Cavanaugh Macdonald
CONSULTING, LLC

The experience and dedication you deserve

Legislative Retirement System of North Carolina Principal Results of Actuarial Valuation as of December 31, 2019

October 29, 2020 Board of Trustees Meeting

Larry Langer, ASA, FCA, EA, MAAA
Jonathan Craven, ASA, FCA, EA, MAAA
Wendy Ludbrook, FSA, FCA, EA, MAAA

www.CavMacConsulting.com

Member Data

The table below provides a summary of the membership data used in this valuation compared to the prior valuation.

Number as of	12/31/2019	12/31/2018
Active Members	170	170
Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits	110	92
Retired members and survivors of deceased members currently receiving benefits	294	289
Total	574	551
Active Reported Compensation	3,575,706	3,556,426
Active Valuation Compensation	3,819,521	3,819,805
Annual Retirement Allowances	2,340,721	2,273,718

The number of retired members and survivors of deceased members currently receiving benefits increased by 1.73% from the previous valuation date.

A detailed summary of the membership data used in this valuation is provided in Section 3 and Appendix B.

Asset Data

The table below provides details of the Market Value of Assets for the current and prior year's valuations.

Asset Data as of	12/31/2019	12/31/2018
Beginning of Year Market Value of Assets	$ 26,543,448	$ 28,554,239
Employer Contributions	883,435	748,384
Employee Contributions	257,451	252,875
Benefit Payments other than Refunds	(2,364,330)	(2,384,758)
Refunds	(266,742)	(255,210)
Administrative Expense	(13,043)	(12,514)
Investment Income	3,759,836	(359,569)
Net Increase/(Decrease)	2,256,607	(2,010,791)
End of Year Value of Assets	$ 28,800,055	$ 26,543,448
Estimated Net Investment Return	14.58%	(1.30)%

LRS assets are held in trust and are invested for the exclusive benefit of plan members.

Over the long term, benefit payments and administrative expenses not covered by contributions are expected to be covered with investment income, illustrating the benefits of following actuarial pre-funding since inception.

A detailed summary of the market value of assets is provided in Section 4.

Net Actuarial Gain or Loss

Inputs
Membership Data
Asset Data
Benefit Provisions
Assumptions
Funding Methodology
↓
Results
Actuarial Value of Assets
Actuarial Accrued Liability
Net Actuarial Gain or Loss
Funded Ratio
Employer Contributions
Benefit Enhancement
Additional Disclosures
Projections

The table below provides a reconciliation of the prior year's unfunded actuarial accrued liability to the current year's unfunded actuarial accrued liability.

(in millions)	
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2018	$ 2.4
Normal Cost and Administrative Expense	1.0
Reduction due to Actual Contributions during 2019	(1.1)
Interest on UAAL, Normal Cost, and Contributions	0.1
Asset (Gain) / Loss	0.3
Actuarial Accrued Liability (Gain) / Loss	(0.5)
Impact of Assumption Changes	0.0
Impact of Legislative Changes	0.0
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2019	$ 2.2

The loss recognized in the actuarial value of assets increased the UAAL by $0.3 million, which was offset by an Actuarial Accrued Liability gain of $0.5 million.

A detailed summary of the net actuarial gain or loss is provided in Section 5.

Employer Contributions

The table below provides a reconciliation of the actuarially determined employer contribution.

Fiscal year ending June 30, 2021 Preliminary ADEC (Based on December 31, 2018 valuation)	27.30%
Impact of Legislative Changes	0.00%
Fiscal year ending June 30, 2021 ADEC for Reconciliation	27.30%
Change Due to Anticipated Reduction in UAAL	0.01%
Change due to Demographic (Gain)/Loss	-2.17%
Change due to Investment (Gain)/Loss	0.95%
Change Due to Contribution Experience	0.24%
Impact of Assumption Changes	0.00%
Impact of Direct Rate Smooothing	0.82%
Fiscal year ending June 30, 2022 Preliminary ADEC (based on December 31, 2019 valuation)	27.15%

The change in rate due to investment loss is based on the actuarial value of assets returns, which was less than the 7.00% assumed return.

A detailed summary of the actuarially determined employer contribution rates is provided in Section 6.

Key Takeaways

- Key results of the December 31, 2019 valuation were:
  - Market value returns of 14.58% compared to 7.00% assumed

- When compared to the December 31, 2018 actuarial valuation, the above resulted in:
  - Higher funded ratio (92.6% in the December 31, 2019 valuation compared to 92.0% in the December 31, 2018 valuation)
  - Lower actuarially determined employer contribution rate (27.15% for fiscal year ending June 30, 2022 compared to the contribution rate of 27.30% calculated in the December 31, 2018 valuation for fiscal year ending June 30, 2021)

Certification

Future actuarial measurements may differ significantly from current measurements due to plan experience differing from that anticipated by the economic and 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. Because of limited scope, Cavanaugh Macdonald performed no analysis of the potential range of such future differences, except for some limited analysis in financial projections or required disclosure information. Results prior to December 31, 2017 were provided by the prior consulting actuary.

We meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained in this report. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and we are available to answer questions about it.

Larry Langer, ASA, EA, FCA, MAAA
Principal and Consulting Actuary

Jonathan T. Craven, ASA, EA, FCA, MAAA
Consulting Actuary

Cavanaugh Macdonald
CONSULTING, LLC
The experience and dedication you deserve

North Carolina Legislative Retirement System

Report on the Actuarial Valuation Prepared as of December 31, 2019

October 2020

www.CavMacConsulting.com

Cavanaugh Macdonald
CONSULTING, LLC
The experience and dedication you deserve

October 7, 2020

Board of Trustees
Legislative Retirement System of
North Carolina
3200 Atlantic Avenue
Raleigh, NC 27604

Members of the Board:

We submit herewith our report on the actuarial valuation of the North Carolina Legislative Retirement System (referred to as "LRS" or the "Legislative Retirement System") prepared as of December 31, 2019. Information contained in our report for plan years prior to December 31, 2017 is based upon valuations performed by the prior actuary.

The primary purpose of the valuation report is to determine the required member and employer contribution rates, to describe the current financial condition of LRS and to analyze changes in such condition. In addition, the report provides information that the Office of the State Controller (OSC) requires for its Comprehensive Annual Financial Report (CAFR) and it summarizes census data. Use of this report for any other purposes or by anyone other than OSC and its auditors, or North Carolina Retirement System Division and Department of State Treasurer staff may not be appropriate and may result in mistaken conclusions because of failure to understand applicable assumptions, methods, or inapplicability of the report for that purpose. The attached pages should not be provided without a copy of this cover letter. Because of the risk of misinterpretation of actuarial results, you should ask Cavanaugh Macdonald Consulting (CMC) to review any statement you wish to make on the results contained in this report. CMC will not accept any liability for any such statement made without prior review.

The valuation is based upon membership data and financial information as furnished by the Retirement Systems Division and the Financial Operations Division and as summarized in this report. Although reviewed for reasonableness and consistency with the prior valuation, these elements have not been audited by CMC and we cannot certify as to the accuracy and completeness of the data supplied. Sometimes assumptions are made by CMC to interpret membership data that is imperfect. The valuation is also based on benefit and contribution provisions as presented in this report. If you have reason to believe that the plan provisions are incorrectly described, that important plan provisions relevant to this valuation are not described, or that conditions have changed since the calculations were made, you should contact the authors of this actuarial report prior to relying on this information.

The valuation is further based on the actuarial valuation assumptions, approved by the Board of Trustees, as presented in this report. We believe that these assumptions are appropriate and reasonable and also comply with the requirements of GASB Statement No. 67. We prepared this valuation in accordance with the requirements of this standard and in accordance with all applicable Actuarial Standards of Practice (ASOP).

3550 Busbee Pkwy, Suite 250, Kennesaw, GA 30144
Phone (678) 388-1700 • Fax (678) 388-1730
www.CavMacConsulting.com
Offices in Kennesaw, GA • Bellevue, NE

The assumptions used for the December 31, 2019 actuarial valuation are based on the experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016, as further updated to use a discount rate of 7.00% in conjunction with direct rate smoothing of the employer contribution rate, as adopted by the Board of Trustees on April 26, 2018. The economic assumptions with respect to investment yield, salary increase and inflation have been based upon a review of the existing portfolio structure as well as recent and anticipated experience.

Where presented, references to “funded ratio” and “unfunded accrued liability” typically are measured on an actuarial value of assets basis. It should be noted that the same measurements using market value of assets would result in different funded ratios and unfunded accrued liabilities. Moreover, the funded ratio presented is appropriate for evaluating the need and level of future contributions but makes no assessment regarding the funded status of the plan if the plan were to settle (i.e. purchase annuities) for a portion or all of its liabilities. In various places in the report the results also show funded ratios and unfunded liabilities based upon varying sets of assumptions as well as market values of assets as that is required for certain disclosure information required per accounting rules or statutes. Where this has been done it has been clearly indicated.

Future actuarial results may differ significantly from the current results presented in this report due to such factors as the following: fund experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; and changes in plan provisions or applicable law. Such changes in law may include additional costs resulting from future legislated benefit improvements or cost-of-living pension increases or supplements, which are not anticipated in the actuarial valuation. Because of limited scope, CMC performed no analysis of the potential range of such future differences, except for some limited analysis in financial projections or required disclosure information.

We meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained in this report. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and we are available to answer questions about it.

Respectfully submitted,

Larry Langer, ASA, EA, FCA, MAAA
Principal and Consulting Actuary

Jonathan T. Craven, ASA, EA, FCA, MAAA
Consulting Actuary

Table of Contents

Table of Contents

Executive Summary

Overview

The North Carolina Retirement Systems Division (RSD) was established in 1941 to provide retirement benefits for public servants in the State of North Carolina. Today, under the management of the Department of State Treasurer, RSD administers seven public pension plans (defined benefit plans), three supplemental retirement plans (voluntary defined contributions plans), a health trust fund, a disability income plan, death benefit funds and a number of other benefit programs. As of December 31, 2019, the RSD defined benefit plans cover over one million current and prior public servants of the state of North Carolina. During the fiscal year ending June 30, 2020, RSD paid over $6.5 billion in pensions to more than 320,000 retirees. And as of June 30, 2020, RSD's defined benefit plan assets were valued at over $103 billion.

Under the supplemental retirement plans, the amount of contributions in any given year is defined by law. The amount of benefits derived is dependent on the investment returns the individual achieves. Conversely, under the pension plans, the amount of the benefit paid to a member upon retirement, termination, death or disability is defined by law. The amount of contributions needed to fund these benefits cannot be known with certainty. In North Carolina, like other states, these contributions are paid during a public servant's career so that upon retirement, termination, death, or disability, there are funds available to pay these benefits. These amounts are determined through an actuarial valuation. Actuarial valuations are performed for each of the pension plans administered by RSD and the results are contained in actuarial valuation reports like this.

The Legislative Retirement System ("LRS") provides benefits to all members of the General Assembly. LRS has over $28 million in assets and 574 members as of December 31, 2019. This actuarial valuation report is our annual analysis of the financial health of LRS. This report, prepared as of December 31, 2019, presents the results of the actuarial valuation of the Retirement System.

Purpose

An actuarial valuation is performed on LRS annually as of the end of the calendar year. The actuary determines the amount of contributions to be made to LRS during each member's career that, when combined with investment return, will be sufficient to pay for retirement benefits.

In addition, the annual actuarial valuation is performed to:

- Determine the progress of funding LRS,
- Explore why the results of the current valuation differ from the results of the valuation of the previous year, and
- Satisfy regulatory and accounting requirements.

A detailed summary of the valuation process and a glossary of actuarial terms are provided in Appendix A.

Risk

Measuring pension obligations and actuarially determined contributions requires the use of assumptions regarding future economic and demographic experience. Whenever assumptions are made about future events, there is risk that actual experience will differ from expected. Actuarial valuations include the risk that actual future measurements will deviate from expected future measurements due to actual experience that is different than the actuarial assumptions.

The primary areas of risk in this actuarial valuation are:

- Investment Risk – the potential that investment returns will be different than expected
- Longevity and Other Demographic Risks – the potential that mortality or other demographic experience will be different than expected.
- Interest Rate Risk – To the extent market rates of interest affect the expected return on assets, there is a risk of change to the discount rate which determines the present value of liabilities and actuarial valuation results.
- Contribution Risk – The potential that actual contributions are different than the actuarially determined contributions.

Annual actuarial valuations are performed for RSD which re-measure the assets and liabilities and compute a new actuarially determined contribution. RSD also has experience studies performed every five years to analyze the discrepancies between actuarial assumptions and actual experience and determine if the actuarial assumptions need to be changed. Annual actuarial valuations and periodic experience studies are practical ways to monitor and reassess risk.

Executive Summary

Key Takeaways

The actuarial valuation is performed each year to replace the estimates the actuary assumed for the prior valuation with the actual events that happened. This past year, as expected, some of the assumptions used in the prior valuation were not realized. Key results of the December 31, 2019 valuation as compared to the December 31, 2018 valuation were:

- Market value returns of 14.58% during calendar year 2019 compared to 7.00% assumed

When compared to the December 31, 2018 actuarial valuation, the above resulted in:

- Higher funded ratio (92.6% in the December 31, 2019 valuation compared to 92.0% the December 31, 2018 valuation)
- Lower actuarially determined employer contribution (27.15% for fiscal year ending June 30, 2022 compared to the contribution rate of 27.30% calculated in the December 31, 2018 valuation for fiscal year ending June 30, 2021)

LRS is well funded compared to its peers. This is due to:

- Stakeholders working together to keep LRS well-funded since inception
- A history of appropriating and contributing the recommended contribution requirements
- Assumptions that in aggregate are more conservative than peers
- A funding policy that aggressively pays down unfunded liability over a 12-year period
- An ad hoc cost-of-living adjustment that supports the health of the system
- Modest changes in benefits when compared to peers

Continued focus on these measures will be needed to maintain the solid status of LRS well into the future.

More details can be found later in this report. We encourage readers to start with Sections 1 and 2 and refer to other sections for additional details as needed.

Section 1: Principal Results

This report, prepared as of December 31, 2019, presents the results of the actuarial valuation of the system. The principal results of the valuation and a comparison with the preceding year's results are summarized below.

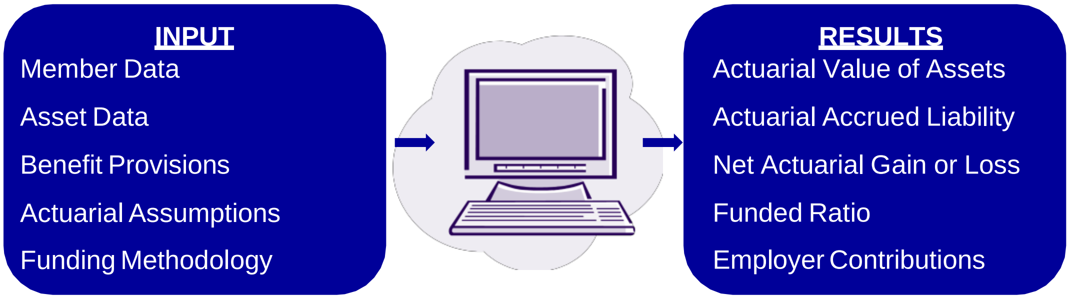
Table 1: Summary of Principal Results

Valuation Results as of	12/31/2019	12/31/2018
Active Members		
Number	170	170
Reported Compensation	$ 3,575,706	$ 3,556,426
Valuation Compensation*	$ 3,819,521	$ 3,819,805
Retired Members and Survivors of Deceased Members Currently Receiving Benefits		
Number	294	289
Annual Allowances	$ 2,340,721	$ 2,273,718
Assets		
Actuarial Value (AVA)	$ 28,028,978	$ 27,909,801
Market Value (MVA)	$ 28,800,055	$ 26,543,448
Actuarial Accrued Liability (AAL)	$ 30,269,003	$ 30,328,299
Unfunded Accrued Liability (AAL - AVA)	$ 2,240,025	$ 2,418,498
Funded Ratio (AVA / AAL)**	92.6%	92.0%
Results for Fiscal Year Ending	**6/30/2022**	**6/30/2021**
Actuarially Determined Employer Contribution (ADEC), as a percentage of payroll		
Normal Cost	19.77%	20.34%
Accrued Liability	7.38%	7.78%
Total	27.15%	28.12%
Total with Direct Rate Smoothing	27.15%	27.30%
Impact of Legislative Changes	N/A	0.00%
Final ADEC	N/A	27.30%
Appropriation Act for Fiscal Year Ending	**6/30/2021**	**6/30/2020**
Employer Contribution Rate as a percentage of payroll		
Normal Cost	19.77%	20.34%
Accrued Liability	7.53%	6.12%
Total	27.30%	26.46%

*Reported compensation annualized for new hires and projected for valuation purposes.
**The Funded Ratio on a Market Value of Assets basis is 95.1% at December 31, 2019.

Section 2:   The Valuation Process

The following diagram summarizes the inputs and results of the actuarial valuation process.



A more detailed description of the valuation process is provided in Appendix A.

Valuation Input: Membership Data

As with any estimate, the actuary collects information that we know now. Under the actuarial valuation process, current information about LRS members is collected annually by the Retirement Systems Division staff at the direction of the actuary. Membership data will assist the actuary in estimating benefits that could be paid in the future. Information about benefit provisions and assets held in the trust as of the valuation date is also collected.

The member information the actuary collects includes data elements such as current service, salary and benefit group identifier for members that have not separated service, and actual benefit amounts and form of payment for members that have separated service. Data elements such as gender and date of birth are used to determine when a benefit might be paid and for how long.

Section 2: The Valuation Process

The table below provides a summary of the membership data used in this valuation compared to the prior valuation.

Number as of	12/31/2019	12/31/2018
Active Members	170	170
Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits	110	92
Retired members and survivors of deceased members currently receiving benefits	294	289
Total	574	551
Active Reported Compensation	3,575,706	3,556,426
Active Valuation Compensation	3,819,521	3,819,805
Annual Retirement Allowances	2,340,721	2,273,718

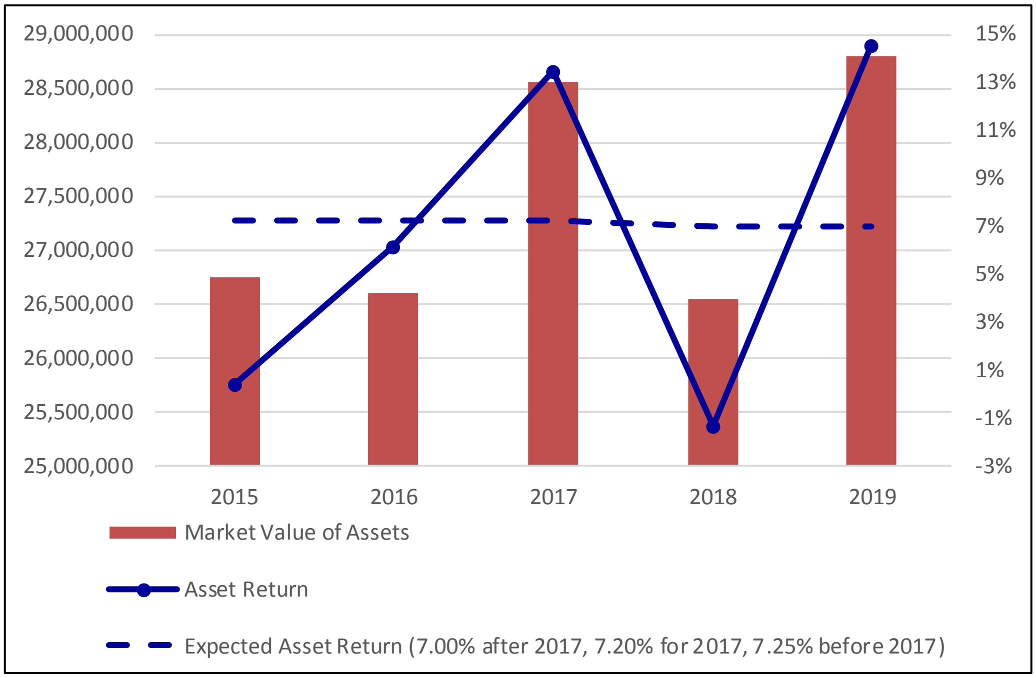
Commentary: The number of retired members and survivors of deceased members currently receiving benefits increased by 1.7% from the previous valuation date.

Valuation Input: Asset Data

LRS assets are held in trust and are invested for the exclusive benefit of plan members. The Market Value of Assets is $28.8 million as of December 31, 2019 and was $26.5 million as of December 31, 2018. The investment return for the market value of assets for calendar year 2019 was 14.58%.

Graph 1: Market Value of Assets and Asset Returns

The graph below provides a history of the market value of assets and asset returns over the past five years.

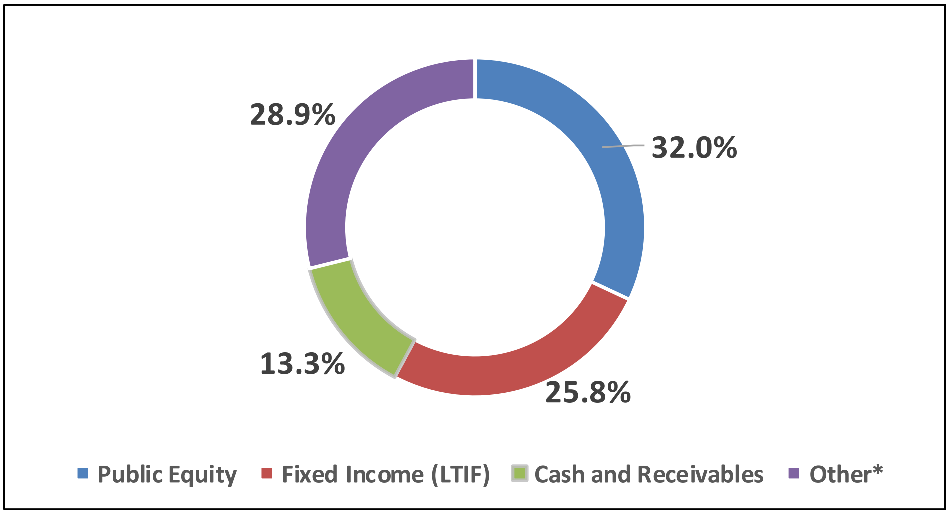


Commentary: Market value returns during 2019 were much greater than the 7.0% assumed rate of return, resulting in lower required contributions and a higher funded ratio than anticipated.

Valuation Input: Asset Data (continued)

Graph 2: Allocation of Investments by Category

The graph below provides the breakdown of the market value of assets at December 31, 2019 by asset category.



* Real Estate, Alternatives, Inflation and Credit

Commentary: Based on historical market returns, the current asset allocation, the current investment policy, and the expectation of future asset returns, as reviewed in the last experience study, the 7.00% discount rate used in this valuation is reasonable and appropriate.

A detailed summary of the market value of assets is provided in Section 4 of this report.

Section 2: The Valuation Process

Valuation Input: Benefit Provisions

Benefit provisions are described in North Carolina General Statutes, Chapter 120.

Highlights of the benefit provisions are described below.

- An unreduced retirement allowance is payable to members who retire from service after attaining age 65 and five years of creditable service
- The unreduced retirement allowance is equal to 4.02% of a member's highest annual compensation multiplied by the number of years of creditable service, with a maximum annual allowance of 75% of a member's highest annual compensation.
- A reduced retirement allowance is payable to members who retire from service:
  - after attaining age 50 and 20 years of creditable service; or
  - after attaining age 60 and five years of creditable service
- Benefits are also payable upon the death or disability of a member
- LRS does not provide for automatic cost of living increases as part of the benefit package. Instead, increases may be provided if certain financial conditions are met and/or the legislature passes a budget that provides for a cost-of-living adjustment

Commentary: Many Public Sector Retirement Systems in the United States have undergone pension reform where the benefits of members (current retirees and active or future members) have been reduced. Because of the well-funded status of LRS due to the legislature contributing the actuarially determined employer contribution when such contribution is required, benefit cuts have not been made in North Carolina as they have been in most other states. Instead, we have seen a modest expansion of benefits in recent years based on sound plan design. However, if North Carolina's investment policy shifts substantively, or if he system incurs other unfavorable investment, economic, or demographic experience, the system should review likely impacts of the shift and consider corresponding changes to actuarial assumptions, funding policy and/or benefit levels.

A detailed summary of the benefit provisions is provided in Appendix C of this report.

Valuation Input: Actuarial Assumptions

Actuarial assumptions bridge the gap between the information that we know with certainty as of the valuation date (age, gender, service, and benefits of the members) and what may happen in the future. The actuarial assumptions of LRS are reviewed at least every five years. Based on this review, the actuary will make recommendations on the demographic and economic assumptions.

Demographic assumptions describe future events that relate to people such as retirement rates, termination rates, disability rates, and mortality rates. Economic assumptions describe future events that relate to the assets such as the interest rate, salary increases, the real return and payroll growth.

With the exception of the discount rate, the assumptions used for the December 31, 2019 actuarial valuation are based on the experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016. The discount rate was updated to be 7.00% as adopted by the Board of Trustees on April 26, 2018.

Valuation Input: Funding Methodology

The Funding Methodology is the payment plan for LRS and is composed of the following three components:

- Actuarial Cost Methods allocate costs to the actuarial accrued liability (i.e. the amount of money that should be in the fund) for past service and normal cost (i.e. the cost of benefits accruing during the year) for current service.
  - –The Board of Trustees has adopted Entry Age Normal as its actuarial cost method
  - –Develops normal costs that stay level as a percent of payroll

- Asset Valuation Methods smooth or average the market value returns over time to alleviate contribution volatility that results from market returns. The Board of Trustees have adopted the following:
  - – Asset returns in excess of or less than the expected return on market value of assets reflected over a five-year period
  - – Assets corridor: not greater than 120% of market value and not less than 80% of market value

- Amortization Methods determine the payment schedule for unfunded actuarial accrued liability (i.e. the difference between the actuarial accrued liability and actuarial value of assets). The Board of Trustees have adopted the following:
  - –Payment level: the payment is determined as a level dollar amount, similar to a mortgage payment
  - –Payment period: a 12-year closed amortization period was adopted for fiscal year ending 2018. A new amortization base is created each year based on the prior year experience

When compared to other Public Sector Retirement Systems in the United States, the funding policy for LRS is quite aggressive in that the policy pays down the unfunded actuarial accrued liability over a much shorter period of time (12 years) compared to most other Public Sector Retirement Systems. As such it is a best practice in the industry.

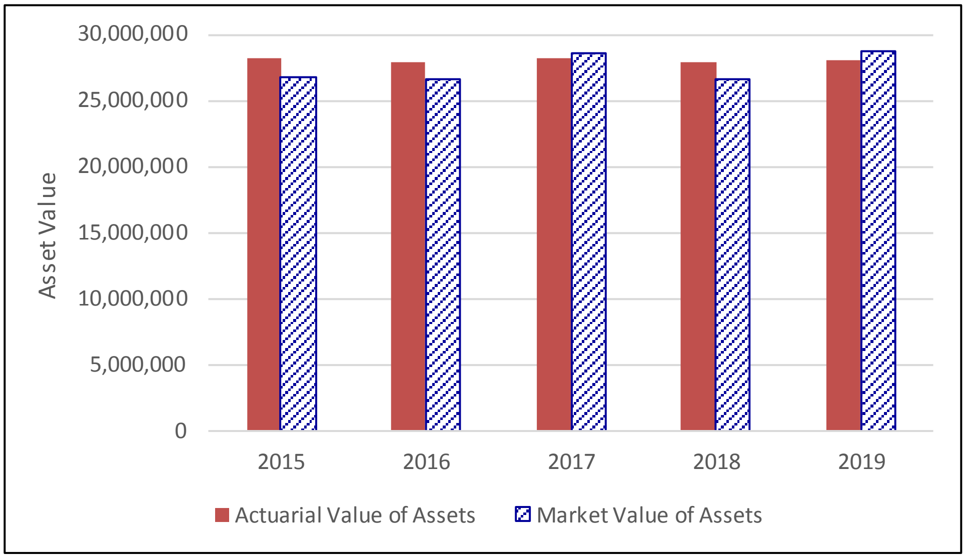
A detailed summary of the actuarial assumptions and methods is provided in Appendix D of this report.

Valuation Results: Actuarial Value of Assets

In order to reduce the volatility that investment gains and losses can have on required contributions and funded status of LRS, the Board adopted an asset valuation method to determine the Actuarial Value of Assets used for funding purposes. The Actuarial Value of Assets is $28.0 million as of December 31, 2019 and $27.9 million as of December 31, 2018.

Graph 3: Actuarial Value and Market Value of Assets

The graph below provides a history of the market value and actuarial value of assets over the past five years.

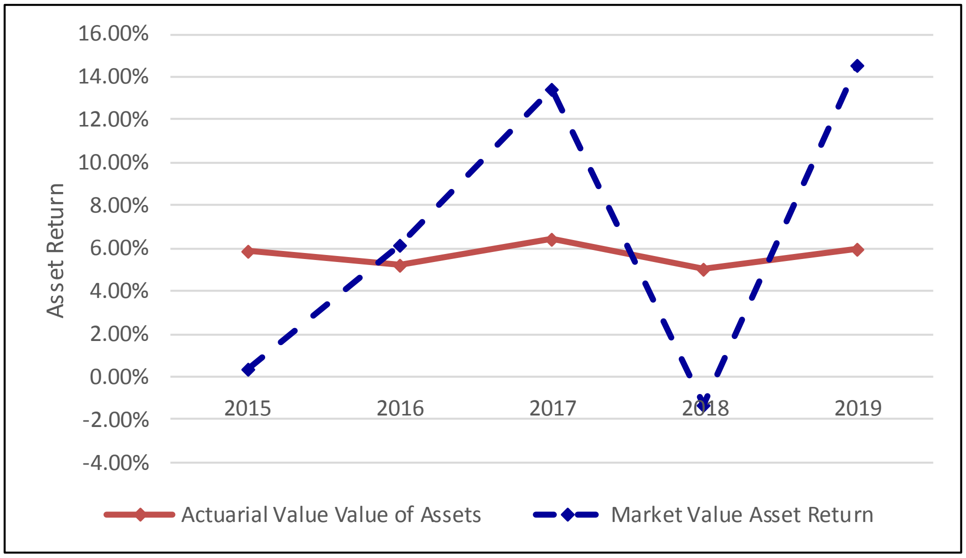


Commentary: The market value of assets is higher than the actuarial value of assets, which is used to determine employer contributions. This indicates that overall there are unrecognized asset gains to be recognized in future valuations.

Valuation Results: Actuarial Value of Assets (continued)

Graph 4: Asset Returns

The graph below provides a history of the market value and actuarial value of asset returns over the past five years.



Commentary: The investment return for the market value of assets for calendar year 2019 was 14.58%. The actuarial value of assets smooths investment gains and losses. Lower than expected market returns, in 2015, 2016, and 2018, resulted in an actuarial value of asset return for calendar year 2019 of 5.97% and a recognized actuarial asset loss of $0.3 million during 2019.

A detailed summary of the Actuarial Value of Assets is provided in Section 4 of this report.

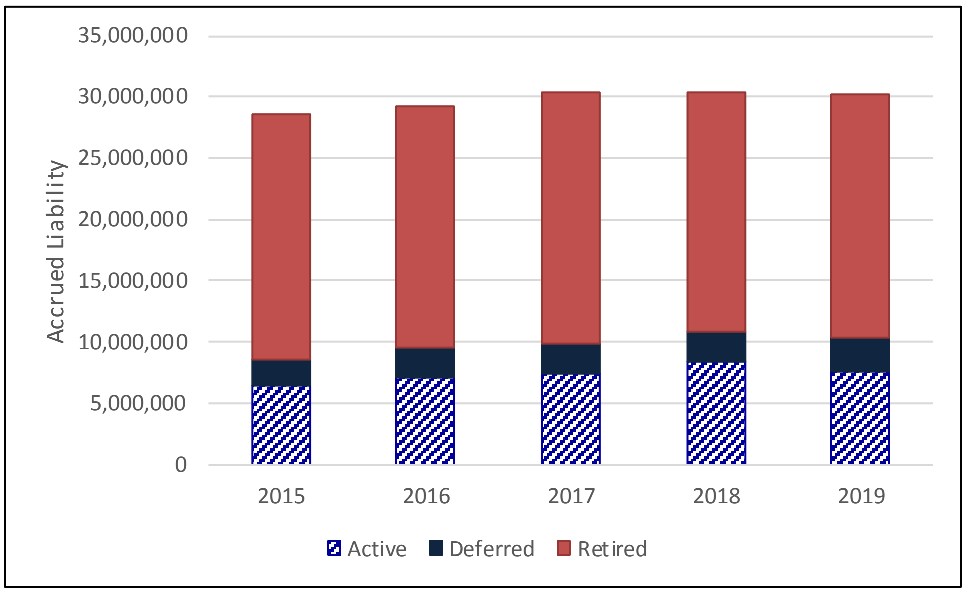
Valuation Results: Actuarial Accrued Liability

Using the provided membership data, benefit provisions, and actuarial assumptions, the future benefit payments of LRS are estimated. These projected future benefit payments are discounted into today's dollars using the assumed rate of investment return assumption to determine the Present Value of Future Benefits (PVFB) of the Retirement System. The PVFB is an estimate of the current value of the benefits promised to all members as of a valuation date.

Once the PVFB is developed, an actuarial cost method is used to allocate the PVFB. Under the actuarial cost method, the PVFB is allocated to past, current and future service, respectively known as the actuarial accrued liability (AAL), normal cost (NC) and present value of future normal costs (PVFNC). The AAL is also referred to as the amount of money the Retirement System should ideally have in the trust. The NC is also referred to as the cost of benefits accruing during the year.

Graph 5: Actuarial Accrued Liability

The graph below provides a history of the actuarial accrued liability over the past five years.



Commentary The AAL remained level at $30.3 million in 2019. LRS is an open plan, which means that new members enter the plan each year. In an open plan, liabilities are expected to grow from one year to next as more benefits accrue and the membership approaches retirement. The AAL was $0.5 million less than expected due to demographic experience.

A detailed summary of the AAL is provided in Section 5 of this report.

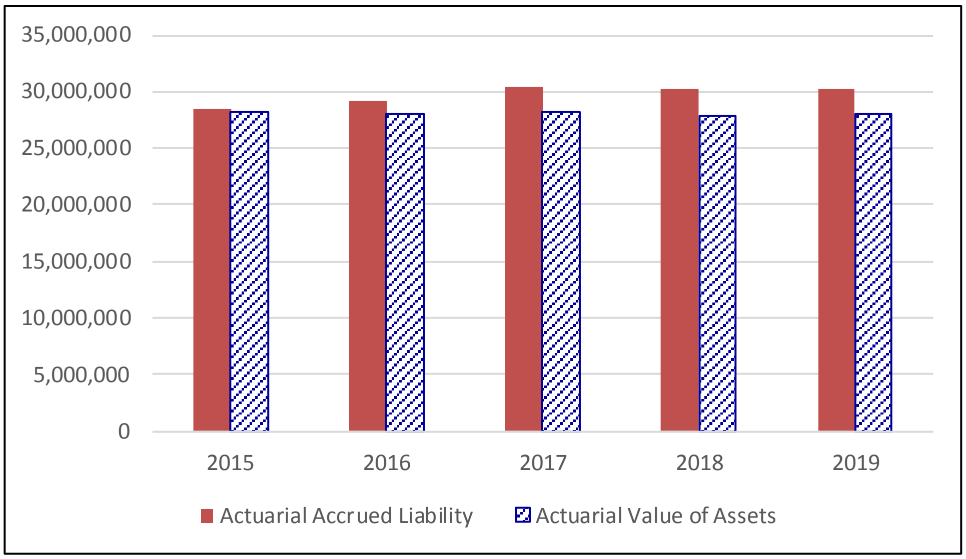
Section 2: The Valuation Process

Valuation Results: Funded Ratio

The funded ratio is a measure of the progress that has been made in funding the plan as of the valuation date. It is the ratio of how much money the Retirement System actually has in the fund to the amount the LRS should have in the fund.

Graph 6: Actuarial Accrued Liability and Actuarial Value of Assets

The graph below provides a history of the present value of future benefits and actuarial accrued liability compared to the actuarial value of assets over the past five years.

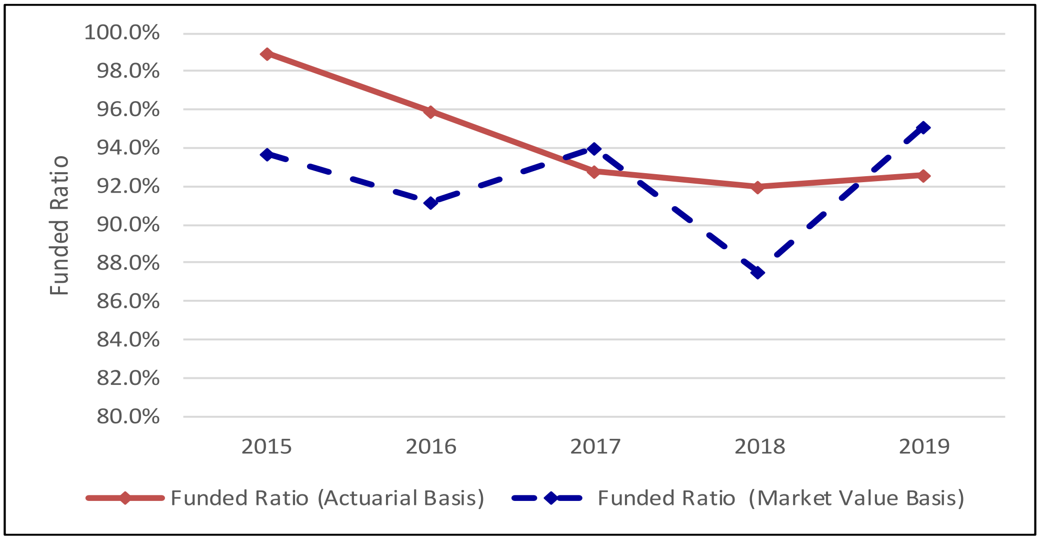


Commentary: The actuarial value of assets basis is used for computing contributions to alleviate contribution volatility. The difference in the actuarial accrued liability and the actuarial value of assets is the amount of pension debt to be paid off in 12 years.

Valuation Results: Funded Ratio (continued)

Graph 7: Funded Ratios

The graph below provides a history of the funded ratio on a market and actuarial basis over the past five years.



Commentary: The ratio of assets to liabilities shows the health of the plan on an accrued basis. The funded ratio on an actuarial basis increased from 92.0% at December 31, 2018 to 92.6% at December 31, 2019.

Section 2: The Valuation Process

Valuation Results: Employer Contributions

G.S. 120-4.20 provides that the contributions of employers shall consist of a normal contribution and an accrued liability contribution.

The December 31, 2018 valuation suggested that the preliminary total employer contribution rate be set at 27.30% of payroll for the fiscal year ending June 30, 2021. As a result of this December 31, 2019 valuation, the preliminary actuarially determined employer contribution rate is 27.15% of payroll for the fiscal year ending June 30, 2022, subject to the impact of any future legislative changes effective during that fiscal year.

A detailed summary of the actuarially determined employer contribution rates is provided in Section 6 of this report.

Valuation Results: Accounting Information

The Governmental Accounting Standards Board (GASB) issues statements which establish financial reporting standards for defined benefit pension plans and accounting for pension expenditures and expenses for governmental employers.

The valuation has been prepared in accordance with the parameters of Statement No. 67 of the GASB and all applicable Actuarial Standards of Practice. The Net Pension Liability (Asset) under GASB 67 for the fiscal year ending June 30, 2020, is $2,549,000 (compared to $2,410,000 for fiscal year ending June 30, 2019). The required financial reporting information for the Retirement System under GASB No. 67 can be found in Section 7 of this report.

Section 3: Membership Data

The Retirement Systems Division provided membership data as of the valuation date for each member of the Retirement System. The membership data assists the actuary in estimating benefits that could be paid in the future. The tables below provide a summary of the membership data used in this valuation. Detailed tabulations of data are provided in Appendix B.

Table 2: Active Member Data

	Member Count	Average Age	Average Service	Reported Compensation
Male	127	58.13	6.28	$ 2,676,258
Female	43	62.56	7.05	899,447
Total	170	59.25	6.47	$ 3,575,706

Table 3: Vested Terminated Member Data

	Member Count	Average Age	Average Service	Deferred Retirement Allowance
Male	44	56.14	8.36	329,434
Female	11	54.64	8.57	78,636
Total	55	55.84	8.41	$ 408,070

The table above includes terminated members entitled to retirement benefits but not yet receiving benefits.

Table 4: Non-Vested Terminated Member Data

	Member Count	Average Age	Average Service	Accumulated Contributions
Male	48	53.31	2.88	$ 277,564
Female	7	57.71	1.81	27,302
Total	55	53.87	2.75	$ 304,867

The table above includes non-vested terminated members who have not received a refund of contributions.

Section 3: Membership Data

Table 5: Data for Members Currently Receiving Benefits

	Member Count	Average Age	Annual Retirement Allowances
Retired Members (Healthy at Retirement)			
Male	175	77.98	$ 1,487,300
Female	56	77.48	450,073
Total	231	77.86	$ 1,937,373
Survivors of Deceased Members			
Male	1	49.83	$ 10,333
Female	62	77.35	393,015
Total	63	76.91	$ 403,348
Grand Total	294	77.66	$ 2,340,721

Section 4: Asset Data

Assets are held in trust and are invested for the exclusive benefit of LRS members. The tables below provide the details of the Market Value of Assets for the current and prior years' valuations.

Table 6: Market Value of Assets

Asset Data as of	12/31/2019	12/31/2018
Beginning of Year Market Value of Assets	$ 26,543,448	$ 28,554,239
Employer Contributions	883,435	748,384
Employee Contributions	257,451	252,875
Benefit Payments other than Refunds	(2,364,330)	(2,384,758)
Refunds	(266,742)	(255,210)
Administrative Expense	(13,043)	(12,514)
Investment Income	3,759,836	(359,569)
Net Increase/(Decrease)	2,256,607	(2,010,791)
End of Year Value of Assets	$ 28,800,055	$ 26,543,448
Estimated Net Investment Return	14.58%	(1.30)%

Table 7: Allocation of Investments by Category of the Market Value of Assets

Asset Data as of	12/31/2019	12/31/2018
Allocation by Dollar Amount		
Public Equity	$ 9,232,090	$ 9,442,109
Fixed Income (LTIF)	7,433,578	6,866,386
Cash and Receivables	3,822,852	1,923,234
Other*	8,311,535	8,311,719
Total Market Value of Assets	$ 28,800,055	$ 26,543,448
Allocation by Percentage of Asset Value		
Public Equity	32.0%	35.5%
Fixed Income (LTIF)	25.8%	25.9%
Cash and Receivables	13.3%	7.2%
Other*	28.9%	31.4%
Total Market Value of Assets	100.0%	100.0%

***** Real Estate, Alternatives, Inflation and Credit

Section 4: Asset Data

In order to reduce the volatility that investment gains and losses can have on the required contributions and funded status of LRS, the Board adopted an asset valuation method to determine the Actuarial Value of Assets used for funding purposes. The table below provides the calculation of the Actuarial Value of Assets at the valuation date.

Table 8: Actuarial Value of Assets

Asset Data as of	12/31/2019
Beginning of Year Market Value of Assets	$ 26,543,448
Contributions	1,140,886
Benefit Payments, Refunds and Administrative Expenses	(2,644,115)
Net Cash Flow	(1,503,229)
Expected Investment Return	1,806,318
Expected End of Year Market Value of Assets	26,846,537
End of Year Market Value of Assets	28,800,055
Excess of Market Value over Expected Market Value of Assets	1,953,518
80% of 2019 Asset Gain/(Loss)	1,562,814
60% of 2018 Asset Gain/(Loss)	(1,380,930)
40% of 2017 Asset Gain/(Loss)	647,130
20% of 2016 Asset Gain/(Loss)	(57,937)
Total Deferred Asset Gain/(Loss)	771,077
Preliminary End of Year Actuarial Value of Assets	28,028,978
Final End of Year Actuarial Value of Asset (not less than 80% and not greater than 120% of Market Value)	28,028,978
Estimated Net Investment Return on Actuarial Value	5.97%

Commentary: The actuarial value of assets smooths investment gains/losses on the market value of assets over a five-year period resulting in less volatility in the actuarially determined employer contribution. The asset valuation recognizes asset returns in excess of or less than the expected return on the market value of assets over a five-year period. Actuarial value of assets was reset to the market value of assets at December 31, 2014.

Section 5: Liability Results

Using the provided membership data, benefit provisions, and actuarial assumptions, the Retirement System's future benefit payments are estimated. These projected future benefit payments are discounted into today's dollars using the assumed rate of investment return assumption to determine the Present Value of Future Benefits. The Present Value of Future Benefits is allocated to past, current and future service, respectively known as the actuarial accrued liability, normal cost and present value of future normal costs. The table below provides these liability numbers for the current and prior years' valuations.

Table 9: Liability Summary

Valuation Results as of	12/31/2019	12/31/2018
(a) Present Value of Future Benefits		
(1) Active Members	$ 13,878,585	$ 14,440,038
(2) Terminated Members	2,877,651	2,404,874
(3) Members Currently Receiving Benefits	19,877,116	19,494,673
(4) Total	$ 36,633,352	$ 36,339,585
(b) Present Value of Future Normal Costs	6,364,349	6,011,286
(c) Actuarial Accrued Liability: (a4) - (b)	$ 30,269,003	$ 30,328,299
(d) Actuarial Value of Assets	$ 28,028,978	$ 27,909,801
(e) Unfunded Actuarial Accrued Liability: (c) - (d)	$ 2,240,025	$ 2,418,498

Section 5: Liability Results

The table below provides a reconciliation of the prior year's unfunded actuarial accrued liability to the current year's unfunded actuarial accrued liability.

Table 10: Reconciliation of Unfunded Actuarial Accrued Liability

(in millions)		
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2018	$	2.4
Normal Cost and Administrative Expense		1.0
Reduction due to Actual Contributions during 2019		(1.1)
Interest on UAAL, Normal Cost, and Contributions		0.1
Asset (Gain) / Loss		0.3
Actuarial Accrued Liability (Gain) / Loss		(0.5)
Impact of Assumption Changes		0.0
Impact of Legislative Changes		0.0
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2019	$	2.2

Commentary: The loss recognized in the actuarial value of assets increased the UAAL by $0.3 million, which was offset by an Actuarial Accrued Liability gain of $0.5 million.

.

Section 6: Actuarially Determined Employer Contribution

The actuarially determined employer contribution consists of a normal cost contribution and an accrued liability contribution. The normal cost contribution is the employer's portion of the cost of benefits accruing during the year after reducing for the member contribution. The accrued liability contribution is the payment toward the unfunded accrued liability in order to pay off the unfunded accrued liability over 12 years.

The table below provides the calculation of the actuarially determined employer contribution for the current and prior years' valuations.

Table 11: Calculation of the Actuarially Determined Employer Contribution (ADEC)

Valuation Date	12/31/2019	12/31/2018
ADEC for Fiscal Year Ending	**6/30/2022**	**6/30/2021**
Normal Cost Rate Calculation		
(a) Total Normal Cost Rate	25.77%	26.34%
(b) Employee Contribution Rate	7.00%	7.00%
(c) Expense Assumption	1.00%	1.00%
(d) Employer Normal Cost Rate: (a) - (b) +(c)	19.77%	20.34%
Accrued Liability Rate Calculation		
(e) Unfunded Accrued Liability	$ 2,240,025	$ 2,418,498
(f) Total Amortization Payments*	$ 291,003	$ 307,169
(g) Valuation Compensation**	$ 3,945,548	$ 3,945,841
(h) Accrued Liability Rate: (f) / (g)	7.38%	7.78%
Preliminary ADEC (d) + (h)	27.15%	28.12%
ADEC (with Direct Rate Smoothing)	27.15%	27.30%
Impact of Legislative Changes	N/A	0.00%
Final ADEC	N/A	27.30%

*See Table 14 for more detail.

** Beginning with the December 31, 2017 valuation, compensation is projected to the fiscal year over which contributions will occur

Section 6: Actuarially Determined Employer Contribution

The table below provides a reconciliation of the actuarially determined employer contributions.

Table 12: Reconciliation of the Change in the ADEC

Fiscal year ending June 30, 2021 Preliminary ADEC (Based on December 31, 2018 valuation)	27.30%
Impact of Legislative Changes	0.00%
Fiscal year ending June 30, 2021 ADEC for Reconciliation	27.30%
Change Due to Anticipated Reduction in UAAL*	0.01%
Change due to Demographic (Gain)/Loss **	-2.17%
Change due to Investment (Gain)/Loss	0.95%
Change Due to Contribution Experience	0.24%
Impact of Assumption Changes	0.00%
Impact of Direct Rate Smooothing	0.82%
Fiscal year ending June 30, 2022 Preliminary ADEC (based on December 31, 2019 valuation)	27.15%

* Amortization of the UAAL is determined as a level dollar amount with payments expected to remain the same over the amortization period, but was calculated as a percentage of valuation payroll in the previous valuation. Payroll is expected to increase annually while the expected amortization payment does not increase. This causes the expected amortization payment to be a lesser percentage of the expected payroll.

** Includes -0.32% change to no longer include the active death benefit paid from the TSERS Death Benefit Trust.

Section 6: Actuarially Determined Employer Contribution

Amortization methods determine the payment schedule for the unfunded actuarial accrued liability. LRS adopted a 12-year closed amortization period for fiscal year ending 2018. A new amortization base is created each year based on the prior years' experience. The tables below provide the calculation of the new amortization base and the amortization schedule for the current year's valuation.

Table 13: Calculation of the New Amortization Base

Calculation as of	12/31/2019
(a) Unfunded Actuarial Accrued Liability	$ 2,240,025
(b) Prior Years' Outstanding Bases	$ 2,360,027
(c) New Amortization Base: (a) - (b)	$ (120,002)
(d) New Amortization Payment	$ (16,166)

Table 14: Amortization Schedule for Unfunded Accrued Liability

Date Established	Original Balance	12/31/2019 Outstanding Balance	Annual Payment
December 31, 2015	$ 249,266	$ 236,136	$ 33,701
December 31, 2016	935,816	949,185	$ 126,303
December 31, 2017	908,785	978,211	$ 122,426
December 31, 2018	183,640	196,495	$ 24,739
December 31, 2019	(120,002)	(120,002)	$ (16,166)
Total		$ 2,240,025	$ 291,003

Commentary: This is the payment schedule for the unfunded actuarial accrued liability of LRS.

Section 6: Actuarially Determined Employer Contribution

The tables below provide a history of the actuarially determined employer contribution and the corresponding appropriated rate.

Table 15: Cost of Benefit Enhancements

Calculation as of	12/31/2019	12/31/2018
Increase in UAAL for 1% COLA*	218,000	220,000
Increase in ADEC for 1% COLA*	0.74%	0.75%

* The 1% COLA calculated at the December 31, 2019 valuation would be effective July 1, 2021. The COLA would be paid in full to retired members and survivors of deceased members on the retirement roll on July 1, 2020 and would be prorated for retired members and survivors of deceased members who commence benefits after July 1, 2020 but before June 30, 2021.

Section 7: Accounting Results

This section contains the accounting information for Governmental Accounting Standards Board (GASB) Statement No. 67 for fiscal year ending June 30, 2020 based on a valuation date of December 31, 2019.

Please note that GASB Statement No. 67 (*Financial Reporting for Pension Plans)* is applicable for fiscal years ending 2014 and later.

The June 30, 2020 total pension liability presented in this section was determined by an actuarial valuation as of December 31, 2019, based on the assumptions, methods and plan provisions described in this report. The actuarial cost method used to develop the total pension liability is the Entry Age Normal Cost method, as required by GASB Statement No. 67.

GASB Statement No. 67 set forth certain items of information to be disclosed in the financial statements of the Plan. The tables below provide a distribution of the number of employees by type of membership.

Table 16: Number of Active and Retired Members as of December 31, 2019

Group	Number
Retired members and survivors of deceased members currently receiving benefits	294
Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits	110
Active Members	170
Total	574

Section 7: Accounting Results

GASB Statement No. 67 set forth certain items of information to be disclosed in the financial statements of the Plan. The tables below provide the schedule of changes in Net Pension Liability (Asset).

Table 17: Schedule of Changes in Net Pension Liability (Asset)

Schedule of Changes in Net Pension Liability as of June 30, 2020	
Total Pension Liability	
Service Cost	$ 1,058,000
Interest	2,051,000
Changes of Benefit Terms	0
Difference between Expected and Actual Experience	(617,000)
Change of Assumptions	0
Benefit Payments, including Refund of Member Contributions	(2,388,000)
Net Change in Total Pension Liability	104,000
Total Pension Liability – Beginning of Year	$ 30,467,000
Total Pension Liability – End of Year	$ 30,571,000
Plan Fiduciary Net Position	
Employer Contributions	$ 957,000
Member Contributions	253,000
Net Investment Income	1,151,000
Benefit Payments, including Refund of Member Contributions	(2,388,000)
Administrative Expenses	(13,000)
Other	5,000
Net Change in Plan Fiduciary Net Position	(35,000)
Plan Fiduciary Net Position – Beginning of Year	$ 28,057,000
Plan Fiduciary Net Position – End of Year	$ 28,022,000

Table 18: Net Pension Liability (Asset)

Net Pension Liability (Asset)	June 30, 2020	June 30, 2019
Total Pension Liability	$ 30,571,000	$ 30,467,000
Plan Fiduciary Net Position	28,022,000	28,057,000
Net Pension Liability (Asset)	$ 2,549,000	$ 2,410,000
Plan Fiduciary Net Position as a Percentage of the Total Pension Liability (Asset)	91.66%	92.09%

Section 7: Accounting Results

The table below is the sensitivity of the net pension liability to changes in the discount rate.

Table 19: Sensitivity of the Net Pension Liability (Asset) at June 30, 2020 to Changes in the Discount Rate

Sensitivity of the Net Pension Liability to Changes in the Discount Rate	1% Decrease	Current	1% Increase
Discount Rate	6.00%	7.00%	8.00%
Net Pension Liability (Asset)	$ 5,315,000	$ 2,549,000	$ 168,000

The discount rate used to measure the total pension liability was 7.00%. The projection of cash flows used to determine the discount rate assumed that System contributions will continue to follow the current funding policy, including "direct-rate smoothing" as adopted by the Board of Trustees on April 26, 2018. Based on those assumptions, the System's fiduciary net position was projected to be available to make all projected future benefit payments of current plan members. Please see Appendix E for additional detail.

The table below provides the methods and assumptions used to calculate the actuarially determined contribution rate.

Table 20: Additional Information for GASB Statement No. 67

Valuation Date	12/31/2019
Actuarial Cost Method	Entry Age
Amortization Method	Level dollar closed
Amortization Period	12-year closed period
Asset Valuation Method	Asset return in excess of or less than the expected return on market value of assets reflected over a five-year period (not greater than 120% of market value and not less than 80% of market value)
Actuarial Assumptions	
Investment Rate of Return*	7.00%
Projected Salary Increases**	5.50%
*Includes Inflation of	3.00%
**Includes Inflation and Productivity of	3.50%
Cost-of-living Adjustments	N/A

Appendix A: Valuation Process and Glossary of Actuarial Terms

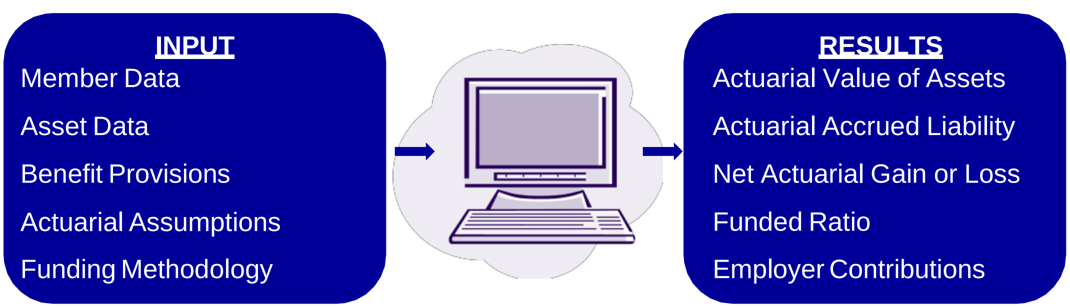
Purpose of an Actuarial Valuation

The majority of Public Sector Retirement Systems in the State of North Carolina are defined benefit (DB) retirement systems. Under a DB retirement system, the amount of benefits payable to a member upon retirement, termination, death or disability is defined in various contracts and legal instruments and is based, in part, on the member's years of credited service and final compensation. The amount of contribution needed to fund these benefits cannot be known with certainty. A primary responsibility of the Board of Trustees of a Retirement System is to establish and monitor a funding policy for the contributions made to the Retirement System.

While somewhat uncommon, in some jurisdictions, contributions are made by the plan sponsor as benefits come due. This is known as pay-as-you-go financing. More commonly, contributions for benefits are made in advance during the course of active employment of the members. This is known as actuarial pre-funding. For example, the State of North Carolina mandates for the Teachers' and State Employees' Retirement System ("TSERS") under G.S.135-8(d), that "on account of each member there shall be paid into the pension accumulation fund by employers an amount equal to a certain percentage of the actual compensation of each member to be known as the 'normal contribution' and an additional amount equal to a percentage of the member's actual compensation to be known as the 'accrued liability contribution'. The rate per centum of such contributions shall be fixed on the basis of the liabilities of the Retirement System as shown by actuarial valuation, duly approved by the Board of Trustees, and shall be called the 'actuarially determined employer contribution rate'…The actuarially determined employer contribution rate shall be calculated annually by the actuary using assumptions and a cost method approved by the Actuarial Standards Board of the American Academy of Actuaries and selected by the Board of Trustees."

The Actuarial Valuation Process

The following diagram summarizes the inputs and results of the actuarial valuation process. A narrative of the process follows the diagram. The reader may find it worthwhile to refer to the diagram from time to time.



Under the actuarial valuation process, current information about Retirement System members is collected annually by staff at the direction of the actuary, namely member data, asset data and information on benefit provisions. Member data is collected for each member of the Retirement System. The member data will assist the actuary in estimating benefits that could be paid in the future. The member information the actuary collects to estimate the amount of benefit includes elements such as current service, salary and benefit group identifier for members that have not separated service; for those that have, the actual benefit amounts are collected. The actuary collects information such as gender and date of birth to determine when a benefit might be paid and for how long.

Appendix A: Valuation Process and Glossary of Actuarial Terms

The actuary collects summary information about assets as of the valuation date and information on cash flows for the year ending on the valuation date. Information about benefit provisions as of the valuation date is also collected. To bridge the gap between the information collected and potential benefits to be paid in the future, the actuary must make assumptions about future activities. These assumptions are recommended by the actuary to the Boards based on the results of an experience review. An experience review is a review of the Retirement System over a period of time, typically five years, where the actuary analyzes the demographic and economic assumptions of the Retirement System. Based on this review, the actuary will make recommendations on the demographic assumptions, such as when members will be projected to retire, terminate, become disabled and/or die in the future, as well as the economic assumptions, such as what rate of return is projected to be earned by the fund based on the Retirement System investment policy and what level of future salary increases is expected for members. To maintain the assumptions, the Board should adopt a prudent policy of having an experience review being performed every five years. The next experience review for the North Carolina Retirement Systems will be based on the five-year period ending on December 31, 2019 and will be presented during 2020. Using these assumptions, the actuary is able to use the member data, asset data and benefit provision information collected to project the benefits that will be paid from the Retirement System to current members. These projected future benefit payments are based not only on service and pay through the valuation date but includes future pay and service, which has not yet been earned by the members but is expected to be earned.

These projected future benefit payments are discounted into today's dollars using the assumed rate of investment return assumption to determine the Present Value of Future Benefits (PVFB) of the Retirement System. The PVFB is an estimate of the value of the benefits promised to all members as of a valuation date. If the Retirement System held assets equal to the PVFB and all the assumptions were realized, there would be sufficient funds to pay off all the benefits to be paid in the future for members in the Retirement System as of the valuation date.

The PVFB is a large sum of money, typically much larger than the amount of Retirement System assets held in the trust. The next step is for the actuary to apply the Funding Policy as adopted by the Board to determine the employer contributions to be made to the Retirement System so that the gap between the PVFB and assets is systematically paid off over time. The Funding Policy is adopted by the Board based on discussions with the actuary. When the Board develops a funding policy, a balance between contributions which are responsive to the needs of the Retirement System yet stable should be struck. There are many different funding policies for the Board to consider, and the actuary is responsible for discussing the various features of the funding policies under consideration. Funding Policies are generally reviewed during an experience review, but it is not uncommon to review a funding policy in between, particularly during period where large increases or decreases in contributions are expected. The Funding Policy is composed of three components: the actuarial cost method, the asset valuation method, and the amortization method.

Once the PVFB is developed, an actuarial cost method is used to allocate the PVFB. Under the actuarial cost method, the PVFB is allocated to past, current and future service, respectively known as the actuarial accrued liability (AAL), normal cost (NC) and present value of future normal costs (PVFNC). The actuary computes the liability components (PVFB, NC, AAL, and PVFNC) for each participant in the Retirement System at the valuation date. These liability components are then totaled for the Retirement System. There are many actuarial cost methods. Different actuarial methods will produce different contribution patterns, but do not change the ultimate cost of the benefits. The entry age normal cost method is the most prevalent method used for public sector plans in the United States, because the expected normal cost is calculated in such a way that it will tend to stay level as a percent of pay over a member's career.

The actuarial accrued liability (AAL) is also referred to as the amount of money the Retirement System should ideally have in the trust. The unfunded actuarial accrued liability (UAAL) is the portion of actuarial accrued liability that is not covered by the assets of the Retirement System. The UAAL can be a negative number, which means that the Retirement System has more assets than actuarial accrued liability. We refer to this condition as overfunded liability in this summary. Having UAAL does not indicate that the Retirement System is in failing actuarial health. Most retirement systems have UAAL. Another related statistic of the Retirement System is the funded ratio. The funded ratio is the percent of the actuarial accrued liabilities covered by the actuarial value of assets. The assets used for these purposes are an actuarial value of assets (AVA), not market. The actuarial value of assets is based on the asset valuation method as recommended by the actuary and adopted by the Board. An actuarial value of assets is a smoothed, or averaged, value of assets, which is used to limit employer contribution volatility. Typically, assets are smoothed, or averaged, over a period of 3 to 5 years. By averaging returns, the UAAL is not as volatile, which we will see later results in contributions that are not as volatile as well. The North Carolina Retirement Systems use an actuarial value of assets with a smoothing period of 5 years.

While having UAAL is common, it is acceptable only if it is systematically being paid off. The method by which the UAAL is paid off is known as the amortization method. The concept is similar to that of a mortgage payment. The Board adopts the amortization method used to pay off the UAAL over a period of time. The amortization method is composed of the amortization period, the amount of payment increase, whether the period is open or closed and by the amount of amortization schedules. The amortization period is the amount of time over which the UAAL will be paid off. This is generally a period of thirty years or less, but actuaries are beginning to recommend shorter periods. The payments can be developed to stay constant from year to year like a mortgage, but often they are developed to increase each year at the same level payroll increases. Amortization type can be closed or open. Under a closed period, the UAAL is expected to be paid off over the amortization period. This is similar to a typical mortgage. Under an open period, the amortization period remains unchanged year after year. The concept is similar to re-mortgaging annually. In many instances, an amortization schedule is developed, whereby the UAAL is amortized over a closed period from the point the UAAL is incurred. Finally, some amortization methods are defined by a schedule of payments, where a new schedule of payments is added with each valuation. Regardless of the amortization type or period, the funding policy should generate a contribution that pays off the UAAL, which results in the funded ratio trending to 100% over time. Caution should be used when an open method is used, because typically an open amortization policy does not result in the UAAL being paid off. North Carolina pays off a much larger amount of UAAL compared to other states. While many states struggle to pay a 30-year level percent of pay UAAL contribution, which doesn't even reduce the amount of UAAL, North Carolina pays down the UAAL with level dollar payments over a 12 year period. This aggressive payment schedule of the UAAL results in North Carolina being home to many of the best funded Public Retirement Systems in the United States.

To satisfy the requirements of the State of North Carolina, the actuary calculates the total annual contribution to the Retirement System as the normal cost plus a contribution towards UAAL. Said another way, this contribution is sufficient to pay for the cost of benefits accruing during the year (normal cost) plus the mortgage payment (UAAL payment). The total contribution is reduced by the amount of member contributions, if any, to arrive at the employer contribution. Continuing to follow the aggressive North Carolina contribution policy will keep the North Carolina Retirement Systems among the best funded in the United States.

Appendix A: Valuation Process and Glossary of Actuarial Terms

An actuarial valuation report is produced annually, which contains the contribution for the fiscal year as well as the funded ratio of the Retirement System. The primary purpose of performing an actuarial valuation annually is to replace the estimated activities from the previous valuation, which were based on assumptions, with the actual experience of the Retirement System for the prior year. The experience gain (loss) is the difference between the expected and the actual UAAL of the Retirement System. An experience loss can be thought of as the amount of additional UAAL over and above the amount that was expected from the prior year due to deviation of actual experience from the assumption. Similarly, an experience gain can be thought of as having less UAAL than that which was expected from the prior year assumptions. As an example, if the Retirement System achieves an asset return of 15% when the assumption was a 7.00% return, an actuarial gain is said to have happened, which typically results in lower contributions and higher funded ratio, all else being equal. Alternatively, a return of 2% under the same circumstances would result in an actuarial loss, requiring an increase in contributions and a funded ratio that is lower than anticipated. Experience gains and losses are common within the valuation process. Typically gains and losses offset each other over time. To the extent that does not occur, the reasons for the gains and losses should be understood, and appropriate recommendations should be made by the actuary after an experience review to adjust the assumptions.

The actuarial valuation report will contain histories of key statistics from prior actuarial valuation reports. In particular, a history of the funded ratio of the Retirement System is an important exhibit. Trustees should understand the reason for the trend of the funded ratio of the Retirement System over time. The actuary will discuss the reasons for changes in the funded ratio of the Retirement System with each valuation report. To the extent that there are unexplained changes in funded ratio corrective action should be explored and the actuary will make recommendations as to whether there should be changes in the assumptions, funding policy, or some other portion of the actuarial valuation process.

In addition to historical information, projections of contributions and funded ratio based on current assumptions can sometimes be found in an actuarial valuation report. Projections of contributions can allow the employer to plan their budget accordingly. Surprises in Retirement System contributions to be paid by the employer serve no one. A one-year projection based on "bad" asset returns can provide ample time for the employer to plan, or allow for a discussion of changing the funding policy to occur. Contribution surprises are a primary contributor to employers considering pension reform. It is important to keep the employer apprised of future contribution requirements. A projection of funded ratio can serve the Trustees by illustrating the trend of the funded ratio over time. The funded ratio, under a prudent funding policy, should trend to 100% over a period of less than 30 years. (It is worthwhile to note that while 30 years has served as an industry standard for the longest period over which 100% funding should be achieved, that period is coming under scrutiny by the actuarial community and will likely be shortened.) If a projection of funded ratio does not trend to 100% over time, consideration should be given to fixing the funding policy to achieve this goal. For the North Carolina Retirement Systems, projections are generally performed for the January board meetings.

Appendix A: Valuation Process and Glossary of Actuarial Terms

The actuarial report will contain schedules of information about the census, plan and asset information submitted by Retirement System staff upon which the actuarial valuation is based. It is important that the Board of Trustees review that information and determine if the information is consistent with their understanding of the Retirement System. If after questioning staff, the Board of Trustees is not comfortable that the information provided is correct, the actuary should be notified to determine if the actuarial valuation report should be corrected.

Finally, the valuation report and/or presentation should contain sufficient information in an understandable fashion to allow the Board to take action and adopt the contribution rate for the upcoming year. It should also allow stakeholders to understand key observations over the past year that resulted in contributions increasing (or decreasing) and where contributions are headed. The actuary is always open to making the results understandable. CMC works with the North Carolina Retirement Systems Division to make your reports and presentations understandable and actionable. If something doesn't make sense – speak up!!

Glossary

Note that the first definitions given are the "official" definitions of the term. For some terms there is a second definition, in italics, which is the unofficial definition.

Actuarial Accrued Liability (AAL). The portion of the Present Value of Projected Benefits (PVFB) allocated to past service. Also difference between (i) the actuarial present value of future benefits, and (ii) the present value of future normal cost. Sometimes referred to as "accrued liability" or "past service liability." The amount of money that should be in the fund. The funding target.

Actuarial Assumptions. Estimates of future plan experience with respect to rates of mortality, disability, retirement, investment income and salary increases. Demographic ("people") assumptions (rates of mortality, separation, and retirement) are generally based on past experience, often modified for projected changes in conditions. Economic ("money") assumptions (salary increases and investment income) consist of an underlying rate appropriate in an inflation-free environment plus a provision for a long-term average rate of inflation. Estimates of future events used to project what we know now- current member data, assets, and benefit provisions –into an estimate of future benefits.

Actuarial Cost Method. A mathematical budgeting procedure for allocating the dollar amount of the Present Value of Projected Benefits (PVFB) between the normal costs to be paid in the future and the actuarial accrued liability. Sometimes referred to as the "actuarial funding method."

Actuarial Methods. The collective term for the Actuarial Cost Method, the Amortization Payment for UAAL Method, and the Asset Valuation Method used to develop the contribution requirements for the Retirement System. *The funding policy*.

Actuarial Equivalent. Benefits whose actuarial present values are equal.

Actuarial Present Value. The amount of funds presently required to provide a payment or series of payments in the future. It is determined by discounting the future payments at a predetermined rate of interest, taking into account the probability of payment.

Actuarial Value of Assets (AVA). A smoothed value of assets which is used to limit contribution volatility. Also known as the funding value of assets. *Smoothed value of assets.*

Amortization Payment for UAAL. Payment of the unfunded actuarial accrued liability by means of periodic contributions of interest and principal, as opposed to a lump sum payment. The components of the amortization payment for UAAL include:

- Amortization Period Length – Generally amortization periods up to 15 to 20 years (and certainly not longer than 30) are allowed. Similar to a mortgage, the shorter the amortization period, the higher the payment and the faster the UAAL is paid off.
- Amortization payment increases – Future payments can be level dollar, like a mortgage, or as a level percent of pay. Most Retirement Systems amortize UAAL as a level percent of pay which when combined with the employer normal cost that is developed as a level percent of pay can result in contributions that are easier to budget.
- Amortization type – An amortization schedule can be closed or open. A closed amortization schedule is similar to a mortgage – at the end of the amortization period the UAAL is designed to be paid off. An open amortization period is similar to refinancing the UAAL year after year.
- Amortization schedule – UAAL can be amortized over a single amortization period, or it can be amortized over a schedule.

The amortization payment for UAAL can be thought of as the UAAL mortgage payment.

Appendix A: Valuation Process and Glossary of Actuarial Terms

Asset Valuation Method. The components of how the actuarial value of assets is to be developed. LRS uses a five-year smoothing of asset gains and losses, which is the most commonly used method

Experience Gain (Loss). A measure of the difference between actual experience and experience anticipated by a set of actuarial assumptions during the period between two actuarial valuation dates, in accordance with the actuarial cost method being used. *The experience Gain (Loss) represents how much the actuary missed the mark in a given year.*

Funded Ratio. The percent of the actuarial accrued liabilities covered by the actuarial value of assets. Also known as the funded status. *The ratio of how much money you actually have in the fund to the amount you should have in the fund.*

Normal Cost. The annual cost assigned, under the actuarial funding method, to current and subsequent plan years. Sometimes referred to as "current service cost." An amortization payment toward the unfunded actuarial accrued liability is paid in addition to the normal cost to arrive at the total contribution in a given year. *The cost of benefits accruing during the year*.

Present Value of Future Normal Cost (PVFNC). The portion of the Present Value of Projected Benefits (PVFB) allocated to future service. *The value in today's dollars of the amount of contribution to be made in the future for benefits accruing for members in the Retirement System as of the valuation date.*

Present Value of Future Benefits (PVFB). The projected future benefit payments of the plan are discounted into today's dollars using an assumed rate of investment return assumption to determine the Present Value of Future Benefits (PVFB) of the Retirement System. The PVFB is the discounted value of the projected benefits promised to all members as of a valuation date, including future pay and service for members which has not yet been earned. *If the Retirement System held assets equal to the PVFB and all the assumptions were realized, there would be sufficient funds to pay off all the benefits to be paid in the future for members in the Retirement System as of the valuation date.*

Reserve Account. An account used to indicate that funds have been set aside for a specific purpose and are not generally available for other uses.

Unfunded Actuarial Accrued Liability (UAAL). The difference between the actuarial accrued liability (AAL) and actuarial value of assets (AVA). The UAAL is sometimes referred to as "unfunded accrued liability." *Funding shortfall, or prefunded amount if negative.*

Valuation Date. The date that the actuarial valuation calculations are performed as of. *Also known as the "snapshot date".*

Table B-1: The Number and Average Reported Compensation of Active Members Distributed by Age and Service as of December 31, 2019

Age	Years of Service										
	Under 1	1 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 & Up	Total
Under 25	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0
25 to 29	1	1	0	0	0	0	0	0	0	0	2
	8,553	20,659	0	0	0	0	0	0	0	0	14,606
30 to 34	0	5	0	0	0	0	0	0	0	0	5
	0	20,659	0	0	0	0	0	0	0	0	20,659
35 to 39	0	2	4	0	0	0	0	0	0	0	6
	0	20,659	20,659	0	0	0	0	0	0	0	20,659
40 to 44	0	9	3	0	0	0	0	0	0	0	12
	0	20,659	25,734	0	0	0	0	0	0	0	21,928
45 to 49	1	8	6	1	2	0	0	0	0	0	18
	5,509	20,659	20,659	25,040	37,883	0	0	0	0	0	21,975
50 to 54	0	10	3	1	1	1	0	0	0	0	16
	0	20,659	20,659	20,659	20,659	20,659	0	0	0	0	20,659
55 to 59	1	11	3	2	0	0	0	0	0	0	17
	10,108	20,659	20,659	26,215	0	0	0	0	0	0	20,692
60 to 64	1	8	12	0	3	0	0	0	0	0	24
	13,773	20,659	20,659	0	22,119	0	0	0	0	0	20,555
65 to 69	0	4	22	2	2	0	0	0	0	0	30
	0	20,659	20,659	20,659	37,883	0	0	0	0	0	21,807
70 & Over	0	8	15	9	6	1	0	1	0	0	40
	0	20,659	20,659	21,146	20,659	20,659	0	20,659	0	0	20,769
Total	4	66	68	15	14	2	0	1	0	0	170
	9,486	20,659	20,883	21,984	25,893	20,659	0	20,659	0	0	21,034

Table B-2: The Number and Reported Compensation of Active Members Distributed by Age as of December 31, 2019

Age	Men		Women	
	Number	Compensation	Number	Compensation
25	1	8,553	0	
29	1	20,659	0	
31	1	20,659	0	
32	1	20,659	0	
33	1	20,659	0	
34	2	41,318	0	
35	2	41,318	0	
36	0	0	1	20,659
37	2	41,318	0	0
38	1	20,659	0	0
40	3	66,358	1	20,659
41	3	61,977	1	20,659
42	1	20,659	0	0
43	1	31,502	0	0
44	1	20,659	1	20,659
45	3	61,977	0	0
46	2	41,318	0	0
47	2	26,168	0	0
48	3	61,977	2	41,318
49	6	162,783	0	0
50	1	20,659	3	61,977
51	4	82,636	0	0
52	2	41,318	0	0
53	1	20,659	1	20,659
54	3	61,977	1	20,659
55	3	51,426	1	20,659
57	1	20,659	1	20,659
58	5	103,295	1	20,659
59	3	61,977	2	52,430
60	3	61,977	0	0
61	2	34,432	2	41,318
62	4	82,636	1	20,659

Table B-2: The Number and Reported Compensation of Active Members Distributed by Age as of December 31, 2019 (continued)

Age	Men		Women	
	Number	Compensation	Number	Compensation
63	3	61,977	2	41,318
64	5	107,676	2	41,318
65	6	123,954	1	20,659
66	3	61,977	1	20,659
67	3	96,425	2	41,318
68	6	123,954	2	41,318
69	6	123,954	0	0
70	6	128,335	1	20,659
71	4	82,636	1	20,659
72	1	20,659	2	41,318
73	3	61,977	0	0
74	2	41,318	2	41,318
75	2	41,318	3	61,977
76	2	41,318	3	61,977
77	1	20,659	0	0
78	1	20,659	0	0
79	1	20,659	0	0
80	3	61,977	1	20,659
83	0	0	1	20,659
Total	127	2,676,258	43	899,447

Table B-3: The Number and Reported Compensation of Active Members Distributed by Service as of December 31, 2019

Service	Men		Women	
	Number	Compensation	Number	Compensation
0	4	37,942	0	0
1	29	599,110	11	227,249
2	0	0	3	61,977
3	16	330,543	5	103,295
4	2	41,318	0	0
5	13	268,566	4	82,636
6	3	61,977	1	20,659
7	19	396,901	6	123,954
8	3	61,977	0	0
9	17	362,046	2	41,318
10	2	41,318	1	20,659
11	5	107,676	1	31,771
12	1	20,659	0	0
13	2	45,699	2	41,318
14	1	20,659	0	0
15	4	87,017	2	41,318
17	3	96,425	2	41,318
19	2	75,766	1	20,659
21	1	20,659	0	0
23	0	0	1	20,659
31	0	0	1	20,659
Total	127	$ 2,676,258	43	$ 899,447

Table B-4: The Number and Deferred Retirement Allowance of Terminated Vested Members Distributed by Age as of December 31, 2019

Age	Men		Women	
	Number	Allowances	Number	Allowances
34	1	8,305		
36	1	4,983		
41			1	8,433
42	1	8,997		
45	2	17,418		
46	1	4,706		
47			1	5,217
49			1	4,983
50	2	9,412		
51	2	11,789		
52	2	11,627	1	4,983
53	1	6,021	1	4,983
54	1	10,234	1	4,983
55	2	13,288		
56	5	35,434	1	8,651
57	4	28,342		
58	1	11,627		
59	4	36,685		
60	1	4,637	2	21,870
61	1	10,218	1	5,191
62	2	16,817		
63	5	42,841		
64	2	17,645		
67	1	4,845		
68			1	9,343
70	1	6,644		
72	1	6,921		
Total	44	329,434	11	78,636

Table B-5: The Number of Accumulated Contributions of Non-Vested Terminated Members Distributed by Age as of December 31, 2019

Age	Men		Women	
	Number	Contributions	Number	Contributions
37	3	11,216		
38	2	4,484	1	5,787
39	1	6,908		
40	1	4,885		
43	1	7,402		
44	1	5,313		
45	1	6,387		
46	2	10,112		
48	4	21,561		
50	2	13,559		
51	1	7,039		
52	3	11,430		
53	2	16,113		
54	1	8,081		
55	2	11,353	2	3,718
56	1	7,419		
57	3	19,930		
59	1	4,930		
60	2	11,149		
61	1	2,063		
62	2	17,143	1	6,121
63	2	17,567	1	1,731
64	1	5,126	1	4,199
65	1	3,068		
66	1	6,318		
67	2	14,468		
68	1	5,313		
69	1	5,313	1	5,746
71	1	8,740		
74	1	3,172		
Total	48	277,564	7	27,302

Table B-6: The Number and Annual Retirement Allowances of Retired Members and Survivors of Deceased Members Distributed by Age as of December 31, 2019

Age	Men		Women	
	Number	Allowances	Number	Allowances
49	1	10,333		
52			2	15,118
57			3	11,912
60			1	12,059
61	1	4,236	1	11,720
62	2	14,573	2	31,738
63	2	9,658	1	1,923
64	3	23,339		
65	1	14,725	1	7,240
66	4	30,591		
67	3	9,883	3	11,116
68	3	21,271	4	19,911
69	4	41,156	2	10,482
70	5	37,302	8	41,964
71	11	93,585	1	21,157
72	6	79,514	6	37,551
73	8	76,554	6	48,693
74	10	87,216	5	35,329
75	8	67,710	6	32,283
76	6	41,813	6	50,506
77	10	70,732	5	28,101
78	11	86,240	2	9,885
79	7	42,701	3	16,526
80	3	33,164	4	37,297
81	7	54,230	4	38,093
82	4	34,418	5	43,182
83	12	119,831	4	32,259

Table B-6: The Number and Annual Retirement Allowances of Retired Members and Survivors of Deceased Members Distributed by Age as of December 31, 2019 (continued)

Age	Men		Women	
	Number	Allowances	Number	Allowances
84	7	60,077	3	20,551
85	7	74,299	2	17,911
86	3	30,915	4	26,117
87	8	47,214	4	37,717
88	2	16,843	6	42,832
89	5	51,837	3	39,740
90	2	29,337	2	14,164
91	2	1,907	2	4,725
92	1	3,652	2	9,652
93	1	3,869	1	763
94	2	14,631		
95	1	23,886	2	12,036
96	1	10,188		
97	2	24,207	1	2,347
100			1	8,490
Total	176	1,497,633	118	843,088

Table B-7: The Number and Annual Retirement Allowances of Retired Members and Survivors of Deceased Members Distributed by Annuity Type as of December 31, 2019

Annuity Type	Men		Women	
	Number	Allowances	Number	Allowances
Maximum	76	694,053	48	400,921
Option 2	91	709,650	8	49,152
Option 3	8	83,597		
Survivors of Deceased Members	1	10,333	62	393,015
Total	176	1,497,633	118	843,088

All members of the General Assembly are eligible for membership.

"Compensation" means salary and expense allowance paid for service as a legislator in the General Assembly, exclusive of travel and per diem. "Highest annual compensation" means the 12 consecutive calendar months of compensation during a member's final legislative term for the highest position that a member held as a member of the General Assembly. "Creditable service" includes all service rendered as a member of the General Assembly.

Benefits:

Service Retirement Allowance

Conditions for Allowance	A service retirement allowance is payable to any member who retires from service and: (a) has attained age 50 and completed 20 or more years of creditable service; or (b) has attained age 60 and completed five or more years of creditable service. (c) Members retiring on or after September 1, 2005 are not entitled to a retirement allowance from this system while employed in a contributing position in the Teachers' and State Employees' Retirement System or the Consolidated Judicial Retirement System
Unreduced Allowance	An unreduced annual service retirement allowance is payable to a member who has attained age 65 and completed five years of creditable service. The Service Retirement Allowance is equal to 4.02% of a member's highest annual compensation multiplied by the number of years of creditable service.
Reduced Allowance	A reduced annual service retirement allowance is payable to a member who retires from service after attaining age 60 and completing five years of creditable service. The reduced amount is an allowance as computed above reduced by 1/4% for each month that the member's retirement date precedes the date upon which the member would have attained age 65 had he remained in service. OR A reduced annual service retirement allowance is payable to a member who retires from service after attaining age 50 and completing 20 years of creditable service. The reduced amount is an allowance as computed above reduced by 5/12 of 1% for each month that the member's retirement date precedes the date upon which the member would have attained age 60, plus 1/4% for each month that the date upon which the member would have attained age 60 precedes the date upon which the member would have attained age 65.

Maximum Amount	The maximum annual service retirement allowance (on an unreduced basis) is 75% of the member's highest annual compensation.
Disability Retirement Allowance	
Condition for Allowance	Any member who becomes permanently and totally disabled prior to the attainment of age 60 and who has completed at least five years of creditable service may be retired by the Board of Trustees on a disability retirement allowance.
Amount of Allowance	The disability retirement allowance is computed as an unreduced service retirement allowance based on the number of years of creditable service the member would have had had he or she remained in service to age 60.
Deferred Allowance	Any member who separates from service after completing five years of creditable service and who leaves his or her total accumulated contributions in the system may receive a deferred allowance, beginning at age 50, computed in the same way as a service retirement allowance on the basis of his creditable service and compensation to the date of separation.
Return of Contributions	Upon the withdrawal of a member without a retirement allowance and upon his request, the member's contributions are returned, together with accumulated regular interest. Upon the death of a member before retirement, the member's contributions, together with the full accumulated regular interest thereon, are paid to the estate or to person(s) designated by the member unless the designated beneficiary, if eligible, elects the survivor's alternate benefit described below. The current interest rate on member contributions is 4%.
Survivor's Alternate Benefit	Upon the death of a member in service who has met conditions (a) or (b) below, the designated beneficiary may elect to receive a benefit equal to that which would have been payable under the provisions of Option 2 had the member retired on the first day of the month following death and elected such option, in lieu of the member's accumulated contributions, provided the member had not instructed the Board of Trustees in writing that he or she did not wish the alternate benefit to apply (a) attainment of age 60 and completion of five years of creditable service; (b) completion of 12 years of creditable service.

Lump Sum Death Benefit	Upon the death of a member in active service after completing one year of creditable service, a lump sum payment equal to the deceased member’s highest annual compensation to a maximum of $15,000 is made to his designated beneficiary or estate. This benefit is payable from the Teachers’ and State Employees’ Retirement System Death Benefit Fund.
Death After Retirement	Upon the death of a beneficiary who did not retire under an effective election of Option 2 or Option 3, an amount equal to the excess if any, of his accumulated contributions at retirement over the retirement allowance payments received is paid to a designated person or to the beneficiary's estate. Upon the death of the survivor of a beneficiary who retired under an effective election of Option 2 or Option 3, an amount equal to the excess, if any, of the beneficiary's accumulated contributions at retirement over the total retirement allowance payments received is paid to such other person designated by the beneficiary or to the beneficiary's estate.
Optional Arrangements at Retirement	In lieu of the full retirement allowance, any member may elect to receive a reduced retirement allowance equal in value to the full allowance, with the provision that: Option 2 - At the death of the member his allowance shall be continued throughout the life of such other person as the member shall have designated at the time of retirement, or Option 3 - At the death of the member one-half of the allowance shall be continued throughout the life of such other person as the member shall have designated at the time of retirement
Post-Retirement Increases in Allowance	Future increases in allowances may be granted at the discretion of the State.

Contributions

Member Contributions	Each member contributes 7% of annual compensation.
Employer Contributions	The State makes annual contributions consisting of a normal contribution and an accrued liability contribution. The normal contribution covers the liability on account of current service and is determined by the actuary after each valuation. The accrued liability contribution covers the liability on account of service rendered before the establishment of the retirement system and the liability on account of increases in benefits for service rendered prior to the effective date of any amendment.

Changes Since Prior Valuation	None

Appendix D: Actuarial Assumptions and Methods

Assumptions are based on the experience investigation prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016 for use beginning with the December 31, 2015 annual actuarial valuation. The interest rate of 7.00% was adopted by the Board of Trustees on April 26, 2018

Interest Rate: 7.00% per annum, compounded annually.

Inflation: Both general and wage inflation are assumed to be 3.00% per annum.

Real Wage Growth: 0.50% per annum.

Annual Rate of Salary Increase: 5.50%.

Separations Before Retirement: Representative values of the assumed annual rates of separation are as follows:

	Annual Rate of			
Age	Disability	Base Mortality*		Withdrawal
		Male	Female	
25	.0001	.0005	.0002	.0500
30	.0004	.0005	.0002	.0500
35	.0010	.0005	.0003	.0500
40	.0029	.0006	.0004	.0500
45	.0049	.0010	.0007	.0500
50	.0084	.0017	.0011	.0500
55	.0144	.0028	.0017	.0500
60		.0047	.0024	.0500
64		.0074	.0034	.0500

** Base mortality rates as of 2014

Service Retirements: Representative values of the assumed annual rates of separation are as follows:

	Service					
Age	5	10	15	20	25	30
60	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000
65	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
70	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500
75	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Appendix D: Actuarial Assumptions and Methods

Post-Retirement Mortality: Representative values of the assumed post-retirement mortality rates as of 2014 prior to any mortality improvements are as follows:

Annual Rate of Death after Retirement
(Retired Members and Survivors of Deceased Members)

Age	Retirees (Healthy at Retirement)		Survivors of Deceased Members		Retirees (Disabled at Retirement)	
	Male	Female	Male	Female	Male	Female
55	.0057	.0036	.0057	.0036	.0244	.0145
60	.0078	.0052	.0078	.0052	.0266	.0170
65	.0110	.0080	.0110	.0080	.0317	.0209
70	.0168	.0129	.0168	.0129	.0403	.0282
75	.0268	.0209	.0268	.0209	.0543	.0410
80	.0447	.0348	.0447	.0348	.0766	.0610

Deaths After Retirement (Healthy at Retirement) and Survivors: Mortality rates are based on the RP-2014 Total Data Set for Healthy Annuitants Mortality Table. The RP-2014 annuitant tables have no rates prior to age 50. The RP-2014 Total Data Set Employee Mortality Table (with no adjustments) is used for ages less than 50.

Deaths After Retirement (Disabled Members at Retirement): Mortality rates are based on the RP-2014 Total Data Set for Disabled Annuitants Mortality Table.

Deaths Prior to Retirement: Mortality rates are based on the RP-2014 Total Data Set Employee Mortality Table

Mortality Projection: All mortality rates are projected from 2014 using generational improvement with Scale MP-2015.

Timing of Assumptions: All withdrawals, deaths, disabilities, retirements and salary increases are assumed to occur July 1 of each year.

Liability for Inactive Members: The liability for members who terminated prior to five years of creditable service is estimated to be 100% of the member's accumulated contributions. The liability for members who terminated after completing five years of creditable service is estimated based on the member's current age and the service and reported compensation at termination of employment.

Administrative Expenses: 1.00% of payroll, added to the normal cost.

Reported Compensation: Calendar year compensation as furnished by the system's office.

Valuation Compensation: Reported compensation adjusted to reflect the assumed rate of pay as of the valuation date.

Actuarial Cost Method: Entry age normal cost method. Entry age is established on an individual basis.

Amortization Period: 12-year closed, level-dollar amount. The first amortization base was created for the contribution payable for fiscal year ending 2018.

Appendix D: Actuarial Assumptions and Methods

Asset Valuation Method: Actuarial value, as developed in Table 8. The actuarial value of assets is based upon a smoothed market value method. Under this method, asset returns in excess of or less than the expected return on market value of assets will be reflected in the actuarial value of assets over a five-year period. The Actuarial Value of Assets was reset to the market value of assets at December 31, 2014. The calculation of the Actuarial Value of Assets is based on the following formula:

$MV – 80\% \times G/(L)_1 – 60\% \times G/(L)_2 – 40\% \times G/(L)_3 – 20\% \times G/(L)_4$

MV = the market value of assets as of the valuation date
$G/(L)_i$ = the asset gain or (loss) for the i-th year preceding the valuation date

Changes Since Previous Valuation: None.

Appendix E: GASB 67 Fiduciary Net Position Projection

Table E-1: Projection of Fiduciary Net Positions (in thousands)

Calendar Year	Beginning Fiduciary Position	Member Contributions	Employer Contributions	Benefit Payments	Administrative Expenses	Investment Earnings	Ending Fiduciary Position
2020	28,800	267	1,047	2,594	38	1,971	29,452
2021	29,452	232	930	2,636	33	2,010	29,955
2022	29,955	218	875	2,681	31	2,041	30,377
2023	30,377	203	795	2,717	29	2,066	30,696
2024	30,696	189	720	2,728	27	2,085	30,934
2025	30,934	172	649	2,770	25	2,097	31,058
2026	31,058	158	607	2,807	23	2,103	31,096
2027	31,096	146	563	2,825	21	2,103	31,063
2028	31,063	134	527	2,842	19	2,099	30,962
2029	30,962	124	486	2,848	18	2,090	30,796
2030	30,796	117	379	2,828	17	2,075	30,522
2031	30,522	109	226	2,815	16	2,051	30,076
2032	30,076	101	132	2,790	14	2,017	29,522
2033	29,522	94	108	2,768	13	1,978	28,921
2034	28,921	88	111	2,743	13	1,936	28,300
2035	28,300	83	123	2,677	12	1,896	27,713
2036	27,713	78	117	2,667	11	1,854	27,084
2037	27,084	72	118	2,643	10	1,811	26,433
2038	26,433	66	129	2,591	9	1,768	25,795
2039	25,795	63	122	2,537	9	1,724	25,159
2040	25,159	60	110	2,512	9	1,680	24,487
2041	24,487	56	99	2,463	8	1,634	23,806
2042	23,806	53	92	2,402	8	1,589	23,130
2043	23,130	50	85	2,346	7	1,543	22,455
2044	22,455	47	76	2,319	7	1,496	21,749
2045	21,749	43	66	2,287	6	1,447	21,013
2046	21,013	39	56	2,235	6	1,397	20,264
2047	20,264	35	49	2,177	5	1,346	19,513
2048	19,513	31	44	2,118	4	1,295	18,762
2049	18,762	29	39	2,059	4	1,245	18,012
2050	18,012	26	34	2,005	4	1,194	17,256
2051	17,256	23	29	1,960	3	1,142	16,488
2052	16,488	21	25	1,899	3	1,090	15,723
2053	15,723	18	22	1,835	3	1,039	14,963
2054	14,963	16	17	1,781	2	987	14,201
2055	14,201	14	13	1,718	2	936	13,444
2056	13,444	11	12	1,655	2	885	12,694
2057	12,694	10	10	1,586	1	835	11,962
2058	11,962	9	8	1,520	1	786	11,244
2059	11,244	7	7	1,449	1	738	10,546
2060	10,546	6	4	1,396	1	690	9,850
2061	9,850	4	3	1,331	1	644	9,168
2062	9,168	3	2	1,262	-	599	8,510
2063	8,510	3	1	1,194	-	555	7,875
2064	7,875	2	1	1,127	-	513	7,264
2065	7,264	1	1	1,057	-	472	6,682
2066	6,682	1	-	993	-	434	6,124
2067	6,124	1	-	926	-	397	5,595
2068	5,595	1	-	862	-	362	5,096
2069	5,096	-	-	799	-	329	4,626

Appendix E: GASB 67 Fiduciary Net Position Projection

Table E-1: Projection of Fiduciary Net Positions (in thousands) (continued)

Calendar Year	Beginning Fiduciary Position	Member Contributions	Employer Contributions	Benefit Payments	Administrative Expenses	Investment Earnings	Ending Fiduciary Position
2070	4,626	-	-	743	-	298	4,181
2071	4,181		-	685	-	269	3,766
2072	3,766		-	629	-	242	3,379
2073	3,379		-	575	-	217	3,020
2074	3,020		-	524	-	193	2,689
2075	2,689		-	476	-	172	2,385
2076	2,385		-	430	-	152	2,107
2077	2,107		-	387	-	134	1,853
2078	1,853		-	347	-	118	1,624
2079	1,624		-	309	-	103	1,419
2080	1,419		-	274	-	90	1,235
2081	1,235		-	241	-	78	1,072
2082	1,072		-	211	-	68	929
2083	929		-	183	-	59	805
2084	805		-	158	-	51	699
2085	699		-	135	-	44	608
2086	608		-	114	-	39	532
2087	532		-	96	-	34	470
2088	470		-	80	-	30	420
2089	420		-	66	-	27	381
2090	381		-	54	-	25	352
2091	352		-	44	-	23	332
2092	332		-	35	-	22	319
2093	319		-	28	-	21	312
2094	312		-	22	-	21	312
2095	312		-	17	-	21	316
2096	316		-	13	-	22	325
2097	325		-	10	-	22	338
2098	338		-	7	-	23	355
2099	355		-	5	-	25	374
2100	374		-	4	-	26	397
2101	397		-	3	-	28	422
2102	422		-	2	-	29	450
2103	450		-	1	-	31	480
2104	480		-	1	-	34	513
2105	513		-	0	-	36	548
2106	548		-	0	-	38	586
2107	586		-	0	-	41	627
2108	627		-	0	-	44	671
2109	671		-	0	-	47	718
2110	718		-	0	-	50	768
2111	768		-	0	-	54	822
2112	822		-	0	-	58	879
2113	879		-	0	-	62	941
2114	941		-	0	-	66	1,007
2115	1,007		-	0	-	70	1,077
2116	1,077		-	0	-	75	1,152
2117	1,152		-	0	-	81	1,233
2118	1,233		-	0	-	86	1,319
2119	1,319		-	0	-	92	1,412

Appendix E: GASB 67 Fiduciary Net Position Projection

Table E-2: Actuarial Present Value of Projected Benefit Payments (in thousands)

					Present Value of Benefit Payments		
Calendar Year	Beginning Fiduciary Position	Benefit Payments	Funded Benefit Payments	Unfunded Benefit Payments	Funded Payments at 7.00%	Unfunded Payments at 2.21%	Using Single Discount Rate of 7.00%
2020	28,800	2,594	2,594	-	2,508	-	2,508
2021	29,452	2,636	2,636	-	2,381	-	2,381
2022	29,955	2,681	2,681	-	2,264	-	2,264
2023	30,377	2,717	2,717	-	2,144	-	2,144
2024	30,696	2,728	2,728	-	2,012	-	2,012
2025	30,934	2,770	2,770	-	1,909	-	1,909
2026	31,058	2,807	2,807	-	1,808	-	1,808
2027	31,096	2,825	2,825	-	1,700	-	1,700
2028	31,063	2,842	2,842	-	1,599	-	1,599
2029	30,962	2,848	2,848	-	1,497	-	1,497
2030	30,796	2,828	2,828	-	1,390	-	1,390
2031	30,522	2,815	2,815	-	1,293	-	1,293
2032	30,076	2,790	2,790	-	1,198	-	1,198
2033	29,522	2,768	2,768	-	1,110	-	1,110
2034	28,921	2,743	2,743	-	1,028	-	1,028
2035	28,300	2,677	2,677	-	938	-	938
2036	27,713	2,667	2,667	-	873	-	873
2037	27,084	2,643	2,643	-	809	-	809
2038	26,433	2,591	2,591	-	741	-	741
2039	25,795	2,537	2,537	-	678	-	678
2040	25,159	2,512	2,512	-	628	-	628
2041	24,487	2,463	2,463	-	575	-	575
2042	23,806	2,402	2,402	-	524	-	524
2043	23,130	2,346	2,346	-	478	-	478
2044	22,455	2,319	2,319	-	442	-	442
2045	21,749	2,287	2,287	-	407	-	407
2046	21,013	2,235	2,235	-	372	-	372
2047	20,264	2,177	2,177	-	339	-	339
2048	19,513	2,118	2,118	-	308	-	308
2049	18,762	2,059	2,059	-	280	-	280
2050	18,012	2,005	2,005	-	255	-	255
2051	17,256	1,960	1,960	-	233	-	233
2052	16,488	1,899	1,899	-	211	-	211
2053	15,723	1,835	1,835	-	190	-	190
2054	14,963	1,781	1,781	-	173	-	173
2055	14,201	1,718	1,718	-	156	-	156
2056	13,444	1,655	1,655	-	140	-	140
2057	12,694	1,586	1,586	-	125	-	125
2058	11,962	1,520	1,520	-	112	-	112
2059	11,244	1,449	1,449	-	100	-	100
2060	10,546	1,396	1,396	-	90	-	90
2061	9,850	1,331	1,331	-	80	-	80
2062	9,168	1,262	1,262	-	71	-	71
2063	8,510	1,194	1,194	-	63	-	63
2064	7,875	1,127	1,127	-	55	-	55
2065	7,264	1,057	1,057	-	49	-	49
2066	6,682	993	993	-	43	-	43
2067	6,124	926	926	-	37	-	37
2068	5,595	862	862	-	32	-	32
2069	5,096	799	799	-	28	-	28

Table E-2: Actuarial Present Value of Projected Benefit Payments (in thousands) (continued))

					Present Value of Benefit Payments		
Calendar Year	Beginning Fiduciary Position	Benefit Payments	Funded Benefit Payments	Unfunded Benefit Payments	Funded Payments at 7.00%	Unfunded Payments at 2.21%	Using Single Discount Rate of 7.00%
2070	4,626	743	743	-	24	-	24
2071	4,181	685	685	-	21	-	21
2072	3,766	629	629	-	18	-	18
2073	3,379	575	575	-	15	-	15
2074	3,020	524	524	-	13	-	13
2075	2,689	476	476	-	11	-	11
2076	2,385	430	430	-	9	-	9
2077	2,107	387	387	-	8	-	8
2078	1,853	347	347	-	7	-	7
2079	1,624	309	309	-	6	-	6
2080	1,419	274	274	-	5	-	5
2081	1,235	241	241	-	4	-	4
2082	1,072	211	211	-	3	-	3
2083	929	183	183	-	2	-	2
2084	805	158	158	-	2	-	2
2085	699	135	135	-	2	-	2
2086	608	114	114	-	1	-	1
2087	532	96	96	-	1	-	1
2088	470	80	80	-	1	-	1
2089	420	66	66	-	1	-	1
2090	381	54	54	-	-	-	-
2091	352	44	44	-	-	-	-
2092	332	35	35	-	-	-	-
2093	319	28	28	-	-	-	-
2094	312	22	22	-	-	-	-
2095	312	17	17	-	-	-	-
2096	316	13	13	-	-	-	-
2097	325	10	10	-	-	-	-
2098	338	7	7	-	-	-	-
2099	355	5	5	-	-	-	-
2100	374	4	4	-	-	-	-
2101	397	3	3	-	-	-	-
2102	422	2	2	-	-	-	-
2103	450	1	1	-	-	-	-
2104	480	1	1	-	-	-	-
2105	513	0	0	-	-	-	-
2106	548	0	0	-	-	-	-
2107	586	0	0	-	-	-	-
2108	627	0	0	-	-	-	-
2109	671	0	0	-	-	-	-
2110	718	0	0	-	-	-	-
2111	768	0	0	-	-	-	-
2112	822	0	0	-	-	-	-
2113	879	0	0	-	-	-	-
2114	941	0	0	-	-	-	-
2115	1,007	0	0	-	-	-	-
2116	1,077	0	0	-	-	-	-
2117	1,152	0	0	-	-	-	-
2118	1,233	0	0	-	-	-	-
2119	1,319	0	0	-	-	-	-

Appendix F: Data for Section 2 Graphs

The tables below provide the numbers associated with the graphs in Section 2 of this report.

Graph 1: Market Value of Assets and Asset Returns

	Market Value of Assets	Asset Return
2015	26,745,706	0.42%
2016	26,605,157	6.13%
2017	28,554,239	13.46%
2018	26,543,448	-1.30%
2019	28,800,055	14.58%

Graph 3: Actuarial Value and Market Value of Assets

	Actuarial Value of Assets	Market Value of Assets
2015	28,265,441	26,745,706
2016	27,976,706	26,605,157
2017	28,193,658	28,554,239
2018	27,909,801	26,543,448
2019	28,028,978	28,800,055

Graph 4: Asset Returns

	Actuarial Value Value of Assets	Market Value Asset Return
2015	5.88%	0.42%
2016	5.25%	6.13%
2017	6.42%	13.46%
2018	5.00%	-1.30%
2019	5.97%	14.58%

Appendix F: Data for Section 2 Graphs

Graph 5: Actuarial Accrued Liability

Fiscal Year Ending	Active	Deferred	Retired	Total
2015	6,390,641	2,221,225	19,944,862	28,556,728
2016	7,081,370	2,502,807	19,595,683	29,179,860
2017	7,357,199	2,556,411	20,483,773	30,397,383
2018	8,428,752	2,404,874	19,494,673	30,328,299
2019	7,514,236	2,877,651	19,877,116	30,269,003

Graph 6: Actuarial Accrued Liability and Actuarial Value of Assets

	Actuarial Accrued Liability	Actuarial Value of Assets
2015	28,556,728	28,265,441
2016	29,179,860	27,976,706
2017	30,397,383	28,193,658
2018	30,328,299	27,909,801
2019	30,269,003	28,028,978

Graph 7: Funded Ratios

	Funded Ratio (Actuarial Basis)	Funded Ratio (Market Value Basis)
2015	99.0%	93.7%
2016	95.9%	91.2%
2017	92.8%	94.0%
2018	92.0%	87.5%
2019	92.6%	95.1%