



Cavanaugh Macdonald
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**Public Employees' Retirement System
of the State of Montana**



**Actuarial Valuation
As of June 30, 2018**





Cavanaugh Macdonald

CONSULTING, LLC

The experience and dedication you deserve

October 1, 2018

Public Employees' Retirement Board
100 North Park, Suite 200
Helena, MT 59620-0139

Members of the Board:

In this report are submitted the results of the annual valuation of the assets and liabilities of the Public Employees' Retirement System of the State of Montana (PERS), prepared as of June 30, 2018.

The purpose of this report is to provide a summary of the funded status of the System as of June 30, 2018. While not verifying the data at source, the actuary performed tests for consistency and reasonability. The valuation indicates that the statutory contribution rate reflecting all anticipated contribution increases are sufficient to amortize the unfunded accrued liability within a 38-year period. The asset values used to determine unfunded liabilities are not market values but less volatile market related values. A smoothing technique is applied to market values to determine the market related values. The unfunded liability amounts using the market value of assets would be different. The interest rate used for determining liabilities is based on the expected return on assets. Therefore, liability amounts in the report cannot be used to assess a settlement of the obligation.

The promised benefits of the System are included in the actuarially calculated contribution rates, which are developed using the Entry Age Normal Cost Method. Four-year market related value of assets is used for actuarial valuation purposes. Gains and losses are reflected in the unfunded accrued liability that is being amortized by regular annual contributions as a level percentage of payroll, on the assumption that payroll will increase by 3.50% annually. The assumptions recommended by the actuary and adopted by the Board are, in the aggregate, reasonably related to the experience under the Fund and to reasonable expectations of anticipated experience under the Fund.

This is to certify that Edward Macdonald and Todd Green, Principal and Consulting Actuaries for Cavanaugh Macdonald Consulting, are members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein. This also certifies that the undersigned have experience in performing valuations for public retirement systems, that the valuation was prepared in accordance with principles of practice prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures, based on the current provisions of the retirement system and on actuarial assumptions that are internally consistent and reasonably based on the actual experience of the System.



Future actuarial results may differ significantly from the current results 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. Since the potential impact of such factors is outside the scope of a normal annual actuarial valuation, an analysis of the range of results is not presented herein.

The Table of Contents, which immediately follows, outlines the material contained in the report.

Respectfully submitted,

A handwritten signature in blue ink, appearing to read 'Edward Macdonald', written in a cursive style.

Edward A. Macdonald, ASA, FCA, MAAA
President

A handwritten signature in blue ink, appearing to read 'Todd B. Green', written in a cursive style.

Todd B. Green, ASA, FCA, MAAA
Principal and Consulting Actuary

A handwritten signature in blue ink, appearing to read 'Matthew Yonz', written in a cursive style.

Matthew Yonz, ASA, FCA, MAAA
Actuary



**Public Employees' Retirement System
State of Montana**

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Section I: Summary of Results

For convenience of reference, the principal results of the valuation and a comparison with the preceding year's results are summarized below:

VALUATION DATE	June 30, 2018	June 30, 2017
Active Members	28,646	29,395
Retirees and Beneficiaries	22,398	21,644
Disabled Members*	158	161
Terminated Vested Members	3,793	3,677
Terminated Non-Vested Members	17,973	16,659
Total**	72,968	71,536
Covered Payroll of Active Members	\$1,230,105,350	\$1,232,066,537
Average Salaries from Covered Payroll	\$ 42,942	\$ 41,914
Annual Retirement Allowances for Retired Members and Beneficiaries	\$ 402,968,960	\$ 375,071,221
Assets		
Actuarial value	\$5,705,235,727	\$5,514,026,586
Market value	5,779,994,008	5,472,519,182
Actuarial Accrued Liability (AAL)	\$7,730,084,077	\$7,578,384,779
Unfunded Actuarial Accrued Liability (UAAL)	\$2,024,848,350	\$2,064,358,193
Funded Ratio	73.81%	72.76%
Market Value Rate of Return	8.90%	11.93%
Annual Cost		
Statutory Funding Rate	16.57%	16.47%
Total Normal Rate	10.27%	9.86%
Employee Contribution Rate	<u>7.90%</u>	<u>7.90%</u>
Employer Normal Rate	2.37%	1.96%
Employer Contribution Rate		
Normal Rate	2.37%	1.96%
Administrative Expense Load	0.26%	0.26%
UAAL Rate	6.00%	6.31%
Transfer to DB Education Fund	<u>0.04%</u>	<u>0.04%</u>
Total Rate***	8.67%	8.57%
Amortization Period****	38 years	30 years
Employer Contribution Rate Necessary to Amortize UAAL over 30 Years		
Normal Rate	2.37%	1.96%
Administrative Expense Load	0.26%	0.26%
UAAL Rate (30-Year Rate)****	6.87%	6.31%
Transfer to DB Education Fund	<u>0.04%</u>	<u>0.04%</u>
Total Rate	9.54%	8.57%
Shortfall/(Surplus)	0.87%	0.00%

* Based on PERS categorization for the annual report. For actuarial purposes, 541 members in 2017 and 532 members in 2018 were valued as disabled members with offsetting reductions to the number of retired members.

** A reconciliation between participant counts used for the annual report and counts for the valuation appears at the beginning of Appendix D.

*** The rates shown are for the fiscal year immediately following the valuation date. The schedule on page 3 highlights the statutory contribution rates payable in each fiscal year including scheduled increases.

**** Reflects anticipated increases in employer contribution rates and General Fund Revenue.



Section I: Summary of Results

As a result of this actuarial valuation of the benefits in effect under the Public Employees' Retirement System as of June 30, 2018, the statutory employer contributions are sufficient to amortize the Unfunded Actuarial Accrued Liability (UAAL) of the Retirement System within 38 years. The Funded Ratio is 73.81%.

Calculations based on the Market Value of Assets

MCA 19-2-407 requires this report to show how market performance is affecting the actuarial funding of the Retirement System. The June 30, 2018 market value of assets is \$74,758,281 more than the actuarial value of assets. This is due to the smoothing of investment gains and losses over a four-year period. If the market value of assets was used, the amortization period would be 33 years, and the Funded Ratio would be 74.77%.

Additional Details

The actuarial costs are calculated using the entry age actuarial cost method. This is the method used by most public plans. It is designed to provide a stable contribution rate as a percent of member pay. This actuarial valuation measures the adequacy of the contribution rates set in Montana State Law.

MCA 19-3-316 requires each employer to contribute 6.90% of total compensation paid to all members employed in a PERS reportable position. This amount increased by 1.27% for fiscal year 2014 and will increase by 0.10% each fiscal year through 2024 until the total employer contribution is equal to 9.17% of member compensation. The employer contribution increases may terminate on January 1 following the board's receipt of the system's actuarial valuation if the actuarial valuation determines that terminating the additional employer contribution would not cause the amortization period of the unfunded actuarial accrued liability to exceed 25 years.

MCA 19-3-315 requires each member to contribute 7.90% compensation. Each member's contribution must be reduced to 6.90% on January 1 following the system's annual actuarial valuation if the valuation determines that reducing the employee contribution and reducing the employer contribution would not cause the system's amortization period of the unfunded actuarial accrued liability to exceed 25 years.

HB 648 and HB 2 requires the coal tax contributions from the state to be \$33,035,000 for the fiscal year beginning July 1, 2017, and \$33,615,000 for the fiscal year beginning July 1, 2018. Starting in the fiscal year beginning July 1, 2019, the state will contribute 101% of the previous year's contribution.

Beginning July 1, 2013, employers who hire PERS retirees who work less than 960 hours in the calendar year, but do not become active members, contribute the employer's contribution rate on the working retiree's compensation.



Section I: Summary of Results

The table below summarizes the legislated contribution increases for both the members and the employers.

History of Legislated Contributions (as a Percent of Pay)

	<u>Members</u>	<u>Employers</u>
July 1, 1999 to June 30, 2007	6.90%	6.90%
July 1, 2007 to June 30, 2009	6.90	7.035
July 1, 2009 to June 30, 2013	6.90	7.17
July 1, 2013 to June 30, 2014	7.90	8.17
July 1, 2014 to June 30, 2015	7.90	8.27
July 1, 2015 to June 30, 2016	7.90	8.37
July 1, 2016 to June 30, 2017	7.90	8.47
July 1, 2017 to June 30, 2018	7.90	8.57
July 1, 2018 to June 30, 2019	7.90	8.67
July 1, 2019 to June 30, 2020	7.90	8.77
July 1, 2020 to June 30, 2021	7.90	8.87
July 1, 2021 to June 30, 2022	7.90	8.97
July 1, 2022 to June 30, 2023	7.90	9.07
July 1, 2023 to June 30, 2024	7.90	9.17

Based on MCA 19-3-1605, for Members hired on or after July 1, 2013, the GABA as of January 1st will be 1.50%, but must be reduced if the funded ratio is less than 90% as of the prior actuarial valuation date. The funded ratio for this purpose is 73.81%. For each full 2% that the unrounded funded ratio is less than 90%, the GABA must be reduced by 0.1%. As a result, the GABA rate for those hired on or after July 1, 2013, is 0.70%. In addition, if the amortization period of the unfunded actuarial accrued liability is equal to or exceeds 40 years, the GABA for members hired on or after July 1, 2013, would be equal 0.00%, regardless of the funded ratio. Since the System amortizes within 38 years which is less than 40 years, the GABA for members hired on or after July 1, 2013 will be 0.70%.



Section I: Summary of Results

Investment Experience

The market assets earned 8.90% net of investment and operating expenses. As a result of prior years' unrecognized losses, the actuarial assets earned 6.69%, which is 0.96% less than the expected return of 7.65%. The return on the actuarial assets differs from the return on market assets because the actuarial value of assets spreads gains and losses over four years. The chart below shows the annual returns for the past ten years.

Year	Market Return	Actuarial Return	Assumed Investment Return	Market Return over Assumption	Actuarial Return over Assumption
7/1/2008 to 6/30/2009	(20.85)%	(0.16)%	8.00%	(28.85)%	(8.16)%
7/1/2009 to 6/30/2010	12.91	(1.18)	7.75	5.16	(8.93)
7/1/2010 to 6/30/2011	21.70	(0.08)	7.75	13.95	(7.83)
7/1/2011 to 6/30/2012	2.27	3.28	7.75	(5.48)	(4.47)
7/1/2012 to 6/30/2013	12.99	11.91	7.75	5.24	4.16
7/1/2013 to 6/30/2014	17.12	13.21	7.75	9.37	5.46
7/1/2014 to 6/30/2015	4.60	9.63	7.75	(3.15)	1.88
7/1/2015 to 6/30/2016	2.02	9.27	7.75	(5.73)	1.52
7/1/2016 to 6/30/2017	11.93	8.08	7.75	4.18	0.33
7/1/2017 to 6/30/2018	8.90	6.69	7.65	1.25	(0.96)

Asset gains or losses result when the return on the actuarial value of assets differs from the assumed actuarial investment return.

Recent Contribution Increases

MCA 19-3-316 and MCA 19-3-315 dictate that employers and members are required to make supplemental contributions until the January 1st following an actuarial valuation shows the unfunded actuarial accrued liability can be amortized over a period of no more than 25 years (without considering the supplemental employee and employer contributions). The individual employers are required to contribute an additional 1.27% of compensation. The employer contribution shall increase by an additional 0.10% each year following June 30, 2013, until the total employer supplemental contribution is equal to 2.27% of compensation.

Each member's contribution must be reduced to 6.90% on January 1 following the system's annual actuarial valuation if the valuation determines that reducing the employee contribution would not cause the system's amortization period to exceed 25 years.

Amortization of the UAAL

The June 30, 2017 actuarial valuation calculated a 30-year amortization period for the UAAL. The resulting amortization period at June 30, 2018 is 38 years. The amortization period anticipates future increases in employer supplemental contributions and future General Fund Revenue as projected by the Office of Budget and Program Planning.



Section I: Summary of Results

Funding and Benefits Policy

The Montana Public Employees' Retirement Board has adopted a Funding and Benefits Policy to provide general guidelines to help ensure decisions are made based on sound, consistent, and thoroughly examined criteria. The Funding and Benefits Policy includes guidance on the following topics:

1) Funding Requirement

a) The Funding and Benefits Policy states:

1. The Entry Age Normal Cost Method shall be applied to the projected benefits in determining the Normal Cost and Actuarial Accrued Liability.
2. Asset smoothing can be used in the valuation process to spread the recognition of investment gains and losses over a four-year period.
3. The unfunded actuarial accrued liability should be amortized over a reasonable period of time and should not exceed 30 years on a rolling basis. Generally, the funding period should be constant or decreasing.

b) Analysis: The liabilities of the System are determined using the Entry Age Normal Cost Method and are compared to the actuarial value of assets, which are developed using asset smoothing that recognizes gains and losses over a four-year period. Finally, the amortization period as of June 30, 2018 is 38 years based on actuarial value of assets. The contributions provided for in statute are not sufficient to fully amortize the unfunded actuarially accrued liability within 30 years.

2) Funding Objectives

a) The Funding and Benefits Policy states: "The primary objectives are to: 1) ensure that the systems are financially sound and pay all benefits promised using assets accumulated from required employer and member contributions and investment income; and 2) achieve a well-funded status with a range of safety to absorb market volatility without creating a UAAL."

b) Analysis: The contributions provided for in statute are not sufficient to fully amortize the unfunded actuarially accrued liability within a 30-year period. It is important to note, that the normal cost rate for new hires is lower than the current active population. As members terminate or retire, and are replaced with a member with a lower normal cost rate, more of the employer contribution will be available to amortize the unfunded accrued liability. As a result the effective amortization period is less than the amortization period calculated in the actuarial valuation which does not reflect new hires.

3) Benefit Enhancements

a) The Funding and Benefits Policy states: "Proposals must provide funding from sources sufficient to cover future costs. Unfunded liabilities created by the proposal must be amortized over a period of time appropriate to the retirement system, but not more than 30 years."

b) Analysis: Without supplemental funding, a benefit enhancement would increase the amortization period of the unfunded actuarial accrued liability and further delay the goal of achieving a well-funded status with a range of safety to absorb market volatility without creating a UAAL.



Section I: Summary of Results

Sensitivity to Future Experience

The valuation results are projections based on the actuarial assumptions. Actual experience will differ from these assumptions, either increasing or decreasing the ultimate cost. The following illustrations provide simple analyses on how the costs are sensitive to changes in the assumed rate of return.

Investment Return – The investment return generally has the largest impact on the funding of the System.

Impact of Assuming 1.00% Lower Investment Return	
	<u>Funded Ratio</u>
Current Assumption 7.65%	73.81%
Lower Assumption 6.65%	<u>66.09%</u>
Increase / (Decrease)	(7.72)%
	<u>Amortization Period</u>
	<u>Increase / (Decrease)</u>
Current Assumption 7.65%	38 Years
Lower Assumption 6.65%	<u>Does not Amortize</u>
Increase / (Decrease)	N/A
Impact of Assuming 0.50% Lower Investment Return	
	<u>Funded Ratio</u>
Current Assumption 7.65%	73.81%
Lower Assumption 7.15%	<u>70.27%</u>
Increase / (Decrease)	(3.54)%
	<u>Amortization Period</u>
	<u>Increase / (Decrease)</u>
Current Assumption 7.65%	38 Years
Lower Assumption 7.15%	<u>55 Years</u>
Increase / (Decrease)	17 Years



Section I: Summary of Results

Impact of Assuming 0.50% Higher Investment Return	
	<u>Funded Ratio</u>
Current Assumption 7.65%	73.81%
Higher Assumption 8.15%	<u>77.47%</u>
Increase / (Decrease)	3.66%
	<u>Amortization Period</u>
	<u>Increase / (Decrease)</u>
Current Assumption 7.65%	38 Years
Higher Assumption 8.15%	<u>19 Years</u>
Increase / (Decrease)	(19) Years
Impact of Assuming 1.00% Higher Investment Return	
	<u>Funded Ratio</u>
Current Assumption 7.65%	73.81%
Higher Assumption 8.65%	<u>81.68%</u>
Increase / (Decrease)	7.87%
	<u>Amortization Period</u>
	<u>Increase / (Decrease)</u>
Current Assumption 7.65%	38 Years
Higher Assumption 8.65%	<u>14 Years</u>
Increase / (Decrease)	(24) Years

The future funding status of the System will be determined by the System's experience. The System's actual asset returns and retirement rates, as well as member longevity, salary increases, withdrawal rates, disability rates and future legislation will all impact the funding status of the System. The entry age normal cost method and four-year smoothing of asset gains and losses will help to provide a more orderly funding of the System's liabilities, but will not change the actual experience. The amortization period of the UAAL is not likely to decrease by the expected 1.0 year with each passing actuarial valuation. Instead, the amortization period is expected to decrease more or less than 1.0 years each year, reflecting gains and losses due to experience different than the actuarial assumptions.

Assumption Changes

There have been no assumption changes since the previous valuation.

Benefit Changes

There have been no benefit changes since the previous valuation.

Contribution Changes

An employer supplemental contribution of 1.27% of compensation is required beginning in fiscal year 2014 which will increase by 0.10% each subsequent fiscal year through 2024. For fiscal years beginning after June 30, 2024, the supplemental employer contribution will equal 2.27% of compensation.

Method Changes

There have been no method changes since the previous valuation.



Section I: Summary of Results

Impact of Changes

The following table summarizes how experience has changed the UAAL since the June 30, 2017 Actuarial Valuation. Further detail can be found in Tables 10 and 11.

Changes in the Unfunded Actuarial Accrued Liability (UAAL)

June 30, 2017 Valuation UAAL	\$2,064,358,193
Normal Cost (Including Expenses)	127,315,295
Contributions	(243,385,430)
Interest	<u>158,353,529</u>
Expected June 30, 2018 UAAL	\$2,106,641,587
Experience (Gain) / Loss on Actuarial Liabilities	\$(134,064,730)
Experience (Gain) / Loss on Actuarial Assets	52,271,493
Assumption & Method Changes	0
Plan Changes	<u>0</u>
Total (Gain) / Loss	<u>\$(81,793,237)</u>
June 30, 2018 Valuation UAAL	\$2,024,848,350



Section I: Summary of Results

Summary

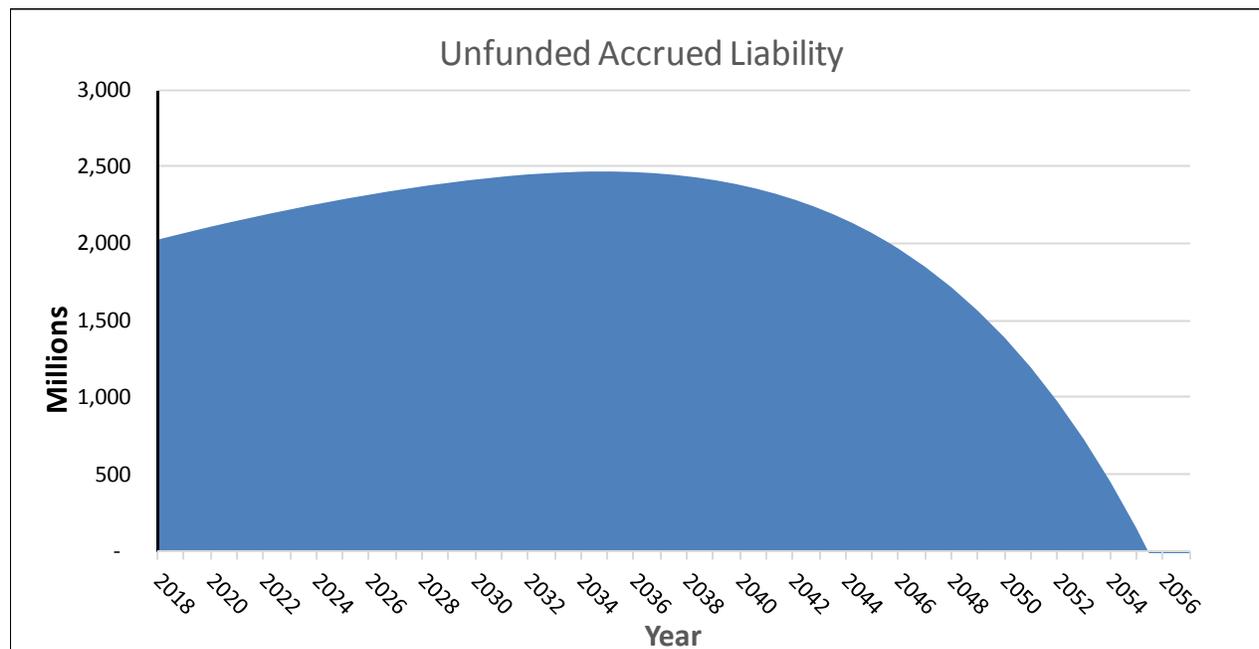
- * The System's actuarial value investment return of 6.69% for the year ended June 30, 2018 is 0.96% less than the expected return of 7.65%. This represents an asset loss of \$52,271,493 due to investment return less than anticipated. As of June 30, 2018, the market value of assets was \$5,779,994,008. As of June 30, 2018, the actuarial value of assets was \$5,705,235,727. The June 30, 2018, market value of assets will be recognized in future actuarial valuations unless it is offset by returns less than the 7.65% assumption.
- * As of June 30, 2018, the amortization period of the UAAL is 38 years. Prior to this valuation, the funding period was 30 years. An increase in the normal cost rate and the lack of payroll growth attributed to the increase in the amortization period. If the actual payroll growth does not meet the assumption, the System will not receive the expected UAAL contribution dollar amount. The ultimate goal of the Board's Funding and Benefits Policy is to increase the funded status to a level such that the amortization period does not exceed 30 years.
- * The funding of the retirement system will be impacted by future experience, which will sometimes be more favorable than the actuarial assumptions and sometimes less favorable. In particular, investment returns larger and smaller than the 7.65% assumption are expected to have significant impacts on the System's funding progress. In the long term, the favorable experience is needed to offset the less favorable experience. This is the reason for using an actuarial value of assets that allows gains and losses to be smoothed over four years.
- * The unfunded actuarial accrued liability is amortized using a level percentage of payroll method over the amortization period. Under the level percentage of payroll method, amortization payments will not be large enough to cover interest on the UAL in the beginning of the amortization schedule, which means that as a dollar amount the UAL is expected to grow. After a period of time, amortization payments will be large enough that the amortization payments will cover both interest and principal, and the UAL as a dollar amount will be projected to decrease in each subsequent year. The payroll growth assumption is used to determine the percentage of payroll required over the remaining amortization period to fully amortize the unfunded liability. The payroll growth assumption is 3.50%.



Section I: Summary of Results

Projected Progress toward 100% Funding

The table below shows the projected progress toward reaching 100%. When the System is 100% funded, the Unfunded Actuarial Accrued Liability will be fully amortized. This is scheduled to occur within 38 years. The ultimate goal of the System is to achieve a well-funded status with a range of safety to absorb market volatility without creating an unfunded actuarial accrued liability.





Section II: Assets

Assets

In many respects, an actuarial valuation can be regarded 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. These assets are compared with the actuarial liabilities. The actuarial process thus leads to a method of determining what contributions by members and their employers are needed to strike a balance.

The asset valuation method being used is a four-year smoothing method. The expected return is determined each year based on the beginning of year market value and actual cash flows during the year. Any difference between the expected market value return and the actual market value return is recognized evenly over a period of four years.

Table 1 lists the assets held and their market value for the past two years. Table 2 summarizes the fund's activity during the past two years. Table 3 summarizes the determination of the actuarial value of assets. Table 4 summarizes historical asset returns for the last 10 years including the amount recognized by the actuarial asset valuation method which was greater or lesser than the actuarial investment return assumption. Table 5 summarizes the historical asset values on a market value and actuarial value basis, to the extent it was available. Additional data can be included in this table for future reports, if provided by the System.

**Section II: Assets**

**Table 1:
Statement of Fiduciary Net Position
Fiscal Year Ended June 30**

	<u>2018</u>	<u>2017</u>
ASSETS		
Cash and Short Term Investments	\$ 121,967,299	\$ 139,342,997
Securities Lending Collateral	\$ 36,792,892	\$ 31,162,478
Receivables:		
Interest Receivable	\$ 209,546	\$ 128,520
Accounts Receivable	4,382,659	3,101,652
Due from Other Funds	672,567	638,328
Due from Primary Government	-	6,051,738
Notes Receivable	15,952	25,634
OPEB Def Outflow of Resources	2,032	-
Total Receivables	<u>\$ 5,282,756</u>	<u>\$ 9,945,872</u>
Investments, at fair value:		
Investment Pools	5,652,705,617	5,326,159,180
Other Investments	-	-
Total Investments	<u>\$ 5,652,705,617</u>	<u>\$ 5,326,159,180</u>
Capital Assets		
Property and Equipment, at cost, net of Accumulated Depreciation	\$ 23,288	\$ 31,574
Intangible Assets, at cost, net of Amortization Expense	1,398,370	1,297,993
Total Capital Assets	<u>\$ 1,421,658</u>	<u>\$ 1,329,567</u>
TOTAL ASSETS	<u>\$ 5,818,170,222</u>	<u>\$ 5,507,940,094</u>
LIABILITIES		
Securities Lending Liability	\$ 36,792,892	\$ 31,162,478
Accounts Payable	611,000	2,891,464
Unearned Revenue	352,570	176,366
Due to Other Funds	-	286,156
Compensated Absences	315,865	377,129
OPEB Def Inflow of Resources	48,443	-
OPEB Implicit Rate Subsidy LT	55,444	527,319
TOTAL LIABILITIES	<u>\$ 38,176,214</u>	<u>\$ 35,420,912</u>
NET POSITION-RESTRICTED FOR PENSION BENEFITS	<u>\$ 5,779,994,008</u>	<u>\$ 5,472,519,182</u>

**Section II: Assets**

**Table 2:
Statement of Changes in Fiduciary Net Position
Fiscal Year Ended June 30**

	<u>2018</u>	<u>2017</u>
ADDITIONS		
Contributions:		
Employer	\$ 106,650,985	\$ 103,537,059
Plan Member	102,075,271	100,768,139
Other	34,659,174	28,757,463
Total Contributions	<u>\$ 243,385,430</u>	<u>\$ 233,062,661</u>
Misc Income	\$ -	\$ -
Investment Income:		
Net Appreciation/(Depreciation) in Fair Value of Investments	\$ 496,954,528	\$ 340,140,001
Investment Earnings	16,307,602	278,015,770
Security Lending Income	1,108,711	1,570,599
Investment Income/(Loss)	<u>\$ 514,370,841</u>	<u>\$ 619,726,370</u>
Investment Expense	(35,238,061)	(27,672,890)
Security Lending Expense	(442,424)	(618,526)
Net Investment Income/(Loss)	<u>\$ 478,690,356</u>	<u>\$ 591,434,954</u>
Total Additions	<u>\$ 722,075,786</u>	<u>\$ 824,497,615</u>
DEDUCTIONS		
Benefit Payments	\$ 395,338,673	\$ 366,354,719
Refunds/Distributions	12,619,498	12,252,007
Refunds to Other Plans	725,998	73,930
Transfers to DCRP	2,068,870	1,419,600
Transfers to MUS-RP	198,062	127,663
OPEB Expense	37,675	85,540
Administrative Expense	4,168,771	4,472,084
Total Deductions	<u>\$ 415,157,547</u>	<u>\$ 384,785,543</u>
NET INCREASE (DECREASE) IN PLAN NET ASSETS	\$ 306,918,239	\$ 439,712,072
NET POSITION-RESTRICTED FOR PENSION BENEFITS BEGINNING OF YEAR	\$ 5,472,519,182	\$ 5,032,807,110
ADJUSTMENT	556,587	-
END OF YEAR	<u>\$ 5,779,994,008</u>	<u>\$ 5,472,519,182</u>



Section II: Assets

**Table 3:
Determination of Actuarial Value of Assets**

Valuation Date June 30:	2017	2018	2019	2020	2021
A. Actuarial Value Beginning of Year	\$ 5,247,685,310	\$ 5,514,026,586			
B. Market Value End of Year	5,472,519,182	5,779,994,008			
C. Market Value of Beginning of Year	5,032,807,110	5,472,519,182			
D. Cash Flow					
D1. Contributions	233,062,661	243,385,430			
D2. Benefit Payments	(380,227,919)	(410,988,776)			
D3. Administrative Expenses	(4,472,084)	(4,168,771)			
D4. Investment Expenses	(28,291,416)	(35,680,485)			
D5. Net	<u>\$ (179,928,758)</u>	<u>\$ (207,452,602)</u>			
E. Investment Income					
E1. Market Total: B. - C. - D5.	\$ 619,640,830	\$ 514,927,428			
E2. Assumed Rate	7.75%	7.65%			
E3. Amount for Immediate Recognition C.*E2. + ((D1.+D2.+D3.)*E2.*0.5) - D4.	412,458,020	447,757,919			
E4. Amount for Phased-in Recognition E1. - E3.	207,182,810	67,169,509			
F. Phased-In Recognition of Investment Income					
F1. Current Year: 0.25 * E4.	\$ 51,795,703	\$ 16,792,377	\$ -	\$ -	\$ -
F2. First Prior Year	(79,210,257)	51,795,703	16,792,377	-	-
F3. Second Prior Year	(38,473,999)	(79,210,257)	51,795,703	16,792,377	-
F4. Third Prior Year	99,700,567	(38,473,999)	(79,210,257)	51,795,703	16,792,377
F5. Total Recognized Investment Gain	<u>\$ 33,812,014</u>	<u>\$ (49,096,176)</u>	<u>\$ (10,622,177)</u>	<u>\$ 68,588,080</u>	<u>\$ 16,792,377</u>
G. Actuarial Value End of Year A. + D5. + E3. + F5.	\$ 5,514,026,586	\$ 5,705,235,727			



Section II: Assets

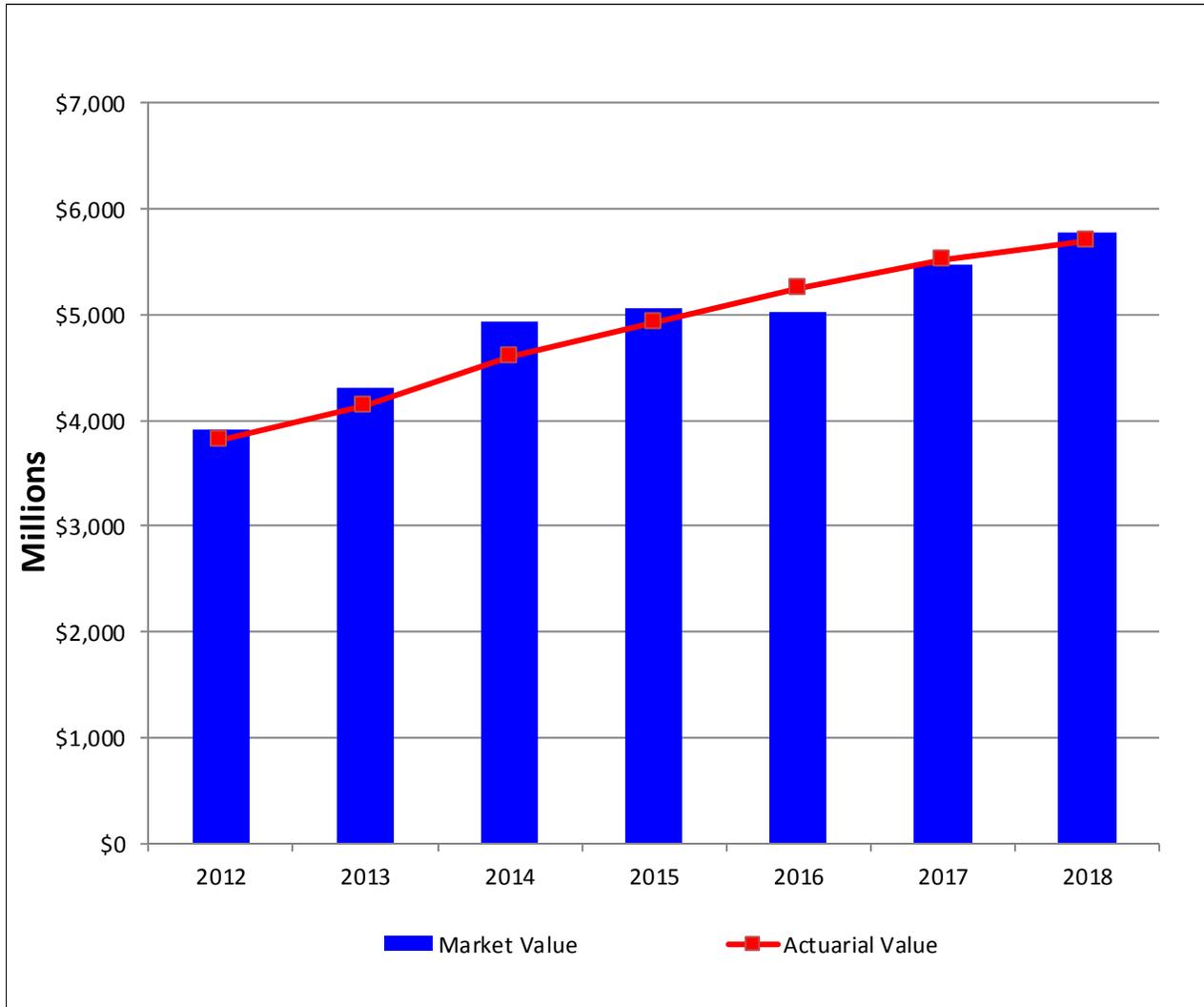
**Table 4:
Historical Investment Returns***

Fiscal Year Ending	Market Returns	Actuarial Returns	Assumed Rate of Return	Actuarial Return Over Assumption
June 30, 2009	(20.85)%	(0.16)%	8.00%	(8.16)%
June 30, 2010	12.91%	(1.18)%	7.75%	(8.93)%
June 30, 2011	21.70%	(0.08)%	7.75%	(7.83)%
June 30, 2012	2.27%	3.28%	7.75%	(4.47)%
June 30, 2013	12.99%	11.91%	7.75%	4.16%
June 30, 2014	17.12%	13.21%	7.75%	5.46%
June 30, 2015	4.60%	9.63%	7.75%	1.88%
June 30, 2016	2.02%	9.27%	7.75%	1.52%
June 30, 2017	11.93%	8.08%	7.75%	0.33%
June 30, 2018	8.90%	6.69%	7.65%	(0.96)%
10 Year Average	6.71%	5.95%		(1.83)%

* Returns reflect all investment returns, including investment income and realized and unrealized investment gains and losses, and are net of investment expenses and administrative expenses paid by the System.



**Table 5:
Market Value of Assets vs. Actuarial Value of Assets**





Section III: Actuarial Present Value of Future Benefits

Actuarial Present Value of Future Benefits

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

Table 6 contains an analysis of the actuarial present value of all future benefits for actives, for retirees, and for beneficiaries. The analysis is given by type of benefit.

The actuarial liabilities summarized in Table 6 include the actuarial present value of all future benefits expected to be paid with respect to each member covered as of the valuation date. For an active member, this value includes a measure of both benefits already earned and future benefits to be earned. Thus, for all members, active and retired, the value extends over benefits earnable and payable for the rest of their lives and, if an optional benefit is chosen, for the lives of their surviving beneficiaries.

The actuarial valuation does not recognize liabilities for employees who become members and participate in the System after the valuation date.



Section III: Actuarial Present Value of Future Benefits

**Table 6:
Actuarial Present Value of Future Benefits for Actives,
Retirees, and Beneficiaries**

	<u>June 30, 2018</u> Total	<u>June 30, 2017</u> Total
A. Active Members Liability Due to Probability of		
Retirement	\$ 3,228,878,570	\$ 3,424,501,105
Disability	\$ 54,341,741	\$ 57,193,356
In-Service Death	\$ 117,807,281	\$ 124,676,620
Termination	\$ 114,979,753	\$ 116,976,470
Total	\$ 3,516,007,345	\$ 3,723,347,551
B. Inactive Members and Annuitants		
Service Retirement	\$ 4,357,288,249	\$ 4,077,349,191
Disability Retirement	\$ 94,046,811	\$ 91,278,936
Beneficiaries*	\$ 267,593,577	\$ 254,802,151
Vested Terminated Members	\$ 248,277,724	\$ 246,191,940
Refund of Member Contributions	\$ 51,202,383	\$ 51,126,843
Total	<u>\$ 5,018,408,743</u>	<u>\$ 4,720,749,061</u>
C. Grand Total	\$ 8,534,416,088	\$ 8,444,096,612

* Includes survivors of active and retired members.



Section IV: Employer Contributions

Employer Contributions

In the previous two sections, attention has been focused on the assets and the present value of all future benefits of the System. A comparison of Tables 3 and 6 indicates that there is a shortfall in current actuarial assets to meet the present value of all future benefits for current members and beneficiaries.

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

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

- A normal cost amount, which ideally is relatively stable as a percentage of salary over the years;
- A load for administrative expenses; and
- An amount which is used to amortize the UAAL.

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

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

The assumed investment rate of return is 7.65%, net of investment expenses only. As a result, the actuarially determined contribution must include an amount for administrative expenses expected to occur during the year.

We have determined the normal cost rates separately by type of benefit under the System. These are summarized in Table 7. In Table 7 we also provide a summary of the member and employer statutory contributions.

The term "fully funded" is often applied to a system where contributions for everyone at the normal cost rate will fully pay for the benefits of existing as well as new employees. Often, systems are not fully funded, either because of benefit improvements in the past that have not been completely paid for or actuarial deficiencies that have occurred because experience has not been as anticipated. Under these circumstances, a UAAL exists.



Section IV: Employer Contributions

Table 8 shows how the UAAL was derived for the System. Lines A and B show, respectively, the total present value of future benefits and the portion of the future liability that is expected to be paid from future normal cost contributions, both employer and employee. The future normal cost contributions are the portion of the present value of future benefits that are attributed to future years of service that have not been earned yet by the active membership. Line C shows the actuarial accrued liability. Line D shows the amount of assets available for benefits. Line E shows the UAAL.

The UAAL at any date after establishment of a system is affected by any actuarial gains or losses arising when the actual experience of the system varies from the experience anticipated by the actuarial assumptions used in the valuations. To the extent actual experience as it develops differs from the assumptions used, so also will the actual emerging costs differ from the estimated costs. The impact of these differences in actual experience from the assumptions is included in Section 1, the Summary of Results.



Section IV: Employer Contributions

**Table 7:
Normal Cost Contribution Rates
As Percentages of Salary**

	<u>June 30, 2018 Total</u>	<u>June 30, 2017 Total</u>
Service retirement	7.60%	7.38%
Disability retirement	0.25%	0.23%
In Service death	0.34%	0.32%
Vested retirement	<u>2.08%</u>	<u>1.93%</u>
Total Normal Rate	<u><u>10.27%</u></u>	<u><u>9.86%</u></u>
Employee Normal Rate	7.90%	7.90%
Employer Normal Rate	2.37%	1.96%
Administrative Expense Load	0.26%	0.26%
Transfer to DB Education Fund	0.04%	0.04%
Rate Available to Amortize Unfunded Actuarial Accrued Liability	<u><u>6.00%</u></u>	<u><u>6.31%</u></u>
Statutory Funding Rate*	16.57%	16.47%

* Rates shown are for the fiscal year following the valuation date.

Note: The normal cost rate for members hired on or after July 1, 2011 is 9.12%.



Section IV: Employer Contributions

**Table 8:
Unfunded Actuarial Accrued Liability**

	<u>June 30, 2018</u>	<u>June 30, 2017</u>
A. Actuarial present value of all future benefits for actives and retirees and their survivors (Table 6)	\$ 8,534,416,088	\$ 8,444,096,612
B. Less actuarial present value of total future normal costs for present members	<u>\$ 804,332,011</u>	<u>\$ 865,711,833</u>
C. Actuarial accrued liability	\$ 7,730,084,077	\$ 7,578,384,779
D. Less assets available for benefits	<u>\$ 5,705,235,727</u>	<u>\$ 5,514,026,586</u>
E. Unfunded actuarial accrued liability	\$ 2,024,848,350	\$ 2,064,358,193



Cash Flows

The fundamental equation for funding a retirement system is that benefits and administrative expenses must be provided for by contributions (past and future) and investment income. When a retirement system matures, benefits and administrative expenses often exceed contributions. In this case we say the system has a “negative cash flow.” Mature systems are characterized by negative cash flows and large pools of assets. This is natural. Actuarial funding is designed to accumulate large pools of assets which will in turn provide investment income and finance negative cash flows when systems mature. If the fund is looked at as a whole, investment income is usually larger than the difference between contributions and benefit payments. The retirement system’s investment strategy should maximize potential returns at a prudent level of risk while providing for needed cash flows.

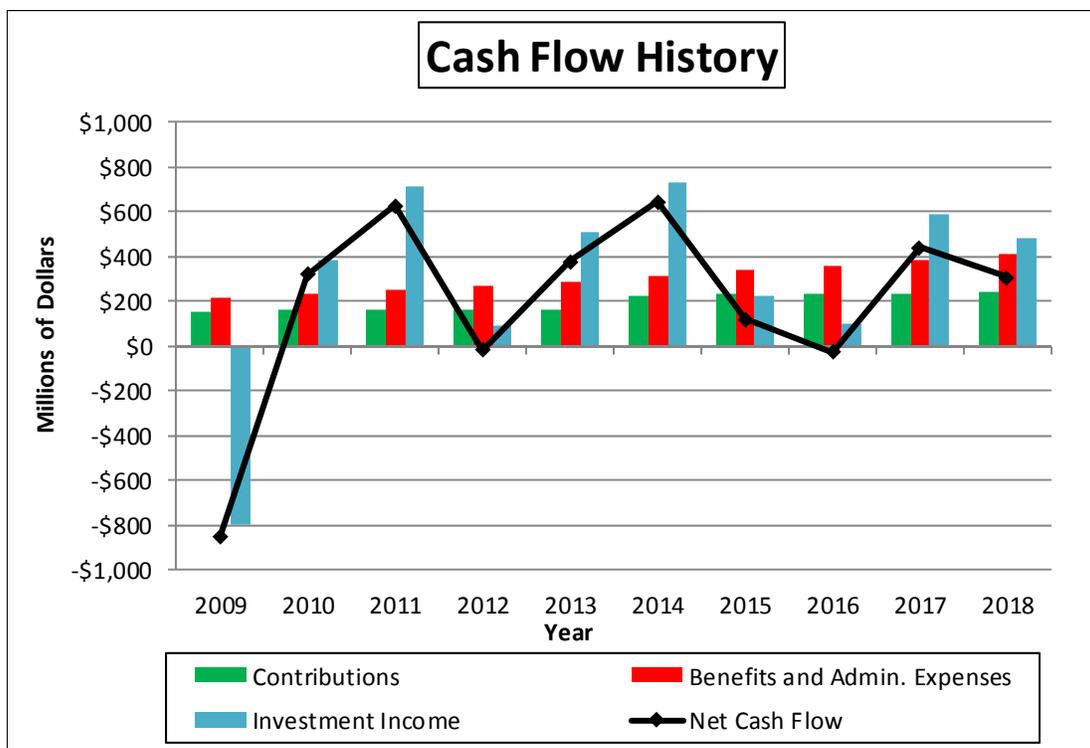
Table 9 shows the System had a positive cash flow for the year ended June 30, 2018. The System’s total cash flow including benefits payments, administrative expenses and investment earnings was \$306.9 million. Of the \$306.9 million, \$478.7 million was due to investment returns.

If the System had a positive cash flow, there would be no need to plan where the funds would come from to pay benefits since benefits could be paid by incoming contributions. A negative cash flow, as defined above, requires planning what funds will be used to pay the difference between benefits and contributions.



Section V: Cash Flow History

**Table 9:
Cash Flow History
(Dollar amounts in millions)**



Year Ended June 30	Historical Cash Flows			Net Cash Flow
	Contributions	Benefits & Administrative Expenses	Investment Income	
2009	\$ 152.3	\$ 211.9	\$ (796.2)	\$ (855.8)
2010	159.5	229.8	387.9	317.6
2011	157.6	246.9	715.4	626.1
2012	159.9	269.2	91.4	(17.9)
2013	163.3	290.7	505.0	377.6
2014	223.0	311.5	732.4	643.9
2015	230.1	337.0	225.1	118.2
2016	230.5	359.9	101.2	(28.2)
2017	233.1	384.8	591.4	439.7
2018	243.4	415.2	478.7	306.9



Section VI: Actuarial Gains of Losses

Actuarial Gains or Losses

An analysis of actuarial gains or losses is performed in conjunction with all regularly scheduled valuations.

The developments of the gains or losses related to the actuarial liability and the assets are shown in Table 10. The results of our analysis of the financial experience of the System in the three most recent regular actuarial valuations are presented in Table 11. Each gain or loss shown represents our estimate of how much the given type of experience caused the Unfunded Actuarial Accrued Liability or Funding Reserve to change in the period since the previous actuarial valuation.

Each gain or loss shown represents our estimate of how much the given type of experience caused the UAAL or Funding Reserve to change in the period since the previous actuarial valuation.

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

Non-recurring gains and losses result from changes in the actuarial assumptions and benefit improvements.



Section VI: Actuarial Gains of Losses

**Table 10:
Analysis of Actuarial (Gains) or Losses***

A. ACTUARIAL ACCRUED LIABILITY (GAIN) / LOSS ANALYSIS	
1. Actual Actuarial Accrued Liability as of June 30, 2017:	\$ 7,578,384,779
2. Normal Cost for this Plan Year (Including Expenses):	127,315,295
3. Interest on items 1 and 2 [(1+2) x 7.65%]:	589,486,056
4. Benefit Payments for this Plan Year (Including Expenses):	(415,157,547)
5. Interest on item [4 x 7.65% x .5]:	<u>(15,879,776)</u>
6. Expected Actuarial Accrued Liability as of June 30, 2018:	<u>\$ 7,864,148,807</u>
7. Changes due to:	
a. Assumption Changes:	0
b. Plan Amendments:	0
c. Funding Method:	0
d. Actuarial (Gain) / Loss:	\$ (134,064,730)
8. Actual Actuarial Accrued Liability as of June 30, 2018:	<u>\$ 7,730,084,077</u>
9. Items Affecting Calculation of Actuarial Accrued Liability:	
a. Benefit provisions reflected in the actuarial accrued liability (see Appendix C)	
b. Actuarial assumptions and methods used to determine actuarial accrued liability (see Appendix B)	
B. ASSET (GAIN) / LOSS ANALYSIS	
1. Actuarial Value of Assets as of June 30, 2017:	\$ 5,514,026,586
2. Interest on item [1 x 7.65%]:	421,823,034
3. Contributions for this Plan Year:	243,385,430
4. Interest on item [3. x 7.65% x .5]:	9,309,493
5. Benefit Payments for this Plan Year (Including Expenses):	(415,157,547)
6. Interest on item [5. x 7.65% x .5]:	<u>(15,879,776)</u>
7. Expected Actuarial Value of Assets as of June 30, 2018:	<u>\$ 5,757,507,220</u>
8. Actuarial Value of Assets as of June 30, 2018:	<u>\$ 5,705,235,727</u>
9. (Gain) / Loss	<u>\$ 52,271,493</u>
C. UNFUNDED ACTUARIAL ACCRUED LIABILITY (GAIN) / LOSS ANALYSIS	
1. Actual Unfunded Actuarial Accrued Liability as of June 30, 2017:	\$ 2,064,358,193
2. Normal Cost for this Plan Year (Including Expenses):	127,315,295
3. Contributions for this Plan Year:	(243,385,430)
4. Interest on items 1 - 3: [(1+2) x 7.65% + (3 x 7.65% x .5)]:	<u>158,353,529</u>
5. Expected Unfunded Actuarial Accrued Liability as of June 30, 2018:	<u>\$ 2,106,641,587</u>
6. Changes due to:	
a. Assumption Changes:	-
b. Plan Amendments:	-
c. Funding Method:	-
d. Actuarial (Gain) / Loss:	<u>\$ (81,793,237)</u>
7. Actual Unfunded Actuarial Accrued Liability as of June 30, 2018:	<u>\$ 2,024,848,350</u>

* Effects related to gains are shown in parentheses. Numerical results are expressed as a (decrease) increase in the Actuarial Accrued Liability (AAL). Gains decrease the AAL and losses increase the AAL.



Section VI: Actuarial Gains of Losses

**Table 11:
Historical Actuarial (Gains) or Losses***
(Dollar amounts in thousands)

	UAAL (Gain)/Loss		
	June 30, 2018	June 30, 2017	June 30, 2016
Investment Income			
Investment income was (greater) less than expected based on actuarial value of assets.	\$ 52,271.5	\$ (17,159.0)	\$ (73,748.8)
Pay Increases			
Pay increases were (less) greater than expected.	(167,094.3)	48,881.5	43,091.1
Age & Service Retirements			
Members retired at (older) younger ages or with (less) greater final average pay than expected	(101,162.2)	4,805.1	2,730.4
Disability Retirements			
Disability claims were (less) greater than expected	290.2	1,275.5	834.0
Death-in-Service Benefits			
Survivor claims were (less) greater than expected	(232.3)	(657.2)	(633.4)
Withdrawal From Employment			
(More) less reserves were released by withdrawals than expected	45,703.4	66,282.2	4,953.4
Death After Retirement			
Retirees (died younger) lived longer than expected	(23,269.2)	(4,326.2)	(3,963.9)
Data Adjustments and Benefit Payment Timing			
Service purchases, data corrections, etc.	98,159.5	25,663.4	21,259.2
Other			
Miscellaneous (gains) and losses	13,540.2	11,735.8	(11,100.8)
Total (Gain) or Loss During Period From Financial Experience	\$ (81,793.2)	\$ 136,501.1	\$ (16,578.8)
Non-Recurring Items.			
Changes in actuarial assumptions and methods	-	365,868.8	-
Changes in benefits caused a (gain) loss	-	-	-
Composite (Gain) Loss During Period	\$ (81,793.2)	\$ 502,369.9	\$ (16,578.8)

* Effects related to gains are shown in parentheses. Numerical results are expressed as a (decrease) increase in the Unfunded Actuarial Accrued Liability (UAAL). Gains decrease the UAAL and losses increase the UAAL.



Appendix A: Actuarial Procedures and Methods

The assumptions and methods utilized in the valuation were developed in the six-year experience study for the period ending June 30, 2016.

Tables B-3 through B-7 give rates of decrement for service retirement, disablement, mortality, and other terminations of employment.

Actuarial Cost Method

The actuarial valuation was prepared using the entry age actuarial cost method. Under this method, the actuarial present value of the projected benefits of each individual included in the valuation is allocated as a level percentage of the individual's projected compensation between entry age and assumed exit. The portion of this actuarial present value allocated to a valuation year is called the normal cost. The normal cost was first calculated for each individual member. The normal cost rate is defined to equal the total of the individual normal costs, divided by the total pay rate.

The portion of this actuarial present value not provided for at a valuation date by the sum of (a) the actuarial value of the assets and (b) the actuarial present value of future normal costs is called the UAAL. The UAAL is amortized as a level percentage of the projected salaries of present and future members of the System.

Records and Data

The data used in the valuation consist of financial information; records of age, sex, service, salary, contribution rates, and account balances of contributing members; and records of age, sex, and amount of benefit for retired members and beneficiaries. All of the data has been supplied by the System and was accepted for valuation purposes without audit.

Replacement of Terminated Members

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

Administrative and Investment Expenses

The investment expenses of the System are assumed to be funded by investment earnings in excess of 7.65% per year.

Administrative expenses are assumed to equal 0.26% of payroll.



Appendix A: Actuarial Procedures and Methods

Valuation of Assets

The actuarial asset valuation method spreads asset gains and losses over four years. The expected return is determined each year based on the beginning of year market value and actual cash flows during the year. Any difference between the expected market value return and the actual market value return is recognized evenly over a period of four years.

Investment Earnings

The annual rate of investment earnings of the assets of the System is assumed to be 7.65% per year net of investment expenses, compounded annually.

Interest on Member Contributions

Interest on member contributions is assumed to accrue at a rate of 2.75% per annum, compounded annually.

Future Salaries

The rates of annual salary increase assumed for the purpose of the valuation are illustrated in Table B-2. In addition to increases in salary due to merit and longevity, this scale includes an assumed 3.5% annual rate of increase in the general wage level of the membership.

Service Retirement

Table B-3 shows the annual assumed rates of retirement for actives members meeting the service retirement eligibilities.

Disablement

The rates of disablement used in this valuation are illustrated in Table B-4.

Mortality

The mortality rates used in this valuation are illustrated in Table B-5. A written description of each table used is included in Table B-1.

Other Terminations of Employment

The rates of assumed future withdrawal from active service for reasons other than death, disability or retirement are shown for representative ages in Table B-6.

Benefits for Terminating Members

Members terminating with less than five years of service are assumed to request an immediate withdrawal of their contributions with interest. Table B-7 shows the assumed probability of retaining membership in the System among members terminating with five or more years of service.



Appendix A: Actuarial Procedures and Methods

We estimated the present value of future benefits for terminated vested members based on the greater of the present value of their deferred benefit at age 60 or their available contribution account.

Probability of Marriage & Dependent Children

If death occurs in active status, all members are assumed to have an eligible surviving spouse with no dependent children.

Records with no Birth Date

New records with no birth date are assumed to be 37 years old. Records that are not new and have no birth date used the same birth date as the prior year's valuation.

Active Records with a Salary Less than \$1,000

These members are included in the active headcounts, however the pay of these members is not included in the Valuation Projected Salaries summarized in Appendix D. The liability for these members is their accumulated member contributions payable on the valuation date.



Table B-1

Summary of Valuation Assumptions

I. Economic assumptions		
A.	General wage increases	3.50%
B.	Investment return	7.65%
C.	Price inflation assumption	2.75%
D.	Growth in membership	0.00%
E.	Interest on member accounts	2.75%
F.	Administrative expenses as a percentage of payroll	0.26%
II. Demographic assumptions		
A.	Individual salary increase due to promotion and longevity	Table B-2
B.	Retirement	Table B-3
C.	Disablement	Table B-4
D.	Mortality among contributing members, service retired members, and beneficiaries. The tables include margins for mortality improvement which is expected to occur in the future. For Males and Females: RP 2000 Combined Employee and Annuitant Mortality Table projected to 2020 using Scale BB, males set back 1 year.	Table B-5
E.	Mortality among disabled members For Males and Females: RP 2000 Combined Mortality Table.	Table B-5
F.	Other terminations of employment	Table B-6
G.	Probability of retaining membership in the System upon vested termination	Table B-7



Table B-2

Future Salaries

	(a)	(b)	(1+(a))*(1+(b))
Years of Service	Individual Merit & Longevity	General Wage Increase	Total Salary Increase
1	4.80%	3.50%	8.47%
2	3.80	3.50	7.43
3	2.80	3.50	6.40
4	2.00	3.50	5.57
5	1.40	3.50	4.95
6	0.80	3.50	4.33
7	0.40	3.50	3.91
8	0.00	3.50	3.50
8 & Up	0.00	3.50	3.50



Appendix B: Summary of Valuation Assumptions

Table B-3
Retirement
Annual Rates

<u>Age</u>	<u>Less than 30 Years of Service</u>	<u>30 Years or more of Service and age 60 with 25 Years of Service</u>
Less than 45		10.0%
45		10.0
46		10.0
47		10.0
48		10.0
49		10.0
50	3.0%	10.0
51	3.0	10.0
52	3.0	10.0
53	3.0	10.0
54	3.0	10.0
55	3.0	15.0
56	4.0	15.0
57	5.0	15.0
58	5.0	15.0
59	6.0	15.0
60	8.0	15.0
61	15.0	15.0
62	25.0	25.0
63	15.0	15.0
64	15.0	15.0
65	30.0	30.0
66	30.0	30.0
67	25.0	25.0
68	25.0	25.0
69	25.0	25.0
70 & Over	100.0	100.0

Vested terminations are assumed to retire at their earliest unreduced eligibility.



Appendix B: Summary of Valuation Assumptions

Table B-4
Disablement
Annual Rates

Age	All Members
22	.00%
27	.01
32	.01
37	.04
42	.10
47	.13
52	.25
57	.36
60	.00
62	.00

All disabilities are assumed to be permanent and without recovery.



Table B-5
Mortality
Annual Rates

Age	Contributing Members, Service Retired Members and Beneficiaries		Disabled Members	
	Men	Women	Men	Women
25	0.0354%	0.0195%	0.0376%	0.0207%
30	0.0388	0.0249	0.0444	0.0264
35	0.0661	0.0447	0.0773	0.0475
40	0.0961	0.0665	0.1079	0.0706
45	0.1316	0.1058	0.1508	0.1124
50	0.1879	0.1578	0.2138	0.1676
55	0.3010	0.2458	0.3624	0.2717
60	0.5271	0.4135	0.6747	0.5055
65	0.9041	0.7624	1.2737	0.9706
70	1.4636	1.3151	2.2206	1.6742
75	2.5057	2.2077	3.7834	2.8106
80	4.2816	3.6037	6.4368	4.5879
85	7.3750	6.0833	11.0757	7.7446
90	13.0721	10.5549	18.3408	13.1682
95	21.7835	17.2452	26.7491	19.4509



Table B-6

**Other Terminations of Employment
Among Members Not Eligible to Retire
Annual Rates**

<u>Years of Service</u>	<u>All Members</u>
0	30.0%
1	22.5
2	15.0
3	12.5
4	10.0
5	10.0
6	8.0
7	6.0
8	6.0
9	6.0
10	6.0
11	4.0
12	4.0
13	4.0
14	4.0
15 & Over	2.0

No terminations are assumed after age 50 with five years of service.



Table B-7

**Probability of Retaining Membership in the System
Upon Vested Termination**

<u>Age</u>	<u>Probability of Retaining Membership</u>
Under 35	40%
35	50
36	50
37	50
38	50
39	50
40	55
41	55
42	55
43	55
44	55
45	65
46	65
47	65
48	65
49	65
50 & Over	70

Family Composition

Female spouses are assumed to be three years younger than males. 100% of non-retired employees are assumed married for both male and female employees. Actual marital characteristics are used for retirees.

Vested Benefits for Termination Members

Vested benefits for members who terminated during years ending June 30, 2009 and later were estimated based upon compensation and service information in the census data. For members who terminated prior to June 30, 2008, vested benefits valued were the same as had been calculated by the prior actuary for the June 30, 2008 actuarial valuation.



Appendix C: Summary of Benefit Provisions

- | | |
|--|---|
| Service credit | <ul style="list-style-type: none">• Service credit is used to determine the amount of a member's retirement benefit.• One month of service credit is earned for each month where the member is paid for 160 hours. This includes certain transferred and purchased service. |
| Membership service | <ul style="list-style-type: none">• Membership service is used to determine eligibility for vesting, retirement or other benefits.• One month of membership service is earned for any month member contributions are made, regardless of the number of hours worked.• Eligible members in all systems may purchase service that counts toward membership service.• Additionally, eligible active and inactive Sheriffs' Retirement System (SRS) members may purchase 1 for 5 (additional) service that will count as membership service. |
| Contributions | <ul style="list-style-type: none">• Member contributions are made through an "employer pick-up" arrangement which results in deferral of taxes on the contributions. |
| Compensation | <ul style="list-style-type: none">• Compensation generally means all remuneration paid, excluding certain allowances, benefits, and lump sum payments. Compensation is specifically defined in law and differs amongst the systems.• Bonuses paid on or after July 1, 2013 to any member will not be treated as compensation for retirement purposes. No member or employer contributions will be paid on bonuses. |
| Withdrawal of employee contributions | <ul style="list-style-type: none">• A member is eligible for a withdrawal of their contributions when they terminate service and are either not eligible for or have not taken a retirement benefit.• The member receives the accumulated member contributions, which consists of member contributions and regular interest.• Upon receipt of a refund of accumulated contributions a member's vested right to a monthly benefit is forfeited. |
| Member contributions interest credited (regular interest) | <ul style="list-style-type: none">• Interest is credited to member accounts at the rates determined by the Board.• The current interest rate credited to member accounts is 0.77%. |
| Refunds | <ul style="list-style-type: none">• Terminating members eligible to retire may, in lieu of receiving a monthly retirement benefit, refund their accumulated contributions in a lump sum.• Terminating members with accumulated contributions between \$200 and \$1,000 who wish to rollover their refund must do so within 90 days of termination of service.• Trusts, estates, and charitable organizations listed as beneficiaries are entitled to receive only a lump sum payment. |



Appendix C: Summary of Benefit Provisions

Lump-sum payouts	<ul style="list-style-type: none">• Effective July 1, 2017, lump sum payouts in all systems are limited to the member's accumulated contributions rather than the present value of the member's benefit.
Type of Plan	<ul style="list-style-type: none">• Multiple-employer cost sharing
Membership eligibility	<ul style="list-style-type: none">• Employees of the State and local governments that have contracted for PERS coverage.• Certain employees of the university system and school districts, not covered by a separate retirement system governed by Title 19 of the Montana Code Annotated.
Member contributions	<ul style="list-style-type: none">• 7.9% of member's compensation.• Temporary 1% increase for all members effective July 1, 2011.• Reduced to 6.9% when amortization period drops below 25 years and remains below 25 years following the termination of the temporary 1% increase and the additional employer contribution rate.
Employer contributions	<ul style="list-style-type: none">• 8.57% of each member's compensation for state and university. Reduced when amortization period drops below 25 years and remains below 25 years following the termination of the additional employer contribution rate and the member's temporary 1% increase.• 8.47% of each member's compensation for local governments• 8.2% of each member's compensation for school districts• Contribution going into the PERS Defined Benefit Plan is reduced by 0.04% of compensation paid into the Educational Fund.• Employers who hire PERS retirees who work less than 960 hours in the calendar year in a PERS-covered position, but do not become active members, contribute the employer's contribution rate on the working retiree's compensation.
State contributions	<ul style="list-style-type: none">• 0.1% of compensation from the State for local governments• 0.37% of compensation from State for School Districts• Contributions are also made to the system from the State General Fund through a statutory appropriation.
Compensation period used in benefit calculation	<ul style="list-style-type: none">• HAC = Highest Average Compensation• Hired prior to July 1, 2011: HAC is average of the highest 36 consecutive months (or shorter period of total service) of compensation paid by member.• Hired on or after July 1, 2011: HAC is average of the highest 60 consecutive months (or shorter period of total service) of compensation paid to member.• Hired on or after July 1, 2013: 110% annual cap on compensation considered as part of a member's HAC.



Appendix C: Summary of Benefit Provisions

Service retirement eligibility

Members hired **prior to** July 1, 2011:

- Age 60, 5 years membership service
- Age 65, regardless of membership service
- Any age, 30 years membership service

Members hired **on or after** July 1, 2011:

- Age 65, 5 years of membership service
- Age 70, regardless of service

Service retirement benefit formula

Members hired **prior to** July 1, 2011:

- Less than 25 years of membership service:
1.785% of HAC x years of service credit
- 25 years or more of membership service:
2% of HAC x years of service credit
- **OR**, if greater than either of the above:
the actuarial equivalent of 2 times the member's regular contributions and interest plus the actuarial equivalent of any additional contributions and interest.

Members hired **on or after** July 1, 2011:

- Less than 10 years of membership service:
1.5% of HAC x years of service credit
- Between 10 and 30 years of membership service:
1.785% of HAC x years of service credit
- 30 years or more of membership service:
2% of HAC x years of service credit
- **OR**, if greater than any of the above:
the actuarial equivalent of 2 times the member's regular contributions and interest plus the actuarial equivalent of any additional contributions and interest.

Second retirement benefit

Members who retire **before January 1, 2016, return to PERS-covered employment, and accumulate less than 2 years of additional service credit receive:**

- A refund of the member's contributions plus regular interest;
- No service credit for second employment;
- The same benefit amount starting the month following termination; **and**
- The member's Guaranteed Annual Benefit Adjustment (GABA) increasing again in January immediately following the member's second retirement.

Members who retire **before January 1, 2016 and return to PERS-covered employment for at least 2 years of additional service credit receive:**

- A re-calculated retirement benefit based on provisions in effect after member's initial retirement; **and**
- GABA on member's re-calculated benefit starting in January after receiving the re-calculated benefit for 12 months.



Appendix C: Summary of Benefit Provisions

Members who retire **on or after January 1, 2016, return to PERS service, and accumulate less than 5 years of additional service credit receive:**

- A refund of a member's contributions plus regular interest;
- No service credit for second employment;
- The same benefit amount starting the month following termination; **and**
- The member's GABA increasing again in January immediately following the member's second retirement.

Members who retire **on or after January 1, 2016, return to PERS service, and accumulate 5 or more years of additional service credit receive:**

- The same retirement benefit paid immediately prior to member's return to service;
- A second retirement benefit for member's second period of service based on laws in effect upon the member's rehire date; **and**
- The member's GABA on both benefits starting in January after receiving the original and new benefit for 12 months.

Early retirement eligibility

Members hired **prior to** July 1, 2011:

- Age 50 with 5 years of membership service; or
- Any age under age 60 with 25 years of membership service

Members hired **on or after** July 1, 2011:

- Age 55 with 5 years of membership service.

Early retirement benefit formula

Members hired **prior to** July 1, 2011 **and**

- who retire **prior to** October 1, 2011

The actuarial equivalent of the accrued portion of the service retirement benefit that would have been payable to the member commencing at age 60 or upon completion of 30 years of membership service. The service retirement benefit is reduced by a factor resulting from multiplying 0.5% (for first five years from service retirement eligibility) and 0.3% (for six to 10 years from service retirement eligibility) by the number of months by which the retirement date precedes the date at which the member would have attained age 60 or completed 30 years of membership service.

- who retire **on or after** October 1, 2011

The actuarial equivalent of the accrued portion of the service retirement benefit that would have been payable to the member commencing at age 60 or upon completion of 30 years of membership service. The service retirement benefit must be reduced using actuarially equivalent factors based on the most recent valuation.



Appendix C: Summary of Benefit Provisions

Disability eligibility and benefit formula

Members hired **on or after** July 1, 2011:

The actuarial equivalent of the accrued portion of the service retirement benefit that would have been payable to the member commencing at age 65. The service retirement benefit must be reduced using actuarially equivalent factors based on the most recent valuation.

- 5 years of membership service

If hired **on or before** February 24, 1991 **and** did not make a contrary election, the greater of:

- (90% of 1.785% of HAC) x service credit, or
- 25% of HAC

If hired **after** February 24, 1991 **and prior to** July 1, 2011, **or** hired **on or before** February 24, 1991 **and** so elected:

- Less than 25 years of membership service:
1.785% of HAC x service credit, or
- At least 25 years of membership service:
2% of HAC x service credit

If hired **on or after** July 1, 2011:

- Less than 10 years of membership:
1.5% of HAC x years of service credit
- Between 10 and 30 years of membership service:
1.785% of HAC x years of service credit
- 30 years or more of membership service:
2% of HAC x years of service credit

Survivor's benefit eligibility

Member's status at time of death:

- active;
 - receiving disability benefit for less than six months;
 - continuously disabled without receiving a disability benefit;
- or**
- inactive



Appendix C: Summary of Benefit Provisions

Death payment benefit formula

- Accumulated contributions + (monthly compensation x lesser of years of service credit **or** 6) + interest until benefit paid.
- However, a survivor of an inactive member who was inactive for more than 6 months will receive only accumulated contributions and interest from the date of death until payment.
- A survivor may elect to receive the payment as a non-increasing annuity that is the actuarial equivalent of the death payment amount.

Survivor benefit formula

Members hired **prior to** July 1, 2011:

- The survivorship benefit payable to a vested member's survivor is:
 - the actuarial equivalent of the member's accrued retirement benefit at the time of death; **or**,
- If the member dies **prior to** age 50 **or** 25 years of membership service:
 - the actuarial equivalent of the accrued portion of the early retirement benefit that would have been paid to the member at age 50.

Members hired **on or after** July 1, 2011:

- The survivorship benefit payable to an active vested member's survivor is:
 - the actuarial equivalent of the member's accrued retirement benefit at the time of death; **or**
- If the member dies **prior to** age 55:
 - the actuarial equivalent of the accrued portion of the early retirement benefit that would have been paid to the member at age 55.

Vesting eligibility and benefit

- 5 years of membership service
- Accrued normal retirement benefit, payable when eligible for retirement.
- In lieu of a pension, a member may receive a refund of accumulated contributions.
- Upon receipt of a refund of accumulated contributions, a member's vested right to a monthly benefit is forfeited.



Appendix C: Summary of Benefit Provisions

Retirement benefits - Form of payment

Option 1, the normal form of payment is a single life annuity with a refund of any remaining account balance to a designated beneficiary. Optional Benefits:

- Option 2, a life annuity and joint 100% survivor benefit,
- Option 3, a life annuity and joint 50% survivor benefit, and
- Option 4, a life annuity with a period certain.

If a retiring member selects Option 2 or 3 and the contingent annuitant predeceases or is divorced from the member, the retiree may, within 18 months of the death or divorce, choose to revert to the higher Option 1 benefit available at retirement or the retiree may select a different contingent annuitant and/or a different option.

Post retirement benefit increases

For retired members hired **before** July 1, 2013 who have been retired at least 12 months, a Guaranteed Annual Benefit Adjustment (GABA) will be made January 1 of each year equal to:

- 3% for members hired **before** July 1, 2007, and
- 1.5% for members hired **on or after** July 1, 2007 and **prior to** July 1, 2013.

For retired members who were hired **on or after** July 1, 2013 and who have been retired at least 12 months, a Guaranteed Annual Benefit Adjustment (GABA) will be made January 1 of each year equal to:

- A maximum of 1.5% for each year PERS is funded at or above 90%, subject to a 0.1% reduction for each 2% PERS is funded below 90%; or
- 0% whenever the amortization period for PERS is 40 years or more.

Changes since last valuation

None



Appendix D: Valuation Data

Valuation Data

This chart is presented for informational purposes only. The counts shown in the valuation line were used for preparation of the liabilities disclosed within this report. The counts disclosed for the Annual Financial Report and the Summary of Results (page 1) match the CAFR at the request of the Board. The differences between counts, if any, have no material effect upon the liability calculation.

	<u>Active</u>	<u>Disabled</u>	<u>Retirees and Beneficiaries</u>	<u>Terminated Vested Members</u>	<u>Terminated Non-Vested Members</u>	<u>Total</u>
Participant Counts Used for Valuation	28,615	690	21,865	3,785	17,943	72,898
Disabled Members having attained normal retirement age		(532)	532			-
Receiving Benefit Payments	17			3	11	31
Actively Working				4	20	24
Other Adjustments	14		1	1	(1)	15
Participant Counts shown in the Annual Financial Report	28,646	158	22,398	3,793	17,973	72,968



Appendix D: Valuation Data

Valuation Data

This valuation is based upon the membership of the System as of June 30, 2018. Membership data was supplied by the System and has been accepted for valuation purposes without audit. However, tests were performed to ensure that the data is sufficiently accurate for valuation purposes.

The salaries used in the tables and charts which follow are different than the salaries used for the Board Summary on page 1. The valuation projected salaries to be paid for the following fiscal year, whereas the Board Summary, salaries are applicable in the year ending on the valuation date.

Active Members	Number	Valuation Projected Salaries	
Full-Time Members	21,898	\$	1,127,162,565
Part-Time Members	6,717	\$	123,137,119
Total Active Members	28,615	\$	1,250,299,684

Table D-1 contains summaries of the data for contributing members. For full-time members, values shown in the tables are the numbers of members and their total and average annual salaries. For part-time members, only the numbers of members are shown.

Table D-2 presents distributions of the following:

- Members receiving service retirement benefits.
- Members receiving disability retirement benefits.
- Survivors of deceased retired members receiving benefits.
- Survivors of deceased active members.
- Terminated vested members.

Table D-3 is a reconciliation of membership data from June 30, 2017 to June 30, 2018.



Appendix D: Valuation Data

The following is a summary of retired members and beneficiaries currently receiving benefits. The chart reflects the counts and benefits used for valuation purposes as a result of data processing. Please refer to the chart on page 45 for an explanation of the number of annuitants used for valuation purposes.

<u>Type of Annuitant</u>	<u>Number</u>	<u>Annual Benefits</u>	<u>Average Annual Benefits</u>
Service Retirement	19,784	\$ 367,391,866	\$ 18,570
Survivors of Deceased Retired Members	1,584	21,780,610	13,750
Survivors of Deceased Active Members	<u>497</u>	<u>5,930,405</u>	<u>11,932</u>
Total Retirees and Beneficiaries	21,865	\$ 395,102,881	\$ 18,070
Disability Retirement	690	7,866,079	11,400
Total Annuitants	22,555	\$ 402,968,960	\$ 17,866

<u>Terminated Members with Contributions Not Withdrawn</u>	<u>Number</u>
Vested Terminated Members	3,785
Non-Vested Terminated Members	<u>17,943</u>
Total Terminated Members	21,728



**Table D-1:
Active Members Distribution of
Full-Time Employees and Salaries
as of June 30, 2018**

Number of Employees

Age	Completed Years of Service												Totals	
	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40+		
<25	387	143	70	38	7									645
25 to 29	443	293	274	341	186	5								1,542
30 to 34	342	258	261	424	565	136	5							1,991
35 to 39	289	216	240	391	614	410	110	1						2,271
40 to 44	262	187	189	298	477	456	299	62						2,230
45 to 49	246	163	175	319	556	441	359	266	88	2				2,615
50 to 54	223	167	172	275	542	467	412	354	300	71	5			2,988
55 to 59	192	158	182	304	597	566	548	455	426	228	77	3		3,736
60 to 64	108	80	76	229	446	469	403	359	337	212	125	44		2,888
65 to 69	26	20	19	35	132	127	114	111	88	50	33	32		787
70 and up	13	2	3	16	37	31	31	20	19	15	4	14		205
Totals	2,531	1,687	1,661	2,670	4,159	3,108	2,281	1,628	1,258	578	244	93		21,898



Appendix D: Valuation Data

**Table D-1:
Active Members Distribution of
Full-Time Employees and Salaries
as of June 30, 2018**

Annual Salaries in Thousands

Age	Completed Years of Service												Totals	
	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40+		
<25	12,281	5,066	2,549	1,585	279									21,760
25 to 29	15,726	12,007	11,598	15,392	8,543	212								63,478
30 to 34	13,222	11,394	11,963	20,487	29,588	7,020	249							93,923
35 to 39	11,334	9,853	10,880	18,897	32,792	23,968	6,627	37						114,389
40 to 44	9,891	8,602	8,959	14,910	25,655	26,550	19,236	4,122						117,925
45 to 49	8,973	7,079	7,608	14,918	29,371	25,818	22,663	18,735	6,246	116				141,528
50 to 54	8,735	7,610	7,666	13,114	27,413	25,805	24,411	22,768	21,277	4,877	297			163,974
55 to 59	6,961	7,062	7,530	14,350	28,695	29,184	31,058	27,441	28,074	15,451	4,818	161		200,785
60 to 64	3,944	3,644	3,432	10,237	21,839	24,724	22,452	20,374	20,628	14,205	8,180	2,972		156,630
65 to 69	1,029	872	882	1,462	6,475	6,660	6,068	6,080	5,338	3,037	2,154	2,084		42,140
70 and up	556	109	97	696	2,183	1,340	1,547	1,101	967	876	221	936		10,629
Totals	92,652	73,299	73,164	126,048	212,834	171,281	134,312	100,658	82,530	38,562	15,670	6,153		1,127,163



Appendix D: Valuation Data

**Table D-1:
Active Members Distribution of
Full-Time Employees and Salaries
as of June 30, 2018**

Average Annual Salary

Age	Completed Years of Service												Totals	
	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40+		
<25	31,735	35,427	36,410	41,715	39,801									33,737
25 to 29	35,498	40,978	42,330	45,138	45,931	42,393								41,166
30 to 34	38,661	44,162	45,836	48,318	52,369	51,616	49,841							47,174
35 to 39	39,217	45,618	45,333	48,331	53,408	58,459	60,242	37,244						50,369
40 to 44	37,751	46,000	47,402	50,035	53,785	58,224	64,335	66,477						52,881
45 to 49	36,476	43,432	43,476	46,765	52,826	58,544	63,129	70,431	70,974	58,100				54,122
50 to 54	39,173	45,571	44,572	47,687	50,577	55,257	59,250	64,316	70,922	68,694	59,462			54,878
55 to 59	36,254	44,697	41,371	47,203	48,065	51,562	56,676	60,310	65,902	67,766	62,573	53,753		53,743
60 to 64	36,518	45,544	45,153	44,702	48,967	52,716	55,713	56,753	61,211	67,005	65,440	67,536		54,235
65 to 69	39,573	43,604	46,406	41,770	49,056	52,445	53,226	54,773	60,656	60,732	65,269	65,130		53,546
70 and up	42,807	54,490	32,273	43,476	58,999	43,211	49,913	55,061	50,920	58,378	55,168	66,886		51,849
Totals	36,607	43,449	44,048	47,209	51,174	55,110	58,883	61,829	65,604	66,715	64,222	66,165		51,473



**Table D-1:
Active Members Distribution of
Part-Time Employees
as of June 30, 2018**

Number of Employees

Age	Completed Years of Service												Totals	
	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40+		
<25	182	73	35	10	1									301
25 to 29	161	128	69	77	19	1								455
30 to 34	124	115	78	93	73	9								492
35 to 39	163	125	86	106	102	28	5	1						616
40 to 44	111	117	85	108	110	45	22	4						602
45 to 49	113	123	91	93	138	88	41	20	6					713
50 to 54	112	113	79	96	179	85	67	25	10	4				770
55 to 59	121	115	78	130	205	147	101	71	40	29	2			1,039
60 to 64	81	89	66	110	201	113	104	72	60	38	13			947
65 to 69	46	53	38	64	96	59	48	26	24	17	4	2		477
70 and up	36	22	22	34	64	53	29	14	15	6	9	1		305
Totals	1,250	1,073	727	921	1,188	628	417	233	155	94	28	3		6,717



Appendix D: Valuation Data

**Table D-2:
Distribution of Inactive Lives**

The charts reflects the counts and benefits used for valuation purposes as a result of data processing. Please refer to the chart on page 45 for an explanation of the number of annuitants used for valuation purposes.

Members Receiving Service Retirement Benefits as of June 30, 2018

<u>Age</u>	<u>Number of Persons</u>	<u>Annual Benefits in Thousands</u>	<u>Average Annual Benefits</u>
<50	7	\$ 229,730	\$ 32,819
50 to 54	120	2,802,971	23,358
55 to 59	704	18,773,512	26,667
60 to 64	2,939	63,389,102	21,568
65 to 69	5,286	107,769,490	20,388
70 to 74	4,359	81,744,005	18,753
75 to 79	2,911	46,964,382	16,133
80 to 84	1,808	25,978,801	14,369
85 to 89	1,066	13,356,039	12,529
90 and up	584	6,383,834	10,931
Totals	19,784	\$ 367,391,866	\$ 18,570

Members Receiving Disability Retirement Benefits as of June 30, 2018

<u>Age</u>	<u>Number of Persons</u>	<u>Annual Benefits in Thousands</u>	<u>Average Annual Benefits</u>
<50	19	\$ 189,332	\$ 9,965
50 to 54	36	450,029	12,501
55 to 59	99	1,294,771	13,078
60 to 64	135	1,669,537	12,367
65 to 69	142	1,596,477	11,243
70 to 74	108	1,178,473	10,912
75 to 79	71	679,779	9,574
80 to 84	44	366,739	8,335
85 to 89	20	230,554	11,528
90 and up	16	210,388	13,149
Totals	690	\$ 7,866,079	\$ 11,400

**Appendix D: Valuation Data****Table D-2:
Distribution of Inactive Lives**

The charts reflects the counts and benefits used for valuation purposes as a result of data processing. Please refer to the chart on page 45 for an explanation of the number of annuitants used for valuation purposes.

Survivors of Deceased Retired Members as of June 30, 2018

Age	Number of Persons	Annual Benefits in Thousands	Average Annual Benefits
<50	60	\$ 480,392	\$ 8,007
50 to 54	22	287,891	13,086
55 to 59	42	545,713	12,993
60 to 64	94	1,198,902	12,754
65 to 69	151	2,358,039	15,616
70 to 74	209	3,130,244	14,977
75 to 79	250	3,626,157	14,505
80 to 84	291	4,162,653	14,305
85 to 89	266	3,673,568	13,810
90 and up	199	2,317,051	11,643
Totals	1,584	\$ 21,780,610	\$ 13,750

Survivors of Deceased Active Members as of June 30, 2018

Age	Number of Persons	Annual Benefits in Thousands	Average Annual Benefits
<50	87	\$ 660,841	\$ 7,596
50 to 54	31	293,341	9,463
55 to 59	52	527,766	10,149
60 to 64	69	917,985	13,304
65 to 69	84	1,087,620	12,948
70 to 74	65	924,935	14,230
75 to 79	46	515,368	11,204
80 to 84	35	549,447	15,698
85 to 89	21	325,369	15,494
90 and up	7	127,733	18,248
Totals	497	\$ 5,930,405	\$ 11,932



**Table D-2:
Distribution of Inactive Lives**

The charts reflects the counts and benefits used for valuation purposes as a result of data processing. Please refer to the chart on page 45 for an explanation of the number of annuitants used for valuation purposes.

**Terminated Vested Members as of June 30, 2018
Number of Persons**

<u>Age</u>	<u>Number</u>
<25	1
25 to 29	20
30 to 34	176
35 to 39	304
40 to 44	344
45 to 49	453
50 to 54	649
55 to 59	937
60 to 64	620
65 to 69	216
70 and above	<u>65</u>
Total	3,785



Appendix D: Valuation Data

**Table D-3:
Data Reconciliation**

The following table shows a reconciliation of the participants used in the previous valuation to this valuation. This chart reflects the counts used for valuation purposes as a result of data processing.

	<u>Active Members</u>	<u>Terminated Vested Members</u>	<u>Service Retired Members</u>	<u>Disabled Members</u>	<u>Survivors and Beneficiaries</u>
June 30, 2017 Valuation	29,382	3,674	19,054	702	2,049
Refunds and Non-Vested Terminations	(2,675)	(81)			
Vested Terminations	(636)	636			
Service Retirements	(980)	(337)	1,317		
Disability Retirements	(14)	(9)	(1)	24	
Deaths	(23)	(12)	(485)	(30)	(55)
New Entrants	3,287				176
Rehires	521	(87)	(9)	(1)	
Benefits Suspended / Expired					(89)
Transfer to DC Plan	(247)				
Other		1	(92)	(5)	
June 30, 2018 Valuation	28,615	3,785	19,784	690	2,081



Appendix E: Comparative Schedules

Comparative Schedules

This section contains tables that summarize the experience of the System shown in present and past valuation reports.

Table E-1 shows a summary of the active members covered as of the various valuation dates.

Table E-2 shows a summary of the retired and inactive members as of the various valuation dates.

Table E-3 summarizes the contribution rates determined by each annual actuarial valuation.



**Table E-1:
Active Membership Data**

<u>Valuation Date (June 30)</u>	<u>Actives</u>	<u>Annual Salaries in Thousands</u>	<u>Average Annual Salary</u>	<u>Average Age</u>	<u>Average Years of Service</u>	<u>Average Hire Age</u>
2018	28,646	1,230,105	42,942	48.3	9.8	38.5
2017	29,395	1,232,067	41,914	48.1	9.5	38.5
2016	28,390	1,185,646	41,763	48.3	9.3	39.0
2015	28,237	1,156,855	40,969	48.7	9.6	39.1
2014	28,229	1,129,939	39,709			
2013	28,401	1,098,341	38,673			
2012	28,548	1,078,710	37,786			



Appendix E: Comparative Schedules

**Table E-2:
Members in Receipt of Annuities and Inactive Membership Data**

Valuation Date (June 30)	Number	All Annuitants					Terminated Members	
		Annual Benefits in Thousands	Average Annual Benefit	Average Current Age	Average Age at Retirement	Average Service at Retirement	Number Vested Terminated	Number Non-Vested Terminated
2018	22,555	402,969	17,866	71.3	60.6	21.1	3,785	17,943
2017	21,805	375,071	17,201	72.0	60.7	21.1	3,674	16,641
2016	21,333	351,708	16,487	72.0	59.5	20.1	3,062	10,031
2015	20,681	331,190	15,782	71.8	58.5	19.9	2,925	8,839
2014	20,081	302,758	15,077				2,825	7,666
2013	19,451	281,466	14,470				2,686	6,712
2012	18,738	258,469	13,794				2,560	6,164



Appendix E: Comparative Schedules

Table E-3: Contribution Rates

Valuation Date (June 30)	Contribution Rates****			Normal	UAAL
	Employee	Employer*	Total	Cost Rate**	Rate***
2018	7.90%	8.67%	16.57%	10.57%	6.00%
2017	7.90	8.57	16.47	10.16	6.31
2016	7.90	8.47	16.37	11.65	4.72
2015	7.90	8.37	16.27	11.49	4.78
2014	7.90	8.27	16.17	11.94	4.23
2013	7.90	8.17	16.07	10.94	5.13
2012****	7.01	7.17	14.18	11.84	2.34

* Does not include Coal Tax Revenue

** Includes DB Educational Fund contribution. Includes Administrative expenses starting with the 2014 Valuation Date.

*** The UAAL rate is the amount available to amortize the UAAL. It is equal to the total contribution rate, minus the normal cost rate.

**** The rates shown are for the fiscal year following the valuation date.

***** Employees hired prior to July 1, 2011 contributed 6.9%. Employees hired on or after July 1, 2011 contributed 7.90%.



Appendix F: Financial Statement Information

The information presented in the required supplementary schedules was determined as part of the actuarial valuation as of June 30, 2018. Additional information as of the latest actuarial valuation follows.

Valuation date	June 30, 2018
Actuarial cost method	Entry Age Normal
Amortization method	Open
Remaining amortization period	38 Years
Asset valuation method	Four-year smoothed market
Actuarial assumptions:	
Investment rate of return*	7.65%
General wage growth*	3.50%
Merit salary increases	0.0% - 6.3%
*Includes inflation	2.75%



Appendix F: Financial Statement Information

Gain and Loss in Accrued Liability During Years Ended June 30 Resulting from Differences Between Assumed Experience and Actual Experience						
Type of Activity	Gain or (Loss) for Year Ending June 30, (expressed in thousands)					
	2013	2014	2015	2016	2017	2018
Investment Income on Actuarial Value of Assets	\$ 155,958	\$ 223,502	\$ 85,416	\$ 73,749	\$ (17,159)	\$ 52,272
Combined Liability Experience	16,760	11,276	(11,373)	(57,170)	(153,660)	(134,065)
(Loss)/Gain During Year from Financial Experience	\$ 172,718	\$ 234,778	\$ 74,043	\$ 16,579	\$(136,501)	\$(81,793)
Non-Recurring Items	755,248	(810,722)	0	0	(365,869)	0
Composite Gain or (Loss) During Year	\$ 927,966	\$(575,944)	\$ 74,043	\$ 16,579	\$(502,370)	\$(81,793)

Schedule of Funding Progress (expressed in thousands)						
Valuation Date	Actuarial Value of Assets	Actuarial Accrued Liability (AAL)	Funded Ratio	Unfunded AAL (UAAL)	Covered Payroll	UAAL as a Percentage of Covered Payroll
2018	\$5,705,236	\$ 7,730,084	74%	\$2,024,848	\$1,230,105	165%
2017	5,514,027	7,578,385	73%	2,064,358	1,232,067	168%
2016	5,247,685	6,787,923	77%	1,540,238	1,185,646	130%
2015	4,926,516	6,470,303	76%	1,543,787	1,154,867	134%
2014	4,595,805	6,177,505	74%	1,581,700	1,129,109	140%
2013	4,139,921	5,160,951	80%	1,021,030	1,104,000	92%



Appendix F: Financial Statement Information

Solvency Test							
Aggregate Accrued Liabilities for (expressed in thousands)							
Valuation Date June 30,	Active Member Contributions (1)	Retirees & Beneficiaries (2)	Active Member Employer Financed Contributions (3)	Actuarial Value of Reported Assets	Portion of Accrued Liability Covered by Reported Assets		
					(1)	(2)	(3)
2018	\$ 876,608	\$ 4,718,929	\$ 2,134,547	\$5,705,236	100%	100%	5%
2017	882,835	4,423,430	2,272,120	5,514,027	100%	100%	9%
2016	842,772	3,955,400	1,989,751	5,247,685	100%	100%	23%
2015	841,907	3,687,451	1,940,945	4,926,516	100%	100%	20%
2014	838,145	3,436,212	1,903,148	4,595,805	100%	100%	17%
2013	828,657	2,790,430	1,541,864	4,139,921	100%	100%	34%



Appendix G: Glossary

The following definitions are largely excerpts from a list adopted in 1981 by the major actuarial organizations in the United States. In some cases the definitions have been modified for specific applicability to the Public Employees' Retirement System. Defined terms are capitalized throughout this Appendix.

Accrued Benefit

The amount of an individual's benefit (whether or not vested) as of a specific date, determined in accordance with the terms of a pension plan and based on compensation and service to that date.

Actuarial Accrued Liability

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

Actuarial Assumptions

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

Actuarial Cost Method

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

Actuarial Gain (Loss)

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

Actuarial Present Value

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

Actuarial Valuation

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

Actuarial Value of Assets

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

Actuarially Equivalent

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



Appendix G: Glossary

Amortization Payment

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

Entry Age Actuarial Cost Method

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

Market Value of Assets

The fair value of cash, investments and other property belonging to a pension plan that could be acquired by exchanging them on the open market.

Normal Cost

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

Projected Benefits

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

Unaccrued Benefit

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

Unfunded Actuarial Accrued Liability

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