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Teachers Retirement Association of Minnesota

Actuarial Valuation Report
For Funding Purposes
As of July 1, 2017

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Cavanaugh Macdonald
CONSULTING, LLC
The experience and dedication you deserve

November 29, 2017

Board of Trustees
Teachers Retirement Association of Minnesota
60 Empire Drive, Suite 400
St. Paul, MN 55103

Dear Board Members:

At your request, we have performed the annual actuarial valuation of the Teachers Retirement Association of Minnesota (TRA or System) as of July 1, 2017. The major findings of the actuarial valuation are contained in this report, which reflects the benefit provisions in place on July 1, 2017. There were no changes to plan provision or actuarial methods; however, there was one change to the actuarial assumptions: an adjustment to the combined service annuity loads. This assumption is based on analysis performed by the actuary retained by Legislative Commission on Pensions and Retirement (LCPR) and their recommendation. Cavanaugh Macdonald Consulting, LLC has not performed its own analysis, but has relied on accuracy of the work performed by the actuary retained by the LCPR.

The investment return assumption to be used for the actuarial funding valuation is set in Minnesota Statute Section 356.215, and currently is 8.5%. Earlier this year, the TRA Board commissioned Cavanaugh Macdonald to perform a review of the economic assumptions to be used in the actuarial funding valuation. The findings and recommendations of that analysis, which were provided to the Board at their November 2017 meeting, included a change to the investment return assumption to 7.5%. In our professional judgment, the 8.5% statutory investment return assumption is not reasonable for the purpose of the funding valuation, i.e., determining the funded status of the plan and future contribution requirements to adequately fund the plan. Nonetheless, this report must be prepared in accordance with the applicable state law, including the statutory investment return assumption of 8.5%. As a result, the investment return assumption used in the July 1, 2017 valuation is unchanged from the prior valuation. While the formal results in this report are prepared using the statutorily required investment return assumption, the key valuation results are also presented in the Executive Summary section of the report using the recently recommended set of economic assumptions, including a 7.5% investment return assumption.

In preparing this report, we relied, without audit, on information (some oral and some in writing) supplied by TRA staff. This information includes, but is not limited to, statutory provisions, member data and financial information. We found this information to be reasonable and comparable to information used in prior valuations. The valuation results depend on the integrity of this information. If any of this information is inaccurate or incomplete, our results may be different and our calculations may need to be revised.

The statutory benefits of the System are reflected in the actuarially calculated contribution rates which are developed using the Entry Age Normal (EAN) cost method. An asset smoothing method is used for actuarial valuation purposes. Gains and losses are reflected in the unfunded actuarial accrued liability and are amortized as a level percent of payroll over a closed period set in state statutes. Actuarial assumptions, including investment return, mortality 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 Trustees. Collectively, these parties are responsible for selecting the plan's funding policy, actuarial methods, asset valuation method, and actuarial assumptions. The policies, methods and assumptions used in this valuation are those that have been so prescribed and are described in Appendix C of this report.

Future actuarial results may differ significantly from the current results presented in this report due to factors such as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law. Since the potential impact of such factors is outside the scope of a normal annual actuarial valuation, an analysis of the range of potential results is not presented herein.

The actuarial computations presented in this report are for purposes of determining the required contribution rates for funding the System. Actuarial computations for purposes of fulfilling financial accounting requirements for the System under the Governmental Accounting Standards Board (GASB) Statement Number 67 will be presented in a separate report. The calculations in the enclosed report have been made on a basis consistent with our understanding of the System's funding requirements and goals and the plan provisions described in Appendix B of this report. Determinations for purposes other than meeting these requirements may be significantly different from the results contained in this report. Accordingly, additional determinations may be needed for other purposes.

On the basis of the foregoing, we hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and that the valuation was prepared in accordance with principles of practice prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures, based on the current provisions of the System. In addition, to the best of our knowledge and belief the valuation 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 State of Minnesota Legislative Commission on Pensions and Retirement (LCPR). We are members of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein. Also, we meet the requirements of "approved actuary" under Minnesota Statutes, Section 356.215, Subdivision 1, Paragraph (c).

Respectfully submitted,

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

Brent A. Banister PhD, FSA, EA, FCA, MAAA
Chief Actuary

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SECTION 1 – EXECUTIVE SUMMARY

The Teachers Retirement Association of Minnesota (TRA or System) provides retirement, disability, and death benefits to Minnesota public school teachers, administrators, and college faculty. This report presents the results of the July 1, 2017 actuarial funding valuation of the System. The primary purposes of performing the actuarial funding valuation are to:

- determine the Required Contribution Rate as set forth in Chapter 356 of the Minnesota statutes;
- determine the sufficiency of the Statutory Contribution Rate as set forth in Chapter 354 of the Minnesota statutes;
- determine the experience of the System since the last valuation date;
- disclose asset and liability measures as of the valuation date; and
- analyze and report on trends in System contributions, assets, and liabilities over the past several years.

There were no changes to plan provisions or actuarial methods since the last valuation; however, there was one change to the actuarial assumptions: an adjustment to the combined service annuity loads. The actuary to the Legislative Commission on Pensions and Retirement, Deloitte Consulting LLP, performed the analysis to determine the appropriate loads for various membership classifications. Based on their work, the liability loads were adjusted as follows:

- Actives: reduced from 1.4% to 0.0%,
- Vested inactive members: increased from 4.0% to 7.0%,
- Non-vested inactive members: increased from 4.0% to 9.0%.

The impact of these changes in assumptions resulted in a decrease in the actuarial accrued liability of $104 million and a decrease in the total required contribution rate of 0.28%.

The actuarial audit of the July 1, 2016 actuarial valuation, performed by Deloitte Consulting LLP, identified two minor changes as potential improvements to the valuation process. Those adjustments were made in the July 1, 2017 valuation and resulted in a small increase in the actuarial accrued liability. In addition, this is the first valuation prepared using the actuarial census file created after significant upgrades to TRA's IT System. There were several improvements in the actuarial file, but one is worth noting. In the past, Cavanaugh Macdonald determined the vested status of members who have terminated employment based on available information. The new actuarial census file includes a data field for the member's vested status, as determined by the System. As a result, some members who were previously assumed to be vested are now identified as non-vested, thereby lowering the actuarial accrued liability. The small increase in the actuarial accrued liability due to the adjustments recommended in the audit report was offset by a decrease in the actuarial accrued liability resulting from the improved quality of the member census data.

The actuarial valuation results provide a "snapshot" view of the System's financial condition on July 1, 2017. The results reflect net favorable experience for the past plan year as demonstrated by an UAAL that was lower than expected. The UAAL on July 1, 2017 is $6.365 billion as compared to an expected UAAL of $6.599 billion (reflecting the $104 million decrease due to the new assumptions). The net favorable experience of $234 million was the combination of an experience gain of $303 million on the actuarial value of assets and an experience loss of $69 million on the System liabilities. The majority of the liability loss was due to the change in the projected date the COLA is expected to increase from 2.0% to 2.5%, which occurs when the System has been 90% funded for two consecutive years.

A summary of the key results from the July 1, 2017 actuarial valuation is shown below. Further detail on the valuation results can be found in the following sections of this Executive Summary.

SECTION 1 – EXECUTIVE SUMMARY

	July 1, 2017 Valuation Results	July 1, 2016 Valuation Results
Total Required Contribution Rate (Chapter 356)	18.43%	18.72%
Statutory Contribution Rate (Chapter 354)	15.93%	15.94%
Sufficiency/(Deficiency)	(2.50%)	(2.78%)
Unfunded Actuarial Accrued Liability ($M)	$6,365	$6,522
Funded Ratio (Actuarial Assets)	76.79%	75.59%

The contribution deficiency decreased from 2.78% of payroll in last year's valuation to 2.50% of payroll in the 2017 valuation. The most significant component of this decrease was due to the gain on actuarial assets.

Experience studies are prepared for TRA periodically, with the most recent report based on the six-year period of July 1, 2008 through June 30, 2014. That experience study included a recommendation to lower the investment return assumption to 8.00%. However, the investment return assumption is set in statute and requires legislative action to make a change. Such action has not yet occurred. Earlier this year, the TRA Board commissioned Cavanaugh Macdonald to perform a review of the economic assumptions used in the actuarial valuation. The findings and recommendations were provided to the Board at their November 2017 meeting. The report's findings represent our best estimate for the economic assumptions to be used in TRA's funding valuation. Specific assumption changes include:

- Inflation: 2.50%
- Investment Return: 7.50%
- Salary Increase: 2.85% for 10 years and 3.25% thereafter plus merit scale
- Payroll Growth: 3.00%

The investment return assumption to be used for the actuarial funding valuation is set in Minnesota Statute Section 356.215, and currently is 8.5%. In our professional judgment, the 8.5% statutory investment return assumption is not reasonable for the purpose of the funding valuation, i.e., determining the funded status of the plan and future contribution requirements to adequately fund the plan. Nonetheless, this report must be prepared in accordance with the applicable state law, including the statutory investment return assumption of 8.5%. However, in order to demonstrate the potential impact of the recently recommended set of economic assumptions, including a 7.5% investment return assumption, the key valuation results are also shown using our recommended set of economic assumptions for illustrative purposes (see page 8). The unfunded actuarial liability increases from $6.36 billion to $9.27 billion and the contribution deficiency increases from 2.50% to 7.40%.

EXPERIENCE FOR THE LAST PLAN YEAR

Numerous factors contributed to the change in the System's assets, liabilities and actuarial contribution rate between July 1, 2016 and July 1, 2017. The components are examined in the following discussion.

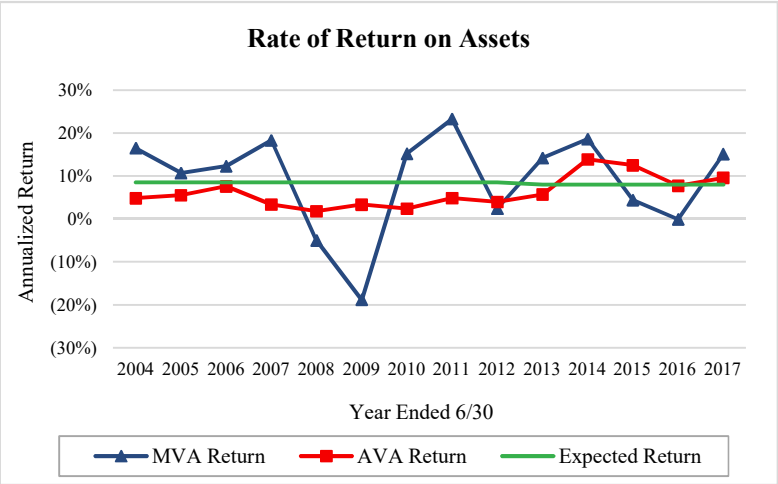
ASSETS

As of June 30, 2017, TRA had net assets of $21.3 billion, when measured on a market value basis. This was an increase of approximately $1.8 billion from the prior year.

The market value of assets is not used directly in the calculation of the unfunded actuarial accrued liability and the Required Contribution Rate (actuarial contribution rate). An asset valuation method, which smoothes the effect of market fluctuations, is used to determine the value of assets used in the valuation, called the "actuarial value of assets". In this year's valuation, the actuarial value of assets as of June 30, 2017 was $21.1 billion, an increase of $0.9 billion from the value in the prior valuation. The components of change in the asset values are shown in the following table:

	Actuarial Value ($M)	Market Value ($M)
Net Assets, June 30, 2016	$20,194	$19,420
- Employer and Member Contributions and State Aid	765	765
- Benefit Payments and Administrative Expenses	(1,789)	(1,789)
- Investment Income	1,893	2,857
Net Assets, June 30, 2017	$21,063	$21,253
Asset Return	9.6%	15.1%

On a market value basis, the rate of return was 15.1% as reported by the State Board of Investment (SBI). Due to the application of the asset smoothing method, including the scheduled recognition of the deferred investment experience, the rate of return on the actuarial value of assets was 9.6%. Because this rate of return was higher than the assumed rate of return for this period of 8.0%, there was an actuarial gain of $303 million. Please see Section II of this report for more detailed information on the market and actuarial value of assets.



Market value returns have been very volatile. An asset smoothing method is used to calculate the actuarial value of assets that recognizes investment gains and losses equally over a five year period. As can be seen in this graph, the return on actuarial assets is much smoother than the return on market value.

LIABILITIES

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

The unfunded actuarial accrued liability is shown as of July 1, 2017 in the following table:

	Actuarial Value of Assets	Market Value of Assets
($Millions)		
Actuarial Accrued Liability	$27,428	$27,428
Value of Assets	21,063	21,253
Unfunded Actuarial Accrued Liability*	6,365	6,174
Funded Ratio	76.79%	77.49%

*Numbers may not add due to rounding

See Section III of the report for the detailed development of the unfunded actuarial accrued liability.

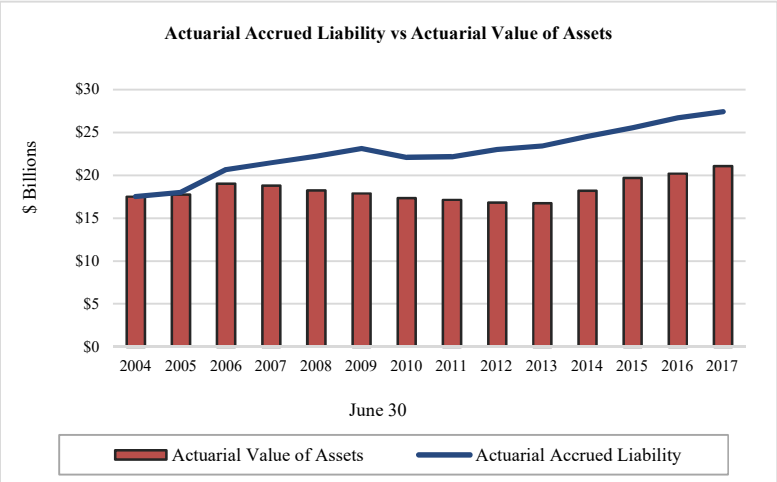
Changes in the UAAL occur for various reasons. The net decrease in the UAAL from July 1, 2016 to July 1, 2017 was $157 million. The components of this net change are shown in the table below (in millions):

Unfunded Actuarial Accrued Liability, July 1, 2016 ($M)		$6,522
• Expected increase from amortization method	$32	
• Expected increase from contributions below Required Rate	140	
• Investment experience	(303)	
• Liability experience	69	
• Other experience	9	
• Assumption change	(104)	
• Total		(157)
Unfunded Actuarial Accrued Liability, July 1, 2017		$6,365

As shown above, various components impacted the UAAL. Actuarial gains (losses), which result from actual experience that is more (less) favorable than anticipated based on the actuarial assumptions, are reflected in the UAAL and are measured as the difference between the expected unfunded actuarial accrued liability and the actual unfunded actuarial accrued liability, taking into account any changes due to actuarial assumptions and methods or benefit provision changes. Overall, the System experienced a net actuarial gain of $234 million. The actuarial gain may be explained by considering the separate experience of assets and liabilities. As noted earlier, there was a $303 million gain on the actuarial value of assets and a $69 million loss on liabilities. Due to the 15% return on the market value of assets, the funded ratio is projected to reach 90% and trigger the

SECTION 1 – EXECUTIVE SUMMARY

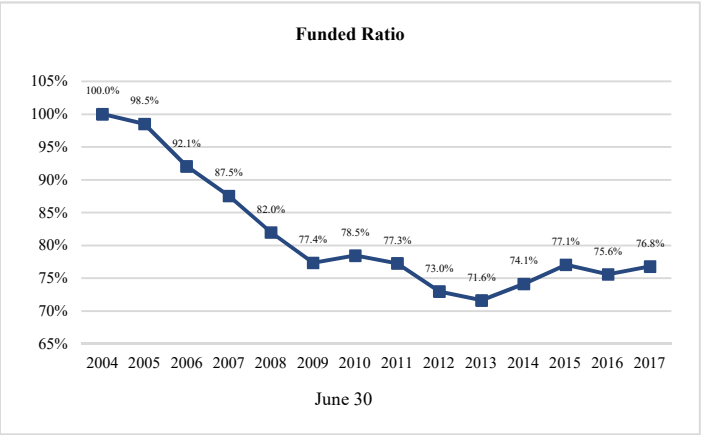
COLA increase from 2.0% to 2.5% in 2045. This created an actuarial loss on liabilities as the prior valuation did not assume an increase in the COLA would occur.



The actuarial value of assets was slightly higher than the actuarial accrued liability in the early part of the period. Investment experience below the assumed rate of return over this period has served to increase the difference between the actuarial accrued liability and actuarial assets.

An evaluation of the unfunded actuarial accrued liability on a pure dollar basis may not provide a complete analysis since only the difference between the assets and liabilities (which are both very large numbers) is reflected. Another way to evaluate the unfunded actuarial accrued liability and the progress made in its funding is to track the funded ratio, the ratio of the actuarial value of assets to the actuarial accrued liability. Note that if the funded status were calculated using the market value of assets, the results could differ. The funded ratios and unfunded actuarial accrued liability measures, as shown, are not indicative of whether or not the System could settle all current benefit obligations with existing assets. Furthermore, these results do not, on their own, indicate whether or not future funding of the System will be required, nor the amount. The funded status information is shown below (in millions).

	7/1/13	7/1/14	7/1/15	7/1/16	7/1/17
Funded Ratio	71.6%	74.1%	77.1%	75.6%	76.8%
Unfunded Actuarial Accrued Liability ($M)	$6,644	$6,347	$5,865	$6,522	$6,365



The funded ratio has decreased over this period largely due to investment experience less than the assumed rate of return. The benefit reductions passed by the 2010 legislature, the final recognition of the 2008 and 2009 losses, and the strong investment returns since FY10 have resulted in the funded ratio beginning to rebound from the funded level in 2013.

CONTRIBUTION RATE

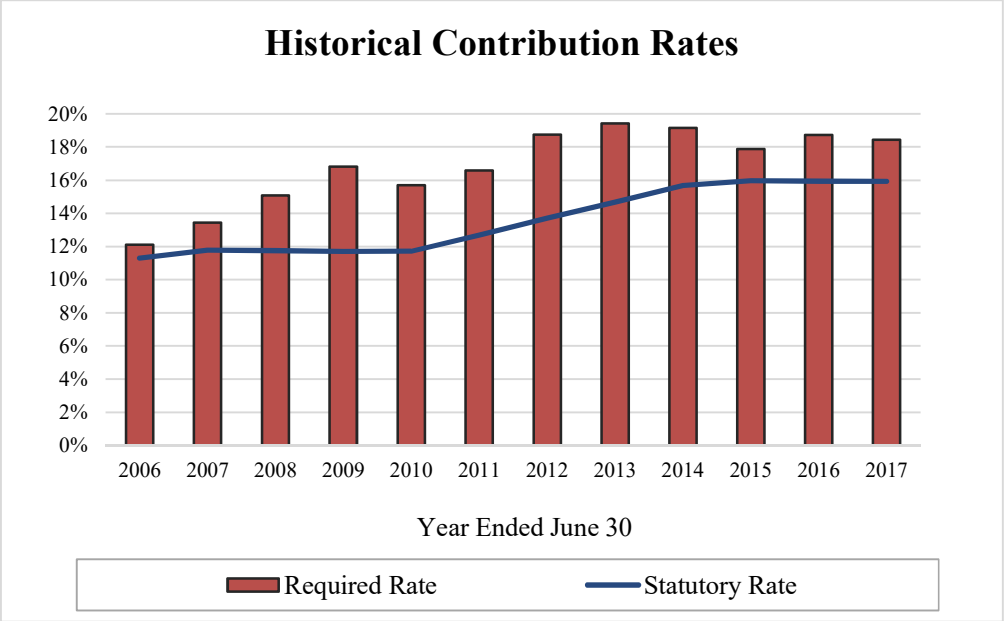
Under the Entry Age Normal cost method, the actuarial contribution rate consists of three components:

- a "normal cost" for the portion of projected liabilities allocated by the actuarial cost method to service of members during the year following the valuation date,
- an "unfunded actuarial accrued liability contribution" for the excess of the portion of projected liabilities allocated to service to date over the actuarial value of assets (unfunded actuarial accrued liability); and
- an amount to cover estimated administrative expenses for the plan year.

See Section IV of the report for the detailed development of these contribution rates which are summarized in the following table:

Contribution Rates	July 1, 2017	July 1, 2016
1. Normal Cost Rate	8.77%	8.79%
2. UAAL Contribution Rate	9.41%	9.70%
3. Expenses	0.25%	0.23%
4. Total Required Contribution Rate	18.43%	18.72%
5. Statutory Contribution Rate	15.93%	15.94%
6. Contribution Deficiency (5) - (4)	(2.50%)	(2.78%)

A historical summary of the Statutory and Required Contribution Rates is shown in the graph below:



When a system is funded with a fixed contribution rate (Statutory Contribution Rate), it is expected that the fixed contribution rate may be either higher or lower than the actuarial contribution rate (Required Contribution Rate for TRA) as determined in the actuarial valuation each year. However, when the Statutory Contribution Rate is consistently lower than the Required Contribution Rate for a long period, it can significantly impact the funding progress of the system and result in an increasing UAAL and declining funded ratio. For TRA, the

SECTION 1 – EXECUTIVE SUMMARY

Statutory Contribution Rate has been significantly below the Required Contribution Rate for more than ten years. Over this time, the funded status of the system has declined from 92% to 77%. Actual investment experience over this time period also had a significant impact on the system's funding, but the long-term continuation of actual contributions that are significantly less than the actuarial contribution rate is a concern from an actuarial standpoint. Additional analysis of the long-term funding of the system should be performed to address what, if any, changes should be made to ensure the health of the retirement system.

The actuarial contribution rate (Required Contribution Rate) is determined based on the snapshot of the System taken on the valuation date, July 1, 2017. The actuarial contribution rate in future years will change each year as the deferred actuarial investment experience is recognized and other experience (both investment and demographic) impacts the System. The most volatile component of the actuarial contribution rate is typically the actual investment return, although the asset smoothing method helps to dampen the impact. Further, the date the funded ratio is projected to reach 90% for two consecutive years, triggering the increase in the COLA from 2.0% to 2.5%, can move significantly with the actual investment return on the market value of assets. As a result, actual investment returns above the assumed rate of return tend to move the projected date forward and increase the actuarial accrued liability, while actual investment returns below the expected return extend the projected date, lowering the actuarial accrued liability. This interactive dynamic between liabilities and asset performance somewhat dampens the impact of investment return volatility on the System's funding.

SUMMARY

The investment return on the market value of assets for FY 2017 was 15.1%, as reported by SBI. However, due to the application of the asset smoothing method, the return on the actuarial value of assets was 9.6%. Since this return was above the assumed rate of return for fiscal year 2017 (8.0%), there was an actuarial gain on the actuarial value of assets and the funded ratio increased from 75.59% in last year's valuation to 76.79% this year.

As mentioned earlier, the System utilizes an asset smoothing method in the valuation process. While this is a common procedure for public retirement systems, it is important to identify the potential impact of the deferred investment experience. The asset smoothing method impacts only the timing of when the actual market experience is recognized in the valuation process. The net deferred investment gain of $0.2 billion represents about 1% of the market value of assets.

The key valuation results from the July 1, 2017 actuarial valuation are shown below, using both actuarial and market value of assets.

	Actuarial Value	Market Value
Statutory Rate	15.93%	15.93%
Required Contribution		
Normal Cost	8.77%	8.77%
UAAL Contribution	9.41%	9.13%
Expenses	0.25%	0.25%
Total Required Contribution	18.43%	18.15%
(Deficiency)/Sufficiency	(2.50%)	(2.22%)
UAAL ($M)	$6,365	$6,174
Funded Ratio	76.79%	77.49%

SECTION 1 – EXECUTIVE SUMMARY

For purposes of the statutorily required actuarial valuation report for funding, the investment return assumption is set in statute. Currently, the assumption is 8.00% for the five year period from July 1, 2012 to June 30, 2017 and 8.50% thereafter. Although the TRA Board recommended a decrease to the long-term investment return assumption, the relevant sections of state law were not changed during the 2016 or 2017 legislative session. Therefore, the formal results in this report have been prepared using an investment return assumption of 8.50%, as prescribed in statute. As noted earlier, the TRA Board commissioned Cavanaugh Macdonald to perform a review of the economic assumptions used in the actuarial valuation. The findings and recommendations were provided to the Board at their November 2017 meeting. The report's findings represent our best estimate for the economic assumptions to be used in TRA's funding valuation, as set out below:

- Lower the investment return assumption from 8.50% to 7.50%.
- Lower price inflation from 2.75% to 2.50%.
- Lower payroll growth assumption from 3.50% to 3.00%.
- Lower the wage inflation component of the salary increase assumption from 3.50% to 2.85% for 10 years and 3.25%, thereafter.

The following table provides a summary of the key valuation measurements, on both an actuarial and market value basis, using the recommended set of economic assumptions. In addition, Minnesota Statutes, Section 356.215, Subdivision 11 addresses the recalculation of the established date for full funding when there is a change in the actuarial assumptions, benefit structure, or actuarial cost method that produces a net increase in the unfunded actuarial accrued liability (UAAL). If the recommended set of economic assumptions are adopted, it would result in a net increase in the UAAL so this section of statute would be applicable. Based on the required calculation in Minnesota Statutes, Section 356.215, Subdivision 11, the amortization period would be extended two years, from FY 2039 to FY 2041.

	Valuation Results	Recommended Assumptions	
		Actuarial Value	Market Value
Value of Assets	$ 21.06B	$ 21.06B	$ 21.25B
Unfunded Actuarial Accrued Liability (UAAL)	$ 6.36B	$ 9.27B	$ 9.08B
Actuarial Accrued Liability Funding Ratio	76.8%	69.4%	70.1%
Normal Cost Rate (% of pay)	8.77%	10.54%	10.54%
Amortization of UAAL (% of pay)	9.41%	12.54% *	12.28% *
Expenses (% of pay)	0.25%	0.25%	0.25%
Total Required Contribution (% of pay)	18.43%	23.33%	23.07%
Member and Employer Contributions	15.22%	15.22%	15.22%
State Aid	0.71%	0.71%	0.71%
Contribution Deficiency (% of pay)	(2.50%)	(7.40%)	(7.14%)

*Reflects extension of amortization period to 24 years following Minnesota Statute Section 356.215, Subdivision 11

If the Total Required Contribution Rate using the recommended set of economic assumptions is calculated, based on the UAAL using the market value of assets, the Required Contribution Rate decreases to 23.07% and the resulting Contribution Deficiency is 7.14%.

The long-term financial health of this retirement System, like all retirement systems, is heavily dependent on two key items: (1) future investment returns and (2) contributions to the System. Changes were made by the 2010 Legislature to strengthen the funding of TRA and enhance its long-term sustainability. Contributions were increased by a total of 4%, phased in over four years beginning July 1, 2011, and benefit reductions were implemented. These changes, along with strong investment performance in several of the following years, significantly improved the projected long-term funding of the System. However, the assumption changes, coupled with some recent years of actual investment experience below the expected investment return have eroded some of this progress. If the recommended set of economic assumptions is changed in statute, the subsequent valuation results will reflect a significant decline in the funding of the system, without accompanying changes in contributions, benefits or both. It is important to note that it is the actual investment returns, not the assumed investment return, that will ultimately determine the cost to provide the promised benefits.

We conclude this executive summary by presenting comparative statistics and actuarial information on both the July 1, 2017 and July 1, 2016 valuations.

Principal Valuation Results

A summary of principal valuation results from the current valuation and the prior valuation follows.

	Actuarial Valuation as of	
	July 1, 2017	**July 1, 2016**
1. PARTICIPANT DATA		
A. Active members		
1. Number	81,811	80,530
2. Projected annual earnings for fiscal year *(000s)*	5,043,499	4,858,593
3. Average projected annual earnings for fiscal year 2018	61,648	60,333
4. Average age	43.2	43.3
5. Average service	11.9	11.9
B. Service retirements	58,989	57,891
C. Survivors	5,268	5,091
D. Disability retirements	517	521
E. Deferred retirements	14,030	13,680
F. Non-vested terminated members	33,344	31,850
G. Total	**193,959**	**189,563**
2. LIABILITIES AND FUNDING RATIOS *(dollars in thousands)*		
A. Accrued Benefit Funding Ratio		
1. Current assets (AVA)	$ 21,062,789	$ 20,194,279
2. Current benefit obligations	25,942,767	25,304,940
3. Funding ratio	81.19%	79.80%
B. Actuarial Accrued Liability Funding Ratio		
1. Current assets (AVA)	$ 21,062,789	$ 20,194,279
2. Market value of assets (MVA)	21,253,486	19,420,131
3. Actuarial accrued liability	27,427,702	26,716,216
4. Unfunded actuarial accrued liability *(B.3. - B.1.)*	6,364,913	6,521,937
5. Funding ratio (AVA) *(B.1. / B.3.)*	76.79%	75.59%
6. Funding ratio (MVA) *(B.2. / B.3.)*	77.49%	72.69%
C. Projected Benefit Funding Ratio		
1. Current and expected future assets	$ 30,180,088	$ 29,080,864
2. Current and expected future benefit obligations	31,871,009	30,950,072
3. Funding ratio (AVA)	94.69%	93.96%
3. CONTRIBUTIONS *(% of Payroll)*		
A. Normal Cost Rate	8.77%	8.79%
B. UAAL Amortization Payment	9.41%	9.70%
C. Expenses	0.25%	0.23%
D. Total Required Contribution (Chapter 356)	18.43%	18.72%
E. Statutory Contribution (Chapter 354)	15.93%	15.94%
F. Contribution (Deficiency)/Sufficiency *(3.E. - 3.D.)*	(2.50%)	(2.78%)

SECTION II

PLAN ASSETS

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SECTION II - PLAN ASSETS

In this section, the values assigned to the assets held by the System are presented. These assets are valued on two different bases: the market value and the actuarial value.

Market Value of Net Assets

Market values represent a "snapshot" of the fair value of System assets as of the valuation date.

Actuarial Value of Net Assets

The market value of assets may not necessarily be the best measure of the System's ongoing ability to meet its obligations.

To arrive at a suitable value for the actuarial valuation, a technique for determining the actuarial value of assets is used which dampens volatility in the market value while still indirectly recognizing market value. The methodology used to determine the actuarial value of assets is prescribed in Minnesota Statutes, Section 356.215, Subdivision 1, Paragraph (f). 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 determined as the excess of actual investment income over the expected investment income based on the average asset value as calculated above;
- The investment gain or (loss) so determined is recognized over five years at 20% per year;
- The asset value is the sum of the market value plus the scheduled recognition of investment gains or (losses) during the current and the preceding four fiscal years.

SECTION II - PLAN ASSETS

TABLE 1

STATEMENT OF FIDUCIARY NET POSITION

(Dollars in Thousands)

	June 30, 2017	June 30, 2016
	Amount	Amount
Cash and short-term investments		
Cash	$ 6,751	$ 8,491
Building account cash	41	64
Short term investments	622,773	410,605
Total cash and short term investments	$ 629,565	$ 419,160
Accounts Receivable	21,281	21,765
Investments (at fair value)		
Bond pool	$ 4,098,977	$ 4,788,125
Alternative investments pool	2,773,952	2,482,640
Indexed equity pool	0	2,995,720
Domestic stock pool	9,142,315	5,996,792
International Stock Fund	4,583,377	2,714,605
Total investments	$ 20,598,621	$ 18,977,882
Securities lending collateral	$ 2,182,399	$ 2,748,476
Building		
Land	$ 171	$ 171
Building & equipment net of depreciation	6,251	6,523
Total building	$ 6,422	$ 6,694
Capital assets net of depreciation	16,797	14,902
Total Assets	**$ 23,455,085**	**$ 22,188,879**

TABLE 1 (continued)

STATEMENT OF FIDUCIARY NET POSITION

(Dollars in Thousands)

	June 30, 2017	June 30, 2016
Liabilities	Amount	Amount
Current		
Accounts payable	$ 8,367	$ 9,136
Accrued compensated absences	99	111
Accrued expenses - building	41	4
Bonds payable	616	603
Bonds interest payable	11	12
Securities lending collateral	2,182,399	2,748,477
Total current liabilities	$ 2,191,533	$ 2,758,343
Long term		
Accrued compensated absences	$ 834	$ 808
Bonds payable	4,628	5,297
Total long term liabilities	$ 5,462	$ 6,105
Total Liabilities	**$ 2,196,995**	$ **2,764,448**
Net position restricted for pensions	**$ 21,258,090**	**$ 19,424,431**
Earnings Limitation Savings Account (ELSA) accounts payable	(4,604)	(4,300)
Net position restricted for pensions, after adjustment for ELSA accounts	**$ 21,253,486**	$ **19,420,131**

TABLE 2

STATEMENT OF CHANGES IN FIDUCIARY NET POSITION

(Dollars in Thousands)

The following exhibit shows the revenue, expenses and resulting assets of the Fund as reported by the Teachers Retirement Association for the Plan's fiscal years ended June 30, 2017 and 2016.

	For Year Ended	
	June 30, 2017	**June 30, 2016**
Additions		
Contributions		
Employee	$ 361,175	$ 347,256
Employer	367,791	354,961
Direct aid (state/city/district)	35,587	35,587
Earnings Limitation Savings Account (ELSA)	1,995	1,961
Total contributions	$ 766,548	$ 739,765
Investment Income		
Investment appreciation in fair value	$ 2,863,554	$ (9,471)
Less investment expenses	(22,060)	(26,265)
Net Investment Income	$ 2,841,494	$ (35,736)
Securities Lending activities		
Securities lending income	$ 31,122	$ 20,348
Securities lending expenses:		
Borrowing rebates	(12,814)	(4,065)
Management fees	(4,584)	(4,219)
Total securities lending expenses	(17,398)	(8,284)
Net income from securities lending	13,724	12,064
Total Net Investment Income	$ 2,855,218	$ (23,672)
Other Income	2,404	3,569
Total Additions	**$ 3,624,170**	**$ 719,662**
Deductions		
Benefits Paid		
Retirement benefits	$ (1,765,573)	$ (1,716,733)
Refunds of contributions to members	(11,241)	(11,290)
Total benefits paid	$ (1,776,814)	$ (1,728,023)
Administrative Expenses	(11,702)	(11,338)
Total Deductions	**$ (1,788,516)**	**$ (1,739,361)**
Increase/(Decrease) in ELSA Account Value	(2,299)	(2,163)
Net Increase (Decrease)	**1,833,355**	**(1,021,862)**
Net Position Restricted for Pensions		
Beginning of Year	**$ 19,420,131**	**$ 20,441,993**
End of Year	**$ 21,253,486**	**$ 19,420,131**

TABLE 3

ACTUARIAL VALUE OF ASSETS AS OF JUNE 30, 2017

(Dollars in Thousands)

1. Market value of assets available for benefits				**$ 21,253,486**
2. Determination of average balance				
a. Assets available at July 1, 2016*				$ 19,424,431
b. Assets available at June 30, 2017*				21,258,090
c. Net investment income for fiscal year ending June 30, 2017				2,855,218
d. Average balance *(a. + b. - c.) / 2*				$ 18,913,652
3. Expected return *(8.0% * 2.d.)*				1,513,092
4. Actual return				2,855,218
5. Current year unrecognized asset return (4. - 3.)				1,342,126
6. Unrecognized asset returns				
	Original Amount	**% Not Recognized**		
a. Year ended June 30, 2017	$ 1,342,126	80%		$ 1,073,701
b. Year ended June 30, 2016	(1,619,440)	60%		(971,664)
c. Year ended June 30, 2015	(706,091)	40%		(282,436)
d. Year ended June 30, 2014	1,855,481	20%		371,096
e. Total return not yet recognized				$ 190,697
7. Actuarial value of assets at June 30, 2017 (1. - 6.e.)				**$ 21,062,789**

* *Before recognition of ELSA accounts payable.*

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SECTION III

PLAN LIABILITIES

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SECTION III - PLAN LIABILITIES

In the previous section, an analysis was given of the assets of the System as of the valuation date, July 1, 2017. In this section, the discussion will focus on the commitments of the System, which are referred to as its liabilities.

Table 5 contains an analysis of the actuarial present value of all projected benefits for contributing members, inactive members, retirees and their beneficiaries. The analysis is provided for each group.

The liabilities summarized in Table 5 include the actuarial present value of all projected benefits expected to be paid with respect to each member. For an active member, this value includes measures of both benefits already earned and future benefits expected to be earned. For all members, active and retired, the value extends over benefits earnable and payable for the rest of their lives and, if an optional benefit is chosen, for the lives of the surviving beneficiaries.

The actuarial assumptions used to determine liabilities are based on the results of the 2008-2014 Experience Study. This set of assumptions is shown in Appendix C.

The liabilities reflect the benefit structure in place as of July 1, 2017.

Actuarial Liabilities

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

(1) that which is attributable to the past and

(2) that which is attributable to the future.

Actuarial terminology calls the part attributable to the past the "past service liability" or the "actuarial accrued liability". The portion allocated to the future is known as the present value of future normal costs, with the specific piece of it allocated to the current year being called the "normal cost". Table 5 contains the calculation of the unfunded actuarial accrued liability.

TABLE 4

ACTUARIAL VALUATION BALANCE SHEET AS OF JULY 1, 2017

(Dollars in Thousands)

The actuarial balance sheet is based on the fundamental equation that, at any given time, the present value of benefits to be paid in the future must be equal to the assets on hand plus the present value of future contributions to be received. The total contribution rate is determined as that amount which will make the total present and potential assets balance with the total present value of projected benefits.

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. This reserve system is designed to enable the establishment of a level rate of contribution each year.

A. Actuarial Value of Assets	$ 21,062,789
B. Expected Future Assets	
1. Present value of expected future statutory supplemental contributions*	$ 4,673,992
2. Present value of expected future normal cost contributions	4,443,307
3. Total expected future assets *(1. + 2.)*	$ 9,117,299
C. Total Current and Expected Future Assets**	$ 30,180,088

	Non-Vested Benefits	Vested Benefits	Total
D. Current Benefit Obligations			
1. Benefit recipients			
a. Service retirements	$ 0	$ 16,397,276	$ 16,397,276
b. Disability	0	147,962	147,962
c. Survivors	0	1,089,032	1,089,032
2. Deferred retirements with augmentation to Normal Retirement Date	0	618,289	618,289
3. Former members without vested rights***	97,331	0	97,331
4. Active members	63,845	7,529,032	7,592,877
5. Total Current Benefit Obligations	$ 161,176	$ 25,781,591	$ 25,942,767

E. Expected Future Benefit Obligations	5,928,242
F. Total Current and Expected Future Benefit Obligations	31,871,009
G. Unfunded Current Benefit Obligations *(D.5. - A.)*	4,879,978
H. Unfunded Current and Future Benefit Obligations *(F. - C.)*	1,690,921

* *Under LCPR guidelines, this amount does not include supplemental payments which could occur after the expiration of the remaining 22 year amortization period.*

** *Does not reflect deferred investment experience in the asset smoothing method. Total expected future assets on a market value basis is $ 30,370,785.*

*** *Former members with insufficient service to vest who have not collected a refund of member contributions as of the valuation date.*

TABLE 5

DETERMINATION OF UNFUNDED ACTUARIAL ACCRUED LIABILITY AS OF JULY 1, 2017

(Dollars in Thousands)

	Actuarial Present Value of Projected Benefits	Actuarial Present Value of Future Normal Costs	Actuarial Accrued Liability
1. Active Members			
a. Retirement annuities	$ 12,688,479	$ (3,642,037)	$ 9,046,442
b. Disability Benefits	277,323	(113,219)	164,104
c. Survivor benefits	102,406	(37,723)	64,683
d. Deferred retirements	435,205	(488,401)	(53,196)
e. Refunds	17,706	(161,927)	(144,221)
f. Total	$ 13,521,119	$ (4,443,307)	$ 9,077,812
2. Deferred Retirements with Future Augmentation to Normal Retirement Date	618,289	0	618,289
3. Former Members Without Vested Rights	97,331	0	97,331
4. Benefit Recipients	17,634,270	0	17,634,270
5. Total Actuarial Accrued Liability	$ 31,871,009	$ (4,443,307)	$ 27,427,702
6. Actuarial Value of Assets			$ 21,062,789
7. Unfunded Actuarial Accrued Liability (UAAL)			$ 6,364,913

* On a market value of assets basis, the unfunded actuarial accrued liability is $6,174,216.

TABLE 6

CHANGES IN UNFUNDED ACTUARIAL ACCRUED LIABILITY (UAAL)

(Dollars in Thousands)

A. Unfunded actuarial accrued liability at beginning of year	$	6,521,937
B. Changes due to interest requirements and current rate of funding*		
1. Normal cost and actual administrative expenses	$	438,803
2. Contributions		(766,548)
3. Interest on A., B.1., and B.2. at 8.0%		508,897
4. Total *(B.1. + B.2. + B.3.)*	$	181,152
C. Expected unfunded actuarial accrued liability at end of year *(A. + B.4.)*	$	6,703,089
D. Increase (decrease) due to actuarial losses (gains) because of experience deviations from expected		
1. Salary increases	$	(123,825)
2. Investment return (actuarial assets)		(302,867)
3. Mortality of active members		(1,640)
4. Mortality of benefit recipients		(10,219)
5. Retirement from active service		58,987
6. Change in date COLA is expected to increase		128,178
7. Other items		17,504
8. Total	$	(233,882)
E. Unfunded actuarial accrued liability at end of year before plan amendments and changes in actuarial assumptions *(C. + D.8.)*	$	6,469,207
F. Change in unfunded actuarial accrued liability due change in assumptions regarding Combined Service Annuity load factors	$	(104,294)
G. Unfunded actuarial accrued liability at end of year *(E. + F.)*	$	6,364,913

* *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 in the absence of actuarial gains.*

SECTION IV

SYSTEM CONTRIBUTIONS

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SECTION IV - CONTRIBUTIONS

Sections II and III were devoted to a discussion of the assets and liabilities of the System. A comparison of Tables 3 and 4 indicates that current assets fall short of meeting the actuarial present value of future projected benefits (total liability). This is expected in all but a fully closed fund, where no further contributions are anticipated.

In an active system, there will almost always be a difference between the actuarial value of assets and total liabilities. This deficiency has to be made up by future contributions and investment returns. An actuarial valuation sets out a schedule of future contributions that will finance this deficiency in an orderly fashion.

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

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

Description of Rate Components

The actuarial cost method for the System is the traditional Entry Age Normal (EAN) – level percent of pay cost method. Under the EAN cost method, the actuarial present value of each member's projected benefits is allocated on a level basis over the member's compensation between the entry age of the member and the assumed exit ages. The portion of the actuarial present value allocated to the valuation year is called the normal cost. The actuarial present value of benefits allocated to prior years of service is called the actuarial accrued liability. The unfunded actuarial accrued liability (UAAL) represents the difference between the actuarial accrued liability and the actuarial value of assets as of the valuation date. The unfunded actuarial accrued liability is calculated each year and reflects experience gains/losses (actual experience versus experience expected based on the actuarial assumptions). The UAAL is amortized over a period set in state statute (by June 30, 2039). Contributions to fund the UAAL are determined as a level percentage of payroll assuming payroll increases 3.50% each year.

TABLE 7

NORMAL COST AT JULY 1, 2017

(Dollars in Thousands)

	Percent of Pay		Dollar Amount
1. Normal Cost Rate			
a. Retirement benefits	7.25%	$	365,673
b. Disability benefits	0.21%		10,593
c. Survivor benefits	0.08%		4,036
d. Deferred retirement benefits*	0.90%		45,393
e. Refunds	0.33%		16,645
f. Total	8.77%	$	442,340

* For vested members, includes the greater of the refund amount or the present value of the deferred monthly benefit.

TABLE 8

DETERMINATION OF SUPPLEMENTAL CONTRIBUTION RATE

(Dollars in Thousands)

		Amount
A. Determination of Unfunded Actuarial Accrued Liability (UAAL)*		
1. Actuarial accrued liability	$	27,427,702
2. Actuarial value of assets		21,062,789
3. Unfunded actuarial accrued liability	$	6,364,913
B. Determination of Supplemental Contribution Rate*		
1. Present value of future payrolls through the amortization date of June 30, 2039	$	67,640,988
2. Supplemental contribution rate *(A.3. / B.1.)***		9.41%

* *On a market value of assets basis, the unfunded actuarial accrued liability is $6,174,216 and the supplemental contribution rate is 9.13% of payroll.*

** *The amortization factor as of July 1, 2017 is 13.4115.*

TABLE 9

DETERMINATION OF CONTRIBUTION SUFFICIENCY/(DEFICIENCY)

(Dollars in Thousands)

The annual required contribution (ARC) is the sum of normal cost, a supplemental contribution to amortize the UAAL, and an allowance for expenses.

	Percent of Payroll		Dollar Amount
A. Statutory contributions - Chapter 354			
1. Employee contributions	7.50%	$	378,272
2. Employer contributions*	7.72%		389,379
3. Supplemental contributions**			
a. 1993 Legislation	0.10%		5,000
b. 1996 Legislation	0.06%		3,256
c. 1997 Legislation	0.26%		12,954
d. 2014 Legislation	0.29%		14,377
4. Total	15.93%	$	803,238
B. Required contributions - Chapter 356			
1. Normal cost			
a. Retirement benefits	7.25%	$	365,673
b. Disability benefits	0.21%		10,593
c. Survivor benefits	0.08%		4,036
d. Deferred retirement benefits	0.90%		45,393
e. Refunds	0.33%		16,645
f. Total	8.77%	$	442,340
2. Supplemental contribution for the amortization of the Unfunded Actuarial Accrued Liability by June 30, 2039	9.41%		474,593
3. Allowance for expenses	0.25%	$	12,609
4. Total annual contribution for fiscal year ending June 30, 2018***	18.43%	$	929,542
C. Contribution Sufficiency / (Deficiency) ***(A.4. - B.4.)*****	(2.50%)	$	(126,304)

Note: Projected annual payroll for fiscal year beginning on the valuation date: $5,043,499

* *Employer contribution rate is blended to reflect rates of 15.14% of pay for Basic members, 7.50% of pay for Coordinated members not employed by Special School District #1, and 11.14% of pay for Coordinated members who are employed by Special School District #1.*

** *Includes contributions from School District #1, the City of Minneapolis, matching state contributions.*

*** *On a market value of assets basis, the total required contribution is 18.15% of payroll and the contribution deficiency is 2.22% of payroll.*

TABLE 10

STATUTORY AND REQUIRED CONTRIBUTION AMOUNTS

(Dollars in Thousands)

Basic Members

	Percent of Payroll		Dollar Amount
A. Statutory contributions - Chapter 354			
1. Employee contributions	11.00%	$	31
2. Employer contributions*	15.14%		43
3. Supplemental contributions**			
a. 1993 Legislation	0.10%		0
b. 1996 Legislation	0.06%		0
c. 1997 Legislation	0.26%		1
d. 2014 Legislation	0.29%		1
4. Total	26.85%	$	76
B. Required contributions - Chapter 356			
1. Normal cost			
a. Retirement benefits	14.05%	$	40
b. Disability benefits	0.76%		2
c. Survivor benefits	0.34%		1
d. Deferred retirement benefits	1.43%		4
e. Refunds	0.58%		2
f. Total	17.16%	$	49

Note: Projected annual payroll for fiscal year beginning on the valuation date: $284 for 3 members.

* *All Basic active members are teachers employed by Special School District #1; employer contribution rate of 15.14% of payroll applies.*

** *Includes contributions from School District #1, the City of Minneapolis, matching state contributions.*

TABLE 11

STATUTORY AND REQUIRED CONTRIBUTION AMOUNTS

(Dollars in Thousands)

Coordinated Members

	Percent of Payroll		Dollar Amount
A. Statutory contributions - Chapter 354			
1. Employee contributions	7.50%	$	378,241
2. Employer contributions*	7.72%		389,336
3. Supplemental contributions**			
a. 1993 Legislation	0.10%		5,000
b. 1996 Legislation	0.06%		3,256
c. 1997 Legislation	0.26%		12,953
d. 2014 Legislation	0.29%		14,376
4. Total	15.93%	$	803,162
B. Required contributions - Chapter 356			
1. Normal cost			
a. Retirement benefits	7.25%	$	365,633
b. Disability benefits	0.21%		10,591
c. Survivor benefits	0.08%		4,035
d. Deferred retirement benefits	0.90%		45,389
e. Refunds	0.33%		16,643
f. Total	8.77%	$	442,291

Note: Projected annual payroll for fiscal year beginning on the valuation date: $5,043,215

* *Employer contribution rate is blended to reflect rates of 7.50% of pay for Coordinated members not employed by Special School District #1, and 11.14% of pay for Coordinated members who are employed by Special School District #1. The rate was blended using the prior year's actual covered payroll of $4,688,875, which includes $4,407,602 for Coordinated members who are not employed by Special School District #1 and $281,273 for members who are employed by Special School District #1.*

** *Includes contributions from School District #1, the City of Minneapolis, matching state contributions.*

SECTION V

ADDITIONAL INFORMATION

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SECTION V – ADDITIONAL INFORMATION

This section contains information that may be helpful in understanding the Systems' historical funding as well as current information regarding membership information and expected benefit payments. Some of the historical information was required under prior GASB accounting standards, but continues to provide useful information. Current financial reporting information required under Governmental Accounting Standards Board Statement No. 67 is provided in a separate report.

TABLE 12

SUMMARY OF MEMBERSHIP DATA

	July 1, 2017	July 1, 2016
Active members:		
Vested	64,890	63,674
Non-vested	16,921	16,856
Total	81,811	80,530
Pensioners and Beneficiaries	64,774	63,503
Terminated vested members entitled to, but not yet receiving, benefits:	14,030	13,680
Other terminated, non-vested members entitled to a refund of contributions	33,344	31,850
Total	**193,959**	**189,563**

TABLE 13

SCHEDULE OF FUNDING PROGRESS*

(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)
07/01/91	$ 5,614,924	$ 7,213,720	$ 1,598,796	77.84%	$ 1,943,375	82.27%
07/01/92	6,324,733	7,662,522	1,337,789	82.54%	1,989,624	67.24%
07/01/93	7,045,937	8,266,059	1,220,122	85.24%	2,065,881	59.06%
07/01/94	7,611,936	9,115,266	1,503,330	83.51%	2,150,300	69.91%
07/01/95	8,348,124	9,717,623	1,369,499	85.91%	2,204,693	62.12%
07/01/96	9,541,221	10,366,168	824,947	92.04%	2,268,390	36.37%
07/01/97	11,103,759	10,963,637	(140,122)	101.28%	2,359,011	(5.94%)
07/01/98	12,727,546	12,046,312	(681,234)	105.66%	2,422,957	(28.12%)
07/01/99	14,011,247	13,259,569	(751,678)	105.67%	2,625,254	(28.63%)
07/01/00	15,573,151	14,802,441	(770,710)	105.21%	2,704,575	(28.50%)
07/01/01	16,834,024	15,903,984	(930,040)	105.85%	2,812,000	(33.07%)
07/01/02	17,378,994	16,503,099	(875,895)	105.31%	2,873,771	(30.48%)
07/01/03	17,384,179	16,856,379	(527,800)	103.13%	2,952,887	(17.87%)
07/01/04	17,519,909	17,518,784	(1,125)	100.01%	3,032,483	(0.04%)
07/01/05	17,752,917	18,021,410	268,493	98.51%	3,121,571	8.60%
07/01/06	19,035,612	20,679,111	1,643,499	92.05%	3,430,645	47.91%
07/01/07	18,794,389	21,470,314	2,675,925	87.54%	3,532,159	75.76%
07/01/08	18,226,985	22,230,841	4,003,856	81.99%	3,645,230	109.84%
07/01/09	17,882,408	23,114,802	5,232,394	77.36%	3,761,484	139.10%
07/01/10	17,323,146	22,081,634	4,758,488	78.45%	3,787,757	125.63%
07/01/11	17,132,383	22,171,493	5,039,110	77.27%	3,838,111	131.29%
07/01/12	16,805,077	23,024,505	6,219,428	72.99%	3,871,809	160.63%
07/01/13	16,774,626	23,418,629	6,644,003	71.63%	3,917,310	169.61%
07/01/14	18,181,932	24,528,506	6,346,574	74.13%	4,056,482	156.46%
07/01/15	19,696,893	25,562,155	5,865,262	77.05%	4,306,426	136.20%
07/01/16	20,194,279	26,716,216	6,521,937	75.59%	4,515,699	144.43%
07/01/17	21,062,789	27,427,702	6,364,913	76.79%	4,688,875	135.74%

* Information prior to 2004 provided by Milliman; from 2004 to 2008 provided by The Segal Company; and 2009 to 2010 by Mercer.

TABLE 14

SCHEDULE OF CONTRIBUTIONS FROM THE EMPLOYER AND OTHER CONTRIBUTING ENTITIES

(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)*(b)] - (c)	Actual Employer Contributions[1]	Percentage Contributed
2000	8.36%	$ 2,704,575	$ 138,696	$ 87,406	$ 134,419	153.79%
2001[2]	7.92%	2,812,000	145,075	77,635	139,799	180.07%
2002	7.85%	2,873,771	152,331	73,260	142,222	194.13%
2003[3]	7.57%	2,952,887	155,577	67,957	149,481	219.96%
2004	8.37%	3,032,483	159,140	94,679	151,029	159.52%
2005	8.46%	3,121,571	160,982	103,103	157,693	152.95%
2006[4]	9.05%	3,430,645	177,085	133,389	200,286	150.15%
2007[5]	12.16%	3,532,159	199,869	229,642	209,219	91.11%
2008[6]	13.44%	3,645,230	209,592	280,327	231,562	82.60%
2009[7]	15.08%	3,761,484	212,043	355,189	240,718	67.72%
2010[8]	16.81%	3,787,757	214,909	421,813	242,088	57.39%
2011[9]	15.71%	3,838,111	218,024	384,943	244,233	63.45%
2012[10]	16.57%	3,871,809	239,834	401,725	266,661	66.38%
2013[11]	18.75%	3,917,310	270,708	463,788	290,662	62.67%
2014[12]	19.41%	4,056,482	294,632	492,731	320,301	65.01%
2015[13]	19.15%	4,261,626	331,905	484,196	358,367	74.01%
2016[14]	17.87%	4,515,699	347,256	459,699	390,548	84.96%
2017[15]	18.72%	4,688,875	361,175	516,582	403,378	78.09%
2018[16]	18.43%					

Note: Information prior to 2004 provided by Milliman USA; 2004 to 2008 information provided by The Segal Company; 2009 and 2010 information provided by Mercer.

1 *Includes contributions from other sources (if applicable)*

2 *Actuarially Required Contribution Rate prior to change in Actuarial Assumptions and Asset Valuation Method is 7.31%.*

3 *Actuarially Required Contribution Rate prior to change in Actuarial Assumptions is 8.11%.*

4 *Actuarially Required Contribution Rate shown is the contribution rate stated in the TRA July 1, 2005 actuarial valuation.*

5 *Actuarially Required Contributions calculated according to parameters of GASB 25 (30-year amortization period), and post-merger of the Minneapolis Teachers' Retirement Fund Association.*

6 *Actuarially Required Contribution Rate prior to change in Asset Valuation Method is 11.58%.*

7 *Actuarially Required Contribution Rate prior to change in Actuarial Assumptions is 15.36%.*

8 *Actuarially Required Contribution Rate prior to change in Asset Valuation Method is 19.98%.*

9 *Actuarially Required Contribution Rate prior to change in Actuarial Assumptions and Plan Provisions is 18.91%.*

10 *Actuarially Required Contribution Rate prior to change in Actuarial Assumptions is 16.91%.*

11 *Actuarially Required Contribution Rate prior to change in Actuarial Assumptions is 18.15%.*

12 *Actuarially Required Contribution Rate prior to change in Plan Provisions is 19.66%.*

13 *Actuarially Required Contribution Rate prior to change in Actuarial Assumptions is 17.95%. Actual Covered Payroll excludes DTRFA payroll of $44.8 million.*

14 *Actuarially Required Contribution Rate prior to DTRFA merger is 17.70%.*

15 *Actuarially Required Contribution Rate prior to change in Actuarial Assumptions is 17.44%.*

16 *Actuarially Required Contribution Rate prior to change in Actuarial Assumptions is 18.71%.*

TABLE 15

PROJECTED BENEFIT PAYMENTS

(Dollars in Thousands)

The table below shows estimated benefits expected to be paid over the next twenty-five years, based on the assumptions used in the valuation. The "Actives" column shows benefits expected to be paid to members currently active on July 1, 2017. The "Retirees" column shows benefits expected to be paid to all other members. This includes those who, as of July 1, 2017, are receiving benefit payments or who terminated employment and are entitled to a deferred benefit.

Year Ending June 30	Actives	Retirees	Total
2018	$ 36,162	$ 1,788,456	$ 1,824,618
2019	88,297	1,770,144	1,858,441
2020	140,250	1,757,203	1,897,453
2021	198,167	1,744,456	1,942,623
2022	258,885	1,731,505	1,990,390
2023	320,580	1,718,973	2,039,553
2024	382,238	1,705,408	2,087,646
2025	444,308	1,690,306	2,134,614
2026	509,117	1,673,448	2,182,565
2027	578,695	1,654,590	2,233,285
2028	654,437	1,633,205	2,287,642
2029	737,769	1,609,874	2,347,643
2030	830,269	1,582,782	2,413,051
2031	933,287	1,552,706	2,485,993
2032	1,047,200	1,519,323	2,566,523
2033	1,172,210	1,482,890	2,655,100
2034	1,306,934	1,443,427	2,750,361
2035	1,450,544	1,402,315	2,852,859
2036	1,602,629	1,357,569	2,960,198
2037	1,763,218	1,310,673	3,073,891
2038	1,930,163	1,260,141	3,190,304
2039	2,102,582	1,205,569	3,308,151
2040	2,282,101	1,149,063	3,431,164
2041	2,469,096	1,089,927	3,559,023
2042	2,661,768	1,029,044	3,690,812

Cash flows are the expected future non-discounted payments to current members. These numbers exclude refund payouts to current nonvested inactives and assume future retirees and future terminated members make benefit elections according to valuation assumptions.

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APPENDIX A

SUMMARY STATISTICS ON MEMBERSHIP DATA

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TABLE 16

RECONCILIATION OF MEMBERS*

			Benefit Recipients****			
	Active Members**	Former Members***	Service Retirements	Disability Retirements	Survivors	Total
Members on 7/1/2016	**80,530**	**45,530**	**57,891**	**521**	**5,091**	**189,563**
New hires	5,767	-	-	-	-	**5,767**
Transfer from active to inactive	(4,358)	4,358	-	-	-	**0**
Transfer from inactive to active	1,564	(1,564)	-	-	-	**0**
Return from zero balance	497	17	-	-	-	**514**
Return from disability	18	1	-	-	-	**19**
Refunded	(252)	(657)	-	-	-	**(909)**
Refunded (non-repayable)	(3)	(13)	-	-	-	**(16)**
Retirements	(1,874)	(497)	2,405	(55)	-	**(21)**
Benefits began	-	-	-	72	479	**551**
Benefits ended	-	-	-	(3)	(62)	**(65)**
Deaths	(38)	(42)	(1,299)	(17)	(248)	**(1,644)**
Adjustments	(40)	241	(8)	(1)	8	**200**
Net changes	1,281	1,844	1,098	(4)	177	**4,396**
Members on 7/1/2017	**81,811**	**47,374**	**58,989**	**517**	**5,268**	**193,959**

* ***All figures in this chart were provided by the Teachers Retirement Association. Recipient counts include all pensions in force, including double counting of multiple benefit types. Service Retirements include Supplemental and Variable optional joint annuitants. We have found these results to be reasonable.***

** *Active members include 3 Basic and 81,808 Coordinated members.*

*** *Former members include 12 Basic and 47,362 Coordinated members.*

**** *Benefit recipients include 3,835 Basic members and 60,939 Coordinated members.*

Former Member Statistics	**Vested**	**Non-vested**	**Total**
Number	14,030	33,344	47,374
Average Age	48.5	46.0	46.8
Average Service (years)	7.6	0.9	2.9
Average annual benefits, with augmentation to Normal Retirement Date and Combined Service Annuity load	$10,500	N/A	N/A
Average refund value, with Combined Service Annuity load	$33,209	$2,919	$11,889

TABLE 17

DISTRIBUTION OF ACTIVE MEMBERS*

	Years of Service as of July 1, 2017										
Age	**<3****	**3-4**	**5-9**	**10-14**	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40 +**	**Total**
<25	2,577	57									**2,634**
Avg. Earnings	29,088	44,767									**29,428**
25-29	4,331	3,235	1,704								**9,270**
Avg. Earnings	33,391	45,511	50,629								**40,789**
30-34	2,323	1,879	5,043	1,379							**10,624**
Avg. Earnings	33,294	46,833	53,710	63,792							**49,338**
35-39	1,923	1,125	2,668	4,856	1,305						**11,877**
Avg. Earnings	30,055	47,962	55,260	66,805	75,561						**57,439**
40-44	1,505	746	1,494	2,119	4,385	873					**11,122**
Avg. Earnings	26,763	48,012	54,595	65,958	75,753	81,151					**62,978**
45-49	1,302	596	1,342	1,509	2,578	3,815	720				**11,862**
Avg. Earnings	25,013	46,180	52,809	63,079	73,829	79,816	83,831				**65,869**
50-54	959	417	951	1,124	1,433	2,060	2,492	588			**10,024**
Avg. Earnings	22,365	43,119	50,607	63,209	72,280	77,501	81,958	83,075			**67,330**
55-59	783	309	725	857	1,170	1,192	1,547	1,598	200		**8,381**
Avg. Earnings	19,814	38,405	46,668	60,692	69,845	74,933	79,308	82,083	82,321		**66,172**
60-64	589	180	413	421	648	703	654	349	352	68	**4,377**
Avg. Earnings	14,216	32,652	40,413	57,234	67,094	74,756	77,946	82,375	82,445	83,761	**60,660**
65-69	426	64	115	116	129	125	93	59	46	71	**1,244**
Avg. Earnings	8,064	19,747	30,419	58,187	60,245	71,392	79,349	87,694	87,159	83,180	**43,498**
70 +	203	38	40	25	15	14	18	11	9	23	**396**
Avg. Earnings	5,517	12,064	15,799	47,750	59,296	82,045	80,331	95,954	81,543	91,639	**27,236**
Total	**16,921**	**8,646**	**14,495**	**12,406**	**11,663**	**8,782**	**5,524**	**2,605**	**607**	**162**	**81,811**
Avg. Earnings	**28,216**	**45,399**	**52,417**	**64,680**	**73,613**	**78,222**	**80,936**	**82,532**	**82,748**	**84,625**	**57,495**

* *Active members include 3 Basic and 81,808 Coordinated members.*

** *This exhibit does not reflect service earned in 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 the amount of average annual earnings. Earnings shown in this exhibit are actual salaries earned during the fiscal year ending June 30, 2017 as reported by the Teachers Retirement Association of Minnesota.

TABLE 18

DISTRIBUTION OF SERVICE RETIREMENTS (TOTAL)

	Years Since Retirement as of July 1, 2017							
Age	**<1**	**1-4**	**5-9**	**10-14**	**15-19**	**20-24**	**25 +**	**Total**
<55	4	3						**7**
Avg. Benefit	34,177	33,804						**34,017**
55-59	519	970	2					**1,491**
Avg. Benefit	36,850	31,090	40,713					**33,108**
60-64	881	4,190	2,133	19				**7,223**
Avg. Benefit	31,368	32,189	28,337	37,449				**30,965**
65-69	552	4,450	6,102	4,070	180	1	2*	**15,357**
Avg. Benefit	22,373	23,430	26,516	24,656	37,320	30,955	2,830	**25,104**
70-74	73	751	3,266	4,795	4,850	141	4*	**13,880**
Avg. Benefit	16,456	18,351	22,309	24,888	24,749	40,553	6,061	**23,988**
75-79	7	76	413	1,673	4,761	2,330	69	**9,329**
Avg. Benefit	9,798	17,970	18,559	21,473	27,591	29,320	26,226	**26,424**
80-84	1	15	55	182	1,419	3,220	1,187	**6,079**
Avg. Benefit	1,287	10,817	17,682	16,120	27,904	36,628	34,983	**33,415**
85-89		7	10	35	129	1,147	2,366	**3,694**
Avg. Benefit		10,760	21,988	13,107	26,497	36,437	35,545	**35,210**
90 +			2	8	20	73	1,826	**1,929**
Avg. Benefit			26,024	31,082	18,126	38,424	34,209	**34,180**
Total	**2,037**	**10,462**	**11,983**	**10,782**	**11,359**	**6,912**	**5,454**	**58,989**
Avg. Benefit	**29,709**	**27,221**	**25,377**	**24,111**	**26,542**	**34,231**	**34,824**	**27,757**

** Pertaining to the accounts of former participants in the Minnesota Variable Annuity Fund, abolished by law in 1989.*

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.

TABLE 18A

DISTRIBUTION OF SERVICE RETIREMENTS
(BASIC)

Distribution of Service Retirements

	Years Since Retirement as of July 1, 2017							
Age	**<1**	**1-4**	**5-9**	**10-14**	**15-19**	**20-24**	**25 +**	**Total**
<55								
Avg. Benefit								
55-59								
Avg. Benefit								
60-64	1	4	9	4				**18**
Avg. Benefit	88,021	85,776	48,362	68,367				**63,325**
65-69	1	16	47	71	66			**201**
Avg. Benefit	20,424	27,819	42,707	53,047	50,316			**47,562**
70-74	1	5	43	102	211	55		**417**
Avg. Benefit	8,975	67,894	28,450	51,954	57,836	51,380		**52,519**
75-79		1	2	35	135	148	28	**349**
Avg. Benefit		101,727	69,117	45,236	50,076	65,301	39,974	**55,494**
80-84			3	12	77	324	332	**748**
Avg. Benefit			10,336	44,134	50,511	71,962	68,969	**67,732**
85-89				6	19	116	647	**788**
Avg. Benefit				28,918	50,731	53,263	60,402	**58,878**
90 +				4	2	13	549	**568**
Avg. Benefit				60,592	4,515	54,995	50,928	**50,926**
Total	**3**	**26**	**104**	**234**	**510**	**656**	**1,556**	**3,089**
Avg. Benefit	**39,140**	**47,284**	**36,876**	**50,717**	**53,229**	**65,091**	**58,520**	**57,609**

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.

TABLE 18B

DISTRIBUTION OF SERVICE RETIREMENTS
(COORDINATED)

Distribution of Service Retirements

	Years Since Retirement as of July 1, 2017							
Age	**<1**	**1-4**	**5-9**	**10-14**	**15-19**	**20-24**	**25 +**	**Total**
<55	4	3						**7**
Avg. Benefit	34,177	33,804						**34,017**
55-59	519	970	2					**1,491**
Avg. Benefit	36,850	31,090	40,713					**33,108**
60-64	880	4,186	2,124	15				**7,205**
Avg. Benefit	31,303	32,138	28,252	29,205				**30,884**
65-69	551	4,434	6,055	3,999	114	1	2*	**15,156**
Avg. Benefit	22,377	23,415	26,391	24,152	29,795	30,955	2,830	**24,806**
70-74	72	746	3,223	4,693	4,639	86	4*	**13,463**
Avg. Benefit	16,560	18,019	22,228	24,299	23,244	33,629	6,061	**23,105**
75-79	7	75	411	1,638	4,626	2,182	41	**8,980**
Avg. Benefit	9,798	16,853	18,313	20,965	26,935	26,879	16,836	**25,294**
80-84	1	15	52	170	1,342	2,896	855	**5,331**
Avg. Benefit	1,287	10,817	18,105	14,143	26,607	32,674	21,786	**28,600**
85-89		7	10	29	110	1,031	1,719	**2,906**
Avg. Benefit		10,760	21,988	9,836	22,311	34,543	26,189	**28,792**
90 +			2	4	18	60	1,277	**1,361**
Avg. Benefit			26,024	1,572	19,639	34,834	27,021	**27,191**
Total	**2,034**	**10,436**	**11,879**	**10,548**	**10,849**	**6,256**	**3,898**	**55,900**
Avg. Benefit	**29,696**	**27,171**	**25,277**	**23,521**	**25,287**	**30,995**	**25,365**	**26,108**

** Pertaining to the accounts of former participants in the Minnesota Variable Annuity Fund, abolished by law in 1989.*

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.

TABLE 19

DISTRIBUTION OF SURVIVORS (TOTAL)

	Years Since Death as of July 1, 2017							
Age	**<1**	**1-4**	**5-9**	**10-14**	**15-19**	**20-24**	**25 +**	**Total**
<45	13	44	46	16	5	2		**126**
Avg. Benefit	23,990	20,713	15,375	13,000	8,102	24,513		**17,683**
45-49	5	31	20	10	6	2		**74**
Avg. Benefit	11,422	12,476	13,231	16,935	11,870	47,326		**14,104**
50-54	9	36	23	8	6	2	2	**86**
Avg. Benefit	15,690	15,025	14,088	15,679	24,405	40,884	24,858	**16,390**
55-59	12	43	37	20	3	3	3	**121**
Avg. Benefit	23,677	19,727	15,715	12,340	18,807	3,188	23,436	**17,330**
60-64	21	116	62	31	14	7	2	**253**
Avg. Benefit	23,610	20,762	17,744	16,776	19,708	20,103	8,415	**19,596**
65-69	57	176	129	82	37	11	4	**496**
Avg. Benefit	23,942	22,809	21,783	20,088	17,743	15,026	12,733	**21,591**
70-74	77	290	230	124	84	26	16	**847**
Avg. Benefit	23,302	24,283	22,461	22,959	19,571	23,961	22,711	**22,998**
75-79	63	285	235	150	88	47	46	**914**
Avg. Benefit	24,472	26,378	27,734	28,891	26,387	22,303	23,733	**26,666**
80-84	71	300	238	149	105	78	59	**1,000**
Avg. Benefit	26,267	33,244	34,203	34,014	36,643	34,556	29,670	**33,340**
85-89	46	221	192	141	101	68	106	**875**
Avg. Benefit	34,926	38,745	37,152	35,169	33,772	37,028	31,983	**36,092**
90 +	16	96	126	84	56	37	61	**476**
Avg. Benefit	57,527	38,393	35,254	38,136	29,452	43,063	36,695	**37,253**
Total	**390**	**1,638**	**1,338**	**815**	**505**	**283**	**299**	**5,268**
Avg. Benefit	**26,622**	**28,017**	**27,793**	**28,623**	**27,962**	**31,869**	**30,174**	**28,274**

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

TABLE 19A

DISTRIBUTION OF SURVIVORS
(BASIC)

Distribution of Survivors

	Years Since Death as of July 1, 2017							
Age	**<1**	**1-4**	**5-9**	**10-14**	**15-19**	**20-24**	**25 +**	**Total**
<45		1	3	1	1			**6**
Avg. Benefit		100,849	23,622	5,718	1,137			**29,762**
45-49					1	1		**2**
Avg. Benefit					18,600	61,495		**40,048**
50-54				1	1		2	**4**
Avg. Benefit				25,021	3,236		24,858	**19,493**
55-59			1				2	**3**
Avg. Benefit			2,520				31,405	**21,777**
60-64	1	1		1	4	3		**10**
Avg. Benefit	40,966	36,351		21,021	33,327	19,271		**28,946**
65-69	1	5	1	2	2		1	**12**
Avg. Benefit	4,309	29,689	54,344	35,154	26,110		8,007	**28,136**
70-74	3	10	6	4	2	1	3	**29**
Avg. Benefit	54,746	51,319	58,154	31,541	17,870	85,395	55,042	**49,613**
75-79	1	19	23	12	6	4	8	**73**
Avg. Benefit	4,704	60,754	48,552	60,484	68,369	37,562	34,881	**52,617**
80-84	8	53	39	31	28	13	27	**199**
Avg. Benefit	49,897	58,118	62,389	55,906	60,239	62,219	41,275	**56,561**
85-89	9	70	44	45	32	21	39	**260**
Avg. Benefit	45,647	53,134	50,844	52,036	50,020	55,083	42,319	**50,449**
90 +	8	31	35	24	20	13	17	**148**
Avg. Benefit	70,841	48,754	53,006	62,335	34,693	58,378	60,322	**53,430**
Total	**31**	**190**	**152**	**121**	**97**	**56**	**99**	**746**
Avg. Benefit	**51,321**	**54,022**	**53,413**	**54,089**	**47,790**	**54,990**	**43,990**	**51,728**

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

TABLE 19B

DISTRIBUTION OF SURVIVORS
(COORDINATED)

Distribution of Survivors

	Years Since Death as of July 1, 2017							
Age	**<1**	**1-4**	**5-9**	**10-14**	**15-19**	**20-24**	**25 +**	**Total**
<45	13	43	43	15	4	2		**120**
Avg. Benefit	23,990	18,849	14,800	13,486	9,843	24,513		**17,079**
45-49	5	31	20	10	5	1		**72**
Avg. Benefit	11,422	12,476	13,231	16,935	10,524	33,157		**13,384**
50-54	9	36	23	7	5	2		**82**
Avg. Benefit	15,690	15,025	14,088	14,345	28,639	40,884		**16,238**
55-59	12	43	36	20	3	3	1	**118**
Avg. Benefit	23,677	19,727	16,081	12,340	18,807	3,188	7,497	**17,217**
60-64	20	115	62	30	10	4	2	**243**
Avg. Benefit	22,742	20,627	17,744	16,635	14,261	20,728	8,415	**19,212**
65-69	56	171	128	80	35	11	3	**484**
Avg. Benefit	24,292	22,608	21,529	19,711	17,265	15,026	14,308	**21,428**
70-74	74	280	224	120	82	25	13	**818**
Avg. Benefit	22,027	23,317	21,505	22,673	19,612	21,504	15,250	**22,055**
75-79	62	266	212	138	82	43	38	**841**
Avg. Benefit	24,791	23,922	25,475	26,144	23,315	20,884	21,386	**24,413**
80-84	63	247	199	118	77	65	32	**801**
Avg. Benefit	23,267	27,906	28,680	28,263	28,063	29,024	19,879	**27,571**
85-89	37	151	148	96	69	47	67	**615**
Avg. Benefit	32,318	32,074	33,081	27,262	26,237	28,960	25,967	**30,022**
90 +	8	65	91	60	36	24	44	**328**
Avg. Benefit	44,212	33,452	28,426	28,457	26,541	34,767	27,566	**29,954**
Total	**359**	**1,448**	**1,186**	**694**	**408**	**227**	**200**	**4,522**
Avg. Benefit	**24,490**	**24,604**	**24,509**	**24,183**	**23,248**	**26,165**	**23,335**	**24,405**

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

TABLE 20

DISTRIBUTION OF DISABILITY RETIREMENTS

	Years Disabled as of July 1, 2017							
Age	**<1**	**1-4**	**5-9**	**10-14**	**15-19**	**20-24**	**25 +**	**Total**
<45		14	6					**20**
Avg. Benefit		12,553	8,002					**11,188**
45-49	3	18	6	8	2			**37**
Avg. Benefit	20,214	19,609	10,118	6,792	2,784			**14,438**
50-54	8	33	15	5	6	1		**68**
Avg. Benefit	27,356	22,194	10,425	9,081	10,962	4,961		**17,996**
55-59	14	65	38	18	5	4		**144**
Avg. Benefit	24,205	24,032	19,579	14,563	7,772	7,758		**20,673**
60-64	3	74	70	42	20	8	5	**222**
Avg. Benefit	30,307	30,235	25,328	20,933	16,570	17,118	12,799	**24,833**
65 +		19	4	2	1			**26**
Avg. Benefit		25,942	22,530	6,946	3,084			**23,077**
Total	**28**	**223**	**139**	**75**	**34**	**13**	**5**	**517**
Avg. Benefit	**25,332**	**24,903**	**20,663**	**16,733**	**13,079**	**13,303**	**12,799**	**21,415**

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

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APPENDIX B

SUMMARY OF PLAN PROVISIONS

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APPENDIX B - SUMMARY OF PLAN PROVISIONS

BASIC MEMBERS

This summary of provisions reflects our interpretation of applicable Statutes for purposes of preparing this valuation. This interpretation is not intended to provide a basis for administering the Plan.

Plan year

July 1 through June 30

Eligibility

Teachers first hired prior to July 1, 1978 employed by the Board of Education of Special School District No. 1, other than a charter school, and not covered by the Social Security Act. Certain part-time licensed employees of Special School District No. 1 are also covered. These members were transferred to TRA as part of the merger of the Minneapolis Teachers Retirement Fund Association (MTRFA) effective June 30, 2006.

Contributions

Shown as a percent of Salary:

Member	Employer
11.00%	15.14%

After June 30, 2015, the member and employer contribution rates may be adjusted if there is a sufficiency of at least 1.00% or a deficiency of at least 0.50%. The Board has discretion to adjust this rate based on discussion with the actuary and consideration of various metrics. The resulting rate may not go below the normal cost plus administrative expenses.

Potential contribution increases after June 30, 2017 are not reflected in this valuation report.

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

Teaching service

A year is earned during a calendar year if the member is employed in a covered position and employee contributions are deducted. Certain part-time service and military service is also included.

APPENDIX B - SUMMARY OF PLAN PROVISIONS

BASIC MEMBERS

Salary

Periodic compensation used for contribution purposes excluding lump sum annual or sick leave payments, severance payments, any payments made in lieu of employer paid fringe benefits or expenses, and employer contributions to a Section 457 deferred compensation plan.

Average salary

Average of the five highest successive years of Salary.

Retirement

Normal retirement

Age/Service requirements

Age 60, or any age with 30 years of Teaching Service

Amount

2.50% of Average Salary for each year of Teaching Service.

Early retirement

Age/Service requirements

Age 55 with less than 30 years of Teaching Service.

Amount

The greater of (a) or (b):

(a) 2.25% of Average Salary for each year of Teaching Service with reduction of 0.25% for each month before the Member would first be eligible for a normal retirement benefit.

(b) 2.50% of Average Salary for each year of Teaching Service assuming augmentation to the age of first eligibility for a normal retirement benefit at 3.00% per year and actuarial reduction for each month before the member would be first eligible for a normal retirement benefit.

An alternative benefit is available to members who are at least age 50 and have seven years of Teaching Service. The benefit is based on the accumulation of the 6.50% "city deposits" to the Retirement Fund. Other benefits are also provided under this alternative depending on the member's age and Teaching Service.

Form of payment

Life annuity. Actuarially equivalent options are:

(a) 10 or 15 year Certain and Life

(b) 50%, 75% or 100% Joint and Survivor with bounce back feature (option is canceled if member is predeceased by beneficiary).

Benefit increases

Under current law, the annual post-retirement increase on January 1 is 2.0 percent. When the funded ratio reaches 90 percent (on a market value of assets basis) for two consecutive years, the annual increase will rise to 2.5 percent. A benefit recipient who has been receiving a benefit for at least 12 full months as of the June 30 preceding the increase date will receive a full increase. Members receiving benefits for at least one full month but less than 12 full months as of the June 30 preceding the increase date will receive a prorated increase.

APPENDIX B - SUMMARY OF PLAN PROVISIONS

BASIC MEMBERS

Disability

Age/service requirement	Total and permanent disability with three years of Teaching Service
Amount	An annuity actuarially equivalent to the continued accumulation of member and city contributions at the current rate for a period of 15 years (but not beyond age 65) plus an additional benefit equal to the smaller of 100% of the annuity provided by city contributions only or $150 per month. A member with 20 years of Teaching Service also receives an additional $7.50 per month. Payments stop earlier if disability ceases or death occurs. Benefits may be reduced on resumption of partial employment.
Form of payment	Same as for retirement.
Benefit increases	Same as for retirement.

Death — Choice of Benefit A, Benefit B or Benefit C

Benefit A

Age/Service requirements	Death before retirement.
Amount	The accumulation of member and city contributions plus 6.00% interest. Paid as a life annuity, 15-year Certain and Life, or lump sum. If an annuity is chosen the beneficiary also receives additional benefits.

Benefit B

Age/Service requirements	An active member with seven years of Teaching Service. A former member age 60 with seven years of Teaching Service who dies before retirement or disability benefits begin.
Amount	The actuarial equivalent of any benefits the member could have received if resignation occurred on the date of death.

Benefit C

Age/Service requirements	As an active member who dies and leaves surviving children.
Amount	A monthly benefit of $248.30 to the surviving widow while caring for a child and an additional $248.30 per month for each surviving dependent child. The maximum family benefit is $579.30 per month. Benefits to the widow cease upon death or when no longer caring for an eligible child. Benefits for dependent children cease upon marriage or age 18 (age 22 if a full time student).
Benefit Increases	Same as for retirement.

APPENDIX B - SUMMARY OF PLAN PROVISIONS

BASIC MEMBERS

Withdrawal

Refund of contribution

Age/Service requirements	Termination of Teaching Service.
Amount	Member's contributions earn 4.00% interest compounded annually. For vested members, a deferred annuity may be elected in lieu of a refund.

Deferred annuity

Age/Service Requirements	Seven years of Teaching Service
Amount	The benefit is computed under law in effect at termination and increased by the following percentage compounded annually: (a) 3.00% therefore until the earlier of January 1 of the year following attainment of age 55 and June 30, 2012; (b) 5.00% thereafter until the earlier of June 30, 2012 and when the annuity begins; and (c) 2.00% beginning July 1, 2012. In addition, the interest earned on the member and city contributions between termination and age 60 can be applied to provide an additional annuity.

APPENDIX B - SUMMARY OF PLAN PROVISIONS

COORDINATED MEMBERS

This summary of provisions reflects our interpretation of applicable Statutes for purposes of preparing this valuation. This interpretation is not intended to provide a basis for administering the Plan.

Plan year

July 1 through June 30

Eligibility

A public school or MNSCU teacher who is covered by the Social Security Act, except for teachers employed by St. Paul public schools or by the University of Minnesota. Charter school teachers employed statewide are covered by TRA.

No MNSCU teacher will become a new Member unless that person elects coverage as defined by Minnesota Statutes under Chapter 354B.

Contributions

Shown as a percent of Salary:

Member	Employer
7.50%	7.50%

Employer also contributes Supplemental amount equal to 3.64% of Salary (members employed by Special School District #1 only).

After June 30, 2015, the member and employer contribution rates may be adjusted if there is a sufficiency of at least 1.00% or a deficiency of at least 0.50%. The Board has discretion to adjust this rate based on discussion with the actuary and consideration of various metrics. The resulting rate may not go below the normal cost plus administrative expenses.

Potential contribution increases after June 30, 2017 are not reflected in this valuation report.

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

Teaching service

A year is earned during a calendar year if the member is employed in a covered position and employee contributions are deducted. Certain part-time service and military service is also included.

COORDINATED MEMBERS

Salary

Periodic compensation used for contribution purposes excluding lump sum annual or sick leave payments, severance payments, any payments made in lieu of employer paid fringe benefits or expenses, and employer contributions to a Section 457 deferred compensation plan.

Average salary

Average of the five highest successive years of Salary. Average salary is based on all Allowable Service if less than five years.

Retirement

Normal retirement

Age/Service requirements

First hired before July 1, 1989:

(a) Age 65 and three years of Allowable Service; or
(b) Age 62 and 30 years of Allowable Service.

Proportionate Retirement Annuity is available at age 65 and one year of
Allowable Service.

First hired after June 30, 1989:

The age when first eligible for full Social Security retirement benefits (but not to exceed age 66) and three years of Allowable Service.
Proportionate Retirement Annuity is available at normal retirement age and one year of Allowable Service.

Early retirement

Age/Service requirements

First hired before July 1, 1989:

(a) Age 55 and three years of Allowable Service; or
(b) Any age and 30 years of Allowable Service; or
(c) Rule of 90: Age plus Allowable Service totals 90.

First hired after June 30, 1989:

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

COORDINATED MEMBERS

Retirement(continued)

Amount

First hired before July 1, 1989:

The greater of (a), (b) or (c):

(a) 1.20% of Average Salary for each of the first ten years of Allowable Service.
1.70% of Average Salary for each year of Allowable Service in excess of 10 prior to July 1, 2006, and
1.90% of Average Salary for years of Allowable Service after July 1, 2006.
No actuarial reduction if age plus years of service totals 90. Otherwise reduction of 0.25% for each month the member is under age 65 (or 62 if 30 years of Allowable Service) at time of retirement.

(b) 1.70% of Average Salary for each year of Allowable Service prior to July 1, 2006 and 1.90% for each year of Allowable Service beginning July 1, 2006, assuming augmentation to normal retirement age at 3.00% per year (2.50% per year for members hired after June 30, 2006) and actuarial reduction for each month the member is under the full Social Security benefit retirement age (not to exceed age 66). Beginning July 1, 2015, new early retirement reduction factors will apply, including special factors for members retiring at age 62 or later with at least 30 years of service.

(c) For eligible members: the monthly benefit that is actuarially equivalent to 2.2 times the members' accumulated deductions plus interest thereon.

First hired after June 30, 1989:

1.70% of Average Salary for each year of Allowable Service prior to July 1, 2006 and 1.90% for each year of Allowable Service beginning July 1, 2006, assuming augmentation to normal retirement age at 3.00% per year (2.50% per year for members hired after June 30, 2006) and actuarial reduction for each month the member is under the full Social Security benefit retirement age (not to exceed age 66). Beginning July 1, 2015, new early retirement reduction factors will apply, including special factors for members retiring at age 62 or later with at least 30 years of service.

Early Retirement Reduction Factors

Age	Hired before 7/1/89	Hired from 7/1/89 to 6/30/06	Hired after 6/30/06
55	43.56%	51.55%	54.08%
58	33.59%	40.46%	42.74%
60	24.65%	30.75%	32.74%
62	13.68%	18.96%	20.53%
65	0.00%	4.21%	4.68%
66	0.00%	0.00%	0.00%

Members who are age 62 with 30 years of service are eligible for a special set of reduction factors:

Age	Hired before 7/1/89	Hired from 7/1/89 to 6/30/06	Hired after 6/30/06
62	10.40%	14.46%	16.11%
63	6.64%	10.40%	11.70%
64	3.18%	6.64%	7.55%
65	0.00%	3.18%	3.65%
66	0.00%	0.00%	0.00%

All of the early retirement reduction factors shown are the ultimate factors. These are being phased in from the prior factors over a five-year period beginning July 1, 2015.

Form of Payment

Life annuity. Actuarially equivalent options are:

(a) 50%, 75% or 100% Joint and Survivor with bounce back feature (option is canceled if member is predeceased by beneficiary).
(b) 15 year Certain and Life
(c) Guaranteed Refund.

COORDINATED MEMBERS

Retirement(continued)

Benefit increases	Under current law, the annual post-retirement increase on January 1 is 2.0 percent. When the funded ratio reaches 90 percent (on a market value of assets basis) for two consecutive years, the annual increase will rise to 2.5 percent. A benefit recipient who has been receiving a benefit for at least 12 full months as of the June 30 preceding the increase date will receive a full increase. Members receiving benefits for at least one full month but less than 12 full months as of the June 30 preceding the increase date will receive a prorated increase.

Disability

Age/service requirement	Total and permanent disability before Normal Retirement Age with three years of Allowable Service.
Amount	Normal Retirement Benefit based on Allowable Service and Average Salary at disability without reduction for commencement before Normal Retirement Age unless an optional annuity plan is selected. Payments stop at Normal Retirement Age 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 reduced on resumption of partial employment.
Form of *payment*	Same as for retirement.
Benefit increases	Same as for retirement.

Retirement after disability

Age/service requirement	Normal Retirement Age or the five year anniversary of the effective date of the disability benefit, whichever is later.
Amount	Any optional annuity continues. Otherwise, the larger of the disability benefit paid before Normal Retirement Age or the normal retirement benefit available at Normal Retirement Age, or an actuarially equivalent optional annuity.
Benefit increases	Same as for retirement.

COORDINATED MEMBERS

Death

Surviving spouse optional annuity

Age/Service requirements	Member or former member with three years of Allowable Service who dies before retirement or disability benefits commence.
Amount	Survivor's payment of the 100% Joint and Survivor benefit or an actuarial equivalent term certain annuity. If commencement is prior to age 65 (age 62 if 30 years of service), the benefit is reduced for early retirement with half the applicable reduction factor used from age 55 to actual commencement age. If no surviving spouse, then an actuarial equivalent dependent child benefit is paid to age 20 or for five years if longer.
Benefit increase	Same as for retirement.

Withdrawal

Refund of contributions

Age/Service requirements	Thirty days following termination of teaching service.
Amount	Member's contributions earn 4.00% interest compounded annually. For vested members, a deferred annuity may be elected in lieu of a refund.

Deferred annuity

Age/Service requirements	Vested at date of termination. Current requirement is three years of Allowable Service.

COORDINATED MEMBERS

Withdrawal (continued)

Amount

For members first hired prior to July 1, 2006, the benefit is computed under law in effect at termination and increased by the following percentage compounded annually:

(a) 3.00% therefore until the earlier of January 1 of the year following attainment of age 55 and June 30, 2012;
(b) 5.00% thereafter until the earlier of June 30, 2012 and when the annuity begins; and
(c) 2.00% from July 1, 2012 forward.

Amount is payable as a normal or early retirement.

A member who terminated service before July 1, 1997 whose benefit does not commence until after June 30, 1997 shall receive an actuarially equivalent increase to reflect the change from 5.00% to 6.00% in the post-retirement interest assumption; or

For eligible members; the monthly benefit that is actuarially equivalent to 2.2 times the members' accumulated deductions plus interest thereon.

For members first hired July 1, 2006 and after, the benefit computed under law in effect at termination is increased by 2.50% compounded annually until June 30, 2012 and increased by 2.00% from July 1, 2012 forward until the annuity begins.

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APPENDIX C

ACTUARIAL METHODS AND ASSUMPTIONS

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APPENDIX C – ACTUARIAL METHODS AND ASSUMPTIONS

Actuarial Cost Method

Liabilities and contributions in this report are computed using the Individual Entry Age Normal Cost Method. This method is prescribed by Minnesota Statutes.

The objective under this method is to fund each member's benefits under the Plan as payments which are level as a percentage of salary, starting at original participation date (or employment date), and continuing until the assumed date of retirement termination, disability or death. For valuation purposes, entry age for each member is determined as the age at valuation minus years of service as of the valuation date.

At any given date, a liability is calculated equal to the contributions which would have been accumulated if this method of funding had always been used, the current plan provisions had always been in place, and all assumptions had been met. The difference between this liability and the assets (if any) which are held in the fund is the unfunded actuarial accrued liability. The unfunded actuarial accrued liability is typically funded over a chosen period in accordance with the amortization schedule.

A detailed description of the calculation follows: The normal cost for each active member under the assumed retirement age is determined by applying to earnings the level percentage of salary which, if contributed each year from date of entry into the Plan until the assumed retirement (termination, disability or death) date, is sufficient to provide the full value of the benefits expected to be payable.

- The present value of future normal costs is the total of the discounted values of all active members' normal cost, assuming these to be paid in each case from the valuation date until retirement (termination, disability or death) date.

- The present value of projected benefits is calculated as the value of all benefit payments expected to be paid to the Plan's current members, including active and retired members, beneficiaries, and terminated members with vested rights.

- The actuarial accrued liability is the excess of the present value of projected benefits over the present value of future normal costs.

- The unfunded actuarial accrued liability is the excess of the actuarial accrued liability over the assets of the fund, and represents that part of the actuarial accrued liability which has not been funded by accumulated past contributions.

Amortization Method

The unfunded actuarial accrued liability is amortized as a level percentage of payroll each year to the statutory amortization date of June 30, 2039, assuming payroll increases of 3.50% per year (effective with the 2016 valuation). If the unfunded actuarial accrued liability is negative, the surplus amount is amortized over 30 years as a level percentage of payroll. If there is an increase in the unfunded actuarial accrued liability due to a change in the actuarial assumptions, plan provisions, or actuarial cost method, a new amortization period is determined. This new amortization period is determined by blending the period needed to amortize the prior unfunded actuarial accrued liability over the prior amortization period and the increase in unfunded actuarial accrued liability amortized over 30 years. If there is a decrease in the unfunded actuarial accrued liability, no change is made to the amortization period.

APPENDIX C – ACTUARIAL METHODS AND ASSUMPTIONS

Asset Valuation Method

As prescribed in the Minnesota Statutes Section 356.215, Subdivision 1, Paragraph (f), the assets are valued based on a five-year moving average of expected and market values (five-year average actuarial value) determined as follows:

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

Supplemental Contributions

The City of Minneapolis, the Minneapolis School District, and the State of Minnesota are scheduled to make the following supplemental contributions to the Fund in FY18:

1993 Legislation:	Supplemental contributions from the City of Minneapolis in the amount of $1,250,000, from Minneapolis Schools in the amount of $1,250,000 and from the State in the amount of $2,500,000 ($5,000,000 total) annually are assumed to be made until full actuarial funding is achieved. Amount is fixed in statute.
1996 Legislation:	Supplemental contributions from the State in the amount of $3,256,410 annually are assumed to be made until the amortization date of June 30, 2039 or full actuarial funding is achieved, whichever is earlier. Amount is variable as described in Minnesota Statutes, Chapter 423A.02. Assumed amount is based on actual amount received in most recent fiscal year, and information provided by the Teachers Retirement Association.
1997 Legislation:	Supplemental contributions from the State in the amount of $12,954,000 annually are assumed to be made until full actuarial funding is achieved or the stabilizer may be used to decrease contribution rates. Amount is fixed in statute.
2014 Legislation:	Supplemental contributions from the State in the amount of $14,377,000 annually are assumed to be made until full actuarial funding is achieved or the stabilizer may be used to decrease contribution rates. Amount is fixed in statute.

APPENDIX C – ACTUARIAL METHODS AND ASSUMPTIONS

Entry Age Calculation

As required by the LCPR Standards for Actuarial Work, a member's Entry Age is calculated as the age at the valuation date less years of service. Age on the valuation date is calculated as age nearest birthday. The years of service for each member are provided by TRA.

Decrement Timing

All decrements are assumed to occur in the middle of the plan year. This is the preferred decrement timing in the LCPR Standards for Actuarial Work.

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.

Benefits included or excluded

To the best of our knowledge, all material benefits have been included in the liability.

IRC Section 415(b): The limitations of Internal Revenue Code Section 415(b) have been incorporated into our calculations. Annual benefits may not exceed the limits in IRC Section 415. This limit is indexed annually. For 2017, the limit is $215,000.

IRC Section 401(a)(17): The limitations of Internal Revenue Code Section 401(a)(l7) have been incorporated into our calculations. Compensation for any 12-month period used to determine accrued benefits may not exceed the limits in IRC Section 401(a)(17) for the calendar year in which the 12-month period begins. This limit is indexed annually. For 2017, the limit is $270,000. Certain members first hired before July 1, 1995 may have a higher limit.

APPENDIX C – ACTUARIAL METHODS AND ASSUMPTIONS

Summary of Actuarial Assumptions

The following assumptions were used in valuing the liabilities and benefits under the plan. All assumptions are prescribed by Statutes, the LCPR, or the Board of Trustees. The assumptions prescribed are based on the experience study dated June 10, 2015.

The Allowance for Combined Service Annuity was based on the recommendation of Deloitte Consulting LLP, the actuary for the Legislative Commission on Pensions and Retirement (LCPR). We are unable to judge the reasonableness of this assumption without performing a substantial amount of additional work beyond the scope of this assignment so we have relied on Deloitte's findings.

Investment Return		8.50% compounded annually.
Future post-retirement adjustments		2.00% per year. Once the funded ratio reaches 90% on a market value basis for two consecutive years, the COLA is scheduled by statute to revert back from 2.00% to 2.50%. Future assets and liabilities were projected using the 2017 valuation results as a starting point and assuming all actuarial assumptions are met in future years. These assumptions include a rate of return on the market value of assets of 8.5%. Further, there is an assumption that the stabilizer provisions will not be utilized by the Board. Based on this methodology, as of July 1, 2017, the COLA is expected to increase with the July 1, 2045 valuation. For the July 1, 2016 valuation, the increased COLA was not expected to be implemented during the next 40 years, and so it was assumed it would not occur.
Salary Increases		Reported salary for prior fiscal year, with new hires annualized, is increased according to the salary increase table shown in the rate table for current fiscal year and annually for each future year. See table of sample rates.
Payroll Growth		3.50% per year
Future Service		Members are assumed to earn future service at a full-time rate.
Mortality:	***Pre-retirement***	RP 2014 white collar employee table, male rates set back 6 years and female rates set back 5 years. Generational projection uses the MP-2015 scale.
	Post-retirement	RP 2014 white collar annuitant table, male rates set back 3 years and female rates set back 3 years, with further adjustments of the rates. Generational projection uses the MP-2015 scale.
	Post-disability	RP 2014 disabled retiree mortality, without adjustment
Disability		Age-related rates based on experience; see table of sample rates.

Summary of Actuarial Assumptions *(continued)*

Withdrawal	Rates vary by service based on actual plan experience, as shown in the rate table.
Expenses	Prior year administrative expenses expressed as percentage of prior year payroll.
Retirement Age	Graded rates beginning at age 55 as shown in rate table. Members who have attained the highest assumed retirement age will retire in one year.
Percentage Married	85% of male members and 65% of female members are assumed to be married. Members are assumed to have no children.
Age Difference	Females two years younger than males.
Allowance for Combined Service Annuity	Liabilities for vested former members are increased by 7.00% and liabilities for non-vested former members are increased by 9.00% to account for the effect of some Participants being eligible for a Combined Service Annuity.
Refund of Contributions	All employees withdrawing after becoming eligible for a deferred benefit are assumed to take the larger of their contributions accumulated with interest or the value of their deferred benefit.
Interest on member contributions	Members and former members who are eligible for the money purchase annuity are assumed to receive interest credits equal to the Pre-Retirement interest rate. All other members and former members receive the interest crediting rate as specified in statutes.
Commencement of deferred benefits	Members receiving deferred annuities (including current terminated deferred members) are assumed to begin receiving benefits at unreduced retirement age.
Form of payment	Members are assumed to elect subsidized joint and survivor form of annuity as follows: Males: 10.0% elect 50% J&S option 10.0% elect 75% J&S option 60.0% elect 100% J&S option 20.0% elect Straight Life option Females: 13.5% elect 50% J&S option 6.5% elect 75% J&S option 35.0% elect 100% J&S option 45.0% elect Straight Life option Members eligible for deferred annuities (including current terminated deferred members) and future disability benefits are assumed to elect a life annuity.

Summary of Actuarial Assumptions *(continued)*

Missing data for members

Membership data was supplied by TRA as of the valuation date. This information has not been audited by CMC. We have reviewed the information for internal consistency and we have no reason to doubt its substantial accuracy. In the small number of cases where submitted data was missing or incomplete and could not be recovered from prior years, the following assumptions were applied, if needed:

Data for active members:	
Salary, Service, and Date of Birth	Based on current active demographics.
Gender	Female
Data for terminated members:	
Date of birth	July 1, 1969
Average salary	$38,500
Date of termination	Derived from date of birth, original entry age, and service
Data for in-pay members:	
Beneficiary date of birth	Wife two years younger than husband
Gender	Based on first name
Form of payment	Life annuity for retirees and beneficiaries, 100% J&S option for disabled retirees.

Termination Rates

Service	Males	Females
Less than 1	32.00%	29.00%
1	15.00%	13.00%
2	11.00%	11.00%
3	8.50%	9.00%
4	6.25%	7.00%
5	5.25%	5.50%
6	4.60%	4.00%
7	4.10%	3.50%
8	2.80%	3.00%
9	2.30%	2.50%
10	2.00%	2.10%
15	1.10%	1.10%
20	0.60%	0.60%
25 or more	0.50%	0.50%

	Rate (%)			
	Pre-retirement Mortality*		Disability	
Age	Male	Female	Male	Female
20	0.023	0.013	0.00	0.00
25	0.026	0.014	0.00	0.00
30	0.036	0.014	0.00	0.00
35	0.031	0.018	0.01	0.01
40	0.035	0.024	0.03	0.03
45	0.041	0.033	0.05	0.05
50	0.061	0.055	0.10	0.10
55	0.105	0.092	0.16	0.16
60	0.175	0.140	0.25	0.25
65	0.292	0.204	0.00	0.00

**Rates shown are for 2014, the base year of the tables.*

	Annuitant Mortality Rates (%)			
	Retirement *		Disability	
Age	Male	Female	Male	Female
55	0.267	0.196	2.337	1.448
60	0.353	0.267	2.660	1.700
65	0.486	0.430	3.169	2.086
70	0.945	0.706	4.035	2.820
75	2.015	1.352	5.429	4.105
80	4.126	2.682	7.662	6.104
85	7.358	5.456	11.330	9.042
90	13.560	9.947	17.301	13.265
95	24.351	18.062	24.717	19.588
100	38.292	29.731	32.672	27.819

* *Rates shown are for 2014, the base year of the tables.*

Summary of Actuarial Assumptions *(continued)*

Salary Scale	
Service	**Salary Increase**
1	9.50%
2	7.75%
3	7.25%
4	7.00%
5	7.00%
6	6.85%
7	6.70%
8	6.55%
9	6.40%
10	6.25%
11	6.00%
12	5.75%
13	5.50%
14	5.25%
15	5.00%
16	4.75%
17	4.50%
18	4.30%
19	4.20%
20	4.10%
21	4.00%
22	3.90%
23	3.80%
24	3.70%
25	3.60%
26 or more	3.50%

	Retirement Rate (%)					
	Coordinated Members				Basic Members	
Age	Tier 1 Early	Tier 1 Unreduced	Tier 2 Early	Tier 2 Unreduced	Eligible for 30 and Out Provision	Not Eligible for 30 and Out Provision
55	5	35	5		40	5
56	10	35	5		40	5
57	10	35	5		40	5
58	10	35	5		40	5
59	14	35	5		40	5
60	17	35	6		25	25
61	20	35	15		25	25
62	25	35	15		25	25
63	25	35	15		25	25
64	25	35	20		25	25
65		40	30		40	40
66		35		35	40	40
67		30		30	40	40
68		30		25	40	40
69		30		25	40	40
70		35		35	60	60
71-74		100		100	60	60
75-79		100		100	60	100
80 & Over		100		100	100	100

Coordinated Tier 2 Members age 62 or older with 30 or more years of service have 5% added to their early retirement rates.

Changes in actuarial assumptions and methods since the previous valuation

The Combined Service Annuity liability loads were updated for active, vested inactive members and non-vested inactive members.

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GLOSSARY

Actuarial Asset Value. The value of assets used in calculating the required contributions. The actuarial asset value may be equal to the fair market value of assets, or it may spread the recognition of certain investment gains or losses over a period of years in accordance with an asset valuation method. The goal of an asset valuation method is to produce a relatively stable asset value thereby reducing year-to-year volatility in contribution requirements.

Actuarial Accrued Liability. The portion of the present value of all benefits attributable to service already rendered.

Actuarial Cost Method. Sometimes called "funding method," a particular technique used by actuaries to establish the amount and incidence of the annual actuarial cost of pension plan benefits, or normal cost, and the related unfunded actuarial accrued liability. Ordinarily, the annual contribution to the plan comprises the normal cost and an amount for amortization of the unfunded actuarial accrued liability.

ASA. Associate of the Society of Actuaries.

Current Benefit Obligations. The present value of benefits earned to the valuation date, based on current service and including future salary increases to retirement.

EA. Enrolled Actuary.

FSA. Fellow of the Society of Actuaries.

MAAA. Member of the American Academy of Actuaries.

Normal Cost. The annual cost assigned to the current year, under the actuarial cost method in use.

Present Value. Sometimes called "actuarial present value," the current worth (on the valuation date) of an amount or series of amounts payable or receivable in the future. The present value is determined by discounting the future payments at a predetermined rate of interest, taking into account the probability of payment.

Statement No. 67 of the Governmental Accounting Standards Board (GASB 67). The accounting standard governing the financial reporting for defined benefit pension plans and note disclosures for defined benefit plans.

Statement No. 68 of the Governmental Accounting Standards Board (GASB 68). The accounting standard governing a state or local governmental employer's accounting for pensions.