Columbia Wastewater and Stormwater IMP

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Our Columbia Waters
Integrated Management Plan
Wastewater & Stormwater

Technical Memorandum 10 *Residential Affordability and Socioeconomic Evaluation*

Columbia Wastewater and Stormwater Integrated Management Plan

Columbia, Missouri
September 28, 2018

HDR
Geosyntec consultants
Shockey Consulting Services, llc
RV
TREKK DESIGN GROUP, LLC

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Section 1. Introduction and Objectives

The City of Columbia, Missouri (City) is preparing an Integrated Management Plan (IMP) for the City's Sewer and Storm Water Utilities. The goal of the IMP is to develop an adaptable and affordable long-term plan that addresses the City's wastewater and stormwater management needs and meets Clean Water Act requirements. The IMP will be developed based on guidance presented in US Environmental Protection Agency's (EPA) *Integrated Municipal Stormwater and Wastewater Planning Approach Framework*[1].

As part of the IMP process, the City and their project team developed a series of potential wastewater treatment, wastewater collection, and stormwater system alternatives and corresponding funding requirements to address infrastructure and environmental needs that are important to Columbia residents. The potential alternatives were evaluated using a multiple criteria decision analysis (MCDA) tool developed from feedback obtained from community outreach activities. The MCDA was used to quantitatively evaluate the costs of the various alternatives relative to their benefits. Through application of this tool, the project team recommended a suite of wastewater and stormwater alternatives that provide the best value to the community. More detailed information regarding the MCDA process is presented in Technical Memorandum 9.

The MCDA evaluation described above was limited to quantifying the costs and benefits of potential alternatives, and did not assess the impact of the increased cost of utility services on the City's ratepayers. EPA allows state regulatory agencies to consider financial and economic impacts when developing water quality standards regulations or implementing water pollution control measures. However, the tools that EPA has historically relied upon for conducting these evaluations are narrowly-focused and did not provide communities sufficient flexibility to fully consider local socioeconomic considerations that may impact the financial capability of the municipality and residential ratepayers.

During the 1990s, EPA published guidance documents outlining analyses municipalities could use to assess the financial impacts of complying with water quality standards regulations[2] and developing combined sewer overflow control programs[3]. Both guidance documents outline a two-part financial capability matrix. The matrix evaluates the cost of wastewater services per household (Residential Indicator) relative to both the community median household income (MHI) and the ability of the community to finance the required construction (Permittee Financial Capability Indicators). The matrix uses this information in an attempt to predict whether or not a community will experience substantial socioeconomic impacts as a result of implementing projects needed to comply with Clean Water Act requirements.

[1] Stoner, N. and C. Giles. 2012. Integrated Municipal Stormwater and Wastewater Planning Approach Framework. June 5, 2012. Washington D.C.
[2] Davies, T. 1995. Economic Guidance for Water Quality Standards Workbook. Office of Science and Technology. Washington, DC. EPA-823-B-95-002.
[3] EPA. 1997. Combined Sewer Overflows – Guidance for Financial Capability Assessment and Schedule Development: Final. Office of Wastewater Management. Washington, D.C. EPA 832-B-97-004.

For the Residential Indicator (RI) evaluation specifically, EPA suggests using a "screener" approach to establish whether or not a community can fund projects by categorizing impacts as a low, mid-range, or high burden. EPA considers financial impacts to be low if average bills are less than 1% of community MHI, mid-range if average bills are between 1% and 2% of MHI, and high if they are greater than 2% of MHI. In their guidance documents, EPA's assumption is that communities with a low burden (average bills less than 1% of MHI) can pay for additional projects and programs without incurring any substantial impacts and therefore do not need to evaluate the additional indicators for second part of the financial capability matrix.

In Columbia, the average residential sewer bill is approximately $27.50 per month (assuming 5,000 gallons per month consumption) and the average residential stormwater bill is $1.66 per month. When compared to the MHI of the City (approximately $45,000), these bills collectively equate to a RI of approximately 0.74%. According to the EPA economic guidance, this result suggests that the financial burden of existing wastewater and stormwater services is low and ratepayers could potentially afford to spend between $38 and 75 per month (1 to 2% of MHI) for additional wastewater and stormwater services, depending on Columbia's financial and socioeconomic strength.

A limitation to EPA's RI approach for evaluating affordability is that it is not useful for characterizing impacts on disadvantaged segments of the community that may be disproportionately impacted by increased sewer and stormwater bills. This issue is especially important in Columbia because the City has identified improving social equity as one of their top five strategic planning priorities[4]. In 2014, EPA issued revised economic guidance to help address this limitation and define expectations for municipalities conducting affordability analyses in the context of an integrated plan[5]. The new guidance clarified that additional, community-specific information may be necessary to develop a "more accurate and complete picture" of financial capability. The Missouri Department of Natural Resources (MDNR) also recognizes the importance of allowing communities flexibility when evaluating affordability for integrated planning[6] or permitting purposes. Since the passage of Missouri's municipal affordability statutes (644.145 RSMo), MDNR has developed robust processes for evaluating the municipal financial capability to afford wastewater and stormwater programs and has emerged as a leading state agency in these assessments.

An additional complication with assessing affordability in Columbia is that residential ratepayers include both customers who reside within the City limits and Boone County Regional Sewer District (BCRSD) customers who reside outside of the City limits. The City and BCRSD operate under a multiple agreements whereby the City accepts wastewater flows from some BCRSD facilities in order to provide regional treatment services. The City understands that future Sewer Utility rate increases will impact both City and BCRSD ratepayers. However, a focused analysis of potential impacts to BCRSD customers was not conducted because sufficiently detailed socioeconomic data specific to those users are not readily available.

[4] City of Columbia, Missouri. 2015. Strategic Plan 2016-2019. https://www.como.gov/wp-content/uploads/2016-2019-Strategic-Plan.pdf

[5] Kopocis, K., and C. Giles.2014. Financial Capability Assessment Framework for Municipal Clean Water Act Requirements. Office of Enforcement and Compliance Assurance. Washington, D.C.

[6] Hirschvogel, L. 2016. Missouri Integrated Planning Framework. Water Protection Program. Jefferson City, Missouri.

Therefore, the purpose of this memorandum is to evaluate and identify potential residential affordability issues associated with implementing the preferred wastewater and stormwater IMP alternatives identified in Technical Memorandum 9. The affordability analysis includes a review of both overall existing socioeconomic conditions in the City and potential future financial impacts on residential City ratepayers related to increased wastewater and stormwater services costs.

Section 2. City-Wide Socioeconomic Evaluation

Evaluating the current socioeconomic conditions in Columbia is important because it helps identify a baseline from which to measure future changes in the community that could influence both the implementation schedule for future IMP projects and the ability of ratepayers to fund those projects. Because there is no specific metric or ratio that is appropriate for adequately characterizing overall socioeconomic conditions in a community, a group of indicators are typically reviewed when conducting these analyses.

The evaluation focused on population trends, unemployment rates, poverty rates, and income distributions to develop a broad understanding of city-wide socioeconomic conditions in Columbia. In Section 3, a more refined group of indicators was used to better characterize existing conditions in specific neighborhoods and census tracts within the City.

2.1 Population Trends

Official population counts occur every 10 years as part of the decennial census. In between censuses, the Census Bureau's Population Estimates Program (PEP) provides the official estimated population based on current migration, birth, and death statistics. At the time of the 2010 Census, the population of Columbia was 108,500. The PEP estimate indicates that the population increased to 119,108 by 2015, which indicates that the City's population has been increasing at a rate of approximately 2% each year (Figure 1).

Columbia is also home to the University of Missouri (MU), Columbia College, and Stephens College. These higher education institutions have a combined student enrollment of nearly 40,000 people. The 2015 American Community Survey[7] (ACS) estimates that 31,000 of those students live in the City limits both on and off-campus, which represents an increase of approximately 2,200 students since 2010. Those 2,200 resident students represent approximately 21% of the City's total population growth since 2010 (Figure 1).

[7]. The ACS is a tool developed by the U.S. Census Bureau to estimate population statistics between decennial (every 10 years) censuses. The ACS 5-year estimates are based on 60 months of survey data and provide the most reliable information at a higher level of resolution; however, there is a margin of error associated with all ACS estimates that must be considered as part of the data interpretation. The 5-year ACS data are labeled with the end year of the 5-year period included in the multi-year estimate. For instance, the 5-year ACS data for 2015 includes 2011, 2012, 2013, 2014, and 2015 information.

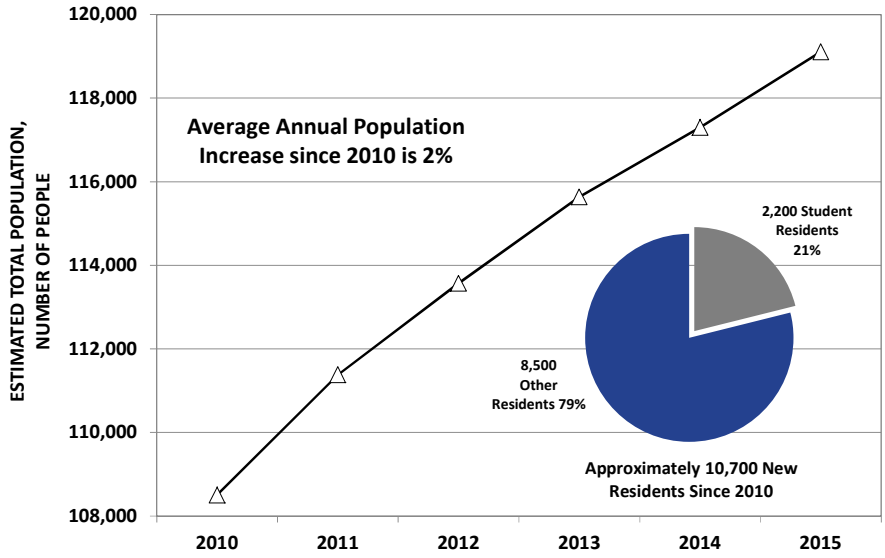

Figure 1. Columbia Population Changes since 2010.

2.2 Unemployment and Poverty Rates

The unemployment rate in Columbia (4.8% in 2015) has decreased since 2011 and is currently lower than both the State of Missouri (7.5% in 2015) and the overall national unemployment rate (8.3% in 2015). Reduced unemployment rates are an indicator that Columbia's overall economy is strong relative to other communities in the state.

Even though the unemployment rate in Columbia is lower than the state and national average, the portion of the population living below the poverty level (24.4%) is higher (Figure 2). However, the poverty level estimate is influenced by the resident college student population. Traditional poverty estimates exclude individuals who live in dormitories but include undergraduate and graduate students living in off-campus housing in the City limits. These students generally report low incomes and contribute to higher poverty rate estimates. When corrected for college students[8], the estimated average poverty level in Columbia drops from 24.4% to 13%, which is lower than levels reported for Missouri and the United States (Figure 2).

[8]Annie Rorem and Luke Juday. "How to modify poverty calculations for college towns." March 7, 2016. http://statchatva.org/2016/03/07/how-to-modify-poverty-calculations-for-college-towns/,accessed February 16, 2017.

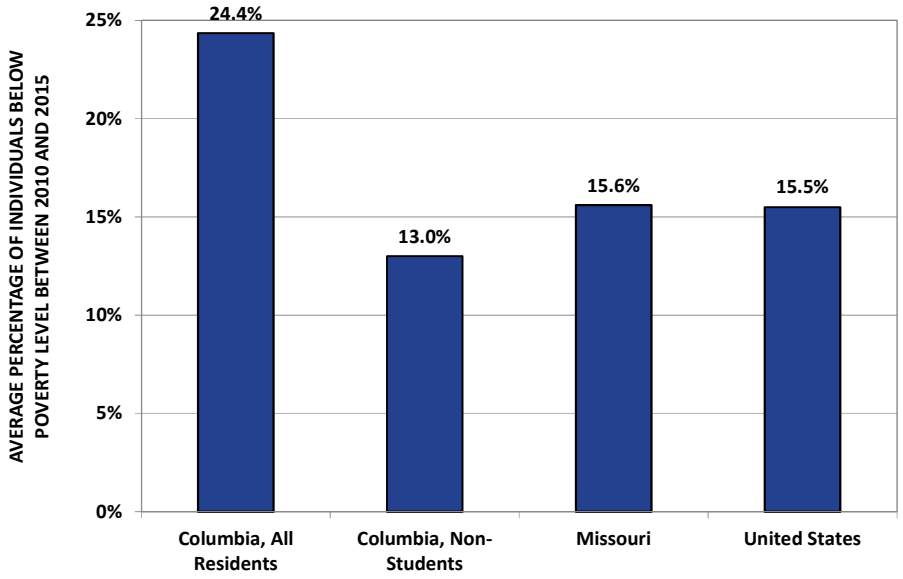

Figure 2. Comparison of 2015 Estimated Average Individual Poverty Rates in Columbia, Missouri, and the United States.

2.3 Median Income and Distribution

City-wide median income values provide a general estimate of income levels for the community. Median household income (MHI) is the 50th percentile of the sum of incomes of the householder and all other individuals in the household 15 years old and over, regardless of whether they are related to the householder. MHI estimates exclude students living in on-campus housing (e.g., dormitories, referred to in the census data as group quarters), but likely include those students living in off-campus housing (e.g. apartments, houses, condominiums). The MHI for Columbia is approximately $45,000 (Statewide MHI = $48,000).

As described in the previous section, when resident students were excluded from the poverty rate calculation, the estimated poverty rate decreased. Therefore, it is reasonable to expect that resident students have a similar impact on MHI in Columbia (skewing it downward). To address the potential impact of students on income estimates, median family income (MFI) was evaluated. MFI is the 50th percentile of the sum of incomes of all related members of a household who are 15 years or over. The MFI in Columbia is approximately $76,000 (Statewide MFI = $61,000). MFI likely provides a better indication of the median income of the City's permanent residents.

Although Columbia MHI and MFI estimates provide a broad measure of resident income, it is necessary to understand the distribution of incomes across the City to better characterize the potential hardships that residents who fall below the median may be facing. The 2015 ACS data show that number of households (13%) in Columbia that report incomes below $10,000 is higher than the number of families (4%, Figure 3). These results reinforce the impact of the

resident student population on socioeconomic metrics in Columbia. When resident students are excluded from the evaluation through application of the MFI, the percent of residents in each of the low-income brackets is more evenly distributed (Figure 3).

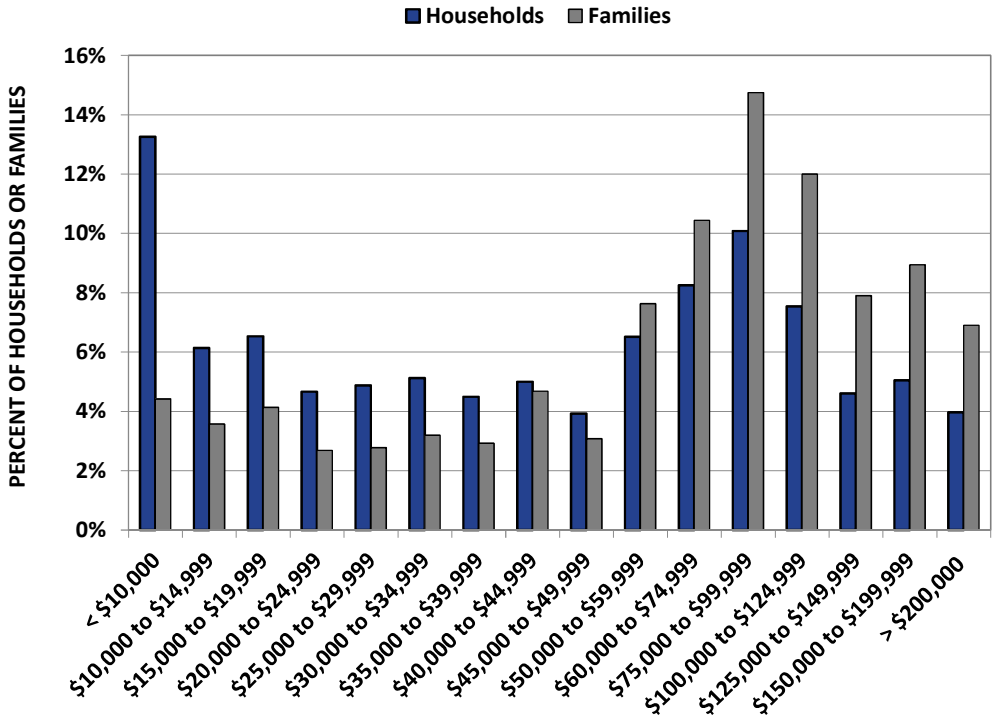

Figure 3. Household and Family Income Distributions in Columbia.

The review of indicators for Columbia shows that socioeconomic conditions in the City are generally strong when compared to state and national averages. However, there are disadvantaged segments of the community which warrant additional consideration. More specifically, the review demonstrates:

- Columbia's population has steadily grown. Since 2010, the population has increased by approximately 2% per year (approximately 10,700 people total).
- Approximately 21% (2,200 people) of the recent population increase can be attributed to an increase in college students who live within the City limts.
- Unemployment in the City (4.8%) is lower than state (7.5%) and national (8.3%) averages.
- The City's overall poverty rate (24.4%) is higher than state (15.6%) and national averages (15.5%) but is influenced by the resident college student population. When adjusted to account for resident college students, the rate decreases to 13%.
- The City's MHI is approximately $45,000, which is lower than the state estimate of $48,000. A review of the underlying income distribution across the City suggests that

college students living in off-campus housing report low incomes and reduce the overall MHI estimate for the City.

- The City's MFI is approximately $76,000, higher than the state estimate of $61,000. Because MFI estimates only include income from related individuals living in the same household, these results suggest that resident college students influence income metrics in the City.

Section 3. Census Tract Socioeconomic Evaluation

As discussed in Section 2, overall socioeconomic conditions in Columbia are generally strong but there are disadvantaged segments of the community which warrant additional consideration. In their most recent Strategic Plan[9], the City identified improving social equity as one of their top five priorities over the next three years. The City's goal is to improve social equity across the entire community and has identified three neighborhoods on which to initially focus their resources. The neighborhoods are located in north, central, and east Columbia. These neighborhoods were selected based on socioeconomic metrics related to income, poverty, unemployment housing, health care, crime rates, nutrition, and participation in assistance programs (Attachment A). The City is currently working with residents in these neighborhoods to develop actions aimed at improving equity issues.

To more closely align the IMP with goals outlined in the Strategic Plan, the City-wide evaluation presented in Section 2 was refined to provide a spatial understanding of socioeconomic conditions across Columbia and identify specific areas of the City that may be disadvantaged. Census tract boundaries were used to guide the evaluation because census tracts provide the highest resolution datasets for the socioeconomic metrics evaluated. Twenty-five census tracts are within or intersect Columbia's city limits (Attachment A). Fifteen of the census tracts evaluated span portions of both the City and Boone County and likely represent data from a mixture of City and BCRSD ratepayers.

The project team identified eight socioeconomic indicators of economic stress that could be used to identify disadvantaged areas of the City. These indicators are similar to those used to identify the City's three Strategic Plan neighborhoods and include MHI, MFI, poverty rates, occupancy rates, homeowner housing costs, renter housing costs, supplemental nutrition assistance program (SNAP) participation rates, and health insurance coverage rates. Using these indicators, the project team evaluated data from each census tract to determine if the tract met the following economic stress thresholds:

- MHI less than the City MHI ($45,000);
- MFI less than the City MFI ($76,000);
- MFI less than the Department of Housing and Urban Development (HUD) definition of low income for the City (less than 80% of the MFI of the City, $60,800);
- MFI less than the HUD definition of very low income (less than 50% of the MFI of the City, $35,500);
- Poverty level higher than that of the City (24%);
- Poverty level, excluding students, higher than that of the City (13%),
- Percent of renter-occupied housing units higher than that of the City (52%);
- Percent of homeowners paying more than 30% of their income in housing costs exceeds 50%;

[9] City of Columbia, Missouri. 2015. Strategic Plan 2016-2019. https://www.como.gov/wp-content/uploads/2016-2019-Strategic-Plan.pdf

- Percent of renters paying more than 30% of their income in housing costs exceeds 50%;
- Percent of residents receiving SNAP assistance higher than that of the City (10%); or
- Percent of residents without health insurance less than that of the City (8%).

Using these indicators, the team developed a matrix to assess overall economic stress in the individual tracts (Table 1). Tracts exceeding the indicator thresholds were marked with an "X" and were qualitatively categorized according to potential stress based on the proportion of indicators exceeded (Economic Stress Indicator). Four tracts exceeded more than 80% of the indicators, suggesting a strong potential for economic stress (red). Four tracts exceeded at least 60% of the indicators and (orange) and three tracts exceeded at least 40% of the indicators (yellow), suggesting a moderate and low potential for economic stress. The remaining fourteen tracts do not currently exhibit the potential for economic stress (Attachment B).

Table 1. Summary of Socioeconomic Stress Indicators across Columbia Census Tracts.

Census Tract Number	Percent of Census Tract in City Limits	Below City Median Household Income	Below City Median Family Income	Below HUD Low Income	Below HUD Very Low Income	Above City Poverty Level	Above City Non-Student Poverty Level	Above City Renter Occupied Rate	More than 50% of Home Owners Paying > 30% of Income	More than 50% of Renters Paying > 30%of Income	Above City SNAP Assistance Rate	Below City Health Insurance Coverage Rate	Economic Stress Indicator*
Tract 02	100	x	x	x	x	x	x	x		x	x	x	**0.91**
Tract 03	100	x	**	**	**	x		x		x			**0.36**
Tract 05	100	x	**	**	**	x	x	x		x	x		**0.55**
Tract 06	100									x			**0.09**
Tract 07	100	x	x	x		x	x	x		x	x	x	**0.82**
Tract 09	100	x	x	x	x	x	x	x	x	x	x	x	**1.0**
Tract 10.01	100	x				x		x		x			**0.36**
Tract 10.02	74									x		x	**0.18**
Tract 11.01	65	x	x	x		x	x	x		x		x	**0.73**
Tract 11.03	91												**0.0**
Tract 11.04	57									x			**0.09**
Tract 12.01	100									x		x	**0.18**
Tract 12.02	96												**0.0**
Tract 13	93	x	x	x		x	x	x			x	x	**0.73**
Tract 14	51		x							x	x		**0.27**
Tract 15.02	72	x	x	x		x	x	x			x	x	**0.73**
Tract 15.03	53	x	x	x		x	x			x	x	x	**0.73**
Tract 15.04	94	x	x	x						x	x	x	**0.55**
Tract 16.01	12							x			x	x	**0.27**
Tract 16.02	3		x								x	x	**0.27**
Tract 17.02	1									x			**0.09**
Tract 18.05	11												**0.0**
Tract 21	100	x	x	x	x	x	x	x	x	x	x	x	**1.0**
Tract 22	100	x	**	**	**	x	x	x		x			**0.45**
Columbia (City-Wide)**	NA	x			x								**0.18**

*The Economic Stress Indicator represents the proportion of indicators exceeded in a census tract. Red shading indicates a significant potential for economic stress (indicator > 0.80, or more than 80% of metrics exceeded). Orange shading indicates a moderate potential for economic stress (indicator > 0.60, or 60% of metrics exceeded). Yellow shading indicates a low potential for economic stress (indicator > 0.4, or 40% of metrics exceeded).

**These tracts do not report families.

***Except for the percent of homeowner and renters paying more than 30% of their income in housing costs, the metrics for Columbia were compared to the state of Missouri.

Section 4. Residential Billing Impact Analysis

The socioeconomic review presented in previous sections is valuable because it helps characterize existing conditions and serves as a screening tool for identifying potentially disadvantaged areas in and around the City. These analyses are useful for qualitatively understanding which segments of the community may be impacted by increased wastewater and stormwater service costs, but do not quantify or forecast the magnitude of those impacts. To better understand the extent of potential affordability issues in Columbia, the qualitative socioeconomic review are combined with a quantitative assessment of future financial impacts.

In the context of implementing the IMP, potential financial impacts are measured most directly through an evaluation of existing and anticipated wastewater and stormwater bills. As discussed in Section 1, the current average residential sewer bill in Columbia is approximately $27.50 per month (assuming 5,000 gallons per month consumption). According to the most recent rate survey conducted by the Missouri Public Utilities Alliance (MPUA), Columbia's average sewer bill is lower than most other large cities or sewer districts in Missouri (Figure 4). Although Columbia is one of the few cities in Missouri that has implemented a stormwater tax (average $1.66 per residential user per month), the combined monthly bill for wastewater and stormwater services is still low when compared to the cities referenced in the MPUA survey.

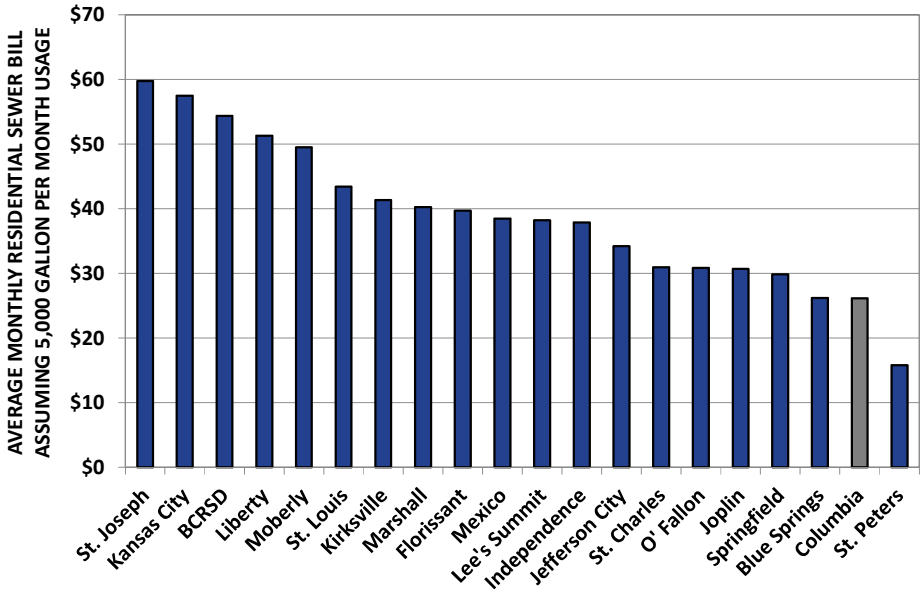

Figure 4. Average Monthly Residential Sewer Bills for Select Missouri Cities. The average monthly bill is calculated assuming 5,000 gallon per month usage.

An important consideration for this affordability evaluation is understanding potential financial impacts that residential ratepayers may experience as the IMP is implemented over time. These impacts are analyzed in the sections that follow.

4.1 IMP Alternatives

As discussed in Technical Memorandum 9, the project team developed suites of wastewater treatment, wastewater collection, and stormwater management alternatives to address system needs, current and anticipated regulatory drivers, and City goals over the next 20 years (the IMP planning period). The alternatives included maintaining existing funding levels or increasing funding to three (Level 1, Level 2, and Level 3) potential higher levels designed to address system needs and goals in an increasingly proactively manner.

Because the City is interested in implementing IMP wastewater and stormwater alternatives that cost-effectively provide the greatest benefit to the community over the 20-year planning period, the project team used a decision analysis tool to identify the funding level that best satisfied that goal. Through that analysis, the team determined that an "Optimized" funding level could be developed by combining the projects that provided the best value from among the four initial funding levels (Table 1).

Table 2. Summary of IMP Alternative Costs and Benefits.

IMP Funding Alternative	20-Year Sewer System Cost (in Millions)	20-Year Stormwater System Cost (in Millions)	Total 20-Year Program Cost (in Millions)	MCDA Incremental Benefit Score
Existing	$488	$70	$558	0.15
Level 1	$803	$163	$966	0.52
Level 2	$893	$237	$1,130	0.79
Level 3	$997	$376	$1,373	0.32
Optimized	**$828**	**$224**	**$1,055**	**0.81**

Before implementing the Optimized alternative, the City must evaluate its impact relative to community affordability and residential monthly bills. To facilitate this analysis, the City applied their existing stormwater and wastewater rate models to forecast future residential user rates based on 20-year cash flows developed for each funding level alternative. Residential bill projections for the existing sewer funding level were calculated assuming rates would increase by 3.1% per year before inflation[10]. For the existing stormwater funding level, bill projections also assume a 3.1% per year average annual increase after the currently scheduled rate increases expire in 2020.

If the City continued funding the Stormwater and Sewer Utilities at existing levels, the average monthly stormwater and sewer bills will increase to $3.80 and $48.51 per month (in 2017 dollars), respectively, by 2036 (Figure 5). Under the three IMP alternatives, average monthly stormwater bills could increase to between $9.12 and $22.51 (in 2017 dollars) and average sewer bills could increase to between $45.46 and $59.90 (in 2017 dollars). The analysis also

[10] According to the National Association of Clean Water Agencies (NACWA) *2016 Cost of Clean Water Index*, the average cost of wastewater services has increased by an average of 3.1% per year before inflation over the last 10 years. The NACWA report may be accessed from http://www.nacwa.org/docs/default-source/news-publications/White-Papers/2017-05-18nacwa_index.pdf?sfvrsn=4

shows that residential stormwater bills for the three IMP alternatives increase at a faster rate than residential sewer bills. This difference is a product of historic underfunding of the stormwater system (see Technical Memoranda 4 and 7) and indicates that relatively more funding is needed to "catch-up" to address stormwater issues.

As noted throughout this memorandum, EPA's 1 to 2% MHI threshold range alone is not a sufficient indicator for characterizing potential financial impacts. However, it does serve as a reasonable starting point for the assessment. The billing analysis shows that the average total monthly sewer and stormwater bill for Levels 3 is above the upper end of this threshold range (2% MHI, see Figure 4 and Attachment C). The average monthly bill in Level 3 also increases at a faster rate during the 20-year planning period than the other alternatives. Together, these results suggest that Level 3 funding is not an affordable alternative. Similarly, average monthly bills for Level 2 (approximately $78) would also exceed the MHI threshold in 2036 (Figure 5). Therefore, it is reasonable to assume that Level 2 is likely not affordable for all segments of the community.

Among the remaining IMP alternatives, the Optimized funding level is preferable because it provides the most overall value to the community (Table 2) and average total monthly bills remain below 2% of MHI throughout the planning period. In the next section, future billing impacts associated with implementing the Optimized funding level are evaluated on a census tract basis to assess the potential geographic distribution of impacts across the City.

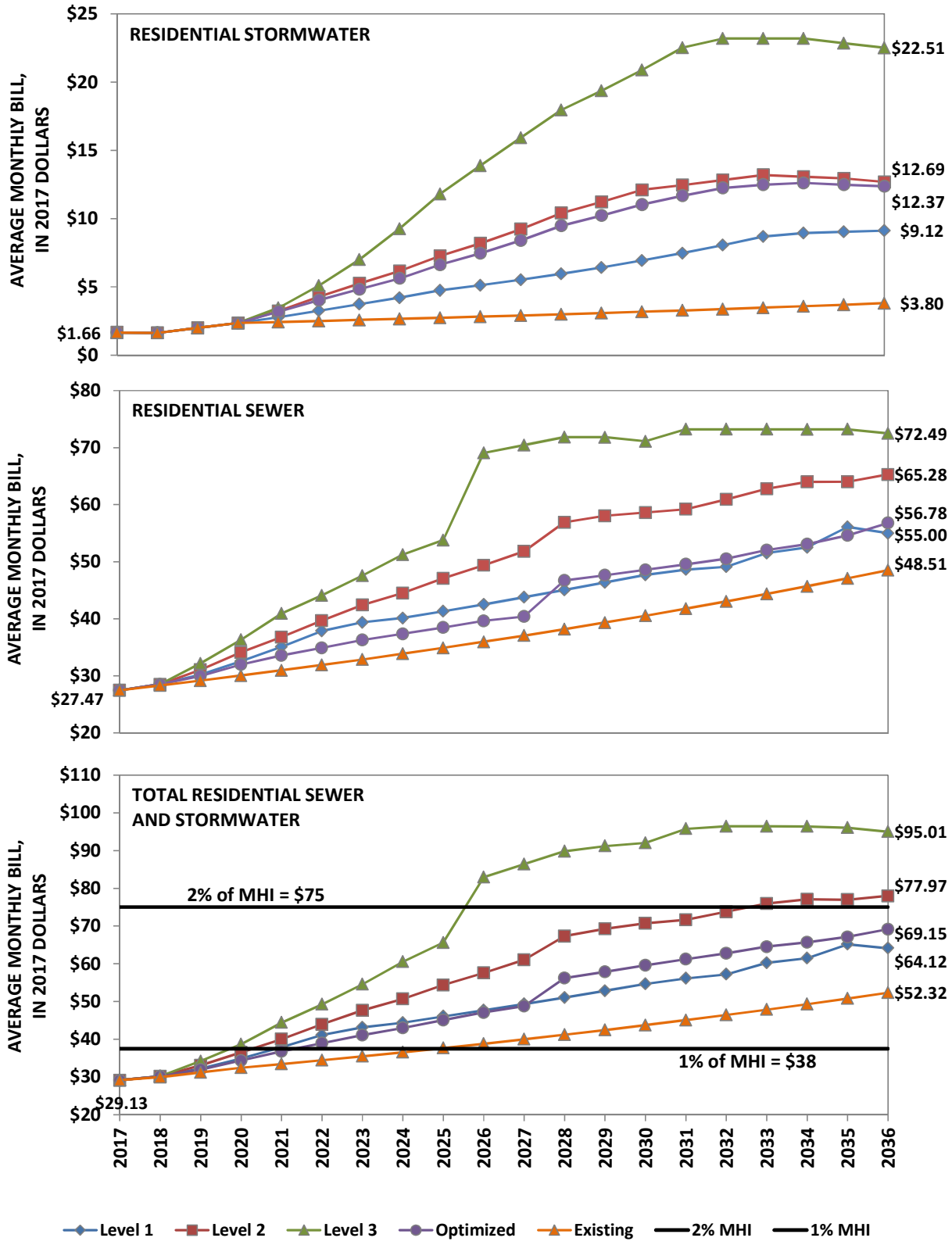

Figure 5. Anticipated Average Monthly Sewer and Stormwater Bills (in 2017 Dollars) for Each of the IMP Alternatives. Sewer bills were calculated assuming 5,000 gallon per month average usage.

4.2 Existing and Projected Billing in Census Tracts

The City provided monthly billing data by account for 2012 through 2014. The residential billing data was aggregated by year for each account to estimate the average monthly sewer bill per census tract. Additionally, the 2017 stormwater rates were used to calculate the average monthly residential stormwater bill per census tract. Collectively, these data represent an estimate of the existing average monthly sewer and stormwater service costs for residential ratepayers in the City based on actual usage (Figure 6).

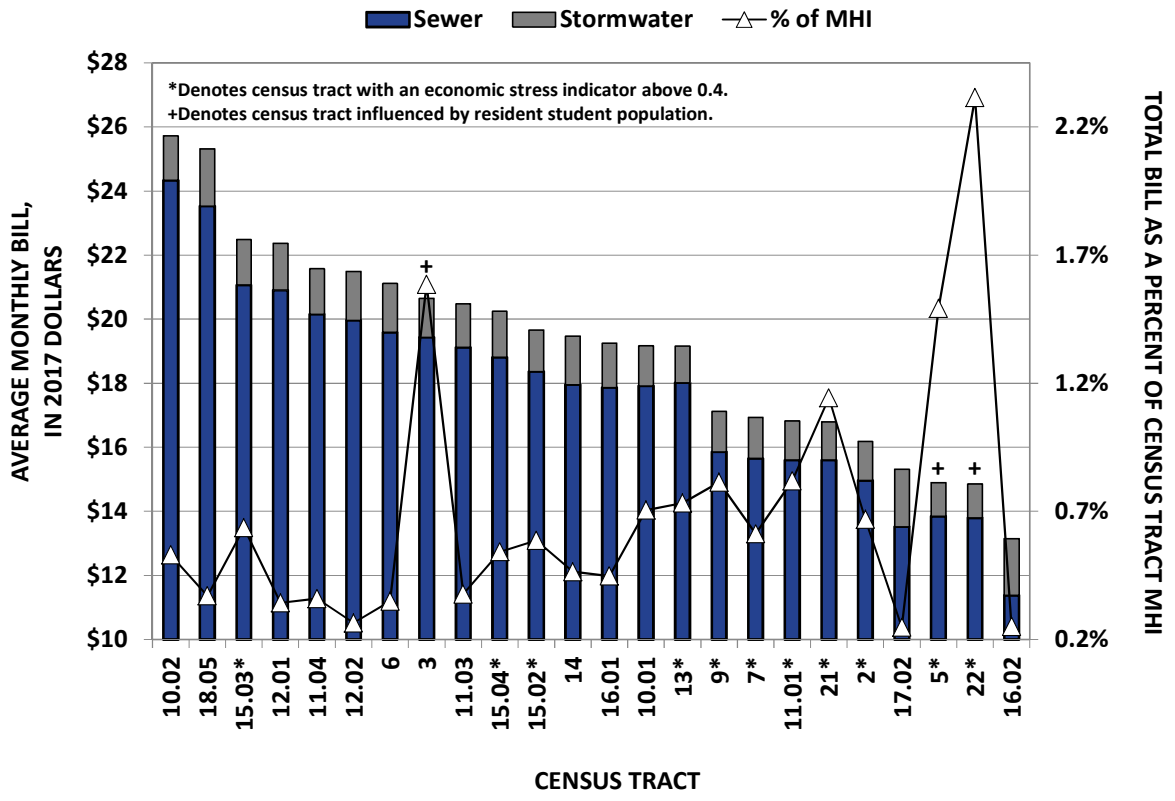

Figure 6. Existing Average Monthly Sewer and Stormwater Bills (in 2017 Dollars) across Columbia Census Tracts. Sewer bills were calculated based on actual usage in each census tract.

Existing total average monthly bills in the census tracts range from approximately $13 to nearly $26 per month, with sewer bills representing the majority of the cost (Figure 6). Only one census tract which is likely heavily influenced by student populations (Tract 22) currently pays more than 2% of their MHI and most tracts currently pay less than 1%. Because residential sewer bills across the City are calculated using the same base and volume charges, the difference in sewer cost between census tracts reflects the difference in actual volume used. These results demonstrate that sewer usage across the City is generally less than the 5,000 gallons per month (equivalent to $27.50 per month) typically assumed for these analyses. Furthermore, the analysis shows that users in economically stressed census tracts use relatively less wastewater services than non-stressed census tracts but pay a higher percentage of their income for those services.

To understand the potential impacts of the Optimized funding level on future bills across the City, average monthly bills were estimated for each census tract at the end of the IMP planning period in 2036. Sewer bills (in 2017 dollars) were estimated by applying the future base and volume rates provided by the City for each IMP alternative to the usage volumes calculated from the 2012 to 2014 sewer bill data. The future stormwater bills were estimated by multiplying the projected Optimized rates (in 2017 dollars) by the existing ratio of average census tract bill to the average city-wide bill.

According to the evaluation, total average bills for the Optimized alternative range from $36 to $61 per month (in 2017 dollars) across census tracts by the end of the 20-year planning period (Figure 7). As with the existing bills, census tracts with the highest percentage of economic stress indicators tend to have lower bills but pay a higher percent of their MHI. The analysis also shows that six census tracts could pay at least 2% of their MHI, but three of those (Tracts 3, 5, and 22) are heavily influenced by the student population.

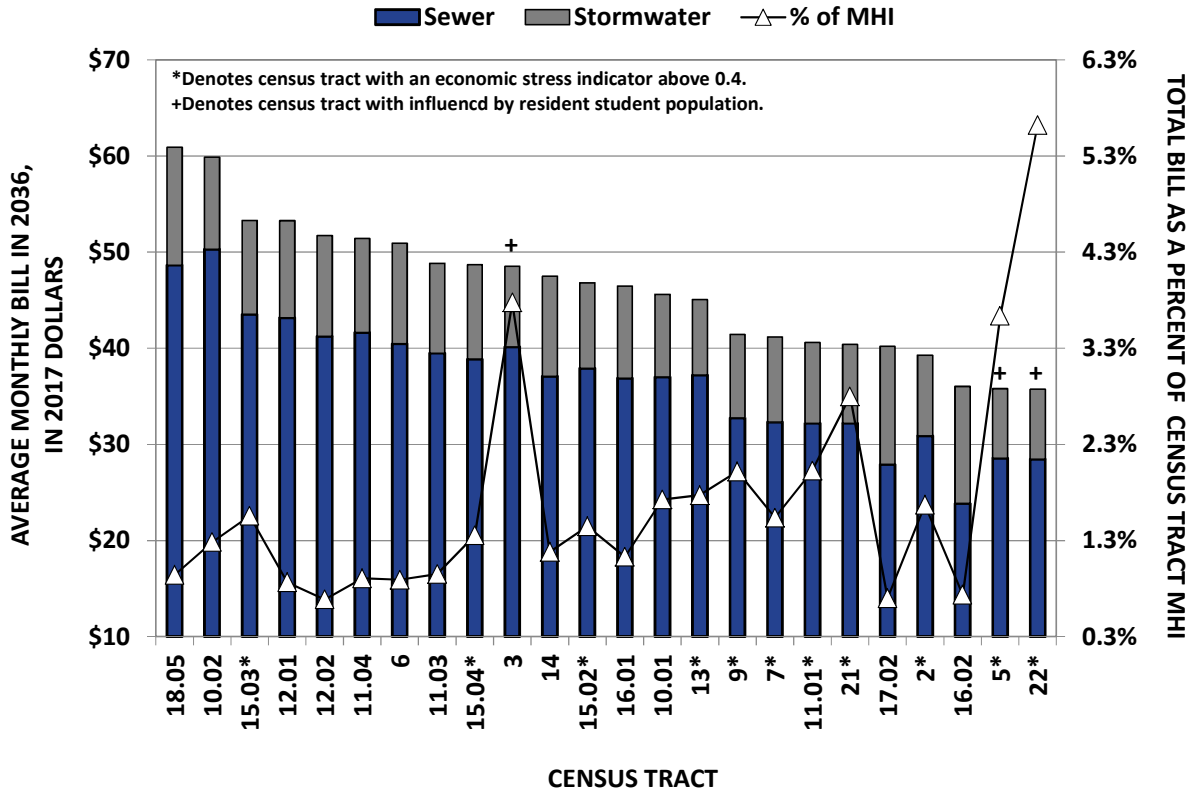

Figure 7. Future Average Monthly Sewer and Stormwater Bills (in 2017 Dollars) across Census Tracts that Result from Implementing the Optimized Alternative. Sewer bills were calculated based on actual usage in each census tract.

4.3 Residential Affordability Analysis

To characterize the extent of potential residential affordability issues associated with implementing the Optimized IMP alternative, results of the qualitative socioeconomic review (Table 1) were combined with the quantitative assessment of future billing impacts (Figure 5). This analysis includes comparison of the projected 2036 residential bill as a percent of projected MHI (assuming a 2% annual increase) in each census tract to the economic stress indicator in each tract.

The analysis assumes that 2% of MHI (EPA's suggested threshold) and 0.6 economic stress indicator (from Table 1) are appropriate thresholds for identifying potentially impacted census tracts. Using these thresholds, census tracts that will pay less than 2% of MHI and have less an economic stress indicator below 0.6 (Quadrant I) are expected to have a low potential to experience affordability impacts (Figure 8). Conversely, census tracts that will pay more than 2% of MHI and have an economic stress indicators above 0.6 (Quadrant IV) are expected to have a high potential to experience affordability impacts. Census tracts that exceed either the MHI (Quadrant II) or economic stress (Quadrant III) threshold are expected to have a moderate potential to experience impacts.

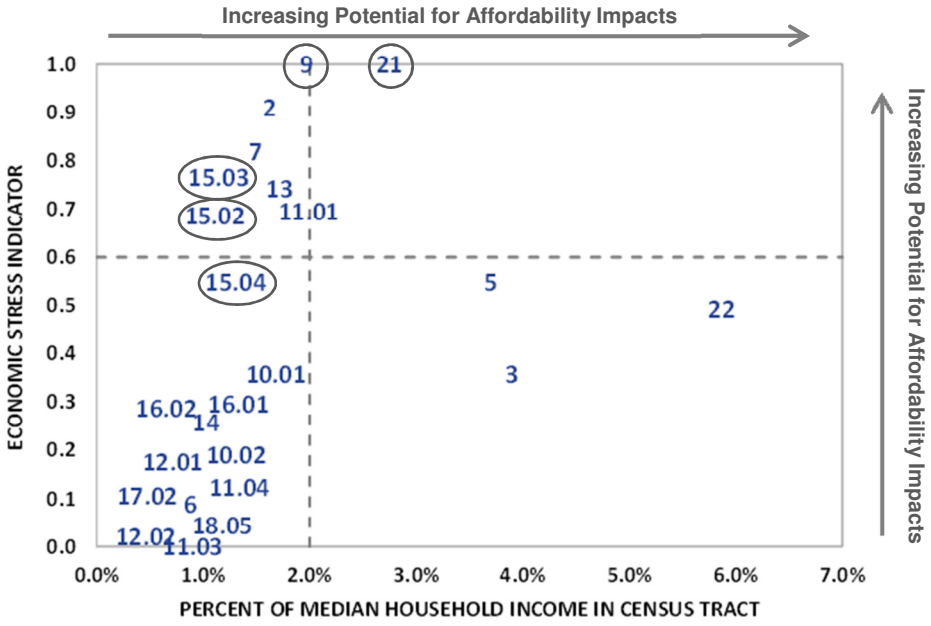

Figure 8. Evaluation of the Potential for Affordability Impacts across Columbia Census Tracts during the 20-Year IMP Planning Period. The numbers in the graph represent the census tract identification number. Circles around the numbers indicate that the census tract includes one of the three social equity neighborhoods identified in the Strategic Plan. The analysis excludes census tracts most heavily influenced by the resident student population (Tracts 3, 5, and 22).

Results of the analysis demonstrate that 12 of the census tracts (Quadrant I) are not expected to experience significant affordability issues over the IMP planning period as a result of implementing the Optimized alternative (Figure 8). Of the remaining tracts, nine equal or exceed

at least one of the evaluation thresholds (Quadrants II and III) and three (Quadrant IV) equal or exceed both thresholds. Two of the census tracts in Quadrant IV (9 and 21) include the entire central neighborhood identified in the Strategic Plan.

Although the three census tracts (9, 11.01, and 21) in Quadrant IV may have significant potential to face affordability impacts, average total monthly bills will increase gradually and will not approach potentially unaffordable level of 2% MHI until 2028 (Tract 21, Figure 9). It is also important to note that the forecasted billing impacts presented here are currently based on planning level cost estimates and must be reevaluated as the City gathers additional data during IMP implementation. As part of the IMP implementation process, City plans to reevaluate regulatory requirements and refine projected sewer and stormwater program needs, costs, and bill impacts every 5 to 10 years.

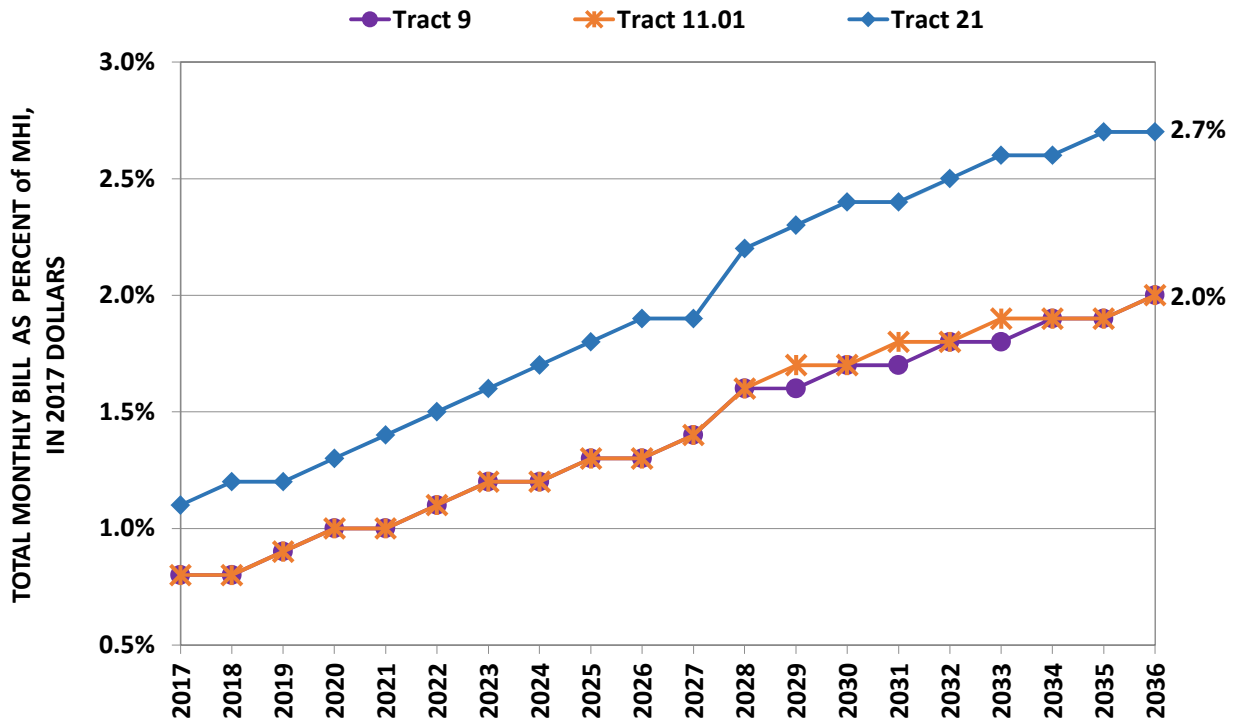

Figure 9. Future Average Total Monthly Bills (in 2017 Dollars) as a Percentage of Median Household Income in Census Tracts with the Greatest Potential to Experience Affordability Impacts.

Section 5. Summary

As part of the IMP process, the City and their project team identified a series of potential wastewater treatment, wastewater collection, and stormwater system alternatives to address infrastructure and environmental needs that are important to Columbia residents. The purpose of this memorandum was to evaluate and identify potential affordability issues that could result from implementing those alternatives.

The IMP affordability evaluation included a review of both the overall existing socioeconomic conditions in the City and potential future financial impacts related to increased wastewater and stormwater service costs. The evaluation was structured such that it incorporates elements of the City's most recent Strategic Plan, which identified improving social equity as one of the top five priorities over the next three years. Results of the evaluation are summarized below.

- **Overall Socioeconomic Conditions –** The project team found that resident college students skew results of important socioeconomic metrics such as population, poverty levels, and income. When metrics are corrected to account for the students, overall socioeconomic conditions in the City are generally strong. However, there are disadvantaged segments of the community which warrant additional consideration. More specifically, the project team evaluated economic stress indicators across the 25 census tracts in the City and found that four tracts, primarily located in central Columbia, exhibited a strong potential for economic stress (Table 1). Seven other tracts exhibited a low to moderate potential for economic stress.

- **Residential Billing Impacts –** The project team developed suites of wastewater treatment, wastewater collection, and stormwater management alternatives to address system needs, current and anticipated regulatory drivers, and City goals over the next 20 years. The alternatives included maintaining existing funding levels, increasing funding to three (Levels 1, 2, and 3) potential higher levels designed to address system needs and goals in an increasingly proactively manner, or implementing an Optimized alternative. The City applied their existing stormwater and wastewater rate models to forecast future residential user rates and bills based on 20-year cash flows developed for each funding level alternative. Rate structures were maintained at current base and volume charge ratios for rate and bill forecasting. Analysis of the resulting average monthly bills indicated that the Optimized funding level is the preferred alternative since it provides the most overall value to the community. Under the Optimized alternative, average community-wide stormwater and sewer bills would increase to approximately $12 and $46 dollars per month (in 2017 dollars), respectively by 2036.

Results from the socioeconomic and residential billing impact evaluation were combined into an overall affordability analysis to characterize the spatial extent of potential economic impacts and affordability issues associated with implementing the Optimized IMP alternative. The analysis indicated that three census tracts have significant potential to experience affordability issues by the end of the planning period in 2036, with two of those three tracts being located within the central neighborhood identified in the City's Strategic Plan.

Over the next 10 years however, average total monthly bills in those tracts will increase gradually and will not approach potentially unaffordable levels until 2028. Because the forecasted impacts presented here are currently based on planning level cost estimates, they will likely change as the City gathers additional during IMP implementation. Additionally, changes in regulatory requirements, program needs, or socioeconomic conditions across the City may also influence future affordability projections. Therefore, the City understands that it will be important to refine projected sewer and stormwater program needs, costs, and bill impacts every 5 to 10 years during IMP implementation.

Results of the affordability and socioeconomic evaluation suggest that the Optimized alternative will be affordable to residential ratepayers over the first 10 years of IMP implementation. The City should therefore move forward with implementing the Optimized alternative while also gathering the information and data needed to refine cost estimates and billing impact projections in the next 10 years. To that end, the City should prepare a 5-year plan that outlines initial IMP projects that will be pursued to develop the information and data necessary to refine program needs, costs, and billing impacts over the remainder of the IMP planning period.

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Attachment A

Columbia Census Tracts

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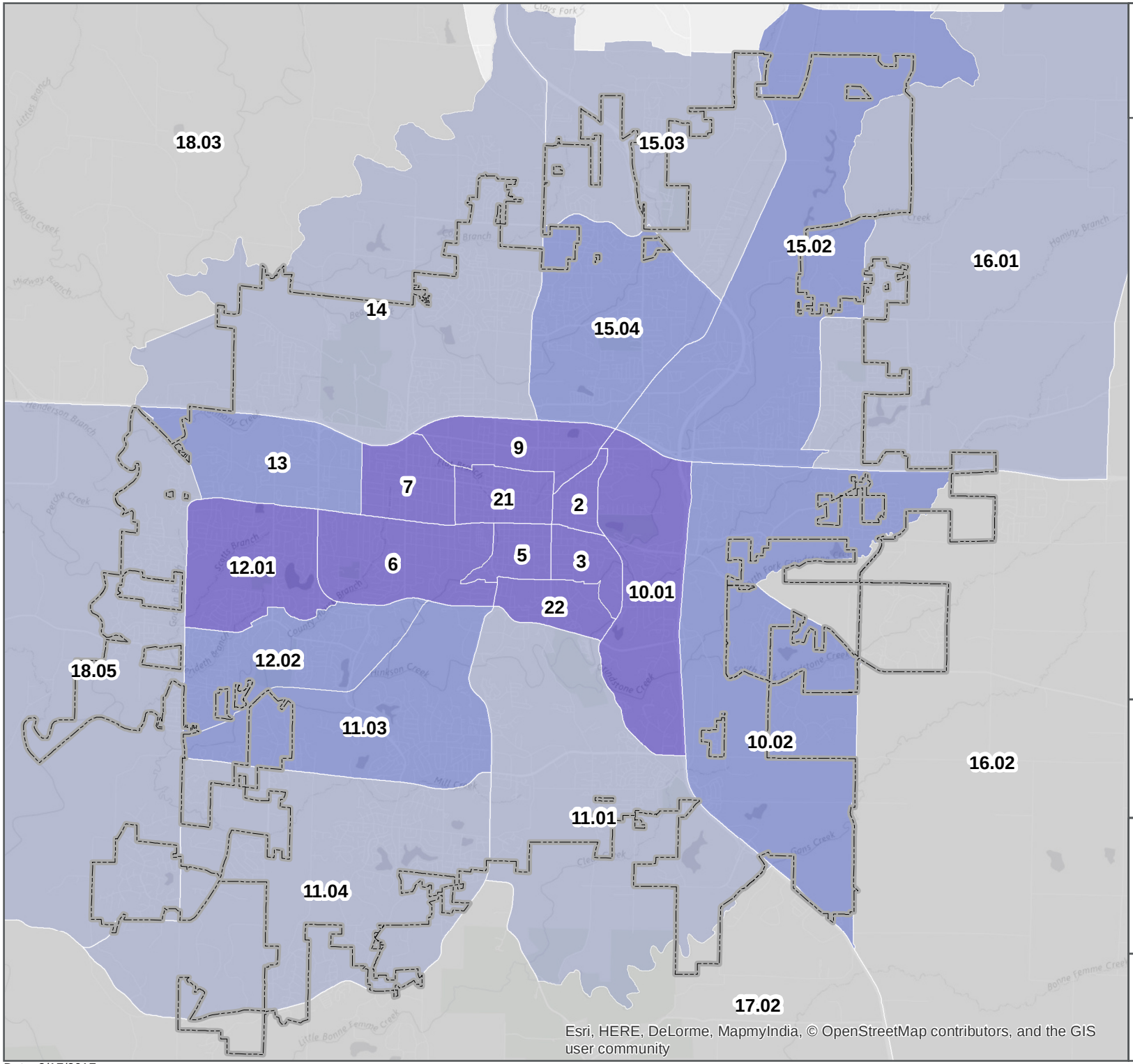

Our Columbia Waters
Integrated Management Plan
Wastewater & Stormwater

LEGEND

- In City limits
- Primarily in City
- City border
- Primarily outside City

Tract	Percent Within City
2	100%
3	100%
5	100%
6	100%
7	100%
9	100%
10.01	100%
10.02	74%
11.01	65%
11.03	91%
11.04	57%
12.01	100%
12.02	96%

Tract	Percent Within City
13	93%
14	51%
15.02	72%
15.03	53%
15.04	94%
16.01	12%
16.02	3%
17.02	1%
18.03	0.01%
18.05	11%
21	100%
22	100%

CENSUS TRACTS

CITY OF COLUMBIA MISSOURI

WASTEWATER & STORMWATER INTEGRATED MANAGEMENT PLAN

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Technical Memorandum 10

Attachment B

Census Tract Economic Stress Indicator Scores

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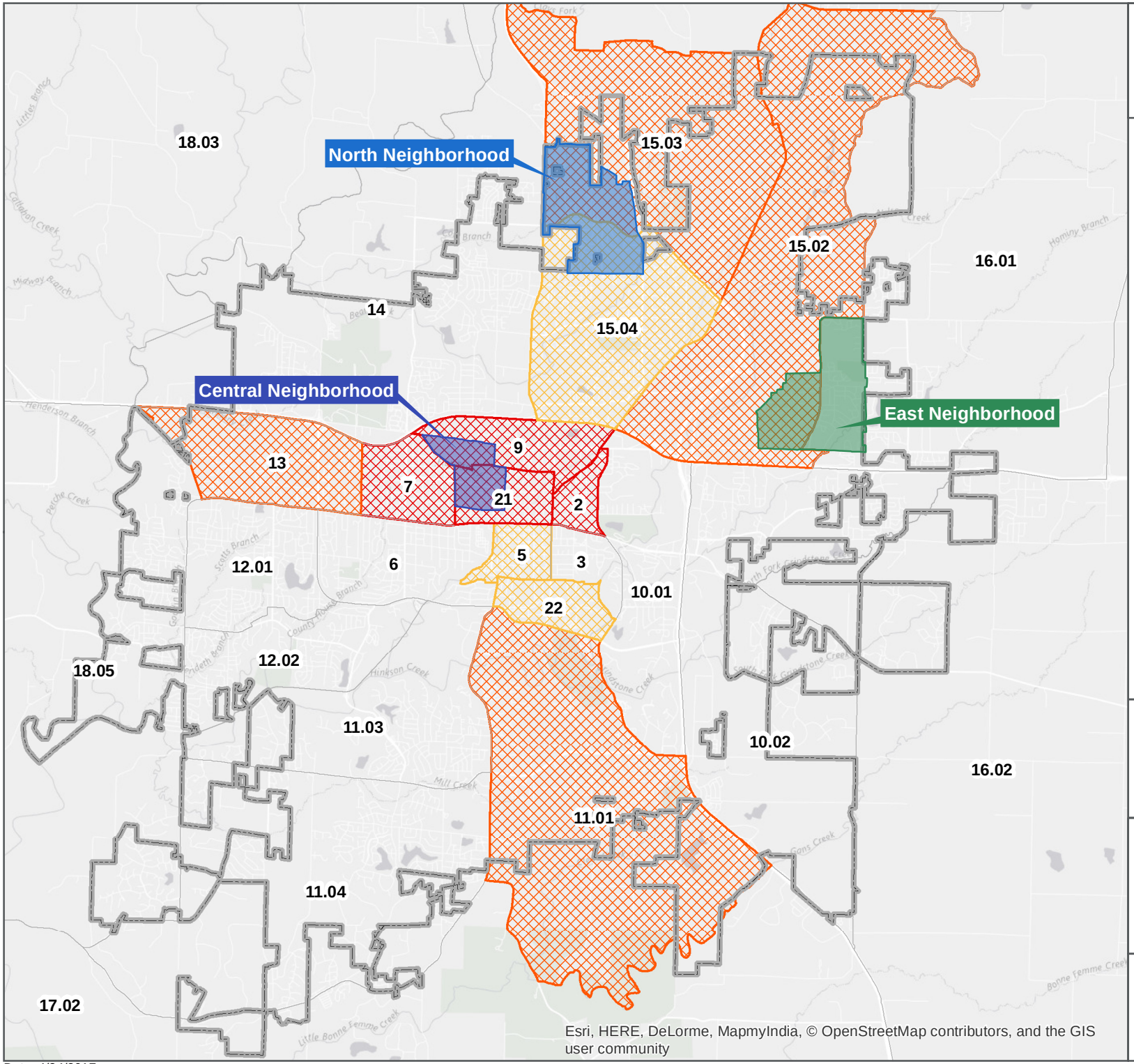

Our Columbia Waters
Integrated Management Plan
Wastewater & Stormwater

LEGEND

Economic Metrics

- < 40%
- 40 - 60%
- 60 - 80%
- > 80%

Tract	Percent Within City
2	100%
3	100%
5	100%
6	100%
7	100%
9	100%
10.01	100%
10.02	74%
11.01	65%
11.03	91%
11.04	57%
12.01	100%
12.02	96%

Tract	Percent Within City
13	93%
14	51%
15.02	72%
15.03	53%
15.04	94%
16.01	12%
16.02	3%
17.02	1%
18.03	0.01%
18.05	11%
21	100%
22	100%

ECONOMIC METRICS CENSUS TRACTS

CITY OF COLUMBIA MISSOURI

WASTEWATER & STORMWATER INTEGRATED MANAGEMENT PLAN

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Technical Memorandum 10

Attachment C

Residential Bill Projections

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Attachment C. Residential Bill Projections.

Attachment C.1. Projected Average Monthly Sewer (assuming 5,000 gallons) and Stormwater Bills (in 2017 Dollars) for Each of the IMP Alternatives.

Year	Residential Sewer					Residential Stormwater					Total Residential Sewer and Stormwater				
	Existing	Level 1	Level 2	Level 3	Optimized	Existing	Level 1	Level 2	Level 3	Optimized	Existing	Level 1	Level 2	Level 3	Optimized
2017	$27.47	$27.47	$27.47	$27.47	$27.47	$1.66	$1.66	$1.66	$1.66	$1.66	$29.13	$29.13	$29.13	$29.13	$29.13
2018	$28.30	$28.52	$28.52	$28.52	$28.52	$1.63	$1.63	$1.63	$1.63	$1.63	$29.93	$30.15	$30.15	$30.15	$30.15
2019	$29.16	$30.19	$31.06	$32.17	$29.95	$2.00	$2.00	$2.00	$2.00	$2.00	$31.16	$32.19	$33.06	$34.17	$31.95
2020	$30.05	$32.54	$34.13	$36.30	$31.98	$2.36	$2.36	$2.36	$2.36	$2.36	$32.41	$34.90	$36.48	$38.66	$34.34
2021	$30.96	$35.11	$36.78	$40.92	$33.58	$2.43	$2.77	$3.23	$3.46	$3.19	$33.39	$37.88	$40.01	$44.39	$36.76
2022	$31.90	$37.87	$39.70	$44.11	$34.90	$2.50	$3.26	$4.28	$5.10	$4.03	$34.40	$41.13	$43.98	$49.21	$38.93
2023	$32.87	$39.37	$42.41	$47.55	$36.27	$2.58	$3.74	$5.25	$7.00	$4.82	$35.45	$43.11	$47.66	$54.55	$41.09
2024	$33.87	$40.12	$44.49	$51.26	$37.35	$2.66	$4.21	$6.17	$9.26	$5.62	$36.53	$44.34	$50.67	$60.52	$42.97
2025	$34.90	$41.31	$47.09	$53.79	$38.47	$2.74	$4.75	$7.26	$11.81	$6.62	$37.64	$46.06	$54.35	$65.60	$45.09
2026	$35.96	$42.52	$49.37	$69.07	$39.63	$2.82	$5.12	$8.19	$13.89	$7.46	$38.78	$47.65	$57.56	$82.96	$47.09
2027	$37.06	$43.77	$51.81	$70.44	$40.39	$2.91	$5.52	$9.23	$15.93	$8.41	$39.96	$49.30	$61.04	$86.37	$48.80
2028	$38.18	$45.05	$56.90	$71.84	$46.73	$2.99	$5.96	$10.41	$17.96	$9.48	$41.18	$51.01	$67.31	$89.80	$56.21
2029	$39.34	$46.36	$58.04	$71.81	$47.64	$3.08	$6.43	$11.22	$19.37	$10.23	$42.43	$52.79	$69.27	$91.18	$57.86
2030	$40.54	$47.71	$58.61	$71.11	$48.58	$3.18	$6.93	$12.10	$20.89	$11.03	$43.72	$54.64	$70.71	$92.00	$59.60
2031	$41.77	$48.62	$59.20	$73.21	$49.54	$3.27	$7.47	$12.46	$22.53	$11.68	$45.04	$56.10	$71.66	$95.74	$61.22
2032	$43.04	$49.12	$60.94	$73.23	$50.53	$3.37	$8.06	$12.83	$23.19	$12.25	$46.41	$57.17	$73.77	$96.42	$62.78
2033	$44.35	$51.52	$62.76	$73.22	$52.04	$3.48	$8.69	$13.20	$23.19	$12.49	$47.82	$60.21	$75.97	$96.41	$64.53
2034	$45.70	$52.51	$64.00	$73.20	$53.07	$3.58	$8.95	$13.07	$23.19	$12.61	$49.28	$61.45	$77.07	$96.40	$65.68
2035	$47.08	$56.10	$64.02	$73.21	$54.62	$3.69	$9.03	$12.95	$22.85	$12.49	$50.78	$65.13	$76.96	$96.06	$67.11
2036	$48.51	$55.00	$65.28	$72.49	$56.78	$3.80	$9.12	$12.69	$22.51	$12.37	$52.32	$64.12	$77.97	$95.01	$69.15