A Review of Connection Fees and Service Charges by Meter Size

Alliance for Water Efficiency

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Preface

Right-sizing premise plumbing systems has become a prominent topic of discussion in the plumbing and water industries, for good reason. Supply line and pipe sizing methodologies have been largely unchanged since Hunter's Curve was created by Roy B. Hunter in 1940 -- yet fixtures and appliances such as faucets, showerheads, toilets, clothes washers, and dishwashers operate much more efficiently than they did in 1940 and thus have slowed the flows. Unfortunately, it is still common for meters and supply and waste lines to be oversized according to Hunter's Curve. These oversized premise plumbing systems create multiple inefficiencies and worse, can have a negative impact on water quality.

The Alliance for Water Efficiency (AWE) conducted this research at the request of the International Association of Plumbing and Mechanical Officials (IAPMO) to better understand the current range of connection fees and recurring service charges related to meter size across metropolitan areas. Additionally, this research assessed the potential financial implications for water providers that would be associated with a possible trend toward downsizing the meter sizes of new connections.

This research has a number of connections to AWE's mission. Installing new plumbing systems with properly sized piping can help address water quality issues associated with lower flows in oversized premise plumbing while also using less water and energy. Properly sized pipes are more compatible with modern fixtures and appliances and can deliver hot water in quicker times, both of which help save water and energy. Research has shown that compared to a conventional design, a 2-bath residential unit with right-sized plumbing results in 10% less energy loss in pipes to supply hot water and 18% less volume of water in pipes.[1] Moreover, right-sized premise plumbing systems can use smaller meters that are more likely to record lower flows and aid in the detection of leaks compared to oversized meters.

Right sizing water supply lines can improve the performance of premise plumbing systems, help protect public health and safety by reducing water aging in premise plumbing systems, and generate water and energy savings. These are all important issues to AWE. We hope this report will help elucidate the financial and water efficiency implications of downsizing water meters, and thus provide important guidance for our water utility partners.

[1] Omaghomi, T., & Buchberger, S. G. 2018. Residential Water and Energy Savings in Right-Sized Premise Plumbing. In WDSA/CCWI Joint Conference Proceedings (Vol. 1).

Acknowledgements

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Introduction

The Alliance for Water Efficiency (AWE) conducted this research at the request of the International Association of Plumbing and Mechanical Officials (IAPMO) to better understand the current range of connection fees and recurring service charges related to meter size across metropolitan areas. Additionally, this research assessed the potential financial implications for water utilities that would be associated with a possible trend toward downsizing the meter sizes of new connections.

This work is connected to the Alliance for Water Efficiency's mission in a number of ways: (1) right-sized premise plumbing systems have water and energy efficiency benefits related to hot water delivery times compared to an oversized system; (2) right-sized premise plumbing systems can help address potential water quality concerns associated with lower flows in oversized premise plumbing; (3) right-sized premise plumbing systems can use smaller meters that are better able to record lower flows and aid in the detection of leaks; and (4) right-sized premise plumbing systems may create a trend toward meter downsizing that will have financial implications for water providers.

The Alliance for Water Efficiency collected data related to water connection fees and recurring water and sewer service charges by meter size for 50 of the fastest growing metro areas in the United States. The purpose was to build a dataset that would provide information about the difference in connection fees and recurring charges based on water meter size, and the potential impacts if new connections were downsized due to increased water efficiency and the emergence of new comprehensive pipe-sizing methodologies. A data matrix was developed to catalogue various charges for new connections that vary by meter size, as well as water and sewer service charges by meter size. The matrix was statistically summarized to identify mean, median, minimum, and maximum values. It was also analyzed to gain insight into the cost savings that can result from downsizing the meters of new connections. If meters are downsized, there is often an initial cost reduction for the new water customer and revenue reduction for the water provider. There are also future financial implications for customers and utilities related to ongoing service charges for water and sewer.

In addition to cataloguing and summarizing data, five theoretical scenarios were constructed to illustrate the financial dynamics of a potential trend toward downsizing meters for new connections. This report documents the data collection process and findings. The focus is on connection fees and service charges related to meter sizes, and not the complex set of considerations related to meter sizing. Overall, this research shows that connection fees have a high degree of variability throughout the United States and that a trend in meter downsizing for new connections due to plumbing system right sizing methodologies would have meaningful financial implications for new water customers and water providers.

City Selection

Data were collected for 50 of the fastest growing metro areas in the United States. Cities were identified and selected based on the *Annual Estimates of the Resident Population for Metropolitan Statistical Areas* data from the U.S. Census Bureau.[2] A five-year population change was calculated for each of the 414

[2] U.S. Census Bureau.2020. Annual Estimates of the Resident Population for Metropolitan Statistical Areas in the United States and Puerto Rico: April 1, 2010 to July 1, 2019.

United States metropolitan areas. Cities in the largest 75 metropolitan areas based on five-year population change were selected for preliminary consideration. Each metropolitan area was thoroughly assessed to see if sufficient connection fee and water rate data was present. After reviewing all 75 metropolitan areas, 46 cities with both comprehensive connection fee and water rate data within these metropolitan areas were selected. To achieve the goal of 50 cities for analysis, an additional four cities were selected to round out the dataset. The cities and their reasons for inclusion are briefly outlined following this paragraph.

- Pittsburgh, PA and Great Neck, NY (close suburb of New York City, NY) were selected to add geographic diversity, since no Northeast cities met the original criteria.
- Bellingham, WA was selected to help further quantify the extremely fast-growing Pacific Northwest region.
- Centennial, CO (close suburb of Denver) was selected to help further quantify the fast-growing Rocky Mountain Region, since Denver's residential connection fee data is not based on meter size.

Figure 1 displays the locations of the 50 selected cities.

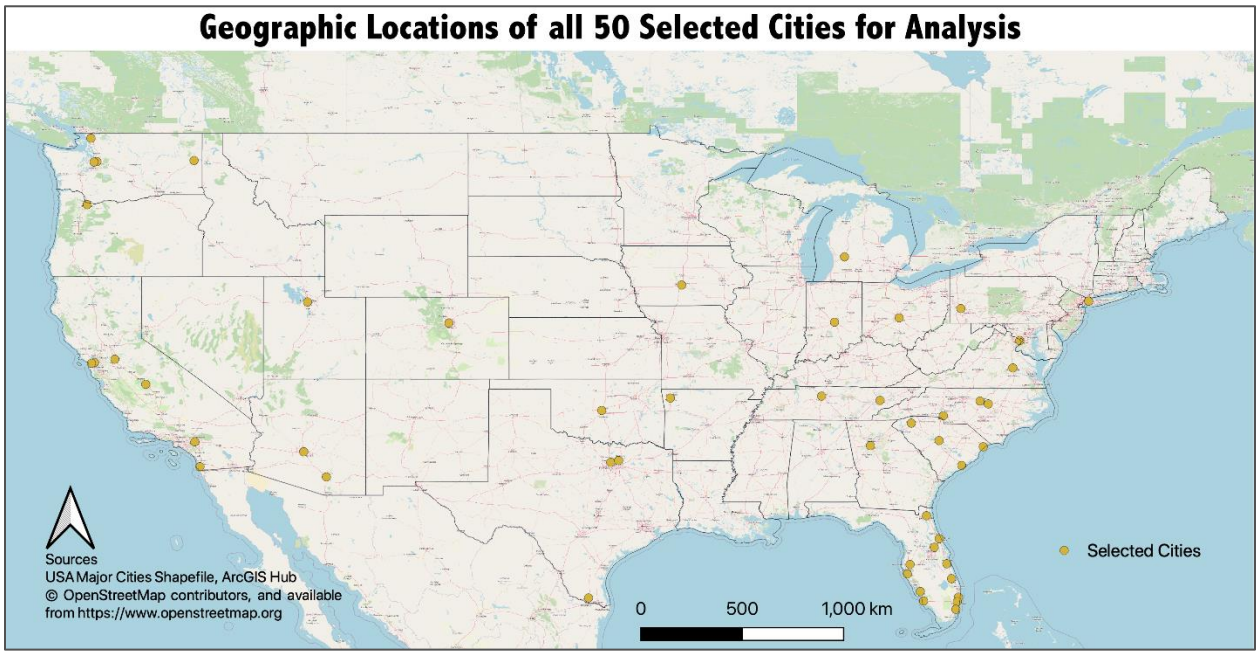

Figure 1: Geographic Locations of Selected Cities

The regional breakdown of the selected cities is outlined in Figure 2. Exactly half of the cities in this analysis fall within the Southeast region of the United States. No other region had more than eight of the 50 cities within it. Very few cities are located in the Northeast and Midwest, as most of the fastest growing regions in the United States are located in the Southeast and Western states.

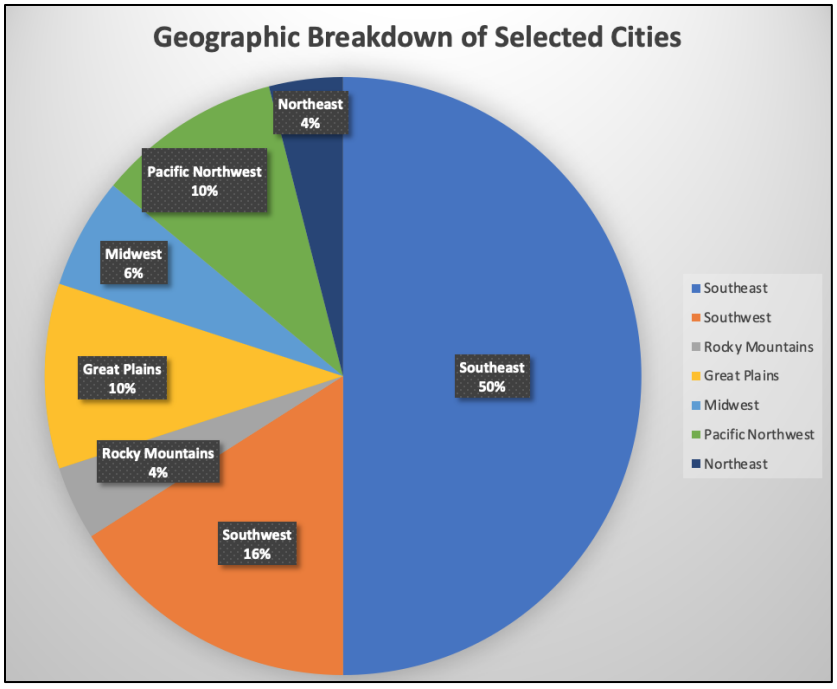

Figure 2: Geographic Breakdown of Selected Cities

Connection Fee and Rate Data

After the 50 cities were determined, they were placed into matrices in Microsoft Excel to analyze both connection fees and water rates.

For the connection fee matrix, a column with common meter sizes from 5/8-inch to 12-inch was added on the most leftward portion of the spreadsheet. Other miscellaneous meter sizes that appeared on some of the fee schedules were then specifically denoted below. All 50 cities have their own columns containing the respective city's connection fee data by meter size. The description for each respective city's connection fees was also recorded in the matrix, since the "connection fees" were referred to by different names in different cities. Additionally, the customer categorization (e.g., residential customers, commercial customers, all customer classes, etc.) was tracked for each city. Most cities used the same connection fees for all customer classes. If a city listed both residential and commercial connection fees, this analysis reported data for the residential customers. Nonresidential-only data were not included in the matrix.

A similar methodology was used to create the recurring service charge matrix. A column with common meter sizes from 5/8-inch to 12-inch was added on the most leftward portion of the excel document, with miscellaneous meter sizes specifically denoted below. Once again, all 50 cities have their own columns containing the service charge data by meter size. This procedure was then repeated once again to document sewer service charges by meter size for each city. The customer categorization was documented in the same manner as the connection fee matrix. Additional data recorded for each city included water billing frequency (e.g., monthly, bi-monthly, or quarterly) and volumetric water rate categorization (uniform rates, inclining block rates, or not applicable).

Due to the wide variety of fees and charges, it is possible the team missed data, although each city was thoroughly reviewed.

Data Observations and Findings

This section presents and discusses data related to fees for new water service connections and water and sewer service charges that vary by meter size.

Connection Fees

Unsurprisingly, the research found incredible variability of connection fees across the country. The cost of a connection fee for a certain meter size can differ by tens or even hundreds of thousands of dollars. For example, the connection fee for a 4-inch meter for one Northwestern city is $9,857, while a regionally similar city has a connection fee of $85,311 for the same meter size. Table 1 provides summary statistics for connection fees at each meter size observed across the 50 selected cities. The table highlights the extreme variability of the cost of connection fees across the country. The reader should note the variability in the far-right column, which denotes the number of communities included in the summary statistics for each meter size. Not every community had data for each meter size.

Meter Size	Min	Max	Mean	Median	Number of Communities
5/8"	$325.00	$5,990.00	$2,228.55	$1,501.84	31
3/4"	$300.00	$8,987.00	$2,581.90	$1,681.00	37
1"	$177.63	$26,551.00	$3,944.90	$2,263.00	48
1.5"	$329.88	$46,212.00	$7,859.89	$5,308.00	44
2"	$600.00	$66,066.00	$11,434.82	$5,400.00	48
3"	$1,300.00	$148,649.00	$33,230.92	$21,968.00	32
4"	$800.00	$297,298.00	$53,351.31	$28,900.00	34
6"	$1,200.00	$776,277.00	$103,603.16	$53,538.00	31
8"	$1,349.95	$541,856.00	$147,516.51	$93,050.00	27
10"	$1,415.93	$748,862.00	$246,413.97	$130,900.00	18
12"	$1,481.90	$1,326,336.00	$351,132.28	$174,800.00	14

Table 1: Summary Statistics of Connection Fees by Meter Size

While the summary statistics in Table 1 are useful, Figure 3 is included to show the distribution of connection fees for 1-inch meters. Figure 3 illustrates a large range of connections fees, although more than half are below the average of $4,000. The data show that over 60 percent of 1-inch meter connection fees exceed $1,500 and over 40 percent exceed $3,000.

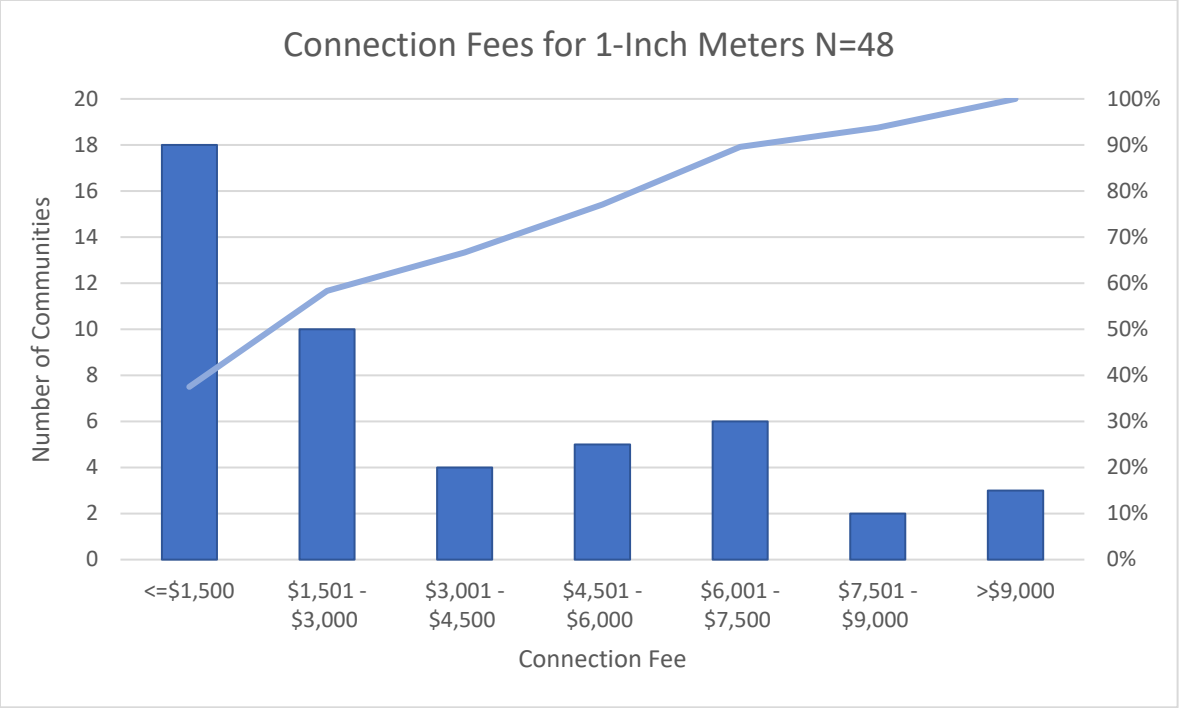

Figure 3: Connection Fees for 1-Inch Meters

Connection fee variability extends far beyond the actual costs of new meters, to a variety of other considerations. First, the official designation of a "connection fee" differed tremendously across the dataset. The 50 selected cities used a total of 22 different names to describe fees for new water service connections. Names such as Tap Fee, Capacity Fee, and Water Connection Charge, etc., all were used to describe what the research designated as a "connection fee." In addition to the lack of standardized naming, the location of connection fee information varied significantly by city. Some cities listed connection fees in the municipal code, other cities had this information on the local utility websites, and some cities had the fee schedule buried deep within massive planning documents. Finding the connection fee information for many cities in this analysis was difficult.

There were certain limitations and inconsistencies within the connection fee data set as well. Not all cities had every meter size from 5/8-inch to 12 inches. For example, 48 cities had connection fee data for 1-inch meters but only 31 cities had connection fee data for 6-inch meters. Additionally, many cities did not list the connection fee cost for larger meter sizes, instead just denoting the price as "At-Cost" and specifying that the price will be determined at installation.

A community of note from the analysis is the city of Plano, TX which in 2009, eliminated its practice of charging developer impact fees on new water and sewer lines. This is a significant anomaly, as according to our analysis, the Dallas-Plano-Irving, TX metro area has the third highest 5-year population increase in the United States. However, due to limitations within Plano's city boundaries and other booming communities around Dallas and Fort Worth, Plano has seen a steady decline in new residents since its peak in the 1990s. Plano's elimination of impact fees is an attempt to help lower housing costs (especially compared to nearby cities) and spark new growth within Plano itself. It should also be noted that Plano's

cost of zero dollars per meter for a connection fee was not included in the summary statistics, as it is not reflective of the rest of the data, and instead serves as an interesting anomaly.[3]

Water and Sewer Service Charges

Recurring service charges for water and sewer service (i.e., monthly, bimonthly, quarterly) often vary by meter size. These charges were collected for the 50 selected cities and have their own nuances and complexities. On the whole, water service charges had less variability among cost. Although there was variability between cities, water/sewer service charges were far more consistent. Additionally, the dataset for water rates was more complete compared to the connection fee data. The connection fee matrix had an average of 33 out of 50 cities (66%) with data for each meter size, while the water rate data had an average of 41 cities (82%) with data for each meter size. However, this trend did not extend to sewer rates, as this data was only present in an average of 16 cities (32%) per meter size.

Similar to the connection fee data, there were some limitations and inconsistencies that need to be addressed. Four cities included in the dataset do not structure service charges by meter size. Some cities did not list charges for both 5/8-inch and 3/4-inch meters and not all of the cities list charges for meters larger than 2-inch. Additionally, the majority of cities did not structure sewer rates by meter size. Table 2 shows summary statistics for monthly water service charges and Figure 4 contains a histogram of monthly water service charges for 1" meters. Table 3 shows summary statistics for monthly sewer service charges and Figure 5 contains a histogram of monthly sewer service charges for 1-inch meters.

Meter Size	Min	Max	Mean	Median	Number of Communities
5/8"	$3.00	$57.91	$15.21	$13.80	40
3/4"	$3.05	$57.91	$17.14	$12.12	37
1"	$5.08	$89.82	$25.80	$18.88	46
1.5"	$10.15	$175.30	$46.77	$34.96	46
2"	$12.07	$289.14	$73.36	$59.62	46
3"	$16.12	$641.48	$148.06	$122.40	44
4"	$16.12	$1,084.28	$230.54	$185.19	45
6"	$16.12	$2,558.16	$468.79	$374.68	45
8"	$16.12	$4,596.96	$778.49	$599.47	41
10"	$16.12	$7,515.81	$1,162.11	$860.88	36
12"	$16.12	$7,515.81	$1,844.81	$1,437.48	23

Table 2: Summary Statistics of Monthly Water Service Charges by Meter Size

[3] Plano Star Courier. February 12, 2008. Council rids impact fees.

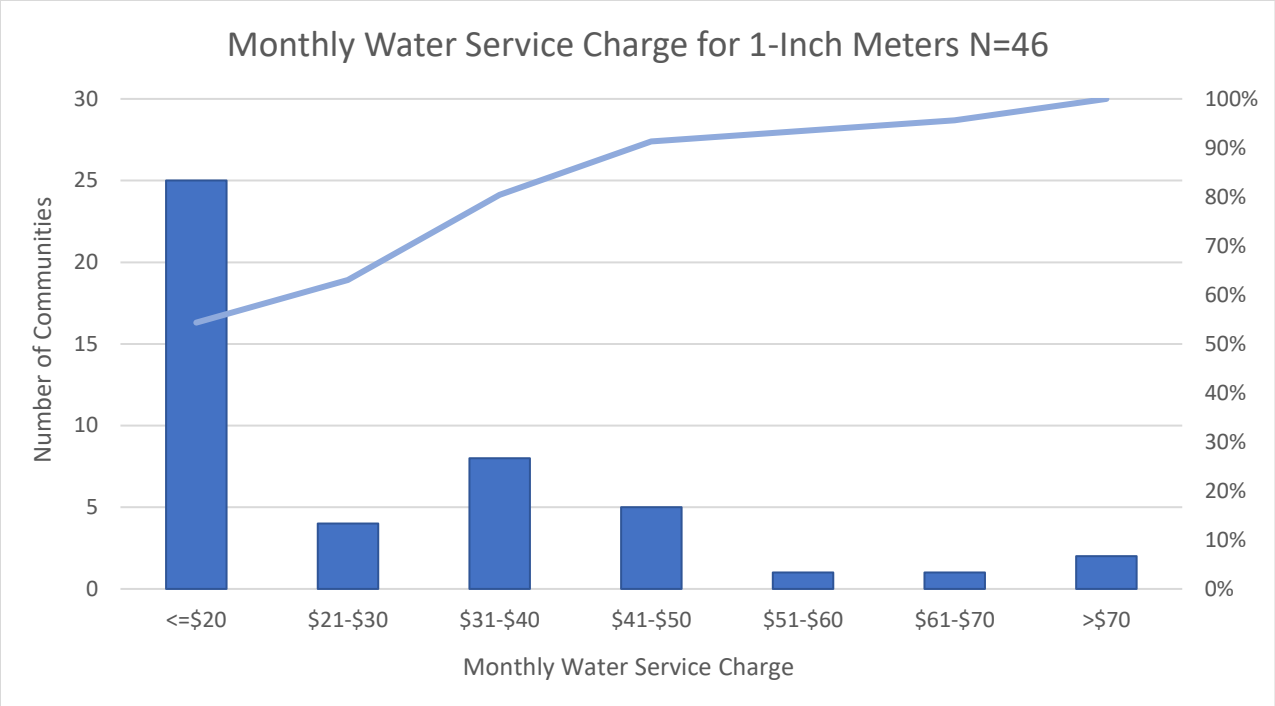

Figure 4: Monthly Water Service Charges for 1-Inch Meters

Meter Size	Min	Max	Mean	Median	Number of Communities
5/8"	$4.04	$21.13	$12.40	$12.09	14
3/4"	$3.16	$36.00	$16.82	$15.61	14
1"	$6.31	$54.56	$30.79	$28.46	20
1.5"	$8.13	$109.11	$59.52	$55.26	20
2"	$13.00	$174.58	$94.24	$90.09	20
3"	$25.99	$349.16	$182.74	$159.22	19
4"	$40.62	$545.56	$306.06	$271.25	19
6"	$81.24	$1,302.21	$614.00	$536.44	19
8"	$129.99	$2,358.93	$1,025.99	$847.59	17
10"	$203.10	$3,883.88	$1,586.63	$1,589.93	14
12"	$847.59	$4,187.89	$2,723.80	$2,563.62	8

Table 3: Summary Statistics of Monthly Sewer Service Charges by Meter Size

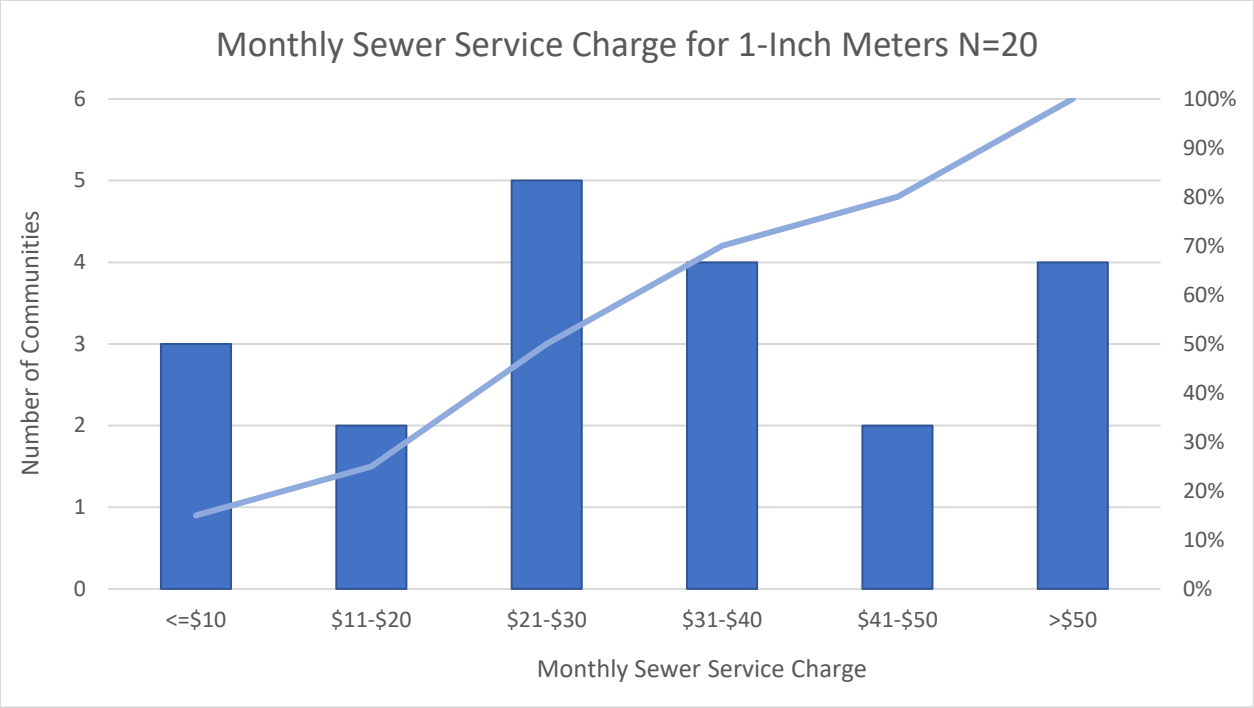

Figure 5: Monthly Sewer Service Charges for 1-Inch Meters

Potential Savings from Downsizing Meters

This analysis details the potential for substantial monetary savings through reducing water pipe sizes in new buildings, thus allowing the installation of smaller water supply lines and water meters. In the future, new plumbing systems will likely trend toward smaller sizes due to technological advances in water efficiency and improved pipe-sizing methodologies. For example, a building constructed today may be designed to have a larger-than-needed supply line and water meter based on outdated pipe sizing requirements contained in the plumbing codes. By applying new pipe sizing methodologies that take current water efficiency requirements into account, the size of the water meter can be reduced up to 3 pipe sizes in some cases, while still meeting peak water demand in the building. As a result, consumers will enjoy faster hot water delivery times, and subsequently realize savings on both their water and water heating related energy utility bills. Smaller diameter service lines and plumbing systems will also result in faster turnover in plumbing systems, reducing water aging related concerns.

Flow requirements for residential fire sprinkler systems may be a limiting factor in downsizing meters, particularly when fire and domestic lines are not separate. For more information related to meters and residential fire sprinkler systems please see AWWA's *Residential Fire Sprinkler Systems: Guidance for Water Utilities* and AWWA's *Manual M22, Sizing Water Service Lines and Meters*.[4,5]

[4] American Water Works Association. 2018. Residential Fire Sprinkler Systems: Guidance for Water Utilities. https://www.awwa.org/Portals/0/AWWA/ETS/Resources/ResidentialFireSprinklerSystems.pdf
[5] American Water Works Association. 2014. Manual M22, Sizing Water Service Lines and Meters.

Data Analysis

In analyzing the connection fee data, summary statistics for financial savings from downsizing water meters were calculated. It is important to again note the extreme variability in these values, due to the large differences in connection fee prices across different cities. Tables 4 through 12 contain summary statistics for connection fee, water service charge, and sewer service charge savings for downsizing meters.

For every table, each row (meter downsize step) has a unique number of communities because not every community has fees and charges for all meter sizes. For example, if a community had data for 2-inch meters but not 1-inch meters, or vice versa, it was not included in the 2-inch to 1-inch downsize calculation. This creates some odd values, and the minimum and maximum columns are particularly erratic. For example, the median values for 1.5-inch to 3/4-inch and 2-inch to 1-inch in Table 7 are identical. This is not an error.

Table 4 contains summary statistics for connection fees savings from downsizing a water meter by one size. Tables 5 and 6 contain summary statistics for annual water and sewer service charge savings, respectively.

Meter Downsize Example	Minimum Connection Fee Savings	Maximum Connection Fee Savings	Mean Connection Fee Savings	Median Connection Fee Savings	Number of Communities
3/4" to 5/8"	($7.99)	$2,997.00	$421.62	$36.36	21
1" to 3/4"	$0.00	$17,564.00	$1,883.05	$887.00	35
1.5" to 1"	$100.00	$19,661.00	$3,699.98	$2,573.50	42
2" to 1.5"	$0.00	$33,571.00	$4,598.31	$2,812.00	42
3" to 2"	$520.00	$82,583.00	$18,512.13	$11,425.27	31
4" to 3"	$0.00	$148,649.00	$24,648.19	$12,357.00	30
6" to 4"	$208.08	$478,979.00	$52,718.44	$25,670.00	30
8" to 6"	$35.52	$210,000.00	$58,349.85	$33,899.65	27
10" to 8"	$65.98	$465,254.69	$97,056.65	$37,910.50	18
12" to 10"	$65.97	$580,272.00	$137,762.23	$45,900.00	13

Table 4: Summary Statistics for Connection Fee Savings Related to Downsizing Meter Size by One Size, as of 2020

Meter Downsize Example	Minimum Annual Water Service Charge Savings	Maximum Annual Water Service Charge Savings	Mean Annual Water Service Charge Savings	Median Annual Water Service Charge Savings	Number of Communities
3/4" to 5/8"	$0.00	$205.20	$28.41	$0.00	31
1" to 3/4"	($0.06)	$545.40	$106.11	$66.61	37
1.5" to 1"	$0.00	$1,025.76	$251.68	$181.53	46
2" to 1.5"	$0.00	$1,366.08	$319.04	$272.40	46
3" to 2"	$41.88	$4,228.08	$886.44	$658.44	44
4" to 3"	$0.00	$5,313.60	$1,002.13	$830.70	44
6" to 4"	$0.00	$17,686.56	$2,858.98	$2,015.04	45
8" to 6"	$0.00	$24,465.60	$3,484.28	$2,697.48	41
10" to 8"	$0.00	$35,026.20	$4,732.66	$3,808.68	36
12" to 10"	$0.00	$22,752.72	$6,345.49	$6,534.24	23

Table 5: Summary Statistics for Annual Water Service Charge Savings Related to Downsizing Meter Size by One Size, as of 2020

Meter Downsize Example	Minimum Annual Sewer Service Charge Savings	Maximum Annual Sewer Service Charge Savings	Mean Annual Sewer Service Charge Savings	Median Annual Sewer Service Charge Savings	Number of Communities
3/4" to 5/8"	$0.00	$334.32	$61.68	$16.80	10
1" to 3/4"	$32.64	$380.28	$159.43	$141.84	14
1.5" to 1"	$0.12	$654.60	$344.82	$321.60	20
2" to 1.5"	$58.44	$785.64	$416.67	$392.82	20
3" to 2"	$155.88	$2,140.08	$1,080.22	$933.60	19
4" to 3"	$175.56	$3,496.68	$1,479.81	$1,344.36	19
6" to 4"	$487.44	$9,106.80	$3,695.29	$2,918.28	19
8" to 6"	$0.00	$12,680.64	$4,381.74	$2,881.32	17
10" to 8"	$0.00	$18,299.40	$6,448.99	$5,801.82	14
12" to 10"	$0.00	$23,357.04	$9,068.76	$7,463.88	8

Table 6: Summary Statistics for Annual Sewer Service Charge Savings Related to Downsizing Meter Size by One Size, as of 2020

Downsizing any size meter by one size will typically lead to substantial monetary savings in both connection fees and annual water/sewer charges. The potential savings associated with downsizing meters increases with meter size.

Monetary savings are amplified if a meter can be downsized by more than one size. Tables 7 through 12 detail the same summary statistics for downsizing a meter by two and three sizes. These data are included as a currently available new pipe-sizing methodology is known to be able to reduce water supply lines and meter size by up to three pipe-sizes in larger buildings.

Meter Downsize Example	Minimum Connection Fee Savings	Maximum Connection Fee Savings	Mean Connection Fee Savings	Median Connection Fee Savings	Number of Communities
1" to 5/8"	$0.00	$20,561.00	$2,101.12	$1,150.00	31
1.5" to 3/4"	$145.00	$37,225.00	$5,655.67	$3,820.00	34
2" to 1"	$170.00	$49,549.00	$7,538.16	$3,820.00	47
3" to 1.5"	$1,230.00	$116,154.00	$25,886.15	$15,213.37	29
4" to 2"	$200.00	$231,232.00	$40,198.27	$20,250.00	33
6" to 4"	$1,290.00	$627,628.00	$80,718.11	$40,470.00	28
8" to 4"	$243.60	$345,585.00	$99,052.42	$57,575.00	27
10" to 6"	$101.50	$499,053.99	$149,578.14	$70,040.00	18
12" to 8"	$131.95	$808,236.00	$200,842.07	$72,350.00	14

Table 7: Summary Statistics for Connection Fee Savings Related to Downsizing Meter Size by Two Sizes, as of 2020

Meter Downsize Example	Minimum Annual Water Service Charge Savings	Maximum Annual Water Service Charge Savings	Mean Annual Water Service Charge Savings	Median Annual Water Service Charge Savings	Number of Communities
1" to 5/8"	($0.06)	$750.60	$149.00	$118.92	40
1.5" to 3/4"	$0.00	$1,571.16	$356.20	$272.16	37
2" to 1"	$0.00	$2,391.84	$570.71	$489.18	46
3" to 1.5"	$48.60	$5,594.16	$1,208.31	$939.66	44
4" to 2"	$48.60	$9,541.68	$1,884.09	$1,528.44	45
6" to 4"	$0.00	$23,000.16	$3,858.74	$2,760.42	44
8" to 4"	$0.00	$42,152.16	$6,441.00	$5,260.20	41
10" to 6"	$0.00	$59,491.80	$8,173.96	$6,021.00	36
12" to 8"	$0.00	$35,026.20	$11,795.46	$10,810.32	23

Table 8: Summary Statistics for Annual Water Service Charge Savings Related to Downsizing Meter Size by Two Sizes, as of 2020

Meter Downsize Example	Minimum Annual Sewer Service Charge Savings	Maximum Annual Sewer Service Charge Savings	Mean Annual Sewer Service Charge Savings	Median Annual Sewer Service Charge Savings	Number of Communities
1" to 5/8"	$0.00	$461.28	$200.30	$163.08	14
1.5" to 3/4"	$113.64	$1,014.12	$500.39	$470.94	14
2" to 1"	$58.56	$1,440.24	$761.49	$719.70	20
3" to 1.5"	$214.32	$2,880.60	$1,490.07	$1,284.24	19
4" to 2"	$331.44	$4,848.96	$2,560.03	$2,366.16	19
6" to 4"	$663.00	$11,815.68	$5,175.10	$4,534.20	19
8" to 4"	$1,072.44	$21,787.44	$8,334.92	$5,799.60	17
10" to 6"	$0.00	$30,980.04	$10,887.71	$10,774.92	14
12" to 8"	$0.00	$31,532.04	$17,624.28	$18,168.96	8

Table 9: Summary Statistics for Annual Sewer Service Charge Savings Related to Downsizing Meter Size by Two Sizes, as of 2020

Meter Downsize Example	Minimum Connection Fee Savings	Maximum Connection Fee Savings	Mean Connection Fee Savings	Median Connection Fee Savings	Number of Communities
1.5" to 5/8"	$185.00	$40,222.00	$6,557.22	$3,910.00	27
2" to 3/4"	$250.00	$57,808.00	$9,687.79	$4,920.00	37
3" to 1"	$690.00	$132,132.00	$28,389.50	$18,392.00	31
4" to 1.5"	$300.00	$264,803.00	$48,021.76	$25,730.00	31
6" to 2"	$600.00	$710,211.00	$92,853.86	$47,090.00	30
8" to 3"	$2,160.00	$435,154.00	$133,123.43	$79,290.00	24
10" to 4"	$309.58	$559,878.33	$193,456.83	$95,074.50	18
12" to 6"	$167.47	$994,752.00	$255,949.32	$108,760.00	14

Table 10: Summary Statistics for Connection Fee Savings Related to Downsizing Meter Size by Three Sizes, as of 2020

Meter Downsize Example	Minimum Annual Water Service Charge Savings	Maximum Annual Water Service Charge Savings	Mean Annual Water Service Charge Savings	Median Annual Water Service Charge Savings	Number of Communities
1.5" to 5/8"	$53.52	$1,776.36	$422.24	$316.14	40
2" to 3/4"	$0.00	$2,937.24	$676.29	$592.20	37
3" to 1"	$48.60	$6,619.92	$1,462.10	$1,169.04	44
4" to 1.5"	$48.60	$10,907.76	$2,203.85	$1,716.00	45
6" to 2"	$48.60	$27,228.24	$4,743.06	$3,776.64	45
8" to 3"	$0.00	$47,465.76	$7,467.47	$5,947.56	40
10" to 4"	$0.00	$77,178.36	$11,129.07	$8,434.98	36
12" to 6"	$0.00	$59,491.80	$15,689.40	$13,212.72	23

Table 11: Summary Statistics for Annual Water Service Charge Savings Related to Downsizing Meter Size by Three Sizes, as of 2020

Meter Downsize Example	Minimum Annual Sewer Service Charge Savings	Maximum Annual Sewer Service Charge Savings	Mean Annual Sewer Service Charge Savings	Median Annual Sewer Service Charge Savings	Number of Communities
1.5" to 5/8"	$0.12	$1,014.12	$521.95	$448.62	14
2" to 3/4"	$210.48	$1,774.80	$910.51	$892.50	14
3" to 1"	$214.44	$3,535.20	$1,829.07	$1,575.72	19
4" to 1.5"	$389.88	$5,532.84	$2,969.88	$2,688.84	19
6" to 2"	$818.88	$13,955.76	$6,255.32	$4,908.84	19
8" to 3"	$1,248.00	$24,496.32	$9,934.43	$7,597.44	17
10" to 4"	$1,949.76	$40,086.84	$14,962.49	$14,918.94	14
12" to 6"	$0.00	$38,539.32	$22,991.01	$22,781.82	8

Table 12: Summary Statistics for Annual Sewer Service Charge Savings Related to Downsizing Meter Size by Three Sizes, as of 2020

Here again, average connection fee savings from downsizing meters increase for every additional meter size. Downsizing by two-meter sizes yields a greater savings compared to downsizing one meter size, and downsizing by three meter sizes yields a greater savings compared to downsizing by two meter sizes. This trend of increased savings for larger meter downsizing efforts is also present in water and sewer service charge values.

Theoretical Case Study Scenarios

In order to gain additional understanding of the financial dynamics of a potential trend in downsizing new connections, five forward-looking "what-if" scenarios were created. Scenarios were created using connection fee data, rate data, and population projections for five cities across the United States. For the purposes of this report, the names of these cities are anonymous and denoted by their geographic region. The cities are as follows: Great Plains City, Mid-Atlantic City, West Coast City, Northwest City, and Southern City.

These theoretical scenarios illustrate the potential impact of downsizing all water meters for new connections from 2021 through 2030 one step and use the following variables:

1. Number of meters by meter size for 2020 (synthetically estimated for four of the five communities)
2. Population data from 2020 through 2030
3. Connection fee data by meter size
4. Water and sewer service charge data by meter size

These scenarios are theoretical and carry caveats. The following notes are offered for transparency, not to take away from the value of the scenarios.

- The number of meters by meter size is artificially constructed for four of the five communities, based on population and number of meters by size of a single community. One community contains actual data for 2020.
- The community that provided data did not include 5/8-inch meters. As such, the 3/4-inch to 5/8-inch step is not included in the analysis.
- New meters were projected using population growth. This is not to suggest it is the ideal methodology for projecting new meters by meter size but was used given the data available to the team.
- Because new meters were estimated based on population ratios there are fractions of meters included in the financial analysis.
- Future dollars are in nominal terms. That is, future dollar values have not been inflation adjusted.

Number of Meters by Meter Size

Obtaining the number of meters by meter size was not possible for each community given the project scope and timeline. These data are not readily available in publicly available documents and resources. However, one of the communities included in this assessment provided the number of meters by meter size for its service area. That dataset was used to create a Meters by Meter Size/Population ratio. The Meters by Meter Size/Population ratios were then applied to the other communities' populations to create a synthetic estimate of the number of meters by meter size for 2020. The future meters by meter size were then projected based on population growth. While this is imperfect, it allows a forward-looking analysis and provides useful results under an understandable set of assumptions.

Population Data from 2020 through 2030

Population statistics for 2020 and population projections for 2030 were obtained from local planning documents and publicly available resources from the five cities.

Years between 2020 and 2030 were interpolated using Microsoft Excel's growth trend function which derives and applies a constant annual growth percentage.

Connection Fee Data and Water and Sewer Service Charge Data

Connection fee data and water and sewer service charge data were used to represent each community in the example scenarios. Only one community, Mid-Atlantic City, has sewer service charges by meter size. The other communities do not charge for sewer service based on meter size.

Analysis Steps

The analysis included the following steps for each community scenario:

1. Enter population forecast from 2020 through 2030.
2. Create 2020 estimate of number of meters by meter size based on Meters by Meter Size/Population ratios.
3. Project new meters to be added from 2021 through 2030 based on population growth.
4. Estimate connection fees to be collected from 2021 through 2030 based on new meters being added (nominal dollars based on current fees).
5. Estimate future cumulative water and sewer service charge revenue to be collected from 2021 through 2030 based on new meters being added (nominal dollars based on current service charges).
6. Modify the 2021 through 2030 new meter projection by assuming all new meters are downsized by one step.
7. Estimate connection fees to be collected from 2021 through 2030 based on new meters added (nominal dollars based on current fees).
8. Estimate future cumulative water and sewer service charge revenue to be collected from 2021 through 2030 based on new meters added (nominal dollars based on current service charges).
9. Subtract the results of the original projection and the projection with downsized meters.

Results are presented for each case-example community. For each example community the following are included:

1. Population forecast from 2020 through 2030.
2. Connection fees, and monthly water and sewer service charges by meter size.
3. An estimate of the number of meters by meter size constructed from the population in 2020.
4. A summary of the impact to revenue collection if all new meters from 2021 through 2030 were downsized one step.
5. A chart illustrating the impact to connection fee revenue collection for two scenarios.
6. A chart illustrating the cumulative impact to water and sewer service charge collection for two scenarios.

Great Plains City

Table 13 shows the population projection for Great Plains City for the years 2020 through 2030.

Year	Population
2020	648,599
2021	657,031
2022	665,572
2023	674,225
2024	682,989
2025	691,868
2026	700,862
2027	709,974
2028	719,203
2029	728,553
2030	738,024

Table 13: Great Plains City Population Forecast

Table 14 contains connection fees and monthly water service charges by meter size for Great Plains City. There is not a sewer service charge that varies by meter size.

Meter Size	Connection Fee	Monthly Water Service Charge	Monthly Sewer Service Charge
3/4"	$1,000.00	$17.22	N/A
1"	$1,670.00	$27.04	N/A
1.5"	$3,330.00	$51.66	N/A
2"	$5,330.00	$81.11	N/A
3"	$11,670.00	$174.62	N/A
4"	$21,000.00	$312.20	N/A
6"	$46,670.00	$690.87	N/A
8"	$60,000.00	$887.52	N/A
10"	$81,670.00	$1,207.30	N/A
12"	$93,330.00	$1,379.33	N/A

Table 14: Great Plains City Current Connection Fees and Monthly Water & Sewer Service Charges

Table 15 contains the estimated number of meters by meter size in 2020. This is based on a meter size to population ratio. While it is a realistic estimate, the actual meter size distribution in Great Plains City may be quite different.

Meter Size	Number of Meters Estimated in 2020
3/4"	82,635
1"	12,067
1.5"	2,731
2"	2,880
3"	250
4"	585
6"	216
8"	71
10"	17
12"	5

Table 15: Constructed Estimate of Meters by Meter Size in 2020 for Great Plains City

The population projection, connection fees and rate data, and the estimated number of meters by meter size were used to estimate new meter installations through 2030. A second scenario was constructed to estimate the impact of downsizing 100 percent of new meters. If 100 percent of new meters installed from 2021-2030 were downsized one step in Great Plains City, the city would collect $4,460,720 (20%) less in connection fees from 2021 through 2030 and would collect $4,256,588 (18%) less in cumulative water service charge revenue during the same time period. The revenue impacts average $446,072 per year for connection fees, and $425,359 per year for cumulative water service charges. Figure 6 illustrates the two scenarios related to connection fees and Figure 7 illustrates the two scenarios pertaining to monthly water service charges.

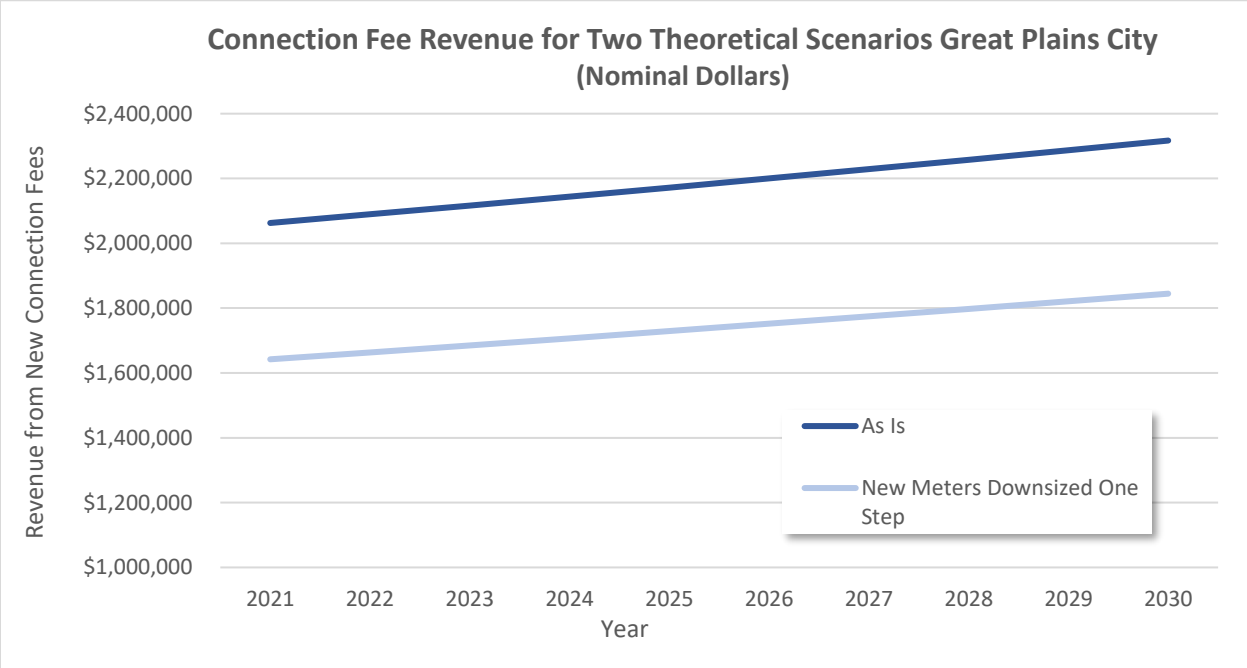

Figure 6: Connection Fee Revenue for Two Theoretical Scenarios Great Plains City, in Nominal Dollars

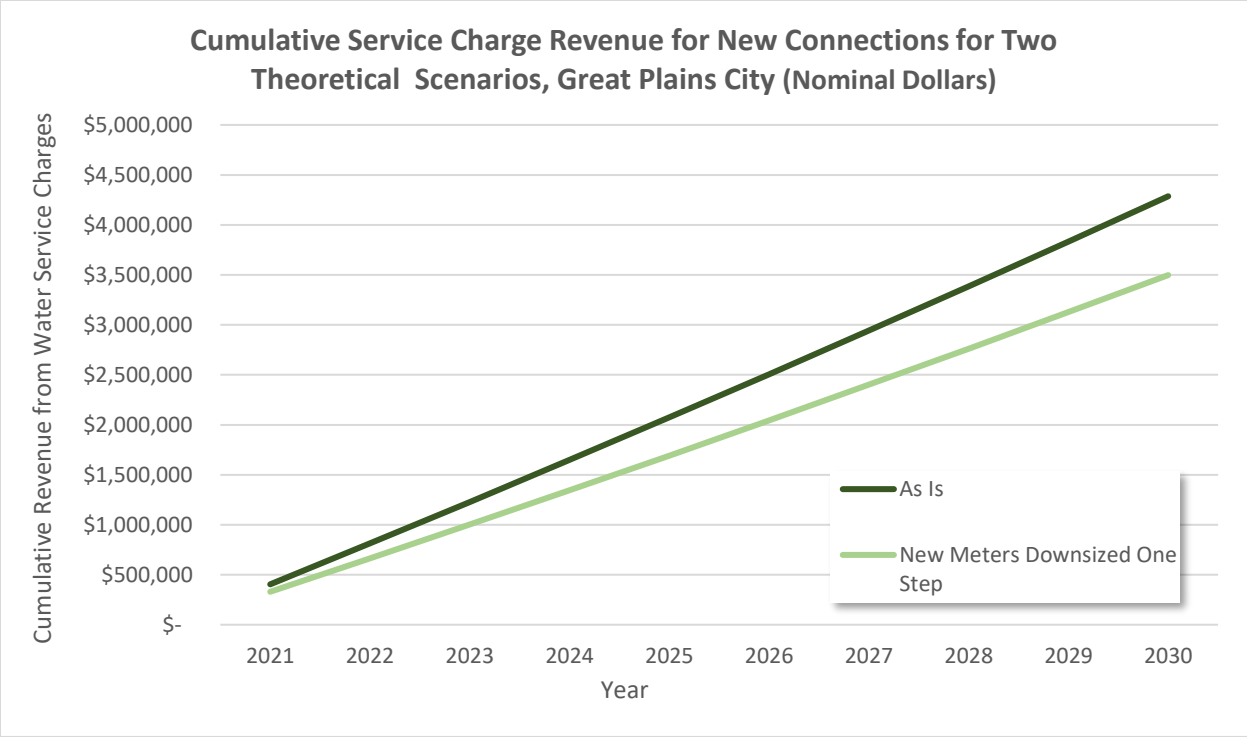

Figure 7: Cumulative Service Charge Revenue for New Connections for Two Theoretical Scenarios, Great Plains City in Nominal Dollars

Mid-Atlantic City

Table 16 shows the population projection for Mid-Atlantic City for the years 2020 through 2030.

Year	Population
2020	638,544
2021	653,032
2022	667,848
2023	683,000
2024	698,496
2025	714,344
2026	730,551
2027	747,126
2028	764,077
2029	781,413
2030	799,142

Table 16: Mid-Atlantic City Population Forecast

Table 17 contains connection fees and monthly water service charges by meter size for Mid-Atlantic City. Raleigh has both water and sewer service charges that vary by meter size.

Meter Size	Connection Fee	Monthly Water Service Charge	Monthly Sewer Service Charge
3/4"	$2,060.00	$8.50	10.41
1"	$3,433.00	$12.98	15.97
1.5"	$6,865.00	$24.19	29.88
2"	$10,984.00	$37.64	46.56
3"	$21,968.00	$73.50	91.08
4"	$34,325.00	$113.85	141.14
6"	$68,650.00	$225.91	280.21
8"	$109,840.00	$360.39	447.11
10"	$288,330.00	$517.30	641.81
12"	$363,845.00	N/A	N/A

Table 17: Mid-Atlantic City Current Connection Fees and Monthly Water & Sewer Service Charges

Table 18 contains the estimated number of meters by meter size in 2020. This is based on a meter size to population ratio. While the estimate is realistic, it may be quite different than the actual meter size distribution in Mid-Atlantic City.

Meter Size	Number of Meters Estimated in 2020
3/4"	81,354
1"	11,880
1.5"	2,688
2"	2,835
3"	246
4"	576
6"	213
8"	70
10"	17
12"	5

Table 18: Constructed Estimate of Meters by Meter Size in 2020 for Mid-Atlantic City

The population projection, connection fees and rate data, and the estimated number of meters by meter size were used to estimate new meter installations through 2030. A second scenario was constructed to estimate the impact of downsizing 100 percent of new meters. If 100 percent of new meters installed from 2021-2030 were downsized one step in Mid-Atlantic City, the city would collect $15,252,188 (19%) less in connection fees from 2021 through 2030 and would collect $6,714,450 (16%) less in cumulative water service charge revenue during the same time period. The revenue impacts average $1,525,219 per year for connection fees, and $671,445 per year for cumulative water service charges. Figure 8 illustrates the two scenarios related to connection fees and Figure 9 illustrates the two scenarios pertaining to monthly water service charges.

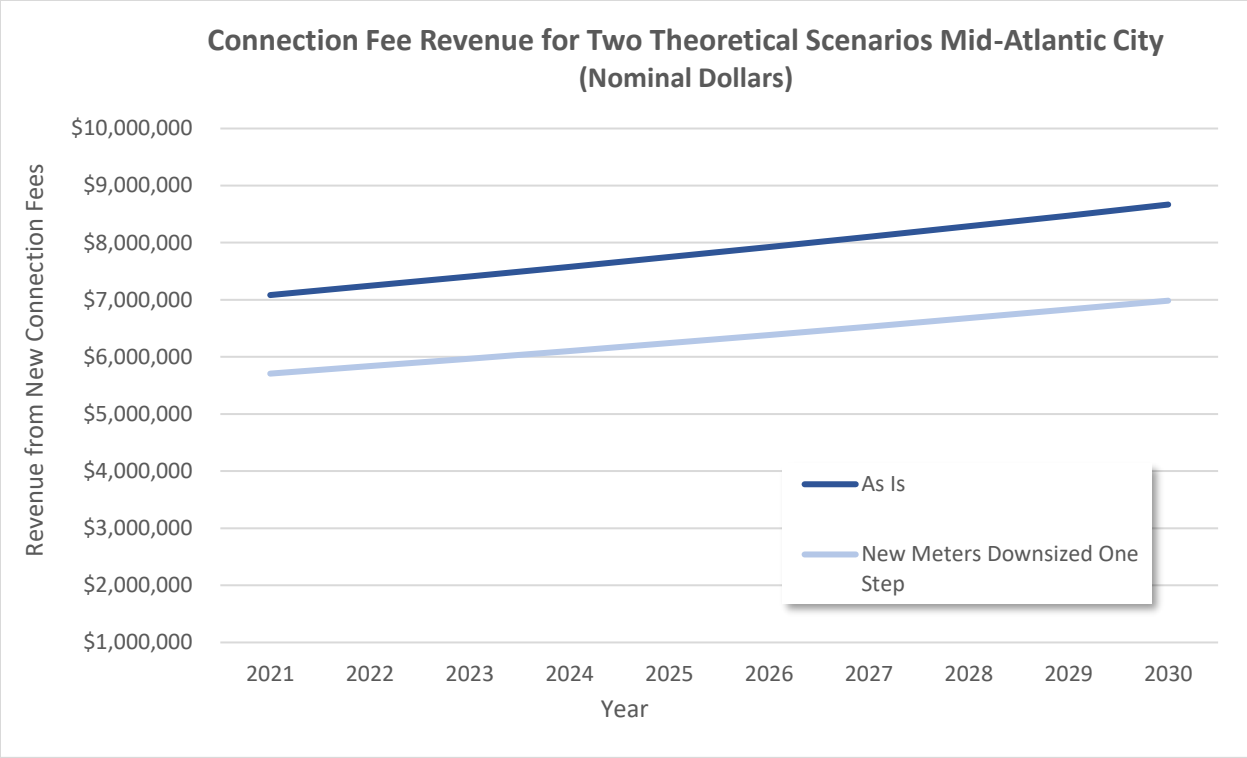

Figure 8: Connection Fee Revenue for Two Theoretical Scenarios Mid-Atlantic City in Nominal Dollars

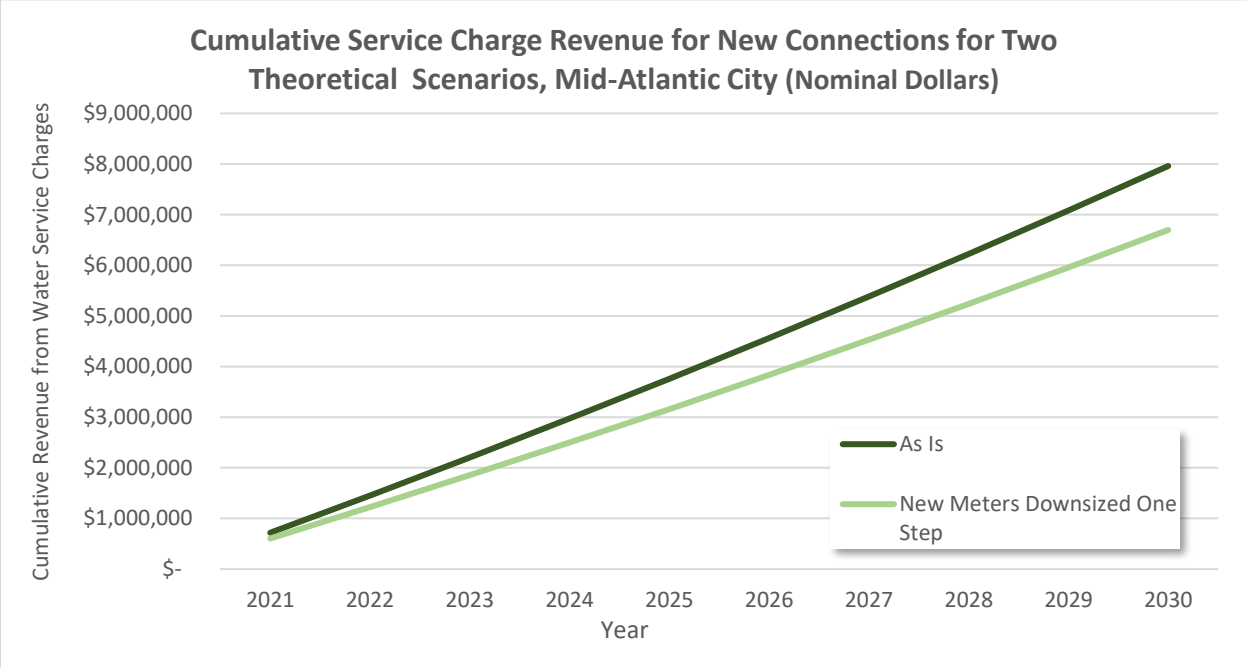

Figure 9: Cumulative Service Charge Revenue for New Connections for Two Theoretical Scenarios, Mid-Atlantic City in Nominal Dollars

West Coast City

Table 19 shows the population projection for West Coast City for the years 2020 through 2030.

Year	Population
2020	890,400
2021	899,143
2022	907,973
2023	916,888
2024	925,892
2025	934,984
2026	944,165
2027	953,436
2028	962,799
2029	972,253
2030	981,800

Table 19: West Coast City Population Forecast

Table 20 contains connection fees and monthly water service charges by meter size for West Coast City. West Coast City has installation charges, water capacity charges, and sewer capacity charges that all differ by meter size.

Meter Size	Connection Fee	Monthly Water Service Charge	Monthly Sewer Service Charge
3/4"	$8,987	$18.18	N/A
1"	$26,551	$26.15	N/A
1.5"	$46,212	$46.07	N/A
2"	$64,186	$68.98	N/A
3"	$142,351	$133.74	N/A
4"	$196,271	$205.47	N/A
6"	$354,130	$404.72	N/A
8"	$541,856	$643.82	N/A
10"	$748,862	$1,002.47	N/A
12"	$1,288,043	$1,609.72	N/A

Table20: West Coast City Current Connection Fees and Monthly Water Service Charges

Table 21 contains the estimated number of meters by meter size in 2020. This is based on a meter size to population ratio. While the estimate is realistic, it may be quite different than the actual meter size distribution in West Coast City.

Meter Size	Number of Meters Estimated in 2020
3/4"	113,442
1"	16,566
1.5"	3,749
2"	3,954
3"	343
4"	803
6"	297
8"	97
10"	24
12"	7

Table 21: Constructed Estimate of Meters by Meter Size in 2020 for West Coast City

The population projection, connection fees and rate data, and the estimated number of meters by meter size were used to estimate new meter installations through 2030. A second scenario was constructed to estimate the impact of downsizing 100 percent of new meters. If 100 percent of new meters installed from 2021-2030 were downsized one step in West Coast City, the city would collect $59,512,315 (25%) less in connection fees from 2021 through 2030 and would collect $3,153,491 (14%) less in cumulative water service charge revenue during the same time period. The revenue impacts average $5,951,232 per year for connection fees, and $315,349 per year for cumulative water service charges. Figure 10 illustrates the two scenarios related to connection fees and Figure 11 illustrates the two scenarios pertaining to monthly water service charges.

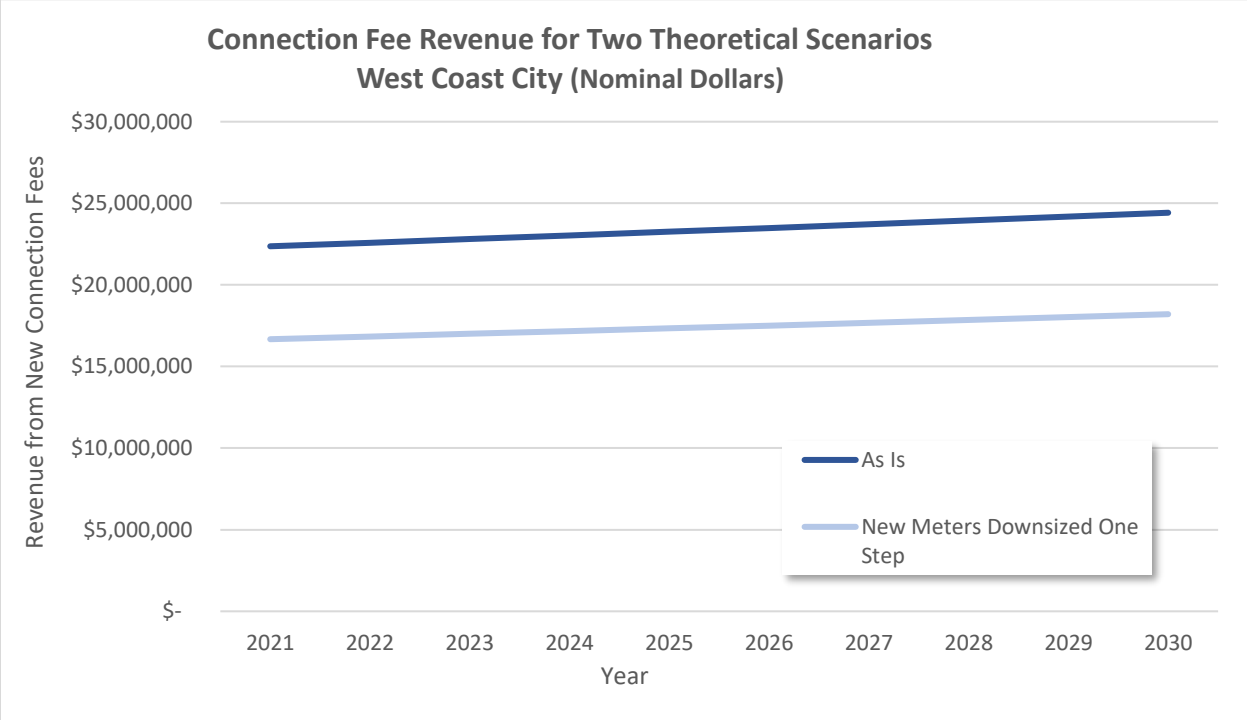

Figure 10: Connection Fee Revenue for Two Theoretical Scenarios West Coast City in Nominal Dollars

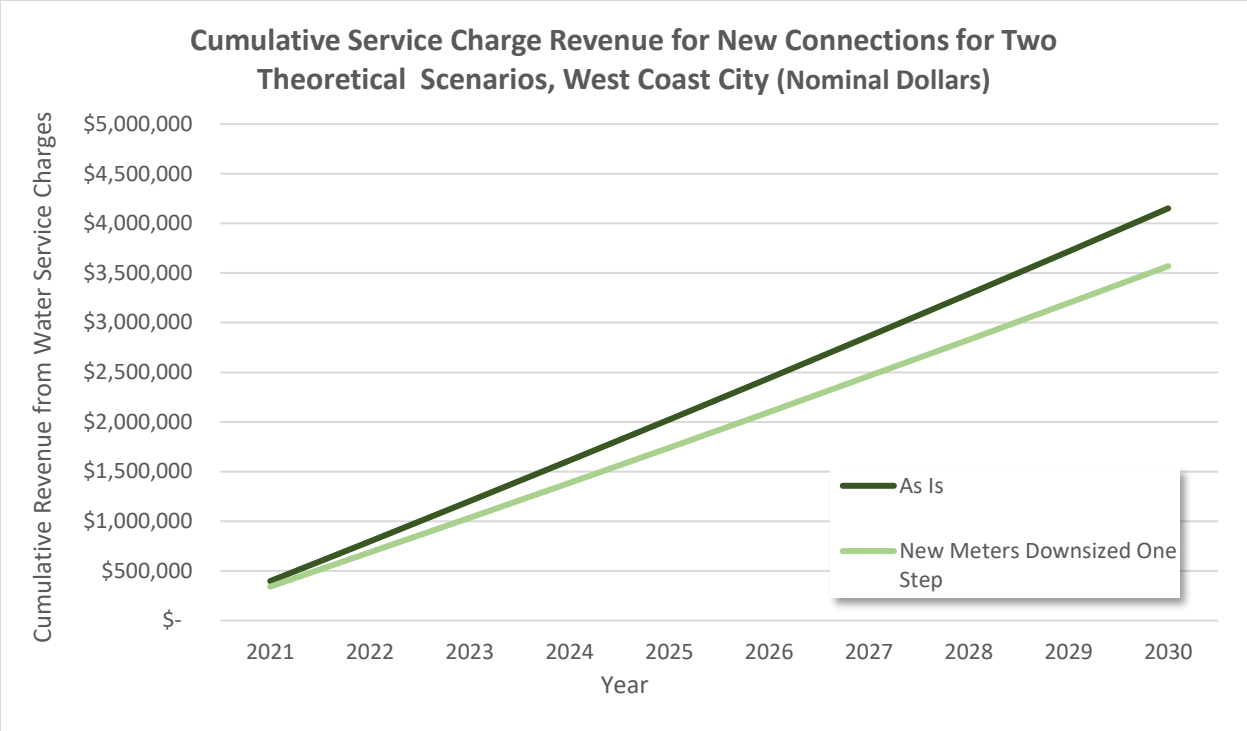

Figure 11: Cumulative Service Charge Revenue for New Connections for Two Theoretical Scenarios, West Coast City in Nominal Dollars

Northwest City

Table 22 shows the population projection for Northwest City for the years 2020 through 2030.

Year	Population
2020	1,238,165
2021	1,245,881
2022	1,253,644
2023	1,261,457
2024	1,269,317
2025	1,277,227
2026	1,285,186
2027	1,293,195
2028	1,301,254
2029	1,309,363
2030	1,317,522

Table 22: Northwest City Population Forecast

Table 23 contains connection fees and monthly water service charges by meter size for Northwest City.

Meter Size	Connection Fee	Monthly Water Service Charge	Monthly Sewer Service Charge
3/4"	$1,700.00	$18.45	N/A
1"	$2,890.00	$19.00	N/A
1.5"	$5,610.00	$29.35	N/A
2"	$9,010.00	$32.50	N/A
3"	$18,700.00	$120.30	N/A
4"	$28,900.00	$172.35	N/A
6"	$56,100.00	$212.00	N/A
8"	$90,100.00	$250.00	N/A
10"	$130,900.00	$305.00	N/A
12"	$176,800.00	$412.00	N/A

Table 23: Northwest City Current Connection Fees and Monthly Water Service Charges

Table 24 contains the estimated number of meters by meter size in 2020. This is based on a meter size to population ratio. While the estimate is realistic, it may be quite different than the actual meter size distribution in Northwest City.

Meter Size	Number of Meters Estimated in 2020
3/4"	157,749
1"	23,036
1.5"	5,213
2"	5,498
3"	477
4"	1,117
6"	413
8"	135
10"	33
12"	10

Table 24: Constructed Estimate of Meters by Meter Size in 2020 for Northwest City

The population projection, connection fees and rate data, and the estimated number of meters by meter size were used to estimate new meter installations through 2030. A second scenario was constructed to estimate the impact of downsizing 100 percent of new meters. If 100 percent of new meters installed from 2021-2030 were downsized one step in Northwest City, the city would collect $6,020,197 (19%) less in connection fees from 2021 through 2030 and would collect $873,146 (5%) less in cumulative water service charge revenue during the same time period. The revenue impacts average $602,020 per year for connection fees, and $87,315 per year for cumulative water service charges. Figure 12 illustrates the two scenarios related to connection fees and Figure 13 illustrates the two scenarios pertaining to monthly water service charges.

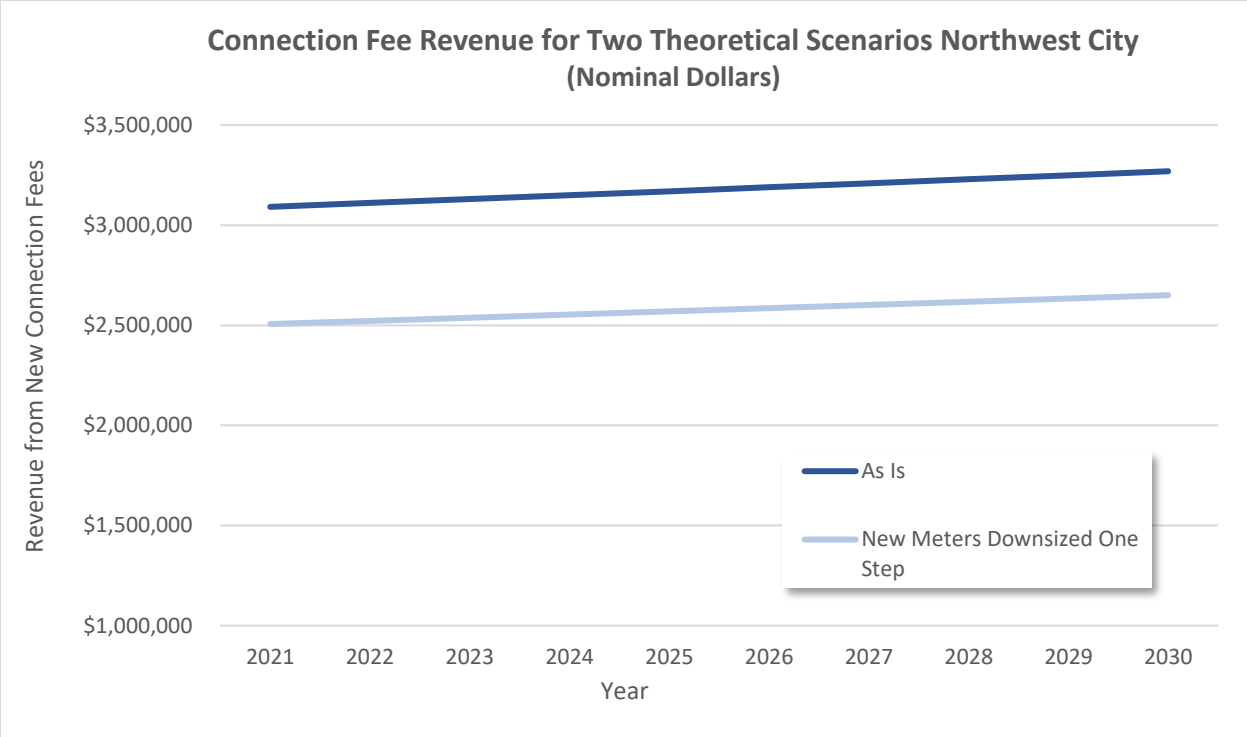

Figure 12: Connection Fee Revenue for Two Theoretical Scenarios Northwest City in Nominal Dollars

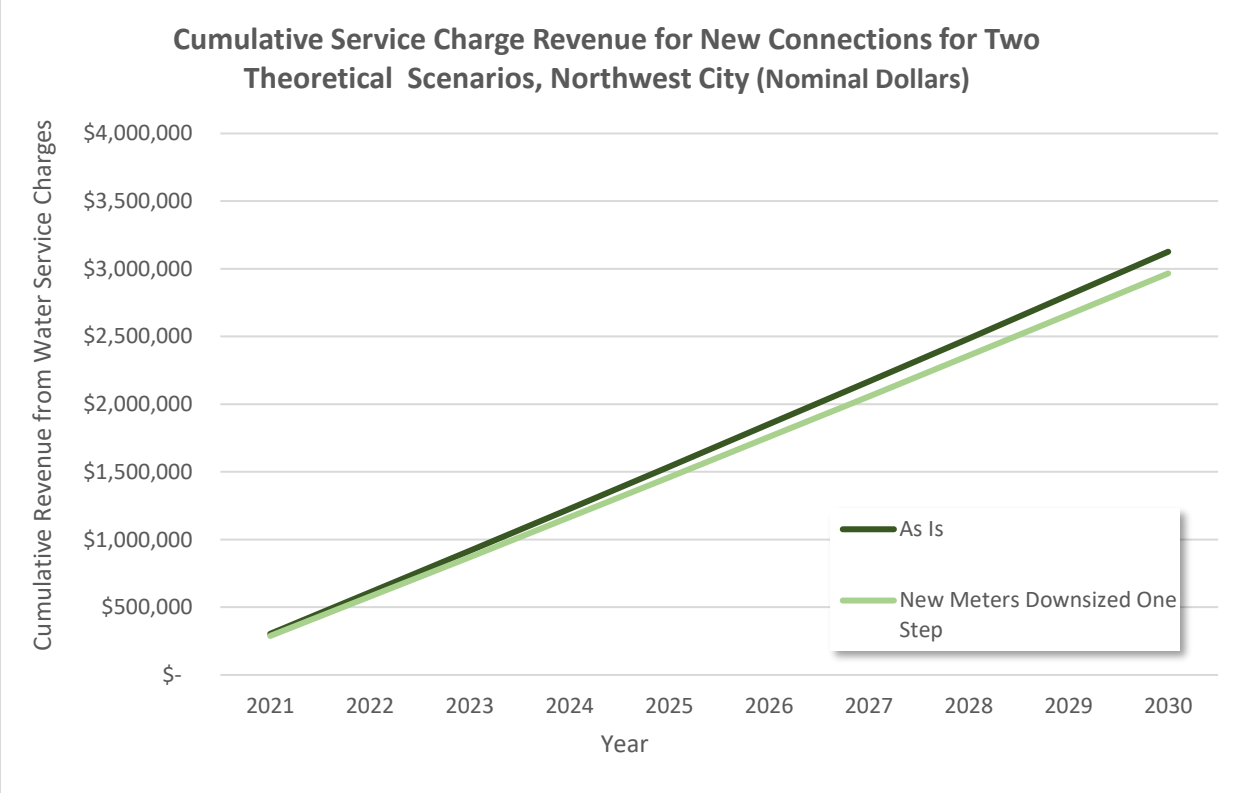

Figure 13: Cumulative Service Charge Revenue for New Connections for Two Theoretical Scenarios, Northwest City in Nominal Dollars

Southern City

Table 25 shows the population projection for Southern City for the years 2020 through 2030.

Year	Population
2020	717,000
2021	727,086
2022	737,314
2023	747,686
2024	758,203
2025	768,869
2026	779,685
2027	790,652
2028	801,775
2029	813,053
2030	824,490

Table 25: Southern City Population Forecast

Table 26 contains connection fees and monthly water service charges by meter size for Southern City.

Meter Size	Connection Fee	Monthly Water Service Charge	Monthly Sewer Service Charge
3/4"	$2,800.00	$3.00	N/A
1"	$7,000.00	$7.50	N/A
1.5"	$10,500.00	$15.00	N/A
2"	$21,000.00	$24.00	N/A
3"	$42,000.00	$45.00	N/A
4"	$105,000.00	$75.00	N/A
6"	$210,000.00	$150.00	N/A
8"	$420,000.00	$240.00	N/A
10"	N/A	$345.00	N/A
12"	N/A	$645.00	N/A

Table 26: Southern City Current Connection Fees and Monthly Water Service Charges

Table 27 contains the estimated number of meters by meter size in 2020. This is based on a meter size to population ratio. While the estimate is realistic, it may be quite different than the actual meter size distribution in Southern City.

Meter Size	Number of Meters Estimated in 2020
3/4"	91,350
1"	13,340
1.5"	3,019
2"	3,184
3"	276
4"	647
6"	239
8"	78
10"	19
12"	6

Table 27: Constructed Estimate of Meters by Meter Size in 2020 for Southern City

The population projection, connection fees and rate data, and the estimated number of meters by meter size were used to estimate new meter installations through 2030. A second scenario was constructed to estimate the impact of downsizing 100 percent of new meters. If 100 percent of new meters installed from 2021-2030 were downsized one step in Southern City, the city would collect $26,996,504 (30%) less in connection fees from 2021 through 2030 and would collect $1,600,781 (27%) less in cumulative water service charge revenue during the same time period. The revenue impacts average $2,699,650 per year for connection fees, and $160,078 per year for cumulative water service charges. Figure 14 illustrates the two scenarios related to connection fees and Figure 15 illustrates the two scenarios pertaining to monthly water service charges.

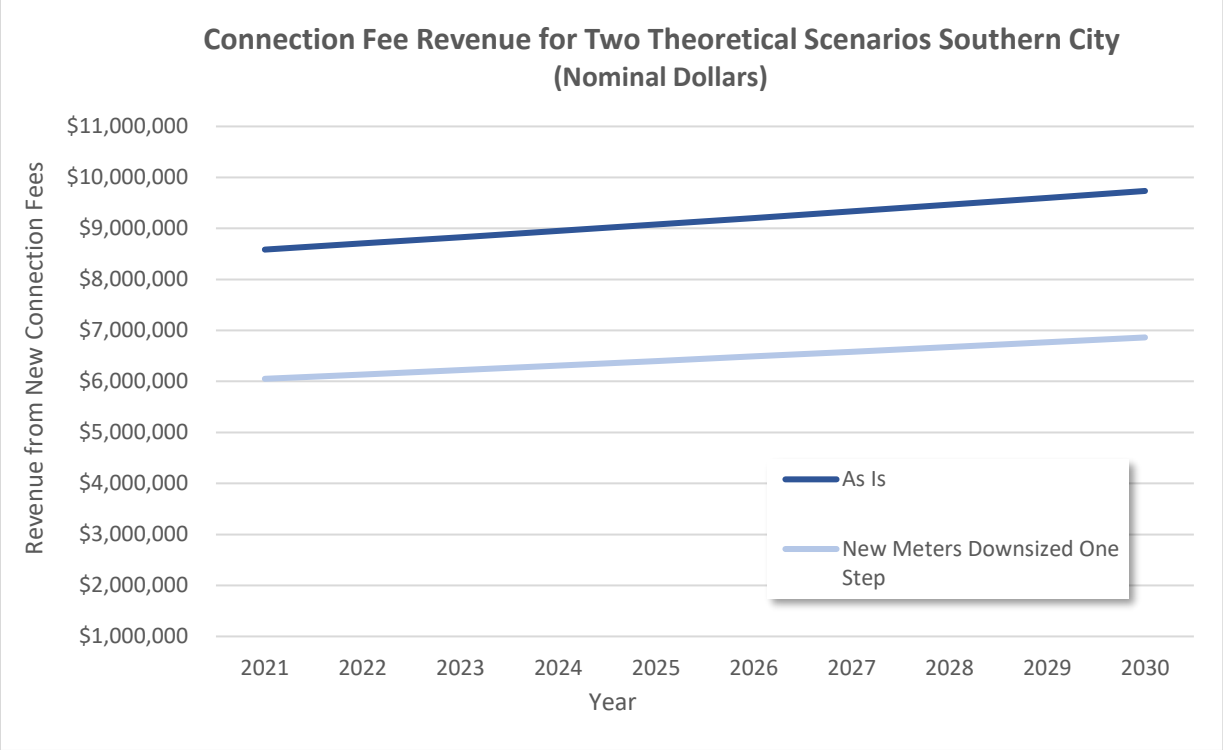

Figure 14: Connection Fee Revenue for Two Theoretical Scenarios Southern City in Nominal Dollars

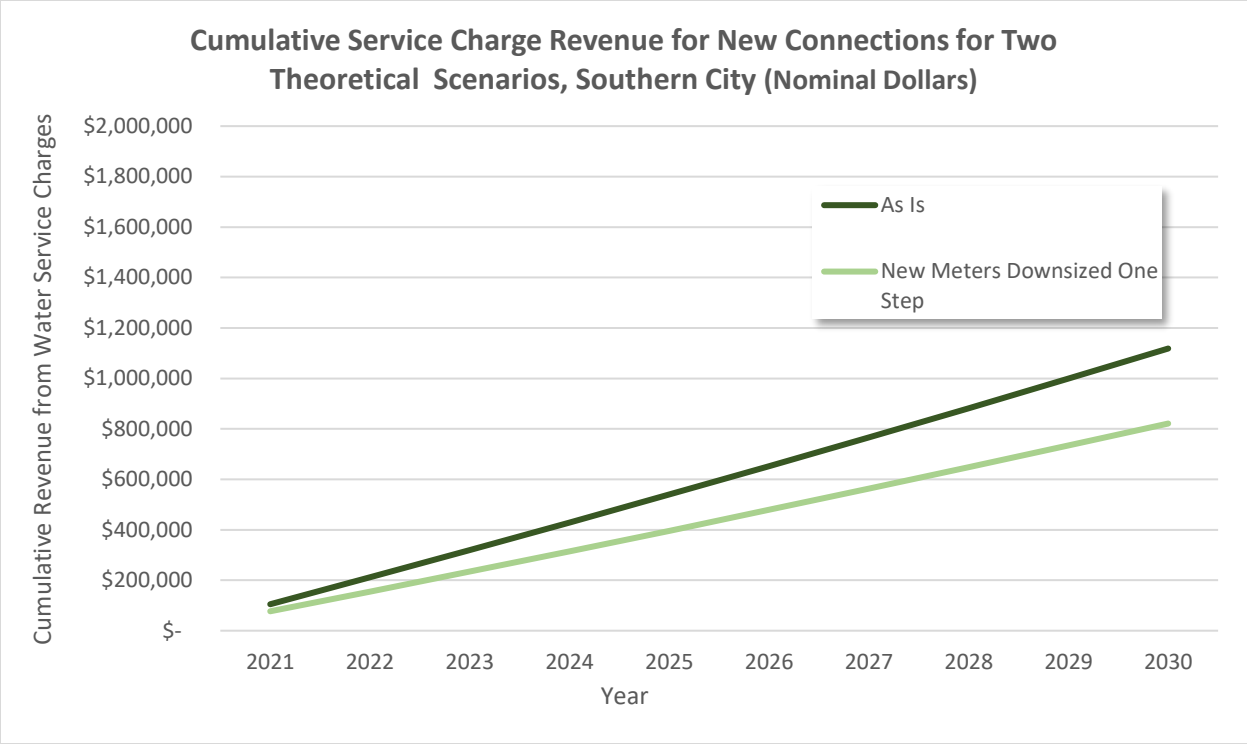

Figure 15: Cumulative Service Charge Revenue for New Connections for Two Theoretical Scenarios, Southern City in Nominal Dollars

Case Study Scenarios Summary

The five case study scenarios demonstrate the financial dynamics of future connection fee, and water and sewer service charge revenue if all new metered connections were downsized one step. Since these scenarios are theoretical it is likely more appropriate to focus on the impacts in terms of percentages. Table 28 contains the percentage impacts to total connection fee revenue and total cumulative water and sewer service charge revenue for new connections from 2021 to 2030.

Revenue Type	Great Plains City	Mid-Atlantic City	West Coast City	Northwest City	Southern City
Total New Connection Fee Revenue 2021-2030	-20%	-19%	-25%	-19%	-30%
Total Cumulative Water and Sewer Service Charge Revenue from New Connections 2021-2030	-18%	-16%	-14%	-5%	-27%

Table 28: Theoretical Revenue Impacts if all New Metered Connections are Downsized One Step from 2021 to 2030

The financial impact of meter downsizing will vary for two primary reasons: (1) growth rates, and (2) the cost differential between meter sizes for connections fees and service charges.

Conclusion

The data collection and analysis demonstrate a high degree of variability and extreme ranges in water meter connection fees throughout the United States. In addition to the variability around costs, the research team found inconsistency surrounding the terminology used to describe fees for new water service connections. There are financial implications for both applicants for new water service and for water providers if new meters are downsized.

Customers can reduce both the one-time cost of connecting to the water system and the ongoing charges for water and sewer service. If downsizing is to become a trend, water providers may find it useful to model the financial impact to determine future revenue projections. An approach using Monte Carlo simulation techniques may prove to be an effective way for a water provider to quantify risk exposure, given the inherent uncertainty embedded in such a projection. A trend toward meter downsizing may reduce expected water utility revenue if not planned for, but it will have benefits. For example, properly sized meters can increase volumetric revenue by registering lower flows that oversized meters may fail to capture.

Key Findings and Observations

- Connection fee data are challenging to collect and catalogue for a variety of reasons.
    - Often hard to locate
    - Terminology variability
    - Not all meter sizes are available
    - Sometimes there are a variety of charges related to meter size that are not located in the same resource
- Connection fees have a high degree of variability throughout the United States.
- A trend in meter downsizing for new connections due to plumbing system right sizing methodologies would have meaningful financial implications for new water customers and water providers.
    - Based on the data collected, the average cost savings for downsizing from a 1-inch to a 3/4-inch meter was $1,883.05.
    - Based on the five theoretical scenarios, the total connection fee revenue impact would be -23 percent for 2021 through 2030 on average for the five example communities, with a minimum of -19 percent and maximum of -30 percent.
- A trend in meter downsizing for new connections would have meaningful financial implications for water and sewer service providers related to service charge revenue collection, and for customers.
    - Based on the data collected, the average annual service charge savings for downsizing from a 1-inch to a 3/4-inch meter was $106.11 for water and $159.43 for sewer.
    - Based on the data collected, the total cumulative water and sewer service charge revenue impact would be -16 percent for 2021 through 2030 on average for the five example communities, with a minimum of -5 percent and maximum of -27 percent. While revenues will be impacted by lower connection fees and service charges if meters are downsized, improved efficiencies can also result in allowing for increased levels of development, especially in water scarce regions.

Additional Considerations

- The emergence of new pipe-sizing methodologies provides the best opportunity to address oversized premise plumbing systems. As of this writing, at least two states (Washington and Oregon) have updated their plumbing codes to include new pipe-sizing methodologies and it is being considered by other jurisdictions. Oversized pipes are inherently water and energy inefficient and can confound emerging water quality concerns related to opportunistic pathogens.
- Improved hot water delivery times resulting from smaller diameter plumbing systems will result in both increased water and energy efficiencies and improved consumer satisfaction levels.