State of Wyoming Retirement System

Actuarial Valuation Report for the Year Beginning January 1, 2019

GRS Retirement Consulting
P: 720.274.7270 | F: 303.694.0633 | www.grsconsulting.com

April 8, 2019

Board of Trustees
State of Wyoming Retirement System
6101 Yellowstone Road
Suite 500
Cheyenne, WY 82002

Dear Board of Trustees:

Subject: Actuarial Valuation as of January 1, 2019

We are pleased to present the report of the actuarial valuation of the State of Wyoming Retirement System ("the Fund") for the plan year commencing January 1, 2019. This report describes the current actuarial condition of the Fund, determines the calculated employer contribution rate (the actuarially determined contribution rate), and analyzes changes in this contribution rate from the prior year. Valuations are prepared annually, as of January 1, the first day of the Fund's plan year.

This report was prepared at the request of the Board and is intended for use by the Retirement System and those designated or approved by the Board. This report may be provided to parties other than the System only in its entirety and only with the permission of the Board. GRS is not responsible for unauthorized use of this report.

Financing objectives and Funding Policy

The employer and employee contribution rates are specified in the statute. The purposes of the valuation are to measure the System's funding progress and to determine whether or not the statutory contribution is sufficient to meet the obligations of the Fund. This report should not be relied on for any purpose other than the purposes described herein. Determinations of financial results, associated with the benefits described in this report, for purposes other than those identified above may be significantly different.

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

Progress toward realization of financing objectives

The funded ratio (the ratio of the actuarial value of assets to the actuarial accrued liability) is a standard measure of a plan's funded status. The funded ratio, based upon the assumption of no further cost-of-living adjustment increases as of January 1, 2019 is 74.15%. In the January 1, 2018 valuation, this funded ratio was 76.28%. On a market value of assets basis, the funded ratio decreased from 76.74% as of January 1, 2018 to 69.22% as of January 1, 2019. The funded status alone is not appropriate for assessing the need for future contributions. The funded status is also not appropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations.

Benefit Provisions

The benefit provisions reflected in this valuation are those, which were in effect on January 1, 2019, including recent legislation that affects benefits for members who join the State of Wyoming Retirement System later than August 31, 2012. W.S. 9-3-454 prohibits benefit changes, including cost-of-living increases, unless the funded ratio stays above 100% plus a margin for adverse experience throughout the life of the benefit change. Therefore, this valuation does not include any liability for future cost-of-living increases.

Pursuant to Enrolled Act No. 10, for a non-vested member hired on or after July 1, 2018, the refund of contributions is based solely on contributions paid by a reduction in cash salary of the employee. Any employer pickup contribution is not eligible for a refund.

Pursuant to Enrolled Act No. 25, interest crediting for non-vested members on a prospective basis is eliminated beginning July 1, 2019.

The benefit provisions are summarized in Appendix B of the report.

Assumptions and Methods

Actuarial assumptions and methods are set by the Board, based upon recommendations made by the plan's actuary. The current assumptions used in the actuarial valuation were adopted by the Board effective August 23, 2017 and were first utilized with the January 1, 2018 valuation report. For a detailed description of the experience related to these assumptions, as well as the rationale for any changes, please see our latest Wyoming Retirement System Actuarial Experience Study Report. Our experience study report was dated January 10, 2018 and it covered the five-year investigation period ending December 31, 2016. All actuarial assumptions used in this report are reasonable for the purposes of this valuation.

The results of the actuarial valuation are dependent upon the actuarial assumptions used. Actual results can and almost certainly will differ, as actual experience deviates from the assumptions. Even seemingly minor changes in the assumptions can materially change the liabilities, calculated contribution rates and funding periods. The actuarial calculations presented in the report are intended to provide information for rational decision making.

Assumptions and Methods (continued)

The 8.25% employee contribution and the 8.37% employer contribution are the rates that comply with State law. Both employee and employer contribution rates will increase each year until July 1, 2021 when an ultimate rate of 9.25% for employees and 9.37% for employers is reached. Due to the many factors affecting a retirement system, users of this report should be aware that contributions made at that rate do not necessarily guarantee long-term benefit security.

The employer contribution requirement in Table 1 of this report is determined using the actuarial assumptions and methods disclosed in Appendix A of this report. This report includes risk metrics in Appendix C but does not include a more robust assessment of the risks of future experience not meeting the actuarial assumptions. Additional assessment of risks was outside the scope of this assignment. We encourage a review and assessment of investment and other significant risks that may have a material effect on the plan's financial condition.

All assumptions and methods are described in Appendix A of our report.

Data

Member data for retired, active and inactive members was supplied as of January 1, 2019 by the System's staff. We did not audit this data, but we did apply a number of tests to the data, and we concluded that it was reasonable and consistent with the prior year's data.

Asset and financial information as of January 1, 2019 was prepared by the Wyoming Retirement System and is the responsibility of management. Eide Bailly, LLP provided us the asset and financial information and will opine on Wyoming Retirement System's statements.

We are not responsible for the accuracy or completeness of the information provided by the System's staff.

Plan Experience

As part of each valuation, we examine the Fund's experience relative to the assumptions. As experience in a given year deviates from the assumptions, a gain occurs if the liabilities grow slower than the assumption set anticipates and a loss occurs if the liabilities grow faster. This past fiscal year, the Fund had a total experience loss of approximately $259 million, composed of a $219 million investment loss, a $47 million contribution loss, and a $7 million liability gain. The gain in liability was primarily due to salary increases being less than expected. The aggregate results of these analyses are disclosed in Tables 4 and 5 under Section III of the report.

Actuarial Certification

All of the tables contained in this actuarial valuation report were prepared by Gabriel, Roeder, Smith & Company. Historical information for years prior to 2010 was prepared by the prior actuarial firm and was not subjected to our actuarial review.

We certify that the information presented herein is accurate and fairly portrays the actuarial position of the System as of January 1, 2019.

All of our work conforms with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board. In our opinion, our calculations also comply with the requirements of state law and, where applicable, the Internal Revenue Code and ERISA.

The undersigned are independent actuaries and consultants.

Mark Randall and Leslie Thompson are Enrolled Actuaries and Mark Randall, Leslie Thompson, and Paul Wood are Members of the American Academy of Actuaries, and all three meet all the Qualification Standards of the American Academy of Actuaries.

Finally, all of the undersigned are experienced in performing valuations for large public retirement systems.

Respectfully submitted,
Gabriel, Roeder, Smith & Company

Mark R. Randall

Mark R. Randall, FCA, EA, MAAA
Chief Executive Officer

Leslie L. Thompson

Leslie Thompson, FSA, FCA, EA, MAAA
Senior Consultant

Paul T. Wood

Paul T. Wood, ASA, FCA, MAAA
Consultant

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SECTION I

EXECUTIVE SUMMARY

Executive Summary

Item	January 1, 2019 No COLA	January 1, 2018 No COLA
1. Contributions:		
a. Total normal cost	10.910%	10.960%
b. Employee contributions*	(8.625%)	(8.375%)
c. Net employer normal cost	2.285%	2.585%
d. Amortization payment	8.950%	7.650%
e. Administrative expenses	0.400%	0.380%
f. Required contribution	11.635%	10.615%
g. Statutory contribution*	(8.745%)	(8.495%)
h. Shortfall/(surplus)	2.890%	2.120%
2. Funding Elements:		
a. Market value of assets (MVA)	$6,831,368,597	$7,358,526,012
b. Actuarial value of assets (AVA)	$7,318,379,669	$7,314,683,343
c. Actuarial accrued liability (AAL)	$9,869,615,224	$9,588,652,976
d. Unfunded/(overfunded) actuarial accrued liability	$2,551,235,555	$2,273,969,633
3. Contributions and Ratios:		
a. Annual required contribution	$207,518,684	$191,677,662
b. Actual contributions	N/A	147,632,510
i. Employer	*N/A*	*145,911,796*
ii. Other	*N/A*	*1,720,714*
c. Percentage contributed	N/A	77.02%
d. Funded ratio on an actuarial basis (AVA/AAL)	74.15%	76.28%
e. Funded ratio on a market basis (MVA/AAL)	69.22%	76.74%
f. Projected payroll	$1,781,668,069	$1,784,888,475

*The contribution rates are blended based on Enrolled Act No. 65. Both employee and employer contribution rates will increase each year until July 1, 2021 when an ultimate rate of 9.25% for employees and 9.37% for employers is reached.

SECTION II

DISCUSSION

Contribution Requirements

- Exhibits throughout this report are based primarily, unless stated otherwise, on the assumption of no future cost-of-living adjustments (COLAs).
- W.S. 9-3-454 prohibits benefit changes, including cost-of-living increases, unless the funded ratio stays above 100% plus a margin for adverse experience throughout the life of the benefit change. The actuarial value funded ratio is 74.15% and the market value funded ratio is 69.22%.
- The actuarial assumptions have not changed since the prior valuation. For a detailed description of the experience related to these assumptions, as well as the rationale for any changes, please see our latest Wyoming Retirement System Actuarial Experience Study Report.
- The amortization payment is based upon the following assumptions:
  - The funding period is based on a 30-year closed period for the initial base as of January 1, 2018 and 20-year closed period layers for future gains and losses
  - Amortization payment amounts are calculated in such a way that they will increase as a level percentage of payroll
  - Total payroll increases are assumed at 2.50% per year, and
  - Future growth in the number of active members is not reflected in the annual valuation
- The analysis of the changes in the contribution rates is shown in Table 5 under Section III of the report
- Pursuant to recently passed legislation, both employee and employer contribution rates will increase each year until July 1, 2021 when an ultimate rate of 9.25% for employees and 9.37% for employers is reached.
- The calculated funding period assuming the new contribution rates is 56 years. In the January 1, 2018 valuation, the funding period was 27 years. Projection results were produced under a separate cover.
- Absent a change in benefit provisions, in order for the plan to achieve full funding by 2048 (30 years from January 1, 2018), the contributions to the plan must increase or the assets must outperform the assumed rate or return.
  - Assuming a 7.0% rate of return on assets going forward, in order to achieve full funding by 2048, both the employee and employer contributions would need to immediately increase by approximately 1.3% of payroll in addition to the scheduled increases.
  - Assuming no additional increases in employee and employer contributions, in order to achieve full funding by 2048, the assets would have to return approximately 7.65%, or 65bp in excess of the current assumption, each year going forward.

Calculation of Contribution Rates

The funds available to pay benefits come from two sources, contributions and investment income on those contributions (the majority of the funds available to pay benefits typically come from investment income). The Fund receives contributions from two sources, employer contributions and member contributions, both of which are determined as a percentage of pay. As shown in Table 1 under Section III of the report, the employer contribution rate has three components:

- The normal cost percentage (NC%)
- The amortization percentage (UAAL%)
- The administrative expenses

The NC% is the theoretical amount which would be required to pay the members' benefits if this amount had been contributed from each member's entry date and if the fund's experience exactly followed the actuarial assumptions. The NC% is shown in Table 3 under Section III of the report.

Members are required to make employee contributions and only the excess of the NC% over the member contribution rate is included in the employer contribution rate.

The actuarial accrued liability (AAL) is the difference between (i) the actuarial present value of all future benefits for all current participants of the fund, including active, inactive and retired members, and (ii) the actuarial present value of future normal costs. Thus, the AAL represents the liability associated with past years. The unfunded actuarial accrued liability (UAAL) is the difference between the AAL and the actuarial value of assets (AVA). It is the shortfall/excess between the liability associated with prior years (the AAL) and the assets actually accumulated (the AVA). This shortfall/excess can arise from several sources, including actuarial gains and losses, which are caused by differences between actual experience and the plan's assumptions, changes to the plan's actuarial assumptions, and amendments to the benefit provisions.

The UAAL% is the amount required to fund this difference. It is the amount, expressed as a level percentage of payroll, necessary to amortize the UAAL. Amortization bases are established each year and amortized based on the Board's policy. The Board's policy consists of amortizing the unfunded liability as of January 1, 2018, over a closed 30 year period with each subsequent amortization base created as a result of year to year experience changes over individual 20 year closed periods. The Executive Summary shows the UAAL%, called Amortization Payment, compared to that of last year.

Assumed administrative expenses are the average of the prior two years, with each year projected at 2.5% to the valuation date.

The calculated rate is used in determining the contributions necessary to meet the Actuarially Determined Contribution for the twelve-month period beginning January 1, 2019. As of January 1, 2019, the employer contribution is within 2.89% of meeting the Actuarially Determined Contribution. The current shortfall in contribution is expected to persist for many years to come.

Financial Data and Experience

As of January 1, 2019, the Fund has a total market value of $6,831 million. Financial information was received from Eide Bailly, LLP.

Table 7 under Section III of the report shows a reconciliation of the market values between the beginning and end of 2018.

During 2018, the total investment return on the market value of assets (MVA), as reported by Meketa Investment Group, Inc., was (3.52%), as shown in Table 10 under Section III of the report.

In determining the contribution rates and funded status of the Fund, an actuarial value of assets (AVA) is used rather than the market value of assets. The actuarial value of assets is based on the market value of assets with a five-year phase-in of actual investment return in excess of (or less than) expected investment income. Expected investment income is determined using the assumed investment return rate and the market value of assets (adjusted for receipts and disbursements during the year). The returns are computed net of investment expenses. An adjustment is made if the actuarial value is not within 20% of the Market Value. For any year following a year in which the 20% of market value adjustment was applied, the actuarial value is determined as if the adjustment was not applied in the previous year.

The development of the AVA is shown in Table 9 under Section III of the report. The AVA is $7.3 billion. The AVA is 107.13% of the MVA as of December 31, 2018, compared to 99.40% last year. The difference between the AVA and the MVA is the deferred gains and losses. As of January 1, 2018, the total deferred gain was $44 million. As of January 1, 2019, the total deferred loss was $487 million. Having a deferred loss in the AVA is an indicator that the funded ratio will have a downward "tilt" in the near term, and contribution requirements will likewise have upward pressure.

In addition to the market return, Table 10 also shows the return on the actuarial value of assets for the Fund. For 2018, this return was 3.88%. Since this return is less than the assumed 7.00% investment return for the prior year, an actuarial loss occurred increasing the unfunded actuarial accrued liabilities of the Fund by $219.6 million.

Member Data

Member data as of January 1, 2019 was supplied electronically by the Fund's staff. While we did not audit this data, we did perform various tests to ensure that it was internally consistent, consistent with the prior year's data, and was reasonable overall.

Table 15 under Section III of the report shows the number of members by category (active, inactive, retired, etc.) along with member statistics. Tables 16 through 28 show summaries of certain historical data and include membership statistics.

Total active member payroll decreased 0.18% last year, compared to a decrease of 3.62% from the prior year.

The number of active members in Tier 1 decreased, from 21,286 to 19,518. There were 1,146 members who retired out of Tier 1, compared to 1,227 who retired out of Tier 1 last year.

Of the 34,873 active participants, 6,371 are eligible or will become eligible for unreduced retirement and 7,221 are eligible or will become eligible for reduced retirement in 2018.

The average of the final average salaries for participants who retired or became disabled this year is $51,529.

Changes in payroll are significant because the methodology used in the valuation to amortize the unfunded actuarial accrued liability assumes a growing payroll into the future. If the payroll does not grow at the assumed 2.50% per year average, then the current amortization payments may be understated and the funding position of the Fund will not strengthen as assumed over time. Higher than expected payroll growth, however, has the opposite effect of this and the funded position of the Fund should trend toward 100%. Table 5 under Section III of the report shows, for the past year, payroll for the plan increased less than expected so the effect is an increase in the calculated contribution rate of 0.23% of payroll.

One reason payroll increased less than expected is that the salary, for continuing active participants, increased less than expected. This represented a gain to the Plan, as shown in Table 4 under Section III of the report.

Benefit Provisions

Appendix B of the report includes a more detailed summary of the benefit provisions for the Fund. A brief summary is as follows:

A new tier of benefits was signed into law on March 23, 2012 and is effective for new members joining the System on or after September 1, 2012.

- *Tier*
  - Members who join the State of Wyoming Retirement System by August 31, 2012 are in Tier 1, while members who join later are in Tier 2
- *Normal Retirement Eligibility*
  - For Tier 1 member - Age 60 with at least four years of service
  - For Tier 2 member - Age 65 with at least four years of service
- *Normal Retirement Benefit*
  - For Tier 1 member - 2.125% of employee's Highest Average Salary for each year of credited service for the first 15 years of service credit plus 2.25% of Highest Average Salary for any years of service credit exceeding 15 years. This amount is reduced by 5.0% per year that the employee is under age 60.
  - For Tier 2 member - 2.00% of employee's Highest Average Salary for each year of credited service. This amount is reduced by 5.0% per year that the employee is under age 65.

    However, members retiring with a combined age and service of at least 85 receive an unreduced benefit. Employees hired prior to July 1, 1981 may be entitled to benefits earned under a different formula.
- *Normal Form of Payment*
  - Monthly benefit for life with a lump-sum death benefit equal to the excess (if any) of the employee contributions with interest over the total benefits received.
- *Employee Contributions* are required
  - 8.63% of pay.
- *Post-retirement Cost-of-Living Adjustments (COLAs)*
  - W.S. 9-3-454 prohibits benefit changes, including cost-of-living increases, unless the funded ratio stays above 100% plus a margin for adverse experience throughout the life of the benefit change.

Pursuant to Enrolled Act No. 65, the contributions will increase for the both the employee and employer 0.25% per year for the next four years starting in September 2018.

Pursuant to Enrolled Act No. 10, for a non-vested member hired on or after July 1, 2018, the refund of contributions is based solely on contributions paid by a reduction in cash salary of the employee. Any employer pickup contribution is not eligible for a refund.

Pursuant to Enrolled Act No. 25, interest crediting for non-vested members on a prospective basis is eliminated beginning July 1, 2019.

Actuarial Methods and Assumptions

Appendix A of the report includes a summary of the actuarial assumptions and methods used in this valuation. A few highlights are listed as follows:

- Costs are determined using the Entry Age Normal actuarial cost method, calculated as a level percentage of payroll.
- The unfunded actuarial accrued liability is amortized over an effective 28 year closed period as a level percent of payroll. Future valuations will include additional amortization layers on a closed 20 year bases.
- The assumed annual investment return rate is 7.00%, with assumed inflation of 2.25%.
- Payroll is assumed to increase at 2.50% per year.
- Inactive vested participants are assumed to retire at age 60 (65 for Tier 2) or on the valuation date if older.
- The benefit amount is not available for all members entitled to deferred benefits. The benefit amount and present value of benefits expected to be paid to vested inactive non-retired members without a benefit in the data is approximated using the data provided.

The average future lifetime for current pensioners is 16.1 years.

The actuarial assumptions and methods were reviewed in detail as part of the 2017 Experience Study covering the five year period ending December 31, 2016. Please see Appendix A for a summary of these assumptions.

GASB and Funding Progress

Governmental Accounting Standards Board Statement Number 67 (GASB 67) contains certain accounting requirements for the Fund. Schedules, notes and required supplementary information are provided under separate cover.

SECTION III

SUPPORTING EXHIBITS

Table 1A

Calculation of Employer Contribution Rate
(Assumes No Future Cost-Of-Living Increases)

Item			January 1, 2019	January 1, 2018
1.	Projected valuation payroll		$1,781,668,069	$1,784,888,475
2.	Present value of future pay		$14,394,639,697	$14,382,166,810
3.	Employer normal cost rate		2.29%	2.71%
4.	Actuarial accrued liability for active members			
	a.	Present value of future benefits for active members	$5,060,062,785	$5,113,244,191
	b.	Less: present value of future employer normal costs	(198,557,378)	(332,644,103)
	c.	Less: present value of future employee contributions*	(1,313,958,918)	(1,186,528,760)
	d.	Actuarial accrued liability	$3,547,546,489	$3,594,071,328
5.	Total actuarial accrued liability for:			
	a.	Retirees and beneficiaries	$5,829,718,015	$5,522,919,403
	b.	Disabled members	38,523,845	38,126,973
	c.	Inactive members	453,826,875	433,535,272
	d.	Active members (Item 4d)	3,547,546,489	3,594,071,328
	e.	Total	$9,869,615,224	$9,588,652,976
6.	Actuarial value of assets (Table 9)		$7,318,379,669	$7,314,683,343
7.	Unfunded actuarial accrued liability (UAAL) (Item 5e - Item 6)		$2,551,235,555	$2,273,969,633
8.	Effective UAAL amortization period		28 years	30 years
9.	Assumed payroll growth rate		2.50%	2.50%
10.	Employer contribution requirement			
	a.	UAAL amortization payment as % of pay	8.95%	7.65%
	b.	Employer normal cost	2.29%	2.71%
	c.	Administrative expense	0.40%	0.38%
	d.	Contribution requirement (a + b + c)	11.64%	10.74%

*Beginning in 2019, includes the anticipated employee increases under Enrolled Act No. 65.

Table 1B

Calculation of UAAL Amortization Payment
(Assumes No Future Cost-Of-Living Increases)

UAAL as of January 1, 2019	$2,551,235,555
Total Prior Remaining Amortization Bases as of January 1, 2019	2,291,897,135
2019 Amortization Base as of January 1, 2019	**$259,338,420**
2019 Payment (20 years, level percent of pay amortization)	**$19,568,171**

		As of January 1, 2019		
Base Year	**Initial Base**	**Remaining Base**	**Years Remaining**	**Amortization Payment**
2019	$ 259,338,420	$ 259,338,420	20	$ 19,568,171
2018	2,273,969,633	2,291,897,135	29	139,965,686
Total		**$ 2,551,235,555**		**$ 159,533,857**

Table 2

Cost Breakdown

(Assumes No Future Cost-Of-Living Increases)

Item	Present Value of Future Normal Costs (1)	Actuarial Accrued Liabilities (2)	Total Present Value of Benefits (3) = (1) + (2)
Age and service allowances based on total service and disability benefits likely to be rendered by present active members	$1,140,713,859	$3,520,570,762	$4,661,284,621
Death-in-service benefits likely to be paid on behalf of present active members (employer financed portion)	33,190,220	85,692,602	118,882,822
Separation benefits (refunds of contributions and deferred allowances) likely to be paid to present active members	338,612,217	(58,716,875)	279,895,342
Benefits likely to be paid to vested inactive members	0	388,965,947	388,965,947
Benefits to be paid to members due refunds	0	64,860,928	64,860,928
Benefits to be paid to current retirees, disabled members, beneficiaries, and future beneficiaries of current retirees	0	5,868,241,860	5,868,241,860
Total	$1,512,516,296	$9,869,615,224	$11,382,131,520
Actuarial value of assets	0	7,318,379,669	7,318,379,669
Liabilities to be covered by future contributions	$1,512,516,296	$2,551,235,555	$4,063,751,851

Table 3

History of Total Normal Cost

(Assumes No Future Cost-Of-Living Increases)

Fiscal Year Ending December 31	Total Normal Cost as Percent of Payroll
(1)	(2)
2008	9.08%
2009	10.10%
2010	10.86%
2011	11.11%
2012	10.86%
2013	10.77%
2014	11.96%
2015	11.96%
2016	11.83%
2017	11.55%
2018	10.96%
2019	10.91%

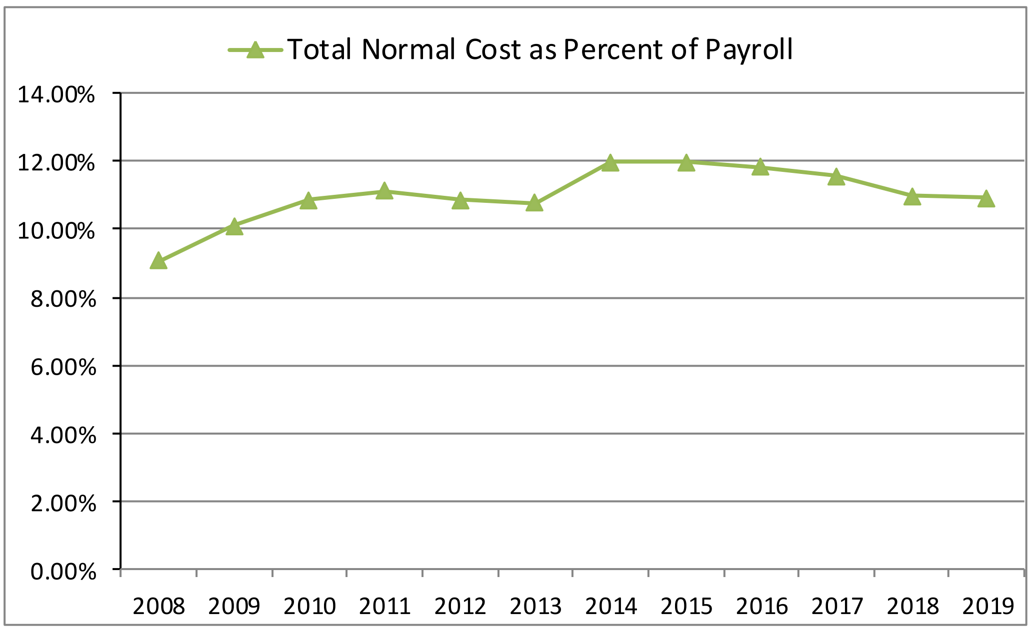

Table 4
Calculation of Total Actuarial Gain/(Loss)
(Assumes No Future Cost-Of-Living Increases)

Item	January 1, 2019
1. Derivation of Experience Gain/(Loss)	
a. Unfunded actuarial accrued liability (UAAL) - previous valuation	$2,273,969,633
b. Normal cost (NC) for fiscal year ending December 31, 2018	195,575,014
c. Expected administrative expenses for fiscal year ending December 31, 2018	6,830,100
d. Actuarially determined contribution for fiscal year ending December 31, 2018	338,957,003
e. Interest accrual:	
(i) For whole year on (a)	159,177,874
(ii) For half year on (b) + (c) - (d)	(4,698,483)
(iii) Total interest: (e)(i) + (e)(ii)	154,479,391
f. Change in UAAL due to plan changes	-
g. Change in UAAL due to assumption changes	-
h. Expected UAAL current year: (a) + (b) + (c) - (d) + (e)(iii) + (f) + (g)	2,291,897,135
i. Actual UAAL current year	2,551,235,555
j. Experience gain/(loss): (h) - (i)	(259,338,420)
k. Experience gain/(loss) as a % of actuarial accrued liability	-2.63%
2. Approximate portion of gain/(loss) due to investments (at actuarial value)	($219,575,776)
3. Approximate portion of gain/(loss) due to contributions higher or lower than expected	($46,806,901)
4. Approximate amount of gain/(loss) due to liabilities: (1)(j) - (2) - (3)	$7,044,256
a. Age & service retirements	($18,177,840)
b. Disability retirements	108,690
c. Death-in-service	(195,716)
d. Withdrawal from employment	(8,382,993)
e. Rehires	1,251,358
f. Pay increases	48,032,731
g. Death after retirement	2,673,444
h. Other	(18,265,417)
i. Other as a % of actuarial accrued liability	-0.19%

Table 5

Change in Calculated Contribution Rate Since the Prior Valuation

(Assumes No Future Cost-Of-Living Increases)

Item	January 1, 2019
1. Calculated contribution rate as of January 1, 2018	10.74%
2. Change in contribution rate during year	
a. Change in employer normal cost	-0.04%
b. Change in employee contributions	-0.38%
c. Actuarial (gain) loss from investments on actuarial value of assets	0.91%
d. Actuarial (gain) loss from liability sources & administrative expenses	-0.01%
e. Difference between contributions made and required contribution	0.19%
f. Effect of payroll growing (faster)/slower than assumption	0.23%
g. Other changes	0.00%
h. Total change	0.90%
3. Calculated contribution rate as of January 1, 2019	11.64%

**Includes the impact of using the blended employee contribution rates for calendar year 2019.*

Table 6

Statement of Plan Net Assets

Assets at Market Value		
Item	**FYE 2018**	**FYE 2017**
1. Cash and Cash Equivalents (Operating Cash)	$514,086,289	$416,656,180
2. Receivables		
a. Insurance premium tax	$0	$0
b. Buy backs	0	0
c. Employer contributions	8,495,602	7,636,163
d. Employee contributions	8,372,198	7,519,751
e. Securities sold	50,124,358	32,664,265
f. Accrued interest and dividends	17,961,224	10,907,712
g. Currency contract receivable	1,497,075,482	1,688,898,064
h. Other	96,924	4,140,794
i. Rebate and fee income receivable	0	93,248
j. Total receivables	$1,582,125,788	$1,751,859,997
3. Investments, at Fair Value	$6,795,047,684	$7,420,792,878
4. Liabilities		
a. Benefits and refunds payable	($382,503)	($858,584)
b. Securities purchased	(107,338,085)	(43,499,973)
c. Administrative and consulting fees payable	(18,656,054)	(14,884,620)
d. Currency contract payable	(1,502,147,520)	(1,697,107,759)
e. Securities lending collateral	(431,367,002)	(474,432,107)
f. Total liabilities	($2,059,891,164)	($2,230,783,043)
5. Total Market Value of Assets Available for Benefits	$6,831,368,597	$7,358,526,012

Table 7

Reconciliation of Plan Net Assets

Assets at Market Value			
	Item	**FYE 2018**	**FYE 2017**
A.	Market Value of Assets at Beginning of Year	$7,358,526,012	$6,678,504,705
B.	Contribution Income:		
	1. Contributions		
	a. Employee	$146,255,015	$145,007,950
	b. Employer	145,911,796	147,037,307
	c. Other	6,596,214	6,453,663
	d. Total	$298,763,025	$298,498,920
	2. Investment Income		
	a. Interest, dividends, and other income	$125,205,471	$129,134,773
	b. Net appreciation	(327,282,467)	857,540,444
	c. Investment expenses	(52,099,148)	(64,632,088)
	d. Net investment income	$(254,176,144)	$922,043,129
	3. Securities Lending		
	a. Gross income	$11,256,456	$6,234,558
	b. Deductions	(9,651,465)	(4,399,598)
	c. Net investment income	$1,604,991	$1,834,960
	4. Benefits and Refunds		
	a. Refunds	$(18,114,423)	$(18,654,997)
	b. Regular monthly benefits	(547,913,244)	(516,837,260)
	c. Total	$(566,027,667)	$(535,492,257)
	5. Administrative and Miscellaneous Expenses	$(7,321,620)	$(6,863,445)
C.	Market Value of Assets at End of Year	$6,831,368,597	$7,358,526,012

Table 8

Progress of Fund Through December 31, 2018

Plan Year Ending December 31	Employer Contributions*	Employee Contributions*	Administrative Expenses	Net Investment Income**	Benefit Payments	Transfers	Actuarial Value of Assets
Total	$ 2,623,419,294	$ 2,458,203,821	$ (84,013,099)	$ 8,893,293,911	$(7,223,007,719)	$ (115,633,895)	
1986	$ 41,364,465	$ 36,365,804	$ (782,000)	$ 98,998,090	$ (42,082,765)	$ -	$ 900,097,591
1987	39,901,834	36,039,418	(808,023)	91,374,783	(50,604,364)	-	1,016,001,239
1988	38,414,939	33,222,264	(444,343)	103,025,282	(48,627,479)	-	1,141,591,902
1989	36,139,394	36,231,108	(424,136)	128,370,680	(55,459,353)	-	1,286,449,595
1990	38,668,634	38,960,372	(850,148)	114,218,588	(61,154,261)	-	1,416,292,780
1991	38,903,350	39,288,267	(863,301)	148,164,188	(69,348,501)	-	1,572,336,783
1992	42,354,843	42,883,874	(909,653)	175,246,400	(75,211,430)	-	1,756,700,817
1993	41,596,571	42,266,219	(801,026)	189,281,426	(82,480,713)	-	1,946,563,294
1994	42,791,243	43,415,880	(888,518)	136,210,578	(89,707,717)	-	2,078,384,760
1995	43,714,263	44,435,762	(937,480)	230,731,781	(99,689,985)	-	2,296,639,101
1996	43,495,146	44,761,611	(1,028,163)	233,212,720	(108,536,621)	-	2,508,543,794
1997	44,958,544	46,152,691	(1,147,818)	314,340,179	(117,126,096)	-	2,795,721,294
1998	46,183,091	47,366,181	(1,074,562)	436,098,461	(123,858,991)	-	3,200,435,474
1999	48,681,209	50,106,535	(1,182,899)	475,758,627	(132,428,572)	-	3,641,370,374
2000	50,539,675	51,868,059	(1,096,747)	592,379,739	(144,620,949)	-	4,190,440,151
2001	56,517,377	53,792,429	(1,387,930)	439,286,379	(156,189,100)	-	4,582,462,306
2002	57,377,428	58,234,324	(1,281,554)	(66,209,697)	(171,160,286)	(106,978,719)	4,352,423,802
2003	55,363,788	60,848,296	(1,435,922)	376,524,142	(185,826,481)	-	4,657,897,625
2004	60,573,670	61,412,824	(1,644,382)	127,831,761	(201,772,174)	-	4,704,299,324
2005	65,191,670	63,381,309	(1,930,627)	238,882,774	(217,308,520)	(8,655,176)	4,843,861,114
2006	72,664,403	69,020,297	(1,949,051)	409,948,934	(232,944,164)	-	5,160,601,533
2007	83,149,236	78,495,298	(2,005,783)	583,547,681	(249,765,088)	-	5,654,022,877
2008	88,451,655	84,814,014	(2,778,990)	(720,402,274)	(268,232,301)	-	4,835,874,981
2009***	244,063,923	89,298,711	(3,081,105)	868,641,735	(292,256,569)	-	5,742,541,676
2010	104,757,666	99,291,423	(3,600,747)	170,797,772	(314,256,856)	-	5,799,530,934
2011	122,557,906	116,691,540	(5,541,488)	71,962,242	(343,979,208)	-	5,761,221,926
2012	124,648,088	119,052,404	(6,463,506)	126,138,774	(374,629,714)	-	5,749,967,972
2013	128,277,269	122,611,180	(6,513,680)	654,726,838	(404,568,029)	-	6,244,501,550
2014	129,627,747	141,061,289	(5,258,065)	535,776,435	(436,096,614)	-	6,609,612,342
2015	144,622,373	153,529,134	(5,410,522)	382,521,078	(469,954,814)	-	6,814,919,591
2016	151,488,715	152,422,538	(6,305,865)	452,136,957	(501,610,080)	-	7,063,051,856
2017	148,746,669	149,752,251	(6,863,445)	495,488,269	(535,492,257)	-	7,314,683,343
2018	147,632,510	151,130,515	(7,321,620)	278,282,588	(566,027,667)	-	7,318,379,669

* Employer contributions include other funding sources and employee contributions may include member redeposits and member service purchase contributions

** Net of investment expenses

*** December 31, 2009 market values exclude Air Guard Firefighters

Table 9

Development of Actuarial Value of Assets

Item	FYE 2018	FYE 2017
1. Actuarial value of assets, beginning of year (without corridor)	$7,314,683,343	$7,063,051,856
2. Market value, end of year	$6,831,368,597	$7,358,526,012
3. Market value, beginning of year	$7,358,526,012	$6,678,504,705
4. Non-investment/administrative net cash flow:		
a. Employee contributions	$146,255,015	$145,007,950
b. Employer contributions	145,911,796	147,037,307
c. Other contributions	6,596,214	6,453,663
d. Refund of employee accounts	(18,114,423)	(18,654,997)
e. Retirement benefits	(547,913,244)	(516,837,260)
f. Administrative expenses	(7,321,620)	(6,863,445)
g. Total net cash flow: [sum of (4a) through (4f)]	($274,586,262)	($243,856,782)
5. Investments and securities lending:		
a. Interest and dividends on investments	$125,205,471	$129,134,773
b. Gross income from securities lending	11,256,456	6,234,558
c. Fees and expenses	(61,750,613)	(69,031,686)
d. Total net income: [sum of (5a) through (5c)]	$74,711,314	$66,337,645
6. Investment income:		
a. Actual market return: (2) - (3) - (4g) - (5d)	($327,282,467)	$857,540,444
b. Assumed rate of return	7.00%	7.75%
c. Assumed amount of return	430,937,531	441,973,334
d. Amount subject to phase-in: (6a) - (6c)	($758,219,998)	$415,567,110
7. Phase-in recognition of investment income:		
a. Current year: 0.20 * (6d)	($151,644,000)	$83,113,422
b. First prior year	83,113,422	(7,136,709)
c. Second prior year	(7,136,709)	(115,501,918)
d. Third prior year	(115,501,918)	(36,197,052)
e. Fourth prior year	(36,197,052)	62,899,547
f. Total recognition	($227,366,257)	($12,822,710)
8. Actuarial value of assets, end of year		
a. Preliminary actuarial value of assets, end of year:		
(1) + (4g) + (5d) + (6c) + (7f)	$7,318,379,669	$7,314,683,343
b. Upper corridor limit: 120% * (2)	8,197,642,316	8,830,231,214
c. Lower corridor limit: 80% * (2)	5,465,094,878	5,886,820,810
d. Actuarial value of assets, end of year	$7,318,379,669	$7,314,683,343
9. Difference between market and actuarial value of assets	($487,011,072)	$43,842,669
10. Actuarial rate of return	3.88%	7.14%
11. Market rate of return*	-3.52%	14.30%
12. Ratio of actuarial value to market value of assets	107.13%	99.40%

* Current year market rate of return is based on unaudited data and is supplied by the plan's investment consultant.

Table 10

History of Investment Returns

Plan Year	Market Value	Actuarial Value
(1)	(2)	(3)
2000	-0.99%	16.37%
2001	-4.47%	10.54%
2002	-9.29%	-1.47%
2003	21.00%	8.72%
2004	11.54%	2.77%
2005	8.22%	5.13%
2006	12.63%	8.55%
2007	7.44%	11.41%
2008	-29.63%	-12.85%
2009	23.72%	17.89%
2010	13.80%	3.00%
2011	-0.90%	1.25%
2012	14.05%	2.22%
2013	13.53%	11.55%
2014	4.70%	8.70%
2015	-0.26%	5.87%
2016	7.60%	6.74%
2017	14.30%	7.14%
2018	-3.52%	3.88%
Average returns:		
Last five years:	4.38%	6.45%
Last ten years:	8.39%	6.72%

The market returns above are gross of investment expenses and were provided by the plan's investment consultant. The actuarial returns above are based on the financial information provided by the plan's

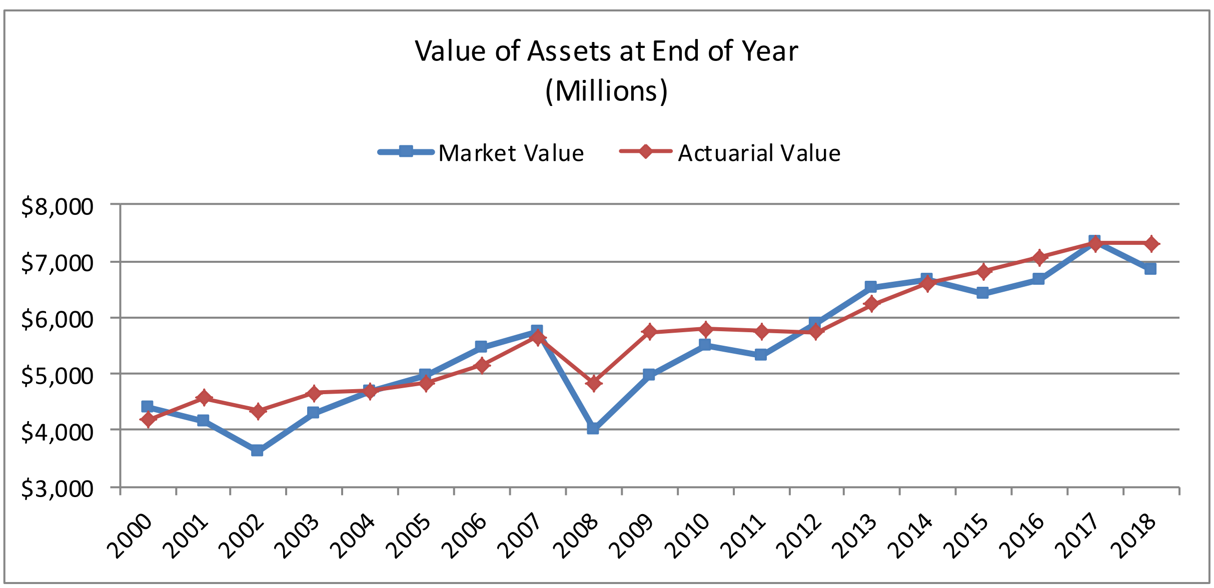

Table 11

Solvency Test

Valuation Date January 1	Total Active Member Contributions (1)	Inactive and Pensioner Liability (2)	Employer Financed Active Accrued Liability (3)	Actuarial Value of Assets	Percentage of Liabilities Covered by Assets (1)	(2)	(3)
2005	$840,104,000	$2,592,159,000	$2,103,929,000	$4,704,299,324	100%	100%	60.5%
2006	888,544,000	2,354,500,000	1,848,710,000	4,843,861,114	100%	100%	86.6%
2007	941,572,000	2,488,504,000	2,038,153,000	5,160,601,533	100%	100%	84.9%
2008	991,444,000	2,699,505,000	2,325,036,000	5,654,022,877	100%	100%	84.4%
2009	1,036,443,231	2,796,308,000	2,319,370,769	4,835,874,981	100%	100%	43.2%
2010	1,109,001,753	2,933,630,669	2,519,698,185	5,742,541,676	100%	100%	67.3%
2011	1,161,508,226	3,178,244,317	2,515,890,340	5,799,530,934	100%	100%	58.0%
2012	1,226,273,201	3,455,740,883	2,355,172,581	5,761,221,926	100%	100%	45.8%
2013	1,286,009,555	3,724,948,051	2,308,247,120	5,749,967,972	100%	100%	32.0%
2014	1,333,532,543	4,251,120,151	2,460,394,278	6,244,501,550	100%	100%	26.8%
2015	1,394,083,171	4,600,839,298	2,375,744,013	6,609,612,342	100%	100%	25.9%
2016	1,472,111,790	4,897,375,395	2,343,866,339	6,814,919,591	100%	100%	19.0%
2017	1,491,204,773	5,255,363,783	2,292,735,275	7,063,051,856	100%	100%	13.8%
2018	1,504,862,214	5,994,581,648	2,089,209,114	7,314,683,343	100%	97%	0.0%
2019	1,527,496,996	6,322,068,735	2,020,049,493	7,318,379,669	100%	92%	0.0%

Excludes Air Guard beginning in 2010

Effective January 1, 2010, liabilities are calculated assuming no future cost-of-living increases.

Table 12

Schedule of Funding Progress

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Valuation Date January 1	Actuarial Value of Assets	Actuarial Accrued Liability (AAL)	Unfunded AAL (UAAL) [(3) - (2)]	Funded Ratio [(2)/(3)]	Covered Payroll	UAAL as a Percentage of Covered Payroll [(4)/(6)]
2001	$4,190,440,151	$3,683,174,000	($507,266,151)	113.77%	$897,641,000	(56.51%)
2002	4,582,462,306	4,442,033,000	(140,429,306)	103.16%	964,121,000	(14.57%)
2003	4,352,423,802	4,718,618,000	366,194,198	92.24%	988,135,000	37.06%
2004	4,657,897,625	5,077,443,000	419,545,375	91.74%	1,032,259,000	40.64%
2005	4,704,299,324	4,902,322,000	198,022,676	95.96%	1,086,736,000	18.22%
2006	4,843,861,114	5,091,763,000	247,901,886	95.13%	1,156,400,000	21.44%
2007	5,160,601,533	5,468,229,000	307,627,467	94.37%	1,285,096,000	23.94%
2008	5,654,022,877	6,015,985,000	361,962,123	93.98%	1,462,474,000	24.75%
2009	4,835,874,981	6,152,122,000	1,316,247,019	78.60%	1,585,728,000	83.01%
2010	5,742,541,676	6,562,330,607	819,788,931	87.51%	1,697,341,384	48.30%
2011	5,799,530,934	6,855,642,883	1,056,111,949	84.59%	1,728,433,786	61.10%
2012	5,761,221,926	7,037,186,665	1,275,964,739	81.87%	1,756,856,648	72.63%
2013	5,749,967,972	7,319,204,726	1,569,236,754	78.56%	1,782,069,208	88.06%
2014	6,244,501,550	8,045,046,972	1,800,545,422	77.62%	1,782,062,471	101.04%
2015	6,609,612,342	8,370,666,482	1,761,054,140	78.96%	1,818,197,022	96.86%
2016	6,814,919,591	8,713,353,524	1,898,433,933	78.21%	1,858,678,687	102.14%
2017	7,063,051,856	9,039,303,831	1,976,251,975	78.14%	1,851,873,634	106.72%
2018	7,314,683,343	9,588,652,976	2,273,969,633	76.28%	1,784,888,475	127.40%
2019	7,318,379,669	9,869,615,224	2,551,235,555	74.15%	1,781,668,069	143.19%

Excludes Air Guard beginning in 2010

Effective January 1, 2010, liabilities are calculated assuming no future cost-of-living increases.

Table 13

Schedule of Contributions from the Employer(s) and Other Contributing Entities

(1)	(2)	(3)	(4)	(5)	(6)
Fiscal Year Ending December 31	Actuarially Determined Contribution		Employer Contributions*		Percentage of Actuarially Determined Contribution Contributed [(5)/(3)]
	% of Payroll	Amount	% of Payroll	Amount	
2004	8.76%	$90,477,000	5.87%	$60,573,670	66.95%
2005	10.00%	108,707,000	6.00%	65,191,670	59.97%
2006	5.68%	65,714,000	6.28%	72,664,403	110.58%
2007	5.68%	73,035,000	6.47%	83,149,236	113.85%
2008	5.68%	83,036,000	6.05%	88,451,655	106.52%
2009	9.15%	145,015,000	15.39%	244,063,923**	168.32%
2010	8.06%	136,689,664	6.17%	104,757,666	76.64%
2011	7.60%	131,260,466	7.09%	122,557,906	93.37%
2012	8.04%	141,299,725	7.09%	124,648,088	88.22%
2013	8.86%	158,013,754	7.20%	128,277,269	81.18%
2014	10.28%	183,086,430	7.27%	129,627,747	70.80%
2015	9.26%	168,411,742	8.12%	144,622,373	85.87%
2016	9.38%	174,211,753	8.15%	151,488,715	86.96%
2017	9.37%	173,551,431	8.03%	148,746,669	85.71%
2018	10.74%	191,677,662	8.27%	147,632,510	77.02%
2019	11.64%	207,518,684	-	-	-

Excludes Air Guard beginning December 31, 2009, including Employer Contributions of $149,244 as of December 31, 2009.

Effective January 1, 2010, liabilities are calculated assuming no future cost-of-living increases.

* Includes other funding sources but excludes member redeposits and member service purchase contributions.

** There was a $150.6 million legislative appropriation to address the increase in school district employee pay.

Table 14

Reconciliation of Participant Data

	Active Participants							
	Tier 1	Tier 2	Vested Former Participants	Retired Participants	Disableds	Beneficiaries	Participants Due Refunds	Total
Number as of January 1, 2018	**21,286**	**13,727**	**6,591**	**24,118**	**238**	**2,452**	**23,281**	**91,693**
New participants	-	3,502	-	-	-	5	645	4,152
Vested terminations	(644)	(328)	980	-	-	-	(8)	-
Retirements	(1,146)	(31)	(355)	1,535	(3)	-	-	-
Disability	(7)	-	(2)	-	9	-	-	-
Deceased with beneficiary	(23)	(3)	(10)	(199)	(4)	239	-	-
Deceased without beneficiary	(8)	(4)	(32)	(441)	(8)	(142)	(29)	(664)
Due refunds	(15)	(1,483)	(3)	-	-	-	1,501	-
Lump sum payoffs	(111)	(544)	(144)	-	-	-	(788)	(1,587)
Rehires/return to active	183	522	(204)	(3)	-	-	(404)	94
Certain period expired	-	-	-	-	-	(15)	-	(15)
Reclassifications	3	(3)	-	-	-	-	-	-
Data corrections	-	-	5	1	-	-	-	6
Number as of January 1, 2019	**19,518**	**15,355**	**6,826**	**25,011**	**232**	**2,539**	**24,198**	**93,679**

Table 15

Demographic Statistics

	January 1		
	2019	**2018**	**Change**
Active Participants			
Number	34,873	35,013	-0.4%
Vested	*23,886*	*23,850*	
Not vested	*10,987*	*11,163*	
Average age (years)	46.24	46.31	-0.2%
Average service (years)	9.97	10.05	-0.8%
Average entry age (years)	36.27	36.26	0.0%
Total payroll*	$1,781,668,069	$1,784,888,475	-0.2%
Average payroll*	$51,090	$50,978	0.2%
Total employee contributions with interest	$1,527,496,996	$1,504,862,214	1.5%
Average employee contributions with interest	$43,802	$42,980	1.9%
Vested Former Participants			
Number	6,826	6,591	3.6%
Average age (years)	50.99	51.39	-0.8%
Total employee contributions with interest	$234,092,797	$221,045,319	5.9%
Average employee contributions with interest	$34,294	$33,537	2.3%
Service Retirees			
Number	25,011	24,118	3.7%
Average age (years)	72.04	71.88	0.2%
Total annual benefits	$517,594,458	$489,298,986	5.8%
Average annual benefit	$20,695	$20,288	2.0%
Disability Retirees			
Number	232	238	-2.5%
Average age (years)	65.03	64.79	0.4%
Total annual benefits	$3,743,642	$3,724,336	0.5%
Average annual benefit	$16,136	$15,648	3.1%
Beneficiaries			
Number	2,539	2,452	3.5%
Average age (years)	76.02	75.87	0.2%
Total annual benefits	$37,193,925	$35,091,325	6.0%
Average annual benefit	$14,649	$14,311	2.4%
Participants Due Refunds			
Number	24,198	23,281	3.9%
Total Refunds Due	$64,860,928	$59,664,095	8.7%

* Projected payroll for the upcoming valuation year

Table 16

Distribution of Male Active Members by Age and by Years of Service

Average Age = 46.9 Average Service = 10.4

Age Last Birthday		Whole Years of Service at Valuation Date							Totals
		0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	
Less than 20	Count	18	-	-	-	-	-	-	18
	Avg. Salary	$24,432	-	-	-	-	-	-	$24,432
20-24	Count	312	4	-	-	-	-	-	316
	Avg. Salary	34,615	$55,775	-	-	-	-	-	34,883
25-29	Count	716	143	4	-	-	-	-	863
	Avg. Salary	42,230	47,109	$53,034	-	-	-	-	43,089
30-34	Count	728	481	97	4	-	-	-	1,310
	Avg. Salary	46,701	57,797	56,939	$66,071	-	-	-	51,592
35-39	Count	563	474	373	65	-	-	-	1,475
	Avg. Salary	48,870	60,791	66,781	65,181	-	-	-	57,949
40-44	Count	438	378	379	241	44	-	-	1,480
	Avg. Salary	49,919	62,798	67,866	72,853	$74,833	-	-	62,280
45-49	Count	418	296	293	238	232	48	-	1,525
	Avg. Salary	47,920	60,420	63,969	72,422	76,991	$75,641	-	62,549
50-54	Count	400	290	310	217	201	239	63	1,720
	Avg. Salary	47,501	58,918	63,955	65,079	76,136	78,458	$72,547	63,174
55-59	Count	381	256	301	224	189	187	201	1,739
	Avg. Salary	43,610	52,547	61,503	64,048	71,723	73,126	76,110	60,641
60-64	Count	267	273	220	170	117	106	176	1,329
	Avg. Salary	45,564	54,056	58,453	60,662	67,870	71,525	77,027	59,574
65-69	Count	134	101	72	60	33	29	61	490
	Avg. Salary	32,103	47,160	60,929	59,533	63,988	71,260	74,632	52,560
70 & Over	Count	70	37	29	23	5	3	23	190
	Avg. Salary	21,475	40,860	44,280	49,131	54,464	*	76,172	40,734
Totals	Count	**4,445**	**2,733**	**2,078**	**1,242**	**821**	**612**	**524**	**12,455**
	Avg. Salary	**$44,650**	**$57,361**	**$63,512**	**$66,649**	**$73,494**	**$75,148**	**$75,820**	**$57,491**

Average salary represents annualized salary earned in 2018 and is not shown for cells with counts less than or equal to three participants

Table 17

Distribution of Female Active Members by Age and by Years of Service

Average Age = 45.8 Average Service = 9.7

Age Last Birthday		Whole Years of Service at Valuation Date 0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	Totals
Less than 20	Count	42	-	-	-	-	-	-	42
	Avg. Salary	$18,733	-	-	-	-	-	-	$18,733
20-24	Count	628	2	-	-	-	-	-	630
	Avg. Salary	28,842	*	-	-	-	-	-	28,836
25-29	Count	1,495	245	-	-	-	-	-	1,740
	Avg. Salary	37,813	$47,906	-	-	-	-	-	39,234
30-34	Count	1,342	904	210	2	-	-	-	2,458
	Avg. Salary	36,419	51,426	$54,809	*	-	-	-	43,519
35-39	Count	1,341	779	632	126	-	-	-	2,878
	Avg. Salary	35,183	50,234	58,881	$59,590	-	-	-	45,529
40-44	Count	1,109	723	561	438	69	1	-	2,901
	Avg. Salary	34,657	46,510	56,583	63,517	$63,707	*	-	46,904
45-49	Count	853	660	590	420	307	70	2	2,902
	Avg. Salary	36,178	45,185	52,353	60,946	67,676	$69,717	*	49,254
50-54	Count	715	516	509	447	256	270	65	2,778
	Avg. Salary	35,911	42,969	48,632	53,717	62,321	70,919	$61,262	48,847
55-59	Count	604	460	566	506	385	297	259	3,077
	Avg. Salary	33,052	41,538	44,433	49,136	54,198	63,113	67,603	47,515
60-64	Count	383	319	381	352	301	218	275	2,229
	Avg. Salary	33,639	39,931	43,571	50,354	48,237	53,821	64,727	46,657
65-69	Count	105	93	119	84	77	56	81	615
	Avg. Salary	23,564	39,114	42,929	44,954	49,544	52,308	59,124	43,138
70 & Over	Count	50	26	21	25	7	16	23	168
	Avg. Salary	18,476	28,589	35,987	35,794	37,943	48,160	49,861	32,742
Totals	Count	**8,667**	**4,727**	**3,589**	**2,400**	**1,402**	**928**	**705**	**22,418**
	Avg. Salary	**$34,926**	**$46,384**	**$51,190**	**$55,122**	**$57,484**	**$62,774**	**$64,310**	**$45,596**

Average salary represents annualized salary earned in 2018 and is not shown for cells with counts less than or equal to three participants

Table 18

Distribution of Total Active Members by Age and by Years of Service

Average Age = 46.2 Average Service = 10.0

Age Last Birthday		Whole Years of Service at Valuation Date 0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	Totals
Less than 20	Count	60	-	-	-	-	-	-	60
	Avg. Salary	$20,443	-	-	-	-	-	-	$20,443
20-24	Count	940	6	-	-	-	-	-	946
	Avg. Salary	30,759	$46,132	-	-	-	-	-	30,856
25-29	Count	2,211	388	4	-	-	-	-	2,603
	Avg. Salary	39,243	47,612	$53,034	-	-	-	-	40,512
30-34	Count	2,070	1,385	307	6	-	-	-	3,768
	Avg. Salary	40,035	53,639	55,482	$60,205	-	-	-	46,326
35-39	Count	1,904	1,253	1,005	191	-	-	-	4,353
	Avg. Salary	39,230	54,227	61,813	61,493	-	-	-	49,738
40-44	Count	1,547	1,101	940	679	113	1	-	4,381
	Avg. Salary	38,978	52,102	61,132	66,830	$68,039	*	-	52,098
45-49	Count	1,271	956	883	658	539	118	2	4,427
	Avg. Salary	40,040	49,902	56,207	65,097	71,685	$72,127	*	53,834
50-54	Count	1,115	806	819	664	457	509	128	4,498
	Avg. Salary	40,069	48,708	54,432	57,430	68,397	74,459	$66,816	54,326
55-59	Count	985	716	867	730	574	484	460	4,816
	Avg. Salary	37,136	45,474	50,359	53,712	59,968	66,982	71,320	52,255
60-64	Count	650	592	601	522	418	324	451	3,558
	Avg. Salary	38,537	46,444	49,019	53,711	53,732	59,613	69,527	51,482
65-69	Count	239	194	191	144	110	85	142	1,105
	Avg. Salary	28,351	43,303	49,715	51,028	53,877	58,774	65,786	47,316
70 & Over	Count	120	63	50	48	12	19	46	358
	Avg. Salary	20,225	35,796	40,797	42,185	44,827	55,605	63,016	36,983
Totals	Count	**13,112**	**7,460**	**5,667**	**3,642**	**2,223**	**1,540**	**1,229**	**34,873**
	Avg. Salary	**$38,222**	**$50,406**	**$55,708**	**$59,053**	**$63,397**	**$67,692**	**$69,217**	**$49,844**

Average salary represents annualized salary earned in 2018 and is not shown for cells with counts less than or equal to three participants

Table 19

Distribution of Male Deferred Members by Age and by Years of Service

Average Age = 50.6 Average Service = 8.6

Age Last Birthday	Whole Years of Service at Valuation Date							Totals
	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	
Less than 20	-	-	-	-	-	-	-	-
20-24	3	-	-	-	-	-	-	3
25-29	15	11	-	-	-	-	-	26
30-34	61	87	6	-	-	-	-	154
35-39	64	143	39	2	-	-	-	248
40-44	53	143	54	16	2	-	-	268
45-49	70	156	52	28	8	-	-	314
50-54	47	171	84	24	12	6	1	345
55-59	75	191	97	48	25	7	-	443
60-64	50	100	49	16	7	4	-	226
65-69	27	56	14	4	3	-	1	105
70 & Over	16	30	4	4	-	2	-	56
Totals	**481**	**1,088**	**399**	**142**	**57**	**19**	**2**	**2,188**

Table 20

Distribution of Female Deferred Members by Age and by Years of Service

Average Age = 51.2 Average Service = 8.6

Age	Whole Years of Service at Valuation Date							
Last Birthday	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	Totals
Less than 20	-	-	-	-	-	-	-	-
20-24	2	-	-	-	-	-	-	2
25-29	49	31	-	-	-	-	-	80
30-34	142	187	8	-	-	-	-	337
35-39	135	304	49	-	-	-	-	488
40-44	114	262	82	24	1	-	-	483
45-49	109	335	123	43	14	-	-	624
50-54	97	344	170	74	19	9	1	714
55-59	140	414	229	123	56	13	1	976
60-64	99	263	119	44	19	4	1	549
65-69	53	125	36	17	11	1	3	246
70 & Over	40	77	18	3	1	-	-	139
Totals	**980**	**2,342**	**834**	**328**	**121**	**27**	**6**	**4,638**

Table 21

Distribution of Total Deferred Members by Age and by Years of Service

Average Age = 51.0 Average Service = 8.6

Age	Whole Years of Service at Valuation Date							
Last Birthday	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	Totals
Less than 20	-	-	-	-	-	-	-	-
20-24	5	-	-	-	-	-	-	5
25-29	64	42	-	-	-	-	-	106
30-34	203	274	14	-	-	-	-	491
35-39	199	447	88	2	-	-	-	736
40-44	167	405	136	40	3	-	-	751
45-49	179	491	175	71	22	-	-	938
50-54	144	515	254	98	31	15	2	1,059
55-59	215	605	326	171	81	20	1	1,419
60-64	149	363	168	60	26	8	1	775
65-69	80	181	50	21	14	1	4	351
70 & Over	56	107	22	7	1	2	-	195
Totals	**1,461**	**3,430**	**1,233**	**470**	**178**	**46**	**8**	**6,826**

Table 22

Schedule of Pension Recipients Added to and Removed from Rolls

Fiscal Year Ending December 31	Added to Rolls*		Removed from Rolls		Total		Percent Increase in Annual Pension Benefits	Average Annual Pension Benefit
	Count	Annual Pension Benefits	Count	Annual Pension Benefits	Count	Annual Pension Benefits		
2008	1,290	$26,985,322	552	$3,650,746	18,333	$268,901,376	9.50%	$14,668
2009	1,160	24,062,484	577	6,292,131	18,916	286,671,729	6.61%	15,155
2010	1,388	31,055,004	562	6,314,155	19,742	311,412,579	8.63%	15,774
2011	1,538	34,517,321	592	7,019,999	20,688	338,909,901	8.83%	16,382
2012	1,497	35,646,627	585	6,920,227	21,600	367,636,301	8.48%	17,020
2013	1,745	39,633,549	614	8,227,809	22,731	399,042,042	8.54%	17,555
2014	1,755	42,076,101	726	9,207,206	23,760	431,910,937	8.24%	18,178
2015	1,657	38,445,600	689	9,453,053	24,728	460,903,484	6.71%	18,639
2016	1,768	43,327,957	728	9,191,130	25,768	495,040,311	7.41%	19,211
2017	1,806	43,470,131	766	10,395,795	26,808	528,114,647	6.68%	19,700
2018	1,786	41,353,498	812	10,936,120	27,782	558,532,025	5.76%	20,104

** Includes cost-of-living increases*

Table 23

Retired and Disabled Members by Option Code

Option Code*	Count			Monthly Benefit			Count elected self-funded COLA**		
	Male	Female	Total	Male	Female	Total	1%	2%	3%
1	2,126	6,613	8,739	$3,756,107	$9,517,060	$13,273,168	29	19	32
2	4,589	3,488	8,077	9,834,531	5,740,512	15,575,042	19	19	32
2P	1,440	1,995	3,435	2,666,411	3,591,478	6,257,889	9	14	17
3	488	559	1,047	1,166,102	932,463	2,098,566	3	3	1
3P	303	593	896	735,668	1,255,949	1,991,616	4	5	7
4a	323	581	904	505,082	799,110	1,304,192	4	-	6
4b	50	77	127	85,425	111,573	196,998	4	4	3
5	513	1,505	2,018	798,433	1,948,937	2,747,371	9	8	7
Total	**9,832**	**15,411**	**25,243**	**$19,547,759**	**$23,897,082**	**$43,444,842**	**81**	**72**	**105**
Beneficiaries	**574**	**1,965**	**2,539**	**$624,737**	**$2,474,757**	**$3,099,494**	**-**	**-**	**-**
Grand Total	**10,406**	**17,376**	**27,782**	**$20,172,496**	**$26,371,839**	**$46,544,336**	**81**	**72**	**105**

**See optional forms of payment in Appendix B*

***Option totals in left portion of the table include these counts of members who elected a self-funded COLA option.*

Table 24

Pensioners by Monthly Benefit and Option Code

Males	Option Code*								
Benefit Amount	**1**	**2**	**2P**	**3**	**3P**	**4a****	**4b**	**5**	**Total**
Under $200	98	144	63	5	5	28	1	105	449
$200-$399	213	336	145	15	19	38	9	152	927
$400-$599	225	331	140	22	13	45	5	141	922
$600-$799	191	301	109	24	15	32	4	97	773
$800-$999	162	277	97	20	13	22	4	90	685
$1,000-$1,499	259	550	178	75	35	56	9	149	1,311
$1,500-$1,999	219	507	129	52	30	31	3	80	1,051
$2,000-$2,499	183	487	150	71	40	20	5	74	1,030
$2,500 & over	576	1,656	429	204	133	70	10	180	3,258
Total	**2,126**	**4,589**	**1,440**	**488**	**303**	**342**	**50**	**1,068**	**10,406**
Females									
Benefit Amount	**1**	**2**	**2P**	**3**	**3P**	**4a****	**4b**	**5**	**Total**
Under $200	485	228	84	16	14	57	4	297	1,185
$200-$399	872	407	199	50	29	98	12	467	2,134
$400-$599	770	334	171	49	39	76	9	440	1,888
$600-$799	629	246	140	57	37	60	8	341	1,518
$800-$999	499	254	146	35	39	42	6	285	1,306
$1,000-$1,499	958	511	279	95	83	88	13	527	2,554
$1,500-$1,999	668	343	209	79	66	38	9	358	1,770
$2,000-$2,499	503	301	202	54	64	36	1	250	1,411
$2,500 & over	1,229	864	565	124	222	110	15	481	3,610
Total	**6,613**	**3,488**	**1,995**	**559**	**593**	**605**	**77**	**3,446**	**17,376**
Males & Females									
Benefit Amount	**1**	**2**	**2P**	**3**	**3P**	**4a****	**4b**	**5**	**Total**
Under $200	583	372	147	21	19	85	5	402	1,634
$200-$399	1,085	743	344	65	48	136	21	619	3,061
$400-$599	995	665	311	71	52	121	14	581	2,810
$600-$799	820	547	249	81	52	92	12	438	2,291
$800-$999	661	531	243	55	52	64	10	375	1,991
$1,000-$1,499	1,217	1,061	457	170	118	144	22	676	3,865
$1,500-$1,999	887	850	338	131	96	69	12	438	2,821
$2,000-$2,499	686	788	352	125	104	56	6	324	2,441
$2,500 & over	1,805	2,520	994	328	355	180	25	661	6,868
Total	**8,739**	**8,077**	**3,435**	**1,047**	**896**	**947**	**127**	**4,514**	**27,782**

**Options include those who elected a self-funded COLA option.*

***Option 4a includes 43 beneficiaries who are receiving a certain only benefit.*

Table 25

Pensioners by Age and Option Code

Average Age Male = 72.4 Average Age Female = 72.3 Average Age Total = 72.3

Males	Option Code*								
Age Last Birthday	**1**	**2**	**2P**	**3**	**3P**	**4a****	**4b**	**5**	**Total**
Under 50	3	1	-	-	1	11	-	9	25
50-54	12	20	5	-	-	1	2	7	47
55-59	60	164	54	11	2	14	7	34	346
60-64	303	666	219	41	36	32	20	118	1,435
65-69	481	1,064	461	91	80	74	15	220	2,486
70-74	467	1,101	384	98	96	72	4	222	2,444
75-79	374	733	204	79	53	67	2	184	1,696
80-84	239	494	86	88	25	36	-	140	1,108
85 & over	187	346	27	80	10	35	-	134	819
Total	**2,126**	**4,589**	**1,440**	**488**	**303**	**342**	**50**	**1,068**	**10,406**
Females									
Age Last Birthday	**1**	**2**	**2P**	**3**	**3P**	**4a****	**4b**	**5**	**Total**
Under 50	1	3	-	-	-	13	-	22	39
50-54	27	12	8	1	2	2	1	23	76
55-59	211	163	94	16	25	18	9	68	604
60-64	918	669	460	92	121	59	32	301	2,652
65-69	1,585	1,050	681	145	197	135	25	616	4,434
70-74	1,381	764	506	129	132	153	8	656	3,729
75-79	1,021	425	185	77	79	97	1	595	2,480
80-84	735	221	51	42	31	66	1	541	1,688
85 & over	734	181	10	57	6	62	-	624	1,674
Total	**6,613**	**3,488**	**1,995**	**559**	**593**	**605**	**77**	**3,446**	**17,376**
Males & Females									
Age Last Birthday	**1**	**2**	**2P**	**3**	**3P**	**4a****	**4b**	**5**	**Total**
Under 50	4	4	-	-	1	24	-	31	64
50-54	39	32	13	1	2	3	3	30	123
55-59	271	327	148	27	27	32	16	102	950
60-64	1,221	1,335	679	133	157	91	52	419	4,087
65-69	2,066	2,114	1,142	236	277	209	40	836	6,920
70-74	1,848	1,865	890	227	228	225	12	878	6,173
75-79	1,395	1,158	389	156	132	164	3	779	4,176
80-84	974	715	137	130	56	102	1	681	2,796
85 & over	921	527	37	137	16	97	-	758	2,493
Total	**8,739**	**8,077**	**3,435**	**1,047**	**896**	**947**	**127**	**4,514**	**27,782**

**Options include those who elected a self-funded COLA option.*

***Option 4a includes 43 beneficiaries who are receiving a certain only benefit.*

Table 26

Pensions Awarded in 2018 by Option Code

Average Age = 62.6

Males & Females	Option Code*								
Benefit Amount	**1**	**2**	**2P**	**3**	**3P**	**4a****	**4b**	**5**	**Total**
Under $200	24	15	10	0	2	4	0	23	78
$200-$399	62	24	16	2	1	1	5	36	147
$400-$599	58	33	22	2	5	4	5	36	165
$600-$799	49	29	14	5	4	5	3	34	143
$800-$999	48	32	15	3	3	5	2	24	132
$1,000-$1,499	100	43	32	8	8	9	7	62	269
$1,500-$1,999	62	60	19	2	2	2	3	30	180
$2,000-$2,499	51	45	19	2	4	2	2	31	156
$2,500 & over	149	197	72	14	14	6	3	61	516
Total	**603**	**478**	**219**	**38**	**43**	**38**	**30**	**337**	**1,786**
Males & Females									
Age Last Birthday	**1**	**2**	**2P**	**3**	**3P**	**4a****	**4b**	**5**	**Total**
Under 50	0	0	0	0	0	8	0	4	12
50-54	13	13	4	0	0	1	2	9	42
55-59	75	86	31	7	7	7	3	19	235
60-64	260	234	111	16	21	9	18	78	747
65-69	205	118	60	15	12	11	6	76	503
70-74	38	25	13	0	3	1	1	43	124
75-79	9	2	0	0	0	1	0	40	52
80-84	3	0	0	0	0	0	0	43	46
85 & over	0	0	0	0	0	0	0	25	25
Total	**603**	**478**	**219**	**38**	**43**	**38**	**30**	**337**	**1,786**

**Options include those who elected a self-funded COLA option*

***Option 4a includes 12 beneficiaries who are receiving a certain only benefit.*

Table 27

Retirees and Disabled Members by Service at Retirement and Years Since Retirement

(Average Monthly Benefit)

Average Service at Retirement = 19.9 Average Years Since Retirement = 11.4

Service at Retirement		Years Elapsed Since Retirement							
		0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	Totals
Less than 5	Count	193	259	213	135	80	88	85	1,053
	Avg. Benefit	$312	$280	$244	$644	$2,043	$163	$132	$230
5-9	Count	1,109	998	656	461	335	259	248	4,066
	Avg. Benefit	$526	$461	$401	$373	$330	$303	$277	$427
10-14	Count	1,167	844	552	469	402	290	215	3,939
	Avg. Benefit	$952	$827	$708	$638	$614	$575	$490	$766
15-19	Count	966	776	593	488	451	228	164	3,666
	Avg. Benefit	$1,441	$1,339	$1,104	$989	$954	$923	$772	$1,183
20-24	Count	976	866	611	448	355	178	106	3,540
	Avg. Benefit	$2,085	$1,969	$1,596	$1,381	$1,345	$1,262	$1,106	$1,738
25-29	Count	1,092	1,045	798	502	341	116	81	3,975
	Avg. Benefit	$2,825	$2,740	$2,325	$2,089	$1,921	$1,871	$1,509	$2,477
30-34	Count	982	964	638	390	288	140	60	3,462
	Avg. Benefit	$3,766	$3,576	$3,047	$2,666	$2,688	$2,739	$2,250	$3,299
35 & Over	Count	747	405	186	76	70	50	8	1,542
	Avg. Benefit	$4,766	$4,371	$3,812	$3,252	$3,275	$3,129	$2,385	$4,340
Totals	Count	**7,232**	**6,157**	**4,247**	**2,969**	**2,322**	**1,349**	**967**	**25,243**
	Avg. Benefit	**$2,147**	**$1,958**	**$1,610**	**$1,325**	**$1,266**	**$1,076**	**$729**	**$1,721**

Table 28

Retirees and Disabled Members by Year of Retirement

January 1, 2019 Total = 25,243

Year of Retirement	Count	Year of Retirement	Count
Under 1961	-	**1990**	225
1961	-	**1991**	239
1962	-	**1992**	359
1963	-	**1993**	310
1964	-	**1994**	372
1965	-	**1995**	620
1966	-	**1996**	431
1967	-	**1997**	436
1968	-	**1998**	450
1969	-	**1999**	480
1970	-	**2000**	547
1971	1	**2001**	623
1972	3	**2002**	604
1973	2	**2003**	696
1974	6	**2004**	817
1975	7	**2005**	746
1976	6	**2006**	769
1977	20	**2007**	893
1978	28	**2008**	1,027
1979	26	**2009**	928
1980	32	**2010**	1,126
1981	45	**2011**	1,315
1982	40	**2012**	1,370
1983	52	**2013**	1,427
1984	73	**2014**	1,481
1985	90	**2015**	1,453
1986	120	**2016**	1,509
1987	212	**2017**	1,457
1988	194	**2018***	1,378
1989	198		

**May include retirements as of January 1, 2019*

Table 29

Thirty Year Projected Benefit Payments

Year Ending December 31	Actives	Retirees*	Total
2019	$ 30,774,135	$ 573,752,592	$ 604,526,727
2020	56,408,306	570,368,708	626,777,014
2021	81,883,464	566,294,570	648,178,034
2022	107,671,780	561,472,800	669,144,580
2023	136,879,680	555,565,066	692,444,746
2024	166,391,521	549,025,953	715,417,474
2025	196,134,848	541,844,281	737,979,129
2026	226,134,188	533,986,047	760,120,235
2027	256,228,349	525,529,512	781,757,861
2028	286,314,222	516,028,076	802,342,298
2029	316,530,664	497,296,925	813,827,589
2030	346,849,955	486,977,912	833,827,867
2031	377,318,456	475,666,600	852,985,056
2032	407,837,194	463,231,563	871,068,757
2033	438,486,613	449,878,388	888,365,001
2034	469,273,067	435,870,454	905,143,521
2035	500,264,841	421,034,152	921,298,993
2036	531,258,861	405,279,882	936,538,743
2037	561,936,297	388,945,772	950,882,069
2038	591,690,966	371,921,319	963,612,285
2039	620,617,938	354,450,638	975,068,576
2040	648,716,431	336,686,150	985,402,581
2041	675,402,372	318,285,529	993,687,901
2042	700,388,201	299,637,547	1,000,025,748
2043	723,268,218	280,612,510	1,003,880,728
2044	744,126,578	261,440,812	1,005,567,390
2045	762,201,469	242,382,864	1,004,584,333
2046	776,874,916	223,459,356	1,000,334,272
2047	788,074,333	204,932,335	993,006,668
2048	795,788,486	186,855,720	982,644,206

* Includes Disabled Members, Beneficiaries, and Deferred Vested Members. Retirement benefit payments for deferred vested members are assumed to commence at age 60 (age 65 for Tier 2).

APPENDIX A

SUMMARY OF ACTUARIAL ASSUMPTIONS AND METHODS

Summary of Actuarial Assumptions and Methods

The following methods and assumptions were used in preparing the January 1, 2019 actuarial valuation report.

1. Valuation Date

   The valuation date for any given year is January 1st, the first day of each plan year. This is the date as of which the actuarial present value of future benefits and the actuarial value of assets are determined.

2. Actuarial Cost Method

   The actuarial valuation uses the Entry Age Normal (EAN) actuarial cost method, amortized as a level percentage of payroll. Under this method, the employer contribution rate is the sum of (i) the employer normal cost rate, and (ii) the rate that will amortize the unfunded actuarial accrued liability (UAAL).

   a. The valuation is prepared on the projected benefit basis, under which the present value, at the investment return rate assumed to be earned in the future (currently 7.00%), of each participant's expected benefit payable at retirement or death is determined, based on his/her age, service, sex and compensation. The calculations take into account the probability of a participant's death or termination of employment prior to becoming eligible for a benefit, as well as the possibility of his/her terminating with a service, disability, or survivor's benefit. Future salary increases are also anticipated. The present value of the expected benefits payable for the active participants is added to the present value of the expected future payments to retired participants and beneficiaries to obtain the present value of all expected benefits payable from the Fund on account of the present group of participants and beneficiaries.

   b. The employer contributions required to support the benefits of the Fund are determined using a level funding approach, and consist of a normal cost contribution and a unfunded accrued liability contribution.

   c. The normal cost contribution is determined using the "entry age normal" actuarial cost method. Under this method, a calculation is made to determine the average uniform and constant percentage rate of employer contribution which, if applied to the compensation of each new participant during the entire period of his/her anticipated covered service, would be required to meet the cost of all benefits payable on his/her behalf based on the benefits provisions applicable for the individual member.

   d. The unfunded accrued liability contributions are determined by subtracting the actuarial value of assets from the actuarial accrued liability. Amortization bases are established each year and amortized based on the Board’s policy. The Board’s policy consists of amortizing the unfunded liability as of January 1, 2018, over a closed 30 year period with each subsequent amortization base created as a result of year to year experience changes over individual 20 year closed periods. The current year amortization base is determined by taking the current unfunded liability less the outstanding amounts of prior year bases.

3. Actuarial Value of Assets

The actuarial value of assets is based on the market value of assets with a five-year phase-in of actual investment return in excess of (less than) expected investment income. Expected investment income is determined using the assumed investment return rate and the market value of assets (adjusted for receipts and disbursements during the year). The returns are computed net of investment expenses. An adjustment is made if the actuarial value is not within 20% of the Market Value. For any year following a year in which the 20% of market value adjustment was applied, the actuarial value is determined as if the adjustment was not applied in the previous year.

4. Economic Assumptions

a. Investment return

7.00% per year, compounded annually, composed of an assumed 2.25% inflation rate and a 4.75% net real rate of return. This rate represents the assumed return, net of investment expenses.

b. Salary increase rate

Service	Rate	Service	Rate
1	6.50%	14	3.50%
2	6.50%	15	3.25%
3	6.50%	16	3.25%
4	6.00%	17	3.25%
5	5.25%	18	3.25%
6	4.75%	19	3.00%
7	4.25%	20	3.00%
8	4.00%	21	2.75%
9	4.00%	22	2.75%
10	4.00%	23	2.75%
11	3.75%	24	2.75%
12	3.50%	25	2.50%
13	3.50%	25+	2.50%

c. Payroll growth rate

In the amortization of the unfunded actuarial accrued liability, payroll is assumed to increase 2.50% per year. This increase rate is solely due to the effect of inflation on salaries, with no allowance for future membership growth.

d. Cost-of-Living adjustment

No cost-of-living adjustment is assumed since the policy for providing the benefit requires Board approval to make the recommendation to the Joint Appropriations Committee and the funded level of the plan shows a cost-of-living requirement would not be permitted.

Summary of Actuarial Assumptions and Methods (continued)

5. Demographic Assumptions

   a. Mortality

      Healthy Pre-Retirement Mortality:
      RP-2014 Employee Mortality Table, fully generational, projected with Scale MP-2017
      Males: No set back with a multiplier of 100%
      Females: No set back with a multiplier of 100%
      Healthy Post-Retirement Mortality:
      RP-2014 Healthy Annuitant Mortality Table, fully generational, projected with Scale MP-2017
      Males: No set back with a multiplier of 100%
      Females: No set back with a multiplier of 88%
      Disabled Mortality
      RP-2014 Disabled Mortality Table, fully generational, projected with Scale MP-2017
      Males: No set back with a multiplier of 100%
      Females: No set back with a multiplier of 100%

	Pre-Retirement		Post-Retirement		Disabled	
	Projected to 2019 using Scale MP-2017					
Age	Male	Female	Male	Female	Male	Female
20	0.04%	0.02%	0.04%	0.01%	0.05%	0.02%
25	0.05%	0.02%	0.06%	0.03%	0.20%	0.09%
30	0.05%	0.02%	0.09%	0.06%	0.51%	0.24%
35	0.06%	0.03%	0.13%	0.09%	0.92%	0.45%
40	0.07%	0.04%	0.19%	0.14%	1.32%	0.68%
45	0.09%	0.06%	0.27%	0.18%	1.63%	0.90%
50	0.16%	0.11%	0.38%	0.24%	1.92%	1.15%
55	0.27%	0.17%	0.55%	0.32%	2.26%	1.45%
60	0.47%	0.25%	0.78%	0.47%	2.67%	1.74%
65	0.83%	0.36%	1.11%	0.70%	3.18%	2.05%
70	1.35%	0.60%	1.63%	1.08%	3.92%	2.69%
75			2.56%	1.76%	5.18%	3.91%
80			4.27%	2.96%	7.31%	5.88%
85			7.44%	5.18%	10.87%	8.80%
90			13.11%	9.20%	16.69%	12.94%
95			21.02%	15.32%	23.77%	19.05%
100			30.49%	23.34%	31.73%	27.24%

b. Disability and Withdrawal

Age	Disability		Withdrawal Ultimate	
	Male	Female	Male	Female
20	0.01%	0.01%	11.00%	10.00%
25	0.01%	0.01%	11.00%	10.00%
30	0.01%	0.01%	6.00%	6.00%
35	0.01%	0.01%	5.00%	5.00%
40	0.01%	0.01%	4.00%	5.00%
45	0.02%	0.02%	4.00%	5.00%
50	0.12%	0.05%	3.00%	4.00%
55	0.24%	0.12%	3.00%	4.00%
60	0.24%	0.24%	3.00%	4.00%

Service	Withdrawal First five years	
	Male	Female
1	22%	25%
2	18%	21%
3	14%	15%
4	13%	15%
5	13%	14%

Retirement Rates

Age	Retirement	
	Unreduced	Reduced
<50	15.0%	1.0%
50	15.0%	0.5%
51	15.0%	0.5%
52	15.0%	0.5%
53	15.0%	0.5%
54	15.0%	0.5%
55	17.0%	1.0%
56	17.0%	1.0%
57	15.0%	1.0%
58	15.0%	1.0%
59	15.0%	2.5%
60	13.0%	2.5%
61	13.0%	2.5%
62	18.0%	2.5%
63	15.0%	2.5%
64	15.0%	2.5%
65	25.0%	
66	30.0%	
67	28.0%	
68	25.0%	
69	25.0%	
70	15.0%	
71	15.0%	
72	15.0%	
73	15.0%	
74	15.0%	
75	15.0%	
76	15.0%	
77	15.0%	
78	15.0%	
79	15.0%	
80+	100.0%	

Summary of Actuarial Assumptions and Methods (continued)

6. Other Assumptions

   a. Percent married: 85.00% of employees are assumed to be married. (No beneficiaries other than the spouse assumed.)

   b. Age difference: Male members are assumed to be three years older than their spouses, and female members are assumed to be three years younger than their spouses.

   c. Percent electing annuity on death (when eligible): All of the spouses of vested, married participants are assumed to elect an annuity.

   d. Percent electing deferred termination benefit: Vested terminating members are assumed to elect a refund or a deferred benefit. It is assumed that 25% of active members who terminate with a deferred vested benefit will elect to have their contributions refunded.

   e. Assumed age for commencement of deferred benefits: Members electing to receive a deferred benefit are assumed to commence receipt at the first age at which unreduced benefits are available, which for this plan is age 60 (65 for Tier 2).

   f. No benefit amount data is available for members entitled to deferred benefits. The benefit is estimated using the final average compensation and service provided by WRS.

   g. There will be no recoveries once disabled. We assume all disabled members are totally disabled.

   h. No surviving spouse will remarry.

   i. Administrative expenses: Assumed to be the average of the prior two years, with each year projected at 2.5% to the valuation date.

   j. Pay increase timing: Beginning of (fiscal) year. This is equivalent to assuming that reported pay represents amount paid to members during the year ended on the valuation date.

   k. Decrement timing: Decrements of all types are assumed to occur mid-year.

   l. Eligibility testing: Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.

   m. Decrement relativity: Decrement rates are converted to probabilities in order to account for multiple decrements.

   n. Incidence of Contributions: Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in the report, and the actual payroll payable at the time contributions are made.

   o. Benefit Service: All members are assumed to accrue one year of service each year. Exact fractional service is used to determine the amount of benefit payable.

Appendix B

Summary of Plan Provisions

Summary of Plan Provisions

Covered Members	Any full-time or regular part-time employee of an employer as defined under W.S. 9-3-402(a)(vii)
Tier	Members who join the State of Wyoming Retirement System by August 31, 2012 are in Tier 1, while members who join on or after September 1, 2012 are in Tier 2.
Final Average Salary	For Tier 1 member: employee's average annual salary for the highest paid three continuous years of service. For Tier 2 members: employee's average annual salary for the highest paid five continuous years of service.
Service Retirement	
Eligibility	Tier 1 members may retire upon normal retirement on the date he/she attains age 60 with four or more years of service while Tier 2 members may retire upon normal retirement on the date he/she attains age 65 with four or more years of service. All employees may also retire upon normal retirement on the date that the sum of the member's age and service is at least 85. Tier 1 members are eligible for a reduced benefit at age 50 with four or more years of service and Tier 2 members are eligible for a reduced benefit at age 55 with four or more years of service. All members are eligible for a reduced benefit at any age with 25 or more years of service.
Benefit	For Tier 1 member: 2.125% of employee's Final Average Salary for each year of credited service for the first 15 years of service credit plus 2.25% of Final Average Salary for any years of service credit exceeding 15 years. For Tier 2 members: 2.000% of employee's Final (5-year) Average Salary for each year of credited service. This amount is reduced by 5.0% per year that the employee is under age 60 for Tier 1 and under age 65 for Tier 2. However, members retiring with a combined age and service of at least 85 receive an unreduced benefit. Employees hired prior to July 1, 1981 may be entitled to benefits earned under a different formula.
Vesting	Any employee who has left employment with four or more years of service, and who has not withdrawn accumulated contributions, is eligible to receive the above benefit or can elect to receive a lump-sum refund of employee contributions with interest. An employee who terminates with less than four years of service is only eligible for the lump-sum benefit.

Summary of Plan Provisions (continued)

Disability Benefit

Eligibility	Ten or more years of service.
Benefit	Service retirement benefit earned as of the date of disability, payable immediately.
Park Rangers	Effective March 5, 2015, for eligible peace officers as defined under W.S. 6-1-104(a)(vi)(P) whose disability is duty-related, the member shall be eligible immediately for a benefit of 62.5% of the member's final salary.

Pre-retirement Death Benefit

Eligibility	No age or service requirements.
Benefit	A lump sum equal to two times the employee contributions with interest. If the employee is vested, the beneficiary can elect, in lieu of this lump sum, to receive a monthly annuity equal to the actuarial equivalent of the retirement benefit that would be due the employee.
Park Rangers	Effective March 5, 2015, for eligible peace officers as defined under W.S. 6-1-104(a)(vi)(P) whose death is duty-related, the member shall be eligible immediately for a benefit of 62.5% of member's final actual salary, payable to the surviving spouse plus 6% of the member's final actual salary for each unmarried child under age 18. Payment shall not exceed the member's final actual salary.

Contributions

Employee	8.50% of salary.
Employer	8.62% plus an additional 1.0% for park rangers. Per Enrolled Act No. 65, both employee and employer contribution rates will increase 0.25% per year for the next four years starting in September 1, 2018.
Interest	3.00% annually. (0.0% for non-vested members after July 1, 2019)

Cost-of-Living Improvements	W.S. 9-3-454 prohibits benefit changes, including cost-of-living increases, unless the funded ratio stays above 100% plus a margin for adverse experience throughout the life of the benefit change.

Optional Forms of Payment

All options include the choice to elect a reduced benefit with a self-funded annual COLA of 1%, 2%, or 3% per year. COLAs commence on July 1 following the two-year anniversary of retirement.

Option 1	Monthly benefit for life with a lump-sum death benefit equal to the excess (if any) of the employee contributions with interest over the total benefits
Option 2	Monthly benefit for life. Upon death, 100% of the benefit continues to be paid to the beneficiary.
Option 2P	Monthly benefit for life. Upon death, 100% of the benefit continues to be paid to the beneficiary. Benefit reverts to Option 1 amount but without the cash refund feature upon beneficiary death.
Option 3	Monthly benefit for life. Upon death, 50% of the benefit continues to be paid to the beneficiary.
Option 3P	Monthly benefit for life. Upon death, 50% of the benefit continues to be paid to the beneficiary. Benefit reverts to Option 1 amount but without the cash refund feature upon beneficiary death.
Option 4a	Monthly benefit for life with a guarantee of 120 monthly payments
Option 4b	Monthly benefit for life with a guarantee of 240 monthly payments
Option 5	The largest possible monthly benefit payable for life with no lump-sum death benefit.

APPENDIX C

RISKS ASSOCIATED WITH MEASURING THE ACCRUED LIABILITY

Risks Associated With Measuring the Accrued Liability and Actuarially Determined Contribution

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

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

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

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

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

The computed contribution rate shown on Table 1A may be considered as a minimum contribution rate that complies with the Board's funding policy. The timely receipt of the actuarially determined contributions is critical to support the financial health of the plan. Users of this report should be aware that contributions made at the actuarially determined rate do not necessarily guarantee benefit security.

Risks Associated With Measuring the Accrued Liability and Actuarially Determined Contribution

Plan Maturity Measures

Risks facing a pension plan evolve over time. A young plan with virtually no investments and paying few benefits may experience little investment risk. An older plan with a large number of members in pay status and a significant trust may be much more exposed to investment risk. Generally accepted plan maturity measures include the following:

	January 1, 2019	January 1, 2018
Ratio of the market value of assets to total payroll	3.8	4.1
Ratio of actuarial accrued liability to payroll	5.5	5.4
Ratio of actives to retirees and beneficiaries	1.3	1.3
Ratio of net cash flows to market value of assets	-4%	-3%
Duration of the actuarial accrued liability	11.9	12.0

Ratio of Market Value of Assets to Payroll

The relationship between assets and payroll is a useful indicator of the potential volatility of contributions. For example, if the market value of assets is 4.0 times the payroll, a return on assets 5% different than assumed would equal 20% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in plan sponsor contributions as a percentage of payroll.

Ratio of Actuarial Accrued Liability to Payroll

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

The ratio of liability to payroll may also be used as a measure of sensitivity of the liability itself. For example, if the actuarial accrued liability is 5.5 times the payroll, a change in liability 2% other than assumed would equal 11% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in liability (and also plan sponsor contributions) as a percentage of payroll.

Ratio of Actives to Retirees and Beneficiaries

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

Risks Associated With Measuring the Accrued Liability and Actuarially Determined Contribution

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

Duration of Actuarial Accrued Liability
The duration of the actuarial accrued liability may be used to approximate the sensitivity to a 1% change in the assumed rate of return. For example, duration of 10 indicates that the liability would increase approximately 10% if the assumed rate of return were lowered 1%.

Additional Risk Assessment
Additional risk assessment is outside the scope of the annual actuarial valuation. Additional assessment may include scenario tests, sensitivity tests, stochastic modeling, stress tests, and a comparison of the present value of accrued benefits at low-risk discount rates with the actuarial accrued liability