# Water Affordability Indicator

**Background:**

**Great Lakes Sustainability Indicators:**

The environmental health of the Great Lakes directly affects the region's economic activity and prosperity, public values and perceptions of the region, and individual and societal health and well-being. Understanding the relationships between these factors, and in particular the central role of a healthy Great Lakes ecosystem, can provide valuable policy insights for the region's decision-makers, advocates, and citizens.

**Drinking Water Indicators:**

The Great Lakes Watershed is a source of drinking water for the majority of the region's inhabitants. Regional leaders and advocates will be better informed to manage this resource or advocate for policies when they know more about:

- People's familiarity with and trust in their water source;
- The reliability of drinking water systems;
- The quality of the water consumed by households and businesses; and
- Water affordability in society, including the extent to which programs exist to assist the poor with water affordability.

**Water Affordability:**

Drinking water is an essential good, making it important to monitor trends in equitable access. Tracking water affordability requires measures that are valid and reliable over time and across geographies. Using national survey data, our measure of water affordability is the annual household expenditure for water and sewer, divided by household income. This ratio is an internationally recognized measure that captures the *relative burden* of this service on the household. One advantage of this affordability indicator is the ability to create a standardized version for the Great Lakes Region by using data from the United States and Canadian federal governments.

Table 1 below, compares the components of the water affordability ratio between the United States national average and averages in the Great Lakes Basin -- total, urban, sub-urban and rural for the year 2018. Further, for each area the table shows the percentage of households whose ratio of water/sewer cost to income is above the United Nations (UN) threshold for water affordability which is less than 5 percent of household (HH) income).

Note that these estimates include imputed values for households that do not report water and sewer expenses because they are rolled into rent, lease or condominium fees, as well as imputed values for households that do not report water and sewer expenses but where the household is in a structure with 5 or more units.

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| Table 1: USA and Great Lakes Basin Summary Statistics for Water Affordability | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **2018** | **USA Total** | **GLB Total** | **USA City** | **GLB City** | **USA Suburb** | **GLB Suburb** | **USA Rural** | **GLB Rural** |
| Average Annual Water Bill | $601.32 | $573.31 | $645.42 | $644.60 | $606.86 | $568.06 | $539.56 | $535.65 |
| Average Water Bill / HH Income | 1.69% | 1.77% | 2.01% | 2.57% | 1.54% | 1.57% | 1.92% | 1.88% |
| Percentage above UN threshold of 5% of HH income | 6.31% | 6.39% | 8.92% | 12.66% | 5.34% | 5.04% | 6.42% | 7.61% |

Table 1 indicates that in 2018 the average annual water and sewer expenses were $601.32 for the US, and $573.31 per U.S. household in the Great Lakes region. Thus, on average, households in the U.S. portion of the Great Lakes Basin have an estimated 4.6 percent lower water and sewer expense than the national average.

While these unadjusted statistics suggest that proximity to the Great Lakes lowers water expenses, there are other possible explanations for this difference. For example, the average resident of the Great Lakes Basin may consume less water, or the region may have more cost-effective water delivery infrastructure. Note that even with lower reported average annual water and sewer expense, residents in the U.S. portion of the Great Lakes Basin have a slightly higher water affordability ratio (i.e. water is less affordable), reflecting the fact that household income is on average lower in the Great Lakes Basin than in the rest of the country.

These data also allow for a comparison across areas with varying levels of population density, from urban to suburban to rural. Here, unadjusted statistics suggest that any Great Lakes Basin advantage in household expense for water may only benefit suburban residents. Over 12 percent of urban residents in the Great Lakes Basin do not meet the UN threshold for water affordability according to these summary statistics, a substantially higher proportion than among urban residents nationally. Again, it is important to note that the primary driver of both the affordability indicator we developed and the proportion of households above the UN threshold is household income; these statistics reflect the location of the poor as much as they do the cost of water.

Table 2 below displays summary statistics on water/sewer expenses, water affordability and the UN threshold across different demographic groups, again comparing US averages to averages in the Great Lakes Basin.

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**Table 2: USA and Great Lakes Basin Summary Statistics for Water Affordability, continued**

| 2018 | USA Cauca-sian | GLB Cauca-sian | USA African American | GLB African American | USA Hispanic/ Latinx | GLB Hispanic/ Latinx | USA Other Race | GLB Other Race |
|---|---|---|---|---|---|---|---|---|
| Average Annual Water Bill | $592.62 | $556.61 | $552.76 | $618.60 | $650.36 | $660.78 | $657.11 | $571.70 |
| Average Water Bill / HH Income | 1.49% | 1.51% | 2.28% | 2.89% | 2.09% | 2.24% | 1.63% | 1.60% |
| Percentage above UN threshold of 5% HH income | 5.09% | 4.85% | 10.09% | 14.16% | 8.29% | 8.15% | 6.62% | 6.23% |

These water affordability statistics suggest racial disparity. The average annual water bill is higher for African Americans and Hispanic households than for Caucasians. This preliminary presentation indicates that living in the Great Lakes Basin may not provide much water expense relief to these minority populations. Keep in mind, however, that race, ethnicity and urban residence correlate in the Great Lakes Basin. Further research is needed to determine the relative predictive strength of each of these factors.

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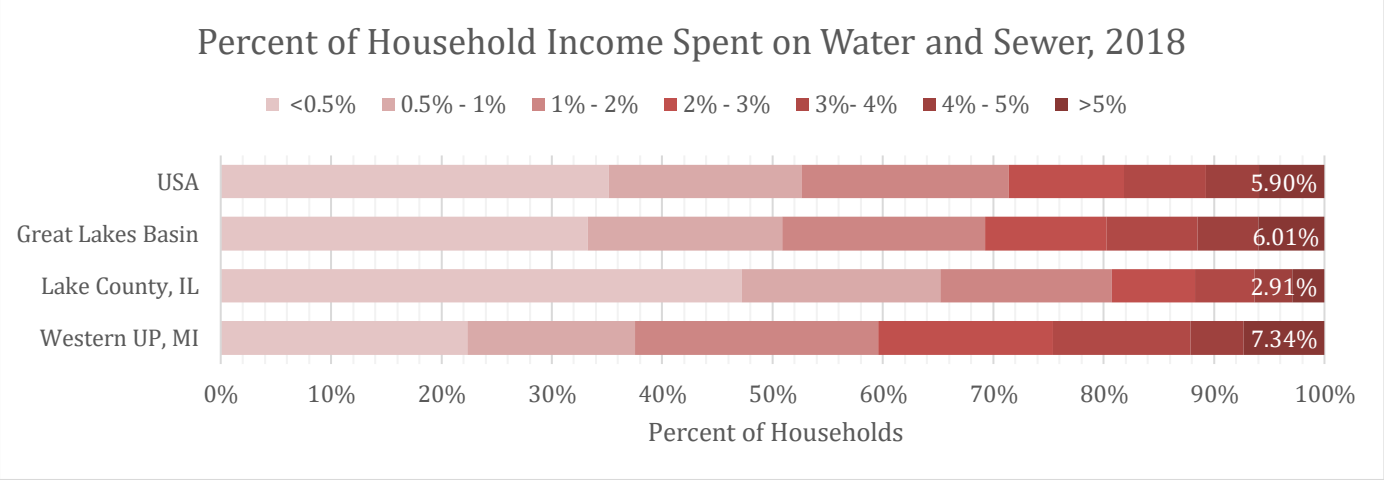
Visualizing the Water Affordability Ratio:

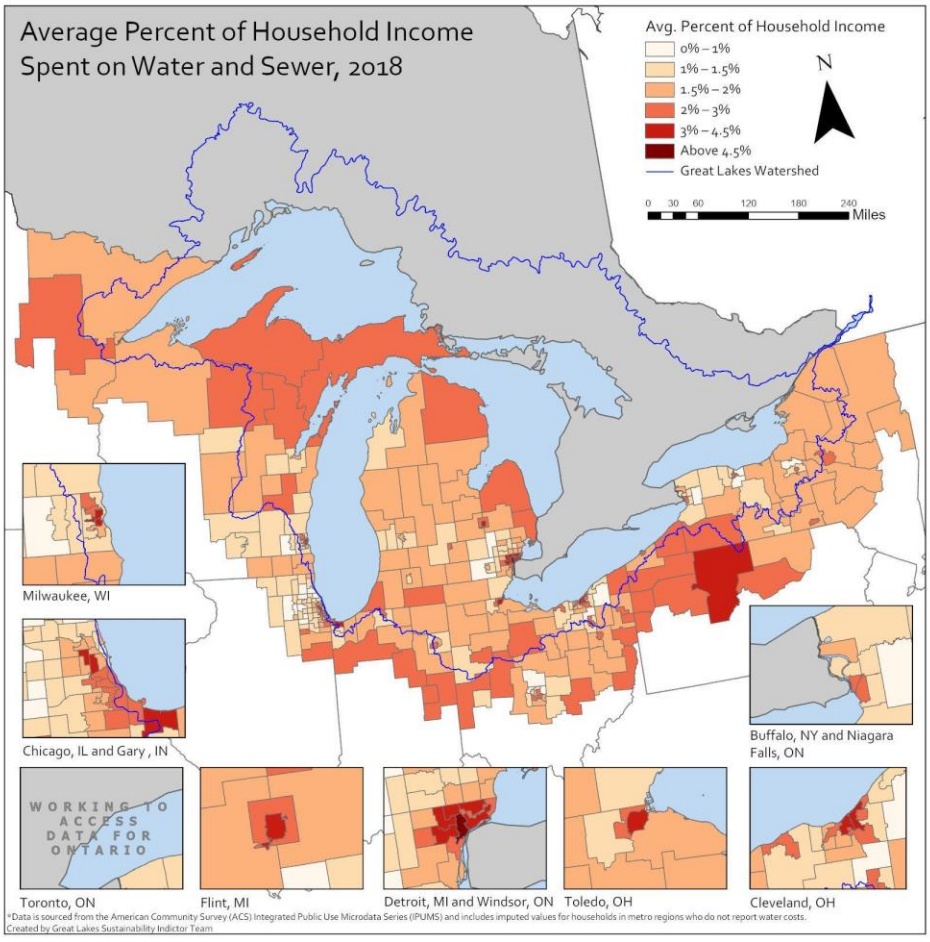
The *graphs in this section* illustrate how the affordability ratio is distributed across a political jurisdiction or geographic area in comparison to the nation. The graphs can be used to demonstrate the relative level of water affordability hardship for a population in a given political jurisdiction or region.

Figure 1 shows the percent of households whose water affordability ratio falls into one of seven categories. The lightest colored category corresponds to the percent of households whose income spent on water and sewer is less than 0.5% of their total household income. The darkest shade represents the percent of households who spend more than 5% of their household income on water and sewer, and are therefore classified as cases where water is unaffordable, according to the U.N. Looking at this distribution across different geographies it is evident that poorer areas such as the Western Upper Peninsula, MI have a higher percentage of households in the unaffordable group. Wealthier areas such as Lake County, IL have the majority of

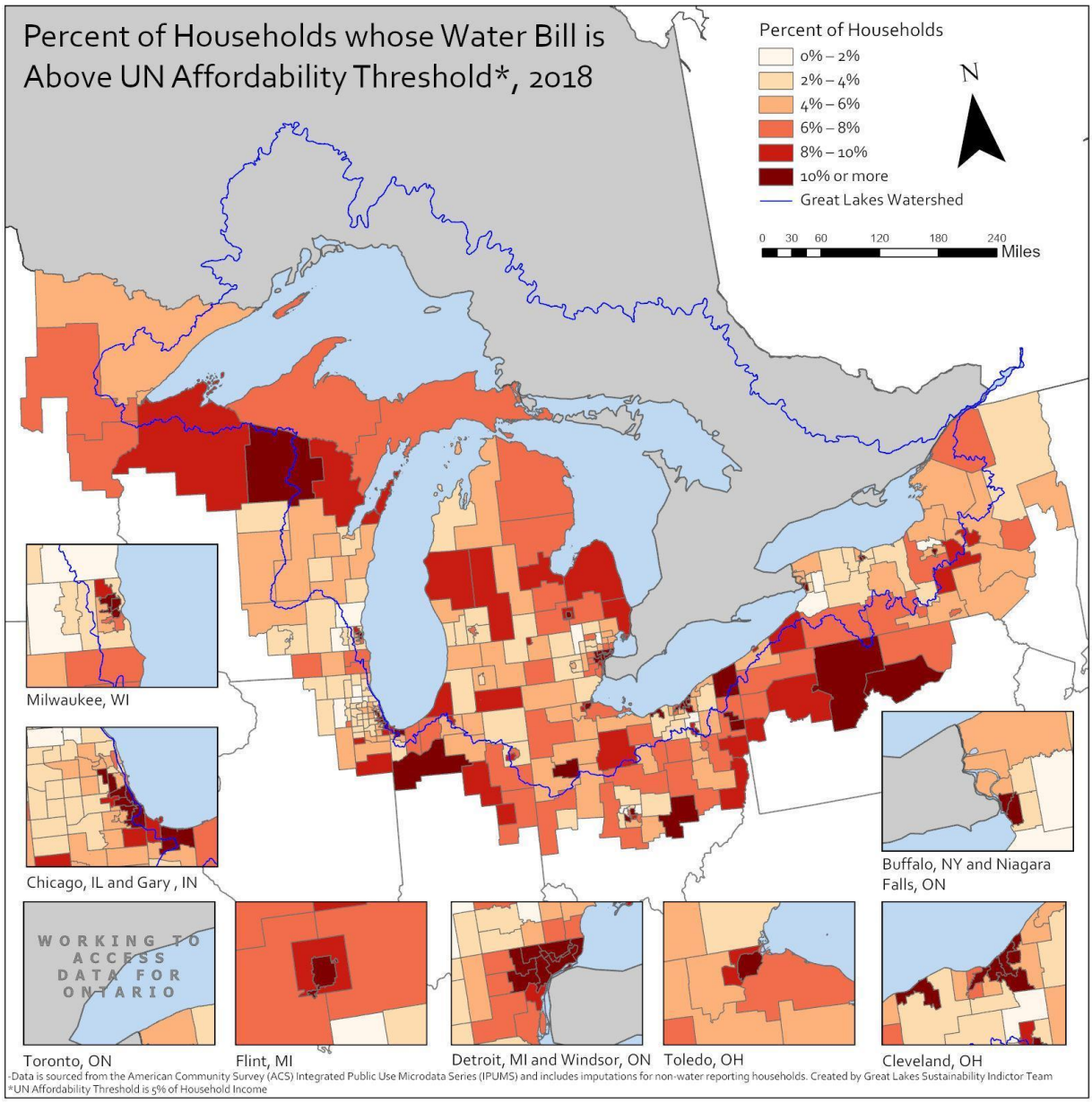
households under 0.5%. For comparative purposes, Figure 1 also displays these distributions for the Great Lakes Basin and USA averages.



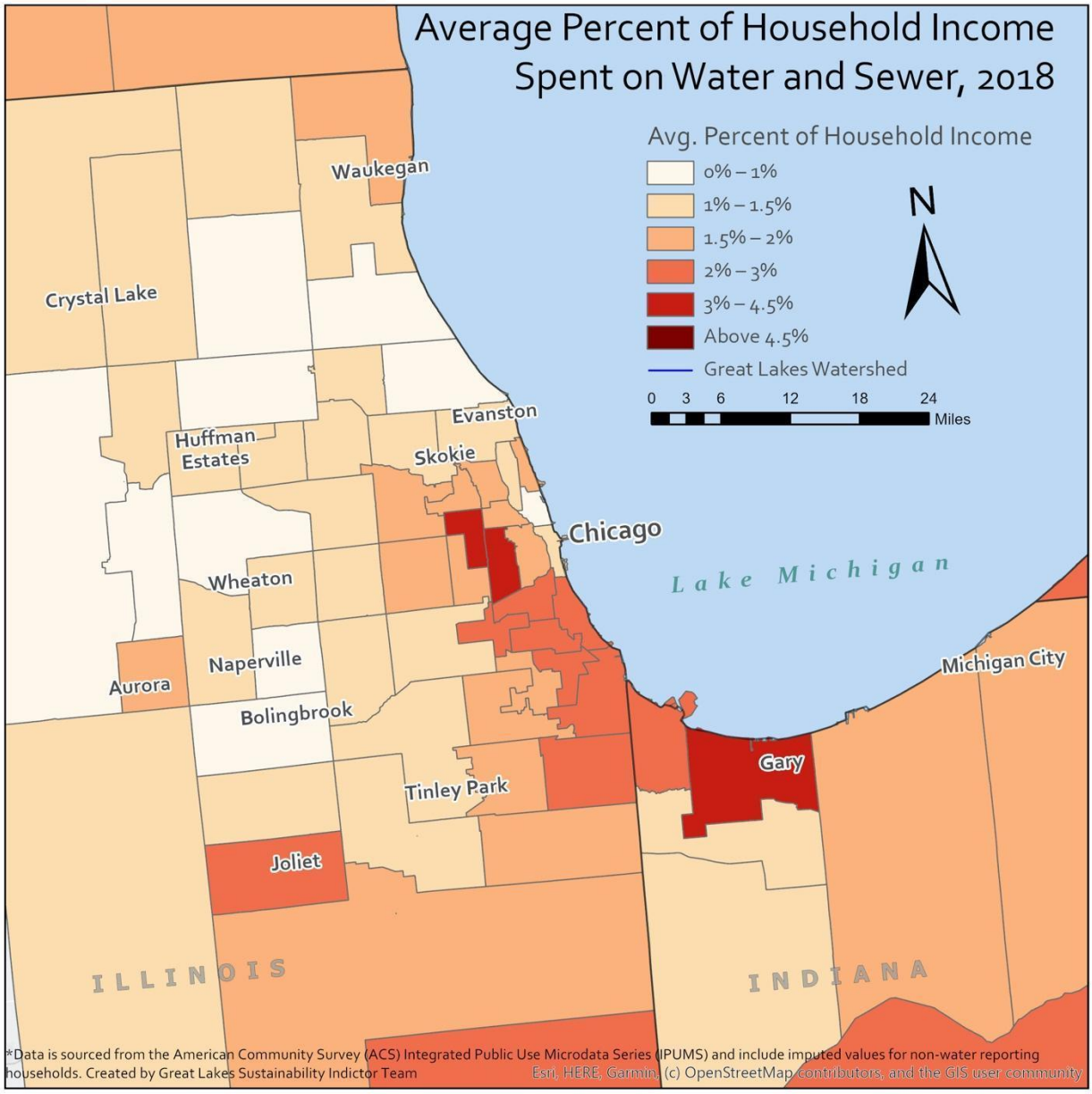

*Maps* offer a way to visualize the affordability ratio in spatial terms. The maps that follow illustrate the average affordability ratio values across the Great Lakes Basin (Figures 2and 2a), the metro Chicago area (Figure 3) and Michigan's Upper Peninsula (Figure 4). Figure 2 displays the spatial variation in the ratio for 2018.



Alternatively, the maps can display these data in terms of the United Nations water affordability standard of five percent of income. Figure 2a shows the percentage of households in a given geographic area that fail to meet the UN threshold in 2018. For example, the darkest areas in Figure 2a are where more than ten percent of the residents report they are expending more than five percent of their income on water and sewer expenses. Lighter areas, in contrast, indicate regions where fewer proportions of households fail to meet the UN standard.




It is possible to use this measure to zoom in on urban areas. Figure 3 is a view of the Chicago urban area showing the average percentage of household income expended on water and sewer bills in 2018.

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Likewise, maps can focus on rural regions. Figure 4 is a view of Michigan's Upper Peninsula area showing the average percentage of household income expended on water and sewer bills in 2018.

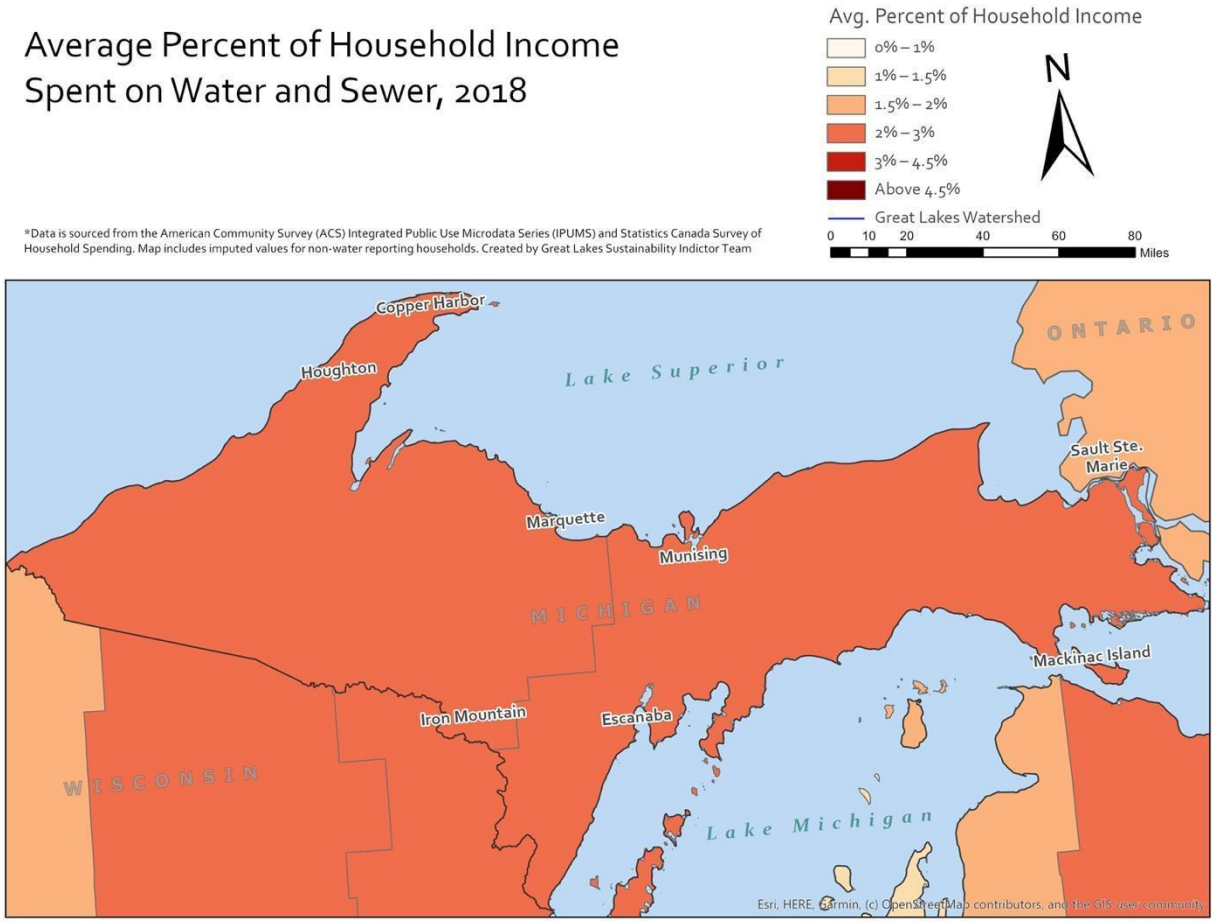


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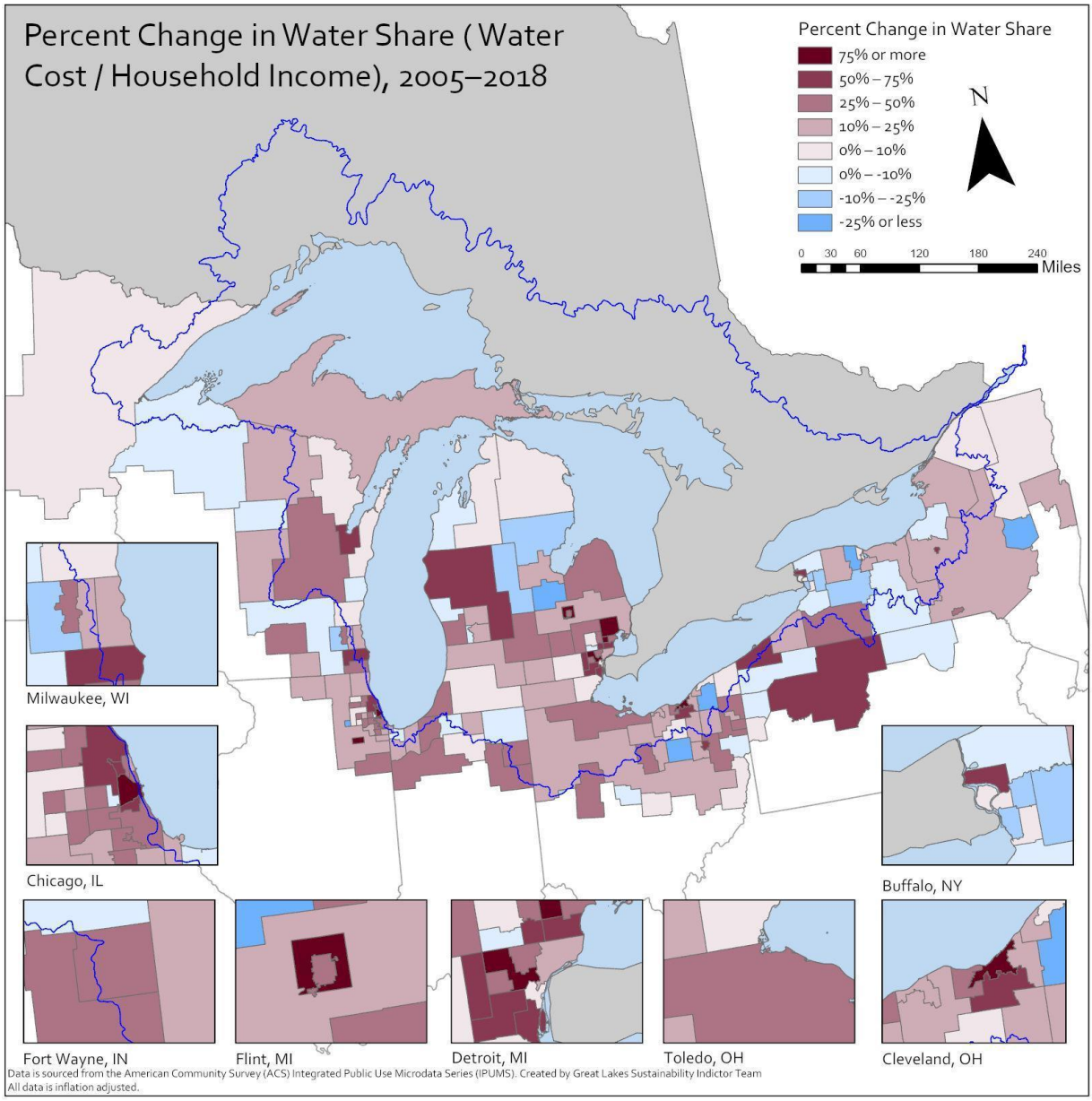
Figure 5 shows the inflation adjusted percentage change in Water Share (household water and sewer expenditures/ Household Income) between 2005 and 2018. Note that in some location's share decreased, while the majority of areas shares increased over the period.


Percent Change in Water Share ( Water Cost / Household Income), 2005–2018
Percent Change in Water Share
75% or more
50% – 75%
25% – 50%
10% – 25%
0% – 10%
0% – -10%
-10% – -25%
-25% or less
N
0 30 60 120 180 240
Miles
Milwaukee, WI
Chicago, IL
Buffalo, NY
Fort Wayne, IN
Flint, MI
Detroit, MI
Toledo, OH
Cleveland, OH
Data is sourced from the American Community Survey (ACS) Integrated Public Use Microdata Series (IPUMS). Created by Great Lakes Sustainability Indictor Team
All data is inflation adjusted.

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