

Appendix B – Methods for benchmarking city-level water infrastructure investment

Water system information and other economic data

This brief primarily relies on 2015 survey data from the American Water Works Association (AWWA) and Raftelis Financial Consultants. Produced annually since 2004, this jointly-led survey tracks a number of different financial indicators from drinking water and wastewater utilities across North America, including the United States, Canada, and Puerto Rico. The 2015 AWWA survey compiled self-reported information on operational performance, capital needs, rates, and several other system characteristics from more than 300 drinking water providers and 200 wastewater providers. While the survey’s coverage is quite extensive, it is important to note that many relevant variables are not easily quantified or included, which can make it difficult to compare utilities directly given their varying economies of scale. Regulatory concerns, governance structures, and other environmental considerations, for instance, are among a host of factors not explored fully in this survey.

More detailed information on the AWWA survey is available at the following webpage:

<http://www.awwa.org/resources-tools/water-and-wastewater-utility-management/water-wastewater-rates.aspx>

For the purposes of this analysis, we have only looked at the largest drinking water providers in the United States, classified as selling at least 20 million gallons of water per day (MGD). Many of these large providers are often municipally-owned, have service populations of at least 100,000 (including retail and wholesale customers), and can have a wide range of total connections and accounts (generally from a few thousand to hundreds of thousands). In some cases, these utilities may focus exclusively on drinking water, but in many instances, they may also focus on wastewater services or other services beyond their core business operations.

Rather than describing each individual utility in detail, we have concentrated instead on the primary cities being served, as identified in the AWWA survey. The geographic extent of these utilities, of course, can often traverse these city boundaries, which should be weighed carefully when interpreting the results presented here. In cities with more than one drinking water providers listed, relevant financial data was aggregated when possible; however, cities with incomplete or limited data were excluded. Ultimately, our analysis considers utilities across 97 different cities across the United States, with many different regions represented.

To complement the water survey data, we have also explored a set of economic indicators, drawn from the U.S. Census Bureau’s American Community Survey. These economic variables – including population and income – cover relevant trends from the past decade (2005 to 2015) for the cities being primarily served by the large drinking water utilities identified in the AWWA survey.

Categories of water investment performance

Gauging “water investment performance” across different regions – or even within a single region – can be a challenging and imprecise exercise. Limited, inconsistent data make it difficult to monitor the financial health of drinking water utilities, in addition to those focusing on wastewater treatment and stormwater management. Where data do exist, there is no clear or established standard for the specific factors that should be included in such an analysis, let alone how to monitor any changes over time. However, as described in this brief, there are certain factors that Moody’s, Fitch Ratings, and other

groups have used to assess financial performance in the past, including the balance sheets, capital demands, and debt burdens for utilities. Moreover, when considering cities like Flint, analysts have pointed to a series of economic characteristics – such as a declining population – that can limit the ability of a utility (or broader region) to provide affordable and dependable service.

With that context in mind, this brief has looked into six different categories of analysis to more consistently examine a city's water investment performance. In particular, it considers three different measures of utility finances – **operating ratios, debt-to-asset ratios, and rates** – and three broad economic variables – **changes in population, changes in median household income, and the share of lower-income households** – to create a new barometer for city-level water infrastructure investment. To be sure, these categories do not capture the full range of factors – quantitative or qualitative – that can influence a city's current or future water status, but they begin to offer a clearer way to view water investment across different geographies nationally.

Among the three utility finance measures, operating ratios have been determined based on the total annual revenues and operating expenses most recently reported by drinking water providers in the AWWA survey. Debt-to-asset ratios are based on the total long-term debt and assets (physical infrastructure, equipment, etc.) reported. Rates are based on monthly residential charges – including service and volume charges – at a usage level of 7,480 gallons, a typical amount for many residential customers. These rates have been collected based on a 5/8 in. water meter size. It is important to note that the specific rate structure, billing cycle, and seasonality of rates can vary from utility to utility (and city to city). Moreover, other charges are excluded from these rates, such as connection fees. To comply with data use restrictions, rates are only expressed as ranges for particular cities.

The three broader economic measures are drawn from city-level Census data. Population changes are estimated based on 2005 and 2015 totals. Changes in annual median household incomes are also estimated based on 2005 to 2015 data, adjusted for inflation. The share of households earning under \$25,000 annually in 2015 represents a proxy for lower-income households in these markets; examining different income levels is one area of future inquiry that falls outside the scope of this brief.

Determining cumulative water investment scores and rankings

By creating cumulative water investment score, we have been able to more precisely determine whether a city ranks “higher” or “lower” according to these six categories. We calculated this cumulative score by setting a common threshold of performance for each category and examining if a city met (or failed to meet) that threshold. Relevant Z scores were then compiled for each city across each category, which were finally combined to form the cumulative score.

In particular, we established the following thresholds across the six categories:

- **Operating ratio > 1.00.** In other words, does the utility in a given city make more in revenue relative to its operating expenses?
- **Debt-to-asset ratio < 0.56.** On average, utilities across the 97 cities have long-term debt equal to 56 percent of the value of their total assets. Does the utility in a given city have a lower debt-to-asset ratio by comparison?
- **Monthly water rate < \$33.** On average, utilities across the 97 cities charge residential customers (using 7,480 gallons) about \$33 monthly. Does the utility in a given city charge a higher or lower rate at this usage level?

- **Population change > 0%.** From 2005 to 2015, has the city’s population grown or declined?
- **Change in median household income > \$0.** From 2005 to 2015, has the city seen its median household incomes increase?
- **Share of lower-income households < 26.7%.** On average, 26.7% of the households across the 97 cities have annual incomes under \$25,000. Does the city have a lower share of households making \$25,000 or less?

if a city meets a given threshold under one of these categories, it earns a positive score, which is then added to its scores across all other categories. If a city fails to meet the given threshold, however, it earns a negative score, detracting from its cumulative total. These Z scores are based on the number of standard deviations from the threshold. For example, the table below shows the two cities with the highest and lowest cumulative water investment scores, Washington, DC, and Detroit, respectively. For additional clarity, a separate water sub-score and economic sub-score are shown for each of their respective three categories, which together form the cumulative water investment score.

Water investment scores for Washington, DC, and Detroit, including relevant Z Scores, 2015

Primary city served	Water system characteristics				Other economic characteristics				Total water investment score
	Operating ratio	Debt-to-asset Ratio	Residential drinking water rate	Water sub-score	Population change, 2005 to 2015	Median income change, 2005 to 2015	Share of households with annual incomes under \$25,000	Economic sub-score	
Washington DC, DC	2.39 (Z Score: 4.58)	0.41 (Z Score: 0.50)	\$33 to \$44 (Z Score: -0.83)	4.25	30.5% (Z Score: 1.54)	\$18,316 (Z Score: 2.96)	20.3% (Z Score: 0.87)	5.36	9.61
Detroit, MI	0.87 (Z Score: -0.42)	0.89 (Z Score: -1.12)	\$23 to \$32 (Z Score: 0.61)	-0.92	-19.0% (Z Score: -0.96)	-\$8,087 (Z Score: -1.35)	48.5% (Z Score: -2.97)	-5.28	-6.20
Threshold level for positive score	1.00	0.56	\$33		0%	\$0	26.7%		

Source: Brookings analysis of American Water Works Association (AWWA) data and Census data