Tacoma Employees' Retirement System

January 1, 2019 Actuarial Valuation

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April 30, 2019

Retirement Board
Tacoma Employees' Retirement System
3628 South 35th Street
Tacoma, Washington 98409

Re: January 1, 2019 Actuarial Valuation

Dear Members of the Board:

As requested, we performed an actuarial valuation of the Tacoma Employees' Retirement System as of January 1, 2019. Our findings are set forth in this actuarial valuation. This report reflects the benefit provision and contribution rates currently in effect. Milliman has performed 26 actuarial valuations for the Tacoma Employees' Retirement System since January 1, 1976. Biennial valuations occurred from 1985 through 2011 and one additional valuation was performed in 1998. Beginning in 2012, annual actuarial valuations have been performed.

All of the exhibits in this valuation report were prepared by Milliman. Please see our table of contents for a list of the exhibits. In preparing this valuation report, we relied, without audit, on information (some oral and some in writing) supplied by the System's staff. This information includes, but is not limited to, statutory provisions, member census data, and financial information. We found this information to be reasonably consistent and comparable with information used for other purposes. The valuation 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.

All costs, liabilities, rates of interest, and other factors for the System have been determined on the basis of actuarial assumptions and methods which are individually reasonable (taking into account the experience of the System and reasonable expectations) and which, in combination, offer our best estimate of anticipated experience affecting the System. Further, in our opinion, each actuarial assumption used is reasonably related to the experience of the Plan and to reasonable expectations which, in combination, represent our best estimate of anticipated experience under the System.

We hereby certify that, to the best of our knowledge, this report, including all costs and liabilities based on actuarial assumptions and method, is complete and accurate and determined in conformance with generally recognized and accepted actuarial principles, which are consistent with the Actuarial Standards of Practice promulgated by the Actuarial Standards Board and the Code of Professional Conduct and supporting Recommendations by the American Academy of Actuaries.

This valuation report is only an estimate of the System's financial condition as of a single date. It can neither predict the System's future condition nor guarantee future financial soundness. Actuarial valuations do not affect the ultimate cost of System benefits, only the timing of System 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.

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 of Trustees has the final decision regarding the appropriateness of the assumptions and adopted them as indicated in Appendix A.

Actuarial computations presented in this report are for purposes of determining the recommended funding amounts for the System. Actuarial computations presented for financial reporting in a separate report under GASB Statements No. 67 and 68 are for purposes of assisting the System and participating employers in fulfilling their financial accounting requirements. The computations prepared for these two purposes may differ as disclosed in our report. The calculations in the enclosed report have been made on a basis consistent with our understanding of the System’s funding requirements and goals. Determinations for purposes other than meeting these requirements may be significantly different from the results contained in this report. Accordingly, additional determinations may be needed for other purposes.

Milliman’s work is prepared solely for the use and benefit of the System and its Trustees and employees (for their use in administering the Fund). 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 exceptions:

(a) The System may provide a copy of Milliman’s work, in its entirety, to the System'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.

(b) The System may provide a copy of Milliman’s work, in its entirety, to other governmental entities, as required by law.

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 retirement actuaries. Milliman’s advice is not intended to be a substitute for qualified legal or accounting counsel.

The signing actuaries are independent of the plan sponsor. We are not aware of any relationship that would impair the objectivity of our work.

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

We would like to express our appreciation to Tim Allen, Retirement System Director, to Catherine Marx, Assistant Retirement Director, and to members of the staff who gave substantial assistance in supplying the data on which this report is based.

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

Sincerely,

Mark C Olleman

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Consulting Actuary

Daniel Wade

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Section 1 Summary of the Findings

We have completed the actuarial valuation of the Tacoma Employees' Retirement System as of January 1, 2019. The actuarial valuation tests whether the scheduled contribution rates are sufficient to satisfy future obligations. The following chart summarizes the various metrics used to assist in making that determination. There is a large difference between the 2018 and 2019 results based on the Fair Value of Assets, due to the 2018 return of negative 3.4%, which is 10.4% below the 7.0% assumption. Changes in the results based on Actuarial Assets are much smaller since they will smooth the 2018 loss over four years. Results are shown for both the current and prior valuations.

Valuation Results (Dollars in Millions)

	2019 Valuation	2018 Valuation
(A) Actuarial Accrued Liability	$ 1,761.7	$ 1,680.7
(B) Actuarial Assets (AVA)	1,713.9	1,667.0
(C) Fair Value of Assets (FVA)	1,635.0	1,723.2
Unfunded Actuarial Accrued Liability (UAAL)/(Funding Reserve)		
Actuarial Assets [A - B]	$ 47.8	$ 13.7
Fair Value of Assets [A - C]	$ 126.7	$ (42.5)
Actuarial Assets Funding Ratio [B ÷ A]	97.3%	99.2%
Fair Value of Assets Funding Ratio [C ÷ A]	92.8%	102.5%
Actuarial Asset Amortization Period	8.7 years	2.3 years
Fair Value of Asset Amortization Period	31.7 years	N/A (1)
25-Year Amortization of UAAL based on AVA, not less than the current contribution rate (Basis for Actuarially Determined Contribution)	21.00% of pay	21.00% of pay
25-Year Amortization of UAAL based on FVA, not less than the current contribution rate	21.43% of pay	21.00% of pay

1. The amortization period is not applicable on a Fair Value basis since there is no UAAL to amortize.

If only calculations using the Actuarial Value of Assets (AVA) are used, the Funding Ratio of 97.3% is between 95% and 120%. Also, the current combined employer and employee contribution rate of 21% is equal to the Actuarially Determined Total Contribution of 21%, as the current contribution rate is projected to amortize the Unfunded Actuarial Accrued Liability (UAAL) in less than 25 years on an Actuarial Value of Assets basis. The Board's Funding and Benefits Policy states that no action will be taken in this situation since the Funding Ratio is between 95% and 120% and the contribution rate is greater than or equal to the Actuarially Determined Total Contribution.

However, the Board's Funding and Benefits Policy also states that calculations based on the Fair Value of Assets should also be considered, since measures based on actuarial assets and Fair Value of Assets can provide different interpretations of the System's funding. Using the Fair Value of Assets, the Funding Ratio of 92.8% is below 95%, the current contribution rate is projected to amortize the UAAL over 31.7 years, and the contribution rate would need to be increased to 21.43% of pay starting January 1, 2020 to amortize the UAAL over 25 years. These calculations are based on the December 31, 2018 Fair Value of Assets and do not reflect any gains which may have occurred after that date.

Amortization Period

The AVA Funding Ratio of 97.3% is high relative to other public retirement systems. The UAAL amortization period of 8.7 years increased from last year's amortization period of 2.3 years. This is primarily due to the asset return of 4.7% on an Actuarial Value of Assets basis being less than the assumed asset return of 7.0%. Note that the asset return on a Fair Value of Assets basis was negative 3.4%.

The cushion between the contribution rate and the Normal Cost rate increased in 2018 due to the increased contribution rate from 20% of payroll to 21%. We incorporated this change in our January 1, 2018 actuarial valuation. The increase in the contribution rate beginning February 2018 makes the amortization period less sensitive than in prior years. While it is not as sensitive as it was in previous years, a 3.5% decline in the funding ratio would result in a contribution rate insufficient to amortize the UAAL over 25 years. As seen below, such a decline is not large by historical standards. In addition, the cushion itself is sensitive to the actuarial assumptions used to calculated the Normal Cost Rate. Based on the actuarial assumptions and the 21.00% of pay contribution rate, the amortization periods for different funding ratios vary as follows:

Funding Ratio	Length of Amortization
88.5% or lower	Never amortizes
93.8%	25 years
97.3% (current actuarial value)	8.7 years
100% or higher	No years

Normal Cost Rate

The Normal Cost Rate increased from 18.49% of pay to 18.53% of pay from the prior actuarial valuation. Therefore, the portion of the total 21.00% of pay contribution rate available to amortize the UAAL after Normal Costs are financed decreased from 2.51% of pay at January 1, 2018 (21.00% - 18.49%) to 2.47% of pay at January 1, 2019 (21.00% - 18.53%).

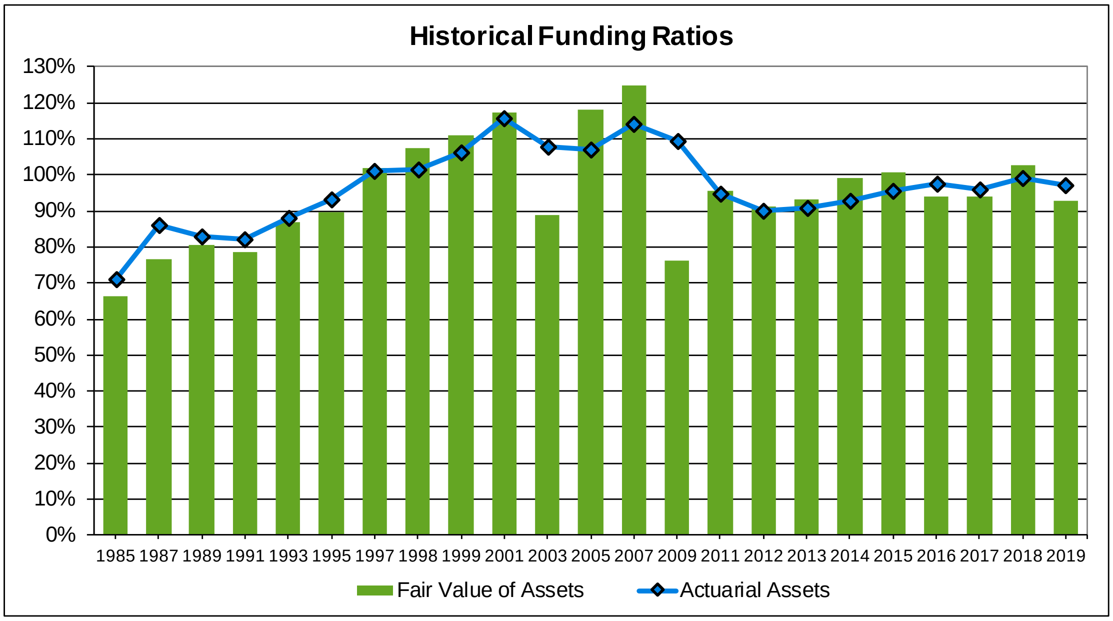
Actuarial Value of Assets

The $1,713.9 million actuarial assets are currently 105% of the $1,635.0 Fair Value of Assets. This difference is due to the actuarial assets' recognition of gains and losses over four years. This means only one fourth of the loss from 2018, two fourths of the gain from 2017, and three fourths of the gain from 2016 have been recognized in the actuarial assets as of January 1, 2019. Losses of $78.9 million have not been recognized in the actuarial assets.

Funding Ratio

Investment gains and losses can cause large fluctuations in the Funding Ratio in a single year, as shown by the System's history.

With the asset return less than expected in the last year, the System's Funding Ratio decreased on an actuarial-value basis as well as on a fair-value basis from 2018 to 2019. As shown in the graph below, the Funding Ratio based on Fair Value of Assets decreased from 103% at January 1, 2018 to 93% at January 1, 2019 primarily due to the negative 3.4% return in 2018. The underlying numbers to the following graph can be seen in Exhibit D-3. The System's investment return history since 1980 can be seen in Exhibit 5.



Contribution Rates

As per sections 1.30.350 and 1.30.360 of the Tacoma Municipal Code, the current contribution rate was increased to 21.00% as of February 2018, split 11.34% to the employer and 9.66% to the member. The following chart shows the history of the contribution rates since 1980.

Actual Contribution Rates as a Percent of Member Pay (Set in Tacoma Municipal Code)			
	Employer	Member	Total
1980 - 1996	10.44%	8.89%	19.33%
1997 - 2000	9.02%	7.68%	16.70%
2001 - 2008	7.56%	6.44%	14.00%
2009	8.64%	7.36%	16.00%
2010	9.72%	8.28%	18.00%
2011	10.26%	8.74%	19.00%
2012 - 2017	10.80%	9.20%	20.00%
2018 and on	11.34%	9.66%	21.00%

Funding and Benefits Policy

Exhibit 2 is a copy of the Board's Funding and Benefits Policy, most recently updated at the July 2016 Board meeting. The objective of the Funding and Benefits Policy states in part, "*The Funding & Benefits Policy is meant to assist in establishing a contribution rate which is relatively stable over the long term*." That objective is reflected in the following interpretation of the valuation results using the guidance of the Funding and Benefits Policy.

- **Funding Ratios from 95% to 120% suggest the Retirement Board maintain the current contribution rate unless it is less than the Actuarially Determined Contribution:** The January 1, 2019 Funding Ratio is 97.3%. The current contribution rate is equal to the Actuarially Determined Contribution. These measures use the Actuarial Value of Assets. Therefore based on this criteria, the Board's Funding and Benefits Policy indicates no action is needed.
- **Amortization Period:** The Policy states, "*Contribution increases should consider amortizing any Unfunded Actuarial Accrued Liability over a period of 25 years or less*." On an actuarial-value basis, the UAAL is projected to be amortized over 8.7 years. Therefore, on an actuarial-value basis, the Board does not need to consider increasing the 21% contribution rate. As noted previously in this report, the length of the amortization period is sensitive to changes in the UAAL, since the contribution rate and Normal Cost rate are close to each other.
- **21% Contribution Rate is equal to the Actuarially Determined Total Contribution:** The Policy states, "*There is a long-term goal of maintaining a combined employer and employee contribution rate greater than or equal to the Actuarially Determined Total Contribution.*" The 21% of pay contribution rate is equal to the ADC since the ADC cannot be less than the actual contribution rate. The ADC uses the Actuarial Value of Assets. Therefore, a contribution rate increase does not need to be considered on this basis.
- **Fair Value of Assets:** The Policy states, "Calculations based on the Fair Value of Assets will be also considered." Based on the Fair Value of Assets at December 31, 2018, the Funding Ratio would be 92.8%, the amortization period would be 31.7 years, and a contribution rate of 21.43% of pay starting January 1, 2020 would be required to amortize the UAAL over the 25 years beginning January 1, 2019. The Fair Value of Assets can change rapidly as evidenced by most retirement systems which had large decreases in the Fair Value of Assets in the last quarter of 2018 and large increases in the Fair Value of Assets in the first quarter of 2019.
- **Long-term Funding Projections:** The Policy states *"Long-term funding projections will also be considered."* The *baseline* in Projection 1 shown later in this summary demonstrates that if experience in all future years matches the actuarial assumptions, including 7.00% investment returns on the Fair Value of Assets, the contribution rate will need to be increased by 0.17% to meet the goal of a 25-year amortization of the UAAL. This does not reflect any of the recovery in the investment markets from the first part of 2019.

  Projection 2 provides a downside scenario showing that adverse investment experience similar to what the System experienced in 2006 to 2008 could require contribution rates to increase as high as 33.60% of pay to amortize the UAAL over 25 years. Projection 3 provides an upside scenario.

  Projection 4 shows that 61% of the statistically generated return scenarios resulted in median contribution rates greater than 21% of pay after 10 years. This is higher than the 44% of the scenarios in last year's projection due primarily to the impact of the 2018 asset returns.

Asset Gains and Losses

Although the System is funded over a long period of time, the measurement of the System's funding status can vary widely from year-to-year due to asset returns. The following chart summarizes the System's asset returns in recent years and compares the fair value gains and losses to the AAL at the following valuation date. Until 2013, the assumed returns were 7.75%, so the comparisons to expectations are based on that 7.75% assumption. Returns greater than the 7.75% actuarial assumption were gains; returns less than the 7.75% actuarial assumption were losses. In 2013 the assumption was 7.50%. In 2014 through 2016, the assumption was 7.25%. In 2017 and in future years, the assumption is 7.00%

Year	Fair Value % Return[1]	Fair Value $ Gain / (Loss) compared to expected	End of Year Actuarial Accrued Liability (AAL)	Gain / (Loss) as a % of next AAL
2008	(32.0)%	$ (451,000,000)	$ 1,002,300,000	(45.0)%
2009	27.3%	$ 147,700,000		13.0%
2010	14.1%	$ 60,200,000	$ 1,132,900,000	5.3%
2011	1.3%	$ (69,900,000)	$ 1,185,500,000	(5.9)%
2012	14.1%	$ 68,700,000	$ 1,306,600,000	5.3%
2013	15.8%	$ 100,000,000	$ 1,400,000,000	7.1%
2014	8.1%	$ 11,500,000	$ 1,468,200,000	0.8%
2015	(0.4)%	$ (111,600,000)	$ 1,542,200,000	(7.2)%
2016	8.7%	$ 20,900,000	$ 1,648,100,000	1.3%
2017	13.4%	$ 98,300,000	$ 1,680,700,000	5.8%
2018	(3.4)%	$ (177,700,000)	$ 1,761,700,000	(10.1)%

1. The fair value returns shown above are net of investment expenses, but not administrative expenses. They are based on the System's annual financial statements, but may have some variance from calculations performed by other parties due to methodology.

The AVA recognizes these fair value gains and losses in four equal pieces starting at the end of the year in which they occur. Gains in good years are needed to offset losses in bad years.

Long-Term Funding Projections

The Funding and Benefits Policy states that *"Long-term funding projections will also be considered."* The future funding status of the System and any changes in future contribution rates will be determined by the System's experience. In the future, the System's actual investment returns, salary increases, and retirement, withdrawal, disability, and mortality rates will all impact the funding status of the System. Investment returns are expected to cause the largest variation in the future funding status of the System. Therefore, the three deterministic projections on the following pages project the System's funding for 20 years based on three different investment return scenarios. All other experience is assumed to match the valuation assumptions.

The inputs at the bottom of each page show (a) investment returns; (b) the UAAL amortization period used to produce the "Calculated Total Contribution Rate" graph; and (c) the total contribution rate which is assumed to be paid 54% by the City and 46% by members. The inputs are shown for both the current bars in blue and the orange baseline.

Baseline: 7.00% Returns in All Future Years

The orange baseline is the same in all projections. It projects experience based on 7.00% investment returns in all years. The orange baseline shows that increases in the current contribution rates are projected to be needed in order to meet the goal of amortizing the UAAL over 25 years under this scenario, due to the current level of the Fair Value of Assets. The Funding Ratio on an Actuarial Value of Assets basis is projected to decrease over the next three years as deferred asset losses are recognized.

Projection 1: 2019 Actuarial Valuation Assumption

Projection 1 is the same as the baseline.

Projection 2: Downside – Repeat of Returns from 2006 – 2008

Projection 2 demonstrates a potential downside based on the assumption that the System's actual returns from 2019 through 2021 match the actual returns from 2006 to 2008, followed by 7.00% in future years. It is estimated that, under these circumstances, total contributions would be required to grade up to 33.60% of pay if the UAAL were to be amortized over 25 years.

Projection 3: Upside – Repeat of Returns from 2003-2005

Projection 3 demonstrates an upside based on the assumption that the System's actual returns from 2019 through 2021 match the actual returns from 2003 to 2005. Once again, returns in years after 2021 are assumed to be 7.00%. It is estimated that under these circumstances the System would attain a Funding Ratio of 115.0% based on actuarial assets and 125.3% based on Fair Value of Assets at the end of the three-year period. A Funding Reserve is created and continues to grow throughout the projections. These projections demonstrate the sensitivity of the System's funding to investment returns.

Projection 4: Stochastic Projection

To give an idea of the potential range of future contribution rates and funding ratios, we ran a stochastic projection. This type of projection allows the assessment of the likelihood of certain events in the 1,000 scenarios modeled. The stochastic projection uses a random number generator, the System's asset allocation, and Milliman's capital market assumptions to generate a probability distribution of future contribution rates and funding ratios based on 1,000 random scenarios.

The median is shown by a diamond. Half of the results are above the median, and half of the results are below the median. The top of the blue bars is the 95th percentile. The top of the green bars is the 75th percentile. The bottom of the yellow bars is the 25th percentile, and the bottom of the red bars is the 5th percentile. Based on the projection assumptions, there is a 25% chance of being above the green bars and another 25% chance of being below the yellow bars.

The projection shows that after 10 years the median contribution rate increases to 23.3%. Note that 61% of the scenarios resulted in contribution rates above 21% after 10 years in this year's projection. In last year's projections, 44% of the scenarios resulted in contribution rates above the current 21% contribution rate. The median funding ratio is 95% at the end of the projection period in the current projections. In last year's projections, the median funding ratio was almost 104% at the end of the projection period. The median results are informative; however, the extremes are just as important.

After 10 years, the projection shows:

- 5% of the scenarios had a contribution rate over 35%, which corresponded to a Funding Ratio of under 58%.
- 75% of the scenarios had a contribution rate below 29% of pay.
- 61% of the scenarios had a contribution rate above 21% of pay, 26% of the scenarios had a contribution rate below 21% of pay, and 13% of the scenarios still had a contribution rate of 21% of pay.
- The middle 50% of the scenarios had a Funding Ratio between 79% and 119%.

After 10 years, the above results are less favorable than the results from the projections last year, based primarily on the negative investment experience in 2018.

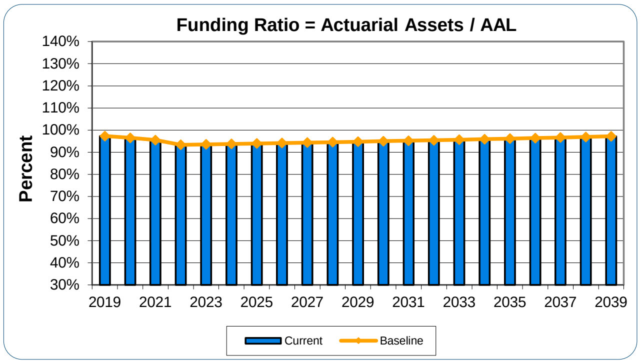
Future contribution rates and funding ratios are heavily dependent on the return on plan assets.

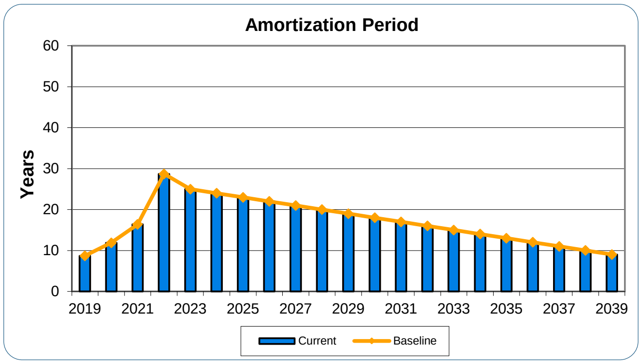
For the purpose of the stochastic projection, we used the following decision parameters to simulate the System's Funding and Benefits Policy:

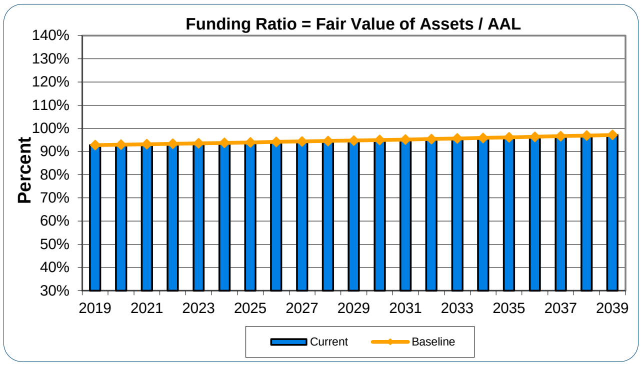
- The contribution rate is only decreased if the funding ratio is over 120%.
- If the funding ratio is over 120%, the contribution rate is set equal to the normal cost rate.
- If the funding ratio is between 95% and 120%, there is no change to the contribution rate, unless the contribution rate is less than the Actuarially Determined Contribution, in which case the contribution rate is set to produce a 25-year amortization period based on the greater of Fair Value of Assets or actuarial assets.
- If the funding ratio is below 95% and the amortization period is over 25 years, the contribution rate is set to produce a 25-year amortization period based on the greater of Fair Value of Assets or actuarial assets.
- The 54%/46% employer/employee contribution rate split is maintained.
- The total employer plus employee contribution rate is never increased by more than 2% in one year.

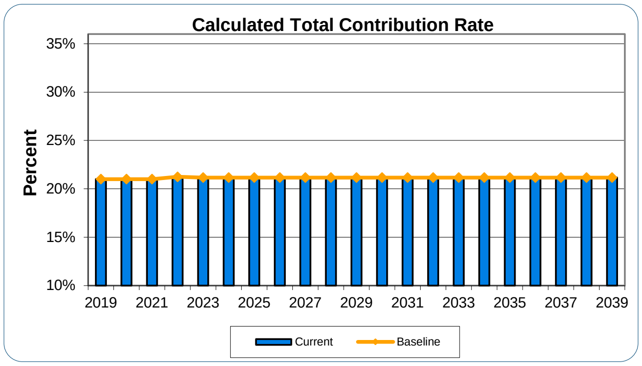
Deterministic Projection 1

2019 Actuarial Valuation









Current Input	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Portfolio Actual Return	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Actual Salary Increases	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
UAAL Amortization Period	25	25	25	25	25	25	25	25	25	25	25
Total Rate % (54% ER, 46% EE)	21.00	21.00	21.00	21.00	21.17	21.17	21.17	21.17	21.17	21.17	21.17

BASELINE NUMBERS BELOW HERE

Current Input	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Portfolio Actual Return	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Actual Salary Increases	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
UAAL Amortization Period	25	25	25	25	25	25	25	25	25	25	25
Total Rate % (54% ER, 46% EE)	21.00	21.00	21.00	21.00	21.17	21.17	21.17	21.17	21.17	21.17	21.17

Deterministic Projection 1b

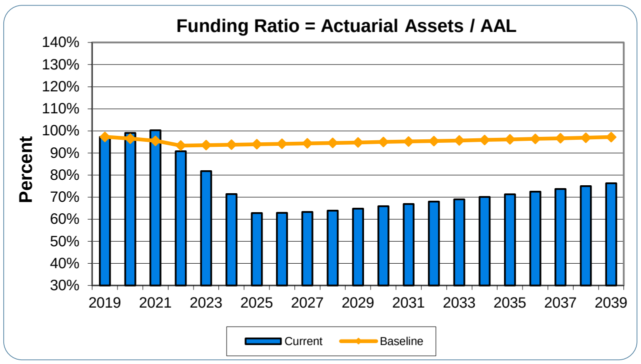
Numerical Summary of Results
2019 Actuarial Valuation

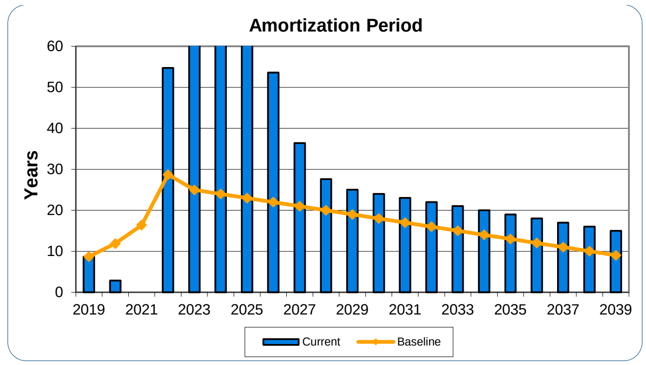
(Dollar Amounts in Millions)

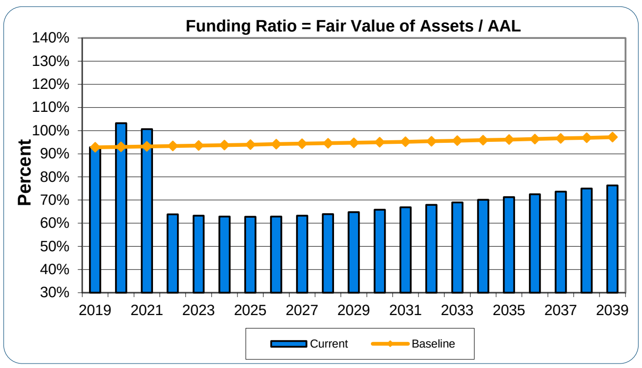
Year	Actuarial Accrued Liability	Actuarial Value of Assets	Funding Ratio = AVA / AAL	Fair Value of Assets	Funding Ratio = FVA / AAL	Normal Cost Rate	Contribution Rate Minus Normal Cost Rate	Amortization Period	Current Rate	Greater of Current Rate or 25 Year Amort Rate
2019	1,761.7	1,713.9	97.3%	1,635.0	92.8%	18.53%	2.47%	8.7	21.00%	21.00%
2020	1,841.2	1,776.5	96.5%	1,712.3	93.0%	18.53%	2.47%	11.9	21.00%	21.00%
2021	1,922.9	1,836.2	95.5%	1,791.8	93.2%	18.53%	2.47%	16.4	21.00%	21.00%
2022	2,006.8	1,873.7	93.4%	1,873.7	93.4%	18.53%	2.47%	28.7	21.00%	21.25%
2023	2,093.0	1,957.9	93.5%	1,957.9	93.5%	18.53%	2.64%	25.0	21.17%	21.17%
2024	2,181.6	2,045.2	93.7%	2,045.2	93.7%	18.53%	2.64%	24.0	21.17%	21.17%
2025	2,272.1	2,134.7	93.9%	2,134.7	93.9%	18.53%	2.64%	23.0	21.17%	21.17%
2026	2,364.7	2,226.4	94.2%	2,226.4	94.2%	18.53%	2.64%	22.0	21.17%	21.17%
2027	2,459.5	2,320.6	94.4%	2,320.6	94.4%	18.53%	2.64%	21.0	21.17%	21.17%
2028	2,556.7	2,417.6	94.6%	2,417.6	94.6%	18.53%	2.64%	20.0	21.17%	21.17%
2029	2,657.1	2,518.0	94.8%	2,518.0	94.8%	18.53%	2.64%	19.0	21.17%	21.17%
2030	2,760.4	2,621.8	95.0%	2,621.8	95.0%	18.53%	2.64%	18.0	21.17%	21.17%
2031	2,867.0	2,729.3	95.2%	2,729.3	95.2%	18.53%	2.64%	17.0	21.17%	21.17%
2032	2,977.2	2,840.7	95.4%	2,840.7	95.4%	18.53%	2.64%	16.0	21.17%	21.17%
2033	3,091.4	2,956.8	95.6%	2,956.8	95.6%	18.53%	2.64%	15.0	21.17%	21.17%
2034	3,210.6	3,078.3	95.9%	3,078.3	95.9%	18.53%	2.64%	14.0	21.17%	21.17%
2035	3,335.1	3,205.7	96.1%	3,205.7	96.1%	18.53%	2.64%	13.0	21.17%	21.17%
2036	3,465.2	3,339.5	96.4%	3,339.5	96.4%	18.53%	2.64%	12.0	21.17%	21.17%
2037	3,601.5	3,480.1	96.6%	3,480.1	96.6%	18.53%	2.64%	11.0	21.17%	21.17%
2038	3,744.8	3,628.6	96.9%	3,628.6	96.9%	18.53%	2.64%	10.0	21.17%	21.17%
2039	3,896.2	3,786.1	97.2%	3,786.1	97.2%	18.53%	2.64%	9.0	21.17%	21.17%

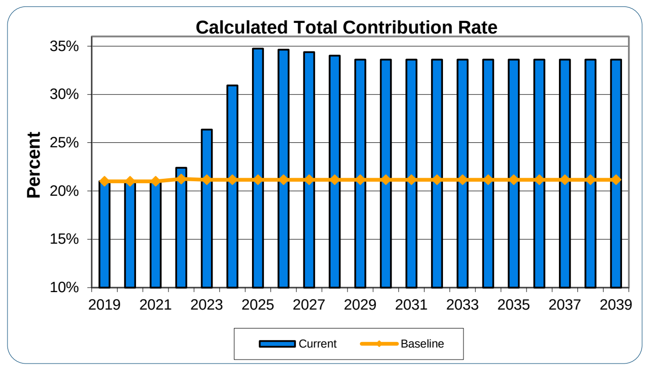
Deterministic Projection 2

Downside – Repeat of Returns from 2006-2008









Current Input	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Portfolio Actual Return	18.60	3.90	-32.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Actual Salary Increases	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
UAAL Amortization Period	25	25	25	25	25	25	25	25	25	25	25
Total Rate % (54% ER, 46% EE)	21.00	21.00	21.00	21.00	23.00	25.00	27.00	29.00	31.00	33.00	33.60

BASELINE NUMBERS BELOW HERE

Current Input	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Portfolio Actual Return	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Actual Salary Increases	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
UAAL Amortization Period	25	25	25	25	25	25	25	25	25	25	25
Total Rate % (54% ER, 46% EE)	21.00	21.00	21.00	21.00	21.17	21.17	21.17	21.17	21.17	21.17	21.17

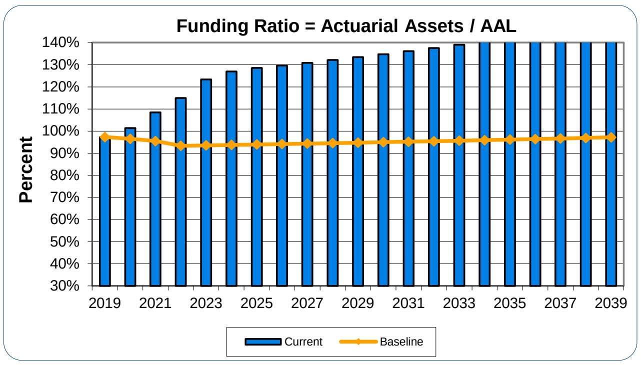
Deterministic Projection 2b

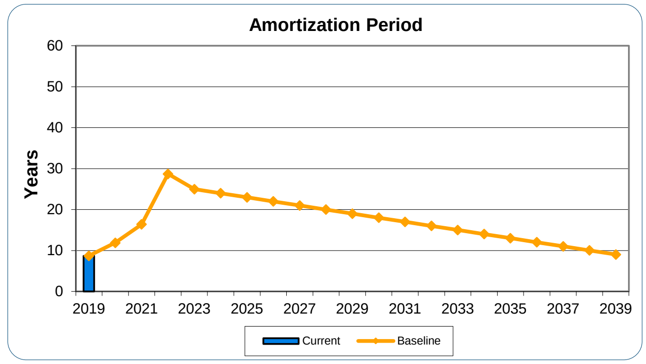
Numerical Summary of Results
Downside – Repeat of Returns from 2006-2008
(Dollar Amounts in Millions)

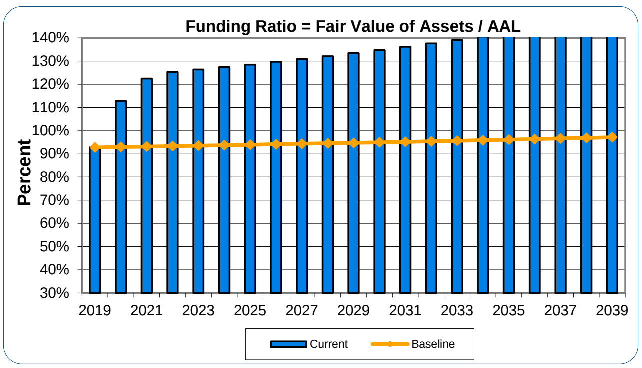
Year	Actuarial Accrued Liability	Actuarial Value of Assets	Funding Ratio = AVA / AAL	Fair Value of Assets	Funding Ratio = FVA / AAL	Normal Cost Rate	Contribution Rate Minus Normal Cost Rate	Amortization Period	Current Rate	Greater of Current Rate or 25 Year Amort Rate
2019	1,761.7	1,713.9	97.3%	1,635.0	92.8%	18.53%	2.47%	8.7	21.00%	21.00%
2020	1,841.2	1,823.4	99.0%	1,900.0	103.2%	18.53%	2.47%	2.9	21.00%	21.00%
2021	1,922.9	1,928.6	100.3%	1,934.3	100.6%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2022	2,006.8	1,822.0	90.8%	1,280.6	63.8%	18.53%	2.47%	54.7	21.00%	22.40%
2023	2,093.0	1,710.7	81.7%	1,323.3	63.2%	18.53%	4.47%	78.2	23.00%	26.35%
2024	2,181.8	1,558.3	71.4%	1,371.9	62.9%	18.53%	6.47%	UAAL Grows	25.00%	30.92%
2025	2,272.7	1,426.5	62.8%	1,426.5	62.8%	18.53%	8.47%	UAAL Grows	27.00%	34.75%
2026	2,366.0	1,488.1	62.9%	1,488.1	62.9%	18.53%	10.47%	53.6	29.00%	34.64%
2027	2,461.8	1,557.7	63.3%	1,557.7	63.3%	18.53%	12.47%	36.4	31.00%	34.39%
2028	2,560.3	1,636.5	63.9%	1,636.5	63.9%	18.53%	14.47%	27.6	33.00%	34.02%
2029	2,662.3	1,726.2	64.8%	1,726.2	64.8%	18.53%	15.07%	25.0	33.60%	33.60%
2030	2,767.5	1,822.6	65.9%	1,822.6	65.9%	18.53%	15.07%	24.0	33.60%	33.60%
2031	2,876.3	1,923.9	66.9%	1,923.9	66.9%	18.53%	15.07%	23.0	33.60%	33.60%
2032	2,988.8	2,030.6	67.9%	2,030.6	67.9%	18.53%	15.07%	22.0	33.60%	33.60%
2033	3,105.6	2,143.5	69.0%	2,143.5	69.0%	18.53%	15.07%	21.0	33.60%	33.60%
2034	3,227.5	2,263.7	70.1%	2,263.7	70.1%	18.53%	15.07%	20.0	33.60%	33.60%
2035	3,355.1	2,391.8	71.3%	2,391.8	71.3%	18.53%	15.07%	19.0	33.60%	33.60%
2036	3,488.5	2,528.4	72.5%	2,528.4	72.5%	18.53%	15.07%	18.0	33.60%	33.60%
2037	3,628.5	2,674.4	73.7%	2,674.4	73.7%	18.53%	15.07%	17.0	33.60%	33.60%
2038	3,775.7	2,830.8	75.0%	2,830.8	75.0%	18.53%	15.07%	16.0	33.60%	33.60%
2039	3,931.5	2,999.3	76.3%	2,999.3	76.3%	18.53%	15.07%	15.0	33.60%	33.60%

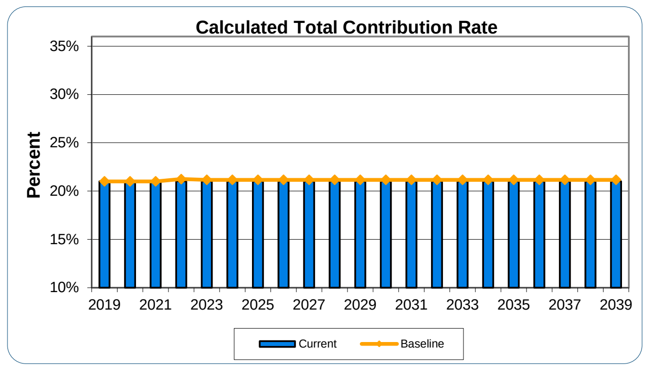
Deterministic Projection 3

Upside – Repeat of Returns from 2003-2005









Current Input	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Portfolio Actual Return	29.40	15.50	8.70	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Actual Salary Increases	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
UAAL Amortization Period	25	25	25	25	25	25	25	25	25	25	25
Total Rate % (54% ER, 46% EE)	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00

BASELINE NUMBERS BELOW HERE

Current Input	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Portfolio Actual Return	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Actual Salary Increases	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
UAAL Amortization Period	25	25	25	25	25	25	25	25	25	25	25
Total Rate % (54% ER, 46% EE)	21.00	21.00	21.00	21.00	21.17	21.17	21.17	21.17	21.17	21.17	21.17

Deterministic Projection 3b

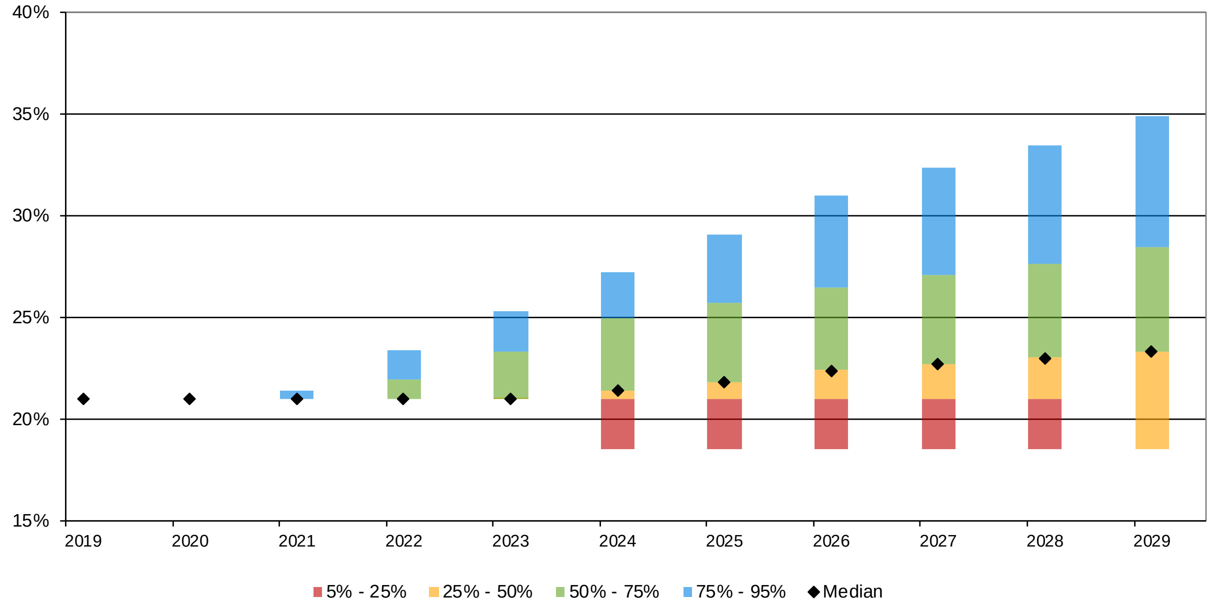
Numerical Summary of Results
Upside – Repeat of Returns from 2003-2005
(Dollar Amounts in Millions)

Year	Actuarial Accrued Liability	Actuarial Value of Assets	Funding Ratio = AVA / AAL	Fair Value of Assets	Funding Ratio = FVA / AAL	Normal Cost Rate	Contribution Rate Minus Normal Cost Rate	Amortization Period	Current Rate	Greater of Current Rate or 25 Year Amort Rate
2019	1,761.7	1,713.9	97.3%	1,635.0	92.8%	18.53%	2.47%	8.7	21.00%	21.00%
2020	1,841.2	1,867.1	101.4%	2,074.8	112.7%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2021	1,922.9	2,086.5	108.5%	2,354.5	122.4%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2022	2,006.8	2,307.7	115.0%	2,515.5	125.3%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2023	2,093.0	2,581.1	123.3%	2,644.6	126.4%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2024	2,181.6	2,769.5	127.0%	2,779.5	127.4%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2025	2,272.1	2,919.8	128.5%	2,919.8	128.5%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2026	2,364.7	3,065.9	129.7%	3,065.9	129.7%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2027	2,459.4	3,218.3	130.9%	3,218.3	130.9%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2028	2,556.6	3,377.5	132.1%	3,377.5	132.1%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2029	2,656.9	3,544.4	133.4%	3,544.4	133.4%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2030	2,760.2	3,719.4	134.7%	3,719.4	134.7%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2031	2,866.8	3,903.0	136.1%	3,903.0	136.1%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2032	2,976.9	4,095.9	137.6%	4,095.9	137.6%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2033	3,091.2	4,299.1	139.1%	4,299.1	139.1%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2034	3,210.2	4,513.8	140.6%	4,513.8	140.6%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2035	3,334.7	4,741.0	142.2%	4,741.0	142.2%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2036	3,464.8	4,981.4	143.8%	4,981.4	143.8%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2037	3,601.0	5,236.2	145.4%	5,236.2	145.4%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2038	3,744.2	5,506.7	147.1%	5,506.7	147.1%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%
2039	3,895.6	5,794.7	148.8%	5,794.7	148.8%	18.53%	2.47%	Rsrv Grows	21.00%	21.00%

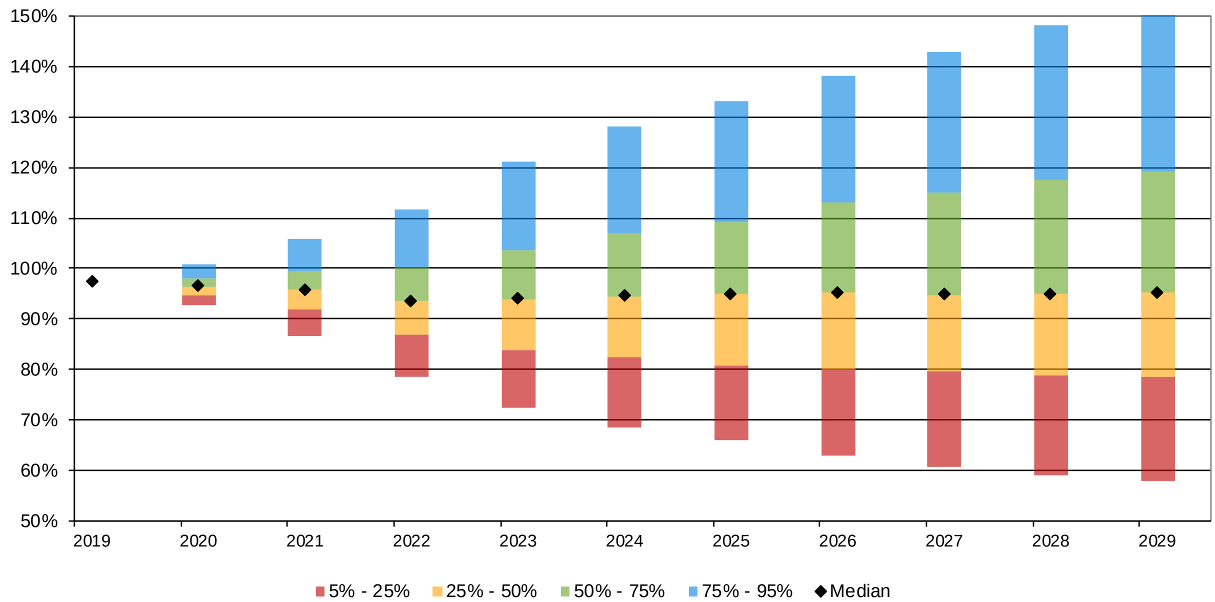
Projection 4

Stochastic Projection[1]

Total Contribution Rate



Funding Ratio = AVA / AAL



1. Refer to pages 6-7 for a description of Projection 4.

Sensitivity to Assumptions

The valuation results are projections based on the actuarial assumptions. Actual experience will differ from these assumptions, either increasing or decreasing the ultimate cost. Of the assumptions, the investment return generally has the biggest impact. The following table provides an analysis on how the short-term costs are affected by the investment return assumption. Note that the long-term cost of the Plan will be largely driven by actual investment returns and other experience. The assumptions impact the timing of contributions, but the three scenarios below illustrate the ultimate long-term employer cost variance that depends on actual investment returns.

Investment Rate of Return Assumption:	6.00%	7.00%	8.00%
Normal Cost Rate:	23.19%	18.53%	14.96%
Actuarial Accrued Liability:	$1,986.4M	$1,761.7M	$1,573.8M
Funding Ratio (AVA basis)	86.3%	97.3%	108.9%
Funding Ratio (FVA basis)	82.3%	92.8%	103.9%

Conclusions

- The System's current Funding Ratio is 97.3% on an actuarial basis. The Board's Funding and Benefits policy says there will be no action when the funding ratio is between 95% and 120% provided the combined employer and employee contribution rate is greater than or equal to the Actuarially Determined Total Contribution; if this condition is not met, then the Retirement Board will consider recommending an increase in the contribution rates. The combined employer and employee contribution rate of 21.00% is equal to the Actuarially Determined Total Contribution Rate. Therefore, the policy says a contribution increase does not need to be considered on this actuarial basis.

- The Policy also states, *"Contribution increases should consider amortizing any Unfunded Actuarial Accrued Liability over a period of 25 years or less*." and "Calculations based on the Fair Value of Assets will also be considered." Based on the Fair Value of Assets at December 31, 2018, the Funding Ratio of 92.8% is less than 95%, the UAAL is projected to be amortized over 31.7 years after the valuation date, and a contribution increase to 21.43% of pay would be required starting January 1, 2020 to amortize the UAAL over the 25 years beginning January 1, 2019. This does not take into account any gains in the Fair Value of Assets which may have occurred after December 31, 2018.

- The Policy also states, *"Long-term funding projections will also be considered*." Projection 4 shows that there is a 61% probability of contribution rates being above the current 21% of pay contribution rate 10 years from now. This is higher than the 44% of the scenarios in last year's projection due primarily to the impact of the 2018 asset returns.

- It is expected that future experience such as investment returns above or below the 7.00% assumption will continue to have an important impact on the funding of the Retirement System.

The table on the following page summarizes the key valuation results. The complete Funding and Benefits Policy is on the page following the key valuations results.

Exhibit 1

Summary of Key Valuation Results

	2019 Valuation	2018 Valuation	Percentage Change
1. Total Membership			
A. Contributing Members	2,989	2,948	1.4 %
B. Annuitants Currently Receiving Benefits	2,474	2,396	3.3 %
C. Vested Terminated Members	557	530	5.1 %
D. Non-vested Terminated Members	190	185	2.7 %
E. Total Membership	6,210	6,059	2.5 %
2. Annual Salaries			
A. Annual Total *($Thousands)*	$ 258,890	$ 248,176	4.3 %
B. Annual Average per Active Member	$ 86,614	$ 84,185	2.9 %
3. Average Annual Allowance Payable			
A. Service Retirement	$ 35,366	$ 34,047	3.9 %
B. Disability Retirement	$ 18,466	$ 17,501	5.5 %
C. Survivors & Beneficiaries	$ 20,064	$ 19,661	2.0 %
D. All Payees	$ 33,332	$ 32,078	3.9 %
4. Actuarial Accrued Liability *($Millions)*			
A. Active Members	$ 693.3	$ 687.0	0.9 %
B. Terminated Members	$ 103.9	$ 96.8	7.3 %
C. Retired Members and Beneficiaries	$ 964.5	$ 896.9	7.5 %
D. Total AAL	$ 1,761.7	$ 1,680.7	4.8 %
5. Value of System Assets *($Millions)*			
A. Fair Value	$ 1,635.0	$ 1,723.2	(5.1) %
B. Smoothing Unrecognized Loss / (Reserve)	$ 78.9	$ (56.2)	
C. Actuarial Value	$ 1,713.9	$ 1,667.0	2.8 %
D. Ratio of Actuarial Value to Fair Value	104.8%	96.7%	
6. Funded Status *($Millions)*			
A. Funding Reserve or (Funding Shortfall) *(5C - 4D)*	$ (47.8)	$ (13.7)	
B. Actuarial Funding Ratio *(5C ÷ 4D)*	97.3%	99.2%	
C. Fair Value Funding Ratio *(5A ÷ 4D)*	92.8%	102.5%	
7. Contribution Rates *(percent of salaries)*			
A. Total Contribution Rate	21.00%	21.00%	
B. Normal Cost Rate	18.53%	18.49%	
C. Contribution Rate minus Normal Cost Rate *(7A – 7B)*	2.47%	2.51%	
D. Amortization Period (Period over which Funding Reserve is projected to be depleted or Funding Shortfall is projected to be depleted by the difference between the Contributions and the Normal Costs).	8.7 years	2.3 years	

Exhibit 2

TERS Retirement Board Funding and Benefits Policy

Objective

A sustainable pension plan is able to pay the promised benefits to members – now and in the future. This policy is intended to provide guidance as to when adjustments to TERS contributions and benefits should be considered. The Funding & Benefits Policy is meant to assist in establishing a contribution rate which is relatively stable over the long term while the System provides its members sustainable retirement income.

Policy

When the Funding Ratio is:

(a) Above 120% - Investment de-risking will be considered, and then the potential for recommendations to the City Council on contribution rate reductions and/or benefit improvements will be reviewed, provided the Retirement System's funding status is expected to remain stable after the changes.

(b) Between 95% and 120% - There will be no action, provided that the combined employer and employee contribution rate is greater than or equal to the Actuarially Determined Total Contribution; if this condition is not met, then the Retirement Board will consider recommending an increase in the contribution rates.

(c) Below 95% - The Retirement Board will consider recommending an increase in the contribution rates.

Additional Guidelines

(a) There is a long-term goal of maintaining a combined employer and employee contribution rate greater than or equal to the Actuarially Determined Total Contribution so that the System is appropriately funded.

(b) Increases in the contribution rate may be made in small increments.

(c) To the extent possible, ample notification regarding changes in the contribution rate should be provided to all parties to facilitate budgetary adjustments.

(d) Contribution rate increases should consider amortizing any Unfunded Actuarial Accrued Liability over a period of 25 years or less.

(e) Calculations based on the Fair Value of Assets will also be considered.

(f) Long-term funding projections will also be considered.

(g) Funding Ratios between 100% and 120% should be viewed as desirable reserves to offset future adverse events and not as surplus funds.

Terminology

(a) The Funding Ratio is calculated by dividing the System's Actuarial Value of Assets by the Actuarial Accrued Liability.

(b) Unfunded Actuarial Accrued Liability is the dollar amount by which the System's Actuarial Accrued Liability exceeds the Actuarial Value of Assets.

(c) The Actuarially Determined Total Contribution is the greater of (1) the Normal Cost Rate or (2) the recommended combined employer and employee contribution for the reporting period that amortizes the UAAL (if any) over a maximum of 25 years, but will not be less than the actual contribution rate.

Section 2 Scope of the Report

This report presents the actuarial valuation of the Tacoma Employees' Retirement System as of January 1, 2019.

A summary of the findings resulting from this valuation is presented in the previous section. Section 3 describes the assets of the System. Sections 3, 4, and 5 describe how the obligations of the System are to be met under the actuarial cost method in use. Section 6 provides analysis of actuarial gains and losses and the impact on the Unfunded Actuarial Accrued Liability. Section 7 provides a general discussion of potential risks to TERS' future funding levels. Section 8 provides supplemental information regarding funding progress and funding ratios.

The actuarial procedures and assumptions used in this valuation are presented in Appendix A. The current benefit structure, as determined by the provisions of the governing law on January 1, 2019, is summarized in Appendix B. Schedules of valuation data classifying the data used in the valuation by various categories of contributing members, former contributing members, and beneficiaries make up Appendix C. Appendix D provides a brief summary of the System's historical experience. Comparative statistics are presented on the System's membership, contribution rates, assets, and changes affecting actuarial valuations. Appendix E is a glossary of actuarial terms used in this valuation report.

Section 3 Assets

In many respects, an actuarial valuation can be considered an inventory process. The inventory is taken as of the actuarial valuation date, which for this valuation is January 1, 2019. On that date, the assets available for the payment of benefits are appraised. These assets are compared with the actuarial liabilities, which are generally well in excess of the assets. The actuarial process thus leads to a method of determining what contributions by members and their employers are needed to strike a balance.

This section of the actuarial valuation report deals with the asset determination. In the next section, the actuarial liabilities will be discussed. Section 5 will deal with the process for determining required contributions based upon the relationship between the assets and actuarial liabilities.

Exhibit 3 summarizes the financial resources of the System on the valuation date. The fair value of net position available to pay pension benefits at the end of the last two years are compared and broken down by investment category.

Exhibit 4 summarizes the changes in the fair value of net position available to pay benefits. The System is mature. Benefits and administrative expenses are larger than contributions. The System must now rely on investment income to pay part of its benefits and expenses.

Exhibit 5 provides the historical returns since 1980 as calculated by Milliman on a fair-value basis.

Exhibit 6 summarizes the determination of the Actuarial Value of Assets. The actuarial asset method smoothes fair value gains and losses over a four-year period. It was adopted for the January 1, 1997 valuation, with the Actuarial Value of Assets set equal to the Fair Value of Assets at January 1, 1996. A complete description of the method is given in Appendix A.

Exhibit 3

Statement of Plan Net Position at Fair Value

	December 31, 2018	December 31, 2017
Assets		
Cash and short-term investments	$ 17,508,429	$ 35,448,884
Receivables		
Contributions and other receivables	$ 1,138,483	$ 868,101
Interest and dividends	2,795,911	2,490,450
Investment Sales	582,248	1,964,681
Total receivables	$ 4,516,642	$ 5,323,232
Investments, at fair value		
Equities	$ 823,620,805	$ 945,892,873
Fixed income	576,714,257	576,353,374
Real estate	76,859,020	70,970,834
Venture capital and partnerships	150,992,698	134,142,756
Total investments	$ 1,628,186,781	$ 1,727,359,837
Securities lending collateral	21,575,741	41,989,985
Capital assets, net of accumulated depreciation	9,285	10,129
Total assets	$ 1,671,796,878	$ 1,810,132,067
Liabilities		
Accounts payable and other liabilities	$ 1,937,311	$ 1,999,360
Investment purchases	13,263,445	42,893,200
Securities lending collateral	21,575,741	41,989,985
Total liabilities	$ 36,776,497	$ 86,882,545
Net position restricted for pensions	**$ 1,635,020,381**	**$ 1,723,249,522**

Note: Numbers may not sum to totals due to rounding

Exhibit 4

Statement of Changes in Plan Net Position
(Plan years ended December 31, 2018 and December 31, 2017)

	2018	2017
Additions		
Contributions		
Employer	$ 28,587,937	$ 26,091,331
Plan Member	25,193,034	23,008,946
Total contributions	$ 53,780,971	$ 49,100,277
Investment income		
Net appreciation (depreciation) in fair value of investments	$ (86,231,014)	$ 180,408,721
Interest & dividends	35,751,087	32,054,547
Investment management fees	(6,625,351)	(6,275,625)
Securities lending - agent fees	(58,548)	(80,824)
Securities lending - broker rebates	(921,994)	(490,542)
Net investment income (loss)	$ (58,085,821)	$ 205,616,277
Total additions (reductions)	$ (4,304,850)	$ 254,716,554
Deductions		
Benefits	$ 80,034,214	$ 75,046,971
Refunds of contributions	2,199,211	2,420,673
Administrative expenses	1,690,865	1,663,105
Total deductions	$ 83,924,291	$ 79,130,749
Net increase (decrease)	(88,229,141)	175,585,805
Net position restricted for pensions		
Beginning of year	1,723,249,522	1,547,663,717
End of year	$ 1,635,020,381	$ 1,723,249,522

Note: Numbers may not sum to totals due to rounding

Exhibit 5

Investment Return History
(TERS Investment Returns on Total Fund Calculated by Milliman)

Period Ended	1 Year	5 Years	10 Years	15 Years	Since 1980
12/31/2018	-3.4	5.1	9.6	6.6	8.9
12/31/2017	13.4	9.0	5.8	8.7	
12/31/2016	8.7	9.1	4.9	7.2	
12/31/2015	-0.4	7.6	5.8	6.4	
12/31/2014	8.1	10.5	6.7	6.7	
12/31/2013	15.8	14.2	7.4	7.2	
12/31/2012	14.1	2.7	8.6	6.8	
12/31/2011	1.3	0.8	6.2	6.8	
12/31/2010	14.1	4.0	5.8	7.3	
12/31/2009	27.3	3.0	4.8	8.0	
12/31/2008	-32.0	1.0	3.9	6.1	
12/31/2007	3.9	14.9	8.9	10.1	
12/31/2006	18.6	11.9	10.0	10.2	
12/31/2005	8.7	7.5	9.0	10.6	
12/31/2004	15.5	6.6	10.5	9.8	
12/31/2003	29.4	6.8	8.8	10.1	
12/31/2002	-8.9	3.2	7.8	8.8	
12/31/2001	-2.9	8.1	9.4	9.8	
12/31/2000	3.9	10.6	12.2	10.8	
12/31/1999	16.9	14.7	11.5	11.8	
12/31/1998	9.0	10.8	11.8	11.0	
12/31/1997	14.9	12.6	11.7	10.8	
12/31/1996	8.7	10.8	10.7	12.2	
12/31/1995	24.7	13.8	10.9	11.5	
12/31/1994	-1.6	8.4	10.4	10.5	
12/31/1993	18.2	12.7	11.1		
12/31/1992	5.7	10.9	10.0		
12/31/1991	24.4	10.5	12.9		
12/31/1990	-2.1	8.0	10.4		
12/31/1989	19.7	12.4	11.6		
12/31/1988	8.8	9.5			
12/31/1987	4.1	9.1			
12/31/1986	10.7	15.2			
12/31/1985	19.8	12.9			
12/31/1984	4.6	10.7			
12/31/1983	6.8				
12/31/1982	37.2				
12/31/1981	-0.1				
12/31/1980	8.8				

Exhibit 6

Actuarial Assets
(January 1, 2019)

Part A

Determination of Recognized Investment Gains and Losses - Four-Year Smoothing

A.	Expected investment return	$	119,572,450
B.	Actual investment return	$	(58,085,821)
C.	Gains/(losses) [B - A]	$	(177,658,271)
D.	Gains/(losses) 2017	$	98,330,883
E.	Gains/(losses) 2016	$	20,850,212
F.	Gains/(losses) 2015	$	(111,638,441)
G.	Gains/(losses) recognized at January 1, 2019 [1/4C + 1/4D + 1/4E + 1/4F][(1)]	$	(42,528,903)

Part B

Determination of Actuarial Assets

Actuarial value of assets January 1, 2018		$ 1,666,985,863
Net cash flow -- 2018	$ (30,143,320)	
Expected investment return --2018	$ 119,572,450	
Recognized investment gains(losses)	$ (42,528,903)	$ 46,900,227
Actuarial value of assets January 1, 2019		$ 1,713,886,090

1. *Includes rounding adjustment.*

Note: The AVA is equal to the expected Fair Value of Assets plus a four-year smoothing of fair value gains and losses.

Section 4 Actuarial Liabilities

In the previous section, an actuarial valuation was described as an inventory process, and an analysis was given of the inventory of assets of the System as of the valuation date. In this section, the discussion will focus on the commitments of the System, which are its actuarial liabilities.

Exhibit 7 contains an analysis of the actuarial present value of all future benefits for contributing members, for former contributing members, and for beneficiaries. The analysis is given by type of benefit.

The actuarial liabilities summarized in Exhibit 7 include the actuarial present value of all future benefits expected to be paid with respect to each member. For an active member, this value includes a measure of both benefits already earned and future benefits to be earned. Thus, for all members, active and retired, the value extends over benefits earnable and payable for the rest of their lives. If an optional benefit is chosen, the value even extends over the lives of the surviving beneficiaries.

Exhibit 7

Actuarial Present Value of Future Benefits for Contributing Members, Former Contributing Members, and Their Survivors

(Dollar Amounts in Millions)

	January 1, 2019	January 1, 2018
Active participants		
Service and early retirement	$ 1,016.9	$ 992.3
Vested termination and return of member contributions	60.5	58.2
Disability retirement	6.9	6.5
Survivors' benefits	22.6	22.4
Total	$ 1,106.9	$ 1,079.4
Inactive and retired participants and beneficiaries		
Service retirement	$ 900.1	$ 835.8
Disability retirement	5.7	5.0
Survivors' benefits	58.7	56.2
Terminated vested benefits	103.9	96.8
Total	$ 1,068.4	$ 993.8
Grand Total	$ 2,175.4	$ 2,073.1

Section 5 Employer Contributions

In an active system, there will always be a difference between the actuarial present value of future benefits and the assets. This difference has to be funded with future contributions. An actuarial valuation sets a schedule of future contributions that will deal with this funding in an orderly fashion.

The method used to determine the incidence of the contributions in various years is called the actuarial cost method. For this valuation, the entry age actuarial cost method has been used. Under this method, or essentially any actuarial cost method, the contributions required to meet the difference between current assets and present value of future benefits are allocated each year between two elements:

- A Normal Cost amount, which ideally is relatively stable as a percentage of salary over the years; and
- Whatever amount is left over, which is used to amortize what is called the Unfunded Actuarial Accrued Liability (UAAL).

The two items described above, Normal Cost and UAAL, are the keys to understanding the actuarial cost method. Let us first discuss the Normal Cost.

The Normal Cost is the theoretical contribution rate that will meet the ongoing costs of a group of average new employees. Suppose that a group of new employees was covered under a separate fund from which all benefits and to which all contributions and associated investment return were paid. Under the entry age actuarial cost method, the Normal Cost contribution rate is that level percentage of pay which would be exactly right to maintain this fund on a stable basis. If experience were to follow the actuarial assumptions exactly, the fund would be completely liquidated with the last payment to the last survivor of the group.

We have determined the Normal Cost rates separately by type of employee and by type of benefit for the System. We have also determined the dollar amounts corresponding to the Normal Cost rates. These are summarized in Exhibit 8. We assume that the contributions will be paid with each pay period.

Exhibit 9 shows the development of the UAAL. Line A shows the actuarial present value of all future benefit payments for present and former members and their survivors. Line B shows the portion that is expected to be paid from future Normal Cost contributions, both employer and employee. The remainder, the AAL, is shown on Line C. Line D shows the AVA, $1,713.9 million, to be smaller than the AAL on Line C, $1,761.7 million. Consequently, the System has an UAAL.

Exhibit 10 shows that the total contribution rate, of 21.00% on Line C is 2.47% more than the total Normal Cost rate of 18.53% on Line D. Line F shows contributions are projected to amortize the UAAL over a 8.7-year period. Line G provides the contribution rate necessary to amortize the UAAL over a 25-year period, but not lower than the current contribution rate. Lines H and I provide information on a fair-value basis.

The assumptions used in this valuation were developed in 2016 based on the System's experience in the four years 2012-2015 and will be reviewed again in 2020.

The UAAL or Funding Reserve at any date after establishment of a system is affected by any actuarial gains or losses arising when the actual experience of the system varies from the experience anticipated by the actuarial assumptions used in the valuations. To the extent actual experience differs from the assumptions used, the actual emerging costs will differ from the estimated costs. An analysis of the System's experience is discussed in Section 6, Actuarial Gains or Losses.

Exhibit 8

Normal Cost Contribution Rates as Percentages of Salary

	January 1, 2019		January 1, 2018	
	Percentage	Dollar Amount in thousands	Percentage	Dollar Amount in thousands
Service and early retirement	14.30%	37,021	14.26%	35,390
Vested termination and return of member contributions	2.84	7,352	2.84	7,048
Disability retirement	0.19	492	0.19	472
Survivors' benefits	0.40	1,036	0.40	993
Administrative Expenses	0.80	2,071	0.80	1,985
Total	18.53%	47,972	18.49%	45,888

Exhibit 9

Unfunded Actuarial Accrued Liability / Funding Reserve

(Dollar Amounts in Millions)

	January 1, 2019	January 1, 2018
A. Actuarial present value of all future benefits for present and former members and their survivors (Exhibit 7)	2,175.4	2,073.1
B. Actuarial present value of total future normal costs for present members	413.7	392.4
C. Actuarial Accrued Liability [A - B]	1,761.7	1,680.7
D. Actuarial value of assets available for benefits (Exhibit 6)	1,713.9	1,667.0
E. Funding Reserve / (Unfunded Actuarial Accrued Liability) [D - C]	(47.8)	(13.7)
F. Funding ratio [D ÷ C]	97.3%	99.2%

Fair Value Calculations[1]

	January 1, 2019	January 1, 2018
G. Fair value of assets	1,635.0	1,723.2
H. Fair value funding reserve / (Unfunded Actuarial Accrued Liability) [G - C]	(126.7)	42.5
I. Fair value funding ratio [G ÷ C]	92.8%	102.5%

1. The Retirement Board's Funding and Benefits Policy specifies that calculations based on the Fair Value of Assets should be considered as well as calculations based on the actuarial assets which smooth gains and losses over four years.

Exhibit 10

Contribution Rate Adequacy

	January 1, 2019	January 1, 2018
A. Employer contribution rate	11.34%	11.34%
B. Member contribution rate	9.66%	9.66%
C. Total contribution rate	21.00%	21.00%
D. Less total normal cost rate (Table 5)	18.53%	18.49%
E. Excess of contribution rate over normal cost rate [C - D]	2.47%	2.51%
F. Amortization period from Valuation Date	8.7 years	2.3 years
G. 25-Year Amortization of Funding Shortfall on an AVA Basis, not lower than the current contribution rate.	21.00%	21.00%
Fair Value Calculations[1]		
H. Amortization period from Valuation Date	31.7 years	N/A [2]
I. 25-Year Amortization of Funding Shortfall on an FVA Basis, not lower than the current contribution rate.	21.43%	21.00%

1. The Retirement Board's Funding and Benefits Policy specifies that calculations based on the Fair Value of Assets should be considered as well as calculations based on the actuarial assets, which smooth gains and losses over four years.

2. The amortization period on a Fair Value basis in not applicable since there is no UAAL to amortize.

Section 6 Actuarial Gains or Losses

An analysis of actuarial gains or losses is performed in conjunction with all regularly scheduled valuations. The results of our analysis of the financial experience of the System in the four recent regular actuarial valuations are presented in Exhibit 11. Each gain or loss shown represents our estimate of how much the given type of experience caused the UAAL or Funding Reserve to change in the period since the previous actuarial valuation.

Gains and losses shown due to demographic sources are approximate. Demographic experience is analyzed in greater detail in our periodic assumption studies.

Non-recurring gains and losses in the 2016 period were from changes in the actuarial assumptions due to the experience study. Those changes were reflected in the January 1, 2017 actuarial valuation. Non-recurring gains and losses in the 2017 period were from changes in the contribution rates in 2018 and changes in the annuity conversion rates in 2020 and beyond. These changes were reflected in the January 1, 2018 actuarial valuation.

Exhibit 12 provides an analysis of the change in the UAAL between the prior and current valuations. It shows the AAL, AVA and the difference between the UAAL. It shows the amounts at the prior valuation and the expected changes, including the impact of the Normal Cost, interest, contributions, benefit payments, and administrative expenses. It then shows the deviation from expectations based on gains and losses to the asset values and liability amounts.

Exhibit 11

Analysis of Actuarial Gains or Losses[1]

(Dollar Amounts in Millions)

	Gain/(Loss) For Period			
	2015	2016	2017	2018
Investment Income Investment Income was greater (less) than expected. Based on actuarial value of assets.	$ 22.7	$ 5.1	$ 2.2	$ (38.6)
Pay Increases Pay increases were less (greater) than expected.	(0.4)	3.4	3.5	1.0
Age & Service Retirements Members retired at older (younger) ages or with less (greater) final average pay than expected.	4.0	4.2	0.0	(3.7)
Disability Retirements Disability claims were less (greater) than expected.	0.2	(0.2)	0.1	0.0
Death-in-Service Benefits Survivor claims were less (greater) than expected.	1.8	1.3	0.3	0.8
Withdrawal From Employment More (Less) reserve was released by withdrawals than expected.	(2.8)	1.8	1.6	(0.1)
Death After Retirement Retirees died younger (lived longer) than expected.	1.4	4.2	5.4	0.0
Other Miscellaneous gains and losses resulting from data adjustments.	-	-	-	(0.5)
Membership Growth (Additional) liability for new members.	(1.4)	(1.5)	(1.9)	(2.3)
Total Gain or (Loss) During Period From Financial Experience	$ 25.5	$ 18.3	$ 11.2	$ (43.4)
Non-Recurring Items Changes in actuarial assumptions caused a gain (loss).	-	(40.8)	-	-
Changes in benefits caused a gain (loss).[2]	-	-	36.8	-
Composite Gain (Loss) During Period	$ 25.5	$ (22.5)	$ 48.0	$ (43.4)

1. Effects related to losses are shown in parentheses. Numerical results are expressed as a decrease (increase) in the UAAL.

2. Changes in contribution rates in 2018 and annuity conversion rates in 2020 and beyond.

Exhibit 12

Analysis of Change in Unfunded Actuarial Accrued Liability

(Dollar Amounts in Millions)

	(a) Actuarial Accrued Liability	(b) Actuarial Value of Assets	(a) - (b) Unfunded Actuarial Accrued Liability
January 1, 2018 Actuarial Valuation	**$ 1,680.7**	**$ 1,667.0**	**$ 13.7**
Normal Cost	40.7	-	40.7
Interest on Beginning of Year Amounts	120.5	116.6	3.9
Contributions	-	53.8	(53.8)
Benefit Payments (Includes Return of Contributions)	(82.2)	(82.2)	-
Administrative Expenses	-	(1.7)	1.7
Interest on Cash Flow Amounts	(2.8)	(1.0)	(1.8)
Expected January 1, 2019 Actuarial Valuation	**$ 1,756.9**	**$ 1,752.5**	**$ 4.4**
Recognized Asset Gain/(Loss)			
Gain/(Loss) from 2015-2017	-	5.8	(5.8)
Gain/(Loss) from 2018	-	(44.4)	44.4
Total Asset Gain/(Loss)	-	(38.6)	38.6
Plan Change	-	-	-
Liability (Gain)/Loss	4.8	-	4.8
Actual January 1, 2019 Actuarial Valuation	**$ 1,761.7**	**$ 1,713.9**	**$ 47.8**

Section 7 Risk Disclosure

The purpose of this appendix is to identify, assess, and provide illustrations of risks that are significant to the Plan, and in some cases to the Plan's participants.

In addition, as plans mature they accumulate larger pools of assets and liabilities. This increases the potential risk to plan funding and the finances of those who are responsible for plan funding. As shown by the Asset Volatility Ratio discussed later in this section, the System's assets are now much larger compared to payroll than in the past. The Asset Volatility Ratio example shows that because of this a 10% investment loss on assets today costs more than four times as much, when measured as a percent of payroll, than a 10% investment loss would have cost in 1976. Since pension plans make long-term promises and rely on long-term funding, it is important to consider how mature the plan is today, and how mature it may become in the future.

The results of any actuarial valuation are based on one set of assumptions. Although we believe the current assumptions for the System provide a reasonable estimate of future expectations, it is almost certain that future experience will differ from the assumptions to some extent. It is therefore important to consider the potential impacts of these potential differences between assumptions and experience when making decisions that may affect the future financial health of the Plan, or of the Plan's participants.

Actuarial Standard of Practice No. 51 (ASOP 51) addresses these issues by providing actuaries with guidance for assessing and disclosing the risk associated with measuring pension liabilities and the determination of pension plan contributions. Specifically, it directs the actuary to:

- Identify risks that may be significant to the plan.
- Assess the risks identified as significant to the plan. The assessment does not need to include numerical calculations.
- Disclose plan maturity measures and historical information that are significant to understanding the plan's risks.

ASOP 51 states that if in the actuary's professional judgment, a more detailed assessment would be significantly beneficial in helping the individuals responsible for the plan to understand the risks identified by the actuary, then the actuary should recommend that such an assessment be performed.

This Section uses the framework of ASOP 51 to communicate important information about significant risks to the System, the System's maturity, and relevant historical Plan data.

Identification of Risks

There are a number of factors that affect future valuation results. To the extent actual experience for these factors varies from the assumptions, this will likely cause either increases or decreases in the plan's future funding level and calculated contribution rates. Examples of factors that can have a significant impact on valuation results are:

- Investment return as this will impact the level of assets available to pay benefits
- Payroll variation as this will impact the ability to finance unfunded amounts as a percent of future pay
- Salary variation as this will impact the size of benefits members receive as a percent of final earnings
- Mortality as this will impact how long retirees receive benefits

- Service retirement as this will impact: how long retirees receive benefits, the size of retiree benefits, the amount of time to receive employer and employee contributions, and the amount of time for investment earnings to accumulate on those contributions
- Termination (members leaving active employment for reasons other than death, disability or service retirement) as this will impact the size of those members benefits

Investment Return

Of the factors listed above, we believe the factor with the greatest potential risk is future investment returns. For this reason, we studied this assumption in multiple ways in the executive summary of this report.

In projections 1-3, we performed deterministic projections to study the impact of various investment return scenarios on the funding ratios and contribution rates necessary to meet the plan's obligations.

In projection 4, to give an idea of the potential range of future contribution rates and funding ratios, we display the results of a stochastic projection. This type of projection allows the assessment of the likelihood of certain events in the 1,000 scenarios modeled. The stochastic projection uses a random number generator, the System's asset allocation, and Milliman's capital market assumptions to generate a probability distribution of future contribution rates and funding ratios based on 1,000 random scenarios.

Our last disclosure about investment returns in the executive summary is a sensitivity analysis where we show the impact on the Normal Cost rate, Actuarial Accrued Liability, and Funding Ratios of a one percent increase or decrease in assumed future investment returns.

Demographic Experience

While future investment returns will likely cause the greatest deviation from expected experience, there are many other assumptions made in an actuarial valuation. For these assumptions, differences between actual and assumed experience will also result in actuarial gains and losses. Exhibit 11 in Section 6 of this report provides a look at the impact in recent years of actual experience deviating from assumed.

Maturity Measures and Historical Information

The remainder of this section contains historical information concerning the System's Asset Volatility Ratio, Liability Volatility Ratio, and Cash Flows, as well as a 10-year projection of the System's cash flows. Additional historical information can be found in Section 8 (Supplemental Information), and Appendix D (Comparative Schedules). Some of the historical information in Section 8 and Appendix D also provides measures of the System's maturity including breakdowns of the System's liability and membership between active and inactive members.

Asset Volatility Ratios and Liability Volatility Ratios

The magnitude of any contribution rate increase or decrease is affected by the System's maturity level. As systems mature, they accumulate larger pools of assets. Gains and losses on these larger pools of assets create more volatility in the contributions needed to fund the system.

One indicator of this potential volatility is the Asset Volatility Ratio (AVR), which is equal to the Fair Value of Assets divided by total payroll. As assets grow compared to payroll, any percentage gain or loss on those assets will be larger compared to payroll. This causes any resulting changes in required contributions from those gains or losses to also be larger when measured as a percent of payroll. Therefore, plans with a high AVR will be subject to a greater level of volatility in required contributions. The AVR is a current measure since it is based on the current level of assets and will vary from year to year.

The current AVR for TERS is 6.3. The AVR grew from 1.4 in 1976 to a high of 6.9 in 2018. The following chart provides an illustration of how increases in the AVR increase the volatility of contributions from asset gains and losses.

A return of negative 3.00% is a 10% loss for TERS because it is 10% below the 7.00% investment return assumption. As shown in the chart, if a return of negative 3.00% is not offset by future gains and the AVR is 1.4, the loss is expected to increase contributions by 0.8% of pay if amortized over 25 years and 1.2% of pay if amortized over 15 years. However, with the AVR of 6.3, the same return is expected to increase contributions by 3.7% of payroll if amortized over 25 years and 5.3% of pay if amortized over 15 years. In both cases this assumes there is no buffer such as a reserve or an amortization period below 25 years to absorb some of the adverse experience.

Approximate eventual increases in contributions for an asset return 10% below the assumption if not offset by future gains(1)		
Asset Volatility Ratio = Assets / Payroll	25-Year Amortization	15-Year Amortization
1.4 (1976)	0.8% of payroll	1.2% of payroll
6.3 (current)	3.7% of payroll	5.3% of payroll

1. Estimate does not reflect increased value of future refunds due to increase in member contribution rates. The total increases would be slightly larger after an adjustment for higher returns of member contributions.

The graph at the top of Exhibit 13 shows how the System matured during the last 25 years of the 20th century, as represented by the increasing AVR.

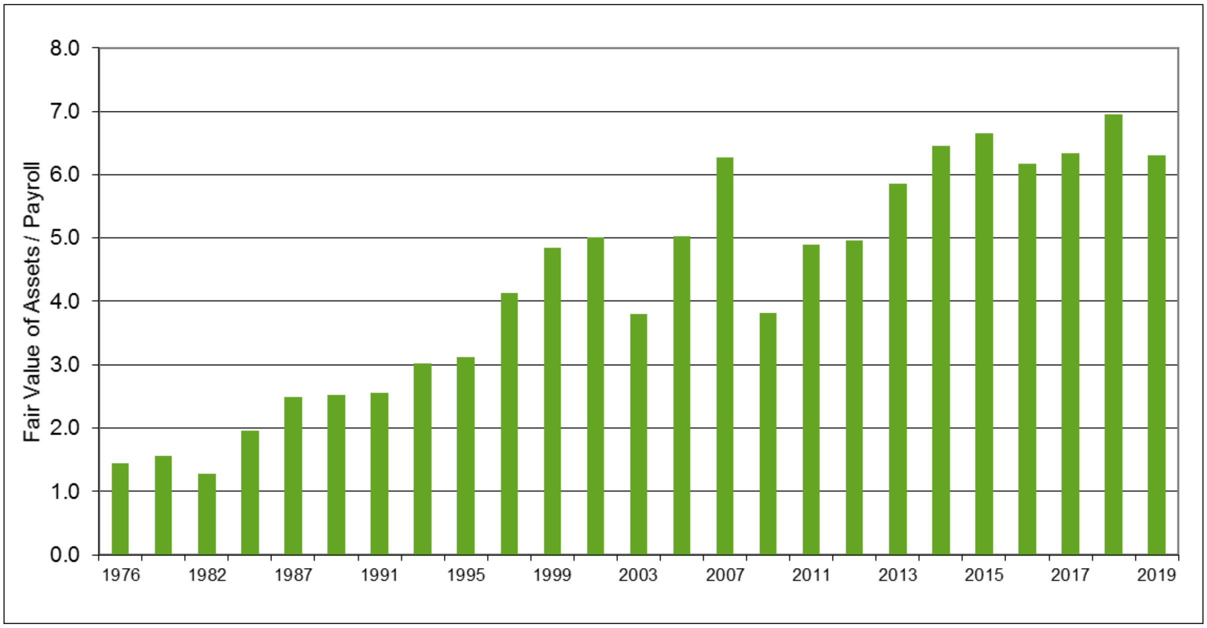
Another measure of a system's maturity is the Liability Volatility Ratio (LVR), which is equal to the AAL divided by the total payroll. This ratio provides an indication of the longer-term potential for contribution volatility for any given level of investment volatility. In addition, this ratio provides an indication of the potential contribution volatility due to liability experience (gains and losses) and liability re-measurements (assumption changes). For TERS, the current LVR is 6.8.

The graph at the bottom of Exhibit 13 shows the historical LVR since 1985. It is a similar pattern to the Asset Volatility Ratio, except the increase is more gradual and the year-to-year variance is significantly less.

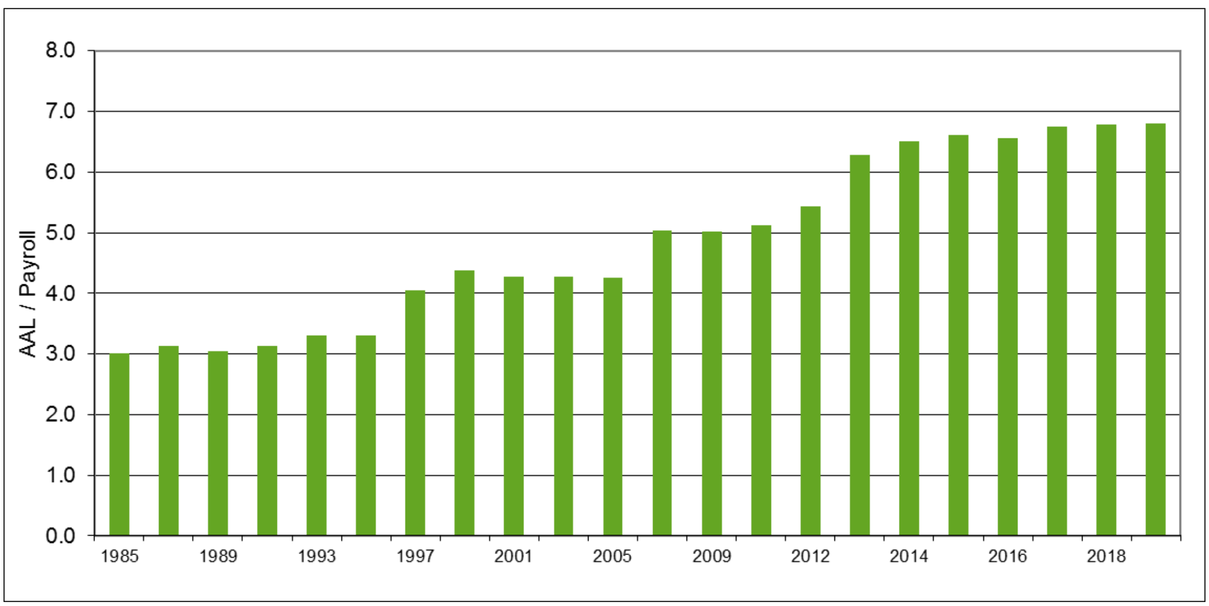
Exhibit 13

Asset and Liability Volatility Ratios

Asset Volatility Ratios (Fair Value of Assets ÷ Payroll)



Liability Volatility Ratios (Actuarial Accrued Liability ÷ Payroll)



Historical and Projected Cash Flows

One way to assess future risks is to look at historical measurements. Exhibit 14 summarizes the System's historical cash flows for the last 10 years and the projected cash flows for the next 10 years. The projected cash flows are based on the actuarial assumptions as stated in Appendix A. Contributions include both employer and member contributions. The total contribution rate increased to 21.00% of pay at February 2018, consistent with the Tacoma Municipal Code. The projections assume this rate continues throughout the projection period. Graphs of Exhibit 14 are on the facing page. Additional historical information can be found in Section 8 and Appendix D.

Exhibit 14

Cash Flow History and Projections

(Dollar Amounts in Millions)

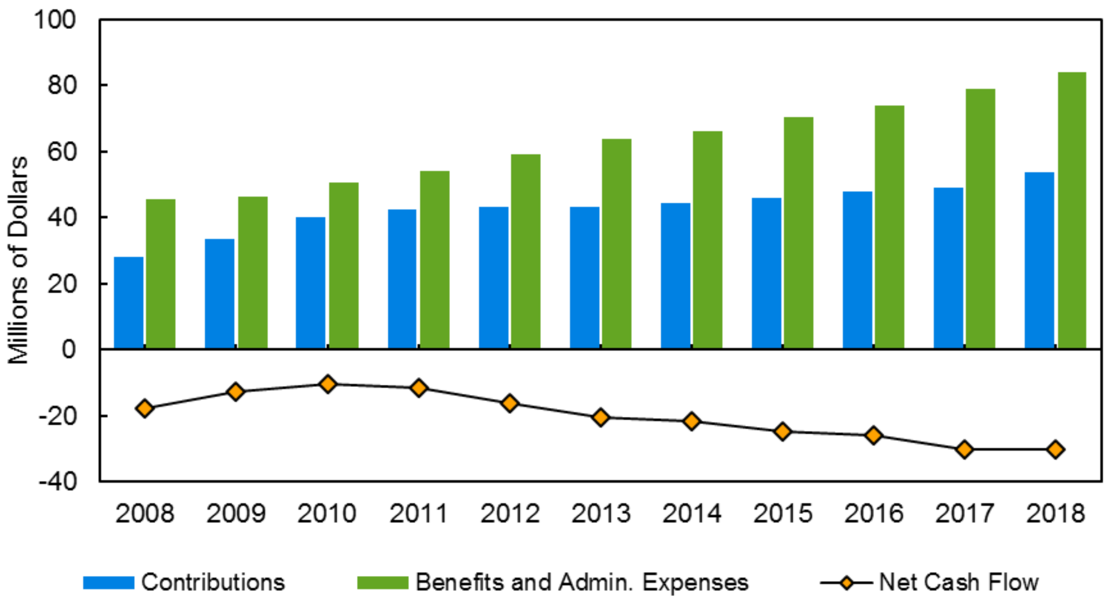
Historical Cash Flows			
Year	Contributions	Benefits & Administrative Expenses	Net Cash Flow[3]
2008	28	46	$ (18)
2009	34	46	(13)
2010	40	51	(10)
2011	42	54	(12)
2012	43	59	(16)
2013	43	64	(21)
2014	45	66	(22)
2015	46	70	(25)
2016	48	74	(26)
2017	49	79	(30)
2018	54	84	(30)

Projected Cash Flows			
Year	Contributions[1]	Benefits & Administrative Expenses[2]	Net Cash Flow[3]
2019	$ 54	$ 90	$ (36)
2020	56	95	(39)
2021	59	100	(42)
2022	61	106	(45)
2023	63	111	(48)
2024	65	118	(52)
2025	68	124	(56)
2026	70	130	(60)
2027	73	137	(64)
2028	76	143	(67)

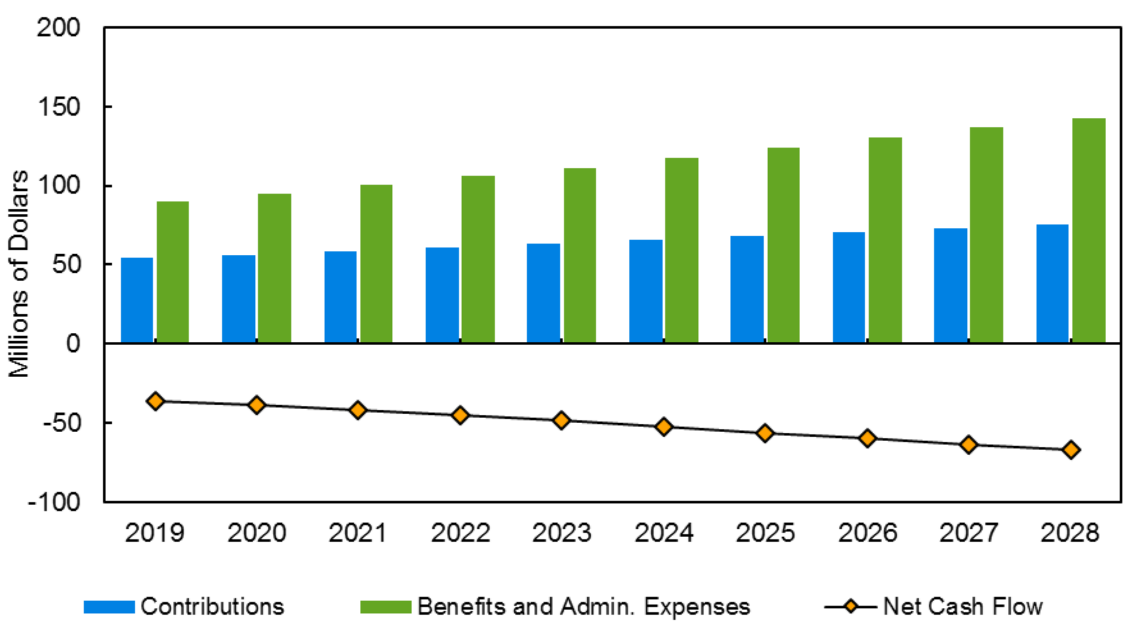
1. *Contributions are based on the current total contribution rate of 21.00%.*
2. *Administrative expenses are based on the current actuarial assumption of 0.80% of pay.*
3. *Due to rounding, net cash flow may not match contributions minus disbursements.*

Exhibit 14 (continued)

Cash Flow History



Cash Flow Projections



Section 8 Supplemental Information

Historical Funding Exhibits

The four exhibits in this section provide historical funding information. Exhibit 15, the Schedule of Funding Progress, and Exhibit 16, Funding Ratios, provide a history of the System's funding based on the Actuarial Value of Assets and the Actuarial Accrued Liability. Exhibit 17, Actuarial Present Value of Accumulated Vested Plan Benefits, provides a history of the System's funding based on the Actuarial Value of Assets and the Actuarial Present Value of Accumulated Plan Benefits. Exhibit 18 is a schedule of retirees and beneficiaries added to and removed from rolls.

Exhibit 15

Schedule of Funding Progress

(Dollar Amounts in Millions)

Actuarial Valuation Date	Actuarial Value of Assets	Actuarial Accrued Liabilities (AAL) (1)	Unfunded Actuarial Accrued Liabilities (UAAL) (2)	Funded Ratio	Funding Ratio Increase (Decrease) Over Prior Valuation	Covered Payroll (3)	UAAL as a Percentage of Covered Payroll
January 1, 1997	$ 482.7	$ 477.9	$ (4.8)	101.0 %	7.9 %	$ 116.3	(4.1) %
January 1, 1998(4)	523.8	515.7	(8.1)	101.6	0.6	116.1	(7.0)
January 1, 1999(5)	570.7	536.9	(33.8)	106.3	4.7	122.3	(27.6)
January 1, 1999(6)	570.7	537.6	(33.1)	106.2	(0.1)	122.3	(27.1)
January 1, 2001	700.7	605.7	(95.0)	115.7	9.5	133.4	(71.2)
January 1, 2003	740.1	686.8	(53.3)	107.8	(7.9)	154.2	(34.6)
January 1, 2005	807.3	754.3	(53.0)	107.0	(0.8)	172.5	(30.7)
January 1, 2007	1,021.3	895.8	(125.5)	114.0	7.0	175.0	(71.7)
January 1, 2009	1,097.3	1,002.3	(95.0)	109.5	(4.5)	197.4	(48.1)
January 1, 2011	1,074.8	1,132.9	58.1	94.9	(14.6)	219.6	26.5
January 1, 2012	1,068.3	1,185.5	117.2	90.1	(4.8)	219.4	53.4
January 1, 2013	1,187.1	1,306.6	119.5	90.9	0.8	210.6	56.7
January 1, 2014	1,297.0	1,400.0	103.0	92.6	1.7	213.8	48.2
January 1, 2015	1,402.7	1,468.2	65.5	95.5	2.9	221.3	29.6
January 1, 2016	1,501.7	1,542.2	40.5	97.4	1.9	227.4	17.8
January 1, 2017	1,585.0	1,648.1	63.1	96.2	(1.2)	236.4	26.7
January 1, 2018	1,667.0	1,680.7	13.7	99.2	3.0	241.6	5.7
January 1, 2019	1,713.9	1,761.7	47.8	97.3	(1.9)	252.8	18.9

1. Actuarial present value of benefits less actuarial present value of future normal costs based on Entry Age Actuarial Cost Method.
2. Actuarial accrued liabilities less Actuarial Value of Assets.
3. Covered Payroll includes compensation paid to all active employees on which contributions were made in the year preceding the valuation date.
4. A special actuarial valuation was performed as of January 1, 1998.
5. Results of January 1, 1999 Actuarial Valuation.
6. January 1, 1999 results adjusted for inclusion of benefit percentage in portability, removal of overtime contributions and removal of 90-day waiting period.

Exhibit 16

Funding Ratios

(Dollar Amounts in Millions)

Actuarial Valuation Date[1]	Actuarial Accrued Liabilities for: A Active Member Contribution	B Inactives, Retirees and Beneficiaries	C Active Members (Employer-Financed Portion)	D Total	Actuarial Value of Assets	Portion of Actuarial Accrued Liabilities Covered by Assets: A	B	C	D
January 1, 1997	$ 136.3	$ 184.8	$ 156.8	$ 477.9	$ 482.7	100.0%	100.0%	100.0%	101.0%
January 1, 1998	133.5	252.5	129.7	515.7	523.8	100.0%	100.0%	100.0%	101.6%
January 1, 1999[2]	138.8	253.7	144.4	536.9	570.7	100.0%	100.0%	100.0%	106.3%
January 1, 1999[3]	138.8	253.7	145.1	537.6	570.7	100.0%	100.0%	100.0%	106.2%
January 1, 2001	165.0	268.2	172.5	605.7	700.7	100.0%	100.0%	100.0%	115.7%
January 1, 2003	186.1	296.1	204.6	686.8	740.1	100.0%	100.0%	100.0%	107.8%
January 1, 2005	204.2	325.4	224.7	754.3	807.3	100.0%	100.0%	100.0%	107.0%
January 1, 2007	194.1	427.2	274.5	895.8	1,021.3	100.0%	100.0%	100.0%	114.0%
January 1, 2009	207.1	497.6	297.6	1,002.3	1,097.3	100.0%	100.0%	100.0%	109.5%
January 1, 2011	236.4	569.8	326.7	1,132.9	1,074.8	100.0%	100.0%	82.2%	94.9%
January 1, 2012	246.7	612.2	326.6	1,185.5	1,068.3	100.0%	100.0%	64.1%	90.1%
January 1, 2013	240.7	734.2	331.7	1,306.6	1,187.1	100.0%	100.0%	64.0%	90.9%
January 1, 2014	261.4	768.3	370.3	1,400.0	1,297.0	100.0%	100.0%	72.2%	92.6%
January 1, 2015	272.6	813.6	382.0	1,468.2	1,402.7	100.0%	100.0%	82.9%	95.5%
January 1, 2016	283.4	863.2	395.6	1,542.2	1,501.7	100.0%	100.0%	89.8%	97.4%
January 1, 2017	291.8	936.9	419.4	1,648.1	1,585.0	100.0%	100.0%	85.0%	96.2%
January 1, 2018	297.1	993.8	389.8	1,680.7	1,667.0	100.0%	100.0%	96.5%	99.2%
January 1, 2019	302.4	1,068.4	390.9	1,761.7	1,713.9	100.0%	100.0%	87.8%	97.3%

1. See Exhibit D-5 for significant changes affecting the valuation results.
2. Results of January 1, 1999 Actuarial Valuation.
3. January 1, 1999 results adjusted for inclusion of benefit percentage in portability, removal of overtime contributions and removal of 90-day waiting period.

Exhibit 17

Actuarial Present Value of Accumulated Vested Plan Benefits

(Dollar Amounts in Millions)

			Active Members				
Actuarial Valuation Date [1]	Retired Members	Inactive Vested	Member Contributions	Employer-Financed Portion	Total	Actuarial Value of Assets	Portion of Accumulated Vested Plan Benefits Covered by Actuarial Assets
January 1, 1997	$ 179.1	$ 5.7	$ 136.3	$ 109.6	$ 430.7	$ 482.7	112.1%
January 1, 1998	246.5	6.0	133.5	93.2	479.2	523.8	109.3%
January 1, 1999[2]	244.3	9.4	138.8	112.1	504.6	570.7	113.1%
January 1, 1999[3]	244.3	9.4	138.8	115.1	507.6	570.7	112.4%
January 1, 2001	250.3	17.8	165.0	123.0	556.1	700.7	126.0%
January 1, 2003	274.8	21.3	186.1	143.1	625.3	740.1	118.4%
January 1, 2005	303.0	22.4	204.2	170.6	700.2	807.3	115.3%
January 1, 2007	377.6	49.6	194.1	213.4	834.7	1,021.3	122.4%
January 1, 2009	438.5	59.1	207.1	226.9	931.6	1,097.3	117.8%
January 1, 2011	500.0	69.8	236.4	236.9	1,043.1	1,074.8	103.0%
January 1, 2012	538.1	74.1	246.7	239.0	1,097.9	1,068.3	97.3%
January 1, 2013	648.7	85.5	240.7	256.0	1,230.9	1,187.1	96.4%
January 1, 2014	677.9	90.4	261.4	299.9	1,329.6	1,297.0	97.5%
January 1, 2015	717.2	96.4	272.6	307.8	1,394.0	1,402.7	100.6%
January 1, 2016	763.4	99.8	283.4	314.4	1,461.0	1,501.7	102.8%
January 1, 2017	835.6	101.3	291.8	334.5	1,563.2	1,585.0	101.4%
January 1, 2018	897.0	96.8	297.1	362.8	1,653.7	1,667.0	100.8%
January 1, 2019	964.5	103.9	302.4	360.2	1,731.0	1,713.9	99.0%

1. See Exhibit D-5 for significant changes affecting the valuation results.
2. Results of January 1, 1999 Actuarial Valuation.
3. January 1, 1999 results adjusted for inclusion of benefit percentage in portability, removal of overtime contributions and removal of 90-day waiting period.

Exhibit 18

Schedule of Retirees and Beneficiaries Added to and Removed from Rolls

Valuation Date January 1	Added to Rolls No.	Added to Rolls Annual Allowances[1]	Removed from Rolls No.	Removed from Rolls Annual Allowances	Rolls No.	Rolls Annual Allowances	Percent Increase in Annual Allowances	Average Annual Allowance	Percent Increase in Average Annual Allowances
1993					1,439	$ 14,868,000	5.5%	$ 10,332	5.0%
1995	128	$ 2,430,000	129	$ 929,000	1,438	16,369,000	4.9	11,383	5.0
1997	116	2,677,000	101	939,000	1,453	18,107,000	5.2	12,462	4.6
1999	269	6,700,000	100	943,000	1,622	23,864,000	14.8	14,713	8.7
2001	74	2,533,000	114	1,242,000	1,582	25,156,000	2.7	15,901	4.0
2003	133	4,057,000	116	1,535,000	1,599	27,677,000	4.9	17,309	4.3
2005	220	5,714,000	173	2,220,000	1,646	31,171,000	6.1	18,937	4.6
2007	236	7,271,000	148	1,964,000	1,734	36,478,000	8.2	21,037	5.4
2009	245	7,952,000	160	2,575,000	1,819	41,855,000	7.1	23,010	4.6
2011	233	8,061,000	158	2,473,000	1,894	47,443,000	6.5	25,049	4.3
2012	135	5,172,000	79	1,558,000	1,950	51,057,000	7.6	26,183	4.5
2013	227	8,224,000	71	1,461,000	2,106	57,820,000	13.2	27,455	4.9
2014	97	3,614,000	84	1,621,000	2,119	59,813,000	3.4	28,227	2.8
2015	136	5,437,000	88	1,758,000	2,167	63,492,000	6.2	29,300	3.8
2016	151	6,080,000	84	1,933,000	2,234	67,639,000	6.5	30,277	3.3
2017	156	6,010,000	87	2,121,000	2,303	71,528,000	5.7	31,059	2.6
2018	181	7,628,000	88	2,297,000	2,396	76,859,000	7.5	32,078	3.3
2019	166	7,706,000	88	2,101,000	2,474	82,464,000	7.3	33,332	3.9

1. Includes postretirement increases.

Note: The numbers added to rolls and removed from rolls were for two-year periods for valuations dated 2011 and earlier, but for one-year periods for valuations dated after 2011.

Appendix A Actuarial Procedures and Assumptions

This section of the actuarial valuation report describes the actuarial procedures and assumptions used in this valuation.

The economic and non-economic assumptions were changed for the January 1, 2017 valuation. The changes in assumptions were discussed and approved by the Board in 2016 based on the System's experience in the four years, 2012-2015.

The actuarial assumptions used in the valuation are intended to estimate the future experience of the members of the System and of the System itself in areas that affect the projected benefit flow and anticipated investment earnings. Any variations in future experience from that expected from these assumptions will result in corresponding changes in the estimated costs of the System's benefits.

Exhibit A-2 presents expected annual rates of salary increases. The other exhibits in this section give probabilities of decrement. The probabilities of decrement are referred to in actuarial literature as the absolute rate of decrement or q'_x.

Actuarial Cost Method

The actuarial valuation was prepared using the entry age actuarial cost method. Under this method, the actuarial present value of the projected benefits of each individual included in the valuation is allocated as a level percentage of the individual's projected compensation between entry age and assumed exit. The portion of this actuarial present value allocated to a valuation year is called the Normal Cost. The portion of this actuarial present value not provided for at a valuation date by the sum of (a) the actuarial value of the assets and (b) the actuarial present value of future normal costs is called the UAAL. The UAAL is amortized as a level percentage of the projected salaries of present and future members of the System.

The Normal Cost for the valuation year was calculated separately for each individual, based on his or her age at entry into the System. The individual normal costs were then aggregated and divided by the total current compensation of the individuals included in the valuation to determine the Normal Cost rate as a percentage of compensation (adopted 1/1/1976).

Records and Data

The data used in the valuation consist of financial information and records of age, service, and income of contributing members, former contributing members, and their survivors. All of the data were supplied by the System and are accepted for valuation purposes without audit (adopted 1/1/1976).

Replacement of Terminated Members

The ages at entry and distribution by sex of future members are assumed to average the same as those of the present members they replace. If the number of active members should increase, it is further assumed that the average entry age of the larger group will be the same, from an actuarial standpoint, as that of the present group. Under these assumptions, the Normal Cost rates for active members will not vary with the termination of present members (adopted 1/1/1976).

Change in Membership

No change in the membership of the System is assumed (adopted 1/1/1985).

Employer Contributions

The Tacoma Municipal Code specifies a total employer contribution rate of 11.34% of members' salaries in 2018 and beyond.

Administrative Expenses

The annual contribution assumed to be necessary to meet administrative expenses of the System is 0.80% of members' salaries. This figure is included in the calculation of the Normal Cost rate (adopted 1/1/2017).

Valuation of Assets

Assets are valued based on their fair value, with a four-year smoothing of all fair value gains and losses. The expected return is determined for each year based on the beginning of year fair value and actual cash flows during the year. Any difference between the expected fair value return and the actual fair value return is recognized evenly over a period of four years. (The method used to value assets was adopted 1/1/1997).

Investment Earnings

The annual rate of investment earnings based on the actuarial value of the assets of the System are assumed to be 7.00% per year, compounded annually and net of investment expenses (adopted 1/1/2017).

Investment Expenses

It is assumed that future investment expenses will be funded by increased investment return of 0.35% on all assets of the fund (adopted 1/1/2009).

Postretirement Benefit Increases

It is assumed that the Consumer Price Index will continue to increase at a rate of 2.75% per year; thus, retirement allowances are assumed to increase at a rate of 2.125% per year plus an additional amount to bring the members' indexed benefits to at least 50% of original purchasing power as provided by the System (adopted 1/1/2017).

Future Salaries

Exhibit A-2 shows a portion of the scale of relative salary values, which is used to estimate future salaries for the purpose of the valuation. In addition to increases in salary due to promotion and longevity, this scale includes an annual rate of increase in the wage growth assumption of 3.75% (adopted 1/1/2017).

Service Retirement

Exhibit A-3 shows the assumed annual rates of retirement among members eligible for service retirement or reduced retirement (adopted 1/1/2017).

Disability

The rates of disability used in this valuation are illustrated in Exhibit A-4 (adopted 1/1/2017). The rates are for members with five or more years of service. Duty disabilities that occur for members with less than five years of service are recognized as they occur. No specific provision is made for these benefits, as none have occurred during the past 10 years.

Mortality

The mortality rates used in this valuation are illustrated in Exhibit A-5.

Contributing Members	RP-2014 Employee Tables for respective sexes, projected with a unisex table based on Social Security Administration data from the most recent 60 years available (adopted 1/1/2017).
Inactive Members, Retired Members and Beneficiaries	Males: RP-2014 Mortality Table for Males, blended 50% Blue Collar and 50% White Collar. Females: RP-2014 Blue Collar Mortality Tables for Females. Both males and females are projected with a unisex table based on Social Security Administration data from the most recent 60 years available (adopted 1/1/2017).
Disabled Members	RP-2014 Disabled Male Mortality projected with a unisex table based on Social Security Administration data from the most recent 60 years available (adopted 1/1/2017).

Other Terminations of Employment

The rates of assumed future withdrawal from active service for reasons other than death, disability, or service retirement are shown for representative ages in Exhibit A-6 (adopted 1/1/2017).

Vesting

We assume all members who terminate with less than five years of service withdraw their accumulated contributions. For members who terminate with five or more years of service, we assume they will elect a deferred retirement benefit, payable at age 60.

Interest on Member Contributions

A portion of employee contributions into the retirement fund is credited with interest at a specified rate set by the Retirement Board. That portion is equal to all contributions made before February 1, 2009 and contributions made up to 6.44% of pay after February 1, 2009. Interest on that portion of member contributions is assumed to accrue at an annual rate of 1.5% per quarter, compounded quarterly. This is equivalent to 6.136% per annum, compounded annually (adopted 1/1/1979).

Portability

The estimated cost of portability with other public retirement systems was included in this valuation. The available data to measure the costs of portability is small. As data on portability retirements continues to be collected, more accurate measurements will be possible in the future. For now, we are assuming:

- A 1% increase to the early retirement liabilities for actives when compared to what the liabilities would be without portability.
- An 18% increase to the deferred vested decrement for actives when compared to what the liabilities would be without portability.
- An 18% increase to the liabilities for vested terminated members when compared to what the liabilities would be without portability.

(The above assumptions were adopted 1/1/2017.)

Probability of Eligible Survivors for Death Benefits of Active Members

For members not currently in pay status, all members are assumed to have eligible survivors (spouses or qualified domestic partners). Survivors are assumed to be three years younger than male members and three years older than female members. Survivors are assumed to be of the opposite sex as the member.

Exhibit A-1

Summary of Valuation Assumptions
(January 1, 2019)

Economic Assumptions - Annual Rates of Growth

A.	Wage inflation	3.75%
B.	Investment return	7.00%
C.	Membership increase	0%
D.	Benefits (postretirement)	2.125%
E.	Member contribution accounts	6.136%
F.	Price inflation	2.75%

Non-economic Assumptions

A.	Salary increases due to promotion and longevity	Exhibit A-2
B.	Service retirement	Exhibit A-3
C.	Disability	Exhibit A-4
D.	Mortality among inactive members, service retired members and beneficiaries RP-2014 Mortality Table for Males, blended 50% Blue Collar and 50% White Collar. RP-2014 Blue Collar Mortality Tables for females. Both males and females are projected with a unisex table based on Social Security Administration data from the most recent 60 years available.	Exhibit A-5
E.	Mortality among disabled members RP-2014 Disabled Male Mortality projected with a unisex table based on Social Security Administration data from the most recent 60 years available.	Exhibit A-5
E.	Mortality among contributing members RP-2014 Employee Mortality for respective sexes, projected with a unisex table based on Social Security Administration data from the most recent 60 years available.	Exhibit A-6
F.	Other terminations of employment	Exhibit A-7

Exhibit A-2

Future Salaries

	Annual Rate of Increase	
Years of Service	Promotion and Longevity	Total*
1	4.75%	8.68%
2	4.00%	7.90%
3	3.50%	7.38%
4	2.75%	6.60%
5	2.25%	6.08%
6	1.90%	5.72%
7	1.70%	5.51%
8	1.40%	5.20%
9	1.25%	5.05%
10	1.10%	4.89%
11	0.95%	4.74%
12	0.80%	4.58%
13	0.75%	4.53%
14	0.70%	4.48%
15	0.65%	4.42%
16	0.60%	4.37%
17	0.55%	4.32%
18	0.50%	4.27%
19	0.47%	4.24%
20	0.44%	4.21%
21	0.41%	4.18%
22	0.38%	4.14%
23	0.35%	4.11%
24	0.33%	4.09%
25	0.31%	4.07%
26	0.29%	4.05%
27	0.27%	4.03%
28 and over	0.25%	4.01%

**Including a 3.75% general wage increase assumption.*

Exhibit A-3

Service Retirement

	Males		Females	
Age	Eligible for Reduced Benefits	Eligible for Full Benefits	Eligible for Reduced Benefits	Eligible for Full Benefits
45 or younger	1.0%	15.0%	2.0%	12.0%
46	1.0%	15.0%	2.0%	12.0%
47	1.0%	15.0%	2.0%	12.0%
48	1.0%	15.0%	2.0%	12.0%
49	1.5%	15.0%	2.5%	12.0%
50	2.0%	15.0%	3.5%	12.0%
51	2.0%	12.0%	3.5%	10.0%
52	2.5%	12.0%	3.5%	10.0%
53	2.5%	12.0%	3.5%	10.0%
54	2.5%	12.0%	3.5%	10.0%
55	2.5%	12.0%	5.0%	10.0%
56	2.5%	12.0%	5.0%	10.0%
57	2.5%	12.0%	5.0%	10.0%
58	2.5%	12.0%	5.0%	10.0%
59	2.5%	12.0%	5.0%	10.0%
60		13.5%		10.0%
61		13.5%		15.0%
62		15.0%		15.0%
63		15.0%		15.0%
64		15.0%		15.0%
65		25.0%		22.0%
66		25.0%		22.0%
67		25.0%		20.0%
68		25.0%		20.0%
69		25.0%		20.0%
70 or older		100.0%		100.0%

Exhibit A-4

Disability

Annual Probabilities

Age	Males and Females
22	.02%
27	.02
32	.05
37	.05
42	.05
47	.08
52	.10
57	.10

Exhibit A-5

Post-Commencement Mortality

Annual Probabilities

	Retired Members and Beneficiaries		Disabled Members	Projection Scale*
Age	Males	Females	Males and Females	Males and Females, Healthy and Disabled
50	0.34%	0.28%	2.04%	1.19%
51	0.37	0.30	2.10	1.20
52	0.40	0.33	2.16	1.21
53	0.43	0.35	2.22	1.20
54	0.46	0.38	2.28	1.19
55	0.50	0.40	2.34	1.17
56	0.53	0.43	2.40	1.17
57	0.56	0.46	2.46	1.17
58	0.60	0.49	2.52	1.19
59	0.64	0.53	2.59	1.21
60	0.68	0.57	2.66	1.24
61	0.73	0.62	2.74	1.25
62	0.79	0.67	2.83	1.26
63	0.85	0.73	2.93	1.27
64	0.93	0.80	3.04	1.26
65	1.01	0.87	3.17	1.25
66	1.10	0.96	3.31	1.25
67	1.21	1.05	3.46	1.24
68	1.33	1.15	3.64	1.24
69	1.46	1.27	3.83	1.23
70	1.60	1.40	4.03	1.22
71	1.77	1.54	4.26	1.21
72	1.95	1.70	4.52	1.20
73	2.16	1.88	4.79	1.19
74	2.38	2.08	5.10	1.18
75	2.64	2.30	5.43	1.16
76	2.92	2.54	5.79	1.13
77	3.24	2.81	6.19	1.11
78	3.60	3.11	6.64	1.11
79	4.00	3.44	7.12	1.11
80	4.46	3.82	7.66	1.10
81	4.97	4.24	8.26	1.07
82	5.55	4.71	8.91	1.02
83	6.20	5.24	9.64	0.95
84	6.94	5.83	10.44	0.87
85	7.76	6.50	11.33	0.79
86	8.69	7.25	12.31	0.71
87	9.73	8.08	13.39	0.64
88	10.89	9.00	14.57	0.58
89	12.18	10.04	15.87	0.53
90	13.63	11.19	17.30	0.49

** Projection Scale is based on Social Security Administration data from 1953-2013. The projection scale is applied to the annual probabilities listed above. The probabilities above reflect the probabilities in 2014. Therefore, the year 2015 is the first year the improvement scale is applied.*

Exhibit A-6

Pre-Commencement Mortality

Annual Probabilities

	Contributing Members		Projection Scale*
Age	Males	Females	Males and Females
20	0.04%	0.02%	1.15%
21	0.04	0.02	1.04
22	0.05	0.02	0.96
23	0.05	0.02	0.90
24	0.05	0.02	0.86
25	0.05	0.02	0.82
26	0.05	0.02	0.78
27	0.04	0.02	0.75
28	0.04	0.02	0.74
29	0.04	0.02	0.75
30	0.05	0.02	0.76
31	0.05	0.03	0.79
32	0.05	0.03	0.81
33	0.05	0.03	0.84
34	0.05	0.03	0.88
35	0.05	0.03	0.91
36	0.05	0.03	0.95
37	0.06	0.04	1.00
38	0.06	0.04	1.06
39	0.06	0.04	1.12
40	0.06	0.04	1.18
41	0.07	0.05	1.22
42	0.07	0.05	1.24
43	0.08	0.06	1.23
44	0.09	0.07	1.21
45	0.10	0.07	1.18
46	0.11	0.08	1.17
47	0.12	0.09	1.16
48	0.14	0.10	1.17
49	0.15	0.11	1.18
50	0.17	0.12	1.19
51	0.19	0.14	1.20
52	0.21	0.15	1.21
53	0.23	0.16	1.20
54	0.25	0.17	1.19
55	0.28	0.19	1.17
56	0.31	0.20	1.17
57	0.34	0.22	1.17
58	0.38	0.24	1.19
59	0.42	0.25	1.21
60	0.47	0.27	1.24

** Projection Scale is based on Social Security Administration data from 1953-2013.*

Exhibit A-7

Other Terminations of Employment Among Members Not Eligible to Retire

Annual Probabilities

Years of Service	Males	Females
1	20.0%	20.0%
2	8.0	10.0
3	7.0	10.0
4	4.5	8.0
5	4.0	6.0
6	3.5	5.7
7	3.5	5.3
8	3.0	5.0
9	2.8	4.8
10	2.6	4.6
11	2.4	4.4
12	2.2	4.2
13	2.0	4.0
14	1.9	3.6
15	1.8	3.2
16	1.7	2.8
17	1.6	2.4
18	1.5	2.0
19	1.5	1.9
20	1.5	1.8
21	1.5	1.7
22	1.5	1.6
23 or more	1.5	1.5

Appendix B Provisions of Governing Law

All actuarial calculations are based upon our understanding of the Tacoma Employees' Retirement System, Chapter 1.30 of the Tacoma City Code. The benefit and contribution provisions of this law are summarized briefly below for reference purposes, along with corresponding references to the City code. This summary encompasses the major provisions of the System. It does not attempt to cover all the detailed provisions.

Effective Date

The effective date of the Retirement System was January 1, 1941.

(Section 1.30.280)

Members' Mandatory Contribution Rate

The members' mandatory contribution rate is currently 9.66% for 2019.

(*Sections 1.30.340 and 1.30.350)*

City Contribution Rate

The City contribution rate is the amount which is determined by actuarial investigation to be necessary to fund membership service, prior service, and basic service pensions on an actuarially sound basis. It has been established at 11.34% of salary for 2019.

(Sections 1.30.360 and 1.30.665)

Normal Accumulated Contributions

An employee's normal accumulated contributions are based on contributions compounded quarterly at 6.00%. Effective February 1, 2009, the accumulated contributions used in determining benefits changed. The outline below specifies which contribution amounts are used in benefit calculations.

A = accumulated contributions earned up until Feb. 1, 2009
B = accumulated contributions based on 6.44% of pay starting Feb. 1, 2009 and running into the foreseeable future
C = accumulated contributions based on the excess of the normal rate (currently 9.66%) over 6.44% of pay
I = accumulated interest on only A and B

1. If a member terminates employment, but does not have five years of service and requests a refund of contributions:
   - The member will be entitled to a payment of (A + B + C + I)
2. If a member terminates employment, has five years or more of service, and requests a refund of contributions:
   - The member will be entitled to a payment of:

     C + 1.5 x (A + B + I)
3. The 200% of employee contributions with interest retirement benefit will be based on (A + B + I).
4. The 10-year death benefit will be based on 200% of (A + B + I).
5. The contribution amount that the reduction for Benefit Options A and B will be based on is (A + B + C + I).

Overtime Contributions

Effective January 1, 2000, neither member nor City contributions are collected on overtime pay. Prior overtime contributions are eligible for a 50% employer match at time of either termination or retirement.

(Sections 1.30.550)

Service Retirement

Eligibility

1. 30 years of service; or
2. Age 60; or
3. Age 55 and 10 years of service; or
4. Age 40 and 20 years of service.

Normal Form Straight life benefit.

Optional Forms Actuarial equivalent according to the mortality and interest basis adopted by the Retirement Board for such purposes.

Amount of Allowance The total monthly allowance is the product of the following items:

1. Total years of service;
2. Average final compensation*; and
3. A percentage determined as follows:

Age	Creditable Service												
	30	29	28	27	26	25	24	23	22	21	20	19-10	9-1
40							0.759	0.698	0.642	0.591	0.544	N/A	N/A
41						0.897	0.825	0.759	0.698	0.642	0.591	N/A	N/A
42					1.060	0.975	0.897	0.825	0.759	0.698	0.642	N/A	N/A
43				1.252	1.152	1.060	0.975	0.897	0.825	0.759	0.698	N/A	N/A
44			1.417	1.332	1.252	1.152	1.060	0.975	0.897	0.825	0.759	N/A	N/A
45		1.603	1.507	1.417	1.332	1.252	1.152	1.060	0.975	0.897	0.825	N/A	N/A
46	2.000	1.706	1.603	1.507	1.417	1.332	1.252	1.152	1.060	0.975	0.897	N/A	N/A
47	2.000	1.815	1.706	1.603	1.507	1.417	1.332	1.252	1.152	1.060	0.975	N/A	N/A
48	2.000	1.871	1.815	1.706	1.603	1.507	1.417	1.332	1.252	1.152	1.060	N/A	N/A
49	2.000	1.929	1.871	1.815	1.706	1.603	1.507	1.417	1.332	1.252	1.152	N/A	N/A
50	2.000	1.964	1.929	1.871	1.815	1.706	1.603	1.507	1.417	1.332	1.252	N/A	N/A
51	2.000	2.000	1.964	1.929	1.871	1.815	1.706	1.603	1.507	1.417	1.332	N/A	N/A
52	2.000	2.000	2.000	1.964	1.929	1.871	1.815	1.706	1.603	1.507	1.417	N/A	N/A
53	2.000	2.000	2.000	2.000	1.964	1.929	1.871	1.815	1.706	1.603	1.507	N/A	N/A
54	2.000	2.000	2.000	2.000	2.000	1.964	1.929	1.871	1.815	1.706	1.603	N/A	N/A
55	2.000	2.000	2.000	2.000	2.000	2.000	1.964	1.929	1.871	1.815	1.706	1.706	N/A
56	2.000	2.000	2.000	2.000	2.000	2.000	2.000	1.964	1.929	1.871	1.815	1.815	N/A
57	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	1.964	1.929	1.871	1.871	N/A
58	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	1.964	1.929	1.929	N/A
59	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	1.964	1.964	N/A
60	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000

In the event a member's age plus years of credited service equals 80 or more, the percentage amount is 2.00%

**Average final compensation is based on greatest compensation during any consecutive 24-month period (Section 1.30.150).*

Maximum Years of Membership Service	Effective January 1, 1976, any member with 30 or more years of membership service shall receive no further membership service credit.
Minimum Benefit Based on Member Contributions	The monthly retirement allowance for members retiring from City service on and after January 1, 1997 will not be less than the actuarial equivalent of 200% of the member's accumulated normal contributions. Note that the factors used to determine the actuarial equivalence will be changed effective January 1, 2020. The new factors were used in the actuarial valuation for purposes of determining retirement benefits for people commencing benefit payments after that date.

(Sections 1.30.570, 1.30.580, and 1.30.660)

Disability Retirement

Service Requirements — Five years of service credited within the 10 years preceding disability retirement. If disabled while on the job, there is no service requirement.

Normal Form — Modified cash refund annuity.

Optional Forms — Actuarial equivalent according to the mortality and interest basis adopted by the Retirement Board for such purposes.

Amount of Allowance — The total monthly disability allowance is the product of the following items:

1. Total years of service that could have been earned to age 65;
2. Average final compensation; and
3. 1.5%.

The maximum disability retirement allowance is 1/3 of average final compensation or, if greater, 1.5% times completed years of service times average final compensation. The minimum disability allowance is $100 per month.
(Sections 1.30.630 and 1.30.640)

Death Benefits

Retired Members

Death benefits to retired members are payable according to the form of retirement allowance elected.

Active Members

1. Payment of accumulated contributions, including additional contributions to the beneficiary in a lump sum refund or in installments not to exceed five years; or
2. If, at the time of death, the member had completed five years of service, the beneficiary may elect to receive, in place of (1) above, a monthly allowance, payable for 10 years, having the same value as twice the accumulated normal member contributions, with interest as of February 1, 2009 plus twice the accumulated normal contributions after such date, up to a rate of 6.44% of compensation; or
3. In lieu of (2) above, the spouse may elect to defer receipt of an immediate monthly allowance and elect to commence payment at a later date. The value of the deferred death benefit is equal to the value of the benefit payable immediately.
4. If, at the time of death, the member was eligible for service retirement and had named a beneficiary, the beneficiary may receive, in place of (1) above, a monthly allowance, for life, equal to the benefit she would have received had the member retired, on the day before he died, with a 100% contingent annuitant option in force; or
5. In lieu of (4) above, the beneficiary may elect to receive a lump-sum cash payment, not to exceed one-half of the deceased member's accumulated contributions and accumulated additional contributions, and a retirement allowance based on a 100% contingent annuitant option, reduced by the value of the cash payment.

(Section 1.30.670)

Withdrawal Benefits

Form

Payment of accumulated contributions, including member overtime, and additional contributions.
(Section 1.30.330)

Vested Withdrawal Benefits

Service Requirements

Five years of service.

Options:

1. Amount of allowance is the same as service retirement benefit. Benefits commence at age 60.
2. If the member terminates employment after December 31, 1996, the member may elect payment of 1.5 times the member's accumulated normal contributions and any overtime contributions, plus any additional contributions. This benefit is in lieu of the deferred retirement benefit in (1) above.

(Section 1.30.600)

Postretirement Cost-of-Living Increases

Provisions

As of July 1st of each year, every monthly retirement allowance less the portion provided by additional contributions is automatically increased 2.125% provided the Consumer Price Index (Seattle Area-all items) has increased 2.125% or more over the preceding calendar year. This increase is granted to any member of the Retirement System whose retirement or death occurred on or before July 1st of the preceding year. The 2.125% rate was effective January 1, 2003.

The amount of any cost-of-living increase or decrease in any year which is in excess of the maximum annual retirement allowance adjustment of 2.125% shall be accumulated from year to year and included in the computation of increases or decreases in succeeding years.

After applying the above adjustment, if the member's inflation-adjusted monthly retirement allowance is less than 50% of the purchasing power of the monthly retirement allowance at date of retirement determined using the same index described above (the indexed benefit), then the monthly retirement allowance will be further increased so that it shall not be less than 50% of the indexed benefit.

(Section 1.30.665)

Portability Benefits

TERS participates in the portability of public retirement benefits in Washington State public retirement systems. As contemplated under Chapter 41.54 RCW, this allows a member to use all years of service with qualified Washington systems to determine eligibility for benefits under TERS. Effective in 1999, TERS expanded the state provisions to include these years for determining the benefit percentage factor for retirement benefits.

(Section 1.30.890)

Appendix C Valuation Data

This valuation is based upon the membership of the System as of January 1, 2019. Membership data were supplied by the Tacoma Employees' Retirement System and accepted for valuation purposes without audit. The data for all contributing members, former contributing members, and their survivors are summarized in Exhibit C-1.

Exhibits C-2 through C-4 present distributions of members receiving service retirement benefits, members receiving disability retirement benefits, and beneficiaries receiving benefits. Shown in the tables are the numbers of persons receiving benefits, the total annual benefits received, and the average annual benefit per recipient. Exhibit C-5 contains a summary of the data for contributing members. Values shown in the table are the numbers of members and their total annual salaries.

The valuation also includes liabilities attributable to vested members who have terminated employment but have neither retired nor withdrawn their contributions. There are 557 such members.

In addition, there are also 190 members who have terminated and are not vested. Their total accumulated employee contributions are $1.0 million.

Exhibit C-1

Summary of Membership Data

	Contributing Members					Annuitants				
	Number			Annual Salaries	Average Annual	Number			Annual Benefits	Average Annual
	Males	Females	Total	($1,000)	Salaries	Males	Females	Total	($1,000)	Benefits
January 1, 2019	1,792	1,197	2,989	$258,890	$86,614	1,346	1,128	2,474	$82,464	$33,332
January 1, 2018	1,775	1,173	2,948	$248,176	$84,185	1,295	1,101	2,396	$76,859	$32,078
January 1, 2017	1,812	1,152	2,964	$243,504	$82,154	1,255	1,048	2,303	$71,528	$31,059
January 1, 2016	1,777	1,150	2,927	$234,597	$80,149	1,234	1,000	2,234	$67,639	$30,277
January 1, 2015	1,756	1,128	2,884	$222,139	$77,025	1,186	981	2,167	$63,492	$29,300

Exhibit C-2

Members and Alternate Payees Receiving Service Retirement Benefits
January 1, 2019

	<50	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90+	Totals
Number of Persons											
Male	0	4	56	209	340	338	171	100	56	31	1,305
Female	1	8	44	149	254	182	99	53	32	21	843
Total	1	12	100	358	594	520	270	153	88	52	2,148
Annual Benefits	$7,580	$398,758	$4,224,918	$14,524,542	$21,537,657	$18,274,869	$8,844,787	$4,494,930	$2,273,398	$1,384,685	$75,966,124
Average Annual Benefits	7,580	33,230	42,249	40,571	36,259	35,144	32,758	29,379	25,834	26,629	35,366

Exhibit C-3

Members Receiving Disability Retirement Benefits
January 1, 2019

	<50	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90+	Totals
Number of Persons											
Male	0	1	2	2	3	2	1	0	0	0	11
Female	1	4	2	3	3	2	0	1	0	0	16
Total	1	5	4	5	6	4	1	1	0	0	27
Annual Benefits	$18,911	$101,133	$71,512	$90,286	$123,175	$63,111	$14,970	$15,484	$0	$0	$498,583
Average Annual Benefits	18,911	20,227	17,878	18,057	20,529	15,778	14,970	15,484	0	0	18,466

Exhibit C-4

Survivors Receiving Benefits
January 1, 2019

	<50	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90+	Totals
Number of Persons											
Male	8	1	3	4	6	2	1	2	2	1	30
Female	19	7	9	19	29	32	32	26	37	59	269
Total	27	8	12	23	35	34	33	28	39	60	299
Annual Benefits	$444,299	$176,053	$260,077	$605,517	$785,480	$792,468	$709,509	$534,257	$794,864	$896,492	$5,999,016
Average Annual Benefits	16,456	22,007	21,673	26,327	22,442	23,308	21,500	19,081	20,381	14,942	20,064

Exhibit C-5

Number of Employees and Monthly Salaries - By Age Group
January 1, 2019

Nearest Year of Service	<20	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70+	Totals
0		14	48	61	52	28	31	23	9	10		1	277
1		3	30	46	35	40	23	16	12	7			212
2		5	24	41	33	25	18	20	14	7		1	188
3-4		2	28	70	63	57	34	33	26	18	1		332
5-9			8	44	83	81	69	60	45	31	11	2	434
10-14				23	84	117	104	105	83	70	18		604
15-19					16	46	85	91	93	58	19	6	414
20-24					1	7	40	70	70	60	16	1	265
25-29							2	30	55	50	16	5	158
30-34								9	26	26	15	2	78
35-39									3	10	3		16
40+										4	7		11
Totals	0	24	138	285	367	401	406	457	436	351	106	18	2,989

Annual Salaries - By Age Group

Nearest Year of Service	<20	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70+	Totals
0		719,494	2,804,413	4,054,483	3,785,287	2,149,142	2,788,420	1,617,101	613,132	972,064		*	19,588,026
1		162,199	2,026,437	3,271,342	2,571,822	3,069,918	1,896,163	1,231,340	1,052,906	638,089			15,920,216
2		326,414	1,409,700	2,784,702	2,587,895	1,762,871	1,524,392	1,512,862	1,110,928	565,947		*	13,628,870
3-4		143,645	2,094,228	5,150,281	5,071,264	4,987,658	3,042,728	2,881,195	2,376,193	1,862,862	*		27,693,255
5-9			658,982	3,594,939	7,579,524	7,460,864	5,898,664	6,017,445	4,352,242	3,016,729	1,221,794	195,166	39,996,349
10-14				1,802,735	8,067,899	10,329,405	9,322,207	9,136,606	6,823,099	6,175,005	1,636,547		53,293,503
15-19					1,541,902	4,427,104	7,548,019	8,340,117	7,875,682	5,215,741	1,875,331	532,958	37,356,853
20-24					*	653,016	4,306,133	7,732,308	7,081,974	5,405,504	1,401,463	*	26,762,711
25-29							181,210	3,263,771	5,326,973	4,142,522	1,376,211	528,986	14,819,673
30-34								777,293	2,691,213	2,292,573	1,389,271	276,349	7,426,699
35-39									240,863	894,669	277,991		1,413,523
40+										356,970	633,337		990,307
Totals	0	1,351,752	8,993,760	20,658,482	31,294,305	34,839,978	36,507,936	42,510,038	39,545,204	31,538,676	9,895,146	1,754,709	258,889,986

** If there is one participant in a cell, the annual salary is not reported.*

Appendix D Comparative Schedules

This section contains tables that summarize the experience of the System since January 1, 1976. Earlier data are not available.

Exhibit D-1 shows a summary of the contributing members and the annuitants covered as of the various valuation dates.

Exhibit D-2 summarizes the contribution rates used by each annual actuarial valuation and the resulting amortization period.

Exhibit D-3 presents a history of the System's funding progress since 1985.

Exhibit D-4 shows a summary of the history of the Economic Assumptions.

Any review of these comparative schedules should be made in the light of Exhibit D-5, which shows the significant changes affecting the actuarial valuations in recent years.

Exhibit D-6 shows the prior and future four-year cycles of actuarial projects.

Exhibit D-1

Membership Data

Valuation Date (Jan. 1)	Active Members: Number	Active Members: Annual Salaries in Millions	Active Members: Average Annual Salary	Active Members: Average Age	Active Members: Average Years of Service	Annuitants: Number	Annuitants: Annual Benefits in Thousands	Annuitants: Average Annual Benefit	Annuitants: Average Age*
1976	2,088	$31	$ 15,006	44.5	10.5	763	$ 2,457	$ 3,221	**
1979	2,099	40	19,024	43.6	10.0	952	3,898	4,095	69.1
1982	2,128	56	26,400	42.6	9.7	1,110	5,743	5,173	69.1
1985	2,137	64	29,765	42.4	9.6	1,244	8,410	6,760	69.6
1987	2,205	68	30,593	42.3	9.5	1,315	10,098	7,679	70.0
1989	2,315	76	32,725	42.5	9.5	1,378	11,899	8,635	70.6
1991	2,515	89	35,397	42.9	9.6	1,425	13,353	9,371	71.4
1993	2,630	100	38,138	43.5	9.9	1,439	14,868	10,332	72.0
1995	2,817	113	39,999	43.7	10.0	1,438	16,369	11,383	72.6
1997	2,667	118	44,230	45.0	10.9	1,453	18,107	12,462	73.1
1998	2,655	119	44,919	44.0	9.8	1,653	23,520	14,229	71.1
1999	2,650	123	46,508	44.7	10.3	1,622	23,864	14,712	71.6
2001	2,814	142	50,540	45.3	10.5	1,582	25,156	15,901	72.1
2003	2,935	161	54,946	46.1	10.9	1,599	27,678	17,310	72.1
2005	3,072	177	57,531	46.2	10.8	1,646	31,171	18,937	72.4
2007	2,967	178	60,070	46.8	11.2	1,734	36,491	21,044	72.0
2009	3,123	200	64,195	46.8	10.9	1,819	41,866	23,016	71.4
2011	3,112	221	70,959	47.6	11.4	1,894	47,443	25,049	71.2
2012	3,038	218	71,615	48.0	11.7	1,950	51,057	26,183	71.2
2013	2,861	208	72,648	47.9	11.7	2,106	57,820	27,455	70.9
2014	2,881	215	74,459	48.2	12.0	2,119	59,813	28,227	71.1
2015	2,884	222	77,025	48.4	12.0	2,167	63,492	29,300	71.2
2016	2,927	235	80,149	48.1	11.8	2,234	67,639	30,277	71.2
2017	2,964	244	82,154	47.9	11.6	2,303	71,528	31,059	71.2
2018	2,948	248	84,185	47.7	11.5	2,396	76,859	32,078	71.3
2019	2,989	259	86,614	47.4	11.3	2,474	82,464	33,332	71.4

**Excludes survivors and disabled members before 2007.*

***Not calculated.*

Exhibit D-2

Contribution Rates

Valuation Date (Jan. 1)	Member	Employer	Total	Normal Cost Rate	UAAL Rate	Amortization (Years)	Funding Ratio
1976	6.50%	9.21%	15.71%	12.78%	2.93%	--	55.0%
1979	7.56%	11.77%	19.33%	15.39%	3.94%	--	52.0%
1982	8.89%	10.44%	19.33%	15.72%	3.63%	35	59.1%
1985	8.89%	10.44%	19.33%	14.44%	4.89%	23	71.2%
1987	8.89%	10.44%	19.33%	14.81%	4.52%	11	86.1%
1989	8.89%	10.44%	19.33%	16.25%	3.08%	22	82.9%
1991	8.89%	10.44%	19.33%	16.96%	2.37%	34	82.3%
1993	8.89%	10.44%	19.33%	17.24%	2.09%	26	88.1%
1995	8.89%	10.44%	19.33%	16.28%	3.05%	9	93.1%
1997	7.68%	9.02%	16.70%	16.84%	-0.14%	Over 30	101.0%
1998	7.68%	9.02%	16.70%	16.96%	-0.26%	Over 30	101.6%
1999	7.68%	9.02%	16.70%	17.04%	-0.34%	Over 30	106.3%
2001	6.44%	7.56%	14.00%	17.65%	-3.65%	27	115.7%
2003	6.44%	7.56%	14.00%	17.67%	-3.67%	11	107.8%
2005	6.44%	7.56%	14.00%	16.25%	-2.25%	19	107.0%
2007	6.44%	7.56%	14.00%	17.37%	-3.37%	40	114.0%
2009	8.28%	9.72%	18.00%	17.16%	0.84%	Does not amortize	109.5%
2011	9.20%	10.80%	20.00%	17.33%	2.67%	13	94.9%
2012	9.20%	10.80%	20.00%	17.34%	2.66%	35	90.1%
2013	9.20%	10.80%	20.00%	17.80%	2.20%	65	90.9%
2014	9.20%	10.80%	20.00%	18.79%	1.21%	Does not amortize	92.6%
2015	9.20%	10.80%	20.00%	18.84%	1.16%	52	95.5%
2016	9.20%	10.80%	20.00%	18.87%	1.13%	21	97.4%
2017	9.20%	10.80%	20.00%	18.69%	1.31%	32	96.2%
2018	9.66%	11.34%	21.00%	18.49%	2.51%	2	99.2%
2019	9.66%	11.34%	21.00%	18.53%	2.47%	9	97.3%

Exhibit D-3

Historical Funding Summary

January 1,	(A) Fair Value of Assets (FVA)	(B) Actuarial Value of Assets (AVA)	(C) Actuarial Accrued Liability*	(A) - (C) FVA Funding Reserve/ (Shortfall)	(A) / (C) FVA Funding Ratio	(B) - (C) AVA Funding Reserve/ (Shortfall)	(B) / (C) AVA Funding Ratio
1985	$ 125,400,000	$ 134,700,000	$ 189,200,000	$ (63,800,000)	66%	$ (54,500,000)	71%
1987	169,200,000	189,900,000	220,500,000	(51,300,000)	77%	(30,600,000)	86%
1989	192,000,000	197,400,000	238,100,000	(46,100,000)	81%	(40,700,000)	83%
1991	227,100,000	238,400,000	289,700,000	(62,600,000)	78%	(51,300,000)	82%
1993	301,600,000	306,100,000	347,600,000	(46,000,000)	87%	(41,500,000)	88%
1995	353,400,000	367,100,000	394,500,000	(41,100,000)	90%	(27,400,000)	93%
1997	486,800,000	482,700,000	477,900,000	8,900,000	102%	4,800,000	101%
1998	553,500,000	523,800,000	515,700,000	37,800,000	107%	8,100,000	102%
1999	596,400,000	570,700,000	537,600,000	58,800,000	111%	33,100,000	106%
2001	710,700,000	700,700,000	605,700,000	105,000,000	117%	95,000,000	116%
2003	611,200,000	740,100,000	686,800,000	(75,600,000)	89%	53,300,000	108%
2005	890,000,000	807,300,000	754,300,000	135,700,000	118%	53,000,000	107%
2007	1,117,600,000	1,021,300,000	895,800,000	221,800,000	125%	125,500,000	114%
2009	763,600,000	1,097,300,000	1,002,300,000	(238,700,000)	76%	95,000,000	109%
2011	1,081,100,000	1,074,800,000	1,132,900,000	(51,800,000)	95%	(58,100,000)	95%
2012	1,082,900,000	1,068,300,000	1,185,500,000	(102,600,000)	91%	(117,200,000)	90%
2013	1,218,700,000	1,187,100,000	1,306,600,000	(87,900,000)	93%	(119,500,000)	91%
2014	1,388,900,000	1,297,000,000	1,400,000,000	(11,100,000)	99%	(103,000,000)	93%
2015	1,478,500,000	1,402,700,000	1,468,200,000	10,300,000	101%	(65,500,000)	96%
2016	1,448,700,000	1,501,700,000	1,542,200,000	(93,500,000)	94%	(40,500,000)	97%
2017	1,547,700,000	1,585,000,000	1,648,100,000	(100,400,000)	94%	(63,100,000)	96%
2018	1,723,200,000	1,667,000,000	1,680,700,000	42,500,000	103%	(13,700,000)	99%
2019	1,635,000,000	1,713,900,000	1,761,700,000	(126,700,000)	93%	(47,800,000)	97%

** Actuarial Accrued Liability values are calculated at a 7.00% discount rate for 2017 and beyond. For 2014-2016, a 7.25% discount rate was used. For 2013, a 7.50% discount rate was used. discount rate was used. From 2001 to 2012, a 7.75%. From 1997 to 2001, a 7.50% discount rate was used. For 1995 and before, a discount rate of 7.00% was used.*

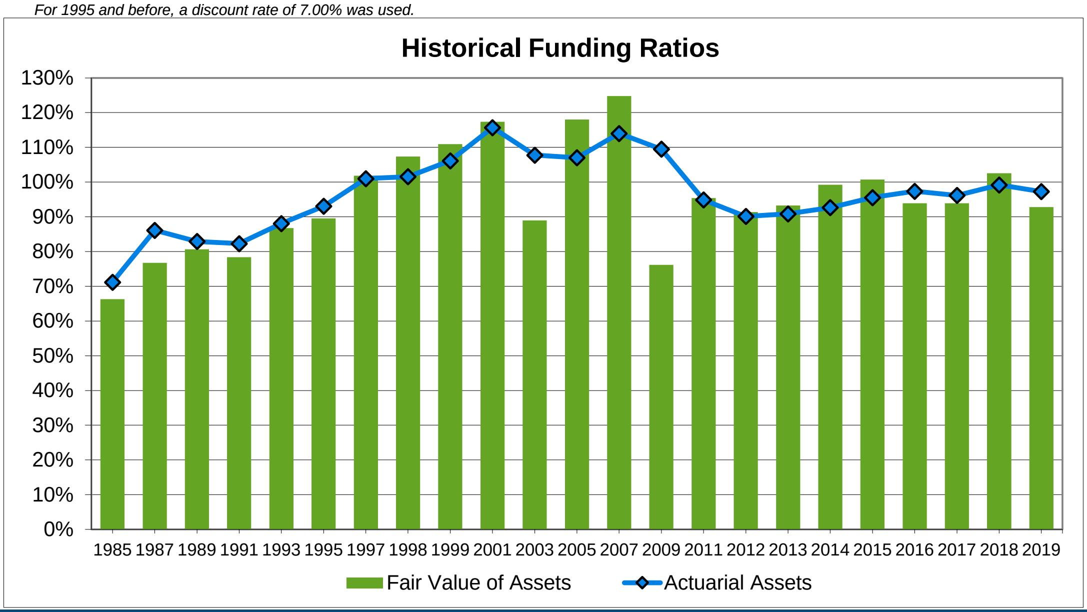


Exhibit D-4

Changes in Economic Assumptions

Actuarial Valuation Date	(a) Price Inflation*	(b) Wage Inflation	(b) - (a) Real Wage Inflation	(c) Discount Rate	(c) - (a) Real Investment	(c) - (b) Spread
1976 - 1989		5.00%		7.00%		2.00%
1991 - 1993		5.00% **		7.00% **		2.00%
1995		4.50%		7.00%		2.50%
1997 - 1999	4.50%	5.00%	0.50%	7.50%	3.00%	2.50%
2001 - 2003	4.00%	4.50%	0.50%	7.75%	3.75%	3.25%
2005 - 2007	3.25%	4.00%	0.75%	7.75%	4.50%	3.75%
2009 - 2012	3.25%	4.25%	1.00%	7.75%	4.50%	3.50%
2013	3.00%	4.00%	1.00%	7.50%	4.50%	3.50%
2014 - 2016	3.00%	4.00%	1.00%	7.25%	4.25%	3.25%
2017-2019	2.75%	3.75%	1.00%	7.00%	4.25%	3.25%

** There was no explicit assumption for price inflation until the January 1, 1997 Valuation.*

*** A select and ultimate assumption was used. The ultimate rate is displayed here.*

Exhibit D-5

Significant Changes in Benefits, Contributions, and Assumptions

Valuation Date*	Change
1976	The actuarial assumptions related to the rate of investment return and the rate of increase in the general wage level were changed from those used by the System's previous actuary.
1979	All actuarial assumptions except those related to the rate of investment return and the rate of increase in the general wage level were changed.
1982	Four-year select and ultimate assumptions were adopted for investment return and general wage level. Employer contribution rates were decreased and employee contribution rates were increased; both are now set by law.
1985	Almost all actuarial assumptions were changed.
1987	Select and ultimate assumptions for investment return and general wage level were dropped. The net administrative expense assumption was increased 0.05%.
1989	Almost all non-economic actuarial assumptions were changed. In addition, select economic assumptions were adopted for the next four-year period.
1991	The mortality assumption for service retirees and beneficiaries was changed. In addition, select economic assumptions were adopted for the next four-year period.
1993	Almost all non-economic actuarial assumptions were changed.
1995	Changed actuarial assumption for rate of increase in the general wage level. Certain retired members benefits were increased.
1997	All economic and non-economic actuarial assumptions except the mortality rates were changed. Benefits were improved. Contribution rates were lowered. The actuarial asset valuation method was changed.
1998	The mortality assumption for service retirees, beneficiaries, and disabled members was changed.
2001	All economic and non-economic actuarial assumptions except the retirement and mortality rate were changed. Benefits were improved in both 1999 and 2000. Contribution rates were lowered effective January 1, 2001.
2003	The mortality assumption for service retirees and beneficiaries was changed.
2005	Wage inflation, price inflation and all active demographic assumptions were changed.
2007	The mortality assumption for contributing members, service retirees, beneficiaries, and disabled members was changed.
2009	Wage inflation, investment expenses, and all active demographic assumptions were changed. Contribution rates were increased effective February 1, 2009.
2011	Contribution rates were increased effective January 1, 2011.
2012	Contribution rates were increased effective January 1, 2012.
2013	The discount rate (investment return assumption) was lowered, along with price and wage inflation. Most active demographic assumptions were changed. The mortality assumption for contributing members, service retirees, beneficiaries, and disabled members was changed.
2014	The discount rate (investment return assumption) was lowered.
2017	Nearly all economic and non-economic actuarial assumptions were changed.
2018	Contribution rates were increased effective February 2018. Reflected new annuity conversion factors effective January 1, 2020.

**Valuations as of January 1.*

Exhibit D-6

Actuarial Project Schedule

(Four-Year Cycle)

Regular Annual Projects in the Four-Year Period Ending with the Current Valuation

Year	Project
2016	January 1, 2016 Actuarial Valuation
2016	Experience Study for four years 2012-2015
2017	January 1, 2017 Actuarial Valuation
2018	January 1, 2018 Actuarial Valuation
2019	January 1, 2019 Actuarial Valuation

Regular Annual Projects in the Four-Year Period Following the Current Valuation

Year	Project
2020	January 1, 2020 Actuarial Valuation
2020	Experience Study for four years 2016-2019
2021	January 1, 2021 Actuarial Valuation
2022	January 1, 2022 Actuarial Valuation
2023	January 1, 2023 Actuarial Valuation

Appendix E Glossary

The following definitions are from a glossary adopted by the Actuarial Standards Board. In some cases, the definitions have been modified for specific applicability to the Tacoma Employees' Retirement System. Defined terms are capitalized throughout this Appendix.

Actuarial Assumptions

Assumptions as to the occurrence of future events affecting pension costs, such as: mortality, withdrawal, disability, and retirement; changes in compensation; rates of investment earnings and asset appreciation or depreciation; procedures used to determine the Actuarial Value of Assets; and other relevant items.

Actuarial Cost Method

A procedure for determining the Actuarial Present Value of pension plan benefits and expenses and for developing an actuarially equivalent allocation of this value to time periods, usually in the form of a Normal Cost and an Actuarial Accrued Liability.

Actuarial Accrued Liability

That portion, as determined by a particular Actuarial Cost Method, of the Actuarial Present Value of pension plan benefits and expenses which is not provided for by future Normal Costs.

Actuarial Present Value

The value of an amount or series of amounts payable or receivable at various times, determined as of a given date by the application of a particular set of Actuarial Assumptions.

Actuarial Valuation

The determination, as of a valuation date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets, and related Actuarial Present Values for a pension plan.

Actuarial Value of Assets

The value of cash, investments, and other property belonging to a pension plan, as used by the actuary for the purpose of an Actuarial Valuation.

Actuarially Determined Total Contribution

A potential payment to the Plan as determined by the actuary using a contribution allocation procedure. For TERS, it is defined in the Retirement Board Funding and Benefits Policy as the rate that is the greater of (1) the Normal Cost Rate or (2) the recommended combined employer and employee contribution for the reporting period that amortizes the UAAL (if any) over a maximum of 25 years, but will not be less than the actual contribution rate.

The Actuarially Determined Employer Contribution is the Actuarially Determined Total Contribution minus the contributions paid by employees. This amount is disclosed with the financial reporting information under GASB Statements 67 and 68.

Actuarially Equivalent

Of equal Actuarial Present Value, determined as of a given date with each value based on the same set of Actuarial Assumptions.

Amortization Payment

That portion of the pension plan contribution that is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.

Credited Projected Benefit

That portion of the projected benefit allocated to each individual's service to date, determined in accordance with the terms of the pension plan and based on future compensation as projected to retirement.

Entry Age Actuarial Cost Method

A method under which the Actuarial Present Value of the Projected Benefits of each individual included in an Actuarial Valuation is allocated on a level basis over the earnings of the individual between entry age and assumed exit ages. The portion of this Actuarial Present Value allocated to a valuation year is called the Normal Cost. The portion of this Actuarial Present Value not provided for at a valuation date by the Actuarial Present Value of future Normal Costs is called the Actuarial Accrued Liability.

Experience Gain (Loss)

A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two Actuarial Valuation dates, as determined in accordance with a particular Actuarial Cost Method.

Funding Reserve or Funding Excess

If the Actuarial Value of Assets exceeds the Actuarial Accrued Liability, the Unfunded Actuarial Accrued Liability is a negative amount and may be referred to as the Funding Reserve.

Normal Cost

That portion of the Actuarial Present Value of pension plan benefits and expenses which is allocated to a valuation year by the Actuarial Cost Method.

Projected Benefits

Those pension plan benefit amounts which are expected to be paid at various future times under a particular set of Actuarial Assumptions, taking into account such items as the effect of advancement in age and past and anticipated future compensation and service credits.

Unaccrued Benefit

The excess of an individual's Projected Benefits over the Nonforfeitable Benefit as of a specified date.

Unfunded Actuarial Accrued Liability

The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets.