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Teachers Retirement Association of Minnesota

**Actuarial Valuation Report
For Funding Purposes
As of July 1, 2018**



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Cavanaugh Macdonald

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November 30, 2018

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, 2018. The major findings of the actuarial valuation are contained in this report, which reflects the benefit provisions in place on July 1, 2018. These provisions include changes to the benefits and contributions resulting from passage of the 2018 Omnibus Pension Bill.

The 2018 legislation also lowered the investment return assumption to be used for the actuarial funding valuation, which is set in Minnesota Statute Section 356.215, from 8.5% to 7.5%, effective with the July 1, 2018 valuation. In 2017, the TRA Board commissioned Cavanaugh Macdonald Consulting 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 lowering the investment return assumption from 8.5% to 7.5%, lowering the general wage increase assumption from 3.75% to 2.85% for the next ten years and 3.25% thereafter, and lowering the payroll growth assumption from 3.5% to 3.0%. Therefore, the current statutorily required investment return assumption, along with the other economic assumptions adopted by the TRA Board, are consistent with the recommended assumptions in our 2017 analysis and, in our opinion, meet actuarial standards of practice.

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,



Board of Trustees
November 30, 2018
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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,

A handwritten signature in blue ink, reading 'Patrice Beckham' in a cursive script.

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

A handwritten signature in blue ink, reading 'Brent A. Banister' in a cursive script.

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 certain college faculty. This report presents the results of the July 1, 2018 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.

The 2018 Omnibus Pension Bill contained significant changes that impacted TRA's funded status and long-term funding outlook including changes to the financing of TRA, changes to benefit provisions, and a decrease in the investment return assumption from 8.5% to 7.5% (set in statute). The change in the investment return assumption resulted in a more realistic (and higher) measurement of the liabilities. The benefit changes in the 2018 legislation nearly offset the increase in liabilities due to the decrease in the investment return assumption. As shown in the following pages, the benefit changes in the 2018 Omnibus Pension Bill had a significant positive financial impact on TRA. While the decrease in the investment return assumption increased the accrued actuarial liability by \$3.3 billion, the benefit changes reduced liabilities by \$2.9 billion, increased the funded ratio from 70% to 77%, and put the plan on track to be over 100% funded in 30 years, assuming all actuarial assumptions are met. The specific changes are summarized below:

BENEFIT CHANGES

Reduced COLA: The COLA was reduced from 2.0 percent each January 1 to 1.0 percent, effective January 1, 2019. Beginning January 1, 2024, the COLA will increase 0.1% each year until reaching the ultimate rate of 1.5% in January 1, 2028.

COLA Eligibility: Beginning July 1, 2024, eligibility for the first COLA changes to normal retirement age (age 65 to 66, depending on date of birth). However, members who retire under Rule of 90 and members who are at least age 62 with 30 years of service credit are exempt.

COLA Trigger: The COLA trigger provision, which would have increased the COLA to 2.5% if the funded ratio was at least 90 percent for two consecutive years, was eliminated.

Early Retirement Benefits: Augmentation in the early retirement reduction factors is phased out over a five-year period beginning July 1, 2019 and ending June 30, 2024 (this reduces early retirement benefits). Members who retire and are at least age 62 with 30 years of service are exempt.

Deferred Benefits: Augmentation on deferred benefits will be reduced to zero percent beginning July 1, 2019. Interest payable on refunds to members will be reduced from 4.0% to 3.0%, effective July 1, 2018. Interest due on payments and purchases from members, employers is reduced from 8.5% to 7.5%, effective July 1, 2018.

Contribution Rates: The employer contribution rate is increased each July 1 over the next 6 years, (7.71% in 2018, 7.92% in 2019, 8.13% in 2020, 8.34% in 2021, 8.55% in 2022, 8.75% in 2023. In



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addition, the employee contribution rate will increase from 7.50% to 7.75% on July 1, 2023. The state provides funding for the higher employer contribution rate through an adjustment in the school aid formula.

CHANGES AFFECTING TRA FINANCING

Investment Return Assumption: The investment return assumption was lowered from 8.5% to 7.5%.

Amortization Period: The amortization date for the funding the Unfunded Actuarial Accrued Liability (UAAL) was reset to June 30, 2048 (30 years).

Contribution Stabilizer: A mechanism in the law that provided the TRA Board with some authority to set contribution rates was eliminated.

In 2017, the TRA Board commissioned Cavanaugh Macdonald Consulting 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 lowering the investment return assumption from 8.5% to 7.5%, lowering the general wage increase assumption from 3.75% to 2.85% for the next ten years and 3.25% thereafter, and lowering the payroll growth assumption from 3.5% to 3.0%. The TRA Board adopted the general wage increase and payroll growth assumptions, but the investment return assumption is set in statute. The LCPR also approved these revised assumption on February 19, 2018. As a result of the 2018 Omnibus Pension Bill, the set of economic assumptions used in the July 1, 2018 valuation (including the statutorily required investment return assumption of 7.5%), is consistent with the recommended assumptions in our 2017 analysis and, in our opinion, meet actuarial standards of practice.

The net impact of all of these changes was an increase in the actuarial accrued liability of \$397 million. The Required Contribution Rate decreased from 18.25% to 17.18% and the contribution deficiency decreased from 2.36% to 1.08%. If the future scheduled contribution increases are considered, the contribution deficiency is eliminated. The following table summarizes the key valuation results first showing the results with no change in assumptions (baseline), the impact of the change in the set of economic assumptions, including the reduction in the investment assumption to 7.5%, and then reflecting the impact of the benefit provision and contribution changes along with the extension of the amortization period:



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	July 1, 2018 Valuation Results (\$ billions)		
	Baseline	Economic Assumption Changes	All Changes
Actuarial Accrued Liability	\$ 28.246	\$ 31.500	\$ 28.643
Actuarial Value of Assets	22.023	22.023	22.023
Unfunded Actuarial Accrued Liability	6.223	9.477	6.620
Funded Ratio (Actuarial Assets)	77.97%	69.91%	76.89%
Normal Cost Rate	8.77%	10.59%	9.16%
UAAL Amortization Payment	9.16%	12.73%	7.70%
Expenses	<u>0.32%</u>	<u>0.32%</u>	<u>0.32%</u>
Total Required Contribution	18.25%	23.64%	17.18%
Statutory Contribution	<u>15.89%</u>	<u>15.89%</u>	<u>16.10%</u>
Contribution (Deficiency)/Sufficiency	(2.36%)	(7.75%)	(1.08%)

The actuarial valuation results provide a “snapshot” view of the System’s financial condition on July 1, 2018. The results reflect net favorable experience for the past plan year as demonstrated by an UAAL that was lower than expected, after taking changes in assumptions, methods and benefit provisions into account. The UAAL on July 1, 2018 is \$6.620 billion as compared to an expected UAAL of \$6.956 billion (reflecting the \$397 million net increase due to the 2018 Omnibus Pension Bill). The aggregate favorable experience of \$336 million was the combined result of an experience gain of \$254 million on the actuarial value of assets and an experience gain of \$82 million on the System liabilities. The majority of the liability gain was a result of salary increases that were lower than expected, based on the actuarial assumptions.

A summary of the key valuation results from the July 1, 2018 actuarial valuation, compared to the July 1, 2017 valuation, is shown in the following table. Further detail on the valuation results can be found in the following sections of this Executive Summary.

	July 1, 2018	July 1, 2017
Total Required Contribution Rate (Chapter 356)	17.18%	18.43%
Statutory Contribution Rate (Chapter 354)	16.10%	15.93%
Sufficiency/(Deficiency)	(1.08%)	(2.50%)
Unfunded Actuarial Accrued Liability (\$M)	\$6,620	\$6,365
Funded Ratio (Actuarial Assets)	76.89%	76.79%

The contribution deficiency decreased from 2.50% of payroll in last year’s valuation to 1.08% of payroll in the 2018 valuation. This is the net impact of an increase in the deficiency arising from the change in economic assumptions including the reduction to the investment return assumption and a decrease in the contribution deficiency from the benefit provision changes, increased employer contribution rate and extended amortization period for the UAAL. If the future scheduled increases in the contribution rates for both the employers and members are considered, the contribution deficiency is eliminated.



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EXPERIENCE FOR THE LAST PLAN YEAR

Numerous factors contributed to the change in the System’s assets, liabilities and Required Contribution Rate (actuarial contribution rate) between July 1, 2017 and July 1, 2018. The components are examined in the following discussion.

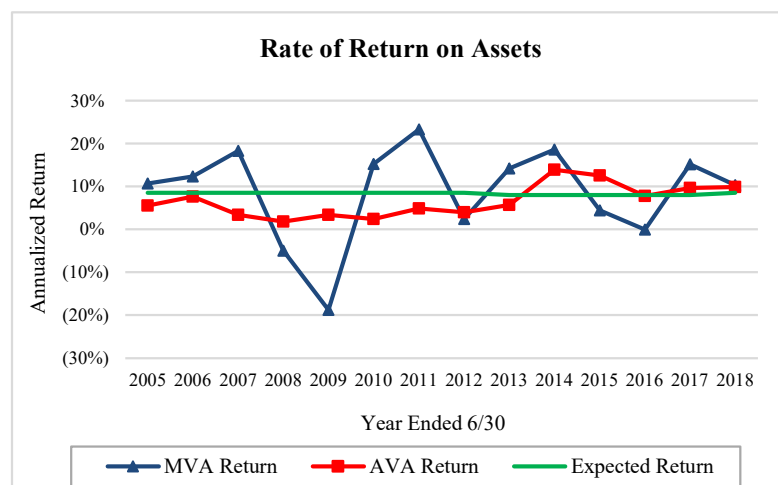
ASSETS

As of June 30, 2018, TRA had net assets of \$22.4 billion, when measured on a market value basis. This was an increase of approximately \$1.1 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. 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, 2018 was \$22.0 billion, an increase of \$1.0 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, 2017	\$21,063	\$21,253
- Employer and Member Contributions and State Aid	789	789
- Benefit Payments and Administrative Expenses	(1,848)	(1,848)
- Investment Income	<u>2,019</u>	<u>2,164</u>
Net Assets, June 30, 2018	\$22,023	\$22,358
Rate of Return	9.8%	10.3%

The Minnesota State Board of Investment (SBI) reported a rate of return of 10.3% on the market value of assets for fiscal year 2018. Due to the application of the asset smoothing method, including the scheduled recognition of the deferred investment experience from prior years, the rate of return on the actuarial value of assets was 9.8%. Because this rate of return was higher than the assumed rate of return for this period of 8.5% (the investment return assumption for the July 1, 2017 valuation), there was an actuarial gain of \$254 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.



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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, 2018 in the following table:

	Actuarial Value of Assets	Market Value of Assets
(\$Millions)		
Actuarial Accrued Liability	\$28,643	\$28,643
Value of Assets	22,023	22,358
Unfunded Actuarial Accrued Liability*	6,620	6,285
Funded Ratio	76.89%	78.06%

*Numbers may not add due to rounding

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

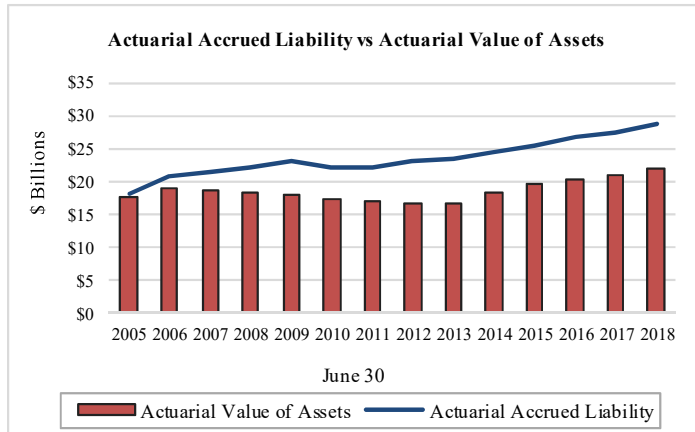
Changes in the UAAL occur for various reasons. The net increase in the UAAL from July 1, 2017 to July 1, 2018 was \$255 million. The components of this net change are shown in the following table (in millions):

Unfunded Actuarial Accrued Liability, July 1, 2017 (\$M)	\$6,365
• Expected increase from amortization method	\$47
• Expected increase from contributions below Required Rate	131
• Investment experience	(254)
• Liability experience	(82)
• Other experience	16
• Investment return assumption change	3,254
• Benefit provision changes	(2,857)
• Total	255
Unfunded Actuarial Accrued Liability, July 1, 2018	\$6,620

As shown above, various components impacted the UAAL from July 1, 2017 to July 1, 2018. 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. These 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 total actuarial gain of \$336 million which may be explained by considering the separate experience of assets and liabilities. As noted earlier, there was a \$254 million gain on the actuarial value of assets and an \$82 million

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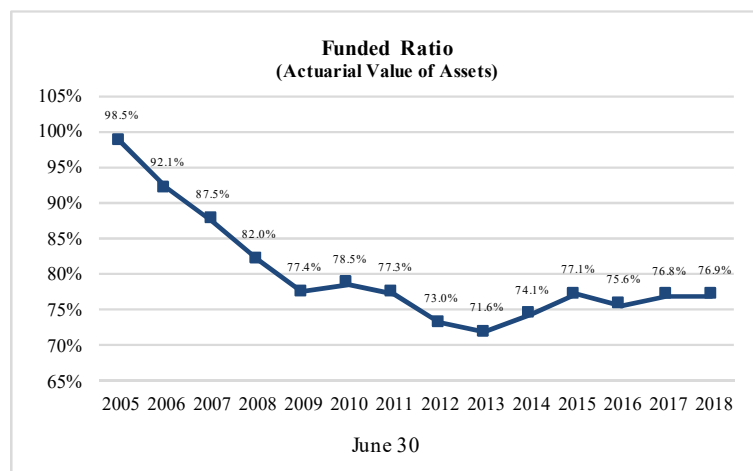
gain on liabilities. The change in the economic assumptions (including the investment return assumption) and the changes to the benefit provisions have a large, but nearly offsetting, impact on the UAAL as well.



The actuarial accrued liability has exceeded the actuarial value of assets during this period. Investment experience below the assumed rate of return, coupled with contributions far below the actuarial contribution rate, 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 in the following table (in millions).

	7/1/14	7/1/15	7/1/16	7/1/17	7/1/18
Funded Ratio	74.1%	77.1%	75.6%	76.8%	76.9%
Unfunded Actuarial Accrued Liability (\$M)	\$6,347	\$5,865	\$6,522	\$6,365	\$6,620



The funded ratio has decreased over this period largely due to investment experience lower than the assumed rate of return. The benefit reductions passed by the 2010 and 2018 legislatures and the strong investment returns since FY10 have resulted in the funded ratio beginning to rebound from the funded level in 2013.



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CONTRIBUTION RATE

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

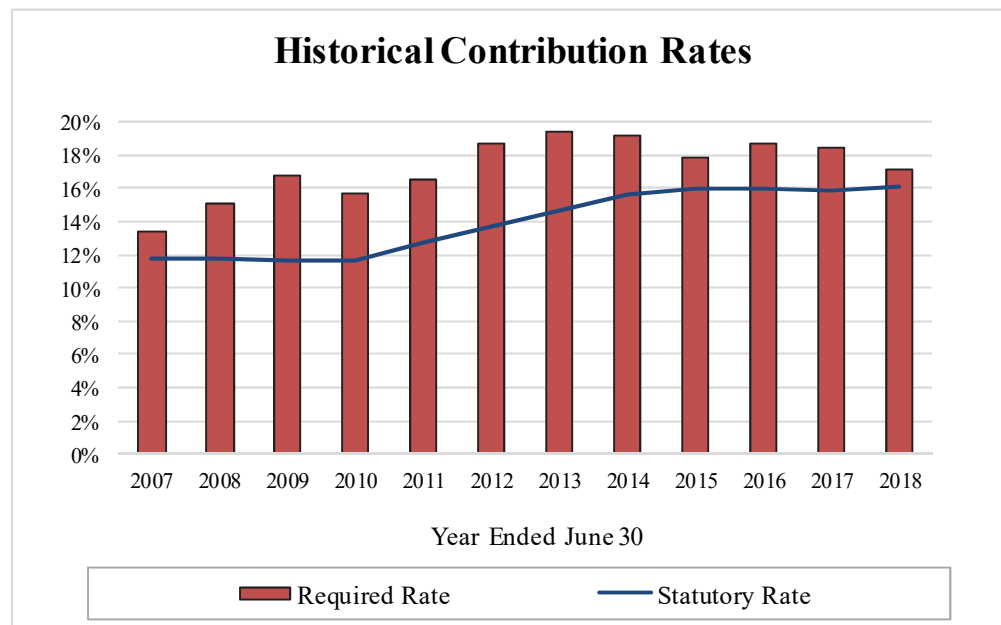
- a "normal cost" for the portion of projected liabilities allocated by the actuarial cost method to service of members during the year following the valuation date,
- an "unfunded actuarial accrued liability contribution" for the excess of the portion of projected liabilities allocated to service to 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. The change in the economic assumptions, including the decrease in the investment return assumption, increased the Required Contribution Rate, but the changes to the benefit provisions along with the extension of the amortization period in the 2018 legislation more than offset the increase. The net result was a decrease in the contribution deficiency from the 2017 to the 2018 valuation. Note that if the future scheduled contribution increases were reflected, the contribution rate would be sufficient.

Contribution Rates	July 1, 2018	July 1, 2017
1. Normal Cost Rate	9.16%	8.77%
2. UAAL Contribution Rate	7.70%	9.41%
3. Expenses	<u>0.32%</u>	<u>0.25%</u>
4. Total Required Contribution Rate	17.18%	18.43%
5. Statutory Contribution Rate	<u>16.10%</u>	<u>15.93%</u>
6. Contribution Deficiency (5) - (4)	(1.08%)	(2.50%)
7. Contribution Sufficiency Reflecting Future Scheduled Contribution Increases	0.21%	(2.50%)

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

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When a system is funded with fixed contribution rates (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 Statutory Contribution Rate has been significantly below the Required Contribution Rate for over 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 pattern of actual contributions that are significantly less than the actuarial contribution rate is a concern from an actuarial standpoint. The benefit and contribution changes enacted by the 2018 legislature had a significant positive impact on the projected long term funding of TRA. While the funded ratio, as of July 1, 2018, did not increase materially, the Contribution Deficiency was reduced from 2.50% in the 2017 valuation to 1.08% in the current valuation. When future scheduled increases in the Statutory Contribution Rate are considered, the Contribution Deficiency is eliminated which is expected to result in an improvement in the funded ratio over time, assuming all assumptions are met.

The actuarial contribution rate (Required Contribution Rate) is determined based on the snapshot of the System taken on the valuation date, July 1, 2018. 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.

SUMMARY

The investment return on the market value of assets for FY 2018 was 10.3%, as reported by SBI. However, due to the application of the asset smoothing method, the return on the actuarial value of assets was 9.8%. Since this return was above the assumed rate of return of 8.5% for the fiscal year ending 2018, there was an actuarial gain on the actuarial value of assets. Coupled with the change to the set of economic assumptions (including the investment return assumption), changes to the benefit provisions, and



SECTION 1 – EXECUTIVE SUMMARY

demographic experience for the year, the funded ratio increased slightly from 76.79% in last year's valuation to 76.89% 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 \$335 million represents about 1.5% of the market value of assets.

The key valuation results from the July 1, 2018 actuarial valuation are shown below, using both actuarial and market value of assets.

	<u>Actuarial Value</u>	<u>Market Value</u>
Statutory Rate	16.10%	16.10%
Required Contribution		
Normal Cost	9.16%	9.16%
UAAL Contribution	7.70%	7.32%
Expenses	<u>0.32%</u>	<u>0.32%</u>
Total Required Contribution	17.18%	16.80%
(Deficiency)/Sufficiency	(1.08%)	(0.70%)
UAAL (\$M)	\$6,620	\$6,285
Funded Ratio	76.89%	78.06%

Note: does not reflect future scheduled increases in the employer and employee contribution rates.

If the Total Required Contribution Rate is calculated, based on the UAAL using the market value of assets, the Required Contribution Rate decreases to 16.80% and the resulting Contribution Deficiency for FY 2019, reflecting the current contribution rates, is 0.70%.

The long-term financial health of this 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 2018 Legislature to strengthen the funding of TRA and enhance its long-term sustainability. Contributions were increased by a total of 1.5%, phased-in over six years beginning July 1, 2018, and benefit reductions were implemented. These changes are expected to lead to improvement in the long-term funding of the System. Of course, actual experience over time will unfold differently from what is assumed, so additional adjustments may be necessary in the future. It is especially 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, 2018 and July 1, 2017 valuations.



SECTION 1 – EXECUTIVE SUMMARY

Principal Valuation Results

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

	Actuarial Valuation as of	
	July 1, 2018	July 1, 2017
1. PARTICIPANT DATA		
A. Active members		
1. Number	82,495	81,811
2. Projected annual earnings for fiscal year (000s)	5,173,114	5,043,499
3. Average projected annual earnings for fiscal year 2019	62,708	61,648
4. Average age	43.2	43.2
5. Average service	11.9	11.9
B. Service retirements	60,128	58,989
C. Survivors	5,476	5,268
D. Disability retirements	500	517
E. Deferred retirements	14,936	14,030
F. Non-vested terminated members	34,375	33,344
G. Total	197,910	193,959
2. LIABILITIES AND FUNDING RATIOS (dollars in thousands)		
A. Accrued Benefit Funding Ratio		
1. Current assets (AVA)	\$ 22,022,842	\$ 21,062,789
2. Current benefit obligations	27,403,889	25,942,767
3. Funding ratio	80.36%	81.19%
B. Actuarial Accrued Liability Funding Ratio		
1. Current assets (AVA)	\$ 22,022,842	\$ 21,062,789
2. Market value of assets (MVA)	22,357,570	21,253,486
3. Actuarial accrued liability	28,643,023	27,427,702
4. Unfunded actuarial accrued liability (B.3. - B.1.)	6,620,181	6,364,913
5. Funding ratio (AVA) (B.1. / B.3.)	76.89%	76.79%
6. Funding ratio (MVA) (B.2. / B.3.)	78.06%	77.49%
C. Projected Benefit Funding Ratio		
1. Current and expected future assets	\$ 32,688,097	\$ 30,180,088
2. Current and expected future benefit obligations	33,620,108	31,871,009
3. Funding ratio (AVA)	97.23%	94.69%
3. CONTRIBUTIONS (% of Payroll)		
A. Normal Cost Rate	9.16%	8.77%
B. UAAL Amortization Payment	7.70%	9.41%
C. Expenses	0.32%	0.25%
D. Total Required Contribution (Chapter 356)	17.18%	18.43%
E. Statutory Contribution (Chapter 354)	16.10%	15.93%
F. Contribution (Deficiency)/Sufficiency (3.E. - 3.D.)	(1.08%)	(2.50%)



SECTION II - PLAN ASSETS

SECTION II PLAN ASSETS



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, 2018	June 30, 2017
	<u>Amount</u>	<u>Amount</u>
Cash and short-term investments		
Cash	\$ 9,533	\$ 6,751
Building account cash	30	41
Short term investments	254,436	622,773
Total cash and short term investments	\$ 263,999	\$ 629,565
Accounts Receivable	24,885	21,281
Investments (at fair value)		
Bond pool	\$ 5,497,619	\$ 4,098,977
Alternative investments pool	3,072,614	2,773,952
Domestic stock pool	9,227,563	9,142,315
Broad International Stock Fund	4,268,602	4,583,377
Total investments	\$ 22,066,398	\$ 20,598,621
Securities lending collateral	\$ 2,234,956	\$ 2,182,399
Building		
Land	\$ 171	\$ 171
Building & equipment net of depreciation	5,974	6,251
Total building	\$ 6,145	\$ 6,422
Capital assets net of depreciation	15,541	16,797
Total Assets	\$ 24,611,924	\$ 23,455,085



SECTION II - PLAN ASSETS

TABLE 1 (continued)

STATEMENT OF FIDUCIARY NET POSITION

(Dollars in Thousands)

	June 30, 2018	June 30, 2017
Liabilities	<u>Amount</u>	<u>Amount</u>
Current		
Accounts payable	\$ 9,384	\$ 8,367
Accrued compensated absences	91	99
Accrued expenses - building	24	41
Bonds payable	634	616
Bonds interest payable	6	11
Securities lending collateral	2,234,956	2,182,399
Total current liabilities	\$ 2,245,095	\$ 2,191,533
Long term		
Accrued compensated absences	\$ 795	\$ 834
Bonds payable	3,947	4,628
Total long term liabilities	\$ 4,742	\$ 5,462
Total Liabilities	\$ 2,249,837	\$ 2,196,995
Net position restricted for pensions	\$ 22,362,087	\$ 21,258,090
Earnings Limitation Savings Account		
(ELSA) accounts payable	(4,517)	(4,604)
Net position restricted for pensions, after adjustment for ELSA accounts	\$ 22,357,570	\$ 21,253,486



SECTION II - PLAN ASSETS

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, 2018 and 2017.

	For Year Ended	
	June 30, 2018	June 30, 2017
Additions		
Contributions		
Employee	\$ 374,550	\$ 361,175
Employer	378,728	367,791
Direct aid (state/city/district)	35,587	35,587
Earnings Limitation Savings Account (ELSA)	1,937	1,995
Total contributions	\$ 790,802	\$ 766,548
Investment Income		
Investment appreciation in fair value	\$ 2,168,525	\$ 2,863,554
Less investment expenses	(23,448)	(22,060)
Net Investment Income	\$ 2,145,077	\$ 2,841,494
Securities Lending activities		
Securities lending income	\$ 46,592	\$ 31,122
Securities lending expenses:		
Borrowing rebates	(29,786)	(12,814)
Management fees	(1,772)	(4,584)
Total securities lending expenses	(31,558)	(17,398)
Net income from securities lending	15,034	13,724
Total Net Investment Income	\$ 2,160,111	\$ 2,855,218
Other Income	2,581	2,404
Total Additions	\$ 2,953,494	\$ 3,624,170
Deductions		
Benefits Paid		
Retirement benefits	\$ (1,818,814)	\$ (1,765,573)
Refunds of contributions to members	(13,073)	(11,241)
Total benefits paid	\$ (1,831,887)	\$ (1,776,814)
Administrative Expenses	(15,673)	(11,702)
Total Deductions	\$ (1,847,560)	\$ (1,788,516)
Increase/(Decrease) in ELSA Account Value	(1,850)	(2,299)
Net Increase (Decrease)	1,104,084	1,833,355
Net Position Restricted for Pensions		
Beginning of Year	\$ 21,253,486	\$ 19,420,131
End of Year	\$ 22,357,570	\$ 21,253,486



SECTION II - PLAN ASSETS

TABLE 3

ACTUARIAL VALUE OF ASSETS AS OF JUNE 30, 2018

(Dollars in Thousands)

1. Market value of assets available for benefits			\$ 22,357,570
2. Determination of average balance			
a. Assets available at July 1, 2017*		\$	21,258,090
b. Assets available at June 30, 2018*			22,362,087
c. Net investment income for fiscal year ending June 30, 2018			2,160,111
d. Average balance $(a. + b. - c.) / 2$		\$	20,730,033
3. Expected return $(8.5\% * 2.d.)$			1,762,053
4. Actual return			2,160,111
5. Current year unrecognized asset return $(4. - 3.)$			398,058
6. Unrecognized asset returns			
	Original	% Not	
	<u>Amount</u>	<u>Recognized</u>	
a. Year ended June 30, 2018	\$ 398,058	80%	\$ 318,446
b. Year ended June 30, 2017	1,342,126	60%	805,276
c. Year ended June 30, 2016	(1,619,440)	40%	(647,776)
d. Year ended June 30, 2015	(706,091)	20%	(141,218)
e. Total return not yet recognized			\$ 334,728
7. Actuarial value of assets at June 30, 2018 (1. - 6.e.)			\$ 22,022,842

* Before recognition of ELSA accounts payable.



SECTION II - PLAN ASSETS

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SECTION III - PLAN LIABILITIES

SECTION III PLAN LIABILITIES



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, 2018. 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 demographic actuarial assumptions used to determine liabilities are based on the results of the 2008-2014 Experience Study. The economic actuarial assumptions used to determine liabilities are based on the results of an economic experience study performed in 2017. This set of assumptions is shown in Appendix C.

The liabilities reflect the benefit structure in place as of July 1, 2018.

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.



SECTION III - PLAN LIABILITIES

TABLE 4

ACTUARIAL VALUATION BALANCE SHEET AS OF JULY 1, 2018

(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				\$	22,022,842	
B. Expected Future Assets						
1. Present value of expected future statutory supplemental contributions*				\$	5,688,170	
2. Present value of expected future normal cost contributions					4,977,085	
3. Total expected future assets (1. + 2.)				\$	10,665,255	
C. Total Current and Expected Future Assets**				\$	32,688,097	
		<u>Non-Vested</u>	<u>Vested</u>			
		<u>Benefits</u>	<u>Benefits</u>		<u>Total</u>	
D. Current Benefit Obligations						
1. Benefit recipients						
a. Service retirements	\$	0	\$	17,135,810	\$	17,135,810
b. Disability		0		147,761		147,761
c. Survivors		0		1,140,657		1,140,657
2. Deferred retirements with applicable future augmentation		0		636,756		636,756
3. Former members without vested rights***		90,338		0		90,338
4. Active members		68,805		8,183,762		8,252,567
5. Total Current Benefit Obligations	\$	159,143	\$	27,244,746	\$	27,403,889
E. Expected Future Benefit Obligations						6,216,219
F. Total Current and Expected Future Benefit Obligations						33,620,108
G. Unfunded Current Benefit Obligations (D.5. - A.)						5,381,047
H. Unfunded Current and Future Benefit Obligations (F. - C.)						932,011

* Under LCPR guidelines, this amount does not include supplemental payments which could occur after the expiration of the remaining 30 year amortization period.

** Does not reflect deferred investment experience in the asset smoothing method. Total expected future assets on a market value basis is \$ 33,022,825.

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



SECTION III - PLAN LIABILITIES

TABLE 5

DETERMINATION OF UNFUNDED ACTUARIAL ACCRUED LIABILITY
AS OF JULY 1, 2018
(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	\$ 13,643,619	\$ (4,129,293)	\$ 9,514,326
b. Disability Benefits	318,719	(135,028)	183,691
c. Survivor benefits	107,439	(41,361)	66,078
d. Deferred retirements	383,778	(487,171)	(103,393)
e. Refunds	15,231	(184,232)	(169,001)
f. Total	\$ 14,468,786	\$ (4,977,085)	\$ 9,491,701
2. Deferred Retirements with Applicable Future Augmentation	636,756	0	636,756
3. Former Members Without Vested Rights	90,338	0	90,338
4. Benefit Recipients	18,424,228	0	18,424,228
5. Total Actuarial Accrued Liability	\$ 33,620,108	\$ (4,977,085)	\$ 28,643,023
6. Actuarial Value of Assets			\$ 22,022,842
7. Unfunded Actuarial Accrued Liability (UAAL)			\$ 6,620,181

* On a market value of assets basis, the unfunded actuarial accrued liability is \$6,285,453.



SECTION III - PLAN LIABILITIES

TABLE 6

CHANGES IN UNFUNDED ACTUARIAL ACCRUED LIABILITY (UAAL)
(Dollars in Thousands)

A. Unfunded actuarial accrued liability at beginning of year	\$	6,364,913
B. Changes due to interest requirements and current rate of funding*		
1. Normal cost and actual administrative expenses	\$	458,013
2. Contributions		(790,802)
3. Interest on A., B.1., and B.2. at 8.5%		527,162
4. Total (B.1. + B.2. + B.3.)	\$	194,373
C. Expected unfunded actuarial accrued liability at end of year (A. + B.4.)	\$	6,559,286
D. Increase (decrease) due to actuarial losses (gains) because of experience deviations from expected		
1. Salary increases	\$	(150,903)
2. Investment return (actuarial assets)		(254,145)
3. Mortality of active members		(810)
4. Mortality of benefit recipients		(11,710)
5. Retirement from active service		67,530
6. Other items		14,243
7. Total	\$	(335,795)
E. Unfunded actuarial accrued liability at end of year before plan amendments and changes in actuarial assumptions (C. + D.7.)	\$	6,223,491
F. Change in unfunded actuarial accrued liability due to new provisions	\$	(2,857,204)
G. Change in unfunded actuarial accrued liability due to change in assumptions	\$	3,253,894
H. Unfunded actuarial accrued liability at end of year (E. + F. + G.)	\$	6,620,181

* 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

SECTION IV SYSTEM CONTRIBUTIONS



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, 2048). Contributions to fund the UAAL are determined as a level percentage of payroll assuming payroll increases 3.00% each year.



SECTION IV - CONTRIBUTIONS

TABLE 7

NORMAL COST AT JULY 1, 2018
(Dollars in Thousands)

	<u>Percent of Pay</u>	<u>Dollar Amount</u>
1. Normal Cost Rate		
a. Retirement benefits	7.66%	\$ 396,274
b. Disability benefits	0.23%	11,899
c. Survivor benefits	0.08%	4,139
d. Deferred retirement benefits*	0.85%	43,972
e. Refunds	0.34%	17,589
f. Total	<u>9.16%</u>	<u>\$ 473,873</u>

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



SECTION IV - CONTRIBUTIONS

TABLE 8

DETERMINATION OF SUPPLEMENTAL CONTRIBUTION RATE
(Dollars in Thousands)

	<u>Amount</u>
A. Determination of Unfunded Actuarial Accrued Liability (UAAL)*	
1. Actuarial accrued liability	\$ 28,643,023
2. Actuarial value of assets	<u>22,022,842</u>
3. Unfunded actuarial accrued liability	\$ 6,620,181
B. Determination of Supplemental Contribution Rate*	
1. Present value of future payrolls through the amortization date of June 30, 2048	\$ 85,924,015
2. Supplemental contribution rate (A.3. / B.1.)**	7.70%

* On a market value of assets basis, the unfunded actuarial accrued liability is \$6,285,453 and the supplemental contribution rate is 7.32% of payroll.

** The amortization factor as of July 1, 2018 is 16.6097.



SECTION IV - CONTRIBUTIONS

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.

	<u>Percent of Payroll</u>	<u>Dollar Amount</u>
A. Statutory contributions - Chapter 354		
1. Employee contributions	7.50%	\$ 387,991
2. Employer contributions*	7.91%	409,208
3. Supplemental contributions**		
a. 1993 Legislation	0.10%	5,000
b. 1996 Legislation	0.06%	3,256
c. 1997 Legislation	0.25%	12,954
d. 2014 Legislation	0.28%	14,377
4. Total	16.10%	\$ 832,786
B. Required contributions - Chapter 356		
1. Normal cost		
a. Retirement benefits	7.66%	\$ 396,274
b. Disability benefits	0.23%	11,899
c. Survivor benefits	0.08%	4,139
d. Deferred retirement benefits	0.85%	43,972
e. Refunds	0.34%	17,589
f. Total	9.16%	\$ 473,873
2. Supplemental contribution for the amortization of the Unfunded Actuarial Accrued Liability by June 30, 2048	7.70%	398,330
3. Allowance for expenses	0.32%	\$ 16,554
4. Total annual contribution for fiscal year ending June 30, 2019***	17.18%	\$ 888,757
C. Contribution Sufficiency / (Deficiency) (A.4. - B.4.)***	(1.08%)	\$ (55,971)

Note: Projected annual payroll for fiscal year beginning on the valuation date: \$5,173,114

* Employer contribution rate is blended to reflect rates of 15.35% of pay for Basic members, 7.71% of pay for Coordinated members not employed by Special School District #1, and 11.35% 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 16.80% of payroll and the contribution deficiency is 0.70% of payroll.



SECTION IV - CONTRIBUTIONS

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%	\$ 21
2. Employer contributions*	15.35%	29
3. Supplemental contributions**		
a. 1993 Legislation	0.10%	0
b. 1996 Legislation	0.06%	0
c. 1997 Legislation	0.25%	0
d. 2014 Legislation	0.28%	1
4. Total	27.04%	\$ 51
B. Required contributions - Chapter 356		
1. Normal cost		
a. Retirement benefits	14.82%	\$ 28
b. Disability benefits	0.76%	1
c. Survivor benefits	0.35%	1
d. Deferred retirement benefits	0.95%	2
e. Refunds	0.35%	1
f. Total	17.23%	\$ 33

Note: Projected annual payroll for fiscal year beginning on the valuation date: \$187 for 2 members.

* Both Basic active members are teachers employed by Special School District #1; employer contribution rate of 15.35% of payroll applies.

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



SECTION IV - 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%	\$ 387,970
2. Employer contributions*	7.91%	409,179
3. Supplemental contributions**		
a. 1993 Legislation	0.10%	5,000
b. 1996 Legislation	0.06%	3,256
c. 1997 Legislation	0.25%	12,954
d. 2014 Legislation	0.28%	14,376
4. Total	16.10%	\$ 832,735
B. Required contributions - Chapter 356		
1. Normal cost		
a. Retirement benefits	7.66%	\$ 396,246
b. Disability benefits	0.23%	11,898
c. Survivor benefits	0.08%	4,138
d. Deferred retirement benefits	0.85%	43,970
e. Refunds	0.34%	17,588
f. Total	9.16%	\$ 473,840

Note: Projected annual payroll for fiscal year beginning on the valuation date: \$5,172,928

* Employer contribution rate is blended to reflect rates of 7.71% of pay for Coordinated members not employed by Special School District #1, and 11.35% 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 \$4,832,917, which includes \$4,565,193 for Coordinated members who are not employed by Special School District #1 and \$267,724 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 – RISK ASSESSMENT

SECTION V RISK ASSESSMENT



SECTION V – RISK ASSESSMENT

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SECTION V – RISK ASSESSMENT

OVERVIEW

Actuarial Standards of Practice (ASOP) No. 51, issued by the Actuarial Standards Board, provides guidance on assessing and disclosing risks related to pension plan funding. This guidance is binding on all credentialed actuaries practicing in the United States. While this standard will be first effective for the July 1, 2019 valuation, we have included some analysis in this valuation to introduce these new concepts to the Board and to provide information that can be useful to the Board and others in their oversight of TRA.

The term “risk” frequently has a negative connotation, but from an actuarial perspective, it may be thought of as simply the fact that what actually happens in the real world will not always match what was expected, based on actuarial assumptions. Of course, when actual experience is better than expected, the favorable risk is easily absorbed. The risk of unfavorable experience will likely be unpleasant, and so there is an understandable focus on the aspects of risk that are negative.

Risk usually can be reduced or eliminated at some cost. Consumers, for example, buy auto and home insurance to reduce the risk of accidents or catastrophes. Another way to express this concept, however, is that there is generally some reward for assuming risk. Thus, retirement plans invest not just in US Treasury bonds which have almost no risk, but also in equities which are considerably riskier – because they have an expected reward of a higher return that justifies the risk.

Under ASOP 51, the actuary is called on to identify the significant risks to the pension plan and provide information to help those sponsoring and administering the plan understand the implications of these risks. In this section, we identify some of the key risks for TRA and provide information to help interested parties better understand these risks.



SECTION V – RISK ASSESSMENT

INVESTMENT RISK

The investment return on assets is the most obvious risk – and usually the largest risk – to funding a pension plan. To illustrate the magnitude of this risk, please review the following chart showing the Asset Volatility Ratio (AVR), defined as the market value of assets divided by covered payroll (dollar in thousands).

<u>Valuation</u>	<u>Market Value of Assets</u>	<u>Covered Payroll</u>	<u>Asset Volatility Ratio</u>
2000	17,749,580	2,704,575	6.56
2001	15,902,336	2,812,000	5.66
2002	13,997,762	2,873,771	4.87
2003	13,061,606	2,952,887	4.42
2004	15,095,804	3,032,483	4.98
2005	15,928,604	3,121,571	5.10
2006	17,764,526	3,430,645	5.18
2007	19,938,882	3,532,159	5.64
2008	18,106,966	3,645,230	4.97
2009	13,833,826	3,761,484	3.68
2010	14,939,540	3,787,757	3.94
2011	17,303,576	3,838,111	4.51
2012	16,689,941	3,871,809	4.31
2013	18,019,319	3,917,310	4.60
2014	20,293,684	4,056,482	5.00
2015	20,446,091	4,261,626	4.80
2016	19,424,431	4,515,699	4.30
2017	21,258,090	4,688,875	4.53
2018	22,357,570	4,832,917	4.63

The asset volatility ratio is especially useful to compare across plans or through time. It is also frequently useful to consider how the AVR translates into changes in the Required Contribution Rate (actuarial contribution rate). For example, the following table demonstrates that with an AVR of 4.00, if the market value return is 10% below assumed, or -2.50% for TRA, there will be an increase in the Required Contribution Rate of 0.46% in the first year. Without asset smoothing or without returns above the expected return in the next four years, the impact on the Required Contribution Rate would be 2.32%. A higher AVR would produce more volatility in the Required Contribution Rate.

Impact of Return 10% Below Expected (Percent of Payroll)			
AVR	Asset Value	Unsmoothed Amortization	Smoothed Amortization
4.0	40%	2.32%	0.46%
5.0	50%	2.90%	0.58%
6.0	60%	3.48%	0.70%



SECTION V – RISK ASSESSMENT

SENSITIVITY MEASURES

Valuations are generally performed with a single set of assumptions that reflects the best estimate of future conditions, in the opinion of the actuary and typically the governing board. Note that under actuarial standards of practice, the set of economic assumptions used for funding must be consistent. To enhance the understanding of the importance of an assumption, a sensitivity test can be performed where the valuation results are recalculated using a different assumption or set of assumptions. The Minnesota Legislative Commission on Pensions and Retirement requires that TRA (along with other Minnesota retirement systems) disclose the sensitivity of valuation results relative to the investment return assumption.

The following table contains the key measures for TRA under the valuation assumption for investment return of 7.5%, along with the results if the assumption were 6.5% or 8.5%. In this analysis, only the investment return assumption is changed. Consequently, there may be inconsistencies between the investment return and other economic assumptions such as inflation or payroll increases. In addition, simply because the valuation results under alternative assumptions are shown here, it should not be implied that Cavanaugh Macdonald Consulting believes that either assumption (6.5% or 8.5%) would comply with actuarial standards of practice.

	Investment Return Assumption		
	6.50%	7.50%	8.50%
Normal Cost Rate	11.84%	9.16%	7.20%
Amortization of UAAL	12.00%	7.70%	4.16%
Expenses	0.32%	0.32%	0.32%
Total Required Contribution	24.16%	17.18%	11.68%
Contribution Sufficiency/(Deficiency)	(8.06%)	(1.08%)	4.42%
Actuarial Accrued Liability Funding Ratio	68.12%	76.89%	86.02%
Actuarial Accrued Liability (\$B)	\$32.3	\$28.6	\$25.6
Unfunded Actuarial Accrued Liability (\$B)	\$10.3	\$6.6	\$3.6

MORTALITY RISK

The mortality assumption is a significant assumption for valuation results, second only to the investment assumption in most situations. The TRA mortality assumption utilizes a mortality table (with separate rates for males and females, as well as different rates by status) and a projection scale for how the mortality table is expected to improve through time. This approach is the current state of the art in retirement actuarial practice, made possible by the increase in computational power over the past 20 years.

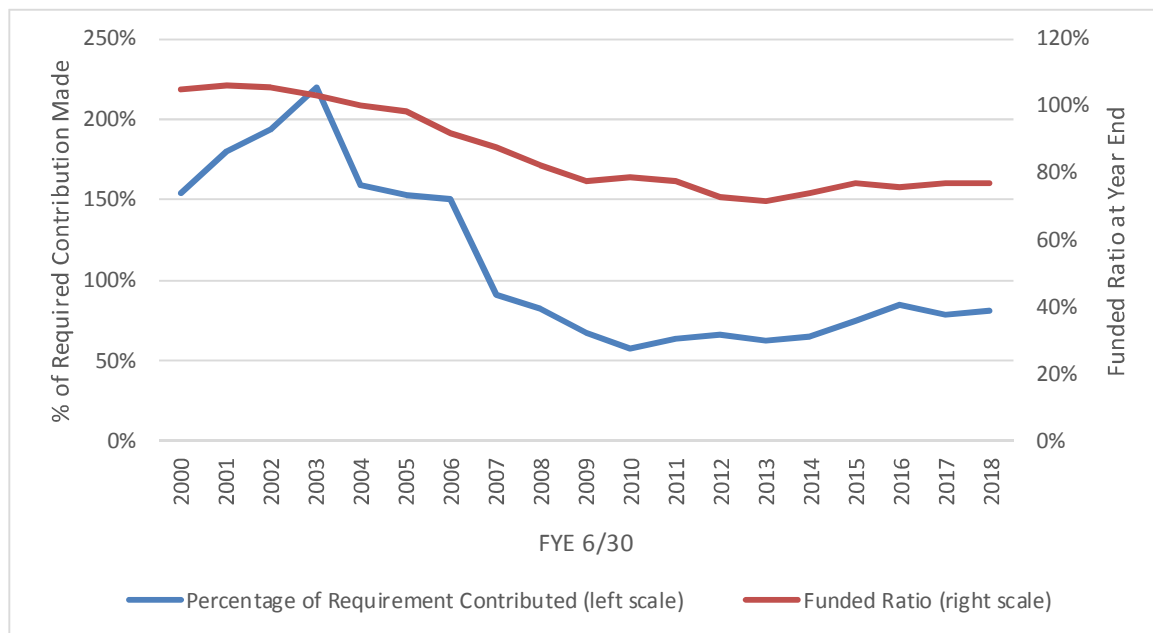
The future, however, is not known, and actual mortality improvements may occur at a faster rate than expected, or at a slower rate than expected (or even decline). Although changes in mortality will affect the benefits paid, this assumption is carefully studied during the regular experience studies that TRA conducts so that incremental changes can be made to smoothly reflect unfolding experience.

SECTION V – RISK ASSESSMENT

CONTRIBUTION RISK

TRA is primarily funded by member and employer contributions to the trust fund, together with the earnings on those accumulated contributions. The contribution rates are set by state statute and intended to provide the needed amounts to fund the system over time. Each year in the valuation, the Required Contribution Rate is determined, based on TRA's funding policy (also in statute). This rate is the sum of the rates for the normal cost for the plan, the amortization of the UAAL, and the administrative expenses. The difference between this Required Contribution Rate and the Statutory Contribution Rate is determined, resulting in a contribution sufficiency (the Statutory Rate exceeds the Required Contribution Rate) or a deficiency (the Statutory Rate is smaller).

A key risk factor to TRA's funding is that over time, the Statutory Contribution Rate will be insufficient to accumulate enough funds, with investment income, to fund the promised benefits. The following graph shows two lines: the blue line shows the proportion of the Required Contribution Rate actually made each year for the past 19 years. As can be seen by looking at the scale on the left, through 2007 the Statutory Rate was at least 100% of the Required Contribution Rate, and so more than 100% of the Required Contribution Rate was contributed. Since 2007, the ratio has been significantly less than 100%, indicating the Statutory Rate has been less than the Required Contribution Rate. Also on the graph (with the scale on the right axis) is the funded ratio of the System. While there have been certain events (large financial market drops, the merger of the Minneapolis and Duluth systems into TRA, etc.) that have had an effect on the funded ratio, there is also a noteworthy decline in the funded ratio during the period the Statutory Contribution Rate has been less than the Required Contribution Rate.

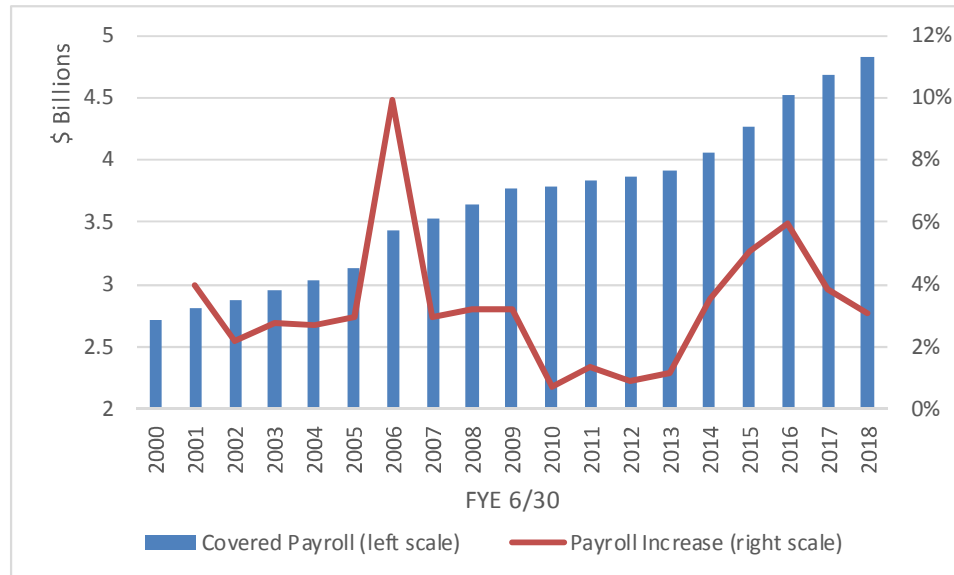


The presence of this risk does not mean that there is an insurmountable problem. For example, benefit and contribution adjustments were made by both the 2010 and the 2018 Legislatures as a way to bring the System's funding into long-term balance and improve its sustainability. The challenge for TRA is that adjustments to address long-term funding require legislative action and the time period to enact such change is outside the control of the Board.

SECTION V – RISK ASSESSMENT

COVERED PAYROLL RISK

The Required Contribution Rate for TRA is calculated under the assumption that total covered payroll will increase over time at a certain rate (currently 3.0% per year). We know that this assumption will not be met exactly every year, because there are many factors that affect the actual pay increases granted by each employer and there are many different employers in TRA. The following graph shows payroll growth since 2000.



Visually, it is clear that there are years when covered payroll has increased significantly and years when there is little to no change. Sometimes this is a function of external events such as the merger of another school district into TRA (leading to large increases), or a nationwide financial crisis (leading to small increases).

The volatility of covered payroll increases affects the plan's funding in multiple ways. First, lower increases in covered payroll mean that less contribution dollars will be collected, which works against the financial health of the plan. At the same time, if lower covered payroll is the result of lower individual pay increases for active members (rather than a decrease in active membership) this results in an actuarial gain on liabilities since the expected future benefits are lower. The trade-off between these two factors is complex, and so it is not always clear if lower than expected covered payroll helps or hurts the plan's funding. What is important to understand, however, is that actual versus expected covered payroll growth is a source of risk to funding the plan. If actuarial assumptions accurately reflect the average increases over time, then the net consequences should be manageable.



SECTION V – RISK ASSESSMENT

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SECTION VI – ADDITIONAL INFORMATION

SECTION VI ADDITIONAL INFORMATION



SECTION VI – ADDITIONAL INFORMATION

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SECTION VI – 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.



SECTION VI – ADDITIONAL INFORMATION

TABLE 12
SUMMARY OF MEMBERSHIP DATA

	<u>July 1, 2018</u>	<u>July 1, 2017</u>
Active members:		
Vested	65,694	64,890
Non-vested	<u>16,801</u>	<u>16,921</u>
Total	82,495	81,811
Pensioners and Beneficiaries	66,104	64,774
Terminated vested members entitled to, but not yet receiving, benefits:	14,936	14,030
Other terminated, non-vested members entitled to a refund of contributions	<u>34,375</u>	<u>33,344</u>
Total	197,910	193,959



SECTION VI – ADDITIONAL INFORMATION

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%
07/01/18	22,022,842	28,643,023	6,620,181	76.89%	4,832,917	136.98%



SECTION VI – ADDITIONAL INFORMATION

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%	4,832,917	374,550	516,157	414,315	80.27%
2019 ¹⁷	17.18%					

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%.
- ¹⁷ Actuarially Required Contribution Rate prior to change in Actuarial Assumptions and Plan Provisions is 18.25%.



SECTION VI – ADDITIONAL INFORMATION

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, 2018. The “Retirees” column shows benefits expected to be paid to all other members. This includes those who, as of July 1, 2018, are receiving benefit payments or who terminated employment and are entitled to a deferred benefit.

Year Ending			
June 30	Actives	Retirees	Total
2019	\$ 67,807	\$ 1,847,173	\$ 1,914,980
2020	120,397	1,810,355	1,930,752
2021	171,403	1,780,096	1,951,499
2022	223,220	1,749,384	1,972,604
2023	274,748	1,719,857	1,994,605
2024	324,979	1,689,551	2,014,530
2025	374,850	1,660,469	2,035,319
2026	426,503	1,631,729	2,058,232
2027	481,685	1,603,054	2,084,739
2028	541,946	1,574,784	2,116,730
2029	608,618	1,546,016	2,154,634
2030	682,383	1,514,415	2,196,798
2031	764,692	1,480,666	2,245,358
2032	855,821	1,443,885	2,299,706
2033	956,031	1,404,525	2,360,556
2034	1,063,972	1,362,901	2,426,873
2035	1,178,849	1,319,798	2,498,647
2036	1,300,195	1,273,798	2,573,993
2037	1,427,973	1,225,755	2,653,728
2038	1,560,356	1,174,945	2,735,301
2039	1,696,930	1,121,187	2,818,117
2040	1,838,579	1,065,739	2,904,318
2041	1,985,140	1,008,363	2,993,503
2042	2,135,637	949,426	3,085,063
2043	2,289,062	889,237	3,178,299

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



SECTION VI – ADDITIONAL INFORMATION

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APPENDIX A

**SUMMARY STATISTICS
ON MEMBERSHIP DATA**



APPENDIX A – MEMBERSHIP DATA

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APPENDIX A – MEMBERSHIP DATA

TABLE 16

RECONCILIATION OF MEMBERS*

	Active Members**	Former Members***	Benefit Recipients****			Total
			Service Retirements	Disability Retirements	Survivors	
Members on 6/30/2017	81,811	47,374	58,989	517	5,268	193,959
New hires	5,490	-	-	-	-	5,490
Transfer from active to inactive	(4,519)	4,519	-	-	-	0
Transfer from inactive to active	1,530	(1,530)	-	-	-	0
Return from zero balance	420	14	-	-	-	434
Return from disability	7	2	-	-	-	9
Refunded	(221)	(596)	-	-	-	(817)
Refunded (non-repayable)	(7)	(35)	-	-	-	(42)
Retirements	(1,967)	(486)	2,460	(47)	-	(40)
Benefits began	-	-	-	52	497	549
Benefits ended	-	-	-	(4)	(56)	(60)
Deaths	(31)	(72)	(1,322)	(16)	(232)	(1,673)
Adjustments	(18)	121	1	(2)	(1)	101
Net changes	684	1,937	1,139	(17)	208	3,951
Members on 6/30/2018	82,495	49,311	60,128	500	5,476	197,910

* 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 2 Basic and 82,493 Coordinated members.

*** Former members include 13 Basic and 49,298 Coordinated members.

**** Benefit recipients include 3,615 Basic members and 62,489 Coordinated members.

Former Member Statistics

	Vested	Non-vested	Total
Number	14,936	34,375	49,311
Average Age	48.5	46.5	47.1
Average Service (years)	7.6	0.8	2.9
Average annual benefits, with applicable future augmentation and Combined Service Annuity load	\$8,035	N/A	N/A
Average refund value, with Combined Service Annuity load	\$34,818	\$2,628	\$12,378



APPENDIX A – MEMBERSHIP DATA

TABLE 17
DISTRIBUTION OF ACTIVE MEMBERS*

Age	Years of Service as of July 1, 2018										Total
	<3**	3-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40 +	
<25	2,590	73									2,663
Avg. Earnings	29,801	44,668									30,209
25-29	4,227	3,264	1,886								9,377
Avg. Earnings	34,013	46,228	51,492								41,780
30-34	2,262	1,816	5,192	1,324							10,594
Avg. Earnings	33,751	47,356	55,050	64,598							50,377
35-39	1,947	1,124	2,746	4,901	1,255						11,973
Avg. Earnings	30,330	50,037	56,532	68,029	76,622						58,473
40-44	1,517	816	1,648	2,226	4,353	1,061					11,621
Avg. Earnings	26,918	48,602	55,579	67,396	77,459	82,082					64,227
45-49	1,321	590	1,376	1,496	2,370	3,908	819				11,880
Avg. Earnings	25,519	47,666	55,494	65,489	74,711	81,261	85,840				67,433
50-54	961	428	938	1,070	1,370	2,082	2,745	569			10,163
Avg. Earnings	24,514	44,682	53,218	64,068	73,349	79,283	84,041	84,849			69,436
55-59	752	306	712	852	1,149	1,180	1,576	1,675	169		8,371
Avg. Earnings	20,171	40,808	49,019	61,740	71,691	76,269	82,030	83,696	83,253		68,220
60-64	569	198	393	455	569	695	645	350	301	68	4,243
Avg. Earnings	14,446	35,961	43,469	58,146	69,548	76,528	78,209	86,119	84,276	86,850	62,102
65-69	424	79	107	110	137	105	95	47	30	54	1,188
Avg. Earnings	7,713	26,463	31,504	60,361	64,630	74,133	78,233	89,726	92,060	91,644	43,240
70 +	231	31	53	21	16	13	16	9	6	26	422
Avg. Earnings	5,295	18,827	18,077	50,397	69,611	81,689	72,067	94,663	95,983	95,260	26,201
Total	16,801	8,725	15,051	12,455	11,219	9,044	5,896	2,650	506	148	82,495
Avg. Earnings	28,709	46,484	53,974	66,017	75,123	79,805	82,989	84,408	84,535	90,076	58,866

* Active members include 2 Basic and 82,493 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, 2018 as reported by the Teachers Retirement Association of Minnesota.



APPENDIX A – MEMBERSHIP DATA

TABLE 18
DISTRIBUTION OF SERVICE RETIREMENTS
(TOTAL)

Age	Years Since Retirement as of July 1, 2018							Total
	<1	1-4	5-9	10-14	15-19	20-24	25 +	
<55	1	2						3
Avg. Benefit	45,106	31,968						36,347
55-59	590	907	3					1,500
Avg. Benefit	39,564	31,331	37,369					34,581
60-64	844	3,894	1,987	15				6,740
Avg. Benefit	32,342	33,157	28,940	36,809				31,820
65-69	581	4,355	6,192	3,624	108		1*	14,861
Avg. Benefit	23,941	23,656	26,919	25,407	38,351		1,691	25,559
70-74	58	804	3,637	5,184	4,621	139	6*	14,449
Avg. Benefit	21,676	19,848	22,672	25,936	24,981	42,287	10,065	24,604
75-79	7	86	529	1,963	4,904	2,634	86	10,209
Avg. Benefit	24,693	20,246	19,066	22,513	26,738	29,151	31,159	26,132
80-84	1	12	71	220	1,403	3,026	1,759	6,492
Avg. Benefit	18,685	18,138	16,079	17,130	26,017	34,694	36,706	32,532
85-89		4	10	33	110	1,023	2,645	3,825
Avg. Benefit		9,996	13,638	11,112	28,301	35,089	37,021	35,941
90 +			4	8	19	87	1,931	2,049
Avg. Benefit			66,050	14,463	12,447	35,096	35,645	35,383
Total	2,082	10,064	12,433	11,047	11,165	6,909	6,428	60,128
Avg. Benefit	31,721	27,680	25,608	24,941	26,024	32,797	36,413	28,102

* 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.



APPENDIX A – MEMBERSHIP DATA

TABLE 18A
DISTRIBUTION OF SERVICE RETIREMENTS
(BASIC)

Distribution of Service Retirements

Age	Years Since Retirement as of July 1, 2018							Total
	<1	1-4	5-9	10-14	15-19	20-24	25 +	
<55								
Avg. Benefit								
55-59								
Avg. Benefit								
60-64	1	2	5	3				11
Avg. Benefit	57,557	89,219	60,443	63,668				66,292
65-69		10	30	52	36			128
Avg. Benefit		28,597	37,986	57,421	55,280			50,012
70-74		7	46	76	212	64		405
Avg. Benefit		29,838	34,466	44,627	58,606	49,940		51,375
75-79		1	7	34	124	146	31	343
Avg. Benefit		103,762	48,397	51,785	52,644	60,767	48,857	55,736
80-84		1	2	12	60	180	394	649
Avg. Benefit		78,098	12,872	55,217	49,046	66,514	73,708	68,910
85-89				5	18	102	632	757
Avg. Benefit				30,018	57,194	49,082	64,134	61,716
90 +				2	2	16	565	585
Avg. Benefit				45,881	5,579	50,784	53,387	53,126
Total	1	21	90	184	452	508	1,622	2,878
Avg. Benefit	57,557	40,720	37,686	50,183	55,146	58,779	62,424	58,921

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.



APPENDIX A – MEMBERSHIP DATA

TABLE 18B
DISTRIBUTION OF SERVICE RETIREMENTS
(COORDINATED)

Distribution of Service Retirements

Age	Years Since Retirement as of July 1, 2018							Total
	<1	1-4	5-9	10-14	15-19	20-24	25 +	
<55	1	2						3
Avg. Benefit	45,106	31,968						36,347
55-59	590	907	3					1,500
Avg. Benefit	39,564	31,331	37,369					34,581
60-64	843	3,892	1,982	12				6,729
Avg. Benefit	32,312	33,129	28,860	30,095				31,764
65-69	581	4,345	6,162	3,572	72		1*	14,733
Avg. Benefit	23,941	23,644	26,865	24,941	29,886		1,691	25,346
70-74	58	797	3,591	5,108	4,409	75	6*	14,044
Avg. Benefit	21,676	19,761	22,521	25,657	23,364	35,757	10,065	23,832
75-79	7	85	522	1,929	4,780	2,488	55	9,866
Avg. Benefit	24,693	19,263	18,673	21,997	26,066	27,296	21,184	25,103
80-84	1	11	69	208	1,343	2,846	1,365	5,843
Avg. Benefit	18,685	12,687	16,172	14,933	24,988	32,681	26,026	28,491
85-89		4	10	28	92	921	2,013	3,068
Avg. Benefit		9,996	13,638	7,736	22,648	33,540	28,509	29,581
90 +			4	6	17	71	1,366	1,464
Avg. Benefit			66,050	3,990	13,255	31,561	28,307	28,293
Total	2,081	10,043	12,343	10,863	10,713	6,401	4,806	57,250
Avg. Benefit	31,709	27,653	25,520	24,513	24,795	30,735	27,634	26,553

* 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.



APPENDIX A – MEMBERSHIP DATA

TABLE 19

DISTRIBUTION OF SURVIVORS (TOTAL)

Age	Years Since Death as of July 1, 2018							Total
	<1	1-4	5-9	10-14	15-19	20-24	25 +	
<45	11	49	37	13	4	4		118
Avg. Benefit	20,057	18,635	15,405	14,952	7,087	17,582		16,922
45-49	7	30	22	11	5	1		76
Avg. Benefit	13,819	13,279	18,280	13,032	13,608	33,820		15,032
50-54	5	35	26	12	4	3	2	87
Avg. Benefit	20,768	13,159	14,186	16,313	12,570	39,159	25,355	15,488
55-59	16	52	34	16	6	5	2	131
Avg. Benefit	26,852	20,039	16,113	13,644	27,266	13,719	32,033	19,344
60-64	20	95	64	30	21	4	3	237
Avg. Benefit	23,247	19,156	18,924	14,937	19,151	17,184	8,271	18,733
65-69	41	179	134	71	32	11	7	475
Avg. Benefit	24,529	22,676	21,781	20,854	18,130	15,650	16,737	21,755
70-74	69	289	229	130	69	32	12	830
Avg. Benefit	22,730	23,933	22,939	22,511	19,862	22,021	15,862	22,807
75-79	77	307	259	172	102	46	53	1,016
Avg. Benefit	24,194	25,943	27,624	28,148	25,444	26,327	24,000	26,478
80-84	73	315	241	161	110	71	71	1,042
Avg. Benefit	34,936	31,355	33,092	35,144	32,944	35,273	29,859	32,926
85-89	49	230	217	142	108	68	97	911
Avg. Benefit	29,308	36,946	37,803	34,250	36,109	40,163	30,120	35,733
90 +	21	113	133	111	56	48	71	553
Avg. Benefit	34,321	41,727	36,762	41,759	32,267	38,624	39,540	38,750
Total	389	1,694	1,396	869	517	293	318	5,476
Avg. Benefit	26,889	27,546	28,291	29,465	28,218	32,547	30,088	28,473

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.



APPENDIX A – MEMBERSHIP DATA

TABLE 19A

DISTRIBUTION OF SURVIVORS (BASIC)

Distribution of Survivors

Age	Years Since Death as of July 1, 2018							Total
	<1	1-4	5-9	10-14	15-19	20-24	25 +	
<45			3	1		1		5
Avg. Benefit			24,094	5,833		1,160		15,855
45-49					1			1
Avg. Benefit					18,972			18,972
50-54				1	1	1	2	5
Avg. Benefit			25,521	3,300	62,725	25,355		28,451
55-59							2	2
Avg. Benefit							32,033	32,033
60-64		1	1		4	2		8
Avg. Benefit		37,078	2,571		33,994	25,341		28,288
65-69	1	4	1	3	1	1	1	12
Avg. Benefit	74,655	26,418	27,269	31,052	48,573	8,287	8,167	30,482
70-74	3	10	6	4	2	1		26
Avg. Benefit	38,965	49,822	50,031	33,946	10,632	87,103		44,594
75-79	6	16	20	12	7	2	9	72
Avg. Benefit	38,141	57,006	60,475	48,437	53,161	78,261	43,008	53,436
80-84	10	45	29	33	18	11	23	169
Avg. Benefit	83,739	55,042	61,723	56,367	65,087	62,651	45,935	58,471
85-89	9	67	54	39	33	27	31	260
Avg. Benefit	49,774	54,827	51,499	54,106	52,668	57,206	42,977	52,413
90 +	5	41	31	38	16	19	27	177
Avg. Benefit	56,355	51,602	62,044	57,609	45,827	51,863	50,613	54,210
Total	34	184	145	131	83	65	95	737
Avg. Benefit	58,457	53,364	55,904	53,442	51,121	55,163	44,898	52,928

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.



APPENDIX A – MEMBERSHIP DATA

TABLE 19B

DISTRIBUTION OF SURVIVORS (COORDINATED)

Distribution of Survivors

Age	Years Since Death as of July 1, 2018							Total
	<1	1-4	5-9	10-14	15-19	20-24	25 +	
<45	11	49	34	12	4	3		113
Avg. Benefit	20,057	18,635	14,638	15,712	7,087	23,055		16,969
45-49	7	30	22	11	4	1		75
Avg. Benefit	13,819	13,279	18,280	13,032	12,266	33,820		14,980
50-54	5	35	26	11	3	2		82
Avg. Benefit	20,768	13,159	14,186	15,476	15,659	27,376		14,697
55-59	16	52	34	16	6	5		129
Avg. Benefit	26,852	20,039	16,113	13,644	27,266	13,719		19,147
60-64	20	94	63	30	17	2	3	229
Avg. Benefit	23,247	18,965	19,184	14,937	15,659	9,028	8,271	18,399
65-69	40	175	133	68	31	10	6	463
Avg. Benefit	23,276	22,590	21,739	20,405	17,148	16,387	18,165	21,528
70-74	66	279	223	126	67	31	12	804
Avg. Benefit	21,992	23,005	22,210	22,147	20,137	19,921	15,862	22,103
75-79	71	291	239	160	95	44	44	944
Avg. Benefit	23,015	24,235	24,875	26,627	23,402	23,966	20,111	24,422
80-84	63	270	212	128	92	60	48	873
Avg. Benefit	27,189	27,407	29,176	29,673	26,655	30,254	22,156	27,981
85-89	40	163	163	103	75	41	66	651
Avg. Benefit	24,703	29,597	33,266	26,732	28,823	28,939	24,081	29,072
90 +	16	72	102	73	40	29	44	376
Avg. Benefit	27,435	36,104	29,078	33,509	26,843	29,951	32,745	31,472
Total	355	1,510	1,251	738	434	228	223	4,739
Avg. Benefit	23,866	24,400	25,090	25,209	23,838	26,099	23,779	24,669

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.



APPENDIX A – MEMBERSHIP DATA

TABLE 20

DISTRIBUTION OF DISABILITY RETIREMENTS

Age	Years Disabled as of July 1, 2018							Total
	<1	1-4	5-9	10-14	15-19	20-24	25 +	
<45	1	11	6					18
Avg. Benefit	29,164	13,173	7,561					12,191
45-49	4	21	7	7	1			40
Avg. Benefit	25,127	19,582	12,070	7,011	1,812			16,178
50-54	2	34	15	9	5	2		67
Avg. Benefit	27,156	25,565	12,939	8,876	8,007	4,381		18,602
55-59	3	57	38	16	7	3	1	125
Avg. Benefit	29,433	24,634	18,040	15,286	9,624	6,025	13,579	20,173
60-64	7	76	71	36	18	8	4	220
Avg. Benefit	15,581	29,086	26,735	19,471	14,350	17,986	10,169	24,371
65 +	1	22	4	2	1			30
Avg. Benefit	29,738	30,739	9,909	14,402	3,115			25,918
Total	18	221	141	70	32	13	5	500
Avg. Benefit	22,838	25,866	20,902	15,761	11,582	13,133	10,851	21,547

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.



APPENDIX A – MEMBERSHIP DATA

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APPENDIX B - SUMMARY OF PLAN PROVISIONS

APPENDIX B

SUMMARY OF PLAN PROVISIONS



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.

<i>Plan year</i>	July 1 through June 30		
<i>Eligibility</i>	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.		
<i>Contributions</i>	Shown as a percent of Salary:		
	<u>Member</u>	<u>Employer</u>	
	11.00%	15.35%	
	Employer rates will increase by 0.21% per year until they reach 16.39% beginning July 1, 2023. Member rates will increase to 11.25% effective July 1, 2023.		
	Employee contributions are "picked up" according to the provisions of Internal Revenue Code 414(h).		
<i>Teaching service</i>	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.		
<i>Salary</i>	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.		
<i>Average salary</i>	Average of the five highest successive years of Salary.		
<i>Retirement</i>			
<u>Normal retirement</u>			
<i>Age/Service requirements</i>	Age 60, or any age with 30 years of Teaching Service		
<i>Amount</i>	2.50% of Average Salary for each year of Teaching Service.		



APPENDIX B - SUMMARY OF PLAN PROVISIONS

BASIC MEMBERS

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 1.0 percent for January, 2019 through January, 2023. Beginning January 1, 2024, this amount will increase in 0.1% step increments until the COLA reaches 1.5%. 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.

Beginning July 1, 2024, eligibility for receipt of first COLA will be changed to Normal Retirement Age. Members who retire under rule of 90 or are least age 62 with 30 years of service are exempt from this delay in COLA.



APPENDIX B - SUMMARY OF PLAN PROVISIONS

BASIC MEMBERS

Disability

<i>Age/service requirement</i>	Total and permanent disability with three years of Teaching Service.
<i>Amount</i>	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.
<i>Form of payment</i>	Same as for retirement.
<i>Benefit increases</i>	Same as for retirement.

Death

Benefit A

<i>Age/Service requirements</i>	Choice of Benefit A, Benefit B or Benefit C Death before retirement.
<i>Amount</i>	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

<i>Age/Service requirements</i>	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.
<i>Amount</i>	The actuarial equivalent of any benefits the member could have received if resignation occurred on the date of death.

Benefit C

<i>Age/Service requirements</i>	As an active member who dies and leaves surviving children.
<i>Amount</i>	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).
<i>Benefit Increases</i>	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 3.00% 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;
- (c) 2.00% beginning July 1, 2012 until the earlier of June 30, 2019 and when the annuity begins; and
- (d) 0.00% beginning July 1, 2019.

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.

<i>Plan year</i>	July 1 through June 30				
<i>Eligibility</i>	<p>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.</p> <p>No MNSCU teacher will become a new Member unless that person elects coverage as defined by Minnesota Statutes under Chapter 354B.</p>				
<i>Contributions</i>	<p>Shown as a percent of Salary:</p> <table><tr><td><u>Member</u></td><td><u>Employer</u></td></tr><tr><td>7.50%</td><td>7.71%</td></tr></table> <p>Employer also contributes Supplemental amount equal to 3.64% of Salary (members employed by Special School District #1 only).</p> <p>Employer rates will increase by 0.21% per year until they reach 8.75% on July 1, 2023. Member rates will increase to 7.75% effective July 1, 2023.</p> <p>Employee contributions are "picked up" according to the provisions of Internal Revenue Code 414(h).</p>	<u>Member</u>	<u>Employer</u>	7.50%	7.71%
<u>Member</u>	<u>Employer</u>				
7.50%	7.71%				
<i>Teaching service</i>	<p>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.</p>				
<i>Salary</i>	<p>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.</p>				
<i>Average salary</i>	<p>Average of the five highest successive years of Salary. Average salary is based on all Allowable Service if less than five years.</p>				



APPENDIX B - SUMMARY OF PLAN PROVISIONS

COORDINATED MEMBERS

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.



APPENDIX B - SUMMARY OF PLAN PROVISIONS

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. Beginning July 1, 2019, the augmentation adjustment will be phased out.



APPENDIX B - SUMMARY OF PLAN PROVISIONS

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 with augmentation reflected. These are being phased in from the prior factors over a five-year period beginning July 1, 2015. Beginning July 1, 2019, the augmentation component will be phased out over five years, for member who are not at least age 62 with 30 years of service.

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.



APPENDIX B - SUMMARY OF PLAN PROVISIONS

COORDINATED MEMBERS

Retirement(continued)

Benefit increases

Under current law, the annual post-retirement increase on January 1 is 1.0 percent for January, 2019 through January, 2023. Beginning January 1, 2024, this amount will increase in 0.1% step increments until the COLA reaches 1.5%. 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.

Beginning July 1, 2024, eligibility for receipt of first COLA will be changed to Normal Retirement Age. Members who retire under rule of 90 or are least age 62 with 30 years of service are exempt from this delay in COLA.

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.



APPENDIX B - SUMMARY OF PLAN PROVISIONS

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 3.00% 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.



APPENDIX B - SUMMARY OF PLAN PROVISIONS

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;
- (c) 2.00% from July 1, 2012 forward until the earlier of June 30, 2019 and when the annuity begins; and
- (d) 0.00% from July 1, 2019 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, increased by 2.00% from July 1, 2012 to July 1, 2019 and no increase going forward until the annuity begins.



APPENDIX B - SUMMARY OF PLAN PROVISIONS

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APPENDIX C

**ACTUARIAL METHODS
AND ASSUMPTIONS**



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, 2048, assuming payroll increases of 3.00% per year (effective with the 2018 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 FY19:

<i>1993 Legislation:</i>	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 the amortization date of June 30, 2048 or full actuarial funding is achieved, whichever is earlier. Amount is fixed in statute.
<i>1996 Legislation:</i>	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, 2048 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.
<i>1997 Legislation:</i>	Supplemental contributions from the State in the amount of \$12,954,000 annually are assumed to be made until the amortization date of June 30, 2048 or full actuarial funding is achieved, whichever is earlier. Amount is fixed in statute.
<i>2014 Legislation:</i>	Supplemental contributions from the State in the amount of \$14,377,000 annually are assumed to be made until the amortization date of June 30, 2048 or full actuarial funding is achieved, whichever is earlier. 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 2018, the limit is \$220,000.

IRC Section 401(a)(17): The limitations of Internal Revenue Code Section 401(a)(17) 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 2018, the limit is \$275,000. 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 full experience study dated June 5, 2015 and the study of economic assumptions presented to the Board in November, 2017 and approved by the LCPR on February 19, 2018.

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.

<i>Investment Return</i>	7.50% compounded annually.
<i>Future post-retirement adjustments</i>	1.0% for January, 2019 through January, 2023, then increasing by 0.1% each year up to 1.5% annually.
<i>Salary Increases</i>	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.
<i>Payroll Growth</i>	3.00% per year
<i>Future Service</i>	Members are assumed to earn future service at a full-time rate.
<i>Mortality:</i> <i>Pre-retirement</i>	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.
<i>Post-retirement</i>	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.
<i>Post-disability</i>	RP 2014 disabled retiree mortality, without adjustment
<i>Disability</i>	Age-related rates based on experience; see table of sample rates.



APPENDIX C – ACTUARIAL METHODS AND ASSUMPTIONS

Summary of Actuarial Assumptions (*continued*)

<i>Withdrawal</i>	Rates vary by service based on actual plan experience, as shown in the rate table.				
<i>Expenses</i>	Prior year administrative expenses expressed as percentage of prior year payroll.				
<i>Retirement Age</i>	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.				
<i>Percentage Married</i>	85% of male members and 65% of female members are assumed to be married. Members are assumed to have no children.				
<i>Age Difference</i>	Females two years younger than males.				
<i>Allowance for Combined Service Annuity</i>	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.				
<i>Refund of Contributions</i>	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.				
<i>Interest on member contributions</i>	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.				
<i>Commencement of deferred benefits</i>	Members receiving deferred annuities (including current terminated deferred members) are assumed to begin receiving benefits at unreduced retirement age.				
<i>Form of payment</i>	<p>Members are assumed to elect subsidized joint and survivor form of annuity as follows:</p> <table><tr><td>Males:</td><td>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</td></tr><tr><td>Females:</td><td>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</td></tr></table> <p>Members eligible for deferred annuities (including current terminated deferred members) and future disability benefits are assumed to elect a life annuity.</p>	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
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				



APPENDIX C – ACTUARIAL METHODS AND ASSUMPTIONS

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, 1970
Average salary	\$40,000
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	0.50%	0.50%
30	0.50%	0.50%
Over 30	0.00%	0.00%



APPENDIX C – ACTUARIAL METHODS AND ASSUMPTIONS

Age	Rate (%)			
	Pre-retirement		Disability	
	Mortality*			
	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.

Age	Annuitant Mortality Rates (%)			
	Retirement *		Disability	
	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.



APPENDIX C – ACTUARIAL METHODS AND ASSUMPTIONS

Summary of Actuarial Assumptions *(continued)*

Service	Salary Scale	
	Select Salary Increase Before July 1, 2028	Ultimate Salary Increase After June 30, 2028
1	8.85%	9.25%
2	7.10%	7.50%
3	6.60%	7.00%
4	6.35%	6.75%
5	6.75%	6.75%
6	6.20%	6.60%
7	6.05%	6.45%
8	5.90%	6.30%
9	5.75%	6.15%
10	5.60%	6.00%
11	5.35%	5.75%
12	5.10%	5.50%
13	4.85%	5.25%
14	4.60%	5.00%
15	4.35%	4.75%
16	4.10%	4.50%
17	3.85%	4.25%
18	3.65%	4.05%
19	3.55%	3.95%
20	3.45%	3.85%
21	3.35%	3.75%
22	3.25%	3.65%
23	3.15%	3.55%
24	3.05%	3.45%
25	2.95%	3.35%
26 or more	2.85%	3.25%



APPENDIX C – ACTUARIAL METHODS AND ASSUMPTIONS

Retirement Rate (%)						
Age	Coordinated Members				Basic Members	
	Tier 1	Tier 1	Tier 2	Tier 2	Eligible for	Not Eligible for
	<u>Early</u>	<u>Unreduced</u>	<u>Early</u>	<u>Unreduced</u>	<u>30 and Out Provision</u>	<u>30 and Out Provision</u>
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 investment return assumption was reduced from 8.5% to 7.5%.
The price inflation assumption was reduced from 3.0% to 2.5%.
The payroll growth assumption was reduced from 3.5% to 3.0%.
The wage inflation assumption (above price inflation) was reduced from 0.75% to 0.35% for the next 10 years, and 0.75% thereafter.
The total salary increase assumption was adjusted by the wage inflation change.



APPENDIX C – ACTUARIAL METHODS AND ASSUMPTIONS

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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.