Wyoming State Highway Patrol, Game & Fish Warden and Criminal Investigator Retirement Fund

Actuarial Valuation Report
for the Year Beginning January 1, 2019

GRS Retirement Consulting

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April 18, 2019

Board of Trustees
Wyoming State Highway Patrol, Game & Fish Warden and Criminal Investigator Retirement Fund
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 Wyoming State Highway Patrol, Game & Fish Warden and Criminal Investigator Retirement Fund ("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 76.52%. As of January 1, 2018, this funded ratio, based on the assumption of no future COLAs and the actuarial value of assets, was 77.91%. On a market value of assets basis, the funded ratio decreased from 78.40% as of January 1, 2018 to 71.45% 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. 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.

Effective July 1, 2019, the interest on contributions for non-vested inactive Employees will be 0%.

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 amounts and funding periods. The actuarial calculations presented in the report are intended to provide information for rational decision making.

The 14.88% employer contribution and the 14.56% employee contribution are the rates that comply with State law. 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.

Assumptions and Methods (continued)

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 relied on the System's staff for the accuracy and completeness of the information.

Plan experience

As part of each valuation, we examine the Fund's experience relative to the assumptions. Experience in a given year will deviate from the assumptions and 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 $3.6 million primarily due to investment experience. 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, FCA, EA, MAAA
Chief Executive Officer

Leslie Thompson, FSA, FCA, EA, MAAA
Senior 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	19.47%	19.38%
b. Employee contributions	(14.56%)	(14.56%)
c. Other expected contributions*	(0.16%)	(0.21%)
d. Net employer normal cost	4.75%	4.61%
e. Amortization payment	11.50%	10.13%
f. Administrative expenses	0.61%	0.52%
g. Required contribution	16.86%	15.26%
h. Statutory*	(14.88%)	(14.88%)
i. Shortfall/(surplus)	1.98%	0.38%
2. Funding Elements:		
a. Market value of assets (MVA)	$133,269,459	$141,608,716
b. Actuarial value of assets (AVA)	$142,734,809	$140,712,382
c. Actuarial accrued liability (AAL)	$186,532,553	$180,615,436
d. Unfunded/(overfunded) actuarial accrued liability	$43,797,744	$39,903,054
3. Contributions and Ratios:		
a. Annual required contribution	$3,997,559	$3,607,303
b. Actual contributions	N/A	3,529,976
i. Employer	*N/A*	*3,491,524*
ii. Other	*N/A*	*38,452*
c. Percentage contributed	N/A	97.86%
d. Funded ratio on an actuarial basis (AVA/AAL)	76.52%	77.91%
e. Funded ratio on a market basis (MVA/AAL)	71.45%	78.40%
f. Projected payroll	$23,696,821	$23,639,756

* As of January 1, 2019, $38,452 ($49,457 as of January 1, 2018) comes from a contribution expected from Highway Patrol or Game & Fish Commission funds for the current year to fund the past cost-of-living improvements to retired members paid under Section 9-3-610(b).

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 76.52% and the market value funded ratio is 71.45%.
- Effective July 1, 2019, the interest on contributions for non-vested inactive Employees will be 0%.
- There were no changes to the actuarial assumptions of methods since the prior valuation. For a detailed description of the experience related to these assumptions, 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
  - Future growth in the number of active members is not reflected in the annual valuation
- Analysis of the change in contribution rates is shown in Table 5 under Section III of the report.
- The calculated funding period assuming the current statutory contribution of 14.88% of pay is 43 years.

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 which are specified in statute and determined as a percentage of pay. As shown in Table 1 under Section III of the report, the calculated 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.

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 actual expenses for the prior two years, with each year projected at 2.50% to the valuation date.

The calculated rate of 16.86% is used in determining the contributions necessary to meet the Actuarially Determined Contribution for the twelve-month period beginning January 1, 2019. The employer contribution is 14.88% as of July 1, 2015. Therefore, a contribution shortfall (when comparing the statutory contributions against the Actuarially Determined Contribution) of 1.98% exists. This is detailed in the Executive Summary.

Financial Data and Experience

As of January 1, 2019, the Fund has a total market value of approximately $133 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 administrative and 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 $143 million. The AVA is 107.1% of the MVA, compared to 99.4% 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 $0.9 million. As of January 1, 2019, the total deferred loss was $9.5 million.

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 3.92%. Because this 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 $3.9 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 increased 0.24% last year, compared with a 4.08% increase the prior year.

There were eleven new retirements this year with an average final average salary at retirement of $82,786.

Of the 304 active participants, 73 are eligible or will become eligible for retirement in 2019.

Variation in the growth of payroll is significant because the methodology used in the valuation to amortize the unfunded actuarial accrued liability assumes a growing payroll into the future. Our current assumption is a 2.50% annual growth rate. 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 towards 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 0.25% of payroll.

Benefit Provisions

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

- *Normal Retirement Eligibility*
  - Age 50 with at least six years of service
- *Normal Retirement Benefit*
  - 2.50% of final average salary not to exceed 75.0% of final average salary
- *Normal Form of Payment* is a 50% Joint & Survivor Annuity for married retirees and Life Annuity for unmarried retirees
- *Employee Contributions* are required
  - 14.56% of payroll as of July 1, 2014
- *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. 25, interest crediting for non-vested inactive 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 basis.
- 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 50 or the valuation date if over age 50.
- No benefit data is available for all members entitled to deferred benefits. The present value of benefits expected to be paid to vested inactive non-retired members is approximated using the data provided.

The average future lifetime for current pensioners is 18.6 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 the new 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 Annual Required Contribution Rate

(Assumes No Future Cost-Of-Living Increases)

Item	January 1, 2019	January 1, 2018
1. Projected valuation payroll	$23,696,821	$23,639,756
2. Present value of future pay	$178,169,852	$178,479,161
3. Employer normal cost rate	4.75%	4.61%
4. Actuarial accrued liability for active members		
a. Present value of future benefits for active members	$95,776,109	$95,002,778
b. Less: present value of future employer normal costs	(7,779,120)	(7,589,730)
c. Less: present value of future employee contributions	(25,941,530)	(25,986,566)
d. Actuarial accrued liability	$62,055,459	$61,426,482
5. Total actuarial accrued liability for:		
a. Retirees and beneficiaries	$104,721,229	$100,840,097
b. Disabled members	14,765,197	14,281,933
c. Inactive members	4,990,668	4,066,924
d. Active members (Item 4d)	62,055,459	61,426,482
e. Total	$186,532,553	$180,615,436
6. Actuarial value of assets (Table 9)	$142,734,809	$140,712,382
7. Unfunded actuarial accrued liability (UAAL) (Item 5e - Item 6)	$43,797,744	$39,903,054
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	11.50%	10.13%
b. Employer normal cost	4.75%	4.61%
c. Administrative expense	0.61%	0.52%
d. Contribution requirement (a + b + c)	16.86%	15.26%

Table 1B

Calculation of UAAL Amortization Payment

(Assumes No Future Cost-Of-Living Increases)

UAAL as of January 1, 2019	$43,797,744
Total Prior Remaining Amortization Bases as of January 1, 2019	40,217,641
2019 Amortization Base as of January 1, 2019	**$3,580,103**
2019 Payment (20 years, level percent of pay amortization)	**$270,134**

		As of January 1, 2019		
Base Year	**Initial Base**	**Remaining Base**	**Years Remaining**	**Amortization Payment**
2019	$ 3,580,103	$ 3,580,103	20	$ 270,134
2018	39,903,054	40,217,641	29	2,456,083
Total		**$ 43,797,744**		**$ 2,726,217**

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	$21,411,601	$56,850,349	$78,261,950
Death-in-service benefits likely to be paid on behalf of present active members (employer financed portion)	809,969	627,069	1,437,038
Separation benefits (refunds of contributions and deferred allowances) likely to be paid to present active members	11,499,080	4,578,041	16,077,121
Benefits likely to be paid to vested inactive members	0	4,355,881	4,355,881
Benefits to be paid to members due refunds	0	634,787	634,787
Benefits to be paid to current retirees, disabled members, beneficiaries, and future beneficiaries of current retirees	0	119,486,426	119,486,426
Total	$33,720,650	$186,532,553	$220,253,203
Actuarial value of assets	0	142,734,809	142,734,809
Liabilities to be covered by future contributions	$33,720,650	$43,797,744	$77,518,394

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)
2007	17.45%
2008	16.93%
2009	18.92%
2010	19.57%
2011	19.63%
2012	19.59%
2013	19.67%
2014	23.20%
2015	23.20%
2016	23.19%
2017	23.16%
2018	19.38%
2019	19.47%

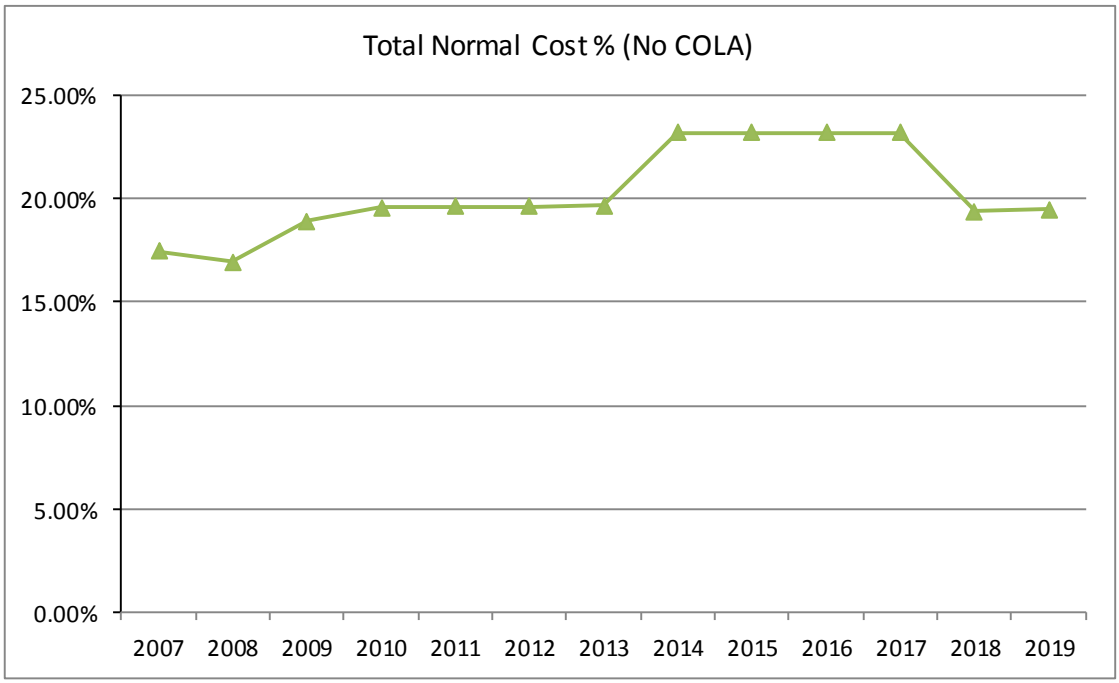

Table 4

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	$39,903,054
b. Normal cost (NC) for fiscal year ending December 31, 2018	4,580,386
c. Expected administrative expenses for fiscal year ending December 31, 2018	122,600
d. Actuarially determined contribution for fiscal year ending December 31, 2018	7,099,165
e. Interest accrual:	
(i) For whole year on (a)	2,793,214
(ii) For half year on (b) + (c) - (d)	(82,448)
(iii) Total interest: (e)(i) + (e)(ii)	2,710,766
f. Change in UAAL due to plan changes	-
g. Change in UAAL due to assumption change	-
h. Expected UAAL current year: (a) + (b) + (c) - (d) + (e)(iii) + (f) + (g)	40,217,641
i. Actual UAAL current year	43,797,744
j. Experience gain/(loss): (h) - (i)	(3,580,103)
k. Experience gain/(loss) as a % of actuarial accrued liability	-1.92%
2. Approximate portion of gain/(loss) due to investments (at actuarial value)	($3,885,775)
3. Approximate portion of gain/(loss) due to contributions and administrative expenses higher or lower than expected	($181,089)
4. Approximate portion of gain/(loss) due to liabilities: (1)(j) - (2) - (3)	$486,761
a. Age & service retirements	32,711
b. Disability retirements	4,415
c. Death-in-service	66,131
d. Withdrawal from employment	160,969
e. Rehires	-
f. Pay increases less than expected	933,742
g. Death after retirement	(538,440)
h. Other	(172,768)
i. Other as a % of actuarial accrued liability	-0.09%

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	15.26%
2. Change in contribution rate during year	
a. Change in employer normal cost	0.14%
b. Actuarial (gain) loss from investments on actuarial value of assets	1.21%
c. Actuarial (gain) loss from liability sources and administrative expenses	-0.06%
d. Difference between contributions made and required contributions	0.06%
e. Effect of payroll growing (faster)/slower than assumption	0.25%
f. Other changes	0.01%
g. Total change	1.60%
3. Calculated contribution rate as of January 1, 2019	16.86%

Table 6

Statement of Plan Net Assets

Assets at Market Value		
Item	**FYE 2018**	**FYE 2017**
1. Cash and cash equivalents (operating cash)	$10,626,161	$8,924,488
2. Receivables		
a. Employee contributions	$0	$0
b. Employer contributions	0	11
c. Securities sold	978,950	630,945
d. Accrued interest and dividends	350,447	209,770
e. Currency contract receivable	29,143,085	32,349,800
f. Other	0	78,934
g. Rebate and fee income receivable	0	0
h. Total receivables	$30,472,482	$33,269,460
3. Investments, at fair value	$132,273,548	$142,138,284
4. Liabilities		
a. Benefits and refunds payable	$0	$0
b. Accrued payroll taxes and deductions	0	0
c. Securities purchased	(2,089,516)	(833,215)
d. Administrative and consulting fees payable	(374,113)	(295,796)
e. Currency contract payable	(29,241,821)	(32,507,051)
f. Securities lending collateral	(8,397,282)	(9,087,454)
g. Total liabilities	($40,102,732)	($42,723,516)
5. Total market value of assets available for benefits	$133,269,459	$141,608,716

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	$141,608,716	$127,386,503
B. Contribution income:		
1. Contributions		
a. Employee	$3,416,437	$3,428,767
b. Employer	3,491,524	3,503,125
c. Other*	418,075	106,446
d. Total	$7,326,036	$7,038,338
2. Investment income		
a. Interest, dividends, and other income	$2,429,841	$2,475,020
b. Net appreciation	(6,360,098)	16,348,095
c. Investment expenses	(1,009,032)	(1,234,877)
d. Net investment income	($4,939,289)	$17,588,238
3. Securities lending		
a. Gross income	$217,299	$118,932
b. Deductions	(186,339)	(83,938)
c. Net investment income	$30,960	$34,994
4. Benefits and refunds		
a. Refunds	($351,230)	($509,361)
b. Regular monthly benefits	(10,260,821)	(9,795,108)
c. Total	($10,612,051)	($10,304,469)
5. Administrative and miscellaneous expenses	($144,913)	($134,888)
C. Market value of assets at end of year	$133,269,459	$141,608,716

* Includes contributions expected from Highway Patrol or Game & Fish Commission funds for the current year to fund the past cost-of-living improvements to retired members paid under Section 9-3-610(b). The remaining contributions come from member service purchases and employee re-deposits ($56,989 for FYE 2017, $379,623 for FYE 2018).

Table 8

Progress of Fund Through December 31, 2018

Plan Year Ending December 31	Employer Contributions*	Employee Contributions*	Administrative Expenses	Net Investment	Benefit Payments	Transfers	Actuarial Value of Assets
Total	$62,098,855	$57,900,559	($1,318,210)	$156,614,966	($147,530,570)	-	
1986	-	-	-	-	-	-	$14,969,209
1987	$954,283	$879,791	-	$1,335,359	($1,117,137)	-	17,021,505
1988	1,031,683	599,492	-	1,407,287	(1,125,353)	-	18,934,614
1989	663,409	643,827	-	2,021,576	(1,149,984)	-	21,113,442
1990	869,103	845,322	-	1,618,799	(1,221,774)	-	23,224,892
1991	920,907	896,033	-	2,411,241	(1,396,348)	-	26,056,725
1992	861,135	837,862	-	2,856,721	(1,363,781)	-	29,248,662
1993	990,413	1,028,810	($11,664)	3,141,296	(1,529,363)	-	32,868,154
1994	943,733	917,798	(24,786)	2,287,536	(1,792,594)	-	35,199,841
1995	1,142,039	951,127	(35,747)	3,871,480	(1,936,127)	-	39,192,613
1996	1,357,890	717,400	(26,244)	3,922,683	(2,268,479)	-	42,895,863
1997	1,281,287	1,081,347	(26,244)	5,310,084	(2,538,318)	-	48,004,019
1998	1,234,083	1,038,101	(26,244)	7,274,604	(2,611,908)	-	54,912,655
1999	1,319,421	1,077,725	(21,226)	8,444,608	(2,977,982)	-	62,755,201
2000	1,389,524	1,182,925	(8,713)	10,158,814	(2,883,760)	-	72,593,991
2001	1,572,526	1,374,139	(14,566)	7,560,569	(3,134,813)	-	79,951,846
2002	1,700,597	1,513,552	(16,782)	(1,094,717)	(3,336,078)	-	78,718,418
2003	1,746,788	1,620,468	(13,121)	6,670,496	(4,025,013)	-	84,718,036
2004	1,796,863	1,595,836	(16,470)	2,497,564	(4,216,369)	-	86,375,460
2005	1,890,808	1,673,570	(26,998)	4,536,171	(4,671,902)	-	89,777,109
2006	2,052,640	1,815,222	(24,618)	7,662,836	(5,488,005)	-	95,795,184
2007	2,258,769	2,085,402	(28,543)	10,815,958	(5,615,684)	-	105,311,086
2008	2,549,234	2,347,711	(39,582)	(13,333,539)	(5,910,493)	-	90,924,417
2009	2,657,556	2,469,358	(43,053)	16,027,603	(6,418,508)	-	105,617,373
2010	2,696,312	2,525,810	(48,843)	3,006,266	(6,797,462)	-	106,999,456
2011	2,799,257	2,685,062	(72,991)	1,198,878	(7,491,767)	-	106,117,895
2012	2,975,898	2,726,295	(84,760)	2,198,614	(7,866,390)	-	106,067,552
2013	3,352,871	2,976,082	(106,839)	12,090,439	(8,228,941)	-	116,151,164
2014	3,077,515	3,310,309	(97,878)	9,972,463	(8,732,855)	-	123,680,718
2015	3,355,688	3,524,286	(101,768)	7,185,652	(9,046,994)	-	128,597,582
2016	3,574,065	3,678,081	(120,729)	8,600,122	(9,719,868)	-	134,609,253
2017	3,552,582	3,485,756	(134,888)	9,504,148	(10,304,469)	-	140,712,382
2018	3,529,976	3,796,060	(144,913)	5,453,355	(10,612,051)	-	142,734,809

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

** Net of investment expenses

Table 9

Development of Actuarial Value of Assets

Item	FYE 2018	FYE 2017
1. Actuarial value of assets, beginning of year (before corridor)	$140,712,382	$134,609,253
2. Market value, end of year	$133,269,459	$141,608,716
3. Market value, beginning of year	$141,608,716	$127,386,503
4. Non-investment/administrative net cash flow:		
a. Employee contributions	$3,416,437	$3,428,767
b. Employer contributions	3,491,524	3,503,125
c. Other contributions	418,075	106,446
d. Refund of employee accounts	(351,230)	(509,361)
e. Retirement benefits	(10,260,821)	(9,795,108)
f. Administrative Expenses	(144,913)	(134,888)
g. Total net cash flow: [sum of (4a) through (4f)]	($3,430,928)	($3,401,019)
5. Investments and securities lending:		
a. Interest and dividends on investments	$2,429,841	$2,475,020
b. Gross income from securities lending	217,299	118,932
c. Fees and expenses	(1,195,371)	(1,318,815)
d. Total net income: [sum of (5a) through (5c)]	$1,451,769	$1,275,137
6. Investment income:		
a. Actual market return: (2) - (3) - (4g) - (5d)	($6,360,098)	$16,348,095
b. Assumed rate of return	7.00%	7.75%
c. Assumed amount of return	8,342,790	8,467,987
d. Amount subject to phase-in: (6a) - (6c)	($14,702,888)	$7,880,108
7. Phase-in recognition of investment income:		
a. Current year: 0.20 * (6d)	($2,940,578)	$1,576,022
b. First prior year	1,576,022	(136,869)
c. Second prior year	(136,869)	(2,157,368)
d. Third prior year	(2,157,368)	(682,411)
e. Fourth prior year	(682,411)	1,161,650
f. Total recognition	($4,341,204)	($238,976)
8. Actuarial value of assets, end of year		
a. Preliminary actuarial value of assets, end of year: (1) + (4g) + (5d) + (6c) + (7f)	$142,734,809	$140,712,382
b. Upper corridor limit: 120% * (2)	$159,923,351	$169,930,459
c. Lower corridor limit: 80% * (2)	$106,615,567	$113,286,973
d. Actuarial value of assets, end of year	$142,734,809	$140,712,382
9. Difference between market and actuarial value of assets	($9,465,350)	$896,334
10. Actuarial rate of return	3.92%	7.15%
11. Market rate of return*	-3.52%	14.20%
12. Ratio of actuarial value to market value of assets	107.10%	99.37%

* 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 (1)	Market Value (2)	Actuarial Value (3)
2000	-0.99%	16.23%
2001	-4.47%	10.43%
2002	-9.29%	-1.37%
2003	21.00%	8.51%
2004	11.54%	2.96%
2005	8.22%	5.29%
2006	12.63%	8.61%
2007	7.44%	11.37%
2008	-29.63%	-12.72%
2009	23.72%	17.76%
2010	13.80%	2.87%
2011	-0.90%	1.13%
2012	14.05%	2.09%
2013	13.53%	11.51%
2014	4.70%	8.68%
2015	-0.26%	5.86%
2016	7.60%	6.76%
2017	14.20%	7.15%
2018	-3.52%	3.92%
Average returns:		
Last five years:	4.38%	6.46%
Last ten years:	8.39%	6.67%

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 auditors.

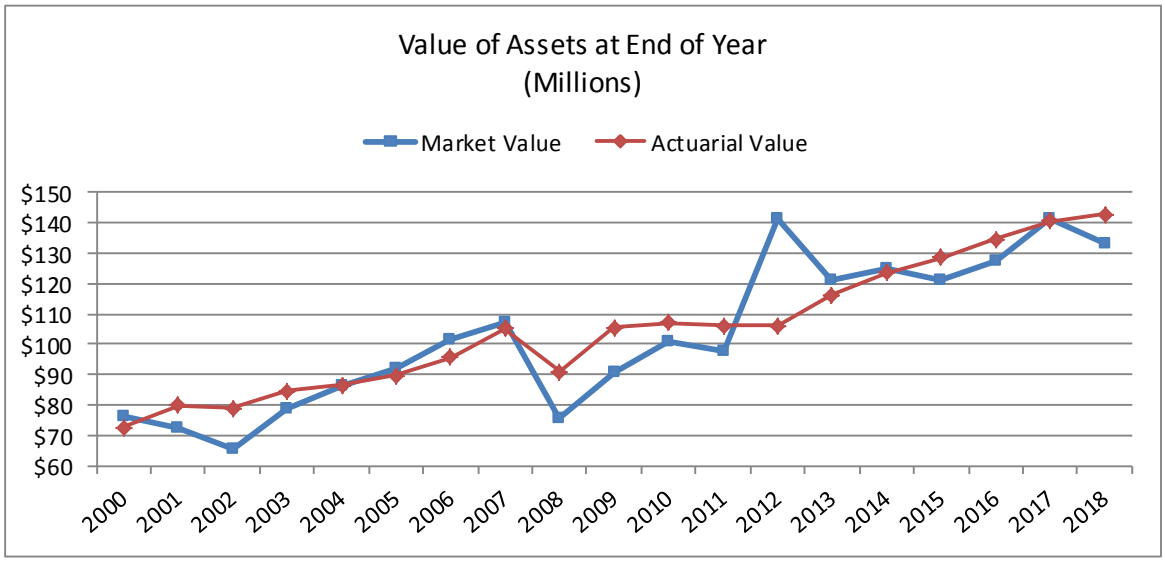

Table 11

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	$19,498,000	$53,707,000	$23,084,000	$86,375,460	100%	100%	57.1%
2006	19,073,000	60,558,000	21,280,000	89,777,109	100%	100%	47.7%
2007	19,825,000	62,684,000	24,394,000	95,795,184	100%	100%	54.5%
2008	22,176,000	65,310,000	30,571,000	105,311,086	100%	100%	58.3%
2009	24,238,540	61,036,800	26,347,750	90,924,417	100%	100%	21.4%
2010	25,781,876	64,603,564	30,513,788	105,617,373	100%	100%	49.9%
2011	26,324,324	71,634,810	29,328,720	106,999,456	100%	100%	30.8%
2012	27,073,115	77,422,955	28,944,716	106,117,895	100%	100%	5.6%
2013	29,760,034	79,144,343	28,676,259	106,067,552	100%	96%	0.0%
2014	31,223,741	87,447,473	31,318,179	116,151,164	100%	97%	0.0%
2015	32,457,623	93,060,143	30,683,536	123,680,718	100%	98%	0.0%
2016	33,664,383	100,994,492	29,863,511	128,597,582	100%	94%	0.0%
2017	35,855,356	103,925,402	29,470,813	134,609,253	100%	95%	0.0%
2018	36,388,053	119,188,954	25,038,429	140,712,382	100%	88%	0.0%
2019	37,279,660	124,477,094	24,775,799	142,734,809	100%	85%	0.0%

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	$72,593,991	$65,605,100	($6,988,891)	110.65%	$10,917,600	-64.01%
2002	79,951,846	79,121,700	(830,146)	101.05%	12,811,600	-6.48%
2003	78,718,418	84,016,000	5,297,582	93.69%	13,633,500	38.86%
2004	84,718,036	89,981,600	5,263,564	94.15%	14,244,400	36.95%
2005	86,375,460	96,288,800	9,913,340	89.70%	14,647,900	67.68%
2006	89,777,109	104,440,300	14,663,191	85.96%	15,527,800	94.43%
2007	95,795,184	115,259,800	19,464,616	83.11%	17,273,900	112.68%
2008	105,311,086	126,147,600	20,836,514	83.48%	20,053,800	103.90%
2009	90,924,417	138,979,800	48,055,383	65.42%	22,865,300	210.17%
2010	105,617,373	120,899,200	15,281,827	87.36%	23,393,277	65.33%
2011	106,999,456	127,287,900	20,288,444	84.06%	23,744,551	85.44%
2012	106,117,895	133,440,800	27,322,905	79.52%	24,389,987	112.03%
2013	106,067,552	137,580,636	31,513,084	77.09%	24,424,919	129.02%
2014	116,151,164	149,989,392	33,838,229	77.44%	22,744,938	148.77%
2015	123,680,718	156,201,302	32,520,584	79.18%	23,140,300	140.54%
2016	128,597,582	164,522,386	35,924,804	78.16%	24,641,033	145.79%
2017	134,609,253	169,251,572	34,642,319	79.53%	24,646,258	140.56%
2018	140,712,382	180,615,436	39,903,054	77.91%	23,639,756	168.80%
2019	142,734,809	186,532,553	43,797,744	76.52%	23,696,821	184.83%

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	
2003	11.95%	$1,629,200	12.81%	$1,746,788	107.22%
2004	11.44%	1,725,500	12.26%	1,796,863	110.29%
2005	11.78%	1,806,100	12.27%	1,890,808	109.58%
2006	11.63%	1,758,200	12.18%	2,052,640	113.65%
2007	10.18%	1,956,300	11.88%	2,258,769	128.47%
2008	11.33%	2,273,000	11.26%	2,549,234	112.15%
2009	12.82%	2,932,200	11.62%	2,657,556	90.63%
2010	11.74%	2,749,422	11.53%	2,696,312	98.07%
2011	12.98%	3,082,639	11.79%	2,799,257	90.81%
2012	14.12%	3,443,430	12.20%	2,975,898	86.42%
2013	13.58%	3,316,553	13.73%	3,352,871	101.10%
2014	17.76%	4,037,681	13.53%	3,077,515	76.22%
2015	16.36%	3,784,380	14.50%	3,355,688	88.67%
2016	16.63%	4,097,473	15.45%	3,574,065	87.23%
2017	16.41%	4,041,445	14.41%	3,552,582	87.90%
2018	15.26%	3,607,303	14.32%	3,529,976	97.86%
2019	16.86%	3,997,559	-	-	-

**Includes other funding sources but excludes member redeposits and member service purchase contributions.*
Effective January 1, 2010, ADCs are calculated assuming no future cost-of-living increases.

Table 14

Reconciliation of Participant Data

	Active Participants	Vested Former Participants	Retired Participants	Disableds	Beneficiaries	Participants Due Refunds	Total
Number as of January 1, 2018	**304**	**16**	**231**	**36**	**63**	**48**	**698**
New participants	29	-	-	-	-	3	32
Vested terminations	(9)	9	-	-	-	-	-
Retirements	(8)	(2)	10	-	-	-	-
Disability	(1)	-	-	1	-	-	-
Deceased with beneficiary	-	-	(2)	-	3	-	1
Deceased without beneficiary	-	-	(1)	-	(1)	-	(2)
Due refunds	(6)	-	-	-	-	6	-
Lump sum payoffs	(5)	-	-	-	-	(8)	(13)
Rehires/return to active	-	-	-	-	-	-	-
Certain period expired	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-
Data corrections	-	-	-	-	-	-	-
Number as of January 1, 2019	**304**	**23**	**238**	**37**	**65**	**49**	**716**

Table 15

Demographic Statistics

	January 1		
	2019	2018	Change
Active Participants			
Number	304	304	0.0%
Vested	*192*	*202*	
Not vested	*112*	*102*	
Average age (years)	40.83	40.77	0.1%
Average service (years)	10.79	10.87	-0.7%
Average entry age (years)	30.04	29.90	0.5%
Total payroll*	$23,696,821	$23,639,756	0.2%
Average payroll*	$77,950	$77,762	0.2%
Total employee contributions with interest	$37,279,660	$36,388,053	2.5%
Average employee contributions with interest	$122,630	$119,698	2.5%
Vested Former Participants			
Number	23	16	43.8%
Average age (years)	43.94	47.28	-7.1%
Total employee contributions with interest	$2,997,512	$1,822,822	64.4%
Average employee contributions with interest	$130,327	$113,926	14.4%
Service Retirees			
Number	238	231	3.0%
Average age (years)	67.03	66.66	0.6%
Total annual benefits	$8,278,132	$7,894,273	4.9%
Average annual benefit	$34,782	$34,174	1.8%
Disability Retirees			
Number	37	36	2.8%
Average age (years)	56.73	56.42	0.5%
Total annual benefits	$1,217,680	$1,173,612	3.8%
Average annual benefit	$32,910	$32,600	1.0%
Beneficiaries			
Number	65	63	3.2%
Average age (years)	75.68	74.73	1.3%
Total annual benefits	$950,037	$938,801	1.2%
Average annual benefit	$14,616	$14,902	-1.9%
Participants Due Refunds			
Number	49	48	2.1%
Total Refunds Due	$634,787	$560,372	13.3%

* Projected payroll for the upcoming valuation year

Table 16

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

Average Age = 40.94 Average Service = 10.84

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	-	-	-	-	-	-	-	-
	Avg. Salary	-	-	-	-	-	-	-	-
20-24	Count	8	-	-	-	-	-	-	8
	Avg. Salary	$43,563	-	-	-	-	-	-	$43,563
25-29	Count	33	3	-	-	-	-	-	36
	Avg. Salary	52,930	*	-	-	-	-	-	55,345
30-34	Count	30	17	4	-	-	-	-	51
	Avg. Salary	63,638	$78,966	$98,432	-	-	-	-	71,477
35-39	Count	14	10	19	2	-	-	-	45
	Avg. Salary	68,340	77,296	83,872	*	-	-	-	77,409
40-44	Count	4	10	12	15	4	-	-	45
	Avg. Salary	60,447	82,228	86,690	83,555	85,013	-	-	82,172
45-49	Count	6	2	16	16	5	1	-	46
	Avg. Salary	58,622	*	87,345	87,667	$95,645	*	-	84,592
50-54	Count	-	2	3	9	6	7	1	28
	Avg. Salary	-	*	*	87,826	92,726	$89,554	*	89,955
55-59	Count	2	1	3	4	-	8	2	20
	Avg. Salary	*	*	*	81,237	-	79,133	*	82,183
60-64	Count	-	-	3	-	2	1	3	9
	Avg. Salary	-	-	*	-	*	*	*	77,928
65-69	Count	-	-	-	-	-	-	-	-
	Avg. Salary	-	-	-	-	-	-	-	-
70 & Over	Count	-	-	-	-	-	-	-	-
	Avg. Salary	-	-	-	-	-	-	-	-
Totals	Count	**97**	**45**	**60**	**46**	**17**	**17**	**6**	**288**
	Avg. Salary	**$58,845**	**$80,371**	**$86,752**	**$85,468**	**$91,880**	**$84,418**	**$77,334**	**$76,119**

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

Table 17

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

Average Age = 38.78 Average Service = 9.89

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	-	-	-	-	-	-	-	-
	Avg. Salary	-	-	-	-	-	-	-	-
20-24	Count	2	-	-	-	-	-	-	2
	Avg. Salary	*	-	-	-	-	-	-	*
25-29	Count	1	1	-	-	-	-	-	2
	Avg. Salary	*	*	-	-	-	-	-	*
30-34	Count	1	2	-	-	-	-	-	3
	Avg. Salary	*	*	-	-	-	-	-	*
35-39	Count	-	-	1	-	-	-	-	1
	Avg. Salary	-	-	*	-	-	-	-	*
40-44	Count	1	-	2	1	-	-	-	4
	Avg. Salary	*	-	*	*	-	-	-	81,518
45-49	Count	-	1	1	-	-	-	-	2
	Avg. Salary	-	*	*	-	-	-	-	*
50-54	Count	-	-	-	1	-	-	-	1
	Avg. Salary	-	-	-	*	-	-	-	*
55-59	Count	-	-	-	-	-	-	1	1
	Avg. Salary	-	-	-	-	-	-	*	*
60-64	Count	-	-	-	-	-	-	-	-
	Avg. Salary	-	-	-	-	-	-	-	-
65-69	Count	-	-	-	-	-	-	-	-
	Avg. Salary	-	-	-	-	-	-	-	-
70 & Over	Count	-	-	-	-	-	-	-	-
	Avg. Salary	-	-	-	-	-	-	-	-
Totals	Count	**5**	**4**	**4**	**2**	**-**	**-**	**1**	**16**
	Avg. Salary	**$54,227**	**$71,310**	**$81,712**	*****	**-**	**-**	*****	**$74,781**

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

Table 18

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

Average Age = 40.83 Average Service = 10.79

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	-	-	-	-	-	-	-	-
	Avg. Salary	-	-	-	-	-	-	-	-
20-24	Count	10	-	-	-	-	-	-	10
	Avg. Salary	$44,742	-	-	-	-	-	-	$44,742
25-29	Count	34	4	-	-	-	-	-	38
	Avg. Salary	53,205	$76,807	-	-	-	-	-	55,690
30-34	Count	31	19	4	-	-	-	-	54
	Avg. Salary	63,089	$78,659	$98,432	-	-	-	-	71,186
35-39	Count	14	10	20	2	-	-	-	46
	Avg. Salary	68,340	77,296	83,524	*	-	-	-	77,398
40-44	Count	5	10	14	16	4	-	-	49
	Avg. Salary	61,024	82,228	87,537	83,177	85,013	-	-	82,118
45-49	Count	6	3	17	16	5	1	-	48
	Avg. Salary	58,622	*	86,013	87,667	$95,645	*	-	83,908
50-54	Count	-	2	3	10	6	7	1	29
	Avg. Salary	-	*	*	87,358	92,726	$89,554	*	89,720
55-59	Count	2	1	3	4	-	8	3	21
	Avg. Salary	*	*	*	81,237	-	79,133	*	85,538
60-64	Count	-	-	3	-	2	1	3	9
	Avg. Salary	-	-	*	-	*	*	*	77,928
65-69	Count	-	-	-	-	-	-	-	-
	Avg. Salary	-	-	-	-	-	-	-	-
70 & Over	Count	-	-	-	-	-	-	-	-
	Avg. Salary	-	-	-	-	-	-	-	-
Totals	Count	**102**	**49**	**64**	**48**	**17**	**17**	**7**	**304**
	Avg. Salary	**$58,619**	**$79,631**	**$86,437**	**$85,253**	**$91,880**	**$84,418**	**$88,090**	**$76,049**

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

Table 19

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

Average Age = 44.60 Average Service = 11.67

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	-	-	-	-	-	-	-	-
25-29	-	-	-	-	-	-	-	-
30-34	-	1	-	-	-	-	-	1
35-39	-	1	4	1	-	-	-	6
40-44	-	3	1	1	-	-	-	5
45-49	-	1	4	1	-	-	-	6
50-54	-	1	-	1	-	-	-	2
55-59	-	1	-	-	-	-	-	1
60-64	-	-	1	-	-	-	-	1
65-69	-	-	-	-	-	-	-	-
70 & Over	-	-	-	-	-	-	-	-
Totals	**-**	**8**	**10**	**4**	**-**	**-**	**-**	**22**

Table 20

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

Average Age = 29.24 Average Service = 6.67

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	-	-	-	-	-	-	-	-
25-29	-	1	-	-	-	-	-	1
30-34	-	-	-	-	-	-	-	-
35-39	-	-	-	-	-	-	-	-
40-44	-	-	-	-	-	-	-	-
45-49	-	-	-	-	-	-	-	-
50-54	-	-	-	-	-	-	-	-
55-59	-	-	-	-	-	-	-	-
60-64	-	-	-	-	-	-	-	-
65-69	-	-	-	-	-	-	-	-
70 & Over	-	-	-	-	-	-	-	-
Totals	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**

Table 21

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

Average Age = 43.94 Average Service = 11.45

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	-	-	-	-	-	-	-	-
25-29	-	1	-	-	-	-	-	1
30-34	-	1	-	-	-	-	-	1
35-39	-	1	4	1	-	-	-	6
40-44	-	3	1	1	-	-	-	5
45-49	-	1	4	1	-	-	-	6
50-54	-	1	-	1	-	-	-	2
55-59	-	1	-	-	-	-	-	1
60-64	-	-	1	-	-	-	-	1
65-69	-	-	-	-	-	-	-	-
70 & Over	-	-	-	-	-	-	-	-
Totals	**-**	**9**	**10**	**4**	**-**	**-**	**-**	**23**

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	14	$354,334	7	$66,261	250	$5,875,488	5.16%	$23,502
2009	13	505,243	5	117,846	258	6,262,885	6.59%	24,275
2010	15	705,497	5	82,482	268	6,885,900	9.95%	25,694
2011	15	576,180	3	48,554	280	7,413,526	7.66%	26,477
2012	14	442,263	10	164,287	284	7,691,502	3.75%	27,083
2013	12	524,215	6	150,013	290	8,065,703	4.87%	27,813
2014	29	835,107	11	292,130	308	8,608,680	6.73%	27,950
2015	20	714,877	8	176,195	320	9,147,362	6.26%	28,586
2016	15	567,619	12	191,375	323	9,523,606	4.11%	29,485
2017	19	715,125	12	232,044	330	10,006,686	5.07%	30,323
2018	14	493,355	4	54,193	340	10,445,848	4.39%	30,723

* Includes cost-of-living increases

Table 23

Pensioners by Option Code

	Count			Monthly Benefit		
	Male	Female	Total	Male	Female	Total
Option Code*						
1	93	1	94	$213,875	$2,733	$216,608
2	154	3	157	496,122	10,474	506,595
3	-	-	-	-	-	-
4	10	2	12	26,978	4,471	31,449
5	12	-	12	36,665	-	36,665
Total	**269**	**6**	**275**	**$773,640**	**$17,678**	**$791,318**
Beneficiaries	**-**	**65**	**65**	**-**	**$79,170**	**$79,170**
Grand Total	**269**	**71**	**340**	**$773,640**	**$96,848**	**$870,487**

* See optional forms of payment in Appendix B.

Table 24

Pensioners by Monthly Benefit and Option Code

Males	Option Code					
Benefit Amount	**1**	**2**	**3**	**4**	**5**	**Total**
Under $200	1	-	-	-	-	1
$200-$399	1	2	-	-	-	3
$400-$599	-	1	-	-	-	1
$600-$799	2	4	-	-	1	7
$800-$999	1	1	-	2	-	4
$1,000-$1,499	15	14	-	1	-	30
$1,500-$1,999	16	11	-	2	1	30
$2,000-$2,499	22	18	-	-	1	41
$2,500 & over	35	103	-	5	9	152
Total	**93**	**154**	**0**	**10**	**12**	**269**
Females						
Benefit Amount	**1**	**2**	**3**	**4**	**5**	**Total**
Under $200	-	-	-	-	-	-
$200-$399	-	-	-	-	-	-
$400-$599	-	-	-	-	8	8
$600-$799	-	-	-	-	11	11
$800-$999	-	-	-	-	7	7
$1,000-$1,499	-	-	-	-	23	23
$1,500-$1,999	-	-	-	1	7	8
$2,000-$2,499	-	-	-	-	7	7
$2,500 & over	1	3	-	1	2	7
Total	**1**	**3**	**0**	**2**	**65**	**71**
Males & Females						
Benefit Amount	**1**	**2**	**3**	**4**	**5**	**Total**
Under $200	1	-	-	-	-	1
$200-$399	1	2	-	-	-	3
$400-$599	-	1	-	-	8	9
$600-$799	2	4	-	-	12	18
$800-$999	1	1	-	2	7	11
$1,000-$1,499	15	14	-	1	23	53
$1,500-$1,999	16	11	-	3	8	38
$2,000-$2,499	22	18	-	-	8	48
$2,500 & over	36	106	-	6	11	159
Total	**94**	**157**	**0**	**12**	**77**	**340**

Table 25

Pensioners by Age and Option Code

Avg. Age Male = 65.8 Avg. Age Female = 74.1 Avg. Age Total = 67.6

Males	Option Code					
Age Last Birthday	**1**	**2**	**3**	**4**	**5**	**Total**
Under 50	5	5	0	0	0	10
50-54	7	20	0	1	1	29
55-59	7	20	0	1	3	31
60-64	10	41	0	2	5	58
65-69	13	38	0	4	2	57
70-74	10	22	0	1	1	34
75-79	20	7	0	1	0	28
80-84	13	1	0	0	0	14
85 & over	8	0	0	0	0	8
Total	**93**	**154**	**0**	**10**	**12**	**269**
Females						
Age Last Birthday	**1**	**2**	**3**	**4**	**5**	**Total**
Under 50	0	0	0	0	2	2
50-54	0	0	0	1	0	1
55-59	1	2	0	1	2	6
60-64	0	1	0	0	5	6
65-69	0	0	0	0	12	12
70-74	0	0	0	0	9	9
75-79	0	0	0	0	9	9
80-84	0	0	0	0	11	11
85 & over	0	0	0	0	15	15
Total	**1**	**3**	**0**	**2**	**65**	**71**
Males & Females						
Age Last Birthday	**1**	**2**	**3**	**4**	**5**	**Total**
Under 50	5	5	0	0	2	12
50-54	7	20	0	2	1	30
55-59	8	22	0	2	5	37
60-64	10	42	0	2	10	64
65-69	13	38	0	4	14	69
70-74	10	22	0	1	10	43
75-79	20	7	0	1	9	37
80-84	13	1	0	0	11	25
85 & over	8	0	0	0	15	23
Total	**94**	**157**	**0**	**12**	**77**	**340**

Table 26

Pensions Awarded in 2018 by Option Code

Average Age = 53.4

Males & Females	Option Code					
Benefit Amount	**1**	**2**	**3**	**4**	**5**	**Total**
Under $200	0	0	0	0	0	0
$200-$399	0	0	0	0	0	0
$400-$599	0	0	0	0	1	1
$600-$799	0	0	0	0	1	1
$800-$999	0	0	0	0	1	1
$1,000-$1,499	0	0	0	0	0	0
$1,500-$1,999	0	0	0	0	0	0
$2,000-$2,499	2	0	0	0	0	2
$2,500 & over	4	4	0	0	1	9
Total	**6**	**4**	**0**	**0**	**4**	**14**
Males & Females						
Age Last Birthday	**1**	**2**	**3**	**4**	**5**	**Total**
Under 50	1	0	0	0	0	1
50-54	2	3	0	0	0	5
55-59	1	0	0	0	0	1
60-64	2	1	0	0	1	4
65-69	0	0	0	0	0	0
70-74	0	0	0	0	1	1
75-79	0	0	0	0	2	2
80-84	0	0	0	0	0	0
85 & over	0	0	0	0	0	0
Total	**6**	**4**	**0**	**0**	**4**	**14**

Table 27

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

Average Service at Retirement = 21.8 Average Years Since Retirement = 12.4

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	-	3	2	-	1	-	-	6
	Avg. Benefit	-	$2,356	$1,215	-	$994	-	-	$1,749
5-9	Count	12	9	11	2	1	-	1	36
	Avg. Benefit	$1,586	$2,487	$1,441	$473	$785	-	$324	$1,648
10-14	Count	12	5	5	1	-	3	-	26
	Avg. Benefit	$2,393	$3,041	$2,340	$688	-	$1,226	-	$2,307
15-19	Count	13	3	11	5	2	-	2	36
	Avg. Benefit	$2,871	$3,175	$2,044	$1,534	$1,277	-	$1,329	$2,284
20-24	Count	10	12	8	10	6	4	5	55
	Avg. Benefit	$3,804	$3,459	$2,821	$1,968	$1,837	$1,817	$1,615	$2,694
25-29	Count	12	9	14	7	6	7	5	60
	Avg. Benefit	$5,131	$4,325	$3,096	$2,917	$2,430	$2,070	$1,928	$3,383
30-34	Count	8	13	8	8	2	3	1	43
	Avg. Benefit	$5,147	$5,120	$3,209	$3,191	$3,592	$2,166	$1,767	$4,056
35 & Over	Count	4	2	5	1	-	1	-	13
	Avg. Benefit	$4,323	$4,302	$4,115	$4,253	-	$3,079	-	$4,139
Totals	Count	**71**	**56**	**64**	**34**	**18**	**18**	**14**	**275**
	Avg. Benefit	**$3,425**	**$3,746**	**$2,572**	**$2,329**	**$2,062**	**$1,945**	**$1,605**	**$2,878**

Table 28

Pensioners by Year of Retirement

January 1, 2019 Total = 275

Year of Retirement	Count	Year of Retirement	Count
Under 1960	-	**1989**	3
1960	-	**1990**	2
1961	-	**1991**	5
1962	-	**1992**	5
1963	-	**1993**	4
1964	-	**1994**	-
1965	-	**1995**	9
1966	-	**1996**	1
1967	-	**1997**	2
1968	-	**1998**	6
1969	-	**1999**	4
1970	-	**2000**	5
1971	-	**2001**	8
1972	-	**2002**	7
1973	-	**2003**	10
1974	-	**2004**	19
1975	-	**2005**	14
1976	-	**2006**	17
1977	-	**2007**	5
1978	1	**2008**	9
1979	-	**2009**	10
1980	1	**2010**	11
1981	2	**2011**	13
1982	-	**2012**	10
1983	-	**2013**	12
1984	3	**2014**	18
1985	-	**2015**	16
1986	2	**2016**	12
1987	1	**2017**	15
1988	3	**2018***	10

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

Table 29

Thirty Year Projected Benefit Payments

Year Ending December 31	Actives	Retirees*	Total
2019	$ 472,408	$ 10,493,851	$ 10,966,259
2020	1,017,436	10,444,701	11,462,137
2021	1,460,237	10,378,767	11,839,004
2022	1,920,395	10,292,237	12,212,633
2023	2,430,872	10,203,381	12,634,253
2024	3,018,931	10,127,004	13,145,935
2025	3,643,450	10,037,537	13,680,987
2026	4,210,014	9,941,019	14,151,033
2027	4,797,221	9,812,542	14,609,763
2028	5,414,166	9,694,663	15,108,829
2029	6,058,962	9,593,575	15,652,537
2030	6,650,687	9,472,690	16,123,377
2031	7,244,398	9,342,637	16,587,035
2032	7,850,167	9,193,478	17,043,645
2033	8,427,931	9,025,950	17,453,881
2034	9,032,730	8,837,652	17,870,382
2035	9,671,847	8,633,075	18,304,922
2036	10,295,740	8,416,944	18,712,685
2037	10,841,264	8,195,070	19,036,334
2038	11,361,306	7,958,157	19,319,463
2039	11,896,397	7,707,902	19,604,299
2040	12,402,414	7,450,801	19,853,215
2041	12,813,533	7,173,648	19,987,181
2042	13,198,952	6,885,290	20,084,241
2043	13,548,746	6,586,736	20,135,482
2044	13,876,611	6,279,346	20,155,957
2045	14,154,498	5,964,827	20,119,325
2046	14,337,884	5,645,175	19,983,059
2047	14,474,843	5,322,578	19,797,421
2048	14,553,952	4,999,298	19,553,250

* Includes Disabled Members, Beneficiaries, and Deferred Vested Members. Retirement benefit payments for deferred vested members are assumed to commence at age 50.

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, with interest, dividends, and other income recognized immediately. 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 administrative and 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

Age	Rate
20	8.50%
25	8.00%
30	5.75%
35	4.00%
40	3.00%
45	3.00%
50	3.00%
55	2.50%
60	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.

5. Demographic Assumptions

a. Rates Before Retirement

Healthy Pre-Retirement Mortality:

RP-2014 Mortality Table for Healthy Employees, 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 Mortality Table for Healthy Annuitants, 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%

100% of active deaths are assumed to be duty-related

b. Disability and Withdrawal

Age	Disability		Withdrawal Ultimate	
	Male	Female	Male	Female
20	0.10%	0.10%	18.00%	18.00%
25	0.10%	0.10%	6.00%	6.00%
30	0.23%	0.23%	6.00%	6.00%
35	0.39%	0.39%	6.00%	6.00%
40	0.57%	0.57%	5.00%	5.00%
45	0.73%	0.73%	5.00%	5.00%
50	0.75%	0.75%	2.50%	2.50%
55	0.75%	0.75%	1.00%	1.00%
60	0.75%	0.75%	1.00%	1.00%

100% of active disabilities are assumed to be duty-related

c. Retirement Rates

Age	Rate	Age	Rate
50	15%	56	10%
51	5%	57	15%
52	5%	58	15%
53	5%	59	15%
54	10%	60	35%
55	10%	61	40%
		62	100%

6. Other Assumptions

a. Percent married: 85% 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, whichever is more valuable at the time of termination.

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 50.

f. No benefit 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.

h. Administrative expenses: Average of actual expenses for the prior two years, with each year projected at 2.50% to the valuation date.

i. 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.

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

k. 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.

l. 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.

m. Benefit service: All members are assumed to accrue one year of service each year.

APPENDIX B

SUMMARY OF PLAN PROVISIONS

Summary of Plan Provisions

Covered Members	Any person who is employed by the Wyoming state highway patrol division as a sworn law enforcement officer; Any person who is commissioned as a full time law enforcement officer of the Wyoming state game and fish department; Any criminal investigator as defined under W.S. 9-3-602(a)(iv); Any person designated and appointed as capitol police under W.S. 9-1-612 and qualified pursuant to W.S. 9-1-701 through 9-1-707.
Final Average Salary	Employee's average annual salary for the highest paid three continuous years of service.
Service Retirement	
Eligibility	Age 50 with six or more years of service.
Monthly Benefit	2.50% of employee's highest three-year average salary for each year of credited service, not to exceed 75.0% of final average salary.
Vesting	Any employee who has left employment with six 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 contributions with interest. An employee who terminates with less than six years of service is only eligible for the lump-sum benefit.
Duty Disability Retirement	
Eligibility	No age or service eligibility requirements. Partial or total disability resulting from an individual and specific act, the type of which would normally occur only while employed as an employee, or as otherwise defined under W.S. 9-3-611(a).
Monthly Benefit	62.5% of Final Average Salary.
Non-duty Disability Retirement	
Eligibility	10 years of credited service. Partial or total disability, but not eligible for duty disability.
Monthly Benefit	50.0% of Final Average Salary.

Pre-retirement Duty Death Benefit

Eligibility	No age or service requirements.
Monthly Benefit	50% of member's final actual salary, payable to the surviving spouse plus 5% of the member's final actual salary for each unmarried child under 18. Payment shall not exceed the member's final actual salary.

Pre-retirement Non-duty Death Benefit

Eligibility	No age or service requirements.
Monthly Benefit	2% for each year of credited service, not to exceed 50%, of the member's final actual salary payable to the surviving spouse plus 5% of the member's final actual salary for each unmarried child under 18. Payment shall not exceed 60% of the member's final actual salary.

Post-retirement Death Benefit

Monthly Benefit	50% of the benefit payable prior to the member's death plus 5% of the member's final actual salary for each unmarried child under 18. Payment shall not exceed 60% of the member's final actual salary.

Contributions

Employee	14.56% of salary. The Employer may subsidize all except 1.62% of the employee contributions, which shall be paid through salary reductions.
Employer	14.88% of salary.
Interest	3.00% annually. (0.0% for non-vested inactive 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

Option 1	Monthly benefit for life. Upon death, 50% of the benefit continues to be paid to the beneficiary.
Option 2	Monthly benefit for life. Upon death, 100% of the benefit continues to be paid to the beneficiary.
Option 3	Not available under this plan.
Option 4	Monthly benefit for life with a guarantee of 120 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 AND ACTUARIALLY DETERMINED CONTRIBUTION

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 page 13 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.

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	5.6	6.0
Ratio of actuarial accrued liability to payroll	7.9	7.6
Ratio of actives to retirees and beneficiaries	0.9	0.9
Ratio of net cash flows to market value of assets	-3%	-2%
Duration of the actuarial accrued liability	12.6	12.7

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.

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