Minnesota State Retirement System

State Employees Retirement Fund

Actuarial Valuation Report as of July 1, 2018

GRS Retirement Consulting

P: 800.521.0498 | F: 763.432.5842 | www.grsconsulting.com

December 5, 2018

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

Dear Board of Directors:

The results of the July 1, 2018 annual actuarial valuation of the State 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 persons other than the intended users as 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, 2018 according to prescribed assumptions. Note that we have not attempted to quantify the impact of GASB Statements No. 67 and No. 68 in this report.

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 a 2018 analysis of long-term rate of investment return and inflation assumptions, GRS suggested that an investment return assumption in the range of 6.64% to 7.56% would be reasonable. Please see our draft letter dated September 17, 2018 for additional information. The current assumed rate, which is mandated by Minnesota Statutes, is 7.5% and is at the upper end of the reasonable range. This report also concluded that the probability of exceeding the current 7.5% assumption over 20 years is only 39%. If capital market assumptions decline further from present levels, the 7.5% return assumption might not comply with actuarial standards for the July 1, 2019 valuation. For informational purposes, results based on a 6.5% discount rate are shown on page five.

The valuation assumed the continuing ability of the plan sponsor to make the contributions necessary to fund this plan. A determination regarding whether or not the plan sponsor is actually able to do so is outside our scope of expertise and was not performed.

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 6 – 9, 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 findings in this report are based on data and other information through June 30, 2018. 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.

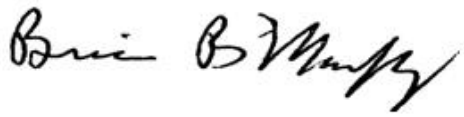
The signing actuaries are independent of the plan sponsor. We are not aware of any relationship that would impair the objectivity of our work.

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).

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 State Employees Retirement Fund as of the valuation date according to 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:rmn

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 7.50%), it is expected that:

(1) The normal cost of the plan is expected to remain approximately level as a percent of pay,
(2) The funded status of the plan is expected to gradually improve and is expected to be 100% funded within the next 30 years, and
(3) The unfunded liability will grow initially as a dollar amount before beginning to decline.

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.

Contents

Summary of Valuation Results

Contributions

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

Total Contributions	Actuarial Valuation as of July 1, 2018	Actuarial Valuation as of July 1, 2017
Statutory Contributions - Chapter 352 (% of Payroll)	11.63%	11.00%
Required Contributions - Chapter 356 (% of Payroll)	11.53%	13.24%
Sufficiency / (Deficiency)	0.10%	(2.24)%

The contribution sufficiency/(deficiency) improved from a deficiency of (2.24)% of payroll to a sufficiency of 0.10% of payroll. The primary reason for the change in contribution sufficiency/(deficiency) was the change in plan provisions, which was partially offset by the change in assumptions, described in the Effects of Changes section. On a market value of assets basis, contributions are sufficient by 0.58% of payroll.

The contribution sufficiency referenced above is based on current snapshot of statutory contributions for the fiscal year ending June 30, 2019. Additional contribution increases will be phased in over the next year, ultimately increasing the statutory contribution rate (and the contribution sufficiency) by an additional 0.62% of payroll, if there are no significant gains or losses.

Based on the actuarial value of assets, statutory contribution rates (including the increases described above), and actuarial assumptions described in this report, statutory contributions are expected to bring the plan to full funding within the 30-year amortization period.

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 10.3% for the plan year ending June 30, 2018. The AVA earned approximately 9.5% for the plan year ending June 30, 2018 as compared to the assumed rate of 8.00%. The assumed rate is mandated by Minnesota Statutes, and was recently lowered to 7.50%.

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 November 29, 2018.

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.

	Actuarial Valuation as of July 1, 2018	Actuarial Valuation as of July 1, 2017
Contributions (*% of Payroll*)		
Statutory - Chapter 352	11.63%	11.00%
Required - Chapter 356	11.53%	13.24%
Sufficiency / (Deficiency)	0.10%	(2.24)%
Funding Ratios (*dollars in thousands*)		
Assets		
- Current assets (AVA)	$ 13,035,350	$ 12,364,957
- Current assets (MVA)	13,293,422	12,485,614
Accrued Benefit Funding Ratio		
- Current benefit obligations	$ 14,033,150	$ 13,856,767
- Funding ratio (AVA)	92.89%	89.23%
- Funding ratio (MVA)	94.73%	90.10%
Accrued Liability Funding Ratio		
- Actuarial accrued liability	$ 14,679,489	$ 14,509,150
- Funding ratio (AVA)	88.80%	85.22%
- Funding ratio (MVA)	90.56%	86.05%
Projected Benefit Funding Ratio		
- Current and expected future assets	$ 16,638,371	$ 15,289,079
- Current and expected future benefit obligations	16,586,206	16,312,136
- Projected benefit funding ratio (AVA)	100.31%	93.73%
Participant Data		
Active Members		
- Number	51,223	50,578
- Annual valuation earnings *(000s)*	$ 2,977,900	$ 2,868,430
- Projected annual earnings *(000s)*	$ 3,133,366	$ 3,023,449
- Average projected annual earnings	$ 61,171	$ 59,778
- Average age	46.6	46.8
- Average service	11.1	11.3
Service Retirements	34,937	33,563
Survivors	4,058	3,940
Disability Retirements	1,826	1,830
Deferred Retirements	17,109	17,006
Terminated Other Non-Vested	8,235	9,468
Total	**117,388**	**116,385**

Summary of Valuation Results

Effects of Changes

The following changes in plan provisions, actuarial assumptions, and methods were recognized as of July 1, 2018:

- The investment return assumption was lowered from 8.00% to 7.50%.
- The assumed payroll growth assumption was lowered from 3.50% to 3.25%.
- The assumed rate of inflation was lowered from 2.75% to 2.50%.
- Salary increase rates were reduced by 0.25% at each year of service.
- The amortization period was reset to 30 years, ending in 2048.
- Post-retirement benefit increases were changed from 2.0% per year, increasing to 2.5% per year upon achieving a 90% funding ratio to a fixed rate of 1.0% for five years (beginning January 1, 2019) and 1.5% per year thereafter.
- The augmentation adjustment in early retirement factors will be eliminated over a five-year period starting July 1, 2019, resulting in actuarial equivalence after June 30, 2024.
- Member contributions were changed from 5.50% to 5.75% of payroll, effective July 1, 2018 and 6.00% of payroll, effective July 1, 2019.
- Employer contributions were changed from 5.50% to 5.875% of payroll, effective July 1, 2018 and 6.25% of payroll, effective July 1, 2019.
- Interest credited on member contributions was decreased from 4.0% to 3.0% beginning July 1, 2018.
- Deferred augmentation was changed to 0.00% for future accruing benefits, effective January 1, 2019. Augmentation that has already accrued for deferred members will still apply.
- The contribution stabilizer was repealed.
- For retirements on or after January 1, 2024, the first benefit increase is delayed until the retiree reaches Normal Retirement Age.

Summary of Valuation Results

Effects of Changes (Concluded)

Refer to the Actuarial Basis section of this report for a complete description of these changes. The combined impact of the above changes was to decrease the accrued liability by $374 million and decrease the required contribution by 1.4% of pay, as follows:

	Before Changes	Reflecting Plan Provision Changes	Reflecting Plan Provision and Assumption Changes	Reflecting Plan Provision, Assumption, and Amortization Changes
Normal Cost Rate, % of Pay	8.2%	7.5%	8.1%	8.1%
Amortization of Unfunded Accrued Liability, % of Pay	4.4%	2.0%	3.5%	3.1%
Expenses (% of Pay)	0.3%	0.3%	0.3%	0.3%
Total Required Contribution, % of Pay	12.9%	9.8%	11.9%	11.5%
Accrued Liability Funding Ratio	86.6%	93.5%	88.8%	88.8%
Projected Benefit Funding Ratio	94.9%	105.3%	99.1%	100.3%
Unfunded Accrued Liability (in billions)	$2.0	$0.9	$1.6	$1.6

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' valuations. Per the LCPR's requirement, we have calculated the liabilities associated with the following scenarios:

1) 6.5% interest rate assumption
2) 8.5% interest rate assumption

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 8.5% interest rate assumption would not comply with Actuarial Standards of Practice.

$ in billions	Final Valuation Assumptions	Final Valuation Assumptions with 6.5% interest	Final Valuation Assumptions with 8.5% interest
Normal Cost Rate, % of Pay	8.1%	10.1%	6.7%
Amortization of Unfunded Accrued Liability, % of Pay	3.1%	5.8%	0.3%
Expenses (% of Pay)	0.3%	0.3%	0.3%
Total Required Contribution, % of Pay	11.5%	16.2%	7.3%
Contribution Sufficiency/(Deficiency), % of Pay	0.1 %	(4.6)%	4.3 %
Accrued Liability Funding Ratio	88.8%	79.0%	99.0%
Present Value of Projected Benefits	$16.6	$19.1	$14.6
Present Value of Future Normal Costs	$1.9	$2.6	$1.4
Actuarial Accrued Liability	$14.7	$16.5	$13.2
Unfunded Accrued Liability	$1.6	$3.5	$0.1

Summary of Valuation Results

Risks Associated with the Measuring the Accrued Liability and Actuarially Determined Contribution

The determination of the accrued liability and the actuarially determined contribution requires the use of assumptions regarding future economic and demographic experience. Risk measures, as illustrated in this report, are intended to aid in the understanding of the effects of future experience differing from the assumptions used in the course of the actuarial valuation. Risk measures may also help with illustrating the potential volatility in the accrued liability and the actuarially determined contribution that result from the differences between actual experience and the actuarial assumptions.

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 due to changing conditions; 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. The scope of an actuarial valuation does not include an analysis of the potential range of such future measurements.

Examples of risk that may reasonably be anticipated to significantly affect the plan's future financial condition include:

1. Investment risk – actual investment returns may differ from the expected returns;
2. Asset/Liability mismatch – changes in asset values may not match changes in liabilities, thereby altering the gap between the accrued liability and assets and consequently altering the funded status and contribution requirements;
3. Contribution risk – actual contributions may differ from expected future contributions. For example, actual contributions may not be made in accordance with the plan's funding policy or material changes may occur in the anticipated number of covered employees, covered payroll, or other relevant contribution base;
4. Salary and Payroll risk – actual salaries and total payroll may differ from expected, resulting in actual future accrued liability and contributions differing from expected;
5. Longevity risk – members may live longer or shorter than expected and receive pensions for a period of time other than assumed;
6. Other demographic risks – members may terminate, retire or become disabled at times or with benefits other than assumed resulting in actual future accrued liability and contributions differing from expected.

The effects of certain trends in experience can generally be anticipated. For example if the investment return since the most recent actuarial valuation is less (or more) than the assumed rate, the cost of the plan can be expected to increase (or decrease). Likewise if longevity is improving (or worsening), increases (or decreases) in cost can be anticipated.

Summary of Valuation Results

The Required Contribution rate shown on page 1 may be considered as a minimum contribution rate that complies with Minnesota Statutes and the requirements of the Standards for Actuarial Work published by the LCPR. The timely receipt of the actuarially determined contributions is critical to support the financial health of the plan. Users of this report should be aware that contributions made at the actuarially determined rate do not necessarily guarantee benefit security.

Plan Maturity Measures

Risks facing a pension plan evolve over time. A young plan with virtually no investments and paying few benefits may experience little investment risk. An older plan with a large number of members in pay status and a significant trust may be much more exposed to investment risk. Generally accepted plan maturity measures and values for the State Employees Retirement Fund for the last two years include the following. Additional maturity measures are shown on the following pages.

	2018	2017
Ratio of market value of assets to total payroll	4.39	4.25
Ratio of actuarial accrued liability to total payroll	4.84	4.94
Ratio of actives to retirees and beneficiaries	1.25	1.29
Ratio of net cash flow to market value of assets	-3.5%	-3.2%
Approximate modified duration* of:		
▪ Total projected benefits:	13.43	13.55
▪ Actuarial accrued liability:	11.33	11.45

* *Approximate modified duration of total projected benefits based on 7.5% interest for 2018 and 8.0% interest for 2017*

Ratio of Market Value of Assets to Payroll

The relationship between assets and payroll is a useful indicator of the potential volatility of contributions. For example, if the market value of assets is 5.0 times the payroll, a return on assets 5% different than assumed would equal 25% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in plan sponsor contributions as a percentage of payroll.

Ratio of Actuarial Accrued Liability to Payroll

The relationship between actuarial accrued liability and payroll is a useful indicator of the potential volatility of contributions for a fully funded plan. A funding policy that targets a funded ratio of 100% is expected to result in the ratio of assets to payroll and the ratio of liability to payroll converging over time.

The ratio of liability to payroll may also be used as a measure of sensitivity of the contribution rates to liability gains and losses. For example, if the actuarial accrued liability is 5.0 times the payroll, a change in liability 2% other than assumed would equal 10% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in liability (and also plan sponsor contributions) as a percentage of payroll.

Summary of Valuation Results

Ratio of Actives to Retirees and Beneficiaries

A young plan with many active members and few retirees will have a high ratio of active to retirees. A mature open plan may have close to the same number of actives to retirees resulting in a ratio near 1.0. A super-mature or closed plan may have significantly more retirees than actives resulting in a ratio below 1.0.

Ratio of Net Cash Flow to Market Value of Assets

A positive net cash flow means contributions exceed benefits and expenses. A negative cash flow means existing funds are being used to make payments. A certain amount of negative net cash flow is generally expected to occur when benefits are prefunded through a qualified trust. Large negative net cash flows as a percent of assets may indicate a super-mature plan or a need for additional contributions.

Duration of Actuarial Accrued Liability

The duration may be used to approximate the sensitivity of the accrued liability to a small change in the assumed rate of return. For example, a duration of 10 indicates that the liability would change by approximately 10% if the assumed rate of return were changed by 1% (i.e., from 7.5% to 6.5%).

Additional Risk Assessment

Additional risk assessment is outside the scope of the annual actuarial valuation but could aid stakeholders in an understanding of the risks to which the System is exposed. Additional assessment may include scenario tests, sensitivity tests, stochastic modeling, stress tests, and a comparison of the present value of accrued benefits at low-risk discount rates with the actuarial accrued liability.

Summary of Valuation Results

Risk Measures Summary (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	$10,264,071	$7,692,531	$2,571,540	$2,327,398	74.9%	$4,535,401	44.2%	441.0%	330.5%
2011	10,576,481	9,197,664	1,378,817	2,440,580	87.0%	4,982,212	47.1%	433.4%	376.9%
2012	11,083,227	9,098,097	1,985,130	2,367,160	82.1%	5,489,756	49.5%	468.2%	384.3%
2013	11,428,641	10,033,499	1,395,142	2,483,000	87.8%	5,807,381	50.8%	460.3%	404.1%
2014	12,445,126	11,498,604	946,522	2,620,660	92.4%	6,471,998	52.0%	474.9%	438.8%
2015	13,092,702	11,638,319	1,454,383	2,714,418	88.9%	6,949,000	53.1%	482.3%	428.8%
2016	14,316,886	11,223,065	3,093,821	2,797,345	78.4%	7,746,511	54.1%	511.8%	401.2%
2017	14,509,150	12,485,614	2,023,536	2,939,455	86.1%	8,207,943	56.6%	493.6%	424.8%
2018	14,679,489	13,293,422	1,386,067	3,031,382	90.6%	8,512,016	58.0%	484.3%	438.5%

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	(17) SBI 10-Year Trailing Average
2010			110.5%	$(245,460)	(3.2%)	15.2%	3.4%	N/A
2011			56.5%	(259,174)	(2.8%)	23.3%	5.3%	N/A
2012			83.9%	(312,027)	(3.4%)	2.4%	2.3%	N/A
2013			56.2%	(339,906)	(3.4%)	14.2%	6.2%	N/A
2014			36.1%	(364,455)	(3.2%)	18.6%	14.5%	N/A
2015	14.1%	60.5%	53.6%	(361,470)	(3.1%)	4.4%	12.3%	N/A
2016	14.1%	56.6%	110.6%	(405,621)	(3.6%)	(0.1%)	7.7%	N/A
2017	14.1%	59.9%	68.8%	(405,013)	(3.2%)	15.1%	10.2%	6.2%
2018	14.1%	61.8%	45.7%	(468,742)	(3.5%)	10.3%	9.4%	7.8%

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) (16) and (17) Investment return is probably the largest single risk that most systems face. The year by year return and the 5-year and 10-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, and historical averages are very sensitive to the time period chosen. 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 provided by 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)*

	Market Value	
	June 30, 2018	**June 30, 2017**
Assets		
Cash, equivalents, short term securities	$ 144,221	$ 329,906
Fixed income	2,080,384	2,412,541
Equity	11,037,045	9,711,222
Other*	1,351,585	1,302,954
Total cash, investments, and other assets	**$ 14,613,235**	**$ 13,756,623**
Amounts Receivable	$ 24,772	$ 23,944
Total Assets	**$ 14,638,007**	**$ 13,780,567**
Amounts Payable*	$ (1,344,585)	$ (1,294,953)
Net Position Restricted for Pensions	**$ 13,293,422**	**$ 12,485,614**

** Includes $1,334,503 in Securities Lending Collateral as of June 30, 2018 and $1,284,498 as of June 30, 2017.*

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	**Market Value**	
Year Ending	**June 30, 2018**	**June 30, 2017**
1. Fund balance at market value at beginning of year	**$ 12,485,614**	**$ 11,223,065**
2. Contributions		
a. Member	166,726	161,670
b. Employer	164,233	158,352
c. Other sources	-	-
d. Total contributions	$ 330,959	$ 320,022
3. Investment income		
a. Investment income/(loss)	1,290,523	1,680,494
b. Investment expenses	(13,973)	(12,932)
c. Net investment income/(loss)	$ 1,276,550	$ 1,667,562
4. Other	20,495	47,287
5. Total income: *(2.d.) + (3.c.) + (4.)*	**$ 1,628,004**	**$ 2,034,871**
6. Benefits Paid		
a. Annuity benefits	(797,027)	(750,526)
b. Refunds	(13,533)	(11,576)
c. Total benefits paid	$ (810,560)	$ (762,102)
7. Expenses		
a. Other	(72)	(55)
b. Administrative	(9,564)	(10,165)
c. Total expenses	$ (9,636)	$ (10,220)
8. Total disbursements: *(6.c.) + (7.c.)*	**(820,196)**	**(772,322)**
9. Fund balance at market value at end of year *(1.) + (5.) + (8.)*	**$ 13,293,422**	**$ 12,485,614**
10. State Board of Investment calculated investment return	10.3%	15.1%

Plan Assets

Actuarial Asset Value *(Dollars in Thousands)*

	June 30, 2018	June 30, 2017
1. Market value of assets available for benefits	**$ 13,293,422**	**$ 12,485,614**
2. Determination of average balance		
a. Total assets available at beginning of year	12,485,614	11,223,065
b. Total assets available at end of year	13,293,422	12,485,614
c. Net investment income for fiscal year	1,276,550	1,667,562
d. Average balance *[a. + b. - c.] / 2*	12,251,243	11,020,559
3. Expected return *[8.0% x 2.d.]*	980,099	881,645
4. Actual return	1,276,550	1,667,562
5. Current year asset gain/(loss) *[4. - 3.]*	296,451	785,917
6. Unrecognized asset returns		

	Original Amount	Unrecognized Amount %	Unrecognized Amount $	Unrecognized Amount %	Unrecognized Amount $
a. Year ended June 30, 2018	$ 296,451	80%	$ 237,161		
b. Year ended June 30, 2017	785,917	60%	471,550	80%	$ 628,734
c. Year ended June 30, 2016	(924,474)	40%	(369,790)	60%	(554,684)
d. Year ended June 30, 2015	(404,245)	20%	(80,849)	40%	(161,698)
e. Year ended June 30, 2014	1,041,524		N/A	20%	208,305
f. Unrecognized return adjustment			**$ 258,072**		**$ 120,657**
7. **Actuarial value at end of year** *(1. - 6.f.)*			**$ 13,035,350**		**$ 12,364,957**
8. Approximate return on actuarial value of assets during fiscal year			9.5%		9.9%
9. Ratio of actuarial value of assets to market value of assets			0.98		0.99

Membership Data

Distribution of Active Members

	Years of Service as of June 30, 2018									
Age	**<3***	**3 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25 - 29**	**30 - 34**	**35+**	**Total**
< 25	1,260	26	3							**1,289**
Avg. Earnings	$ 28,307	$ 41,633	$ 36,243							**$ 28,594**
25 - 29	2,932	758	299	2						**3,991**
Avg. Earnings	$ 37,791	$ 44,759	$ 50,246	$ 48,782						**$ 40,053**
30 - 34	2,583	1,104	1,512	336	3					**5,538**
Avg. Earnings	$ 43,197	$ 51,432	$ 55,072	$ 57,138	$ 57,549					**$ 48,934**
35 - 39	2,005	962	1,607	1,256	233	4				**6,067**
Avg. Earnings	$ 46,537	$ 56,247	$ 59,302	$ 62,623	$ 63,355	$ 77,882				**$ 55,454**
40 - 44	1,428	650	1,198	1,125	771	159	1			**5,332**
Avg. Earnings	$ 48,025	$ 60,513	$ 62,170	$ 65,788	$ 69,673	$ 70,726	$ 97,420			**$ 60,290**
45 - 49	1,281	576	1,135	1,006	920	581	112	2		**5,613**
Avg. Earnings	$ 47,800	$ 58,465	$ 62,127	$ 66,621	$ 69,975	$ 75,096	$ 72,452	$ 42,922		**$ 62,115**
50 - 54	1,014	553	1,130	1,079	984	819	640	280	14	**6,513**
Avg. Earnings	$ 46,610	$ 57,974	$ 61,539	$ 65,518	$ 69,419	$ 75,073	$ 75,071	$ 71,900	$ 65,677	**$ 64,248**
55 - 59	980	533	1,099	1,094	1,023	816	975	900	439	**7,859**
Avg. Earnings	$ 46,782	$ 57,004	$ 60,714	$ 64,611	$ 66,871	$ 72,267	$ 73,180	$ 74,662	$ 67,404	**$ 64,786**
60 - 64	547	334	814	847	868	718	717	696	827	**6,368**
Avg. Earnings	$ 45,399	$ 58,806	$ 60,802	$ 62,750	$ 65,664	$ 69,834	$ 71,970	$ 73,315	$ 68,335	**$ 64,918**
65 - 69	178	112	304	328	331	184	224	172	342	**2,175**
Avg. Earnings	$ 35,165	$ 52,420	$ 59,352	$ 62,466	$ 67,329	$ 67,609	$ 70,303	$ 71,690	$ 70,499	**$ 63,254**
70+	86	33	61	62	50	40	42	24	80	**478**
Avg. Earnings	$ 21,022	$ 30,164	$ 45,278	$ 52,140	$ 59,387	$ 68,258	$ 68,436	$ 66,243	$ 76,545	**$ 52,480**
Total	**14,294**	**5,641**	**9,162**	**7,135**	**5,183**	**3,321**	**2,711**	**2,074**	**1,702**	**51,223**
Avg. Earnings	**$ 42,477**	**$ 54,576**	**$ 59,513**	**$ 64,083**	**$ 67,914**	**$ 72,555**	**$ 72,974**	**$ 73,463**	**$ 68,894**	**$ 58,136**

* *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 valuation earnings for the fiscal year ending on the valuation date.

Membership Data

Distribution of Service Retirements

	Years Retired as of June 30, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
<50		6	12	1				**19**
Avg. Benefit		$ 5,174	$ 4,780	$ 5,604				**$ 4,948**
50 - 54	7	5	6					**18**
Avg. Benefit	$ 15,417	$ 7,501	$ 4,891					**$ 9,709**
55 - 59	234	497	39	2				**772**
Avg. Benefit	$ 20,169	$ 16,181	$ 11,264	$ 14,168				**$ 17,136**
60 - 64	766	2,123	1,081	29				**3,999**
Avg. Benefit	$ 21,657	$ 21,490	$ 18,158	$ 12,010				**$ 20,553**
65 - 69	1,083	4,432	3,197	1,178	16			**9,906**
Avg. Benefit	$ 20,750	$ 20,695	$ 21,628	$ 17,672	$ 14,828			**$ 20,633**
70 - 74	195	1,378	3,841	2,530	886	16		**8,846**
Avg. Benefit	$ 18,684	$ 20,591	$ 20,876	$ 21,178	$ 17,063	$ 17,919		**$ 20,482**
75 - 79	25	186	847	2,117	1,680	483	2	**5,340**
Avg. Benefit	$ 17,971	$ 17,317	$ 19,336	$ 19,335	$ 20,654	$ 17,769	$ 12,517	**$ 19,529**
80 - 84	4	39	116	393	1,381	971	250	**3,154**
Avg. Benefit	$ 12,123	$ 13,540	$ 14,764	$ 15,839	$ 18,178	$ 21,715	$ 24,827	**$ 19,312**
85 - 89	1	8	20	53	188	887	583	**1,740**
Avg. Benefit	$ 8,257	$ 18,257	$ 19,129	$ 14,972	$ 15,622	$ 21,586	$ 25,858	**$ 22,120**
90+			4	13	39	176	911	**1,143**
Avg. Benefit			$ 14,386	$ 9,959	$ 14,085	$ 21,101	$ 21,971	**$ 21,405**
Total	**2,315**	**8,674**	**9,163**	**6,316**	**4,190**	**2,533**	**1,746**	**34,937**
Avg. Benefit	**$ 20,751**	**$ 20,489**	**$ 20,519**	**$ 19,452**	**$ 18,770**	**$ 20,851**	**$ 23,667**	**$ 20,306**

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

	Years Since Death as of June 30, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
<45	5	49	27	11			2	**94**
Avg. Benefit	$ 6,102	$ 6,913	$ 7,551	$ 15,718			$ 17,118	**$ 8,301**
45 - 49	8	9	23	7	2	1		**50**
Avg. Benefit	$ 3,583	$ 6,810	$ 8,693	$ 15,409	$ 3,922	$ 8,795		**$ 8,288**
50 - 54	4	25	18	3	6	2		**58**
Avg. Benefit	$ 7,762	$ 12,103	$ 10,185	$ 9,853	$ 4,762	$ 6,539		**$ 10,141**
55 - 59	16	65	41	24	8	7	2	**163**
Avg. Benefit	$ 13,640	$ 13,551	$ 9,854	$ 13,052	$ 7,487	$ 6,114	$ 6,407	**$ 11,852**
60 - 64	42	97	77	49	28	13	2	**308**
Avg. Benefit	$ 15,120	$ 15,918	$ 15,856	$ 15,804	$ 10,217	$ 7,607	$ 6,013	**$ 14,842**
65 - 69	58	127	149	108	57	22	6	**527**
Avg. Benefit	$ 19,514	$ 17,822	$ 17,918	$ 14,700	$ 12,535	$ 12,211	$ 5,047	**$ 16,444**
70 - 74	47	160	156	133	65	31	12	**604**
Avg. Benefit	$ 19,869	$ 19,983	$ 18,279	$ 16,734	$ 16,914	$ 16,696	$ 15,141	**$ 18,223**
75 - 79	50	152	162	104	71	53	29	**621**
Avg. Benefit	$ 19,985	$ 20,936	$ 18,233	$ 15,600	$ 15,754	$ 18,685	$ 17,382	**$ 18,310**
80 - 84	63	153	146	117	88	47	35	**649**
Avg. Benefit	$ 22,121	$ 23,335	$ 20,745	$ 20,667	$ 19,837	$ 17,373	$ 18,503	**$ 20,987**
85 - 89	40	91	123	83	82	48	52	**519**
Avg. Benefit	$ 18,291	$ 23,117	$ 22,792	$ 21,801	$ 24,439	$ 22,100	$ 19,172	**$ 22,177**
90+	16	68	80	106	71	67	57	**465**
Avg. Benefit	$ 24,586	$ 19,488	$ 23,935	$ 20,685	$ 23,026	$ 20,676	$ 21,942	**$ 21,714**
Total	**349**	**996**	**1,002**	**745**	**478**	**291**	**197**	**4,058**
Avg. Benefit	**$ 18,702**	**$ 18,845**	**$ 18,397**	**$ 17,790**	**$ 18,199**	**$ 17,879**	**$ 18,631**	**$ 18,373**

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, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
< 45	2	5	5	3				**15**
Avg. Benefit	$ 9,017	$ 6,733	$ 5,585	$ 2,503				**$ 5,809**
45 - 49	5	5	4	6	2			**22**
Avg. Benefit	$ 6,913	$ 7,974	$ 8,682	$ 4,048	$ 8,122			**$ 6,804**
50 - 54	7	29	26	12	6	3		**83**
Avg. Benefit	$ 11,770	$ 10,425	$ 9,291	$ 8,856	$ 6,513	$ 7,471		**$ 9,567**
55 - 59	15	76	72	41	21	6	3	**234**
Avg. Benefit	$ 20,935	$ 14,251	$ 14,880	$ 11,220	$ 10,350	$ 10,140	$ 5,224	**$ 13,771**
60 - 64	28	112	116	88	50	27	7	**428**
Avg. Benefit	$ 18,164	$ 14,790	$ 16,918	$ 15,132	$ 11,358	$ 11,216	$ 7,806	**$ 14,917**
65 - 69	1	51	140	162	82	28	7	**471**
Avg. Benefit	$ 17,124	$ 15,071	$ 17,570	$ 16,675	$ 14,027	$ 14,327	$ 11,242	**$ 16,087**
70 - 74			41	115	90	27	25	**298**
Avg. Benefit			$ 13,120	$ 15,784	$ 17,223	$ 17,451	$ 15,459	**$ 15,976**
75+				22	95	90	68	**275**
Avg. Benefit				$ 13,778	$ 14,279	$ 17,663	$ 15,443	**$ 15,634**
Total	**58**	**278**	**404**	**449**	**346**	**181**	**110**	**1,826**
Avg. Benefit	**$ 16,806**	**$ 13,971**	**$ 15,682**	**$ 15,032**	**$ 14,154**	**$ 15,735**	**$ 14,414**	**$ 14,937**

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**			
	Actives*	Deferred Retirement	Other Non-Vested	Service Retirement	Disability Retirement	Survivor	Total
Members on July 1, 2017	**50,578**	**17,006**	**9,468**	**33,563**	**1,830**	**3,940**	**116,385**
New members	5,649	0	0	0	0	0	**5,649**
Return to active	347	(156)	(191)	0	0	0	**0**
Terminated non-vested	(1,944)	0	1,944	0	0	0	**0**
Service retirements	(1,450)	(709)	0	2,159	0	0	**0**
Unclassified retirements	0	0	0	62	0	0	**62**
Terminated deferred	(1,005)	1,005	0	0	0	0	**0**
Terminated refund/transfer	(823)	(164)	(3,278)	0	0	0	**(4,265)**
Deaths	(88)	(37)	(15)	(911)	(68)	(185)	**(1,304)**
New beneficiary	0	0	0	0	0	325	**325**
Disabled	(41)	0	0	0	41	0	**0**
Data adjustments	0	164	307	64	23	(22)	**536**
Net change	645	103	(1,233)	1,374	(4)	118	**1,003**
Members on July 1, 2018	**51,223**	**17,109**	**8,235**	**34,937**	**1,826**	**4,058**	**117,388**

* *Includes members in the General or Military Affairs Plans.*
** *Includes members in the General, Military Affairs or Unclassified Plans.*

Terminated Member Statistics on June 30, 2018	Deferred Retirement	Other Non-Vested	Total
Number	17,109	8,235	25,344
Average age	51.4	37.1	46.7
Average service	7.9	1.2	5.7
Average annual benefit, with augmentation to December 31, 2018 and 4% CSA load	$8,836	N/A	$8,836
Average refund value, with 4% CSA load (5% CSA load for Non-Vested)	$29,471	$2,922	$20,844

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 11.63% 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.

				June 30, 2018
A.	Actuarial Value of Assets			$ 13,035,350
B.	Expected Future Assets			
	1. Present value of expected future statutory supplemental contributions*			1,696,304
	2. Present value of future normal cost contributions			1,906,717
	3. Total expected future assets: *(1.) + (2.)*			$ 3,603,021
C.	Total Current and Expected Future Assets			16,638,371
D.	Current Benefit Obligations**			
	1. Benefit recipients	**Non-Vested**	**Vested**	**Total**
	a. Service retirements	$ -	$ 7,642,145	$ 7,642,145
	b. Disability retirements	-	265,018	265,018
	c. Survivors	-	604,853	604,853
	2. Deferred retirements	-	960,715	960,715
	3. Former members without vested rights***	8,328	-	8,328
	4. Active members	151,051	4,401,040	4,552,091
	5. Total Current Benefit Obligations	$ 159,379	$ 13,873,771	$ 14,033,150
E.	Expected Future Benefit Obligations			2,553,056
F.	Total Current and Expected Future Benefit Obligations****			16,586,206
G.	Unfunded Current Benefit Obligations: *(D.5.) - (A.)*			997,800
H.	Unfunded Current and Future Benefit Obligations: *(F.) - (C.)*			(52,165)
I.	Accrued Benefit Funding Ratio: *(A.)/(D.5.)*			92.89%
J.	Projected Benefit Funding Ratio: *(C.)/(F.)*			100.31%

* *Per the LCPR Standards for Actuarial Work, calculated assuming the current contribution toward the unfunded liability continues for the entire amortization period. Excludes future statutory contribution increases.*

** *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	$ 6,473,659	$ 1,398,051	$ 5,075,608
b. Disability benefits	229,463	91,252	138,211
c. Survivor's benefits	90,748	24,480	66,268
d. Deferred retirements	262,230	288,870	(26,640)
e. Refunds*	41,772	104,064	(62,292)
f. Total	$ 7,097,872	$ 1,906,717	$ 5,191,155
2. Deferred retirements	960,715	-	960,715
3. Former members without vested rights	8,328	-	8,328
4. Benefit recipients	8,512,016	-	8,512,016
5. Contingent actuarial accrued liability - UNCL Plan	7,275	-	7,275
6. Total	$ 16,586,206	$ 1,906,717	$ 14,679,489
B. Determination of Unfunded Actuarial Accrued Liability (UAAL)			
1. Actuarial accrued liability			$ 14,679,489
2. Current assets (AVA)			13,035,350
3. Unfunded actuarial accrued liability			$ 1,644,139
C. Determination of Supplemental Contribution Rate**			
1. Present value of future payrolls through the amortization date of June 30, 2048			$ 53,511,175
2. Supplemental contribution rate: *(B.3.) / (C.1.)*			3.07% ***

* *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, 2018 is 17.07786.*

Development of Costs

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

	Year Ending June 30, 2018		
	Actuarial Accrued Liability	Current Assets	Unfunded Actuarial Accrued Liability
A. Unfunded actuarial accrued liability at beginning of year	$ 14,509,150	$ 12,364,957	$ 2,144,193
B. Changes due to interest requirements and current rate of funding			
1. Normal cost, including expenses	257,185	-	257,185
2. Benefit payments	(810,560)	(810,560)	-
3. Contributions	-	330,959	(330,959)
4. Interest on A., B.1., B.2. and B.3.	1,138,597	970,013	168,584
5. Total *(B.1. + B.2. + B.3. + B.4.)*	$ 585,222	$ 490,412	$ 94,810
C. Expected unfunded actuarial accrued liability at end of year *(A. + B.5.)*	$ 15,094,372	$ 12,855,369	$ 2,239,003
D. Increase (decrease) due to actuarial losses (gains) because of experience deviations from expected			
1. Age and service retirements			3,546
2. Disability retirements			(1,161)
3. Death-in-service benefits			(1,036)
4. Withdrawals			(2,500)
5. Salary increases			(39,788)
6. Investment income			(179,981)
7. Mortality of annuitants			(8,091)
8. Other items			8,174
9. Total			$ (220,837)
E. Unfunded actuarial accrued liability at end of year before plan amendments and changes in actuarial assumptions *(C. + D.9.)*			$ 2,018,166
F. Change in unfunded actuarial accrued liability due to changes in plan provisions			(1,111,699)
G. Change in unfunded actuarial accrued liability due to changes in actuarial assumptions			737,672
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.)**			$ 1,644,139

** The unfunded actuarial accrued liability on a market value of assets basis is $1,386,067.*

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	5.75%	$ 180,169
2. Employer contributions	5.88%	184,242
3. Total	11.63%	$ 364,411
B. Required contributions - Chapter 356		
1. Normal cost		
a. Retirement benefits	6.18%	$ 193,642
b. Disability benefits	0.35%	10,967
c. Survivors	0.10%	3,133
d. Deferred retirement benefits	1.09%	34,154
e. Refunds*	0.42%	13,160
f. Total	8.14%	$ 255,056
2. Supplemental contribution amortization of Unfunded Actuarial Accrued Liability by June 30, 2048	3.07%	$ 96,194
3. Allowance for expenses	0.32%	10,027
4. Total	11.53%	$ 361,277
C. Contribution Sufficiency/(Deficiency) *(A.3. - B.4.)*	0.10%	$ 3,134

Note: Projected annual payroll for fiscal year beginning on the valuation date: $3,133,366 (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 11.05% of payroll.*

Development of Costs

Special Groups - Military Affairs Calculation

Section 352.85 of Chapter 352 of Minnesota Statutes provides that certain military affairs personnel may retire, with an unreduced benefit, at age 60. In addition, they may receive disability benefits upon being found disqualified for retention in active military duty. To fund these special benefits, employees and employer contribute an extra 1.60% of payroll.

To recognize the effect of the unreduced early retirement benefit available at age 60, we have assumed that all military affairs personnel will retire at age 60, or if over age 60, one year from the valuation date.

The unfunded liability for these members, if any, is reflected in the total unfunded liability shown on page 20.

	Year Ending June 30, 2018
A. Projected annual earnings	$ 684,628
B. Total normal cost	
1. Dollar amount	$ 89,344
2. Percent of payroll	13.05%
C. Normal cost of State Employees Retirement Fund (percent of payroll)	8.14%
D. Difference in normal cost *(B. - C., not less than zero)*	4.91%

Active Military Affairs Statistics	Active Members
Number	10
Average Age, in years	42.6
Average Service, in years	3.9

Development of Costs

Special Groups - Fire Marshals Calculation

Section 352.87 of Chapter 352 of Minnesota Statutes provides that deputy state fire marshals may retire, with an unreduced benefit (with respect to service after July 1, 1999), at age 55. Credited Service after July 1, 1999 accrues retirement benefits at a rate of 2.00% per year, and disability benefits are based on a minimum of 15 years of service (20 years if duty related). To fund these special benefits, members contribute an extra 2.78% of payroll and employers contribute an extra 4.20% of payroll.

To recognize the effect of the unreduced early retirement benefit available at age 55, we have assumed that all fire marshals will retire in accordance with the retirement assumptions which apply to the members of the Correctional Employees Retirement Fund.

The unfunded liability for these members, if any, is reflected in the total unfunded liability shown on page 20.

	Year Ending June 30, 2018
A. Projected annual earnings	$ 1,110,023
B. Total normal cost	
1. Dollar amount	$ 180,046
2. Percent of payroll	16.22%
C. Normal cost of State Employees Retirement Fund (percent of payroll)	8.14%
D. Difference in normal cost (B. - C.)	8.08%

Active Fire Marshals Statistics	Active Members
Number	14
Average Age, in years	54.7
Average Service, in years	14.0

Development of Costs

Special Groups - Unclassified Plan Contingent Liability Calculation
(Dollars in Thousands)

Section 352D.02 of Chapter 352D of Minnesota Statutes provides that members credited with employee shares in the Unclassified Plan may elect to terminate participation in the Unclassified Plan and be covered by the State Employees Retirement Fund (General Plan) prior to termination of covered employment assuming that the member has acquired at least 10 years of allowable state service if hired prior to July 1, 2010 and has no more than 7 years of service if hired after June 30, 2010. Unclassified Plan members contribute 5.75% of payroll and employers contribute 6.00% of payroll. Certain members (Judges and Legislators) are not eligible to elect coverage under the State Employees Retirement Fund.

To recognize the effect of the option to elect coverage under the General Plan, we have assumed that all eligible Unclassified Plan members will elect coverage under the General Plan if such election provides the member with a greater economic present value than the accumulated contribution balance under the Unclassified Plan. The liabilities were measured using the actuarial assumptions that are applied to the State Employees Retirement Fund.

		Year Ending June 30, 2018
A.	Number of active eligible members	1,292
B.	Account balances for active eligible members	$ 172,235
C.	Accrued liability for active members	$ 179,510
D.	Contingent liability (C. - B.)	$ 7,275
E.	Projected annual earnings for active eligible members	$ 104,919
F.	Normal cost	
G.	1. Dollar amount	$ 12,392
	2. Percent of payroll	11.81%
H.	Normal cost of State Employee Retirement Fund (percent of payroll)	8.14%
	Difference in normal cost (G.2. - H.)	3.67%

Unclassified Member Statistics	Active Eligible Members
Number	1,292
Average Age, in years	43.8
Average Service, in years	8.8
Average Unclassified Account Balance	$ 133,309

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 the normal cost, expenses, and the payment toward the UAAL.

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; and
- 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, 2048 assuming payroll increases of 3.25% 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.

As required by the Standards for Actuarial Work, projected payroll is 1) determined by increasing reported payroll for each member by one full year's assumed pay increase according to the actuarial salary scale and 2) multiplied by 0.962 in the determination of the present value of future payroll to account for timing differences.

Changes in Methods since Prior Valuation

The amortization period was reset to 30 years, ending in 2048.

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 June 30, 2015, and a review of inflation and investment return assumptions, dated September 11, 2017. 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.

Investment return	7.50% per annum.
Salary increases	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.
Inflation	2.50% per year.
Payroll growth	3.25% per year.
Mortality rates	
Healthy Pre-retirement	RP-2014 employee generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2014, white collar adjustment, set forward one year for males and no age adjustment for females.
Healthy Post-retirement	RP-2014 annuitant generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2014, white collar adjustment, set forward two years for males and no age adjustment for females.
Disabled	RP-2014 disabled mortality table projected with mortality improvement Scale MP-2015 from a base year of 2014, set forward two years for males and four years for females.
Notes	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.
Retirement	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. Note that significant plan changes reflected in this report may result in behavior changes that are not anticipated in the current retirement rates.
Withdrawal	Service-related rates based on experience; see table of sample rates.
Disability	Age-related rates based on experience; see table of sample rates.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Allowance for combined service annuity	Liabilities for former, vested members are increased by 4.00%, and liabilities for former, non-vested members are increased by 5.00% to account for the effect of some participants having eligibility for a Combined Service Annuity.
Administrative expenses	Prior year administrative expenses expressed as percentage of prior year projected payroll.
Refund of contributions	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 are assumed to take the larger of the contributions accumulated with interest or the value of the deferred benefit.
Commencement of deferred benefits	Members receiving deferred annuities (including current terminated deferred members) are assumed to begin receiving benefits at normal retirement age.
Percentage married	80% of active male members and 65% of female members are assumed to be married. Actual marital status is used for members in payment status.
Age of spouse	Male members are assumed to have a beneficiary three years younger and female members are assumed to have a beneficiary two years older.
Form of payment	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: 15% elect 50% Joint & Survivor option 10% elect 75% Joint & Survivor option 30% elect 100% Joint & Survivor option Remaining married members and unmarried members are assumed to elect the Straight Life option. Members receiving deferred annuities (including current terminated deferred members) are assumed to elect a life annuity.
Eligibility testing	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
Decrement operation	Withdrawal decrements do not operate during retirement eligibility. Decrements are assumed to occur mid-fiscal year.
Service credit accruals	It is assumed that members accrue one year of service credit per year.
Pay increases	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.

Unknown data for certain members

To prepare this report, GRS has used and relied on participant data supplied by the Fund. 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.

In cases where submitted data was missing or incomplete, the following assumptions, based on average results for applicable members at the time of the last experience study, were applied:

Data for active members:

There were 85 members reported with zero or invalid salary (<$100). We used prior year salary (57 members), if available, otherwise, high five salary with a 10% load to account for salary increases (21 members). If neither pay or high five salary was available, we assumed a value of $35,000 (7 members).

There were 11 members reported with zero or negative 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.

There were also 111 members reported without a gender and 9 members reported with an invalid date of birth. We assumed the member was hired at age 37 and female gender.

Data for terminated members:

Benefits were reported with full augmentation to Normal Retirement Age. Based on direction from MSRS, we adjusted benefits by removing augmentation on a prospective basis beginning January 1, 2019.

There were 372 members reported with a missing or invalid 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 or invalid (357 members), we assumed a value of $30,000. If termination date was not reported (7 members), we assumed the member terminated at age 40 (or current age if younger than 40). If credited service was either not reported or invalid (10 members), we assumed a value of 7.5 years.

There were no members with a missing date of birth, and no members with an invalid gender.

Data for members receiving benefits:

There were 16 members reported without a gender. We assumed female gender for the valuation. No retired members were reported with an invalid date of birth.

There were no members reported without a benefit.

There were 5 survivor members reported with a certain end date prior to the valuation date. These members were excluded from the valuation.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Unknown data for certain members – (Concluded)	Data for members receiving benefits: There were 108 retirees reported with a survivor option and a survivor date of death. We assumed no benefit was payable to the survivor, and the member benefit already reflected the increase to the life annuity (i.e. "bounce back,") if applicable. There were no retirees reported with a bounce back annuity and an unreasonable reduction factor. There were retired members reported with a survivor option and an invalid or missing survivor gender (3,973 members) and/or survivor date of birth (3,444 members). We used the valuation assumptions if the survivor gender or date of birth was missing or invalid.
Changes in actuarial assumptions	The assumed investment return was lowered from 8.0% to 7.5%. The assumed rate of inflation decreased from 2.75% to 2.50%. The assumed payroll growth rate decreased from 3.50% to 3.25%. Salary increase rates were reduced by 0.25% at each year of service.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Age in 2018	Percent 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%	0.03%	0.01%	0.08%	0.06%
25	0.04	0.02	0.03	0.01	0.27	0.18
30	0.06	0.05	0.03	0.02	0.57	0.37
35	0.09	0.08	0.04	0.02	0.95	0.61
40	0.13	0.11	0.04	0.03	1.32	0.84
45	0.20	0.15	0.07	0.05	1.64	1.05
50	0.29	0.19	0.12	0.09	1.94	1.31
55	0.41	0.27	0.20	0.14	2.31	1.61
60	0.58	0.38	0.36	0.20	2.76	1.94
65	0.88	0.62	0.63	0.30	3.34	2.50
70	1.45	0.99	1.09	0.51	4.27	3.55
75	2.50	1.65	1.92	0.89	5.83	5.30
80	4.47	2.89	3.48	1.57	8.41	7.94
85	8.29	5.21	7.29	4.12	12.68	11.72
90	14.99	9.53	13.53	9.22	19.16	17.26

* *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 2014.*

Age	Percent of Members Decrementing Each Year	
	Disability Retirement	
	Male	Female
20	0.00%	0.00%
25	0.01	0.01
30	0.01	0.01
35	0.02	0.02
40	0.06	0.06
45	0.11	0.11
50	0.22	0.22
55	0.32	0.32
60	0.47	0.47
65	0.00	0.00

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

	Percent Retiring Each Year		
Age	Rule of 90 Eligible	Hired prior to 7/1/1989	Hired after 6/30/1989
55	15.0%	4.0%	4.0%
56	15.0	4.0	4.0
57	12.5	4.0	4.0
58	12.5	4.0	4.0
59	15.0	6.0	5.0
60	15.0	8.0	5.0
61	20.0	10.0	10.0
62	30.0	20.0	15.0
63	25.0	18.0	15.0
64	25.0	18.0	15.0
65	35.0	35.0	20.0
66	30.0	30.0	30.0
67	25.0	25.0	25.0
68	25.0	25.0	25.0
69	22.0	22.0	22.0
70	30.0	30.0	30.0
71+	100.0	100.0	100.0

Actuarial Basis

Summary of Actuarial Assumptions (Concluded)

Salary Scale	
Year	Increase
1	13.75%
2	11.25
3	6.00
4	5.25
5	5.00
6	4.90
7	4.75
8	4.50
9	4.25
10	4.00
11	3.95
12	3.90
13	3.85
14	3.80
15	3.75
16	3.70
17	3.65
18	3.60
19	3.55
20	3.50
21	3.45
22	3.40
23	3.35
24	3.30
25+	3.25

Percent of Members Terminating (Withdrawing) Each Year		
Year	Males	Females
1	20.00%	24.00%
2	15.00	18.00
3	11.00	13.00
4	8.50	11.00
5	7.75	9.00
6	6.50	8.50
7	5.75	7.50
8	5.00	5.75
9	4.00	5.00
10	3.25	4.50
11	3.00	4.00
12	2.75	4.00
13	2.50	3.00
14	2.50	2.75
15	2.50	2.50
16	2.00	2.25
17	2.00	2.25
18	2.00	2.25
19	2.00	2.25
20	1.50	2.25
21	1.50	2.00
22	1.50	2.00
23	1.00	1.50
24	1.00	1.50
25	1.00	1.50
26	1.00	1.50
27	1.00	1.25
28	1.00	1.25
29	1.00	1.25
30+	1.00	1.00

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.

Plan Year	July 1 through June 30.
Eligibility	State employees, non-academic staff of the University of Minnesota and employees of certain Metro level government units, unless excluded by law.
Contributions	Shown as a percent of salary:

Effective as of	Member	Employer
Prior to July 1, 2018	5.50%	5.50%
July 1, 2018	5.75%	5.875%
July 1, 2019	6.00%	6.25%

Member contributions are "picked up" according to the provisions of Internal Revenue Code 414(h).

Allowable Service	Service during which member contributions were made. May also include certain leaves of absence, military service and periods while temporary Worker's Compensation is paid. Excludes lump sum vacation and severance pay at termination.
Average Salary	Average of the five highest successive years of Salary. Average Salary is based on all Allowable Service if less than five years.
Salary	Includes wages, allowances and fees. Excludes lump sum payments at separation, employer contributions to deferred compensation and tax-sheltered annuity plans and benevolent vacation and sick leave donation programs.
Retirement	
Normal retirement benefit	
Age/Service requirement	First hired before July 1, 1989: (a.) Age 65 and three years of Allowable Service. (b.) Proportionate Retirement Annuity is available at age 65 and one year of Allowable Service. First hired after June 30, 1989: (a.) The greater of age 65 or the age eligible for full Social Security retirement benefits (but not higher than age 66) and three years of Allowable Service (five years if hired after June 30, 2010). (b.) Proportionate Retirement Annuity is available at normal retirement age and one year of Allowable Service.
Amount	1.70% of Average Salary for each year of Allowable Service.

Actuarial Basis

Summary of Plan Provisions (Continued)

Retirement (Continued)

Early retirement

Age/Service requirement

First hired before July 1, 1989:

(a.) Age 55 and three years of Allowable Service.

(b.) Any age with 30 years of Allowable Service.

(c.) Rule of 90: Age plus Allowable Service totals 90.

First hired after June 30, 1989:

(a.) Age 55 and three years (five years if hired after June 30, 2010) of Allowable Service.

Amount

First hired before July 1, 1989:

The greater of (a) or (b):

(a.) 1.20% of Average Salary for each of the first ten years of Allowable Service and 1.70% of Average Salary for each subsequent year with reduction of 0.25% for each month the member is under age 65 at time of retirement or under age 62 if 30 or more years of Allowable Service. No reduction if age plus years of Allowable Service totals 90.

(b.) 1.70% of Average Salary for each year of Allowable Service assuming augmentation to age 65 at 3.00% per year and actuarial reduction for each month the member is under age 65. Augmentation adjustment is phased out over a five-year period starting July 1, 2019, resulting in no augmentation adjustment after June 30, 2024.

First hired after June 30, 1989:

1.70% of Average Salary for each year of Allowable Service assuming augmentation to the age eligible for full Social Security retirement benefit (but not higher than age 66) at 3.00% (2.50% if hired after June 30, 2006) per year and actuarial reduction for each month the member is under the normal retirement age. Augmentation adjustment is phased out over a five-year period starting July 1, 2019, resulting in no augmentation adjustment after June 30, 2024.

Form of payment

Life annuity with return on death of any balance of member contributions over aggregate monthly payments. Actuarially equivalent options are:

(a.) 50%, 75%, or 100% Joint and Survivor with bounce back feature without additional reduction.

(b.) 15-year Certain and Life.

Benefit increases

Through December 31, 2018: 2.0%

January 1, 2019 – December 31, 2023: 1.0%

January 1, 2024 and after: 1.5%

For retirements on or after January 1, 2024, the first benefit increase is delayed until the retiree reaches Normal Retirement Age (not applicable to Rule of 90 retirees, disability benefit recipients, or survivors).

Actuarial Basis

Summary of Plan Provisions (Continued)

Retirement (Continued)	
Benefit increases (Continued)	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. Prior to 2002, members who retired under the laws in effect before July 1, 1973, received an additional lump sum payment each year. In 1989, this lump sum payment was the greater of $25 times each full year of Allowable Service or $400 per full year of service less any Social Security benefits received or annuity from a Minnesota public employee pension plan. In each following year, the lump sum payment was increased by the same percentage increase that was applied to regular annuities paid from the Minnesota Post Retirement Investment Fund. Effective January 1, 2002, the annual lump sum payment was divided by 12 and paid as a monthly life annuity in the annuity form elected.
Disability	
Disability benefit	
Age/Service requirement	Total and permanent disability before normal retirement age with three years of Allowable Service (five years if hired after June 30, 2010).
Amount	Normal Retirement benefit based on Allowable Service and Average Salary at disability without reduction for commencement before normal retirement age. Payments stop if disability ceases or death occurs. Payments revert to a retirement annuity at normal retirement age. Benefits may be reduced on resumption of partial employment.
Retirement after disability	
Age/Service requirement	Normal retirement age with continued disability.
Amount	Any optional annuity continues. Otherwise, a normal retirement benefit equal to the disability benefit paid before normal retirement age, or an actuarially equivalent optional annuity.
Form of payment	Same as for retirement.
Benefit Increases	Same as for retirement, except benefit increases are paid prior to Normal Retirement.

Actuarial Basis

Summary of Plan Provisions (Continued)

Death

Surviving spouse optional benefit

Age/Service requirement	Member or former member who dies before retirement or disability benefits commence with three years of Allowable Service (five years if hired after June 30, 2010). 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.
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 55 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. If a member dies prior to July 1, 1997, and the beneficiary was not eligible to commence a survivor benefit as of July 1, 1997, an actuarial increase shall be made for the change in the post-retirement interest rates from 5.00% to 6.00%.
Benefit increases	Same as for retirement, except benefit increases are paid prior to Normal 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 100% joint and survivor annuity to surviving spouse payable to the later of age 20 or five years. The amount is proportionally divided among surviving children.
Benefit increases	Same as for retirement, except benefit increases are paid prior to Normal Retirement.

Refund of contributions

Age/Service requirement	Active member dies and survivor benefits are not payable or a former member dies before annuity begins or former member who is not entitled to an annuity dies.
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. Beginning July 1, 2018, a member's contributions increase at 3.00% interest compounded daily.

Actuarial Basis

Summary of Plan Provisions (Continued)

Death (Continued)	
Refund of contributions (Continued)	
Age/Service requirement	Retired or disabled annuitant who did not select an optional annuity dies, or the remaining recipient of an option dies.
Amount	The excess of the member's contributions over all benefits paid.
Unclassified Plan Provision	Eligible members credited with employee shares in the Unclassified Plan may elect to terminate participation in the Unclassified Plan and be covered by the State Employees Retirement Fund prior to termination of covered employment assuming that the member has acquired at least 10 years of allowable state service (no more than seven years of service if hired after June 30, 2010).
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. Beginning July 1, 2018, a member's contributions increase at 3.00% interest compounded daily. If a member is vested, a deferred annuity may be elected in lieu of a refund.
Deferred benefit	
Age/Service requirement	Three years of Allowable Service if hired prior to June 30, 2010, five years of Allowable Service if hired after June 30, 2010.
Amount	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; (e.) 2.00% from January 1, 2012 through December 31, 2018; and (f.) 0.00% from January 1, 2019, thereafter. Amount is payable at normal or early retirement. If a member terminated employment prior to July 1, 1997, but was not eligible to commence their pension before July 1, 1997, an actuarial increase shall be made for the change in the post-retirement interest rates from 5.00% to 6.00%.

Actuarial Basis

Summary of Plan Provisions (Concluded)

Combined Service Annuity	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 is 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.
Actuarial Equivalent Factors	Actuarially equivalent factors based on RP-2014 mortality for healthy annuitants, white collar adjustment, male rates set forward two years, projected to 2019 using Scale MP-2015, blended 50% males, 5.88% post-retirement interest, and 7.50% pre-retirement interest. Based upon statutory requirements; joint and survivor factors are based on an interest assumption of 6.50%. The actuarially equivalent factors are currently being updated to reflect changes adopted during the 2018 legislative session.
Changes in Plan Provisions	The augmentation adjustment in early retirement factors will be eliminated over a five-year period starting July 1, 2019, resulting in actuarial equivalence after June 30, 2024. Member contributions were changed from 5.50% to 5.75% of pay, effective July 1, 2018 and 6.00% of pay, effective July 1, 2019. Employer contributions were changed from 5.50% to 5.875% of pay, effective July 1, 2018 and 6.25% of pay, effective July 1, 2019. Interest credited on member contributions will decrease from 4.0% to 3.0%, beginning July 1, 2018. Deferred augmentation was changed to 0.00% for future accruing benefits, effective January 1, 2019. Augmentation that has already accrued for deferred members will still apply. Contribution stabilizer provisions were repealed. Post-retirement benefit increases were changed from 2.0% per year, increasing to 2.5% per year upon achieving a 90% funding ratio to a fixed rate of 1.0% for five years (beginning January 1, 2019) and 1.5% per year thereafter. For retirements on or after January 1, 2024, the first benefit increase is delayed until the retiree reaches Normal Retirement Age.

Additional Schedules

Schedule of Funding Progress[1] *(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	$ 2,304,311	$ 2,883,603	$ 579,292	79.91%	$ 1,370,964	42.25%
7-1-1992	2,613,472	3,125,299	511,827	83.62%	1,409,108	36.32%
7-1-1993	2,905,578	3,563,492	657,914	81.54%	1,482,005	44.39%
7-1-1994	3,158,068	3,876,584	718,516	81.47%	1,536,978	46.75%
7-1-1995	3,462,098	3,795,926	333,828	91.21%	1,514,177	22.05%
7-1-1996	3,975,832	4,087,273	111,441	97.27%	1,560,369	7.14%
7-1-1997	4,664,519	4,519,542	(144,977)	103.21%	1,568,747	(9.24%)
7-1-1998	5,390,526	5,005,165	(385,361)	107.70%	1,557,880	(24.74%)
7-1-1999	5,968,692	5,464,207	(504,485)	109.23%	1,649,469	(30.58%)
7-1-2000	6,744,165	6,105,703	(638,462)	110.46%	1,733,054	(36.84%)
7-1-2001	7,366,673	6,573,193	(793,480)	112.07%	1,834,042	(43.26%)
7-1-2002	7,673,028	7,340,397	(332,631)	104.53%	1,915,350	(17.37%)
7-1-2003	7,757,292	7,830,671	73,379	99.06%	2,009,975	3.65%
7-1-2004	7,884,984	7,878,363	(6,621)	100.08%	1,965,546	(0.34%)
7-1-2005	8,081,736	8,455,336	373,600	95.58%	1,952,320	19.14%
7-1-2006	8,486,756	8,819,161	332,405	96.23%	2,016,588	16.48%
7-1-2007	8,904,517	9,627,305	722,788	92.49%	2,095,310	34.50%
7-1-2008	9,013,456	9,994,602	981,146	90.18%	2,256,528	43.48%
7-1-2009	9,030,401	10,512,760	1,482,359	85.90%	2,329,499	63.63%
7-1-2010	8,960,391	10,264,071	1,303,680	87.30%	2,327,398	56.01%
7-1-2011	9,130,011	10,576,481	1,446,470	86.32%	2,440,580	59.27%
7-1-2012	9,162,301	11,083,227	1,920,926	82.67%	2,367,160 [2]	81.15%
7-1-2013	9,375,780	11,428,641	2,052,861	82.04%	2,483,000 [2]	82.68%
7-1-2014	10,326,272	12,445,126	2,118,854	82.97%	2,620,660 [2]	80.85%
7-1-2015	11,223,285	13,092,702	1,869,417	85.72%	2,714,418 [3]	68.87%
7-1-2016	11,676,370	14,316,886	2,640,516	81.56%	2,797,345 [3]	94.39%
7-1-2017	12,364,957	14,509,150	2,144,193	85.22%	2,939,455 [3]	72.95%
7-1-2018	13,035,350	14,679,489	1,644,139	88.80%	3,031,382 [3]	54.24%

[1] *Information prior to 2012 provided by prior actuaries. See prior reports for additional detail.*
[2] *Assumed equal to actual member contributions divided by 5.00%.*
[3] *Assumed equal to actual member contributions divided by 5.50%.*

Additional Schedules

Schedule of Contributions from the Employer and Other Contributing Entities[1]

(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[2] (e)	Percentage Contributed (e)/(d)
1991	8.17%	$ 1,370,964	$ 56,895	$ 55,113	$ 57,986	105.21%
1992	7.86%	1,409,108	58,478	52,278	59,244	113.33%
1993	8.27%	1,482,005	59,132	63,430	58,982	92.99%
1994	8.93%	1,536,978	62,555	74,697	60,741	81.32%
1995	9.15%	1,514,177	61,627	76,920	63,161	82.11%
1996	8.05%	1,560,369	63,507	62,103	65,557	105.56%
1997	7.21%	1,568,747	63,848	49,259	66,568	135.14%
1998	7.13%	1,557,880	62,901	48,176	62,315	129.35%
1999	6.48%	1,649,469	66,823	40,063	65,979	164.69%
2000	6.12%	1,733,054	70,378	35,685	69,322	194.26%
2001	7.12%	1,834,042	74,364	56,220	73,362	130.49%
2002	6.79%	1,915,350	79,487	50,565	76,614	151.52%
2003	8.34%	2,009,975	83,850	83,782	80,399	95.96%
2004	9.43%	1,965,546	82,103	103,248	78,622	76.15%
2005	9.33%	1,952,323	83,101	99,051	80,312	81.08%
2006	10.55%	2,016,588	85,379	127,371	82,645	64.88%
2007	10.11%	2,095,310	89,447	122,389	86,492	70.67%
2008	11.76%	2,256,528	99,280	166,088	96,746	58.25%
2009	12.39%	2,329,499	108,866	179,759	107,211	59.64%
2010	14.85%	2,327,398	115,180	230,439	113,716	49.35%
2011	10.99%	2,440,580	122,029	146,191	118,563	81.10%
2012	11.03%	2,367,160[3]	118,358	142,740	115,159	80.68%
2013	12.32%	2,483,000[3]	124,150	181,756	121,673	66.94%
2014	12.45%	2,620,660[3]	131,033	195,239	128,037	65.58%
2015	12.82%	2,714,418[4]	149,293	198,695	146,333	73.65%
2016	12.44%	2,797,345[4]	153,854	194,136	151,168	77.87%
2017	14.49%	2,939,455[4]	161,670	264,257	158,352	59.92%
2018	13.24%	3,031,382[4]	166,726	234,629	164,233	70.00%
2019	11.53%	N/A	N/A	N/A	N/A	N/A

[1] *Information prior to 2012 provided by prior actuary. See prior reports for additional detail.*
[2] *Includes contributions from other sources (if applicable).*
[3] *Assumed equal to actual member contributions divided by 5.00%.*
[4] *Assumed equal to actual member contributions divided by 5.50%.*

Glossary of Terms

Accrued Benefit Funding Ratio	The ratio of assets to Current Benefit Obligations.
Accrued Liability Funding Ratio	The ratio of assets to Actuarial Accrued Liability.
Actuarial Accrued Liability (AAL)	The difference between the Actuarial Present Value of Future Benefits, and the Actuarial Present Value of Future Normal Costs.
Actuarial Assumptions	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.
Actuarial Cost Method	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.
Actuarial Equivalent	Of equal Actuarial Present Value, determined as of a given date and based on a given set of Actuarial Assumptions.
Actuarial Present Value (APV)	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.
Actuarial Present Value of Projected Benefits	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.
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 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).
Actuarial Value of Assets	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 Annual Required Contribution (ARC).
Amortization Method	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.

Glossary of Terms (Continued)

Amortization Payment	That portion of the plan contribution or ARC which is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.
Amortization Period	The period used in calculating the Amortization Payment.
Annual Required Contribution (ARC)	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.
Augmentation	Annual increases to deferred benefits.
Closed Amortization Period	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.
Current Benefit Obligations	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).
Employer Normal Cost	The portion of the Normal Cost to be paid by the employer. This is equal to the Normal Cost less expected member contributions.
Expected Assets	The present value of anticipated future contributions intended to fund benefits for current members.
Experience Gain/Loss	A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two actuarial 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.
GASB	Governmental Accounting Standards Board.
GASB Statements No. 25 and No. 27	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 on the following page.

Glossary of Terms (Concluded)

GASB Statement No. 50	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.
GASB Statements No. 67 and No. 68	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 information prepared according to Statements No. 67 and No. 68 is provided in a separate report beginning with the June 30, 2014 actuarial valuation.
GASB Statement No. 82	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.
Normal Cost	The annual cost assigned, under the Actuarial Cost Method, to the current plan year.
Projected Benefit Funding Ratio	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.
Unfunded Actuarial Accrued Liability	The difference between the Actuarial Accrued Liability and Actuarial Value of Assets.
Valuation Date	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.

Minnesota State Retirement System

Correctional Employees Retirement Fund

Actuarial Valuation Report as of July 1, 2018

GRS Retirement Consulting

P: 800.521.0498 | F: 763.432.5842 | www.grsconsulting.com

December 5, 2018

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

Dear Board of Directors:

The results of the July 1, 2018 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, 2018, 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.

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 a 2018 analysis of long-term rate of investment return and inflation assumptions, GRS suggested that an investment return assumption in the range of 6.64% to 7.56% would be reasonable. Please see our draft letter dated September 17, 2018 for additional information. The current assumed rate, which is mandated by Minnesota Statutes, is 7.5% and is at the upper end of the reasonable range. This report also concluded that the probability of exceeding the current 7.5% assumption over 20 years is only 39%. If capital market assumptions decline further from present levels, the 7.5% return assumption might not comply with actuarial standards for the July 1, 2019 valuation. For informational purposes, results based on a 6.5% discount rate are shown on page four.

The valuation assumed the continuing ability of the plan sponsor to make the contributions necessary to fund this plan. A determination regarding whether or not the plan sponsor is actually able to do so is outside our scope of expertise and was not performed.

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 5 – 8, 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 findings in this report are based on data and other information through June 30, 2018. 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).

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, PhD

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

BBM/BJW:rmn

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 7.50%), it is expected that:

(1) The normal cost of the plan is expected to remain approximately level as a percent of pay,
(2) The funded status of the plan is expected to gradually improve and is expected to be 100% funded within the next 30 years, and
(3) The unfunded liability will grow initially as a dollar amount before beginning to decline.

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.

Contents

Summary of Valuation Results

Contributions

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

	Actuarial Valuation as of	
Total Contributions	**July 1, 2018**	**July 1, 2017**
Statutory Contributions - Chapter 352.92 (% of Payroll)	24.00%	21.95%
Required Contributions - Chapter 356 (% of Payroll)	25.77%	28.40%
Sufficiency / (Deficiency)	(1.77)%	(6.45)%

The contribution sufficiency/(deficiency) improved from a deficiency of (6.45)% of payroll to a deficiency of (1.77)% of payroll. The primary reasons for the change in contribution sufficiency/(deficiency) were the changes in plan provisions and amortization period, which was partially offset by the change in assumptions, described in the Effects of Changes section. On a market value of assets basis, contributions are deficient by (1.29)% of payroll.

The contribution sufficiency referenced above is based on current snapshot of statutory contributions for the fiscal year ending June 30, 2019. Additional employer contribution increases will be phased in over the next three years, ultimately increasing the statutory contribution rate (and the contribution sufficiency) by an additional 4.45% of payroll, if there are no significant gains or losses.

Based on the actuarial value of assets, statutory contribution rates (including the increases described above), and actuarial assumptions described in this report, statutory contributions are expected to bring the plan to full funding within the 30-year amortization period.

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 10.3% for the plan year ending June 30, 2018. The AVA earned approximately 9.2% for the plan year ending June 30, 2018 as compared to the assumed rate of 8.00%. The assumed rate is mandated by Minnesota Statutes, and was recently lowered to 7.50%.

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 November 29, 2018.

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.

	Actuarial Valuation as of	
	July 1, 2018	**July 1, 2017**
Contributions (*% of Payroll*)		
Statutory - Chapter 352	24.00%	21.95%
Required - Chapter 356	25.77%	28.40%
Sufficiency / (Deficiency)	(1.77)%	(6.45)%
Funding Ratios (*dollars in thousands*)		
Assets		
- Current assets (AVA)	$ 1,092,719	$1,013,173
- Current assets (MVA)	$ 1,114,887	$1,023,817
Accrued Benefit Funding Ratio		
- Current benefit obligations	$ 1,424,929	$1,352,906
- Funding ratio (AVA)	76.69%	74.89%
- Funding ratio (MVA)	78.24%	75.68%
Accrued Liability Funding Ratio		
- Actuarial accrued liability	$ 1,490,521	$1,414,443
- Funding ratio (AVA)	73.31%	71.63%
- Funding ratio (MVA)	74.80%	72.38%
Projected Benefit Funding Ratio		
- Current and expected future assets	$ 1,749,579	$1,505,335
- Current and expected future benefit obligations	$ 1,830,691	$1,731,837
- Projected benefit funding ratio (AVA)	95.57%	86.92%
Participant Data		
Active members		
- Number	4,650	4,579
- Annual valuation earnings *(000s)*	$ 254,588	$244,427
- Projected annual earnings *(000s)*	$ 267,975	$258,003
- Average projected annual earnings	$ 57,629	$56,345
- Average age	41.3	41.5
- Average service	8.8	8.8
Service retirements	2,736	2,576
Survivors	226	216
Disability retirements	297	292
Deferred retirements	1,347	1,310
Terminated other non-vested	843	818
Total	**10,099**	**9,791**

Summary of Valuation Results

Effects of Changes

The following changes in plan provisions, actuarial assumptions, and methods were recognized as of July 1, 2018:

- The investment return assumption was lowered from 8.00% to 7.50%.
- The assumed payroll growth assumption was lowered from 3.50% to 3.25%.
- The assumed rate of inflation was lowered from 2.75% to 2.50%.
- Salary increase rates were reduced by 0.25% at each year of service.
- The amortization period was reset to 30 years, ending in 2048.
- Post-retirement benefit increases were changed from 2.0% per year, increasing to 2.5% per year upon achieving a 90% funding ratio to a fixed rate of 1.50% per year.
- Member contributions were increased from 9.10% of pay to 9.60% of pay, effective July 1, 2018.
- Regular employer contributions were increased from 12.85% to 14.40%, effective July 1, 2018.
- Supplemental employer contributions of 4.45% will be phased in over three years beginning July 1, 2019.
- Interest credited on member contributions will decrease from 4.0% to 3.0%, beginning July 1, 2018.
- Deferred augmentation was changed to 0.00% for future accruing benefits, effective January 1, 2019. Augmentation that has already accrued for deferred members will still apply.
- Contribution stabilizer provisions were repealed.

Refer to the Actuarial Basis section of this report for a complete description of these changes. The combined impact of the above changes was to decrease the accrued liability by $6 million and decrease the required contribution by 2.4% of pay, as follows:

	Before Changes	Reflecting Plan Provision Changes	Reflecting Plan Provision and Actuarial Assumption Changes	Reflecting Plan Provision, Actuarial Assumption, and Amortization Changes
Normal Cost Rate, % of pay	16.5%	15.5%	16.8%	16.8%
Amortization of UAAL*, % of pay	11.4%	8.8%	11.0%	8.7%
Expenses (% of pay)	0.3%	0.3%	0.3%	0.3%
Total Required Contribution, % of pay	28.2%	24.6%	28.1%	25.8%
Accrued Liability Funding Ratio	73.0%	77.7%	73.3%	73.3%
Projected Benefit Funding Ratio	87.8%	98.7%	91.9%	95.6%
UAAL* (in millions)	$403.9	$313.3	$397.8	$397.8

**Unfunded Actuarial Accrued Liability*

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' valuations. Per the LCPR's requirement, we have calculated the liabilities associated with the following scenarios:

1) 6.5% interest rate assumption
2) 8.5% interest rate assumption

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 8.5% interest rate assumption would not comply with Actuarial Standards of Practice.

$ in millions	Final Valuation Assumptions	Final Valuation Assumptions with 6.5%	Final Valuation Assumptions with 8.5%
Normal Cost Rate, % of Pay	16.8%	20.8%	13.8%
Amortization of Unfunded Accrued Liability, % of Pay	8.7%	11.9%	5.5%
Expenses (% of Pay)	0.3%	0.3%	0.3%
Total Required Contribution, % of Pay	25.8%	33.0%	19.6%
Contribution Sufficiency/(Deficiency), % of Pay	(1.8)%	(9.0)%	4.4 %
Accrued Liability Funding Ratio	73.3%	64.2%	82.9%
Present Value of Projected Benefits	$1,831	$2,157	$1,579
Present Value of Future Normal Costs	$340	$455	$261
Actuarial Accrued Liability	$1,491	$1,702	$1,318
Unfunded Accrued Liability	$398	$609	$226

Summary of Valuation Results

Risks Associated with the Measuring the Accrued Liability and Actuarially Determined Contribution

The determination of the accrued liability and the actuarially determined contribution requires the use of assumptions regarding future economic and demographic experience. Risk measures, as illustrated in this report, are intended to aid in the understanding of the effects of future experience differing from the assumptions used in the course of the actuarial valuation. Risk measures may also help with illustrating the potential volatility in the accrued liability and the actuarially determined contribution that result from the differences between actual experience and the actuarial assumptions.

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 due to changing conditions; 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. The scope of an actuarial valuation does not include an analysis of the potential range of such future measurements.

Examples of risk that may reasonably be anticipated to significantly affect the plan's future financial condition include:

1. Investment risk – actual investment returns may differ from the expected returns;
2. Asset/Liability mismatch – changes in asset values may not match changes in liabilities, thereby altering the gap between the accrued liability and assets and consequently altering the funded status and contribution requirements;
3. Contribution risk – actual contributions may differ from expected future contributions. For example, actual contributions may not be made in accordance with the plan's funding policy or material changes may occur in the anticipated number of covered employees, covered payroll, or other relevant contribution base;
4. Salary and Payroll risk – actual salaries and total payroll may differ from expected, resulting in actual future accrued liability and contributions differing from expected;
5. Longevity risk – members may live longer or shorter than expected and receive pensions for a period of time other than assumed;
6. Other demographic risks – members may terminate, retire or become disabled at times or with benefits other than assumed resulting in actual future accrued liability and contributions differing from expected.

The effects of certain trends in experience can generally be anticipated. For example if the investment return since the most recent actuarial valuation is less (or more) than the assumed rate, the cost of the plan can be expected to increase (or decrease). Likewise if longevity is improving (or worsening), increases (or decreases) in cost can be anticipated.

Summary of Valuation Results

The Required Contribution rate shown on page 1 may be considered as a minimum contribution rate that complies with Minnesota Statutes and the requirements of the Standards for Actuarial Work published by the LCPR. The timely receipt of the actuarially determined contributions is critical to support the financial health of the plan. Users of this report should be aware that contributions made at the actuarially determined rate do not necessarily guarantee benefit security.

Plan Maturity Measures

Risks facing a pension plan evolve over time. A young plan with virtually no investments and paying few benefits may experience little investment risk. An older plan with a large number of members in pay status and a significant trust may be much more exposed to investment risk. Generally accepted plan maturity measures and the values for the Correctional Employees Retirement Fund for the last two years include the following. Additional maturity measures are shown on the following pages.

	2018	2017
Ratio of market value of assets to total payroll	4.33	4.11
Ratio of actuarial accrued liability to total payroll	5.79	5.68
Ratio of actives to retirees and beneficiaries	1.43	1.48
Ratio of net cash flow to market value of assets	-1.3%	-1.1%
Approximate modified duration* of:		
▪ Total projected benefits:	15.80	15.87
▪ Actuarial accrued liability:	12.85	12.86

* *Approximate modified duration of total projected benefits based on 7.5% interest for 2018 and 8.0% interest for 2017*

Ratio of Market Value of Assets to Payroll

The relationship between assets and payroll is a useful indicator of the potential volatility of contributions. For example, if the market value of assets is 5.0 times the payroll, a return on assets 5% different than assumed would equal 25% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in plan sponsor contributions as a percentage of payroll.

Ratio of Actuarial Accrued Liability to Payroll

The relationship between actuarial accrued liability and payroll is a useful indicator of the potential volatility of contributions for a fully funded plan. A funding policy that targets a funded ratio of 100% is expected to result in the ratio of assets to payroll and the ratio of liability to payroll converging over time.

The ratio of liability to payroll may also be used as a measure of sensitivity of the contribution rates to liability gains and losses. For example, if the actuarial accrued liability is 5.0 times the payroll, a change in liability 2% other than assumed would equal 10% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in liability (and also plan sponsor contributions) as a percentage of payroll.

Summary of Valuation Results

Ratio of Actives to Retirees and Beneficiaries

A young plan with many active members and few retirees will have a high ratio of active to retirees. A mature open plan may have close to the same number of actives to retirees resulting in a ratio near 1.0. A super-mature or closed plan may have significantly more retirees than actives resulting in a ratio below 1.0.

Ratio of Net Cash Flow to Market Value of Assets

A positive net cash flow means contributions exceed benefits and expenses. A negative cash flow means existing funds are being used to make payments. A certain amount of negative net cash flow is generally expected to occur when benefits are prefunded through a qualified trust. Large negative net cash flows as a percent of assets may indicate a super-mature plan or a need for additional contributions.

Duration of Actuarial Accrued Liability

The duration may be used to approximate the sensitivity of the accrued liability to a small change in the assumed rate of return. For example, a duration of 10 indicates that the liability would change by approximately 10% if the assumed rate of return were changed by 1% (i.e. from 7.5% to 6.5%).

Additional Risk Assessment

Additional risk assessment is outside the scope of the annual actuarial valuation but could aid stakeholders in an understanding of the risks to which the System is exposed. Additional assessment may include scenario tests, sensitivity tests, stochastic modeling, stress tests, and a comparison of the present value of accrued benefits at low-risk discount rates with the actuarial accrued liability.

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%
2018	$1,490,521	$1,114,887	$ 375,634	$ 257,330	74.8%	$ 792,275	53.2%	579.2%	433.3%

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	(17) SBI 10-Year Trailing Average
2010			169.3%	$ (418)	-0.1%	15.2%	3.4%	N/A
2011			131.7%	$ (76)	0.0%	23.3%	5.3%	N/A
2012			154.3%	$ (2,985)	-0.5%	2.4%	2.3%	N/A
2013			136.6%	$ (5,758)	-0.8%	14.2%	6.2%	N/A
2014			111.9%	$ (7,624)	-0.9%	18.6%	14.5%	N/A
2015	14.1%	55.4%	142.7%	$ (6,678)	-0.7%	4.4%	12.3%	N/A
2016	14.1%	52.6%	171.6%	$ (9,215)	-1.0%	-0.1%	7.7%	N/A
2017	14.1%	58.0%	157.0%	$ (11,134)	-1.1%	15.1%	10.2%	6.2%
2018	14.1%	61.1%	146.0%	$ (14,193)	-1.3%	10.3%	9.4%	7.8%

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) (16) and (17) Investment return is probably the largest single risk that most systems face. The year by year return and the 5-year and 10-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, and historical averages are very sensitive to the time period chosen. 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)*

	Market Value	
Assets	**June 30, 2018**	**June 30, 2017**
Cash, equivalents, short term securities	$ 15,753	$ 30,093
Fixed income	174,115	197,493
Equity	923,731	794,971
Other*	111,689	105,151
Total cash, investments, and other assets	**$ 1,225,288**	**$ 1,127,708**
Amounts Receivable	2,873	2,780
Total Assets	**$ 1,228,161**	**$ 1,130,488**
Amounts Payable*	(113,274)	(106,671)
Net Position Restricted for Pensions	**$ 1,114,887**	**$ 1,023,817**

** Includes $111,689 in Securities Lending Collateral as of June 30, 2018 and $105,151 as of June 30, 2017.*

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	**Market Value**	
Year Ending	**June 30, 2018**	**June 30, 2017**
1. Fund balance at market value at beginning of year	**1,023,817**	**899,592**
2. Contributions		
a. Member	23,417	22,648
b. Employer	32,893	31,763
c. Other sources	-	-
d. Total contributions	$ 56,310	$ 54,411
3. Investment income		
a. Investment income/(loss)	106,422	136,409
b. Investment expenses	(1,159)	(1,050)
c. Net investment income/(loss)	$ 105,263	$ 135,359
4. Other	-	-
5. Total income: *(2.d.) + (3.c.) + (4.)*	**$ 161,573**	**$ 189,770**
6. Benefits Paid		
a. Annuity benefits	(67,622)	(63,221)
b. Refunds	(2,052)	(1,466)
c. Total benefits paid	$ (69,674)	$ (64,687)
7. Expenses		
a. Other	(2)	(2)
b. Administrative	(827)	(856)
c. Total expenses	$ (829)	$ (858)
8. Total disbursements: *(6.c.) + (7.c.)*	**$ (70,503)**	**$ (65,545)**
9. Fund balance at market value at end of year: *(1.) + (5.) + (8.)*	**$ 1,114,887**	**$ 1,023,817**
10. State Board of Investment calculated investment return	10.3%	15.1%

Plan Assets

Actuarial Asset Value *(Dollars in Thousands)*

	June 30, 2018	June 30, 2017
1. Market value of assets available for benefits	**$ 1,114,887**	**$ 1,023,817**
2. Determination of average balance		
a. Total assets available at beginning of year	1,023,817	899,592
b. Total assets available at end of year	1,114,887	1,023,817
c. Net investment income for fiscal year	105,263	135,359
d. Average balance *[a. + b. - c.] / 2*	1,016,721	894,025
3. Expected return *[8.0% x 2.d.]*	81,338	71,522
4. Actual return	105,263	135,359
5. Current year asset gain/(loss) *[4. - 3.]*	23,925	63,837
6. Unrecognized asset returns		

	Original Amount	Unrecognized Amount %	Unrecognized Amount Dollar	Unrecognized Amount %	Unrecognized Amount Dollar
a. Year ended June 30, 2018	$ 23,925	80%	$ 19,140		
b. Year ended June 30, 2017	63,837	60%	38,302	80%	$ 51,070
c. Year ended June 30, 2016	(72,547)	40%	(29,019)	60%	(43,528)
d. Year ended June 30, 2015	(31,273)	20%	(6,255)	40%	(12,509)
e. Year ended June 30, 2014	78,055		N/A	20%	15,611
f. Unrecognized return adjustment			**$ 22,168**		**$ 10,644**
7. **Actuarial value at end of year** *(1. - 6.f.)*			**$ 1,092,719**		**$ 1,013,173**
8. Approximate return on actuarial value of assets during fiscal year			9.2%		9.3%
9. Ratio of actuarial value of assets to market value of assets			0.98		0.99

Membership Data

Distribution of Active Members

	Years of Service as of June 30, 2018									
Age	**<3***	**3 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25 - 29**	**30 - 34**	**35+**	**Total**
< 25	187	9	1							**197**
Avg. Earnings	$ 34,001	$ 41,722	$ 46,931							**$ 34,419**
25 - 29	336	125	49							**510**
Avg. Earnings	$ 38,218	$ 46,976	$ 51,130							**$ 41,605**
30 - 34	242	162	253	76						**733**
Avg. Earnings	$ 43,967	$ 49,444	$ 51,878	$ 56,048						**$ 49,160**
35 - 39	150	99	182	289	32					**752**
Avg. Earnings	$ 44,445	$ 50,970	$ 53,722	$ 58,550	$ 63,803					**$ 53,794**
40 - 44	128	58	109	210	117	14				**636**
Avg. Earnings	$ 48,501	$ 54,709	$ 56,134	$ 59,120	$ 66,192	$ 73,918				**$ 57,696**
45 - 49	89	56	83	157	121	104	7			**617**
Avg. Earnings	$ 44,775	$ 56,918	$ 56,691	$ 62,055	$ 64,952	$ 71,586	$ 76,579			**$ 60,714**
50 - 54	70	30	88	123	109	123	71	10	1	**625**
Avg. Earnings	$ 47,246	$ 50,889	$ 56,890	$ 64,512	$ 65,314	$ 69,444	$ 72,491	$ 78,506	$ 83,052	**$ 63,122**
55 - 59	56	38	72	91	54	39	17	8	1	**376**
Avg. Earnings	$ 49,921	$ 59,421	$ 58,164	$ 63,895	$ 68,281	$ 69,047	$ 70,963	$ 84,427	$ 65,897	**$ 62,190**
60 - 64	31	19	31	46	22	12	2		1	**164**
Avg. Earnings	$ 55,344	$ 54,775	$ 67,906	$ 67,438	$ 69,923	$ 65,300	$ 77,220		$ 78,140	**$ 64,135**
65 - 69	6	4	8	5	7	2	1		1	**34**
Avg. Earnings	$ 23,303	$ 74,518	$ 64,869	$ 67,436	$ 83,388	$ 69,435	$ 89,882		$ 71,752	**$ 64,066**
70+	1	2			2	1				**6**
Avg. Earnings	$ 14,904	$ 65,035			$ 62,359	$ 147,080				**$ 69,462**
Total	**1,296**	**602**	**876**	**997**	**464**	**295**	**98**	**18**	**4**	**4,650**
Avg. Earnings	**$ 42,186**	**$ 51,358**	**$ 54,905**	**$ 60,709**	**$ 66,160**	**$ 70,453**	**$ 72,792**	**$ 81,138**	**$ 74,711**	**$ 54,750**

** 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

	Years Retired as of June 30, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
<50	1	1	2					**4**
Avg. Benefit	$ 13,758	$ 5,165	$ 6,076					**$ 7,769**
50 - 54	17	39	3					**59**
Avg. Benefit	$ 14,859	$ 17,111	$ 4,996					**$ 15,846**
55 - 59	109	333	82		1			**525**
Avg. Benefit	$ 30,663	$ 28,859	$ 21,735		$ 5,864			**$ 28,077**
60 - 64	42	230	388	54		1		**715**
Avg. Benefit	$ 21,063	$ 22,169	$ 23,662	$ 22,842		$ 42,289		**$ 22,993**
65 - 69	18	102	146	332	38			**636**
Avg. Benefit	$ 10,132	$ 14,930	$ 16,352	$ 21,394	$ 17,932			**$ 18,674**
70 - 74	1	18	98	80	245	9		**451**
Avg. Benefit	$ 1,551	$ 11,416	$ 9,981	$ 13,654	$ 20,974	$ 23,795		**$ 16,919**
75 - 79		2	16	40	53	72		**183**
Avg. Benefit		$ 15,500	$ 11,235	$ 11,754	$ 20,820	$ 28,139		**$ 20,822**
80 - 84		2	3	7	30	35	32	**109**
Avg. Benefit		$ 5,879	$ 20,263	$ 28,018	$ 20,074	$ 26,554	$ 33,399	**$ 26,322**
85 - 89					2	4	33	**39**
Avg. Benefit					$ 4,048	$ 21,671	$ 25,259	**$ 23,803**
90+							15	**15**
Avg. Benefit							$ 29,953	**$ 29,953**
Total	**188**	**727**	**738**	**513**	**369**	**121**	**80**	**2,736**
Avg. Benefit	**$ 24,879**	**$ 23,593**	**$ 19,778**	**$ 19,678**	**$ 20,433**	**$ 27,261**	**$ 29,395**	**$ 21,824**

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

	Years Since Death as of June 30, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
<45	2	14	7		1			**24**
Avg. Benefit	$ 4,058	$ 11,113	$ 5,052		$ 0			**$ 8,294**
45 - 49	2	3	2					**7**
Avg. Benefit	$ 6,455	$ 19,782	$ 11,409					**$ 13,582**
50 - 54		4	2	4	1			**11**
Avg. Benefit		$ 19,701	$ 13,563	$ 7,251	$ 17,873			**$ 13,892**
55 - 59	1	7	2	3	3	1		**17**
Avg. Benefit	$ 39,620	$ 13,316	$ 18,940	$ 15,154	$ 6,306	$ 16,626		**$ 14,807**
60 - 64	4	11	10	9	4	2		**40**
Avg. Benefit	$ 14,655	$ 19,025	$ 19,380	$ 14,602	$ 9,597	$ 10,172		**$ 16,296**
65 - 69	2	11	6	7	9	2	1	**38**
Avg. Benefit	$ 10,528	$ 19,541	$ 10,302	$ 14,474	$ 14,631	$ 8,195	$ 10,203	**$ 14,669**
70 - 74	3	7	6	12	5	5		**38**
Avg. Benefit	$ 14,347	$ 18,615	$ 17,561	$ 16,208	$ 11,865	$ 12,538		**$ 15,664**
75 - 79		1	4	3	4	1	2	**15**
Avg. Benefit		$ 7,033	$ 22,512	$ 17,957	$ 26,060	$ 23,357	$ 8,874	**$ 19,753**
80 - 84	2	2	2	5	4	2		**17**
Avg. Benefit	$ 21,696	$ 25,975	$ 38,527	$ 22,831	$ 17,592	$ 13,077		**$ 22,534**
85 - 89		2	4		1	1	2	**10**
Avg. Benefit		$ 45,646	$ 25,675		$ 13,903	$ 9,176	$ 10,949	**$ 23,897**
90+	1	2	3		1	1	1	**9**
Avg. Benefit	$ 19,905	$ 18,555	$ 13,637		$ 17,018	$ 1,884	$ 4,399	**$ 13,470**
Total	**17**	**64**	**48**	**43**	**33**	**15**	**6**	**226**
Avg. Benefit	**$ 14,509**	**$ 17,639**	**$ 16,560**	**$ 15,575**	**$ 14,294**	**$ 11,775**	**$ 9,041**	**$ 15,676**

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, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
< 45		9	8	1	1			**19**
Avg. Benefit		$ 17,900	$ 17,774	$ 17,564	$ 17,158			**$ 17,790**
45 - 49	2	7	12	9	8	1		**39**
Avg. Benefit	$ 17,049	$ 20,211	$ 17,489	$ 16,202	$ 21,264	$ 23,414		**$ 18,584**
50 - 54	2	13	9	9	7	1		**41**
Avg. Benefit	$ 24,821	$ 22,401	$ 18,906	$ 22,830	$ 17,629	$ 32,688		**$ 21,282**
55 - 59	2	16	16	13	9	5	1	**62**
Avg. Benefit	$ 16,882	$ 16,031	$ 23,650	$ 20,241	$ 20,500	$ 33,397	$ 31,036	**$ 21,199**
60 - 64	1	7	18	14	11	7		**58**
Avg. Benefit	$ 1,739	$ 14,394	$ 19,019	$ 22,213	$ 23,605	$ 25,957		**$ 20,641**
65 - 69		5	10	14	14	5	1	**49**
Avg. Benefit		$ 18,600	$ 20,078	$ 20,980	$ 20,626	$ 20,987	$ 31,456	**$ 20,667**
70 - 74			4	3	11	4		**22**
Avg. Benefit			$ 18,567	$ 24,918	$ 16,653	$ 20,632		**$ 18,851**
75+				3	2	1	1	**7**
Avg. Benefit				$ 18,868	$ 30,431	$ 41,284	$ 21,538	**$ 25,755**
Total	**7**	**57**	**77**	**66**	**63**	**24**	**3**	**297**
Avg. Benefit	**$ 17,035**	**$ 18,316**	**$ 19,714**	**$ 20,728**	**$ 20,439**	**$ 26,397**	**$ 28,010**	**$ 20,386**

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			
	Actives	Deferred Retirement	Other Non-Vested	Service Retirement	Disability Retirement	Survivor	Total
Members on 7/1/2017	**4,579**	**1,310**	**818**	**2,576**	**292**	**216**	**9,791**
New members	554	0	0	0	0	0	**554**
Return to active	33	(15)	(18)	0	0	0	**0**
Terminated non-vested	(170)	0	170	0	0	0	**0**
Service retirements	(148)	(33)	0	181	0	0	**0**
Terminated deferred	(78)	78	0	0	0	0	**0**
Terminated refund/transfer	(114)	(13)	(171)	0	0	0	**(298)**
Deaths	(2)	(1)	(1)	(28)	(5)	(7)	**(44)**
New beneficiary	0	0	0	0	0	17	**17**
Disabled	(4)	0	0	0	4	0	**0**
Unexpected status changes	0	21	45	7	6	0	**79**
Net change	71	37	25	160	5	10	**308**
Members on 6/30/2018	**4,650**	**1,347**	**843**	**2,736**	**297**	**226**	**10,099**

Terminated Member Statistics	Deferred Retirement	Other Non-Vested	Total
Number	1,347	843	2,190
Average age	46.4	37.0	42.8
Average service	6.0	1.3	4.2
Average annual benefit, with augmentation to December 31, 2018 and 17% CSA load	$ 10,022	N/A	$ 10,022
Average refund value, with 17% CSA load (6% for non-vested members)	$ 31,347	$ 6,082	$ 21,622

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 24.00% 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.

				June 30, 2018
A. Actuarial Value of Assets				$ 1,092,719
B. Expected Future Assets				
1. Present value of expected future statutory supplemental contributions*				316,690
2. Present value of future normal cost contributions				340,170
3. Total expected future assets: *(1.) + (2.)*				$ 656,860
C. Total Current and Expected Future Assets				1,749,579
D. Current Benefit Obligations**				
1. Benefit recipients	**Non-Vested**	**Vested**	**Total**	
a. Service retirements	$ -	$ 682,890	$ 682,890	
b. Disability retirements	-	73,331	73,331	
c. Survivors	-	36,054	36,054	
2. Deferred retirements	-	116,232	116,232	
3. Former members without vested rights***	2,579	-	2,579	
4. Active members	40,520	473,323	513,843	
5. Total Current Benefit Obligations	$ 43,099	$ 1,381,830	$ 1,424,929	
E. Expected Future Benefit Obligations				405,762
F. Total Current and Expected Future Benefit Obligations****				1,830,691
G. Unfunded Current Benefit Obligations: *(D.5.) - (A.)*				332,210
H. Unfunded Current and Future Benefit Obligations: *(F.) - (C.)*				81,112
I. Accrued Benefit Funding Ratio: *(A.)/(D.5.)*				76.69%
J. Projected Benefit Funding Ratio: *(C.)/(F.)*				95.57%

* *Per the LCPR Standards for Actuarial Work, calculated assuming the current contribution toward the unfunded liability continues for the entire amortization period. Excludes future statutory contribution increases.*

** *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	$ 804,255	$ 247,501	$ 556,754
b. Disability benefits	42,299	32,004	10,295
c. Survivor's benefits	7,637	2,647	4,990
d. Deferred retirements	61,513	46,906	14,607
e. Refunds*	3,901	11,112	(7,211)
f. Total	$ 919,605	$ 340,170	$ 579,435
2. Deferred retirements	116,232	-	116,232
3. Former members without vested rights	2,579	-	2,579
4. Benefit recipients	792,275	-	792,275
5. Total	$ 1,830,691	$ 340,170	$ 1,490,521

B. Determination of Unfunded Actuarial Accrued Liability (UAAL)	
1. Actuarial accrued liability	$ 1,490,521
2. Current assets (AVA)	1,092,719
3. Unfunded actuarial accrued liability	$ 397,802
C. Determination of Supplemental Contribution Rate**	
1. Present value of future payrolls through the amortization date of June 30, 2048	$ 4,576,439
2. Supplemental contribution rate: *(B.3.) / (C.1.)*	8.69% ***

* *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, 2018 is 17.0779.*

Development of Costs

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

	Year Ending June 30, 2018		
	Actuarial Accrued Liability	Current Assets	Unfunded Actuarial Accrued Liability
A. Unfunded actuarial accrued liability at beginning of year	$ 1,414,443	$ 1,013,173	$ 401,270
B. Changes due to interest requirements and current rate of funding			
1. Normal cost, including expenses	43,707	-	43,707
2. Benefit payments	(69,674)	(69,674)	-
3. Contributions	-	56,310	(56,310)
4. Interest on A., B.1., B.2. and B.3.	112,116	80,519	31,597
5. Total *(B.1. + B.2. + B.3. + B.4.)*	$ 86,149	$ 67,155	$ 18,994
C. Expected unfunded actuarial accrued liability at end of year *(A. + B.5.)*	$ 1,500,592	$ 1,080,328	$ 420,264
D. Increase (decrease) due to actuarial losses (gains) because of experience deviations from expected			
1. Age and service retirements			3,308
2. Disability retirements			(1,971)
3. Death-in-service benefits			(59)
4. Withdrawals			(963)
5. Salary increases			(4,382)
6. Investment income			(12,391)
7. Mortality of annuitants			(77)
8. Other items			150
9. Total			$ (16,385)
E. Unfunded actuarial accrued liability at end of year before plan amendments and changes in actuarial assumptions *(C. + D.9.)*			$ 403,879
F. Change in unfunded actuarial accrued liability due to changes in plan provisions			(90,562)
G. Change in unfunded actuarial accrued liability due to changes in actuarial assumptions			84,485
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.)**			397,802

** The unfunded actuarial accrued liability on a market value of assets basis is $375,634.*

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	9.60%	$ 25,726
2. Employer contributions	14.40%	38,588
3. Total	24.00%	$ 64,314
B. Required contributions - Chapter 356		
1. Normal cost		
a. Retirement benefits	12.55%	$ 33,631
b. Disability benefits	1.55%	4,154
c. Survivors	0.13%	348
d. Deferred retirement benefits	2.01%	5,386
e. Refunds*	0.52%	1,393
f. Total	16.76%	$ 44,912
2. Supplemental contribution amortization of Unfunded Actuarial Accrued Liability by June 30, 2048	8.69%	$ 23,287
3. Allowance for expenses	0.32%	$ 858
4. Total	25.77% **	$ 69,057
C. Contribution sufficiency/(deficiency) *(A.3. - B.4.)*	(1.77)%	$ (4,743)

Note: Projected annual payroll for fiscal year beginning on the valuation date: $267,975 (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 25.29% 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.

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.

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; and
- 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.

Actuarial Basis

Actuarial Methods (Concluded)

Payment on the Unfunded Actuarial Accrued Liability

Payment equals a level percentage of payroll each year to the statutory amortization date of June 30, 2048 assuming payroll increases of 3.25% 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.

As required by the Standards for Actuarial Work, projected payroll is 1) determined by increasing reported payroll for each member by one full year's assumed pay increase according to the actuarial salary scale and 2) multiplied by 0.962 in the determination of the present value of future payroll to account for timing differences.

Changes in Methods since Prior Valuation

The amortization period was reset to 30 years, ending in 2048.

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, and a review of inflation and investment return assumptions, dated September 11, 2017. 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.

Investment return	7.50% per annum.
Salary increases	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.
Inflation	2.50% per year.
Payroll Growth	3.25% per year.
Mortality rates	
Healthy pre-retirement	RP-2014 employee generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2006, white collar adjustment.
Healthy post-retirement	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.
Disabled	RP-2014 disabled mortality table projected with mortality improvement Scale MP-2015 from a base year of 2006.
Notes	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.
Retirement	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. Note that plan changes reflected in this report may result in behavior changes that are not anticipated in the current retirement rates.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Withdrawal

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:

	Select Withdrawal Rates	
Year	**Male**	**Female**
1	10%	12%
2	10%	12%
3	10%	12%

Disability

Age-related rates based on experience; see table of sample rates. All incidences are assumed to be duty-related.

Allowance for combined service annuity

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.

Administrative expenses

Prior year administrative expenses expressed as a percentage of prior year projected payroll.

Refund of contributions

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 are assumed to take the larger of the contributions accumulated with interest or the value of the deferred benefit.

Commencement of deferred benefits

Members receiving deferred annuities (including current terminated deferred members) are assumed to begin receiving benefits at age 55.

Percentage married

75% of active members are assumed to be married. Actual marital status is used for members in payment status.

Age of spouse

Females are assumed to be two years younger than their male spouses.

Form of payment

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)

Form of payment (Concluded)	Remaining married members and unmarried members are assumed to elect the Straight Life option. 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.
Eligibility testing	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
Decrement operation	Withdrawal decrements do not operate during retirement eligibility. Decrements are assumed to occur mid-fiscal year.
Service credit accruals	It is assumed that members accrue one year of service credit per year.
Pay increases	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.
Unknown data for certain members	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. In cases where submitted data was missing or incomplete, the following assumptions, based on average results for applicable members at the time of the last experience study, were applied: <u>Data for active members</u>: There were 13 members reported without a gender and no members reported with an invalid date of birth. We assumed male gender. There were 8 members reported with zero or invalid salary. We used prior year salary (5 members), if available, otherwise, high five salary with a 10% load to account for salary increases (1 member). If neither pay or high five salary was available, we assumed a value of $30,000 (2 members). There was 1 member reported with zero service. Due to the small number of members with 0 service, and based on direction from MSRS, we used service of 0 years for this member.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Unknown data for certain members (Concluded)	Data for terminated members: Benefits were reported with full augmentation to Normal Retirement age. Based on direction from MSRS, we adjusted benefits by removing augmentation on a prospective basis beginning January 1, 2019. There were no members reported with missing or invalid gender or birth dates. There were 48 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 (20 members), we assumed a value of $30,000. There were no members reported without a Termination Date or Credited Service. There were 52 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. Data for members receiving benefits: There were 3 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 was one retiree reported 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 (360 members) and/or survivor date of birth (296 members). We used the valuation assumptions if the survivor gender or date of birth was missing or invalid.
Changes in actuarial assumptions	The assumed investment return was lowered from 8.0% to 7.5%. The assumed rate of inflation decreased from 2.75% to 2.50%. The assumed payroll growth rate decreased from 3.50% to 3.25%. Salary increase rates were reduced by 0.25% at each year of service.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

	Percentage of Members Dying Each Year*					
	Healthy Post-Retirement Mortality**		Healthy Pre-Retirement Mortality**		Disability Mortality**	
Age in 2018	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	0.42	0.22
35	0.09	0.09	0.03	0.03	0.78	0.44
40	0.13	0.12	0.04	0.03	1.13	0.66
45	0.19	0.15	0.06	0.05	1.46	0.84
50	0.28	0.20	0.11	0.09	1.83	1.10
55	0.40	0.29	0.18	0.14	2.21	1.45
60	0.60	0.45	0.32	0.21	2.59	1.71
65	0.90	0.70	0.56	0.30	3.06	2.02
70	1.50	1.12	0.99	0.52	3.89	2.71
75	2.60	1.91	1.79	0.93	5.33	4.01
80	4.67	3.41	3.20	1.65	7.61	6.10
85	8.66	6.29	6.66	4.41	11.29	9.22
90	15.43	11.40	12.64	9.84	17.12	13.45

* *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.*

	Percent of Members Decrementing Each Year			
	Termination (Withdrawal) Rates After Third Year		Disability Retirement	
Age	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
50	5%
51	3
52	3
53	3
54	5
55	45
56	20
57	15
58	15
59	15
60	15
61	15
62	25
63	25
64	25
65	30
66	30
67	25
68	25
69	40
70+	100

Salary Scale	
Year	Increase
1	12.25%
2	8.75
3	5.75
4	5.25
5	5.00
6	4.75
7	4.75
8	4.75
9	4.75
10	4.75
11	4.75
12	4.50
13	4.25
14	4.25
15	4.00
16	4.00
17	4.00
18	3.75
19	3.75
20	3.75
21	3.50
22	3.50
23	3.50
24+	3.25

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.

Plan year	July 1 through June 30.
Eligibility	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.
Contributions	Shown as a percent of salary:

Effective as of	Member	Regular Employer	Supplemental Employer	Total
Prior to July 1, 2018	9.10%	12.85%	0.00%	21.95%
July 1, 2018	9.60%	14.40%	0.00%	24.00%
July 1, 2019	9.60%	14.40%	1.45%	25.45%
July 1, 2020	9.60%	14.40%	2.95%	26.95%
July 1, 2021 and later	9.60%	14.40%	4.45%	28.45%

Supplemental employer contribution remains in effect until the plan is 100% funded.

Member contributions are “picked up” according to the provisions of Internal Revenue Code 414(h).

Allowable service	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.
Salary	Includes wages, allowances and fees. Excludes lump sum payments of separation and reduced salary while receiving Worker’s Compensation benefits.
Average salary	Average of the five highest successive years of Salary. Average Salary is based on all Allowable Service if less than five years.
Vesting	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.

Actuarial Basis

Summary of Plan Provisions (Continued)

Retirement	
Normal retirement benefit	
Age/Service requirement	Age 55 and at least partially vested. Proportionate Retirement Annuity is available at age 65 and one year of Allowable Service.
Amount	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, adjusted for partial vesting if applicable.
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	Through December 31, 2018: 2.00% January 1, 2019 and after: 1.50% 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.
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).

Actuarial Basis

Summary of Plan Provisions (Continued)

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.
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)

Death (Continued)	
Surviving spouse benefit (Concluded)	
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 through June 30, 2011, compounded daily. Beginning July 1, 2011, a member's contributions increase with 4.00% interest compounded daily. Beginning July 1, 2018, member contributions increase with 3.00% interest compounded daily.
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 with 4.00% interest compounded daily. Beginning July 1, 2018, member contributions increase with 3.00% 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)

Termination (Continued)	
Deferred benefit	
Age/service requirement	Partially or fully vested.
Amount	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; (e.) 2.00% from January 1, 2012 to December 31, 2018; and (f.) 0.00% thereafter. Amount is payable at normal or early retirement.
Optional form conversion factors	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. The actuarially equivalent factors are currently being updated to reflect changes adopted during the 2018 legislative session.
Combined service annuity	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.

Actuarial Basis

Summary of Plan Provisions (Concluded)

Changes in plan provisions	Member contributions were increased from 9.10% of pay to 9.60% of pay, effective July 1, 2018. Regular employer contributions were increased from 12.85% of pay to 14.40% of pay, effective July 1, 2018. Supplemental employer contributions totaling 4.45% of pay will be phased-in through fiscal year 2022; supplemental employer contributions remain in effect until the plan is 100% funded. Interest credited on member contributions will decrease from 4.0% to 3.0%, beginning July 1, 2018. Deferred augmentation was changed to 0.00% for future accruing benefits, effective January 1, 2019. Augmentation that has already accrued for deferred members will still apply. Contribution stabilizer provisions were repealed. Post-retirement benefit increases were changed from 2.0% per year, increasing to 2.5% per year upon achieving a 90% funding ratio to a fixed rate of 1.5% per year.

Additional Schedules

Schedule of Funding Progress[1] *(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 [2]	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 [3]	152.20
7-1-2013	701,091	1,026,098	325,007	68.33	204,198 [3]	159.16
7-1-2014	790,304	1,122,474	332,170	70.41	219,244 [3]	151.51
7-1-2015	878,624	1,239,258	360,634	70.90	231,440 [4]	155.82
7-1-2016	937,000	1,313,516	376,516	71.34	241,242 [4]	156.07
7-1-2017	1,013,173	1,414,443	401,270	71.63	248,879 [4]	161.23
7-1-2018	1,092,719	1,490,521	397,802	73.31	257,330 [4]	154.59

[1] *Information prior to 2012 provided by prior actuary. See prior reports for additional detail.*
[2] *Provided by MSRS instead of prior actuary.*
[3] *Assumed equal to actual member contributions divided by 8.60%.*
[4] *Assumed equal to actual member contributions divided by 9.10%.*

Additional Schedules

Schedule of Contributions from the Employer and Other Contributing Entities[1] *(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 [2]	17,203	34,806	24,188	69.49
2013	25.28	204,198 [2]	17,561	34,060	24,632	72.32
2014	26.11	219,244 [2]	18,855	38,390	26,468	68.95
2015	26.43	231,440 [3]	21,061	40,109	29,480	73.50
2016	27.41	241,242 [3]	21,953	44,171	30,678	69.45
2017	27.56	248,879 [3]	22,648	45,943	31,763	69.14
2018	28.40	257,330 [3]	23,417	49,665	32,893	66.23
2019	25.77	N/A	N/A	N/A	N/A	N/A

[1] *Information prior to 2012 provided by prior actuary. See prior reports for additional detail.*
[2] *Assumed equal to actual member contributions divided by 8.60%.*
[3] *Assumed equal to actual member contributions divided by 9.10%.*

Glossary of Terms

Accrued Benefit Funding Ratio	The ratio of assets to Current Benefit Obligations.
Accrued Liability Funding Ratio	The ratio of assets to Actuarial Accrued Liability.
Actuarial Accrued Liability (AAL)	The difference between the Actuarial Present Value of Future Benefits, and the Actuarial Present Value of Future Normal Costs.
Actuarial Assumptions	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.
Actuarial Cost Method	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.
Actuarial Equivalent	Of equal Actuarial Present Value, determined as of a given date and based on a given set of Actuarial Assumptions.
Actuarial Present Value (APV)	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.
Actuarial Present Value of Projected Benefits	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.
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 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).
Actuarial Value of Assets	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)

Amortization Method	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.
Amortization Payment	That portion of the plan contribution or ARC which is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.
Amortization Period	The period used in calculating the Amortization Payment.
Annual Required Contribution (ARC)	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.
Augmentation	Annual increases to deferred benefits.
Closed Amortization Period	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.
Current Benefit Obligations	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).
Employer Normal Cost	The portion of the Normal Cost to be paid by the employer. This is equal to the Normal Cost less expected member contributions.
Expected Assets	The present value of anticipated future contributions intended to fund benefits for current members.
Experience Gain/Loss	A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two actuarial 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)

GASB	Governmental Accounting Standards Board.
GASB Statements No. 25 and No. 27	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.
GASB Statement No. 50	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.
GASB Statements No. 67 and No. 68	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.
GASB Statement No. 82	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.
Normal Cost	The annual cost assigned, under the Actuarial Cost Method, to the current plan year.
Projected Benefit Funding Ratio	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.
Unfunded Actuarial Accrued Liability	The difference between the Actuarial Accrued Liability and Actuarial Value of Assets.
Valuation Date	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.

Minnesota State Retirement System

State Patrol Retirement Fund

Actuarial Valuation Report as of July 1, 2018

GRS Retirement Consulting

P: 800.521.0498 | F: 763.432.5842 | www.grsconsulting.com

December 5, 2018

Minnesota State Retirement System
State Patrol Retirement Fund
St. Paul, Minnesota

Dear Board of Directors:

The results of the July 1, 2018 annual actuarial valuation of the State Patrol 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 persons other than intended users as 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, 2018 based on the prescribed assumptions. Note that we have not attempted to quantify the impact of GASB Statements No. 67 and No. 68 in this report.

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 a 2018 analysis of long-term rate of investment return and inflation assumptions, GRS suggested that an investment return assumption in the range of 6.64% to 7.56% would be reasonable. Please see our draft letter dated September 17, 2018 for additional information. The current assumed rate, which is mandated by Minnesota Statutes, is 7.5% and is at the upper end of the reasonable range. This report also concluded that the probability of exceeding the current 7.5% assumption over 20 years is only 39%. If capital market assumptions decline further from present levels, the 7.5% return assumption might not comply with actuarial standards for the July 1, 2019 valuation. For informational purposes, results based on a 6.5% discount rate are shown on page five.

The valuation assumed the continuing ability of the plan sponsor to make the contributions necessary to fund this plan. A determination regarding whether or not the plan sponsor is actually able to do so is outside our scope of expertise and was not performed.

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 6 – 9, 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 findings in this report are based on data and other information through June 30, 2018. 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).

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 State Patrol Retirement Fund as of the valuation date according to 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 7.50%), it is expected that:

(1) The normal cost of the plan is expected to remain approximately level as a percent of pay,
(2) The funded status of the plan is expected to gradually improve and is expected to be 100% funded within the next 30 years, and
(3) The unfunded liability will grow initially as a dollar amount before beginning to decline.

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.

Contents

Summary of Valuation Results

Contributions

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

	Actuarial Valuation as of	
Total Contributions	**July 1, 2018**	**July 1, 2017**
Statutory Contributions - Chapter 352B (% of Payroll)	40.28%	37.31%
Required Contributions - Chapter 356 (% of Payroll)	41.24%	42.64%
Sufficiency / (Deficiency)	(0.96)%	(5.33)%

The contribution sufficiency/(deficiency) improved from a deficiency of (5.33)% of payroll to a deficiency of (0.96)% of payroll. The primary reasons for the change in contribution sufficiency/(deficiency) were the changes in plan provisions and the statutory amortization period, which was partially offset by the change in assumptions, described in the Effects of Changes section. On a market value of assets basis, contributions are sufficient by 0.08% of payroll.

The contribution deficiency referenced above is based on current snapshot of statutory contributions for the fiscal year ending June 30, 2019. Additional contribution increases will be phased in over the next three years, ultimately increasing the statutory contribution rate (and the contribution sufficiency) by an additional 6.50% of payroll, if there are no significant gains or losses.

Based on the actuarial value of assets, statutory contribution rates (including the increases described above), and actuarial assumptions described in this report, statutory contributions are expected to bring the plan to full funding within the 30-year amortization period.

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 10.3% for the plan year ending June 30, 2018. The AVA earned approximately 9.4% for the plan year ending June 30, 2018 as compared to the assumed rate of 8.00%. The assumed rate is a prescribed assumption mandated by Minnesota Statutes. The assumed rate is mandated by Minnesota Statutes, and was recently lowered to 7.50%.

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 has been provided in a separate report dated November 29, 2018.

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.

	Actuarial Valuation as of	
	July 1, 2018	**July 1, 2017**
Contributions (*% of Payroll*)		
Statutory - Chapter 352B	40.28%	37.31%
Required - Chapter 356	41.24%	42.64%
Sufficiency / (Deficiency)	(0.96)%	(5.33)%
Funding Ratios (*dollars in thousands*)		
Assets		
- Current assets (AVA)	$ 715,964	$ 685,077
- Current assets (MVA)	$ 729,799	$ 691,599
Accrued Benefit Funding Ratio		
- Current benefit obligations	$ 910,079	$ 859,510
- Funding ratio (AVA)	78.67%	79.71%
- Funding ratio (MVA)	80.19%	80.46%
Accrued Liability Funding Ratio		
- Actuarial accrued liability	$ 930,408	$ 880,846
- Funding ratio (AVA)	76.95%	77.77%
- Funding ratio (MVA)	78.44%	78.52%
Projected Benefit Funding Ratio		
- Current and expected future assets	$ 1,106,022	$ 1,001,263
- Current and expected future benefit obligations	$ 1,118,851	$ 1,058,358
- Projected benefit funding ratio (AVA)	98.85%	94.61%
Participant Data		
Active members		
- Number	921	902
- Annual valuation earnings *(000s)*	73,852	72,287
- Projected annual earnings *(000s)*	77,874	76,532
- Average projected annual earnings	84,554	84,847
- Average age	40.6	40.7
- Average service	11.1	11.2
Service retirements	862	847
Survivors	150	148
Disability retirements	59	57
Deferred retirements	56	59
Terminated other non-vested	22	28
Total	**2,070**	**2,041**

Summary of Valuation Results

Effects of Changes

The following changes in plan provisions, actuarial assumptions, and methods were recognized as of July 1, 2018:

- The investment return assumption was lowered from 8.00% to 7.50%.
- The assumed payroll growth assumption was lowered from 3.50% to 3.25%.
- The assumed rate of inflation was lowered from 2.75% to 2.50%.
- Salary scale rates were reduced by 0.25% at each year of service.
- The amortization period was reset to 30-years, ending in 2048.
- Post-retirement benefit increases were changed from 1.0% per year, increasing to 2.5% per year upon achieving a 90% funding ratio to a fixed rate of 1.0% per year.
- Member contributions were increased from 14.4% of payroll to 15.4% of payroll over three years, effective July 1, 2018.
- Regular employer contributions were increased from 21.6% of payroll to 23.1% of payroll over two years, effective July 1, 2018.
- Supplemental employer contributions totaling 7.0% of pay will be phased-in through fiscal year 2022; the supplemental employer contributions remain in effect until the plan is 100% funded.
- An end date of July 1, 2048 was added for the $1 million state contributions.
- Interest credited on member contributions decreased from 4.0% to 3.0%, beginning July 1, 2018.
- Deferred augmentation was changed to 0.00% for future accruing benefits, effective January 1, 2019. Augmentation that has already accrued for deferred members will still apply.
- The contribution stabilizer was repealed.

Summary of Valuation Results

Effects of Changes

The combined impact of the changes on the previous page was to increase the accrued liability by $29.4 million and decrease the required contribution by 0.6% of pay, as follows:

	Before Changes	Reflecting Plan Provision Changes	Reflecting Plan Provision and Actuarial Assumption Changes	Provision, Actuarial Assumption, and Amortization Changes
Normal Cost Rate, % of Pay	24.2%	22.8%	24.9%	24.9%
Amortization of Unfunded Accrued Liability, % of Pay	17.4%	15.8%	19.8%	16.1%
Expenses (% of Pay)	0.2%	0.2%	0.2%	0.2%
Total Required Contribution, % of Pay	41.8%	38.8%	44.9%	41.2%
Accrued Liability Funding Ratio	79.5%	81.0%	77.0%	77.0%
Projected Benefit Funding Ratio	95.5%	101.5%	95.5%	98.9%
Unfunded Accrued Liability (in millions)	$185.0	$168.0	$214.4	$214.4

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' valuations. Per the LCPR's requirement, we have calculated the liabilities associated with the following scenarios:

1) 6.5% interest rate assumption
2) 8.5% interest rate assumption

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 8.5% interest rate would not comply with Actuarial Standards of Practice.

$ in millions	Final Valuation Assumptions	Final Valuation Assumptions with 6.5% interest	Final Valuation Assumptions with 8.5% interest
Normal Cost Rate, % of Pay	24.9%	31.5%	19.9%
Amortization of Unfunded Accrued Liability, % of Pay	16.1%	21.9%	10.2%
Expenses (% of Pay)	0.2%	0.2%	0.2%
Total Required Contribution, % of Pay	41.2%	53.6%	30.3%
Contribution Sufficiency/(Deficiency), % of Pay	(1.0)%	(13.3)%	10.0 %
Accrued Liability Funding Ratio	77.0%	68.7%	85.5%
Present Value of Projected Benefits	$1,118.9	$1,301.2	$976.9
Present Value of Future Normal Costs	$188.5	$258.9	$139.3
Actuarial Accrued Liability	$930.4	$1,042.3	$837.6
Unfunded Accrued Liability	$214.4	$326.4	$121.7

Summary of Valuation Results

Risks Associated with the Measuring the Accrued Liability and Actuarially Determined Contribution

The determination of the accrued liability and the actuarially determined contribution requires the use of assumptions regarding future economic and demographic experience. Risk measures, as illustrated in this report, are intended to aid in the understanding of the effects of future experience differing from the assumptions used in the course of the actuarial valuation. Risk measures may also help with illustrating the potential volatility in the accrued liability and the actuarially determined contribution that result from the differences between actual experience and the actuarial assumptions.

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 due to changing conditions; 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. The scope of an actuarial valuation does not include an analysis of the potential range of such future measurements.

Examples of risk that may reasonably be anticipated to significantly affect the plan's future financial condition include:

1. Investment risk – actual investment returns may differ from the expected returns;
2. Asset/Liability mismatch – changes in asset values may not match changes in liabilities, thereby altering the gap between the accrued liability and assets and consequently altering the funded status and contribution requirements;
3. Contribution risk – actual contributions may differ from expected future contributions. For example, actual contributions may not be made in accordance with the plan's funding policy or material changes may occur in the anticipated number of covered employees, covered payroll, or other relevant contribution base;
4. Salary and Payroll risk – actual salaries and total payroll may differ from expected, resulting in actual future accrued liability and contributions differing from expected;
5. Longevity risk – members may live longer or shorter than expected and receive pensions for a period of time other than assumed;
6. Other demographic risks – members may terminate, retire or become disabled at times or with benefits other than assumed resulting in actual future accrued liability and contributions differing from expected.

The effects of certain trends in experience can generally be anticipated. For example if the investment return since the most recent actuarial valuation is less (or more) than the assumed rate, the cost of the plan can be expected to increase (or decrease). Likewise if longevity is improving (or worsening), increases (or decreases) in cost can be anticipated.

Summary of Valuation Results

The Required Contribution rate shown on page 1 may be considered as a minimum contribution rate that complies with Minnesota Statutes and the requirements of the Standards for Actuarial Work published by the LCPR. The timely receipt of the actuarially determined contributions is critical to support the financial health of the plan. Users of this report should be aware that contributions made at the actuarially determined rate do not necessarily guarantee benefit security.

Plan Maturity Measures

Risks facing a pension plan evolve over time. A young plan with virtually no investments and paying few benefits may experience little investment risk. An older plan with a large number of members in pay status and a significant trust may be much more exposed to investment risk. Generally accepted plan maturity measures and values for the State Patrol Retirement Fund for the last two years include the following. Additional maturity measures are shown on the following pages.

	2018	2017
Ratio of market value of assets to total payroll	9.86	9.47
Ratio of actuarial accrued liability to total payroll	12.57	12.06
Ratio of actives to retirees and beneficiaries	0.86	0.86
Ratio of net cash flow to market value of assets	-4.4%	-4.6%
Approximate modified duration* of:		
▪ Total projected benefits:	14.49	14.49
▪ Actuarial accrued liability:	11.00	10.92

* *Approximate modified duration of total projected benefits based on 7.5% interest for 2018 and 8.0% interest for 2017*

Ratio of Market Value of Assets to Payroll

The relationship between assets and payroll is a useful indicator of the potential volatility of contributions. For example, if the market value of assets is 5.0 times the payroll, a return on assets 5% different than assumed would equal 25% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in plan sponsor contributions as a percentage of payroll.

Ratio of Actuarial Accrued Liability to Payroll

The relationship between actuarial accrued liability and payroll is a useful indicator of the potential volatility of contributions for a fully funded plan. A funding policy that targets a funded ratio of 100% is expected to result in the ratio of assets to payroll and the ratio of liability to payroll converging over time.

The ratio of liability to payroll may also be used as a measure of sensitivity of the contribution rates to liability gains and losses. For example, if the actuarial accrued liability is 5.0 times the payroll, a change in liability 2% other than assumed would equal 10% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in liability (and also plan sponsor contributions) as a percentage of payroll.

Summary of Valuation Results

Ratio of Actives to Retirees and Beneficiaries

A young plan with many active members and few retirees will have a high ratio of active to retirees. A mature open plan may have close to the same number of actives to retirees resulting in a ratio near 1.0. A super-mature or closed plan may have significantly more retirees than actives resulting in a ratio below 1.0.

Ratio of Net Cash Flow to Market Value of Assets

A positive net cash flow means contributions exceed benefits and expenses. A negative cash flow means existing funds are being used to make payments. A certain amount of negative net cash flow is generally expected to occur when benefits are prefunded through a qualified trust. Large negative net cash flows as a percent of assets may indicate a super-mature plan or a need for additional contributions.

Duration of Actuarial Accrued Liability

The duration may be used to approximate the sensitivity of the accrued liability to a small change in the assumed rate of return. For example, a duration of 10 indicates that the liability would change by approximately 10% if the assumed rate of return were changed by 1% (i.e. from 7.5% to 6.5%).

Additional Risk Assessment

Additional risk assessment is outside the scope of the annual actuarial valuation but could aid stakeholders in an understanding of the risks to which the System is exposed. Additional assessment may include scenario tests, sensitivity tests, stochastic modeling, stress tests, and a comparison of the present value of accrued benefits at low-risk discount rates with the actuarial accrued liability.

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	$683,360	$488,870	$194,490	$63,250	71.5%	$441,901	64.7%	1080.4%	772.9%
2011	$700,898	$568,279	$132,619	$63,250	81.1%	$454,811	64.9%	1108.1%	898.5%
2012	$760,955	$549,956	$210,999	$62,524	72.3%	$513,106	67.4%	1217.1%	879.6%
2013	$741,850	$593,201	$148,649	$62,121	80.0%	$507,005	68.3%	1194.2%	954.9%
2014	$800,421	$667,340	$133,081	$63,952	83.4%	$537,866	67.2%	1251.6%	1043.5%
2015	$833,033	$664,530	$168,503	$68,463	79.8%	$570,541	68.5%	1216.8%	970.6%
2016	$833,886	$629,992	$203,894	$69,343	75.6%	$581,343	69.7%	1202.6%	908.5%
2017	$880,846	$691,599	$189,247	$73,056	78.5%	$611,782	69.5%	1205.7%	946.7%
2018	$930,408	$729,799	$200,609	$74,007	78.4%	$647,308	69.6%	1257.2%	986.1%

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	(17) SBI 10-Year Trailing Average
2010			307.5%	$(29,374)	-6.0%	15.2%	3.4%	N/A
2011			209.7%	$(31,499)	-5.5%	23.3%	5.3%	N/A
2012			337.5%	$(31,067)	-5.6%	2.4%	2.3%	N/A
2013			239.3%	$(33,070)	-5.6%	14.2%	6.2%	N/A
2014			208.1%	$(33,048)	-5.0%	18.6%	14.5%	N/A
2015	14.1%	136.9%	246.1%	$(31,713)	-4.8%	4.4%	12.3%	N/A
2016	14.1%	128.1%	294.0%	$(33,764)	-5.4%	-0.1%	7.7%	N/A
2017	14.1%	133.5%	259.0%	$(31,470)	-4.6%	15.1%	10.2%	6.2%
2018	14.1%	139.0%	271.1%	$(32,274)	-4.4%	10.3%	9.4%	7.8%

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) (16) and (17). Investment return is probably the largest single risk that most systems face. The year by year return and the 5-year and 10-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, and historical averages are very sensitive to the time period chosen. 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 provided by 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 and contributions over the long term.
- **Glossary** defines the terms used in this report.

Plan Assets

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

	Market Value	
Assets	**June 30, 2018**	**June 30, 2017**
Cash, equivalents, short term securities	$ 9,241	$ 18,849
Fixed income	114,111	133,670
Equity	605,392	538,064
Other*	73,199	71,169
Total cash, investments, and other assets	**$ 801,943**	**$ 761,752**
Amounts receivable	$ 1,412	$ 1,391
Total Assets	**$ 803,355**	**$ 763,143**
Amounts payable*	$ (73,556)	$ (71,544)
Net Position Restricted for Pensions	**$ 729,799**	**$ 691,599**

** Includes $73,199 in Securities Lending Collateral as of June 30, 2018 and $71,169 as of June 30, 2017.*

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 Plan's prior two fiscal years.

Change in Assets	**Market Value**	
Year Ending	**June 30, 2018**	**June 30, 2017**
1. Fund balance at market value at beginning of year	**$ 691,599**	**$ 629,992**
2. Contributions		
a. Member	10,657	10,520
b. Employer	15,952	15,783
c. Other sources - Supplemental State Aid	1,000	1,000
d. Total contributions	$ 27,609	$ 27,303
3. Investment income		
a. Investment income/(loss)	$ 71,244	$ 93,798
b. Investment expenses	(770)	(721)
c. Net investment income/(loss)	$ 70,474	$ 93,077
4. Other	$ -	$ -
5. Total income: *(2.d.) + (3.c.) + (4.)*	**$ 98,083**	**$ 120,380**
6. Benefits Paid		
a. Annuity benefits	(59,653)	(58,560)
b. Refunds	(39)	(5)
c. Total benefits paid	$ (59,692)	$ (58,565)
7. Expenses		
a. Other	(7)	-
b. Administrative	(184)	(208)
c. Total expenses	$ (191)	$ (208)
8. Total disbursements: *(6.c.) + (7.c.)*	**$ (59,883)**	**$ (58,773)**
9. Fund balance at market value at end of year: *(1.) + (5.) + (8.)*	**$ 729,799**	**$ 691,599**
10. State Board of Investment calculated investment return	10.3%	15.1%

Plan Assets

Actuarial Asset Value *(Dollars in Thousands)*

	June 30, 2018	June 30, 2017
1. Market value of assets available for benefits	**$ 729,799**	**$ 691,599**
2. Determination of average balance		
a. Total assets available at beginning of year	691,599	629,992
b. Total assets available at end of year	729,799	691,599
c. Net investment income for fiscal year	70,474	93,077
d. Average balance *[a. + b. - c.] / 2*	675,462	614,257
3. Expected return *[8.0% x 2.d.]*	54,037	49,141
4. Actual return	70,474	93,077
5. Current year asset gain/(loss) *[4. - 3.]*	16,437	43,936
6. Unrecognized asset returns		

	Original Amount	Unrecognized Amount %	Unrecognized Amount $	Unrecognized Amount %	Unrecognized Amount $
a. Year ended June 30, 2018	$ 16,437	80%	$ 13,150	N/A	N/A
b. Year ended June 30, 2017	43,936	60%	26,362	80%	$ 35,149
c. Year ended June 30, 2016	(52,586)	40%	(21,034)	60%	(31,552)
d. Year ended June 30, 2015	(23,216)	20%	(4,643)	40%	(9,286)
e. Year ended June 30, 2014	61,053		N/A	20%	12,211
f. Unrecognized return adjustment			**$ 13,835**		**$ 6,522**

7. **Actuarial value at end of year** *(1. - 6.f.)*	**$ 715,964**	**$ 685,077**
8. Approximate return on actuarial value of assets during fiscal year	9.4%	9.6%
9. Ratio of actuarial value of assets to market value of assets	0.98	0.99

Membership Data

Distribution of Active Members

	Years of Service as of June 30, 2018									
Age	**<3***	**3 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25 - 29**	**30 - 34**	**35+**	**Total**
< 25	24									**24**
Avg. Earnings	$ 41,084									**$ 41,084**
25 - 29	64	39	11							**114**
Avg. Earnings	$ 53,921	$ 68,736	$ 74,647							**$ 60,989**
30 - 34	37	26	59	6						**128**
Avg. Earnings	$ 53,812	$ 73,938	$ 78,535	$ 89,785						**$ 70,982**
35 - 39	32	22	38	36	7					**135**
Avg. Earnings	$ 69,699	$ 70,993	$ 80,788	$ 87,143	$ 85,097					**$ 78,482**
40 - 44	14	9	22	63	49	12				**169**
Avg. Earnings	$ 66,410	$ 80,618	$ 84,105	$ 89,735	$ 93,144	$ 90,637				**$ 87,637**
45 - 49	9	8	13	51	58	45	2			**186**
Avg. Earnings	$ 74,563	$ 73,559	$ 85,811	$ 87,822	$ 89,208	$ 93,547	$110,130			**$ 88,484**
50 - 54	2	2	5	11	29	35	32	4		**120**
Avg. Earnings	$ 54,881	$ 92,022	$ 83,025	$ 90,398	$ 84,976	$ 92,382	$ 96,021	$ 88,834		**$ 90,242**
55 - 59	3	4	3	9	5	12	3	3		**42**
Avg. Earnings	$ 71,443	$ 95,619	$ 91,608	$ 92,352	$ 94,332	$ 91,388	$101,609	$ 93,757		**$ 91,838**
60 - 64	1			1		1				**3**
Avg. Earnings	$ 86,816			$ 94,272		$ 96,617				**$ 92,568**
65 - 69										
Avg. Earnings										
70+										
Avg. Earnings										
Total	**186**	**110**	**151**	**177**	**148**	**105**	**37**	**7**		**921**
Avg. Earnings	**$ 57,366**	**$ 73,141**	**$ 80,665**	**$ 88,858**	**$ 89,661**	**$ 92,609**	**$ 97,237**	**$ 90,944**		**$ 80,187**

* *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

	Years Retired as of June 30, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
<50		1						**1**
Avg. Benefit		$ 16,967						**$ 16,967**
50 - 54	7	21						**28**
Avg. Benefit	$ 35,983	$ 47,543						**$ 44,653**
55 - 59	24	89	27					**140**
Avg. Benefit	$ 51,322	$ 61,326	$ 44,589					**$ 56,383**
60 - 64	2	44	97	29				**172**
Avg. Benefit	$ 44,416	$ 50,833	$ 62,173	$ 48,153				**$ 56,702**
65 - 69		2	26	89	21			**138**
Avg. Benefit		$ 39,197	$ 56,852	$ 54,763	$ 51,793			**$ 54,479**
70 - 74			4	25	113	7		**149**
Avg. Benefit			$ 26,642	$ 56,613	$ 58,977	$ 55,511		**$ 57,549**
75 - 79		1		5	34	65	1	**106**
Avg. Benefit		$ 35,129		$ 52,752	$ 66,979	$ 67,046	$ 72,195	**$ 66,098**
80 - 84					9	16	39	**64**
Avg. Benefit					$ 71,155	$ 83,450	$ 72,547	**$ 75,077**
85 - 89						1	36	**37**
Avg. Benefit						$ 84,294	$ 75,860	**$ 76,088**
90+							27	**27**
Avg. Benefit							$ 74,921	**$ 74,921**
Total	**33**	**158**	**154**	**148**	**177**	**89**	**103**	**862**
Avg. Benefit	**$ 47,650**	**$ 55,845**	**$ 57,269**	**$ 53,712**	**$ 60,281**	**$ 69,282**	**$ 74,324**	**$ 59,926**

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

	Years Since Death as of June 30, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
<45	2			2	2	1		**7**
Avg. Benefit	$ 20,112			$ 10,361	$ 6,550	$ 12,092		**$ 12,305**
45 - 49	1			3	1			**5**
Avg. Benefit	$ 47,647			$ 25,365	$ 30,748			**$ 30,898**
50 - 54					1			**1**
Avg. Benefit					$ 33,148			**$ 33,148**
55 - 59		3		1	1	1		**6**
Avg. Benefit		$ 53,861		$ 16,563	$ 14,551	$ 63,605		**$ 42,717**
60 - 64	1	2	1	3	2			**9**
Avg. Benefit	$ 26,866	$ 24,072	$ 27,369	$ 46,187	$ 28,249			**$ 33,049**
65 - 69	3	3	1	5	1	2		**15**
Avg. Benefit	$ 37,214	$ 64,466	$ 34,190	$ 25,675	$ 27,735	$ 52,971		**$ 40,085**
70 - 74	1	5	4	8	6	4	1	**29**
Avg. Benefit	$ 37,538	$ 40,960	$ 34,453	$ 27,943	$ 38,227	$ 39,305	$ 33,419	**$ 35,300**
75 - 79	1	3	3	6	4	2		**19**
Avg. Benefit	$ 33,232	$ 32,023	$ 36,279	$ 50,330	$ 45,481	$ 38,802		**$ 42,087**
80 - 84	4	5	3	1	1		4	**18**
Avg. Benefit	$ 32,721	$ 29,824	$ 57,034	$ 17,802	$ 21,432		$ 23,772	**$ 32,524**
85 - 89		6	4	4	7	1	2	**24**
Avg. Benefit		$ 33,978	$ 35,365	$ 33,795	$ 46,825	$ 35,486	$ 21,549	**$ 36,953**
90+	2		2	5	5	1	2	**17**
Avg. Benefit	$ 42,053		$ 43,424	$ 26,138	$ 44,028	$ 32,211	$ 38,301	**$ 37,094**
Total	**15**	**27**	**18**	**38**	**31**	**12**	**9**	**150**
Avg. Benefit	**$ 34,143**	**$ 39,147**	**$ 39,312**	**$ 31,303**	**$ 37,304**	**$ 40,347**	**$ 27,579**	**$ 35,700**

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, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
< 45	1	3						**4**
Avg. Benefit	$ 26,699	$ 46,806						**$ 41,779**
45 - 49		4	1	2				**7**
Avg. Benefit		$ 43,241	$ 38,584	$ 31,456				**$ 39,209**
50 - 54	2	5	2	3	1			**13**
Avg. Benefit	$ 61,533	$ 53,964	$ 42,849	$ 51,451	$ 31,588			**$ 51,117**
55 - 59		1	4	1				**6**
Avg. Benefit		$ 43,924	$ 56,632	$ 44,734				**$ 52,531**
60 - 64		1	2	2	2	2		**9**
Avg. Benefit		$ 30,125	$ 48,370	$ 52,435	$ 35,844	$ 33,617		**$ 41,184**
65 - 69				3	3	1	1	**8**
Avg. Benefit				$ 46,366	$ 29,673	$ 43,567	$ 44,078	**$ 39,470**
70 - 74				2	4	1	1	**8**
Avg. Benefit				$ 45,597	$ 32,094	$ 51,214	$ 53,954	**$ 40,592**
75+						1	3	**4**
Avg. Benefit						$ 69,950	$ 54,608	**$ 58,443**
Total	**3**	**14**	**9**	**13**	**10**	**5**	**5**	**59**
Avg. Benefit	**$ 49,922**	**$ 46,946**	**$ 49,728**	**$ 45,936**	**$ 32,067**	**$ 46,393**	**$ 52,371**	**$ 45,190**

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			
	Actives	Deferred Retirement	Other Non-Vested	Service Retirement	Disability Retirement	Survivor	Total
Members on 7/1/2017	**902**	**59**	**28**	**847**	**57**	**148**	**2,041**
New members	60	0	0	0	0	0	**60**
Return to active	1	0	(1)	0	0	0	**0**
Terminated non-vested	(4)	0	4	0	0	0	**0**
Service retirements	(28)	(3)	0	31	0	0	**0**
Terminated deferred	(4)	4	0	0	0	0	**0**
Terminated refund/transfer	(1)	(3)	(9)	0	0	0	**(13)**
Deaths	(2)	0	0	(19)	0	(8)	**(29)**
New beneficiary	0	0	0	0	0	11	**11**
Disabled	(3)	0	0	0	3	0	**0**
Unexpected status change	0	(1)	0	3	(1)	(1)	**0**
Net change	19	(3)	(6)	15	2	2	**29**
Members on 6/30/2018	**921**	**56**	**22**	**862**	**59**	**150**	**2,070**

Terminated Member Statistics on June 30, 2018	Deferred Retirement	Other Non-Vested	Total
Number	56	22	78
Average age	45.0	34.3	42.0
Average service	8.6	0.5	6.3
Average annual benefit, with augmentation to December 31, 2018 and 13% CSA load	$ 22,355	N/A	$ 22,355
Average refund value, with 13% CSA load (0% for Non-Vested Members)	$ 100,670	$ 3,581	$ 73,286

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 40.28% 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.

			June 30, 2018
A. Actuarial Value of Assets			$ 715,964
B. Expected Future Assets			
1. Present value of expected future statutory supplemental contributions*			201,615
2. Present value of future normal cost contributions			188,443
3. Total expected future assets: *(1.) + (2.)*			$ 390,058
C. Total Current and Expected Future Assets			1,106,022
D. Current Benefit Obligations**			
1. Benefit recipients	**Non-Vested**	**Vested**	**Total**
a. Service retirements	$ -	$ 566,038	$ 566,038
b. Disability retirements	-	34,399	34,399
c. Survivors	-	46,871	46,871
2. Deferred retirements	-	9,297	9,297
3. Former members without vested rights***	33	-	33
4. Active members	11,472	241,969	253,441
5. Total Current Benefit Obligations	$ 11,505	$ 898,574	$ 910,079
E. Expected Future Benefit Obligations			208,772
F. Total Current and Expected Future Benefit Obligations****			1,118,851
G. Unfunded Current Benefit Obligations: *(D.5.) - (A.)*			194,115
H. Unfunded Current and Future Benefit Obligations: *(F.) - (C.)*			12,829
I. Accrued Benefit Funding Ratio: *(A.)/(D.5.)*			78.67%
J. Projected Benefit Funding Ratio: *(C.)/(F.)*			98.85%

* *Per the LCPR Standards for Actuarial Work, calculated assuming the current contribution toward the unfunded liability continues for the entire amortization period. Includes $1,000,000 state contribution and excludes future statutory contribution increases.*

** *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	$ 431,204	$ 166,002	$ 265,202
b. Disability benefits	21,646	14,780	6,866
c. Survivor's benefits	4,286	2,947	1,339
d. Deferred retirements	4,341	3,811	530
e. Refunds*	736	903	(167)
f. Total	$ 462,213	$ 188,443	$ 273,770
2. Deferred retirements	9,297	-	9,297
3. Former members without vested rights	33	-	33
4. Benefit recipients	647,308	-	647,308
5. Total	$ 1,118,851	$ 188,443	$ 930,408

B. Determination of Unfunded Actuarial Accrued Liability (UAAL)	
1. Actuarial accrued liability	$ 930,408
2. Current assets (AVA)	715,964
3. Unfunded actuarial accrued liability	$ 214,444
C. Determination of Supplemental Contribution Rate**	
1. Present value of future payrolls through the amortization date of June 30, 2048	$ 1,329,917
2. Supplemental contribution rate: *(B.3.) / (C.1.)*	16.12% ***

* *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 June 30, 2018 is 17.07781.*

Development of Costs

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

	Year Ending June 30, 2018		
	Actuarial Accrued Liability	Current Assets	Unfunded Actuarial Accrued Liability
A. Unfunded Actuarial Accrued Liability at beginning of year	$ 880,846	$ 685,077	$ 195,769
B. Changes due to interest requirements and current rate of funding			
1. Normal cost, including expenses	18,613	-	18,613
2. Benefit payments	(59,692)	(59,692)	-
3. Contributions	-	27,609	(27,609)
4. Interest on A., B.1., B.2. and B.3.	68,825	53,523	15,302
5. Total *(B.1. + B.2. + B.3. + B.4.)*	$ 27,746	$ 21,440	$ 6,306
C. Expected Unfunded Actuarial Accrued Liability at end of year *(A. + B.5.)*	$ 908,592	$ 706,517	$ 202,075
D. Increase (decrease) due to actuarial losses (gains) because of experience deviations from expected			
1. Age and service retirements			$ (56)
2. Disability retirements			185
3. Death-in-service benefits			935
4. Withdrawals			(129)
5. Salary increases			(9,352)
6. Investment income			(9,447)
7. Mortality of annuitants			844
8. Other items			(57)
9. Total			$ (17,077)
E. Unfunded Actuarial Accrued Liability at end of year before plan amendments and changes in actuarial assumptions *(C. + D.9.)*			$ 184,998
F. Change in Unfunded Actuarial Accrued Liability due to changes in plan provisions			(16,970)
G. Change in Unfunded Actuarial Accrued Liability due to changes in actuarial assumptions			46,416
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.)**			$ 214,444

** The Unfunded Actuarial Accrued Liability on a market value of assets basis is $200,609.*

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 352B		
1. Employee contributions	14.90%	$ 11,603
2. Employer contributions	22.35%	17,405
3. Employer supplemental contributions	1.75%	1,363
4. State contributions***	1.28%	1,000
5. Total	40.28%	$ 31,371
B. Required contributions - Chapter 356		
1. Normal cost		
a. Retirement benefits	21.93%	$ 17,078
b. Disability benefits	1.96%	1,526
c. Survivors	0.41%	319
d. Deferred retirement benefits	0.48%	374
e. Refunds*	0.10%	78
f. Total	24.88%	$ 19,375
2. Supplemental contribution amortization of Unfunded Actuarial Accrued Liability by June 30, 2048	16.12%	$ 12,553
3. Allowance for expenses	0.24%	$ 187
4. Total	41.24% **	$ 32,115
C. Contribution Sufficiency/(Deficiency) *(A.5. - B.4.)*	(0.96)%	$ (744)

Note: Projected annual payroll for fiscal year beginning on the valuation date: $77,874 (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 40.20% of payroll.*
*** *Contributions paid until both the Public Employees Retirement Association Police and Fire Plan and the State Patrol Retirement Fund reach 90% funding (on a Market Value of Assets basis) or July 1, 2048 if earlier.*

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.

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; and
- 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, 2048 assuming payroll increases of 3.25% 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.

As required by the Standards for Actuarial Work, projected payroll is 1) determined by increasing reported payroll for each member by one full year's assumed pay increase according to the actuarial salary scale and 2) multiplied by 0.962 in the determination of the present value of future payroll to account for timing differences.

Changes in Methods since Prior Valuation

The amortization period was reset to 30 years, ending in 2048.

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, and a review of inflation and investment return assumptions, dated September 11, 2017. 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.

Investment return	7.50% per annum.
Salary increases	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.
Inflation	2.50% per year.
Payroll growth	3.25% per year.
Mortality rates	
Healthy pre-retirement	RP-2014 employee generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2006, white collar adjustment.
Healthy post-retirement	RP-2014 annuitant generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2006, white collar adjustment.
Disabled	RP-2014 annuitant generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2006, white collar adjustment.
Notes	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.
Retirement	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. Note that plan changes reflected in this report may result in behavior changes that are not anticipated in the current retirement rates.
Withdrawal	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:

Year	Select Withdrawal Rates
1	2.50%
2	2.00%
3	1.50%

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Disability	Age-related rates based on experience; see table of sample rates. All incidences are assumed to be duty-related.
Allowance for combined service annuity	Liabilities for former, vested members are increased by 13.00% to account for the effect of some participants having eligibility for a Combined Service Annuity.
Administrative expenses	Prior year administrative expenses expressed as percentage of prior year projected payroll.
Refund of contributions	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 are assumed to take the larger of the contributions accumulated with interest or the value of the deferred benefit.
Commencement of deferred benefits	Members receiving deferred annuities (including current terminated deferred members) are assumed to begin receiving benefits at age 55.
Percentage married	85% of active members are assumed to be married. Actual marital status is used for members in payment status.
Age of spouse	Females are assumed to be two years younger than their spouses, and males are assumed to be two years older than their spouses.
Eligible children	Each member may have two dependent children depending on member's age. Assumed first child is born at member's age 28 and second child at member's age 31.
Form of payment	Married members retiring from active status are assumed to elect subsidized Joint and Survivor form of annuity as follows: 20% elect 50% Joint & Survivor option 10% elect 75% Joint & Survivor option 55% elect 100% Joint & Survivor option Remaining married and unmarried members are assumed to elect the Straight Life option.
Eligibility testing	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
Decrement operation	Withdrawal decrements do not operate during retirement eligibility. Decrements are assumed to occur mid-fiscal year.
Service credit accruals	It is assumed that members accrue one year of service credit per year.
Pay increases	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.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Unknown data for certain members	To prepare this report, GRS has used and relied on participant data supplied by the Fund. 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. In cases where submitted data was missing or incomplete, the following assumptions, based on average results for applicable members at the time of the last experience study, were applied: **Data for active members:** There were two members reported with missing salary and no members reported with missing service. We used prior year reported salary. There were no members reported with a missing or invalid date of birth or gender. **Data for terminated members:** Benefits were reported with full augmentation to Normal Retirement Age. Based on direction from MSRS, we adjusted benefits by removing augmentation on a prospective basis beginning January 1, 2019. There was one member reported without a benefit. We calculated benefits for this member using the reported Credited Service and Termination Date. Average Salary was not reported, so we assumed a value of $35,000. **Data for members receiving benefits:** There was one member reported with a missing gender and no members reported with an invalid date of birth. We assumed male gender. There were no members reported without a benefit. There were no survivors reported with an expired benefit. There were no retirees reported with a bounceback annuity and an unreasonable reduction factor. There were no retirees reported with a survivor option and a survivor date of death. For retirees who elected a survivor benefit option, we used the valuation assumptions if the survivor date of birth was missing or invalid (184 members) and/or the survivor gender was missing or invalid (201 members).
Changes in actuarial assumptions	The assumed investment return was lowered from 8.0% to 7.5%. The assumed rate of inflation decreased from 2.75% to 2.50%. The assumed payroll growth rate decreased from 3.50% to 3.25%. Salary increase rates were reduced by 0.25% at each year of service.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

	Percentage of Members Dying each Year*					
	Healthy Post-Retirement Mortality**		Healthy Pre-Retirement Mortality**		Disability Mortality**	
Age in 2018	Male	Female	Male	Female	Male	Female
20	0.02%	0.01%	0.02%	0.01%	0.02%	0.01%
25	0.03	0.02	0.03	0.01	0.03	0.02
30	0.05	0.05	0.03	0.02	0.05	0.05
35	0.08	0.08	0.03	0.03	0.08	0.08
40	0.11	0.12	0.04	0.03	0.11	0.12
45	0.16	0.14	0.06	0.05	0.16	0.14
50	0.25	0.19	0.11	0.09	0.25	0.19
55	0.37	0.27	0.18	0.14	0.37	0.27
60	0.51	0.39	0.32	0.21	0.51	0.39
65	0.73	0.63	0.56	0.30	0.73	0.63
70	1.20	1.02	0.99	0.52	1.20	1.02
75	2.09	1.72	1.79	0.93	2.09	1.72
80	3.70	3.04	3.20	1.65	3.70	3.04
85	6.82	5.57	6.66	4.41	6.82	5.57
90	12.49	10.16	12.64	9.84	12.49	10.16

* *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.*

	Percent of Members Decrementing Each Year			
	Termination (Withdrawal) Rates After Third Year		Disability Retirement	
Age	Male	Female	Male	Female
20	1.47%	1.47%	0.03%	0.03%
25	1.13	1.13	0.05	0.05
30	0.80	0.80	0.06	0.06
35	0.47	0.47	0.11	0.11
40	0.40	0.40	0.18	0.18
45	0.40	0.40	0.30	0.30
50	0.00	0.00	0.48	0.48
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

Actuarial Basis

Summary of Actuarial Assumptions (Concluded)

Age	Percent Retiring
50	5 %
51	5
52	5
53	5
54	5
55	65
56	50
57	30
58	20
59	30
60+	100

Salary Scale	
Year	Increase
1	15.25%
2	9.25
3	7.75
4	7.25
5	6.75
6	6.25
7	6.00
8	5.75
9	5.50
10	5.25
11	5.00
12	4.75
13	4.50
14	4.25
15	4.25
16	4.25
17	4.00
18	4.00
19	3.75
20	3.75
21	3.65
22	3.55
23	3.45
24	3.35
25+	3.25

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.

Plan year

July 1 through June 30.

Eligibility

State troopers, conservation officers, certain crime bureau and gambling enforcement officers, and certain other persons listed in Minnesota Statutes 352B.011 subdivision 10.

Contributions

Percent of Salary:

Effective as of	Member	Regular Employer	Supplemental Employer	Total
Prior to July 1, 2018	14.40%	21.60%	0.00%	36.00%
July 1, 2018	14.90%	22.35%	1.75%	39.00%
July 1, 2019	14.90%	23.10%	3.00%	41.00%
July 1, 2020	15.40%	23.10%	5.00%	43.50%
July 1, 2021 and later	15.40%	23.10%	7.00%	45.50%

Supplemental employer contributions remain in effect until the plan is 100% funded.

Member contributions are “picked up” according to the provisions of Internal Revenue Code 414(h).

State contributions

$1 million paid annually on October 1 until the earlier of 1) both the Public Employees Retirement Association Police and Fire Plan and the State Patrol Retirement Fund attaining 90% funded status (on a Market Value of Assets basis), or 2) July 1, 2048.

Allowable service

Service during which member contributions were deducted. Includes period receiving temporary Worker's Compensation and reduced salary from employer. See Normal Retirement benefit definition on the following page for information about service limits.

Salary

Salaries excluding lump sum payments at separation.

Average salary

Average of the five highest years of Salary. Average Salary is based on all Allowable Service if less than five years. Average Salary is based on all years without regard to any service limits.

Actuarial Basis

Summary of Plan Provisions (Continued)

Retirement

Normal retirement benefit

Age/Service requirement	Age 55 and three years (ten years if first hired after June 30, 2013) of Allowable Service.
Amount	3.00% of Average Salary for each year of Allowable Service up to 33 years. Members with at least 28 years of service as of July 1, 2013, are not subject to this service limit. Member contributions made after the service cap will be refunded at retirement.

Early retirement benefit

Age/Service requirement	Age 50 and three years (ten years if first hired after June 30, 2013) of Allowable Service.
Amount	Normal Retirement Benefit based on Allowable Service and Average Salary at retirement reduced by 1/10% for each month that the member is under age 55. If the effective date of retirement is after June 30, 2015, the reduction is 0.34% for each month that the member is under age 55 at the time of retirement.
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	1.00% per year. 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.

Disability

Occupational disability benefit

Age/Service requirement	Member who cannot perform his duties as a direct result of a disability relating to an act of duty.

Actuarial Basis

Summary of Plan Provisions (Continued)

Disability (Concluded)	
Occupational disability benefit (Continued)	
Amount	60% of Average Salary plus 3.00% of Average Salary for each year in excess of 20 years of Allowable Service (pro rata for completed months). Payments cease at age 65 (age 55 if disabled after June 30, 2015) or the 5-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.
Non-duty disability benefit	
Age/Service requirement	At least one year of Allowable Service and disability not related to covered employment.
Amount	Normal Retirement Benefit based on Allowable Service (minimum of 15 years) and Average Salary at disability without reduction for commencement before age 55. Payments cease at age 65 (age 55 if disabled after June 30, 2015) or 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.
Retirement after disability	
Age/Service requirement	Age 65 (age 55 if disabled after June 30, 2015) with continued disability.
Amount	Optional annuity continues. Otherwise, normal retirement benefit equal to the disability benefit paid, or an actuarially equivalent option.
Form of payment	Same as for retirement.
Benefit increases	Same as for retirement.

Actuarial Basis

Summary of Plan Provisions (Continued)

Death

Surviving spouse benefit

Age/Service requirement	Member who is active or receiving a disability benefit or former member.
Amount	50% of Average Salary if member was active or occupational disability and either had less than three years (five years if first hired after June 30, 2013) of Allowable Service or was under age 55. Annuity is paid for life. Surviving spouse receives the 100% Joint and Survivor benefit commencing on the member's 55th birthday if member was active or a disability with three years (five years if first hired after June 30, 2013) of Allowable Service. A spouse who had been receiving the 50% benefit shall be entitled to the greater benefit. The surviving spouse of a former member receives the 100% Joint and Survivor benefit commencing on the member's 55th birthday if former member had three years (five years if first hired after June 30, 2013) of Allowable Service.
Benefit increases	Same as for retirement.

Surviving dependent children's benefit

Age/Service requirement	Member who is active or receiving a disability benefit. Child must be unmarried, under age 18 (or 23 if full-time student) and dependent upon the member.
Amount	10% of Average Salary for each child and $20 per month prorated among all dependent children. Benefit must not be less than 50% nor exceed 70% of Average Salary.
Benefit increases	Same as for retirement.

Refund of contributions

Age/Service requirement	Member dies before receiving any retirement benefits and survivor benefits are not payable.
Amount	Member's contributions with 6.00% interest through June 30, 2011, compounded daily. Beginning July 1, 2011, a member's contributions increase with 4.00% interest compounded daily. Beginning July 1, 2018, member contributions increase with 3.00% interest compounded daily.

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 with 4.00% interest compounded daily. Beginning July 1, 2018, member contributions increase with 3.00% 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)

Termination (Concluded)	
Deferred benefit	
Age/service requirement	Three years (ten years if first hired after June 30, 2013) of Allowable Service.
Amount	Benefit is 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, 2012; (d.) 2.00% after December 31, 2011, through December 31, 2018; and (e.) 0.00% thereafter. Amount is payable at normal or early retirement. If a member terminated employment prior to July 1, 1997, but was not eligible to commence their pension before July 1, 1997, an actuarial increase shall be made for the change in the post-retirement interest rates from 5.00% to 6.00%.
Optional form conversion factors	Actuarially equivalent factors based on RP-2000 for healthy annuitants, white collar adjustment, projected to 2027 using scale AA, set back two years for males and set forward one year for females, blended 95% males, 6.50% post-retirement interest, and 8.50% pre-retirement interest. The actuarially equivalent factors are currently being updated to reflect changes adopted during the 2018 legislative session.
Combined service annuity	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.

Actuarial Basis

Summary of Plan Provisions (Concluded)

Changes in plan provisions	Member contributions were increased from 14.4% of pay to 15.4% of pay over three years, effective July 1, 2018. Regular employer contributions were increased from 21.6% of pay to 23.1% of pay over two years, effective July 1, 2018. Supplemental employer contributions totaling 7.0% of pay will be phased-in through fiscal year 2022; the supplemental employer contributions remain in effect until the plan is 100% funded. Interest credited on member contributions will decrease from 4.0% to 3.0%, beginning July 1, 2018. Deferred augmentation was changed to 0.00% for future accruing benefits, effective January 1, 2019. Augmentation that has already accrued for deferred members will still apply. Contribution stabilizer provisions were repealed. Post-retirement benefit increases were changed from 1.0% per year, increasing to 2.5% per year upon achieving a 90% funding ratio to a fixed rate of 1.0% per year. An end date of July 1, 2048 was added for the $1 million state contribution.

Additional Schedules

Schedule of Funding Progress[1] *(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	$ 200,068	$ 224,033	$ 23,965	89.30%	$ 32,365	74.05 %
7-1-1992	222,314	233,656	11,342	95.15	32,882	34.49
7-1-1993	244,352	258,202	13,850	94.64	35,765	38.73
7-1-1994	262,570	275,377	12,807	95.35	35,341	36.24
7-1-1995	284,918	283,078	(1,840)	100.65	37,518	(4.90)
7-1-1996	323,868	303,941	(19,927)	106.56	41,476	(48.04)
7-1-1997	375,650	332,427	(43,223)	113.00	41,996	(102.92)
7-1-1998	430,011	371,369	(58,642)	115.79	43,456	(134.95)
7-1-1999	472,687	406,215	(66,472)	116.36	45,333	(146.63)
7-1-2000	528,573	458,384	(70,189)	115.31	48,167	(145.72)
7-1-2001	572,815	489,483	(83,332)	117.02	48,935	(170.29)
7-1-2002	591,383	510,344	(81,039)	115.88	49,278	(164.45)
7-1-2003	591,521	538,980	(52,541)	109.75	54,175	(96.98)
7-1-2004	594,785	545,244	(49,542)	109.09	51,619	(95.98)
7-1-2005	601,220	566,764	(34,456)	106.08	55,142	(62.49)
7-1-2006	618,990	641,479	22,489	96.49	57,765	38.93
7-1-2007	617,901	673,444	55,543	91.75	61,498	90.32
7-1-2008	595,082	693,686	98,604	85.79	60,029	164.26
7-1-2009	584,501	725,334	140,833	80.58	61,511	228.96
7-1-2010	567,211	683,360	116,149	83.00	63,250	183.63
7-1-2011	563,046	700,898	137,852	80.33	63,250	217.95
7-1-2012	554,244	760,955	206,711	72.84	62,524 [2]	330.61
7-1-2013	552,319	741,850	189,531	74.45	62,121 [2]	305.10
7-1-2014	597,870	800,421	202,551	74.69	63,952 [2]	316.72
7-1-2015	639,863	833,033	193,170	76.81	68,463 [3]	282.15
7-1-2016	654,842	833,886	179,044	78.53	69,343 [3]	258.20
7-1-2017	685,077	880,846	195,769	77.77	73,056 [4]	267.97
7-1-2018	715,964	930,408	214,444	76.95	74,007 [4]	289.76

[1] *Information prior to 2012 provided by prior actuary. See prior reports for additional detail.*
[2] *Assumed equal to actual member contributions divided by 12.4%.*
[3] *Assumed equal to actual member contributions divided by 13.4%.*
[4] *Assumed equal to actual member contributions divided by 14.4%.*

Additional Schedules

Schedule of Contributions from the Employer and Other Contributing Entities[1]

(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[2] (e)	Percentage Contributed (e)/(d)
1991	22.15%	$ 32,365	$ 2,751	$ 4,418	$ 4,825	109.21%
1992	22.58	32,882	2,795	4,630	4,893	105.68
1993	22.27	35,765	3,040	4,925	5,288	107.37
1994	21.94	35,341	3,004	4,750	5,159	108.61
1995	21.79	37,518	3,189	4,986	5,583	111.97
1996	21.34	41,476	3,484	5,367	5,742	106.99
1997	21.33	41,996	3,746	5,212	6,151	118.02
1998	15.67	43,456	3,634	3,176	5,475	172.39
1999	14.14	45,333	3,850	2,560	5,712	223.13
2000	15.17	48,167	4,044	3,263	6,069	185.99
2001	15.48	48,935	4,145	3,430	6,166	179.77
2002	14.00	49,278	4,215	2,684	6,209	231.33
2003	14.34	54,175	4,555	3,214	6,826	212.38
2004	17.81	51,619	4,493	4,700	6,504	138.39
2005	18.15	55,142	4,517	5,491	6,670	121.47
2006	19.84	57,765	4,719	6,741	7,055	104.66
2007	26.69	61,498	4,987	11,427	7,461	65.30
2008	29.90	60,029	5,594	12,355	8,279	67.01
2009	34.49	61,511	6,216	14,999	9,178	61.19
2010	38.16	63,250	6,726	17,410	10,104	58.04
2011	33.84	63,250	6,578	14,826	9,873	66.59
2012	36.25	62,524 [3]	7,753	14,912	11,620	77.92
2013	42.52	62,121 [3]	7,703	18,711	11,482	61.37
2014	41.24	63,952 [3]	7,930	18,444	12,894	69.91
2015	43.56	68,463 [4]	9,174	20,648	14,763	71.50
2016	42.91	69,343 [4]	9,292	20,463	14,938	73.00
2017	40.45	73,056 [5]	10,520	19,031	16,783	88.19
2018	42.64	74,007 [5]	10,657	20,900	16,952	81.11
2019	41.24	N/A	N/A	N/A	N/A	N/A

[1] Information prior to 2012 provided by prior actuary. See prior reports for additional detail.
[2] Includes contributions from other sources (if applicable).
[3] Assumed equal to actual member contributions divided by 12.4%.
[4] Assumed equal to actual member contributions divided by 13.4%.
[5] Assumed equal to actual member contributions divided by 14.4%.

Glossary of Terms

Accrued Benefit Funding Ratio	The ratio of assets to Current Benefit Obligations.
Accrued Liability Funding Ratio	The ratio of assets to Actuarial Accrued Liability.
Actuarial Accrued Liability (AAL)	The difference between the Actuarial Present Value of Future Benefits, and the Actuarial Present Value of Future Normal Costs.
Actuarial Assumptions	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.
Actuarial Cost Method	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.
Actuarial Equivalent	Of equal Actuarial Present Value, determined as of a given date and based on a given set of Actuarial Assumptions.
Actuarial Present Value (APV)	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.
Actuarial Present Value of Projected Benefits	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.
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 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).

Glossary of Terms (Continued)

Actuarial Value of Assets	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).
Amortization Method	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.
Amortization Payment	That portion of the plan contribution or ARC which is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.
Amortization Period	The period used in calculating the Amortization Payment.
Annual Required Contribution (ARC)	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.
Augmentation	Annual increases to deferred benefits.
Closed Amortization Period	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.
Current Benefit Obligations	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).
Employer Normal Cost	The portion of the Normal Cost to be paid by the employer. This is equal to the Normal Cost less expected member contributions.
Expected Assets	The present value of anticipated future contributions intended to fund benefits for current members.

Glossary of Terms (Continued)

Experience Gain/Loss	A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two actuarial 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.
GASB	Governmental Accounting Standards Board.
GASB Statements No. 25 and No. 27	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 for GASB Statements No. 67 and No. 68 below.
GASB Statement No. 50	The accounting standard governing a state or local governmental employer's accounting for pensions. This statement remains in effect for pension plans that are not administered as trusts. Please refer to the definition of GASB Statements No. 67 and No. 68 below.
GASB Statements No. 67 and No. 68	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 sets the accounting and financial reporting rules for the employers that sponsor or contribute to public retirement systems, while Statement No. 67 sets the rules for the systems themselves. Accounting and financial reporting information prepared according to Statements No. 67 and No. 68 is provided in a separate report beginning with the June 30, 2014 actuarial valuation.
GASB Statement No. 82	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.

Glossary of Terms (Concluded)

Normal Cost	The annual cost assigned, under the Actuarial Cost Method, to the current plan year.
Projected Benefit Funding Ratio	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.
Unfunded Actuarial Accrued Liability	The difference between the Actuarial Accrued Liability and Actuarial Value of Assets.
Valuation Date	The date as of which the Actuarial Present Value of Future Benefits is determined. The benefits expected to be paid in the future are discounted to this date.

Minnesota State Retirement System

Judges Retirement Fund

Actuarial Valuation Report as of July 1, 2018

GRS Retirement Consulting

P: 800.521.0498 | F: 763.432.5842 | www.grsconsulting.com

December 5, 2018

Minnesota State Retirement System
Judges Retirement Fund
St. Paul, Minnesota

Dear Board of Directors:

The results of the July 1, 2018 annual actuarial valuation of the Judges 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 persons other than the intended users as 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, 2018 according to prescribed assumptions. Note that we have not attempted to quantify the impact of GASB Statements No. 67 and No. 68 in this report.

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 a 2018 analysis of long-term rate of investment return and inflation assumptions, GRS suggested that an investment return assumption in the range of 6.64% to 7.56% would be reasonable. Please see our draft letter dated September 17, 2018 for additional information. The current assumed rate, which is mandated by Minnesota Statutes, is 7.5% and is at the upper end of the reasonable range. This report also concluded that the probability of exceeding the current 7.5% assumption over 20 years is only 39%. If capital market assumptions decline further from present levels, the 7.5% return assumption might not comply with actuarial standards for the July 1, 2019 valuation. For informational purposes, results based on a 6.5% discount rate are shown on page 5.

The valuation assumed the continuing ability of the plan sponsor to make the contributions necessary to fund this plan. A determination regarding whether or not the plan sponsor is actually able to do so is outside our scope of expertise and was not performed.

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 6 through 9, 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 findings in this report are based on data and other information through June 30, 2018. 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).

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 Judges Retirement Fund as of the valuation date according to 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 7.50%), it is expected that:

(1) The normal cost of the plan is expected to remain approximately level as a percent of pay,
(2) The funded status of the plan is expected to gradually improve and is expected to be 100% funded in approximately 30 years, and
(3) The unfunded liability will grow initially as a dollar amount before beginning to decline.

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.

Contents

Summary of Valuation Results

Contributions

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

	Actuarial Valuation as of	
Total Contributions	**July 1, 2018**	**July 1, 2017**
Statutory Contributions - Chapter 490* (% of Payroll)	42.54%	42.93%
Required Contributions - Chapter 356 (% of Payroll)	42.94%	44.90%
Sufficiency / (Deficiency)	(0.40)%	(1.97)%

The contribution sufficiency/(deficiency) improved from a deficiency of (1.97)% of payroll to a deficiency of (0.40)% of payroll. The primary reason for the change in contribution sufficiency/(deficiency) was the extension in the statutory amortization period, from a closed period ending June 30, 2039 to a closed period ending June 30, 2048, which was partially offset by the change in assumptions, described in the Effects of Changes section. On a market value of assets basis, contributions are sufficient by 0.10% of payroll.

Based on the actuarial value of assets, statutory contribution rates, and actuarial assumptions described in this report, statutory contributions are expected to bring the plan to full funding in approximately 30 to 35 years.

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 10.3% for the plan year ending June 30, 2018. The AVA earned approximately 9.4% for the plan year ending June 30, 2018 as compared to the assumed rate of 8.00%. The assumed rate is mandated by Minnesota Statutes, and was recently lowered to 7.50%.

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 November 29, 2018.

** Statutory contributions reflect the fact that member contributions for Judges at the maximum benefit level are directed to the Unclassified Employees Retirement Plan. If these contributions were not directed to the Unclassified Employees Retirement Plan, the statutory contribution rate would be 42.91% instead of 42.54% as of July 1, 2018 and 43.30% instead of 42.93% as of July 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.

	Actuarial Valuation as of	
	July 1, 2018	**July 1, 2017**
Contributions (*% of Payroll*)		
Statutory - Chapter 490*	42.54%	42.93%
Required - Chapter 356	42.94%	44.90%
Sufficiency / (Deficiency)	(0.40)%	(1.97)%
Funding Ratios (*dollars in thousands*)		
Assets		
- Current assets (AVA)	$ 197,852	$183,361
- Current assets (MVA)	$ 201,755	$185,141
Accrued Benefit Funding Ratio		
- Current benefit obligations	$ 364,332	$335,811
- Funding ratio (AVA)	54.31%	54.60%
- Funding ratio (MVA)	55.38%	55.13%
Accrued Liability Funding Ratio		
- Actuarial accrued liability	$ 377,925	$348,976
- Funding ratio (AVA)	52.35%	52.54%
- Funding ratio (MVA)	53.38%	53.05%
Projected Benefit Funding Ratio		
- Current and expected future assets	$ 442,655	$396,652
- Current and expected future benefit obligations	$ 445,788	$409,304
- Projected benefit funding ratio (AVA)	99.30%	96.91%
Participant Data		
Active Members		
- Number	317	317
- Annual valuation earnings *(000s)*	$ 48,608	$47,634
- Projected annual earnings *(000s)*	$ 49,824	$48,944
- Average projected annual earnings	$ 157,174	$154,397
- Average age	56.4	57.0
- Average service	9.5	10.1
Service Retirements	272	255
Survivors	81	80
Disability Retirements	16	16
Deferred Retirements	15	15
Terminated other Non-Vested	0	0
Total	**701**	**683**

** Statutory contributions reflect the fact that member contributions for Judges at the maximum benefit level are directed to the Unclassified Employees Retirement Plan. If these contributions were not directed to the Unclassified Employees Retirement Plan, the statutory contribution rate would be 42.91% instead of 42.54% as of July 1, 2018 and 43.30% instead of 42.93% as of July 1, 2017.*

Summary of Valuation Results

Effects of Changes

The following changes in plan provisions, actuarial assumptions, and methods were recognized as of July 1, 2018:

- The investment return assumption was lowered from 8.00% to 7.50%.
- The assumed rate of inflation was lowered from 2.75% to 2.50%.
- The assumed payroll growth assumption was lowered from 2.75% to 2.50%.
- The assumed salary increase rate was lowered from 2.75% to 2.50%.
- The assumed benefit increase was changed from 1.75% per year through 2032, 2.00% per year from 2033 to 2044 and 2.50% thereafter to 1.75% per year through 2037, 2.00% per year from 2038 to 2051 and 2.50% thereafter.
- The amortization period was reset to 30 years, ending in 2048.
- Interest credited on member contributions will decrease from 4.0% to 3.0%, beginning July 1, 2018.
- An end date of July 1, 2048 was added for the $6 million State contribution.

The combined impact of the above changes was to increase the accrued liability by $15.1 million and decrease the required contribution by 1.6% of pay, as follows:

	Before Changes	Reflecting Plan Provision Changes	Reflecting Plan Provision and Actuarial Assumption Changes	Reflecting Plan Provision, Actuarial Assumption, and Amortization Changes
Normal Cost Rate, % of Pay	18.6%	18.6%	19.8%	19.8%
Amortization of UAAL*, % of Pay	25.8%	25.8%	27.7%	23.0%
Expenses (% of Pay)	0.1%	0.1%	0.1%	0.1%
Total Required Contribution, % of Pay	44.5%	44.5%	47.6%	42.9%
Accrued Liability Funding Ratio	54.5%	54.5%	52.4%	52.4%
Projected Benefit Funding Ratio	97.0%	97.0%	92.6%	99.3%
UAAL* (in millions)	$165.0	$165.0	$180.1	$180.1

**Unfunded Actuarial Accrued Liability.*

Refer to the Actuarial Basis section of this report for a complete description of these changes.

Summary of Valuation Results

Valuation of Future Annual Post-Retirement Benefit Increases

Benefit recipients receive a future annual compounding 1.75% post-retirement benefit increase. If the accrued liability funding ratio (determined on a market value of assets basis), reaches or exceeds 70% (based on a 2.00% post-retirement benefit increase assumption) for two consecutive years, the benefit increase will revert to 2.00%. Similarly, 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%.

Minnesota Statutes were revised in 2014 to establish a process for establishing a post-retirement benefit increase assumption for each valuation. If the plan has not yet reached the accrued liability funding ratio threshold required to pay a 2.00% or 2.50% benefit increase, a projection must be performed to determine the expected attainment of the threshold, and the expected change to a 2.00% or 2.50% benefit increase rate must be reflected in the liability calculations.

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

- Future investment returns of 7.50%;
- 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 1.75% per year until the accrued liability funding ratio threshold (determined on a market value of assets basis) required to pay a 2.00% post-retirement benefit increase is reached and is assumed to be 2.00% per year until the 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).

Based on these assumptions and methods, the projection indicates this plan is expected to attain the accrued liability funding ratio threshold to pay the 2.00% benefit increase in the year 2037 and the plan would begin paying 2.00% benefit increases on January 1, 2038. Similarly, the projection indicates this plan is expected to attain the accrued liability funding ratio threshold to pay the 2.50% benefit increase in the year 2051 and the plan would begin paying 2.50% benefit increases on January 1, 2052. 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' valuations. Per the LCPR's requirement, we have calculated the liabilities associated with the following scenarios:

1) 6.5% interest rate assumption
2) 8.5% interest rate assumption
3) 1.75% post-retirement benefit increase for all future years
4) 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 8.5% interest rate assumption would not comply with Actuarial Standards of Practice.

$ in millions	Final Valuation Assumptions	Final Valuation Assumptions with 6.5% interest	Final Valuation Assumptions with 8.5% interest	Final Valuation Assumptions with 1.75% COLA for all future years	Final Valuation Assumptions with 2.5% COLA for all future years
Normal Cost Rate, % of Pay	19.8%	24.0%	16.5%	19.6%	21.0%
Amortization of Unfunded Accrued Liability, % of Pay	23.0%	25.0%	20.8%	22.8%	26.0%
Expenses (% of Pay)	0.1%	0.1%	0.1%	0.1%	0.1%
Total Required Contribution, % of Pay	42.9%	49.1%	37.4%	42.5%	47.1%
Contribution Sufficiency/(Deficiency), % of Pay	(0.4)%	(6.6)%	5.1 %	0.0 %	(4.6)%
Accrued Liability Funding Ratio	52.4%	47.5%	57.4%	52.5%	49.3%
Present Value of Projected Benefits	$445.8	$504.3	$397.8	$443.4	$472.9
Present Value of Future Normal Costs	$67.9	$87.7	$53.0	$66.7	$71.5
Actuarial Accrued Liability	$377.9	$416.6	$344.8	$376.7	$401.4
Unfunded Accrued Liability	$180.1	$218.7	$147.0	$178.8	$203.6

Summary of Valuation Results

Risks Associated with the Measuring the Accrued Liability and Actuarially Determined Contribution

The determination of the accrued liability and the actuarially determined contribution requires the use of assumptions regarding future economic and demographic experience. Risk measures, as illustrated in this report, are intended to aid in the understanding of the effects of future experience differing from the assumptions used in the course of the actuarial valuation. Risk measures may also help with illustrating the potential volatility in the accrued liability and the actuarially determined contribution that result from the differences between actual experience and the actuarial assumptions.

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 due to changing conditions; 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. The scope of an actuarial valuation does not include an analysis of the potential range of such future measurements.

Examples of risk that may reasonably be anticipated to significantly affect the plan's future financial condition include:

1. Investment risk – actual investment returns may differ from the expected returns;
2. Asset/Liability mismatch – changes in asset values may not match changes in liabilities, thereby altering the gap between the accrued liability and assets and consequently altering the funded status and contribution requirements;
3. Contribution risk – actual contributions may differ from expected future contributions. For example, actual contributions may not be made in accordance with the plan's funding policy or material changes may occur in the anticipated number of covered employees, covered payroll, or other relevant contribution base;
4. Salary and Payroll risk – actual salaries and total payroll may differ from expected, resulting in actual future accrued liability and contributions differing from expected;
5. Longevity risk – members may live longer or shorter than expected and receive pensions for a period of time other than assumed;
6. Other demographic risks – members may terminate, retire or become disabled at times or with benefits other than assumed resulting in actual future accrued liability and contributions differing from expected.

The effects of certain trends in experience can generally be anticipated. For example if the investment return since the most recent actuarial valuation is less (or more) than the assumed rate, the cost of the plan can be expected to increase (or decrease). Likewise if longevity is improving (or worsening), increases (or decreases) in cost can be anticipated.

Summary of Valuation Results

The Required Contribution rate shown on page 1 may be considered as a minimum contribution rate that complies with Minnesota Statutes and the requirements of the Standards for Actuarial Work published by the LCPR. The timely receipt of the actuarially determined contributions is critical to support the financial health of the plan. Users of this report should be aware that contributions made at the actuarially determined rate do not necessarily guarantee benefit security.

Plan Maturity Measures

Risks facing a pension plan evolve over time. A young plan with virtually no investments and paying few benefits may experience little investment risk. An older plan with a large number of members in pay status and a significant trust may be much more exposed to investment risk. Generally accepted plan maturity measures and values for the Judges Retirement Fund for the last two years include the following. Additional maturity measures are shown on the following pages.

	2018	2017
Ratio of market value of assets to total payroll	4.12	3.87
Ratio of actuarial accrued liability to total payroll	7.71	7.30
Ratio of actives to retirees and beneficiaries	0.86	0.90
Ratio of net cash flow to market value of assets	-1.3%	-3.0%
Approximate modified duration* of:		
▪ Total projected benefits:	11.94	11.59
▪ Actuarial accrued liability:	9.49	9.26

* *Approximate modified duration of total projected benefits based on 7.5% interest for 2018 and 8.0% interest for 2017*

Ratio of Market Value of Assets to Payroll

The relationship between assets and payroll is a useful indicator of the potential volatility of contributions. For example, if the market value of assets is 5.0 times the payroll, a return on assets 5% different than assumed would equal 25% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in plan sponsor contributions as a percentage of payroll.

Ratio of Actuarial Accrued Liability to Payroll

The relationship between actuarial accrued liability and payroll is a useful indicator of the potential volatility of contributions for a fully funded plan. A funding policy that targets a funded ratio of 100% is expected to result in the ratio of assets to payroll and the ratio of liability to payroll converging over time.

The ratio of liability to payroll may also be used as a measure of sensitivity of contribution rates to liability gains and losses. For example, if the actuarial accrued liability is 5.0 times the payroll, a change in liability 2% other than assumed would equal 10% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in liability (and also plan sponsor contributions) as a percentage of payroll.

Summary of Valuation Results

Ratio of Actives to Retirees and Beneficiaries

A young plan with many active members and few retirees will have a high ratio of active to retirees. A mature open plan may have close to the same number of actives to retirees resulting in a ratio near 1.0. A super-mature or closed plan may have significantly more retirees than actives resulting in a ratio below 1.0.

Ratio of Net Cash Flow to Market Value of Assets

A positive net cash flow means contributions exceed benefits and expenses. A negative cash flow means existing funds are being used to make payments. A certain amount of negative net cash flow is generally expected to occur when benefits are prefunded through a qualified trust. Large negative net cash flows as a percent of assets may indicate a super-mature plan or a need for additional contributions.

Duration of Actuarial Accrued Liability

The duration may be used to approximate the sensitivity of the accrued liability to a small change in the assumed rate of return. For example, a duration of 10 indicates that the liability would change by approximately 10% if the assumed rate of return were changed by 1% (i.e., from 7.5% to 6.5%).

Additional Risk Assessment

Additional risk assessment is outside the scope of the annual actuarial valuation but could aid stakeholders in an understanding of the risks to which the System is exposed. Additional assessment may include scenario tests, sensitivity tests, stochastic modeling, stress tests, and a comparison of the present value of accrued benefits at low-risk discount rates with the actuarial accrued liability.

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	$ 240,579	$ 126,201	$ 114,378	$ 39,291	52.5%	$ 135,184	56.2%	612.3%	321.2%
2011	$ 248,630	$ 148,504	$ 100,126	$ 40,473	59.7%	$ 141,762	57.0%	614.3%	366.9%
2012	$ 281,576	$ 144,086	$ 137,490	$ 38,644	51.2%	$ 169,262	60.1%	728.6%	372.9%
2013	$ 284,513	$ 155,398	$ 129,115	$ 39,888	54.6%	$ 180,641	63.5%	713.3%	389.6%
2014	$ 298,233	$ 175,556	$ 122,677	$ 41,893	58.9%	$ 190,570	63.9%	711.9%	419.1%
2015	$ 315,633	$ 174,580	$ 141,053	$ 43,449	55.3%	$ 205,115	65.0%	726.4%	401.8%
2016	$ 331,334	$ 165,905	$ 165,429	$ 45,418	50.1%	$ 211,594	63.9%	729.5%	365.3%
2017	$ 348,976	$ 185,141	$ 163,835	$ 47,813	53.1%	$ 219,587	62.9%	729.9%	387.2%
2018	$ 377,925	$ 201,755	$ 176,170	$ 49,009	53.4%	$ 246,060	65.1%	771.1%	411.7%

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	(17) SBI 10-year Trailing Average
2010			291.1%	$ (5,828)	-4.6%	15.2%	3.4%	N/A
2011			247.4%	$ (6,341)	-4.3%	23.3%	5.3%	N/A
2012			355.8%	$ (7,759)	-5.4%	2.4%	2.3%	N/A
2013			323.7%	$ (8,631)	-5.6%	14.2%	6.2%	N/A
2014			292.8%	$ (7,853)	-4.5%	18.6%	14.5%	N/A
2015	14.1%	56.7%	324.6%	$ (8,548)	-4.9%	4.4%	12.3%	N/A
2016	14.1%	51.5%	364.2%	$ (8,489)	-5.1%	-0.1%	7.7%	N/A
2018	14.1%	54.6%	342.7%	$ (5,493)	-3.0%	15.1%	10.2%	6.2%
2018	14.1%	58.0%	359.5%	$ (2,651)	-1.3%	10.3%	12.4%	7.9%

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) (16) and (17). Investment return is probably the largest single risk that most systems face. The year by year return and the 5-year and 10-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, and historical averages are very sensitive to the time period chosen. 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 provided by 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 and contributions 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, 2018	Market Value June 30, 2017
Cash, equivalents, short term securities	$ 3,458	$ 6,245
Fixed income	31,429	35,579
Equity	166,741	143,214
Other*	20,161	18,943
Total cash, investments, and other assets	**$ 221,789**	**$ 203,981**
Amounts Receivable	241	236
Total Assets	**$ 222,030**	**$ 204,217**
Amounts Payable*	(20,275)	(19,076)
Net Position Restricted for Pensions	**$ 201,755**	**$ 185,141**

** Includes $20,161 in Securities Lending Collateral as of June 30, 2018 and $18,943 as of June 30, 2017.*

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	**Market Value**	
Year Ending	**June 30, 2018**	**June 30, 2017**
1. Fund balance at market value at beginning of year	**$ 185,141**	**$ 165,905**
2. Contributions		
a. Member	3,973	3,932
b. Employer	11,027	10,758
c. Other sources	6,000	3,000
d. Total contributions	$ 21,000	$ 17,690
3. Investment income		
a. Investment income/(loss)	19,477	24,921
b. Investment expenses	(212)	(192)
c. Net investment income/(loss)	$ 19,265	$ 24,729
4. Other	-	-
5. Total income: *(2.d.) + (3.c.) + (4.)*	**$ 40,265**	**$ 42,419**
6. Benefits Paid		
a. Annuity benefits	(23,585)	(22,785)
b. Refunds	-	(309)
c. Total benefits paid	$ (23,585)	$ (23,094)
7. Expenses		
a. Other	-	-
b. Administrative	(66)	(89)
c. Total expenses	$ (66)	$ (89)
8. Total disbursements: *(6.c.) + (7.c.)*	**$ (23,651)**	**$ (23,183)**
9. Fund balance at market value at end of year: *(1.) + (5.) + (8.)*	**$ 201,755**	**$ 185,141**
10. State Board of Investment calculated return on investments	10.3%	15.1%

Plan Assets

Actuarial Asset Value *(Dollars in Thousands)*

	June 30, 2018	June 30, 2017
1. Market value of assets available for benefits	**$ 201,755**	**$ 185,141**
2. Determination of average balance		
a. Total assets available at beginning of year	185,141	165,905
b. Total assets available at end of year	201,755	185,141
c. Net investment income for fiscal year	19,265	24,729
d. Average balance *[a. + b. - c.] / 2*	183,816	163,159
3. Expected return *[8.0% x 2.d.]*	14,705	13,053
4. Actual return	19,265	24,729
5. Current year asset gain/(loss) *[4. - 3.]*	4,560	11,676
6. Unrecognized asset returns		

	Original Amount	Unrecognized Amount %	Unrecognized Amount Dollar	Unrecognized Amount %	Unrecognized Amount Dollar
a. Year ended June 30, 2018	$ 4,560	80%	$ 3,648	N/A	N/A
b. Year ended June 30, 2017	11,676	60%	7,006	80%	$ 9,341
c. Year ended June 30, 2016	(13,813)	40%	(5,525)	60%	(8,288)
d. Year ended June 30, 2015	(6,131)	20%	(1,226)	40%	(2,452)
e. Year ended June 30, 2014	15,893		N/A	20%	3,179
f. Unrecognized return adjustment			**$ 3,903**		**$ 1,780**
7. **Actuarial value at end of year** *(1. - 6.f.)*			**$ 197,852**		**$ 183,361**
8. Approximate return on actuarial value of assets during fiscal year			9.4%		9.6%
9. Ratio of actuarial value of assets to market value of assets			0.98		0.99

Membership Data

Distribution of Active Members (Total)*

	Years of Service as of June 30, 2018									
Age	**<3****	**3 - 4****	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25 - 29**	**30 - 34**	**35+**	**Total**
< 25										
Avg. Earnings										
25 - 29										
Avg. Earnings										
30 - 34										
Avg. Earnings										
35 - 39	4									**4**
Avg. Earnings	$146,710									**$146,710**
40 - 44	10	7	3							**20**
Avg. Earnings	$140,201	$153,345	$153,345							**$146,773**
45 - 49	15	8	13							**36**
Avg. Earnings	$142,610	$153,345	$153,935							**$149,085**
50 - 54	21	10	19	13						**63**
Avg. Earnings	$149,106	$154,346	$152,786	$155,655						**$152,399**
55 - 59	10	7	22	25	10	3				**77**
Avg. Earnings	$153,598	$154,775	$153,345	$156,265	$154,346	$153,345				**$154,586**
60 - 64	2	6	10	14	19	8	2			**61**
Avg. Earnings	$158,350	$153,345	$157,348	$154,988	$157,720	$155,258	$153,595			**$156,164**
65 - 69		2	12	11	15	6	3	2	1	**52**
Avg. Earnings		$153,345	$153,470	$154,739	$155,768	$158,001	$160,018	$153,595	$153,345	**$155,299**
70+ ***			1		1	1	1			**4**
Avg. Earnings			$153,345		$153,345	$153,345	$153,345			**$153,345**
Total	**62**	**40**	**80**	**63**	**45**	**18**	**6**	**2**	**1**	**317**
Avg. Earnings	**$146,966**	**$153,845**	**$153,827**	**$155,589**	**$156,222**	**$155,747**	**$156,765**	**$153,595**	**$153,345**	**$153,339**

* *Includes 13 Tier 1 Judges who have reached the maximum benefit formula (member contributions are directed to the Unclassified Employees Retirement Plan).*

** *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.*

*** *All active Judges are under age 70 as of the valuation date based on actual age (unrounded).*

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 Active Members (Tier 1)*

	Years of Service as of June 30, 2018									
Age	**<3****	**3 - 4****	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25 - 29**	**30 - 34**	**35+**	**Total**
< 25										
Avg. Earnings										
25 - 29										
Avg. Earnings										
30 - 34										
Avg. Earnings										
35 - 39										
Avg. Earnings										
40 - 44			3							**3**
Avg. Earnings			$153,345							**$153,345**
45 - 49			13							**13**
Avg. Earnings			$153,935							**$153,935**
50 - 54			19	13						**32**
Avg. Earnings			$152,786	$155,655						**$153,951**
55 - 59			22	25	10	3				**60**
Avg. Earnings			$153,345	$156,265	$154,346	$153,345				**$154,728**
60 - 64			10	14	19	8	2			**53**
Avg. Earnings			$157,348	$154,988	$157,720	$155,258	$153,595			**$156,401**
65 - 69			12	11	15	6	3	2	1	**50**
Avg. Earnings			$153,470	$154,739	$155,768	$158,001	$160,018	$153,595	$153,345	**$155,377**
70+ ***			1		1	1	1			**4**
Avg. Earnings			$153,345		$153,345	$153,345	$153,345			**$153,345**
Total			**80**	**63**	**45**	**18**	**6**	**2**	**1**	**215**
Avg. Earnings			**$153,827**	**$155,589**	**$156,222**	**$155,747**	**$156,765**	**$153,595**	**$153,345**	**$155,083**

* *Includes 13 Tier 1 Judges who have reached the maximum benefit formula (member contributions are directed to the Unclassified Employees Retirement Plan).*

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

*** *All active Judges are under age 70 as of the valuation date based on actual age (unrounded).*

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 Active Members (Tier 2)

	Years of Service as of June 30, 2018									
Age	**<3***	**3 - 4***	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25 - 29**	**30 - 34**	**35+**	**Total**
< 25										
Avg. Earnings										
25 - 29										
Avg. Earnings										
30 - 34										
Avg. Earnings										
35 - 39	4									**4**
Avg. Earnings	$146,710									**$ 146,710**
40 - 44	10	7								**17**
Avg. Earnings	$140,201	$153,345								**$ 145,613**
45 - 49	15	8								**23**
Avg. Earnings	$142,610	$153,345								**$ 146,344**
50 - 54	21	10								**31**
Avg. Earnings	$149,106	$154,346								**$ 150,796**
55 - 59	10	7								**17**
Avg. Earnings	$153,598	$154,775								**$ 154,082**
60 - 64	2	6								**8**
Avg. Earnings	$158,350	$153,345								**$ 154,596**
65 - 69		2								**2**
Avg. Earnings		$153,345								**$ 153,345**
70+										
Avg. Earnings										
Total	**62**	**40**								**102**
Avg. Earnings	**$146,966**	**$153,845**								**$ 149,664**

* *This exhibit does not reflect service earned in other MSRS 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

	Years Retired as of June 30, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
<50								
Avg. Benefit								
50 - 54								
Avg. Benefit								
55 - 59								
Avg. Benefit								
60 - 64	3	4	1					**8**
Avg. Benefit	$53,451	$51,117	$20,727					**$48,193**
65 - 69	14	22	12	1				**49**
Avg. Benefit	$70,159	$72,521	$63,248	$22,147				**$68,547**
70 - 74	10	41	46	6				**103**
Avg. Benefit	$69,240	$66,734	$72,005	$65,824				**$69,278**
75 - 79		1	22	25	4			**52**
Avg. Benefit		$106,065	$68,823	$71,853	$48,587			**$69,440**
80 - 84			1	9	17			**27**
Avg. Benefit			$85,443	$65,630	$70,806			**$69,623**
85 - 89					7	10	2	**19**
Avg. Benefit					$61,483	$88,631	$76,792	**$77,383**
90+					1	6	7	**14**
Avg. Benefit					$59,470	$71,316	$78,787	**$74,205**
Total	**27**	**68**	**82**	**41**	**29**	**16**	**9**	**272**
Avg. Benefit	**$67,962**	**$68,266**	**$69,409**	**$68,393**	**$65,100**	**$82,138**	**$78,343**	**$69,411**

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

	Years Since Death as of June 30, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
<45								
Avg. Benefit								
45 - 49								
Avg. Benefit								
50 - 54								
Avg. Benefit								
55 - 59								
Avg. Benefit								
60 - 64	1		1	1	1			**4**
Avg. Benefit	$ 34,880		$ 61,800	$ 46,742	$ 32,030			**$ 43,863**
65 - 69		2	4	2		2	1	**11**
Avg. Benefit		$ 45,456	$ 44,657	$ 56,306		$ 52,506	$ 61,026	**$ 49,836**
70 - 74	1	1	3	3	2		2	**12**
Avg. Benefit	$ 41,614	$ 33,035	$ 49,079	$ 45,902	$ 50,345		$ 74,406	**$ 50,758**
75 - 79	1	2	4	1		1		**9**
Avg. Benefit	$ 81,454	$ 41,290	$ 46,987	$ 42,248		$ 52,055		**$ 49,587**
80 - 84	1	3	8			2	1	**15**
Avg. Benefit	$ 43,146	$ 50,243	$ 55,572			$ 73,433	$ 51,168	**$ 55,766**
85 - 89			3	2	2	3	1	**11**
Avg. Benefit			$ 55,739	$ 61,997	$ 31,412	$ 43,532	$ 26,273	**$ 46,446**
90+		3	3	4	5	3	1	**19**
Avg. Benefit		$ 50,327	$ 60,929	$ 46,097	$ 35,504	$ 67,357	$ 61,475	**$ 50,485**
Total	**4**	**11**	**26**	**13**	**10**	**11**	**6**	**81**
Avg. Benefit	**$ 50,274**	**$ 46,203**	**$ 52,700**	**$ 49,822**	**$ 37,306**	**$ 57,873**	**$ 58,126**	**$ 50,440**

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, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
< 45								
Avg. Benefit								
45 - 49								
Avg. Benefit								
50 - 54								
Avg. Benefit								
55 - 59								
Avg. Benefit								
60 - 64								
Avg. Benefit								
65 - 69				2				**2**
Avg. Benefit				$53,940				**$53,940**
70 - 74				6				**6**
Avg. Benefit				$65,757				**$65,757**
75+				3	4	1		**8**
Avg. Benefit				$67,309	$65,207	$119,127		**$72,735**
Total				**11**	**4**	**1**		**16**
Avg. Benefit				**$64,031**	**$65,207**	**$119,127**		**$67,769**

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			
	Actives*	Deferred Retirement	Other Non-Vested	Service Retirement	Disability Retirement	Survivor	Total
Members on 7/1/2017	**317**	**15**	**0**	**255**	**16**	**80**	**683**
New members	27	0	0	0	0	0	**27**
Return to active	0	0	0	0	0	0	**0**
Terminated non-vested	0	0	0	0	0	0	**0**
Service retirements	(26)	(1)	0	27	0	0	**0**
Terminated deferred	(1)	1	0	0	0	0	**0**
Terminated refund/transfer	0	0	0	0	0	0	**0**
Deaths	0	0	0	(10)	0	(3)	**(13)**
New beneficiary	0	0	0	0	0	4	**4**
Disabled	0	0	0	0	0	0	**0**
Unexpected status changes	0	0	0	0	0	0	**0**
Net change	0	0	0	17	0	1	**18**
Members on 6/30/2018	**317**	**15**	**0**	**272**	**16**	**81**	**701**

Terminated Member Statistics	Deferred Retirement	Other Non-Vested	Total
Number	15	0	15
Average age	58.5	N/A	58.5
Average service	9.8	N/A	9.8
Average annual benefit at Normal Retirement Date	$ 39,907	N/A	$ 39,907
Average refund value	$ 171,552	N/A	$ 171,552

* *Includes active Judges who have reached the maximum benefit formula (employee contributions are directed to the Unclassified Employees Retirement Plan).*

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 42.54% 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.

				June 30, 2018
A. Actuarial Value of Assets				$ 197,852
B. Expected Future Assets				
1. Present value of expected future statutory supplemental contributions*				176,940
2. Present value of future normal cost contributions				67,863
3. Total expected future assets: *(1.) + (2.)*				$ 244,803
C. Total Current and Expected Future Assets				442,655
D. Current Benefit Obligations**				
1. Benefit recipients	**Non-Vested**	**Vested**	**Total**	
a. Service retirements	$ -	$ 202,205	$ 202,205	
b. Disability retirements	-	11,573	11,573	
c. Survivors	-	32,282	32,282	
2. Deferred retirements	-	4,639	4,639	
3. Former members without vested rights***	-	-	-	
4. Active members	3,262	110,371	113,633	
5. Total current benefit obligations	$ 3,262	$ 361,070	$ 364,332	
E. Expected Future Benefit Obligations				81,456
F. Total Current and Expected Future Benefit Obligations****				445,788
G. Unfunded Current Benefit Obligations: *(D.5.) - (A.)*				166,480
H. Unfunded Current and Future Benefit Obligations: *(F.) - (C.)*				3,133
I. Accrued Benefit Funding Ratio: *(A.)/(D.5.)*				54.31%
J. Projected Benefit Funding Ratio: *(C.)/(F.)*				99.30%

* *Per the LCPR Standards for Actuarial Work, calculated assuming the current contribution toward the unfunded liability continues for the entire amortization period. Based on a blended Tier 1 and Tier 2 member contribution rate and normal cost.*

** *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	$ 186,768	$ 62,934	$ 123,834
b. Disability benefits	3,961	2,481	1,480
c. Survivor's benefits	4,167	2,363	1,804
d. Deferred retirements	-	-	-
e. Refunds*	193	85	108
f. Total	$ 195,089	$ 67,863	$ 127,226
2. Deferred retirements	4,639	-	4,639
3. Former members without vested rights	-	-	-
4. Benefit recipients	246,060	-	246,060
5. Total	$ 445,788	$ 67,863	$ 377,925
B. Determination of Unfunded Actuarial Accrued Liability (UAAL)			
1. Actuarial accrued liability			$ 377,925
2. Current assets (AVA)			197,852
3. Unfunded actuarial accrued liability			$ 180,073
C. Determination of Supplemental Contribution Rate**			
1. Present value of future payrolls through the amortization date of June 30, 2048			$ 783,614
2. Supplemental contribution rate: *(B.3.) / (C.1.)*			22.98% ***

* *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, 2018 is 15.72764.*

Development of Costs

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

	Year Ending June 30, 2018		
	Actuarial Accrued Liability	Current Assets	Unfunded Actuarial Accrued Liability
A. At beginning of year	$ 348,976	$ 183,361	$ 165,615
B. Changes due to interest requirements and current rate of funding			
1. Normal cost and expenses	9,342	-	9,342
2. Benefit payments	(23,585)	(23,585)	-
3. Contributions	-	21,000	(21,000)
4. Interest on A., B.1., B.2., and B.3.	27,348	14,565	12,783
5. Total *(B.1. + B.2. + B.3. + B.4.)*	$ 13,105	$ 11,980	$ 1,125
C. Expected unfunded actuarial accrued liability at end of year *(A. + B.5.)*	$ 362,081	$ 195,341	$ 166,740
D. Increase (decrease) due to actuarial losses (gains) because of experience deviations from expected			
1. Age and service retirements			1,197
2. Disability retirements			(122)
3. Death-in-service benefits			(78)
4. Withdrawals			(97)
5. Salary increases			(163)
6. Investment income			(2,511)
7. Mortality of annuitants			207
8. Other items			(203)
9. Total			$ (1,770)
E. Unfunded actuarial accrued liability at end of year before plan amendments and changes in actuarial assumptions *(C. + D.9.)*			$ 164,970
F. Change in unfunded actuarial accrued liability due to changes in plan provisions			(2)
G. Change in unfunded actuarial accrued liability due to changes in actuarial assumptions			15,105
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.)**			$ 180,073

** The unfunded actuarial accrued liability on a market value of assets basis is $176,170.*

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 490		
1. Employee contributions*	8.00%	$ 3,986
2. Employer contributions	22.50%	11,210
3. State contributions****	12.04%	6,000
4. Total	42.54%	$ 21,196
B. Required contributions - Chapter 356		
1. Normal cost		
a. Retirement benefits	18.38%	$ 9,158
b. Disability benefits	0.70%	349
c. Survivors	0.72%	359
d. Deferred retirement benefits	0.00%	-
e. Refunds**	0.03%	15
f. Total	19.83%	$ 9,881
2. Supplemental contribution amortization of Unfunded	22.98%	$ 11,450
3. Allowance for expenses	0.13%	65
4. Total	42.94% ***	$ 21,396
C. Contribution Sufficiency/(Deficiency) *(A.3. - B.4.)*	(0.40)%	$ (200)

Note: Projected annual payroll for fiscal year beginning on the valuation date: $49,824 (based on methods prescribed in the LCPR Standards for Actuarial Work).

* *For Tier I Judges who have reached the maximum benefit amount, member contributions equal to 9% of pay are directed to the Unclassified Employees Retirement Plan. The member contribution amount of $3,986 shown above is equal to 9% of a Tier 1 payroll amount of $32,111 (which excludes the payroll for Tier 1 Judges at the maximum level) and 7.00% of a Tier 2 payroll amount of $15,648 for Tier 2 Judges.*

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

*** *The required contribution on a market value of assets basis is 42.44% of payroll.*

**** *$6,000,000 per year until the plan is fully funded or July 1, 2048, if earlier.*

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. An actuarial cost method is a set of techniques used by the actuary to develop contribution levels under a retirement plan. The actuarial cost method used in this valuation for all purposes is the Entry Age Actuarial Cost Method. 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 2.00% or 2.50% benefit increase, Minnesota Statutes require the 2.00% or 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 2.00% or 2.50% benefit increase, Minnesota Statutes require a projection to be performed to determine the expected attainment of the accrued liability funding ratio thresholds, and the expected payment of 2.00% or 2.50% benefit increases 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; and
- 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, 2048 assuming payroll increases of 2.50% 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.

As required by the Standards for Actuarial Work, projected payroll is 1) determined by increasing reported payroll for each member by one full year's assumed pay increase according to the actuarial salary scale and 2) multiplied by 0.962 in the determination of the present value of future payroll to account for timing differences.

Changes in Methods since Prior Valuation

The amortization period was reset to 30 years, ending in 2048.

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, and a review of inflation and investment return assumptions, dated September 11, 2017.

Investment return	7.50% per annum.
Benefit increases after retirement	1.75% per annum through 2037, 2.00% per annum from 2038 to 2051, and 2.50% per annum thereafter.
Salary increases	2.50% per year.
Payroll growth	2.50% per year.
Inflation	2.50% per year.
Mortality rates	
Healthy pre-retirement	RP-2014 employee generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2006, white collar adjustment.
Healthy post-retirement	RP-2014 annuitant generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2006, white collar adjustment.
Disabled	RP-2014 annuitant generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2006, white collar adjustment.
Notes	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.
Retirement	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.
Withdrawal	None.
Disability	Age-related rates based on experience; see table of sample rates.
Administrative expenses	Prior year administrative expenses expressed as percentage of prior year projected payroll.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Refund of contributions	Account balances for deferred members accumulate interest until normal retirement date and are discounted back to the valuation date.
Commencement of deferred benefits	Members receiving deferred annuities (including current terminated deferred members) are assumed to begin receiving benefits at age 65.
Percentage married	Marital status as indicated by data.
Age of spouse	Females are assumed to be three years younger than their male spouses.
Form of payment	Members are assumed to elect a life annuity.
Allowance for Combined Service Annuity	None.
Eligibility testing	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
Decrement operation	Decrements are assumed to occur mid-fiscal year.
Service credit accruals	It is assumed that members accrue one year of service credit per year.
Pay increases	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.
Unknown data for certain members	To prepare this report, GRS has used and relied on participant data supplied by the Fund. 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. There were no members reported with missing or invalid birth dates or gender. In cases where submitted data was missing or incomplete, the following assumptions, based on average results for applicable members at the time of the last experience study, were applied: <u>Data for active members</u>: There were 13 members who have reached the 24 year service cap. These members are reflected as active members in this valuation. We assumed these members earned the greater of the salary reported under the Unclassified Employees Retirement Plan or $153,345 for the July 1, 2017 to June 30, 2018 plan year. There were no members reported with missing service. <u>Data for terminated members</u>: There were no members reported without a benefit.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Unknown data for certain members – (Concluded)	Data for members receiving benefits: There were no members reported without a benefit. There were three retirees reported with a survivor option and a survivor date of death. We assumed no benefit was payable to the survivor and the member benefit already reflected the increase to the life annuity value (i.e., "bounce back"), if applicable. There were no retirees reported with a bounceback annuity and an unreasonable reduction factor. There were retired members reported with a survivor option and an invalid or missing survivor gender (41 members) and/or survivor date of birth (33 members). We used the valuation assumptions if the survivor gender or date of birth was missing or invalid. There were no survivors reported on the data file with an expired benefit.
Changes in actuarial assumptions	The assumed investment return was lowered from 8.0% to 7.5%. The assumed rate of inflation decreased from 2.75% to 2.50%. The assumed payroll growth rate decreased from 2.75% to 2.50%. The assumed salary increase rate decreased from 2.75% to 2.50%. The assumed benefit increase was changed from 1.75% per year through 2032, 2.00% per year from 2033 to 2044 and 2.50% thereafter to 1.75% per year through 2037, 2.00% per year from 2038 to 2051 and 2.50% thereafter.

Actuarial Basis

Summary of Actuarial Assumptions (Concluded)

Age in 2018	Percentage of Members Dying each Year*					
	Healthy Post-Retirement Mortality**		Healthy Pre-Retirement Mortality**		Disability Mortality**	
	Male	Female	Male	Female	Male	Female
20	0.02%	0.01%	0.02%	0.01%	0.02%	0.01%
25	0.03	0.02	0.03	0.01	0.03	0.02
30	0.05	0.05	0.03	0.02	0.05	0.05
35	0.08	0.08	0.03	0.03	0.08	0.08
40	0.11	0.12	0.04	0.03	0.11	0.12
45	0.16	0.14	0.06	0.05	0.16	0.14
50	0.25	0.19	0.11	0.09	0.25	0.19
55	0.37	0.27	0.18	0.14	0.37	0.27
60	0.51	0.39	0.32	0.21	0.51	0.39
65	0.73	0.63	0.56	0.30	0.73	0.63
70	1.20	1.02	0.99	0.52	1.20	1.02
75	2.09	1.72	1.79	0.93	2.09	1.72
80	3.70	3.04	3.20	1.65	3.70	3.04
85	6.82	5.57	6.66	4.41	6.82	5.57
90	12.49	10.16	12.64	9.84	12.49	10.16

* *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	Percentage of Eligible Members Retiring each Year			
	Disability Retirement			
	Male	Female	Age	Retirement
20	0.00%	0.00%	60	0%
25	0.00	0.00	61	0
30	0.00	0.00	62	8
35	0.00	0.00	63	8
40	0.01	0.01	64	5
45	0.03	0.03	65	20
50	0.05	0.05	66	23
55	0.12	0.12	67	23
60	0.31	0.31	68	20
65	0.00	0.00	69	20
70	0.00	0.00	70	100

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.

Plan year	July 1 through June 30.
Eligibility	A judge or justice of any court. If the member was active prior to January 1, 1974, benefits may be computed according to provisions of the prior plan.
Tier 1 / Tier 2 member	Tier 1 includes judges or justices first appointed or elected before July 1, 2013, and Tier 2 includes judges or justices first appointed or elected after June 30, 2013. A judge or justice with less than five years of service as of December 30, 2013, may make a one-time irrevocable election into Tier 2. For the purpose of this valuation, we have assumed no Tier 1 members elected Tier 2 benefits as of the valuation date.
Contributions	
Member	9.00% of salary for Tier 1 members, 7.00% of salary for Tier 2 members. Tier 1 member contributions after maximum benefit is reached are redirected to the Unclassified Employees Retirement Plan.
Employer	22.50% of salary. Member contributions are "picked up" according to the provisions of Internal Revenue Code 414(h).
State contributions	$6,000,000 per year until the earlier of 1) the year after the plan reaches full funding, and 2) July 1, 2048.
Allowable service	Service as a judge. Credit may also be earned for uncredited judicial service if the appropriate employee contributions, with interest, are made.
Salary	Salary set by law.
Average salary	Average of the five highest years of salary of the last 10 years prior to termination of judicial service.

Actuarial Basis

Summary of Plan Provisions (Continued)

Retirement	
Normal retirement benefit	
Age/Service requirement	First appointed as a judge before July 1, 2013 (Tier 1): (a.) Age 65 and five years of Allowable Service (b.) Age 70 (mandatory retirement age) First appointed as a judge after June 30, 2013 (Tier 2): (a.) Age 66 and five years of Allowable Service (b.) Age 70 (mandatory retirement age) Judges appointed before July 1, 2013, with less than five years of allowable service on or before December 31, 2013, may make a one-time election for the Tier 2 benefit package.
Amount	First appointed as a judge before July 1, 2013 (Tier 1): 2.70% of Average Salary for each year of Allowable Service prior to July 1, 1980, and 3.20% of Average Salary for each year of Allowable Service after June 30, 1980. Maximum benefit equal to 76.80% of Average Salary. First appointed as a judge after June 30, 2013 (Tier 2): 2.50% of Average Salary for each year of Allowable Service. Tier 1 who elected into Tier 2: 3.20% of Average Salary for each year of Allowable Service prior to January 1, 2014, plus 2.50% of Average Salary for each year of Allowable Service after December 31, 2013.
Early retirement	
Age/Service requirement	Age 60 and five years of Allowable Service.
Amount	Normal Retirement Benefit based on Allowable Service and Average Salary at retirement date with reduction of 0.50% for each month the member is under Normal Retirement Age at time of retirement.
Form of payment	Life annuity. Actuarially equivalent options are: (a.) 50%,75% or 100% joint and survivor with no bounce back feature (b.) 50%, 75% or 100% with bounce back feature (c.) 15-year certain and life thereafter
Benefit increases	Since January 1, 2014, benefit recipients receive annual 1.75% benefit increases. If the accrued liability funding ratio reaches or exceeds 70% for two consecutive years (on a Market Value of Assets basis), the benefit increase will revert to 2.00%. If the accrued liability funding ratio reaches or exceeds 90% for two consecutive years (on a Market Value of Assets basis), the benefit increase will revert to 2.50%.

Actuarial Basis

Summary of Plan Provisions (Continued)

Benefit increases (Continued)	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.
Disability	
Disability benefit	
Age/Service requirement	Permanent inability to perform the function of judge.
Amount	No benefit is paid by the Fund. Instead salary is continued for one year but not beyond age 70. Employee contributions continue and Allowable Service is earned. If disability continues after the first year (or at age 70 if earlier), the larger of 25.00% of Average Salary or the Normal Retirement Benefit, without reduction.
Retirement after disability	
Age/Service requirement	Member is still disabled after salary payments cease after one year or at age 70, if earlier.
Amount	No change in disability benefit amount from pre-retirement computed benefit amount.
Form of payment	Same as for retirement.
Benefit increases	Same as for retirement.
Death	
Survivor's benefit	
Age/service requirement	Active or disabled member dies before retirement or a former member eligible for a deferred annuity dies.
Amount	Larger of 25% of Average Salary or 60% of Normal Retirement Benefit earned at date of death. If member dies after age 60 with five or more years of service, spouse may receive the 100% joint and survivor benefit the member had earned as of date of death. Benefit paid to spouse for life. If no spouse, benefit is paid to surviving dependent children until child marries, dies, or attains age 18 (age 22 if full-time student).
Benefit increases	Same as for retirement.
Refund of contributions	
Age/service requirement	Member dies prior to retirement or former member eligible for a deferred annuity dies and survivors' benefits are not payable.
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. Beginning July 1, 2018, a member's contributions increase at 3.00% interest compounded daily.

Actuarial Basis

Summary of Plan Provisions (Concluded)

Termination	
Refund of contributions	
Age/Service requirement	Termination of service as a judge.
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. Beginning July 1, 2018, a member's contributions increase at 3.00% interest compounded daily. If a member is vested, a deferred annuity may be elected in lieu of a refund.
Deferred benefit	
Age/service requirement	Five years of Allowable Service.
Amount	Benefit computed under law in effect at termination. Amount is payable at normal or early retirement. If a member terminated employment prior to July 1, 1997 but was not eligible to commence their pension before July 1, 1997, an actuarial increase shall be made for the change in the post-retirement interest rates from 5.00% to 6.00%.
Form of payment	Same as for retirement.
Optional form conversion factors	Actuarially equivalent factors based on RP-2000 for healthy annuitants, white collar adjustment, projected to 2022 using scale AA, set back one year for males and set back two years for females, blended 80% males, and 6.50% interest. The actuarially equivalent factors are currently being updated to reflect changes adopted during the 2018 legislative session.
Combined service annuity	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; and (b.) Average salary is based on the high five consecutive years during their entire service in all covered plans.
Changes in plan provisions	Interest accrued on member contributions will decrease from 4.0% to 3.0%, beginning July 1, 2018. An end date of July 1, 2048 was added for the $6 million state contribution.

Additional Schedules

Schedule of Funding Progress[1] *(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	$ 33,559	$ 78,429	$ 44,870	42.79%	$ 18,410	243.73 %
7-1-1992	37,768	83,969	46,201	44.98	22,765	202.95
7-1-1993	44,156	90,509	46,353	48.79	22,084	209.89
7-1-1994	50,428	98,313	47,885	51.29	22,264	215.08
7-1-1995	56,813	102,238	45,425	55.57	22,877	198.56
7-1-1996	64,851	108,150	43,299	59.96	22,421	193.12
7-1-1997	74,681	117,714	43,033	63.44	22,909	187.84
7-1-1998	86,578	130,727	44,149	66.23	24,965	176.84
7-1-1999	97,692	139,649	41,957	69.96	32,940	127.37
7-1-2000	111,113	153,660	42,547	72.31	26,315	161.68
7-1-2001	123,589	165,244	41,655	74.79	28,246	147.47
7-1-2002	131,379	171,921	40,542	76.42	31,078	130.45
7-1-2003	134,142	176,291	42,149	76.09	33,771	124.81
7-1-2004	138,948	190,338	51,390	73.00	34,683	148.17
7-1-2005	144,465	191,414	46,949	75.47	35,941	130.63
7-1-2006	151,850	202,301	50,451	75.06	36,529	138.11
7-1-2007	153,562	214,297	60,735	71.66	36,195	167.80
7-1-2008	147,542	231,623	84,081	63.70	38,296	219.56
7-1-2009	147,120	241,815	94,695	60.84	39,444	240.07
7-1-2010	144,728	240,579	95,851	60.16	39,291	243.95
7-1-2011	145,996	248,630	102,634	58.72	40,473	253.59
7-1-2012	144,898	281,576	136,678	51.46	38,644 [2]	353.69
7-1-2013	144,918	284,513	139,595	50.94	39,888 [2]	349.97
7-1-2014	157,528	298,233	140,705	52.82	41,893 [3]	335.86
7-1-2015	168,235	315,633	147,398	53.30	43,449 [3]	339.24
7-1-2016	172,525	331,334	158,809	52.07	45,418 [3]	349.66
7-1-2017	183,361	348,976	165,615	52.54	47,813 [3]	346.38
7-1-2018	197,852	377,925	180,073	52.35	49,009 [3]	367.43

[1] *Information prior to 2012 provided by prior actuaries. See prior reports for additional detail.*
[2] *Assumed equal to actual employer contribution divided by 20.50%.*
[3] *Assumed equal to actual employer contribution divided by 22.50%.*

Additional Schedules

Schedule of Contributions from the Employer and Other Contributing Entities[1] *(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[2] (e)	Percentage Contributed (e)/(d)
1991	23.59%	$ 18,410	$ 799	$ 3,544	$ -	0.00 %
1992	25.10	22,765	988	4,726	4,722	99.92
1993	26.59	22,084	1,409	4,463	4,845	108.56
1994	26.29	22,264	1,416	4,437	4,912	110.71
1995	28.27	22,877	1,455	5,012	5,162	102.99
1996	27.32	22,421	1,426	4,699	4,972	105.81
1997	27.01	22,909	1,457	4,731	6,632	140.18
1998	27.60	24,965	1,570	5,320	7,129	134.00
1999	27.32	32,940	2,069	6,930	7,051	101.75
2000	26.75	26,315	2,107	4,932	7,298	147.97
2001	24.58	28,246	2,162	4,781	7,793	163.00
2002	26.72	31,078	2,345	5,959	8,369	140.44
2003	26.82	33,771	2,574	6,483	6,923	106.79
2004	26.73	34,683	2,643	6,628	7,110	107.27
2005	29.42	35,941	2,662	7,912	7,225	91.32
2006	29.14	36,529	2,866	7,779	7,336	94.30
2007	30.73	36,195	2,792	8,331	7,572	90.88
2008	33.70	38,296	2,861	10,045	7,936	79.00
2009	30.33	39,444	2,978	8,985	8,219	91.47
2010	31.53	39,291	2,988	9,400	8,283 [3]	88.12
2011	31.66	40,473	3,010	9,804	8,297	84.63 [3]
2012	33.15	38,644 [4]	2,931	9,879	7,922	80.19
2013	41.52	39,888 [4]	3,037	13,524	8,177	60.46
2014	42.42	41,893 [5]	3,578	14,193	9,426	66.41
2015	41.26	43,449 [5]	3,629	14,298	9,776	68.37
2016	42.73	45,418 [5]	3,763	15,644	10,219	65.32
2017	43.34	47,813 [5]	3,932	16,790	13,758	81.94
2018	44.90	49,009 [5]	3,973	18,032	17,027	94.43
2019	42.94	N/A	N/A	N/A	N/A	N/A

[1] *Information prior to 2012 provided by prior actuary. See prior reports for additional detail.*
[2] *Includes contributions from other sources (if applicable).*
[3] *Provided by MSRS instead of prior actuary.*
[4] *Assumed equal to actual employer contribution divided by 20.50%.*
[5] *Assumed equal to actual employer contribution divided by 22.50%.*

Glossary of Terms

Accrued Benefit Funding Ratio	The ratio of assets to Current Benefit Obligations.
Accrued Liability Funding Ratio	The ratio of assets to Actuarial Accrued Liability.
Actuarial Accrued Liability (AAL)	The difference between the Actuarial Present Value of Future Benefits, and the Actuarial Present Value of Future Normal Costs.
Actuarial Assumptions	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.
Actuarial Cost Method	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.
Actuarial Equivalent	Of equal Actuarial Present Value, determined as of a given date and based on a given set of Actuarial Assumptions.
Actuarial Present Value (APV)	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.
Actuarial Present Value of Projected Benefits	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.
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 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).
Actuarial Value of Assets	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)

Amortization Method	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.
Amortization Payment	That portion of the plan contribution or ARC which is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.
Amortization Period	The period used in calculating the Amortization Payment.
Annual Required Contribution (ARC)	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.
Augmentation	Annual increases to deferred benefits.
Closed Amortization Period	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.
Current Benefit Obligations	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).
Employer Normal Cost	The portion of the Normal Cost to be paid by the employer. This is equal to the Normal Cost less expected member contributions.
Expected Assets	The present value of anticipated future contributions intended to fund benefits for current members.
Experience Gain/Loss	A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two actuarial 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.
GASB	Governmental Accounting Standards Board.

Glossary of Terms (Concluded)

GASB Statements No. 25 and No. 27	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.
GASB Statement No. 50	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.
GASB Statements No. 67 and No. 68	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 information prepared according to Statements No. 67 and No. 68 is provided in a separate report beginning with the June 30, 2014 actuarial valuation.
GASB Statement No. 82	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.
Normal Cost	The annual cost assigned, under the Actuarial Cost Method, to the current plan year.
Projected Benefit Funding Ratio	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.
Unfunded Actuarial Accrued Liability	The difference between the Actuarial Accrued Liability and Actuarial Value of Assets.
Valuation Date	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.

Minnesota State Retirement System

Legislators Retirement Fund

Actuarial Valuation Report as of July 1, 2018

GRS Retirement Consulting

P: 800.521.0498 | F: 763.432.5842 | www.grsconsulting.com

December 5, 2018

Minnesota State Retirement System
Legislators Retirement Fund
St. Paul, Minnesota

Dear Board of Directors:

The results of the July 1, 2018 annual actuarial valuation of the Legislators 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, 2018 according to prescribed assumptions. Note that we have not attempted to quantify the impact of GASB Statements No. 67 and No. 68 in this report.

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 Section of this report. MSRS is solely responsible for communicating to GRS any changes required thereto.

The valuation assumed the continuing ability of the plan sponsor to make the contributions necessary to fund this plan. A determination regarding whether or not the plan sponsor is actually able to do so is outside our scope of expertise and was not performed.

The contribution rate in this report is determined using the actuarial assumptions and methods disclosed in the Actuarial Basis of this report. This report does not include a 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 findings in this report are based on data and other information through June 30, 2018. 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.

The Required Contribution rate shown on page 1 may be considered as a minimum contribution rate that complies with Minnesota Statutes and the requirements of the Standards for Actuarial Work published by the LCPR. The timely receipt of the actuarially determined contributions is critical to support the financial health of the plan. Users of this report should be aware that contributions made at the actuarially determined rate do not necessarily guarantee benefit security.

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).

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 Legislators Retirement Fund as of the valuation date according to 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

GRS

CELEBRATING 80 YEARS OF EXCELLENCE 1938-2018

Other Observations

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

Given the plan's pay-as-you-go contribution policy, if there are no changes in benefits or contributions and all actuarial assumptions are met (including the statutory assumption of the plan earning 0.00%), it is expected that:

(1) The funded status of the plan will remain at 0%, and

(2) The fund will be completely dependent upon current contributions to pay benefits.

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 market 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).

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.

Contents

Summary of Valuation Results

Contributions

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

Total Contributions *(dollars in thousands)*	**Actuarial Valuation as of July 1, 2018**	**Actuarial Valuation as of July 1, 2017**
Statutory Contributions* - Chapter 3A	$ 93	$ 73
Required Contributions - Chapter 356	$ 28,007	$ 26,518
Sufficiency / (Deficiency)	$ (27,914)	$ (26,445)

** Active member contributions from the Legislators Retirement Plan are equal to 9% of payroll.*

This plan has been closed to new members since July 1, 1997.

The Minnesota Statutes Chapter 356 Required Contribution shown above represents the estimated annual contribution amount that would be needed for this plan to attain 100% funding by July 1, 2026, based upon the prescribed assumptions. The Required Contribution includes not only the expected benefit payments for the year, but also amounts intended to pre-fund future benefit payments. Actual contributions have been less than the Required Contribution amount since 1999. The funding target identified by Chapter 356 will not be met given the history of actual contributions made to the Fund.

This plan is currently funded on a pay-as-you-go basis by annual appropriations from the state's General Fund. For the fiscal year ending June 30, 2018, total contributions were $8.9 million and total benefit payments were $8.9 million. The ability of the fund to pay benefits in the future is critically dependent upon timely receipt of the contributions from the State's General Fund. The actuary cannot judge the probability that such payments will, in fact, be made. See page 5 for the expected benefit payments based on current data methods and assumptions.

Summary of Valuation Results

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 changes. A ratio on the order of 50% indicates a maturing system. The ratio of retiree liabilities to total accrued liabilities as of July 1, 2018 is 73.5%, down from 75.7% in the prior year.

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 information prepared according to GASB Statements No. 67 and No. 68 has been provided in a separate report dated November 30, 2018.

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.

	Actuarial Valuation as of	
	July 1, 2018	**July 1, 2017**
Assumptions		
- Pre-retirement discount rate	0.0%	0.0%
- Post-retirement discount rate	0.0%	0.0%
Contributions (*dollars in thousands*)		
Statutory - Chapter 3A	$ 93 *	$ 73
Required - Chapter 356	$ 28,007 **	$ 26,518
Sufficiency / (Deficiency)	$ (27,914) **	$ (26,445)
Funding Ratios (*dollars in thousands*)		
Accrued Liability Funding Ratio		
- Current assets (AVA)	$ -	$ -
- Actuarial accrued liability	$ 213,008	$ 227,700
- Funding ratio	0.00%	0.00%
Projected Benefit Funding Ratio		
- Current and expected future assets	$ 367	$ 340
- Current and expected future benefit obligations	$ 217,080	$ 231,907
- Projected benefit funding ratio	0.17%	0.15%
Participant Data		
Active Members		
- Number	19	19
- Annual valuation earnings *(000s)*	981	776
- Projected annual earnings *(000s)*	1,031	814
- Average projected annual earnings	54,263	42,842
- Average age	69.0	68.0
- Average service	30.0	29.0
Service Retirements	293	301
Survivors	79	74
Disability Retirements	0	0
Deferred Retirements	39	44
Terminated other Non-Vested	0	0
Total	**430**	**438**

* *Active member contributions from the Legislators Retirement Plan are equal to 9% of payroll.*

** *Expected benefit payments for the fiscal year ending June 30, 2018 are $9,236. The total contribution (employer plus active member) will need to be approximately this amount. The Required Contribution also includes amounts intended to pre-fund future benefit payments.*

Summary of Valuation Results

Effects of Changes

The following changes in plan provisions, actuarial assumptions, and methods were recognized as of July 1, 2018:

- For retirements on or after January 1, 2024, the first benefit increase is delayed until the retiree reaches Normal Retirement Age.
- Interest credited on member contributions decreased from 4.0% to 3.0%, beginning July 1, 2018.
- Deferred augmentation was changed to 0.00% for future accruing benefits, effective January 1, 2019. Augmentation that has already accrued for deferred members will still apply.
- Post-retirement benefit increases were changed from 2.0% per year, increasing to 2.5% per year upon achieving a 90% funding ratio to a fixed rate of 1.0% for five years (beginning January 1, 2019) and 1.5% per year thereafter.
- Assumed rate of inflation was decreased from 2.75% to 2.50%.

Refer to the Actuarial Basis section of this report for a complete description of these changes.

The combined impact of the above changes was to decrease the unfunded actuarial accrued liability by $18.1 million and decrease the required contribution by $2.4 million, as follows:

	(000s)	
	Before Changes	Reflecting Assumption Changes
Normal Cost	$ 1,496	$ 1,334
Amortization of UAAL*	$ 28,891	$ 26,626
Expenses	$ 47	$ 47
Total Required Contribution	$ 30,434	$ 28,007
Accrued Liability Funding Ratio	0.0%	0.0%
Projected Benefit Funding Ratio	0.2%	0.2%
UAAL*	$231,125	$ 213,008

** Unfunded Actuarial Accrued Liability.*

Summary of Valuation Results

Undiscounted Cash Flows

Fiscal Year Ending	Projected Benefit Payments	Fiscal Year Ending	Projected Benefit Payments
2019	$ 9,236,000	2069	$ 71,000
2020	9,430,000	2070	53,000
2021	9,576,000	2071	39,000
2022	9,529,000	2072	29,000
2023	9,422,000	2073	20,000
2024	9,282,000	2074	14,000
2025	9,253,000	2075	10,000
2026	9,042,000	2076	7,000
2027	8,863,000	2077	4,000
2028	8,623,000	2078	3,000
2029	8,361,000	2079	2,000
2030	8,077,000	2080	1,000
2031	7,781,000	2081	1,000
2032	7,499,000	2082	-
2033	7,182,000	2083	-
2034	6,858,000	2084	-
2035	6,530,000	2085	-
2036	6,200,000	2086	-
2037	5,869,000	2087	-
2038	5,537,000	2088	-
2039	5,205,000	2089	-
2040	4,875,000	2090	-
2041	4,549,000	2091	-
2042	4,227,000	2092	-
2043	3,913,000	2093	-
2044	3,606,000	2094	-
2045	3,309,000	2095	-
2046	3,023,000	2096	-
2047	2,749,000	2097	-
2048	2,488,000	2098	-
2049	2,241,000	2099	-
2050	2,008,000	2100	-
2051	1,791,000	2101	-
2052	1,589,000	2102	-
2053	1,403,000	2103	-
2054	1,233,000	2104	-
2055	1,077,000	2105	-
2056	936,000	2106	-
2057	809,000	2107	-
2058	695,000	2108	-
2059	593,000	2109	-
2060	502,000	2110	-
2061	422,000	2111	-
2062	351,000	2112	-
2063	290,000	2113	-
2064	236,000	2114	-
2065	191,000	2115	-
2066	152,000	2116	-
2067	120,000	2117	-
2068	93,000	2118	-
Total for all years:			$ 217,080,000

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, 2018	Market Value June 30, 2017
Cash, equivalents, short term securities	$ 235	$ 259
Fixed income	-	-
Equity	-	-
Other	-	-
Total cash, investments, and other assets	**$ 235**	**$ 259**
Amounts Receivable	-	-
Total Assets	**$ 235**	**$ 259**
Amounts Payable	(235)	(259)
Net Position Restricted for Pensions	**$ -**	**$ -**
Adjustment to Zero	**$ -**	**$ -**
Adjusted Net Pension Restricted for Pensions	**$ -**	**$ -**

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	Market Value	
Year Ending	June 30, 2018	June 30, 2017
1. Fund balance at market value at beginning of year	**$ -**	**$ (41)**
2. Contributions		
a. Member	93	80
b. Employer	-	-
c. Other sources (annual appropriations from state's General Fund)	8,856	8,716
d. Total contributions	$ 8,949	$ 8,796
3. Investment income		
a. Investment income/(loss)	-	-
b. Investment expenses	-	-
c. Net investment income/(loss)	$ -	$ -
4. Other	-	-
5. Total income: *(2.d.) + (3.c.) + (4.)*	**$ 8,949**	**$ 8,796**
6. Benefits paid		
a. Annuity benefits	$ (8,912)	$ (8,716)
b. Refunds	-	-
c. Total benefits paid	$ (8,912)	$ (8,716)
7. Expenses		
a. Other	$ -	$ -
b. Administrative	(37)	(39)
c. Total expenses	$ (37)	$ (39)
8. Total disbursements: *(6.c.) + (7.c.)*	**$ (8,949)**	**$ (8,755)**
9. Fund balance at market value at end of year: *(1.) + (5.) + (8.)*	**$ -**	**$ -**
10. State Board of Investment calculated investment return	N/A	N/A

Actuarial Asset Value

The Actuarial Value of Assets (AVA) is equal to the Market Value of Assets (consistent with valuations since July 1, 2000).

Membership Data

Distribution of Active Members

	Years of Service as of June 30, 2018									
Age	**<3***	**3 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25 - 29**	**30 - 34**	**35+**	**Total**
< 25										
Avg. Earnings										
25 - 29										
Avg. Earnings										
30 - 34										
Avg. Earnings										
35 - 39										
Avg. Earnings										
40 - 44										
Avg. Earnings										
45 - 49										
Avg. Earnings										
50 - 54						1				**1**
Avg. Earnings						$49,334				**$49,334**
55 - 59										
Avg. Earnings										
60 - 64						1	3	1		**5**
Avg. Earnings						$53,684	$51,987	$52,045		**$52,338**
65 - 69						2		2	1	**5**
Avg. Earnings						$53,826		$52,334	$53,084	**$53,081**
70+						2	1	2	3	**8**
Avg. Earnings						$51,270	$51,270	$48,913	$51,138	**$50,631**
Total						**6**	**4**	**5**	**4**	**19**
Avg. Earnings						**$52,202**	**$51,808**	**$50,908**	**$51,625**	**$51,657**

* *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

	Years Retired as of June 30, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
<50								
Avg. Benefit								
50 - 54								
Avg. Benefit								
55 - 59		1						**1**
Avg. Benefit		$ 12,664						**$ 12,664**
60 - 64	1	5	1					**7**
Avg. Benefit	$ 21,023	$ 29,463	$ 14,460					**$ 26,114**
65 - 69	2	19	19	4				**44**
Avg. Benefit	$ 35,712	$ 23,833	$ 30,055	$ 18,780				**$ 26,601**
70 - 74	2	4	23	16	12			**57**
Avg. Benefit	$ 55,359	$ 30,363	$ 20,387	$ 22,583	$ 16,212			**$ 22,052**
75 - 79		1	11	24	29	1		**66**
Avg. Benefit		$ 25,505	$ 26,289	$ 16,033	$ 20,178	$ 19,903		**$ 19,766**
80 - 84		2	5	7	15	20		**49**
Avg. Benefit		$ 39,269	$ 30,982	$ 20,853	$ 33,076	$ 27,335		**$ 29,026**
85 - 89			2	2	10	16	16	**46**
Avg. Benefit			$ 24,321	$ 27,183	$ 31,584	$ 24,348	$ 22,591	**$ 25,432**
90+			1	1		4	17	**23**
Avg. Benefit			$ 30,556	$ 34,311		$ 29,583	$ 23,694	**$ 25,478**
Total	**5**	**32**	**62**	**54**	**66**	**41**	**33**	**293**
Avg. Benefit	**$ 40,633**	**$ 26,197**	**$ 25,447**	**$ 19,553**	**$ 24,117**	**$ 26,207**	**$ 23,159**	**$ 24,251**

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

	Years Since Death as of June 30, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
<45								
Avg. Benefit								
45 - 49								
Avg. Benefit								
50 - 54								
Avg. Benefit								
55 - 59			1					**1**
Avg. Benefit			$ 6,957					**$ 6,957**
60 - 64				1				**1**
Avg. Benefit				$ 14,027				**$ 14,027**
65 - 69	2	2						**4**
Avg. Benefit	$ 19,141	$ 11,007						**$ 15,074**
70 - 74		4	2	1	2			**9**
Avg. Benefit		$ 29,689	$ 39,852	$ 20,934	$ 26,297			**$ 30,221**
75 - 79		3	4	1		1	2	**11**
Avg. Benefit		$ 28,650	$ 13,770	$ 6,440		$ 12,564	$ 36,714	**$ 21,224**
80 - 84	5	3	4	2			1	**15**
Avg. Benefit	$ 31,799	$ 14,597	$ 25,356	$ 17,001			$ 14,887	**$ 23,540**
85 - 89	1	5	6		2	3	2	**19**
Avg. Benefit	$ 28,898	$ 20,767	$ 20,995		$ 41,429	$ 42,535	$ 15,780	**$ 26,354**
90+	1	4	4	2	1	5	2	**19**
Avg. Benefit	$ 20,928	$ 16,729	$ 8,996	$ 18,895	$ 4,369	$ 15,563	$ 6,202	**$ 13,485**
Total	**9**	**21**	**21**	**7**	**5**	**9**	**7**	**79**
Avg. Benefit	**$ 27,456**	**$ 21,013**	**$ 19,292**	**$ 16,170**	**$ 27,964**	**$ 24,220**	**$ 18,897**	**$ 21,478**

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

Reconciliation of Members

		Terminated		Recipients			
	Actives	Deferred Retirement	Other Non-Vested	Service Retirement	Disability Retirement	Survivor	Total
Members on 7/1/2017	**19**	**44**	**0**	**301**	**0**	**74**	**438**
Additions	0	0	0	0	0	0	**0**
Return to active	0	0	0	0	0	0	**0**
Terminated non-vested	0	0	0	0	0	0	**0**
Service retirements	0	(5)	0	5	0	0	**0**
Terminated deferred	0	0	0	0	0	0	**0**
Terminated refund/transfer	0	0	0	0	0	0	**0**
Deaths	0	0	0	(13)	0	(3)	**(16)**
New beneficiary	0	0	0	0	0	8	**8**
Disabled	0	0	0	0	0	0	**0**
Unexpected status changes	0	0	0	0	0	0	**0**
Net change	0	(5)	0	(8)	0	5	**(8)**
Members on 6/30/2018	**19**	**39**	**0**	**293**	**0**	**79**	**430**

Terminated Member Statistics on June 30, 2018	Deferred Retirement	Other Non-Vested	Total
Number	39	0	39
Average age	60.5	N/A	60.5
Average service	11.1	N/A	11.1
Average annual benefit, with augmentation to December 31, 2018	$29,478	N/A	$29,478
Average refund value	$75,780	N/A	$75,780

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, since statutory contributions are less than normal cost, B.2. is equal to the statutory contribution rate, minus expenses, times the present value of future payroll and Item B.1 is zero, as required by the LCPR Standards for Actuarial Work. Future pay-as-you-go contributions are not reflected in this exhibit.

				June 30, 2018
A. Actuarial Value of Assets				$ -
B. Expected Future Assets				
1. Present value of expected future statutory supplemental contributions				-
2. Present value of future normal cost contributions				367
3. Total expected future assets: *(1.) + (2.)*				$ 367
C. Total Current and Expected Future Assets				$ 367
D. Current Benefit Obligations*				
1. Benefit recipients	**Non-Vested**	**Vested**	**Total**	
a. Service retirements	$ -	$ 134,795	$ 134,795	
b. Disability retirements	-	-	-	
c. Survivors	-	21,706	21,706	
2. Deferred retirements	-	39,921	39,921	
3. Former members without vested rights	-	-	-	
4. Active members	-	18,487	18,487	
5. Total Current Benefit Obligations	$ -	$ 214,909	$ 214,909	
E. Expected Future Benefit Obligations				$ 2,171
F. Total Current and Expected Future Benefit Obligations**				$ 217,080
G. Unfunded Current Benefit Obligations: *(D.5.) - (A.)*				$ 214,909
H. Unfunded Current and Future Benefit Obligations: *(F.) - (C.)*				$ 216,713
I. Accrued Benefit Funding Ratio: *(A.)/(D.5.)*				0.00%
J. Projected Benefit Funding Ratio: *(C.)/(F.)*				0.17%

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

** *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	$ 20,346	$ 3,882	$ 16,464	
b. Disability benefits	-	-	-	
c. Survivor's benefits	312	91	221	
d. Deferred retirements	-	87	(87)	
e. Refunds*	-	12	(12)	
f. Total	$ 20,658	$ 4,072	$ 16,586	
2. Deferred retirements	39,921	-	39,921	
3. Former members without vested rights	-	-	-	
4. Benefit recipients	156,501	-	156,501	
5. Total	$ 217,080	$ 4,072	$ 213,008	
B. Determination of Unfunded Actuarial Accrued Liability (UAAL)				
1. Actuarial accrued liability			$ 213,008	
2. Current assets (AVA)			-	
3. Unfunded actuarial accrued liability			$ 213,008	
C. Determination of Supplemental Contribution Rate				
1. Current unfunded actuarial accrued liability to be amortized by June 30, 2026			$ 213,008	
2. Supplemental contribution amount			26,626	**

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

** *The amortization factor as of July 1, 2018 is 8.0000.*

Development of Costs

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

		Year Ending June 30, 2018
A. Unfunded actuarial accrued liability at beginning of year	$	227,700
B. Changes due to interest requirements and current rate of funding		
1. Normal cost, including expenses		1,220
2. Contributions		(8,949)
3. Interest on A., B.1. and B.2.		-
4. Total *(B.1. + B.2. + B.3.)*	$	(7,729)
C. Expected unfunded actuarial accrued liability at end of year *(A. + B.4.)*	$	219,971
D. Increase (decrease) due to actuarial losses (gains) because of experience deviations from expected		
1. Age and service retirements		(127)
2. Disability retirements		-
3. Death-in-service benefits		13
4. Withdrawals		-
5. Salary increases		1,870
6. Investment income		-
7. Mortality of annuitants		(325)
8. Other items*		9,723
9. Total	$	11,154
E. Unfunded actuarial accrued liability at end of year before plan amendments and changes in actuarial assumptions *(C. + D.9.)*	$	231,125
F. Change in unfunded actuarial accrued liability due to changes in plan provisions		(18,117)
G. Change in unfunded actuarial accrued liability due to changes in actuarial assumptions		-
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.)*		213,008

** Other liability loss reflects MSRS refinements to deferred member data ($9.2 million).*

Development of Costs

Determination of Contribution Sufficiency/(Deficiency)*

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 (000s)
A. Statutory Contributions - Chapter 3A		
1. Employee contributions	9.00%	$ 93
2. Employer contributions	0.00%	-
3. Total	9.00%	$ 93
B. Required Contributions - Chapter 356		
1. Normal cost		
a. Retirement benefits	122.03%	$ 1,258
b. Disability benefits	0.00%	-
c. Survivors	3.22%	33
d. Deferred retirement benefits	3.56%	37
e. Refunds	0.57%	6
f. Total	129.38%	$ 1,334
2. Supplemental contribution amortization of Unfunded Actuarial Accrued Liability by June 30, 2026	2,582.54%	$ 26,626
3. Allowance for expenses	4.55%	47
4. Total	2,716.47% *	$ 28,007
C. Contribution Sufficiency/(Deficiency) *(A.3. - B.4.)*	(2,707.47%)	$ (27,914)

* *Plan is funded by annual appropriations from the State's General Fund. Estimated benefit payments of $9,236 are expected to be paid during the upcoming fiscal year.*

Note: Projected annual payroll for fiscal year beginning on the valuation date: $1,031 (based on methods prescribed in the LCPR Standards for Actuarial Work).

Development of Costs

Elective State Officers Retirement Plan *(Dollars in Thousands)*

The Elective State Officers Retirement Plan was consolidated with the Legislators Retirement Plan on July 1, 2013, per 2013 legislation. These liabilities are included in the Unfunded Actuarial Accrued Liabilities on page 14 of this report.

Year Ending June 30, 2018

Group	Number	Annual Benefits	Average Age	Actuarial Accrued Liability
Deferred, Vested	0	N/A	N/A	$ -
Service Retirements	8	$ 290	82.3	$ 3,759
Survivors	4	$ 170	85.6	$ 1,949
Total	**12**	**$ 460**	**83.4**	**$ 5,708**

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 dollar. The total contribution developed under this method is the sum of normal cost, expenses, and the payment toward the UAAL.

Asset Valuation Method

Market Value (consistent with valuations since July 1, 2000).

Payment on the Unfunded Actuarial Accrued Liability

The unfunded liability is amortized as a level dollar each year to the statutory amortization date of June 30, 2026. If the Unfunded Actuarial Accrued Liability is negative, the surplus amount shall be amortized over 30 years as a level dollar amount. If the unfunded liability increases due to changes in benefits, assumptions, or methods, the statutory amortization date may be extended.

Funding Objective

This plan is primarily funded on a pay-as-you-go basis, offset by active Legislators Retirement Fund member contributions and annual appropriations from the State's General Fund.

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 mortality assumption is based on the State Employees Retirement Fund experience study, dated June 30, 2015. Unless noted otherwise, all other assumptions prescribed are based on the last assumption review, dated January 2012, prepared by a former actuary, and are consistent with the *Alternative Assumptions* used in the 2011 valuation. 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.

Investment return	0.00% per annum.
Salary increases	5.00% annually.
Inflation	2.50% annually.
Mortality rates	
Healthy Pre-retirement	RP-2014 employee generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2014, white collar adjustment, set forward one year for males and no adjustment for females.
Healthy Post-retirement	RP-2014 annuitant generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2014, white collar adjustment, set forward two years for males and no adjustment for females.
Notes	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.
Retirement	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.
Withdrawal	Ultimate rates based on actual experience. Rates are shown in rate table.
Disability	None.
Allowance for combined service annuity	None.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Administrative expenses	Prior year administrative expenses expressed as percentage of prior year projected payroll.
Refund of contributions	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 are assumed to take the larger of the contributions accumulated with interest or the value of the deferred benefit.
Commencement of deferred benefits	Members receiving deferred annuities (including current terminated deferred members) are assumed to begin receiving benefits at age 62.
Percentage married	85% of active members are assumed to be married. Legislators in payment status are assumed to be 100% married for purposes of a death benefit, except if reported with a joint & survivor benefit. 100% of Elective State Officers members are assumed to be eligible for the automatic survivor benefit.
Age of spouse	Females are assumed to be three years younger than their spouses, and males are assumed to be three years older than their spouses.
Eligible children	Each member may have two dependent children depending on member's age. Assumed first born child born at member's age 28 and second born child at member's age 31.
Form of payment	Active married members are assumed to elect 50% joint and survivor annuity. Active single members and deferred members are assumed to elect a life annuity. Unless reported with a joint & survivor option, retired members are assumed to have a spouse that is eligible for the automatic survivor benefit. Deferred Elective State Officers Retirement Fund members are assumed to elect a life annuity with automatic survivor benefits.
Eligibility testing	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
Decrement operation	Withdrawal decrements do not operate during retirement eligibility. Decrements are assumed to occur mid-fiscal year.
Service credit accruals	It is assumed that members accrue one year of service credit per year.
Pay increases	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.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Unknown data for certain members

To prepare this report, GRS has used and relied on participant data supplied by the Fund. 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.

In cases where submitted data was missing or incomplete, the following assumptions, based on average results for applicable members, were applied:

Legislators Retirement Plan

Data for active members:

There were no members reported with zero or invalid salary.

There were no members reported with missing service.

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

Data for terminated members:

Benefits were reported with full augmentation to Normal Retirement Age. Based on direction from MSRS, we adjusted benefits by removing augmentation on a prospective basis beginning January 1, 2019.

There was 1 member reported without a benefit. If available, we calculated benefits for these members using the reported Average Salary and credited service. If Average Salary was also not reported (0 members), we assumed a value of $30,000. There were no members reported without credited service or a termination date.

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

Data for members receiving benefits:

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

There were 285 retired members reported:

- 110 members were reported with the 75% or 100% joint and survivor option. These members were valued as indicated by the option elected.
- 174 members were reported with the life annuity option and 1 member was reported with the 50% joint and survivor option. All of these members were valued as a 50% joint & survivor annuity per MSRS' direction.

Of the 285 retired members, 141 members had an invalid or missing survivor gender and 138 members had a missing or invalid survivor date of birth. We used the valuation assumptions if the survivor gender or date of birth was missing or invalid.

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

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

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Unknown data for certain members – (Concluded)	**Elective State Officers Retirement Plan** Data for members receiving benefits: There were no members reported with missing or invalid birth dates, genders or benefits. All retired members were reported with a life annuity option. Members were assumed to have a spouse that is eligible for the automatic survivor benefits. Valuation assumptions were used if the survivor gender (5 members) or date of birth (5 members) were missing or invalid.
Changes in actuarial assumptions	Assumed rate of inflation was decreased from 2.75% to 2.50%.

Actuarial Basis

Summary of Actuarial Assumptions (Concluded)

Age in 2018	Percent of Members Dying Each Year*			
	Healthy Post-Retirement Mortality**		Healthy Pre-Retirement Mortality**	
	Male	Female	Male	Female
20	0.03%	0.01%	0.03%	0.01%
25	0.04	0.02	0.03	0.01
30	0.06	0.05	0.03	0.02
35	0.09	0.08	0.04	0.02
40	0.13	0.11	0.04	0.03
45	0.20	0.15	0.07	0.05
50	0.29	0.19	0.12	0.09
55	0.41	0.27	0.20	0.14
60	0.58	0.38	0.36	0.20
65	0.88	0.62	0.63	0.30
70	1.45	0.99	1.09	0.51
75	2.50	1.65	1.92	0.89
80	4.47	2.89	3.48	1.57
85	8.29	5.21	7.29	4.12
90	14.99	9.53	13.53	9.22

* *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 2014.*

Age	Percent Retiring
60	0.00%
61	0.00
62	40.00
63	30.00
64	30.00
65	40.00
66	30.00
67	25.00
68	25.00
69	25.00
70	30.00
71+	100.00

Service	Percent Terminating (Withdrawing)	
	House	Senate
1	0.0%	0.0%
2	30.0	0.0
3	0.0	0.0
4	20.0	25.0
5	0.0	0.0
6	10.0	0.0
7	0.0	0.0
8	5.0	10.0
9+	0.0	0.0

Actuarial Basis

Summary of Plan Provisions – Legislators Retirement Plan

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.

Plan year	July 1 through June 30.
Eligibility	Members of the State Legislature first elected to office before July 1, 1997, and who elect to retain coverage under this plan (i.e., do not elect Social Security coverage). Plan is closed to new members.
Contributions	
Member	9.00% of salary which must be paid to the state's General Fund.
Employer	Plan is funded by annual appropriations from the state's General Fund. Employee contributions are "picked up" according to the provisions of Internal Revenue Code 414(h).
Allowable service	Service while in an eligible position.
Salary	Compensation received for service as a member of the legislature. Salary includes the monthly compensation paid to a legislator and the per diem payments paid during a regular or special session. Salary does not include additional compensation attributable to a leadership position.
Average salary	Average of the five highest successive years of salary.
Retirement	
Normal retirement benefit	
Age/Service requirements	Age 62 and either six full years of service or service during all or part of four regular legislative sessions. For eligibility purposes, service does not include credit for time not served when a member does not serve a full term of office.
Amount	A percentage of Average Salary for each year of service as follows: First elected prior to January 1, 1979: (a) 5.00% for the first eight years of service prior to January 1, 1979; and (b) 2.50% for subsequent years. Elected after December 31, 1978: (a) 2.50%.
Early retirement benefit	
Age/service requirements	Age 55 and either six full years of service or service during all or part of four regular legislative sessions.

Actuarial Basis

Summary of Plan Provisions – Legislators Retirement Plan (Continued)

Retirement (Concluded)	
Early retirement benefit (Concluded)	
Amount	Normal retirement benefit based on service and Average Salary at retirement date and actuarially reduced for each month the member is under age 62 assuming augmentation to age 62 at 3.00% per year.
Form of payment	Paid as a 50% joint and survivor annuity to member, spouse and dependent children. Annuitants may elect 100% joint and survivor bounce back annuity, life annuity, or a term certain and life annuity on an actuarially equivalent basis.
Benefit increases	Through December 31, 2018: 2.0% January 1, 2019 – December 31, 2023: 1.0% January 1, 2024 and after: 1.5% For retirements on or after January 1, 2024, the first benefit increase is delayed until the retiree reaches Normal Retirement Age (not applicable to disability benefit recipients, or survivors). 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.
Disability	No additional benefits provided beyond standard plan. Treated as retirement or termination, depending on age and service at termination.
Death	
Surviving spouse benefit	
Age/Service requirement	Death while active, or after termination if service requirements for a normal retirement benefit is met but payments have not begun.
Amount	Survivor payments of 50% of the retirement benefit of the member assuming the member had attained normal retirement age and had a minimum of eight years of service. Benefit is paid for life. A former member's benefit is augmented as a Deferred Annuity to date of death before determining the portion payable to the spouse. If the legislator was at least age 60 at death, the surviving spouse may elect an optional joint and survivor annuity. If a deferred benefit was not eligible to be in pay status before July 1, 1997, an actuarial increase shall be made for the change in the post-retirement interest rates from 5.00% to 6.00%.
Benefit increases	Same as for retirement, except benefit increases are paid prior to Normal Retirement.

Actuarial Basis

Summary of Plan Provisions – Legislators Retirement Plan (Continued)

Death (Concluded)

Surviving dependent children's benefit

Age/Service requirement	Same as spouse's benefit.
Amount	Benefit for first child is 25.00% of the retirement benefit (computed as for surviving spouse) with 12.50% for each additional child. Maximum payable (including spouse) is 100.00% of the retirement benefit. Benefits cease when a child marries or attains age 18 (22 if a full-time student).
Benefit increases	Same as for retirement, except benefit increases are paid prior to Normal Retirement.

Refund of contributions

Age/Service requirement	Member dies before receiving any retirement benefits and survivor benefits are not payable.
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. Beginning July 1, 2018, a member's contributions increase at 3.00% interest compounded daily.

Termination

Refund of contributions

Age/Service requirement	Termination of 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. Beginning July 1, 2018, a member's contributions increase at 3.00% interest compounded daily. If a member is vested, a deferred annuity may be elected in lieu of a refund.

Deferred benefit

Age/service requirement	Same service requirements as for normal retirement.
Amount	Benefit computed under law in effect at termination and increased by the following annual augmentation percentage: (a.) 0.00% before July 1, 1973; (b.) 5.00% from July 1, 1973, to January 1, 1981; (c.) 3.00% until the earlier of January 1 of the year following attainment of age 55 and January 1, 2012; (d.) 5.00% until the earlier of January 1, 2012, and when the annuity begins; and (e.) 2.00% from January 1, 2012 through December 31, 2018; and (f.) 0.00% from January 1, 2019, thereafter.

Actuarial Basis

Summary of Plan Provisions – Legislators Retirement Plan (Concluded)

Deferred benefit - (Concluded)	
Amount (Concluded)	Amount is payable at normal or early retirement. For members who terminated prior to July 1, 1997, but were not eligible to commence their pensions before July 1, 1997, the benefit shall be increased to reflect the actuarial equivalent change in post-retirement interest rate from 5.00% to 6.00%.
Adjustments for benefits not in pay status	Benefits are adjusted on an actuarial equivalent basis to reflect the 1997 change in post-retirement interest rate assumption from 5.00% to 6.00%.
Actuarial equivalent factors	Actuarially equivalent factors based on RP-2014 mortality for healthy annuitants, white collar adjustment, male rates set forward two years, projected to 2019 using Scale MP-2015, blended 50% males, 5.88% post-retirement interest, and 8.00% pre-retirement interest. Based upon statutory requirements; Joint and Survivor factors are based on an interest assumption of 6.50%. The actuarially equivalent factors are currently being updated to reflect changes adopted during the 2018 legislative session.
Combined service annuity	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.
Changes in Plan Provisions	For retirements on or after January 1, 2024, the first benefit increase is delayed until the retiree reaches Normal Retirement Age. Interest credited on member contributions decreased from 4.0% to 3.0%, beginning July 1, 2018. Deferred augmentation was changed to 0.00% for future accruing benefits, effective January 1, 2019. Augmentation that has already accrued for deferred members will still apply. Post-retirement benefit increases were changed from 2.0% per year, increasing to 2.5% per year upon achieving a 90% funding ratio to a fixed rate of 1.0% for five years (beginning January 1, 2019) and 1.5% per year thereafter.

Actuarial Basis

Summary of Plan Provisions – Elective State Officers Retirement Plan

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.

Plan year	July 1 through June 30.
Eligibility	Must be employed as a "Constitutional Officer" first elected prior to July 1, 1997, and must elect to retain coverage under this plan (i.e., does not elect Social Security coverage). Plan is closed to new members since July 1, 1997.
Contributions	Plan is funded by annual appropriations from the State's General Fund.
Allowable service	Service while in an eligible position as a constitution officer.
Salary	Salary upon which Elective State Officers Retirement Fund contributions have been made.
Average salary	Average of the five highest successive years of Salary.
Retirement	
Normal retirement benefit	
Age/Service requirements	Age 62 and eight years of Allowable Service.
Amount	2.50% of Average Salary for each year of Allowable Service. For members who terminated service after June 30, 1997, an actuarial increase shall be made for the change in the post-retirement interest rates from 5.00% to 6.00%.
Early retirement benefit	
Age/Service requirement	Age 60 and eight years of Allowable Service.
Amount	Normal retirement benefit based on Allowable Service and Average Salary at retirement date with reduction of 0.50% for each month the member is under age 62 at the time of retirement.
Form of payment	Life annuity.
Benefit increases	Through December 31, 2018: 2.0% January 1, 2019 – December 31, 2023: 1.0% January 1, 2024 and after: 1.5% For retirements on or after January 1, 2024, the first benefit increase is delayed until the retiree reaches Normal Retirement Age (not applicable to disability benefit recipients, or survivors).

Actuarial Basis

Summary of Plan Provisions – Elective State Officers Retirement Plan (Continued)

Retirement (Continued)	
Early retirement benefit	
Benefit increases (Continued)	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.
Disability	No additional benefits provided beyond standard plan. Treated as retirement or termination, depending on age and Allowable Service as of disablement.
Death	
Surviving spouse benefit	
Age/Service requirement	Death while active, or after retirement, or after termination but prior to retirement with at least eight years of Allowable Service.
Amount	Survivor payments of 50% of the retirement benefit of the member assuming the member had attained age 62 and had a minimum of eight years of Allowable Service. A former member's benefit is augmented as a Deferred Annuity to date of death before determining the portion payable to the spouse. If a member dies prior to July 1, 1997, and the beneficiary was not eligible to commence a survivor benefit as of July 1, 1997, an actuarial increase shall be made for the change in the post-retirement interest rates from 5.00% to 6.00%.
Benefit increases	Same as for retirement, except benefit increases are paid prior to Normal Retirement.
Surviving dependent children's benefit	
Age/Service requirement	Same as spouse's benefit.
Amount	Benefit for first child is 25.00% of the retirement benefit (computed as for surviving spouse) with 12.50% for each additional eligible child. Maximum payable (including spouse) is 100.00% of the retirement benefit. Benefits cease when a child marries or attains age 18 (22 if a full-time student).
Benefit increases	Same as for retirement, except benefit increases are paid prior to Normal Retirement.
Termination	
Refund of contributions	
Age/Service requirement	Termination of service.

Actuarial Basis

Summary of Plan Provisions – Elective State Officers Retirement Plan (Continued)

Termination (Concluded)	
Refund of contributions (Concluded)	
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. Beginning July 1, 2018, a member's contributions increase at 3.00% interest compounded daily. If a member is vested, a deferred annuity may be elected in lieu of a refund.
Deferred benefit	
Age/service requirement	Eight years of Allowable Service.
Amount	Benefit computed under law in effect at termination and increased by the following annual augmentation percentage: (a.) 0.00% before July 1, 1979; (b.) 5.00% from July 1, 1979, to January 1, 1981; (c.) 3.00% until age 55, or until January 1, 2012, whichever is earlier; (d.) 5.00% thereafter until the annuity begins but prior to January 1, 2012; (e.) 2.00% from January 1, 2012 through December 31, 2018; and (f.) 0.00% from January 1, 2019, thereafter. Amount is payable at normal or early retirement. If a member terminated prior to July 1, 1997, but was not eligible to commence his or her pension before July 1, 1997, an actuarial increase shall be made for the change in the post-retirement interest rates from 5.00% to 6.00%.
Combined service annuity	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.

Actuarial Basis

Summary of Plan Provisions – Elective State Officers Retirement Plan (Concluded)

Combined service annuity (Concluded)	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.
Actuarial equivalent factors	Actuarially equivalent factors based on RP-2014 mortality for healthy annuitants, white collar adjustment, male rates set forward two years, projected to 2019 using Scale MP-2015, blended 50% males, 5.88% post-retirement interest, and 8.00% pre-retirement interest. Based upon statutory requirements; Joint and Survivor factors are based on an interest assumption of 6.50%. The actuarially equivalent factors are currently being updated to reflect changes adopted during the 2018 legislative session.
Changes in plan provisions	All Elective State Officers members are receiving benefit payments. A number of provisions affecting benefits for active and deferred members were changed. See the Summary of Plan Provisions for the Legislators Retirement Plan for detail. Post-retirement benefit increases were changed from 2.0% per year, increasing to 2.5% per year upon achieving a 90% funding ratio to a fixed rate of 1.0% for five years (beginning January 1, 2019) and 1.5% per year thereafter.

Additional Schedules

Schedule of Funding Progress[1] *(Dollars in Thousands)*

Legislators Retirement Fund

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)
07/01/1991	$ 14,694	$ 30,403	$ 15,709	48.33%	$ 7,078	221.94%
07/01/1992	15,160	33,224	18,064	45.63	6,556	275.53
07/01/1993	17,169	36,801	19,632	46.65	7,322	268.12
07/01/1994	18,738	45,448	26,710	41.23	6,589	405.37
07/01/1995	21,213	50,255	29,042	42.21	7,056	411.59
07/01/1996	22,532	54,225	31,693	41.55	6,267	505.71
07/01/1997	25,678	60,055	34,377	42.76	7,767	442.60
07/01/1998	31,212	62,928	31,716	49.60	6,802	466.27
07/01/1999	33,474	66,418	32,944	50.40	7,490	439.84
07/01/2000	37,265	69,364	32,099	53.72	5,808	552.67
07/01/2001	42,608	75,072	32,464	56.76	5,858	554.18
07/01/2002	45,501	78,070	32,569	58.28	5,089	639.99
07/01/2003[2]	-	-	-	-	-	-
07/01/2004	46,155	83,197	37,042	55.48	3,815	970.89
07/01/2005	45,523	81,836	36,314	55.63	3,014	1,204.84
07/01/2006	48,504	81,361	32,858	59.62	2,894	1,135.45
07/01/2007	44,869	86,449	41,580	51.90	2,380	1,747.42
07/01/2008	39,209	86,131	46,922	45.52	1,993	2,354.34
07/01/2009	28,663	90,431	61,768	31.70	1,963	3,146.61
07/01/2010	26,821	86,236	59,415	31.10	1,877	3,165.42
07/01/2011[3]	19,140	216,559	197,419	8.84	1,774	11,128.47
07/01/2012	15,523	247,657	232,134	6.27	1,378 [4]	16,845.72
07/01/2013	11,493	235,877	224,384	4.87	1,233 [4]	18,198.22
07/01/2014[5]	8,258	250,860	242,602	3.29	1,122 [4]	21,622.28
07/01/2015	3,430	230,219	226,789	1.49	1,700 [4]	13,340.53
07/01/2016	-	218,514	218,514	0.00	989 [4]	22,094.44
07/01/2017	-	227,700	227,700	0.00	889 [4]	25,613.05
07/01/2018	-	213,008	213,008	0.00	1,033 [4]	20,620.33

[1] *Information prior to 2012 provided by prior actuaries. See prior reports for additional detail.*

[2] *An actuarial valuation was not completed as of July 1, 2003.*

[3] *Based on the alternate assumptions, including an investment return assumption of 0%.*

[4] *Assumed equal to actual member contributions divided by 9%.*

[5] *Effective July 1, 2013, the Elective State Officers Retirement Fund was administratively consolidated with the Legislators Retirement Fund, first combined as of July 1, 2014 in this exhibit.*

Additional Schedules

Schedule of Funding Progress[1] *(Dollars in Thousands)*

Elective State Officers Retirement Fund

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	$ 308	$ 2,249	$ 1,941	13.69%	$ 422	459.95 %
7-1-1992	334	2,380	2,046	14.03	378	541.27
7-1-1993	322	2,689	2,367	11.97	500	473.40
7-1-1994	361	2,848	2,487	12.68	411	605.11
7-1-1995	378	2,948	2,570	12.82	422	609.00
7-1-1996	412	2,983	2,571	13.81	456	563.82
7-1-1997	456	3,214	2,758	14.19	467	590.58
7-1-1998	500	3,369	2,869	14.84	461	622.34
7-1-1999	198	3,373	3,175	5.87	291	1091.07
7-1-2000	199	3,535	3,336	5.63	-	N/A
7-1-2001	201	3,775	3,574	5.32	-	N/A
7-1-2002	201	4,075	3,874	4.93	-	N/A
7-1-2003 [2]						
7-1-2004	204	4,002	3,798	5.09	-	N/A
7-1-2005	204	4,065	3,861	5.03	-	N/A
7-1-2006	207	3,970	3,763	5.22	-	N/A
7-1-2007	212	3,969	3,757	5.33	-	N/A
7-1-2008	212	3,908	3,696	5.43	-	N/A
7-1-2009	213	3,886	3,673	5.49	-	N/A
7-1-2010	214	3,782	3,568	5.66	-	N/A
7-1-2011 [3]	-	7,610	7,610	0.00	-	N/A
7-1-2012	-	8,907	8,907	0.00	-	N/A
7-1-2013[4]	-	8,595	8,595	0.00	-	N/A

[1] *Information prior to 2012 provided by prior actuaries. See prior reports for additional detail.*
[2] *An actuarial valuation was not completed as of July 1, 2003.*
[3] *Based on the alternate assumptions, including an investment return assumption of 0%.*
[4] *Effective July 1, 2013, the Elective State Officers Retirement Fund was administratively consolidated with the Legislators Retirement Fund. Effective July 1, 2014 combined results are shown with the Legislators Retirement Fund exhibit.*

Additional Schedules

Schedule of Contributions from the Employer and Other Contributing Entities[1] *(Dollars in Thousands)*

Legislators Retirement Fund

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[2] (e)	Percentage Contributed (e)/(d)
1991	32.62 %	$ 7,078	$ 637	$ 1,672	$ 1,889	112.98 %
1992	27.67	6,556	590	1,224	601	49.10
1993	30.49	7,322	659	1,573	2,284	145.20
1994	32.12	6,589	593	1,457	1,618	111.05
1995	38.34	7,056	635	2,070	2,938	141.93
1996	41.54	6,267	564	2,039	1,511	74.10
1997	43.96	7,767	699	2,715	3,176	116.98
1998	48.03	6,802	612	2,655	5,199	195.82
1999	47.19	7,490	674	2,861	2,091	73.09
2000	52.72	5,808	523	2,539	3,192	125.72
2001	47.26	5,858	527	2,241	5,039	224.85
2002	60.14	5,089	458	2,603	4,135	158.86
2003[3]	63.12	-	-	-	-	-
2004	63.12	3,815	343	2,065	425	20.58
2005	104.72	3,014	384	2,773	1,822	65.71
2006	112.64	2,894	264	2,995	5,684	189.78
2007	111.24	2,380	239	2,408	1,772	73.59
2008	171.10	1,993	180	3,230	2,217	68.64
2009	243.21	1,963	248	4,526	1,269	28.04
2010	413.00	1,877	170	7,582	1,975	26.05
2011	432.92	1,774	160	7,520	2,805	37.30
2012[4]	1,320.95	1,378[5]	124	18,079	3,935	21.77
2013	1,340.00	1,233[5]	111	16,411	3,399	20.71
2014[6]	1,983.78	1,122[5]	101	22,157	3,436	15.51
2015	2,287.58	1,700[5]	153	38,736	3,216	8.30
2016	2,204.22	989[5]	89	21,711	5,087	23.43
2017	2,578.68	889[5]	80	22,844	8,716	38.15
2018	3,257.81	1,033[5]	93	33,560	8,856	26.39
2019	2,716.47	N/A	N/A	N/A	N/A	N/A

[1] *Information prior to 2012 provided by prior actuary. See prior reports for additional detail.*

[2] *Includes contributions from other sources (if applicable). Information for 2004 to 2012 provided by MSRS.*

[3] *An actuarial valuation for this fiscal year was not completed.*

[4] *Based on the alternate assumptions, including an investment return assumption of 0%.*

[5] *Assumed equal to actual member contributions divided by 9%.*

[6] *Effective July 1, 2013, the Elective State Officers Retirement Fund was administratively consolidated with the Legislators Retirement Fund, first combined for plan year ending June 30, 2014 in this exhibit.*

Additional Schedules

Schedule of Contributions from the Employer and Other Contributing Entities[1] *(Dollars in Thousands)*

Elective State Officers Retirement Fund

Plan Year Ended June 30	Actuarially Required Contribution Rate/Amount[2] (a)	Actual Covered Payroll (b)	Actual Member Contributions (c)	Annual Required Contributions[3] [(a)x(b)] - (c) = (d)	Actual Employer Contributions (e)	Percentage Contributed (e)/(d)
1991	34.84%	$ 422	$ 38	$ 109	$ 40	36.70%
1992	33.28	378	34	92	111	120.65
1993	36.23	500	45	136	88	64.71
1994	38.64	411	37	122	164	134.43
1995	42.00	422	38	139	165	118.71
1996	43.58	456	41	158	151	95.57
1997	43.49	467	42	161	167	103.73
1998	51.07	461	42	193	175	90.67
1999	51.66	291	26	124	40	32.26
2000	$ 321	-	-	321	306	95.33
2001	340	-	-	340	330	97.06
2002	371	-	-	371	354	95.42
2003	412	-	-	412	371	90.12
2004	412	-	-	412	383	92.88
2005	437	-	-	437	395	90.37
2006	465	-	-	465	417	89.66
2007	477	-	-	477	427	89.57
2008	506	-	-	506	435	85.92
2009	558	-	-	558	442	79.28
2010	601	-	-	601	453	75.37
2011	644	-	-	644	460	71.54
2012[4]	1,269	-	-	1,269	466	36.73
2013[5]	991	-	-	991	470	47.43

[1] Information prior to 2012 provided by prior actuaries. See prior reports for additional detail.
[2] Shown as a percent of payroll for years before 2000.
[3] For years after 1999, the Annual Required Contribution is the dollar amount shown in (a).
[4] Based on the alternate assumptions, including an investment return assumption of 0%.
[5] Effective July 1, 2013, the Elective State Officers Retirement Fund was administratively consolidated with the Legislators Retirement Fund. Effective July 1, 2014 combined results are shown with the Legislators Retirement Fund exhibit.

Glossary of Terms

Accrued Benefit Funding Ratio	The ratio of assets to Current Benefit Obligations.
Accrued Liability Funding Ratio	The ratio of assets to Actuarial Accrued Liability.
Actuarial Accrued Liability (AAL)	The difference between the Actuarial Present Value of Future Benefits, and the Actuarial Present Value of Future Normal Costs.
Actuarial Assumptions	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.
Actuarial Cost Method	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.
Actuarial Equivalent	Of equal Actuarial Present Value, determined as of a given date and based on a given set of Actuarial Assumptions.
Actuarial Present Value (APV)	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.
Actuarial Present Value of Projected Benefits	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.
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 plan. An Actuarial Valuation for a governmental retirement system typically also includes calculations of items needed for developing and monitoring retirement system's funding policy, such as the Funded Ratio and the Annual Required Contribution (ARC).
Actuarial Value of Assets	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)

Amortization Method	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.
Amortization Payment	That portion of the plan contribution or ARC which is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.
Amortization Period	The period used in calculating the Amortization Payment.
Annual Required Contribution (ARC)	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.
Augmentation	Annual increases to deferred benefits.
Closed Amortization Period	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.
Current Benefit Obligations	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).
Employer Normal Cost	The portion of the Normal Cost to be paid by the employer. This is equal to the Normal Cost less expected member contributions.
Expected Assets	The present value of anticipated future contributions intended to fund benefits for current members.
Experience Gain/Loss	A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two actuarial 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.
GASB	Governmental Accounting Standards Board.

Glossary of Terms (Concluded)

GASB Statements No. 25 and No. 27	These are the governmental accounting standards that set the accounting rules for public retirement systems and the employers that sponsor or contribute to them. Statement No. 27 sets the accounting 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 for GASB Statements No. 67 and No. 68 below.
GASB Statement No. 50	The accounting standard governing a state or local governmental employer's accounting for pensions. This statement remains in effect for pension plans that are not administered as trusts. Please refer to the definition of GASB Statements No. 67 and No. 68 below.
GASB Statements No. 67 and No. 68	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 information prepared according to Statements No. 67 and No. 68 is provided in a separate report beginning with the June 30, 2014 actuarial valuation.
GASB Statement No. 82	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.
Normal Cost	The annual cost assigned, under the Actuarial Cost Method, to the current plan year.
Projected Benefit Funding Ratio	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.
Unfunded Actuarial Accrued Liability	The difference between the Actuarial Accrued Liability and Actuarial Value of Assets.
Valuation Date	The date as of which the Actuarial Present Value of Future Benefits is determined. The benefits expected to be paid in the future are discounted to this date.