



**Cavanaugh Macdonald**  
CONSULTING, LLC

*The experience and dedication you deserve*

***MISSOURI STATE EMPLOYEES’  
RETIREMENT SYSTEM***

**ACTUARIAL VALUATION REPORT  
as of June 30, 2019**

**Contribution Rates for Fiscal Year Ending  
June 30, 2021**





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# Cavanaugh Macdonald

CONSULTING, LLC

*The experience and dedication you deserve*

September 9, 2019

Board of Trustees  
Missouri State Employees' Retirement System  
907 Wildewood Drive  
Jefferson City, MO 65102

Dear Members of the Board:

At your request, we performed an actuarial valuation of the Missouri State Employees' Retirement System (MOSERS) as of June 30, 2019 for the purpose of determining the employer required contribution rate for the fiscal year ending June 30, 2021. This report provides valuation results for the Missouri State Employees' Plan (MSEP). The major findings of the valuation are contained in this report, which reflects the benefit provisions in place on June 30, 2019. There have been no changes to the plan provisions or actuarial methods since the prior valuation, but the economic assumptions have changed.

In July 2018 after extensive analysis, the MOSERS Board adopted a plan to phase in a change in the set of economic assumptions over a three year period (2018 through 2020 valuations). The scheduled economic assumption changes include price inflation, cost of living adjustments, general wage growth, payroll growth, and the investment return assumption. The nominal investment return assumption decreased from 7.50% to 7.25%, effective with the June 30, 2018 actuarial valuation, and additional reductions of 15 basis points per year are scheduled until the investment return assumption reaches 6.95% in the June 30, 2020 actuarial valuation. The scheduled decline will occur absent a vote of the Board otherwise. Since such schedule is subject to potential modification by a future board, the assumed investment return in the current actuarial valuation applies to all future years until such time as the rate changes per the schedule or other Board action occurs. As of June 30, 2019, the investment return assumption is 7.10%. These changes are discussed in further detail in the Executive Summary section of this report.

In preparing our 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 data and financial information. We found this information to be reasonably consistent and comparable with the information received in the prior year. 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.



Board of Trustees  
September 9, 2019  
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We further certify that all costs, liabilities, rates of interest and other factors for MSEP have been determined on the basis of actuarial assumptions and methods which are individually reasonable (taking into account the experience of each Plan and reasonable expectations); and which, in combination, offer the best estimate of anticipated experience affecting MSEP. Nevertheless, the emerging costs will vary from those presented in this report to the extent actual experience differs from that projected by the actuarial assumptions. The MOSERS Board has the final decision regarding the appropriateness of the assumptions and adopted them as indicated in Appendix D.

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 actuarial computations presented in this report are for purposes of determining the funding amounts for MSEP as set out in the Missouri state statutes. The calculations in the enclosed report have been made on a basis consistent with our understanding of MOSERS' funding policy. 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. For example, actuarial computations for purposes of fulfilling financial accounting requirements for the System under Governmental Accounting Standards No. 67 and No. 68 will be presented in separate reports.

The consultants who worked on this assignment are pension actuaries with substantive experience valuing public retirement systems. Cavanaugh Macdonald's advice is not intended to be a substitute for qualified legal or accounting counsel.

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 are available to answer any questions on the material contained in the report or to provide explanations or further details as may be appropriate.

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

Sincerely,

A handwritten signature in blue ink that reads "Patrice Beckham".

Patrice A. Beckham, FSA, EA, FCA, MAAA  
Principal and Consulting Actuary

A handwritten signature in blue ink that reads "Bryan K. Hoge".

Bryan K. Hoge, FSA, EA, FCA, MAAA  
Senior Actuary





## SECTION 1 – EXECUTIVE SUMMARY

This report presents the results of the June 30, 2019 actuarial valuation of the Missouri State Employees’ Plan (MSEP). The primary purposes of performing this actuarial valuation are to:

- Determine the employer contribution rate, as defined in the Missouri state statutes and set out in the Board’s funding policy, for the fiscal year ending June 30, 2021;
- Disclose asset and liability measurements as well as the current funded status of MSEP on the valuation date;
- Compare the actual and expected experience of MSEP during the plan year ended June 30, 2019;
- Assess and disclose the key risks associated with funding the System; and
- Analyze and report on trends in MSEP contributions, assets and liabilities over the past several years.

### Changes Since the Prior Valuation

In July 2018 after extensive analysis, the MOSERS Board adopted a plan to phase in a change in the set of economic assumptions over a three year period (2018 through 2020 valuations). The scheduled economic assumption changes include price inflation, cost of living adjustments, general wage growth, payroll growth, and the investment return assumption. The nominal investment return assumption decreased from 7.50% to 7.25%, effective with the June 30, 2018 actuarial valuation, and additional reductions of 15 basis points per year are scheduled until the investment return assumption reaches 6.95% in the June 30, 2020 actuarial valuation. The scheduled decline will occur absent a vote of the Board otherwise. Since such schedule is subject to potential modification by a future board, the assumed investment return in the current actuarial valuation applies to all future years until such time as the rate changes per the schedule or other Board action occurs. The schedule created by the board in 2018 is shown below. The MOSERS board confirmed the set of economic assumptions shown below for the June 30, 2019 actuarial valuation.

Economic Assumption	Effective June 30, 2018	Effective June 30, 2019	Effective June 30, 2020
1. Investment Return	7.25%	7.10%	6.95%
2. Inflation	2.50%	2.35%	2.25%
3. Cost-of-Living Adjustment (COLA)	2.00%	1.88%	1.80%
4. General Wage Growth	2.75%	2.60%	2.50%
5. Payroll Growth	2.50%	2.35%	2.25%

The impact of the changes to the economic assumptions is summarized in the following table:

	Prior Assumptions	Current Assumptions	Difference
Actuarial Accrued Liability	\$13,883,285,468	\$13,957,626,309	\$74,340,841
Actuarial Value of Assets	<u>8,782,383,977</u>	<u>8,782,383,977</u>	<u>0</u>
Unfunded Actuarial Accrued Liability	\$5,100,901,491	\$5,175,242,332	\$74,340,841
Funded Ratio	63.3%	62.9%	(0.4%)
Normal Cost	8.55%	8.61%	0.06%
UAAL Amortization	<u>15.66%</u>	<u>15.93%</u>	<u>0.27%</u>
Actuarial Contribution	24.21%	24.54%	0.33%
Member Contribution Rate	<u>(1.66%)</u>	<u>(1.66%)</u>	0.00%
Employer Contribution Rate	22.55%	22.88%	0.33%





## SECTION 1 – EXECUTIVE SUMMARY

### Key Valuation Results

The actuarial valuation results provide a “snapshot” view of the System’s financial condition on June 30, 2019. The UAAL for MSEP increased from \$4.782 billion last year to \$5.175 billion this year and the funded ratio decreased from 64.9% to 62.9%. In addition, the employer contribution rate increased from 21.77% of pay last year to 22.88% of pay in this year’s valuation, an increase of 1.11% of pay. This change was impacted by various events over the past year. The most significant impact was the unfavorable investment return on the actuarial assets which increased the employer contribution rate by 0.77%. Additional increases resulted from the change in the economic assumptions (0.33%) and actual payroll growth less than expected (0.26%). The effective employee contribution rate increased from the prior valuation by 0.16% due to additional active members in the MSEP 2011 Plan.

The valuation results reflect net unfavorable experience of \$244 million for the past plan year as demonstrated by an UAAL that was higher than expected (actual UAAL of \$5.175 billion compared to an expected UAAL of \$4.931 billion). The unfavorable experience was due to the combined impact of an actuarial loss on the actuarial value of assets (\$241 million) and a small net actuarial loss on liabilities (\$3.5 million). The more significant sources of liability loss were a larger number of service retirements than expected and changes to the Plan Indicator field (MSEP, MSEP 2000 or MSEP 2011) for about 650 active members.

A summary of the key results from the June 30, 2019 actuarial valuation, compared to the prior valuation, is shown in the following table. Further detail on the changes and actuarial experience affecting the valuation results can be found in the following sections of this Executive Summary.

	June 30, 2019	June 30, 2018
Unfunded Actuarial Accrued Liability (\$M)	\$5,175	\$4,782
Funded Ratio (Actuarial Assets)	62.92%	64.87%
Normal Cost Rate	8.61%	8.62%
UAAL Amortization Rate	15.93%	14.65%
Total Actuarial Required Contribution	24.54%	23.27%
Member Contribution Rate	(1.66%)	(1.50%)
Employer Contribution Rate	22.88%	21.77%

### Experience for the Last Plan Year

Numerous factors contributed to the change in the MSEP assets, liabilities, and actuarial required contribution rate between June 30, 2018 and June 30, 2019. The components are examined in the following discussion.

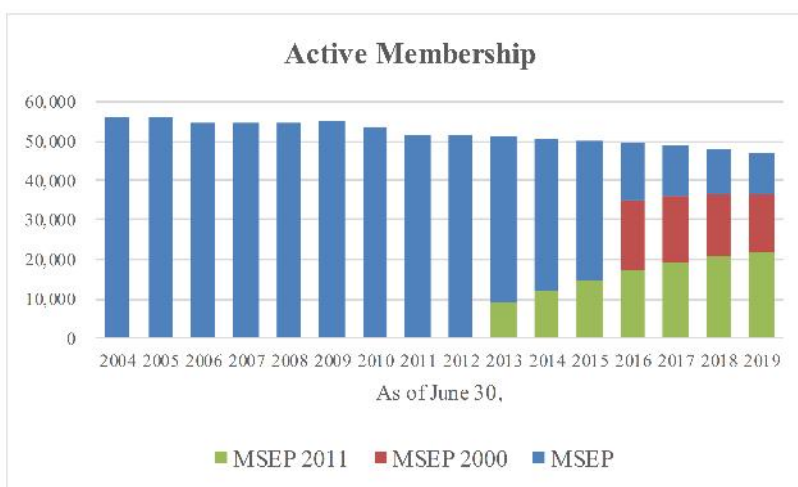
### Membership

There was a decline of 2.0% in the number of active members in the current valuation (46,864 compared to 47,806 in the prior valuation). As shown in the following graph, the active membership has declined about 16% over the last 15 years from 55,914 active members in the 2004 valuation to 46,864 in the current valuation. A decline in size of the active membership puts a strain on the system’s funding because covered



## SECTION 1 – EXECUTIVE SUMMARY

payroll does not increase, as assumed, and consequently, the UAAL amortization payment is higher as a percent of payroll.



Note: Split between MSEP and MSEP 2000 is not available prior to June 30, 2016. MSEP 2011 active counts are not available for June 30, 2011 or June 30, 2012.

The percentage of active members covered by the MSEP 2011 Plan has increased each year as actives covered by the MSEP or MSEP 2000 Plans leave covered employment and are replaced by new hires. The number of active members covered by the MSEP 2011 Plan increased from 20,477 in the 2018 valuation (about 43%) to 21,893 (about 47% of total) in the 2019 valuation. Because the benefit structure is different for MSEP 2011 members, including an employee contribution rate of 4%, the ongoing cost of the System declines as a greater percentage of active members are covered by MSEP 2011.

As is expected in a mature retirement system, the number of members receiving benefits increased from 48,207 last year to 49,696 in the current valuation. In addition, the average benefit amount for this group increased (1.6%), which is typical.

### System Assets

As of June 30, 2019, MSEP had net assets of \$7.916 billion, when measured on a market value basis, a decrease of \$119 million from the prior year value of \$8.035 billion. However, the market value of assets is not used directly in the calculation of the unfunded actuarial accrued liability and the employer actuarial contribution rate. An asset valuation method, which smooths the effect of market fluctuations, is applied to determine the value of assets used in the valuation, called the actuarial value of assets. A new asset valuation method was implemented in the June 30, 2018 valuation. Under the method, the difference between the dollar amount of the actual and assumed investment return on the market value of assets is recognized evenly over a closed five-year period. In addition, to transition from the prior to the new smoothing method, the total unrecognized investment experience as of June 30, 2017 (\$927 million) was established on a schedule to evenly recognize the amount over a closed seven-year period beginning June 30, 2018.

In the current valuation, the actuarial value of assets for MSEP is \$8.782 billion, a decrease of \$48 million from the prior year. The components of the change in the asset values are shown in the following table.

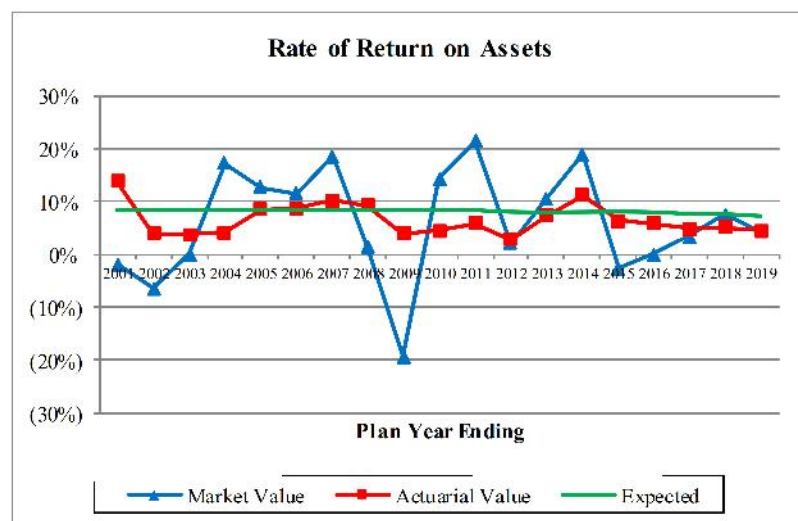




**SECTION 1 – EXECUTIVE SUMMARY**

	Market Value (\$M)		Actuarial Value (\$M)	
<b>Net Assets, June 30, 2018</b>	\$	8,034.51	\$	8,830.41
- Employer and Member Contributions	+	429.32	+	429.32
- Benefit Payments	-	851.82	-	851.82
- Net Investment Income	+	313.66	+	383.67
- Administrative Expenses	-	9.20	-	9.20
<b>Net Assets, June 30, 2019</b>	\$	7,916.47	\$	8,782.38
Estimated Net Rate of Return		4.3%		4.5%

Due to the scheduled recognition of the current and prior investment experience in the asset smoothing method, the estimated rate of return on the actuarial value of assets for FY 2019 was 4.5%, which is lower than the investment return assumption of 7.25% for that year. As a result, there was an actuarial loss on the smoothed value of assets of \$241 million. The investment return on the market value of assets for FY 2019 of 4.3%, as reported by MOSERS, was below the assumed return and produced an investment income shortfall during FY 2019 of \$254, million which increased the amount by which the actuarial value of assets exceeds the market value. Please see Section 3 of this report for more detailed information on the market and actuarial value of assets.

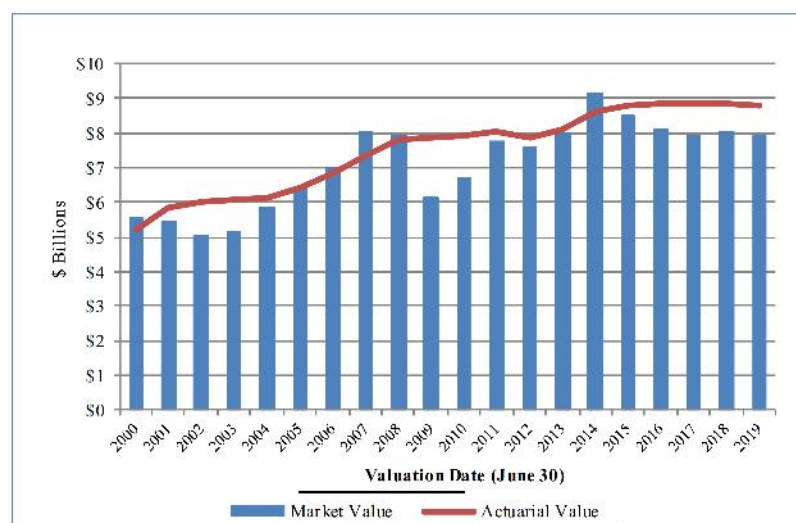


*The rate of return of the actuarial value of assets has been less volatile than the market value return, illustrating the benefit of using an asset smoothing method. However, during this time period, the rate of return on actuarial assets has been at or below the assumed rate of return for most years.*





## SECTION 1 – EXECUTIVE SUMMARY



*An asset smoothing method is used to mitigate the volatility in the market value of assets. By using a smoothing method, the actuarial (or smoothed) value can be, and actually should be, both above or below the pure market value.*

*Note the asset smoothing method changed with the 2018 valuation.*

### System Liabilities

The actuarial accrued liability is that portion of the present value of future benefits that will not be paid by future normal costs. The difference between this liability and the actuarial value of assets as of the valuation date is called the unfunded actuarial accrued liability. The dollar amount of the UAAL is reduced if the contributions to the System exceed the normal cost for the year plus interest on the prior year's UAAL.

The UAAL, using both the actuarial and market value of assets, is shown as of June 30, 2019 in the following table:

	Actuarial Value of Assets	Market Value of Assets
Actuarial Accrued Liability	\$13,957,626,309	\$13,957,626,309
Value of Assets	<u>8,782,383,977</u>	<u>7,916,465,279</u>
Unfunded Actuarial Accrued Liability	\$5,175,242,332	\$6,041,161,030
Funded Ratio	62.92%	56.72%

See Section 4 of the report for the detailed development of the UAAL.



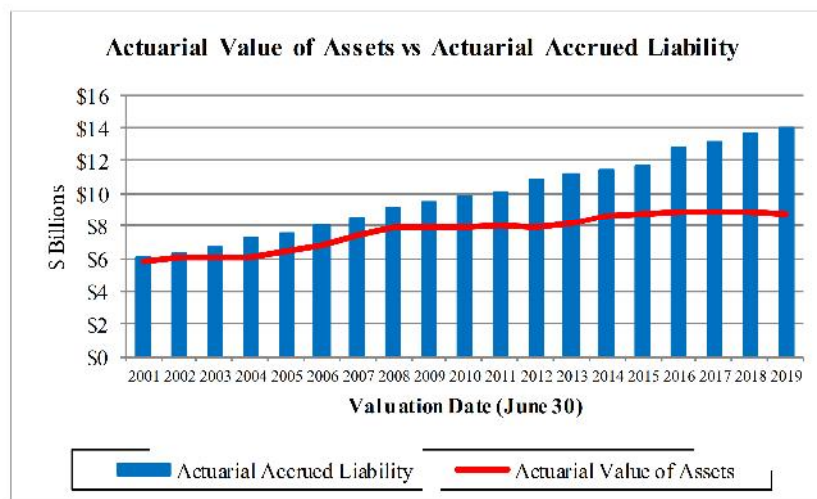
## SECTION 1 – EXECUTIVE SUMMARY

The net change in the UAAL from June 30, 2018 to June 30, 2019 was an increase of \$392.8 million. The components of this net change are shown in the following table:

	(\$ Millions)
<b>Unfunded Actuarial Accrued Liability, June 30, 2018</b>	\$4,782.4
- Expected increase due to amortization method	69.9
- Investment experience	241.2
- Liability experience	3.5
- Change due to new economic assumptions	74.3
- Other experience	<u>3.9</u>
<b>Unfunded Actuarial Accrued Liability, June 30, 2019</b>	<b>\$5,175.2</b>

As shown above, various components impacted the dollar amount of the UAAL. Actuarial gains (losses), which result from actual experience that is more (less) favorable than anticipated based on the actuarial assumptions in place in the prior valuation, are reflected in the UAAL and are measured as the difference between the expected UAAL and the actual UAAL, taking into account any changes due to actuarial assumptions and methods, or benefit provision changes. Overall, MSEP experienced a net actuarial loss of \$244.7 million, the result of an actuarial loss of \$241.2 million on actuarial assets and a \$3.5 million actuarial loss on System liabilities. The liability loss was the net result of various components of actuarial gains and losses for the year. The more significant sources of liability loss were a larger number of service retirements than expected and changes to the Plan Indicator field (MSEP, MSEP 2000 or MSEP 2011) for about 650 active members. A breakdown of the components of actuarial gains and losses can be found in Table 7 of this report.

As the following graph of historical actuarial assets and actuarial accrued liabilities shows, the System's liabilities have grown faster than the System's assets since FY 2009. Some of the growth is due to significant changes in the actuarial assumptions during this timeframe, including lowering the investment return assumption from 8.50% to 7.10%. As a result, the unfunded portion of the actuarial accrued liability has increased.





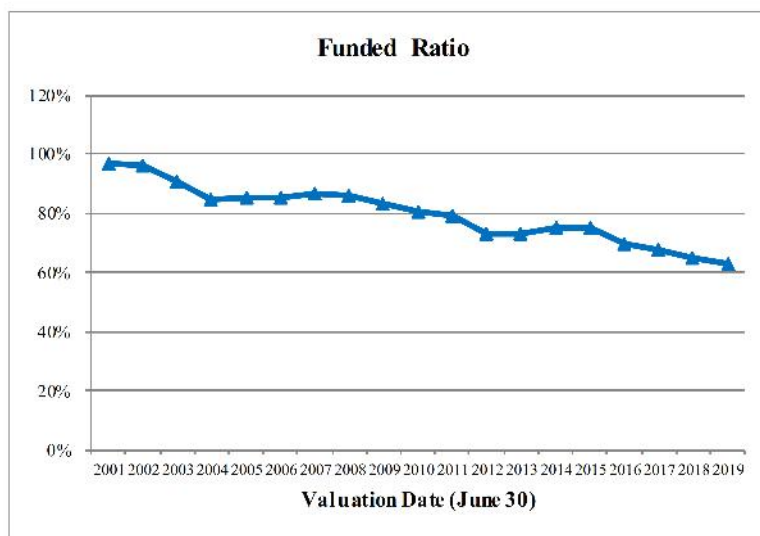
## SECTION 1 – EXECUTIVE SUMMARY

An evaluation of the UAAL on a pure dollar basis may not provide a complete analysis since only the difference between the assets and liabilities (which are both very large numbers) is reflected. Another way to evaluate the UAAL and the progress made in its funding is to track the funded ratio, the ratio of the actuarial value of assets to the actuarial accrued liability. The funded status information, using both the actuarial value of assets and the market value of assets, is shown below (in millions).

	6/30/2014	6/30/2015	6/30/2016	6/30/2017	6/30/2018	6/30/2019
Using Actuarial Value of Assets:						
- Funded Ratio	75.1%	75.0%	69.6%	67.5%	64.9%	62.9%
- UAAL (\$M)	\$2,857	\$2,936	\$3,873	\$4,280	\$4,782	\$5,175
Using Market Value of Assets:						
- Funded Ratio	79.5%	72.6%	63.6%	60.4%	59.0%	56.7%
- UAAL (\$M)	\$2,358	\$3,211	\$4,641	\$5,207	\$5,578	\$6,041

Note that the funded ratio does not indicate whether or not the System assets are sufficient to settle benefits earned to date. The funded ratio, by itself, also may not be indicative of future funding requirements. As shown in the table above, the funded ratios differ using the market value of assets.

The funded ratio over a longer period is shown in the following graph:



As the graph above shows, the System’s funded ratio has declined over the past 19 years. It is important to note that historical trends are not simply a reflection of past investment performance and other actuarial experience. Changes to actuarial assumptions and methods, benefit provisions and the System’s funding policy have also had a significant impact on valuation results over time. The Board adopted new assumptions several times during this period which had the general impact of decreasing the funded ratio.





## SECTION 1 – EXECUTIVE SUMMARY

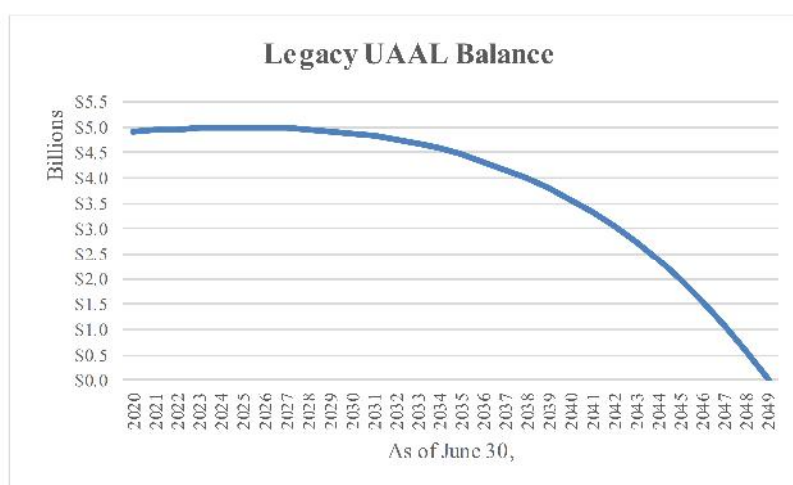
### Actuarial Required Contribution Rate

The System is funded by contributions from employers (actuarially determined) and from employees hired after December 31, 2010 (4.00% of pay). Under the Entry Age Normal cost method, the actuarial contribution rate consists of two components:

- A “normal cost” for the portion of projected liabilities allocated by the actuarial cost method to service of members during the year following the valuation date.
- An “unfunded actuarial accrued liability contribution” for the excess of the portion of projected liabilities allocated to service to date over the actuarial value of assets.

Under the System’s current funding policy, the UAAL contribution rate is determined by amortizing the UAAL using the laycred amortization method. To implement this method, the projected UAAL developed in the June 30, 2018 valuation was amortized as a level-percent of payroll over a closed, 30-year period. In subsequent years (starting with the 2019 valuation), changes to the projected UAAL that are generated by actuarial experience that is different than expected or changes in assumptions and methods will be amortized as a level-percent of payroll over separate closed, 30-year periods beginning on that date. Any change in the UAAL due to changes in the benefit provisions will be amortized over a closed 20-year period, as required by statute. Note that the use of closed amortization periods for each layer will eventually result in the System being fully funded, if the full actuarial contribution is made and all actuarial assumptions are met in the future.

The level-percent of payroll methodology for UAAL payments results in dollar amounts of payments that are lower than the level-dollar payment method in the early portion of the amortization period, but increase each year in the future with the assumed payroll growth assumption (currently 2.35%). Because the UAAL contribution rate is determined as a level-percent of payroll, the dollar amount of the UAAL contribution is scheduled to increase 2.35% each year in the future, even if all actuarial assumptions are met. If covered payroll increases, as expected based on the assumption, the contribution rate will remain stable. However, if actual payroll increases are lower than 2.35% the UAAL contribution rate will increase. Note that with this payment methodology the dollar amount of the UAAL is expected to hold steady for about ten years before starting to decline as illustrated in the following graph of the legacy UAAL base:





## SECTION 1 – EXECUTIVE SUMMARY

See Section 5 of the report for the detailed development of the employer contribution rate, which is summarized in the following table:

Contribution Rates	June 30 Valuation*	
	2019	2018
1. Normal Cost Rate	8.61%	8.62%
2. UAAL Contribution Rate	15.93%	14.65%
3. Total Actuarial Required Contribution Rate	24.54%	23.27%
4. Member Contribution Rate	(1.66%)	(1.50%)
5. Employer Contribution Rate	22.88%	21.77%

\*Note different assumptions were used in the two valuation reports so results are not directly comparable.

The total actuarial contribution rate in the June 30, 2019 valuation is 24.54%. The member contribution rate (as a percentage of total payroll) is anticipated to be 1.66%, resulting in an employer contribution rate for the fiscal year ending June 30, 2021 of 22.88%. This amount exceeds the minimum employer contribution rate of 16.97%, as required by the Funding Policy.

The following table shows the reconciliation of the Computed Employer Contribution Rate from the June 30, 2018 to June 30, 2019 valuation:

	% of Payroll
<b>6/30/2018 Computed Employer Contribution Rate</b>	<b>21.77%</b>
Asset (Gain)/Loss	0.77%
Liability (Gain)/Loss	0.01%
Economic Assumption Changes	0.33%
Projected Payroll Lower than Expected	0.26%
Change in Normal Cost Rate	(0.07%)
Change in Effective Employee Contribution Rate	(0.16%)
Other Experience	(0.03%)
<b>6/30/2019 Computed Employer Contribution Rate</b>	<b>22.88%</b>

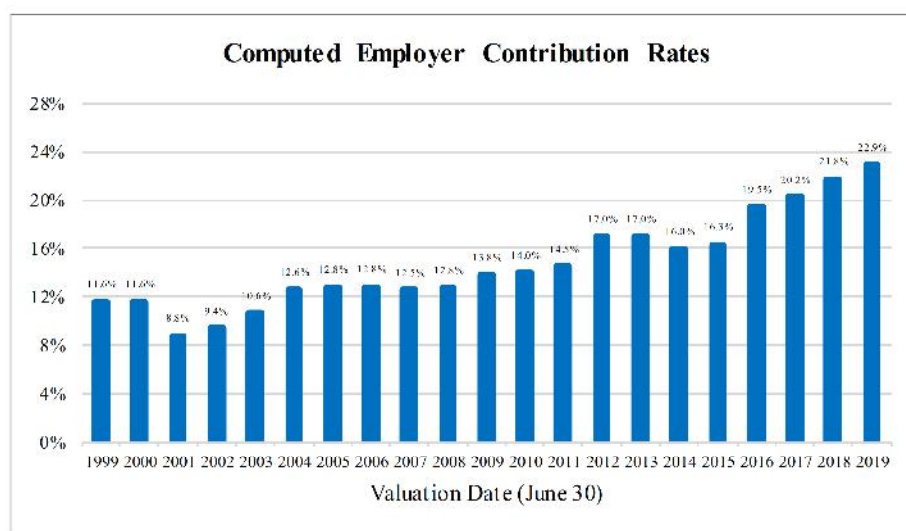


## SECTION 1 – EXECUTIVE SUMMARY

MOSERS covered employers have historically contributed the full actuarial contribution as shown in the table below which compares the actuarially determined employer contribution and actual contribution amounts:

Fiscal Year Ending	Actuarially Determined Employer Contribution	Actual Dollar Amount	Percent Contributed
June 30, 2005	\$195.6	\$195.6	100.0%
June 30, 2006	227.2	227.2	100.0%
June 30, 2007	239.5	239.5	100.0%
June 30, 2008	249.8	249.8	100.0%
June 30, 2009	252.1	252.1	100.0%
June 30, 2010	251.2	251.2	100.0%
June 30, 2011	263.4	263.4	100.0%
June 30, 2012	263.4	263.4	100.0%
June 30, 2013	290.3	290.3	100.0%
June 30, 2014	326.4	326.4	100.0%
June 30, 2015	329.8	329.8	100.0%
June 30, 2016	310.1	330.0	106.4%
June 30, 2017	322.8	335.2	103.8%
June 30, 2018	379.6	379.6	100.0%
June 30, 2019	394.2	394.2	100.0%

The historical computed employer contribution rates are shown graphically below:



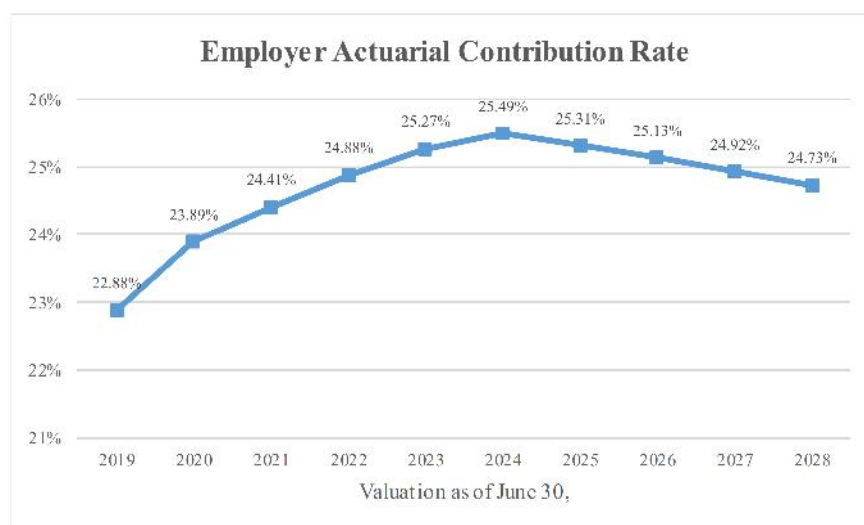
The computed employer contribution rate, which is determined based on the snapshot of the System taken on each valuation date, is anticipated to increase over the short-term as the deferred investment experience is recognized through the asset smoothing method and the investment return assumption declines to 6.95% in the 2020 valuation. Anticipated increases in employee contributions, as a percentage of total payroll, will provide a small offset to the increase in the employer contribution rate. To the extent the size of the active group continues to decline in future years, there will be a slower increase in the effective employee





## SECTION 1 – EXECUTIVE SUMMARY

contribution rate. Future experience (both investment and demographic), which is not modeled here, will also have an impact on the ultimate level of MSEP contributions. The following graph of the projected employer contribution rate over the next ten years reflects the combined impact of the recognition of the deferred investment experience (\$866 million) and the step down in the investment return assumption to 6.95% with the June 30, 2020 valuation. Once the deferred investment experience is recognized, the employer contribution rate begins to decline due to the normal cost rate decreasing from more MSEP 2011 members in the System as well as increases in the effective employee contribution rate.



The deferred investment loss (actuarial value of assets minus the market value) is \$866 million as of June 30, 2019. Absent favorable investment experience in future years, the deferred investment loss will eventually be reflected in the actuarial value of assets in future years. While the use of an asset smoothing method is a common procedure for public retirement systems, it is important to disclose the potential impact of the deferred investment experience. This is accomplished by comparing the key valuation results from the June 30, 2019 actuarial valuation using both the actuarial and market value of assets (see table below):

	Using Actuarial Value of Assets	Using Market Value of Assets
Actuarial Accrued Liability	\$13,957,626,309	\$13,957,626,309
Asset Value	<u>(8,782,383,977)</u>	<u>(7,916,465,279)</u>
Unfunded Actuarial Accrued Liability	\$5,175,242,332	\$6,041,161,030
Funded Ratio	62.9%	56.7%
Normal Cost Rate	8.61%	8.61%
UAAL Contribution Rate	<u>15.93%</u>	<u>18.71%</u>
Total Contribution Rate	<u>24.54%</u>	<u>27.32%</u>
Member Contribution Rate	<u>(1.66%)</u>	<u>(1.66%)</u>
Employer Contribution Rate	22.88%	25.66%



## **SECTION 1 – EXECUTIVE SUMMARY**

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A typical retirement plan faces many different risks. The term “risk” is most commonly associated with an outcome with undesirable results. However, in the actuarial world risk can be translated as uncertainty. The actuarial valuation process uses many actuarial assumptions to project how future contributions and investment returns will meet the cash flow needs for future benefit payments. Of course, we know that actual experience will not unfold exactly as anticipated by the assumptions and that uncertainty, whether favorable or unfavorable, creates risk. Actuarial Standard of Practice Number 51 defines risk as the potential of actual future measurements to deviate from expected results due to actual experience that is different than the actuarial assumptions. Risk evaluation is an important part of managing a defined benefit plan. Please see Section 7 of this report for an in-depth discussion of the specific risks facing MOSERS.

The next page contains a comprehensive summary of valuation results for the current and prior year. Detailed exhibits deriving the results can be found in the following sections.



**SECTION 1 – EXECUTIVE SUMMARY**

**SUMMARY OF PRINCIPAL RESULTS**  
(\$ in millions)

<b>Valuation Date</b>	<b>June 30, 2019</b>	<b>June 30, 2018</b>	
<b>Contribution for Fiscal Year Ending</b>	<b>June 30, 2021</b>	<b>June 30, 2020</b>	<b>% Change</b>
<b>Computed Employer Contribution</b>			
Annual Amount (Estimated)	\$471.4	\$445.9	5.7%
Percentage of Covered Payroll	22.88%	21.77%	5.1%
<b>Benefit Payments During Prior Year</b>	\$852	\$887	(3.9%)
<b>Membership</b>			
Number of			
- Active Members	46,864	47,806	(2.0%)
- Retirees and Beneficiaries	49,696	48,207	3.1%
- Terminated Vested Members	16,016	15,476	3.5%
- Leave-of-Absence Members	175	178	(1.7%)
- Long Term Disability Members	682	732	(6.8%)
- Terminated Nonvested Members	18,852	15,619	20.7%
- Total	132,285	128,018	3.3%
- Reported Payroll	\$1,931	\$1,915	0.8%
<b>Assets</b>			
Market Value (MVA)	\$7,916	\$8,035	(1.5%)
Actuarial Value (AVA)	\$8,782	\$8,830	(0.5%)
Ratio - Actuarial Value to Market Value	110.94%	109.89%	
Return on Market Value*	4.3%	7.4%	
Return on Actuarial Value	4.5%	5.2%	
<b>Actuarial Information</b>			
Actuarial Accrued Liability (AAL)	\$13,958	\$13,613	2.5%
Unfunded Actuarial Accrued Liability (UAAL)	\$5,175	\$4,782	8.2%
Funded Ratio	62.9%	64.9%	(3.1%)
Ratio of AVA to Payroll	4.5	4.6	
Ratio of AAL to Payroll	7.2	7.1	
Normal Cost Rate	8.61%	8.62%	(0.1%)
UAAL Contribution Rate	15.93%	14.65%	8.7%
Total Contribution Rate	24.54%	23.27%	5.5%
Member Contribution Rate	(1.66%)	(1.50%)	10.7%
Employer Contribution Rate	22.88%	21.77%	5.1%

\* As reported by MOSERS.





## **SECTION 2 – SCOPE OF THE REPORT**

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This report presents the actuarial valuation results of the Missouri State Employees' Retirement System as of June 30, 2019. This valuation was prepared at the request of the MOSERS Board.

Please pay particular attention to our actuarial certification letter, where the guidelines employed in the preparation of this report are outlined. We also comment on the sources and reliability of both the data and the actuarial assumptions upon which our findings are based. Those comments are the basis for our certification that this report is complete and accurate to the best of our knowledge and belief.

A summary of the findings which result from this valuation is presented in the previous section. Section 3 describes the assets and investment experience of the System. Sections 4 and 5 describe how the obligations of the System are to be met under the System's funding policy. Section 6 contains projections of future valuation results, assuming all actuarial assumptions are met. Section 7 discloses key maturity measurements and discusses the key risks facing the funding of the System. Section 8 includes some historical funding information that was required by the Governmental Accounting Standards Board (GASB) in the past.



### **SECTION 3 – SYSTEM ASSETS**

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In many respects, an actuarial valuation can be thought of as an inventory process. The inventory is taken as of the actuarial valuation date, which for this valuation is June 30, 2019. On that date, the assets available for the payment of benefits are appraised. The assets are compared with the liabilities of the System, which are generally in excess of assets. The actuarial process then leads to a method of determining the contributions needed by members and the employer in the future to balance the System assets and liabilities.

#### **Market Value of Assets**

The current market value represents the "snapshot" or "cash-out" value of System assets as of the valuation date. In addition, the market value of assets provides a basis for measuring investment performance from time to time. Table 1 shows a summary of changes to both the market and the actuarial value assets for the year beginning June 30, 2018 and ending June 30, 2019.

#### **Actuarial Value of Assets**

Neither the market value of assets, representing a "cash-out" value of System assets, nor the book values of assets, representing the cost of investments, may be the best measure of the System's ongoing ability to meet its obligations.

To arrive at a suitable value of assets for the actuarial valuation, a technique for determining the actuarial value of assets is used which dampens swings in the market value while still indirectly recognizing market values.

Table 2 shows the development of the actuarial value of assets (AVA) as of the valuation date.

**SECTION 3 – SYSTEM ASSETS****TABLE 1  
ASSET SUMMARY**

	Market Value	Actuarial Value
1. Assets at June 30, 2018	8,034,508,424	8,830,410,210
2. Contributions		
State Contributions	394,150,042	394,150,042
Employee Contributions	31,286,632	31,286,632
Member Purchases of Service Credit	1,293,774	1,293,774
Service Transfer Contributions	2,592,737	2,592,737
Total	<u>429,323,185</u>	<u>429,323,185</u>
3. Investment Income, Net of Investment Expenses	313,656,076	383,672,988
4. Benefit Payments and Transfers Out		
Monthly Benefit Payments	769,612,853	769,612,853
BackDROP and Lump Sum Payments	72,882,398	72,882,398
Inactive Vested Lump Sum Payments	318,656	318,656
Service Transfer Payments	3,001,189	3,001,189
Contribution Refunds	6,006,484	6,006,484
Total	<u>851,821,580</u>	<u>851,821,580</u>
5. Administrative and Misc. Expenses	9,200,826	9,200,826
6. Assets at June 30, 2019	7,916,465,279	8,782,383,977
(1) + (2) + (3) - (4) - (5)		
7. Rate of Return, Net of Investment Expenses*	4.3%	4.5%

\* Based on the approximation formula:  $I / [.5 \times (A+B-I)]$ , where

I = Investment Increment

A = Beginning of year asset value

B = End of year asset value

Market Value return reported by MOSERS



**SECTION 3 – SYSTEM ASSETS****TABLE 2  
DEVELOPMENT OF ACTUARIAL VALUE OF ASSETS**

Under the current asset smoothing method, the difference between the dollar amount of actual and assumed investment return on the market value of assets will be recognized evenly over a closed five-year period. The method was first implemented with the June 30, 2018 valuation. Deferred asset experience as of June 30, 2017 is recognized evenly over a closed seven-year period, beginning June 30, 2018.

<b>Fiscal Year End June 30,</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>
A. Market Value of Assets, Beginning of Year	\$ 7,941,650,400	\$ 8,034,508,424	\$ NA	\$ NA
B. Contributions During Year	413,179,927	429,323,185	NA	NA
C. Benefit Payments and Expenses During Year	896,510,729	861,022,406	NA	NA
D. Expected Rate of Return	7.50%	7.25%	7.10%	6.95%
E. Expected Net Investment Income	577,826,541	567,126,565	NA	NA
F. Expected Market Value of Assets, End of Year	8,036,146,139	8,169,935,768	NA	NA
G. Market Value of Assets, End of Year	8,034,508,424	7,916,465,279	NA	NA
H. Excess/(Shortfall) of Net Investment Income	\$ (1,637,715)	\$ (253,470,489)	\$ NA	\$ NA

The table below shows the development of gain/(loss) to be recognized in the current year:

<b>Plan Year Ended</b>	<b>Asset Gain/(Loss)</b>	<b>Gain/(Loss) Recognized in Prior Years</b>	<b>Gain/(Loss) Recognized This Year</b>	<b>Gain/(Loss) Deferred to Future Years</b>
6/30/2017	(927,023,550)	(132,431,936)	(132,431,936) *	(662,159,678)
6/30/2018	(1,637,715)	(327,543)	(327,543)	(982,629)
6/30/2019	(253,470,489)	0	(50,694,098)	(202,776,391)
<b>Total</b>	<b>(1,182,131,754)</b>	<b>(132,759,479)</b>	<b>(183,453,577)</b>	<b>(865,918,698)</b>

A. Market Value of Assets as of June 30, 2019	\$ 7,916,465,279
B. Total Deferred Investment Experience	\$ (865,918,698)
C. Actuarial Value of Assets as of June 30, 2019 (A. - B.)	\$ 8,782,383,977
D. Ratio of Actuarial Value to Market Value	110.9%

\* The unrecognized investment experience as of June 30, 2017 will be recognized over a closed seven-year period.



## SECTION 4 – SYSTEM LIABILITIES

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In the previous section, an analysis of System’s current assets was given as of June 30, 2019. In this section, the discussion will focus on the commitments (future benefit payments) of the System, which are referred to as its liabilities.

Table 3 contains an analysis of the actuarial present value of all future benefits (PVFB) for contributing members, inactive members, retirees and their beneficiaries. The liabilities summarized in Table 3 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 measures of both benefits already earned and future benefits expected to be earned. For all members, active and retired, the value extends over benefits earnable and payable for the rest of their lives and, if an optional benefit is chosen, for the lives of their surviving spouses.

The actuarial assumptions used to determine liabilities are based on the results of the latest experience study. These assumptions are outlined in Appendix D.

Table 4 illustrates the amortization schedule of the projected UAAL calculated in Table 4, given the Board’s funding policy that amortizes the UAAL using a “layered” bases method. Under this method, the “Legacy UAAL”, as determined in the June 30, 2018 valuation, is amortized over a closed 30-year period. Subsequent changes in the UAAL due to actuarial gains/losses or assumption changes are separately financed by establishing amortization bases and payments, as a level percentage of payroll, over closed 30-year periods. Any change in the System’s benefit structure shall be amortized over a closed period of 20 years, as set out in state statutes. The total UAAL amortization payment is the sum of the payments for each of the amortization bases. Note that the use of closed amortization periods will result in the System being fully funded at the end of the amortization period if all actuarial assumptions are met.

All liabilities reflect the benefit provisions in place as of June 30, 2019, as amended by any legislation in the 2019 Legislative Session.

### **Actuarial Accrued Liability**

A fundamental principle in financing the liabilities of a retirement program is that the cost of its benefits should be related to the period in which benefits are earned, rather than to the period of benefit distribution. An actuarial cost method is a mathematical technique that allocates the present value of future benefits into annual costs. In order to do this allocation, it is necessary for the funding method to “breakdown” the present value of future benefits into two components:

- (1) that which is attributable to the past and
- (2) that which is attributable to the future.

Actuarial terminology calls the part attributable to the past the “past service liability” or the “actuarial accrued liability.” The portion allocated to the future is known as the present value of future normal costs, with the specific piece of it allocated to the current year being called the “normal cost.” Table 5 contains the actuarial balance sheet for the System. The Entry Age Normal actuarial cost method is used to develop the actuarial accrued liability. Tables 6 and 7 show the gain/(loss) analysis in total and by source for the System. Table 8 shows historical data for gain/(loss) experience by source.

**SECTION 4 – SYSTEM LIABILITIES**

**TABLE 3**  
**UNFUNDED ACTUARIAL ACCRUED LIABILITY**  
**As of June 30, 2019**

	(1) Actuarial Present Value	(2) Present Value of Future Normal Cost Contributions	(3) = (1) - (2) Actuarial Accrued Liabilities
<b>Active Members</b>			
Service retirement benefits based on service rendered before and likely to be rendered after valuation date	\$5,315,453,978	\$739,698,607	\$4,575,755,371
Disability benefits likely to be paid to present active members who become totally and permanently disabled	159,803,629	102,082,080	57,721,549
Survivor benefits likely to be paid to widows and children of present active members who die before retiring	63,470,496	17,501,758	45,968,738
Separation benefits likely to be paid to present active members	227,021,237	158,016,990	69,004,247
Active Member Totals	\$5,765,749,340	\$1,017,299,435	\$4,748,449,905
<b>Members on Leave of Absence &amp; LTD</b>			
Service retirement benefits based on service rendered before the valuation date			94,581,573
<b>Terminated Vested Members</b>			
Service retirement benefits based on service rendered before the valuation date			660,192,743
<b>Retired Lives</b>			
			8,430,014,943
<b>Pending Refunds</b>			
			24,387,145
<b>Total Actuarial Accrued Liability</b>			\$13,957,626,309
<b>Actuarial Value of Assets</b>			8,782,383,977
<b>Unfunded Actuarial Accrued Liability</b>			\$5,175,242,332
<b>Funded Ratio</b>			62.9%





**SECTION 4 – SYSTEM LIABILITIES**

**TABLE 4  
AMORTIZATION SCHEDULE FOR LEGACY UAAL**

This amortization schedule for the outstanding balance of the legacy UAAL projected to June 30, 2020 reflects the underlying assumptions used in this valuation including an investment return assumption of 7.10% and the assumed payroll growth of 2.35%. Any change in these assumptions in the future, will impact the projected UAAL contribution schedule for the legacy UAAL.

As of June 30	Outstanding Balance (BOY)	Amortization Years Remaining	Contributions (SM)
2020	4,903	29	308
2021	4,933	28	315
2022	4,957	27	322
2023	4,976	26	330
2024	4,988	25	338
2025	4,993	24	345
2026	4,990	23	354
2027	4,978	22	362
2028	4,957	21	370
2029	4,926	20	379
2030	4,883	19	388
2031	4,828	18	397
2032	4,760	17	406
2033	4,678	16	416
2034	4,579	15	426
2035	4,464	14	436
2036	4,330	13	446
2037	4,175	12	457
2038	3,999	11	467
2039	3,800	10	478
2040	3,575	9	489
2041	3,322	8	501
2042	3,039	7	513
2043	2,724	6	525
2044	2,375	5	537
2045	1,988	4	550
2046	1,560	3	563
2047	1,088	2	576
2048	570	1	589
2049	0	0	0



SECTION 4 – SYSTEM LIABILITIES

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**TABLE 5**  
**ACTUARIAL BALANCE SHEET**

ASSETS

Actuarial Value of Assets		\$	8,782,383,977
Unfunded Actuarial Accrued Liability			5,175,242,332
Present Value of Future Normal Costs			<u>1,017,299,435</u>
Total Assets		\$	14,974,925,744

LIABILITIES

Present Value of Future Benefits

Active members

Retirement	\$	5,315,453,978	
Withdrawal		227,021,237	
Death		63,470,496	
Disability		<u>159,803,629</u>	
Total	\$		5,765,749,340

Inactive members

Currently receiving benefits		8,430,014,943	
Not currently receiving benefits		<u>779,161,461</u>	
Total	\$		9,209,176,404

Total Liabilities		\$	14,974,925,744
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**SECTION 4 – SYSTEM LIABILITIES****TABLE 6  
ANALYSIS OF GAIN/(LOSS)**

	(1) Actuarial Accrued Liabilities	(2) Valuation Assets	(3) = (1) - (2) UAAL
(1) Value at start of year	\$ 13,612,763,961	\$ 8,830,410,210	4,782,353,751
(2) Total normal cost from last valuation	147,497,311	0	147,497,311
(3) Actual contributions (Employer and Member)	0	425,436,674	(425,436,674)
(4) Benefit payments	(851,821,580)	(851,821,580)	0
(5) Administrative expenses	0	(9,200,826)	9,200,826
(6) Service Purchases/Transfers	3,886,511	3,886,511	0
(7) Interest on (1), (2), (3), (4), (5) and (6) at 7.25%	<u>967,419,091</u>	<u>624,829,445</u>	<u>342,589,646</u>
(8) Expected value before changes	\$ 13,879,745,294	\$ 9,023,540,434	\$ 4,856,204,860
(9) Change in actuarial assumptions	<u>74,340,841</u>	<u>0</u>	<u>74,340,841</u>
(10) Expected value after changes: (8) + (9)	\$ 13,954,086,135	\$ 9,023,540,434	\$ 4,930,545,701
(11) Actual value at end of year	13,957,626,309	8,782,383,977	5,175,242,332
(12) Gain / (Loss)	\$ (3,540,174)	\$ (241,156,457)	\$ (244,696,631)
(13) Gain / (Loss) as percent of expected actuarial accrued liability: \$13,879,745,294	(0.0%)	(1.7%)	(1.8%)





**TABLE 7**  
**GAIN/(LOSS) ANALYSIS BY SOURCE**

Type of Activity	Gain or (Loss) for Year Ended 6/30/2019	
<b>Age &amp; Service Retirements.</b> If members retire at older ages or with lower final average pay than assumed, there is a gain. If younger ages or higher average pays, a loss.	(\$26,400,000)	(0.2%)
<b>Death-in-Service Benefits.</b> If survivor claims are less than assumed, there is a gain. If more claims, there is a loss.	7,100,000	0.1%
<b>Withdrawal From Employment.</b> If more liabilities are released by withdrawals than assumed, there is a gain. If smaller releases, a loss.	1,500,000	0.0%
<b>Long Term Disability.</b> The occurrence of a gain or loss depends upon the age at disability and the incidence of disability.	(2,300,000)	(0.0%)
<b>Pay Increases.</b> If there are smaller pay increases than assumed, there is a gain. If greater increases, a loss.	24,900,000	0.2%
<b>Investment Income.</b> If there is greater investment return on assets than assumed, there is a gain. If less return, a loss.	(241,200,000)	(1.7%)
<b>Retiree Mortality.</b> If more deaths than assumed, there is a gain. If fewer deaths, a loss.	6,400,000	0.0%
<b>COLAs.</b> If Cost of Living Adjustments are less than expected, a gain, if more a loss.	29,500,000	0.2%
<b>Other.</b> Miscellaneous gains and losses resulting from data adjustments, timing of financial transactions, valuation methods, etc.	(44,200,000)	(0.3%)
<b>Gain (or Loss) During Year From Experience</b>	(\$244,700,000)	(1.8%)



**SECTION 4 – SYSTEM LIABILITIES**

**TABLE 8  
HISTORICAL EXPERIENCE GAINS AND LOSSES BY SOURCE**

Year Ending June 30	Gain (Loss) By Risk Area										Total Exper. Gain (Loss)	Exper. Gain (Loss) as % of AAL	Accrued Liability Beginning of Year
	Salary Increases	Investments	Age & Service Retirement	Disability	Death In- Service	Withdrawal	Death Retired Lives &	COLAs	Other				
1998	(56.9)	325.9	9.6	0.2	(0.3)	(1.7)	16.3			(48.3)	244.8	5.5	4,484
1999	(21.9)	299.8	(1.3)	(0.3)	(0.9)	1.7	10.5			(58.1)	229.5	4.7	4,919
2000*	(6.4)	162.0	1.7	(0.5)	(0.7)	8.9	18.5			(34.7)	148.8	2.7	5,506
2001*	(23.2)	(67.9)	(59.8)	(1.0)	(0.2)	(28.2)	(13.1)			(66.1)	(259.5)	(4.4)	5,921
2002	115.0	(284.6)	(14.4)	(0.5)	(1.3)	(21.4)	37.1			(62.6)	(232.8)	(3.8)	6,065
2003	7.7	(314.1)	(27.2)	(0.6)	(2.6)	(14.6)	9.6			(63.1)	(404.9)	(6.5)	6,294
2004*	(40.0)	(240.1)	(51.5)	(1.4)	(1.3)	(6.7)	(4.3)			(53.8)	(399.1)	(6.0)	6,662
2005	(3.4)	(196.6)	3.1	(2.0)	(1.7)	(0.9)	(11.7)			(35.5)	(248.7)	(3.4)	7,230
2006	(29.5)	38.0	(1.7)	(2.3)	(2.4)	15.5	(21.1)			(3.6)	(7.1)	(0.1)	7,578
2007	(11.5)	179.4	(17.3)	(2.1)	(2.4)	3.8	(29.7)			(43.0)	77.2	1.0	8,013
2008*	(10.5)	78.3	(22.9)	(2.0)	(3.4)	6.6	8.7			(49.8)	5.0	0.1	8,500
2009*	(15.9)	(354.3)	8.8	(1.5)	0.0	(31.3)	(39.8)			(37.6)	(471.6)	(5.2)	9,128
2010	23.2	(313.6)	(19.0)	8.4	8.0	(30.6)	4.7			(56.9)	(375.8)	(3.9)	9,495
2011	49.6	(204.0)	(52.8)	10.8	7.5	(21.0)	32.7			(60.4)	(237.6)	(2.4)	9,853
2012*	12.3	(447.2)	(24.3)	8.3	8.9	8.1	10.3			(53.6)	(477.2)	(4.7)	10,124
2013**	60.4	(313.7)	6.7	11.1	7.4	2.0	(7.7)		(3.1)	(70.4)	(307.3)	(2.8)	10,794
2014	52.6	249.5	(6.9)	(4.2)	(2.5)	(12.7)	6.3		18.0	(68.3)	231.8	2.1	11,135
2015	51.4	(137.9)	(29.1)	(1.6)	(0.5)	15.6	18.9		30.0	(54.0)	(107.2)	(0.9)	11,495
2016***	(59.3)	(320.4)	7.5	(1.2)	3.0	(8.3)	16.9		50.3	(70.0)	(381.5)	(3.3)	11,728
2017*	17.0	(232.1)	(53.3)	(0.6)	6.2	(28.2)	14.3		68.3	(2.2)	(210.5)	(1.6)	12,751
2018***	85.3	(202.1)	(51.8)	(0.9)	7.2	(38.0)	20.1		43.3	17.9	(119.0)	(0.9)	13,152
<b>2019*</b>	<b>24.9</b>	<b>(241.2)</b>	<b>(26.4)</b>	<b>(2.3)</b>	<b>7.1</b>	<b>1.5</b>	<b>6.4</b>		<b>29.5</b>	<b>(44.2)</b>	<b>(244.7)</b>	<b>(1.8)</b>	<b>13,613</b>

\* Revision in assumptions.  
 \*\* Revision in asset valuation method.  
 \*\*\* Revision in assumptions & asset valuation method.  
 & Prior to the 2013 valuation, this amount included COLAs.



## SECTION 5 – EMPLOYER CONTRIBUTIONS

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The previous two sections were devoted to a discussion of the assets and liabilities the Missouri State Employees' Retirement System. Table 5 indicates that current assets fall short of meeting the present value of future benefits (total liability). This is expected in all but a completely closed fund, where no further contributions are anticipated. In an active system, there will almost always be a difference between the actuarial value of assets and total liabilities. This deficiency has to be made up by future contributions and investment returns. An actuarial valuation sets out a schedule of future contributions that will deal with this deficiency in an orderly fashion.

The method used to determine the incidence of the contributions in various years is called the actuarial cost method. Under an actuarial cost method, the contributions required to meet the difference between current assets and current liabilities are allocated each year between two elements: (1) the normal cost rate and (2) the unfunded actuarial accrued liability contribution rate.

The term "fully funded" is often applied to a system in which contributions at the normal cost rate are sufficient to pay for the benefits of existing employees as well as for those of new employees. More often than not, systems are not fully funded, either because of past benefit improvements that have not been completely funded or because of actuarial deficiencies that have occurred because experience has not been as favorable as anticipated by the actuarial assumptions. Under these circumstances, an unfunded actuarial accrued liability (UAAL) exists. Likewise, when the actuarial value of assets is greater than the actuarial accrued liability, a surplus exists.

### Description of Contribution Rate Components

The Entry Age Normal (EAN) actuarial cost method is used for the valuation. Under that method, the normal cost for each year from entry age to assumed exit age is a constant percentage of the member's year by year projected compensation. The portion of the present value of future benefits not provided by the present value of future normal costs is the actuarial accrued liability. The unfunded actuarial accrued liability represents the difference between the actuarial accrued liability and the actuarial value of assets as of the valuation date. The UAAL is calculated each year and reflects experience gains and losses.

In general, contributions are computed in accordance with a level percent-of-payroll funding objective. The contribution rate based on the June 30, 2019 actuarial valuation will be used to determine the employer contribution rate for the plan year ending June 30, 2021. In this context, the term "contribution rate" means the percentage, which is applied to a particular active member payroll to determine the actual employer contribution amount (i.e., in dollars) for the group.

### Contribution Rate Summary

Table 9 shows the development of the June 30, 2020 projected UAAL. In Table 10, the amortization payment related to the UAAL is developed. Table 11 develops the computed employer contribution rate for the Plan and the estimated amount of required State contributions. Table 12 shows a summary what the actuarial results would be under different investment return assumptions.

The contribution rates shown in this report are based on the actuarial assumptions and cost methods described in Appendix D.





**SECTION 5 – EMPLOYER CONTRIBUTIONS**

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**TABLE 9  
PROJECTED UAAL AS OF JUNE 30, 2020**

(1) Unfunded Actuarial Accrued Liability at June 30, 2019	\$5,175,242,332
(2) Expected Contribution Rate for Year Ending June 30, 2020*	23.27%
(3) Normal Cost Rate for Year Ending June 30, 2020	8.61%
(4) Contribution Rate Applied to UAAL [(2) - (3)]	14.66%
(5) Projected Payroll for the Year After the Valuation Date	\$2,013,146,182
(6) Expected UAAL Contribution [(4) * (5)]	\$295,127,230
(7) Interest on (1) and (6) to June 30, 2020 at 7.10%	\$357,144,833
(8) Projected UAAL at June 30, 2020 [(1) - (6) + (7)]	\$5,237,259,935

\*The Total Contribution Rate was the employer rate of 21.77% plus the weighted average member rate of 1.50% of payroll.



SECTION 5 – EMPLOYER CONTRIBUTIONS

TABLE 10  
UAAL CONTRIBUTION RATE

Amortization Base	Original Amount	Remaining Payments	Projected June 30, 2020 Balance	Annual Payment*
2018 Legacy UAAL	\$ 4,861,507,879	29	\$ 4,903,204,638	\$ 307,579,693
2019 Assumption Changes	74,340,841	30	74,340,841	4,588,793
2019 Experience Base	\$ 259,714,456	30	259,714,456	16,031,239
<b>Total</b>			<b>\$ 5,237,259,935</b>	<b>\$ 328,199,725</b>

\* Payment amount reflects mid-year timing.

1. Total UAAL Amortization Payments	\$ 328,199,725
2. Expected Payroll for FYE 2021	\$ 2,060,455,117
3. UAAL Amortization Payment Rate (1) / (2)	15.93%



**SECTION 5 – EMPLOYER CONTRIBUTIONS**

**TABLE 11  
COMPUTED EMPLOYER CONTRIBUTION RATE  
FOR THE FISCAL YEAR ENDING JUNE 30, 2021**

**ACTUARIAL VALUATION RESULTS AS OF JUNE 30, 2019**

	Percents of Payroll		Weighted Average
	<u>MSEP &amp; MSEP 2000</u>	<u>MSEP 2011</u>	
A. Normal Cost			
(1) Service retirement benefits	6.65 %	5.04 %	5.98 %
(2) Termination benefits	1.02	1.55	1.24
(3) Survivor benefits	0.13	0.14	0.14
(4) Disability benefits	0.80	0.79	0.79
(5) Administrative expenses	0.46	0.46	0.46
(6) Total	<u>9.06</u>	<u>7.98</u>	<u>8.61</u>
B. Less Member Contributions	0.00	4.00	1.66
C. Employer Normal Cost [A(6) - B]	9.06	3.98	6.95
D. Unfunded Actuarial Accrued Liabilities (UAAL) (level percent-of-payroll amortization with layered bases)			<u>15.93</u>
<b>E. TOTAL COMPUTED EMPLOYER CONTRIBUTION RATE [C. + D.]</b>			<b>22.88 %</b>
<b>F. POLICY MINIMUM EMPLOYER CONTRIBUTION RATE</b>			<b>16.97 %</b>
<b>G. ESTIMATED EMPLOYER CONTRIBUTION (\$Millions)#</b>			<b>\$471.4</b>

At the September 18, 2014 meeting, the Board adopted a policy minimum contribution rate so that the employer shall not fall below the fiscal 2015 rate (16.97% of payroll) until the plan is 80% funded.

# Illustrative only. Estimated employer contribution amounts (shown in millions) are based on the greater of the Total Computed Employer Contribution Rate and the Policy Minimum Contribution Rate shown and the valuation payroll projected two years to the applicable fiscal year using the valuation assumption of 2.35% per year.





## SECTION 6 – PROJECTIONS

The June 30, 2019 valuation results present the System’s financial status at a single point in time and contribution requirements for a single fiscal year. Historical valuation results allow analysis of past trends, but no insight into future trends. A projection model provides insight into the longer term trend of (1) the projected Employer contributions; (2) the projected System funded status (ratio of actuarial assets over liabilities); (3) net cash flow patterns; and (4) the unfunded actuarial accrued liability (actuarial accrued liability minus actuarial assets). Projections can also be used to demonstrate how sensitive the valuation results are to the key variables being modeled. Such projections can be found in Section 7 of this report.

For MSEP, projections are particularly important and insightful due to the multiple-tiered benefit structure. The current valuation produces a normal cost and actuarial accrued liability based on the composition of active members on the valuation date, June 30, 2019. Without a tiered structure, systems can assume that the normal cost, as a percentage of payroll, will remain relatively level. However, since all new employees are covered under a lower cost benefit structure, until all new employees are covered under MSEP 2011 benefits, the normal cost percentage will continue to decrease. In addition, MSEP 2011 members are the only group making employee contributions so projections allow for the projected payroll to be segregated by tier so that total future contributions reflect an estimate of the amounts to be contributed by employees.

The member data (active and in-pay status) is projected for each year in the future using current assumptions. After the first year, a new-member profile is used to estimate the demographics of new employees replacing members who are projected to terminate, retire, die or become disabled in future years. ***For this modeling, the number of active members is assumed to remain level over the projection period.*** To the extent that assumption does not occur, i.e., the size of the active membership declines or increases, the actual valuation results are expected to be different than those shown here.

The projections in this section assume that all actuarial assumptions are met in all future years, including the investment return assumption, and that the Employer makes contributions equal to the full amount of the actuarially determined contribution, as calculated by the valuation, based on the Board’s Funding Policy. In addition, the projections assume the current phase-in of economic assumptions occur as scheduled. Therefore, the economic assumptions used in the projections are shown in the table below. The projections are based on the current plan provisions and assume that all new members joining after June 30, 2019 will make employee contributions and participate in the MSEP 2011 plan.

Economic Assumption	Effective June 30, 2018	Effective June 30, 2019	Effective June 30, 2020
1. Investment Return	7.25%	7.10%	6.95%
2. Inflation	2.50%	2.35%	2.25%
3. Cost-of-Living Adjustment (COLA)	2.00%	1.88%	1.80%
4. General Wage Growth	2.75%	2.60%	2.50%
5. Payroll Growth	2.50%	2.35%	2.25%

**The projections do not predict the System’s financial condition or its ability to pay benefits in the future and do not provide any guarantee of future financial soundness of the System nor do they, on their own, indicate future funding requirements.** Over time, a defined benefit plan’s total cost will depend on a number of factors, including the amount of benefits paid, the number of people paid benefits, plan expenses and the amount of earnings on assets invested to pay benefits. These amounts, and other variables, are uncertain and unknowable at the time the projections were prepared. Because not all of the assumptions will unfold exactly as expected, actual results will differ from the projections shown.



**TABLE 12  
PROJECTION OF FUTURE ACTUARIAL VALUATION RESULTS  
AS OF JUNE 30, 2019**

Projection Based on Assumptions Outlined in Appendix D												
Amounts in thousands												
Valuation as of June 30, (1)	Covered Payroll at Valuation (2)	Actuarial Accrued Liability (AAL) (3)	Actuarial Value of Assets (AVA) (4)	Unfunded AAL (5)	Funded Ratio Using AVA (6)	Normal Cost Rate (7)	UAAL Amortization Payment Rate (8)	Actuarial Contribution Rate (9)	Member Contribution Rate (10)	Employer Actuarial Contribution Rate (11)	Estimated Dollar Amount of Employer's Contribution* (12)	
2019	\$2,013,146	\$13,957,626	\$8,782,384	\$5,175,242	62.9%	8.61%	15.93%	24.54%	1.66%	22.88%	\$464,872	
2020	2,031,781	14,305,574	8,708,002	5,597,572	60.9%	8.54%	17.21%	25.75%	1.86%	23.89%	492,550	
2021	2,060,906	14,509,874	8,626,734	5,883,140	59.5%	8.39%	18.07%	26.46%	2.05%	24.41%	511,098	
2022	2,093,805	14,688,701	8,548,219	6,140,483	58.2%	8.23%	18.86%	27.09%	2.21%	24.88%	529,113	
2023	2,126,661	14,829,785	8,453,032	6,376,753	57.0%	8.08%	19.60%	27.65%	2.38%	25.27%	546,502	
2024	2,162,651	14,948,215	8,406,853	6,541,362	56.2%	7.92%	20.12%	28.04%	2.55%	25.49%	561,115	
2025	2,201,315	15,053,062	8,500,536	6,552,526	56.5%	7.81%	20.20%	28.01%	2.70%	25.31%	567,834	
2026	2,243,515	15,136,889	8,593,431	6,543,458	56.3%	7.71%	20.26%	27.97%	2.84%	25.13%	575,355	
2027	2,289,516	15,192,306	8,670,646	6,521,661	57.1%	7.61%	20.28%	27.89%	2.97%	24.92%	581,167	
2028	2,332,129	15,208,645	8,722,737	6,485,908	57.4%	7.49%	20.33%	27.82%	3.09%	24.73%	588,520	
2029	2,379,782	15,199,296	8,762,827	6,436,469	57.7%	7.41%	20.35%	27.76%	3.21%	24.55%	596,559	
2030	2,429,976	15,177,929	8,805,305	6,372,624	58.0%	7.31%	20.35%	27.66%	3.32%	24.34%	604,568	
2031	2,483,847	15,134,858	8,843,074	6,291,784	58.4%	7.23%	20.32%	27.55%	3.41%	24.14%	613,214	
2032	2,540,241	15,075,001	8,880,936	6,194,066	58.9%	7.15%	20.29%	27.44%	3.49%	23.95%	621,441	
2033	2,594,745	14,988,206	8,909,789	6,078,417	59.4%	7.07%	20.28%	27.35%	3.57%	23.78%	631,048	
2034	2,653,692	14,889,221	8,945,518	5,943,702	60.1%	7.01%	20.25%	27.26%	3.64%	23.62%	641,363	
2035	2,715,423	14,784,123	8,996,436	5,787,687	60.9%	6.95%	20.20%	27.15%	3.70%	23.45%	651,760	
2036	2,779,358	14,667,577	9,059,408	5,608,169	61.8%	6.91%	20.15%	27.06%	3.76%	23.30%	663,393	
2037	2,847,182	14,552,714	9,148,046	5,404,667	62.9%	6.87%	20.08%	26.95%	3.80%	23.15%	674,284	
2038	2,912,676	14,428,338	9,254,039	5,174,299	64.1%	6.83%	20.04%	26.87%	3.84%	23.03%	687,109	
2039	2,983,540	14,307,797	9,392,032	4,915,765	65.6%	6.80%	19.98%	26.78%	3.87%	22.91%	700,171	
2040	3,056,179	14,195,280	9,569,523	4,625,757	67.4%	6.77%	19.91%	26.68%	3.91%	22.77%	712,894	
2041	3,130,845	14,091,323	9,789,554	4,301,770	69.5%	6.74%	19.84%	26.58%	3.93%	22.65%	726,949	
2042	3,209,489	14,010,267	10,067,961	3,942,306	71.9%	6.72%	19.76%	26.48%	3.94%	22.54%	740,861	
2043	3,286,871	13,943,657	10,399,278	3,544,379	74.6%	6.70%	19.71%	26.41%	3.98%	22.45%	756,255	

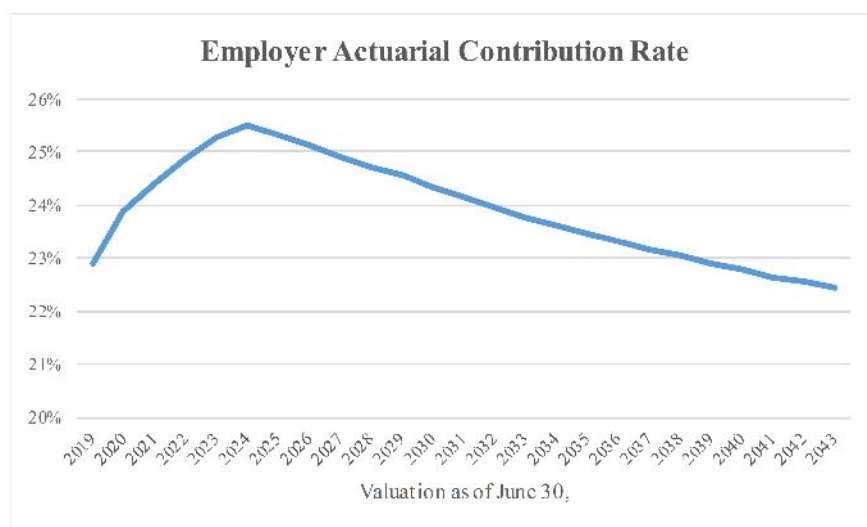
\* Amounts shown are contributions in the fiscal year ending two years after the valuation date.

Note: Projections reflect the final phase-in of economic assumptions including an investment return assumption of 6.95% in the June 30, 2020 valuation. Projections also assume the size of the active population remains constant over the projection period.

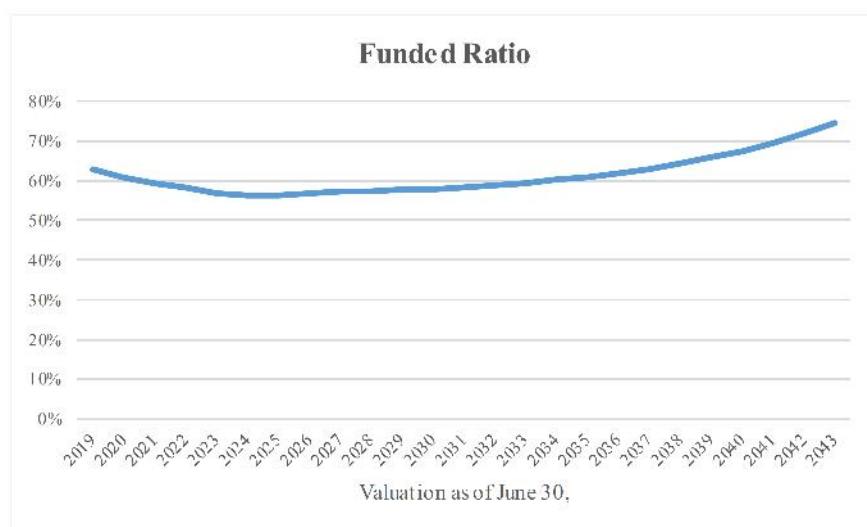


**TABLE 12**  
**PROJECTION OF FUTURE ACTUARIAL VALUATION RESULTS**  
**AS OF JUNE 30, 2019**

(continued)



The employer contribution rate is projected to increase until the June 30, 2024 valuation as a result of recognition of the deferred investment experience. After that, the employer contribution rate declines due to more of the membership being in the MSEP 2011 Plan (lower cost and employee contributions).



Even if all assumptions are met in the future, the funded ratio declines as the deferred investment losses are recognized in the asset smoothing method. After 2024, the funded ratio gradually improves over time. With the current amortization policy, the System is not expected to reach full funding by the end of this projection period.

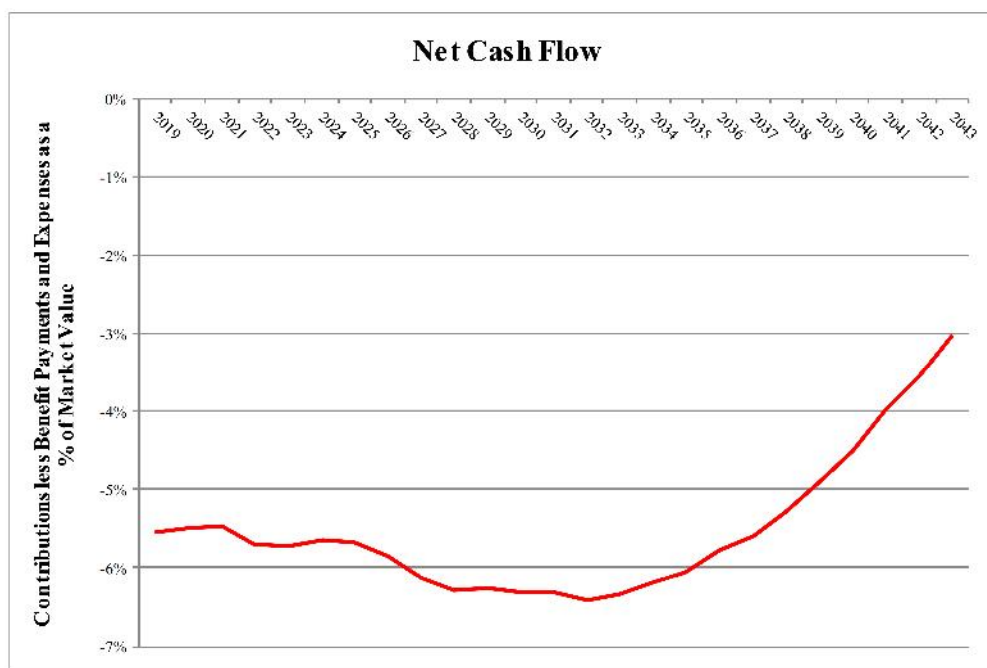




SECTION 6 – PROJECTIONS

**TABLE 13  
PROJECTION OF FUTURE NET CASH FLOWS  
AS OF JUNE 30, 2019**

Projection Based on Assumptions Outlined in Appendix D						
Amounts in thousands						
Valuation as of June 30, (1)	Total Contributions (2)	Benefit Payments (3)	Administrative Expenses (4)	Net Cash Flows (5)	Market Value of Assets (MVA) (6)	Net Cash Flow as a % of MVA (7)
2019	\$468,459	\$896,767	\$9,417	(\$437,725)	\$7,916,465	(5.53%)
2020	498,599	929,508	9,629	(440,538)	8,025,537	(5.49%)
2021	530,683	965,581	9,846	(444,743)	8,127,722	(5.47%)
2022	554,021	1,012,187	10,067	(468,233)	8,232,661	(5.69%)
2023	576,112	1,041,592	10,294	(475,773)	8,320,600	(5.72%)
2024	597,973	1,061,833	10,525	(474,385)	8,406,853	(5.64%)
2025	617,249	1,087,930	10,762	(481,443)	8,500,536	(5.66%)
2026	628,409	1,120,253	11,004	(502,849)	8,593,431	(5.85%)
2027	640,378	1,161,456	11,252	(532,331)	8,670,646	(6.14%)
2028	650,431	1,186,362	11,505	(547,437)	8,722,737	(6.28%)
2029	662,055	1,198,113	11,764	(547,821)	8,762,827	(6.25%)
2030	674,561	1,217,762	12,028	(555,229)	8,805,305	(6.31%)
2031	687,032	1,232,411	12,299	(557,678)	8,843,074	(6.31%)
2032	699,836	1,256,194	12,576	(568,934)	8,880,936	(6.41%)
2033	711,998	1,263,363	12,859	(564,223)	8,909,789	(6.33%)
2034	725,785	1,264,575	13,148	(551,938)	8,945,518	(6.17%)
2035	740,224	1,270,484	13,444	(543,704)	8,996,436	(6.04%)
2036	754,596	1,263,966	13,746	(523,117)	9,059,408	(5.77%)
2037	770,447	1,268,685	14,056	(512,294)	9,148,046	(5.60%)
2038	784,966	1,259,067	14,372	(488,473)	9,254,039	(5.28%)
2039	801,677	1,246,536	14,695	(459,554)	9,392,032	(4.89%)
2040	818,445	1,233,767	15,026	(430,348)	9,569,523	(4.50%)
2041	835,310	1,208,632	15,364	(388,687)	9,789,554	(3.97%)
2042	853,082	1,193,607	15,710	(356,235)	10,067,961	(3.54%)
2043	870,363	1,170,415	16,063	(316,115)	10,399,278	(3.04%)





## RISK MEASURES

Actuarial Standards of Practice are issued by the Actuarial Standards Board and are binding on credentialed actuaries practicing in the United States. These standards generally identify what the actuary should consider, document and disclose when performing an actuarial assignment. In September 2017, Actuarial Standard of Practice Number 51, *Assessment and Disclosure of Risk in Measuring Pension Obligations*, (ASOP 51) was issued as final with application to measurement dates on or after November 1, 2018. This ASOP, which applies to funding valuations, actuarial projections, and actuarial cost studies of proposed plan changes, is first applicable for the June 30, 2019 actuarial valuation for the Missouri State Employees' Retirement System (MOSERS or System).

A typical retirement plan faces many different risks, but the greatest risk is the inability to make benefit payments when due. If plan assets are depleted, benefits may not be paid which could create legal and litigation risk or the plan could become “pay as you go”. This risk is why consistent funding of the full actuarial contribution rate, based on reasonable assumptions and methods, is so critical to the successful funding of a retirement system.

The term “risk” is most commonly associated with an outcome with undesirable results. However, in the actuarial world, risk can be translated as uncertainty. The actuarial valuation process uses many actuarial assumptions to project how future contributions and investment returns will meet the cash flow needs for future benefit payments. Of course, we know that actual experience will not unfold exactly as anticipated by the assumptions and that uncertainty, whether favorable or unfavorable, creates risk. ASOP 51 defines risk as the potential of actual future measurements to deviate from expected results due to actual experience that is different than the actuarial assumptions.

The various risk factors for a given plan can have a significant impact – positive or negative – on the actuarial projection of liability and contribution rates.

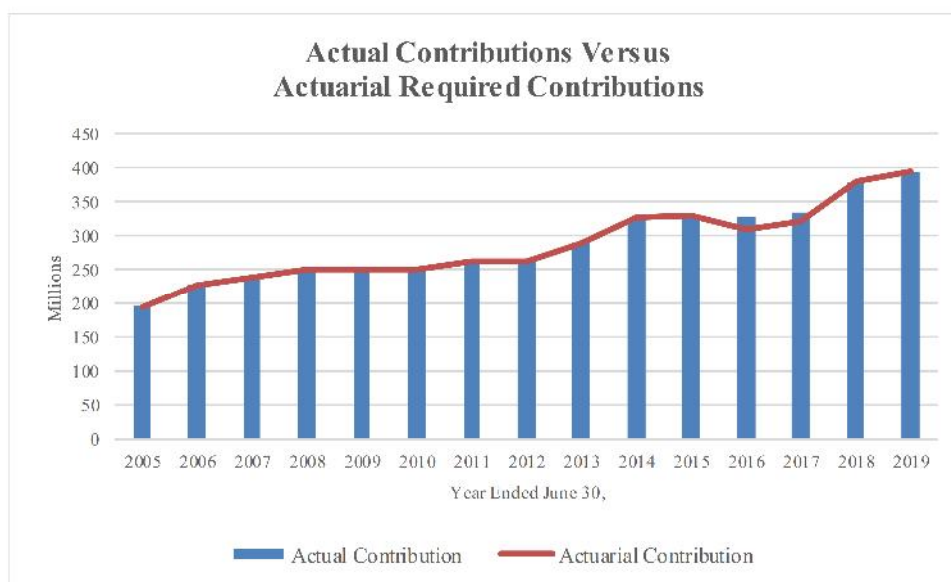
There are a number of risks inherent in the funding of a defined benefit plan. These include:

- economic risks, such as investment return and price inflation;
- demographic risks such as mortality, payroll growth, aging population, declining active membership and retirement ages;
- external risks such as the regulatory and political environment.

There is typically a direct correlation between healthy, well-funded retirement plans and consistent contributions equal to the full actuarial contribution rate each year. Historically, MOSERS covered employers have contributed the full actuarial rate. At their September 18, 2014 meeting, the Board adopted a policy minimum contribution rate so that the employer contribute rate will not fall below the fiscal 2015 rate (16.97% of payroll) until the plan is 80% funded. As a result, the System's contributions were slightly above the actuarial rate during FY 2016 and FY 2017. The following graph displays the System's historical contribution levels over the past 15 years.

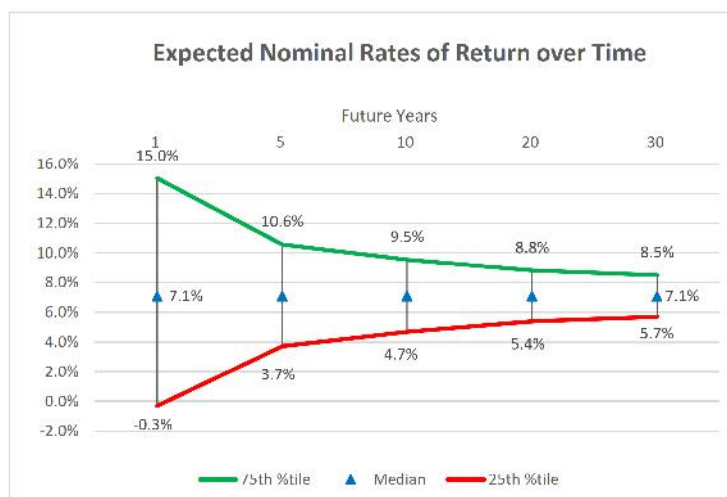


## SECTION 7 – RISK MEASURES



One of the strongest positive factors regarding the MOSERS' contribution risk is MOSERS covered employers' commitment to make contributions that are at least equal to the actuarial required contribution. This commitment has been illustrated by consistently contributing the full actuarial required contribution amount even with the increases that have occurred in the recent past. Despite the fact the full actuarial contribution rate has been contributed, the MSEP Plan is only 63% funded. Additional analysis of the Plan's historical funding indicates that the funded ratio was close to 100% in 2001. Several changes have occurred since that time which have impacted the funded status of the Plan. The actuarial assumptions have been changed six times in the last eight years, including a reduction in the investment return from 8.50% in the 2011 valuation to 7.10% in the 2019 valuation. In addition, actual investment experience over this period has lagged the assumptions causing a decline in the funded ratio. However, to the extent the State continues to fund the full actuarial contribution rate in the future, we would expect the funded ratio to steadily improve.

The most significant risk factor for most systems is investment return because of the volatility of returns and the size of plan assets compared to payroll (see Table 14). Given the underlying capital market assumptions and the System's asset allocation, a wide range of returns in any given year is to be expected.





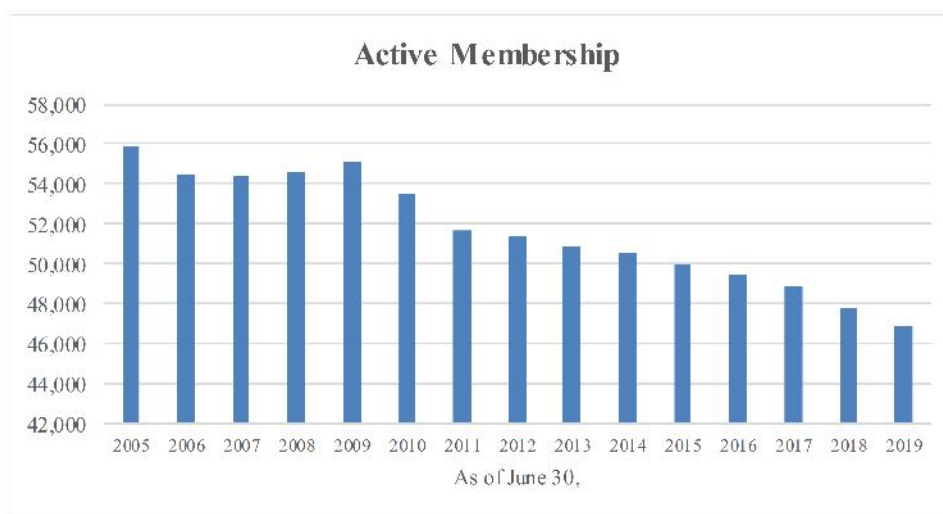


## SECTION 7 – RISK MEASURES

As the graph illustrates, in any single year the rate of return is expected to fall between 0% and 15% about 50% of the time. This volatility creates significant risk to funding a retirement plan because of the volatility it creates in the contribution rate. As Exhibit 14 explains, if the actual return is 10% different than the expected return, it would result in an increase in the actuarial contribution rate of 2.53% once the experience is fully recognized in the asset smoothing method (five years).

A key demographic risk for all retirement systems, including MOSERS, is improvements in mortality (longevity) greater than anticipated. While the actuarial assumptions reflect small, continuous improvements in mortality experience over time and these assumptions are refined every experience study, the risk arises because there is a possibility of some sudden shift, perhaps from a significant medical breakthrough that could quickly increase liabilities. Likewise, there is some possibility of a significant public health crisis that could result in a significant number of additional deaths in a short time period, which would also be significant, although more easily absorbed. While either of these events could happen, it represents a small probability and thus represents much less risk than the volatility associated with investment returns.

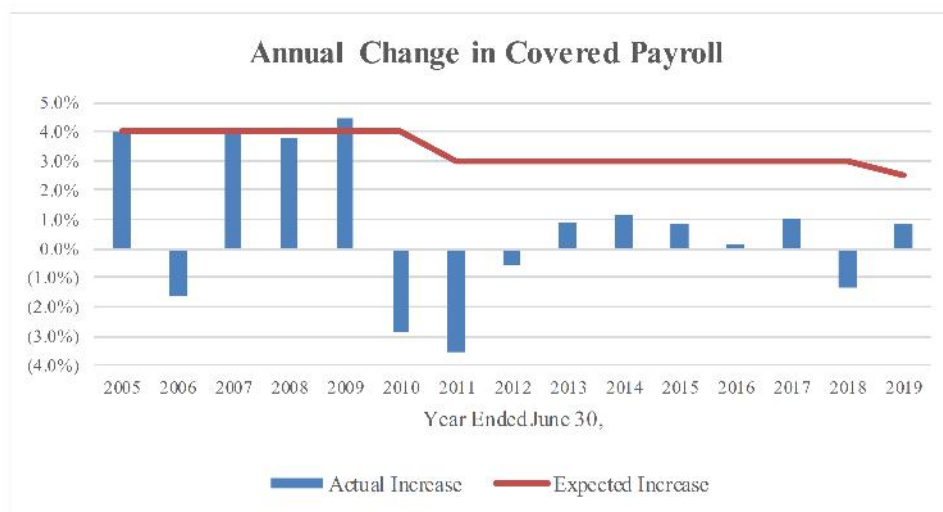
Another risk for the MSEP Plan is the decline in the active membership. The active member count has been steadily declining since 2009 as shown below, with a decrease of about 16%. This is important because the unfunded actuarial accrued liability (UAAL) is amortized with payments that are calculated as a level-percent of payroll. When payroll does not grow as expected, the UAAL contribution rate increases because the UAAL payment is divided by a smaller payroll amount. The reduction in the number of active members also mutes the positive impact of the MSEP 2011 Plan on the employer contribution rate.



The decline in the number of active members over this period, coupled with low salary increases for state employees, has resulted in actual payroll changes that are far below the expected increase (based on the payroll growth assumption). The graph below shows the actual versus expected payroll growth from 2005 through 2015. In the early part of the period, actual increases were reasonable close to the expected increase, but since 2009 when the number of active members started to decline actual payroll growth has been low and even negative. While this does not necessarily impact the amount of the UAAL payment directly, it does cause the UAAL contribution rate to be higher.



## SECTION 7 – RISK MEASURES



Many of the public retirement systems were created shortly after World War II. In general, the aging of the population, including the retirement of the baby boomers, along with earlier retirement eligibility has created a shift in the demographics of most systems. This change is not unexpected and has, in fact, been anticipated in the funding of the retirement system. Even though it was anticipated, the demographic shift and maturing of the plans have increased the risk associated with funding the system. The following exhibits summarize certain historical information that indicates how certain key risk metrics have changed over time due to the maturing of the retirement system.



**TABLE 14**  
**HISTORICAL ASSET VOLATILITY RATIOS**

As a retirement system matures, the size of the market value of assets increases relative to the covered payroll of active members, on which the System is funded. The size of the plan assets relative to covered payroll, sometimes referred to as the asset volatility ratio, is an important indicator of the contribution risk for the System. The higher this ratio, the more sensitive a plan's contribution rate is to investment return volatility. In other words, it will be harder to recover from investment losses with increased contributions.

Valuation Date	Market Value of Assets	Covered Payroll	Asset Volatility Ratio	Change in ACR with a Return 10% Different than Assumed*
6/30/2004	5,859,486,975	1,737,454,454	3.37	2.08%
6/30/2005	6,431,033,445	1,806,600,560	3.56	2.20%
6/30/2006	6,983,737,684	1,777,277,138	3.93	2.43%
6/30/2007	8,056,993,537	1,846,643,330	4.36	2.69%
6/30/2008	7,934,030,312	1,916,527,398	4.14	2.56%
6/30/2009	6,163,086,701	2,002,402,087	3.08	1.90%
6/30/2010	6,727,623,355	1,945,095,321	3.46	2.14%
6/30/2011	7,768,709,373	1,875,569,816	4.14	2.56%
6/30/2012	7,581,882,309	1,864,069,493	4.07	2.51%
6/30/2013	7,993,837,570	1,880,212,950	4.25	2.62%
6/30/2014	9,136,781,826	1,902,719,928	4.80	2.96%
6/30/2015	8,516,654,912	1,918,527,768	4.44	2.74%
6/30/2016	8,109,161,214	1,921,528,936	4.22	2.60%
6/30/2017	7,945,358,298	1,941,969,786	4.09	2.52%
6/30/2018	8,034,508,424	1,915,143,002	4.20	2.59%
6/30/2019	7,916,465,279	1,930,764,635	4.10	2.53%

\*The impact of asset smoothing is not reflected in the impact on the Actuarial Contribution Rate (ACR). Current year assumptions are used for all years shown.

The assets at June 30, 2019 are about four times the amount of covered payroll. Consequently, underperforming the investment return assumption by 10.00% (i.e., earn -2.90% for one year) is equivalent to about 40% of payroll. While the actual impact of this experience in the first year is mitigated by the asset smoothing method and amortization of the UAAL, this table illustrates the risk associated with volatile investment returns. Such an event in one year would be expected to increase the actuarial contribution rate by 2.53% of payroll once it is fully recognized in the asset smoothing method.

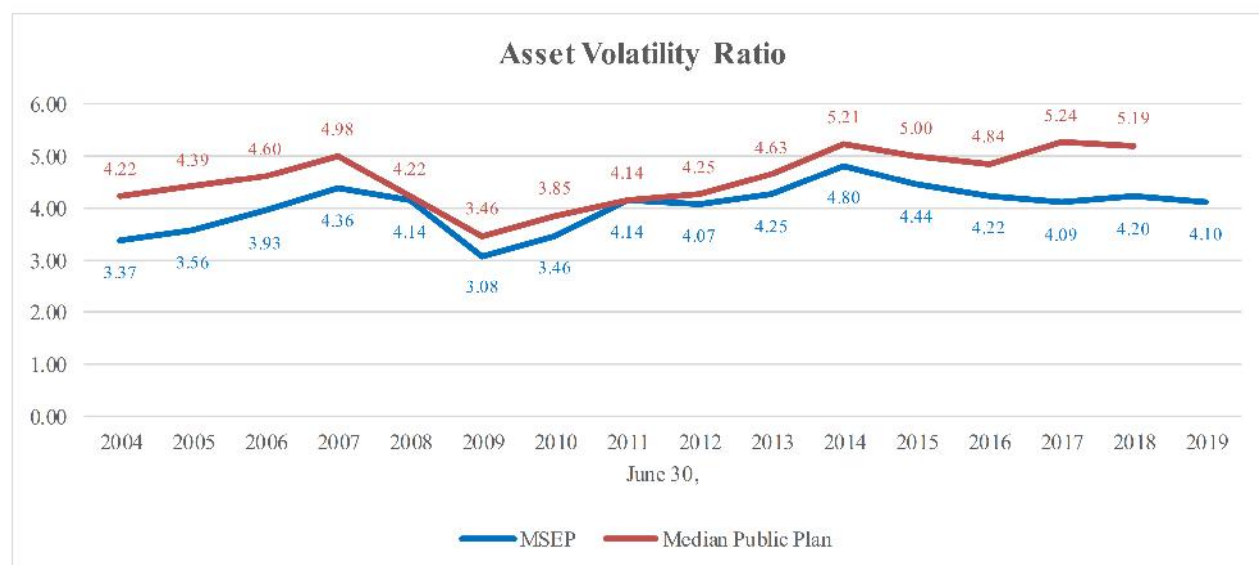




**TABLE 14  
HISTORICAL ASSET VOLATILITY RATIOS**

(continued)

The following graph shows a comparison of MSEP’s historical asset volatility ratios and the historical median asset volatility ratio for the group of large public plans that are tracked in the National Association of State Retirement Administrators (NASRA) Public Fund Survey. The pattern of the change in the asset volatility ratio for MSEP over time is similar to that observed in the Public Fund Survey data. When asset values drop significantly (like in 2009), the ratio drops as well. MSEP’s funded ratio is lower than the median funded ratio for systems in the Public Fund Survey. This fact, coupled with the reduction in active members/covered payroll over the last decade, likely explains the lower asset volatility ratio.





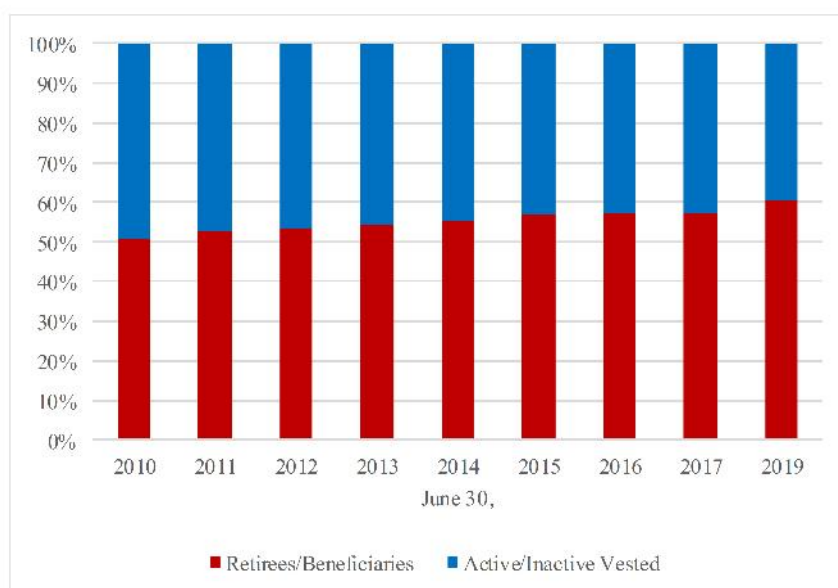
**SECTION 7 – RISK MEASURES**

**TABLE 15  
LIABILITY MATURITY MEASUREMENTS**

Most public sector retirement systems have been in operation for many years. As a result, they have aging plan populations, and in some cases declining active populations, resulting in an increasing ratio of retirees to active members and a growing percentage of retiree liability. The retirement of the remaining baby boomers over the next decade is expected to further exacerbate the aging of the retirement system population. With more of the total liability residing with retirees, investment volatility has a greater impact on the funding of the system since it is more difficult to restore the system financially after losses occur when there is comparatively less payroll over which to spread costs.

Projections provide the most effective way of analyzing the impact of these changes on future funding measures, but studying several key metrics from the valuation can also provide some valuable insight.

<u>Fiscal Year End</u>	<u>Retiree Liability</u> (a)	<u>Total Actuarial Accrued Liability</u> (b)	<u>Retiree Percentage</u> (a) / (b)	<u>Covered Payroll</u> (c)	<u>Ratio</u> (b) / (c)
6/30/10	5,012,677,769	9,853,155,445	50.87%	1,945,095,321	5.07
6/30/11	5,357,794,617	10,123,544,043	52.92%	1,875,569,816	5.40
6/30/12	5,749,411,068	10,793,651,577	53.27%	1,864,069,493	5.79
6/30/13	6,062,654,441	11,134,637,484	54.45%	1,880,212,950	5.92
6/30/14	6,347,728,717	11,494,571,835	55.22%	1,902,719,928	6.04
6/30/15	6,695,661,737	11,727,618,410	57.09%	1,918,527,768	6.11
6/30/16	7,305,895,284	12,751,162,753	57.30%	1,921,528,936	6.64
6/30/17	7,559,623,100	13,152,273,895	57.48%	1,941,969,786	6.77
6/30/18	8,073,692,664	13,612,763,961	59.31%	1,915,143,002	7.11
6/30/19	8,430,014,943	13,957,626,309	60.40%	1,930,764,635	7.23

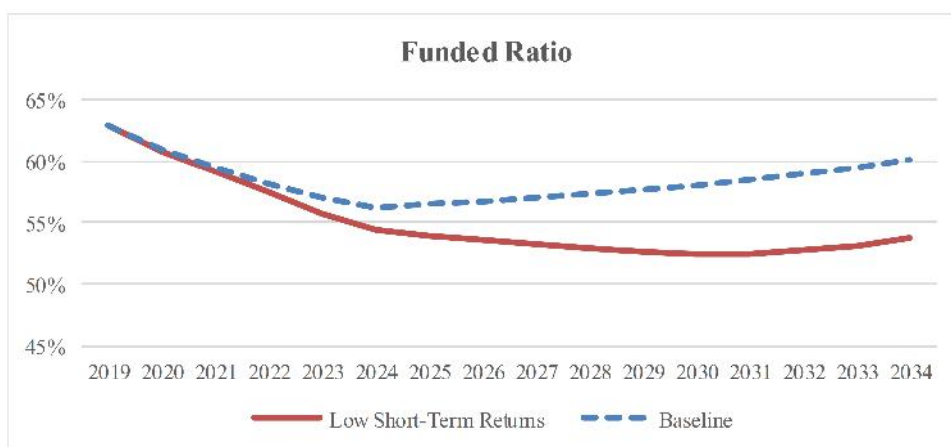




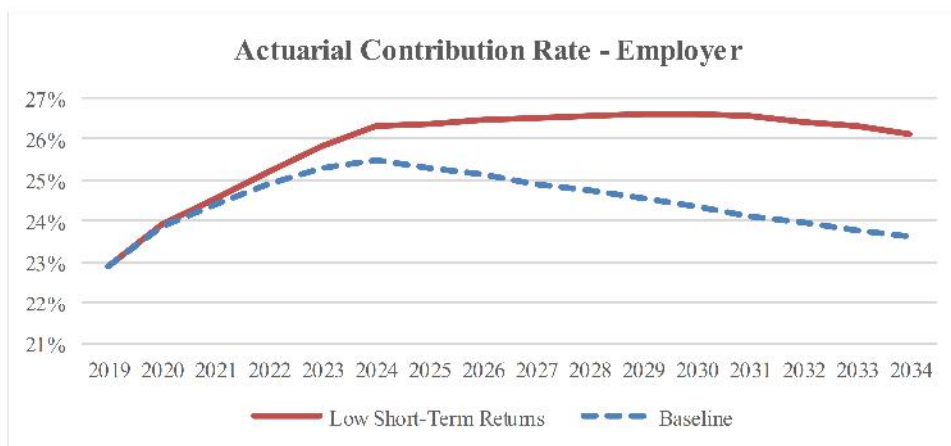
**TABLE 16  
SCENARIO TESTING**

As mentioned earlier, the most significant risk factor for most systems is investment return. There are many different tools that can be useful when assessing investment risk. One of these tools is to perform scenario testing using a projection model. Scenario testing is choosing one set of specific criteria to compare against another set of specific criteria, also known as a “what if” scenario.

Many investment consultants are projecting lower returns over the next ten year compared to the longer term (30+ years). The scenario test below shows results if actual investment returns are 1.0% less than assumed (6.10% for FY 2020, 5.95% for FY 2021 through FY 2029) over the next ten years (“Low Short-Term Returns”) compared to if all assumptions are met (“Baseline”).



In both scenarios, the funded ratio declines for the next five years as deferred asset losses are recognized. In the scenario with low short-term returns, the funded ratio continues to decline to around 52% (about 6% lower than the baseline scenario), before beginning to increase.



In both scenarios, the employer contribution rate increases for the next five years as deferred asset losses are recognized. In the scenario with low short-term returns, the employer contribution rate remains steady around 26% of pay, while the baseline scenario rate begins to decline due to the normal cost rate decreasing from more MSEP 2011 members in the System as well as increases in the effective employee contribution rate.

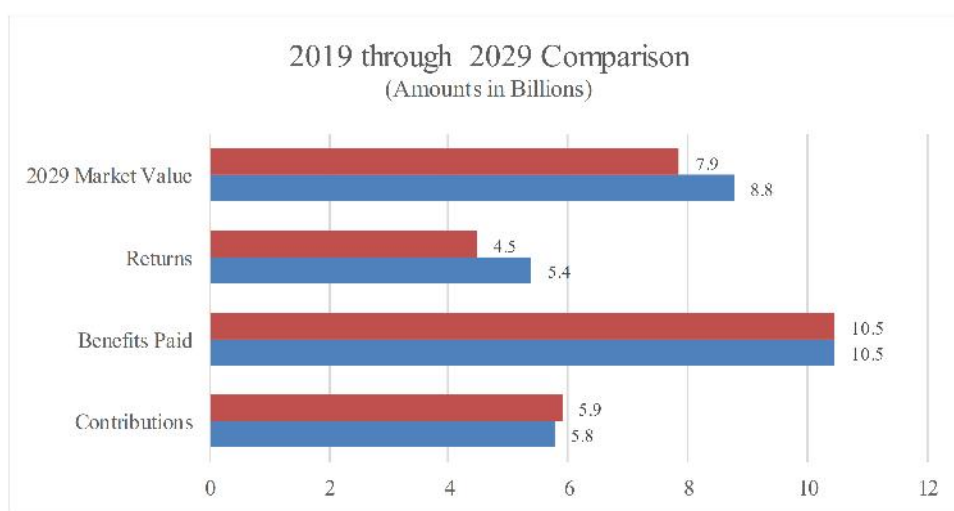




**TABLE 16**  
**SCENARIO TESTING**

(continued)

While it is sometimes helpful to see funded ratio and employer contribution rate trends lines when scenario testing, it can sometimes be difficult to grasp without seeing how actual dollars are affected. The graph below compares the projected 2029 market value of the baseline (blue bars) and the low short-term return scenario (red bars). In addition, the sum over a ten year period of actual investment returns, benefits paid and contribution to the System are compared.



Under the low short-term return scenario, the 2029 market value of assets is almost \$1 billion lower when compared with the baseline. If asset returns are 1.0% lower than assumed for the next ten years, actual investment returns would be \$0.9 billion less than assumed. Also note that even though contributions are only slightly higher under the low short-term return scenario (\$5.9 billion vs \$5.8 billion) over the ten year period, contributions would continue to be higher in the future as the asset losses flow through the smoothing method.



**TABLE 17**  
**COMPARISON OF VALUATION RESULTS UNDER ALTERNATE**  
**INVESTMENT RETURN ASSUMPTIONS**

This exhibit compares the key January 1, 2019 valuation results under five (5) different investment return assumptions to illustrate the impact of different assumptions on the funding of the System. Note that only the investment return assumption is changed, as identified in the heading below. All other assumptions are unchanged for purposes of this analysis.

Investment Return Assumption	6.10%	6.60%	7.10%	7.60%	8.10%
<b>Contributions</b>					
Total Normal Cost	10.88%	9.66%	8.61%	7.70%	6.91%
Member Contributions	1.66%	1.66%	1.66%	1.66%	1.66%
Employer Normal Cost	9.22%	8.00%	6.95%	6.04%	5.25%
Unfunded Actuarial Accrued Liability	18.75%	17.36%	15.93%	14.45%	12.93%
<b>Total Employer Contribution</b>					
	27.97%	25.36%	22.88%	20.49%	18.18%
<b>Total Employer Contribution (\$ in millions)</b>	\$576.3	\$522.5	\$471.4	\$422.2	\$374.6
<b>Actuarial Value of Assets</b>					
<b>Actuarial Accrued Liability</b>	\$8,782.4	\$8,782.4	\$8,782.4	\$8,782.4	\$8,782.4
<b>Unfunded Actuarial Accrued Liability</b>	\$15,537.7	\$14,712.6	\$13,957.6	\$13,265.3	\$12,629.2
<b>Funded Ratio</b>	56.5%	59.7%	62.9%	66.2%	69.5%

Note: All other assumptions are unchanged for purposes of this sensitivity analysis.



## **HISTORICAL FUNDING AND OTHER INFORMATION**

This section of the report provides a historical perspective on the System’s funding and contribution practices, along with other information that may be of interest.

The information required for financial reporting by the System and participating employers is established by the Governmental Accounting Standards Board (GASB). GASB 67 separates accounting and financial reporting from funding requirements by creating disclosure and reporting requirements that are independent of the basis used for funding the System. A separate report that contains all of the information and exhibits of an actuarial nature that are necessary for the System’s financial reporting under GASB 67 will be issued in the future.

GASB Statement No. 68 establishes standards for the measurement, recognition, and display of pension expense and related liabilities. Annual pension cost is measured and disclosed on the accrual basis of accounting. A separate report containing all of the pertinent information under GASB 68 reporting will also be prepared in the future.



**SECTION 8 – HISTORICAL FUNDING AND OTHER INFORMATION****TABLE 18  
SCHEDULE OF FUNDING PROGRESS**

Actuarial Valuation Date	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) (b)	Unfunded Actuarial Accrued Liability (UAAL) (b - a)	Funded Ratio (a / b)	Covered Payroll (c)	UAAL as a % of Covered Payroll [(b - a) / c]
June 30, 2004*	\$6,118	\$7,230	\$1,112	84.6%	\$1,737	64.0%
June 30, 2005	6,435	7,578	1,143	84.9%	1,807	63.3%
June 30, 2006	6,837	8,013	1,176	85.3%	1,777	66.2%
June 30, 2007	7,377	8,500	1,123	86.8%	1,847	60.8%
June 30, 2008*	7,838	9,128	1,290	85.9%	1,917	67.3%
June 30, 2009*	7,876	9,495	1,619	83.0%	2,002	80.9%
June 30, 2010	7,923	9,853	1,930	80.4%	1,945	99.2%
June 30, 2011	8,022	10,124	2,102	79.2%	1,876	112.0%
June 30, 2012*	7,897	10,794	2,897	73.2%	1,864	155.4%
June 30, 2013*	8,096	11,135	3,039	72.7%	1,880	161.6%
June 30, 2014	8,638	11,495	2,857	75.1%	1,903	150.1%
June 30, 2015	8,792	11,728	2,936	75.0%	1,919	153.0%
June 30, 2016*	8,878	12,751	3,873	69.6%	1,922	201.5%
June 30, 2017*	8,872	13,152	4,280	67.5%	1,942	220.4%
June 30, 2018*	8,830	13,613	4,782	64.9%	1,915	249.7%
June 30, 2019*	8,782	13,958	5,175	62.9%	1,931	268.0%

\* Revision in actuarial assumptions and methods.

Note: Information before 2017 was produced by prior actuary. Numbers may not add due to rounding.



**TABLE 19**  
**HISTORICAL EMPLOYER CONTRIBUTIONS**

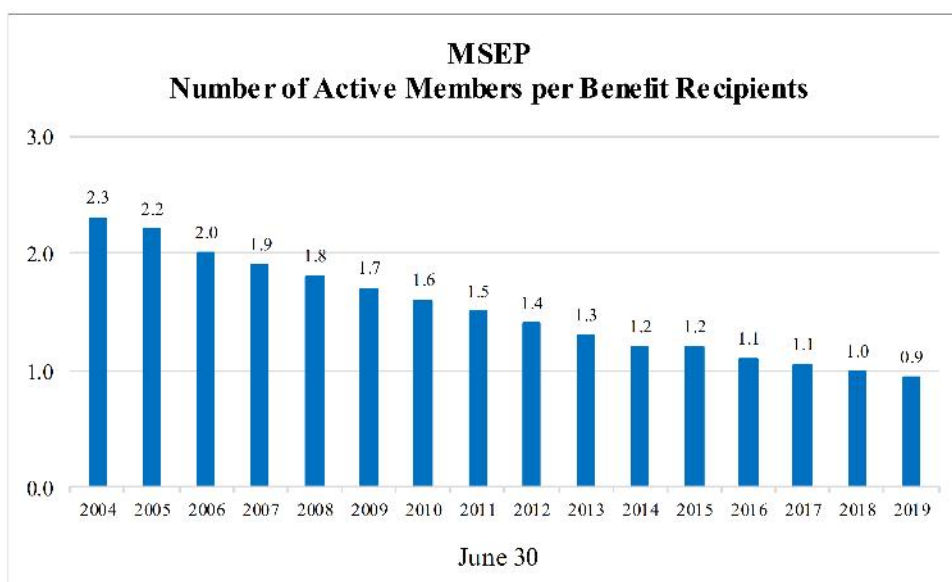
<b>Fiscal Year Ending</b>	<b>Actuarially Determined Employer Contribution</b>	<b>Actual Dollar Amount</b>	<b>Percent Contributed</b>
June 30, 2005	\$195.6	\$195.6	100.0%
June 30, 2006	227.2	227.2	100.0%
June 30, 2007	239.5	239.5	100.0%
June 30, 2008	249.8	249.8	100.0%
June 30, 2009	252.1	252.1	100.0%
June 30, 2010	251.2	251.2	100.0%
June 30, 2011	263.4	263.4	100.0%
June 30, 2012	263.4	263.4	100.0%
June 30, 2013	290.3	290.3	100.0%
June 30, 2014	326.4	326.4	100.0%
June 30, 2015	329.8	329.8	100.0%
June 30, 2016	310.1	330.0	106.4%
June 30, 2017	322.8	335.2	103.8%
June 30, 2018	379.6	379.6	100.0%
June 30, 2019	394.2	394.2	100.0%



**SECTION 8 – HISTORICAL FUNDING AND OTHER INFORMATION**

**TABLE 20  
HISTORICAL MEMBER STATISTICS**

Valuation Date June 30	Active Members				Retired Members			
	Number	Payroll \$ Millions	Average Salary \$	% Incr.	Number	Active/ Retired	Annual Benefits \$ Millions	% Incr.
2004	55,914	\$1,737	\$31,074		24,757	2.3	\$324.6	
2005	55,944	1,807	32,293	3.9	25,780	2.2	348.1	7.2
2006	54,493	1,777	32,615	1.0	27,052	2.0	373.6	7.3
2007	54,363	1,847	33,969	4.2	28,692	1.9	406.4	8.8
2008	54,542	1,917	35,139	3.4	30,132	1.8	434.6	6.9
2009	55,057	2,002	36,370	3.5	31,637	1.7	465.4	7.1
2010	53,478	1,945	36,372	0.0	33,251	1.6	493.7	6.1
2011	51,660	1,876	36,306	(0.2)	35,315	1.5	525.6	6.5
2012	51,332	1,864	36,314	0.0	37,308	1.4	558.6	6.3
2013	50,833	1,880	36,988	1.9	39,139	1.3	589.9	5.6
2014	50,621	1,903	37,588	1.6	41,000	1.2	618.7	4.9
2015	49,980	1,919	38,386	2.1	42,964	1.2	650.9	5.2
2016	49,464	1,922	38,847	1.2	44,828	1.1	680.8	4.6
2017	48,910	1,942	39,705	2.2	46,560	1.1	710.2	4.3
2018	47,806	1,915	40,061	0.9	48,207	1.0	744.9	4.9
2019	46,864	1,931	41,199	2.8	49,696	0.9	779.9	4.7





**APPENDIX A – MEMBERSHIP DATA****MEMBER DATA RECONCILIATION**

	<b>Active Members</b>	<b>Inactive Vested</b>	<b>Inactive Nonvested</b>	<b>Leave of Absence</b>	<b>Long-term Disability</b>	<b>Retirees and Beneficiaries</b>	<b>Total</b>
As of June 30, 2018	47,806	15,476	15,619	178	732	48,207	128,018
Changes in status:							
a) Retirement	(1,704)	(728)	0	(5)	(68)	2,505	0
b) Death	(62)	(57)	0	(3)	(20)	(1,428)	(1,570)
c) Non-vested termination	(2,724)	0	2,770	(37)	(9)	0	0
d) Leave of absence	(89)	0	(2)	91	0	0	0
e) Vested termination	(1,502)	1,616	0	(19)	(95)	0	0
f) Contribution refund	(1,195)	(74)	(1,198)	(11)	(5)	0	(2,483)
g) Beneficiary in receipt	0	0	0	0	0	480	480
h) Long-term disability	(118)	(17)	(9)	(6)	150	0	0
h) Disability retirement	0	0	0	0	0	0	0
i) Return to active service	616	(197)	(330)	(63)	(3)	(23)	0
j) Expired benefit	0	0	0	0	0	(50)	(50)
k) Transfer to MPERS	(68)	(13)	0	(1)	0	0	(82)
k) Data adjustment	(5)	10	(3)	0	0	5	7
Total changes in status	(6,851)	540	1,228	(54)	(50)	1,489	(3,698)
New entrants	5,909	0	2,005	51	0	0	7,965
Net Change	(942)	540	3,233	(3)	(50)	1,489	4,267
As of June 30, 2019	46,864	16,016	18,852	175	682	49,696	132,285

**APPENDIX A – MEMBERSHIP DATA****SUMMARY OF MEMBERSHIP DATA**

<b>A. ACTIVE MEMBERS</b>	<b>June 30, 2019</b>	<b>June 30, 2018</b>	<b>% Change</b>
1. Number of Active Members			
(a) MSEP	10,621	11,394	(6.8)
(b) MSEP 2000	14,350	15,935	(9.9)
(c) MSEP 2011	21,893	20,477	6.9
(d) Total	<u>46,864</u>	<u>47,806</u>	(2.0)
2. Annualized Reported Salary			
(a) MSEP	\$ 516,620,685	\$ 543,062,272	(4.9)
(b) MSEP 2000	612,236,815	654,529,970	(6.5)
(c) MSEP 2011	801,907,135	717,550,760	11.8
(d) Total	<u>\$ 1,930,764,635</u>	<u>\$ 1,915,143,002</u>	0.8
3. Accumulated Member Contributions	\$ 97,481,815	\$ 81,836,680	19.1
4. Active Member Averages			
(a) Age	45.5	45.4	0.2
(b) Service	10.8	10.9	(0.9)
(c) Compensation	\$ 41,199	\$ 40,061	2.8
<b>B. INACTIVE MEMBERS</b>			
1. Number of Inactive Members			
(a) Terminated vested	16,016	15,476	3.5
(b) Terminated nonvested (refund only)	18,852	15,619	20.7
(c) Leave of absence	175	178	(1.7)
(d) Long-term disability	682	732	(6.8)
(e) Total	<u>35,725</u>	<u>32,005</u>	11.6
2. Accumulated Member Contributions	\$ 30,773,496	\$ 21,947,834	40.2
3. Inactive Member Averages			
(a) Age (vesteds only)	48.8	48.9	(0.2)
(b) Monthly benefit	\$ 518	\$ 521	(0.6)
(c) Accumulated member contributions	\$ 861	\$ 686	25.5
<b>C. RETIREES, DISABLEDS, AND BENEFICIARIES</b>			
1. Number of Members			
(a) Service retirees and disableds	44,159	42,837	3.1
(b) Beneficiaries	5,537	5,370	3.1
(c) Total	<u>49,696</u>	<u>48,207</u>	3.1
2. Total Monthly Benefits			
(a) Service retirees and disableds	\$ 59,330,057	\$ 56,747,183	4.6
(b) Beneficiaries	5,665,503	5,325,471	6.4
(c) Total	<u>\$ 64,995,560</u>	<u>\$ 62,072,654</u>	4.7



**APPENDIX A – MEMBERSHIP DATA**

**MEMBERSHIP DATA BY GROUP**

Valuation Group	Number	Payroll	Group Averages		
			Salary	Age(yrs.)	Service(yrs.)
Regular State Employees	44,454	\$ 1,793,297,961	\$ 40,341	45.2	10.5
Elected Officials	6	654,754	109,126	46.7	2.4
Legislative Clerks	8	323,618	40,452	66.4	21.3
Legislators	192	6,902,692	35,952	52.2	4.0
Uniformed Water Patrol	10	738,934	73,893	43.0	17.2
Conservation Department	1,348	61,049,428	45,289	44.5	14.1
School-Term Salaried Employees	829	65,762,962	79,328	58.2	22.3
Administrative Law Judges	17	2,034,286	119,664	60.8	24.9
<b>Total MSEP</b>	<b>46,864</b>	<b>\$ 1,930,764,635</b>	<b>\$ 41,199</b>	<b>45.5</b>	<b>10.8</b>

The total number of System active members includes 10,621 MSEP members, 14,350 MSEP 2000 members and 21,893 MSEP 2011 members.

Type of Benefit Payment	No.	Monthly Benefit	Group Averages	
			Benefit	Age(yrs.)
Retirement	44,158	\$ 59,329,867	\$ 1,344	70.4
Disability	1	190	190	63.0
Survivor of Active Member	1,728	1,590,460	920	63.1
Survivor of Retired Member	3,809	4,075,043	1,070	75.8
<b>Total MSEP</b>	<b>49,696</b>	<b>\$ 64,995,560</b>	<b>\$ 1,308</b>	<b>70.5</b>

This valuation also includes 16,016 terminated vested members, 18,852 terminated members who have a refund pending, 175 members on leave and 682 members on long-term disability.



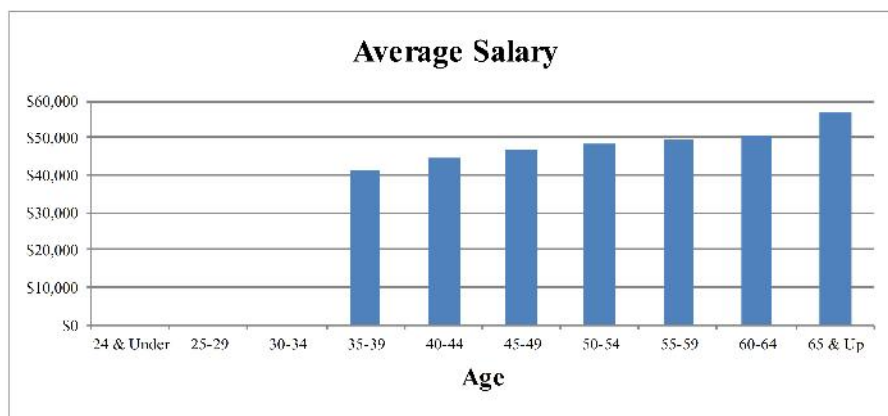
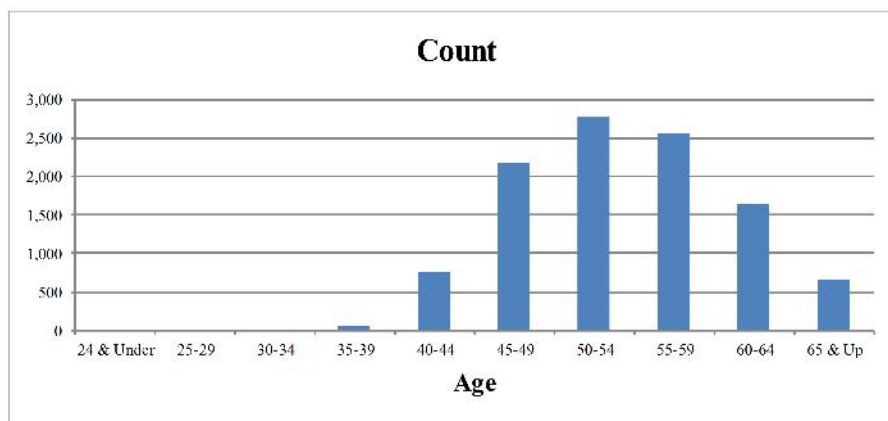


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2019**

**MSEP**

Age	Count of Members			Reported Annualized Earnings for Current Members		
	Male	Female	Total	Male	Female	Total
24 & Under	0	0	0	\$ 0	\$ 0	\$ 0
25-29	0	0	0	0	0	0
30-34	0	0	0	0	0	0
35-39	11	53	64	470,701	2,191,708	2,662,409
40-44	248	510	758	11,523,695	22,286,523	33,810,218
45-49	765	1,399	2,164	38,253,542	62,657,136	100,910,678
50-54	994	1,770	2,764	51,890,504	80,963,349	132,853,853
55-59	1,008	1,545	2,553	55,585,257	69,816,316	125,401,573
60-64	703	957	1,660	41,049,637	42,616,926	83,666,563
65 & Up	287	371	658	19,448,991	17,866,400	37,315,391
Total	4,016	6,605	10,621	\$ 218,222,327	\$ 298,398,358	\$ 516,620,685



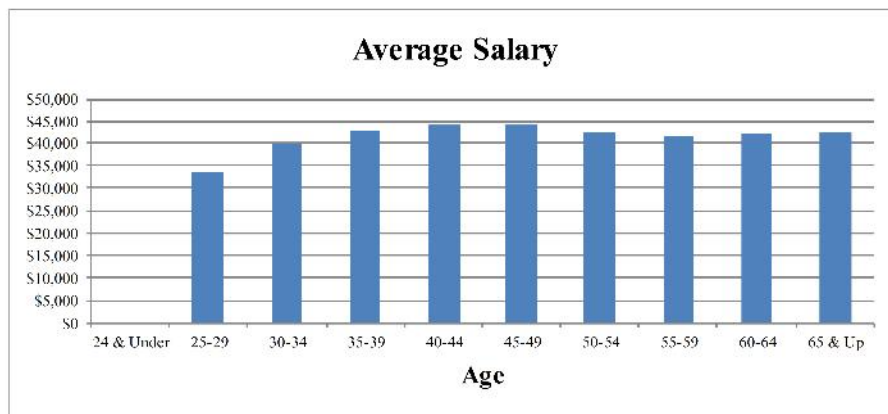
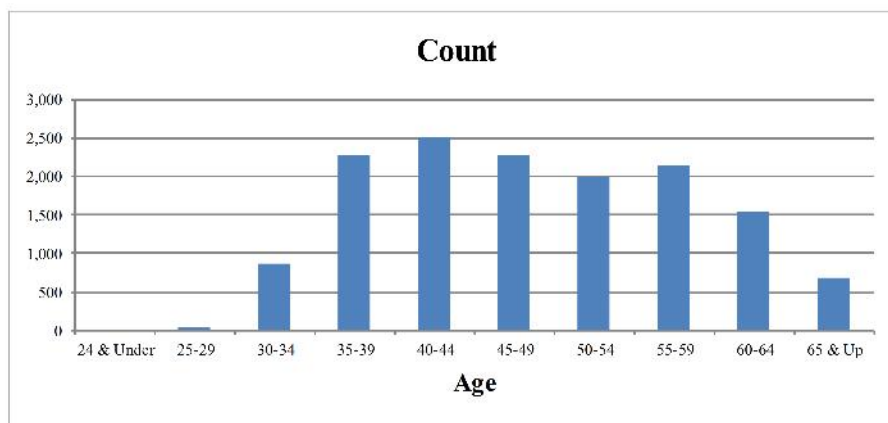


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2019**

**MSEP 2000**

Age	Count of Members			Reported Annualized Earnings for Current Members		
	Male	Female	Total	Male	Female	Total
24 & Under	0	0	0	\$ 0	\$ 0	\$ 0
25-29	21	26	47	685,568	892,854	1,578,422
30-34	350	528	878	14,874,616	20,159,838	35,034,454
35-39	877	1,393	2,270	39,078,635	58,241,423	97,320,058
40-44	965	1,542	2,507	44,338,142	66,220,858	110,559,000
45-49	882	1,393	2,275	43,126,365	57,084,656	100,211,021
50-54	767	1,213	1,980	36,097,755	48,174,782	84,272,537
55-59	830	1,324	2,154	37,973,636	51,203,810	89,177,446
60-64	595	961	1,556	27,697,671	37,505,813	65,203,484
65 & Up	308	375	683	14,234,469	14,645,924	28,880,393
Total	5,595	8,755	14,350	\$ 258,106,857	\$ 354,129,958	\$ 612,236,815



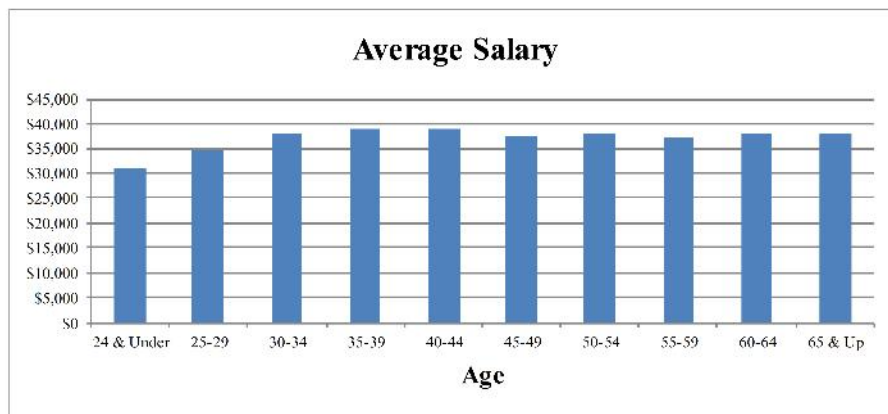
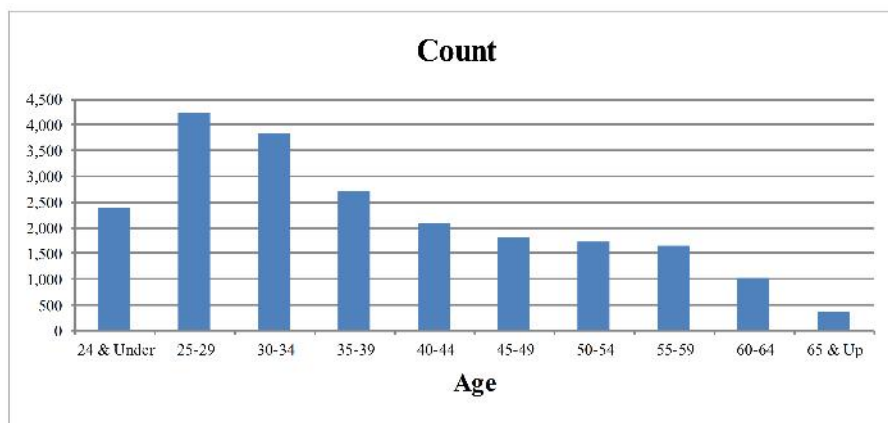


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2019**

**MSEP 2011**

<u>Age</u>	<u>Count of Members</u>			<u>Reported Annualized Earnings for Current Members</u>		
	<u>Male</u>	<u>Female</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
24 & Under	1,031	1,360	2,391	\$ 34,050,901	\$ 40,466,667	\$ 74,517,568
25-29	1,746	2,476	4,222	63,898,397	82,348,154	146,246,551
30-34	1,555	2,303	3,858	62,657,177	83,202,033	145,859,210
35-39	1,016	1,706	2,722	42,900,277	62,937,590	105,837,867
40-44	771	1,322	2,093	33,129,077	48,551,088	81,680,165
45-49	589	1,228	1,817	24,658,721	43,467,649	68,126,370
50-54	574	1,146	1,720	23,696,539	41,058,579	64,755,118
55-59	586	1,069	1,655	24,293,723	37,244,699	61,538,422
60-64	401	637	1,038	16,541,673	22,578,995	39,120,668
65 & Up	191	186	377	7,718,777	6,506,419	14,225,196
<b>Total</b>	<b>8,460</b>	<b>13,433</b>	<b>21,893</b>	<b>\$ 333,545,262</b>	<b>\$ 468,361,873</b>	<b>\$ 801,907,135</b>





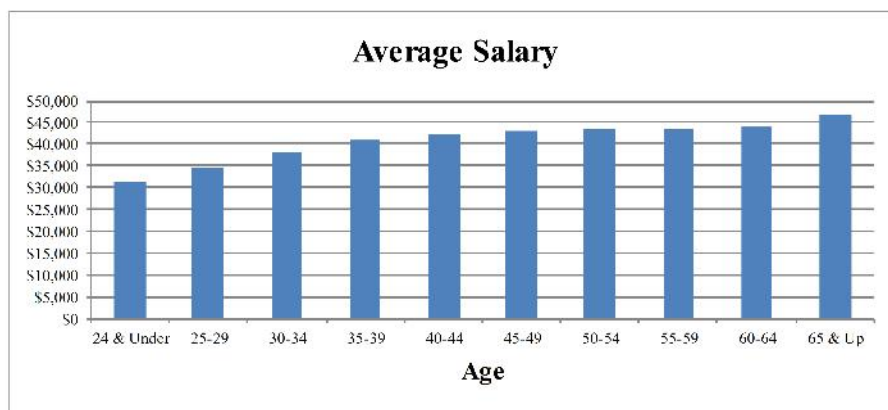
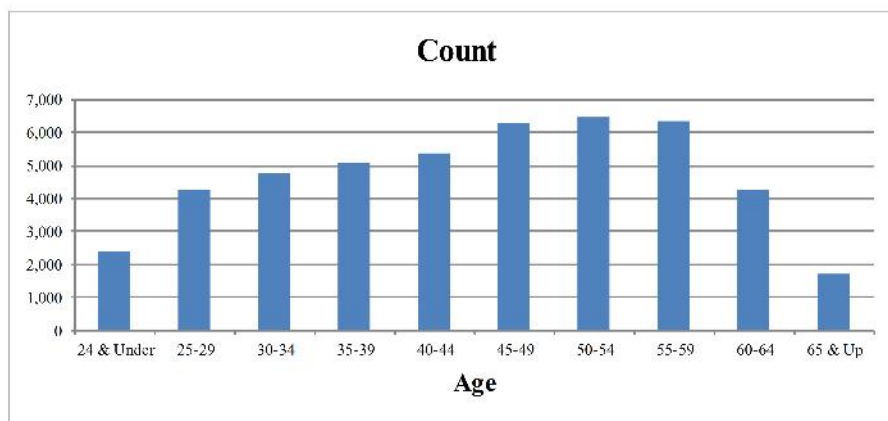


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2019**

**TOTAL**

Age	Count of Members			Reported Annualized Earnings for Current Members		
	Male	Female	Total	Male	Female	Total
24 & Under	1,031	1,360	2,391	\$ 34,050,901	\$ 40,466,667	\$ 74,517,568
25-29	1,767	2,502	4,269	64,583,965	83,241,008	147,824,973
30-34	1,905	2,831	4,736	77,531,793	103,361,871	180,893,664
35-39	1,904	3,152	5,056	82,449,613	123,370,721	205,820,334
40-44	1,984	3,374	5,358	88,990,914	137,058,469	226,049,383
45-49	2,236	4,020	6,256	106,038,628	163,209,441	269,248,069
50-54	2,335	4,129	6,464	111,684,798	170,196,710	281,881,508
55-59	2,424	3,938	6,362	117,852,616	158,264,825	276,117,441
60-64	1,699	2,555	4,254	85,288,981	102,701,734	187,990,715
65 & Up	786	932	1,718	41,402,237	39,018,743	80,420,980
Total	18,071	28,793	46,864	\$ 809,874,446	\$ 1,120,890,189	\$ 1,930,764,635





**APPENDIX A – MEMBERSHIP DATA**

**AGE AND SERVICE DISTRIBUTION  
AS OF JUNE 30, 2019**

Age	0-4	5-9	10-14	15-19	20-24	25-29	30-34	Over 34	Total
<b>24 &amp; Under</b>	Number	15	0	0	0	0	0	0	2,391
	Total Salary	\$ 447,097	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 74,517,568
	Average Sal.	\$ 29,806	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 31,166
<b>25-29</b>	Number	563	11	0	0	0	0	0	4,269
	Total Salary	\$ 20,806,865	\$ 342,088	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 147,824,973
	Average Sal.	\$ 36,957	\$ 31,099	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 34,628
<b>30-34</b>	Number	2,774	468	9	0	0	0	0	4,736
	Total Salary	\$ 101,261,000	\$ 18,442,671	\$ 338,150	\$ 0	\$ 0	\$ 0	\$ 0	\$ 180,893,664
	Average Sal.	\$ 36,504	\$ 39,407	\$ 37,572	\$ 0	\$ 0	\$ 0	\$ 0	\$ 38,195
<b>35-39</b>	Number	2,052	1,287	463	26	0	0	0	5,056
	Total Salary	\$ 78,138,088	\$ 55,592,997	\$ 19,394,798	\$ 1,144,674	\$ 0	\$ 0	\$ 0	\$ 205,820,334
	Average Sal.	\$ 38,079	\$ 43,196	\$ 41,889	\$ 44,026	\$ 0	\$ 0	\$ 0	\$ 40,708
<b>40-44</b>	Number	1,642	1,075	1,156	484	15	0	0	5,358
	Total Salary	\$ 63,289,834	\$ 46,040,913	\$ 51,751,149	\$ 21,593,624	\$ 678,361	\$ 0	\$ 0	\$ 226,049,383
	Average Sal.	\$ 38,544	\$ 42,829	\$ 44,767	\$ 44,615	\$ 45,224	\$ 0	\$ 0	\$ 42,189
<b>45-49</b>	Number	1,439	939	1,083	1,390	407	32	0	6,256
	Total Salary	\$ 54,477,356	\$ 39,424,826	\$ 49,418,126	\$ 64,736,671	\$ 19,897,176	\$ 1,497,013	\$ 0	\$ 269,248,069
	Average Sal.	\$ 37,858	\$ 41,986	\$ 45,631	\$ 46,573	\$ 48,887	\$ 46,782	\$ 0	\$ 43,038
<b>50-54</b>	Number	1,305	906	883	958	946	311	17	6,464
	Total Salary	\$ 49,249,773	\$ 36,414,587	\$ 36,437,875	\$ 42,211,479	\$ 53,758,433	\$ 47,603,091	\$ 15,367,851	\$ 281,881,508
	Average Sal.	\$ 37,739	\$ 40,193	\$ 41,266	\$ 44,062	\$ 47,239	\$ 50,320	\$ 49,414	\$ 43,608
<b>55-59</b>	Number	1,215	918	945	1,074	1,079	426	134	6,362
	Total Salary	\$ 46,118,898	\$ 35,771,973	\$ 38,159,729	\$ 45,709,127	\$ 50,823,507	\$ 29,496,461	\$ 23,444,214	\$ 276,117,441
	Average Sal.	\$ 37,958	\$ 38,967	\$ 40,381	\$ 42,560	\$ 47,102	\$ 51,658	\$ 55,033	\$ 43,401
<b>60-64</b>	Number	728	636	718	720	663	253	158	4,254
	Total Salary	\$ 28,917,563	\$ 25,506,868	\$ 28,030,620	\$ 30,304,208	\$ 30,712,502	\$ 20,932,341	\$ 14,814,583	\$ 187,990,715
	Average Sal.	\$ 39,722	\$ 40,105	\$ 39,040	\$ 42,089	\$ 46,324	\$ 55,377	\$ 58,556	\$ 44,192
<b>65 &amp; Up</b>	Number	265	285	307	261	226	104	124	1,718
	Total Salary	\$ 10,672,785	\$ 11,446,118	\$ 12,643,012	\$ 11,298,300	\$ 10,850,729	\$ 8,788,180	\$ 6,494,813	\$ 80,420,980
	Average Sal.	\$ 40,275	\$ 40,162	\$ 41,182	\$ 43,289	\$ 48,012	\$ 60,193	\$ 62,450	\$ 46,811
<b>Total</b>	Number	17,491	7,961	6,660	5,724	5,006	1,126	433	46,864
	Total Salary	\$ 632,871,788	\$ 324,915,456	\$ 275,486,806	\$ 250,425,337	\$ 233,620,140	\$ 127,395,610	\$ 61,618,474	\$ 1,930,764,635
	Average Sal.	\$ 36,183	\$ 40,813	\$ 41,364	\$ 43,750	\$ 46,668	\$ 51,724	\$ 54,723	\$ 41,199

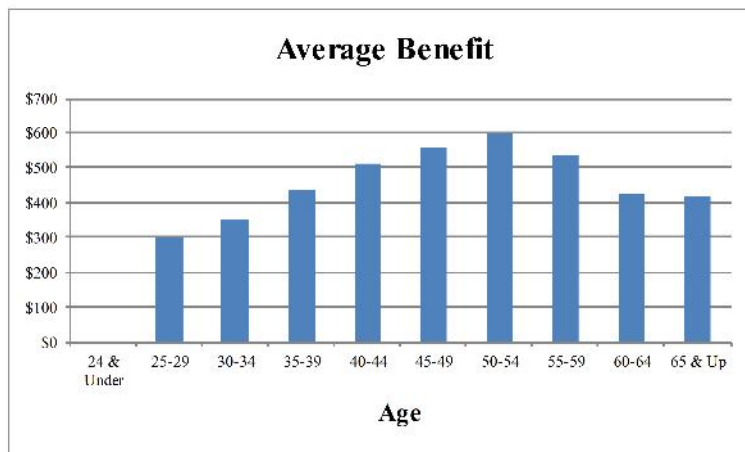
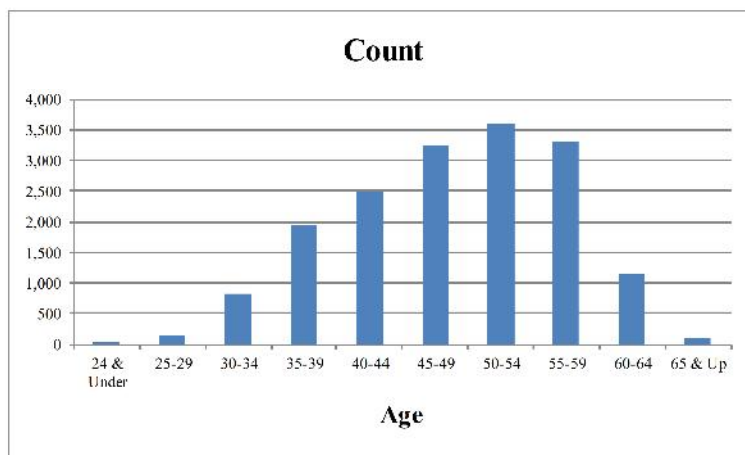


**APPENDIX A – MEMBERSHIP DATA**

**INACTIVE VESTED MEMBERS  
AS OF JUNE 30, 2019**

Age	Count of Members*			Monthly Deferred Benefits*		
	Male	Female	Total	Male	Female	Total
24 & Under	20	19	39	\$ 969	\$ 3,546	\$ 4,515
25-29	65	85	150	18,386	26,568	44,954
30-34	349	481	830	131,085	160,827	291,912
35-39	745	1,208	1,953	343,247	507,995	851,242
40-44	927	1,565	2,492	493,484	779,226	1,272,710
45-49	1,154	2,083	3,237	677,182	1,127,143	1,804,325
50-54	1,317	2,300	3,617	858,029	1,308,897	2,166,926
55-59	1,129	2,184	3,313	717,149	1,059,245	1,776,394
60-64	378	775	1,153	185,419	307,894	493,313
65 & Up	<u>43</u>	<u>46</u>	<u>89</u>	<u>22,448</u>	<u>14,739</u>	<u>37,187</u>
Total	6,127	10,746	16,873	\$ 3,447,398	\$ 5,296,080	\$ 8,743,478

\* There are 175 members currently on leave and 682 members on LTD. Their counts and estimated deferred monthly benefits are included.



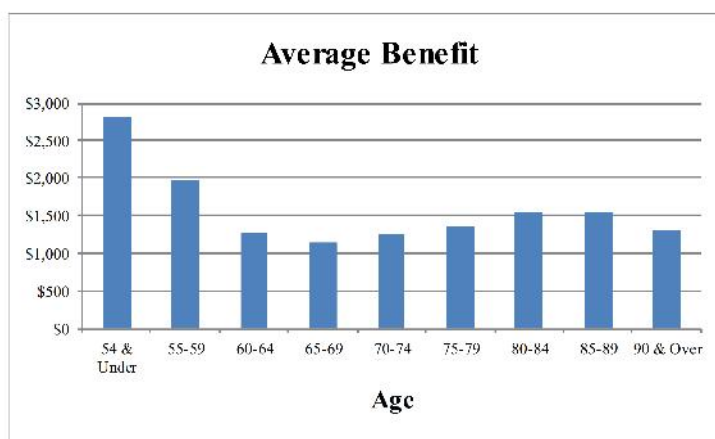
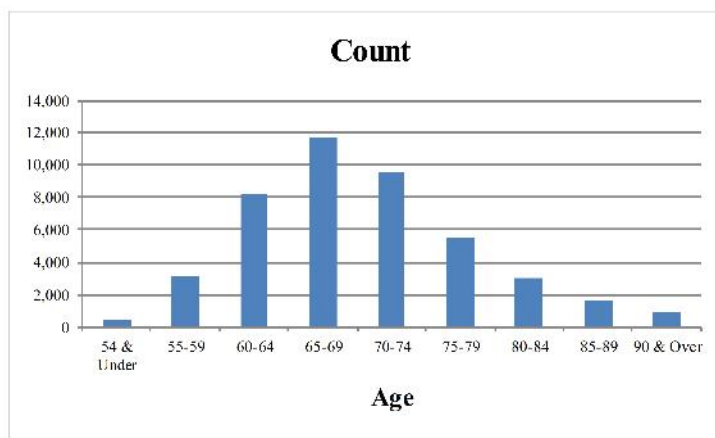




**APPENDIX A – MEMBERSHIP DATA**

**RETIRED AND DISABLED MEMBERS  
AS OF JUNE 30, 2019**

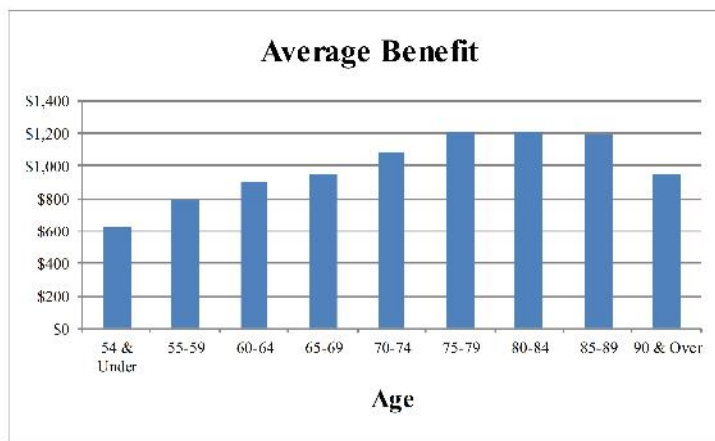
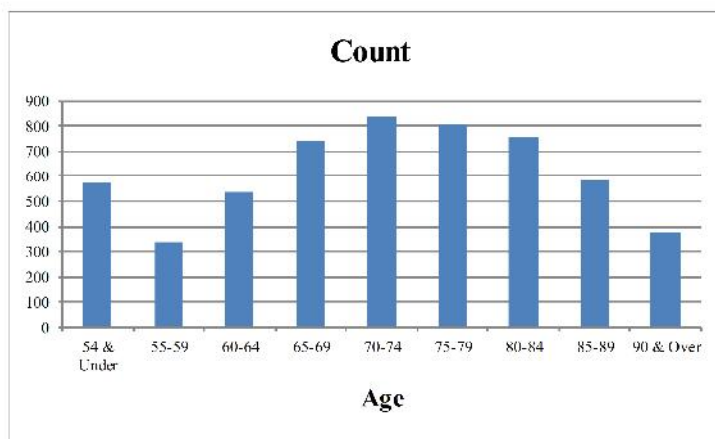
Age	Count of Members			Monthly Benefits		
	Male	Female	Total	Male	Female	Total
54 & Under	165	295	460	\$ 494,834	\$ 805,679	\$ 1,300,513
55-59	1,069	2,051	3,120	2,168,588	3,980,554	6,149,142
60-64	2,927	5,294	8,221	4,032,169	6,537,117	10,569,286
65-69	4,531	7,131	11,662	5,844,120	7,584,098	13,428,218
70-74	3,928	5,686	9,614	5,868,167	6,107,378	11,975,545
75-79	2,207	3,293	5,500	3,864,902	3,612,297	7,477,199
80-84	1,177	1,894	3,071	2,508,017	2,255,602	4,763,619
85-89	579	1,052	1,631	1,279,315	1,242,467	2,521,782
90 & Over	<u>238</u>	<u>642</u>	<u>880</u>	<u>436,017</u>	<u>708,736</u>	<u>1,144,753</u>
Total	16,821	27,338	44,159	\$ 26,496,129	\$ 32,833,928	\$ 59,330,057





**BENEFICIARIES RECEIVING BENEFITS  
AS OF JUNE 30, 2019**

Age	Count of Members			Monthly Benefits		
	Male	Female	Total	Male	Female	Total
54 & Under	235	339	574	\$ 125,887	\$ 239,870	\$ 365,757
55-59	100	234	334	64,979	199,126	264,105
60-64	150	383	533	104,540	373,695	478,235
65-69	213	531	744	157,399	553,421	710,820
70-74	222	613	835	167,412	742,954	910,366
75-79	180	622	802	148,891	819,727	968,618
80-84	185	573	758	138,894	772,736	911,630
85-89	133	451	584	96,871	602,732	699,603
90 & Over	<u>90</u>	<u>283</u>	<u>373</u>	<u>52,068</u>	<u>304,301</u>	<u>356,369</u>
Total	1,508	4,029	5,537	\$ 1,056,941	\$ 4,608,562	\$ 5,665,503





**RETIRED LIVES BENEFITS PAYABLE AS OF JUNE 30, 2019  
TABULATED BY OPTION AND TYPE OF BENEFIT**

**MSEP Benefits**

<b>Type of Benefit</b>	<b>No.</b>	<b>Total Monthly Benefits</b>
Service Retirement		
Life Annuity	5,903	\$ 7,615,098
50% Joint and Survivor	5,209	8,674,469
100% Joint and Survivor	3,157	5,932,245
5-Year Certain and Life	144	154,286
10-Year Certain and Life	170	176,576
Survivor Beneficiary	2,638	3,126,781
Total	<u>17,221</u>	<u>25,679,455</u>
Disability Retirement	1	190
Death-in-Service	1,437	1,473,758
<b>Total</b>	<b>18,659</b>	<b>\$ 27,153,403</b>

**MSEP 2000 Benefits**

<b>Type of Benefit</b>	<b>No.</b>	<b>Total Monthly Benefits</b>
Service Retirement		
Life Annuity	18,376	\$ 21,570,869
50% Joint and Survivor	4,359	7,206,506
100% Joint and Survivor	5,190	6,752,049
5-Year Certain and Life	20	25,577
10-Year Certain and Life	842	693,411
15-Year Certain and Life	689	491,419
Survivor Beneficiary	1,171	948,263
Total	<u>30,647</u>	<u>37,688,094</u>
Death-in-Service	289	115,163
<b>Total</b>	<b>30,936</b>	<b>\$ 37,803,257</b>





**RETIRED LIVES BENEFITS PAYABLE AS OF JUNE 30, 2019  
TABULATED BY OPTION AND TYPE OF BENEFIT**

**MSEP 2011 Benefits**

Type of Benefit	No.	Total Monthly Benefits
Service Retirement		
Life Annuity	50	\$ 17,232
50% Joint and Survivor	11	5,174
100% Joint and Survivor	26	9,308
5-Year Certain and Life	0	0
10-Year Certain and Life	5	1,809
15-Year Certain and Life	7	3,839
Survivor Beneficiary	0	0
Total	<u>99</u>	<u>37,362</u>
Death-in-Service	2	1,538
<b>Total</b>	<b>101</b>	<b>\$ 38,900</b>



**SALARY INCREASES  
DURING PLAN YEAR 2018-2019**

Age	Count	Salary Increases	
		Actual*	Expected
Under 20	29	26.3%	7.2%
20 - 24	1,169	10.9%	5.5%
25 - 29	3,106	7.3%	4.6%
30 - 34	3,837	6.1%	4.1%
35 - 39	4,439	5.0%	3.8%
40 - 44	4,841	4.1%	3.6%
45 - 49	5,873	3.6%	3.5%
50 - 54	5,996	3.1%	3.4%
55 - 59	5,860	3.0%	3.4%
60 - 64	3,767	2.6%	3.4%
65 & Over	1,423	1.8%	3.3%
<b>Total</b>	<b>40,340</b>		
<b>Average</b>		<b>4.1%</b>	<b>3.7%</b>

\* Excludes new entrants and terminations.

	Payroll Growth			
	2019	2018	2017	2016
Actual	0.8%	-1.4%	1.1%	0.2%
Assumed	2.5%	3.0%	3.0%	0.0%



**ACTIVE MEMBERS WHO RETIRED WITH  
SERVICE RETIREMENT BENEFITS  
DURING PLAN YEAR 2018-2019**

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 50	2	0.2	10	1.6	12	1.8
50	6	1.5	8	5.1	14	6.6
51	15	3.8	12	12.7	27	16.5
52	14	11.0	17	17.3	31	28.3
53	14	11.8	25	20.5	39	32.3
54	16	16.1	45	26.8	61	42.8
55	29	25.1	52	34.3	81	59.3
56	28	22.5	51	33.4	79	56.0
57	33	32.8	55	51.9	88	84.7
58	35	32.0	50	48.9	85	80.8
59	34	35.9	61	49.6	95	85.5
60	26	40.3	59	66.1	85	106.4
61	43	38.8	84	55.1	127	93.9
62	56	67.1	104	105.3	160	172.3
63	28	52.2	43	72.3	71	124.5
64	51	36.3	64	47.0	115	83.2
65	54	52.8	105	83.5	159	136.3
66	48	42.9	68	56.2	116	99.1
67	20	20.9	40	32.5	60	53.3
68	22	16.7	26	21.8	48	38.5
69	18	15.0	18	16.3	36	31.3
70 & Over	58	60.3	57	52.9	115	113.3
<b>Total</b>	<b>650</b>	<b>635.8</b>	<b>1,054</b>	<b>911.0</b>	<b>1,704</b>	<b>1,546.9</b>

	Male	Female	Total
Average age at retirement	61.9 years	61.2 years	61.5 years
Average service at retirement	22.0 years	23.0 years	22.6 years





**ACTIVE MEMBERS WHO BECAME DISABLED  
DURING PLAN YEAR 2018-2019**

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 25	0	0.8	1	1.1	1	1.9
25 - 29	1	1.9	1	2.6	2	4.4
30 - 34	1	2.0	3	2.8	4	4.8
35 - 39	3	4.9	7	8.2	10	13.1
40 - 44	4	7.5	7	12.5	11	20.0
45 - 49	5	10.9	10	18.8	15	29.7
50 - 54	14	13.9	18	24.3	32	38.3
55 - 59	13	15.8	17	25.7	30	41.5
60 & Over	5	7.7	8	12.4	13	20.0
<b>Total</b>	<b>46</b>	<b>65.4</b>	<b>72</b>	<b>108.5</b>	<b>118</b>	<b>173.9</b>

	Male	Female	Total
Average age at disability	51.0 years	49.8 years	50.3 years
Average service at disability	12.1 years	11.2 years	11.6 years



**ACTIVE MEMBERS WHO DIED  
DURING PLAN YEAR 2018-2019**

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 30	0	0.8	0	0.5	0	1.3
30 - 34	0	0.7	2	0.6	2	1.3
35 - 39	1	0.8	0	0.9	1	1.7
40 - 44	2	1.1	3	1.3	5	2.4
45 - 49	1	2.1	1	2.5	2	4.6
50 - 54	4	3.9	7	4.4	11	8.3
55 - 59	7	7.2	8	6.6	15	13.8
60 - 64	9	8.7	9	6.3	18	15.0
65 & Over	5	8.6	3	4.4	8	13.0
<b>Total</b>	<b>29</b>	<b>34.0</b>	<b>33</b>	<b>27.5</b>	<b>62</b>	<b>61.5</b>

	Male	Female	Total
Average age at death	58.4 years	54.9 years	56.6 years
Average service at death	18.8 years	17.0 years	17.8 years

Of the 62 active members who died in service during plan year 2018-2019, 29 members had a benefit payable to a survivor.



**ACTIVE MEMBERS WHO TERMINATED EMPLOYMENT  
WITH A DEFERRED BENEFIT  
DURING PLAN YEAR 2018-2019**

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 30	49	24.4	62	33.7	111	58.0
30 - 34	113	74.7	134	105.7	247	180.4
35 - 39	127	91.5	168	136.4	295	227.8
40 - 44	95	77.0	154	127.5	249	204.4
45 - 49	94	69.5	139	118.6	233	188.1
50 - 54	71	49.4	139	85.5	210	134.9
55 - 59	53	21.1	63	35.6	116	56.6
60 & Over	16	2.1	25	2.8	41	4.8
<b>Total</b>	<b>618</b>	<b>409.5</b>	<b>884</b>	<b>645.6</b>	<b>1,502</b>	<b>1,055.1</b>

	Male	Female	Total
Average age at termination	41.9 years	42.5 years	42.2 years
Average service at termination	9.7 years	10.2 years	10.0 years



**APPENDIX B – DEMOGRAPHIC EXPERIENCE**

**ACTIVE MEMBERS WHO TERMINATED EMPLOYMENT  
WITHOUT A DEFERRED BENEFIT PAYABLE  
DURING PLAN YEAR 2018-2019**

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 20	7	0.0	21	0.0	28	0.0
20 - 24	320	159.6	391	230.5	711	390.1
25 - 29	474	274.3	638	405.9	1,112	680.3
30 - 34	290	184.0	355	291.4	645	475.4
35 - 39	150	111.4	242	233.4	392	344.8
40 - 44	122	91.0	164	168.5	286	259.5
45 - 49	90	73.3	160	167.2	250	240.5
50 - 54	66	66.4	139	139.8	205	206.3
55 - 59	62	66.2	93	128.0	155	194.2
60 - 64	43	40.5	58	68.1	101	108.6
65 - 69	10	12.9	13	12.9	23	25.8
70 & Over	5	3.4	6	4.5	11	7.9
<b>Total</b>	<b>1,639</b>	<b>1,083.0</b>	<b>2,280</b>	<b>1,850.4</b>	<b>3,919</b>	<b>2,933.4</b>

Service	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
0 - 1	626	395.2	948	723.8	1,574	1,119.0
1 - 2	410	279.2	592	476.4	1,002	755.7
2 - 3	264	186.0	337	305.3	601	491.3
3 - 4	179	134.5	245	211.3	424	345.9
4 - 5	160	88.1	158	133.5	318	221.6
<b>Total</b>	<b>1,639</b>	<b>1,083.0</b>	<b>2,280</b>	<b>1,850.4</b>	<b>3,919</b>	<b>2,933.4</b>

	Male	Female	Total
Average age at termination	33.4 years	34.4 years	34.0 years
Average service at termination	1.8 years	1.7 years	1.7 years





**APPENDIX B – DEMOGRAPHIC EXPERIENCE**

**COMPARISON OF ACTUAL TO EXPECTED DEATHS  
AMONG RETIRED LIVES  
(SERVICE RETIREMENT ONLY)  
DURING PLAN YEAR 2018-2019**

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 50	0	0.0	1	0.0	0	0.0
50 - 54	4	0.6	127	0.8	6	1.5
55 - 59	13	7.0	992	9.2	23	16.2
60 - 64	36	27.3	2,795	34.8	78	62.2
65 - 69	65	62.5	4,467	72.0	143	134.5
70 - 74	89	80.7	3,785	88.3	199	168.9
75 - 79	80	75.9	2,179	87.4	172	163.3
80 - 84	94	70.7	1,190	91.5	200	162.2
85 - 89	87	64.5	624	90.9	178	155.4
90 - 94	46	39.6	226	77.4	120	117.0
95 - 99	12	9.8	39	27.4	39	37.2
100 & Over	1	1.5	4	8.0	10	9.5
<b>Total</b>	<b>527</b>	<b>440.1</b>	<b>16,429</b>	<b>587.8</b>	<b>1,168</b>	<b>1,027.9</b>

**Average Ages**      77.5      78.5      70.2      80.4      78.2      79.6      70.1



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

<p><b>MSEP (Missouri State Employees' Plan)</b></p>	<p><b>MSEP 2000 (Missouri State Employees' Plan 2000)</b></p>	<p><b>MSEP 2011 (Missouri State Employees' Plan 2011)</b></p>
<p><b>DEFINITIONS</b></p> <p><b>Participants</b></p> <p>All MOSERS members, vested former members, retirees and survivors who first became members prior to July 1, 2000 and who do <b>not</b> elect to transfer to the MSEP 2000 plan. Election is made at the time benefits commence.</p>	<p>(1) All new employees who first become members on or after July 1, 2000, except full-time teaching and senior administrative personnel of the regional colleges and universities hired on or after July 1, 2002 who will be participants in the Colleges and Universities Retirement Plan (CURP).</p> <p>(2) MSEP active members and vested former members who elect to transfer to the MSEP 2000 plan prior to retirement.</p> <p>(3) MSEP retirees who elect to transfer to the MSEP 2000 plan during the election window from July 1, 2000 through June 30, 2001, and their survivors.</p> <p>(4) MSEP non-vested terminations rehired on or after July 1, 2000.</p> <p>(5) Members hired prior to January 1, 2011 participating in the CURP for six years may elect to change to MOSERS. Transferred service is for vesting purposes only.</p>	<p>(1) All new employees who first become employees on or after January 1, 2011, except full-time teaching and senior administrative personnel of the regional colleges and universities hired on or after July 1, 2002 who will be participants in the Colleges and Universities Retirement Plan (CURP).</p> <p>(2) Members hired on or after January 1, 2011 participating in the CURP for six years may elect to change to MOSERS. Transferred service is for vesting purposes only.</p>



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

<p><b>MSEP (Missouri State Employees' Plan)</b></p>	<p><b>MSEP 2000 (Missouri State Employees' Plan 2000)</b></p>	<p><b>MSEP 2011 (Missouri State Employees' Plan 2011)</b></p>
<p><b>Final average earnings</b></p> <p>The average annual compensation of a member for the three consecutive years of service during which pay was highest (overtime pay is included for purposes of determining Average Compensation). Non-recurring lump sum payments are excluded. Unused sick leave may be converted to additional credited service (usable only for benefit computation, not eligibility).</p>	<p>The average annual compensation of a member for the three consecutive years of service during which pay was highest (overtime pay is included for purposes of determining Average Compensation). Non-recurring lump sum payments are excluded. Unused sick leave may be converted to additional credited service (usable only for benefit computation, not eligibility).</p>	<p>The average annual compensation of a member for the three consecutive years of service during which pay was highest (overtime pay is included for purposes of determining Average Compensation). Non-recurring lump sum payments are excluded. Unused sick leave may be converted to additional credited service (usable only for benefit computation, not eligibility).</p>
<p><b>Member contributions</b></p> <p>None.</p>	<p>Same as MSEP.</p>	<p>4.0% of salary, with interest credited to member contributions based on the 52-week Treasury bill rate (4% prior to June 30, 2014).</p>



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

<p style="text-align: center;"><b>MSEP (Missouri State Employees' Plan)</b></p>	<p style="text-align: center;"><b>MSEP 2000 (Missouri State Employees' Plan 2000)</b></p>	<p style="text-align: center;"><b>MSEP 2011 (Missouri State Employees' Plan 2011)</b></p>
<p><b>ELIGIBILITY FOR BENEFITS</b></p>		
<p><b>Normal retirement</b></p>		
<p><i>Members of the General Assembly:</i> Age 55 with completion of at least 3 full biennial assemblies.</p> <p><i>Statewide Elected Officials:</i> The earliest of attaining: (1) Age 65 with at least 4 years of credited service. (2) Age 60 with at least 15 years of credited service. (3) Age 50 with age plus credited service equal to 80 or more.</p> <p><i>General Employees:</i> The earliest of attaining: (1) Age 65 and active with at least 4 years of credited service. (2) Age 65 with at least 5 years of credited service. (3) Age 60 with at least 15 years of credited service. (4) Age 48 with age plus credited service equal to 80 or more.</p>	<p><i>Members of the General Assembly:</i> The earliest of attaining: (1) Age 55 with completion of at least 3 full biennial assemblies. (2) Age 50 with completion of at least 3 full biennial assemblies and with age plus credited service equal to 80 or more.</p> <p><i>Statewide Elected Officials:</i> The earliest of attaining: (1) Age 55 with at least 4 years of credited service. (2) Age 50 with age plus credited service equal to 80 or more.</p> <p><i>General Employees:</i> The earliest of attaining: (1) Age 62 with at least 5 years of credited service. (2) Age 48 with age plus credited service equal to 80 or more.</p>	<p><i>Members of the General Assembly:</i> The earliest of attaining: (1) Age 62 with completion of at least 3 full biennial assemblies. (2) Age 55 with completion of at least 3 full biennial assemblies and with age plus credited service equal to 90 or more.</p> <p><i>Statewide Elected Officials:</i> The earliest of attaining: (1) Age 62 with at least 4 years of credited service as a statewide elected official. (2) Age 55 with age plus credited service equal to 90 or more.</p> <p><i>General Employees:</i> The earliest of attaining: (1) Age 67 with at least 5 years of credited service. (2) Age 55 with age plus credited service equal to 90 or more.</p>





**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

<p><b>MSEP (Missouri State Employees' Plan)</b></p>	<p><b>MSEP 2000 (Missouri State Employees' Plan 2000)</b></p>	<p><b>MSEP 2011 (Missouri State Employees' Plan 2011)</b></p>
<p><i>Uniformed Water Patrol Employees:</i> The earliest of attaining: (1) Age 55 and active with at least 4 years of credited service. (2) Age 55 with at least 5 years of credited service. (3) Age 48 with age plus credited service equal to 80 or more.</p> <p><i>Administrative Law Judges:</i> The earliest of attaining: (1) Age 62 and active with at least 12 years of credited service. (2) Age 60 with at least 15 years of credited service. (3) Age 55 with at least 20 years of credited service.</p> <p><b>Early retirement for general employees</b> Age 55 with at least 10 years of credited service.</p>		<p>Age 57 with at least 5 years of credited service.</p> <p>Age 62 with at least 5 years of credited service.</p>



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

<p><b>MSEP</b> <b>(Missouri State Employees' Plan)</b></p>	<p><b>MSEP 2000</b> <b>(Missouri State Employees' Plan 2000)</b></p>	<p><b>MSEP 2011</b> <b>(Missouri State Employees' Plan 2011)</b></p>
<p><b>MONTHLY BENEFITS PAYABLE</b></p> <p><b>Normal Retirement</b></p> <p><i>Members of the General Assembly:</i> \$150 per month per biennial assembly served.</p> <p><i>Statewide Elected Officials:</i></p> <ol style="list-style-type: none"> <li>1) Less than 12 years of credited service: 1.6% of Average Compensation times years of credited service.</li> <li>2) 12 or more years of credited service: 50% of pay of the highest elected position held prior to retirement.</li> </ol> <p><i>General Employees:</i> 1.6% of Average Compensation times years of credited service.</p> <p>2.1% of Average Compensation times years of credited service for any period of non-social security covered employment transferred from the Public School Retirement System.</p> <p><i>Uniformed Water Patrol:</i> 2.13% of Average Compensation times years of credited service.</p>	<p><i>Members of the General Assembly:</i> 1/24 of pay times first 24 years of credited service as a member of the General Assembly.</p> <p><i>Statewide Elected Officials:</i> 1/24 of pay (of the highest elected position held prior to retirement) times the first 12 years of credited service as a statewide elected official.</p> <p><i>General Employees:</i> 1.7% of Average Compensation times years of credited service.</p> <p>Temporary Benefit: If member retires between ages 48 and 62 with age plus credited service equal to 80 or more, a temporary benefit is payable until the attainment of the minimum age at which reduced social security benefits are payable, in the amount of 0.8% of Average Compensation times years of credited service.</p>	<p><i>Members of the General Assembly:</i> 1/24 of pay times first 24 years of credited service as a member of the General Assembly.</p> <p><i>Statewide Elected Officials:</i> 1/24 of pay (of the highest elected position held prior to retirement) times the first 12 years of credited service as a statewide elected official.</p> <p><i>General Employees:</i> 1.7% of Average Compensation times years of credited service.</p> <p>Temporary Benefit: If member retires between ages 55 and 62 with age plus credited service equal to 90 or more, a temporary benefit is payable until the attainment of the minimum age at which reduced social security benefits are payable, in the amount of 0.8% of Average Compensation times years of credited service.</p>



APPENDIX C – SUMMARY OF PLAN PROVISIONS

<p>MSEP (Missouri State Employees' Plan)</p>	<p>MSEP 2000 (Missouri State Employees' Plan 2000)</p>	<p>MSEP 2011 (Missouri State Employees' Plan 2011)</p>
<p><i>Administrative Law Judges:</i> 50% of Compensation</p> <p><b>Early retirement for general employees</b></p> <p>Normal retirement amount reduced by ½% for each month that retirement precedes eligibility for normal retirement.</p> <ol style="list-style-type: none"> <li>1) Less than 15 years of service: Normal retirement amount actuarially reduced for years younger than age 65.</li> <li>2) 15 years but less than 20 years of service, and less than the number of years of service necessary for age and service to total 80: Normal retirement amount actuarially reduced for years younger than age 60.</li> <li>3) 20 or more years of service, but less than the number of years of service necessary for age and service to total 80: Normal retirement amount reduced for years younger than the 80 and out eligibility date.</li> </ol>	<p>Non-Social Security Covered Service: 2.5% of Average Compensation times years of credited service for any period of non-social security covered employment transferred from the Public School Retirement System.</p> <p>Normal retirement amount reduced by ½% for each month that retirement precedes eligibility for normal retirement, age 62.</p>	<p>Non-Social Security Covered Service: 2.5% of Average Compensation times years of credited service for any period of non-social security covered employment transferred from the Public School Retirement System.</p> <p>Normal retirement amount reduced by ½% for each month that retirement precedes eligibility for normal retirement, age 67.</p>



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

<p><b>MSEP (Missouri State Employees' Plan)</b></p>	<p><b>MSEP 2000 (Missouri State Employees' Plan 2000)</b></p>	<p><b>MSEP 2011 (Missouri State Employees' Plan 2011)</b></p>																																																
<p><b>Vested deferred benefits</b></p> <p>Benefits for employees who terminate prior to eligibility for an immediate benefit are considered to be vested in accordance with the following schedule (benefits commence at the age the individual would have been eligible for early or normal retirement, considering years of credited service). Unused sick leave is not converted.</p> <table border="1" data-bbox="717 1360 857 1890"> <thead> <tr> <th>Years of Service</th> <th>General Assembly</th> <th>Elected Officials</th> <th>General Employees</th> </tr> </thead> <tbody> <tr> <td>4</td> <td></td> <td>100%</td> <td></td> </tr> <tr> <td>5</td> <td></td> <td></td> <td>100%</td> </tr> <tr> <td>6*</td> <td>100%</td> <td></td> <td></td> </tr> </tbody> </table> <p>*3 Assemblies</p>	Years of Service	General Assembly	Elected Officials	General Employees	4		100%		5			100%	6*	100%			<p>Benefits for employees who terminate prior to eligibility for an immediate benefit are considered to be vested in accordance with the following schedule (benefits commence at age 57 for early retirement or 62 for normal retirement). Unused sick leave is not converted. CURP to MOSERS transfers with 6 years of service are immediately vested.</p> <table border="1" data-bbox="717 787 857 1316"> <thead> <tr> <th>Years of Service</th> <th>General Assembly</th> <th>Elected Officials</th> <th>General Employees</th> </tr> </thead> <tbody> <tr> <td>4</td> <td></td> <td>100%</td> <td></td> </tr> <tr> <td>5</td> <td></td> <td></td> <td>100%</td> </tr> <tr> <td>6*</td> <td>100%</td> <td></td> <td></td> </tr> </tbody> </table> <p>*3 Assemblies, HB1455 prospectively</p>	Years of Service	General Assembly	Elected Officials	General Employees	4		100%		5			100%	6*	100%			<p>Benefits for employees who terminate prior to eligibility for an immediate benefit are considered to be vested in accordance with the following schedule (benefits commence at age 67 normal retirement). Unused sick leave is not converted.</p> <table border="1" data-bbox="717 220 857 749"> <thead> <tr> <th>Years of Service</th> <th>General Assembly</th> <th>Elected Officials</th> <th>General Employees</th> </tr> </thead> <tbody> <tr> <td>4</td> <td></td> <td>100%</td> <td></td> </tr> <tr> <td>6*</td> <td></td> <td></td> <td>100%</td> </tr> <tr> <td>5</td> <td>100%</td> <td></td> <td></td> </tr> </tbody> </table> <p>*3 Assemblies, HB1455 prospectively</p>	Years of Service	General Assembly	Elected Officials	General Employees	4		100%		6*			100%	5	100%		
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<p><b>Death prior to retirement</b></p> <p>The surviving spouse benefit is computed as if the member had been normal retirement age on the date of death and elected the joint and 100% survivor optional form of payment, provided the member had at least 5 years of credited service and was married on the date of death. If no eligible spouse survives, 80% of the member's life income annuity is paid to eligible children until age 21. If the death is duty related, the service requirement is waived and the minimum</p>	<p>The surviving spouse benefit is computed as if the member had been normal retirement age on the date of death and elected the joint and 100% survivor optional form of payment, provided the member had at least 5 years of credited service (3 full assemblies for a member of the General Assembly, 4 years of credited service for a statewide elected official). If no eligible spouse survives, 80% of the member's life income annuity is paid to eligible children until age 21. If the death is duty related, the service requirement is waived</p>	<p>The surviving spouse benefit is computed as if the member had been normal retirement age on the date of death and elected the joint and 100% survivor optional form of payment, provided the member had at least 5 years of credited service (2 full assemblies for a member of the General Assembly, 4 years of credited service for a statewide elected official). If no eligible spouse survives, 80% of the member's life income annuity is paid to eligible children until age 21. If the death is duty related, the service requirement is waived</p>																																																





**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

<p><b>MSEP (Missouri State Employees' Plan)</b></p>	<p><b>MSEP 2000 (Missouri State Employees' Plan 2000)</b></p>	<p><b>MSEP 2011 (Missouri State Employees' Plan 2011)</b></p>
<p>spouse benefit is 50% of Average Compensation (rate of compensation for members of the General Assembly).</p> <p><b>Death after retirement</b></p> <p>50% of the benefit the retired member was receiving on the date of death (the normal form of payment), or the benefit payable under the joint and survivor or period certain form of payment, if the member elected an optional form of payment at time of retirement and provided the member was married on their date of retirement. Effective July 1, 2000, a member who is not married at retirement but marries thereafter may designate a spouse as beneficiary within one year of marriage. Additionally, a member may designate a new spouse as beneficiary within one year of marriage in the event of the death of the spouse the member was married to at the date of retirement (this provision does not apply to period certain annuities).</p>	<p>and the minimum spouse benefit is 50% of Average Compensation (rate of compensation for members of the General Assembly).</p> <p>The benefit payable under the joint and survivor or period certain form of payment, if the member elected an optional form of payment at time of retirement. A member who is not married at retirement but marries thereafter may designate a spouse as beneficiary within one year of marriage. Additionally, a member may designate a new spouse as beneficiary within one year of marriage in the event of the death of the spouse the member was married to at the date of retirement (this provision does not apply to period certain annuities).</p>	<p>and the minimum spouse benefit is 50% of Average Compensation (rate of compensation for members of the General Assembly).</p> <p>The benefit payable under the joint and survivor or period certain form of payment, if the member elected an optional form of payment at time of retirement. A member who is not married at retirement but marries thereafter may designate a spouse as beneficiary upon completion of one year of marriage. Additionally, a member may designate a new spouse as beneficiary upon completion of one year of marriage in the event of the death of the spouse the member was married to at the date of retirement (this provision does not apply to period certain annuities).</p>



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

<p><b>MSEP</b> <b>(Missouri State Employees' Plan)</b></p>	<p><b>MSEP 2000</b> <b>(Missouri State Employees' Plan 2000)</b></p>	<p><b>MSEP 2011</b> <b>(Missouri State Employees' Plan 2011)</b></p>												
<p><b>Disability</b></p> <p>Normal retirement benefits become payable at the time the member is eligible for normal retirement, and are computed based on: i) the service that would have accrued to the member if active employment had continued; and ii) the member's rate of pay at the time of disability (if the member retires on or after August 28, 1999, the member's rate of pay is based on the rate of pay at the time of disability indexed to the time of benefit commencement). An exception is Uniformed Water Patrol employees who are eligible for an immediate occupational disability benefit equal to 50% of pay at time of disability.</p> <p><b>Post-retirement benefit adjustments</b></p> <p>Benefits are increased to retired members (including survivors) annually in accordance with the following formulas:</p> <table border="1" data-bbox="1153 1354 1380 1890"> <thead> <tr> <th>Increase in CPI</th> <th>Formula 1 Benefit Increase</th> <th>Formula 2 Benefit Increase</th> </tr> </thead> <tbody> <tr> <td>5.00% or less</td> <td>4%</td> <td>80% of CPI increase</td> </tr> <tr> <td>5.01% - 6.24%</td> <td>80% of CPI increase</td> <td>80% of CPI increase</td> </tr> <tr> <td>6.25% or more</td> <td>5%</td> <td>5%</td> </tr> </tbody> </table>	Increase in CPI	Formula 1 Benefit Increase	Formula 2 Benefit Increase	5.00% or less	4%	80% of CPI increase	5.01% - 6.24%	80% of CPI increase	80% of CPI increase	6.25% or more	5%	5%	<p>Normal retirement benefits become payable at the time the member is eligible for normal retirement, and are computed based on: i) the service that would have accrued to the member if active employment had continued; and ii) the member's rate of pay at the time of disability indexed to the time of benefit commencement. The annual percentage increase in the pay used to compute benefits is the lesser of: i) 80% of the CPI increase and ii) 5%.</p> <p>Benefits are increased to retired members (including survivors) annually in accordance with the following:</p> <p><i>Members of the General Assembly:</i> Benefit is adjusted annually based on the increase in the pay for an active member of the General Assembly.</p>	<p>Normal retirement benefits become payable at the time the member is eligible for normal retirement, and are computed based on: i) the service that would have accrued to the member if active employment had continued; and ii) the member's rate of pay at the time of disability indexed to the time of benefit commencement. The annual percentage increase in the pay used to compute benefits is the lesser of: i) 80% of the CPI increase and ii) 5%.</p> <p>Benefits are increased to retired members (including survivors) annually in accordance with the following:</p> <p><i>Members of the General Assembly:</i> Benefit is adjusted annually based on the increase in the pay for an active member of the General Assembly.</p>
Increase in CPI	Formula 1 Benefit Increase	Formula 2 Benefit Increase												
5.00% or less	4%	80% of CPI increase												
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**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

<p><b>MSEP (Missouri State Employees' Plan)</b></p>	<p><b>MSEP 2000 (Missouri State Employees' Plan 2000)</b></p>	<p><b>MSEP 2011 (Missouri State Employees' Plan 2011)</b></p>
<p>Members first hired prior to August 28, 1997 receive COLAs based on Formula 1 until an aggregate increase of 65% is reached. At that point subsequent COLAs based on Formula 2 are granted.</p> <p>Members first hired on or after August 28, 1997 receive COLAs based solely on Formula 2.</p> <p>Statewide Elected Officials with 12 or more years of service have their benefit adjusted annually based on the increase in the pay for an active statewide elected official in the member's highest elected position.</p> <p>Members who are fully vested and work beyond age 65 will have their monthly benefit increased upon retirement. The percentage increase in benefit is equal to all COLAs for the years between age 65 and date of retirement, not to exceed 65% and counts toward the Formula 1 65% maximum.</p>	<p><i>Statewide Elected Officials:</i> Benefit is adjusted annually based on the increase in the pay for an active statewide elected official in the retired member's highest elected position.</p> <p><i>General Employees:</i> Annual benefit percentage increase equal to the lesser of: i) 80% of the CPI increase, and 5%.</p> <p><i>CPI:</i> For the basis of determining CPI, the average monthly reported CPI for the prior calendar year is divided by the average monthly reported CPI for the second prior calendar year to determine the current year increases, if any. If this amount is less than one, benefits are not reduced, nor is there any cumulative effect on future years determination of CPI.</p> <p><i>Timing of Increase:</i> Benefits are adjusted on the anniversary of the effective date of retirement for most members. Members retiring under the BackDROP provisions have an anniversary based on the retroactive starting date for the BackDROP.</p>	<p><i>Statewide Elected Officials:</i> Benefit is adjusted annually based on the increase in the pay for an active statewide elected official in the retired member's highest elected position.</p> <p><i>General Employees:</i> Annual benefit percentage increase equal to the lesser of: i) 80% of the CPI increase, and 5%.</p> <p><i>CPI:</i> For the basis of determining CPI, the average monthly reported CPI for the prior calendar year is divided by the average monthly reported CPI for the second prior calendar year to determine the current year increases, if any. If this amount is less than one, benefits are not reduced, nor is there any cumulative effect on future years determination of CPI.</p> <p><i>Timing of Increase:</i> Benefits are adjusted on the anniversary of the effective date of retirement. For inactive vested General Employees who enter retirement, the first COLA will not be granted until the second anniversary of the effective date of retirement.</p>





**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

<b>MSEP (Missouri State Employees' Plan)</b>	<b>MSEP 2000 (Missouri State Employees' Plan 2000)</b>	<b>MSEP 2011 (Missouri State Employees' Plan 2011)</b>
<p><b>Pop-up provision</b></p> <p>Benefits to members who choose a survivor form of payment and whose spouse precedes the member in death, will "pop-up" or revert to the amount the member would have received had he/she not elected a survivor option.</p>	<p>Same.</p>	<p>Same.</p>
<p><b>Portability</b></p> <p>Purchase/Transfer Provisions (in addition to military). Effective August 28, 1999, a member may purchase up to four years of non-federal full-time Missouri public service, provided the member is not vested in another retirement system for that same service.</p>	<p>Purchase/Transfer Provisions (in addition to military). A member may purchase up to four years of non-federal full-time Missouri public service, provided the member is not vested in another retirement system for that same service. Local vested service credit granted after 10 years of state service if the other retirement plan agrees to transfer assets equal to the accrued liability to MOSERS.</p>	<p>May purchase qualifying public sector service at full actuarial cost.</p>





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<p><b>BackDROP</b></p> <p>To be eligible to participate in the BackDROP, a member must have been eligible to retire under normal retirement age and/or service conditions for at least two years. A retroactive starting date is established for BackDROP purposes which is the later of: 1) the member's normal retirement date or 2) five years prior to the annuity starting date under the retirement plan selected by the member.</p> <p>A member may elect the BackDROP period for the accumulation of the BackDROP account in 12 month increments prior to their actual retirement date or back to the earliest possible date. This results in a BackDROP period of one to five years depending upon the individual situation.</p> <p>A theoretical BackDROP account is accumulated that includes 90% of the value of the benefit payments that would have been paid during the BackDROP period had the member retired at the retroactive starting date with their respective option election. These payments include applicable post-retirement benefit increases.</p>	<p>Same as MSEP.</p>	<p>Not eligible for the BackDROP.</p>



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<p>The member is paid the resulting lump sum value of the BackDROP account as of the annuity starting date or as three equal annual installments beginning at the annuity starting date.</p> <p>The annuity benefit payable from the actual retirement date is computed with years of service and average pay as of the retroactive starting date for the BackDROP. Post-retirement benefit increases that occurred during the BackDROP period are applied in the calculation of the monthly annuity.</p>		



## APPENDIX D – SUMMARY OF ACTUARIAL ASSUMPTIONS

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### ACTUARIAL METHODS

1. **Calculation of Normal Cost and Actuarial Accrued Liability:** The funding method used to determine the normal cost and actuarial accrued liability was the Entry Age Actuarial Cost Method described below.

#### Entry Age Actuarial Cost Method

Under the entry age normal cost method, the actuarial present value of each member's projected benefit is allocated on a level basis over the member's compensation between the entry age of the member and their assumed exit age. The portion of the actuarial present value allocated to the valuation year is called the normal cost. The actuarial present value of benefits allocated to prior years of service is called the actuarial accrued liability. The unfunded actuarial accrued liability represents the difference between the actuarial accrued liability and the actuarial value of assets as of the valuation date. The unfunded actuarial accrued liability is calculated each year and reflects experience gains/losses.

2. **Calculation of the Actuarial Value of Assets:** Calculation of the Actuarial Value of Assets (AVA): The Board adopted a new asset smoothing method effective with the June 30, 2018 valuation. Under the new method, the difference between the actual and assumed investment return on the market value of assets is recognized evenly over a five-year period. No corridor is used with the new method. In addition, the total unrecognized investment experience as of June 30, 2017 will be recognized evenly over a seven-year period beginning June 30, 2018.
3. **Amortization of the Unfunded Actuarial Accrued Liability (UAAL):** Beginning with the June 30, 2018 valuation, the UAAL is amortized using a "layered" approach. Under this method, the "Legacy UAAL", as determined in the June 30, 2018 valuation, is amortized over a closed 30-year period. Subsequent changes in the UAAL due to actuarial gains/losses or assumption changes are separately financed by establishing amortization bases and payments, as a level percentage of payroll, over closed 30-year periods. Any change in the System's benefit structure shall be amortized over a closed period of 20 years, as set out in state statutes. The total UAAL amortization payment is the sum of the payments for each of the amortization bases.

#### Changes in Methods and Assumptions since the Prior Year

An experience study which analyzed the System's economic assumptions was performed in 2018 and the results were presented to the Board. Below is a summary of the changes to methods and assumptions since the prior year:

- The investment return assumption was lowered from 7.25% to 7.10%.
- The inflation assumption was lowered from 2.50% to 2.35%
- The general wage growth assumption was lowered from 2.75% to 2.60%.
- The payroll growth assumption was lowered from 2.50% to 2.35%.
- The COLA assumption was lowered from 2.00% to 1.88%.



## APPENDIX D – SUMMARY OF ACTUARIAL ASSUMPTIONS

### ACTUARIAL ASSUMPTIONS

#### Economic Assumptions

1. Investment Return 7.10%, compounded annually, net of investment expenses.

Note: This assumption will change to 6.95% for the June 30, 2020 valuation and thereafter, absent Board action.

2. Inflation 2.35% per year

Note: This assumption will change to 2.25% for the June 30, 2020 valuation and thereafter, absent Board action.

3. Salary Increases Rates vary by service. Sample rates are as follows:

Years	Rates by Service			
	Inflation	Productivity	Merit	Total
1	2.35%	0.25%	5.75%	8.35%
2	2.35	0.25	2.50	5.10
3	2.35	0.25	1.50	4.10
4	2.35	0.25	1.25	3.85
5	2.35	0.25	1.00	3.60
9	2.35	0.25	0.75	3.35
10	2.35	0.25	0.50	3.10
21+	2.35	0.25	0.25	2.85

General Assembly members have a flat 2.60% assumption

4. Payroll Growth 2.35% per year

Note: This assumption will change to 2.25% for the June 30, 2020 valuation and thereafter, absent Board action.

5. Cost-of-Living Adjustment (COLA) 4.00% on a compounded basis when a minimum COLA of 4.00% is in effect.

1.88% on a compounded basis when no minimum COLA is in effect.

Note: This assumption will change to 1.80% for the June 30, 2020 valuation and thereafter, absent Board action.

6. Interest on Member Contributions 1.50% per year

7. Administrative Expenses Actual prior year expenses, included in normal cost rate.





**APPENDIX D – SUMMARY OF ACTUARIAL ASSUMPTIONS**

**Demographic Assumptions**

- 1. Mortality
  - The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement.
  - a. Post-retirement
    - RP-2014 Healthy Annuitant mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 120%
  - b. Pre-retirement
    - RP-2014 Employee mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females
  - c. Long-term disability
    - RP-2014 Disabled mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females
- 2. Retirement Assumption

Retirement Age	Normal Retirement			MSEP 2011**	Retirement Age	Early Retirement	
	MSEP and MSEP 2000*					MSEP and MSEP 2000	MSEP 2011
	Percent Retiring			Percent Retiring		Percent Retiring	Percent Retiring
	1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year				
48	20 %						
49	20	10 %					
50	20	10	21 %				
51	20	10	21				
52	20	10	21				
53	20	10	21				
54	20	10	21				
55	20	10	21	45 %			
56	20	10	21	45			
57	20	10	21	35	57	2.4 %	
58	20	10	21	35	58	3.1	
59	20	10	21	30	59	3.0	
60	20	10	21	35	60	5.1	
61	19	10	21	25	61	6.0	
62	18	22	29	40	62	6.0	10 %
63	16	18	24	30	63	6.0	10
64	15	17	17	20	64	6.0	10
65	19	19	27	30	65		50
66	24	25	28	25	66		50
67	10	25	23	20	67		
68	20	25	23	20	68		
69	20	25	23	20	69		
70	20	25	23	20	70		
71	20	25	23	20	71		
72	20	25	23	20	72		
73	20	25	23	20	73		
74	20	25	23	20	74		
75	50	50	23	50	75		
76	50	50	23	50	76		
77	75	75	23	75	77		
78	100	100	100	100	78		

\* For members hired prior to January 1, 2011.  
 \*\* For members hired on or after January 1, 2011.



**APPENDIX D – SUMMARY OF ACTUARIAL ASSUMPTIONS**

**3. Termination From Active Employment**

<b>Percent of Active Members Separating within the Next Year</b>							
<b>Sample Age</b>	<b>Years of Service</b>	<b>Termination**</b>		<b>Death*</b>		<b>Disability</b>	
		<b>Males</b>	<b>Females</b>	<b>Males</b>	<b>Females</b>	<b>Males</b>	<b>Females</b>
	0-1	24.0 %	27.5 %				
	1-2	19.0	21.5				
	2-3	15.5	16.3				
	3-4	13.3	13.5				
	4-5	11.2	11.3				
25	5+	13.5 %	14.0 %	0.03 %	0.01%	0.10 %	0.10 %
30		10.6	11.0	0.03	0.02	0.10	0.10
35		8.2	8.5	0.04	0.03	0.10	0.10
40		5.8	6.0	0.05	0.03	0.36	0.36
45		4.3	4.5	0.07	0.05	0.41	0.41
50		2.9	3.0	0.13	0.08	0.57	0.57
55		2.9	3.0	0.22	0.14	0.77	0.77
60		2.9	3.0	0.40	0.20	1.02	1.02
65		2.9	3.0	0.70	0.30	1.23	1.23
70		2.9	3.0	1.17	0.50	1.23	1.23

\* The pre-retirement mortality table used was the RP-2014 Employee mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females. 2% of the deaths in active service are assumed to be duty related.

\*\* Does not apply to Elected Officials and Legislators.

**Elected Officials and Legislators**

<b>Years of Service</b>	<b>Percent of Active Members Separating within the Next Year</b>
	<b>Termination Male/Female</b>
0-1	8.0 %
1-2	8.0
2-3	8.0
3-4	8.0
4-5	12.0
5-6	12.0
6-7	12.0
7+	35.0



## APPENDIX D – SUMMARY OF ACTUARIAL ASSUMPTIONS

### Other Assumptions

- |                                |  |
|--------------------------------|--|
| 1. Form of Payment             | MSEP – 50% joint and survivor<br>MSEP 2000 and MSEP 2011 – Straight life annuity   |
| 2. Marital Status              |  |
| a. Percent married             | 70% married at retirement, 60% of those dying in active service are married  |
| b. Spouse’s age                | Females assumed to be three years younger than males.  |
| 3. Pay Increase Timing         | Beginning of the fiscal year.  |
| 4. Decrement Timing            | Decrements of all types are assumed to occur mid-year.   |
| 5. Eligibility Testing         | Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur. |
| 6. Benefit Service             | Exact fractional service is used to determine the amount of the benefit payable.   |
| 7. Decrement Relativity        | Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.                                    |
| 8. Decrement Operation         | Disability and withdrawal do not operate during normal retirement eligibility.   |
| 9. Other Liability Adjustments | Pre-Retirement Survivor Benefits for Spouse of Terminated Vested Member  |

Age	Male/Female
<30	1.57/1.31
30-39	1.24/1.13
40-49	1.09/1.05
>50	1.02/1.01

These factors are used to estimate the cost of immediate unreduced survivor annuities upon the death of a vested member.

- |                                |   |
|--------------------------------|---|
| 10. Incidence of Contributions | Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made. New entrant normal cost |
|--------------------------------|---|



## APPENDIX D – SUMMARY OF ACTUARIAL ASSUMPTIONS

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	contributions are applied to the funding of new entrant benefits.
11. MSEP 2000 Election	All regular state employees hired on or before June 30, 2000 are assumed to elect MSEP 2000 prior to age 62 and MSEP on or after age 62. Elected Officials, General Assembly, and Uniformed Water Patrol Members hired before July 1, 2000 are assumed to elect MSEP at retirement.
12. Service Adjustment	It is assumed that each member will be granted 8 months of service credit, 4 months for unused leave upon retirement and 4 months for military service purchases. For members hired on or after January 1, 2011 it is assumed that each member will be granted 5 months for unused leave.
13. Forfeitures	MSEP - For those hired on or after January 1, 2011, 50% of state employees terminating at first vesting eligibility are assumed to take a refund and forfeit their deferred pension. This percentage decreases to 0% at first retirement eligibility.
14. Salary and Benefit Limits	For purposes of the valuation, no limits were applied to member compensation or benefits.
15. Commencement age for deferred vested benefit	Normal Retirement Date





## **APPENDIX D – SUMMARY OF ACTUARIAL ASSUMPTIONS**

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### **Data Adjustments**

Active and retired member data was reported as of May 31, 2019. It was brought forward to June 30, 2019 by adding one month of service for all active members, one month of contributions and interest for MSEP 2011 members, and the June COLA for certain retired members. Financial information continues to be reported as of June 30. This procedure was instituted to provide sufficient time for the Board of Trustees to certify the appropriate contribution rate prior to the October 1 statutory deadline.

Active members reported with less than a \$100 annualized salary were assumed to receive the average active member pay.

When the option of choosing plans is available, terminated vested members are reported with two records, one with benefits under the MSEP plan and one with benefits under the MSEP 2000 plan. Because it is unknown what the member will elect at retirement, both records are valued and the plan that produces the higher present value of future benefits is used for valuation purposes.

For any retired member who has elected a joint and survivor benefit yet has no beneficiary date of birth provided, it was assumed that the beneficiary is 3 years younger for male retirees and 3 years older for female retirees.

For members reported with no gender, the member is assumed to be male.

Due to limitations in our valuation program, members who are not eligible for normal retirement prior to age 85 had their date of birth adjusted.

### **TECHNICAL VALUATION PROCEDURES**

#### **Other Valuation Procedures**

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur mid-year, except that immediate retirement is assumed for those who are at or above the age at which retirement rates are 100%. Standard adjustments are made for multiple decrements.

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.



## APPENDIX E – GLOSSARY OF TERMS

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<b>Actuarial Accrued Liability</b>	The difference between the actuarial present value of system benefits and the actuarial value of future normal costs. Also referred to as “accrued liability” or “actuarial liability”.
<b>Actuarial Assumptions</b>	Estimates of future experience with respect to rates of mortality, disability, turnover, retirement, rate or rates of investment income and salary increases. Decrement assumptions (rates of mortality, disability, turnover and retirement) are generally based on past experience, often modified for projected changes in conditions. Economic assumptions (salary increases and investment income) consist of an underlying rate in an inflation-free environment plus a provision for a long-term average rate of inflation.
<b>Accrued Service</b>	Service credited under the system which was rendered before the date of the actuarial valuation.
<b>Actuarial Equivalent</b>	A single amount or series of amounts of equal actuarial value to another single amount or series of amounts, computed on the basis of appropriate assumptions.
<b>Actuarial Cost Method</b>	A mathematical budgeting procedure for allocating the dollar amount of the actuarial present value of retirement system benefit between future normal cost and actuarial accrued liability. Sometimes referred to as the “actuarial funding method”.
<b>Experience Gain (Loss)</b>	The difference between actual experience and actuarial assumptions anticipated experience during the period between two actuarial valuation dates.
<b>Actuarial Present Value</b>	The amount of funds currently required to provide a payment or series of payments in the future. It is determined by discounting future payments at predetermined rates of interest and by probabilities of payment.
<b>Amortization</b>	Paying off an interest-discounted amount with periodic payments of interest and principal, as opposed to paying off with lump sum payment.
<b>Normal Cost</b>	The actuarial present value of retirement system benefits allocated to the current year by the actuarial cost method.
<b>Unfunded Actuarial Accrued Liability</b>	<p>The difference between actuarial accrued liability and the valuation assets. Sometimes referred to as “unfunded actuarial liability” or “unfunded accrued liability”.</p> <p>Most retirement systems have unfunded actuarial accrued liability. They arise each time new benefits are added and each time an actuarial loss is realized.</p>

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