City of Aurora General Employees' Retirement Plan

Experience Study: 2014 - 2018

February 2020

Joel E. Stewart, FSA, EA, MAAA
Francine Moyer, ASA, MAAA

Milliman

February 17, 2020

Board of Trustees
City of Aurora General Employees' Retirement Plan
12100 E. Iliff Avenue, Suite 108
Aurora, Colorado 80014

Dear Members of the Board:

As requested, we have performed an experience study of the City of Aurora General Employees' Retirement Plan ("Plan") for the period January 1, 2014 through December 31, 2018. Our findings are set forth in this report.

In preparing this report, we relied, without audit, on information (some oral and some in writing) supplied by Plan staff. This information includes, but is not limited to, plan provisions, member census data, and financial information. We found this information to be reasonably consistent and comparable with information used for other purposes. The results depend on the integrity of this information. If any of this information is inaccurate or incomplete our results may be different and our calculations may need to be revised.

The purpose of this report is to communicate the results of our review of the economic and demographic assumptions to be used in the completion of the upcoming actuarial valuation. Several of our recommendations represent changes from the prior valuation assumptions and are designed to better anticipate the emerging experience of the Plan, in our professional opinion.

We have provided financial information showing the estimated impact of the recommended assumptions, if they had been reflected in the January 1, 2019 actuarial valuation. We believe the recommended assumptions provide a reasonable estimate of anticipated future experience affecting the Plan. Nevertheless, the emerging costs will vary from those presented in this report to the extent that actual experience differs from that projected by the actuarial assumptions.

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the Plan's funded status); and changes in plan provisions or applicable law. Due to the limited scope of our assignment, we did not perform an analysis of the potential range of future measurements. The Board has the final decision regarding the appropriateness of the assumptions and actuarial cost methods.

This experience study report recommends assumptions to be used in the valuation to provide an estimate of the Plan's financial condition as of a single date. The valuation can neither predict the Plan's future condition nor guarantee future financial soundness. Actuarial valuations do not affect the ultimate cost of Plan benefits, only the timing of Plan contributions. While the valuation is based on an array of individually

reasonable assumptions, other assumption sets may also be reasonable and valuation results based on those assumptions would be different. No one set of assumptions is uniquely correct. Determining results using alternative assumptions is outside the scope of our engagement.

Milliman's work is prepared solely for the use and benefit of the City of Aurora General Employees' Retirement Plan ("Plan"). To the extent that Milliman's work is not subject to disclosure under applicable public records laws, Milliman's work may not be provided to third parties without Milliman's prior written consent. Milliman does not intend to benefit or create a legal duty to any third party recipient of its work product. Milliman's consent to release its work product to any third party may be conditioned on the third party signing a Release, subject to the following exception(s):

(a) The Plan may provide a copy of Milliman's work, in its entirety, to the Plan's professional service advisors who are subject to a duty of confidentiality and who agree to not use Milliman's work for any purpose other than to benefit the System.

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No third party recipient of Milliman's work product should rely upon Milliman's work product. Such recipients should engage qualified professionals for advice appropriate to their own specific needs.

The consultants who worked on this assignment are pension actuaries. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel.

The signing actuary is independent of the plan sponsor. I am not aware of any relationship that would impair the objectivity of Milliman's work.

On the basis of the foregoing, I hereby certify that, to the best of my knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices. I am a member of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein.

We respectfully submit the following report, and we look forward to discussing it with you.

Joel E. Stewart, FSA, EA, MAAA
Principal and Consulting Actuary

JES:wp

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City of Aurora General Employees' Retirement Plan

Executive Summary

In order to complete an actuarial valuation, a number of economic and demographic assumptions concerning future events must be made. Economic assumptions include items such as inflation, investment return, salary scale, etc. Economic assumptions are related to the overall economy. Demographic assumptions estimate the future behavior of the City of Aurora General Employees' Retirement Plan (GERP) employee group. Demographic assumptions include mortality, retirement rates, withdrawal (termination) rates, and form of payment (e.g., contribution refund election). Each assumption should be individually reasonable, and also consistent with other assumptions (example – the inflation assumption is an underlying building block for the investment return and salary scale assumptions).

The level of the Actuarially Determined Contribution (ADC) is highly dependent on the assumptions that the actuary uses to project the future benefit payments and then to discount the value of future benefits to determine the actuarial present value of those payments. Thus, the use of reasonable assumptions is critical in assisting the Plan in adequately pre-funding for the benefits prior to retirement. The ultimate cost of the Plan will be the actual dollars paid out to the members in the form of retirement benefits, plus any administrative expenses paid out of the Plan's assets, less actual investment returns garnered on Plan contributions. The purpose of an actuarial valuation is to make a prudent estimate at future Plan experience so those benefits can be funded while members are working and accruing benefits.

We have a number of assumption change recommendations for the January 1, 2020 actuarial valuation. After we discuss the reasons for the changes, we will show the impact on the Plan's ADC and Net Pension Liability (NPL) if the recommended assumptions had been used in the January 1, 2019 actuarial valuation. We would anticipate the relationship between the results to be similar for future effective dates.

This report will explore economic and demographic assumptions. The following recommendations will be made for the current economic assumptions, as discussed in Section 2:

Assumption	Current	Recommended
Price Inflation	2.75%	2.50%
Investment Return	7.25%	7.00%
Salary Scale		
Price Inflation	2.75%	2.50%
Productivity	0.50%	0.75%
Merit	Service Based	Service Based
Administrative Expenses	$585,000 per year, added to Normal Cost	$585,000 per year, added to Normal Cost

The following adopted changed will be made for the current demographic assumptions, as discussed in Section 3:

Assumption	Current	Recommended
Mortality	RP2000 projected to 2020 (BB); 1-year set-forward for males and 85% adjustment for females	Pub-2010 (amount-weighted) General Employee and Retiree tables, projected generationally using Scale MP2018

Retirement:
    Reduced
    Unreduced/Normal Retirement
    Vested Inactive
	Age and Tier based
	Age and Tier based
	Earliest age eligible
		Age based (updated)
		Age based
		Later of 55/10 or Normal Retirement (Tier 1); Normal Retirement for Tier 2

Withdrawal (Termination)	Age and service based	Age and service based (updated)

Form of Payment (Lump Sum Election):
    Termination
    Retirement from Active
	
	50%
	12%
		
		30%
		0%

Results

The impact on the ADC and NPL calculated as of January 1, 2019 is reported in Section 4 of this report. Using the 2019 valuation's assumptions, the ADC is 13.53% of pay and the NPL is $34.6 million. When reflecting all of the recommended assumption changes the ADC would have been 16.22% of pay and the NPL would have been $69.2 million. The increase in the NPL represents an increase of approximately 6.8% of the actuarial liability, primarily due to the change in the mortality assumption.

The Pub-2010 table recommended for adoption was published in 2019 by the Society of Actuaries. It was the outcome of a large-scale national study of the life expectancy of public sector employees and retirees, which differs at a statistically significant level from that of employees and retirees in the private sector. The Pub-2010 study created separate mortality tables for teachers, public safety officers, and general service employees and retirees. The ADC and NPL values will obviously vary based upon implementation with the January 1, 2020 actuarial valuation, based on the results at that date, including reflecting the December 31, 2019 value of assets.

Please see Appendix D of the January 1, 2019 actuarial valuation for a risk assessment and disclosure and key plan maturity metrics applicable to these calculations.

Economic Assumptions

Economic assumptions used to measure the pension obligations for the Retirement Plan include:

    a.   Price Inflation

    b.   Investment Return

    c.   Salary Scale

    d.   Administrative Expenses

Actuarial Standard of Practice (ASOP) No. 27, Selection of Economic Assumptions for Measuring Pension Obligations, provides guidance to actuaries giving advice on selecting economic assumptions for measuring obligations under defined benefit plans. Because no one knows with precision what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment. The actuary should consider a number of factors, including the purpose and nature of the measurement, and appropriate recent and long-term historical economic data. However, the standard explicitly advises the actuary not to give undue weight to recent experience.

Recognizing that there is not one unique right answer, the standard lays out a general selection process, and then calls for the actuary to select a reasonable assumption. Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period.

After completing the selection process, the actuary should review the set of economic assumptions for consistency. Generally this will require the actuary to use the same inflation component in each of the economic assumptions selected. If a change occurs in one assumption, the actuary needs to consider if the change would modify other economic assumptions as well.

The current and recommended economic assumptions are summarized below:

Assumption	Current	Recommended
Price Inflation	2.75%	2.50%
Investment Return	7.25%	7.00%

Salary Scale
   Price Inflation + Productivity
   Merit
	3.25%
	Service Based
		3.25%
		Service Based

Administrative Expenses	$585,000 per year, added to Normal Cost	$585,000 per year, added to Normal Cost

A discussion of the assumptions follows.

a. Price Inflation

When we refer to inflation in this report, we are generally referring to price inflation. The inflation assumption has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return, general wage increase, salary scale, and the post-retirement cost of living adjustment.

The long-term relationship between inflation and nominal investment return has long been recognized by economists. The basic principle is that the investors in risk-bearing, return-seeking assets expect a "real return" – the excess of nominal investment return over inflation. If inflation rates are expected to be high, investors will expect higher nominal investment returns that will exceed inflation, while lower inflation rates will result in lower expected nominal investment returns.

Inflation is also a building block of the salary scale assumption. The underlying economic theory is that the City must compensate employees in a manner that reflects inflation as well as productivity and merit.

Current Assumption: 2.75%

Discussion:

CPI: The data for inflation shown below is based on the national Consumer Price Index, Urban Wage Earners and Clerical Workers (CPI-W) as published by the Bureau of Labor Statistics. CPI-W is the metric used by the Plan to determine the annual cost of living adjustment for Tier 1 members. The data for periods ending in December of each year is documented in Exhibit 1 at the end of this section.

There are numerous ways to review historical data, with significantly differing results. The table below shows the compound average annualized inflation rate for various trailing 10-year periods, and for longer trailing periods of 20 and 30 years that ended in December 2018.

Decade	CPI-W Increase
2009-2018	1.4%
1999-2008	3.0%
1989-1998	3.1%
1979-1988	5.9%
Prior 30 Years	
1989-2018	2.5%
Prior 20 Years	
1999-2018	2.2%

The following graph shows historical national CPI increases.
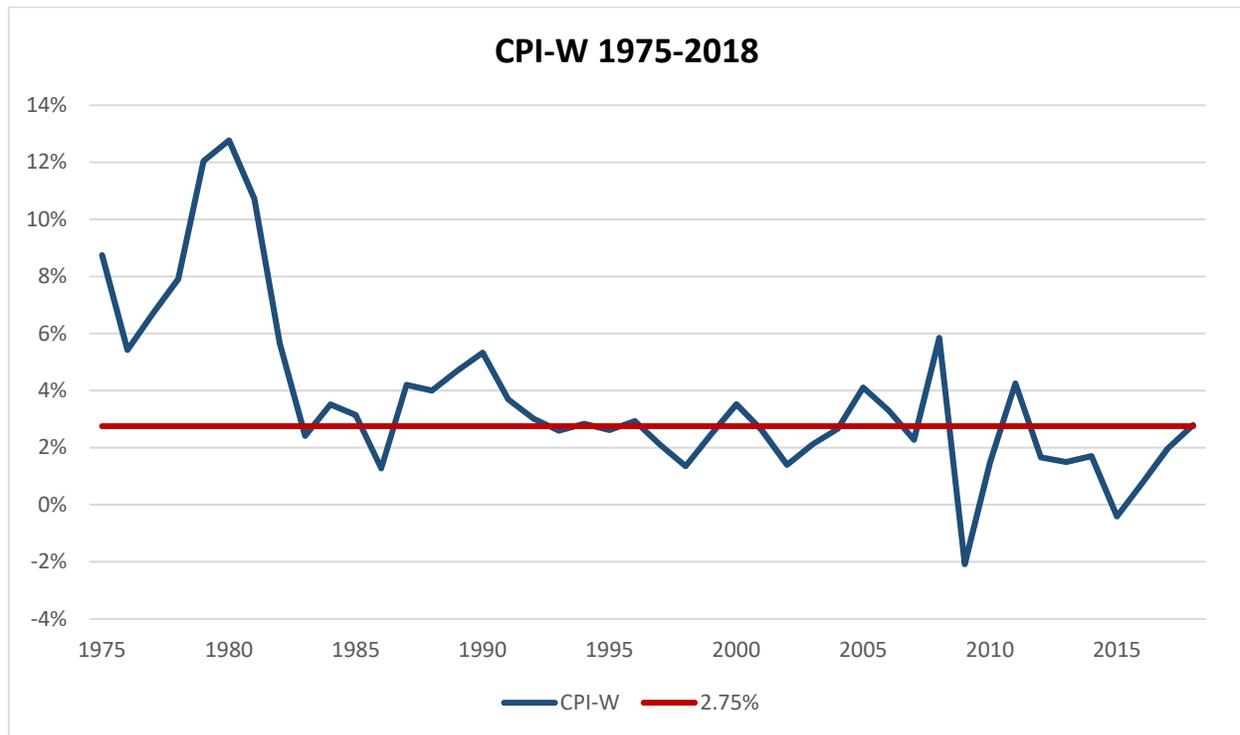
Although economic activities in general, and inflation in particular, do not lend themselves to prediction on the basis of historical analysis, historical patterns and long term trends are a factor to be considered in developing the inflation assumption.

Markets and Forecasts: Since the U.S. Treasury started issuing inflation indexed bonds, it is possible to determine the approximate rate of inflation anticipated by the financial markets by comparing the yields on inflation indexed bonds with traditional fixed government bonds. June 2019 market prices suggest investors expect inflation to be about 1.7% over the next 30 years.

The June 2019 *Blue Chip Financial Forecasts* project 1.95% for 2019, 2.05% for 2020, and then average annual inflation of 2.1% for 2021-2030. In addition, the Congressional Budget Office's June 2019 report *The Long-Term Budget Outlook* uses an annualized expected CPI from 2019-2049 of 2.4%.

Many economists have been forecasting lower inflation for a number of years. Some of them may be considering shorter time periods than appropriate for a pension valuation. To find an economic forecast with a time frame long enough to suit our purposes, we look to several sources for guidance. In its 2018 Trustees Report, the expected increase in the CPI used by the Social Security Administration (SSA) under its intermediate cost assumptions was 2.6%. Semi-annually, Milliman publishes a set of capital market outlook (CMO) assumptions developed by Milliman's credentialed investment professionals. The most recent Milliman CMO has a long-term inflation assumption of 2.2%.

Recommendation: 2.5%

Exhibit 1

URBAN WAGE EARNERS AND CLERICAL WORKERS (CPI-W) – 3RD QUARTER

3rd Quarter:	Average	Increase	3rd Quarter:	Average	Increase
1974	50.300		1997	157.867	2.09%
1975	54.700	8.75%	1998	160.000	1.35%
1976	57.667	5.42%	1999	163.933	2.46%
1977	61.533	6.71%	2000	169.700	3.52%
1978	66.400	7.91%	2001	174.133	2.61%
1979	74.400	12.05%	2002	176.567	1.40%
1980	83.900	12.77%	2003	180.300	2.11%
1981	92.900	10.73%	2004	185.100	2.66%
1982	98.167	5.67%	2005	192.700	4.11%
1983	100.533	2.41%	2006	199.067	3.30%
1984	104.067	3.51%	2007	203.596	2.28%
1985	107.333	3.14%	2008	215.495	5.84%
1986	108.700	1.27%	2009	211.001	-2.09%
1987	113.267	4.20%	2010	214.136	1.49%
1988	117.800	4.00%	2011	223.233	4.25%
1989	123.333	4.70%	2012	226.936	1.66%
1990	129.900	5.32%	2013	230.327	1.49%
1991	134.700	3.70%	2014	234.242	1.70%
1992	138.767	3.02%	2015	233.278	-0.41%
1993	142.367	2.59%	2016	235.057	0.76%
1994	146.400	2.83%	2017	239.668	1.96%
1995	150.233	2.62%	2018	246.352	2.79%
1996	154.633	2.93%			

City of Aurora General Employees' Retirement Plan

b. Investment Return

The investment return assumption is one of the primary determinants in the calculation of the expected cost of the Plan's benefits, providing a discounted actuarial present value of the future benefit payments that reflects the anticipated time value of money. This assumption has a direct impact on the calculation of liabilities, normal costs, and actuarially determined contribution rates.

Current Assumption: 7.25% net of investment-related expenses (4.50% real return; 2.75% inflation)

Discussion:

One of the most important assumptions in an actuarial valuation is the investment return assumption, which represents the expected long-term rate of nominal return on plan assets. Actuarial Standard of Practice (ASOP) No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*, provides guidance to actuaries giving advice on selecting economic assumptions for measuring obligations under defined benefit plans. Because no one knows with precision what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment. The actuary should consider a number of factors, including the purpose and nature of the measurement, and appropriate recent and long-term historical economic data. However, the standard explicitly advises the actuary not to give undue weight to recent experience.

Recognizing that there is not one unique right answer, the standard lays out a general selection process, and then calls for the actuary to select a reasonable assumption. Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period.

Historical Perspective: One of the inherent problems with analyzing historical data is that the results can look significantly different depending on the time frame used if the year-to-year results tend to vary widely. Even though history provides a valuable perspective for setting this assumption, the economy of the past is not today's economy.

Projection Model using Capital Market Assumptions: In our opinion, a better approach builds upon the latest forward-looking capital market models from credentialed investment professionals. We compared the results of models using inputs produced by three sources: Callan (the Plan's outside investment consultant), Milliman's investment consultants, and an annual survey of investment professionals produced by Horizon Actuarial Services.

Callan provided assumptions reflecting a 10 year time horizon. Horizon surveyed 34 investment consultants, publishing the range of assumptions for each asset class surveyed over the same time frame. The Milliman assumptions range from five to 75 years. For consistency, we focused on the average expectations for each asset class in the 10 year time horizon. In addition we include the Plan's resulting Milliman 30-year return expectation to show the anticipated impact of using a longer time horizon typically associated with pension plan valuations.

A formula-based model was used to calculate average annualized future returns based on these capital market assumptions, the asset allocation policy, and assumed annual rebalancing. The asset allocation and the expected real (i.e., in excess of inflation) returns by asset class are shown below.

Asset Class	Allocation For GERP	10-Year Geometric Real Returns		
		Callan	Horizon Survey	Milliman
US Equity	26%	4.90%	4.00%	3.75%
Global ex-US Equity	19	4.75	4.50	4.60
Domestic Fixed Income	25	1.50	1.10	1.30
Real Estate	10	4.00	3.70	3.25
Private Equity	10	6.25	6.10	5.60
Alternatives	10	0.95	3.00	3.70
Total Portfolio	100%	4.65%	4.15%	4.00%

The 10-year real return assumptions shown above range from 4.00% to 4.65%, depending upon the model. The Milliman 30-year real return expectation is 4.20%. In our experience, 20 to 30 basis points would seem to be a reasonable adjustment when evaluating return expectations for time horizons longer than ten years, such as those typically associated with pension benefit funding. In addition, the return expectations shown above assume index returns with no premium for active management for asset classes where indices exist.

The figures noted above are gross returns, while the investment return assumption used in the valuation is net of investment-related expenses. Returns should be adjusted approximately 10 to 20 basis points for passive investment expenses and custodial fees.

Components of Return	Callan	Horizon	Milliman (10-Year)	Milliman (30-Year)
Real Rate of Return	4.65%	4.15%	4.00%	4.20%
Assumed Inflation	2.50	2.50	2.50	2.50
Gross Investment Return	7.15%	6.65%	6.50%	6.70%
Assumed Investment-Related Expenses	(0.15)%	(0.15)%	(0.15)%	(0.15)%
Net Investment Return	7.00%	6.50%	6.35%	6.55%

Recommendation: Maintain current net real return assumption of 4.5% (7.25% minus 2.75% current assumed inflation). Reduce overall investment return assumption to 7.00%, net of investment-related expenses, to reflect the reduction in the inflation assumption to 2.50%.

c. Salary Scale

The salary scale assumption is comprised of three parts:

Price Inflation (CPI)	+	Productivity	+	Merit Scale

(Wage Growth)

Wage Growth is comprised of Price Inflation and Productivity. The wage growth over price inflation represents an increase in the assumed standard of living, also called the real wage inflation rate. The combined effects of promotion and longevity comprise Merit Scale.

Current Assumption: The current assumption is based on service. Rates are shown below.

Service	Price Inflation	Productivity	Merit	Total
0-1	2.75%	0.50%	2.75%	6.00%
2	2.75	0.50	2.25	5.50
3	2.75	0.50	1.75	5.00
4-7	2.75	0.50	1.25	4.50
8	2.75	0.50	0.75	4.00
9	2.75	0.50	0.50	3.75
10+	2.75	0.50	0.00	3.25

The table above produced a median expected increase of approximately 4.50% as of January 1, 2019.

PRODUCTIVITY

Current Assumption: 0.5%

Discussion:

We have used statistics from the Social Security Administration on the National Average Wage back to 1951. For years prior to 1951, we studied the Total Private Nonagricultural Wages as published in Historical Statistics of the U.S., Colonial Times to 1970.

There are numerous ways to review this data. For consistency with our observations of other indices, the table below shows the compounded annual inflation rate for various 10-year periods, and for the longer periods of 20, 30, and 75 years ending in December 2018. The excess of wage growth over price inflation represents "productivity" or the increase in the standard of living (also called the real wage inflation rate).

Decade	Wage Growth	CPI-U Increase	Real Wage Inflation
2009-2018	2.4%	1.8%	0.6%
1999-2008	3.6%	2.5%	1.1%
1989-1998	4.1%	3.1%	1.0%
1979-1988	6.2%	5.9%	0.3%
1969-1978	6.6%	6.7%	-0.1%
Prior 75 Years			
1944-2018	4.5%	3.6%	0.9%
Prior 30 Years			
1989-2018	3.4%	2.5%	0.9%
Prior 20 Years			
1999-2018	3.0%	2.2%	0.8%

Wage inflation is also projected by the Office of the Chief Actuary of the Social Security Administration. In the 2019 Trustees Report, the long-term expected annual increase in the National Average Wage is estimated to be 1.2% higher than the Social Security inflation assumption of 2.6% per year using its intermediate cost assumption set. The range of the assumed real wage growth in the 2019 Trustees Report was from 0.6% to 1.8% per year.

Recommendation: Increase productivity component to 0.75%. Combined with the recommended reduction in the inflation component to 2.5% results in a net "no change" to the underlying wage growth assumption.

MERIT

The final building block of the salary increase assumption is the increase in salary due to merit which represents salary increases due to longevity and promotion.

Current Assumption: The current assumption is based on service as shown previously.

Discussion:

Unlike the first two parts, merit scale is not typically applied uniformly to each employee. Merit scale increases relate to individual increases in performance or responsibility during an employee's career. Merit scale increases tend to be linked to events such as promotions and/or contractual step increases. As such, a typical merit scale structure can be age-linked or service-linked, with larger percentage merit increases assumed for younger and/or lower service employees.

We evaluated actual salary increases by service over the study period. While processing the January 1, 2019 actuarial valuation, we noted that salary increases during 2018 were quite a bit higher than they had been in prior years. Through discussion with Plan staff we learned that some departments had higher than normal increases in 2018 in an attempt to reset salaries closer to market after salary freezes during the years following the 2008 economic downturn. We pulled the 2018 data from the analysis and remodeled the actual increases for the four-year period 2014-2017, as illustrated on the following graph.
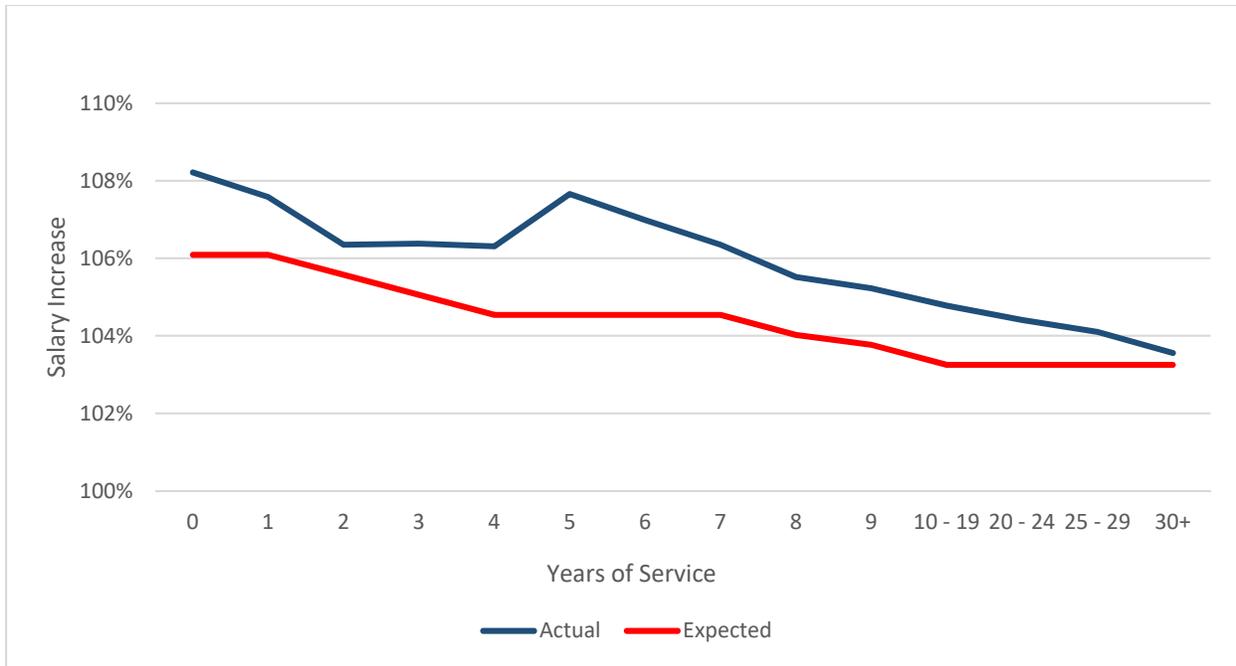
While noting that there may be short-term losses while other departments catch up to market over the next several years, the actual salary increases tracked much more closely to the assumed increases for 2014-2017.

Recommendation: Maintain the current assumption to reflect long-term expectation of salary increases.

d. Administrative Expenses

An explicit provision for administrative expenses paid out of plan assets was incorporated beginning with the January 1, 2017 actuarial valuation, in response to the new GASB Standards for financial reporting that required the long-term investment return assumption be net of investment-related expenses only. Administrative expenses include all expenses other than those for investment consulting, investment management and custodial services. For example, administrative expenses would include those costs paid for actuarial, auditing and legal services.

The assumed amount of administrative expenses is added to the calculation of the ADC for the year.

Current Assumption: $585,000 per year, payable mid-year

Discussion:

The most recent three-year inflation adjusted average is $586,561. This assumption remains reasonable.

Recommendation: No change

Demographic Assumptions

Demographic assumptions used to measure the pension obligations for the Plan include:

    a.   Mortality

    b.   Retirement

    c.   Withdrawal

    d.   Form of payment (refund of contributions)

The Actuarial Standard of Practice (ASOP) No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligation* provides guidance to actuaries giving advice on selecting demographic assumptions for measuring obligations under defined benefit plans.

In developing demographic and other noneconomic assumptions the actuary should consider the characteristics of the pension group, the plan provisions that may impact the assumption, the materiality of the assumption being reviewed, the availability of credible data and the trends shown by the given data.

The current and recommended economic assumptions are summarized below:

Assumption	Current	Recommended
Mortality	RP2000 projected to 2020 (Scale BB); 1-year set forward for males and 85% adjustment for females	PUB2010 (amount weighted) General Employee and Retiree mortality tables, projected generationally with Scale MP-2018
Retirement:		
Reduced Retirement	Age and tier based	Age based (updated)
Unreduced/Normal Retirement	Age and tier based	Age based
Vested Inactive	Earliest age eligible	Age and tier based
Withdrawal (Termination)	Age and service based	Age and service based (updated)
Form of Payment (refund of contributions):		
Termination	50%	30%
Retirement from Active	12%	0%
Vested Inactive	0%	0%

A discussion of the assumptions follows.

a. Mortality

The City of Aurora General Employees' Retirement Plan includes an active membership of approximately 1,750 employees, and an in-pay membership of approximately 1,100 retirees and beneficiaries. This is not a large enough population to have statistically credible data necessary to justify a plan-specific mortality assumption; therefore, the Board should consider using an industry standard mortality assumption, adjusted as necessary to reflect plan specific demographics.

Current Assumption:

Healthy Lives (post-retirement) – RP2000 Combined Healthy Mortality Tables projected to 2020 using Scale BB; males set forward 1 year, females with 85% multiplier

Healthy Lives (pre-retirement) – RP2000 Healthy Non-Annuitant Mortality Table with no projection of future mortality improvements

Disabled Lives – RP2000 Disabled Mortality table with no projection of future mortality improvements

Discussion:

The following table summarizes actual to expected deaths from members in pay status over the last 5 years.

	Actual	Expected	A/E
Healthy Pensioner Mortality	92	103.7	89%

Excluding beneficiaries the actual-to-expected ratio drops to 80%. The size of the Plan's population is not large enough to have a statistically fully credible independent study of retiree mortality. Further an actual-to-expected ratio below 90% indicates fewer in-pay deaths occurred than projected by the current assumption, and that benefits on average will be paid for a longer period than projected by the current mortality assumption. Given all this, we recommend reliance on an up-to-date standard published table that is appropriate to the Plan's employee and retiree population.

The RP2000 table used for the current assumption is based on observed mortality experience for Social Security and other large pension systems from the early 1990s. At time of publication, the table included a "projection scale" (Scale AA) which allows the table to be adjusted for anticipated future mortality improvements due to advancements in healthcare. Projection Scale BB was issued in September 2012 and includes future mortality improvements based on Social Security census data from the years subsequent to RP2000's publication.

The governing Actuarial Standard of Practice (ASOP) requires that we include in our assumption an allowance for anticipated future improvements in mortality. There are several ways to accomplish this, from static or generational projections of future improvements, to age setbacks or loads on the base table mortality rates. The current assumption uses a static approach with some margin adjustments to projecting potential future mortality improvements. The most theoretically sound way to project future mortality improvements is to use a "generational" table, which dynamically incorporates the projection scale on a participant by participant basis. A generational table reflects the common sense understanding that, for example, a child born in 1957 has a lower life expectancy than a child born in 2019.

One drawback of the static approach is that it will become outdated after a number of years and requires more frequent review and potential updates. In addition, you will want to build in a margin when reviewing historical data to account for improvements in mortality for future retiree populations. As noted in the table above, the actual to expected ratio over the last five years has been 89%. When excluding beneficiaries, who are predominantly female, the ratio falls to 80%. Incorporating a margin for future mortality improvements into a static table approach would result in an actual to expected ratio of over 100%.

In January 2019, the Society of Actuaries (SOA) published new base mortality tables (Pub-2010), developed exclusively from public-sector pension plan experience from 78 different pension plans and including approximately 46 million life-years of exposure. The new tables include separate mortality for teachers, public safety, and general employees. The tables included subsets of these groups for above-median and below-median income, based on salary for active employees and benefit amounts for retirees. Teachers include school teachers and college/university professors, public safety includes police officers, firefighters, and correctional officers and general employees include all other types of public plan members.

Recommendation:

Healthy Lives (post-retirement) – Pub-2010 General Employees Retiree Mortality Table (amount weighted), projected generationally using Projection Scale MP2018

Healthy Lives (pre-retirement) – Pub-2010 General Employees Mortality Table (amount weighted), projected generationally using Projection Scale MP2018

Disabled Lives – Pub-2010 Disabled Retiree (Non Safety) Mortality Table (amount weighted), projected generationally using Projection Scale MP2018

The following table illustrates the age 65 life expectancy for male and female members of various ages under the current assumption as well as using the new Pub-2010 General tables (PubG-2010) with projection scale MP2018.

	Age 65 Life Expectancy - Male		Age 65 Life Expectancy - Female	
Current Age (2019)	**Current Assumption**	**PubG-2010 MP2018**	**Current Assumption**	**PubG-2010 MP2018**
Age 45	19.0	23.1	23.4	25.5
Age 55	19.0	22.3	23.4	24.7
Age 65	19.0	21.5	23.4	24.0

As you can see, the increase in life expectancy at age 65 under the new tables is quite a bit higher for males than it is for females. This is primarily due to the margin adjustments that were incorporated under the prior assumption. Males had a one-year set forward (i.e. all males were assumed to be one year older than their actual age) whereas female mortality rates were reduced by 15% from the published table.

Applying the recommended assumption to this study's experience observation period, the actual-to-expected ratio for in-pay deaths would have been 94%. The recommended assumption more closely matches the observed experience than the current assumption, which produced an 89% actual-to-expected ratio for in-pay deaths. For a plan the size of the GERP, deviations of that ratio from 100% over a typical multi-year observation period is both expected and reasonable.

b. Retirement

The retirement assumption attempts to project when active members will retire. Normal Retirement under the Plan is age 65 for Tier 1 members and age 67 for Tier 2 members. Special early retirement benefits are offered to members who are age 50 or older with age plus credited service totaling 80 or more, referred to as "Rule of 80" retirement. The benefit under Rule of 80 retirement is unreduced for commencement prior to Normal Retirement. In addition, the Plan offers basic Early Retirement benefits for members age 50 or older with 10 or more years of service. This benefit is reduced to reflect the fact that payments are being made over a longer period of time than the benefit payable at Normal Retirement. The reduction is based on age and years prior to the earlier of Normal Retirement or Rule of 80 eligibility, and also differs by Tier.

Current Assumption: Age-based table related to the type of retirement available to a member by Tier, summarized as follows.

Age	Reduced		Unreduced	
	Tier 1	Tier 2	Tier 1	Tier 2
50	2.0%	1.5%	3.0%	3.0%
51	3.0	1.5	3.0	3.0
52	3.0	1.5	10.0	10.0
53	3.0	1.5	10.0	10.0
54	3.0	1.5	10.0	10.0
55	3.0	2.5	8.0	8.0
56	6.0	2.5	8.0	8.0
57	6.0	2.5	8.0	8.0
58	6.0	2.5	8.0	8.0
59	6.0	2.5	8.0	8.0
60	6.0	6.0	8.0	8.0
61	6.0	6.0	15.0	15.0
62	15.0	15.0	25.0	25.0
63	6.0	6.0	20.0	20.0
64	6.0	6.0	15.0	15.0
65	N/A	30.0	30.0	30.0
66	N/A	30.0	30.0	30.0
67	N/A	N/A	30.0	30.0
68	N/A	N/A	50.0	50.0
69	N/A	N/A	50.0	50.0
70-74	N/A	N/A	100.0	75.0
75+	N/A	N/A	100.0	100.0

Current and future vested inactive members are assumed to retire at the earliest age eligible for retirement benefits (age 50 with 10 or more years of service, or age 65).

Discussion:

Exhibits 2 and 3 show the actual and expected rates of retirement for Reduced and Unreduced Retirement, respectively. Unreduced retirement includes Rule of 80 and Normal Retirement. The following table shows the actual versus expected retirements for the period January 1, 2014 through December 31, 2018.

	Actual	Expected	A/E
Reduced	92	72	128%
Unreduced	239	289	83%
Total	**331**	**361**	**92%**

As shown in the table above and depicted graphically in Exhibits 2 and 3, overall actual retirement experience has tracked fairly closely to the assumed rates over the five year study period. One exception would be ages 63 and 64 for those members exiting under reduced retirement. There does not appear to be as substantial of a drop off in retirement rates at those ages as projected by the current assumption. We combined the experience for ages 63 and 64 with that at age 62, and propose a single assumed annual rate of 15% for that age cohort.

There was limited experience for retirement over the study period for Tier 2 members. As such, their expectations have been set equal to the anticipated rates for Tier 1 members.

Vested Inactive Retirement

Most members who leave employment with the City will move on to another career, and may not draw their pension until they retire from their new job. Furthermore, for Tier 2 members, the reductions for retirement prior to normal retirement age are much higher than they are for Tier 1 members. As shown in the following chart, annual rates of retirement over the study period have generally been at or below 10% for ages prior to 65.
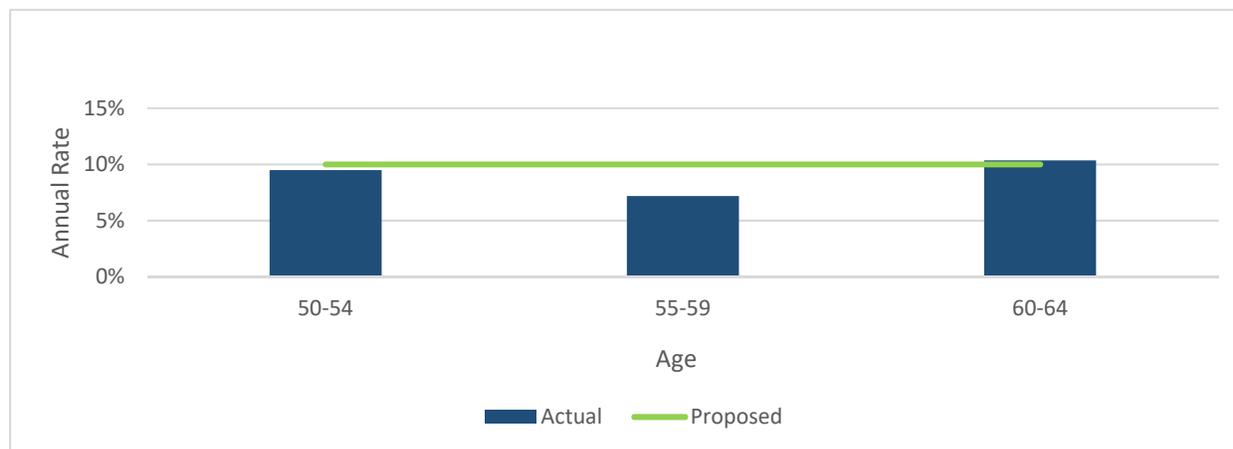
While some retirement occurs prior to normal retirement age, it is not nearly 100% at the earliest age eligible. However, the combination of the money purchase plan benefit and early retirement subsidies for Tier 1 members will result in some retirement prior to normal retirement. Given the early retirement reductions for Tier 2 members, it seems unlikely many of those members will draw benefits prior to normal retirement (age 67).

Recommendation: No change to Tier 1 Unreduced retirement rates. Modify Tier 1 Reduced retirement rates for ages 63 and 64 to reflect higher rates of retirement for those ages. No change to Tier 2 retirement assumption (Reduced and Unreduced).

Adopted Assumption: No change to Tier 1 Unreduced retirement rates. Modify Tier 1 Reduced retirement rates for ages 63 and 64 to reflect higher rates of retirement for those ages. Set Tier 2 retirement rates (Reduced and Unreduced) equal to Tier 1 rates due to lack of credible experience. A summary of the revised assumption follows.

Age	Reduced	Unreduced
50	2%	3%
51	3	3
52	3	10
53	3	10
54	3	10
55	3	8
56	6	8
57	6	8
58	6	8
59	6	8
60	6	8
61	6	15
62	15	25
63	15	20
64	15	15
65	30	30
66	30	30
67	N/A	30
68	N/A	50
69	N/A	50
70-74	N/A	100
75+	N/A	100

The adopted rates for Reduced and Unreduced retirement are also shown graphically in Exhibits 2 and 3.

<u>Vested Inactive Retirement</u>

Upon discussing with the Board and Plan staff, there was acknowledgement that assumed retirement at age 50 with ten or more years of service for Tier 1 vested inactive members was overly conservative, but some concern exists with extending that assumed age out to Normal Retirement due to the combination of the money purchase plan benefit and early retirement subsidies.

Tier 1 – Earlier of age 55 with 10 or more years of service, or age 65
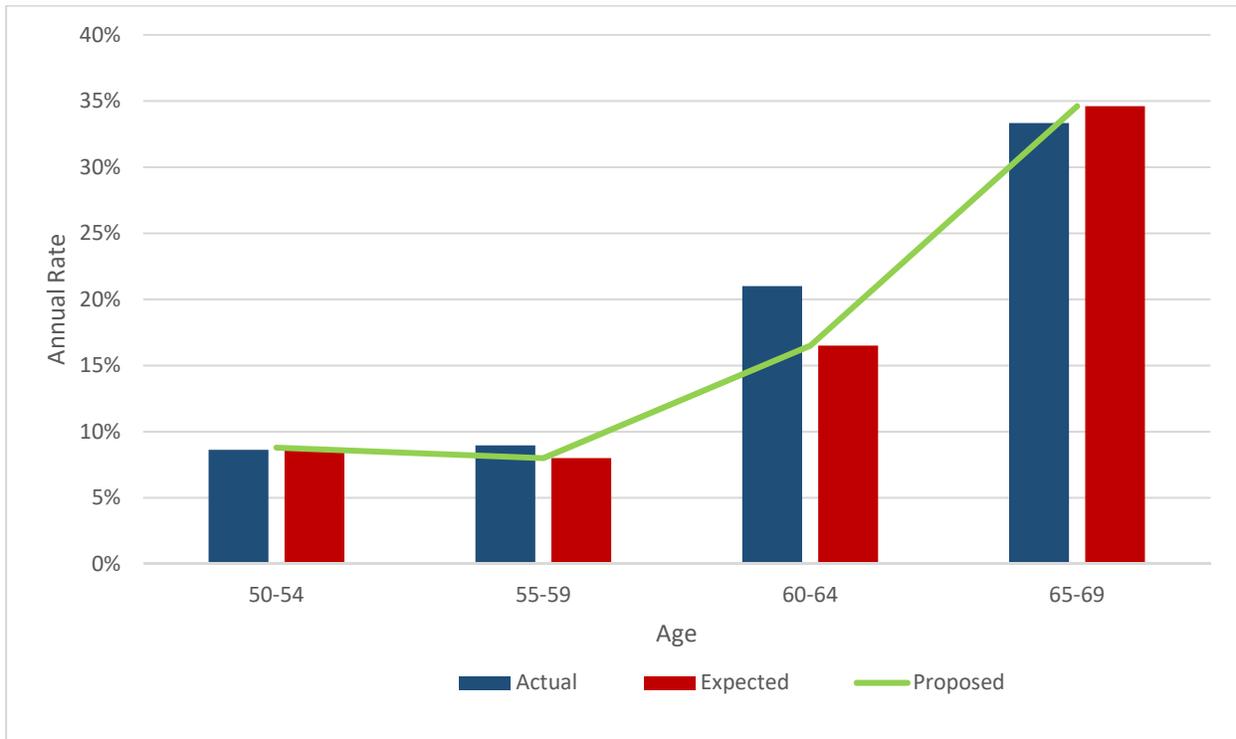
Tier 2 – Normal retirement age (67)

Exhibit 2

REDUCED RETIREMENT RATES
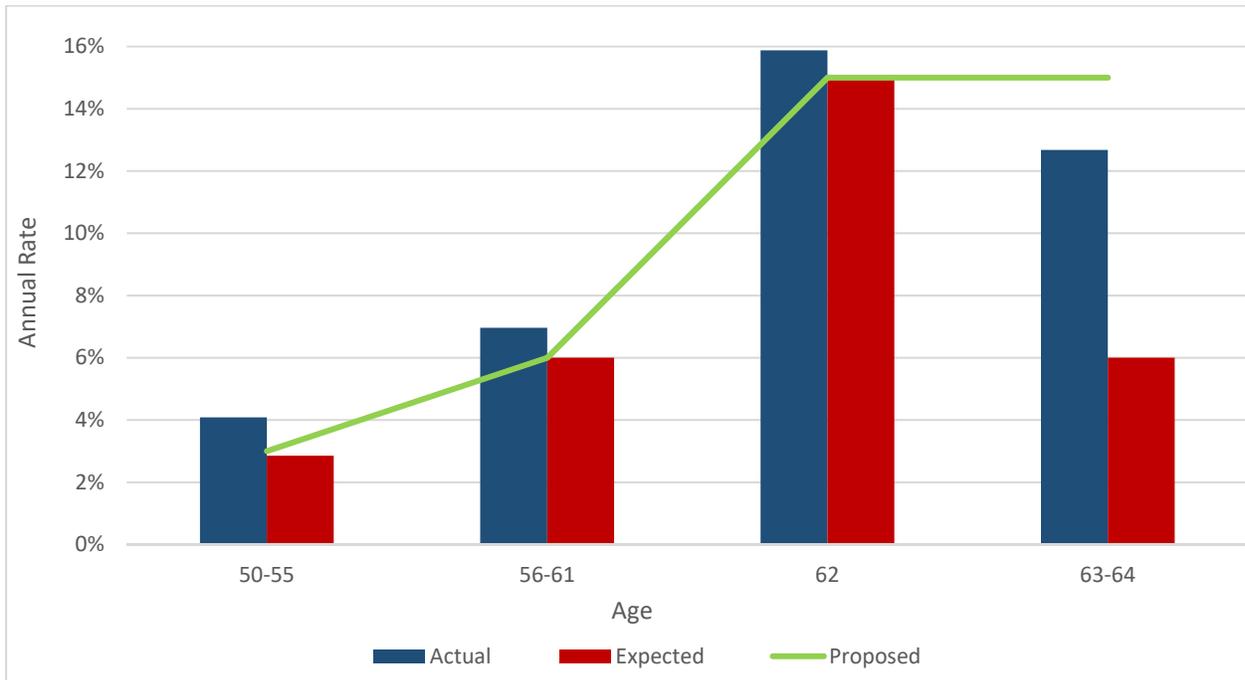
	Expected	Actual	Proposed
Total Count	72	92	78
Actual / Expected	128%		118%

City of Aurora General Employees' Retirement Plan

Exhibit 3

RULE OF 80 AND NORMAL RETIREMENT RATES

	Expected	Actual	Proposed
Total Count	289	239	289
Actual / Expected	83%		83%

c. Withdrawal

The withdrawal assumption is used to measure the probability of a member leaving Plan-covered employment prior to retirement.

Current Assumption: Graded rates based on age and years of service; also varies by gender.

Years of Service	Male	Female
0-1	20.0%	23.0%
1-2	16.0	18.0
2-3	13.0	15.0
3-4	11.0	13.0
4-5	9.0	11.0
At Five or More Years of Service:		
Age		
30	7.7%	10.0%
40	5.3	6.5
50	3.4	3.5
60	2.1	1.5

Discussion:

Actual and expected termination experience for the last five years are summarized below.

	Actual	Expected	A/E
Termination	679	610	111%

We analyzed rates of termination by age and years of service. The current U.S. trend typically shows termination as more closely correlated to length of employment with the employer rather than age. As noted above, the current assumption is a table of graded rates based on years of service for the first five years of employment, and by age after five years of employment.

Exhibit 4 shows the actual and expected rates of termination. With the exception of the first and fourth years of employment, actual rates were consistently about 10% higher than expected. This relationship was fairly consistent across age, years of service and gender.

Recommendation: Maintain current rate at service years 0 and 3; increase service years 1, 2 and 4 and the ultimate (age-based) rates by 10%. Recommended rates summarized as follows.

Years of Service	Male	Female
0-1	20.0%	23.0%
1-2	17.6	19.8
2-3	14.3	16.5
3-4	11.0	13.0
4-5	9.9	12.1
At Five or More Years of Service:		
Age		
30	8.5%	11.0%
40	5.8	7.2
50	3.8	3.9
60	2.3	1.7

Exhibit 4

WITHDRAWAL RATES
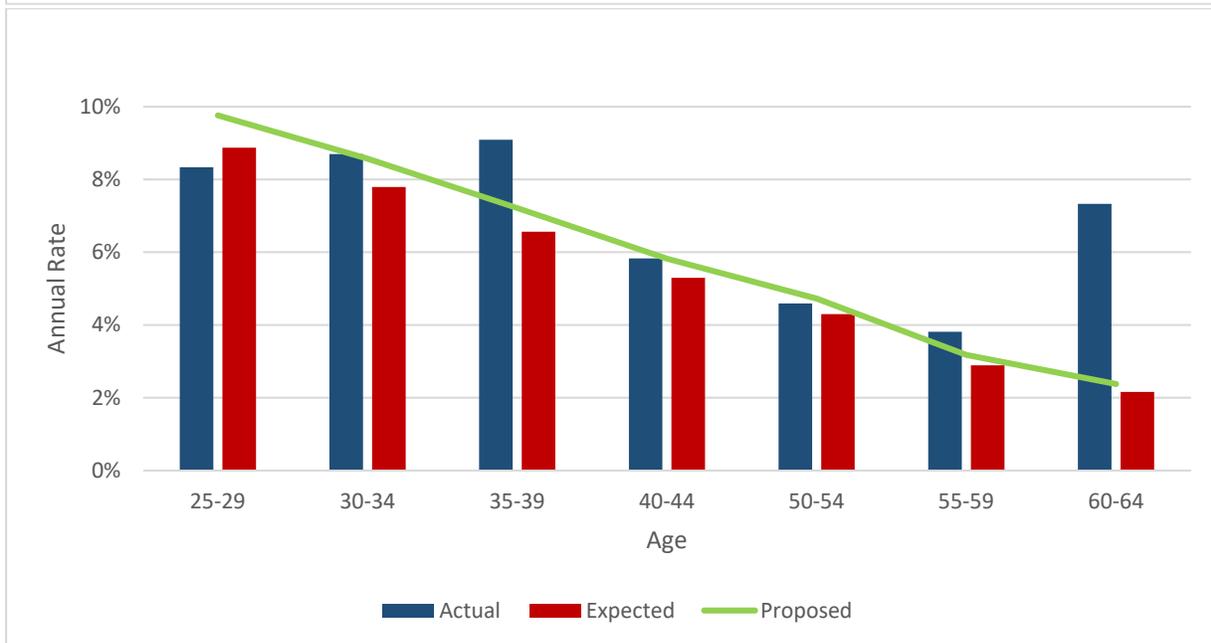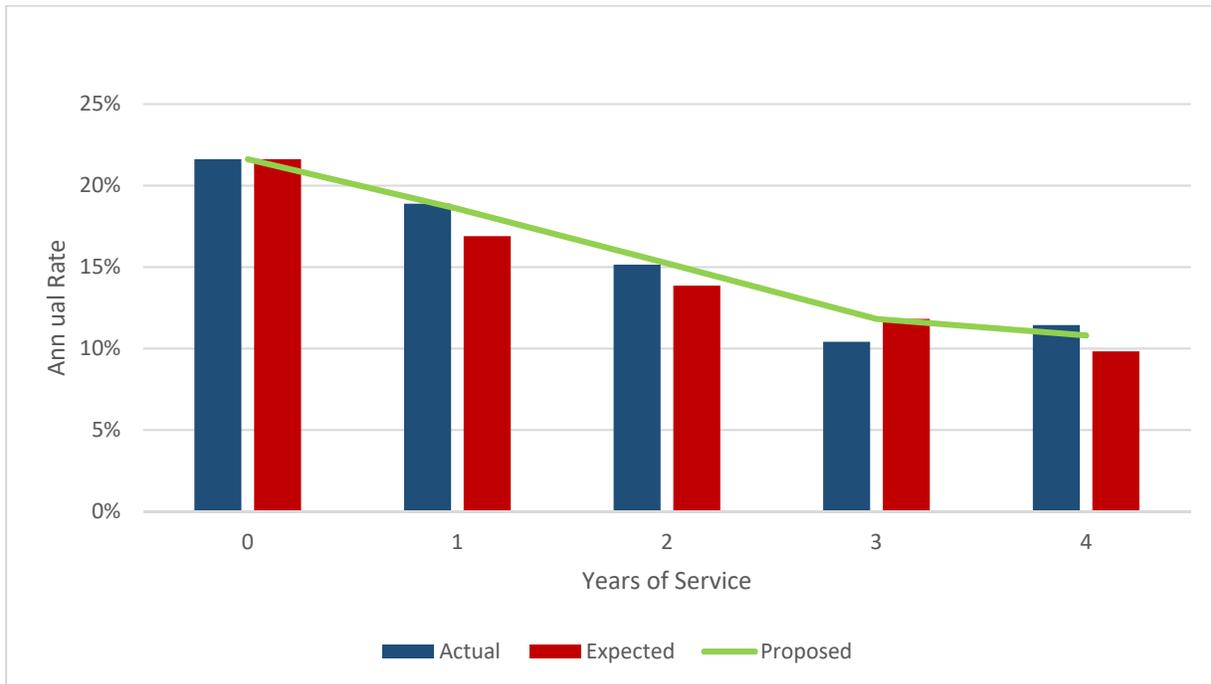
	Expected	Actual	Proposed
Total Count	610	679	653
Actual / Expected	111%		104%

d. Form of Payment (Contribution Refund)

Benefits from the retirement plan are paid in monthly installments. Alternatively a member may elect to receive a refund of accumulated employee plus vested City contributions with interest in a single lump sum payment, with no further benefits payable thereafter.

Current Assumption:

- **12% of retirements from active service and 50% of terminations from active service are assumed to take a refund of accumulated contributions**

- **Current inactive vested members are assumed to take a monthly annuity at time of assumed future retirement**

Discussion:

The following table summarizes the refund of contribution election experience over the study period.

Type	Exits	Refunds	Percent Electing
Active – Retirement Eligible	331	9	3%
Active – Withdrawal	165	47	28%
Vested Inactive	41	13	32%

Fewer members are taking a refund upon retirement/termination from service than expected under the current assumption, in part due to Plan staff education on the value of the monthly annuity. Some vested inactive members are taking a deferred refund upon attaining retirement eligibility. However, it is expected that these are not common and the figures will continue to decline in the future due to these education efforts by Plan staff. It is anticipated that if a member does not take a refund upon termination of employment, they will elect one of the monthly annuity options at a later retirement date.

Recommendation:

- **0% of retirements from active service and 30% of terminations from active service are assumed to take a refund of accumulated contributions**

- **Maintain assumption that current inactive vested members will take a monthly annuity at retirement**

Impact on Pension Liabilities and the ADC

The chart on the following page summarizes the expected financial impact of the proposed assumption changes on the Plan's Actuarially Determined Contribution (ADC) and Net Pension Liability (NPL).

The financial impact was evaluated by performing additional valuations as of January 1, 2019 using the member and financial data as of that date. The actual impact of assumptions on calculated results will vary somewhat for the January 1, 2020 valuation due to year-to-year changes in the member population. In addition, the ultimate value of the ADC and the NPL will be impacted by the value of the Plan's assets at December 31, 2019, reflecting the strong asset performance for the calendar year 2019. However, the relative impact of the various assumption changes can be evaluated with the data on the following page.

Please note, the financial impact of each assumption scenario presented herein is additive; in other words, it assumes the adoption of the recommendations from the prior scenarios. To the extent one or more of the recommendations are not adopted, subsequent results and relative impacts may vary.

The following assumption changes were evaluated:

1. Baseline (Current Assumptions). These are the results from our January 1, 2019 actuarial valuation, incorporating the assumptions noted in the associated valuation report.

2. Change the inflation assumption from 2.75% to 2.5%. This change also reduces the investment return assumption from 7.25% to 7.00%.

3. Update the mortality assumption to use relevant tables from the recently released Pub-2010 study, which focused on life expectancy for public sector employees and retirees. Update mortality improvement to a generational projection using Scale MP2018.

4. Update the withdrawal assumption to the table of rates presented earlier in the report.

5. Update the retirement assumption to the table of rates presented earlier in the report.

6. Update the contribution refund percentages to those presented earlier in the report.

The chart shows the impact to the NPL and ADC as of January 1, 2019, as well as the relative increase/(decrease) in the UAL as a percentage of the total actuarial liability.

IMPACT OF RECOMMENDED ASSUMPTION CHANGES IF THEY HAD BEEN EFFECTIVE JANUARY 1, 2019

(All figures in millions)	Baseline (Current Assumptions)	Inflation/ Investment Return	Mortality	Withdrawal	Retirement	Contribution Refund
1. Actuarial Liability (AL)						
a. Retired Members	$ 294.3	$ 294.8	$ 305.3	$ 305.3	$ 305.3	$ 305.3
b. Inactive Vested Members	17.8	18.1	18.9	18.9	18.6	18.6
c. Active Members	196.8	200.0	211.6	212.2	209.4	219.6
d. Total	$ 508.9	$ 512.9	$ 535.8	$ 536.4	$ 533.3	$ 543.5
2. Actuarial Value of Assets (AVA)	$ 474.3	$ 474.3	$ 474.3	$ 474.3	$ 474.3	$ 474.3
3. UAL: (1. - 2.)	$ 34.6	$ 38.6	$ 61.5	$ 62.1	$ 59.0	$ 69.2
Increase/(Decrease)		$ 4.0	$ 22.9	$ 0.6	$ (3.1)	$ 10.2
Increase/(Decrease) as a % of AL		0.8%	4.5%	0.1%	-0.6%	1.9%
4. Normal Cost Rate	11.29%	11.68%	12.20%	12.05%	11.58%	11.82%
UAL Amortization	2.24%	2.45%	3.91%	3.94%	3.75%	4.40%
Total ADC	13.53%	14.13%	16.11%	15.99%	15.33%	16.22%
50% of ADC	6.77%	7.07%	8.05%	8.00%	7.66%	8.11%
5. Fiduciary Net Position	$ 450.4	$ 450.4	$ 450.4	$ 450.4	$ 450.4	$ 450.4
Net Pension Liability: (1. - 4.)	$ 58.5	$ 62.5	$ 85.4	$ 86.0	$ 82.9	$ 93.2
Funded Status: (4. ÷ 1.)	88%	88%	84%	84%	84%	83%

Please note, the financial impact of each assumption change presented herein is additive; in other words, it assumes the adoption of the recommendations from the prior scenarios. To the extent one of more of the recommendations are not adopted, subsequent results and relative impacts may vary.