Drinking Water Affordability in Kentucky

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APPALACHIAN CITIZENS' Law Center

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About Appalachian Citizens' Law Center
ACLC is a nonprofit law firm and policy advocacy organization that fights for justice in the coalfields by representing coal miners and their families on issues of black lung and mine safety and by working with grassroots groups and individuals to protect the land and people from misuse and degradation caused by extractive industries. The Center uses a high-impact strategy for change: analysis, litigation, and advocacy.

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Introduction

Access to clean, affordable water is a human right,[1] but it is becoming increasingly difficult for consumers to pay their water bills. Water bills are rising across the country at a rate outpacing inflation.[2] Researchers have found that combined water and wastewater bills increased 43% from 2012 to 2021 across a sample of U.S. cities.[3] Not only are water bills rising,[4] but water burdens (the percentage of one's income that is allocated to pay water bills) have also increased, and many households must make the choice between water and other essentials.[5]

Affordable water is not only important for households to make ends meet, but also from a water system sustainability perspective. Households' inabilities to pay for water services can create a shortfall in revenue for the utility, thereby jeopardizing the ability to operate and maintain the water system. If many households cannot pay and are disconnected, it strains the communities' ability to support its water system, putting the viability of the system at risk. The COVID-19 pandemic only exacerbated financial challenges for both water systems and households.[6] In response to the growing needs of consumers, the federal government created the first ever federal program designed to aid families with their water bills, the Low Income Household Water Assistance Program (LIHWAP). The *Infrastructure Investment and Jobs Act* also invested funding in water and wastewater infrastructure and laid the groundwork for the Environmental Protection Agency (EPA) to create a permanent water affordability program. Given increasing need across the United States and federal investments that provide new opportunities to respond to these needs, it is more important than ever to understand which communities face the highest water costs and burdens.

Our focus in this report is on household water affordability in Kentucky. Utility affordability issues are widespread[7] throughout the state. In recent years, the Kentucky Energy and Environment Cabinet, has dedicated capacity to examine and formulate policy solutions for high energy burdens, but similar resources have not been allocated to

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1 The United Nations adopted a resolution in 2010 recognizing the right to water and sanitation as a human right. See: https://www.un.org/waterforlifedecade/human_right_to_water.shtml#:~:text=On%2028%20July%202010%2C%20through,realisation%20of%20all%20human%20rights.

2 Stratton, H., Fuchs, H., Chen, Y., Dunham, C., & Williams, A. 2016. Water and Wastewater Rate Hikes Outpace CPI. United States. https://doi.org/10.2172/1377851

3 Bluefield Research. "Up 43% over Last Decade, Water Rates Rising Faster than Other Household Utility Bills," Aug 23, 2021. https://www.bluefieldresearch.com/ns/up-43-over-last-decade-water-rates-rising-faster-than-other-household-utility-bills/

4 Patterson, L. A., & Doyle, M. W. 2021. Measuring water affordability and the financial capability of utilities. AWWA Water Science, e1260. https://doi.org/10.1002/aws2.1260

5 Stratton, H., Fuchs, H., Chen, Y., Dunham, C., & Williams, A. 2016. Water and Wastewater Rate Hikes Outpace CPI. United States. https://doi.org/10.2172/1377851

6 Bostic, D., Grimshaw, W., Cohen, M., Landes, L., Ohle, N., Stiger, T., Barnes, G., and Neumann, A. 2021. Customer Debt and Lost Revenue: The Financial Impacts of COVID-19 on Small Community Water Systems. Oakland, Calif.: Pacific Institute. https://pacinst.org/publication/COVID19_impacts_small_community_water_systems

7 Kentucky Energy & Environment Cabinet. 2022. Energy Affordability. https://eec.ky.gov/Energy/Programs/EnergyAffordability/Pages/default.aspx

examine and address water burden. However, Kentucky was one of the first states to exhaust its LIHWAP allocation, indicating that Kentucky households across the state are facing water affordability challenges.[8]

Our report provides a snapshot analysis of water bills and water burden across Kentucky using water rates collected in late 2021 through early 2022. Water burden is calculated by dividing monthly household water bill by monthly household income. We find large variations in monthly water bills across the state, revealing that some households pay six to nine times as much as other households. We calculated water burden at the census tract level, at the Median Household Income and at the first- and second-quintile income maximums.[9] We find as much as a twenty-fold difference in water burden across Kentucky. We also found that water affordability is a challenge for the majority of Kentucky households with incomes at or less than the first-quintile income maximum.

In addition to ongoing need for water assistance programs and water infrastructure investments, our analysis reveals one potential solution in some instances. In instances where household incomes vary greatly across the census tracts served by a single water system, there is a potential to relieve water burdens using innovative rate structures that would distribute the cost of water more equitably. Further research is needed to determine the drivers of variation in household water bills. Policy makers in Kentucky should dedicate resources to examine and consider the use of innovative rate structures and policy mechanisms to decrease inequities in household water affordability.

Methods

Approach to Calculating Water Affordability

Following the approach of Roger Colton, a lawyer and economist who has testified in numerous regulatory proceedings, including in Kentucky, we consider a household water burden greater than 2% unaffordable.[10] We used a simple ratio method to calculate water burden (water bill divided by monthly household income). For each system, we calculated water burden at median household income (MHI) and at first- and second-quintile income maximums to provide insight into water burden at different income levels for each system.

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8 Administration for Children and Families. 2023. LIHWAP Helps Keep the Water On: Every Drop Counts. https://www.youtube.com/watch?v=WFk0pAGA9R4

9 Water burden was calculated using the maximum income for a given quintile. For example, 20% of households in census tract 21001970300 have an annual household income of $14,070 or below. This portion of households falls within the first quintile, or 20th percentile, of households based on income. In the same census tract, 20% of households, the second quintile, have an annual household income between $14,070 and $25,314. That means that 40% of households have incomes below $25,314, the second quintile maximum or 40th percentile. We calculated water burden at both the first and second-quintile income maximums, using $14,070 and $25,314 as annual incomes.

10 See report authored by Roger Colton and submitted as evidence in Martin County Water District rate case. Kentucky Public Service Commission, Case No. 2021-00154, Aug. 25, 2021. Available at: https://psc.ky.gov/pscecf/2021-00154/mary%40appalachianlawcenter.org/08252021043813/MCCC_EX_1.pdf

Using MHI alone obscures the degree of unaffordability for lower income households.[11] Therefore, we also calculated water burden using income quintiles to account for income inequality in our study area.[12] Quintiles divide households into five groups with equal numbers of households in each group according to their income. The first quintile income maximum represents the maximum income for the lowest 20% of income earners (20th percentile) and the second quintile income maximum is the maximum income for the next 20% of income earners (40th percentile).

Using water rate schedules, we calculate water bills at different quantities of monthly water usage (2000, 4000 and 6000 gallons) and then we divide each of these water bills by different income statistics (MHI, first quintile income maximum, and second quintile income maximum) to calculate water burden at those usage levels. Respectively, these usage levels were selected because 1) the majority of water systems in our dataset set their rates such that their minimum bill accounts for 2,000 gallons of usage; 2) the Kentucky Public Service Commission (PSC) considers 4,000 gallons of water as a typical usage level for residential customers; and 3) many regulated water utilities in Kentucky report that their average customer used more than 4,000 gallons, so we also calculate water burdens for a higher 6,000 gallon usage level.

Data

We used QGIS to spatially associate water bill data with Kentucky census tract household income data.[13] The Kentucky state government maintains a shapefile of water lines for public water systems in the Commonwealth[14] and we spatially joined the line file to the 1306 census tracts in Kentucky. Some census tracts had water lines from multiple community water systems.[15] In these cases, we identified both a dominant (N = 190) and secondary water system (N = 274) serving the tract. There was some overlap between water systems that were dominant and secondary across the tracts (e.g. a water system may be dominant in one tract and secondary in an adjacent tract) and thus the total number of water systems identified was N=297 (Figure 1).

There are limitations to this approach. As we selected for dominant and secondary water systems, that means that the majority of water systems excluded from our analysis are small water systems (Figure 1). For example, there are 99 water systems in Kentucky with fewer than 1000 customers and only fourteen of these appear as dominant or secondary water systems (Figure 1). It will be important for future research to examine affordability in these systems. In addition, some systems are not included in the water line

[11] In a report prepared for the American Water Works Association, authors state that calculating affordability at MHI "is highly misleading as an indicator of a community's ability to pay." See: "Affordability Assessment Tool for Federal Water Mandates" Stratus Consulting, Boulder, Colorado. 2013. https://www.awwa.org/Portals/0/AWWA/ETS/Resources/AffordabilityAssessmentTool.pdf

[12] See Appendix A for a discussion of margin of error for income statistics at the census tract level.

[13] QGIS Development Team (2023). QGIS Geographic Information System. Open Source Geospatial Foundation Project

[14] See: WRIS Web Maps, WRIS/Ky_WRIS_Existing_Water_WM, Accessed via: https://kygisportalservices.ky.gov/server/rest/services/WRIS/Ky_WRIS_Existing_Water_WM/MapServer

[15] We looked only at community water systems, those systems that serve the same customers year round.

shapefile. For example, Logan-Todd Regional Water Commission and Louisville Water Company do not have water lines in the shapefile. However, we assigned census tracts in Jefferson County that did not have other water lines in the tract to Louisville Water Company.

We collected water rate schedules for the water systems we identified in our spatial analysis. For those systems regulated by the PSC, we obtained a list of rates from the PSC in March 2022. Rates from other systems were collected between November 2021 and April 2022 by email and phone correspondence with managers of the systems. Our resulting data set includes 233 systems: 135 PSC regulated and 98 unregulated systems (Figure 1).[16] Throughout the report, we refer to both "rates" and "bills." The difference between the two is that a bill accounts for both the rate of water plus any additional system wide surcharges. A rate refers only to the cost to the customer for a designated amount of usage.

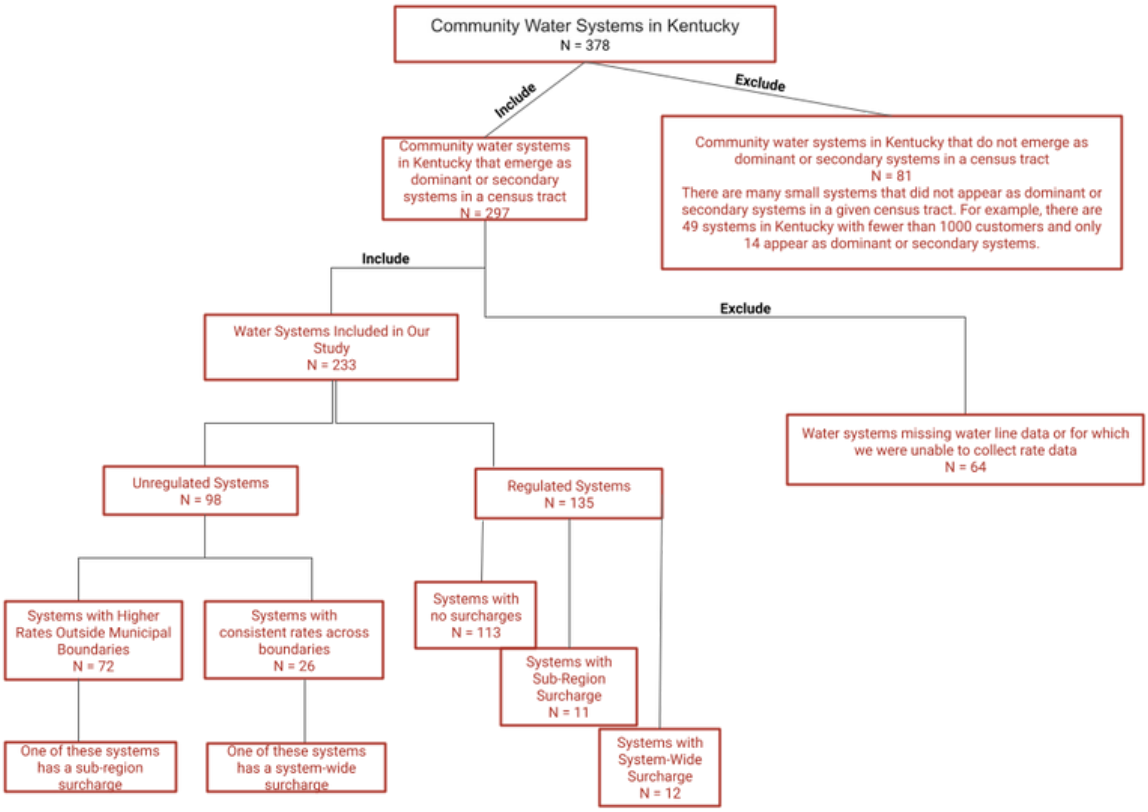


Figure 1: Description of the community water systems excluded from and included in water bill and burden analyses

[16] Water utilities that are owned, controlled, operated, or managed by a city in Kentucky are not regulated by the Public Service Commission (KRS 278.010(3)). Water commissions are also not regulated by the Public Service Commission (KRS § 74.510). We refer to these throughout the report as unregulated systems. However, the Kentucky Division of Water does enforce drinking water quality standards as required by the U.S. Environmental Protection Agency under the Safe Drinking Water Act (42 U.S.C §300f et seq.).

To calculate water burden, American Community Survey (ACS) five-year estimates at the census tract level were used for household income data.[17] We used the ACS for both MHI and income quintile data. MHI was available for 1285 census tracts and income quintile data for 1184 census tracts (Table 1). We focused primarily on reporting water burden for the dominant water systems. Water burdens calculated for the dominant water system are displayed on maps in the report and are the primary topic of discussion throughout our results on water affordability. We do, however, report water burden ranges across both secondary and dominant water systems. Overall, we were able to calculate water burden for dominant water systems at MHI for 1274 census tracts and at income quintile maximums for 1173 census tracts (Table 1). For further detail on methods see Appendix A and for background on ratemaking processes in Kentucky see Appendix B.

Table 1: Data availability across Kentucky census tracts for dominant water systems

	Number of census tracts for which data was available	Percent of census tracts included in analysis
Water Line Data	1299	99.5%
Water Bill Data for Dominant Water System	1287	98.5%
Median Household Income Data	1285	98.4%
Income Quintile Data	1184	90.6%
Water Burden for Dominant Water System Calculated at Median Household Income	1274	97.5%
Water Burden for Dominant Water System Calculated at Income Quintile Maximums	1173	89.8%

[17] We used data from ACS tables B19013 and B19081

Results

Monthly Water Bills

Our results showed that there is large variation in water bills across the 233 water systems we examined. On average, water bills are $22.34, $36.42, and $50.32 per month for 2000, 4000, and 6000 gallons of water, respectively (Table 2). However, **those with the largest bills**[18] **are paying nearly nine and six times as much as those paying the least** (Table 3). The maps in figure 2 show that dominant water systems with the largest bills are primarily located in Eastern and Western Kentucky.

Table 2: Average bills at 2000, 4000, and 6000 gallon usage rates across 233 water systems

	Number of Systems	Average - 2000 Gallons	Average - 4000 Gallons	Average - 6000 Gallons
All Systems	233	$22.34	$36.42	$50.32
PSC Regulated	135	$24.82	$41.25	$56.93
Unregulated	98	$18.98	$29.81	$41.12

Table 3: The lowest and highest bills for 2000, 4000, and 6000 gallon usage rates

	Lowest Bill - 2000 Gallons	Highest Bill - 2000 Gallons	Lowest Bill - 4000 Gallons	Highest Bill - 4000 Gallons	Lowest Bill - 6000 Gallons	Highest Bill - 6000 Gallons
Water Bills	$8.70	$77.63	$12.55	$77.63	$16.35	$95.16

[18] Note that Bluegrass Water, the water system with the highest bills of $77.63 per month for 2000 and 4000 gallon usage rates as displayed in Table 3 is not reflected on the maps in Figure 1. That is because this water system is a secondary system per our methodology and thus not reflected on the maps as they display results only for dominant water systems.

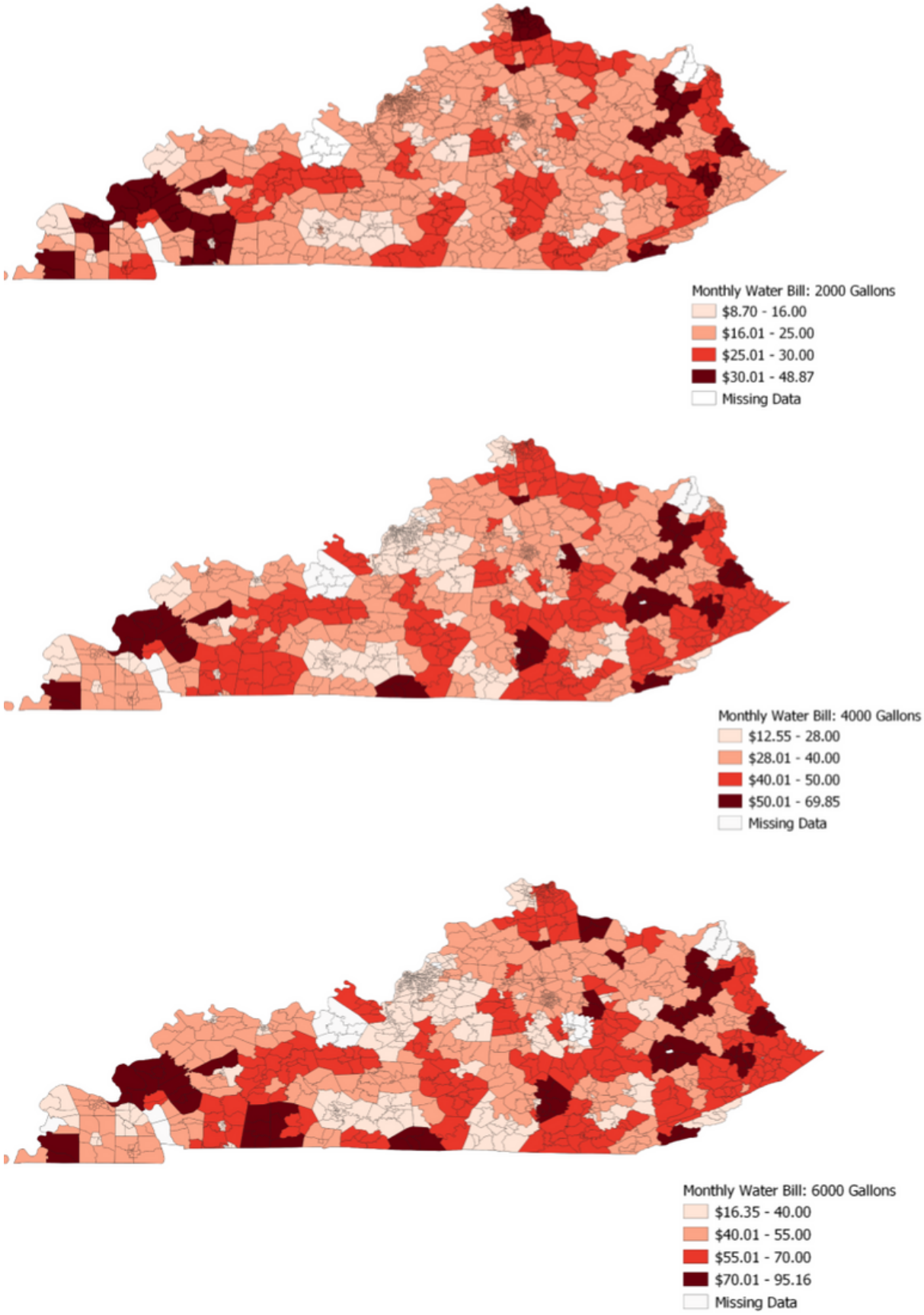
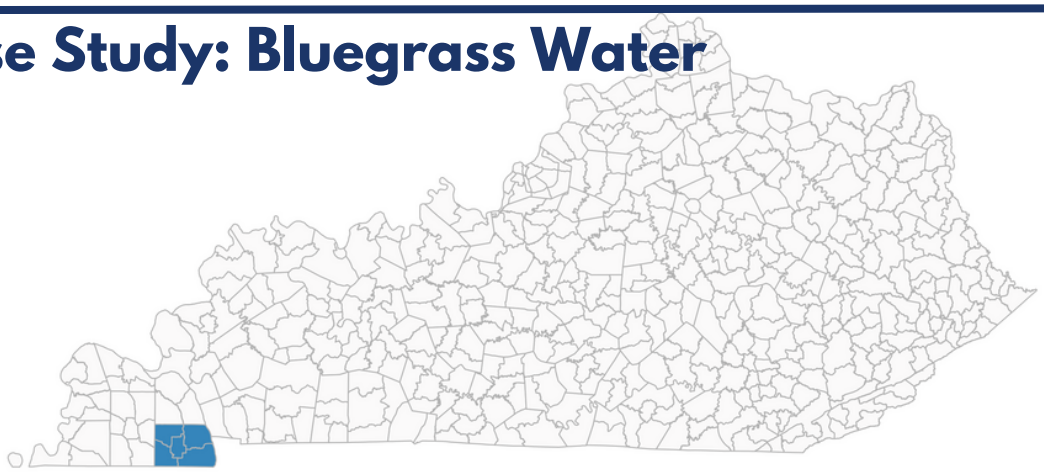


Figure 2: Monthly water bills in dominant water systems for 2000, 4000, and 6000 gallon usage rates

Water systems with the largest bills at 4000 gallons used per month

There are some commonalities among the three water systems with the highest bills. Evidence from recent rate cases reveals that these systems are historically distressed in terms of infrastructure maintenance and have struggled to pay off debt accrued through much-needed investments in water infrastructure.

Case Study: Bluegrass Water



At almost $80 regardless of the customer's monthly usage, Bluegrass Water Utility Operating Company ("Bluegrass Water") in Calloway County has the highest water bill in Kentucky. Bluegrass Water is a private company based in Missouri that began purchasing water and sewer systems in Kentucky in August 2019. PSC Vice Chairmen Kent Chandler wrote that "Bluegrass Water came into the Commonwealth claiming it intended to 'professionaliz[e] distressed' utilities".[19] Between August 2019 and January 2021, the PSC approved Bluegrass Water's purchase of eighteen wastewater systems, which in total serve over 3,000 customers, and one water system, Center Ridge Water District, which served 339 customers.

Bluegrass Water purchased Center Ridge Water District, Inc. in February 2020. At the time of purchase, Center Ridge Water District charged a flat rate[20] of $22.79 per month to its 339 residential customers. In October 2020, Bluegrass Water applied for rate increases for all of its purchased wastewater and water systems in Kentucky. For its one purchased water system, Bluegrass Water proposed a flat rate for its residential customers of $105.84 per month, a 364.4% increase. Bluegrass Water claimed that its capital investment in the water and wastewater systems they purchased justified the proposed rate increases. In direct testimony, a Bluegrass Water executive itemized the "repairs, replacements, and improvements and their estimated cost" and estimated these costs at $1,156,060 for its water system.[21]

The company sent a letter to its customers explaining the rate increase,

> *"Since purchasing the infrastructure that serves your home, Bluegrass Water Utility Operating Co., (Bluegrass Water) has invested nearly $2.5 million in urgently needed improvements in Kentucky communities to ensure you, your families and neighbors have access to clean, safe and reliable drinking water and wastewater systems. Additionally, Bluegrass Water intends to invest an additional $3.5 million to ensure safe and reliable service."*[22]

[19] "Opinion of Vice Chairman Kent A. Chandler in Case No. 2020-00290, Concurring In Part and Dissenting In Part," Aug. 2, 2021, PSC Case 2020-00290. https://psc.ky.gov/pscscf/2020%20Cases/2020-00290//20210802_PSC_ORDER.pdf, 121.

[20] A flat rate is the same rate for each customer, regardless of water usage

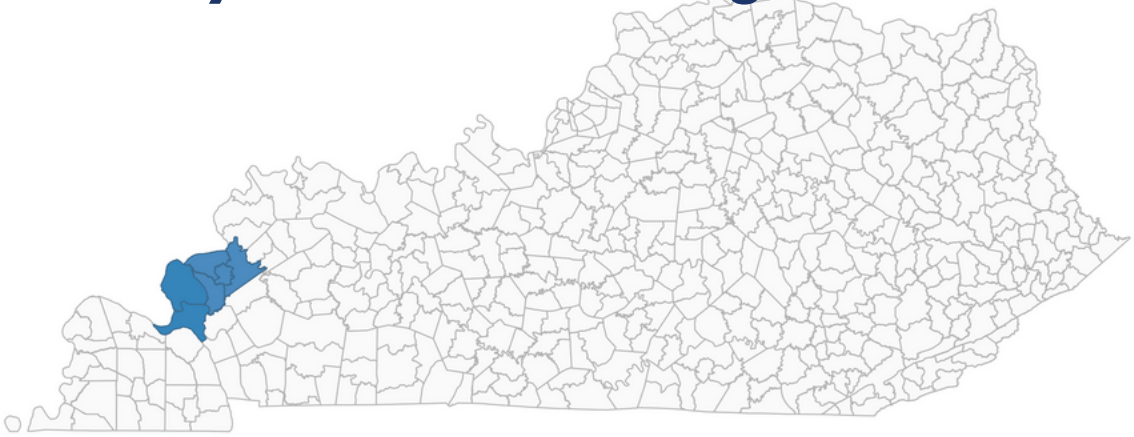
[21] "Rates and Construction Application," Oct. 1, 2020, PSC Case 2020-00290. https://psc.ky.gov/pscecf/2020-00290/keckert%40mcbrayerfirm.com/10012020101903/093020BW_Rate_Appl.pdf, 12-13.

[22] Skogin, Mike. "BG Water Utility seeks 220.5 percent rate increase," Dec. 1, 2020. News-Graphic Georgetown, KY. https://www.news-graphic.com/news/bg-water-utility-seeks-220-5-percent-rate-increase/article_6d62225a-3352-11eb-bc38-8317a1570a53.html

The PSC received almost 550 complaints from customers, state senators, state representatives, business associations and neighborhood associations regarding the rate increase for their wastewater and water systems.[23] Customers shared what the proposed rate increase would mean for their families. One comment read, "Most living here are retired or of retirement age living on social security and cannot absorb the increase Bluegrass Water is requesting…Are we supposed to buy less food? Do without medication in order to pay an outrageously high water bill?"[24]

The PSC approved a flat rate of $77.63 per month for water customers, more than tripling their previous rate. Vice Chairman Kent Chandler issued a dissenting opinion, claiming that Bluegrass Water did not meet its burden of proof to justify its proposed rates.

Case Study: Crittendon-Livingston



At $67.00 for 4000 gallons, Crittendon-Livingston Water District (CLWD) has the third highest water bill at average household usage in our dataset. CLWD is a PSC regulated system that serves 3,607 customers in Crittenden and Livingston counties. The District raised their rates by 32% in May 2019, after maintaining the same rate for nearly seven years.[25]

In their application, the explanation given for their requested rate increase included the district's inabilities to pay off long-term debt without tapping into depreciation reserves, cover the current cost of service, and maintain compliance water quality standards.[26] In 2019, CLWD's water loss rate was 17%.[27]

CLWD requested a 31.68% increase. Based on PSC staff's analysis of the district's Cost of Operation. PSC Staff found that CLWD required a retail revenue increase of $608,746, calculated as a 32% increase. CLWD raised rates through phased increases over three years, each year increasing rates by 9 - 10.5%. CLWD's Rate Adjustment Case (PSC Case 2018-00414) was resolved within five months, and CLWD waived its right to a Formal Hearing.[28] There were no public comments or intervenors in the case.

[23] Saad, Hannah. "Bluegrass Water appeals PSC case affecting several McCracken sewer systems," Sept. 29, 2021. The Paducah Sun, Paducah, KY. https://www.paducahsun.com/news/bluegrass-water-appeals-psc-case-affecting-several-mccracken-sewer-systems/article_7cfabc05-54a3-5e4a-ac83-5d5a8c69a866.html

[24] "Multiple Public Comments," Oct. 10, 2020, PSC Case 2020-00290. https://psc.ky.gov/pscscf/2020%20cases/2020-00290/Public%20Comments//20201009_Multiple%20Public%20Comments.pdf, 7-8.

[25] "PSC Order," May 23, 2019, PSC Case 2018-00414.

[26] "Crittenden-Livingston County Water District Application for an Alternative Rate Adjustment," Dec. 28, 2018, PSC Case 2018-00414. https://psc.ky.gov/pscscf/2018%20cases/2018-00414/20181212_crittenden-livingston%20county%20water%20district%20application.pdf.

[27] "Commonwealth of Kentucky Public Service Commission ANNUAL REPORT STATISTICS - 2019". https://psc.ky.gov/utility_financial_reports_NET/stats/700_336.pdf.

[28] "Crittenden-Livingston County Water District Response to Commission Order," April 15, 2019, PSC Case 2018-00414. http://psc.ky.gov/pscscf/2018%20cases/2018-00414/20190415_Crittenden-Livingston%20County%20Water%20District%20Response%20to%20Commission%20Order.pdf

Case Study: Martin County Water District

At $69.85 for 4000 gallons, Martin County Water District has the second highest water bill at average household usage in our dataset. Since 2018, Martin County Water District has applied for two rate increases in efforts to stabilize the county's dilapidated water system after years of disinvestment and neglect. The first case sought a 49.5% increase for all water customers. As Vice Chairman Schmitt explained in his November 5, 2018 concurrence in the first case, "[r]egular breaks in Martin District's water mains and leaks in its service lines have caused many customers to live without safe, clean, drinking water and sometimes without any water at all for extended periods." The PSC found that the small public water district had been badly mismanaged for decades, resulting in a high level of vendor debt and water loss well above 60%. Because of the degree of local mismanagement, the PSC ordered the district to contract with an outside company to handle all of the district's daily operations and management. Alliance Water Resources, a company from Columbia, MO, was chosen and began running the district in 2020. The first rate increase, which included two surcharges, increased the district's minimum bill by 53%.

"Because we [the PSC] expect Martin District's financial position to improve significantly due to Alliance's professional expertise and economies of scale," the district was ordered to file a second rate case in 2021. (11/15/2019 order, 27). Unfortunately, neither the district's financial position nor the water loss improved in the time between the two cases. In 2021, the district sought another increase. At that time, the PSC staff found that the amount the district requested was not sufficient to meet the district's revenue needs, which it found required a 24% increase. Martin County Concerned Citizens intervened and sought rate protections for the county's lowest income customers. The group asked the PSC to order the district to provide an opt-in low-use rate option for low-income customers and asked that surcharges not be included in low-income customer's bills. The PSC denied those requests, "[w]hile the Commission agrees that the issue of affordability should be considered as part of the larger process to rehabilitate Martin District, the Commission finds that there is insufficient evidence in the case record to support MCCC's proposals." (2/8/22 Order, 13). The PSC granted the increase. The second case increased customer's minimum bills by another 10%. Combined, the two cases brought about an 84% increase in customer's minimum bills in the county.

In addition to geographic trends, we also found that the monthly bills vary based on other water system characteristics. For instance, on average, water bills for customers served by PSC regulated systems were higher than unregulated systems for all usage rates (24 - 28% higher) (Table 2). However, unregulated systems are municipal water systems which may be characteristically different from regulated systems in terms of density. The majority of municipal systems have a rate for customers inside municipal boundaries and the rate plus a surcharge for customers outside the boundaries (Figure 1).

In the analysis presented above, comparing bills for regulated versus unregulated water systems, the bills for unregulated systems were calculated using the bills for customers inside the boundaries as we assumed that the majority of customers for these systems are located within these jurisdictional boundaries. However, we did also calculate average water bills for customers served by unregulated systems located outside of municipal boundaries. We found that regulated systems still trend more costly but the percent difference is reduced with unregulated systems costing customers on average just 2-10% less than regulated systems.

We also looked at water bills across different class sizes of water systems (class size I is less than 1,500 customers; class size II is 1,500 - 15,000 customers; class size III is 15,000 - 50,000 customers; class size IV is greater than 50,000 customers). Though water bills are not substantially different between the smallest class I and class II size water systems, bills are comparatively lower in larger class III and IV water systems (Figure 3).

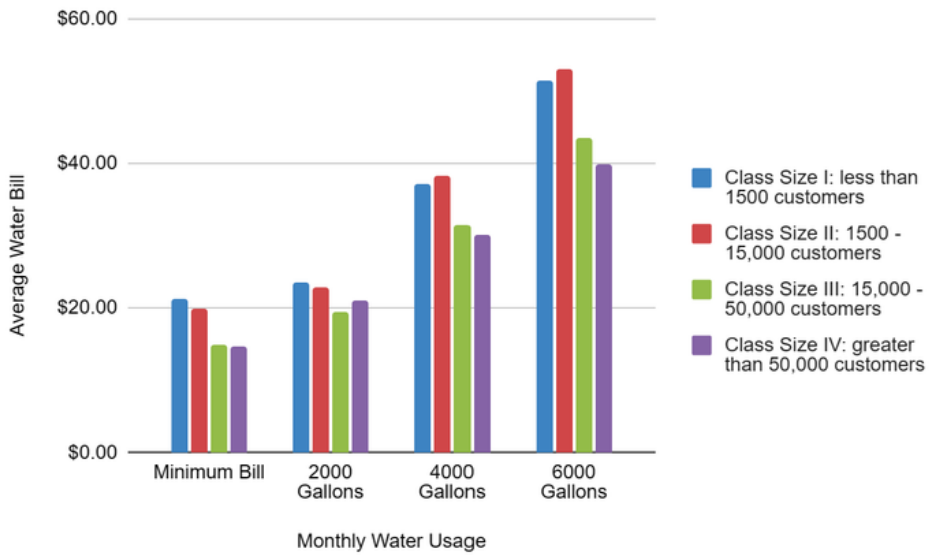


Figure 3: Average customer bills by water system size

We observed an additional rate structure characteristic among water systems with the highest bills. Five of the ten systems with the highest bills have a rate structure that may act as a perverse incentive for usage. Specifically, in those systems, the per gallon rate decreases for customers that use over 4000 or 5000 gallons a month, making water less

expensive per gallon as you use more of it. Only one of the systems with the lowest bills implemented this rate structure. We subsequently examined the entire dataset and found that 81 systems decrease per gallon rates at higher usage levels and, on average, bills are higher in systems that implement that type of rate structure (Table 4).

Table 4: Average bills across water systems with variations in rate structure

	Number of systems	Average Minimum Bill	Average bill for 2000 gallons	Average bill for 4000 gallons	Average bill for 6000 gallons
Cost per gallon increases as usage increases	7	19.09	22.57	33.67	46.67
Cost per gallon is consistent across usage levels	145	18.06	21.95	35.22	48.97
Cost per gallon decreases as usage increases	81	20.60	23.02	38.81	53.49

In addition to variation in water bills across systems, there is also substantial water bill variation within many systems. Thirty-one percent of the water systems have different monthly bills for customers located inside and outside the boundaries of the municipality. Monthly bills for those located outside the municipal boundaries are, on average, 22 - 26% higher (Table 5). In addition we identified twelve water systems that have subregion surcharges for specific groups of customers and those surcharges increase monthly bills by 5 - 67%.

Table 5: Average bills across systems with variations in rate structure

	Inside City	Outside City	Percent Difference
Average Bill: 2000 Gallons	$17.74	$24.30	25.95%
Average Bill: 4000 Gallons	$28.36	$38.04	24.50%
Average Bill: 6000 Gallons	$39.36	$50.98	21.94%

An examination of monthly water bills plotted against MHI suggests that household income does not heavily influence the water rates. If income were an important criteria in decision making, we would expect to see water bills trend lower for census tracts with lower MHI. However, the opposite is true. Water bills are largely not proportional to household income and actually trend higher for census tracts with lower MHIs (Figure 4). For example, the plot in figure 4 shows that $35 to $36 for 4000 gallons is the monthly water bill for 4000 gallons in census tracts with MHIs less than $18,000 as well as for those with MHIs higher than $200,000. These trends suggest that there will be a large variation in water burden which is further investigated in the next section.

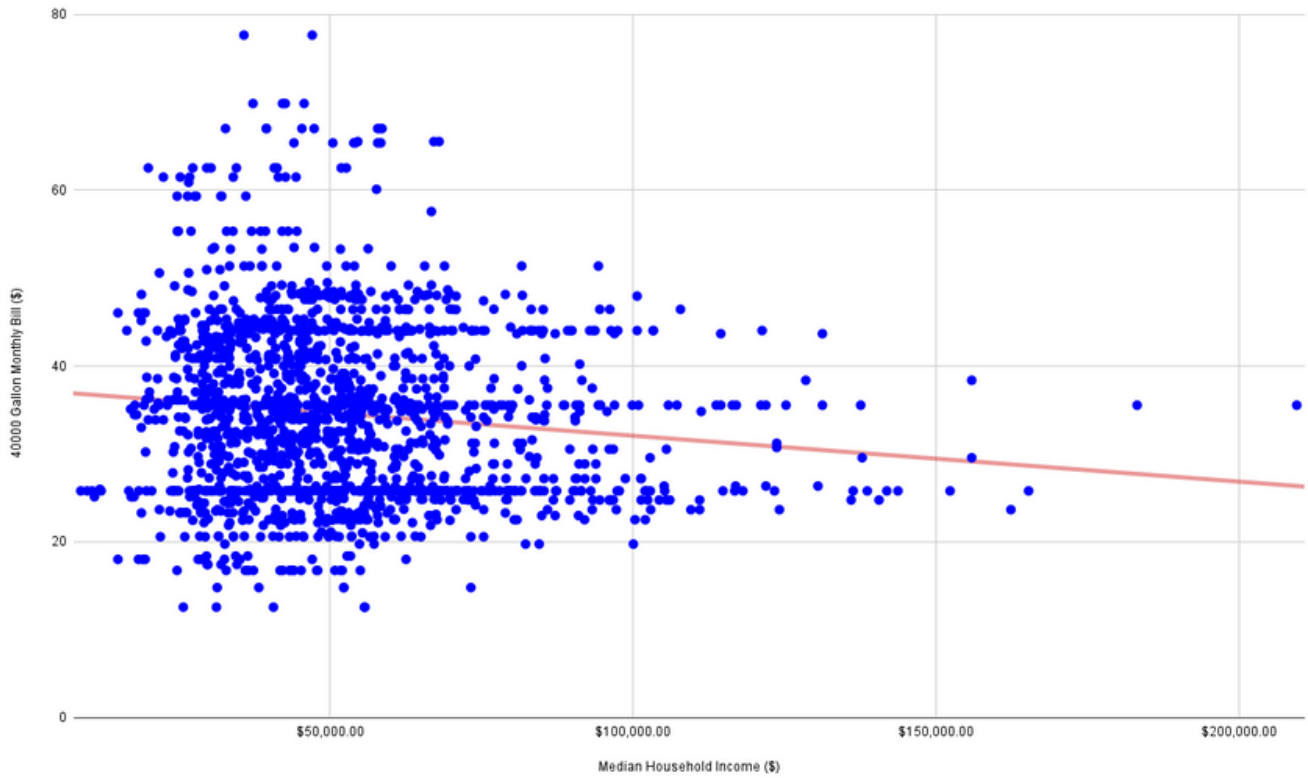


Figure 4: Relationship between median household income and 4,000 gallon usage monthly bill per census tract

Water Burden

Burden calculated using Median Household Income

To assess affordability, we first examined water burden at the census tract level using MHI for the three water usage levels of 2000, 4000, and 6000 gallons per month (Table 6).

At a conservative usage level of 2000 gallons per month, there is large variation in water burden across Kentucky. In fact, there is an over twenty-fold difference in water burden at 2000 gallons per month among census tracts, ranging from 0.12% to 2.6%.[29] Even at minimal water usage of 2000 gallons per month, water for customers served by the dominant water system in five census tracts is unaffordable (Figure 5, Table 6).[30] Though our above analysis shows that water systems with larger service populations tend to be less expensive, four of these five most heavily burdened census tracts are served by a large class III or IV water system. The exception is the census tract in the southeastern part of the state.

Water burden is a function of both income and amount paid for water but we find that lower than average income is not the sole driver of the high water burdens in the five tracts

[29] Including both dominant and secondary water systems serving each census tract

[30] We also found three census tracts where customers served by the secondary water system had burden greater than 2%

for which 2000 gallons is unaffordable. Though each of these census tracts does have an MHI below the state average of $52,238[31] (Figure 6), the cost of the water bill also plays a role. Though the water bills ($17.88/month for 2000 gallons) for the two Jefferson county tracts, which are served by the same water system, are 20% lower than the average bill for 2000 gallons ($22.34 as seen in Table 2), the water bills in the remaining three census tracts are 24 - 36% higher than the average bill, ranging from $29.39 - $34.39.

Table 6: Extent of water unaffordability (e.g. number of census tracts in which water burden is greater than 2%) for each income level and monthly water usage rate*

	Census tracts with Unaffordable Water Burden: 2000 Gallon Monthly Usage	Census tracts with Unaffordable Water Burden: 4000 Gallon Monthly Usage	Census tracts with Unaffordable Water Burden: 6000 Gallon Monthly Usage
Median Household Income	5 (0.4%)	57 (4.5%)	187 (14.7%)
Second Quintile Income Maximum	71 (6.0%)	277 (23.6%)	487 (41.5%)
First Quintile Income Maximum	602 (51.3%)	852 (72.6%)	989 (84.3%)

*This table considers only water burdens calculated for a census tract's dominant water system. Percentages of tracts with burdens greater than 2% are calculated out of a total of 1274 census tracts for water burden at MHI and 1173 census tracts for water burden at Income Quintile Maximums.

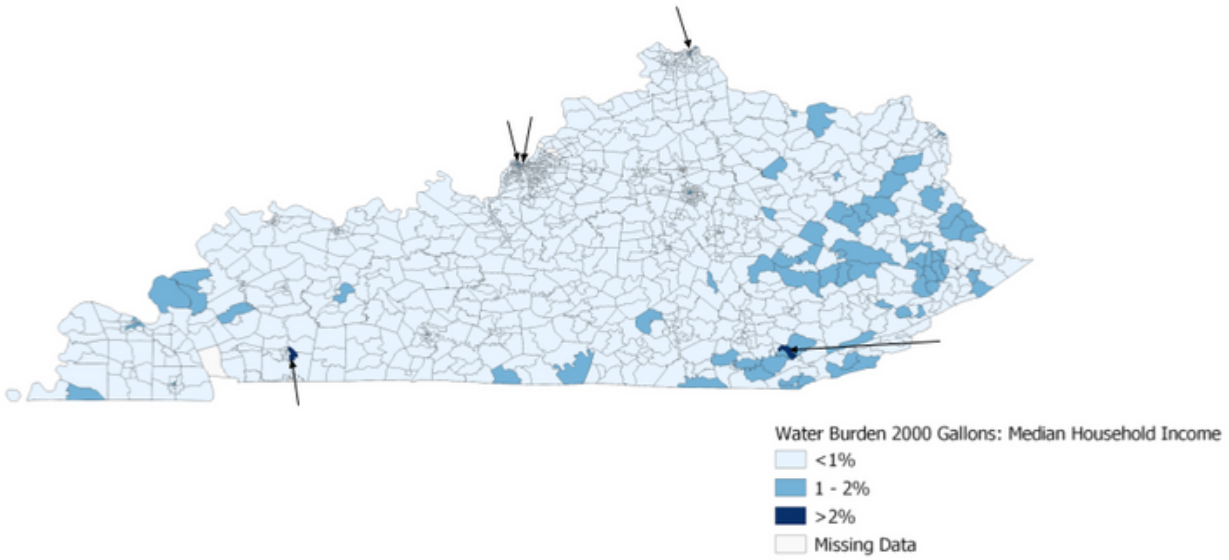


Figure 5: Water burden at median household income in dominant water systems for 2000 gallon monthly usage. Arrows point to each of the five census tracts with water burdens greater than 2%.

[31] This amount of $52,238 is the 2020 ACS MHI five-year estimate for the state of Kentucky. The MHI in each of the five census tracts is less than $19,000. There are 19 census tracts with MHIs less than $19,000 in the state. The two Jefferson county census tracts have the lowest MHIs in the state of just $8,861 and $9,919.

Figure 6: Median household income per census tract

Four water systems serve the five most heavily burdened census tracts.[32] Examining those water system territories reveals large inequities across the service population. Though the water systems have some of the most burdened populations in the state, for three of the four systems, the weighted average MHI for the entire service territory is higher than Kentucky's average MHI (Table 7). For example, though Jefferson county contains some of the poorest census tracts in the state, it also contains some of the wealthiest. There is a large range of water burden in the system for three of the four water systems (Table 7). The water system in the southeastern part of the state is the exception. Its service territory MHI is less than half of the state's MHI, and the range of water burden is, comparatively, much smaller.

Table 7: Household income and burden statistics for dominant water systems that serve census tracts with the highest water burdens

Water System	Service Territory MHI*	Range of Water Burden Among Served Census Tracts for 2000 gallon monthly usage rate**
Water System 1 (Louisville, KY)	$86,738	0.13 - 2.42%
Water System 2 (southwest KY)	$56,078	0.52 - 2.19%
Water System 3 (northern KY)	$66,416	0.31 - 2.28%
Water System 4 (southeast KY)	$20,176	1.14 - 2.35%

*Data is from Kentucky Infrastructure Authority Water Resources Information System, using ACS 5 year data 2016 - 2020
**In census tracts where it is the dominant water system

[32] There are just four water systems as a single water system serves each of the two heavily burdened census tracts in Jefferson county.

There is also a large variation in water burden across census tracts at the 4000 gallon usage rate and water becomes unaffordable for many more households at this average usage level. Again, there is an over twenty-fold difference between those with the lowest and greatest water burdens, with burdens ranging from 0.17% to 3.75% (Figure 7).[33] Water for customers served by the dominant water system is unaffordable in 57 census tracts (Table 6).[34] Again, MHI is a notable factor in higher burden, as all 57 census tracts have MHIs lower than $40,000. However, 75% of the tracts also have water bills that are greater than the average bill for 4000 gallons ($36.42 as seen in Table 2). The majority of these census tracts are located in Eastern Kentucky.

When looking at the water burden at 6000 gallons per month of usage for customers served by the dominant system, we found that water was unaffordable in 187 census tracts (Figure 8, Table 6). The trends in water bills, MHI, and geographic location for water burdens at 6000 gallons per month usage are very similar to those described above for 4000 gallon burdens. The water bills for 84% of these census tracts are higher than the state's average bill for 6000 gallons ($50.32 as seen in Table 2); the MHI for the majority of the tracts is less than $40,000; and the majority of these census tracts are located in Eastern Kentucky.

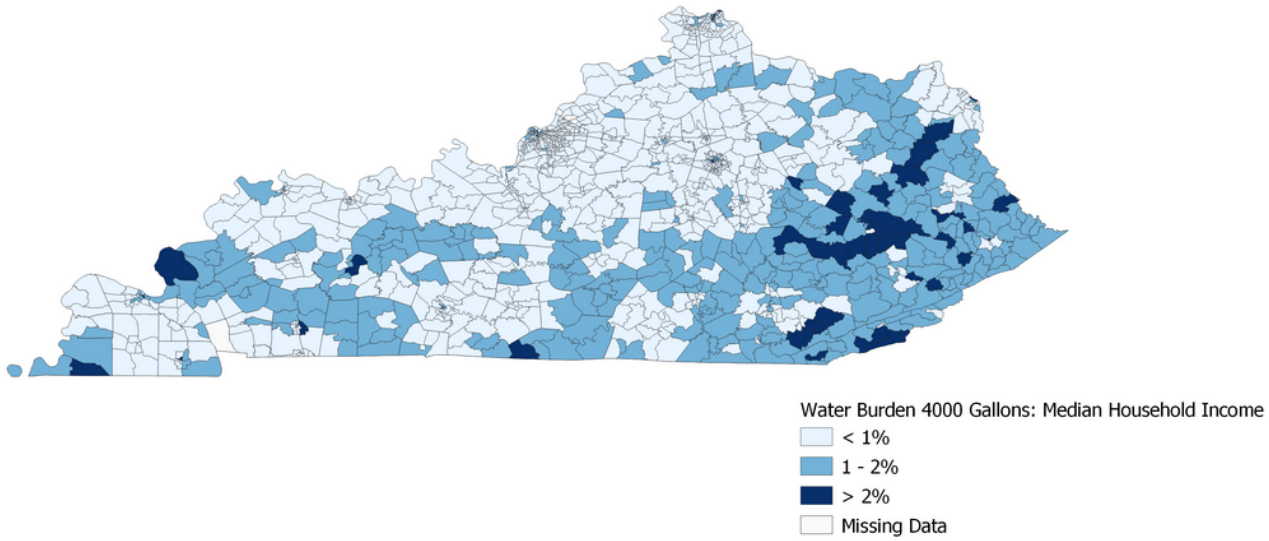


Figure 7: Water burden at median household income in dominant water systems for 4000 gallon monthly usage

[33] Including both dominant and secondary water systems serving each census tract

[34] We also found 17 census tracts where customers served by the secondary water system had burden greater than 2%

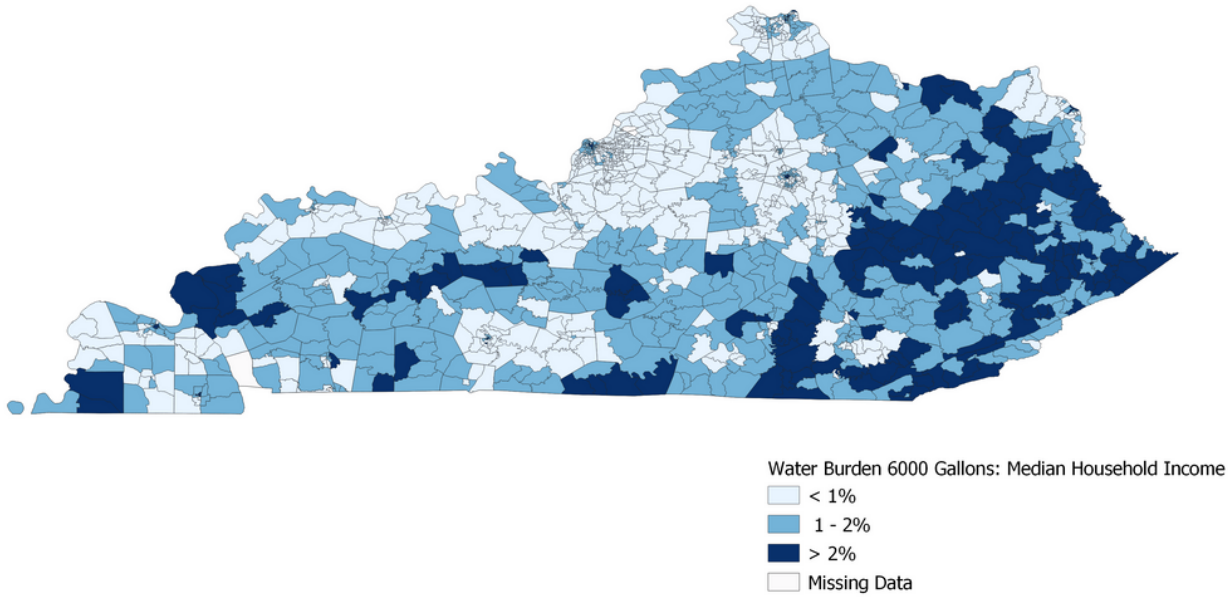


Figure 8: Water burden at median household income in dominant water systems for 6000 gallon monthly usage

Burden for households with incomes less than the Median Household Income: Burden analyses for first and second quintile income maximums

To capture burden for lower income households in each census tract, we examined water burden at the first and second quintile income maximums. MHI is commonly used to understand affordability across the customer base of a water system, but can be problematic as an indicator of household water affordability because, by definition, half of the households in a census tract have incomes less than the MHI.

For water customers served by the dominant water system, 2000 gallons of water is unaffordable in 602 census tracts for households with incomes at or below the first quintile income maximum (Figure 9, Table 6). In over 100 tracts, the lowest income households are paying 5% or more of their annual income on water, even at this low usage level. In over 20 tracts, the lowest income households are paying 10% or more. In one census tract, the lowest income households are paying over 40% of their income on water.[35] Even at the second quintile income maximum, the number of households across the state with unaffordable water at this low usage level is very high. In over 70 census tracts, 2000 gallons of water remains unaffordable at the second quintile income maximum, meaning that **water affordability is an issue for approximately 40% of the households in those tracts** served by the dominant water system (Table 6).

At the average usage level of 4000 gallons of water per month, for water customers served by the dominant water system, water is unaffordable for households with incomes at or below the first quintile income maximum in 852 census tracts (Figure 10, Table 6).

[35] Due to high standard error in the ACS income data, this statistic does not consider the two outlier census tracts that had water bills that totaled an amount higher than the first quintile maximum.

In 63 tracts, the lowest income households using 4000 gallons per month are paying **10% or more of their annual income on water.**[36] In nearly 280 census tracts, water remains unaffordable at the second quintile income maximum for households using 4000 gallons per month (Table 6). Though some of the highest water burdens are concentrated in Eastern Kentucky, water affordability for households with incomes lower than the MHI is a widespread problem across the state (Figures 9 and 10). At a 6000 gallon usage level, water is unaffordable for households with incomes at or below the first quintile income maximum in 989 census tracts and remains unaffordable at the second quintile income maximum for 487 census tracts (Table 6).

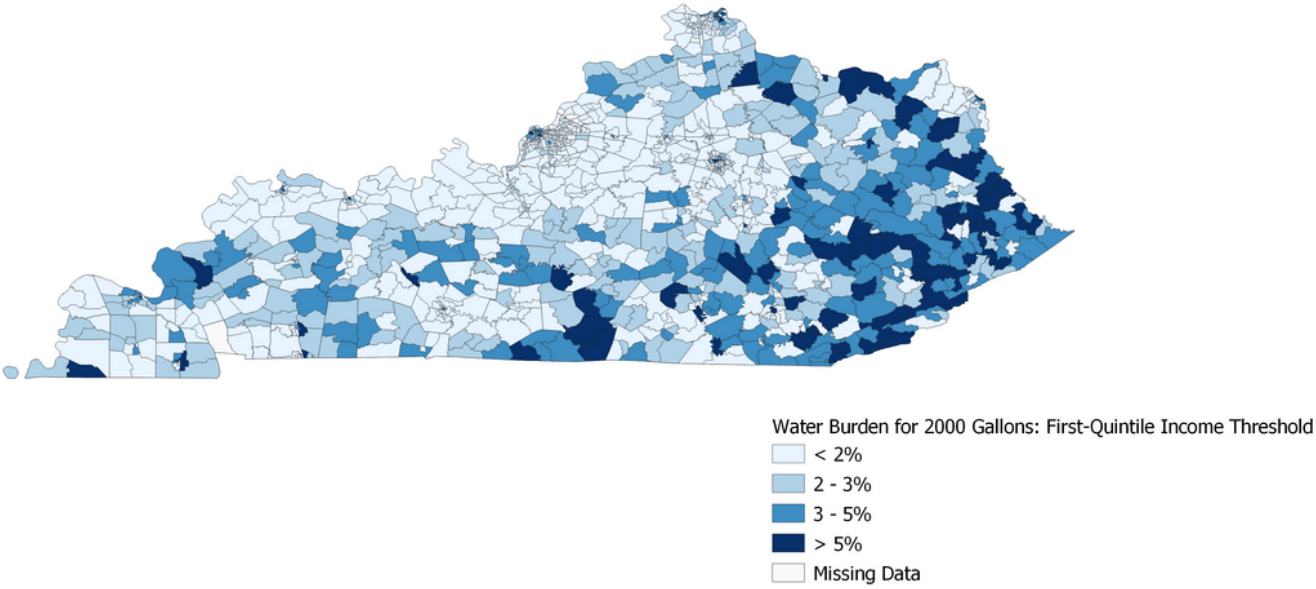


Figure 9: Water burden at the first quintile income maximum in dominant water systems for 2000 gallon monthly usage

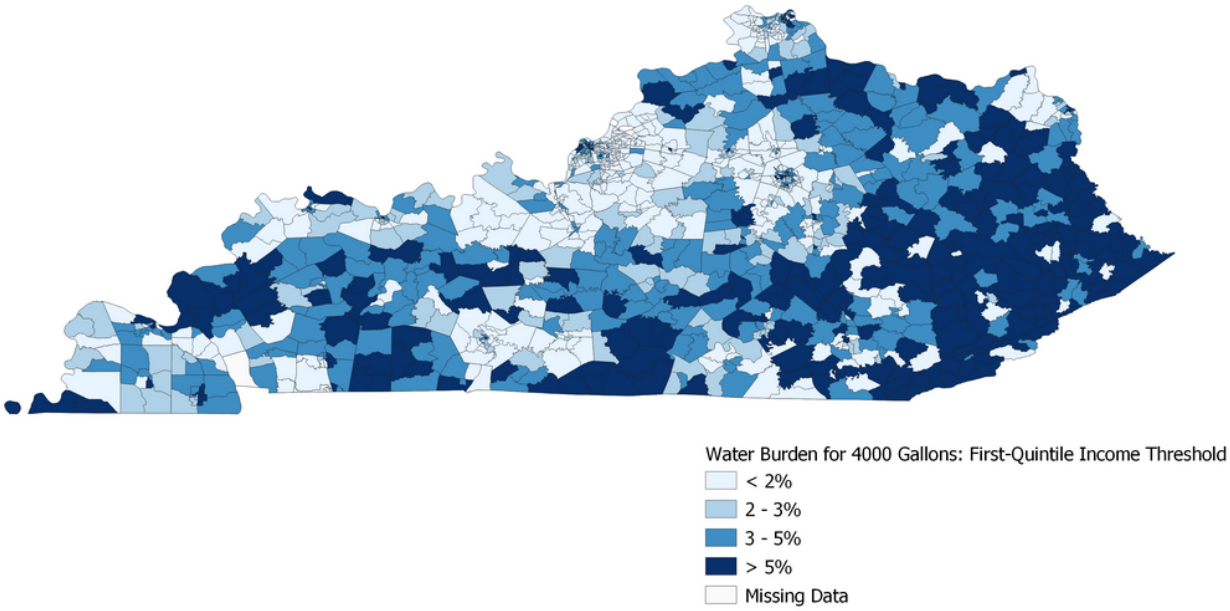


Figure 10: Water burden at the first quintile income maximum in dominant water systems for 4000 gallon monthly usage

[36] Due to high standard error in the ACS income data, this statistic does not consider the three outlier census tracts that had water bills that totaled an amount higher than the first quintile maximum.

Discussions & Recommendations

Our report makes clear that high water burdens are an issue across the state, especially for households with incomes lower than census tract level MHI. However, we also demonstrate that water affordability and high water burdens are not wholly dependent on household income. Though our report indicates that the most severe water burdens do tend to be in areas of the state with lower than average income, areas with higher burdens also tend to have higher than average water bills. This pattern suggests that a better understanding of the factors driving the cost of water and variation in water bills might help reveal solutions for making water more affordable.

Across Kentucky, monthly water bills are highly disparate. Further research is needed to determine the drivers of such variation in household water bills. Our analysis suggests that the ability for a customer base to pay for water is not driving variation in water bills. In fact, some of the highest bills are in some of the census tracts with the lowest MHIs. Rather, several other factors may play a role, including the size of a water system (both in terms of customer base as well as the geographic spread of a water system's customers), rate structure, service territory population change, and history of infrastructure investment.

One possible solution for reducing water burdens for low income families may be to consider innovative rate structures. As demonstrated in this report, large inequities in water burden occur not just across different water systems but also within the service population of a given water system. This raises the question of whether there are rate structures that could more equitably distribute, rather than equally distribute, the cost of maintaining a water system across its customers. Increasingly, for example, utilities across the country are adopting Percentage of Income Payment Plans (PIPPs). PIPPs allow lower income families to pay a set percentage of their income on utilities, allowing for bills that are predictable and consistent in cost and more affordable. However, these types of rate structures are only possible in systems with substantial variation in household income and wealth.

The three case studies in this report on the water systems with the highest water bills also clearly show that poor water infrastructure is an issue in Kentucky water systems, and yet repairing and replacing failing infrastructure drives up water bills. In the long-term, improved water infrastructure can make water systems more efficient and possibly reduce water bills. For example, reducing water loss in distribution lines would reduce the cost to provide water to each customer. The relationship between system health and customer bills reveals the crux of the challenge in balancing water affordability in the short-term against more affordable rates and a sustainable water system in the long-term.

Existing federal water infrastructure and water assistance programs can work in synergy to lower the cost of water system capital improvements while maintaining

customers' ability to pay for water. For example, revisions to the Environmental Protection Agency Drinking Water State Revolving Fund program in the 2021 *Infrastructure Investment and Jobs Act* direct states to provide loans with more principal forgiveness and lower interest rates specifically to disadvantaged communities with high water burdens. However, these funds are insufficient to meet infrastructure needs.[37] They are annually oversubscribed and even with low or no-interest loans to make infrastructure repairs, many water systems are likely to be faced with increased water treatment costs to meet new Per- and Polyfluorinated substances (PFAS) regulatory standards.[38] Therefore, customer water assistance programs are also a much-needed policy mechanism to maintain low income households' access to water.

In 2021, as part of a package of COVID-19 response policies, Congress created the Low Income Household Water Assistance Program (LIHWAP). LIHWAP has provided vital water bill assistance to hundreds of thousands of families but now faces funding cuts. LIHWAP is the first federal level water assistance program and Congress allocated just over $1 billion in 2021 to be spent through the end of 2023, granting funds to states to manage distribution. In Kentucky, the LIHWAP program has helped thousands of families maintain water and sewer connections. Over 43,000 households in the state have accessed the LIHWAP program.[39] However, the future of LIHWAP is bleak. The Biden Administration's budget for FY24 greatly reduced funding for the program to a mere $111 million and the House and Senate appropriation bills included no funding for LIHWAP.

High water burdens are problematic not just from the human rights perspective, but also because they negatively impact the ability of a water system to provide water services.[40] If customers are unable to meet the revenue needs of the system through rates, household unaffordability becomes problematic from a utility collectability perspective. Inability to collect bills will create further strain on water system revenues and budgets, creating a problematic cycle that can lead to understaffing, failures to maintain existing infrastructure, vendor debt, failures to set aside funds for future infrastructure needs, and other issues. To better understand and address high water burdens, further research is needed to examine the factors that drive variation in the cost to produce and deliver water and to identify rate structures and other policy mechanisms through which to more equitably redistribute these costs across customers.

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[37] Note that these are certainly not the only federal funds available for water infrastructure investments. The state of Kentucky also uses Abandoned Mine Land Fund, Abandoned Mine Land Economic Revitalization Funds, USDA Rural Development Loans and Grants, Appalachian Regional Commission funding, and several other sources of funding to invest in water infrastructure.; See August 2023 presentation from Kentucky Rural Water Association highlighting the need for funds to invest in Kentucky's deteriorating water infrastructure: https://apps.legislature.ky.gov/CommitteeDocuments/10/26596/03.%20KY%20Rural%20Water%20Association%20Presentation.pdf

[38] See August 2023 presentation from Kentucky Rural Water Association highlighting the need for funds to invest in Kentucky's deteriorating water infrastructure: https://apps.legislature.ky.gov/CommitteeDocuments/10/26596/03.%20KY%20Rural%20Water%20Association%20Presentation.pdf

[39] The Administration for Children & Families. 2023. Quarterly Reports. https://lihwap-hhs-acf.opendata.arcgis.com/pages/quarterly-reports

[40] Natural Resources Defense Council. 2023. Water Affordability Business Case Downloadable Tool. https://www.nrdc.org/resources/water-affordability-business-case-downloadable-tool

Based on our analysis of water burden in Kentucky and our understanding of the state and federal policy landscape, we recommend the following:

1. Congress should create a permanent program to provide household water bill assistance. In the immediate future, Congress should appropriate at least $500M annually to support the continuation of LIHWAP at original funding levels.

2. Federal funding for water infrastructure should be directed, in grant form, to low-resource water systems with system-wide affordability issues, especially now that they are statutorily mandated to direct more funding to disadvantaged communities.

3. Kentucky needs to dedicate governmental resources to address water burdens. We recommend the state commence a cabinet level initiative similar to the Energy and Environment Cabinet's Energy Affordability Workgroup to examine the issue of water affordability.

4. Kentucky has over $4 billion in its rainy day fund. We recommend that in the next budget cycle (2024 - 2026), the state make an additional investment in its recently created Water Management Assistance Fund to support capital and non-capital investments in the water systems that serve households with the most severe water burdens.

5. Kentucky policy makers and an administrative working group should investigate the potential for innovative rate structures to distribute the cost of water more equitably across households.

6. Kentucky needs to pass legislation that requires the PSC to consider affordability in setting water rates.

Appendix A

The Safe Drinking Water Information System maintained by the Kentucky Energy and Environment Cabinet lists 378 active community water systems in the state of Kentucky. Community water systems serve the same customers (homes and businesses) year-round, as opposed to transient non-community water systems that do not serve the same people, for example rest stops or campgrounds. Of the 378 active community water systems, 147 (39%) are regulated by the Public Service Commission (PSC), under KRS Chapter 278. The PSC has jurisdiction over the rates and services of these systems. The remaining 231 systems are considered municipal systems, and are not subject to regulation by the PSC. Instead, they are governed by the city government and overseen by the mayor.

We requested a list of rates from the PSC in March 2022 and updated the dataset provided by the PSC to reflect any rate increases ordered prior to May 1, 2022. The PSC provided rates for 2000 and 4000 gallons usage levels. Rates for 6000 gallon usage were collected from utility tariffs maintained and made publicly available by the PSC. Rates for unregulated systems were collected between December 2021 and April 2022. They were collected by finding rates online, as well as by communicating via email and telephone with select water systems. We attempted to contact each water system at least three times if rates were not listed online. Our resulting data set includes 233 systems: 135 regulated and 98 unregulated (See Figure 1 in the report).

Thirteen utilities in our dataset have system-wide surcharges, which are flat fees added to every customer's bill, designated for a specific purpose and extend conditionally, that is they expire after a set date or condition is met. All of these are PSC-regulated utilities except one, Paducah Water Works. System-wide surcharges range from $1.12-9.00 per month. These system-wide surcharges were added to the water bill in water burden calculations. In addition, twelve utilities in our dataset have subregion surcharges which are flat fees added to a subsection of customers' bills depending on variables like when they were added onto the system or their geographic location. All water systems except one, Grayson Utility Commission, are PSC regulated. Subregion surcharges range from $1.56-25.00 per month. Subregion surcharges are analyzed in the section of the report that assess water bills but are not included in burden calculations. Some water systems also have one rate for customers within municipal boundaries and a higher rate for customers outside municipal boundaries. Again, we discuss these rates in the results section but used only the lower, inside rate for water burden calculations when the municipal system was dominant for a given census tract.

Our report includes water rates and water burdens at three different usage levels: 2,000 gallons, 4,000 gallons, and 6,000 gallons. We chose to include 2,000 gallons because, out of the 233 systems in our dataset, over half (142) include 2,000 gallons in their minimum bill. Thus, even the most conservative water user is paying for 2,000 gallons in the majority of water systems. A usage rate of 4,000 gallons is considered by the PSC as "typical" for a residential customer (e.g., see https://psc.ky.gov/agencies/psc/press/082018/0830_r02.pdf).

Furthermore, according to the PSC 2021 Annual Report, the average customer usage across all systems was 3,941 gallons. However, we also decided that it was necessary to look at higher usage rates because in utility-reported usage data in the PSC 2021 Annual Report, more than half of the utilities reported that the average customer used more than 4,000 gallons per month. Some utilities (6 of 93) reported that their average user used more than 5,000 gallons. In addition, the most recent USGS report on water use, from 2015, states that Kentuckians use an average of 68 gallons per capita per day, translating to 2040 gallons per month for a single person household.[41] And, on average, the number of persons per household in Kentucky is 2.5,[42] translating to over 5,000 gallons per month per household. Therefore, we also calculated water rates and burdens at 6,000 gallons.

We used QGIS to spatially associate water bill data with Kentucky census tract household income data. The Kentucky state government maintains a shapefile of water lines for public water systems in the Commonwealth and we spatially joined the line file to the 1306 census tracts in Kentucky. The shapefile contains transmission and distribution lines. We selected for distribution lines that carry finished, rather than raw, water as we assumed that those lines would best indicate the service territory of a water system (i.e., distribution lines are carrying finished water to customers). We overlaid a census tract shapefile and spatially joined the water lines to their corresponding census tract(s). Some census tracts contained lines from multiple water systems. In order to determine a 'dominant' system per census tract, we summed the length of the selected water lines per system in a given census tract. The system with the highest length of distribution line in a census tract we refer to as the 'dominant' water system (N = 190). Some census tracts also have secondary and tertiary systems. There was some overlap between water systems that were dominant and secondary across the tracts (e.g. a water system may be dominant in one tract and secondary in an adjacent tract) and thus the total number of water systems identified was N=297 (See Figure 1 in the report). However, only 224 water systems were included in the water burden analysis as we were unable to get water bill data for some of the unregulated systems (mostly those identified as secondary systems) and nine of the PSC regulated systems were neither dominant nor secondary systems.

There are limitations to our approach to selecting the largest water systems. As we selected for dominant and secondary water systems, that means that the majority of water systems excluded from our analysis are small water systems. For example, there are 49 community water systems in Kentucky with fewer than 1000 customers and only fourteen of these appear as dominant or secondary water systems (See Figure 1 in the report). In addition, some systems are not included in the water line shapefile. Specifically, water lines were not available for 18 water systems.[43] We did assign census tracts in Jefferson County that did not have other water lines in the tract to Louisville Water Company. In spite of missing water line data, we were able to identify a dominant water system for

[41] Dieter, C.A., Maupin, M.A., Caldwell, R.R., Harris, M.A., Ivahnenko, T.I., Lovelace, J.K., Barber, N.L., and Linsey, K.S., 2018, Estimated use of water in the United States in 2015: U.S. Geological Survey Circular 1441, 65 p., https://doi.org/10.3133/cir1441. [Supersedes USGS Open-File Report 2017–1131.]

[42] U.S. Census Bureau. 2022. QuickFacts Kentucky. https://www.census.gov/quickfacts/fact/table/KY/PST045221

[43] Water line data missing for: Beech Fork Water Commission, Birkle Water Supply, Cave Run Regional Wt Comm, Center Ridge #4, City Of West Liberty, Fort Campbell, Greater Fleming Co Wt Comm, Green Hills Water District, Hardin Co. Water Dist #1/Ft. Knox, Kentucky American Water - Eastern Rockcastle, Locust Valley, Mobile Est, Logan-Todd Regional Water Commission, Louisville Water Company, Mclean County Regional Water Commission, Montgomery County Water District #1, Riverside 25 Llc, Trapp Water Company, West Carroll Water District

1299 census tracts. However, we were missing water bill data for 12 of these systems, resulting in 1287 census tracts for which we identified both the dominant water system and the corresponding water bill data (98.5% of census tracts) (See Table 1 in the report). We associated water systems to census tracts in this way in order to use the census tract level income data to calculate water burden. We use the American Community Survey (ACS) five-year estimates at the census tract level for household income data.[44] We used the ACS for both MHI and income quintile data. MHI was available for 1285 census tracts and income quintile data for 1184 census tracts. We focused primarily on reporting water burden for the dominant water systems. Water burdens calculated for the dominant water system are displayed on maps in the report and are the primary topic of discussion throughout our results on water affordability. We do, however, report water burden ranges across both secondary and dominant water systems. Overall, we were able to calculate water burden at MHI for 1274 census tracts and at income quintile maximums for 1173 census tracts. Water burdens calculated for the dominant water system are displayed on maps in the report.

We focused on estimating household affordability to provide a complementary perspective to the system level affordability calculations that are already completed by Kentucky Infrastructure Authority. Following the approach of Roger Colton, a lawyer and economist who has testified in numerous regulatory proceedings, including in Kentucky, we consider a household water burden greater than 2% unaffordable.[45] We used a simple ratio method to calculate water burden (water bill/household income). These affordability calculations look at whether the rates are affordable for a representative low-income household in the community.

There are several limitations to our analysis. First, as our analysis is based on relatively small geographic regions (census tracts), in some cases the margin of error (MOE) for an income statistic is large. To demonstrate the potential variability in our results, we assessed affordability at the upper and lower bounds of the 90% confidence interval for income quintiles and MHI (Table A1). Though the number of census tracts for which water is unaffordable decreases at the upper confidence bound, it is clear that issues of water affordability are still problematic at each of the utilized income statistics. At the lower bounds of the confidence interval, issues of unaffordability dramatically increase.

[44] We used data from ACS tables B19013 and B19081

[45] Kentucky Public Service Commission, Docket No. 2021-00154. Available at: Microsoft Word - 08-19-21--RDC Martin County draft MC final edits tracked.docx (ky.gov)

Table A1: Extent of water unaffordability (e.g. number and percentage of census tracts in which water burden is greater than 2% for dominant water system) using each income statistics as well as the upper and lower bounds of the 90% confidence interval for each statistic.

	Census tracts with Unaffordable Water Burden: 2000 Gallon Monthly Usage			**Census tracts with Unaffordable Water Burden: 4000 Gallon Monthly Usage**			**Census tracts with Unaffordable Water Burden: 6000 Gallon Monthly Usage**		
	Lower Bound	Statistic	Upper Bound	Lower Bound	Statistic	Upper Bound	Lower Bound	Statistic	Upper Bound
Median Household Income	59 (4.6%)	5 (0.4%)	1 (0.1%)	211 (16.6%)	57 (4.5%)	13 (1%)	379 (30.1%)	187 (14.7%)	71 (5.6%)
Second Quintile Income Maximum	211 (18.0%)	71 (6.0%)	25 (2.1%)	484 (41.2%)	277 (23.6%)	144 (12.3%)	671 (57.9%)	487 (41.5%)	313 (27.0%)
First Quintile Income Maximum	794 (70.5%)	602 (51.3%)	362 (30.9%)	971 (81.6%)	852 (72.6%)	696 (59.3%)	1053 (19.4%)	989 (84.3%)	846 (72.9%)

An additional limitation to our study is that our water burden metric is a very simple approach to assessing burden. We realize that we are not capturing, for example, the amount of income that households spend on purchasing bottled water – something that we know that many households do, especially in Eastern Kentucky. Therefore, our calculations will likely lean towards being more conservative. Our approach also makes it challenging to identify the absolute number of households that have a high water burden. This is because sometimes there is more than one water system that serves customers in a census tract and thus the Census data, particularly income quintiles, doesn't map onto a single water system. Therefore, we cannot claim that the 20% of lowest income households in a given census tract have unaffordable water because there may be a large difference in the rates of the two or more water systems within a given census tract. Last, the analysis is focused on potential household affordability stress; it was beyond the scope of the study to determine the extent to which these stresses may already be mitigated through existing policies and programs.

Appendix B

Ratemaking process for regulated systems

In PSC-regulated systems, water board members can elect to file a rate adjustment to the PSC to request a rate increase. Water utilities must justify the requested rate increase, showing how existing revenue fails to capture required expenses.

To assess the reasonableness of a utility's requested rate increase, the PSC determines the annual revenue requirement for a utility based on either historic or forecasted data. Allowable expenses for revenue requirement include: "routine construction equipment purchases; operations: maintenance, billings, customer service, etc.; personnel costs: salaries & benefits; major construction – some costs recoverable in progress, but most are not until project is in service; [and] borrowing costs".[46]

After determining a utility's revenue requirement, the PSC examines rate design to distribute costs across various rate classes (ie. residential, commercial, or industrial). With their application, the utility may be required to submit a "cost of service" study. Often, rates are not set in direct proportion to cost of service, instead, industrial rates might be higher than actual cost to lower the burden on residential customers, who cannot achieve economies of scale.[47]

Rate cases before the PSC are subject to public review and comment. All public comments and case files are made available on the PSC website. Under KRS 278.190, the PSC may hold a hearing concerning the reasonableness of the requested rates. The Kentucky Attorney General, as well as "full intervenors", can request to become parties to the case, which, if permitted by the PSC, grants the party permission to request data, call witnesses, and cross-examine witnesses. Full intervenors must show that they will "present issues or develop facts that will assist the commission in fully considering the matter without unduly complicating or disrupting the proceedings."[48]

Rate Structure

Water systems design their own rate structure; subject to approval by the PSC or city government. Rate design is generally seen as being comprised of fixed costs, which is billed as a monthly base rate that is the same for all customers, and variable costs, which are billed based on consumption. According to the PSC, "monthly service charges historically have not fully recovered fixed costs,"[49]so variable costs must recover a portion of fixed costs. Within our data set, rate structures vary widely. The majority of utilities in our dataset include 2000 gallons in their monthly base rate, as shown in Table B1 below. Ninety utilities include less than 2000 gallons in their base rate, while 10 include more than 2000. There is no apparent relationship between gallons of water included in the minimum bill and the rate for 4000 gallons.

[46] Kentucky Public Service Commission, "UTILITY RATEMAKING: The Kentucky PSC Process." February 2020. https://psc.ky.gov/agencies/psc/presentations/Ratemaking-DukeEnergyKentuckyElectricRateCase2019-00271-February2020.pdf, 12.

[47] Ibid, 20

[48] 807 KAR 5:001

[49] Kentucky Public Service Commission, "UTILITY RATEMAKING: The Kentucky PSC Process," February 2020. https://psc.ky.gov/agencies/psc/presentations/Ratemaking-DukeEnergyKentuckyElectricRateCase2019-00271-February2020.pdf, 21.

Table B1: Gallons of water included in water systems' minimum bills

Gallons of Water included in Minimum Bill	Number of Water Systems
0	28
748	3
1000	50
1500	9
2000	132
2095	1
2244	2
2500	4
3000	3
Flat fee	1

Rate Adjustments

Our data captures rates as of May 1, 2022. Over half of the systems in our dataset (144) have had a rate increase within the preceding two years. A quarter of the water systems have not had a rate change since 2016, and four have not had a rate change for over ten years (Figure B1). For both regulated and unregulated systems, the average time since the last rate change is two years. Over 35 systems did not provide the date of their last rate change, so they are represented by "N/A" on the graph.

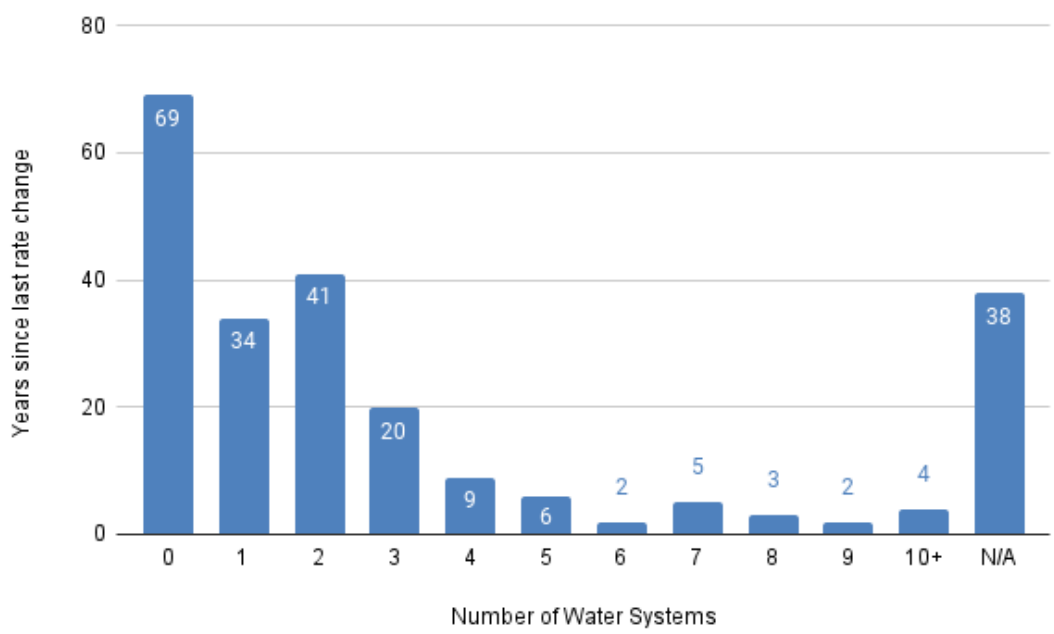

Figure B1: Years since a water system's last rate change