



**Cavanaugh Macdonald**  
CONSULTING, LLC

*The experience and dedication you deserve*

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

**ACTUARIAL VALUATION REPORT  
as of June 30, 2018**

**Contribution Rates for Fiscal Year Ending  
June 30, 2020**





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# Cavanaugh Macdonald

CONSULTING, LLC

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September 7, 2018

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, 2018 for the purpose of determining the employer required contribution rate for the plan year ending June 30, 2020. 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, 2018.

There have been no new plan provisions reflected since the prior valuation. However, based on authority granted by legislation in 2017, the Board of Trustees established a voluntary buyout program for terminated vested members. The program allowed members to voluntarily elect to cash out their future monthly benefit in exchange for a one-time lump sum payment equal to 60% of the actuarial present value of their retirement benefit. According to data supplied by the System, over 4,300 terminated vested members participated in the voluntary buyout program. As a result, the unfunded actuarial accrued liability decreased by \$40.5 million and the employer contribution rate declined by 0.14%.

In July 2018 after extensive analysis, the MOSERS Board adopted a 7.25% assumed nominal rate of investment return, effective with the June 30, 2018 actuarial valuation, along with a schedule to systematically lower the assumed nominal rate of investment return by 15 basis points per year until reaching 6.95% in the June 30, 2020 actuarial valuation. 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 7, 2018  
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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 completely separate reports.

The consultants who worked on this assignment are pension actuaries. 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, 2018 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, 2020;
- 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, 2018; 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 new set of economic assumptions that included an investment return assumption of 7.25%, effective with the June 30, 2018 actuarial valuation, along with a schedule to systematically lower the assumed nominal rate of investment return by 15 basis points per year, as shown in the table below, until reaching 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.

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%

In addition to the economic assumption changes listed above, the Board also adopted two changes to the actuarial methods used in the valuation: the asset smoothing method and the amortization of the unfunded actuarial accrued liability (UAAL).

**Asset Smoothing Method:** A new asset smoothing method will be used to determine the actuarial value of assets (AVA). Beginning with the fiscal year ending June 30, 2018, the dollar amount of the difference between the actual investment return and the expected actuarial investment return on the market value of assets each year shall be recognized annually in level amounts over closed five-year periods. Due to the change in the asset smoothing method, a plan was necessary to transition from the prior smoothing method. Therefore, the existing unrecognized investment experience (difference between the actuarial and market value of assets) of \$927 million, as of June 30, 2017, will be recognized annually in level amounts over a closed seven-year period starting with the June 30, 2018 valuation. This approach was utilized because it provides a systematic method to reflect the existing deferred experience that results in more stable and predictable contribution rates than other alternatives.

**Amortization of UAAL:** Under the current UAAL amortization method, the UAAL is amortized as one amortization base over a closed 30-year period that began June 30, 2014. The new method adopted by the Board uses “layered amortization” and is first effective with the June 30, 2018



## SECTION 1 – EXECUTIVE SUMMARY

valuation. 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.

The impact of the actuarial assumption and method changes are summarized in the following table:

	Prior Assumptions and Methods	Current Assumptions and Methods	Difference
Actuarial Accrued Liability	\$13,260,863,988	\$13,612,763,961	\$351,899,973
Actuarial Value of Assets	<u>8,832,796,716</u>	<u>8,830,410,210</u>	<u>(2,386,506)</u>
Unfunded Actuarial Accrued Liability	\$4,428,067,272	\$4,782,353,751	\$354,286,479
Funded Ratio	66.6%	64.9%	(1.7%)
Normal Cost	8.36%	8.62%	0.26%
UAAL Amortization	<u>14.07%</u>	<u>14.65%</u>	<u>0.58%</u>
Actuarial Contribution	22.43%	23.27%	0.84%
Member Contribution Rate	<u>(1.50%)</u>	<u>(1.50%)</u>	0.00%
Employer Contribution Rate	20.93%	21.77%	0.84%

The change in the actuarial methods did not impact the actuarial accrued liability or the normal cost rate. Those changes are driven by changes in the actuarial assumptions. However, the change in actuarial methods did impact the actuarial value of assets and, therefore, the amount of the UAAL and the UAAL contribution rate. As shown above, the change in the asset smoothing method decreased the actuarial value of assets by \$2.4 million which increased the employer contribution rate by 0.01%. The change in the UAAL amortization policy, including 30-year amortization of the June 30, 2018 UAAL, decreased the employer contribution rate by 1.08%.

There were no changes to the plan provisions since the prior valuation. However, legislation passed in the 2017 session allowed the MOSERS Board of Trustees to establish a voluntary buy-out program prior to May 31, 2018 for terminated vested members (those who left state employment with a vested retirement benefit but prior to reaching retirement eligibility). The Board parameters for the buyout provided that eligible terminated-vested members could elect to cash out their future monthly retirement benefit in exchange for a one-time lump-sum payment equal to 60% of the actuarial present value of their retirement benefit amount (referred to as the “voluntary buyout program” in this report). According to data supplied by the System, over 4,300 terminated vested members participated in the voluntary buyout program with total payments of \$60.7 million. As a result, the actuarial accrued liability in the current valuation is lower by \$101.2 million, the unfunded actuarial accrued liability decreased by \$40.5 million and the actuarial contribution rate is lower by 0.14% of payroll.



## SECTION 1 – EXECUTIVE SUMMARY

### Key Valuation Results

The actuarial valuation results provide a “snapshot” view of the System’s financial condition on June 30, 2018. The UAAL for MSEP increased from \$4.280 billion last year to \$4.782 billion this year and the funded ratio decreased from 67.5% to 64.9%. In addition, the employer contribution rate increased from 20.21% of pay last year to 21.77% of pay in this year’s valuation, an increase of 1.56% of pay.

The most significant impact on the June 30, 2018 valuation results was the change in the economic assumptions and actuarial methods which increased the UAAL by \$354.3 million, the normal cost rate by 0.26%, and the employer contribution rate by 0.84%. The valuation results also reflect net unfavorable experience for the past plan year as demonstrated by an UAAL that was higher than expected (actual UAAL of \$4.782 billion compared to an expected UAAL of \$4.663 billion). The unfavorable experience was due to the combined impact of an actuarial loss on the actuarial value of assets and a net actuarial gain on liabilities. The more significant sources of liability gain were salary experience, mortality experience, and cost of living adjustments that were lower than assumed in the prior valuation.

A summary of the key results from the June 30, 2018 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, 2018	June 30, 2017
Unfunded Actuarial Accrued Liability (\$M)	\$4,782	\$4,280
Funded Ratio (Actuarial Assets)	64.90%	67.46%
Normal Cost Rate	8.62%	8.39%
UAAL Amortization Rate	14.65%	13.16%
Total Actuarial Required Contribution	23.27%	21.55%
Member Contribution Rate	(1.50%)	(1.34%)
Employer Contribution Rate	21.77%	20.21%

### Experience for the Last Plan Year

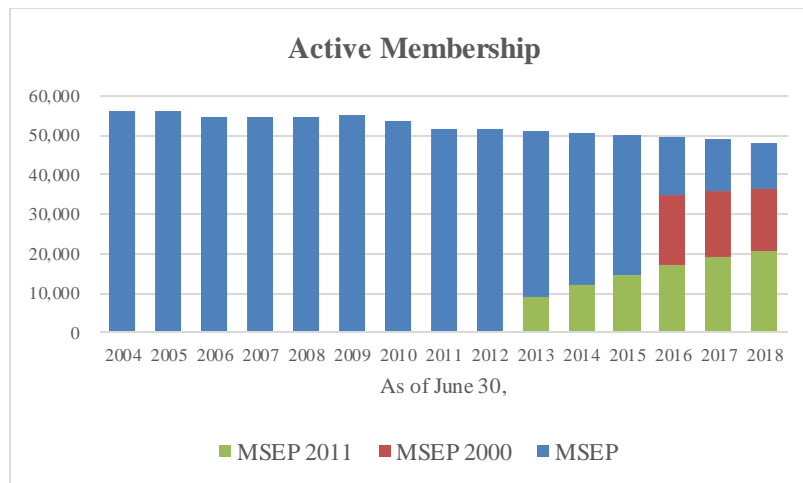
Numerous factors contributed to the change in the MSEP assets, liabilities, and actuarial required contribution rate between June 30, 2017 and June 30, 2018. The components are examined in the following discussion.

### Membership

There was a decline of 2.3% in the number of active members in this valuation (47,806) compared to 48,910 in the prior valuation. As shown in the following graph, there has been a decline of nearly 15% in the active membership over the last 15 years from 55,914 active members in the 2004 valuation to 47,806 in the current valuation. A decline in active membership typically constrains the growth of covered payroll and results in higher UAAL amortization contributions, as a percent of payroll.



## SECTION 1 – EXECUTIVE SUMMARY



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 18,893 in the 2017 valuation (about 39%) to 20,477 (about 43% of total) in the 2018 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 is covered by MSEP 2011.

As is expected in a mature retirement system, the number of members receiving benefits increased from 46,560 last year to 48,207 in the current valuation. In addition, the average benefit amount for this group also increased (1.3%).

### System Assets

As of June 30, 2018, MSEP had net assets of \$8.035 billion, when measured on a market value basis, an increase of \$90 million from the prior year value of \$7.945 billion.

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 smoothes the effect of market fluctuations, is applied to determine the value of assets used in the valuation. The resulting amount is called the actuarial value of assets. As of June 30, 2018, a new method is utilized for calculating the AVA. Under the new asset smoothing 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, the total unrecognized investment experience as of June 30, 2017 (\$927 million) is recognized evenly over a closed seven-year period beginning June 30, 2018. As a result of the new asset smoothing method, the actuarial value of assets in the current valuation is \$2.4 million lower than the value produced by the prior method. In this year's valuation, the actuarial value of assets for MSEP is \$8.830 billion, a decrease of \$42 million from the prior year. The components of the change in the asset values are shown in the following table:

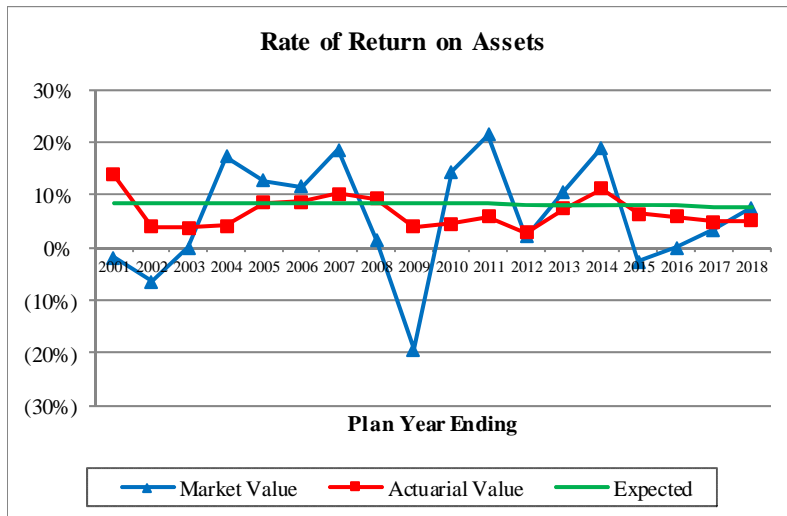




**SECTION 1 – EXECUTIVE SUMMARY**

	Market Value (\$M)	Actuarial Value (\$M)
<b>Net Assets, June 30, 2017</b>	\$ 7,945.36	\$ 8,872.38
- Asset Adjustment for GASB 75	- 3.71	- 3.71
- Employer and Member Contributions	+ 413.18	+ 413.18
- Benefit Payments	- 886.71	- 886.71
- Net Investment Income	+ 576.19	+ 445.07
- Administrative Expenses	- 9.80	- 9.80
<b>Net Assets, June 30, 2018</b>	\$ 8,034.51	\$ 8,830.41
Estimated Net Rate of Return	7.48%	5.16%

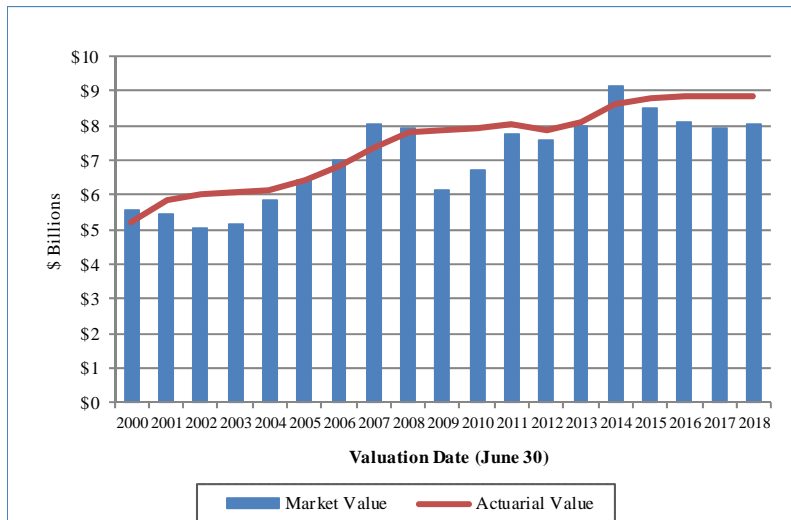
Due to the recognition of some of the deferred investment experience in the asset smoothing method, the estimated rate of return on the actuarial value of assets was 5.16%, which is lower than the investment return assumption of 7.50% for FY 2018. As a result, there was an actuarial loss on the smoothed value of assets of \$202.1 million. The investment return on the market value of assets for FY 2018 of 7.48% was very close to the assumed return, but produced a small shortfall of \$1.6 million. 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, either 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, 2018 in the following table:

	Actuarial Value of Assets	Market Value of Assets
Actuarial Accrued Liability	\$13,612,763,961	\$13,612,763,961
Value of Assets	<u>8,830,410,210</u>	<u>8,034,508,424</u>
Unfunded Actuarial Accrued Liability	\$4,782,353,751	\$5,578,255,537
Funded Ratio	64.87%	59.02%

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



## SECTION 1 – EXECUTIVE SUMMARY

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The net change in the UAAL from June 30, 2017 to June 30, 2018 was an increase of \$502.5 million. The components of this net change are shown in the following table:

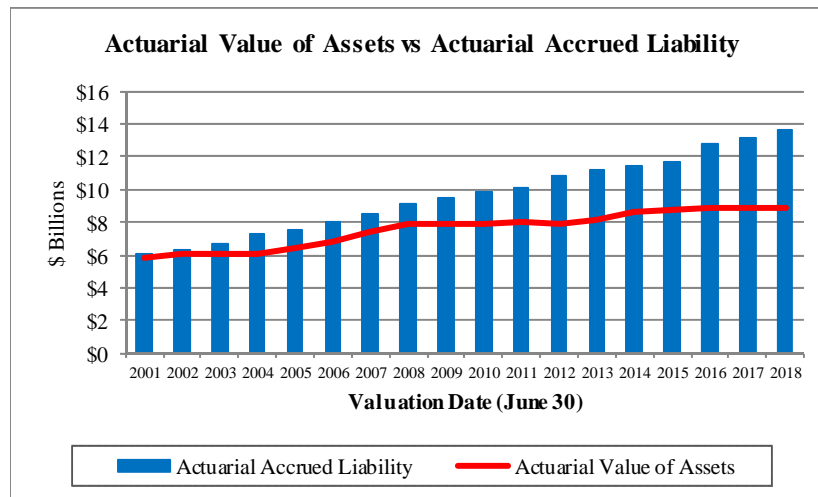
	(\$ Millions)
<b>Unfunded Actuarial Accrued Liability, June 30, 2017</b>	\$4,279.9
- Expected increase due to amortization method	62.8
- Impact of the Policy Minimum Employer Contribution Rate	0.0
- Investment experience	202.1
- Liability experience	(83.1)
- Change due to new economic assumptions	351.9
- Change due to revised asset smoothing method	2.4
- Impact of voluntary buyout program	(40.5)
- Other experience	<u>6.9</u>
<b>Unfunded Actuarial Accrued Liability, June 30, 2018</b>	\$4,782.4

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 \$119.0 million, the result of an actuarial loss of \$202.1 million on actuarial assets and an \$83.1 million actuarial gain on System liabilities. The liability gain was the net result of various components of actuarial gains and losses, the largest of which were gains from salary increases and cost of living adjustments that were lower than expected. 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 7.25%. 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).

	6/30/2013	6/30/2014	6/30/2015	6/30/2016	6/30/2017	6/30/2018
Using Actuarial Value of Assets:						
- Funded Ratio	72.7%	75.1%	75.0%	69.6%	67.5%	64.9%
- UAAL (\$M)	\$3,039	\$2,857	\$2,936	\$3,873	\$4,280	\$4,782
Using Market Value of Assets:						
- Funded Ratio	71.8%	79.5%	72.6%	63.6%	60.4%	59.0%
- UAAL (\$M)	\$3,141	\$2,358	\$3,211	\$4,641	\$5,207	\$5,578

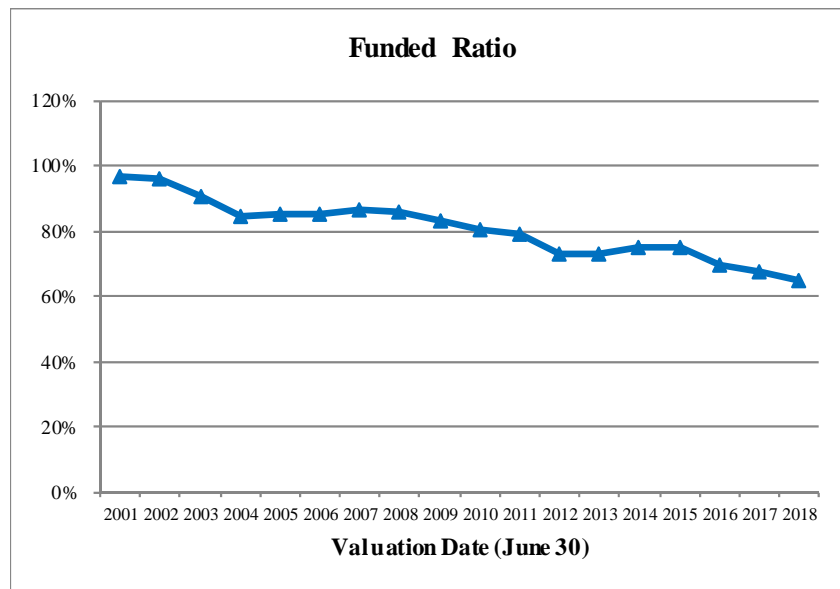
Note that the funded ratio does not indicate whether or not the System assets are sufficient to settle benefits earned to date. The funded ratio, by itself, also may not be indicative of future funding requirements. As shown in the table above, the funded ratios differ using the market value of assets.



## SECTION 1 – EXECUTIVE SUMMARY

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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 18 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.

### 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.

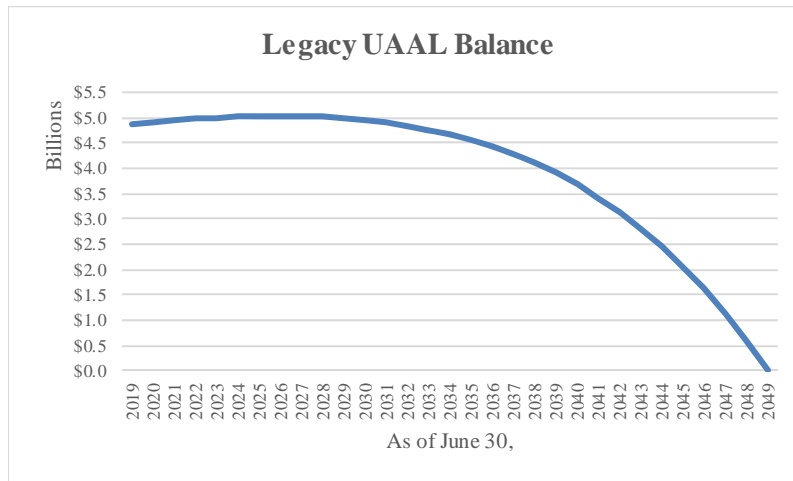
Effective with the June 30, 2018 valuation, the UAAL contribution rate is determined by amortizing the UAAL using the layered amortization method. To implement this method, the projected UAAL developed in the June 30, 2018 valuation is amortized as a level-percent of payroll over a closed, 30-year period. In subsequent years, 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 all actuarial assumptions are met.

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 initial years of the amortization period, but increase each year in the future with the assumed payroll growth assumption of 2.50%. Because the UAAL



**SECTION 1 – EXECUTIVE SUMMARY**

contribution rate is determined as a level-percent of payroll, the dollar amount of the UAAL contribution is scheduled to increase 2.50% 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. In addition, 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:



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*	
	2018	2017
1. Normal Cost Rate	8.62%	8.39%
2. UAAL Contribution Rate	14.65%	13.16%
3. Total Actuarial Required Contribution Rate	23.27%	21.55%
4. Member Contribution Rate	(1.50%)	(1.34%)
5. Employer Contribution Rate	21.77%	20.21%

\*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, 2018 valuation is 23.27%. The member contribution rate (as a percentage of total payroll) is anticipated to be 1.50%, resulting in an employer contribution rate for the fiscal year ending June 30, 2020 of 21.77%. This amount exceeds the minimum employer contribution rate of 16.97%, as required by the Funding Policy.



**SECTION 1 – EXECUTIVE SUMMARY**

The following table shows the reconciliation of the Computed Employer Contribution Rate from June 30, 2017 to June 30, 2018 valuation:

	<b>% of Payroll</b>
<b>6/30/2017 Computed Employer Contribution Rate</b>	<b>20.21%</b>
Asset (Gain)/Loss	0.68%
Liability (Gain)/Loss	(0.28%)
Economic Assumption Changes	1.91%
Change to Asset Smoothing Method	0.01%
Change to UAAL Amortization Method	(1.08%)
Projected Payroll Lower than Expected	0.64%
Impact of the Policy Minimum Employer Contribution Rate	0.00%
Change in Normal Cost Rate	(0.03%)
Change in Effective Employee Contribution Rate	(0.16%)
Voluntary buyout program	(0.14%)
Other Experience	0.01%
<b>6/30/2018 Computed Employer Contribution Rate</b>	<b>21.77%</b>

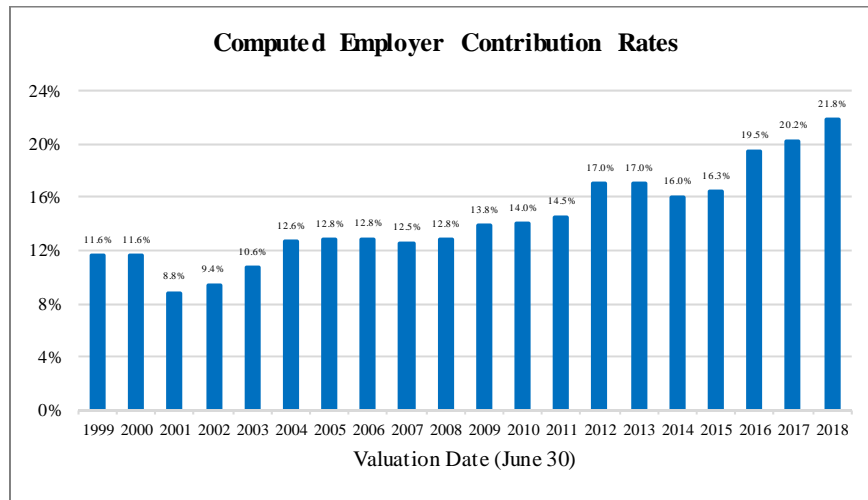
The state of Missouri has historically contributed the full actuarial contribution as shown in the table below which compares the actuarially determined employer contribution and actual contribution amounts:

<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	310.2	330.0	106.4%
June 30, 2017	322.8	335.2	103.8%
June 30, 2018	379.6	379.6	100.0%

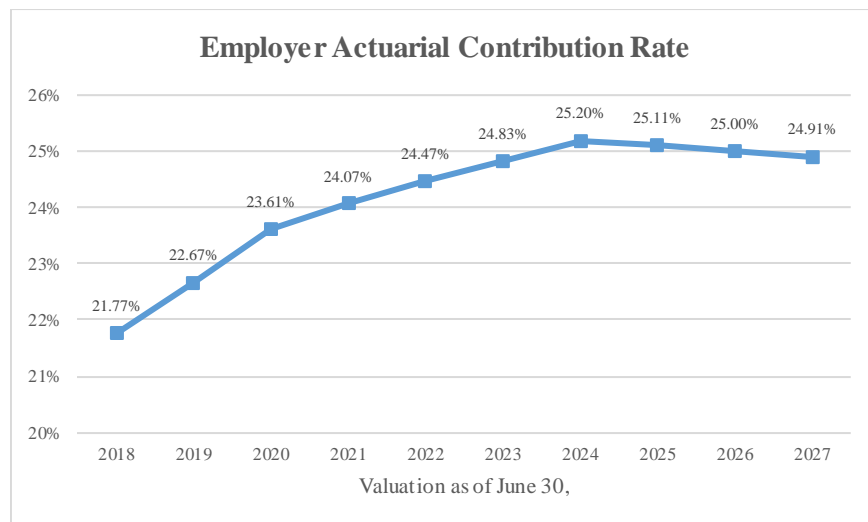


## SECTION 1 – EXECUTIVE SUMMARY

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 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 (\$796 million) and the step down in the investment return assumption to 6.95% over the next two valuations:



The deferred investment loss (actuarial value of assets greater than market value) is \$795.9 million as of June 30, 2018. 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





## SECTION 1 – EXECUTIVE SUMMARY

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method is a common procedure for public retirement systems, it is important to identify the potential impact of the deferred investment experience. This is accomplished by comparing the key valuation results from the June 30, 2018 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	\$13,612,763,961	\$13,612,763,961
Asset Value	<u>(8,830,410,210)</u>	<u>(8,034,508,424)</u>
Unfunded Actuarial Accrued Liability	\$4,782,353,751	\$5,578,255,537
Funded Ratio	64.9%	59.0%
Normal Cost Rate	8.62%	8.62%
UAAL Contribution Rate	<u>14.65%</u>	<u>17.22%</u>
Total Contribution Rate	23.27%	25.84%
Member Contribution Rate	<u>(1.50%)</u>	<u>(1.50%)</u>
Employer Contribution Rate	21.77%	24.34%

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, 2018</b>	<b>June 30, 2017</b>	
<b>Contribution for Fiscal Year Ending</b>	<b>June 30, 2020</b>	<b>June 30, 2019</b>	<b>% Change</b>
<b>Computed Employer Contribution</b>			
Annual Amount (Estimated)	\$445.9	\$422.7	5.5%
Percentage of Covered Payroll	21.77%	20.21%	7.7%
<b>Benefit Payments</b>	\$887	\$794	11.7%
<b>Membership</b>			
Number of			
- Active Members	47,806	48,910	(2.3%)
- Retirees and Beneficiaries	48,207	46,560	3.5%
- Terminated Vested Members	15,476	19,578	(21.0%)
- Leave-of-Absence Members	178	178	0.0%
- Long Term Disability Members	732	849	(13.8%)
- Terminated Nonvested Members*	15,619	3,899	300.6%
- Total	128,018	119,974	6.7%
- Reported Payroll	\$1,915	\$1,942	(1.4%)
<b>Assets</b>			
Market Value (MVA)	\$8,035	\$7,945	1.1%
Actuarial Value (AVA)	\$8,830	\$8,872	(0.5%)
Ratio - Actuarial Value to Market Value	109.89%	111.67%	
Return on Market Value	7.48%	3.45%	
Return on Actuarial Value	5.16%	4.97%	
<b>Actuarial Information</b>			
Actuarial Accrued Liability (AAL)	\$13,613	\$13,152	3.5%
Unfunded Actuarial Accrued Liability (UAAL)	\$4,782	\$4,280	11.7%
Funded Ratio	64.9%	67.5%	(3.9%)
Amortization Period	30 Years	27 years	
Ratio of AVA to Payroll	4.6	4.6	
Ratio of AAL to Payroll	7.1	6.8	
Normal Cost Rate	8.62%	8.39%	2.7%
UAAL Contribution Rate	14.65%	13.16%	11.3%
Total Contribution Rate	23.27%	21.55%	8.0%
Member Contribution Rate	(1.50%)	(1.34%)	11.9%
Employer Contribution Rate	21.77%	20.21%	7.7%

\* In the past, members who had terminated non-vested and had not yet been paid their contribution balance were being removed from the data. For this year and going forward, these members will be included.



## **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, 2018. 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 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, 2018. 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, 2017 and ending June 30, 2018.

### **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, 2017	7,945,358,298	8,872,381,848
2. Asset Adjustment for GASB 75	(3,707,898)	(3,707,898)
3. Adjusted Assets at June 30, 2017	7,941,650,400	8,868,673,950
4. Contributions		
State Contributions	379,557,962	379,557,962
Employee Contributions	28,303,994	28,303,994
Member Purchases of Service Credit	2,020,720	2,020,720
Service Transfer Contributions	3,297,251	3,297,251
Total	413,179,927	413,179,927
5. Investment Income, Net of Investment Expenses	576,188,826	445,067,062
6. Benefit Payments and Transfers Out		
Monthly Benefit Payments	733,750,284	733,750,284
BackDROP and Lump Sum Payments	84,357,196	84,357,196
Voluntary Buyout Program Payments	60,719,240	60,719,240
Inactive Vested Lump Sum Payments	322,018	322,018
Service Transfer Payments	2,060,037	2,060,037
Contribution Refunds	5,502,698	5,502,698
Total	886,711,473	886,711,473
7. Administrative and Misc. Expenses	9,799,256	9,799,256
8. Assets at June 30, 2018	8,034,508,424	8,830,410,210
(3) + (4) + (5) - (6) - (7)		
9. Rate of Return, Net of Investment Expenses*	7.48%	5.16%

\* 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



**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	\$ NA	\$ NA	\$ NA
B. Contributions During Year	413,179,927	NA	NA	NA
C. Benefit Payments and Expenses During Year	896,510,729	NA	NA	NA
D. Expected Rate of Return	7.50%	7.25%	7.10%	6.95%
E. Expected Net Investment Income	577,826,541	NA	NA	NA
F. Expected Market Value of Assets, End of Year	8,036,146,139	NA	NA	NA
G. Market Value of Assets, End of Year	8,034,508,424	NA	NA	NA
H. Excess/(Shortfall) of Net Investment Income	\$ (1,637,715)	\$ NA	\$ 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)	0	(132,431,936) *	(794,591,614)
6/30/2018	(1,637,715)	0	(327,543)	(1,310,172)
<b>Total</b>	<b>(928,661,265)</b>	<b>0</b>	<b>(132,759,479)</b>	<b>(795,901,786)</b>

A. Market Value of Assets as of June 30, 2018	\$ 8,034,508,424
B. Total Deferred Investment Experience	\$ (795,901,786)
C. Actuarial Value of Assets as of June 30, 2018 (A. - B.)	\$ 8,830,410,210
D. Ratio of Actuarial Value to Market Value	109.9%

\* 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, 2018. 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, 2018, as amended by any legislation in the 2018 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, 2018

Table with 4 columns: Description, (1) Actuarial Present Value, (2) Present Value of Future Normal Cost Contributions, and (3) = (1) - (2) Actuarial Accrued Liabilities. Rows include Active Members (Service retirement, Disability, Survivor, Separation), Members on Leave of Absence & LTD, Terminated Vested Members, Retired Lives, Pending Refunds, Total Actuarial Accrued Liability, Actuarial Value of Assets, Unfunded Actuarial Accrued Liability, and Funded Ratio.





**SECTION 4 – SYSTEM LIABILITIES**

**TABLE 4  
AMORTIZATION SCHEDULE FOR LEGACY UAAL**

This amortization schedule for the projected UAAL at June 30, 2019 reflects the underlying assumptions used in this valuation including an investment return assumption of 7.25% and the assumed payroll growth of 2.50%. Any change in these assumptions in the future, will impact the projected UAAL contribution schedule for the legacy UAAL.

As of June 30	Unfunded Actuarial Accrued Liability (BOY)	Amortization Years Remaining	Contributions (\$M)
2019	4,862	30	300
2020	4,903	29	308
2021	4,940	28	315
2022	4,972	27	323
2023	4,998	26	331
2024	5,017	25	339
2025	5,029	24	348
2026	5,033	23	357
2027	5,028	22	366
2028	5,014	21	375
2029	4,990	20	384
2030	4,954	19	394
2031	4,905	18	404
2032	4,843	17	414
2033	4,766	16	424
2034	4,672	15	435
2035	4,561	14	445
2036	4,430	13	457
2037	4,279	12	468
2038	4,104	11	480
2039	3,905	10	492
2040	3,679	9	504
2041	3,424	8	517
2042	3,137	7	529
2043	2,816	6	543
2044	2,458	5	556
2045	2,060	4	570
2046	1,619	3	584
2047	1,131	2	599
2048	593	1	614
2049	0	0	0



**SECTION 4 – SYSTEM LIABILITIES**

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**TABLE 5  
ACTUARIAL BALANCE SHEET**

ASSETS

Actuarial Value of Assets	\$	8,830,410,210
Unfunded Actuarial Accrued Liability		4,782,353,751
Present Value of Future Normal Costs		<u>1,008,188,427</u>
Total Assets	\$	14,620,952,388

LIABILITIES

Present Value of Future Benefits

Active members

Retirement	\$	5,333,470,332	
Withdrawal		224,061,215	
Death		63,062,882	
Disability		<u>158,683,272</u>	
Total	\$		5,779,277,701

Inactive members

Currently receiving benefits		8,073,692,664	
Not currently receiving benefits		<u>767,982,023</u>	
Total	\$		8,841,674,687

Total Liabilities	\$	14,620,952,388
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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	\$ 13,152,273,895	\$ 8,872,381,848	\$ 4,279,892,047
(2) Asset adjustment for GASB 75	<u>0</u>	<u>(3,707,898)</u>	<u>3,707,898</u>
(3) Adjusted value at start of year	13,152,273,895	8,868,673,950	4,283,599,945
(4) Total normal cost from last valuation	146,373,934	0	146,373,934
(5) Actual contributions (Employer and Member)	0	407,861,956	(407,861,956)
(6) Benefit payments	(825,992,233)	(825,992,233)	0
(7) Administrative expenses	0	(9,799,256)	9,799,256
(8) Service Purchases/Transfers	5,317,971	5,317,971	0
(9) Interest on (3), (4), (5), (6), (7) and (8) at 7.50%	<u>967,179,664</u>	<u>649,589,115</u>	<u>317,590,549</u>
(10) Expected value before changes	\$ 13,445,153,231	\$ 9,095,651,503	\$ 4,349,501,728
(11) Change from voluntary buyout program	(101,198,733)	(60,719,240)	(40,479,493)
(12) Change in actuarial assumptions and methods	<u>351,899,973</u>	<u>(2,386,506)</u>	<u>354,286,479</u>
(13) Expected value after changes: (10) + (11) + (12)	\$ 13,695,854,471	\$ 9,032,545,757	\$ 4,663,308,714
(14) Actual value at end of year	13,612,763,961	8,830,410,210	4,782,353,751
(15) Gain / (Loss)	\$ 83,090,510	\$ (202,135,547)	\$ (119,045,037)
(16) Gain / (Loss) as percent of expected actuarial accrued liability: \$13,445,153,231	0.6%	(1.5%)	(0.9%)



SECTION 4 – SYSTEM LIABILITIES

TABLE 7  
GAIN/(LOSS) ANALYSIS BY SOURCE

Type of Activity	Gain or (Loss) for Year Ended 6/30/2018	
<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.	(\$51,800,000)	(0.4%)
<b>Death-in-Service Benefits.</b> If survivor claims are less than assumed, there is a gain. If more claims, there is a loss.	7,200,000	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.	(38,000,000)	(0.3%)
<b>Long Term Disability.</b> The occurrence of a gain or loss depends upon the age at disability and the incidence of disability.	(900,000)	(0.0%)
<b>Pay Increases.</b> If there are smaller pay increases than assumed, there is a gain. If greater increases, a loss.	85,300,000	0.6%
<b>Investment Income.</b> If there is greater investment return on assets than assumed, there is a gain. If less return, a loss.	(202,100,000)	(1.5%)
<b>Retiree Mortality.</b> If more deaths than assumed, there is a gain. If fewer deaths, a loss.	20,100,000	0.1%
<b>COLAs.</b> If Cost of Living Adjustments are less than expected, a gain, if more a loss.	43,300,000	0.3%
<b>Other.</b> Miscellaneous gains and losses resulting from data adjustments, timing of financial transactions, valuation methods, etc.	17,900,000	0.1%
<b>Gain (or Loss) During Year From Experience</b>	(\$119,000,000)	(0.9%)



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
<b>2018***</b>	<b>85.3</b>	<b>(202.1)</b>	<b>(51.8)</b>	<b>(0.9)</b>	<b>7.2</b>	<b>(38.0)</b>	<b>20.1</b>	<b>43.3</b>	<b>17.9</b>	<b>(119.0)</b>	<b>(0.9)</b>	<b>13,152</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, 2018 actuarial valuation will be used to determine the employer contribution rate for the plan year ending June 30, 2020. 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, 2019 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, 2019**

(1) Unfunded Actuarial Accrued Liability at June 30, 2018	4,782,353,751
(2) Expected Contribution Rate for Year Ending June 30, 2019*	21.55%
(3) Normal Cost Rate for Year Ending June 30, 2019	8.62%
(4) Contribution Rate Applied to UAAL [(2) - (3)]	12.93%
(5) Projected Payroll for the Year After the Valuation Date	1,998,179,932
(6) Expected UAAL Contribution [(4) * (5)]	258,364,665
(7) Interest on (1) and (6) to June 30, 2019 at 7.25%	337,518,793
(8) Projected UAAL at June 30, 2019 [(1) - (6) + (7)]	4,861,507,879

\*The Total Contribution Rate was the employer rate of 20.21% plus the weighted average member rate of 1.34% of payroll.



SECTION 5 – EMPLOYER CONTRIBUTIONS

**TABLE 10**  
**UAAL CONTRIBUTION RATE**

<b>Amortization Base</b>	<b>Original Amount</b>	<b>Remaining Payments</b>	<b>Projected June 30, 2019 Balance</b>	<b>Annual Payment*</b>
2018 Legacy UAAL	4,861,507,879	30	4,861,507,879	300,075,158
<b>Total</b>			<b>\$ 4,861,507,879</b>	<b>\$ 300,075,158</b>

\* Payment amount reflects mid-year timing.

1. Total UAAL Amortization Payments	\$ 300,075,158
2. Expected Payroll for FYE 2020	\$ 2,048,134,430
3. UAAL Amortization Payment Rate (1) / (2)	14.65%





**SECTION 5 – EMPLOYER CONTRIBUTIONS**

**TABLE 11  
COMPUTED EMPLOYER CONTRIBUTION RATE  
FOR THE FISCAL YEAR ENDING JUNE 30, 2020**

**ACTUARIAL VALUATION RESULTS AS OF JUNE 30, 2018**

	Percents of Payroll		Weighted Average
	<u>MSEP &amp; MSEP 2000</u>	<u>MSEP 2011</u>	
A. Normal Cost			
(1) Service retirement benefits	6.64 %	4.98 %	6.01 %
(2) Termination benefits	0.98	1.55	1.19
(3) Survivor benefits	0.13	0.14	0.14
(4) Disability benefits	0.79	0.78	0.79
(5) Administrative expenses	0.49	0.49	0.49
(6) Total	<u>9.03</u>	<u>7.94</u>	<u>8.62</u>
B. Less Member Contributions	0.00	4.00	1.50
C. Employer Normal Cost [A(6) - B]	9.03	3.94	7.12
D. Unfunded Actuarial Accrued Liabilities (UAAL) (level percent-of-payroll amortization with layered bases)			<u>14.65</u>
<b>E. TOTAL COMPUTED EMPLOYER CONTRIBUTION RATE [C. + D.]</b>			<b>21.77 %</b>
<b>F. POLICY MINIMUM EMPLOYER CONTRIBUTION RATE</b>			<b>16.97 %</b>
<b>G. ESTIMATED EMPLOYER CONTRIBUTION (\$Millions)#</b>			<b>\$445.9</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 2.50% per year.



**TABLE 12  
COMPARISON OF VALUATION RESULTS UNDER ALTERNATE  
INVESTMENT RETURN ASSUMPTIONS**

<b>Investment Return Assumption</b>	<b>6.25%</b>	<b>6.75%</b>	<b>7.25%</b>	<b>7.75%</b>	<b>8.25%</b>
<b>Contributions</b>					
Total Normal Cost	10.88%	9.67%	8.62%	7.71%	6.93%
Member Contributions	1.50%	1.50%	1.50%	1.50%	1.50%
Employer Normal Cost	9.38%	8.17%	7.12%	6.21%	5.43%
Unfunded Actuarial Accrued Liability	17.39%	16.05%	14.65%	13.21%	11.72%
<b>Total Employer Contribution</b>	<b>26.77%</b>	<b>24.22%</b>	<b>21.77%</b>	<b>19.42%</b>	<b>17.15%</b>
<b>Total Employer Contribution (\$ in millions)</b>	<b>\$548.3</b>	<b>\$496.1</b>	<b>\$445.9</b>	<b>\$397.7</b>	<b>\$351.3</b>
<b>Actuarial Value of Assets</b>	<b>\$8,830.4</b>	<b>\$8,830.4</b>	<b>\$8,830.4</b>	<b>\$8,830.4</b>	<b>\$8,830.4</b>
<b>Actuarial Accrued Liability</b>	<b>\$15,160.3</b>	<b>\$14,352.2</b>	<b>\$13,612.8</b>	<b>\$12,934.6</b>	<b>\$12,311.5</b>
<b>Funded Ratio</b>	<b>58.2%</b>	<b>61.5%</b>	<b>64.9%</b>	<b>68.3%</b>	<b>71.7%</b>

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



## SECTION 6 – PROJECTIONS

The June 30, 2018 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, but such projections are not included in 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, 2018. 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 less costly 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.***

These projections 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 Board will not take action to change the current phase-in of assumptions. 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, 2018 will make employee contributions and be 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.



SECTION 6 – PROJECTIONS

**TABLE 13**  
**30-YEAR PROJECTION OF ACTUARIAL VALUATION RESULTS**  
**AS OF JUNE 30, 2018**

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 Contribution* (12)
2018	\$1,998,180	\$13,612,764	\$8,830,410	\$4,782,354	64.9%	8.62%	14.65%	23.27%	1.50%	21.77%	\$435,579
2019	2,000,822	13,938,272	8,819,936	5,118,336	63.3%	8.52%	15.84%	24.36%	1.69%	22.67%	455,775
2020	2,010,477	14,269,355	8,810,080	5,459,275	61.7%	8.51%	16.97%	25.48%	1.87%	23.61%	479,540
2021	2,031,088	14,464,307	8,784,365	5,679,943	60.7%	8.38%	17.72%	26.10%	2.03%	24.07%	493,582
2022	2,050,612	14,621,853	8,746,119	5,875,734	59.8%	8.22%	18.45%	26.67%	2.20%	24.47%	507,693
2023	2,074,758	14,764,355	8,709,714	6,054,640	59.0%	8.09%	19.11%	27.20%	2.37%	24.83%	521,524
2024	2,100,379	14,884,749	8,667,647	6,217,103	58.2%	7.99%	19.74%	27.73%	2.53%	25.20%	536,901
2025	2,130,560	14,982,215	8,753,612	6,228,603	58.4%	7.90%	19.89%	27.79%	2.68%	25.11%	543,750
2026	2,165,470	15,052,813	8,833,248	6,219,566	58.7%	7.80%	20.00%	27.80%	2.80%	25.00%	548,927
2027	2,195,708	15,083,368	8,885,249	6,198,118	58.9%	7.70%	20.15%	27.85%	2.94%	24.91%	555,876
2028	2,231,536	15,089,115	8,924,205	6,164,910	59.1%	7.62%	20.26%	27.88%	3.07%	24.81%	563,167
2029	2,269,919	15,077,766	8,959,369	6,118,397	59.4%	7.52%	20.34%	27.86%	3.19%	24.67%	570,650
2030	2,313,133	15,043,783	8,987,047	6,056,736	59.7%	7.45%	20.38%	27.83%	3.29%	24.54%	578,904
2031	2,359,021	14,988,479	9,008,705	5,979,774	60.1%	7.37%	20.41%	27.78%	3.38%	24.40%	586,246
2032	2,402,646	14,902,439	9,015,824	5,886,615	60.5%	7.28%	20.46%	27.74%	3.47%	24.27%	595,003
2033	2,451,599	14,797,392	9,020,805	5,776,587	61.0%	7.22%	20.48%	27.70%	3.55%	24.15%	604,311
2034	2,502,322	14,686,285	9,038,330	5,647,955	61.5%	7.16%	20.49%	27.65%	3.63%	24.02%	614,050
2035	2,556,412	14,561,765	9,063,367	5,498,398	62.2%	7.12%	20.48%	27.60%	3.69%	23.91%	625,208
2036	2,614,838	14,434,274	9,107,205	5,327,068	63.1%	7.08%	20.44%	27.52%	3.75%	23.77%	634,685
2037	2,670,110	14,290,727	9,158,994	5,131,733	64.1%	7.04%	20.44%	27.48%	3.79%	23.69%	647,004
2038	2,731,129	14,147,179	9,235,501	4,911,677	65.3%	7.00%	20.41%	27.41%	3.84%	23.57%	658,659
2039	2,794,482	14,010,478	9,347,099	4,663,379	66.7%	6.97%	20.37%	27.34%	3.88%	23.46%	670,871
2040	2,859,637	13,877,009	9,492,154	4,384,855	68.4%	6.95%	20.32%	27.27%	3.90%	23.37%	684,499
2041	2,928,963	13,761,578	9,686,919	4,074,660	70.4%	6.92%	20.26%	27.18%	3.92%	23.26%	697,163
2042	2,997,261	13,656,535	9,926,765	3,729,770	72.7%	6.90%	20.21%	27.11%	3.94%	23.17%	711,184
2043	3,069,416	13,569,414	10,221,083	3,348,331	75.3%	6.88%	20.15%	27.03%	3.95%	23.08%	725,261
2044	3,142,377	13,502,400	10,575,655	2,926,745	78.3%	6.86%	20.10%	26.96%	3.97%	22.99%	739,583
2045	3,216,975	13,452,230	10,989,926	2,462,304	81.7%	6.85%	20.05%	26.90%	3.97%	22.93%	755,590
2046	3,295,203	13,428,322	11,476,418	1,951,904	85.5%	6.83%	19.98%	26.81%	3.98%	22.83%	769,946
2047	3,372,518	13,422,624	12,031,066	1,391,557	89.6%	6.82%	19.94%	26.76%	3.99%	22.77%	786,631

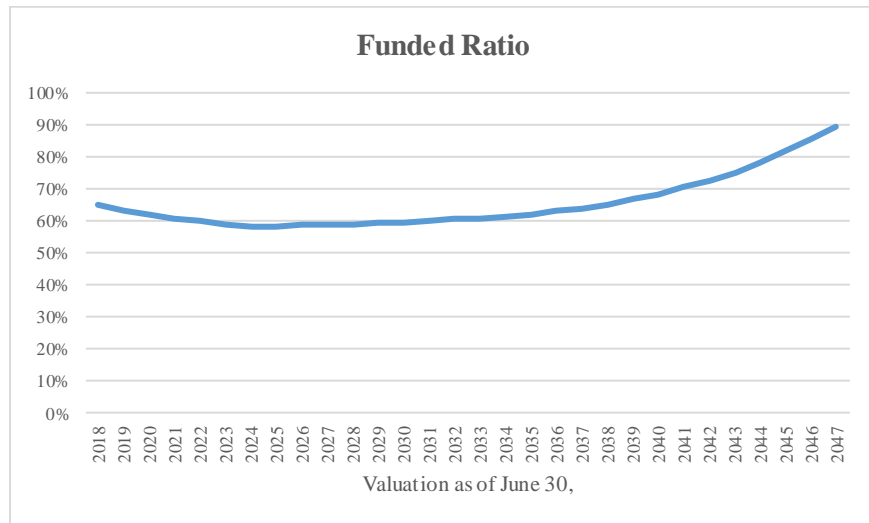
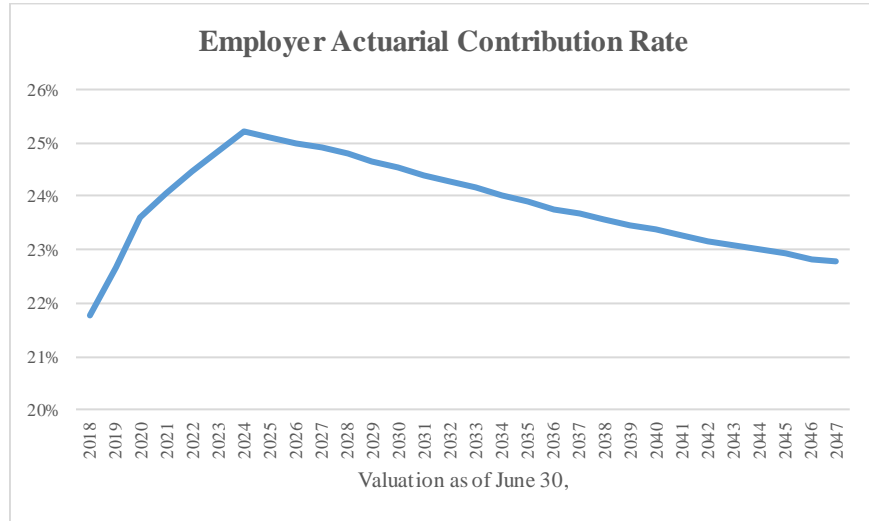
\* Amounts shown are contributions in the fiscal year ending two years after the valuation date.

Note: Projections assume phase-in of assumptions until an investment return assumption of 6.95% is reached with the June 30, 2020 valuation. Projections also assume the active population remains constant over the projection period.



**TABLE 13**  
**30-YEAR PROJECTION OF ACTUARIAL VALUATION RESULTS**  
**AS OF JUNE 30, 2018**

(continued)

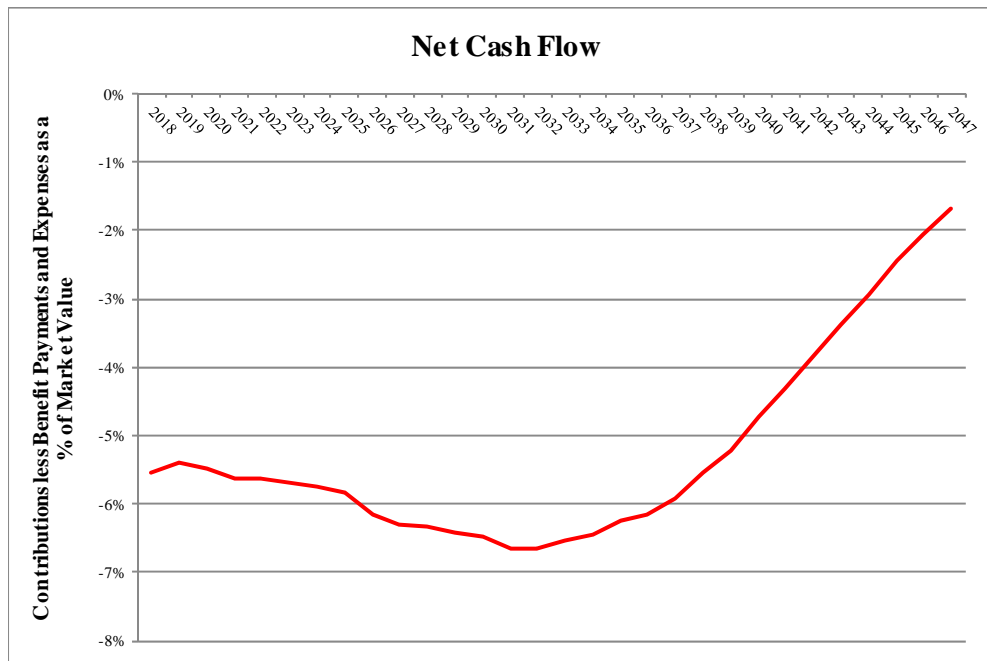




SECTION 6 – PROJECTIONS

**TABLE 14**  
**30-YEAR PROJECTION OF NET CASH FLOWS**  
**AS OF JUNE 30, 2018**

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)
2018	\$430,608	\$864,953	\$10,044	(\$444,389)	\$8,034,508	(5.53%)
2019	465,591	896,158	10,280	(440,847)	8,156,794	(5.40%)
2020	489,752	932,160	10,512	(452,920)	8,279,697	(5.47%)
2021	517,521	979,003	10,748	(472,230)	8,386,742	(5.63%)
2022	535,210	1,001,339	10,990	(477,119)	8,481,255	(5.63%)
2023	553,338	1,031,149	11,237	(489,048)	8,577,283	(5.70%)
2024	571,303	1,059,187	11,490	(499,374)	8,667,647	(5.76%)
2025	590,804	1,090,328	11,749	(511,272)	8,753,612	(5.84%)
2026	601,784	1,133,116	12,013	(543,345)	8,833,248	(6.15%)
2027	610,407	1,157,578	12,283	(559,455)	8,885,249	(6.30%)
2028	621,483	1,174,662	12,560	(565,739)	8,924,205	(6.34%)
2029	632,853	1,195,353	12,842	(575,341)	8,959,369	(6.42%)
2030	644,439	1,214,329	13,131	(583,022)	8,987,047	(6.49%)
2031	656,516	1,241,625	13,427	(598,536)	9,008,705	(6.64%)
2032	667,455	1,254,809	13,729	(601,082)	9,015,824	(6.67%)
2033	680,074	1,255,323	14,038	(589,287)	9,020,805	(6.53%)
2034	693,143	1,261,991	14,353	(583,201)	9,038,330	(6.45%)
2035	706,848	1,258,875	14,676	(566,703)	9,063,367	(6.25%)
2036	721,695	1,268,651	15,007	(561,962)	9,107,205	(6.17%)
2037	734,814	1,261,010	15,344	(541,540)	9,158,994	(5.91%)
2038	750,514	1,247,576	15,689	(512,751)	9,235,501	(5.55%)
2039	765,967	1,237,823	16,042	(487,898)	9,347,099	(5.22%)
2040	781,825	1,215,001	16,403	(449,580)	9,492,154	(4.74%)
2041	798,728	1,201,032	16,772	(419,076)	9,686,919	(4.33%)
2042	814,656	1,180,028	17,150	(382,523)	9,926,765	(3.85%)
2043	832,119	1,158,622	17,536	(344,039)	10,221,083	(3.37%)
2044	849,384	1,141,595	17,930	(310,141)	10,575,655	(2.93%)
2045	867,296	1,117,109	18,334	(268,146)	10,989,926	(2.44%)
2046	886,410	1,102,599	18,746	(234,936)	11,476,418	(2.05%)
2047	904,172	1,086,917	19,168	(201,913)	12,031,066	(1.68%)





## **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 7 – OTHER INFORMATION

TABLE 15  
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%

\* Revision in actuarial assumptions and methods.

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





**TABLE 16**  
**HISTORICAL EMPLOYER CONTRIBUTIONS**

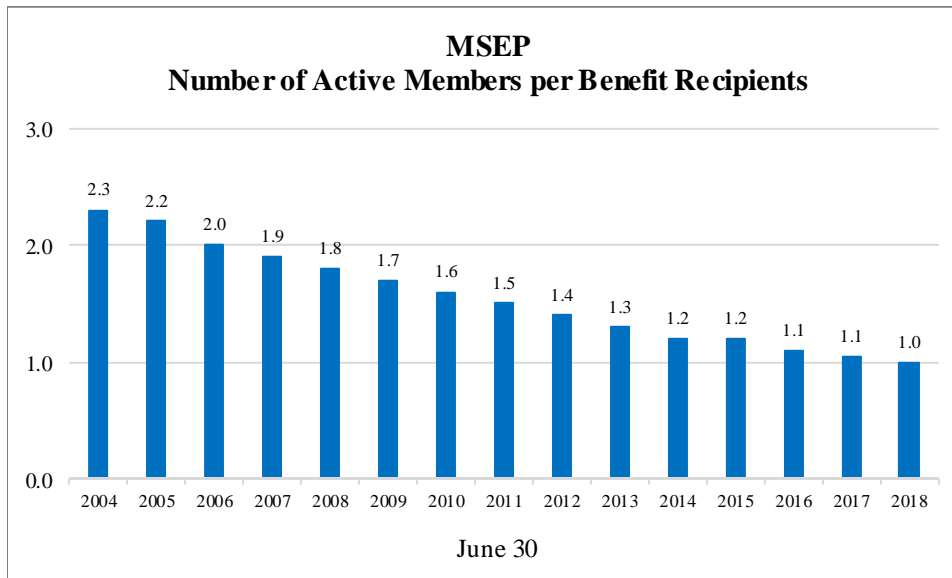
<b>Fiscal Year Ending</b>	<b>Actuarially Determined Employer Contribution</b>	<b>Actual Dollar Amount</b>	<b>Percent Contributed</b>
June 30, 2005	\$195.6	\$195.6	100.0%
June 30, 2006	227.2	227.2	100.0%
June 30, 2007	239.5	239.5	100.0%
June 30, 2008	249.8	249.8	100.0%
June 30, 2009	252.1	252.1	100.0%
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	310.2	330.0	106.4%
June 30, 2017	322.8	335.2	103.8%
June 30, 2018	379.6	379.6	100.0%



SECTION 7 – OTHER INFORMATION

**TABLE 16  
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





**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, 2017	48,910	19,578	3,899	178	849	46,560	119,974
Changes in status:							
a) Retirement	(1,833)	(716)	0	(2)	(97)	2,648	0
b) Death	(97)	(55)	(1)	0	(23)	(1,444)	(1,620)
c) Non-vested termination	(2,487)	0	2,539	(34)	(18)	0	0
d) Leave of absence	(132)	(1)	(1)	134	0	0	0
e) Vested termination	(1,218)	1,304	0	(14)	(72)	0	0
f) Contribution refund	(1,150)	(4,351)	(693)	(18)	(8)	0	(6,220)*
g) Beneficiary in receipt	0	0	0	0	0	474	474
h) Long-term disability	(89)	(11)	0	(9)	109	0	0
i) Disability retirement	0	0	0	0	0	0	0
j) Return to active service	481	(255)	(132)	(68)	(6)	(20)	0
k) Expired benefit	0	0	0	0	0	(23)	(23)
l) Transfer to MPERS	(44)	(19)	0	0	0	0	(63)
m) Data adjustment	<u>(16)</u>	<u>2</u>	<u>8,049**</u>	<u>(3)</u>	<u>(2)</u>	<u>12</u>	<u>8,042</u>
Total changes in status	(6,585)	(4,102)	9,761	(14)	(117)	1,647	590
New entrants	<u>5,481</u>	<u>0</u>	<u>1,959</u>	<u>14</u>	<u>0</u>	<u>0</u>	<u>7,454</u>
Net Change	(1,104)	(4,102)	11,720	0	(117)	1,647	8,044
As of June 30, 2018	47,806	15,476	15,619	178	732	48,207	128,018

\* Includes members who participated in the voluntary buyout program.

\*\* In the past, members who had terminated non-vested and had not yet been paid their contribution balance were being removed from the data. For this year and going forward, these members will be included.



**APPENDIX A – MEMBERSHIP DATA**

**SUMMARY OF MEMBERSHIP DATA**

<b>A. ACTIVE MEMBERS</b>	<b>June 30, 2018</b>	<b>June 30, 2017</b>	<b>% Change</b>
1. Number of Active Members			
(a) MSEP	11,394	12,977	(12.2)
(b) MSEP 2000	15,935	16,950	(6.0)
(c) MSEP 2011	20,477	18,983	7.9
(d) Total	<u>47,806</u>	<u>48,910</u>	(2.3)
2. Annualized Reported Salary			
(a) MSEP	\$ 543,062,272	\$ 611,186,626	(11.1)
(b) MSEP 2000	654,529,970	679,044,458	(3.6)
(c) MSEP 2011	717,550,760	651,738,702	10.1
(d) Total	<u>\$ 1,915,143,002</u>	<u>\$ 1,941,969,786</u>	(1.4)
3. Accumulated Member Contributions	\$ 81,836,680	\$ 62,971,479	30.0
4. Active Member Averages			
(a) Age	45.4	45.4	0.0
(b) Service	10.9	11.0	(0.9)
(c) Compensation	\$ 40,061	\$ 39,705	0.9
<b>B. INACTIVE MEMBERS</b>			
1. Number of Inactive Members			
(a) Terminated vested	15,476	19,578	(21.0)
(b) Terminated nonvested (refund only)	15,619	3,899	300.6
(c) Leave of absence	178	178	0.0
(d) Long-term disability	732	849	(13.8)
(e) Total	<u>32,005</u>	<u>24,504</u>	30.6
2. Accumulated Member Contributions	\$ 21,947,834	\$ 7,442,984	194.9
3. Inactive Member Averages			
(a) Age (vesteds only)	48.9	48.4	1.0
(b) Monthly benefit	\$ 521	\$ 487	7.0
(c) Accumulated member contributions	\$ 686	\$ 304	125.7
<b>C. RETIREES, DISABLEDS, AND BENEFICIARIES</b>			
1. Number of Members			
(a) Service retirees and disableds	42,837	41,365	3.6
(b) Beneficiaries	5,370	5,195	3.4
(c) Total	<u>48,207</u>	<u>46,560</u>	3.5
2. Total Monthly Benefits			
(a) Service retirees and disableds	\$ 56,747,183	\$ 54,121,380	4.9
(b) Beneficiaries	5,325,471	5,061,637	5.2
(c) Total	<u>\$ 62,072,654</u>	<u>\$ 59,183,017</u>	4.9



**APPENDIX A – MEMBERSHIP DATA**

**MEMBERSHIP DATA BY GROUP**

Valuation Group	Number	Payroll	Group Averages		
			Salary	Age(yrs.)	Service(yrs.)
Regular State Employees	45,288	\$ 1,771,249,595	\$ 39,111	45.1	10.6
Elected Officials	6	659,976	109,996	45.0	2.2
Legislative Clerks	10	348,806	34,881	67.2	19.8
Legislators	192	6,907,919	35,979	52.8	5.5
Uniformed Water Patrol	10	704,722	70,472	42.0	16.2
Conservation Department	1,359	60,574,106	44,573	44.5	14.1
School-Term Salaried Employees	923	72,540,065	78,592	57.9	22.0
Administrative Law Judges	18	2,157,813	119,879	60.4	23.8
<b>Total MSEP</b>	<b>47,806</b>	<b>\$ 1,915,143,002</b>	<b>\$ 40,061</b>	<b>45.4</b>	<b>10.9</b>

The total number of System active members includes 11,394 MSEP members, 15,935 MSEP 2000 members and 20,477 MSEP 2011 members.

Type of Benefit Payment	No.	Monthly Benefit	Group Averages	
			Benefit	Age(yrs.)
Retirement	42,836	\$ 56,746,996	\$ 1,325	70.1
Disability	1	187	187	62.0
Survivor of Active Member	1,720	1,558,511	906	62.8
Survivor of Retired Member	3,650	3,766,960	1,032	75.7
<b>Total MSEP</b>	<b>48,207</b>	<b>\$ 62,072,654</b>	<b>\$ 1,288</b>	<b>70.3</b>

This valuation also includes 15,476 terminated vested members, 15,619 terminated members who have a refund pending, 178 members on leave and 732 members on long-term disability.

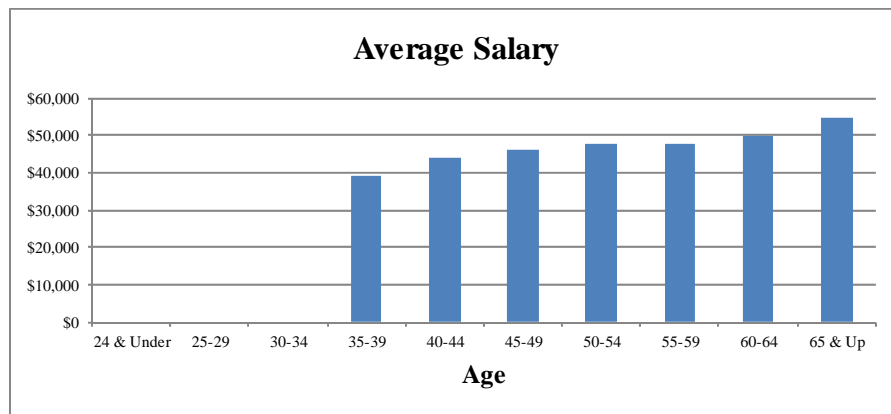
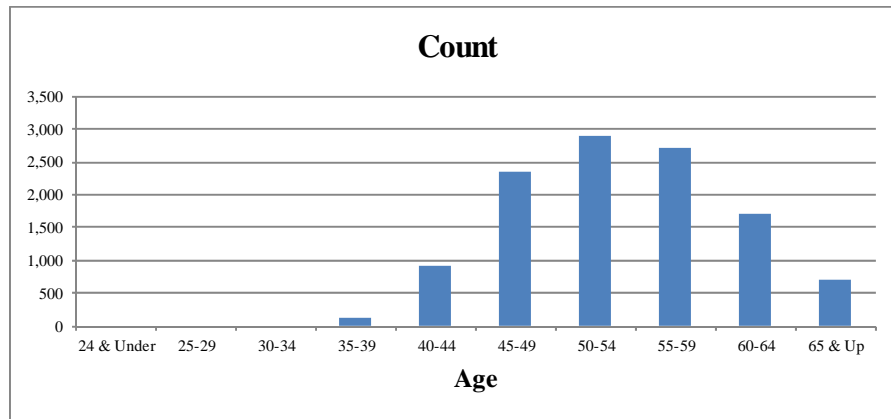


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2018**

**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	30	90	120	1,244,588	3,466,526	4,711,114
40-44	308	605	913	14,058,731	25,965,183	40,023,914
45-49	834	1,504	2,338	40,678,967	66,615,986	107,294,953
50-54	1,090	1,805	2,895	56,309,186	81,296,513	137,605,699
55-59	1,061	1,639	2,700	56,908,214	72,074,106	128,982,320
60-64	718	1,002	1,720	41,295,709	44,588,518	85,884,227
65 & Up	<u>300</u>	<u>408</u>	<u>708</u>	<u>19,426,881</u>	<u>19,133,164</u>	<u>38,560,045</u>
Total	4,341	7,053	11,394	\$ 229,922,276	\$ 313,139,996	\$ 543,062,272



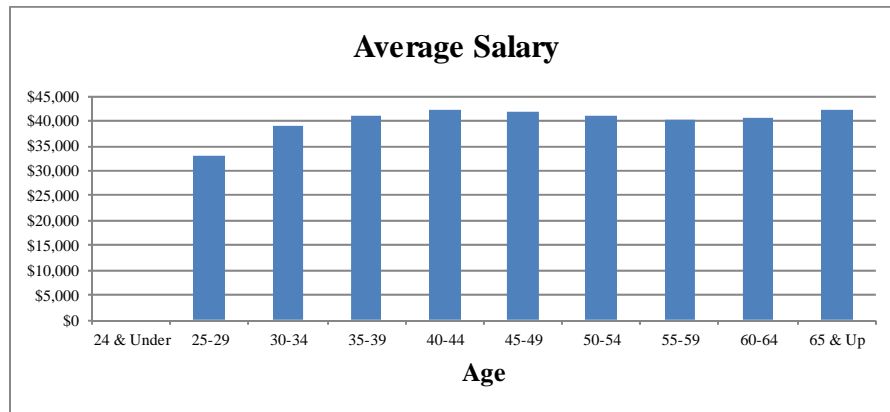
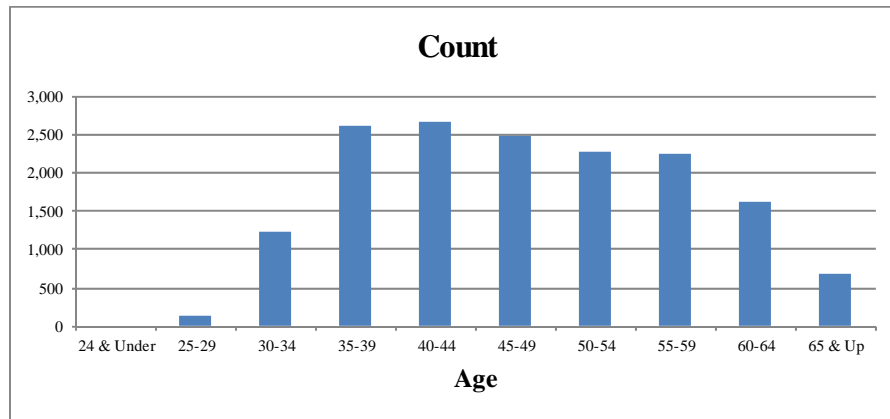


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2018**

**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	44	86	130	1,425,708	2,879,121	4,304,829
30-34	507	720	1,227	20,841,442	26,808,240	47,649,682
35-39	1,011	1,598	2,609	43,026,648	64,425,375	107,452,023
40-44	1,027	1,638	2,665	45,642,904	67,186,209	112,829,113
45-49	959	1,523	2,482	44,358,016	59,778,536	104,136,552
50-54	854	1,416	2,270	38,302,339	54,782,429	93,084,768
55-59	874	1,376	2,250	38,364,621	52,303,218	90,667,839
60-64	610	1,000	1,610	27,432,707	37,769,600	65,202,307
65 & Up	<u>326</u>	<u>366</u>	<u>692</u>	<u>15,425,553</u>	<u>13,777,304</u>	<u>29,202,857</u>
Total	6,212	9,723	15,935	\$ 274,819,938	\$ 379,710,032	\$ 654,529,970



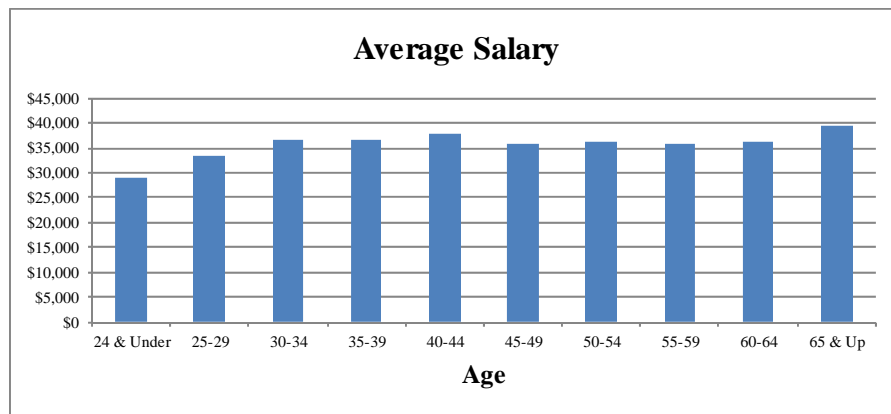
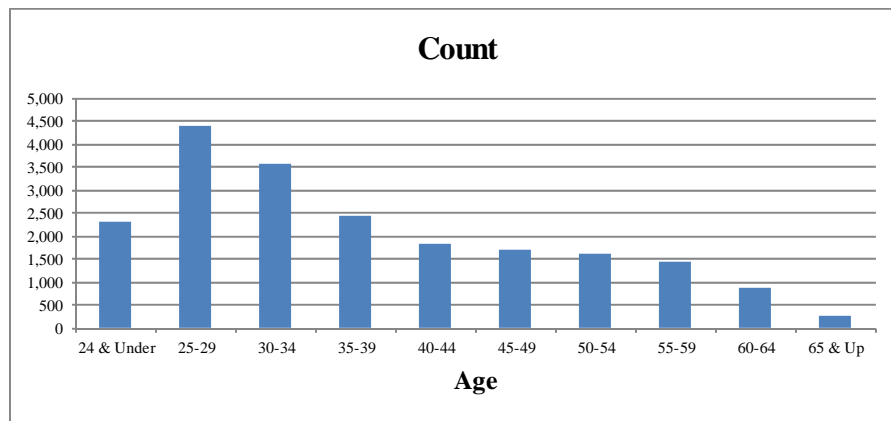


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2018**

**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	989	1,308	2,297	\$ 30,107,535	\$ 36,852,234	\$ 66,959,769
25-29	1,876	2,508	4,384	65,025,974	81,430,087	146,456,061
30-34	1,479	2,074	3,553	57,241,045	72,877,754	130,118,799
35-39	911	1,540	2,451	35,781,818	53,788,465	89,570,283
40-44	692	1,148	1,840	28,453,891	40,882,397	69,336,288
45-49	568	1,145	1,713	21,977,175	39,130,078	61,107,253
50-54	546	1,066	1,612	21,669,067	36,873,010	58,542,077
55-59	516	924	1,440	20,154,425	31,232,721	51,387,146
60-64	354	549	903	14,228,854	18,607,328	32,836,182
65 & Up	<u>149</u>	<u>135</u>	<u>284</u>	<u>5,985,272</u>	<u>5,251,630</u>	<u>11,236,902</u>
<b>Total</b>	<b>8,080</b>	<b>12,397</b>	<b>20,477</b>	<b>\$ 300,625,056</b>	<b>\$ 416,925,704</b>	<b>\$ 717,550,760</b>





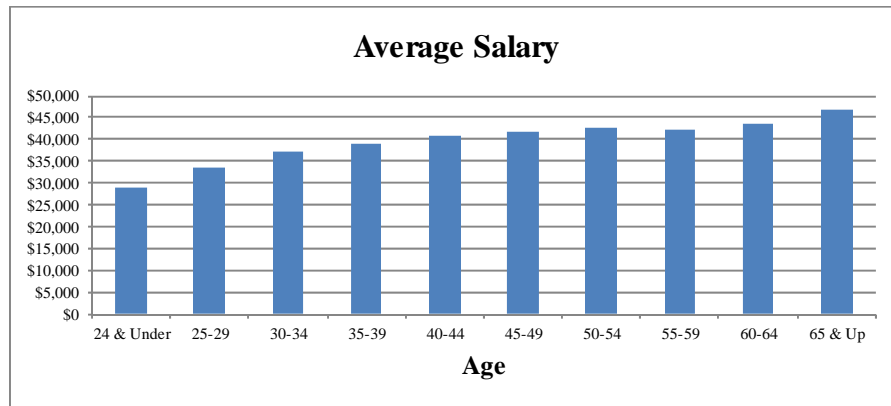
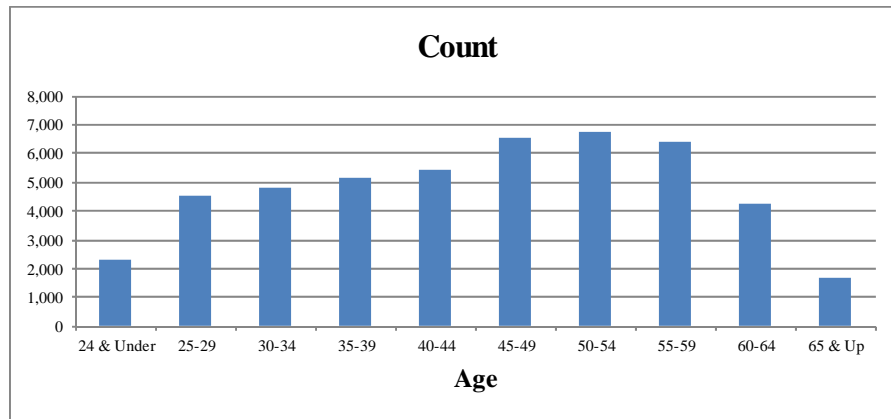


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2018**

**TOTAL**

<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	989	1,308	2,297	\$ 30,107,535	\$ 36,852,234	\$ 66,959,769
25-29	1,920	2,594	4,514	66,451,682	84,309,208	150,760,890
30-34	1,986	2,794	4,780	78,082,487	99,685,994	177,768,481
35-39	1,952	3,228	5,180	80,053,054	121,680,366	201,733,420
40-44	2,027	3,391	5,418	88,155,526	134,033,789	222,189,315
45-49	2,361	4,172	6,533	107,014,158	165,524,600	272,538,758
50-54	2,490	4,287	6,777	116,280,592	172,951,952	289,232,544
55-59	2,451	3,939	6,390	115,427,260	155,610,045	271,037,305
60-64	1,682	2,551	4,233	82,957,270	100,965,446	183,922,716
65 & Up	<u>775</u>	<u>909</u>	<u>1,684</u>	<u>40,837,706</u>	<u>38,162,098</u>	<u>78,999,804</u>
<b>Total</b>	<b>18,633</b>	<b>29,173</b>	<b>47,806</b>	<b>\$ 805,367,270</b>	<b>\$ 1,109,775,732</b>	<b>\$ 1,915,143,002</b>





**APPENDIX A – MEMBERSHIP DATA**

**AGE AND SERVICE DISTRIBUTION  
AS OF JUNE 30, 2018**

Age		0-4	5-9	10-14	15-19	20-24	25-29	30-34	Over 34	Total
<b>24 &amp; Under</b>	Number	2,285	12	0	0	0	0	0	0	2,297
	Total Salary	\$ 66,599,407	\$ 360,362	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 66,959,769
	Average Sal.	\$ 29,146	\$ 30,030	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 29,151
<b>25-29</b>	Number	3,910	589	15	0	0	0	0	0	4,514
	Total Salary	\$ 129,540,034	\$ 20,743,560	\$ 477,296	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 150,760,890
	Average Sal.	\$ 33,130	\$ 35,218	\$ 31,820	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 33,399
<b>30-34</b>	Number	2,796	1,464	505	15	0	0	0	0	4,780
	Total Salary	\$ 100,420,359	\$ 57,247,501	\$ 19,527,685	\$ 572,936	\$ 0	\$ 0	\$ 0	\$ 0	\$ 177,768,481
	Average Sal.	\$ 35,916	\$ 39,103	\$ 38,669	\$ 38,196	\$ 0	\$ 0	\$ 0	\$ 0	\$ 37,190
<b>35-39</b>	Number	1,995	1,291	1,340	532	22	0	0	0	5,180
	Total Salary	\$ 71,297,680	\$ 52,220,643	\$ 55,750,250	\$ 21,526,834	\$ 938,013	\$ 0	\$ 0	\$ 0	\$ 201,733,420
	Average Sal.	\$ 35,738	\$ 40,450	\$ 41,605	\$ 40,464	\$ 42,637	\$ 0	\$ 0	\$ 0	\$ 38,945
<b>40-44</b>	Number	1,587	1,047	1,084	1,222	470	8	0	0	5,418
	Total Salary	\$ 59,330,015	\$ 43,512,399	\$ 45,149,500	\$ 53,563,193	\$ 20,266,589	\$ 367,619	\$ 0	\$ 0	\$ 222,189,315
	Average Sal.	\$ 37,385	\$ 41,559	\$ 41,651	\$ 43,832	\$ 43,120	\$ 45,952	\$ 0	\$ 0	\$ 41,009
<b>45-49</b>	Number	1,496	995	981	1,239	1,365	415	42	0	6,533
	Total Salary	\$ 54,430,926	\$ 39,787,126	\$ 39,370,285	\$ 54,487,121	\$ 62,449,741	\$ 20,177,994	\$ 1,835,565	\$ 0	\$ 272,538,758
	Average Sal.	\$ 36,384	\$ 39,987	\$ 40,133	\$ 43,977	\$ 45,751	\$ 48,622	\$ 43,704	\$ 0	\$ 41,717
<b>50-54</b>	Number	1,293	987	907	1,148	1,147	918	350	27	6,777
	Total Salary	\$ 48,065,864	\$ 38,619,395	\$ 35,114,588	\$ 49,063,037	\$ 54,086,322	\$ 45,631,718	\$ 17,359,645	\$ 1,291,975	\$ 289,232,544
	Average Sal.	\$ 37,174	\$ 39,128	\$ 38,715	\$ 42,738	\$ 47,155	\$ 49,708	\$ 49,599	\$ 47,851	\$ 42,679
<b>55-59</b>	Number	1,176	895	937	1,175	1,024	612	425	146	6,390
	Total Salary	\$ 43,540,692	\$ 33,412,893	\$ 36,503,696	\$ 49,798,593	\$ 47,107,179	\$ 31,150,587	\$ 22,622,071	\$ 6,901,594	\$ 271,037,305
	Average Sal.	\$ 37,024	\$ 37,333	\$ 38,958	\$ 42,382	\$ 46,003	\$ 50,900	\$ 53,228	\$ 47,271	\$ 42,416
<b>60-64</b>	Number	685	645	734	781	654	355	231	148	4,233
	Total Salary	\$ 26,068,886	\$ 25,387,012	\$ 27,652,285	\$ 32,303,683	\$ 30,486,986	\$ 19,923,351	\$ 13,958,708	\$ 8,141,805	\$ 183,922,716
	Average Sal.	\$ 38,057	\$ 39,360	\$ 37,673	\$ 41,362	\$ 46,616	\$ 56,122	\$ 60,427	\$ 55,012	\$ 43,450
<b>65 &amp; Up</b>	Number	199	303	300	288	227	135	104	128	1,684
	Total Salary	\$ 8,568,267	\$ 12,089,364	\$ 12,317,318	\$ 12,585,905	\$ 10,407,647	\$ 8,024,365	\$ 6,476,045	\$ 8,530,893	\$ 78,999,804
	Average Sal.	\$ 43,057	\$ 39,899	\$ 41,058	\$ 43,701	\$ 45,849	\$ 59,440	\$ 62,270	\$ 66,648	\$ 46,912
<b>Total</b>	Number	17,422	8,228	6,803	6,400	4,909	2,443	1,152	449	47,806
	Total Salary	\$ 607,862,130	\$ 323,380,255	\$ 271,862,903	\$ 273,901,302	\$ 225,742,477	\$ 125,275,634	\$ 62,252,034	\$ 24,866,267	\$ 1,915,143,002
	Average Sal.	\$ 34,890	\$ 39,302	\$ 39,962	\$ 42,797	\$ 45,985	\$ 51,279	\$ 54,038	\$ 55,381	\$ 40,061

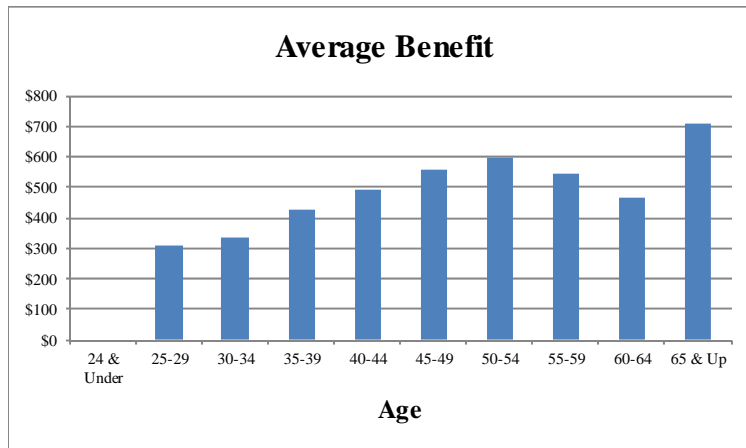
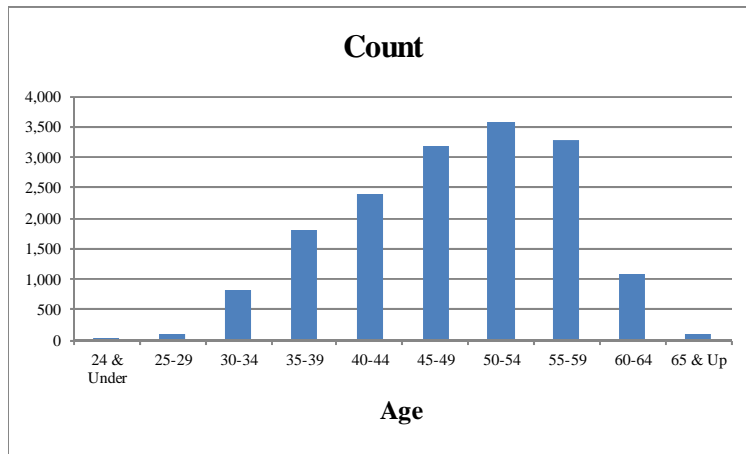


**APPENDIX A – MEMBERSHIP DATA**

**INACTIVE VESTED MEMBERS  
AS OF JUNE 30, 2018**

<u>Age</u>	<u>Count of Members*</u>			<u>Monthly Deferred Benefits*</u>		
	<u>Male</u>	<u>Female</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
24 & Under	17	5	22	\$ 3,871	\$ 404	\$ 4,275
25-29	45	65	110	16,029	17,855	33,884
30-34	346	483	829	117,010	161,178	278,188
35-39	675	1,130	1,805	308,075	464,534	772,609
40-44	867	1,540	2,407	434,082	745,411	1,179,493
45-49	1,134	2,034	3,168	672,720	1,096,403	1,769,123
50-54	1,281	2,286	3,567	867,474	1,256,000	2,123,474
55-59	1,059	2,217	3,276	666,895	1,117,071	1,783,966
60-64	375	716	1,091	199,112	309,140	508,252
65 & Up	<u>58</u>	<u>53</u>	<u>111</u>	<u>47,645</u>	<u>31,346</u>	<u>78,991</u>
Total	5,857	10,529	16,386	\$ 3,332,913	\$ 5,199,342	\$ 8,532,255

\* There are 178 members currently on leave and 732 members on LTD. Their counts and estimated deferred monthly benefits are included.

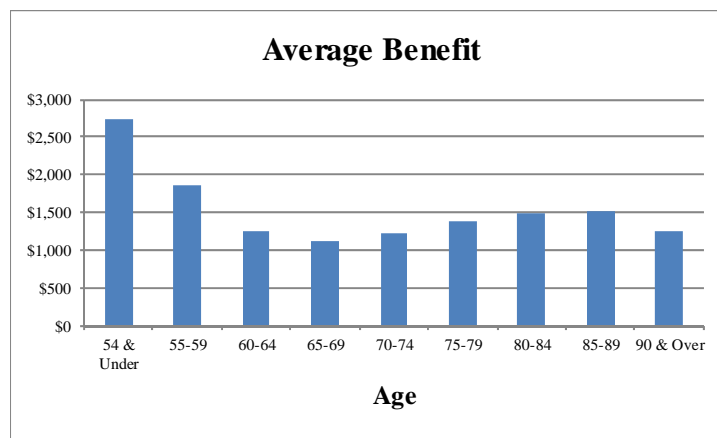
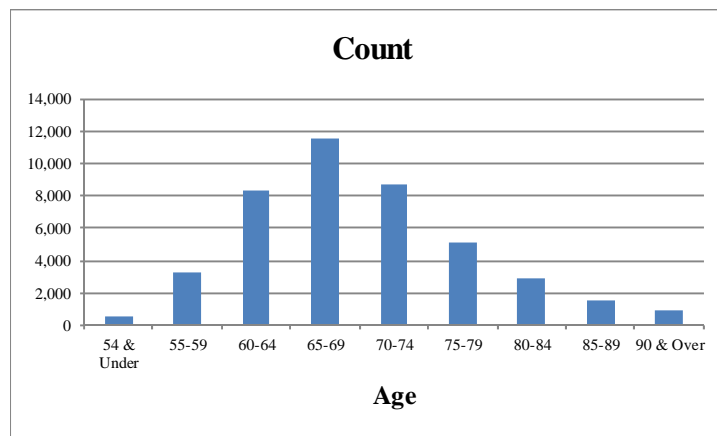




**APPENDIX A – MEMBERSHIP DATA**

**RETIRED AND DISABLED MEMBERS  
AS OF JUNE 30, 2018**

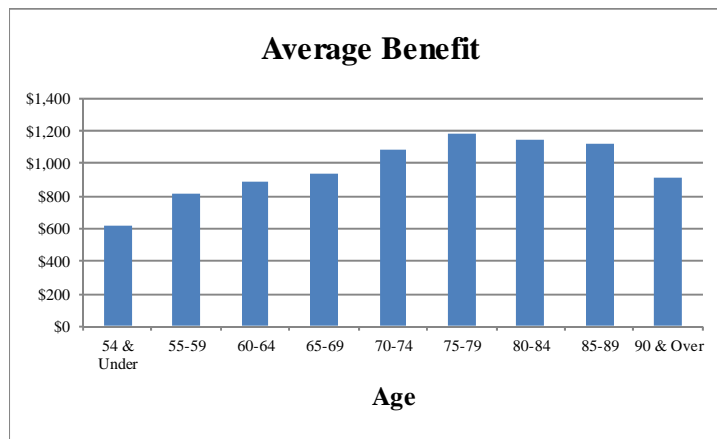
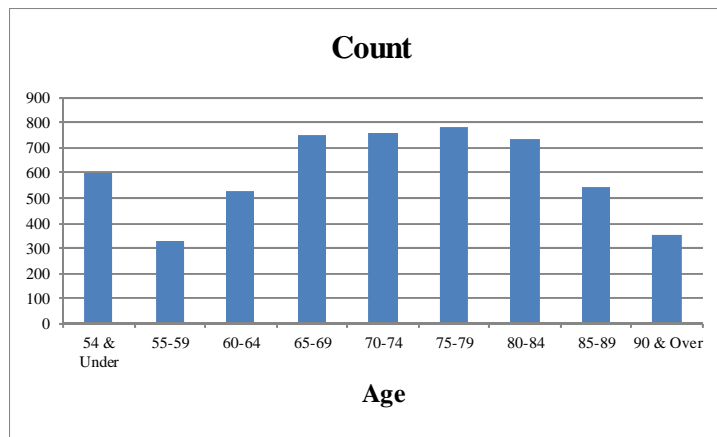
<u>Age</u>	<u>Count of Members</u>			<u>Monthly Benefits</u>		
	<u>Male</u>	<u>Female</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
54 & Under	168	319	487	\$ 475,766	\$ 853,081	\$ 1,328,847
55-59	1,145	2,172	3,317	2,196,597	4,008,373	6,204,970
60-64	3,031	5,324	8,355	4,056,312	6,432,319	10,488,631
65-69	4,517	6,963	11,480	5,773,867	7,198,717	12,972,584
70-74	3,601	5,140	8,741	5,402,300	5,444,328	10,846,628
75-79	2,041	3,061	5,102	3,740,950	3,300,717	7,041,667
80-84	1,118	1,803	2,921	2,290,416	2,092,597	4,383,013
85-89	570	1,007	1,577	1,247,287	1,156,051	2,403,338
90 & Over	<u>238</u>	<u>619</u>	<u>857</u>	<u>419,093</u>	<u>658,412</u>	<u>1,077,505</u>
Total	16,429	26,408	42,837	\$ 25,602,588	\$ 31,144,595	\$ 56,747,183





**BENEFICIARIES RECEIVING BENEFITS  
AS OF JUNE 30, 2018**

<u>Age</u>	<u>Count of Members</u>			<u>Monthly Benefits</u>		
	<u>Male</u>	<u>Female</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
54 & Under	244	351	595	\$ 127,530	\$ 244,299	\$ 371,829
55-59	90	242	332	54,383	215,523	269,906
60-64	162	367	529	113,747	358,707	472,454
65-69	206	544	750	148,817	553,345	702,162
70-74	204	552	756	158,869	659,136	818,005
75-79	192	593	785	153,213	776,947	930,160
80-84	158	573	731	118,281	717,419	835,700
85-89	139	402	541	91,864	514,694	606,558
90 & Over	<u>87</u>	<u>264</u>	<u>351</u>	<u>49,226</u>	<u>269,471</u>	<u>318,697</u>
Total	1,482	3,888	5,370	\$ 1,015,930	\$ 4,309,541	\$ 5,325,471





**RETIRED LIVES BENEFITS PAYABLE AS OF JUNE 30, 2018  
TABULATED BY OPTION AND TYPE OF BENEFIT**

**MSEP Benefits**

Type of Benefit	No.	Total Monthly Benefits
Service Retirement		
Life Annuity	5,933	\$ 7,404,065
50% Joint and Survivor	5,184	8,362,888
100% Joint and Survivor	3,098	5,693,793
5-Year Certain and Life	142	137,246
10-Year Certain and Life	170	171,858
Survivor Beneficiary	2,585	2,915,662
Total	<u>17,112</u>	<u>24,685,512</u>
Disability Retirement	1	187
Death-in-Service	1,461	1,457,276
<b>Total</b>	<b>18,574</b>	<b>\$ 26,142,975</b>

**MSEP 2000 Benefits**

Type of Benefit	No.	Total Monthly Benefits
Service Retirement		
Life Annuity	17,619	\$ 20,500,351
50% Joint and Survivor	4,206	6,869,825
100% Joint and Survivor	4,980	6,463,961
5-Year Certain and Life	21	26,617
10-Year Certain and Life	795	652,432
15-Year Certain and Life	664	456,455
Survivor Beneficiary	1,066	851,747
Total	<u>29,351</u>	<u>35,821,388</u>
Death-in-Service	257	99,469
<b>Total</b>	<b>29,608</b>	<b>\$ 35,920,857</b>



**RETIRED LIVES BENEFITS PAYABLE AS OF JUNE 30, 2018  
TABULATED BY OPTION AND TYPE OF BENEFIT**

**MSEP 2011 Benefits**

<b>Type of Benefit</b>	<b>No.</b>	<b>Total Monthly Benefits</b>
Service Retirement		
Life Annuity	11	\$ 3,688
50% Joint and Survivor	2	881
100% Joint and Survivor	5	1,544
5-Year Certain and Life	0	0
10-Year Certain and Life	3	676
15-Year Certain and Life	3	716
Survivor Beneficiary	0	0
Total	<u>24</u>	<u>7,505</u>
Death-in-Service	1	1,317
<b>Total</b>	<b>25</b>	<b>\$ 8,822</b>



**SALARY INCREASES  
DURING PLAN YEAR 2017-2018**

Age	Count	Salary Increases	
		Actual*	Expected
Under 20	17	15.8%	5.7%
20 - 24	1,206	7.7%	5.0%
25 - 29	3,412	4.9%	4.5%
30 - 34	4,052	3.9%	4.1%
35 - 39	4,565	3.4%	3.9%
40 - 44	4,916	2.8%	3.8%
45 - 49	6,193	2.5%	3.6%
50 - 54	6,403	1.9%	3.6%
55 - 59	5,883	1.5%	3.6%
60 - 64	3,789	1.3%	3.5%
65 & Over	1,408	1.1%	3.5%
<b>Total</b>	<b>41,844</b>		
<b>Average</b>		<b>2.6%</b>	<b>3.8%</b>

*\* Excludes new entrants and terminations.*

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





**ACTIVE MEMBERS WHO RETIRED WITH  
SERVICE RETIREMENT BENEFITS  
DURING PLAN YEAR 2017-2018**

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 50	2	0.2	5	2.0	7	2.2
50	3	1.4	8	5.7	11	7.1
51	11	3.5	22	10.0	33	13.5
52	19	9.3	22	14.2	41	23.5
53	16	13.9	22	23.0	38	36.8
54	24	20.3	34	28.6	58	48.8
55	30	22.3	46	34.2	76	56.4
56	35	25.9	58	41.6	93	67.5
57	45	33.4	54	49.1	99	82.4
58	41	39.3	64	53.3	105	92.6
59	43	34.6	69	55.5	112	90.1
60	52	49.8	68	71.8	120	121.7
61	54	40.9	74	58.5	128	99.3
62	66	76.6	101	105.6	167	182.2
63	45	55.3	51	70.6	96	125.9
64	45	36.6	62	59.0	107	95.6
65	57	57.6	98	80.0	155	137.6
66	61	44.9	71	64.3	132	109.2
67	29	23.3	44	31.5	73	54.9
68	28	22.0	28	22.6	56	44.6
69	15	15.1	17	15.1	32	30.2
70 & Over	52	66.7	42	53.2	94	119.8
<b>Total</b>	<b>773</b>	<b>692.6</b>	<b>1,060</b>	<b>949.1</b>	<b>1,833</b>	<b>1,641.8</b>

	Male	Female	Total
Average age at retirement	61.6 years	61.1 years	61.3 years
Average service at retirement	22.7 years	22.6 years	22.7 years



**ACTIVE MEMBERS WHO BECAME DISABLED  
DURING PLAN YEAR 2017-2018**

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 25	0	0.8	0	1.1	0	1.9
25 - 29	2	2.0	1	2.6	3	4.5
30 - 34	1	2.1	0	2.9	1	5.0
35 - 39	4	5.0	5	8.2	9	13.2
40 - 44	3	7.5	9	12.6	12	20.1
45 - 49	5	11.2	9	19.7	14	30.9
50 - 54	10	14.9	16	25.5	26	40.3
55 - 59	3	15.7	18	25.7	21	41.5
60 & Over	1	7.1	2	11.3	3	18.4
<b>Total</b>	<b>29</b>	<b>66.3</b>	<b>60</b>	<b>109.6</b>	<b>89</b>	<b>175.9</b>

	Male	Female	Total
Average age at disability	46.3 years	49.9 years	48.7 years
Average service at disability	11.9 years	10.6 years	11.0 years



**ACTIVE MEMBERS WHO DIED  
DURING PLAN YEAR 2017-2018**

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 30	2	0.9	3	0.5	5	1.3
30 - 34	0	0.7	2	0.6	2	1.3
35 - 39	2	0.8	2	0.9	4	1.7
40 - 44	6	1.1	4	1.3	10	2.4
45 - 49	3	2.2	4	2.6	7	4.8
50 - 54	7	4.2	5	4.6	12	8.8
55 - 59	9	7.3	9	6.7	18	14.0
60 - 64	16	9.0	11	6.4	27	15.4
65 & Over	6	8.8	6	4.2	12	13.0
<b>Total</b>	<b>51</b>	<b>35.0</b>	<b>46</b>	<b>27.8</b>	<b>97</b>	<b>62.8</b>

	Male	Female	Total
Average age at death	55.2 years	53.0 years	54.1 years
Average service at death	12.2 years	16.3 years	14.2 years

Of the 97 active members who died in service during plan year 2017-2018, 58 members had a benefit payable to a survivor.



**ACTIVE MEMBERS WHO TERMINATED EMPLOYMENT  
WITH A DEFERRED BENEFIT  
DURING PLAN YEAR 2017-2018**

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 30	24	21.0	30	33.7	54	54.7
30 - 34	79	76.8	89	106.0	168	182.8
35 - 39	81	88.5	136	144.4	217	232.9
40 - 44	75	76.4	117	129.4	192	205.8
45 - 49	73	71.9	134	124.8	207	196.7
50 - 54	49	51.8	109	87.6	158	139.4
55 - 59	32	18.8	86	32.9	118	51.8
60 & Over	45	1.0	59	2.3	104	3.3
<b>Total</b>	<b>458</b>	<b>406.2</b>	<b>760</b>	<b>661.2</b>	<b>1,218</b>	<b>1,067.4</b>

	Male	Female	Total
Average age at termination	43.9 years	45.0 years	44.6 years
Average service at termination	11.1 years	11.8 years	11.5 years



**APPENDIX B – DEMOGRAPHIC EXPERIENCE**

**ACTIVE MEMBERS WHO TERMINATED EMPLOYMENT  
WITHOUT A DEFERRED BENEFIT PAYABLE  
DURING PLAN YEAR 2017-2018**

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 20	11	0.0	20	0.0	31	0.0
20 - 24	274	158.9	390	233.2	664	392.2
25 - 29	413	291.5	546	408.8	959	700.3
30 - 34	239	191.4	367	301.6	606	493.0
35 - 39	160	118.9	252	222.8	412	341.6
40 - 44	96	89.4	180	168.6	276	258.0
45 - 49	80	78.6	169	177.8	249	256.5
50 - 54	58	66.4	133	148.1	191	214.5
55 - 59	55	68.9	85	117.1	140	186.0
60 - 64	30	38.8	47	65.9	77	104.7
65 - 69	8	12.0	17	12.8	25	24.8
70 & Over	2	2.5	5	2.3	7	4.8
<b>Total</b>	<b>1,426</b>	<b>1,117.4</b>	<b>2,211</b>	<b>1,859.0</b>	<b>3,637</b>	<b>2,976.4</b>

Service	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
0 - 1	545	413.2	927	739.6	1,472	1,152.9
1 - 2	352	283.4	535	487.1	887	770.5
2 - 3	229	189.8	316	296.5	545	486.2
3 - 4	154	137.0	214	205.4	368	342.4
4 - 5	146	94.0	219	130.4	365	224.4
<b>Total</b>	<b>1,426</b>	<b>1,117.4</b>	<b>2,211</b>	<b>1,859.0</b>	<b>3,637</b>	<b>2,976.4</b>

	Male	Female	Total
Average age at termination	33.3 years	34.5 years	34.0 years
Average service at termination	1.8 years	1.8 years	1.8 years



**COMPARISON OF ACTUAL TO EXPECTED DEATHS  
AMONG RETIRED LIVES  
(SERVICE RETIREMENT ONLY)  
DURING PLAN YEAR 2017-2018**

Age	Male			Female			Total		
	Actual	Expected	Exposures	Actual	Expected	Exposures	Actual	Expected	Exposures
Under 50	1	0.0	1	0	0.0	0	1	0.0	1
50 - 54	1	0.6	120	2	1.0	285	3	1.6	405
55 - 59	9	7.1	998	12	9.5	1,945	21	16.6	2,943
60 - 64	34	27.7	2,831	53	34.8	5,005	87	62.6	7,836
65 - 69	66	61.6	4,412	84	70.2	6,767	150	131.8	11,179
70 - 74	96	74.2	3,488	95	80.7	4,969	191	154.8	8,457
75 - 79	84	71.1	2,036	104	81.8	3,002	188	153.0	5,038
80 - 84	83	66.5	1,109	91	86.1	1,807	174	152.6	2,916
85 - 89	58	59.1	577	95	87.4	1,035	153	146.4	1,612
90 - 94	50	42.2	243	107	77.9	549	157	120.1	792
95 - 99	13	8.2	31	35	29.6	130	48	37.7	161
100 & Over	0	0.7	2	10	7.2	20	10	7.9	22
<b>Total</b>	<b>495</b>	<b>419.0</b>	<b>15,848</b>	<b>688</b>	<b>566.2</b>	<b>25,514</b>	<b>1,183</b>	<b>985.2</b>	<b>41,362</b>

**Average**

<b>Ages</b>	<b>77.2</b>	<b>77.4</b>	<b>70.0</b>	<b>79.2</b>	<b>79.5</b>	<b>69.8</b>	<b>78.4</b>	<b>78.6</b>	<b>69.9</b>
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**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>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>	<ol style="list-style-type: none"> <li>(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).</li> <li>(2) MSEP active members and vested former members who elect to transfer to the MSEP 2000 plan prior to retirement.</li> <li>(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.</li> <li>(4) MSEP non-vested terminations rehired on or after July 1, 2000.</li> <li>(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.</li> </ol>	<ol style="list-style-type: none"> <li>(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).</li> <li>(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.</li> </ol>



**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>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><b>Member contributions</b></p> <p>None.</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>Same as MSEP.</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>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**

<b>MSEP</b> <b>(Missouri State Employees' Plan)</b>	<b>MSEP 2000</b> <b>(Missouri State Employees' Plan 2000)</b>	<b>MSEP 2011</b> <b>(Missouri State Employees' Plan 2011)</b>
<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**

<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><i>Uniformed Water Patrol Employees:</i> The earliest of attaining:</p> <ol style="list-style-type: none"> <li>(1) Age 55 and active with at least 4 years of credited service.</li> <li>(2) Age 55 with at least 5 years of credited service.</li> <li>(3) Age 48 with age plus credited service equal to 80 or more.</li> </ol> <p><i>Administrative Law Judges:</i> The earliest of attaining:</p> <ol style="list-style-type: none"> <li>(1) Age 62 and active with at least 12 years of credited service.</li> <li>(2) Age 60 with at least 15 years of credited service.</li> <li>(3) Age 55 with at least 20 years of credited service.</li> </ol> <p><b>Early retirement for general employees</b></p> <p>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**

<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>
<b>MONTHLY BENEFITS PAYABLE</b>		
<b>Normal Retirement</b>		
<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><i>Temporary Benefit:</i> 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><i>Temporary Benefit:</i> 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**

<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><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**

<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>			
<b>Vested deferred benefits</b>											
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.				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.				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.			
Years of Service	General Assembly	Elected Officials	General Employees	Years of Service	General Assembly	Elected Officials	General Employees	Years of Service	General Assembly	Elected Officials	General Employees
4		100%		4		100%		4		100%	
5			100%	5			100%	6*	100%		
6*	100%			6*	100%			5			100%
*3 Assemblies				*3 Assemblies, HB1455 prospectively				*3 Assemblies, HB1455 prospectively			
<b>Death prior to retirement</b>											
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				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				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			



**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>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**

<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>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"> <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												
5.01% - 6.24%	80% of CPI increase	80% of CPI increase												
6.25% or more	5%	5%												



**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>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>CPI: 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>Timing of Increase: 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>CPI: 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>Timing of Increase: 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><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>Same.</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>Same.</p> <p>May purchase qualifying public sector service at full actuarial cost.</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>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>



**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>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>		



## 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 7.50% to 7.25%.
- The general wage growth assumption was lowered from 3.00% to 2.75%.
- The payroll growth assumption was lowered from 3.00% to 2.50%.
- The unfunded actuarial accrued liability amortization method was changed from amortizing the entire unfunded actuarial accrued liability as a single base to using a "layered" bases approach.
- The actuarial value of assets is now calculated by recognizing the difference between the actual and expected return on the market value of assets each year over a closed five-year period. 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.



**APPENDIX D – SUMMARY OF ACTUARIAL ASSUMPTIONS**

**ACTUARIAL ASSUMPTIONS**

**Economic Assumptions**

1. Investment Return 7.25%, compounded annually, net of investment expenses.

Note: This assumption will change to 7.10% for the June 30, 2019 valuation and 6.95% for the June 30, 2020 valuation and thereafter, absent Board action.

2. Inflation 2.50% per year

Note: This assumption will change to 2.35% for the June 30, 2019 valuation and 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	2.50%	0.25%	5.75%	8.50 %
2	2.50	0.25	2.50	5.25
3	2.50	0.25	1.50	4.25
4	2.50	0.25	1.25	4.00
5	2.50	0.25	1.00	3.75
9	2.50	0.25	0.75	3.50
10	2.50	0.25	0.50	3.25
21+	2.50	0.25	0.25	3.00

General Assembly members have a flat 2.75% assumption

4. Payroll Growth 2.50% per year

Note: This assumption will change to 2.35% for the June 30, 2019 valuation and 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.

2.00% on a compounded basis when no minimum COLA is in effect.

Note: This assumption will change to 1.88% for the June 30, 2019 valuation and 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 2011	
	Percent Retiring			Percent Retiring			Percent Retiring
1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	Percent Retiring	Retirement Age	Percent Retiring	Percent Retiring	
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**

Sample Age	Years of Service	<u>Percent of Active Members Separating within the Next Year</u>					
		Termination**		Death*		Disability	
		Males	Females	Males	Females	Males	Females
	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**

Years of Service	Percent of Active Members Separating within the Next Year
	Termination
	Male/Female
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**

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**Other Assumptions**

- 1. Form of Payment MSEP – 50% joint and survivor  
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, 2018. It was brought forward to June 30, 2018 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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