

# Minnesota State Retirement System

Correctional Employees Retirement Fund

Actuarial Valuation Report as of July 1, 2017





December 6, 2017

Minnesota State Retirement System  
Correctional Employees Retirement Fund  
St. Paul, Minnesota

Dear Board of Directors:

The results of the July 1, 2017 annual actuarial valuation of the Correctional Employees Retirement Fund are presented in this report. This report was prepared at the request of the Board and is intended for use by the Board and staff and those designated or approved by the Board. This report may be provided to parties other than the Fund only in its entirety. GRS is not responsible for the consequences of any unauthorized use of this report by parties other than the intended users described above.

The purpose of the valuation is to measure the Fund's funding progress and to determine the required contribution rate for the fiscal year beginning July 1, 2017, according to the prescribed assumptions. Note that we have not attempted to quantify the impact of GASB Statements No. 67 and No. 68 in this report. Please see the separate report dated December 1, 2017.

Based on the current statutory contributions, the unfunded liability determined on an actuarial value of asset basis will not be eliminated if all actuarial assumptions are met.

The required contribution rate shown on page one was designed to comply with Minnesota Statutes. Users of this report should be aware that contributions made at that rate do not guarantee benefit security. Given the importance of benefit security to any retirement system, we suggest that contributions to the System in excess of those presented in this report be considered.

Actuarial assumptions, including discount rates, mortality tables and others identified in this report, are prescribed by Minnesota Statutes Section 356.215, the Legislative Commission on Pensions and Retirement (LCPR), and the Board of Directors. These parties are responsible for selecting the plan's funding policy, actuarial valuation methods, asset valuation methods, and assumptions. The policies, methods and assumptions used in this valuation are those that have been so prescribed and are described in the Actuarial Basis of this report. MSRS is solely responsible for communicating to GRS any changes required thereto.

**In our professional judgement, the statutory discount rate of 8.0% used in this report deviates materially from the guidance set forth in Actuarial Standards of Practice No. 27 (ASOP No. 27).** In a 2017 analysis of long-term rate of investment return and inflation assumptions, GRS suggested that an investment return assumption in the range of 6.85% to 7.68% would be reasonable. Please see our letter dated September 11, 2017 for additional information. If a discount rate within the reasonable range were used in this valuation instead of 8.0%, the unfunded liability and contribution deficiency would be higher than shown. Note that estimated results based on a 7.0% discount rate are shown on page five.

The contribution rate in this report is determined using the actuarial assumptions and methods disclosed in the Actuarial Basis of this report. This report includes risk metrics on pages five and six, but does not include a more robust assessment of the risks of future experience differing materially from the actuarial assumptions. Additional assessment of risks was outside the scope of this assignment. We encourage a review and assessment of investment and other significant risks that may have a material effect on the plan's financial condition.

The valuation was based upon information furnished by the Minnesota State Retirement System (MSRS), concerning benefits, financial transactions, plan provisions and active members, terminated members, retirees and beneficiaries. We checked for internal and year-to-year consistency, but did not audit the data. We are not responsible for the accuracy or completeness of the information provided by MSRS.

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 such future measurements.

This report should not be relied on for any purpose other than the purpose described herein. Determinations of the financial results associated with the benefits described in this report in a manner other than the intended purpose may produce significantly different results.

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

Brian B. Murphy and Bonita J. Wurst are Members of the American Academy of Actuaries (MAAA) and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. In addition, Mr. Murphy meets the requirements of "approved actuary" under Minnesota Statutes Section 356.215, Subdivision 1, Paragraph (c).



Board of Directors  
December 6, 2017  
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This report has been prepared by actuaries who have substantial experience valuing public employee retirement systems. To the best of our knowledge and belief the information contained in this report is accurate and presents the actuarial position of the Correctional Employees Retirement Fund as of the valuation date according to the prescribed assumptions, and was performed in accordance with the requirements of Minnesota Statutes Section 356.215, and the requirements of the Standards for Actuarial Work established by the LCPR. All calculations have been made in conformity with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board and with applicable statutes.

We are available to answer any questions or provide further details.

Respectfully submitted,



Brian B. Murphy, FSA, EA, FCA, MAAA



Bonita J. Wurst, ASA, EA, FCA, MAAA

BBM/BJW:sc



## Other Observations

### General Implications of Contribution Allocation Procedure or Funding Policy on Future Expected Plan Contributions and Funded Status

Given the plan's contribution allocation procedure, if there are no changes in benefits or contributions and all actuarial assumptions are met (including the statutory assumption of the plan earning 8.00% on the actuarial value of assets), it is expected that:

- (1) The unfunded actuarial accrued liabilities will increase and not be eliminated,
- (2) The funded status of the plan will decrease, and
- (3) The plan may eventually become insolvent and unable to pay benefits.

As noted elsewhere in this report, we do not expect the earnings assumption of 8.00% to be met. The funded status of the plan based on a lower earnings assumption would deteriorate at a faster rate.

### Limitations of Funded Status Measurements

Unless otherwise indicated, a funded status measurement presented in this report is based upon the actuarial accrued liability and the actuarial value of assets. Unless otherwise indicated, with regard to any funded status measurements presented in this report:

- (1) The measurement is inappropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations, in other words, of transferring the obligations to an unrelated third party in an arm's length market value type transaction.
- (2) The measurement is dependent upon the actuarial cost method which, in combination with the plan's amortization policy, affects the timing and amounts of future contributions. The amounts of future contributions will most certainly differ from those assumed in this report due to future actual experience differing from assumed experience based upon the actuarial assumptions. A funded status measurement in this report of 100% is not synonymous with no required future contributions. If the funded status were 100%, the plan would still require future normal cost contributions (i.e., contributions to cover the cost of the active membership accruing an additional year of service credit).
- (3) The measurement would produce a different result if the market value of assets were used instead of the actuarial value of assets.

### Limitations of Project Scope

Actuarial standards do not require the actuary to evaluate the ability of the plan sponsor or other contributing entity to make required contributions to the plan when due. Such an evaluation was not within the scope of this project and is not within the actuary's domain of expertise. Consequently, the actuary performed no such evaluation.



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# Summary of Valuation Results

## Contributions

The following table summarizes important contribution information as described in the Development of Costs section.

Contributions	Actuarial Valuation as of	
	July 1, 2017	July 1, 2016
Statutory Contributions - Chapter 352.92 (% of Payroll)	21.95%	21.95%
Required Contributions - Chapter 356 (% of Payroll)	28.40%	27.56%
Sufficiency / (Deficiency)	(6.45)%	(5.61)%

The contribution deficiency increased from 5.61% of payroll to 6.45% of payroll. Plan changes affecting members first hired after June 30, 2010 are expected to ultimately reduce the cost of the plan, but have only a small impact on the valuation results in the 2017 valuation.

Statutory contributions are not sufficient to fully amortize the unfunded actuarial accrued liability over the statutory amortization period of 21 years. Based on the current member and employer contribution rates and other statutory methods and assumptions described in this report, the unfunded liability will not be eliminated. Current statutory contributions are not sufficient to cover interest on the unfunded liability, which will result in the unfunded liability growing. The plan may eventually become insolvent and unable to pay benefits. On a market value of assets basis, contributions are deficient by 6.15% of payroll. We recommend utilizing the contribution stabilizer provisions described in the Summary of Plan Provisions and/or modifying benefits to address the contribution deficiency.

The Plan Assets section provides detail on the plan assets used for the valuation including a development of the Actuarial Value of Assets (AVA). The Market Value of Assets (MVA) earned approximately 15.1% for the plan year ending June 30, 2017. The AVA earned approximately 9.3% for the plan year ending June 30, 2017 as compared to the assumed rate of 8.00%. The assumed rate is a prescribed assumption mandated by Minnesota Statutes, and is outside the upper end of the reasonable range. According to the NASRA survey, the most common assumption for statewide plans is currently 7.50%. Use of a 7.50% return assumption would produce a deficiency greater than shown above.

Participant reconciliation and statistics are detailed in the Membership Data section. The Actuarial Basis section includes a summary of plan provisions and actuarial methods and assumptions used for the calculations in this report.

Accounting and financial reporting information prepared according to GASB Statements No. 67 and No. 68 was provided to MSRS in a separate report dated December 1, 2017.

## Summary of Valuation Results

A summary of principal valuation results from the current valuation and the prior valuation follows. Any changes in plan provisions, actuarial assumptions or valuation methods and procedures between the two valuations are described after the summary.

	<b>Actuarial Valuation as of</b>	
	<b>July 1, 2017</b>	<b>July 1, 2016</b>
<b>Contributions (% of Payroll )</b>		
Statutory - Chapter 352	21.95%	21.95%
Required - Chapter 356	28.40%	27.56%
Sufficiency / (Deficiency)	(6.45)%	(5.61)%
<b>Funding Ratios (dollars in thousands )</b>		
<b>Assets</b>		
- Current assets (AVA)	\$ 1,013,173	\$ 937,000
- Current assets (MVA)	\$ 1,023,817	\$ 899,592
<b>Accrued Benefit Funding Ratio</b>		
- Current benefit obligations	\$ 1,352,906	\$ 1,255,948
- Funding ratio (AVA)	74.89%	74.60%
- Funding ratio (MVA)	75.68%	71.63%
<b>Accrued Liability Funding Ratio</b>		
- Actuarial accrued liability	\$ 1,414,443	\$ 1,313,516
- Funding ratio (AVA)	71.63%	71.34%
- Funding ratio (MVA)	72.38%	68.49%
<b>Projected Benefit Funding Ratio</b>		
- Current and expected future assets	\$ 1,505,335	\$ 1,404,396
- Current and expected future benefit obligations	\$ 1,731,837	\$ 1,598,826
- Projected benefit funding ratio (AVA)	86.92%	87.84%
<b>Participant Data</b>		
<b>Active members</b>		
- Number	4,579	4,521
- Annual valuation earnings (000s)	\$ 244,427	\$ 237,461
- Projected annual earnings (000s)	\$ 258,003	\$ 247,876
- Average projected annual earnings	\$ 56,345	\$ 54,828
- Average age	41.5	41.4
- Average service	8.8	8.7
Service retirements	2,576	2,426
Survivors	216	208
Disability retirements	292	284
Deferred retirements	1,310	1,316
Terminated other non-vested	818	661
<b>Total</b>	<b>9,791</b>	<b>9,416</b>



# Summary of Valuation Results

## Effects of Changes

The following changes in actuarial assumptions were recognized as of July 1, 2017:

- Assumed salary increase rates were changed as recommended in the July 26, 2016, experience study. The net effect is proposed rates that average 0.60% greater than the previous rates.
- Assumed rates of retirement were changed, resulting in fewer expected unreduced (normal) retirements.
- Assumed termination rates were decreased for the first two years of service and increased for the third year of service. For rates beyond the select period of three years, select rates were increased.
- Rates of disability incidence were decreased for ages 39 and older.
- The base mortality table for healthy annuitants and employees was changed from the RP-2000 fully generational table to the RP-2014 fully generational table (with a base year of 2006), white collar adjustments, with age adjustments. The mortality improvement scale was changed from Scale AA to Scale MP-2015. The base mortality table for disabled annuitants was changed from the RP-2000 disabled mortality table (no projection for future mortality improvement) to the RP-2014 disabled annuitant mortality table (with future mortality improvement according to MP-2015).
- Assumed percentage of married members was changed from 85% to 75%.
- Assumed age difference for members and their spouse was lowered from 3 years to 2 years.
- The assumed percentage of members electing joint and survivor annuities were increased and the assumed percentage of members electing the single life annuity was decreased.
- The Combined Service Annuity (CSA) load was changed from 30% for vested and non-vested deferred member liability to 17% for vested deferred member liability and 6% for non-vested deferred member liability. The CSA assumption changes were approved by the LCPR based on an analysis completed by the LCPR actuary and documented in a report dated October 2016. The prior CSA assumptions were based on a 2001 study performed by a prior actuary.

The combined impact of the above changes was to increase the accrued liability by \$21.1 million and increase the required contribution by 0.9% of pay, as follows:

	<b>Before Changes</b>	<b>Reflecting Assumption Changes</b>
Normal Cost Rate, % of pay	16.2%	16.6%
Amortization of UAAL*, % of pay	10.9%	11.4%
Expenses (% of pay)	0.4%	0.4%
Total Required Contribution, % of pay	27.5%	28.4%
Accrued Liability Funding Ratio	72.7%	71.6%
Projected Benefit Funding Ratio	88.6%	86.9%
UAAL* (in millions)	\$380.2	\$401.3

*\*Unfunded Actuarial Accrued Liability*

# Summary of Valuation Results

## Valuation of Future Annual Post-Retirement Benefit Increases

Benefit recipients receive a future annual compounding 2.00% post-retirement benefit increase. If the accrued liability funding ratio, determined on a market value of assets basis, reaches or exceeds 90% (based on a 2.50% post-retirement benefit increase assumption) for two consecutive years, the benefit increase will revert to 2.50%. If, after reverting to a 2.50% benefit increase, the accrued liability funding ratio declines to 80% or less for one year or 85% or less for two consecutive years, the benefit increase will decrease to 2.00%. Benefit increases already granted, however, will not be affected.

To determine an assumption regarding a future change in the post-retirement benefit increase, we performed a projection of liabilities and assets based on the following methods and assumptions:

- Future investment returns and liability discount rates of 8.00%;
- Open group; stable active population (new member profile based on average new members hired in recent years);
- The post-retirement benefit increase rate is assumed to be 2.00% per year until the accrued liability funding ratio threshold required to pay a 2.50% post-retirement benefit increase is reached; and
- Current statutory contribution levels (i.e., not including potential contribution increases under the contribution stabilizer statutes).

Based on these assumptions and methods, the projection indicates that this plan is not expected to attain the accrued liability funding ratio threshold required to pay a 2.50% post-retirement benefit increase and will pay a 2.00% post-retirement benefit increase indefinitely. This assumption is reflected in our calculations. This is only an assumption; actual timing will depend on actual experience.

# Summary of Valuation Results

## Sensitivity Tests

During the 2017 legislative session, the Legislative Commission on Pensions and Retirement (LCPR) enacted a new sensitivity disclosure requirement for MSRS' 2017 valuations. Per the LCPR's requirement, we have calculated the liabilities associated with the following scenarios:

- 1) 7% interest rate assumption
- 2) 9% interest rate assumption
- 3) 2.5% post-retirement benefit increase for all future years

In each case, all other assumptions were unchanged from those used to develop the final valuation results in this report. Note that we believe the 9% interest rate assumption is an unrealistic assumption.

	<b>Final Valuation Assumptions</b>	<b>Final Valuation Assumptions with 7% Interest</b>	<b>Final Valuation Assumptions with 9% Interest</b>	<b>Final Valuation Assumptions with 2.5% COLA</b>
Normal Cost Rate, % of Pay	16.6%	20.7%	13.6%	17.5%
Amortization of Unfunded Accrued Liability, % of Pay	11.4%	15.7%	7.3%	13.6%
Expenses (% of Pay)	0.4%	0.4%	0.4%	0.4%
Total Required Contribution, % of Pay	28.4%	36.7%	21.3%	31.5%
Contribution Sufficiency/(Deficiency), % of Pay	(6.5)%	(14.8)%	0.7 %	(9.5)%
Accrued Liability Funding Ratio	71.6%	62.8%	81.0%	68.0%
Actuarial Accrued Liability (in millions)	\$1,414	\$1,614	\$1,251	\$1,490
Unfunded Accrued Liability (in millions)	\$401	\$601	\$237	\$477

# Summary of Valuation Results

## Risk Measures (Dollars in Thousands)

Valuation Date (July 1)	(1) Accrued Liabilities (AAL)	(2) Market Value of Assets	(3) Market Value Unfunded AAL (1) - (2)	(4) Valuation Payroll	(5) Market Value Funded Ratio (2) / (1)	(6) Retiree Liabilities	(7) RetLiab/ AAL (6) / (1)	(8) AAL/ Payroll (1) / (4)	(9) Assets/ Payroll (2) / (4)
2010	\$ 851,086	\$ 525,245	\$ 325,841	\$ 192,450	61.7%	\$ 383,387	45.0%	442.2%	272.9%
2011	\$ 907,012	\$ 646,582	\$ 260,430	\$ 197,702	71.3%	\$ 417,110	46.0%	458.8%	327.0%
2012	\$ 968,166	\$ 659,523	\$ 308,643	\$ 200,035	68.1%	\$ 456,495	47.2%	484.0%	329.7%
2013	\$1,026,098	\$ 747,157	\$ 278,941	\$ 204,198	72.8%	\$ 498,718	48.6%	502.5%	365.9%
2014	\$1,122,474	\$ 877,056	\$ 245,418	\$ 219,244	78.1%	\$ 543,049	48.4%	512.0%	400.0%
2015	\$1,239,258	\$ 909,002	\$ 330,256	\$ 231,440	73.4%	\$ 634,592	51.2%	535.5%	392.8%
2016	\$1,313,516	\$ 899,592	\$ 413,924	\$ 241,242	68.5%	\$ 673,129	51.2%	544.5%	372.9%
2017	\$1,414,443	\$1,023,817	\$ 390,626	\$ 248,879	72.4%	\$ 741,694	52.4%	568.3%	411.4%

Valuation Date (July 1)	(10) Portfolio StdDev	(11) Std Dev % of Pay (9) x (10)	(12) Unfunded / Payroll (3) / (4)	(13) Non-Investment Cash Flow (NICF)	(14) NICF/ Assets (13) / (2)	(15) SBI Market Rate of Return	(16) SBI 5-year Average
2010			169.3%	\$ (418)	-0.1%	15.2%	3.4%
2011			131.7%	\$ (76)	0.0%	23.3%	5.3%
2012			154.3%	\$ (2,985)	-0.5%	2.4%	2.3%
2013			136.6%	\$ (5,758)	-0.8%	14.2%	6.2%
2014			111.9%	\$ (7,624)	-0.9%	18.6%	14.5%
2015	14.1%	55.4%	142.7%	\$ (6,678)	-0.7%	4.4%	12.3%
2016	14.1%	52.6%	171.6%	\$ (9,215)	-1.0%	-0.1%	7.7%
2017	14.1%	58.0%	157.0%	\$ (11,134)	-1.1%	15.1%	10.2%

### Notes pertaining to numbered columns:

- (5) The Funded ratio is the most widely known measure of a plan's financial strength, but the trend in the funded ratio is much more important than the absolute ratio. The funded ratio should trend to 100%. As it approaches 100%, it is important to re-evaluate the level of investment risk in the portfolio and potentially to re-evaluate the assumed rate of return.
- (6) and (7) The ratio of Retiree liabilities to total accrued liabilities gives an indication of the maturity of the system. As the ratio increases, cash flow needs increase, and the liquidity needs of the portfolio change. A ratio on the order of 50% indicates a maturing system.
- (8) and (9) The ratios of liabilities and assets to payroll gives an indication of both maturity and volatility. Many systems have ratios between 500% and 700%. Ratios significantly above that range may indicate difficulty in supporting the benefit level as a level % of payroll.
- (10) and (11) The portfolio standard deviation measures the volatility of investment return. When multiplied by the ratio of assets to payroll it gives the effect of a one standard deviation asset move as a percent of payroll. This figure helps users understand the difficulty of dealing with investment volatility and the challenges volatility brings to sustainability.
- (12) The ratio of unfunded liability to payroll gives an indication of the plan sponsor's ability to actually pay off the unfunded liability. A ratio above approximately 300% or 400% may indicate difficulty in discharging the unfunded liability within a reasonable time frame.
- (13) and (14). The ratio of non-investment cash flow to assets is an important measure of sustainability. Negative ratios are common and expected for a maturing system. In the longer term, this ratio should be on the order of approximately -4%. A ratio that is significantly more negative than that for an extended period could be a leading indicator of potential exhaustion of assets.
- (15) and (16) Investment return is probably the largest single risk that most systems face. The year by year return and the 5-year geometric average give an indicator of the realism of the systems assumed return. Of course, past performance is not a guarantee of future results. The performance data for the Combined Funds (pooled investments of major Minnesota Public Retirement Systems) is presented in these columns. The source of this data is the Minnesota State Board of Investment.

Information prior to 2012 was provided by the prior actuary. See prior reports for additional detail.

## Supplemental Information

The remainder of the report includes information supporting the results presented in the previous sections.

- **Plan assets** presents information about the plan's assets as reported by the Minnesota State Retirement System. The assets represent the portion of total fund liabilities that has been funded.
- **Membership data** presents and describes the membership data used in the valuation.
- **Development of costs** shows the liabilities for plan benefits and the derivation of the contribution amount.
- **Actuarial basis** describes the plan provisions, as well as the methods and assumptions used to value the plan. The valuation is based on the premise that the plan is ongoing.
- **Additional Schedules** includes a summary of funding progress over the long term.
- **Glossary** defines the terms used in this report.

## Plan Assets

### Statement of Fiduciary Net Position (*Dollars in Thousands*)

Assets	Market Value	
	June 30, 2017	June 30, 2016
Cash, equivalents, short term securities	\$ 30,093	\$ 23,048
Fixed income	197,493	220,910
Equity	794,971	654,674
Other*	105,151	126,970
<b>Total cash, investments, and other assets</b>	<b>\$ 1,127,708</b>	<b>\$ 1,025,602</b>
Amounts Receivable	2,780	2,447
<b>Total Assets</b>	<b>\$ 1,130,488</b>	<b>\$ 1,028,049</b>
Amounts Payable*	(106,671)	(128,457)
<b>Net Position Restricted for Pensions</b>	<b>\$ 1,023,817</b>	<b>\$ 899,592</b>

\* Includes \$105,151 in Securities Lending Collateral as of June 30, 2017 and \$126,970 as of June 30, 2016.

# Plan Assets

## Reconciliation of Plan Assets (*Dollars in Thousands*)

The following exhibit shows the revenue, expenses and resulting assets of the Fund as reported by the Minnesota State Retirement System for the prior two fiscal years.

Change in Assets Year Ending	Market Value	
	June 30, 2017	June 30, 2016
<b>1. Fund balance at market value at beginning of year</b>	<b>\$ 899,592</b>	<b>\$ 909,002</b>
2. Contributions		
a. Member	22,648	21,953
b. Employer	31,763	30,678
c. Other sources	-	-
d. Total contributions	<u>\$ 54,411</u>	<u>\$ 52,631</u>
3. Investment income		
a. Investment income/(loss)	136,409	993
b. Investment expenses	<u>(1,050)</u>	<u>(1,188)</u>
c. Net investment income/(loss)	<u>\$ 135,359</u>	<u>\$ (195)</u>
4. Other	<u>-</u>	<u>-</u>
<b>5. Total income: (2.d.) + (3.c.) + (4.)</b>	<b>\$ 189,770</b>	<b>\$ 52,436</b>
6. Benefits Paid		
a. Annuity benefits	(63,221)	(59,045)
b. Refunds	<u>(1,466)</u>	<u>(1,895)</u>
c. Total benefits paid	<u>\$ (64,687)</u>	<u>\$ (60,940)</u>
7. Expenses		
a. Other	(2)	-
b. Administrative	<u>(856)</u>	<u>(906)</u>
c. Total expenses	<u>\$ (858)</u>	<u>\$ (906)</u>
<b>8. Total disbursements: (6.c.) + (7.c.)</b>	<b>\$ (65,545)</b>	<b>\$ (61,846)</b>
<b>9. Fund balance at market value at end of year: (1.) + (5.) + (8.)</b>	<b>\$ 1,023,817</b>	<b>\$ 899,592</b>
10. State Board of Investment calculated investment return	15.1%	-0.1%

# Plan Assets

## Actuarial Asset Value (*Dollars in Thousands*)

	June 30, 2017		June 30, 2016	
<b>1. Market value of assets available for benefits</b>	<b>\$</b>	<b>1,023,817</b>	<b>\$</b>	<b>899,592</b>
2. Determination of average balance				
a. Total assets available at beginning of year		899,592		909,002
b. Total assets available at end of year		1,023,817		899,592
c. Net investment income for fiscal year		135,359		(195)
d. Average balance $[a. + b. - c.] / 2$		894,025		904,395
3. Expected return $[8.0\% \times 2.d.]$		71,522		72,352
4. Actual return		135,359		(195)
5. Current year asset gain/(loss) $[4. - 3.]$		63,837		(72,547)
6. Unrecognized asset returns				
	<b>Original</b>	<b>Unrecognized Amount</b>		<b>Unrecognized Amount</b>
	<b>Amount</b>	<b>%</b>	<b>Dollar</b>	<b>% Dollar</b>
a. Year ended June 30, 2017	\$ 63,837	80%	\$ 51,070	
b. Year ended June 30, 2016	(72,547)	60%	(43,528)	80% \$ (58,038)
c. Year ended June 30, 2015	(31,273)	40%	(12,509)	60% (18,764)
d. Year ended June 30, 2014	78,055	20%	15,611	40% 31,222
e. Year ended June 30, 2013	40,860		N/A	20% 8,172
<b>f. Unrecognized return adjustment</b>			<b>\$ 10,644</b>	<b>\$ (37,408)</b>
<b>7. Actuarial value at end of year (1. - 6.f.)</b>			<b>\$ 1,013,173</b>	<b>\$ 937,000</b>
8. Approximate return on actuarial value of assets during fiscal year			9.3%	7.6%
9. Ratio of actuarial value of assets to market value of assets			0.99	1.04



# Membership Data

## Distribution of Active Members

Age	Years of Service as of June 30, 2017									Total
	<3*	3 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35+	
< 25	158	4	1							<b>163</b>
Avg. Earnings	\$ 31,478	\$ 41,868	\$ 47,094							<b>\$ 31,829</b>
25 - 29	306	132	46							<b>484</b>
Avg. Earnings	\$ 38,838	\$ 45,926	\$ 47,666							<b>\$ 41,610</b>
30 - 34	243	151	239	87						<b>720</b>
Avg. Earnings	\$ 41,757	\$ 47,264	\$ 50,777	\$ 54,318						<b>\$ 47,424</b>
35 - 39	178	93	203	274	32					<b>780</b>
Avg. Earnings	\$ 43,712	\$ 46,876	\$ 53,207	\$ 56,846	\$ 63,830					<b>\$ 51,999</b>
40 - 44	113	49	111	187	111	17				<b>588</b>
Avg. Earnings	\$ 44,560	\$ 51,962	\$ 55,389	\$ 56,293	\$ 65,073	\$ 71,791				<b>\$ 55,612</b>
45 - 49	98	45	93	144	119	106	14			<b>619</b>
Avg. Earnings	\$ 42,587	\$ 55,047	\$ 56,011	\$ 59,272	\$ 63,443	\$ 69,191	\$ 75,168			<b>\$ 58,693</b>
50 - 54	68	35	94	132	114	114	61	17		<b>635</b>
Avg. Earnings	\$ 45,544	\$ 50,615	\$ 56,399	\$ 62,640	\$ 63,939	\$ 67,893	\$ 72,882	\$ 80,215		<b>\$ 61,853</b>
55 - 59	63	22	74	87	59	42	28	10		<b>385</b>
Avg. Earnings	\$ 47,388	\$ 56,656	\$ 56,823	\$ 64,018	\$ 64,033	\$ 64,676	\$ 70,854	\$ 80,349		<b>\$ 60,488</b>
60 - 64	31	10	41	51	20	8	2		1	<b>164</b>
Avg. Earnings	\$ 46,753	\$ 57,468	\$ 61,742	\$ 65,179	\$ 68,607	\$ 67,272	\$ 81,479		\$ 73,102	<b>\$ 61,134</b>
65 - 69	8	7	5	8	7	2			1	<b>38</b>
Avg. Earnings	\$ 58,356	\$ 63,782	\$ 70,554	\$ 73,182	\$ 66,800	\$109,510			\$ 84,412	<b>\$ 69,015</b>
70+	1	2								<b>3</b>
Avg. Earnings	\$ 69,433	\$ 40,236								<b>\$ 49,968</b>
<b>Total</b>	<b>1,267</b>	<b>550</b>	<b>907</b>	<b>970</b>	<b>462</b>	<b>289</b>	<b>105</b>	<b>27</b>	<b>2</b>	<b>4,579</b>
<b>Avg. Earnings</b>	<b>\$ 41,091</b>	<b>\$ 48,852</b>	<b>\$ 53,941</b>	<b>\$ 58,877</b>	<b>\$ 64,333</b>	<b>\$ 68,402</b>	<b>\$ 72,810</b>	<b>\$ 80,264</b>	<b>\$ 78,757</b>	<b>\$ 53,380</b>

\* This exhibit does not reflect service earned in other MSRS Plans or Combined Service Annuity benefits. It should not be relied upon as an indicator of non-vested status.

In each cell, the top number is the count of active participants for the age/service combination and the bottom number is average valuation earnings for the fiscal year ending on the valuation date.

# Membership Data

## Distribution of Service Retirements

Age	Years Retired as of June 30, 2017							Total
	<1	1 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25+	
<50		3	1					4
Avg. Benefit		\$ 5,224	\$ 8,502					\$ 6,043
50 - 54	13	56	2					71
Avg. Benefit	\$ 18,914	\$ 17,134	\$ 4,522					\$ 17,105
55 - 59	103	320	76		1	1		501
Avg. Benefit	\$ 28,088	\$ 28,591	\$ 23,194		\$ 5,749	\$ 41,460		\$ 27,649
60 - 64	46	237	342	56				681
Avg. Benefit	\$ 20,763	\$ 21,103	\$ 23,703	\$ 21,894				\$ 22,451
65 - 69	19	90	145	324	37			615
Avg. Benefit	\$ 16,708	\$ 13,231	\$ 14,365	\$ 20,778	\$ 18,846			\$ 17,920
70 - 74	2	22	84	83	216	2		409
Avg. Benefit	\$ 6,706	\$ 10,060	\$ 10,075	\$ 15,643	\$ 22,105	\$ 6,871		\$ 17,525
75 - 79		3	11	35	50	50	1	150
Avg. Benefit		\$ 4,994	\$ 14,296	\$ 13,803	\$ 21,482	\$ 28,516	\$ 21,030	\$ 21,175
80 - 84	1	1		5	33	20	37	97
Avg. Benefit	\$ 2,389	\$ 12,498		\$ 18,144	\$ 22,562	\$ 22,834	\$ 31,362	\$ 25,435
85 - 89				1	1	3	30	35
Avg. Benefit				\$ 2,803	\$ 7,696	\$ 32,919	\$ 25,361	\$ 24,860
90+							13	13
Avg. Benefit							\$ 31,471	\$ 31,471
<b>Total</b>	<b>184</b>	<b>732</b>	<b>661</b>	<b>504</b>	<b>338</b>	<b>76</b>	<b>81</b>	<b>2,576</b>
<b>Avg. Benefit</b>	<b>\$ 24,061</b>	<b>\$ 22,630</b>	<b>\$ 19,627</b>	<b>\$ 19,510</b>	<b>\$ 21,610</b>	<b>\$ 26,796</b>	<b>\$ 29,029</b>	<b>\$ 21,542</b>

In each cell, the top number is the count of retired participants for the age/years retired combination and the bottom number is the average annual benefit amount.

# Membership Data

## Distribution of Survivors

Age	Years Since Death as of June 30, 2017							Total
	<1	1 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25+	
<45	1	15	5	1				<b>22</b>
Avg. Benefit	\$ 10,951	\$ 10,010	\$ 5,222	\$ 0				\$ <b>8,509</b>
45 - 49		6		1				<b>7</b>
Avg. Benefit		\$ 18,980		\$ 766				\$ <b>16,378</b>
50 - 54	2	4	1	3	2			<b>12</b>
Avg. Benefit	\$ 13,296	\$ 9,609	\$ 16,453	\$ 9,223	\$ 8,761			\$ <b>10,556</b>
55 - 59	2	6	4	1	2	2		<b>17</b>
Avg. Benefit	\$ 7,669	\$ 23,837	\$ 15,438	\$ 24,047	\$ 9,274	\$ 11,277		\$ <b>16,780</b>
60 - 64	2	11	10	12	3	1		<b>39</b>
Avg. Benefit	\$ 18,813	\$ 18,206	\$ 18,011	\$ 13,988	\$ 9,558	\$ 13,690		\$ <b>16,108</b>
65 - 69	2	8	4	14	4	3	1	<b>36</b>
Avg. Benefit	\$ 21,072	\$ 19,161	\$ 6,406	\$ 12,220	\$ 20,093	\$ 10,349	\$ 10,003	\$ <b>14,265</b>
70 - 74	2	7	9	9	6	3	1	<b>37</b>
Avg. Benefit	\$ 4,874	\$ 21,915	\$ 19,715	\$ 16,044	\$ 11,961	\$ 17,860	\$ 7,062	\$ <b>16,686</b>
75 - 79	1	1	2	3	3	2		<b>12</b>
Avg. Benefit	\$ 34,705	\$ 4,905	\$ 14,685	\$ 15,885	\$ 30,128	\$ 15,050		\$ <b>19,760</b>
80 - 84		4	4	4	4	3	1	<b>20</b>
Avg. Benefit		\$ 33,005	\$ 33,164	\$ 21,005	\$ 17,247	\$ 11,546	\$ 14,340	\$ <b>23,333</b>
85 - 89		2	2	2			1	<b>7</b>
Avg. Benefit		\$ 29,443	\$ 10,630	\$ 10,541			\$ 7,128	\$ <b>15,480</b>
90+		2	2		1	1	1	<b>7</b>
Avg. Benefit		\$ 14,088	\$ 14,561		\$ 16,685	\$ 1,847	\$ 4,313	\$ <b>11,449</b>
<b>Total</b>	<b>12</b>	<b>66</b>	<b>43</b>	<b>50</b>	<b>25</b>	<b>15</b>	<b>5</b>	<b>216</b>
<b>Avg. Benefit</b>	<b>\$ 14,759</b>	<b>\$ 17,825</b>	<b>\$ 16,277</b>	<b>\$ 13,771</b>	<b>\$ 15,718</b>	<b>\$ 12,497</b>	<b>\$ 8,569</b>	<b>\$ 15,580</b>

In each cell, the top number is the count of survivors for the age/years since death combination and the bottom number is the average annual benefit amount.

# Membership Data

## Distribution of Disability Retirements

Years Disabled as of June 30, 2017

Age	<1	1 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25+	Total
< 45	5	7	7	2				<b>21</b>
Avg. Benefit	\$ 21,510	\$ 13,129	\$ 18,873	\$ 17,020				<b>\$ 17,410</b>
45 - 49	1	8	15	4	7			<b>35</b>
Avg. Benefit	\$ 39,332	\$ 19,220	\$ 17,858	\$ 16,149	\$ 21,052			<b>\$ 19,227</b>
50 - 54	2	20	7	12	8	3		<b>52</b>
Avg. Benefit	\$ 19,717	\$ 19,231	\$ 18,665	\$ 21,561	\$ 18,446	\$ 34,244		<b>\$ 20,456</b>
55 - 59	1	15	21	13	8	2		<b>60</b>
Avg. Benefit	\$ 22,044	\$ 16,014	\$ 20,764	\$ 21,387	\$ 24,538	\$ 35,912		<b>\$ 20,741</b>
60 - 64		7	18	14	9	6		<b>54</b>
Avg. Benefit		\$ 21,833	\$ 18,470	\$ 21,476	\$ 22,939	\$ 27,367		<b>\$ 21,419</b>
65 - 69		5	10	17	14	2	1	<b>49</b>
Avg. Benefit		\$ 18,004	\$ 15,918	\$ 20,885	\$ 18,875	\$ 22,883	\$ 30,839	<b>\$ 19,288</b>
70 - 74			1	5	8	1		<b>15</b>
Avg. Benefit			\$ 15,282	\$ 23,043	\$ 20,752	\$ 15,971		<b>\$ 20,832</b>
75+				2	1	2	1	<b>6</b>
Avg. Benefit				\$ 14,907	\$ 21,318	\$ 30,795	\$ 26,801	<b>\$ 23,254</b>
<b>Total</b>	<b>9</b>	<b>62</b>	<b>79</b>	<b>69</b>	<b>55</b>	<b>16</b>	<b>2</b>	<b>292</b>
<b>Avg. Benefit</b>	<b>\$ 23,151</b>	<b>\$ 17,957</b>	<b>\$ 18,653</b>	<b>\$ 20,813</b>	<b>\$ 20,896</b>	<b>\$ 28,880</b>	<b>\$ 28,820</b>	<b>\$ 20,207</b>

In each cell, the top number is the count of disabled participants for the age/years since disability combination and the bottom number is the average annual benefit amount.

# Membership Data

## Reconciliation of Members

	Terminated			Recipients			Total
	Actives	Deferred Retirement	Other Non-Vested	Service Retirement	Disability Retirement	Survivor	
<b>Members on 7/1/2016</b>	<b>4,521</b>	<b>1,316</b>	<b>661</b>	<b>2,426</b>	<b>284</b>	<b>208</b>	<b>9,416</b>
New members	506	0	0	0	0	0	<b>506</b>
Return to active	30	(22)	(8)	0	0	0	<b>0</b>
Terminated non-vested	(161)	0	161	0	0	0	<b>0</b>
Service retirements	(126)	(54)	0	180	0	0	<b>0</b>
Terminated deferred	(83)	83	0	0	0	0	<b>0</b>
Terminated refund/transfer	(96)	(14)	(42)	0	0	0	<b>(152)</b>
Deaths	(4)	(2)	(3)	(32)	(5)	(4)	<b>(50)</b>
New beneficiary	0	0	0	0	0	12	<b>12</b>
Disabled	(7)	0	0	0	7	0	<b>0</b>
Unexpected status changes	(1)	3	49	2	6	0	<b>59</b>
Net change	58	(6)	157	150	8	8	<b>375</b>
<b>Members on 6/30/2017</b>	<b>4,579</b>	<b>1,310</b>	<b>818</b>	<b>2,576</b>	<b>292</b>	<b>216</b>	<b>9,791</b>

Terminated Member Statistics	Deferred Retirement	Other Non-Vested	Total
Number	1,310	818	2,128
Average age	46.0	37.2	42.6
Average service	5.9	1.3	4.1
Average annual benefit, with augmentation to Normal Retirement Date and 17% CSA load	\$ 11,363	N/A	\$ 11,363
Average refund value, with 17% CSA load (6% for non-vested members)	\$ 29,416	\$ 5,523	\$ 20,232

# Development of Costs

## Actuarial Valuation Balance Sheet *(Dollars in Thousands)*

The actuarial balance sheet is based on the principle that the long-term projected benefit obligations of the plan should be ideally equal to the long-term resources available to fund those obligations. **A Projected Benefit Funding Ratio less than 100% indicates that contributions are insufficient.** The resources available to meet projected obligations for current members consist of current fund assets plus the present value of anticipated future contributions intended to fund benefits for current members. In the exhibit below, B.2 is the estimated present value of contributions to fund the normal cost rate for current members until their respective termination dates. Item B.1. is the present value of the total 21.95% statutory contribution net of normal cost and anticipated plan expenses during the period from the valuation date to the statutory unfunded amortization date.

The contributions made in excess of amounts required for current benefit payments are accumulated as a reserve to help meet benefit payments in later years. It is this reserve system which permits the establishment of a level rate of contribution each year.

				<b>June 30, 2017</b>
A. Actuarial Value of Assets				\$ 1,013,173
B. Expected Future Assets				
1. Present value of expected future statutory supplemental contributions				174,768
2. Present value of future normal cost contributions				317,394
3. Total expected future assets: (1.) + (2.)				\$ 492,162
C. Total Current and Expected Future Assets				1,505,335
D. Current Benefit Obligations*				
1. Benefit recipients	<b>Non-Vested</b>	<b>Vested</b>	<b>Total</b>	
a. Service retirements	\$ -	\$ 634,718	\$ 634,718	
b. Disability retirements	-	72,053	72,053	
c. Survivors	-	34,923	34,923	
2. Deferred retirements with augmentation	-	115,754	115,754	
3. Former members without vested rights**	2,460	-	2,460	
4. Active members	33,848	459,150	492,998	
5. Total Current Benefit Obligations	\$ 36,308	\$ 1,316,598	\$ 1,352,906	
E. Expected Future Benefit Obligations				378,931
F. Total Current and Expected Future Benefit Obligations***				1,731,837
G. Unfunded Current Benefit Obligations: (D.5.) - (A.)				339,733
H. Unfunded Current and Future Benefit Obligations: (F.) - (C.)				226,502
I. Accrued Benefit Funding Ratio: (A.)/(D.5.)				74.89%
J. Projected Benefit Funding Ratio: (C.)/(F.)				86.92%

\* Present value of credited projected benefits (projected compensation, current service).

\*\* Former members who have not satisfied vesting requirements and have not collected a refund of member contributions as of the valuation date.

\*\*\* Present value of projected benefits (projected compensation, projected service).

## Development of Costs

### Determination of Unfunded Actuarial Accrued Liability and Supplemental Contribution Rate *(Dollars in Thousands)*

	Actuarial Present Value of Projected Benefits	Actuarial Present Value of Future Normal Costs	Actuarial Accrued Liability
A. Determination of Actuarial Accrued Liability (AAL)			
1. Active members			
a. Retirement annuities	\$ 755,353	\$ 226,178	\$ 529,175
b. Disability benefits	39,420	29,877	9,543
c. Survivor's benefits	7,275	2,467	4,808
d. Deferred retirements	66,290	48,981	17,309
e. Refunds*	<u>3,591</u>	<u>9,891</u>	<u>(6,300)</u>
f. Total	\$ 871,929	\$ 317,394	\$ 554,535
2. Deferred retirements with future augmentation	115,754	-	115,754
3. Former members without vested rights	2,460	-	2,460
4. Benefit recipients	<u>741,694</u>	<u>-</u>	<u>741,694</u>
5. Total	\$ 1,731,837	\$ 317,394	\$ 1,414,443
B. Determination of Unfunded Actuarial Accrued Liability (UAAL)			
1. Actuarial accrued liability			\$ 1,414,443
2. Current assets (AVA)			<u>1,013,173</u>
3. Unfunded actuarial accrued liability			\$ 401,270
C. Determination of Supplemental Contribution Rate**			
1. Present value of future payrolls through the amortization date of June 30, 2038			\$ 3,509,395
2. Supplemental contribution rate: (B.3.) / (C.1.)			11.43% ***

\* Includes non-vested refunds and non-married survivor benefits only.

\*\* The amortization of the Unfunded Actuarial Accrued Liability (UAAL) using the current amortization method results in initial payments less than the "interest only" payment on the UAAL. Payments less than the interest only amount will result in the UAAL increasing for an initial period of time.

\*\*\* The amortization factor as of July 1, 2017 is 13.6021.

# Development of Costs

## Changes in Unfunded Actuarial Accrued Liability (UAAL) (Dollars in Thousands)

	Year Ending June 30, 2017		
	Actuarial Accrued Liability	Current Assets	Unfunded Actuarial Accrued Liability
A. Unfunded actuarial accrued liability at beginning of year	\$ 1,313,516	\$ 937,000	\$ 376,516
B. Changes due to interest requirements and current rate of funding			
1. Normal cost, including expenses	41,311	-	41,311
2. Benefit payments	(64,687)	(64,687)	-
3. Contributions	-	54,411	(54,411)
4. Interest on A., B.1., B.2. and B.3.	104,146	74,549	29,597
5. Total (B.1. + B.2. + B.3. + B.4.)	\$ 80,770	\$ 64,273	\$ 16,497
C. Expected unfunded actuarial accrued liability at end of year (A. + B.5.)	\$ 1,394,286	\$ 1,001,273	\$ 393,013
D. Increase (decrease) due to actuarial losses (gains) because of experience deviations from expected			
1. Age and service retirements			1,939
2. Disability retirements			(1,916)
3. Death-in-service benefits			108
4. Withdrawals			(948)
5. Salary increases			899
6. Investment income			(11,900)
7. Mortality of annuitants			672
8. Other items			(1,695)
9. Total			\$ (12,841)
E. Unfunded actuarial accrued liability at end of year before plan amendments and changes in actuarial assumptions (C. + D.9.)			\$ 380,172
F. Change in unfunded actuarial accrued liability due to changes in plan provisions			-
G. Change in unfunded actuarial accrued liability due to changes in actuarial assumptions			21,098
H. Change in unfunded actuarial accrued liability due to changes in actuarial methods			-
I. Unfunded actuarial accrued liability at end of year (E. + F. + G. + H.)*			401,270

\* The unfunded actuarial accrued liability on a market value of assets basis is \$390,626.



## Development of Costs

### Determination of Contribution Sufficiency/(Deficiency) (*Dollars in Thousands*)

The required contribution is defined in Minnesota Statutes as the sum of normal cost, a supplemental contribution to amortize the UAAL, and an allowance for expenses. The dollar amounts shown are for illustrative purposes and equal percent of payroll multiplied by projected annual payroll.

	Percent of Payroll	Dollar Amount
A. Statutory contributions - Chapter 352		
1. Employee contributions	9.10%	\$ 23,478
2. Employer contributions	12.85%	33,153
3. Total	21.95%	\$ 56,631
B. Required contributions - Chapter 356		
1. Normal cost		
a. Retirement benefits	12.24%	\$ 31,580
b. Disability benefits	1.54%	3,973
c. Survivors	0.13%	335
d. Deferred retirement benefits	2.22%	5,728
e. Refunds*	0.49%	1,264
f. Total	16.62%	\$ 42,880
2. Supplemental contribution amortization of Unfunded Actuarial Accrued Liability by June 30, 2038		
	11.43%	\$ 29,490
3. Allowance for expenses		
	0.35%	\$ 903
4. Total		
	28.40% **	\$ 73,273
C. Contribution sufficiency/(deficiency) (A.3. - B.4.)		
	(6.45)%	\$ (16,642)

Note: Projected annual payroll for fiscal year beginning on the valuation date: \$258,003 (based on methods prescribed in the LCPR Standards for Actuarial Work).

\* Includes non-vested refunds and non-married survivor benefits only.

\*\* The required contribution on a market value of assets basis is 28.1 % of payroll.

# Actuarial Basis

## Actuarial Methods

All actuarial methods are prescribed by Minnesota Statutes, the Legislative Commission on Pensions and Retirement, or the MSRS Board of Directors. Different methodologies may also be reasonable and results based on other methodologies would be different.

### **Actuarial Cost Method**

Actuarial accrued liability and required contributions in this report are computed using the Entry Age Normal Cost method. This method is prescribed by Minnesota Statute. Under this method, a normal cost is developed by amortizing the actuarial value of benefits expected to be received by each active participant (as a level percentage of pay) over the total working lifetime of that participant, from hire to termination. Age as of the valuation date was calculated based on the dates of birth provided by the Fund. Entry age for valuation purposes was calculated as the age on the valuation date minus the provided years of service on the valuation date.

To the extent that current assets and future normal costs do not support participants' expected future benefits, an unfunded actuarial accrued liability ("UAAL") develops. The UAAL is amortized over the statutory amortization period using level percent of payroll assuming payroll increases. The total contribution developed under this method is the sum of normal cost, expenses, and the payment toward the UAAL.

### **Valuation of Future Post-Retirement Benefit Increases**

If the plan has reached the accrued liability funding ratio threshold (determined on a market value of assets basis) required to pay a 2.50% benefit increase, Minnesota Statutes require the 2.50% benefit increase rate to be reflected in the liability calculations. If the plan has not yet reached the accrued liability funding ratio threshold required to pay a 2.50% benefit increase, Minnesota Statutes require a projection to be performed to determine the expected attainment of the accrued liability funding ratio threshold, and the expected reversion to a 2.50% benefit increase rate must be reflected in the liability calculations.

### **Funding Objective**

The fundamental financing objective of the fund is to establish contribution rates which, when expressed as a percentage of active member payroll, will remain approximately level from generation to generation and meet the required deadline for full funding.

# Actuarial Basis

## Actuarial Methods (Concluded)

### Asset Valuation Method

The assets are valued based on a five-year moving average of expected and market values (five-year average actuarial value) determined as follows:

- At the end of each plan year, an average asset value is calculated as the average of the market asset value at the beginning and end of the fiscal year net of investment income for the fiscal year;
- The investment gain or (loss) is taken as the excess of actual investment income over the expected investment income based on the average asset value as calculated above;
- The investment gain or (loss) so determined is recognized over five years at 20% per year;
- The asset value is the sum of the market asset value plus the scheduled recognition of investment gains or (losses) during the current and the preceding four fiscal years.

### Payment on the Unfunded Actuarial Accrued Liability

Payment equals a level percentage of payroll each year to the statutory amortization date of June 30, 2038 assuming payroll increases of 3.50% per annum. If there is a negative Unfunded Actuarial Accrued Liability, the surplus amount is amortized over 30 years as a level percentage of payroll. If the unfunded liability increases due to changes in benefits, assumptions, or methods, the statutory amortization date may be extended. Projected payroll is multiplied by 0.959 in the determination of the present value of future payroll to account for timing differences (as required by the Standards for Actuarial Work).

### Changes in Methods since Prior Valuation

There have been no changes in actuarial methods since the prior valuation.

# Actuarial Basis

## Summary of Actuarial Assumptions

The following assumptions were used in valuing the liabilities and benefits under the plan. All actuarial assumptions are prescribed by Minnesota Statutes, the Legislative Commission on Pensions and Retirement (LCPR), or the MSRS Board of Directors. These parties are responsible for selecting the assumptions used for this valuation. The assumptions prescribed are based on the last experience study, dated July 26, 2016. The Allowance for Combined Service Annuity assumptions are based on an analysis completed by the LCPR actuary and documented in a report dated October 2016.

<b>Investment return</b>	8.00% per annum.
<b>Benefit increases after retirement</b>	2.00% per annum.
<b>Salary increases</b>	Reported salary at valuation date increased according to the rate table, to current fiscal year and annually for each future year. Prior fiscal year salary is annualized for members with less than one year of service.
<b>Payroll growth</b>	3.50% per year.
<b>Inflation</b>	2.75% per year.
<b>Mortality rates</b>	
<b>Healthy pre-retirement</b>	RP-2014 employee generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2006, white collar adjustment.
<b>Healthy post-retirement</b>	RP-2014 annuitant generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2006, white collar adjustment, set forward two years for males and set forward one year for females.
<b>Disabled</b>	RP-2014 disabled mortality table projected with mortality improvement Scale MP-2015 from a base year of 2006.  The RP-2014 employee mortality table as published by the Society of Actuaries (SOA) contains mortality rates for ages 18 to 80 and the annuitant mortality table contains mortality rates for ages 50 to 120. We have extended the annuitant mortality table as needed for members younger than age 50 who are receiving a benefit by deriving rates based on the employee table and the juvenile table. Similarly, we have extended the employee table as needed for members older than age 80 by deriving rates based on the annuitant table.
<b>Retirement</b>	Members retiring from active status are assumed to retire according to the age related rates shown in the rate table. Members who have attained the highest assumed retirement age are assumed to retire in one year.

# Actuarial Basis

## Summary of Actuarial Assumptions (Continued)

<b>Withdrawal</b>	Select and Ultimate rates based on actual experience. Ultimate rates after the third year are shown in rate table. Select rates in the first three years are:															
	<table border="1"> <thead> <tr> <th colspan="3"><u>Select Withdrawal Rates</u></th> </tr> <tr> <th><u>Year</u></th> <th><u>Male</u></th> <th><u>Female</u></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>10%</td> <td>12%</td> </tr> <tr> <td>2</td> <td>10%</td> <td>12%</td> </tr> <tr> <td>3</td> <td>10%</td> <td>12%</td> </tr> </tbody> </table>	<u>Select Withdrawal Rates</u>			<u>Year</u>	<u>Male</u>	<u>Female</u>	1	10%	12%	2	10%	12%	3	10%	12%
<u>Select Withdrawal Rates</u>																
<u>Year</u>	<u>Male</u>	<u>Female</u>														
1	10%	12%														
2	10%	12%														
3	10%	12%														
<b>Disability</b>	Age-related rates based on experience; see table of sample rates. All incidences are assumed to be duty-related.															
<b>Allowance for combined service annuity</b>	Liabilities for former members are increased by 17.0% for vested members and 6.0% for non-vested members to account for the effect of some participants having eligibility for a Combined Service Annuity.															
<b>Administrative expenses</b>	Prior year administrative expenses expressed as a percentage of prior year projected payroll.															
<b>Refund of contributions</b>	Account balances accumulate interest until normal retirement date and are discounted back to the valuation date. All employees withdrawing after becoming eligible for a deferred benefit take the larger of their contributions accumulated with interest or the value of their deferred benefit.															
<b>Commencement of deferred benefits</b>	Members receiving deferred annuities (including current terminated deferred members) are assumed to begin receiving benefits at age 55.															
<b>Percentage married</b>	75% of active members are assumed to be married. Actual marital status is used for members in payment status.															
<b>Age of spouse</b>	Females are assumed to be two years younger than their male spouses.															
<b>Form of payment</b>	Married members retiring from active status are assumed to elect subsidized joint and survivor form of annuity as follows:  Males:            15% elect 50% Joint & Survivor option 15% elect 75% Joint & Survivor option 50% elect 100% Joint & Survivor option Females:        10% elect 50% Joint & Survivor option 10% elect 75% Joint & Survivor option 35% elect 100% Joint & Survivor option															

# Actuarial Basis

## Summary of Actuarial Assumptions (Continued)

<b>Form of payment (Continued)</b>	<p>Remaining married members and unmarried members are assumed to elect the Straight Life option.</p> <p>Members receiving deferred annuities (including current terminated deferred members) are assumed to elect a straight life annuity, except that current terminated deferred members who terminated prior to July 1, 1997, are assumed to receive the Level Social Security option to age 62.</p>
<b>Eligibility testing</b>	<p>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.</p>
<b>Decrement operation</b>	<p>Withdrawal decrements do not operate during retirement eligibility. Decrements are assumed to occur mid-fiscal year.</p>
<b>Service credit accruals</b>	<p>It is assumed that members accrue one year of service credit per year.</p>
<b>Pay Increases</b>	<p>Pay increases are assumed to happen at the beginning of the fiscal year. This is equivalent to assuming that reported earnings are pensionable earnings for the year ending on the valuation date.</p>
<b>Unknown data for certain members</b>	<p>To prepare this report, GRS has used and relied on participant data supplied by MSRS. Although GRS has reviewed the data in accordance with Actuarial Standards of Practice No. 23, GRS has not verified or audited any of the data or information provided.</p> <p>In cases where submitted data was missing or incomplete, the following assumptions were applied:</p> <p><u>Data for active members:</u></p> <p>There were 5 members reported without a gender and 2 members reported with an invalid date of birth. We assumed members were hired at age 33 and male gender.</p> <p>There were 3 members reported with zero or invalid salary. We used prior year salary (2 members), if available, otherwise, high five salary with a 10% load to account for salary increases (1 member).</p> <p>There were 2 members reported with zero service. Due to the small number of members with zero service, and based on direction from MSRS, we used service of 0 years for these members.</p>

# Actuarial Basis

## Summary of Actuarial Assumptions (Continued)

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### Unknown data for certain members

#### Data for terminated members:

There were 47 members reported without a benefit. If available, we calculated benefits for these members using the reported Average Salary, Credited Service and Termination Date provided. If Average Salary was not reported (17 members), we assumed a value of \$30,000. If Credited Service was not reported (0 members), we assumed a value of 7.5 years. There were no members reported without a Termination Date.

There were 53 members who terminated after June 30, 1997 and who were reported with a benefit in the Accelerated to Age 62 option. Based on direction from MSRS, we adjusted benefits for these members to reflect the assumed life annuity election.

There were no members reported with missing or invalid gender or birth dates.

#### Data for members receiving benefits:

There were 2 members reported with a missing gender. We assumed male gender.

There were no members reported with a missing or invalid birth date.

There were no survivors reported on the data file with an expired benefit.

There were 2 members reported without a benefit. Due to the small number of members with missing benefits, we made no adjustment to the reported data for members receiving benefits.

There were no retirees reported with a survivor option and a survivor date of death.

There were no retirees reported with a bounce back annuity and an unreasonable reduction factor.

There were 7 retired members with an accelerated benefit election and a missing accelerated benefit amount and end date. We assumed the accelerated period has ended.

There were retired members reported with a survivor option and an invalid or missing survivor gender (368 members) and/or survivor date of birth (303 members). We used the valuation assumptions if the survivor gender or date of birth was missing or invalid.

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# Actuarial Basis

## Summary of Actuarial Assumptions (Continued)

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**Changes in actuarial assumptions**

Assumed salary increase rates were changed as recommended in the July 26, 2016, experience study. The net effect is proposed rates that average 0.60% greater than the previous rates.

Assumed rates of retirement were changed, resulting in fewer expected unreduced (normal) retirements.

Assumed termination rates were decreased for the first two years of service and increased for the third year of service. For rates beyond the select period of three years, male rates for ages less than 43 were increased; female rates for ages less than 35 and ages 42-44 were increased.

Rates of disability incidence were decreased for ages 39 and older.

The base mortality table for healthy annuitants and employees was changed from the RP-2000 fully generational table to the RP-2014 fully generational table (with a base year of 2006), white collar adjustments, with age adjustments. The mortality improvement scale was changed from Scale AA to Scale MP-2015. The base mortality table for disabled annuitants was changed from the RP-2000 disabled mortality table (no projection for future mortality improvement) to the RP-2014 disabled annuitant mortality table (with future mortality improvement according to MP-2015).

Assumed percentage of married members was changed from 85% to 75%.

Assumed age difference for members and their spouse was lowered from 3 years to 2 years.

The assumed percentage of members electing joint and survivor annuities were increased and the assumed percentage of members electing the single life annuity was decreased.

The Combined Service Annuity (CSA) load was 30% for vested and non-vested deferred member liability. The CSA has been changed to 17% for vested deferred member liability and 6% for non-vested deferred member liability.

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# Actuarial Basis

## Summary of Actuarial Assumptions (Continued)

Age in 2017	Percentage of Members Dying Each Year*					
	Healthy Post- Retirement Mortality**		Healthy Pre- Retirement Mortality**		Disability Mortality**	
	Male	Female	Male	Female	Male	Female
20	0.03%	0.01%	0.02%	0.01%	0.04%	0.02%
25	0.04	0.03	0.03	0.01	0.17	0.08
30	0.06	0.05	0.03	0.02	0.43	0.22
35	0.09	0.09	0.03	0.03	0.79	0.44
40	0.14	0.12	0.04	0.03	1.15	0.66
45	0.19	0.15	0.06	0.05	1.49	0.85
50	0.28	0.20	0.11	0.09	1.87	1.12
55	0.41	0.30	0.19	0.14	2.24	1.46
60	0.61	0.45	0.32	0.21	2.61	1.72
65	0.91	0.71	0.56	0.31	3.08	2.04
70	1.52	1.14	1.00	0.53	3.94	2.76

\* Generally, mortality rates are expected to increase as age increases. These standard mortality rates have been adjusted slightly to prevent decreasing mortality rates. If the rates were not adjusted as described, we would not expect the valuation results to be materially different.

\*\* Rates are adjusted for mortality improvements using Scale MP-2015 from a base year of 2006.

Age	Percent of Members Decrementing Each Year			
	Termination (Withdrawal) Rates After Third Year		Disability Retirement	
	Male	Female	Male	Female
20	10.00%	12.00%	0.05%	0.05%
25	10.00	11.50	0.08	0.08
30	5.00	9.10	0.11	0.11
35	4.50	7.10	0.15	0.15
40	3.50	5.70	0.22	0.22
45	1.95	3.50	0.35	0.35
50	0.00	0.00	0.54	0.54
55	0.00	0.00	0.00	0.00
60	0.00	0.00	0.00	0.00
65	0.00	0.00	0.00	0.00
70	0.00	0.00	0.00	0.00

# Actuarial Basis

## Summary of Actuarial Assumptions (Concluded)

Age	Percent Retiring	Salary Scale	
		Year	Increase
50	5%	1	12.50%
51	3	2	9.00
52	3	3	6.00
53	3	4	5.50
54	5	5	5.25
55	45	6	5.00
56	20	7	5.00
57	15	8	5.00
58	15	9	5.00
59	15	10	5.00
60	15	11	5.00
61	15	12	4.75
62	25	13	4.50
63	25	14	4.50
64	25	15	4.25
65	30	16	4.25
66	30	17	4.25
67	25	18	4.00
68	25	19	4.00
69	40	20	4.00
70+	100	21	3.75
		22	3.75
		23	3.75
		24+	3.50

# Actuarial Basis

## Summary of Plan Provisions

Following is a summary of the major plan provisions used in the valuation of this report. MSRS is solely responsible for the validity, accuracy and comprehensiveness of this information. If any of the plan provisions shown below are not accurate and complete, the valuation results may differ significantly from those shown in this report and may require a revision of this report.

<b>Plan year</b>	July 1 through June 30				
<b>Eligibility</b>	State employees in covered correctional service. Certain state employees with 75 percent working time spent in direct contact with inmates or patients are also eligible.				
<b>Contributions</b>	Shown as a percent of salary: <table><tr><td><u>Member</u></td><td><u>Employer</u></td></tr><tr><td>9.10%</td><td>12.85%</td></tr></table> Member contributions are “picked up” according to the provisions of Internal Revenue Code 414(h).	<u>Member</u>	<u>Employer</u>	9.10%	12.85%
<u>Member</u>	<u>Employer</u>				
9.10%	12.85%				
<b>Allowable service</b>	Service during which member contributions were made. May also include certain leave of absence, military service and periods while temporary Worker’s Compensation is paid.				
<b>Salary</b>	Includes wages, allowances and fees. Excludes lump sum payments of separation and reduced salary while receiving Worker’s Compensation benefits.				
<b>Average salary</b>	Average of the five highest successive years of Salary. Average Salary is based on all Allowable Service if less than five years.				
<b>Vesting</b>	Hired before July 1, 2010: 100% vested after 3 years of Allowable Service. Hired after June 30, 2010: 50% vested after 5 years of Allowable Service; 60% vested after 6 years of Allowable Service; 70% vested after 7 years of Allowable Service; 80% vested after 8 years of Allowable Service; 90% vested after 9 years of Allowable Service; and 100% vested after 10 years of Allowable Service.				
<b>Retirement</b>					
<b><u>Normal retirement benefit</u></b>					
<b>Age/Service requirement</b>	Age 55 and vested. Proportionate Retirement Annuity is available at age 65 and one year of Allowable Service.				
<b>Amount</b>	2.40% (2.20% if first hired after June 30, 2010) of Average Salary for each year of Allowable Service, pro-rata for completed months.				

# Actuarial Basis

## Summary of Plan Provisions (Continued)

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### Retirement (Continued)

#### Early retirement

**Age/Service requirement** Age 50 and vested.

**Amount** Normal Retirement Benefit based on Allowable Service and Average Salary at retirement date reduced by 2/10% (5/12% if first hired after June 30, 2010, or if hired before July 1, 2010, and retire after June 30, 2015) per month for each month that the member is under age 55.

#### Form of payment

Life annuity.

Actuarially equivalent options are:

50%, 75%, or 100% Joint and Survivor, or 15-year certain. If a Joint and Survivor benefit is elected and the beneficiary predeceases the annuitant, the annuitant's benefit increases to the Life Annuity amount. This "bounce back" is subsidized by the plan.

#### Benefit increases

Since 2011, benefit recipients have received annual 2.00% benefit increases. If the accrued liability funding ratio reaches or exceeds 90% (determined on a Market Value of Assets basis) for two consecutive years, the benefit increase will revert to 2.50%. If, after reverting to a 2.50% increase, the accrued liability funding ratio declines to 80% or less for one year or 85% or less for two consecutive years, the benefit increase will decrease to 2.00%.

A benefit recipient who has been receiving a benefit for at least 12 full months as of the June 30 of the calendar year immediately before the adjustment will receive a full increase. Members receiving benefits for at least one month but less than 12 full months as of the June 30 of the calendar year immediately before the adjustment will receive a pro rata increase.

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### Disability

#### Duty Disability

**Age/Service requirement** Physically or mentally unable to perform normal job duties as a direct result of a disability relating to an incident while performing the duties of the job which present inherent dangers to the employee. Members who become disabled after June 30, 2009, will have disability benefits converted to retirement benefits at age 55 instead of age 65.

**Amount** 50.00% of Average Salary plus 2.40% (2.20% if first hired after June 30, 2010) of Average Salary for each year in excess of 20 years and 10 months of Allowable Service (pro rata for completed months).

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# Actuarial Basis

## Summary of Plan Provisions (Continued)

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### Disability (Continued)

#### Duty Disability Continued

##### **Amount (Continued)**

Payment begins at disability and ends at age 55 (age 65 if disabled prior to July 1, 2009) or the five-year anniversary of the effective date of the disability benefit, whichever is later. Payments stop earlier if disability ceases or death occurs. Benefits may be paid upon re-employment but salary plus benefit cannot exceed current salary of position held at time of disability.

Member is reclassified from disabled to retired at age 55 (age 65 if disabled prior to July 1, 2009). Optional amount continues. Otherwise, normal retirement benefit equal to the disability benefit paid, or an actuarially equivalent option.

#### Regular Disability

##### **Age/Service requirement**

At least one year of covered Correctional service for employees hired before July 1, 2009, or a vested Correctional employee hired after June 30, 2009, and the employee is determined to have a regular disability not related to an incident while performing the duties of the job.

##### **Amount**

Normal retirement benefit based on covered Correctional Service (minimum of 15 years if hired prior to July 1, 2009) and Average Salary at disability.

Payment begins at disability and ends at age 55 (age 65 if disabled prior to July 1, 2009) or the five-year anniversary of the effective date of the disability benefit, whichever is later. Payments stop earlier if disability ceases or death occurs. Benefits may be paid upon re-employment but salary plus benefit cannot exceed current salary of position held at time of disability. Member is reclassified from disabled to retired at age 55 (age 65 if disabled prior to July 1, 2009). Optional amount continues. Otherwise, normal retirement benefit equal to the disability benefit paid, or an actuarially equivalent option.

#### Benefit Increases

Same as for retirement.

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### Death

#### Surviving spouse benefit

##### **Age/Service requirement**

Member at any age or former member age 50 or older who dies before retirement or disability benefit commences and was vested. If a former member dies before age 55 and has less than 30 years of Allowable Service, benefits commence when the former member would have been age 55. If an active member dies, benefits may commence immediately, regardless of age.

# Actuarial Basis

## Summary of Plan Provisions (Continued)

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### Death (Continued)

#### Surviving spouse benefit Continued)

**Amount**

Surviving spouse receives the 100% joint and survivor benefits using the Normal Retirement formula above. If commencement is prior to age 55, the appropriate early retirement formula described above applies except that one-half the monthly reduction factor is used from age 50 to the commencement age and the Rule of 90 does not apply. In lieu of this benefit, the surviving spouse may elect a refund of member contributions with interest or an actuarially equivalent term certain annuity (lump sum payable to estate at death).

**Benefit increases**

Same as for retirement.

#### Surviving dependent children's benefit

**Age/service requirement**

If no surviving spouse, all children (biological or adopted) below age 20 who are dependent for more than half of their support on deceased member.

**Amount**

Actuarially equivalent to surviving spouse 100% joint and survivor annuity payable to the later of age 20 or five years. The amount is to be proportionally divided among surviving children.

**Benefit increases**

Same as for retirement.

#### Refund of contributions with interest

**Age/service requirement**

Active employee dies and survivor benefits are not payable or a former employee dies before annuity begins. If accumulated member contributions with interest exceed total payments to the surviving spouse and children, then the remainder is paid out.

**Amount**

Member's contributions with 6.00% interest compounded daily until July 1, 2011, and 4.00% thereafter.

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### Termination

#### Refund of contributions

**Age/Service requirement**

Termination of state service.

**Amount**

Member's contributions with 6.00% interest through June 30, 2011, compounded daily. Beginning July 1, 2011, a member's contributions increase at 4.00% interest compounded daily. If a member is vested, a deferred annuity may be elected in lieu of a refund.

# Actuarial Basis

## Summary of Plan Provisions (Continued)

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<b>Termination (Continued)</b>	
<b><u>Deferred benefit</u></b>	
<b>Age/service requirement</b>	Partially or fully vested.
<b>Amount</b>	Benefit computed under law in effect at termination and increased by the following annual augmentation percentage: (a.) 0.00% before July 1, 1971; (b.) 5.00% from July 1, 1971, to January 1, 1981; (c.) 3.00% thereafter (2.50% if hired after June 30, 2006) until January 1 of the year following attainment of age 55 or January 1, 2012, whichever is earlier; (d.) 5.00% thereafter until the annuity begins (2.50% if hired after June 30, 2006), but before January 1, 2012; and (e.) 2.00% from January 1, 2012, thereafter.  Amount is payable at normal or early retirement.
<b>Optional form conversion factors</b>	Actuarially equivalent factors based on RP-2000 mortality for healthy annuitants, white collar adjustment, projected to 2027 using scale AA, set forward one year for males and set back one year for females, blended 70% males, and 6.50% post-retirement interest.
<b>Combined service annuity</b>	Members are eligible for combined service benefits if they: (a.) Have sufficient allowable service in total that equals or exceeds the applicable service credit vesting requirement of the retirement plan with the longest applicable service credit vesting requirement; (b.) Have at least six months of allowable service credit in each plan worked under; and (c.) Are not in receipt of a benefit from another plan, or have applied for benefits with an effective date within one year.  Members who meet the above requirements must have their benefit based on the following: (a.) Allowable service in all covered plans are combined in order to determine eligibility for early retirement. (b.) Average salary is based on the high five consecutive years during their entire service in all covered plans.

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# Actuarial Basis

## Summary of Plan Provisions (Concluded)

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**Contribution stabilizer**

The following is a summary of the contribution stabilizer provisions in Minnesota Statute 352.045:

- If a contribution sufficiency of at least 1.00% exists, member and employer contributions may be adjusted by the MSRS Board of Directors to a level necessary to maintain a 1.00% sufficiency. Member and employer contributions may not be less than the sum of normal cost and administrative expenses. Employer contributions must be equal to 60% of the sum of member and employer contributions.
- If a contribution deficiency of at least 0.50% exists, member and employer contribution rates may be increased by the MSRS Board of Directors to eliminate the deficiency. Employer contributions must be equal to 60% of the sum of member and employer contributions.
- Any adjustment to the contribution rates must be reported to the Legislative Commission on Pensions and Retirement (LCPR) by January 15 following the most recent valuation report. If the LCPR does not recommend against or alter the change in rates, the adjustment becomes effective on the first day of the first full payroll period of the next fiscal year.

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**Changes in plan provisions**

There have been no changes in plan provisions since the prior valuation.

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## Additional Schedules

### Schedule of Funding Progress<sup>1</sup> (Dollars in Thousands)

Actuarial Valuation Date	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) (b)	Unfunded (Overfunded) AAL (UAAL) (b) - (a)	Funded Ratio (a)/(b)	Actual Covered Payroll (Previous FY) (c)	UAAL as a Percentage of Covered Payroll [(b)-(a)]/(c)
7-1-1991	\$ 105,925	\$ 112,171	\$ 6,246	94.43%	\$ 43,429	14.38 %
7-1-1992	121,051	123,515	2,464	98.01	47,592	5.18
7-1-1993	135,939	134,280	(1,659)	101.24	52,122	(3.18)
7-1-1994	148,163	152,702	4,539	97.03	54,673	8.30
7-1-1995	165,427	153,491	(11,936)	107.78	66,939	(17.83)
7-1-1996	193,833	170,959	(22,874)	113.38	72,959	(31.35)
7-1-1997	241,916	212,638	(29,278)	113.77	112,408	(26.05)
7-1-1998	295,291	261,869	(33,422)	112.76	105,796	(31.59)
7-1-1999	335,408	307,408	(28,000)	109.11	106,131	(26.38)
7-1-2000	386,964	359,885	(27,079)	107.52	112,587	(24.05)
7-1-2001	431,134	398,633	(32,501)	108.15	120,947	(26.87)
7-1-2002	457,416	446,426	(10,990)	102.46	124,373	(8.84)
7-1-2003	470,716	484,974	14,258	97.06	131,328	10.86
7-1-2004	486,617	524,215	37,598	92.83	133,172	28.23
7-1-2005	503,573	546,118	42,545 <sup>2</sup>	92.21	132,335	32.15
7-1-2006	535,357	647,480	112,123	82.68	145,879	76.86
7-1-2007	559,852	708,292	148,440	79.04	167,727	88.50
7-1-2008	572,719	760,363	187,644	75.32	194,391	96.53
7-1-2009	590,399	821,250	230,851	71.89	193,445	119.34
7-1-2010	603,863	851,086	247,223	70.95	192,450	128.46
7-1-2011	637,027	907,012	269,985	70.23	197,702	136.56
7-1-2012	663,713	968,166	304,453	68.55	200,035 <sup>3</sup>	152.20
7-1-2013	701,091	1,026,098	325,007	68.33	204,198 <sup>3</sup>	159.16
7-1-2014	790,304	1,122,474	332,170	70.41	219,244 <sup>3</sup>	151.51
7-1-2015	878,624	1,239,258	360,634	70.90	231,440 <sup>4</sup>	155.82
7-1-2016	937,000	1,313,516	376,516	71.34	241,242 <sup>4</sup>	156.07
7-1-2017	1,013,173	1,414,443	401,270	71.63	248,879 <sup>4</sup>	161.23

<sup>1</sup> Information prior to 2012 provided by prior actuary. See prior reports for additional detail.

<sup>2</sup> Provided by MSRS instead of prior actuary.

<sup>3</sup> Assumed equal to actual member contributions divided by 8.60%.

<sup>4</sup> Assumed equal to actual member contributions divided by 9.10%.

## Additional Schedules

### Schedule of Contributions from the Employer and Other Contributing Entities<sup>1</sup> (Dollars in Thousands)

Plan Year Ended June 30	Actuarially Required Contribution Rate (a)	Actual Covered Payroll (b)	Actual Member Contributions (c)	Annual Required Contributions [(a)x(b)] - (c) = (d)	Actual Employer Contributions (e)	Percentage Contributed (e)/(d)
1991	10.73%	\$ 43,429	\$ 2,128	\$ 2,532	\$ 2,731	107.86%
1992	10.82	47,592	2,332	2,817	2,955	104.90
1993	11.41	52,122	2,554	3,393	3,217	94.81
1994	10.97	54,673	2,679	3,319	3,355	101.08
1995	11.30	66,939	3,280	4,284	4,195	97.92
1996	11.11	72,959	3,575	4,531	4,559	100.62
1997	11.21	112,408	5,508	7,093	9,129	128.70
1998	12.49	105,796	5,954	7,260	8,146	112.20
1999	12.99	106,131	6,378	7,408	8,172	110.31
2000	13.66	112,587	6,526	8,853	8,984	101.48
2001	13.72	120,947	6,996	9,598	9,652	100.56
2002	13.81	124,373	7,207	9,969	9,925	99.56
2003	14.73	131,328	7,610	11,735	10,480	89.31
2004	15.83	133,172	7,748	13,333	10,627	79.71
2005	17.48	132,335	7,943	15,189	11,016	72.52
2006	17.71	145,879	8,964	16,871	12,152	72.03
2007	23.34	167,727	10,032	29,115	13,927	47.83
2008	24.44	194,391	12,775	34,734	18,623	53.62
2009	23.66	193,445	14,031	31,738	20,126	63.41
2010	24.85	192,450	15,267	32,557	21,988	67.54
2011	25.43	197,702	17,002	33,274	23,892	71.80
2012	26.00	200,035 <sup>2</sup>	17,203	34,806	24,188	69.49
2013	25.28	204,198 <sup>2</sup>	17,561	34,060	24,632	72.32
2014	26.11	219,244 <sup>2</sup>	18,855	38,390	26,468	68.95
2015	26.43	231,440 <sup>3</sup>	21,061	40,109	29,480	73.50
2016	27.41	241,242 <sup>3</sup>	21,953	44,171	30,678	69.45
2017	27.56	248,879 <sup>3</sup>	22,648	45,943	31,763	69.14
2018	28.40	N/A	N/A	N/A	N/A	N/A

<sup>1</sup> Information prior to 2012 provided by prior actuary. See prior reports for additional detail.

<sup>2</sup> Assumed equal to actual member contributions divided by 8.60%.

<sup>3</sup> Assumed equal to actual member contributions divided by 9.10%.

## Glossary of Terms

<b>Accrued Benefit Funding Ratio</b>	The ratio of assets to Current Benefit Obligations.
<b>Accrued Liability Funding Ratio</b>	The ratio of assets to Actuarial Accrued Liability.
<b>Actuarial Accrued Liability (AAL)</b>	The difference between the Actuarial Present Value of Future Benefits, and the Actuarial Present Value of Future Normal Costs.
<b>Actuarial Assumptions</b>	Assumptions about future plan experience that affect costs or liabilities, such as: mortality, withdrawal, disablement, and retirement; future increases in salary; future rates of investment earnings; future investment and administrative expenses; characteristics of members not specified in the data, such as marital status; characteristics of future members; future elections made by members; and other items.
<b>Actuarial Cost Method</b>	A procedure for allocating the Actuarial Present Value of Future Benefits between the Actuarial Present Value of future Normal Costs and the Actuarial Accrued Liability.
<b>Actuarial Equivalent</b>	Of equal Actuarial Present Value, determined as of a given date and based on a given set of Actuarial Assumptions.
<b>Actuarial Present Value (APV)</b>	The amount of funds required to provide a payment or series of payments in the future. It is determined by discounting the future payments with an assumed interest rate and with the assumed probability each payment will be made.
<b>Actuarial Present Value of Projected Benefits</b>	The Actuarial Present Value of amounts which are expected to be paid at various future times to active members, retired members, beneficiaries receiving benefits, and inactive, non-retired members entitled to either a refund or a future retirement benefit. Expressed another way, it is the value that would have to be invested on the valuation date so that the amount invested plus investment earnings would provide sufficient assets to pay all projected benefits and expenses when due.
<b>Actuarial Valuation</b>	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 plan. An Actuarial Valuation for a governmental retirement system typically also includes calculations of items needed for developing and monitoring a retirement system's funding policy, such as the Funded Ratio and the Annual Required Contribution (ARC).
<b>Actuarial Value of Assets</b>	The value of the assets as of a given date, used by the actuary for valuation purposes. This may be the market or fair value of plan assets or a smoothed value in order to reduce the year-to-year volatility of calculated results, such as the funded ratio and the actuarially required contribution (ARC).

## Glossary of Terms (Continued)

<b>Amortization Method</b>	A method for determining the Amortization Payment. Under the Level Percentage of Pay method, the Amortization payment is one of a stream of increasing payments, whose Actuarial Present Value is equal to the UAAL. The stream of payments increases at the rate at which total covered payroll of all active members is assumed to increase.
<b>Amortization Payment</b>	That portion of the plan contribution or ARC which is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.
<b>Amortization Period</b>	The period used in calculating the Amortization Payment.
<b>Annual Required Contribution (ARC)</b>	The employer's periodic required contributions, expressed as a dollar amount or a percentage of covered plan compensation. The ARC consists of the Employer Normal Cost and Amortization Payment.
<b>Augmentation</b>	Annual increases to deferred benefits.
<b>Closed Amortization Period</b>	A specific number of years that is reduced by one each year, and declines to zero with the passage of time. For example if the amortization period is initially set at 30 years, it is 29 years at the end of one year, 28 years at the end of two years, etc.
<b>Current Benefit Obligations</b>	The present value of benefits earned to the valuation date, based on current service and including future salary increases to retirement (comparable to a Projected Unit Credit measurement).
<b>Employer Normal Cost</b>	The portion of the Normal Cost to be paid by the employer. This is equal to the Normal Cost less expected member contributions.
<b>Expected Assets</b>	The present value of anticipated future contributions intended to fund benefits for current members.
<b>Experience Gain/Loss</b>	A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two actuarial valuations. To the extent that actual experience differs from that assumed, Unfunded Actuarial Accrued Liabilities emerge which may be larger or smaller than projected. Gains are due to favorable experience, e.g., the assets earn more than projected, salaries do not increase as fast as assumed, members retire later than assumed, etc. Favorable experience means actual results produce actuarial liabilities not as large as projected by the actuarial assumptions. On the other hand, losses are the result of unfavorable experience, i.e., actual results that produce Unfunded Actuarial Accrued Liabilities which are larger than projected.

## Glossary of Terms (Concluded)

<b>GASB</b>	Governmental Accounting Standards Board.
<b>GASB Statements No. 25 and No. 27</b>	These are the governmental accounting standards that set the accounting and financial reporting rules for public retirement systems and the employers that sponsor or contribute to them. Statement No. 27 sets the accounting and financial reporting rules for the employers that sponsor or contribute to public retirement systems, while Statement No. 25 sets the rules for the systems themselves. These statements remain in effect only for pension plans that are not administered as trusts or equivalent arrangements. Please refer to the definition of GASB Statements No. 67 and No. 68 below.
<b>GASB Statement No. 50</b>	The accounting standard governing a state or local governmental employer's accounting for pensions. This statement remains in effect only for pension plans that are not administered as trusts. Please refer to the definition of GASB Statements No. 67 and No. 68.
<b>GASB Statements No. 67 and No. 68</b>	Statements No. 67 and No. 68, issued in June 2012, replace the requirements of Statements No. 25, No. 27 and No. 50, respectively, for pension plans administered as trusts. Statement No. 68, effective for the fiscal year beginning July 1, 2014, sets the accounting and financial reporting rules for the employers that sponsor or contribute to public retirement systems, while Statement No. 67, effective for the fiscal year beginning July 1, 2013, sets the rules for the systems themselves. Accounting and financial reporting rules information prepared according to Statements No. 67 and No. 68 is provided in a separate report beginning with the June 30, 2014 actuarial valuation.
<b>GASB Statement No. 82</b>	Statement No. 82, issued in March 2016, is an amendment to Statements No. 67, No. 68, and No. 73, and is intended to improve consistency in the application of the accounting statements.
<b>Normal Cost</b>	The annual cost assigned, under the Actuarial Cost Method, to the current plan year.
<b>Projected Benefit Funding Ratio</b>	The ratio of the sum of Actuarial Value of Assets and Expected Assets to the Actuarial Present Value of Projected Benefits. A Ratio less than 100% indicates that contributions are insufficient.
<b>Unfunded Actuarial Accrued Liability</b>	The difference between the Actuarial Accrued Liability and Actuarial Value of Assets.
<b>Valuation Date</b>	The date as of which the Actuarial Present Value of Future Benefits are determined. The benefits expected to be paid in the future are discounted to this date.