North Dakota Teachers' Fund for Retirement

Actuarial Valuation and Review as of July 1, 2019

Segal Consulting

This report has been prepared at the request of the Board of Trustees to assist in administering the Fund. The measurements shown in this actuarial valuation may not be applicable for other purposes.

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October 15, 2019

Board of Trustees
North Dakota Teachers' Fund for Retirement
3442 East Century Avenue
Bismarck, ND 58507-7100

Dear Trustees:

We certify that the information contained in this report is accurate and fairly presents the actuarial position of the North Dakota Teachers' Fund for Retirement (TFFR) as of July 1, 2019.

All calculations have been made in conformity with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board. In our opinion the results presented also comply with the State Code, and, where applicable, the Internal Revenue Code, ERISA, and the Statements of the Governmental Accounting Standards Board (GASB). The undersigned are independent actuaries. All are Fellows of the Society of Actuaries, Enrolled Actuaries, and Members of the American Academy of Actuaries, and are experienced in performing valuations for large public retirement systems. They meet the Qualification Standards of the American Academy of Actuaries.

ACTUARIAL VALUATION

The primary purposes of the valuation report are to determine the adequacy of the current employer contribution rate, to describe the current financial condition of TFFR, and to analyze changes in TFFR's financial condition. In addition, the report provides information required by TFFR in connection with the Governmental Accounting Standards Board Statement No. 67 (GASB 67) and it provides various summaries of the data. Valuations are prepared annually, as of July 1 of each year, the first day of TFFR's plan and fiscal year.

FINANCING OBJECTIVES

The member and employer contribution rates are established by statute. Member and employer rates are 11.75% and 12.75%, respectively. The 11.75% member contribution rate and 12.75% employer contribution rate will remain in effect until TFFR is 100% funded on an actuarial basis. At that point, the employer and member contribution rates will revert to 7.75%. The rates are intended to be sufficient to pay TFFR's normal cost and to amortize TFFR's unfunded actuarial accrued liability (UAAL) over a period of 24 years beginning July 1, 2019, although at any given time the statutory rates may be insufficient.

PROGRESS TOWARD REALIZATION OF FINANCING OBJECTIVES

In order to determine the adequacy of the 12.75% statutory employer contribution rate, it is compared to the actuarially determined contribution (ADC). The ADC is equal to the sum of (a) the employer normal cost rate and (b) the level percentage of pay required to amortize the UAAL over the 30-year closed period that began July 1, 2013 (24 years remaining as of July 1, 2019). For this calculation, payroll is assumed to increase 3.25% per year. As of July 1, 2019, the ADC is 12.84%, compared to 12.94% last year. This is greater than the 12.75% rate currently required by law. The decrease in ADC is driven by payroll and other demographic liability gains.

The funded ratio (the ratio of the actuarial value of assets to the actuarial accrued liability) increased from last year. The funded ratio at July 1, 2018, was 65.4%, while it is 66.0% as of July 1, 2019. Based on the market value of assets rather than the actuarial value of assets, the funded ratio remained the same at 65.5%, compared to 65.5% last year.

The Plan has a net investment loss of $19.4 million from previous years that has not yet been recognized in the actuarial value of assets because of the five-year smoothing. This unrecognized asset loss is due to market losses during FY 2016 and FY 2019 offset by market gains in FY 2017 and FY 2018. As these losses are recognized over the next four years, the losses will tend to reduce the funded ratio. Despite this factor, the projections shown in this report indicate that the funded ratio is projected to increase over this period, assuming the plan's market return on assets meets the 7.75% assumption in the future.

REPORTING CONSEQUENCES

TFFR is required to disclose certain actuarial information in its Comprehensive Annual Financial Report (CAFR), including the Net Pension Liability (NPL), the sensitivity of the NPL to changes in the discount rate, a schedule of changes in NPL, and a comparison of actual contributions to the ADC. The State and the school districts need to comply with GASB 68, which also requires disclosure of certain actuarial information in their financial statements. This information will be provided in a separate report.

BENEFIT PROVISIONS

The actuarial valuation reflects the benefit and contribution provisions set forth in the North Dakota Century Code. These have not changed from the prior valuation.

ASSUMPTIONS AND METHODS

Actuarial assumptions and methods are set by the Board of Trustees, based upon recommendations made by the Plan's actuary. On April 30, 2015, the Board adopted new assumptions, effective for the July 1, 2015 valuation. In our opinion, the actuarial assumptions as approved by the Board are reasonable, taking into account the experience of the Plan and reasonable long-term expectations, and represent our best estimate of the anticipated long-term experience of the Plan. The actuarial assumptions and methods used for funding purposes meet the parameters set by Actuarial Standards of Practice.

Effective with the July 1, 2013, actuarial valuation, the Trustees adopted an Actuarial Funding Policy, which provides direction on how to calculate an actuarially determined contribution. The actuarially determined contribution is compared to statutory contribution rates as a measure of funding adequacy.

The results of the actuarial valuation are dependent on the actuarial assumptions used. Actual results can and almost certainly will differ, as actual experience deviates from the assumptions. Even seemingly minor changes in the assumptions can materially change the liabilities, calculated contribution rates, and funding periods.

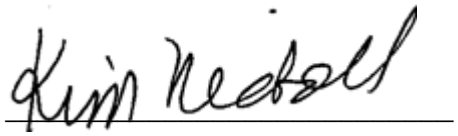
DATA

Member data for retired, active, and inactive participants was supplied as of July 1, 2019, by the staff of the Retirement Office. We have not subjected this data to any auditing procedures, but have examined the data for reasonableness and consistency with the prior year's data. Asset information was also supplied by the staff. That assistance is gratefully acknowledged.

Sincerely,

Segal Consulting, a Member of The Segal Group, Inc.

By:



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North Dakota Teachers' Fund for Retirement Actuarial Valuation and Review as of July 1, 2019

Section 1: Actuarial Valuation Summary

Purpose and Basis

This report was prepared by Segal Consulting to present a valuation of the Plan as of July 1, 2019. The valuation was performed to determine whether the assets and contribution rates are sufficient to provide the prescribed benefits and to provide information for required disclosures under Governmental Accounting Standards Board (GASB) Statement No. 67. The measurements shown in this actuarial valuation may not be applicable for other purposes. In particular, the measures herein are not necessarily appropriate for assessing the sufficiency of Plan assets to cover the estimated cost of settling the Plan's benefit obligations. Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements; and changes in plan provisions or applicable law.

Certain disclosure information required by GASB Statements 67 and 68 as of July 1, 2019 for TFFR is provided in a separate report.

The contribution requirements presented in this report are based on:

- The benefit provisions set forth in the North Dakota Century Code, as administered by the TFFR Board of Trustees;
- The characteristics of covered active members, inactive members, and retirees and beneficiaries as of July 1, 2019, provided by the North Dakota Retirement and Investment Office;
- The assets of the Plan as of June 30, 2019, provided by the North Dakota Retirement and Investment Office;
- Economic assumptions regarding future salary increases and investment earnings;
- Other actuarial assumptions, regarding employee terminations, retirement, death, etc.; and
- The funding policy adopted by the TFFR Board of Trustees.

Valuation Highlights

1. Segal strongly recommends an actuarial funding method that targets 100% funding of the actuarial accrued liability. Generally, this implies payments that are ultimately at least enough to cover normal cost, interest on the unfunded actuarial accrued liability and a portion of the principal balance. The funding policy adopted by the TFFR meets this standard.
2. The employer statutory contribution rate for the fiscal year beginning July 1, 2019, under the North Dakota Century Code is equal to 12.75% of payroll for employers. Compared to the actuarially determined contribution of 12.84% of payroll, there is a contribution deficiency of 0.09% of payroll as of July 1, 2019. The actuarially determined contribution rate defined by the Plan's funding policy is based on a 24-year, level percent of payroll amortization of the unfunded actuarial accrued liability. The employer statutory contribution rate of 12.75% results in an effective amortization period of 24 years; the same number of years as the Plan's funding policy amortization period.
3. Actual employer contributions made during the fiscal year ending June 30, 2019, were $89,444,881, which is 98.5% of the actuarially determined contribution. In the prior fiscal year, actual contributions were $86,675,715, which was 98.2% of the prior year actuarially determined contribution.
4. The funded ratio based on the actuarial value of assets over the actuarial accrued liability as of July 1, 2019 is 66.0%, compared to 65.4% as of July 1, 2018. This ratio is a measure of funding status and its history is a measure of funded progress. These measurements are not necessarily appropriate for assessing the sufficiency of the Plan's assets to cover the estimated cost of settling the Plan's benefit obligation or the need for or the amount of future contributions.
5. For the year ended June 30, 2019, Segal has determined that the asset return on a market value basis was 5.4%. After gradual recognition of investment gains and losses under the actuarial smoothing method, the actuarial rate of return was 6.4%. This represents an experience loss when compared to the assumed rate of 7.75%. As of June 30, 2019, the actuarial value of assets ($2.636 billion) represented 100.7% of the market value ($2.616 billion).
6. The portion of deferred investment gains and losses recognized during the calculation of the July 1, 2019, actuarial value of assets contributed to a loss of $34.8 million. The demographic and liability experience resulted in a $24.1 million gain.
7. As mentioned above, the current method used to determine the actuarial value of assets yields an amount that is 100.7% of the market value of assets as of June 30, 2019. 100.7% falls within the 20% corridor, so no further adjustment to the actuarial value of assets is necessary. Guidelines in Actuarial Standard of Practice No. 44 (Selection and Use of Asset Valuation Methods for Pension Valuations) recommend that asset values fall within a reasonable range around the corresponding market value. The actuarial asset method complies with these guidelines.

8. When measuring pension liability for GASB purposes, the same actuarial cost method (Entry Age Normal) is used to determine the funded status of the Plan, the actuarially determined contribution rate, and the effective amortization period. In addition, the GASB blended discount rate calculation results in the same discount rate (expected return on assets) as used for funding purposes (7.75%). This means that the Total Pension Liability (TPL) measure for financial reporting shown in this report is determined on the same basis as the Actuarial Accrued Liability (AAL) measure for funding. We note that the same is true for the Normal Cost component of the annual plan cost for funding and financial reporting.
9. The Net Pension Liability (NPL) is equal to the difference between the TPL and the Plan Fiduciary Net Position. The Plan Fiduciary Net Position is equal to the market value of assets and therefore, the NPL measure is the same as the Unfunded Actuarial Accrued Liability on a market value basis. The NPL increased from $1,332,858,315 as of June 30, 2018, to $1,377,253,104 as of June 30, 2019.
10. The Fund's net cash flow (contributions minus benefit payments, refunds, and expenses) as a percentage of the market value of assets is -1.9% as of June 30, 2019, compared to -1.6% as of June 30, 2018. The decrease in net cash flow is primarily due to the growth of benefit payments and expenses. It is not unusual for a mature pension system to operate with minor negative cash flow as returns on investments generally exceed the net cash outflow and assets continue to rise. However, as the degree of negative cash flow increases, the plan's vulnerability to investment market volatility increases.
11. This actuarial report as of July 1, 2019 is based on financial and demographic data as of that date. Changes subsequent to that date are not reflected and will affect future actuarial costs of the plan.
12. Since the actuarial valuation results are dependent on a given set of assumptions, there is a risk that emerging results may differ significantly as actual experience proves to be different from the assumptions. We have included a discussion of various risks that may affect the plan in Section 2.

Summary of Key Valuation Results

		2019	2018
Demographic data for plan year beginning July 1	• Number of retirees and beneficiaries	8,918	8,743
	• Number of inactive vested members	1,657	1,623
	• Number of inactive non-vested members contributions	1,035	971
	• Number of active members	11,175	10,881
	• Total payroll supplied by System, annualized	$680,481,816	$653,456,893
	• Average payroll supplied by System, annualized	$60,893	$60,055
Statutory contributions for fiscal year beginning July 1:	• Member rate	11.75%	11.75%
	• Employer rate	12.75%	12.75%
	• Actuarially determined contribution rate	12.84%	12.94%
	• Margin/(deficit)	-0.09%	-0.19%
Actuarial accrued liability for plan year beginning July 1:	• Retirees and beneficiaries	$2,314,016,956	$2,222,021,190
	• Inactive vested members	99,848,736	95,439,788
	• Inactive non-vested members	9,911,187	8,416,461
	• Active members	1,569,647,281	1,537,638,287
	• Total	$3,993,424,160	$3,863,515,726
	• Normal cost including administrative expenses for plan year beginning July 1	$85,956,750	$82,888,334
Assets for plan year beginning July 1:	• Market value of assets (MVA)	$2,616,171,056	$2,530,657,411
	• Actuarial value of assets (AVA)	2,635,557,447	2,526,058,269
	• Actuarial value of assets as a percentage of market value of assets	100.7%	99.8%
Funded status for plan year beginning July 1:	• Unfunded/(overfunded) actuarial accrued liability on market value of assets	$1,377,253,104	$1,332,858,315
	• Funded percentage on MVA basis	65.5%	65.5%
	• Unfunded/(overfunded) actuarial accrued liability on actuarial value of assets	$1,357,866,713	$1,337,457,457
	• Funded percentage on AVA basis	66.0%	65.4%
	• Effective amortization period	24 years	26 years
GASB information:	• Discount rate	7.75%	7.75%
	• Total pension liability	$3,993,424,160	$3,863,515,726
	• Plan fiduciary net position	2,616,171,056	2,530,657,411
	• Net pension liability	$1,377,253,104	$1,332,858,315
	• Plan fiduciary net position as a percentage of total pension liability	65.5%	65.5%
Gains/(losses):	• Asset experience	($34,821,389)	$4,586,416
	• Liability experience	24,138,806	28,564,402
	• Administrative expenses	(59,112)	115,624
	• Assumption/method changes	0	0
	• Total gain/(loss)	($10,741,695)	$33,266,442

Important Information About Actuarial Valuations

An actuarial valuation is a budgeting tool with respect to the financing of future projected obligations of a pension plan. It is an estimated forecast – the actual long-term cost of the plan will be determined by the actual benefits and expenses paid and the actual investment experience of the plan.

In order to prepare a valuation, Segal Consulting ("Segal") relies on a number of input items. These include:

Plan of benefits	Plan provisions define the rules that will be used to determine benefit payments, and those rules, or the interpretation of them, may change over time. Even where they appear precise, outside factors may change how they operate. It is important to keep Segal informed with respect to plan provisions and administrative procedures, and to review the plan summary included in our report to confirm that Segal has correctly interpreted the plan of benefits.
Participant data	An actuarial valuation for a plan is based on data provided to the actuary by TFFR. Segal does not audit such data for completeness or accuracy, other than reviewing it for obvious inconsistencies compared to prior data and other information that appears unreasonable. It is important for Segal to receive the best possible data and to be informed about any known incomplete or inaccurate data.
Assets	The valuation is based on the market value of assets as of the valuation date, as provided by TFFR. TFFR uses an "actuarial value of assets" that differs from market value to gradually reflect year-to-year changes in the market value of assets in determining the contribution requirements.
Actuarial assumptions	In preparing an actuarial valuation, Segal projects the benefits to be paid to existing plan participants for the rest of their lives and the lives of their beneficiaries. This projection requires actuarial assumptions as to the probability of death, disability, withdrawal, and retirement of each participant for each year. In addition, the benefits projected to be paid for each of those events in each future year reflect actuarial assumptions as to salary increases and cost-of-living adjustments. The projected benefits are then discounted to a present value, based on the assumed rate of return that is expected to be achieved on the plan's assets. There is a reasonable range for each assumption used in the projection and the results may vary materially based on which assumptions are selected. It is important for any user of an actuarial valuation to understand this concept. Actuarial assumptions are periodically reviewed to ensure that future valuations reflect emerging plan experience. While future changes in actuarial assumptions may have a significant impact on the reported results, that does not mean that the previous assumptions were unreasonable.

The user of Segal's actuarial valuation (or other actuarial calculations) should keep the following in mind:

- The actuarial valuation is prepared at the request of the TFFR. Segal is not responsible for the use or misuse of its report, particularly by any other party.
- An actuarial valuation is a measurement of the Plan's assets and liabilities at a specific date. Accordingly, except where otherwise noted, Segal did not perform an analysis of the potential range of future financial measures. The actual long-term cost of the plan will be determined by the actual benefits and expenses paid and the actual investment experience of the Plan.
- Actuarial results in this report are not rounded, but that does not imply precision.
- If the TFFR is aware of any event or trend that was not considered in this valuation that may materially change the results of the valuation, Segal should be advised, so that we can evaluate it.
- Segal does not provide investment, legal, accounting, or tax advice. Segal's valuation is based on our understanding of applicable guidance in these areas and of the plan's provisions, but they may be subject to alternative interpretations. TFFR should look to their other advisors for expertise in these areas.

As Segal Consulting has no discretionary authority with respect to the management or assets of the Plan, it is not a fiduciary in its capacity as actuaries and consultants with respect to the Plan.

Section 2: Actuarial Valuation Results

A. Member Data

The Actuarial Valuation and Review considers the number and demographic characteristics of covered members, including active members, inactive members, retirees and beneficiaries.

This section presents a summary of significant statistical data on these member groups.

More detailed information for this valuation year and the preceding valuation can be found in *Section 3, Exhibits A, B, C, D and E*.

MEMBER POPULATION: 2010 – 2019

As of July 1	Active Members	Inactive Vested Members	Inactive Non-vested Members	Retirees and Beneficiaries	Ratio of Non-Actives to Actives*
2010	9,907	1,472	331	6,672	0.82
2011	10,004	1,463	407	6,933	0.84
2012	10,014	1,483	468	7,151	0.86
2013	10,138	1,500	563	7,489	0.89
2014	10,305	1,509	661	7,747	0.90
2015	10,514	1,607	660	8,025	0.92
2016	10,813	1,601	779	8,249	0.91
2017	10,874	1,600	878	8,501	0.93
2018	10,881	1,623	971	8,743	0.95
2019	11,175	1,657	1,035	8,918	0.95

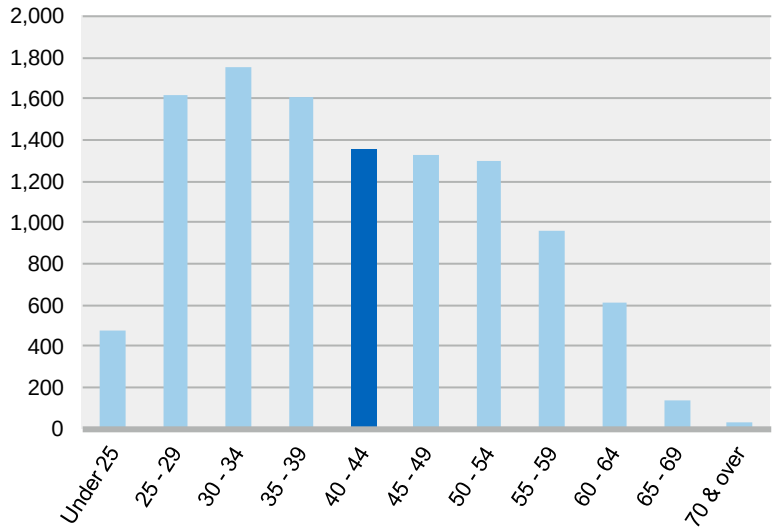
*Excluding inactive non-vested members

Active Members

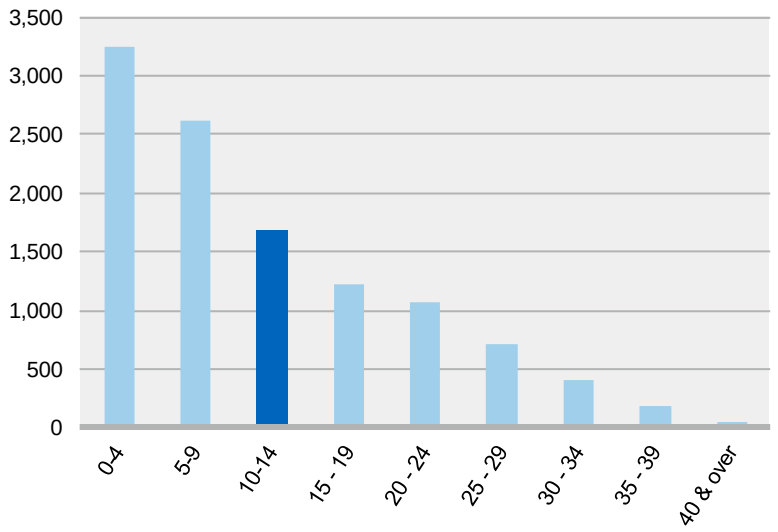
Plan costs are affected by the age, years of service and compensation of active members. In this year's valuation, there were 11,175 active members with an average age of 41.8 and average years of service of 11.7 years. The 10,881 active members in the prior valuation had an average age of 41.9 and average service of 11.8 years.

Distribution of Active Participants as of July 1, 2019

ACTIVES BY AGE



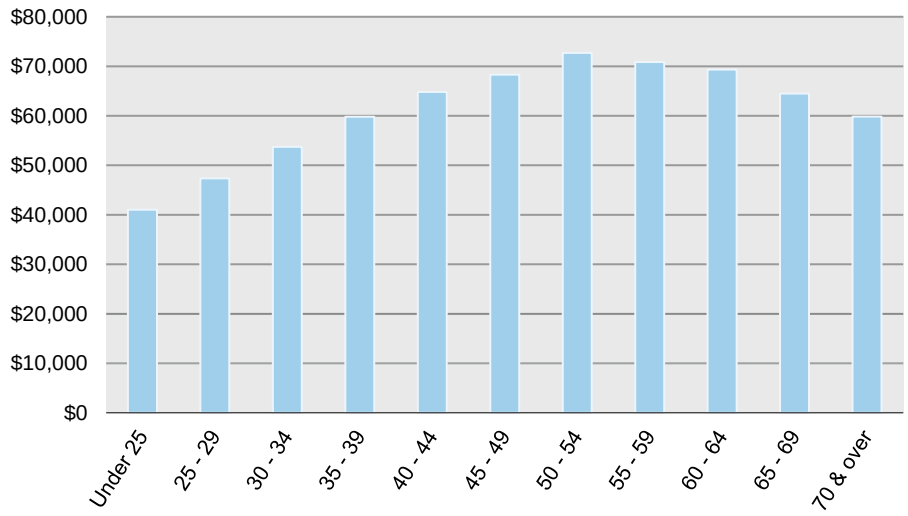
ACTIVES BY YEARS OF SERVICE



In this year's valuation, the 11,175 active members have an average compensation of $60,893. The 10,881 active members in the prior valuation had an average compensation of $60,055.

Distribution of Active Participants as of July 1, 2019

AVERAGE COMPENSATION OF ACTIVES BY AGE



Inactive Members

In this year's valuation, there were 1,657 members with a vested right to a deferred or immediate vested benefit.

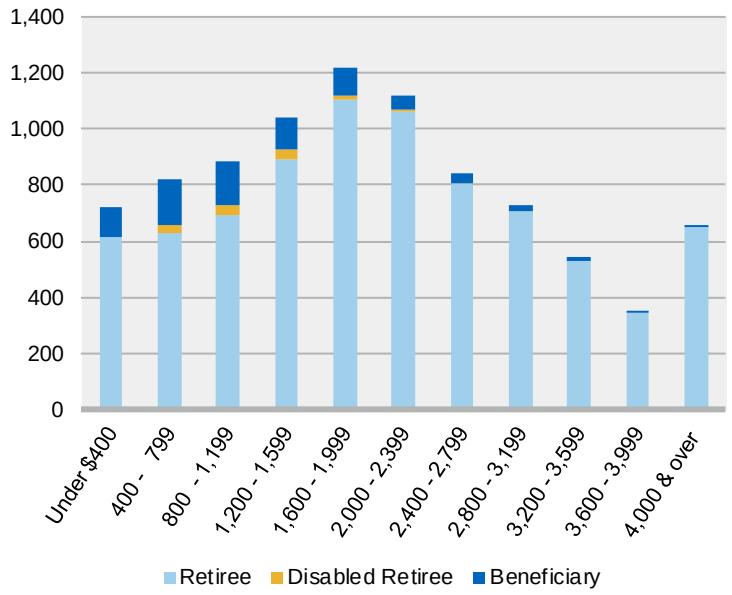
In addition, there were 1,035 non-vested members entitled to a return of their employee contributions.

Retirees and Beneficiaries

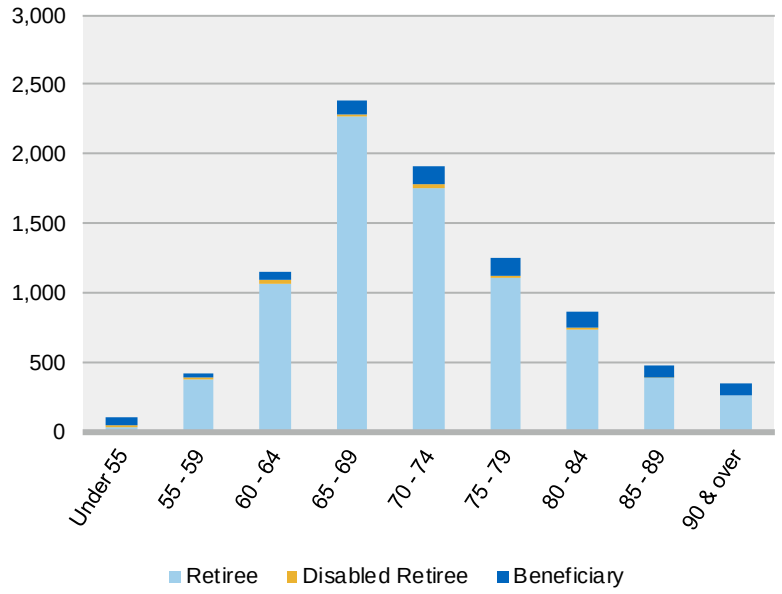
As of July 1, 2019, 8,146 retirees and 772 beneficiaries were receiving total monthly benefits of $18,435,515. For comparison, in the previous valuation, there were 8,002 retirees and 741 beneficiaries receiving monthly benefits of $17,617,313.

Distribution of Retirees and Beneficiaries as of July 1, 2019

RETIREES AND BENEFICIARIES BY TYPE AND MONTHLY AMOUNT



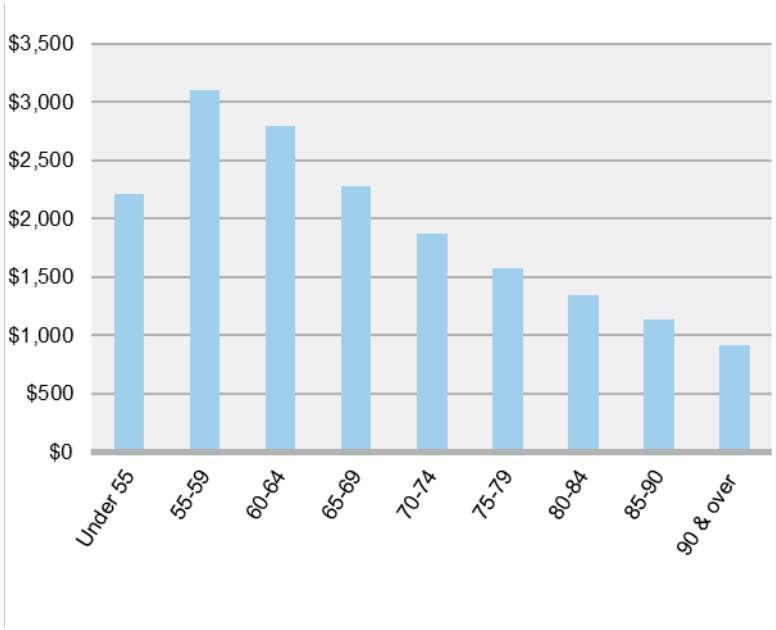
RETIREES AND BENEFICIARIES BY TYPE AND BY AGE



As of July 1, 2019, the average monthly benefit for retirees and beneficiaries is $2,067, compared to $2,015 in the previous valuation. The average age for retirees and beneficiaries is 72.2 in the current valuation, compared with 71.8 in the prior valuation.

Distribution of Retirees and Beneficiaries as of July 1, 2019

AVERAGE MONTHLY AMOUNT OF RETIREES AND BENEFICIARIES BY AGE



Historical Plan Population

The chart below demonstrates the progression of the active population over the last 20 years.

ACTIVE MEMBER DATA STATISTICS: 2000 – 2019

	Active Members		Total Payroll Supplied by System, Annualized		Average Salary			
As of July 1	Number	Percent Change	Amount in $ Millions	Percent Change	$ Amount	Percent Change	Average Age	Average Service
2000	10,025	-0.2%	323.0	2.7%	32,223	2.9%	43.9	14.1
2001	10,239	2.1%	342.2	5.9%	33,421	3.7%	44.4	14.4
2002	9,931	-3.0%	348.1	1.7%	35,052	4.9%	44.5	14.4
2003	9,916	-0.2%	367.9	5.7%	37,105	5.9%	44.8	14.6
2004	9,826	-0.9%	376.5	2.3%	38,321	3.3%	44.9	14.7
2005	9,801	-0.3%	386.6	2.7%	39,447	2.9%	44.9	14.7
2006	9,585	-2.2%	390.1	0.9%	40,703	3.2%	44.8	14.6
2007	9,599	0.1%	401.3	2.9%	41,810	2.7%	44.7	14.5
2008	9,561	-0.4%	417.7	4.1%	43,684	4.5%	44.6	14.4
2009	9,707	1.5%	440.0	5.3%	45,327	3.8%	44.5	14.3
2010	9,907	2.1%	465.0	5.7%	46,937	3.6%	44.2	14.0
2011	10,004	1.0%	488.8	5.1%	48,857	4.1%	43.9	13.8
2012	10,014	0.1%	505.3	3.4%	50,458	3.3%	43.7	13.7
2013	10,138	1.2%	526.7	4.2%	51,953	3.0%	43.2	13.2
2014	10,305	1.6%	557.2	5.8%	54,073	4.1%	42.9	12.8
2015	10,514	2.0%	589.8	5.8%	56,095	3.7%	42.5	12.4
2016	10,813	2.8%	627.0	6.3%	57,986	3.4%	42.3	12.1
2017	10,874	0.6%	650.1	3.7%	59,780	3.1%	42.1	11.9
2018	10,881	0.1%	653.5	0.5%	60,055	0.5%	41.9	11.8
2019	11,175	2.7%	680.5	4.1%	60,893	1.4%	41.8	11.7

The chart below shows the growth among the retired population over the last 10 years.

SERVICE RETIREES DATA STATISTICS: 2010 – 2019

	Service Retirees		Average Annual Amount		
As of July 1	Number	Percent Change	$ Amount	Percent Change	Average Age
2010	6,029	3.4%	19,445	3.4%	70.7
2011	6,252	3.7%	19,990	2.8%	70.7
2012	6,448	3.1%	20,739	3.7%	70.8
2013	6,754	4.7%	21,462	3.5%	70.8
2014	6,991	3.5%	22,230	3.6%	70.9
2015	7,250	3.7%	22,976	3.4%	71.0
2016	7,435	2.6%	23,593	2.7%	71.3
2017	7,664	3.1%	24,352	3.2%	71.5
2018	7,877	2.8%	25,187	3.4%	71.7
2019	8,019	1.8%	25,887	2.8%	72.0

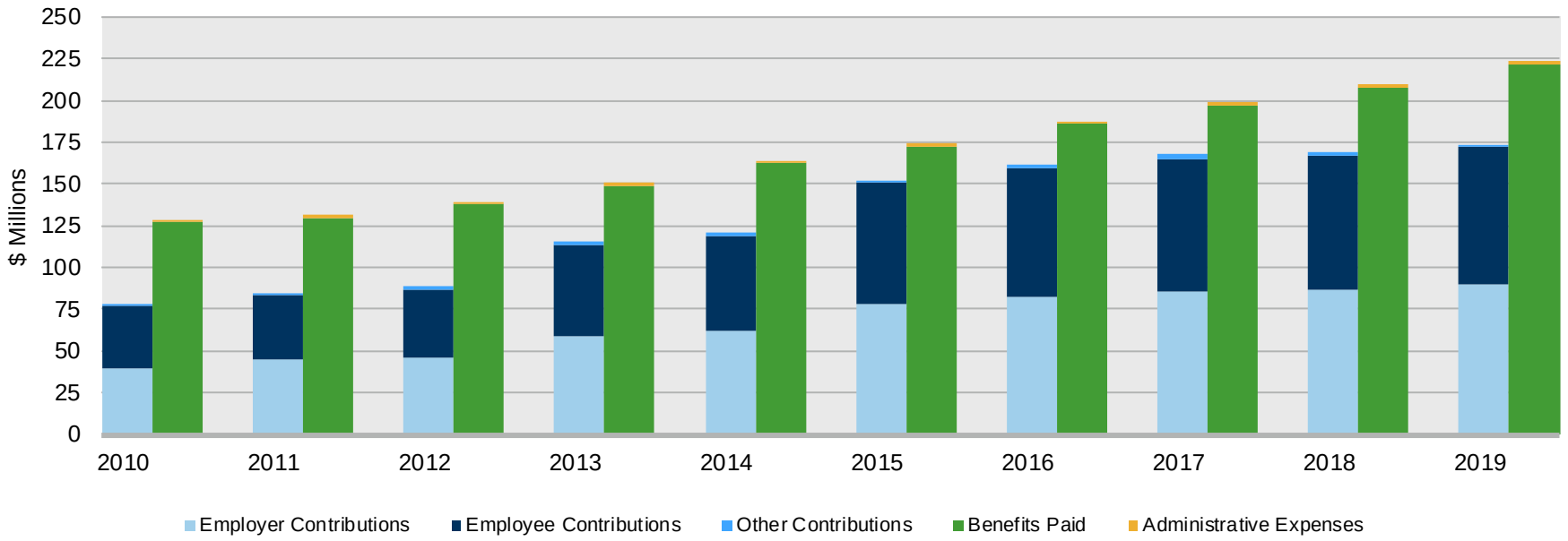
This table does not include disability retirees or beneficiaries.

B. Financial Information

Retirement plan funding anticipates that, over the long term, both contributions (less administrative expenses) and investment earnings (less investment fees) will be needed to cover benefit payments. Retirement plan assets change as a result of the net impact of these income and expense components.

Additional financial information, including a summary of these transactions for the valuation year, is presented in *Section 3, Exhibits E, F* and *G*.

COMPARISON OF CONTRIBUTIONS WITH BENEFITS PAID FOR YEARS ENDED JUNE 30, 2010 – 2019



It is desirable to have level and predictable plan costs from one year to the next. For this reason, the Board has approved an asset valuation method that gradually adjusts to market value. Under this valuation method, the full value of market fluctuations is not recognized in a single year and, as a result, the asset value and the plan costs are more stable. The amount of the adjustment to recognize market value is treated as income, which may be positive or negative. Realized and unrealized gains and losses are treated equally and, therefore, the sale of assets has no immediate effect on the actuarial value.

DETERMINATION OF ACTUARIAL VALUE OF ASSETS FOR YEAR ENDED JUNE 30, 2019, AND JUNE 30, 2018

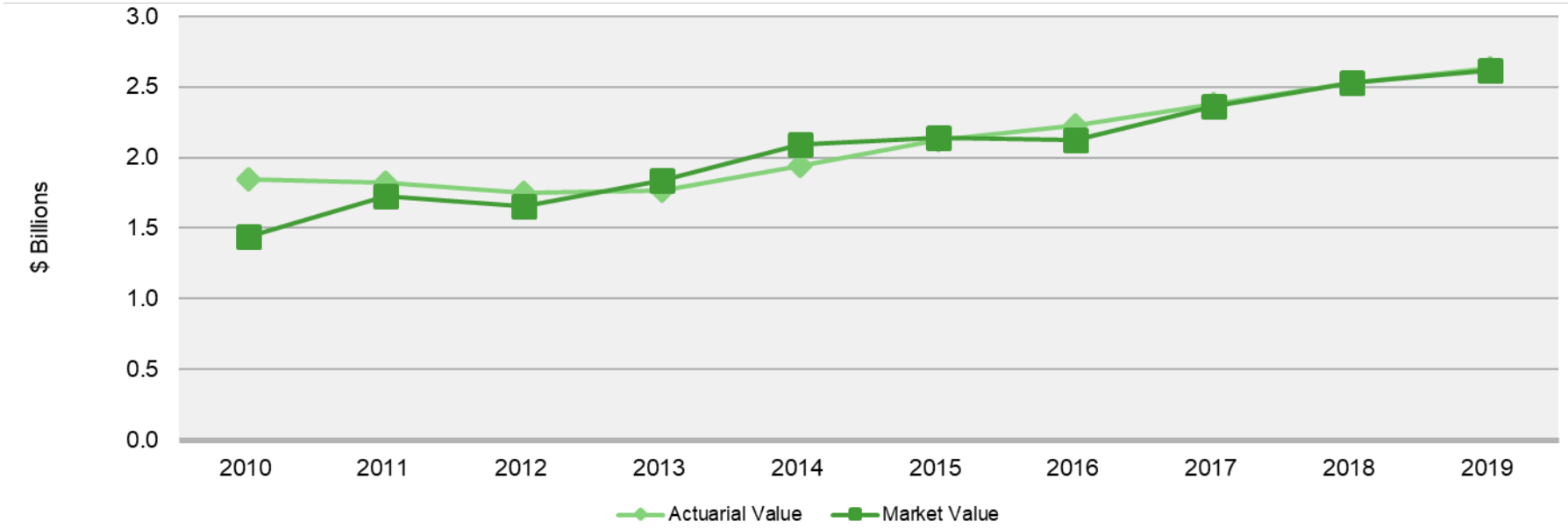
				2019		2018
1.	Market value of assets available for benefits			$2,616,171,056		$2,530,657,411
2.	Calculation of unrecognized return*	Original Amount**	% Not Recognized		% Not Recognized	
	a. Year ended June 30, 2019	-$59,163,355	80%	-$47,330,684		
	b. Year ended June 30, 2018	30,002,998	60%	18,001,800	80%	$24,002,398
	c. Year ended June 30, 2017	103,235,815	40%	41,294,326	60%	61,941,489
	d. Year ended June 30, 2016	-156,759,166	20%	-31,351,833	40%	-62,703,666
	e. Year ended June 30, 2015	-93,205,396		0	20%	-18,641,079
	f. Total unrecognized return			-$19,386,391		$4,599,142
3.	Actuarial value of assets (Current Assets): 1 – 2f			$2,635,557,447		$2,526,058,269
4.	Actuarial value as a percent of market value: 3 ÷ 1			100.7%		99.8%

* Recognition at 20% per year over five years

** Total return minus expected return on a market value basis

Both the actuarial value and market value of assets are representations of TFFR's financial status. As investment gains and losses are gradually taken into account, the actuarial value of assets tracks the market value of assets. The actuarial asset value is significant because the Plan's liabilities are compared to these assets to determine what portion, if any, remains unfunded. Amortization of the unfunded actuarial accrued liability is an important element in determining the contribution requirement.

ACTUARIAL VALUE OF ASSETS VS. MARKET VALUE OF ASSETS AS OF JUNE 30, 2010 – 2019



C. Actuarial Experience

To calculate any actuarially determined contribution, assumptions are made about future events that affect the amount and timing of benefits to be paid and assets to be accumulated. Each year actual experience is measured against the assumptions. If overall experience is more favorable than anticipated (an actuarial gain), any contribution requirement will decrease from the previous year. On the other hand, any contribution requirement will increase if overall actuarial experience is less favorable than expected (an actuarial loss).

Taking account of experience gains or losses in one year without making a change in assumptions reflects the belief that the single year's experience was a short-term development and that, over the long term, experience will return to the original assumptions. For contribution requirements to remain stable, assumptions should approximate experience.

If assumptions are changed, the contribution requirement is adjusted to take into account a change in experience anticipated for all future years.

The total loss is $10,741,695, which includes $34,821,389 from investment losses and $24,079,694 in net gains from all other sources. The net experience variation from individual sources other than investments was 0.6% of the actuarial accrued liability. A discussion of the major components of the actuarial experience is on the following pages.

ACTUARIAL EXPERIENCE FOR YEAR ENDED JUNE 30, 2019

1.	Net gain/(loss) from investments*	-$34,821,389
2.	Net gain/(loss) from administrative expenses	-59,112
3.	Net gain/(loss) from liability and other experience	24,138,806
4.	Net experience gain/(loss): 1 + 2 + 3	-$10,741,695

* Details on next page.

Investment Experience

A major component of projected asset growth is the assumed rate of return. The assumed return should represent the expected long-term rate of return, based on the Plan's investment policy. The rate of return on the market value of assets was 5.39% for the year ended June 30, 2019.

For valuation purposes, the assumed rate of return on the actuarial value of assets is 7.75%. The actual rate of return on an actuarial basis for the 2019 plan year was 6.36%. Since the actual return for the year was less than the assumed return, the Plan experienced an actuarial loss during the year ended June 30, 2019 with regard to its investments.

INVESTMENT EXPERIENCE

		Year Ended June 30, 2019		Year Ended June 30, 2018	
		Market Value	Actuarial Value	Market Value	Actuarial Value
1.	Value assets at the beginning of year	$2,530,657,411	$2,526,058,269	$2,360,491,075	$2,379,811,205
2.	Contributions during the fiscal year	173,949,975	173,949,975	168,928,460	168,928,460
3.	Benefits and expense during the fiscal year	223,479,649	223,479,649	210,107,493	210,107,493
4.	Value of assets at end of year	2,616,171,056	2,635,557,447	2,530,657,411	2,526,058,269
5.	Net investment income: 4 – 1 – 2 + 3	$135,043,319	$159,028,852	$211,345,369	$187,426,097
6.	Average value of assets: 1 + [2 – 3] x ½	$2,505,892,574	$2,501,293,432	$2,339,901,559	$2,359,221,689
7.	Rate of return: 5 ÷ 6	5.39%	6.36%	9.03%	7.94%
8.	Assumed rate of return	7.75%	7.75%	7.75%	7.75%
9.	Expected investment income: 6 x 8	$194,206,674	$193,850,241	$181,342,371	$182,839,681
10.	Actuarial gain/(loss): 5 – 9	($59,163,355)	($34,821,389)	$30,002,998	$4,586,416

Because actuarial planning is long term, it is useful to see how the assumed investment rate of return has followed actual experience over time. The chart below shows the rate of return on an actuarial basis compared to the actual market value investment return for the last 20 years, including averages over select time periods.

INVESTMENT RETURN – MARKET VALUE VS. ACTUARIAL VALUE: 1990 - 2019

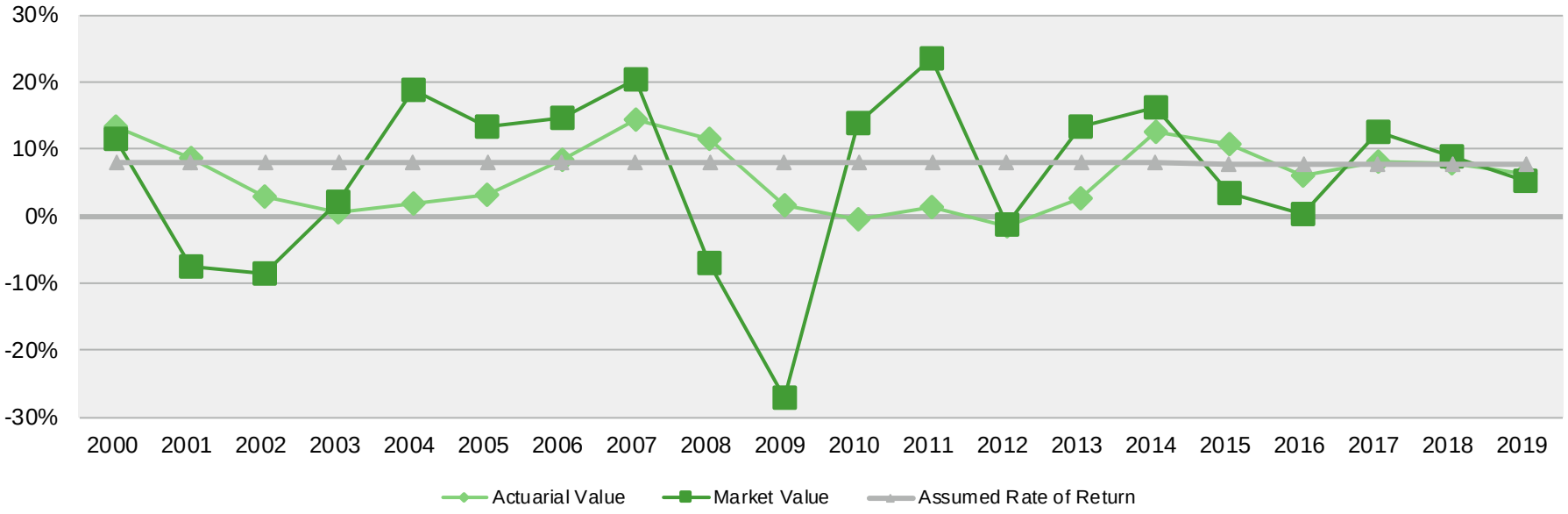
Year Ended June 30	Market Value	Actuarial Value	Year Ended June 30	Market Value	Actuarial Value	Year Ended June 30	Market Value	Actuarial Value
1990	6.7%	7.7%	2000	11.6%	13.3%	2010	13.9%	-0.5%
1991	7.5	5.8	2001	-7.6	8.6	2011	23.5	1.4
1992	12.4	6.5	2002	-8.6	3.0	2012	-1.4	-1.4
1993	14.7	8.1	2003	2.1	0.6	2013	13.4	2.7
1994	1.2	7.0	2004	18.9	1.9	2014	16.1	12.6
1995	13.6	9.1	2005	13.3	3.3	2015	3.5	10.7
1996	15.6	11.3	2006	14.6	8.5	2016	0.4	6.2
1997	18.5	12.6	2007	20.4	14.4	2017	12.6	8.2
1998	13.2	12.6	2008	-7.0	11.6	2018	9.0	7.9
1999	11.5	13.5	2009	-27.0	1.7	2019	5.4	6.4

Most recent five-year average return	6.1%	7.9%
Most recent ten-year average return	9.4%	5.3%
Most recent 15-year average return	6.6%	6.1%
Most recent 20-year average return	5.6%	5.9%
Most recent 30-year average return	7.5%	7.1%

Note: For 2011-2019, investment returns on market basis were determined by Segal.

Subsection B described the actuarial asset valuation method that gradually recognizes fluctuations in the market value rate of return. The goal of this is to stabilize the actuarial rate of return and to produce more level pension plan costs.

MARKET AND ACTUARIAL RATES OF RETURN FOR YEARS ENDED JUNE 30, 2000 - 2019



Administrative Expenses

Administrative expenses for the year ended June 30, 2019 totaled $2,251,083 compared to the assumption of $2,114,256. This resulted in a loss of $59,112 for the year, when adjusted for timing.

Other Experience

There are other differences between the expected and the actual experience that appear when the new valuation is compared with the projections from the previous valuation. These include:

- the extent of turnover among participants,
- retirement experience (earlier or later than projected),
- mortality (more or fewer deaths than projected),
- the number of disability retirements (more or fewer than projected), and
- salary increases (greater or smaller than projected).

The net gain from this other experience for the year ended June 30, 2019 amounted to $24,138,806, which is 0.6% of the actuarial accrued liability.

EXPERIENCE DUE TO CHANGES IN DEMOGRAPHICS FOR YEAR ENDED JUNE 30, 2019

Turnover	-$3,820,142
Retirement	-1,286,280
Deaths among retired members and beneficiaries	9,737,737
Salary/service increase for continuing actives	21,895,994
New entrants	-7,394,261
Miscellaneous	5,005,758
Total gain/ (loss)	**$24,138,806**

D. Changes in the Actuarial Accrued Liability

The actuarial accrued liability as of July 1, 2019 is $3,993,424,160, an increase of $129,908,434, or 3.4%, from the actuarial accrued liability as of the prior valuation date. The change in liability is due to interest, accumulation and payment of benefits, and actuarial experience (as discussed in the previous subsection).

Actuarial Assumptions

- There are no assumption changes reflected in this report.
- Details on actuarial assumptions and methods are in *Section 4, Exhibit I*.

Plan Provisions

- There were no changes in plan provisions since the prior valuation.
- A summary of plan provisions is in *Section 4, Exhibit II*.

E. Cash Flow

Cash flow is the difference between contributions and benefit payments, refunds, and expenses. Negative cash flow indicates that the payments made from the Fund exceed contributions made to the Fund.

HISTORY OF CASH FLOW: 2010 - 2019

Year Ended June 30	Contributions[1]	Disbursements or Expenditures				Net Cash Flow for the Year[2]	Market Value of Assets	Net Cash Flow as Percent of Market Value
		Benefit Payments	Refunds	Administrative Expenses	Total Disbursements			
2010	$78,105,830	($124,472,154)	($2,557,240)	($1,902,796)	($128,932,190)	($50,826,360)	$1,437,949,843	-3.5%
2011	84,923,250	(127,435,564)	(2,210,738)	(2,003,705)	(131,650,007)	(46,726,757)	1,726,179,317	-2.7%
2012	88,808,604	(135,250,568)	(2,479,194)	(1,596,976)	(139,326,738)	(50,518,134)	1,654,149,659	-3.1%
2013	115,849,348	(145,943,323)	(3,053,395)	(1,623,638)	(150,620,356)	(34,771,008)	1,839,583,960	-1.9%
2014	120,991,968	(158,350,355)	(3,908,921)	(1,586,045)	(163,845,321)	(42,853,353)	2,090,977,056	-2.0%
2015	152,463,762	(168,349,762)	(3,889,671)	(1,923,392)	(174,162,825)	(21,699,063)	2,141,920,800	-1.0%
2016	161,995,828	(180,617,784)	(5,350,896)	(1,851,656)	(187,820,336)	(25,824,508)	2,124,335,288	-1.2%
2017	168,157,111	(191,104,694)	(5,411,850)	(2,173,431)	(198,689,975)	(30,532,864)	2,360,491,075	-1.3%
2018	168,928,460	(202,417,031)	(5,561,668)	(2,128,794)	(210,107,493)	(41,179,033)	2,530,657,411	-1.6%
2019	173,949,975	(215,328,174)	(5,900,392)	(2,251,083)	(223,479,649)	(49,529,649)	2,616,171,056	-1.9%

[1] Includes employee and employer contributions, as well as any purchased service credits during the year
[2] Equal to Contributions + Total Disbursements

F. Development of Unfunded/(Overfunded) Actuarial Accrued Liability

DEVELOPMENT OF UNFUNDED/(OVERFUNDED) ACTUARIAL ACCRUED LIABILITY FOR YEAR ENDED JUNE 30, 2019, AND JUNE 30, 2018

		2019		2018	
1.	Unfunded/(overfunded) actuarial accrued liability at beginning of year		$1,337,457,457		$1,354,205,623
2.	Normal cost at beginning of year		79,870,221		80,199,924
3.	Total contributions		-173,949,975		-168,928,460
4.	Interest on:				
	a. Unfunded actuarial accrued liability and normal cost	$109,842,895		$111,166,430	
	b. Total contributions	-6,095,580		-5,919,617	
	c. Total interest: 4a + 4b		103,747,315		105,246,813
5.	Expected unfunded/(overfunded) actuarial accrued liability		$1,347,125,018		$1,370,723,899
6.	Changes due to (gain)/loss:				
	a. Investments	$34,821,389		-$4,586,416	
	b. Demographics	-24,079,694		-28,680,026	
	c. Total changes due to (gain)/loss: 6a + 6b		10,741,695		-33,266,442
7.	Changes due to plan amendments		0		0
8.	Changes in actuarial cost method		0		0
9.	Changes in actuarial assumptions		0		0
10.	Unfunded/(overfunded) actuarial accrued liability at end of year: 5 + 6c + 7 + 8 + 9		$1,357,866,713		$1,337,457,457

G. Actuarially Determined Contribution

The amount of the actuarially determined contribution is comprised of an employer normal cost payment and a payment on the unfunded/(overfunded) actuarial accrued liability. This total amount is divided by the projected payroll for active members to determine the actuarially determined contribution of 12.84% of payroll.

TFFR sets the methodology used to calculate the actuarially determined contribution based on a closed amortization period of 30 years, established as of July 1, 2013. As of July 1, 2019, there are 24 years remaining on this schedule. The employer contribution rate for TFFR set by statute is currently 12.75% of payroll. Since the actuarially determined contribution is 12.84% of payroll, there is a deficit of 0.09% of payroll. The calculated employer normal cost (including expenses) is 0.14% of payroll. The remaining 12.70% of payroll will amortize the unfunded actuarial accrued liability over a period of 24 years.

The contribution requirement as of July 1, 2019 is based on the data previously described, the actuarial assumptions and Plan provisions described in *Section 4*, including all changes affecting future costs adopted at the time of the actuarial valuation, actuarial gains and losses, and changes in the actuarial assumptions.

ACTUARIALLY DETERMINED CONTRIBUTION*

		Year Beginning July 1			
		2019		2018	
		Amount	% of Payroll	Amount	% of Payroll
1.	Total normal cost, adjusted for timing*	$85,956,750	11.89%	$82,888,334	11.95%
2.	Expected employee contributions	84,973,059	11.75%	81,514,258	11.75%
3.	Employer normal cost, adjusted for timing*: 1 - 2	$983,691	0.14%	$1,374,076	0.20%
4.	Actuarial accrued liability	3,993,424,160		3,863,515,726	
5.	Actuarial value of assets	2,635,557,447		2,526,058,269	
6.	Unfunded/(overfunded) actuarial accrued liability: 4 – 5	1,357,866,713		1,337,457,457	
7.	Payment on unfunded actuarial accrued liability, adjusted for timing*	91,842,615	12.70%	88,392,796	12.74%
8.	Actuarially determined contribution: 3 + 7	$92,826,306	12.84%	$89,766,872	12.94%
9.	Total payroll supplied by System, annualized	$680,481,816		$653,456,893	
10.	Projected annual payroll for fiscal year beginning July 1	$723,174,975		$693,738,366	

* Normal cost includes administrative expenses and contributions are assumed to be paid at the middle of every month

Reconciliation of Actuarially Determined Contribution

The chart below details the changes in the actuarially determined contribution from the prior valuation to the current year's valuation.

RECONCILIATION OF ACTUARIALLY DETERMINED CONTRIBUTION

		July 1, 2019	July 1, 2018
1.	Prior valuation	12.94%	12.99%
2.	Increases/(decreases) due to:		
	• Effect of change in amortization period (decrease from 26 years to 25 years remaining as of July 1, 2018 and decrease from 25 years to 24 years remaining as of July 1, 2019)	0.00%	0.00%
	• Effect of change in covered payroll and normal cost	-0.20%	0.25%
	• Effect of contributions (more)/less than actuarially determined contribution: 12.75% rather than 12.99% for FY2018 and 12.75% rather than 12.94% for FY2019	-0.02%	0.02%
	• Effect of gains and losses on accrued liability and administrative expenses	-0.21%	-0.28%
	• Effect of investment (gain)/loss	0.33%	-0.04%
	• Effect of legislative changes	0.00%	0.00%
	• Effect of change in actuarial assumptions	0.00%	0.00%
	• Net effect of other changes	0.00%	0.00%
	Total change	-0.10%	-0.05%
3.	Current valuation: 1 + 2	12.84%	12.94%
4.	Statutory employer contribution rate	12.75%	12.75%
5.	Margin available [contribution sufficiency/(deficiency)]: 4 – 3	-0.09%	-0.19%

H. History of Employer Contributions

Critical information to assess the funding progress is the historical comparison of the actuarially determined contribution (annual required contribution prior to July 1, 2014) to the actual contributions. A history of the most recent years of contributions is shown below.

HISTORY OF EMPLOYER CONTRIBUTIONS: 2010 – 2019

Fiscal Year Ended June 30	Actuarially Determined Employer Contribution (ADC)[1]		Actual Employer Contribution[2]		
	Amount[3]	Percentage of Payroll[4]	Amount	Percentage of Payroll	Percent Contributed
2010	$52,053,217	10.78%	$39,836,646	8.25%	76.5%
2011	65,112,696	12.79%	44,545,433	8.75%	68.4%
2012	69,373,794	13.16%	46,126,193	8.75%	66.5%
2013	52,396,153	9.49%[5]	59,352,860	10.75%	113.3%
2014	59,513,485	10.26%	62,355,146	10.75%	104.8%
2015	71,167,632	11.57%	78,422,098	12.75%	110.2%
2016	84,724,122	13.04%	82,839,932	12.75%	97.8%
2017	89,231,211	13.22%	86,058,868	12.75%	97.7%
2018	88,307,239	12.99%	86,675,715	12.75%	98.2%
2019	90,777,781	12.94%	89,444,881	12.75%	98.5%

[1] Prior to FY 2014, the ADC is the same as the GASB ARC determined under GASB 25.

[2] Prior to FY 2014, these amounts include prior year corrections.

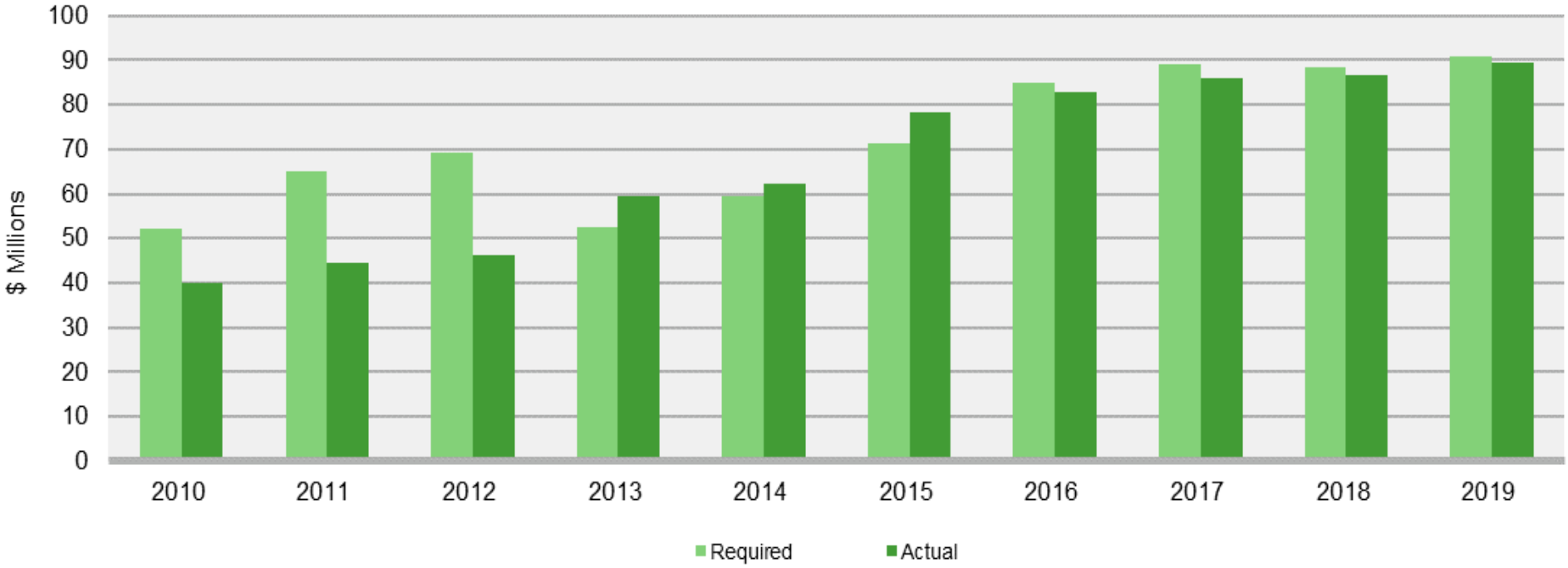
[3] The dollar amount of the ADC for FY 2014 through FY 2019 is based on actual payroll for the year and differs from the estimated dollar amount shown in the prior year's actuarial valuation report because of differences between estimated and actual payroll.

[4] The ADC for each fiscal year is based on the actuarial valuation as of the beginning of the year. Therefore, the FY 2019 ADC is based on the July 1, 2018 valuation. The ADC is defined as the contribution rate required to pay the employer normal cost and to amortize the unfunded actuarial accrued liability over the closed 30-year period that began July 1, 2013 as a level percentage of payroll.

[5] The FY 2013 ADC reflects the actuarial present value of the increased statutory contributions scheduled to occur July 1, 2014.

The chart below presents a graphical representation of the historical comparison of the actuarially determined contribution to the actual contributions for TFFR.

ACTUARIALLY DETERMINED VERSUS ACTUAL EMPLOYER CONTRIBUTIONS, YEARS ENDED JUNE 30



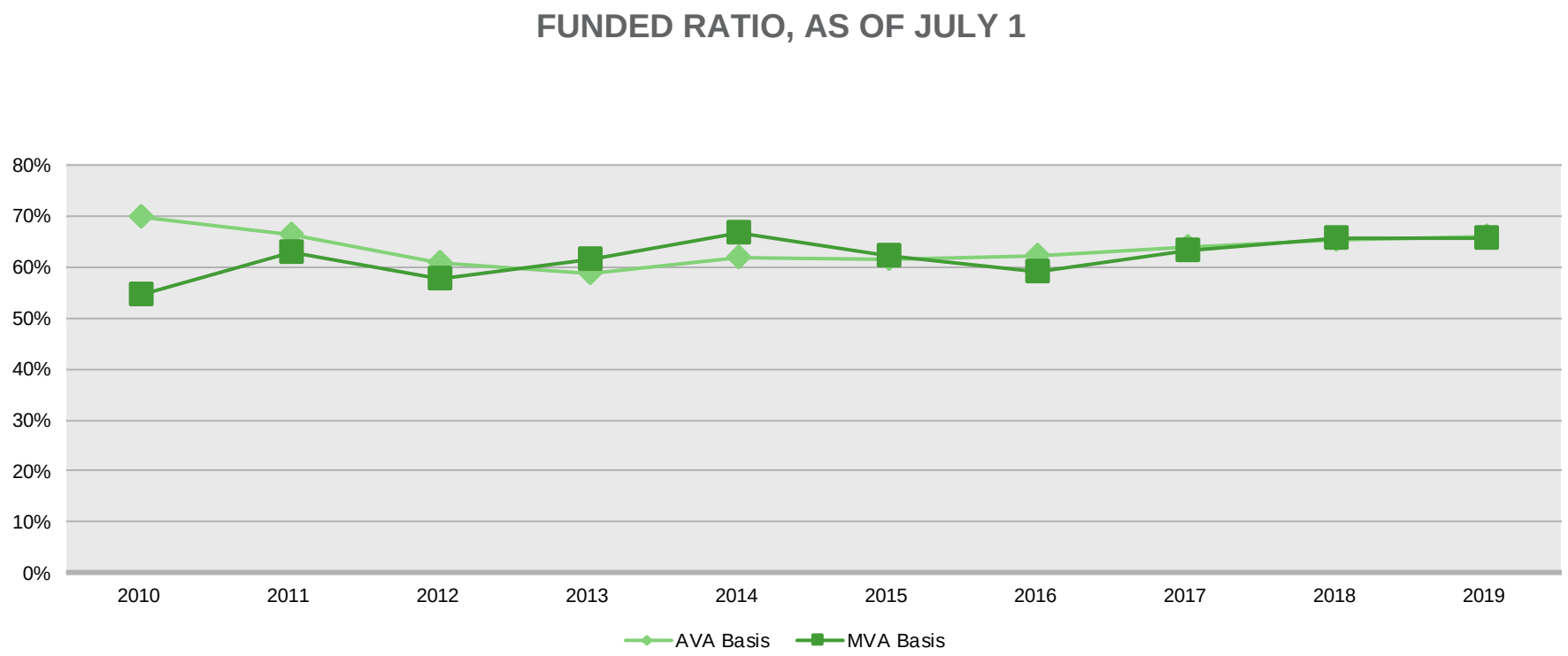
I. Additional Information

The other critical piece of information regarding TFFR's financial status is the funded ratio. This ratio compares the actuarial value of assets to the actuarial accrued liabilities of the Plan. High ratios indicate a well-funded plan with assets sufficient to cover the plan's actuarial accrued liabilities. Lower ratios may indicate recent changes to benefit structures, funding of the plan below actuarial requirements, poor asset performance, or a variety of other factors. The chart below shows the funded ratio calculated using the actuarial value of assets.

SCHEDULE OF FUNDING PROGRESS

As of July 1	Actuarial Value of Assets (AVA)	Actuarial Accrued Liability (AAL)	Unfunded/ Accrued Liability (UAAL)	Funded Ratio	Total Payroll Supplied by System, Annualized	UAAL as a % of Compensation
2010	$1,841,960,220	$2,637,165,045	$795,204,825	69.8%	$465,007,110	171.0%
2011	1,822,598,871	2,749,751,755	927,152,884	66.3%	488,764,292	189.7%
2012	1,748,080,771	2,871,870,286	1,123,789,515	60.9%	505,285,069	222.4%
2013	1,762,321,644	2,997,139,087	1,234,817,443	58.8%	526,698,342	234.4%
2014	1,940,473,504	3,138,799,773	1,198,326,269	61.8%	557,222,917	215.1%
2015	2,125,017,451	3,449,775,982	1,324,758,531	61.6%	589,783,780	224.6%
2016	2,229,292,988	3,589,393,851	1,360,100,863	62.1%	627,002,353	216.9%
2017	2,379,811,205	3,734,016,828	1,354,205,623	63.7%	650,052,674	208.3%
2018	2,526,058,269	3,863,515,726	1,337,457,457	65.4%	653,456,893	204.7%
2019	2,635,557,447	3,993,424,160	1,357,866,713	66.0%	680,481,816	199.5%

The chart below shows the funded ratio calculated using both the actuarial value of assets and the market value of assets.



J. GFOA Solvency Test

The Actuarial Accrued Liability represents the present value of benefits earned, calculated using the Plan's actuarial cost method. The Actuarial Value of Assets reflects the financial resources available to liquidate the liability. The portion of the liability covered by assets reflects the extent to which accumulated plan assets are sufficient to pay future benefits, and is shown for liabilities associated with employee contributions, pensioner liabilities, and other liabilities. The Government Finance Officers Association (GFOA) recommends that the funding policy aim to achieve a funded ratio of 100 percent.

GFOA SOLVENCY TEST AS OF JULY 1

	2019	2018
Actuarial accrued liability (AAL)		
• Active member contributions	$941,512,724	$881,392,433
• Retirees and beneficiaries	2,314,016,956	2,222,021,190
• Active and inactive members (employer financed)	737,894,480	760,102,103
Total	$3,993,424,160	$3,863,515,726
Actuarial value of assets	$2,635,557,447	$2,526,058,269
Cumulative portion of AAL covered		
• Active member contributions	100.0%	100.0%
• Retirees and beneficiaries	73.2%	74.0%
• Active and inactive members (employer financed)	0.0%	0.0%

K. Summary of Actuarial Valuation Results

		July 1, 2019		July 1, 2018	
A.	**Determination of Actuarial Accrued Liability**				
1.	Active members				
	a. Retirement benefits	$2,221,580,016		$2,161,868,443	
	b. Disability benefits	37,445,914		35,619,428	
	c. Death benefits	39,168,167		37,705,085	
	d. Withdrawal benefits	170,765,844		159,411,742	
	e. Total		$2,468,959,941		$2,394,604,698
2.	Inactive vested members		99,848,736		95,439,788
3.	Inactive non-vested members		9,911,187		8,416,461
4.	Retirees and beneficiaries		2,314,016,956		2,222,021,190
5.	**Actuarial Present Value of Projected Benefits:** 1e + 2 + 3 + 4		**$4,892,736,820**		**$4,720,482,137**
6.	Actuarial Present Value of Future Normal Costs, Active Members				
	a. Retirement benefits	$698,093,917		$668,561,346	
	b. Disability benefits	16,788,356		15,997,612	
	c. Death benefits	16,995,532		16,351,408	
	d. Withdrawal benefits	167,434,855		156,056,045	
	e. Total		**$899,312,660**		**$856,966,411**
7.	**Actuarial Accrued Liability:** 5 – 6e		**$3,993,424,160**		**$3,863,515,726**
B.	**Determination of Unfunded Actuarial Accrued Liability**				
1.	Actuarial accrued liability		$3,993,424,160		$3,863,515,726
2.	Actuarial value of assets		2,635,557,447		$2,526,058,269
3.	Unfunded actuarial accrued liability: 1 – 2		$1,357,866,713		$1,337,457,457

L. Actuarial Balance Sheet

An overview of the Plan's funding is given by an Actuarial Balance Sheet. In this approach, first the amount and timing of all future payments that will be made by the Plan for current participants is determined. Then these payments are discounted at the valuation interest rate to the date of the valuation, thereby determining the present value, referred to as the "liability" of the Plan.

Second, this liability is compared to the assets. The "assets" for this purpose include the net amount of assets already accumulated by the Plan, the present value of future member contributions, the present value of future employer normal cost contributions, and the present value of future employer amortization payments for the unfunded actuarial accrued liability.

ACTUARIAL BALANCE SHEET

	As of	
	July 1, 2019	July 1, 2018
Liabilities		
• Present value of benefits for retirees and beneficiaries	$2,314,016,956	$2,222,021,190
• Present value of benefits for inactive members	109,759,923	103,856,249
• Present value of benefits for active members	$2,468,959,941	2,394,604,698
Total liabilities	**$4,892,736,820**	**$4,720,482,137**
Assets		
• Total valuation value of assets	$2,635,557,447	$2,526,058,269
• Present value of future contributions by members	971,523,395	922,733,395
• Present value of future employer contributions for:		
» Entry age normal costs	-72,210,735	-65,766,984
» Unfunded actuarial accrued liability	1,357,866,713	1,337,457,457
Total of current and future assets	**$4,892,736,820**	**$4,720,482,137**

M. Determination of Contribution Sufficiency

		July 1, 2019		July 1, 2018	
A.	**Statutory Contributions**	**%Payroll**	**$ Amount**	**% Payroll**	**$ Amount**
1.	Member contributions	11.75%	$84,973,059	11.75%	$81,514,258
2.	Employer contributions	12.75%	92,204,809	12.75%	88,451,642
3.	Total	24.50%	$177,177,868	24.50%	$169,965,900
B.	**Actuarially Determined Contribution**	**% Payroll**	**$ Amount**	**% Payroll**	**$ Amount**
1.	Normal cost				
	a. Retirement	8.78%	$63,476,011	8.87%	$61,494,846
	b. Disability	0.20%	1,448,195	0.20%	1,391,024
	c. Death	0.21%	1,530,204	0.21%	1,481,355
	d. Deferred termination benefit and refunds	1.95%	14,136,791	1.93%	13,388,740
	e. Total	11.14%	$80,591,201	11.21%	$77,755,965
	f. Normal cost, adjusted for timing	11.57%	83,636,558	11.63%	80,694,185
2.	Administrative expenses, adjusted for timing	0.32%	2,320,192	0.32%	2,194,149
3.	**Gross normal cost including administrative expenses, adjusted for timing:** 1f + 2	**11.89%**	**$85,956,750**	**11.95%**	**$82,888,334**
4.	Less member contribution rate	11.75%	84,973,059	11.75%	81,514,258
5.	Employer normal cost rate: 3– 4	0.14%	983,691	0.20%	1,374,076
6.	Unfunded actuarial accrued liability rate, adjusted for timing	12.70%	91,842,615	12.74%	88,392,796
7.	Total: 5 + 6	12.84%	92,826,306	12.94%	89,766,872
C.	**Contribution Sufficiency / (Deficiency): A2 – B7**	**-0.09%**	**-$621,497**	**-0.19%**	**-$1,315,230**
	Projected annual payroll for fiscal year beginning on the valuation date		$723,174,975		$693,738,366

N. Risk

The actuarial valuation results depend on a single set of assumptions; however, there is a risk that emerging results may differ significantly as actual experience proves to be different than projected from the current assumptions.

In 2019, the Board engaged Segal to perform a detailed analysis of the potential range of the impact of risks relative to the Plan's future financial condition. This study included an overview of risks that affect the Fund and stakeholders, as well as various stochastic and deterministic modeling, primarily focusing on investment returns. The study concluded with the development of a Plan Management Policy designed to assess the overall health of TFFR.

Below is a brief discussion of some of the risks that may affect the Plan. This discussion is focused on funding-related risks, but similar concerns may apply to risks regarding the level of expense and liabilities reported for Plan accounting purposes as well.

A detailed risk assessment is important for TFFR because:

- The negative cash flow position of the Plan could be exacerbated by relatively small deviations from assumed future experience.
- Retired and inactive participants account for more than half of the Plan's liabilities limiting options for reducing plan liabilities in the event of adverse experience.
- The employer contribution rate has been less than the actuarially determined contribution rate for several years, which may indicate additional funding challenges in the future.
- The risks identified below show significant potential for variability.

The following risks could significantly affect the Plan's future condition:

a. **Investment Risk** (the risk that returns will be different than expected)

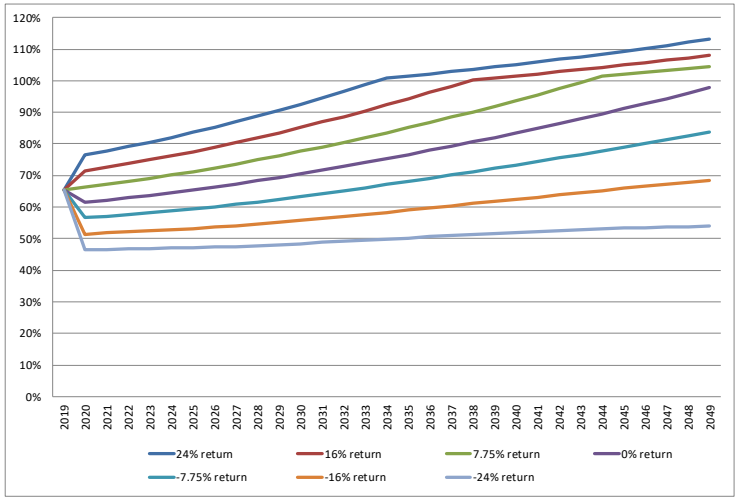
   If the actual market value return for the Plan Year were 1% different from the assumed (either higher or lower), the projected unfunded actuarial liability would change by about 2%, or about $25 million.

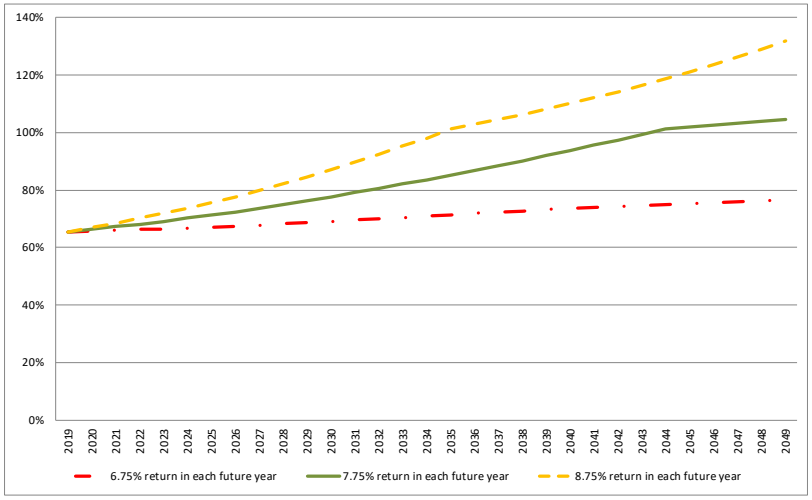
   If the prior year's investment performance resulted in a market value of assets that is 10% different than the current value, it would result in a change of $261.6 million in the asset value. A 10% increase in assets would cause the unfunded liability (market value basis) to decrease from $1,377.3 million to $1,115.7 million. Likewise, a 10% decrease in the asset value would cause the unfunded liability to increase from $1,377.3 million to $1,638.9 million.

Since the Plan's assets are much larger than contributions, investment performance may create volatility in the actuarially determined contribution requirements. For example, for each 1% difference in actual return, the actuarially determined contribution would increase or decrease by 0.05% of payroll. Ignoring the effects of the five-year phase-in of investment gains and losses, the actuarially determined contribution would change by 0.2% of payroll.

The market value rate of return over the last ten years has ranged from a low of -1.4% to a high of 23.5%, with an average of 9.4%. However looking over a longer historical period of 20 years, the fair value rate of return has an average of 5.6%.

The following graphs illustrate the impact on projected funded ratios (market value basis) under two scenarios: 1) market value returns for the next Plan year vary between -24% and +24%, and 2) market value returns in each future Plan year are +1% or -1% above or below the 7.75% assumption.





b. **Longevity Risk** (the risk that mortality experience will be different than expected)

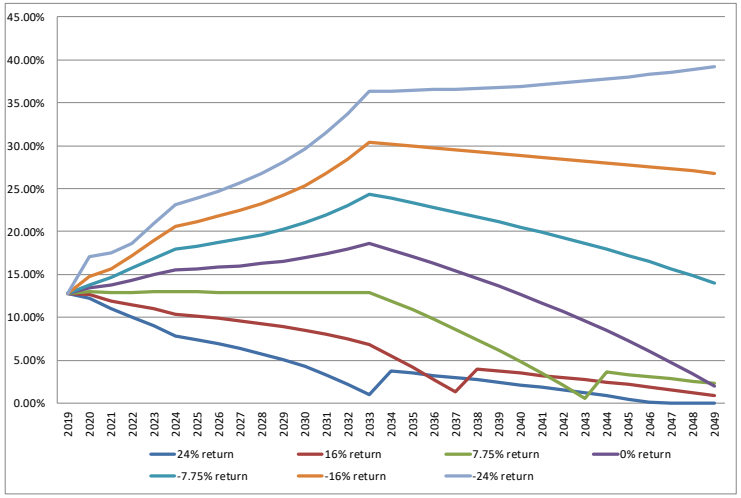
The actuarial valuation includes an expectation of future improvement in life expectancy. Emerging plan experience that does not match these expectations will result in either an increase or decrease in the actuarially determined contribution.

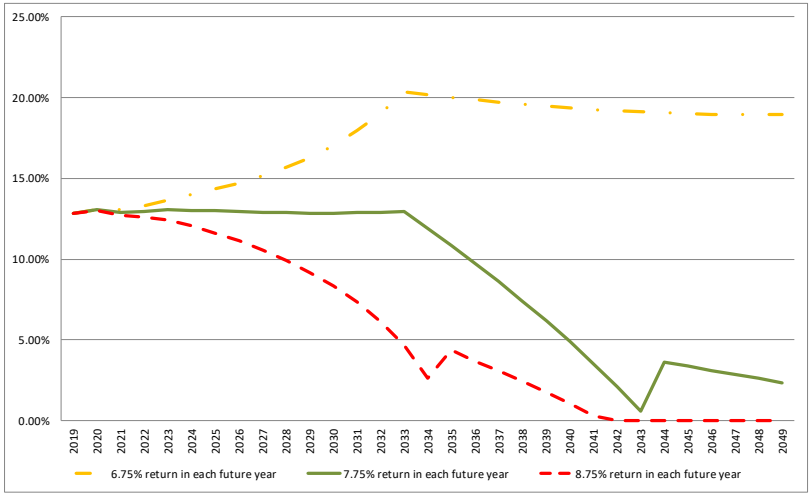
A 10% reduction in the assumed mortality rates results in an increase in the liabilities of roughly 3% for most plans. For TFFR, a 3% liability increase would result in an increase in the unfunded accrued liability of $119.8 million. The unfunded accrued liability (market value of assets basis) would increase from $1,377.3 million to $1,497.1 million.

c. **Contribution Risk** (the risk that actual contributions will be different from actuarially determined contribution)

Plan contributions are set by statute. If contributions remain at the current level and future experience matches the current assumptions, we project the unfunded actuarial accrued liability (market value basis) will be paid off in 2043 (in 24 years).

The following graphs illustrate the impact on projected actuarially determined contribution rates under two scenarios: 1) market value returns for the next Plan year vary between -24% and +24%, and 2) market value returns in each future Plan year are +1% or -1% above or below the 7.75% assumption.





d. **Demographic Risk** (the risk that participant experience will be different than assumed)

Examples of this risk include:

- Actual retirements occurring earlier or later than assumed. The value of retirement plan benefits is sensitive to the rate of benefit accruals and any early retirement subsidies that apply.
- More or less active participant turnover than assumed.
- Salary increases more or less than assumed.

e. Actual Experience

- Past experience can help demonstrate the sensitivity of key results to the Plan's actual experience. Over the past nine years:
  - » The investment gain/loss for a year has ranged from a loss of $169 million to a gain of $80 million.
  - » The non-investment gain/loss for a year has ranged from a loss of $8.9 million to a gain of $28.7 million.
- The funded percentage on the actuarial value of assets has ranged from a low of 59% to a high of 102% since 2000.

f. Maturity Measures

The risk associated with a pension plan increases as it becomes more mature, meaning that the actives represent a smaller portion of the liabilities of the plan. When this happens, there is a greater risk that fluctuations in the experience of the non-active participants or of the assets of the plan can result in large swings in the contribution requirements.

- Over the past ten years, the ratio of non-active participants (excluding inactive non-vested members) to active participants has increased from a low of 0.82 to a high of 0.95. Currently the Plan has a non-active to active participant ratio of 0.95. For the prior year, benefits paid were $49.5 million more than contributions received. As the Plan matures, more cash will be needed from the investment portfolio to meet benefit payments.
- As of July 1, 2019, the retired life actuarial accrued liability represents 58% of the total actuarial accrued liability. In addition, the actuarial accrued liability for inactive vested participants represents 3% of the total. The higher the non-active actuarial accrued liability is as a percent of the total liability, the greater the danger of volatility in results.
- Benefits and administrative expenses less contributions totaled $49.5 million for the year ending June 30, 2019, 1.9% of the market value of assets. The Plan is dependent upon investment returns in order to pay benefits.

Section 3: Supplemental Information

MEMBERSHIP DATA

Membership data was provided on electronic files sent by the RIO staff. Data for active members includes sex, birth date, service, salary for the prior fiscal year, and accumulated contributions. Data for inactive members was similar, but also includes the members' unreduced benefit. For retired members, data includes status (service retiree, disabled retiree or beneficiary), sex, birth date, pension amount, date of retirement, form of payment, and beneficiary sex and birth date if applicable.

While not verifying the correctness of the data at the source, we performed various tests to ensure the internal consistency of the data and its overall reasonableness.

Membership statistics are summarized in Exhibit A. Exhibit B shows the age/service distribution of active members. Exhibit C-1 and Exhibit C-2 show the distribution of retirees by option and by benefit amount. Exhibit D shows a reconciliation of the member data from last year's valuation to this year's valuation.

The number of active members increased by 2.7% since last year, from 10,881 to 11,175. Note that normally the actual number of members employed during the year will be somewhat higher than the valuation count, since the July 1 count excludes most June and July retirees but does not include new teachers joining the system for the next school year.

Total payroll increased 4.1% since last year. For all comparative purposes, payroll is the amount supplied by the RIO staff (i.e., the 2018-2019 member pay), annualized. However, this figure is increased by one year's assumed pay increase to determine the member's rate of pay (and thus, total projected payroll) at July 1, 2019. Pay is assumed to change only at the beginning of a school/fiscal year.

Average pay increased by 1.4%, from $60,055 to $60,893. This change includes the impact of replacing more highly paid members who retire with new teachers. The average increase in salary for the 10,086 continuing members (members active in both this valuation and the preceding valuation) was 4.1%.

The average age of active members decreased from 41.9 years to 41.8 years, and their average service decreased from 11.8 years to 11.7 years.

The table below shows additional information about the active membership this year and last year. Tier 1 Grandfathered members are those who had 65 points as of June 30, 2013, or were at least age 55 and vested. Members who joined prior to June 30, 2008, and did not meet these criteria are considered Tier 1 Non-grandfathered members. Tier 2 members are those hired or rehired after June 30, 2008. All new members in future years will enter as Tier 2 members, so the number will increase over time. The Tier 1 Grandfathered and Non-grandfathered population will decrease each year as members leave due to retirement, termination, death, and disability.

ACTIVE STATISTICS

Category	July 1, 2019	July 1, 2018
Plan Eligibility:		
• Tier 1 Grandfathered	1,633	1,889
• Tier 1 Non-grandfathered	3,131	3,180
• Tier 2	6,411	5,812
• **Total**	**11,175**	**10,881**
Benefit Eligibility:		
• Non-Vested	3,239	3,185
• Vested	6,229	6,019
• Early Retirement	843	812
• Normal Retirement	864	865
• **Total**	**11,175**	**10,881**

In addition, this table shows the number of members who are non-vested, those who are vested but not eligible for retirement, those who are eligible only for an early retirement (reduced) benefit, and those eligible for a normal (unreduced) benefit. As of the valuation date, 1,707 members were eligible for either reduced or unreduced retirement, an increase over last year's figure of 1,677.

Exhibit A – Member Data

Category	July 1, 2019	July 1, 2018	Change From Prior Year
Active members:			
• Males	2,764	2,717	1.73%
• Females	8,411	8,164	3.03%
• Total number	11,175	10,881	2.70%
• Total payroll supplied by System, annualized	$680,481,816	$653,456,893	4.14%
• Average salary	$60,893	$60,055	1.40%
• Average age	41.8	41.9	-0.1
• Average service	11.7	11.8	-0.1
• Total contributions with interest	$941,512,724	$881,392,433	6.82%
• Average contribution with interest	$84,252	$81,003	4.01%
Vested inactive members:			
• Number	1,657	1,623	2.09%
• Total annual deferred benefits	$12,828,016	$12,348,432	3.88%
• Average annual deferred benefit	$7,742	$7,608	1.76%
• Average age	48.9	49.0	-0.1
Non-vested inactive members:			
• Number	1,035	971	6.59%
• Employee contributions with interest due	$7,347,557	$6,365,397	15.43%
• Average refund due	$7,099	$6,556	8.28%
• Average age	37.7	37.5	0.2
Service retirees:			
• Number	8,019	7,877	1.80%
• Total annual benefit	$207,589,824	$198,399,020	4.63%
• Average annual benefit	$25,887	$25,187	2.78%
• Average age	72.0	71.7	0.3
Disabled retirees:			
• Number	127	125	1.60%
• Total annual benefit	$1,911,396	$1,861,025	2.71%
• Average annual benefit	$15,050	$14,888	1.09%
• Average age	64.7	64.0	0.7
Beneficiaries:			
• Number	772	741	4.18%
• Total annual benefit	$11,724,954	$11,147,709	5.18%
• Average annual benefit	$15,188	$15,044	0.96%
• Average age	75.8	75.7	0.1

Exhibit B – Members in Active Service as of July 1, 2019
By Age, Years of Credited Service, and Average Compensation

		Years of Credited Service								
Age	Total	0-4	5-9	10-14	15 - 19	20 - 24	25 - 29	30 - 34	35 – 39	40 & over
Under 25	476	476	0	0	0	0	0	0	0	0
	$41,022	$41,022	0	0	0	0	0	0	0	0
25 - 29	1,620	1,209	411	0	0	0	0	0	0	0
	$47,356	$46,146	$50,915	0	0	0	0	0	0	0
30 - 34	1,751	476	1,007	266	2	0	0	0	0	0
	$53,716	$48,207	$54,639	$60,034	$60,217	0	0	0	0	0
35 - 39	1,606	327	409	672	197	1	0	0	0	0
	$59,809	$49,875	$57,218	$63,656	$68,527	$65,519	0	0	0	0
40 - 44	1,352	233	254	285	435	144	1	0	0	0
	$64,829	$50,214	$60,129	$66,190	$71,099	$75,084	$72,202	0	0	0
45 - 49	1,329	182	199	167	227	447	105	2	0	0
	$68,289	$52,755	$60,961	$67,973	$71,067	$74,918	$74,704	$103,784	0	0
50 - 54	1,302	147	122	125	160	245	368	134	1	0
	$72,712	$59,481	$64,195	$65,166	$69,291	$75,744	$78,703	$84,291	$48,834	0
55 - 59	959	111	109	81	104	137	166	193	58	0
	$70,849	$56,524	$61,315	$67,798	$69,374	$73,209	$75,826	$80,163	$72,278	0
60 - 64	610	58	70	60	70	80	56	67	116	33
	$69,328	$54,186	$62,192	$59,662	$68,054	$74,383	$74,410	$73,647	$77,110	$74,346
65 - 69	139	24	23	19	20	9	9	7	7	21
	$64,479	$53,531	$68,907	$58,039	$61,377	$64,650	$58,879	$72,552	$77,673	$76,159
70 & over	31	11	7	0	5	3	0	1	2	2
	$59,832	$49,870	$56,404	0	$66,567	$76,006	0	$74,966	$70,909	$59,832
Total	11,175	3,254	2,611	1,675	1,220	1,066	705	404	184	56
	$60,893	$47,900	$56,531	$64,049	$69,923	$74,778	$76,827	$80,424	$75,387	$74,760

Exhibit C-1 – Schedule of Annuitants by Type of Benefit as of July 1, 2019

Type of Benefits/Form of Payment	Number	Annual Benefits Amount	Average Monthly Benefits
Service:			
• Straight Life	2,994	$67,886,343	$1,890
• 100% J&S	3,483	102,067,017	2,442
• 50% J&S	689	19,482,961	2,356
• 5 Years C&L	17	257,967	1,265
• 10 Years C&L	175	3,895,757	1,855
• 20 Years C&L	143	3,819,636	2,226
• Level	518	10,180,147	1,638
Subtotal:	8,019	$207,589,828	$2,157
Disability:			
• Straight Life	98	$1,509,002	$1,283
• 100% J&S	21	297,384	1,180
• 50% J&S	5	70,842	1,181
• 5 Years C&L	1	6,254	521
• 10 Years C&L	0	0	0
• 20 Years C&L	2	27,913	1,163
• Level	0	0	0
Subtotal:	127	$1,911,395	$1,254
Beneficiaries:			
• Straight Life	717	$11,315,587	$1,315
• 10 Years Certain	4	28,081	585
• 20 Years Certain	23	154,519	560
• QDRO Alternate Payee	28	226,767	675
Subtotal:	772	$11,724,954	$1,266
Total:	**8,918**	**$221,226,177**	**$2,067**

Exhibit C-2 – Schedule of Annuitants by Monthly Benefit as of July 1, 2019

Monthly Benefit Amount	Number of Members	Female	Male	Average Service
Under $200	260	194	66	6.04
200 - 399	463	344	119	11.25
400 - 599	424	329	95	15.23
600 - 799	399	288	111	19.16
800 - 999	387	282	105	21.56
1,000 - 1,199	498	376	122	24.99
1,200 - 1,399	490	339	151	26.69
1,400 - 1,599	550	371	179	28.36
1,600 - 1,799	608	411	197	28.73
1,800 - 1,999	608	421	187	29.51
2,000 - 2,199	573	403	170	29.64
2,200 - 2,399	542	363	179	30.08
2,400 - 2,599	440	301	139	31.26
2,600 - 2,799	402	276	126	31.62
2,800 - 2,999	387	251	136	32.51
3,000 - 3,199	341	243	98	32.69
3,200 - 3,399	301	199	102	33.63
3,400 - 3,599	239	149	90	33.33
3,600 - 3,799	197	122	75	34.57
3,800 - 3,999	154	107	47	34.62
4,000 & over	655	356	299	36.38
Total:	**8,918**	**6,125**	**2,793**	**27.28**

Exhibit D – Reconciliation of Member Data by Status

	Active Members	Vested Terminated Members	Non-Vested Terminated Members	Service Retirees	Disabled Retirees	Beneficiaries	Total
Number as of July 1, 2018	**10,881**	**1,623**	**971**	**7,877**	**125**	**741**	**22,218**
• Additions and new members	969	0	0	0	0	0	969
• Retirements	-273	-53	0	326	0	0	0
• Disability	-3	-1	0	0	4	0	0
• Died with beneficiary	-4	-1	0	-54	0	66	7*
• Died without beneficiary	-3	-1	-2	-128	-1	-39	-174
• Terminated vested	-171	173	-1	0	-1	0	0
• Terminated non-vested	-178	0	178	0	0	0	0
• Refunds	-163	-25	-51	0	0	0	-239
• Rehired as active	120	-58	-60	-2	0	0	0
• Expired benefits	0	0	0	0	0	0	0
• New alternate payee	0	0	0	0	0	2	2
• Data adjustments	0	0	0	0	0	2	2
Number as of July 1, 2019	**11,175**	**1,657**	**1,035**	**8,019**	**127**	**772**	**22,785**

* Due to multiple beneficiaries

Exhibit E – Summary Statement of Income and Expenses on a Market Value Basis

	Year Ended June 30 , 2019		Year Ended June 30 , 2018	
Net assets at market value at the beginning of the year		$2,530,657,411		$2,360,491,075
Contribution:				
• Employee contributions	$82,429,594		$79,877,611	
• Employer contributions	89,444,881		86,675,715	
• Purchased service credit	1,916,787		2,181,106	
• Interest, penalties and other	158,713		194,028	
Total contribution income		*$173,949,975*		*$168,928,460*
Investment income:				
• Interest, dividends and other income	$56,434,954		$54,486,768	
• Securities lending income	224,713		231,448	
• Investment expenses	-6,272,801		-5,352,945	
• Securities lending expenses=	-44,927		-46,271	
Net investment income		*$50,341,939*		*$49,319,000*
Net realized and unrealized gains/(losses)		84,701,380		162,026,369
Total income available for benefits		**$308,993,294**		**$380,273,829**
Less benefit payments and expenses:				
• Regular annuity benefits	$214,091,045		$201,648,202	
• Partial lump-sum benefits paid	1,237,129		768,829	
• Refunds	5,900,392		5,561,668	
Total benefits and refunds	$221,228,566		$207,978,699	
• Administrative and miscellaneous expenses	2,251,083		2,128,794	
Total benefit payments and expenses		*$223,479,649*		*$210,107,493*
Change in reserve for future benefits		**$85,513,645**		**$170,166,336**
Net assets at market value at the end of the year		**$2,616,171,056**		**$2,530,657,411**

Exhibit F – Summary Statement of Plan Assets

	June 30 , 2019		June 30 , 2018	
Cash and cash equivalents (operating cash)		$20,309,990		$20,493,198
Invested securities lending collateral		8,495,437		7,413,200
Total accounts receivable		37,603,789		36,322,393
Investments:				
• Equities	$1,495,354,621		$1,441,132,463	
• Fixed Income	575,551,625		589,368,951	
• Short-term	35,025,659		28,631,157	
• Real assets	455,163,805		416,937,112	
Total investments at market value		$2,561,095,710		$2,476,069,683
Total assets		$2,627,504,926		$2,540,298,474
Deferred outflows of resources related to pensions		709,618		813,903
Total accounts payable		-11,939,417		-10,406,447
Deferred inflows related to pensions		-104,071		-48,519
Net assets at market value		**$2,616,171,056**		**$2,530,657,411**
Net assets at actuarial value		**$2,635,557,447**		**$2,526,058,269**

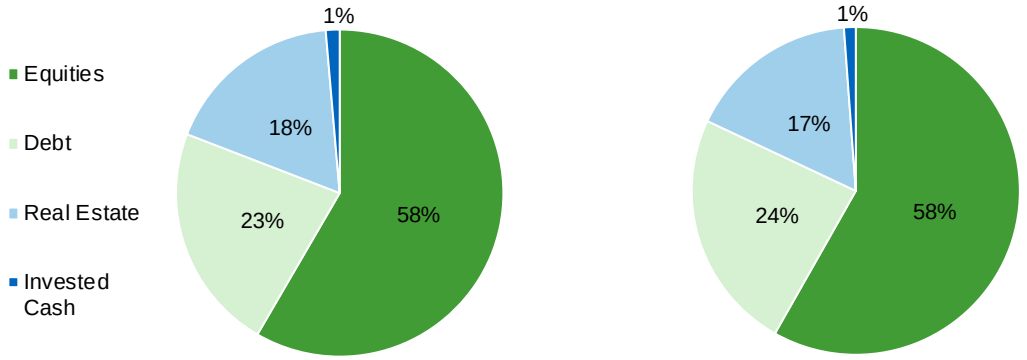


Exhibit G – Development of the Fund Through June 30, 2019

Year Ended June 30	Employer Contributions	Employee Contributions	Other Contributions	Net Investment Return*	Admin. Expenses	Benefit Payments	Market Value of Assets at Year-End**	Actuarial Value of Assets at Year-End	Actuarial Value as a Percent of Market Value
2010	$39,836,646	$36,848,481	$1,420,703	$179,059,473	($1,902,796)	($127,029,394)	$1,437,949,843	$1,841,960,220	128.1%
2011	44,545,433	38,869,260	1,508,557	332,952,526	(2,003,705)	(129,646,302)	1,726,179,317	1,822,598,871	105.6%
2012	46,126,193	40,254,562	2,427,849	(23,108,500)	(1,596,976)	(137,729,762)	1,654,149,659	1,748,080,771	105.7%
2013	59,352,860	53,824,557	2,671,931	218,581,671	(1,623,638)	(148,996,718)	1,839,583,960	1,762,321,644	95.8%
2014	62,355,146	56,554,767	2,082,055	292,660,404	(1,586,045)	(162,259,276)	2,090,977,056	1,940,473,504	92.8%
2015	78,422,098	72,268,451	1,773,213	73,204,806	(1,923,392)	(172,239,433)	2,141,920,800	2,125,017,451	99.2%
2016	82,839,932	76,342,685	2,813,211	8,238,996	(1,851,656)	(185,968,680)	2,124,335,288	2,229,292,988	104.9%
2017	86,058,868	79,309,153	2,789,090	266,688,651	(2,173,431)	(196,516,544)	2,360,491,075	2,379,811,205	100.8%
2018	86,675,715	79,877,611	2,375,134	211,345,369	(2,128,794)	(207,978,699)	2,530,657,411	2,526,058,269	99.8%
2019	89,444,881	82,429,594	2,075,500	135,043,319	(2,251,083)	(221,228,566)	2,616,171,056	2,635,557,447	100.7%

* On a market basis, net of investment fees; for 2010 and 2015-2019, net of investment fees and administrative expenses

** The market value of assets as of June 30, 2014 was restated by ($561,999) due to GASB 68 implementation. The restated amount is $2,090,415,057.

Exhibit H – Definition of Pension Terms

The following list defines certain technical terms for the convenience of the reader:

Actuarial Accrued Liability for Actives:	The value of all projected benefit payments for current members less the portion that will be paid by future normal costs.
Actuarial Accrued Liability for Pensioners:	The single-sum value of lifetime benefits to existing pensioners. This sum takes into account life expectancies appropriate to the ages of the pensioners and the interest that the sum is expected to earn before it is entirely paid out in benefits.
Actuarial Cost Method:	A procedure allocating the Actuarial Present Value of Future Benefits to various time periods; a method used to determine the Normal Cost and the Actuarial Accrued Liability that are used to determine the Actuarially Determined Contribution (ADC).
Actuarial Gain or Loss:	A measure of the difference between actual experience and expected based upon a set of Actuarial Assumptions, during the period between two Actuarial Valuation dates. Through the actuarial assumptions, rates of decrements, rates of salary increases, and rates of fund earnings have been forecasted. To the extent that actual experience differs from that assumed, Actuarial Accrued Liabilities emerge that may be the same as forecasted, or may be larger or smaller than projected. Actuarial gains are due to favorable experience, e.g., assets earn more than projected, salary increases are less than assumed, members retire later than assumed, etc. Favorable experience means actual results produce actuarial liabilities not as large as projected by the actuarial assumptions. On the other hand, actuarial losses are the result of unfavorable experience, i.e., actual results yield actuarial liabilities that are larger than projected. Actuarial gains will shorten the time required for funding the actuarial balance sheet deficiency while actuarial losses will lengthen the funding period.
Actuarially Equivalent:	Of equal actuarial present value, determined as of a given date and based on a given set of Actuarial Assumptions.
Actuarial Present Value (APV):	The value of an amount or series of amounts payable or receivable at various times, determined as of a given date by the application of a particular set of Actuarial Assumptions. Each such amount or series of amounts is: a. Adjusted for the probable financial effect of certain intervening events (such as changes in compensation levels, marital status, etc.) b. Multiplied by the probability of the occurrence of an event (such as survival, death, disability, withdrawal, etc.) on which the payment is conditioned, and c. Discounted according to an assumed rate (or rates) of return to reflect the time value of money.

Actuarial Present Value of Future Plan Benefits:	The Actuarial Present Value of benefit amounts expected to be paid at various future times under a particular set of Actuarial Assumptions, taking into account such items as the effect of advancement in age, anticipated future compensation, and future service credits. The Actuarial Present Value of Future Plan Benefits includes the liabilities for active members, retired members, beneficiaries receiving benefits, and inactive members entitled to either a refund or a future retirement benefit. Expressed another way, it is the value that would have to be invested on the valuation date so that the amount invested plus investment earnings would provide sufficient assets to pay all projected benefits and expenses when due.
Actuarial Valuation:	The determination, as of a valuation date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets, and related Actuarial Present Values for a plan. An Actuarial Valuation for a governmental retirement system typically also includes calculations of items needed for compliance with GASB, such as the Actuarially Determined Contribution (ADC) and the Net Pension Liability (NPL).
Actuarial Value of Assets (AVA):	The value of the Fund's assets as of a given date, used by the actuary for valuation purposes. This may be the market or fair value of plan assets, but commonly plans use a smoothed value in order to reduce the year-to-year volatility of calculated results, such as the funded ratio and the ADC.
Actuarially Determined:	Values that have been determined utilizing the principles of actuarial science. An actuarially determined value is derived by application of the appropriate actuarial assumptions to specified values determined by provisions of the law.
Actuarially Determined Contribution (ADC):	The employer's periodic required contributions, expressed as a dollar amount or a percentage of covered plan compensation, determined under the Plan's funding policy. The ADC consists of the Employer Normal Cost and the Amortization Payment.
Amortization Method:	A method for determining the Amortization Payment. The most common methods used are level dollar and level percentage of payroll. Under the Level Dollar method, the Amortization Payment is one of a stream of payments, all equal, whose Actuarial Present Value is equal to the UAAL. Under the Level Percentage of Pay method, the Amortization Payment is one of a stream of increasing payments, whose Actuarial Present Value is equal to the UAAL. Under the Level Percentage of Pay method, the stream of payments increases at the assumed rate at which total covered payroll of all active members will increase.
Amortization Payment:	The portion of the pension plan contribution, or ADC, that is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.

Assumptions or Actuarial Assumptions:	The estimates upon which the cost of the Fund is calculated, including: a. Investment return - the rate of investment yield that the Fund will earn over the long-term future; b. Mortality rates - the death rates of employees and pensioners; life expectancy is based on these rates; c. Retirement rates - the rate or probability of retirement at a given age; d. Withdrawal rates - the rates at which employees of various ages are expected to leave employment for reasons other than death, disability, or retirement; e. Salary increase rates - the rates of salary increase due to inflation and productivity growth.
Closed Amortization Period:	A specific number of years that is counted down by one each year and therefore declines to zero with the passage of time. For example, if the amortization period is initially set at 30 years, it is 29 years at the end of one year, 28 years at the end of two years, etc. See Open Amortization Period.
Decrements:	Those causes/events due to which a member's status (active-inactive-retiree-beneficiary) changes, that is: death, retirement, disability, or termination.
Defined Benefit Plan:	A retirement plan in which benefits are defined by a formula applied to the member's compensation and/or years of service.
Defined Contribution Plan:	A retirement plan, such as a 401(k) plan, a 403(b) plan, or a 457 plan, in which the contributions to the plan are assigned to an account for each member, the plan's earnings are allocated to each account, and each member's benefits are a direct function of the account balance.
Employer Normal Cost:	The portion of the Normal Cost to be paid by the employer. This is equal to the Normal Cost less expected member contributions.
Experience Study:	A periodic review and analysis of the actual experience of the Fund that may lead to a revision of one or more Actuarial Assumptions. Actual rates of decrement and salary increases are compared to the actuarially assumed values and modified as deemed appropriate by the Actuary.
Funded Ratio:	The ratio of the Actuarial Value of Assets (AVA) to the Actuarial Accrued Liability (AAL). Plans sometimes calculate a market funded ratio, using the market value of assets (MVA), rather than the AVA.

Funding Period or Amortization Period:	The term “Funding Period” is used in two ways. First, it is the period used in calculating the Amortization Payment as a component of the ADC. Second, it is a calculated item: the number of years in the future that will theoretically be required to amortize (i.e., pay off or eliminate) the Unfunded Actuarial Accrued Liability, based on the statutory employer contribution rate, and assuming no future actuarial gains or losses.
GASB:	Governmental Accounting Standards Board.
GASB 67 and GASB 68:	Governmental Accounting Standards Board (GASB) Statements No. 67 and No. 68. These are the governmental accounting standards that set the accounting rules for public retirement systems and the employers that sponsor or contribute to them. Statement No. 68 sets the accounting rules for the employers that sponsor or contribute to public retirement systems, while Statement No. 67 sets the rules for the systems themselves.
Investment Return:	The rate of earnings of the Fund from its investments, including interest, dividends and capital gain and loss adjustments, computed as a percentage of the average value of the fund. For actuarial purposes, the investment return often reflects a smoothing of the capital gains and losses to avoid significant swings in the value of assets from one year to the next.
Margin:	The difference, whether positive or negative, between the statutory employer contribution rate and the Actuarially Determined Contribution (ADC).
Net Pension Liability (NPL):	The Net Pension Liability is equal to the Total Pension Liability minus the Plan Fiduciary Net Position.
Normal Cost:	That portion of the Actuarial Present Value of pension plan benefits and expenses allocated to a valuation year by the Actuarial Cost Method. Any payment with respect to an Unfunded Actuarial Accrued Liability is not part of Normal Cost (see Amortization Payment). For pension plan benefits that are provided in part by employee contributions, Normal Cost refers to the total of employee contributions and employer Normal Cost unless otherwise specifically stated. Under the entry age normal cost method, the Normal Cost is intended to be the level cost (when expressed as a percentage of pay) needed to fund the benefits of a member form hire until ultimate termination, death, disability, or retirement.
Open Amortization Period:	An open amortization period is one that is used to determine the Amortization Payment, but which does not change over time. If the initial period is set as 30 years, the same 30-year period is used in determining the Amortization Period each year. In theory, if an Open Amortization Period with level percentage of payroll is used to amortize the Unfunded Actuarial Accrued Liability, the UAAL will never decrease, but will become smaller each year, in relation to covered payroll, if the Actuarial Assumptions are realized.
Plan Fiduciary Net Position:	Market value of assets.
Real Rate of Return:	Nominal rate of return on investments, adjusted for inflation.

Total Pension Liability (TPL):	The actuarial accrued liability under the entry age normal cost method and based on the blended discount rate as described in GASB 67 and 68.
Unfunded Actuarial Accrued Liability (UAAL):	The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets. This value may be negative, in which case it may be expressed as a negative Unfunded Actuarial Accrued Liability, also called the Funding Surplus.
Valuation Date or Actuarial Valuation Date:	The date as of which the value of assets is determined and as of which the Actuarial Present Value of Future Plan Benefits is determined. The expected benefits to be paid in the future are discounted to this date.

Section 4: Actuarial Valuation Basis

Exhibit I – Actuarial Assumptions and Actuarial Cost Method

Investment Return Rate:

7.75% per annum, compounded annually, equal to an assumed 2.75% inflation rate plus a 5.50% real rate of return, less 0.50% for expected investment expenses. (Adopted effective July 1, 2015).

Mortality Rates:

The mortality rates were based on historical and current demographic data, as used in the experience study dated April 30, 2015. The underlying tables reasonably reflect the mortality experience of the Fund as of the measurement date.

Post-Retirement Non-Disabled:

RP-2014 Healthy Annuitant Mortality Table set back one year, multiplied by 50% for ages under 75 and grading up to 100% by age 80, projected generationally using Scale MP-2014. (Adopted effective July 1, 2015). Sample 2014 mortality rates are as follows:

Age	Male	Female
50	0.20%	0.14%
55	0.27%	0.17%
60	0.37%	0.24%
65	0.51%	0.37%
70	0.77%	0.58%
75	1.22%	0.95%
80	3.62%	2.82%
85	6.93%	5.40%
90	12.15%	9.56%
95	20.11%	16.30%
100	29.38%	25.11%

The mortality tables are adjusted forward from 2014 using a generational projection to reflect future mortality improvement.

Post-Retirement Disabled:

RP-2014 Disabled Mortality Table set forward 4 years. (Adopted effective July 1, 2015).

Pre-Retirement Non-Disabled:

RP-2014 Employee Mortality Table, projected generationally using Scale MP-2014. (Adopted effective July 1, 2015).

Retirement Rates:

The following rates of retirement are assumed for members eligible to retire. (Adopted effective July 1, 2015).

	Unreduced Retirement*		Reduced Retirement
Age	Male	Female	Male/Female
50-54	15.00%	15.00%	
55-57	15.00%	15.00%	2.00%
58	15.00%	15.00%	3.00%
59	15.00%	15.00%	3.50%
60	15.00%	15.00%	4.00%
61	25.00%	25.00%	6.50%
62	35.00%	35.00%	9.00%
63	25.00%	30.00%	12.00%
64	35.00%	40.00%	12.00%
65	40.00%	50.00%	
66	30.00%	40.00%	
67	30.00%	30.00%	
68	25.00%	30.00%	
69	25.00%	30.00%	
70-74	25.00%	25.00%	
75	100.00%	100.00%	

*If a member reaches eligibility for unreduced retirement before age 65 under the rule of 85 (Grandfathered Tier 1) or the Rule of 90/Age 60 (Non-grandfathered Tier 1 and Tier 2), 10% is added to the rate at the age (and only this age) the member becomes first eligible for an unreduced retirement benefit.

Disability Rates:

Shown below for selected ages. (Adopted effective July 1, 2010).

Age	Rates
20	0.011%
25	0.011%
30	0.011%
35	0.011%
40	0.033%
45	0.055%
50	0.088%
55	0.154%
60	0.297%

Termination Rates:

Termination rates based on years of service, for causes other than death, disability, or retirement. (Adopted effective July 1, 2015).

Years from Hire	Male	Female	Years from Hire	Male	Female
0	20.00%	20.00%	10	2.50%	2.50%
1	14.00%	12.00%	11	2.00%	2.50%
2	11.00%	9.00%	12	2.00%	2.50%
3	8.00%	7.00%	13	2.00%	2.50%
4	6.50%	6.00%	14	2.00%	2.50%
5	5.00%	5.00%	15-18	1.50%	2.00%
6	4.00%	4.00%	19	0.75%	2.00%
7	3.50%	3.50%	20-24	0.75%	1.50%
8	3.00%	3.00%	25 & over	0.75%	0.75%
9	2.50%	2.50%			

Termination rates eliminated at first retirement eligibility

Salary Increase Rates:

Inflation rate of 2.75% plus productivity increase rate of 1.50%, plus step-rate/promotional increase as shown below. (Adopted effective July 1, 2015).

Years from Hire	Annual Step-Rate Promotional Component	Annual Total Salary Increase
0	10.25%	14.50%
1	3.50	7.75
2	3.25	7.50
3	3.00	7.25
4	2.75	7.00
5	2.50	6.75
6	2.25	6.50
7	2.00	6.25
8-9	1.75	6.00
10-11	1.50	5.75
12-13	1.25	5.50
14-15	1.00	5.25
16-18	0.75	5.00
19-22	0.50	4.75
23-24	0.25	4.50
25 & over	0.00	4.25

Payroll Growth Rate:

3.25% per annum. This assumption does not include any allowance for future increase in the number of members. (Adopted effective July 1, 2010).

Percent Married:

For valuation purposes, 75% of members are assumed to be married. Male members are assumed to be three years older than their spouses, and female members are assumed to be three years younger than their spouses. (Adopted effective July 1, 1992).

Percent Electing a Deferred Termination Benefit:

Terminating members are assumed to elect the most valuable benefit at the time of termination. Termination benefits are assumed to commence at the first age at which unreduced benefits are available. (Adopted effective July 1, 1990).

Loading Factor for New Retirees:	The liability includes a 3% load for members who retired during the year ended June 30, 2019, to reflect that their benefits are not finalized as of the valuation date.
Annual Administrative Expenses:	Administrative expenses of $2,312,987 (actual expenses for the previous year, increased with inflation) are expected to be paid monthly for the year beginning July 1, 2019.
Asset Valuation Method:	The actuarial value of assets is based on the market value of assets with a five-year phase-in of actual investment return in excess of (or less than) expected investment income. Expected investment income is determined using the assumed investment return rate and the market value of assets (adjusted for receipts and disbursements during the year). The actual investment return for this purpose is determined net of all investment expenses. The actuarial value is further adjusted, if necessary, to be within 20% of the market value.
Actuarial Cost Method:	Normal cost and actuarial accrued liability are calculated on an individual basis and are allocated by salary. Entry age is determined as the age at member's enrollment in TFFR. The actuarial accrued liability is the difference between the total present value of future benefits and the actuarial present value of future normal costs. The unfunded actuarial accrued liability (UAAL) is the excess of the actuarial accrued liability over the actuarial value of assets.
Amortization Period and Method:	The actuarially determined contribution (ADC) is determined as the sum of (a) the employer normal cost rate, and (b) a level percentage of payroll required to amortize the unfunded actuarial accrued liability over the 30-year closed period that began July 1, 2013.

Exhibit II – Summary of Plan Provisions

This exhibit summarizes the major provisions of the Plan included in the valuation. It is not intended to be, nor should it be interpreted as, a complete statement of all plan provisions.

<table>
<tr><td>Effective Date:</td><td>July 1, 1971</td></tr>
<tr><td>Plan Year:</td><td>July 1 through June 30</td></tr>
<tr><td>Administration:</td><td>The Teachers' Fund for Retirement (TFFR) is administrated by a Board of Trustees. A separate State Investment Board is responsible for the investment of the trust assets, although TFFR's Board establishes the asset allocation policy. The Retirement and Investment Office is the administrative agency for TFFR.</td></tr>
<tr><td>Type of Plan:</td><td>TFFR is a qualified governmental defined benefit retirement plan. For Governmental Accounting Standards Board purposes, it is a cost-sharing multiple-employer public employee retirement system.</td></tr>
<tr><td>Eligibility:</td><td>All certified teachers of any public school in the State participate in TFFR. This includes teachers, supervisors, principals, administrators, etc. Non-certified employees such as teacher's aides, janitors, secretaries, drivers, etc. are not allowed to participate in TFFR. Eligible employees become members at their date of employment.</td></tr>
<tr><td>Member Contributions:</td><td>All active members contribute 11.75% of their salary per year. The employer may "pick up" the member's contribution under the provisions of Internal Revenue Code Section 414(h). The member contribution rate was increased from 7.75% to 9.75% effective July 1, 2012, and was increased to 11.75% effective July 1, 2014. The total addition of 4.00% to the member contribution rate will remain in effect until TFFR is 100% funded on an actuarial basis. At that point, the member contribution rate will revert to 7.75%.</td></tr>
<tr><td>Salary:</td><td>A member's total earnings are used for salary purposes, including overtime, etc., and including nontaxable wages under a Section 125 plan, but excluding certain extraordinary compensation, such as fringe benefits or unused sick and vacation leave.</td></tr>
<tr><td>Employer Contributions:</td><td>The district or other employer that employs a member contributes a percentage of the member's salary. This percentage consists of a base percentage of 7.75%, plus, since July 1, 2008, additions as shown below.
<table>
<tr><th>Effective Date</th><th>Addition to 7.75% Base Rate</th><th>Employer Contribution Rate</th></tr>
<tr><td>July 1, 2008</td><td>0.50%</td><td>8.25%</td></tr>
<tr><td>July 1, 2010</td><td>1.00%</td><td>8.75%</td></tr>
<tr><td>July 1, 2012</td><td>3.00%</td><td>10.75%</td></tr>
<tr><td>July 1, 2014</td><td>5.00%</td><td>12.75%</td></tr>
</table>
However, the additions are subject to a "sunset" provision, so the contribution rate will revert to 7.75% once the funded ratio reaches 100%, measured using the actuarial value of assets. The contribution rate will not automatically increase if the funded ratio later falls back below 100%.</td></tr>
</table>

Service:	Employees receive credit for service while a member. A member may also purchase credit for certain periods, such as time spent teaching at a public school in another state, by paying the actuarially determined cost of the additional service. Special rules and limits govern the purchase of additional service.
Tiers:	Members who join TFFR by June 30, 2008 are in Tier 1, while members who join later are in Tier 2. If a Tier 1 member terminates, takes a refund, and later rejoins TFFR after June 30, 2008, that member will be in Tier 2. As of June 30, 2013, Tier 1 members who are at least age 55 and vested (3 years of service) as of the effective date, or the sum of the member's age and service is at least 65, are considered Grandfathered, and previous plan provisions will not change. Tier 1 members who do not fit these criteria as of June 30, 2013, are considered Non-grandfathered. These members, along with Tier 2, have new plan provisions, as described below.
Final Average Compensation (FAC):	The average of the member's highest three (Tier 1 members) or five (Tier 2 members) plan year salaries. Monthly benefits are based on one-twelfth of this amount.
Normal Retirement:	a. Eligibility: • Tier 1 members may retire upon Normal Retirement on or after age 65 with credit for 3 years of service, or if earlier, when the sum of the member's age and service is at least 85. Effective as of June 30, 2013, Tier 1 members who are at least age 55 and vested (3 years of service) as of the effective date, or the sum of the member's age and service is at least 65, normal retirement eligibility will not change (participants are Grandfathered). For those who did not meet these criteria as of June 30, 2013 (Non-grandfathered), members may retire upon Normal Retirement on or after age 65 with credit for 3 years of service, or if earlier, when the sum of the member's age and service is at least 90, with a minimum age of 60. • Tier 2 members may retire upon Normal Retirement on or after age 65 with credit for 5 years of service, or, if earlier, when the sum of the member's age and service is at least 90. Effective July 1, 2013, Tier 2 members may retire upon Normal Retirement on or after age 65 with credit for 5 years of service, or if earlier, when the sum of the member's age and service is at least 90, with a minimum age of 60. b. Monthly Benefit: 2.00% of FAC (monthly) times years of service. c. Payment Form: Benefits are paid as a monthly life annuity, with a guarantee that if the payments made do not exceed the member's contributions plus interest, determined as of the date of retirement, the balance will be paid in a lump-sum to the member's beneficiary. Optional forms of payment are available; see below.

Early Retirement:	a. Eligibility: Tier 1 members may retire early after reaching age 55 with credit for three years of service, while Tier 2 members may retire early after reaching age 55 with credit for five years of service. b. Monthly Benefit: 2.00% of FAC (monthly) times years of service, multiplied by a factor that reduces the benefit 6% for each year from the earlier of (i) age 65, or (ii) the age at which current service plus age equals 85 (Tier 1 members) or 90 (Tier 2 members). Effective July 1, 2013 for members who are either Non-grandfathered Tier 1 or Tier 2: 2.00% of FAC (monthly) times years of service, multiplied by a factor that reduces the benefit 8% for each year from the earlier of (i) age 65, or (ii) the age at which current service plus age equals 90 with a minimum age of 60. c. Payment Form: Same as for Normal Retirement above.
Disability Retirement:	a. Eligibility: A member is eligible provided he/she has credit for at least one year of service. Effective July 1, 2013, a member is eligible provided he/she has credit for at least five years of service. b. Monthly Benefit: 2.00% of FAC (monthly) times years of service with a minimum 20 years of service. Effective July 1, 2013, 2.00% of FAC (monthly) times years of service. c. Payment Form: The disability benefit commences immediately upon the member's retirement. Benefits cease upon recovery or reemployment. Disability benefits are payable as a monthly life annuity with a guarantee that, at the member's death, the sum of the member's contributions plus interest as of the date of retirement that is in excess of the sum of payments already received will be paid in a lump sum to the member's beneficiary. d. All alternative forms of payment other than level income and the partial lump-sum option are also permitted in the case of disability retirement. For basis recovery only, disability benefits are converted to normal retirement benefits when the member reaches normal retirement age or age 65, whichever is earlier.
Deferred Termination Benefit:	a. Eligibility: A Tier 1 member with at least three years of service, or a Tier 2 member with at least five years of service, who does not withdraw his/her contributions from the fund, is eligible for a deferred termination benefit. b. Monthly Benefit: 2.00% of FAC (monthly) times years of service. Both FAC and service are determined at the time the member leaves active employment. Benefits may commence unreduced at age 65 or when the sum of the member’s age and service is 85 (Grandfathered Tier 1 members) or 90 with a minimum age of 60 (Non-grandfathered Tier 1 and Tier 2 members). Reduced benefits may commence at or after age 55 if the member is not eligible for an unreduced benefit. Reductions are the same as for Early Retirement. c. Payment Form: The form of payment is the same as for Normal Retirement above. d. Death Benefit: A member who dies after leaving active service but before retiring is entitled to receive a benefit as described below.
Withdrawal (Refund) Benefit:	a. Eligibility: Tier 1 members leaving covered employment with less than three years of service, and Tier 2 members leaving covered employment with less than five years of service, are eligible. Optionally, vested members may withdraw their contributions plus interest in lieu of the deferred benefits otherwise due. b. Benefit: The member who withdraws receives a lump-sum payment of his/her employee contributions, plus the interest credited on these contributions. Interest is credited at 6% per year prior to benefit commencement (0.5% per month).

Death Benefit:	a. Eligibility: Death must have occurred while an active or an inactive, non-retired member. b. Benefit: Upon the death of a nonvested member, a refund of the member's contributions and interest is paid. Upon the death of a vested member, the beneficiary may elect (i) the refund benefit above, or (ii) a life annuity of the normal retirement benefit, determined under Option One below, based on FAC and service as of the date of death, but without applying any reduction for the member's age at death. In determining the reduction for Option One, members not eligible for normal retirement benefits use the Fund's option tables for disabled members.
Optional Forms of Payment:	There are optional forms of payment available on an actuarially equivalent basis, as follows: Option 1 - A life annuity payable while either the participant or his beneficiary is alive, "popping-up" to the original life annuity if the beneficiary predeceases the member. Option 2 - A life annuity payable to the member while both the member and beneficiary are alive, reducing to 50% of this amount if the member predeceases the beneficiary, and "popping-up" to the original life annuity if the beneficiary predeceases the member. Option 3a - A life annuity payable to the member, with a guarantee that, should the member die prior to receiving 60 payments (five years), the payments will be continued to a beneficiary for the balance of the five-year period. (This option has been replaced by Option 3b. It is not available to employees who retire on or after August 1, 2003. Retirees who elected this option prior to that date are unaffected.) Option 3b - A life annuity payable to the member, with a guarantee that, should the member die prior to receiving 240 payments (twenty years), the payments will be continued to a beneficiary for the balance of the twenty-year period. (This option replaced Option 3a effective August 1, 2003.) Option 4 - A life annuity payable to the member, with a guarantee that, should the member die prior to receiving 120 payments (10 years), the payments will be continued to a beneficiary for the balance of the ten-year period. Option 5 - A non-level annuity payable to the member, designed to provide a level total income when combined with the member's Social Security benefit. This option is not available to disabled retirees. In addition, members may elect a partial lump-sum option (PLSO) at retirement. Under this option, a member receives an immediate lump sum equal to 12 times the monthly life annuity benefit and a reduced annuity. The reduction is determined actuarially. The member can then elect to receive the annuity benefit in one of the other optional forms, except that members who receive a PLSO may not elect Option 5 – the level income option. The PLSO is not available to disabled retirees or retirees who are not eligible for an unreduced retirement benefit. Actuarial equivalence is based on tables adopted by the Board of Trustees.
Cost-of-living Increase:	From time to time, TFFR has been amended to grant certain post-retirement benefit increases. However, TFFR has no automatic cost-of-living increase features.

Exhibit III – Summary of Plan Changes

1991 Legislative Sessions:

1. Benefit multiplier increased form 1.275% to 1.39% for all future retirees.
2. Provide a post retirement benefit increases for all annuitants receiving a monthly benefit on June 30, 1991. The monthly increase is the greater of a 10% increase or a level increase based on years of service and retirement date:
    a. $3 per year of service for retirements before 1980
    b. $2 per year of service for retirements between 1980 and 1983
    c. $1 per year of service for retirements from 1984 through June 30, 1991

    Minimum increase is $5 per month. Maximum increase is $75 per month

1993 Legislative Session:

1. Benefit multiplier increased from 1.39% to 1.55% for all future retirees.
2. Provide a post-retirement benefit increase for all annuitants receiving a monthly benefit on June 30, 1993. The monthly increase is the greater of a 10% increase or a level increase based on years of service and retirement date:
    a. $3 per year of service for retirements before 1980
    b. $2.50 per year of service for retirements between 1980 and 1983
    c. $1 per year of service for retirements from 1984 through June 30, 1993

    Minimum increase is $5 per month. Maximum increase is $100 per month.
3. Minimum retirement benefit increased to $10 times years of service up to 25, plus $15 times years of service greater than 25. (Previously was $6 up to 25 years of service plus $7.50 over 25 years of service.)
4. Disability benefit changed to 1.55% of FAC times years of service using a minimum of 20 years of service.

1995 Legislative Session:

There were no material changes made during the 1995 legislative session.

1997 Legislative Session:

1. Benefit multiplier increased from 1.55% to 1.75% for all future retirees.
2. Member contribution rate and employer contribution rate increased from 6.75% to 7.75%.
3. A $30.00/month benefit improvement was granted to all retirees and beneficiaries.

1999 Legislative Session:

1. Active members will now be fully vested after three years (rather than five years) of service.
2. Early retirement benefits will be reduced 6% per year from the earlier of (i) age 65, or (ii) the date as of which age plus service equals 85 (rather than from age 65 in all cases).
3. An ad hoc COLA was provided for all retirees and beneficiaries. This increase is equal to an additional $2.00 per month for each year of service plus $1.00 per month for each year since the member's retirement.
4. The formula multiplier was increased from 1.75% to 1.88% effective July 1, 1999.

2001 Legislative Session:

1. An ad hoc COLA was provided for all retirees and beneficiaries. The ad hoc COLA increase is equal to an additional $2.00 per month for each year of service plus $1.00 per month for each year since the member's retirement. Retirees and beneficiaries will also receive two additional increases equal to 0.75% times the monthly benefit, payable July 1, 2001 and July 1, 2002. The two 0.75% increases are conditional. If the actuarial margin is a shortfall, i.e., is negative, by 60 basis points or more, or if the margin has been negative by 30 or more basis points for two years, the Board could elect to suspend the increase.
2. The formula multiplier was increased from 1.88% to 2.00% effective July 1, 2001.

2003 Legislative Session:

1. Partial lump-sum option adopted, equal to twelve times the monthly life annuity benefit. Not available if level-income option is elected. Not available for reduced retirement or disability retirement.
2. Five-year certain and life option replaced with 20-year certain and life. This does not impact retirees who retired under the five-years certain and life option.
3. Employer service purchase authorized.
4. Active members of the Department of Public Instruction are permitted to make a one-time irrevocable election to transfer to the State Public Employees Retirement System in FY 2004. Both assets and liabilities for all TFFR service will be transferred for electing employees. Transferred assets will be based on the actuarial present value of the member's accrued TFFR benefit, or the member's contribution account balance if larger.

2005 Legislative Session:

There were no material changes made during the 2005 legislative sessions.

2007 Legislative Session:

1. For active members hired on or after July 1, 2008 (called Tier 2 members):
    a. Members will be eligible for an unreduced retirement benefit when they reach age 65 with at least five years of service (rather than three years of service); or if earlier, when the sum of the member's age and service is at least 90 (rather than 85).
    b. Members will be eligible for a reduced (early) retirement benefit when they reach age 55 with five years of service, rather than three years of service.
    c. Members will be fully vested after five years of service (rather than three year of service).
    d. The Final Average Compensation for Tier 2 members is the average of the member's highest five plan year salaries, rather than the average of the three highest salaries.
2. The employer contribution rate increases from 7.75% to 8.25% effective July 1, 2008, but this rate will be reset to 7.75% once the Fund reaches a 90% funded ratio, measured using the actuarial value of assets. (If the funded ratio later falls below 90% again, the contribution rate will not automatically return to 8.25%.)
3. Employer contributions are required on the salary of reemployed retirees.
4. Active members of the Department of Career and Technical Education are permitted to make a one-time irrevocable election to transfer to the State Public Employees Retirement System in FY 2008. Both assets and liabilities for all TFFR service will be transferred for electing employees. Transferred assets will be the actuarial present value of the member's accrued TFFR benefit, or the member's contribution account balance, if larger.

2009 Legislative Session:

1. An individual who retired before January 1, 2009, and is receiving monthly benefits is entitled to receive a supplemental payment from the fund. The supplemental payment is equal to an amount determined by taking twenty dollars multiplied by the member's number of years of service credit plus fifteen dollars multiplied by the number of years since the member's retirement as of January 1, 2009. The supplemental payment may not exceed the greater of 10% of the member's annual annuity or $750.00. TFFR will make the supplemental payment in December 2009.
2. The employer contribution rate increases from 8.25% to 8.75% effective July 1, 2010, but this rate will be reset to 7.75% once the Fund reaches a 90% funded ratio, measured using the actuarial value of assets. (If the funded ratio later falls below 90% again, the contribution rate will not automatically return to 8.75%.)

2011 Legislative Session:

1. The employer contribution rate increases from 8.75% to 10.75% effective July 1, 2012, and increases thereafter to 12.75% effective July 1, 2014. The member contribution rate increases from 7.75% to 9.75% effective July 1, 2012, and increases thereafter to 11.75% effective July 1, 2014. Employer and member contributions will be reset to 7.75% once the Fund reaches a 90% funded ratio, measured using the actuarial value of assets.
2. For current Tier 1 members who, as of June 30, 2013, are vested (at least 3 years of service), and at least age 55, OR the sum of the member's age and service is at least 65, are considered a Tier 1 Grandfathered member. Current Tier 1 members, who will not meet this criteria as of June 30, 2013, are considered a Tier 1 Non-grandfathered member.
3. Eligibility for normal/ unreduced retirement benefits do not change for Tier 1 Grandfathered members. For Tier 1 Non-grandfathered and Tier 2 members, effective after June 30, 2013, unreduced retirement benefits start when the member reaches age 65 and is vested (3 years for Tier 1 Non-grandfathered, 5 years for Tier 2); or if earlier, when the sum of the member's age and service is at least 90, with a minimum age of 60.
4. Early retirement benefits do not change for Tier 1 Grandfathered members. For Tier 1 Non-grandfathered and Tier 2 members, effective after June 30, 2013, the normal retirement benefit will be reduced by 8% per year from the earlier of age 65 OR the age at which the sum of the member's age and service is at least 90, with a minimum age of 60.
5. Effective after June 30, 2013, all members may retire on disability after a period of at least five years of service (rather one year of service). The amount of the benefit is based on a 2% multiplier and actual service (rather than a minimum of twenty years of service in the current calculation).
6. Effective July 1, 2012, re-employed retirees are required to pay member contributions.
7. Effective August 1, 2011, beneficiary and death benefit provisions were updated, and the 60-month death payment benefit was removed.

2013 Legislative Session:

1. Employer and member contribution rates will be reset to 7.75% once the Fund reaches a 100% funded ratio (rather than the 90% funded ratio enacted with the 2011 Legislation), measured using the actuarial value of assets.
2. Various technical and administrative changes that do not have an actuarial effect on the Plan were enacted.

2015 Legislative Session:

1. Various technical and administrative changes that do not have an actuarial effect on the Plan were enacted.

2017 Legislative Session:

There were no material changes made during the 2017 legislative sessions.

2019 Legislative Session:

There were no material changes made during the 2019 legislative sessions.

Section 5: GASB Information

Exhibit 1 – Net Pension Liability

The components of the net pension liability at were as follows:

	July 1, 2019	July 1, 2018
Total pension liability	$3,993,424,160	$3,863,515,726
Plan fiduciary net position	(2,616,171,056)	(2,530,657,411)
Net pension liability	$1,377,253,104	$1,332,858,315
Plan fiduciary net position as a percentage of the total pension liability	65.5%	65.5%

The net pension liability was measured as of June 30, 2019, and is determined based on the total pension liability from the July 1, 2019, actuarial valuation.

Plan provisions. The plan provisions used in the measurement of the net pension liability are the same as those used in the actuarial valuation as of July 1, 2019.

Actuarial assumptions. The total pension liability was determined by an actuarial valuation as of July 1, 2019, using the following actuarial assumptions, applied to all periods included in the measurement:

Inflation	2.75%
Salary increases	4.25% to 14.50%, varying by service, including inflation and productivity
Investment rate of return	7.75%, net of pension plan investment expense, including inflation
Cost-of-living adjustments	None

For active and inactive members, mortality rates were based on the RP-2014 Employee Mortality Table, projected generationally using Scale MP-2014. For healthy retirees, mortality rates were based on the RP-2014 Healthy Annuitant Mortality Table set back one year, multiplied by 50% for ages under 75 and grading up to 100% by age 80, projected generationally using Scale MP-2014. For disabled retirees, mortality rates were based on the RP-2014 Disabled Mortality Table set forward four years.

The actuarial assumptions used were based on the results of an experience study dated April 30, 2015. They are the same as the assumptions used in the July 1, 2019 funding actuarial valuation.

The long-term expected rate of return on pension plan investments was determined using a building-block method in which best-estimate ranges of expected future real rates of return (expected returns, net of pension plan investment expense and inflation) are developed for each major asset class. These ranges are combined to produce the long-term expected rate of return by weighting the expected future real rates of return by the target asset allocation percentage and by adding expected inflation. Best estimates of arithmetic real rates of return for each major asset class included in the pension plan's target asset allocation as of July 1, 2019, are summarized in the following table:

Asset Class	Target Allocation	Long-Term Expected Real Rate of Return*
Global Equities	58%	6.9%
Global Fixed Income	23%	2.1%
Global Real Assets	18%	5.4%
Cash Equivalents	1%	0.0%
Total	100%	

*As reported by the North Dakota Retirement and Investment Office.

Discount rate: The long-term expected rate of return on pension plan investments is 7.75%. The high quality tax-exempt general obligation municipal bond rate (20-Bond GO Index) as of the closest date prior to the valuation date of June 30, 2019, is 3.50%, as published by The Bond Buyer.

The discount rate used to measure the total pension liability was 7.75% as of June 30, 2019. The projection of cash flows used to determine the discount rate assumed plan member and employer contributions will be made at rates equal to those based on this July 1, 2019, Actuarial Valuation Report. For this purpose, only employer contributions that are intended to fund benefits of current plan members and their beneficiaries are included. Projected employer contributions that are intended to fund the service costs of future plan members and their beneficiaries, as well as projected contributions from future plan members, are not included. Based on those assumptions, the pension plan's fiduciary net position was projected to be available to make all projected future benefit payments of current plan members as of June 30, 2019 Therefore, the long-term expected rate of return on pension plan investments was applied to all periods of projected benefit payments to determine the total pension liability as of June 30, 2019.

Sensitivity of the net pension liability to changes in the discount rate. The following presents the net pension liability, calculated using the discount rate of 7.75%, as well as what the net pension liability would be if it were calculated using a discount rate that is one-percentage-point lower (6.75%) or one-percentage-point higher (8.75%) than the current rate:

	1% Decrease (6.75%)	Current Discount (7.75%)	1% Increase (8.75%)
Net pension liability as of June 30, 2016	$1,900,291,033	$1,465,058,563	$1,102,551,032
Net pension liability as of June 30, 2017	1,826,126,843	1,373,525,753	996,748,988
Net pension liability as of June 30, 2018	1,799,744,383	1,332,858,315	944,554,161
Net pension liability as of June 30, 2019	1,859,994,289	1,377,253,104	976,082,834

Exhibit 2 – Schedules of Changes in Net Pension Liability

	2019	2018
Total pension liability		
• Service cost	$77,755,965	$78,041,335
• Interest	296,875,949	287,375,333
• Change of benefit terms	0	0
• Differences between expected and actual experience	(23,494,914)	(27,939,071)
• Changes of assumptions	0	0
• Benefit payments, including refunds of employee contributions	(221,228,566)	(207,978,699)
Net change in total pension liability	**$129,908,434**	**$129,498,898**
Total pension liability – beginning	**3,863,515,726**	**3,734,016,828**
Total pension liability – ending (a)	**$3,993,424,160**	**$3,863,515,726**
Plan fiduciary net position		
• Contributions – employer	$89,444,881	$86,675,715
• Contributions – employee	82,429,594	79,877,611
• Contributions – purchased service credit	1,916,787	2,181,106
• Contributions – other	158,713	194,028
• Net investment income	135,043,319	211,345,369
• Benefit payments, including refunds of employee contributions	(221,228,566)	(207,978,699)
• Administrative expense	(2,251,083)	(2,128,794)
• Other	0	0
Net change in plan fiduciary net position	**85,513,645**	**170,166,336**
Plan fiduciary net position – beginning	**2,530,657,411**	**2,360,491,075**
Plan fiduciary net position – ending (b)	**$2,616,171,056**	**$2,530,657,411**
Net pension liability – ending (a) – (b)	**$1,377,253,104**	**$1,332,858,315**
Plan fiduciary net position as a percentage of the total pension liability	**65.5%**	**65.5%**
Covered payroll	**$701,528,450**	**$679,809,385**
Net pension liability as percentage of covered payroll	**196.3%**	**196.1%**

Exhibit 3 – Schedule of Employer Contributions

Fiscal Year Ended June 30	Actuarially Determined Contributions	Contributions in Relation to the Actuarially Determined Contributions	Contribution Deficiency (Excess)	Covered Payroll	Contributions as a Percentage of Covered Payroll
2013	$52,396,153	$59,300,720	($6,904,567)	$551,655,590	10.75%
2014	59,513,485	62,355,146	(2,841,661)	580,053,235	10.75%
2015	71,167,632	78,422,098	(7,254,466)	615,104,860	12.75%
2016	84,724,122	82,839,932	1,884,190	649,724,868	12.75%
2017	89,231,211	86,058,868	3,172,343	674,971,342	12.75%
2018	88,307,239	86,675,715	1,631,524	679,809,385	12.75%
2019	90,777,781	89,444,881	1,332,900	701,528,450	12.75%

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