todas las que no son latinas, para ver si es nada más a mí con todo el mundo...” [a day to sit there and see how they treat people who aren’t latinas, to see if it isn’t me but everyone...].

Descriptions of challenges in interactions with DWSD staff were not limited to Spanish speakers. Participants in English speaking focus groups described similarly experiences, as illustrated by the following excerpts:

“They take you for stupid,”

“They act like they can’t hear you.”

Beyond those interpersonal experiences with DWSD staff members, a number of focus group participants also described a deep lack of trust in the organization, including for example:

“I think it's just ‘put your foot on the neck and force feed these bills’ to us. I really don't have faith that there's legitimacy to it or fairness.”

“They lie about infrastructure improvements.”

A sense of unfairness was also expressed by several focus group participants, who had heard of differences between fees charged to Detroiters versus suburbanites (see Background of this Report, and Mapping the Water Crisis). For example:

“They had a special on the news a couple years back, but this man in the suburbs had a building downtown where his water bill was like \$20,000... they never turned it off... The

news reporter was saying, 'Well, why your water on? This person over here only owed \$200, and they turned theirs off.'"

and

"...we have to be the ones that pay for the suburbs. Why do we get treated so bad? Go out there and get the money from them. They got a lot more money than we do."

Recommendations or Proposed Solutions.

Focus group participants offered a number of suggestions for ways to improve water affordability in Detroit, and to rebuild trust between residents and DWSD as their service provider. Several suggested strategies for improving billing practices and increasing transparency from DWSD. These included increasing the billing transparency:

"It needs to be legitimate. How did you [DWSD] come up with that amount? Why is there no differentiation between my bill when I'm conserving than somebody who's out there washing their car every day in the driveway?"

Residents' also suggested reductions in the high costs associated with sewerage fees, as in the following excerpt:

"They should reduce the amount of the cost for sewage. It should not be twice the water. It should be legitimate."

Finally, participants across focus groups expressed a sentiment that DWSD should be more lenient and understanding for residents who wanted to pay their water bills but who were struggling or had fallen behind in making payments. Suggestions including offering grace periods, and being more proactive in reaching out to residents who are struggling to pay their bills to notify them about the affordability programs:

"¿Por qué cuando vieron mi bill , que no lo podía pagar, ellos no utilizaron estos programas para ayudarme? Como dice la señora [otra participante], si te traen un boletín a tu buzón y tú no le haces caso, tú ya te perdiste de este programa." [Why when they see my bill, that I couldn't pay, they didn't utilize these programs to help me? Like the woman [another participant] said, if they bring a flier to your mail and you don't pay attention, you lose out on this program.]

SUMMARY AND RECOMMENDATIONS

Results from this study highlight multiple concerns related to water affordability for residential households in Detroit. These include worries about affordability, anxiety about water shut offs and their implications for the health and well-being of household members. Focus group participants described multiple challenges to emotional well-being as they grappled with the possibility - and sometimes the reality - of water shut offs. They described a lack of clarity or transparency as to how billing and shut off decisions were made, and frustration with the inability to anticipate or control the amount of their water bills. Many expressed a strong sense of injustice, grounded in a clear understanding of structural inequities that shape payment metrics and systems. Together, these create a context in which mistrust, uncertainty, and frustration characterize Detroit residents' efforts to access clean, affordable water.

Based on the results from this study, we offer a number of recommendations for strategic actions to improve water affordability in Detroit, and ultimately to assure that Detroit residents have access to adequate, affordable and clean water with which to sustain health.

Recommendations to Assure Water Affordability

1. ***Recognize and build sustained commitment to assure access to clean, affordable and adequate water as a fundamental determinant of population health and well-being.*** Assuring such access requires that water be considered a common good, rather than a commodity that can be afforded by some and not by others. Privatization of water systems should be avoided given their focus on commodification of water and scientific evidence of their adverse impacts on affordability and equitable access to water (Zhang et al, 2022).
2. ***Implement a comprehensive plan for federal investment in rebuilding and replacing water infrastructure.*** The burden of water affordability has shifted over recent decades to be mostly placed on municipal and state governments. As a result, water affordability efforts have often taken the form of short term, insufficiently funded, *programs* rather than sustained efforts to address the underlying structural challenges that threaten equitable access to water. Such a comprehensive plan must: 1) address the practical replacement and updating of infrastructure; 2) correct systemic inequities that underlie differential access to affordable water, grounded in outdated decisions such as the 1999 decision requiring Detroit to pay 83% of infrastructure costs for

suburban wastewater treatment efforts; and 3) include specific mechanisms that assure transparency and required reporting. New, more flexible policies that emphasize equity, recognize the shifting population base and economic structures across the Detroit metropolitan areas, and define specific mechanisms that assure accountability of GLWA, DWSD and EGLE to assure the equitable distribution of costs and benefits for taxpayers who rely on the Detroit metropolitan area water system.

3. ***Determine water pricing using a sliding scale, income-based model that recognizes that larger households are more likely to experience water unaffordability.*** As

demonstrated in this report and elsewhere, low income households, those with dependent children, and those with larger numbers of residents are more likely to experience water unaffordability and its associated impacts on the ability to access clean water. Creating sustainable and affordable water systems requires recognition that household water consumption is influenced by multiple factors, including household size. Models for estimating water consumption and cost such as those developed by the EPA that estimate per capita water consumption, should be used in estimating water consumption and associated costs

(<https://www.epa.gov/watersense/understanding-your-water-bill>).

4. ***Center public health: Assure that vulnerable populations including elders, children, and those with health issues have adequate access to water.*** A sustainable water system

will recognize the public health imperative and societal benefits (economic, health, social) of supporting households with limited incomes, elders, children, and those with existing conditions that make access to water especially important for health while simultaneously impacting the ability to pay. It will be designed to assure sustained access to affordable water for all, regardless of ability to pay (e.g. a sliding scale based on income, number of dependent children, household medical needs). Access to adequate water is especially critical as the number and frequency of high heat events is projected to rise due to changing climatic conditions, and adequate water intake is essential to reduce the risk of heat stroke and death associated with those events. Households with limited income, dependent children, elders, those with medical conditions requiring adequate hydration, or other vulnerable residents should have clear and non-burdensome pathways to request reduced water rates and other supports to assure that access to affordable water is not interrupted.

5. ***Increase federal appropriations and state funding (e.g. grants, loans and forgivable funding sources) for replacement of aging municipal water infrastructure.*** Currently a majority of the burden for assuring access to affordable water falls primarily on state and municipal budgets, a result of eroding federal support over multiple decades. Encouraging legislation such as the 2024 Infrastructure Bill, which provided funding to support thousands of drinking water and wastewater systems across the United States, can help to fund the cost of needed infrastructure updates, avoiding current challenges in which the costs of infrastructure updates and repairs are passed along to customers. As noted above, such efforts must be undertaken in conjunction with revisions to existing rules (e.g., the 1999 ruling that required Detroit residents to cover 83% of wastewater infrastructure costs) to assure a more equitable distribution of costs and benefits related to system ownership and decision making influence, system maintenance, and water treatment infrastructure and processing.

Recommendations to Assure Water Quality

1. ***Encourage continued, and increased, federal investment in water infrastructure and upgrades.*** As noted above, current costs for needed water infrastructure upgrades are primarily borne by states and municipalities, and in some cases, passed along to consumers. The 2024 Infrastructure Bill is currently funding much needed efforts to replace aging water infrastructure, with substantial implications for reductions in lead exposure and reducing the risk of breaks, leaks or flooding. These investments are critical for Detroit, where exposure to lead as a result of aging infrastructure and recent flooding events have been directly linked to aging infrastructure. Continued federal investment, in addition to state and municipal actions, are needed to assure that Detroit and surrounding communities have sustained access to water that is both safe and affordable.
2. ***Assure that EGLE and other regulatory agencies provide clear and meaningful oversight, with penalties when necessary, to limit the discharge of environmental pollutants into water systems that raise the cost of providing clean, affordable water.*** Strains on water infrastructure, and the costs of water treatment, are exacerbated with discharge of environmental pollutants into water systems. Those costs are currently disproportionately borne by Detroit residents. Adequate oversight by EGLE and other

regulatory agencies is necessary to assure that discharges do not exceed permitted levels, and that adequate penalties are enacted and enforced, especially for entities that repeatedly violate permitted levels.

3. ***Provide drainage fee exemptions or reductions for low income households and those with 75-80% pervious surface (e.g., lawn, grass) surrounding them.*** Low income residential households should be provided exemptions for drainage fees. Similarly, homes with high percentages (e.g. 75-80%) of pervious surfaces surrounding the home such that, for example, run off from roofs goes into the grass, should be provided a drainage fee exemption or reduction. This will incentivize homeowners to create pervious surfaces that decrease runoff into storm water systems, reducing risks of flooding and burden on those systems.

Recommendations to Increase Transparency and Trustworthiness of Water Service Providers (e.g. DWSD)

1. ***DWSD should hire and provide adequate support for community liaisons.*** Community liaisons should be available who speak Spanish, Arabic, Bengali, French and other commonly spoken languages in the area to communicate with customers for whom English is not a first language. Adequate funding should be available, and clear and timely systems in place to assure that those translators are available when they are needed.
2. ***Assure that outreach strategies and community liaisons are communicating and collaborating with community organizers and community based organizations that are often the first point of contact for Detroit residents.***
3. ***Create performance standards for DWSD customer service representatives who interact with customers.***
 - a. Define customer service quality metrics that make respectful customer interactions a part of performance reviews.

- b. Assure that DWSD customer service representatives have the resources needed to support their work and interactions with customers, and that DWSD communicates to both staff and customers that they are valued.

4. *Install meters on all Detroit residences and abandon customer billing “estimates.”*

DWSD should be responsible for installing accurate, working meters on all Detroit residents, and for maintaining those meters to assure that they are operational and accurate. This will avoid the need for estimated bills. In the event that meters are not working and estimates are necessary, this should be on a temporary basis, for the shortest possible time period (e.g. no more than 3 months, preferably shorter).

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