



**STATE OF WISCONSIN**  
**Department of Employee Trust Funds**  
 Robert J. Conlin  
 SECRETARY

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 of Employee Trust Funds  
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## **Correspondence Memorandum**

**Date:** June 1, 2018  
**To:** Employee Trust Funds Board  
**From:** Cindy Klimke-Armatoski, CPA  
 Chief Trust Finance Officer  
**Subject:** WRS Active Lives Valuation & Gain/Loss Analysis

**ETF requests the Employee Trust Funds Board (Board) approve the Thirty-Seventh Annual Actuarial Valuation and Gain/Loss Analysis as of December 31, 2017.**

Gabriel Roeder Smith & Company (GRS) has completed the actuarial valuation of non-retired members of the Wisconsin Retirement System. The results of the study are summarized below (millions \$):

	December 31,	
	2017	2016
Actuarial Accrued Liability	\$100,819.3	\$ 95,414.0
Actuarial Value of Assets	100,802.5	95,396.2
Unfunded Actuarial Accrued Liability	16.8	17.8
Funded Ratio	99.98%	99.98%

GRS is recommending the following contribution rates for 2019.

	<b>General, Teachers, Executive and Elected Officials</b>		<b>Protective Occupations</b>			
			<b>With Social Security</b>		<b>Without Social Security</b>	
	<b>2019</b>	<b>2018</b>	<b>2019</b>	<b>2018</b>	<b>2019</b>	<b>2018</b>
<b>Employer Normal Cost</b>	6.55%	6.70%	10.55%	10.70%	14.95%	14.90%
<b>Participant Normal Cost</b>	6.55%	6.70%	6.55%	6.70%	6.55%	6.70%
<b>Total Normal Cost</b>	13.1%	13.4%	17.1%	17.4%	21.5%	21.6%

Actuaries from GRS will be at the Board meeting to present their report and to answer any questions.

Attachment: Thirty-Seventh Annual Actuarial Valuation and Gain/Loss Analysis

Reviewed and approved by Robert J. Conlin, Secretary

Electronically Signed 6/8/18

Board	Mtg Date	Item #
JM	6.21.18	3B
ETF	6.21.18	4A

# Wisconsin Retirement System

Thirty-Seventh Annual Actuarial Valuation and  
Gain/Loss Analysis  
December 31, 2017



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June 1, 2018

Employee Trust Funds Board  
 Wisconsin Department of Employee  
 Trust Funds  
 4822 Madison Yards Way  
 Madison, Wisconsin 53705

Ladies and Gentlemen:

The results of the **December 31, 2017 annual actuarial valuations of non-retired members covered by the Wisconsin Retirement System** are presented in this report. The valuations establish contribution rates for the 2019 calendar year in conformance with Chapter 40 of the Wisconsin Statutes. This report should not be relied upon for any other purpose. This report may be distributed to parties other than the Fund only in its entirety and only with the permission of the Board. GRS is not responsible for unauthorized use of this report. Determinations of financial results, associated with the benefits described in this report, for purposes other than those identified above may be significantly different. The change in the normal cost rates from last year are shown below:

<u>General and Executive/Elected</u>	<u>Protective with SS</u>	<u>Protective without SS</u>
-0.3%	-0.3%	-0.1%

The valuations are based upon our understanding of the main plan provisions related to General, Executive and Elected, and Protective Occupation employment with and without Social Security coverage. The plan provisions evaluated are summarized in Section H of this report. Please advise us of any material misstatements in the summary and do not rely on this report until such are resolved.

The individual member statistical data required for the valuations was furnished by the Department of Employee Trust Funds (DETF), together with pertinent data on financial operations. The cooperation of DETF staff in furnishing these materials is acknowledged with appreciation. We checked for internal reasonability and year-to-year consistency, but did not audit the data. We are not responsible for the accuracy or completeness of the information provided by others.

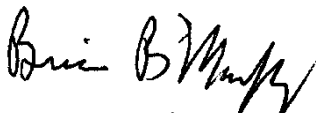
Actuarial valuations are based upon assumptions regarding future activity in specific risk areas including the rates of investment return and payroll growth, eligibility for the various classes of benefits, and longevity among retired lives. The Board adopts these assumptions after considering the advice of the actuary and other professionals. Each actuarial valuation takes into account all prior differences between actual and assumed experience in each risk area and adjusts the contribution rates as needed. The December 31, 2017 valuations were based upon assumptions that were recommended in connection with a study of experience during 2012-2014 and benefit provisions in effect on December 31, 2017.

Future actuarial measurements may differ significantly from those presented in this report due to such factors as experience differing from that anticipated by actuarial assumptions, changes in plan provisions, actuarial assumptions/methods or applicable law. Due to the limited scope of this assignment, we did not perform an analysis of the potential range of future measurements.

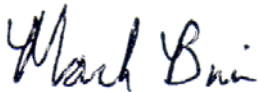
To the best of our knowledge, this report is complete and accurate and was made in accordance with generally recognized actuarial methods. Brian B. Murphy, Mark Buis, and James D. Anderson are Members of the American Academy of Actuaries (MAAA), and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. The signing actuaries are independent of the plan sponsor.

The valuations were completed by qualified actuaries in accordance with accepted actuarial procedures as prescribed by the Actuarial Standards Board. It is our opinion that the Wisconsin Retirement System is operating in accordance with actuarial principles of level percent-of-payroll financing.

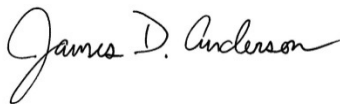
Respectfully submitted,



Brian B. Murphy, FSA, EA, FCA, MAAA, PhD



Mark Buis, FSA, EA, FCA, MAAA



James D. Anderson, FSA, EA, FCA, MAAA

BBM/MB/JDA:sc



## **SECTION A**

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### **EXECUTIVE SUMMARY**

# Executive Summary

## 1. Required Employer Contributions to Support Retirement System Benefits

	General, Executive & Elected Officials		Protective Occupation				Average 2019
			With Soc. Sec.		Without Soc. Sec.		
	2019	2018	2019	2018	2019	2018	
Employer Normal Cost	6.55%	6.70%	10.55%	10.70%	14.95%	14.90%	7.10%
Participant Normal Cost	6.55%	6.70%	6.55%	6.70%	6.55%	6.70%	6.55%
<b>Total Normal Cost</b>	<b>13.1%</b>	<b>13.4%</b>	<b>17.1%</b>	<b>17.4%</b>	<b>21.5%</b>	<b>21.6%</b>	<b>13.65%</b>

All employers are required to contribute the employer normal cost shown above. Certain employers are required to make additional contributions to fund their “Frozen Initial Liability” which are liabilities that they either brought on when they joined the WRS, or when they increased their prior service percentage. Related information is provided on page B-2.

Under Section 40.05 of the Wisconsin statutes updated for Acts 10 and 32 of 2011, contribution rates are split evenly between the employer normal cost and the participant normal cost for both General Participants and Executive and Elected Officials. For protective occupations, the participant normal cost is set equal to the participant normal cost for General Participants.

Contributions to support the Section 40.65 Duty Disability Program and the Accumulated Sick Leave Conversion Credit Program are in addition to the WRS rates shown above.

# Executive Summary

## 2. Reasons for Change

There are three general reasons why contribution rates change from one valuation to the next. The first is a change in the benefits or eligibility conditions of the plan. The second is a change in the valuation assumptions used to project future occurrences. The third is the difference during the year between the plan's actual experience and what the assumptions predicted.

In Wisconsin, there is a fourth reason. When the contribution rate changes for any of the first three reasons, the effect of the change is split evenly between employers and participants, except for protective occupation participants. When the participant normal cost changes, projected future participant account balances also change. By statute, the value of the participant retirement benefits must be at least equal to twice the account balance at retirement. This then changes the value of the retirement benefit, which then changes the total normal cost, which is then split between employers and participants. This final effect on normal cost is referred to as the "Money Purchase Effect".

In total, changes in the contribution rate are illustrated on the following chart. Additional detail on gains and losses can be found in Section D of this report.

	<b>General, Executive &amp; Elected Officials</b>	<b>Protective with Soc. Sec.</b>	<b>Protective without Soc. Sec.</b>
2018 Normal Cost Rate	13.40%	17.40%	21.60%
Effect of Benefit Change	0.00%	0.00%	0.00%
Effect of Assumption Change	0.00%	0.00%	0.00%
Effect of Asset Performance	(0.16)%	(0.27)%	(0.29)%
Effect of Salary Experience	(0.08)%	(0.02)%	0.07%
Effect of Money Purchase Benefit	(0.06)%	(0.03)%	(0.01)%
Demographic and Other Experience	0.00%	0.02%	0.13%
2019 Normal Cost Rate	13.10%	17.10%	21.50%

Although the investment income is allocated proportionately to each group, the effect on the contribution rate will be different because the ratio of assets to payroll is different for each group.



# Executive Summary

## 3. General Comments

Based upon this valuation, normal cost contribution rates decreased for all groups primarily due to favorable investment performance from prior years flowing through the Market Recognition Account (MRA) and lower than assumed salary increases.

In total, during 2017, investment return was above the assumed 2017 level of 7.20% on a market value basis. Under the asset valuation method (using the MRA), gains and losses are phased-in over a five-year period, resulting in an 8.2% return on an Actuarial Value of Assets basis in the Core Fund. The Market Value of Assets exceeds the Actuarial Value of Assets by approximately 3.4% as of the valuation date. The statutory asset valuation method will recognize all of the differences between actuarial value and market value of \$3.3 billion over four future years putting downward pressure on future contribution rates.

This valuation includes liabilities for future claims under the Long Term Disability Insurance (LTDI) program that became operational late in 1992. Inter-fund transfers between WRS and the LTDI program to support claims currently payable are addressed by a different actuarial firm in communications to the Group Insurance and Employee Trust Funds Boards.

**Conclusion.** Based upon the results of the December 31, 2017 regular annual actuarial valuation, it is our opinion that *the Wisconsin Retirement System continues to operate in accordance with actuarial principles of level percent-of-payroll financing.*

## Other Observations

### General Implications of Contribution Allocation Procedure or Funding Policy on Future Expected Plan Contributions and Funded Status

Given the plan's contribution allocation procedure, if all actuarial assumptions are met (including the assumption of the plan earning 7.2% on the actuarial value of assets), it is expected that:

- (1) The normal cost as a percentage of pay will decrease asymptotically to the level of the entry age normal cost as time passes.
- (2) The unfunded liability will decrease in dollar amount until it is fully funded.
- (3) The funded status of the plan will remain very close to a 100% funded ratio.

### Limitations of Funded Status Measurements

Unless otherwise indicated, a funded ratio measurement presented in this report is based upon the actuarial accrued liability and the actuarial value of assets. Unless otherwise indicated, with regard to any funded status measurements presented in this report:

- (1) The measurement is inappropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations, in other words, of transferring the obligations to an unrelated third party in an arm's length market value type transaction.
- (2) The measurement is dependent upon the actuarial cost method which, in combination with the plan's amortization policy, affects the timing and amounts of future contributions. The amount of future contributions will most certainly differ from those assumed in this report due to future actual experience differing from assumed experience based upon actuarial assumptions. A funded ratio measurement in this report of 100% is not synonymous with no required future contributions. If the funded ratio were 100%, the plan would still require future normal cost contributions (i.e., contributions to cover the cost of the active membership accruing an additional year of service credit).
- (3) The measurement would produce a different result if the market value of assets were used instead of the actuarial value of assets, unless the market value of assets is used in the measurement.

### Limitation of Project Scope

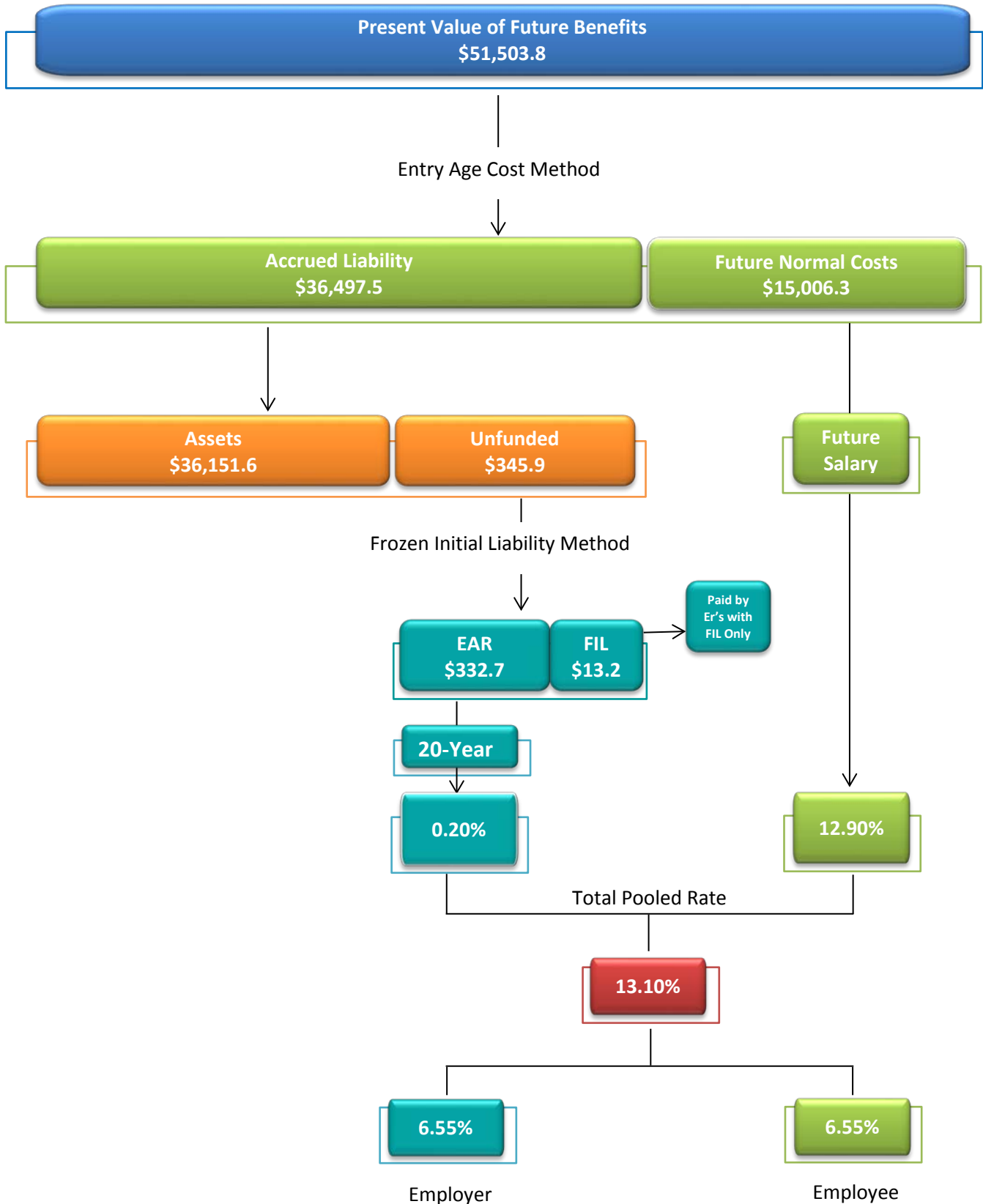
Actuarial standards do not require the actuary to evaluate the ability of the plan sponsor or other contributing entity to make required contributions to the plan when due. Such an evaluation was not within the scope of this project and is not within the actuary's domain of expertise. Consequently, the actuary performed no such evaluation.

## **SECTION B**

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### **VALUATION RESULTS**

# Actuarial Valuation Process (Illustration for General/Elected Group) \$ Millions



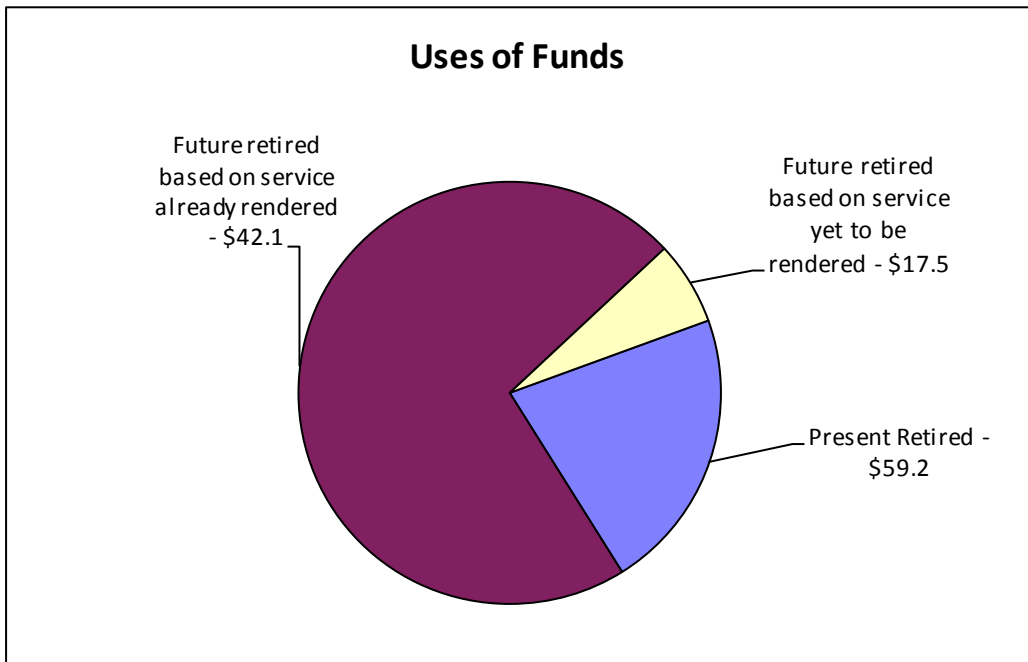
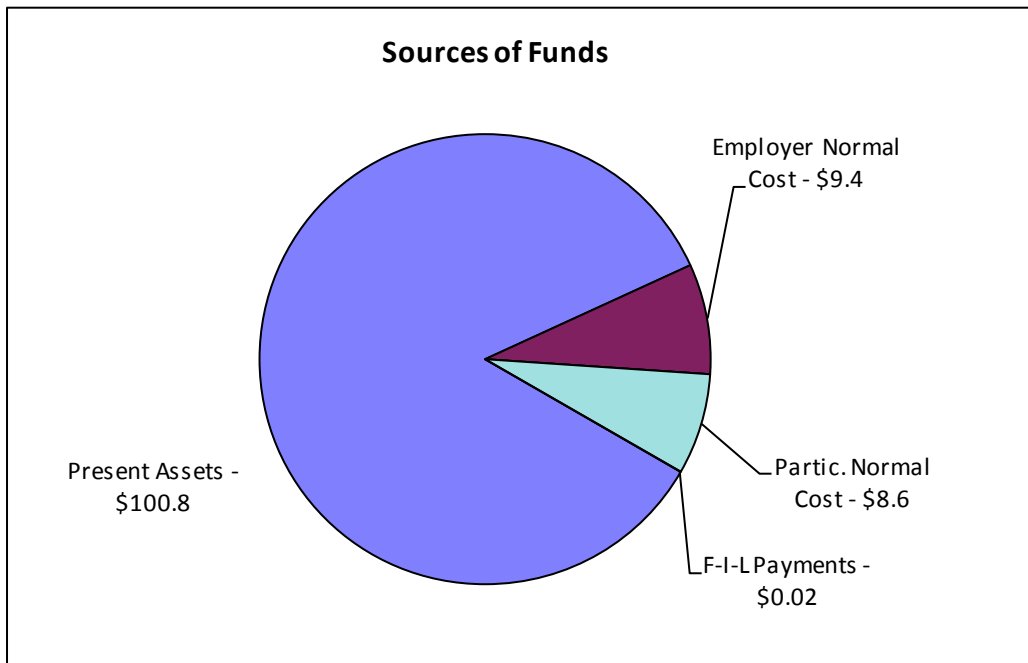
# Wisconsin Retirement System

## December 31, 2017 Valuation Overview

		\$ Millions					
		Non Retired					
		Protective		Unallocated			
		General, Executives & Elected Officials	With Soc. Sec.	Without Soc. Sec.	Add 'I Contribs	Retired	Total/Average
1	Number of People						
	a. Active	234,209	19,431	2,743			256,383
	b. Inactive, not retired	158,363	6,467	221			165,051
	c. Total	392,572	25,898	2,964		203,202	624,636
2	Current Earnings	\$12,274.7	\$1,227.0	\$218.8			\$13,720.5
3	<b>Present Values of</b>						
	Future Benefits for						
	a. Active	\$44,666.9	\$5,834.2	\$1,405.4			\$51,906.5
	b. Inactive, not retired	\$6,131.2	\$531.5	\$50.7			\$6,713.4
	c. Variable Adjustment	\$705.7	\$72.1	\$14.1			\$791.9
	d. Total	\$51,503.8	\$6,437.8	\$1,470.2	\$197.0	\$59,224.9	\$118,833.7
4	Future Entry Age Normal Costs	\$15,006.3	\$2,043.3	\$462.2			\$17,511.8
5	Future Earnings	\$116,626.0	\$12,604.3	\$2,219.1			\$131,449.4
6	<b>Pooled Entry Age Normal Cost (4/5)</b>	<b>12.87%</b>	<b>16.21%</b>	<b>20.83%</b>			<b>13.32%</b>
7	Entry Age Accrued Liability (3d-4)	\$36,497.5	\$4,394.5	\$1,008.0	\$197.0	\$59,224.9	\$101,321.9
8	Assets	\$36,151.6	\$4,243.6	\$985.4	\$197.0	\$59,224.9	\$100,802.5
9	<b>Total Entry Age Unfunded Liability (7-8)</b>	<b>\$345.9</b>	<b>\$150.9</b>	<b>\$22.6</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$519.4</b>
10	Frozen Initial Liability Portion	\$13.2	\$1.3	\$2.4	\$0.0	\$0.0	\$16.8
11	Pooled Unfunded Liability (EAR) (9-10)	\$332.7	\$149.6	\$20.2	\$0.0	\$0.0	\$502.6
12	20 year amortization factor	13.7885	13.7885	13.7885			13.7885
13	<b>Pooled Amortization % (11/12/2)</b>	<b>0.20%</b>	<b>0.88%</b>	<b>0.67%</b>			<b>0.27%</b>
14	<b>Total Pooled Rate Rounded (6+13)</b>	<b>13.1%</b>	<b>17.1%</b>	<b>21.5%</b>			<b>13.6%</b>
15	<b>2019 F-I-L Normal Cost Rates</b>						
16	Employer (0.5x14)	6.55%	10.55%	14.95%			7.10%
17	Participant (0.5x14 (Gen'I))	6.55%	6.55%	6.55%			6.55%
18	<b>Total (16+17)</b>	<b>13.1%</b>	<b>17.1%</b>	<b>21.5%</b>			<b>13.65%</b>
19	Entry Age Funded Ratio (8/7)	99.1%	96.6%	97.8%	100.0%	100.0%	99.5%

		Unfunded Frozen Initial Liability (UFIL)			
		Protective			
		General, Executives & Elected Officials	With Soc. Sec.	Without Soc Sec	Total
	Balance January 1, 2017	\$14,175,089	\$1,226,327	\$2,431,763	\$17,833,179
	New Employers	\$0	\$0	\$0	\$0
	Adjustments	\$0	\$0	\$0	\$0
	Payments	(\$1,875,444)	(\$59,500)	(\$199,539)	(\$2,134,483)
	Interest	\$885,575	\$84,012	\$160,720	\$1,130,307
	<b>Balance December 31, 2017</b>	<b>\$13,185,220</b>	<b>\$1,250,839</b>	<b>\$2,392,944</b>	<b>\$16,829,003</b>
	<b>WRS Average UFIL Contribution</b>	<b>0.02%</b>	<b>0.00%</b>	<b>0.09%</b>	<b>0.02%</b>

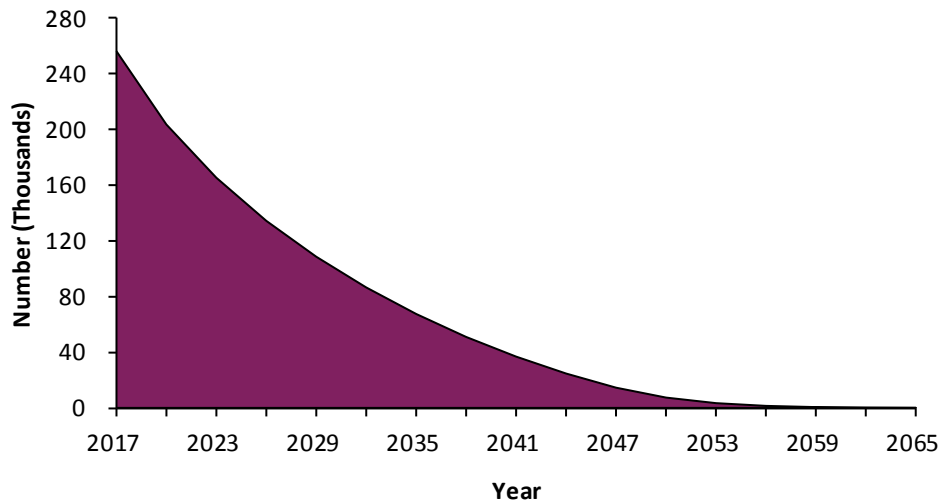
# Financing \$118.8 Billion\* of Benefit Promises for Present Active and Retired Participants December 31, 2017



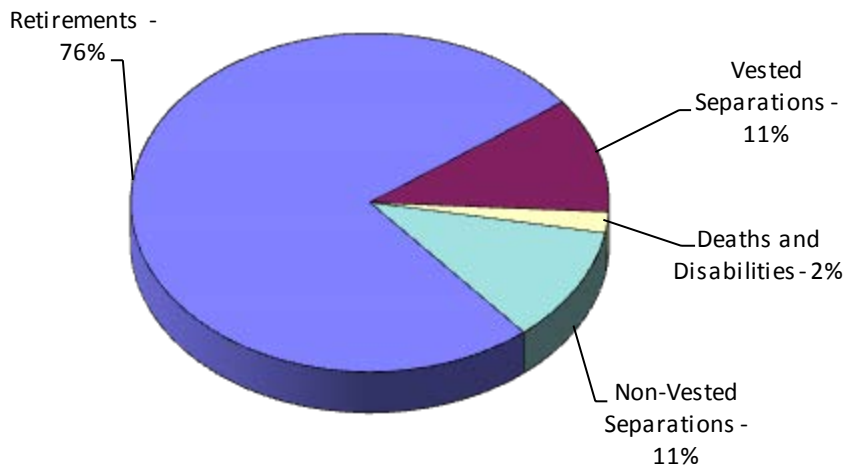
\* Present value of future benefits; all divisions combined.

# Expected Development of Present Population December 31, 2017

## Closed Group Active Population Projection



## Expected Terminations from Active Employment for Current Active Members



The charts above show the expected future development of the present population in simplified terms. The retirement system presently covers **256,383** active members. Eventually, **11%** of the population is expected to terminate covered employment prior to retirement and forfeit eligibility for a monthly benefit. About **87%** of the present population is expected to receive monthly retirement benefits either by retiring directly from active service, or by retiring from vested deferred status. The remaining **2%** of the present population is expected to become eligible for death-in-service or disability benefits. Within **ten** years, over half of the covered membership is expected to consist of new hires.

## Comparative Statement of Computed Contribution Rates

Valuation 12/31	Rate Effective 1/1	General				Executive and Elected			
		Participant	Benefit Adj. Contr.	Employer <sup>1</sup>	Total	Participant	Benefit Adj. Contr.	Employer <sup>1</sup>	Total
1993	1995	5.00 %	1.20 %	6.10 %	12.30 %	5.50 %	0.10 %	12.00 %	17.60 %
1994	1996	5.00 %	1.50 %	6.40 %	12.90 %	4.60 %	0.00 %	11.10 %	15.70 %
1995	1997	5.00 %	1.40 %	6.30 %	12.70 %	4.70 %	0.00 %	11.20 %	15.90 %
1996	1998	5.00 %	1.20 %	6.10 %	12.30 %	4.70 %	0.00 %	11.20 %	15.90 %
1997	1999	5.00 %	0.80 %	5.80 %	11.60 %	4.30 %	0.00 %	10.80 %	15.10 %
1998	2000	5.00 %	0.50 %	5.50 %	11.00 %	4.10 %	0.00 %	10.60 %	14.70 %
1999	2001	5.00 %	0.20 %	5.10 %	10.30 %	3.90 %	0.00 %	10.40 %	14.30 %
2000	2002	5.00 %	0.20 %	5.10 %	10.30 %	3.10 %	0.00 %	9.60 %	12.70 %
2001 <sup>2</sup>	2003	5.00 %	0.40 %	5.23 %	10.63 %	2.60 %	0.00 %	9.06 %	11.66 %
2002	2004	5.00 %	0.60 %	5.22 %	10.82 %	2.60 %	0.00 %	8.91 %	11.51 %
2003	2005	5.00 %	0.80 %	4.70 %	10.50 %	2.80 %	0.00 %	8.40 %	11.20 %
2004	2006	5.00 %	0.90 %	4.73 %	10.63 %	2.90 %	0.00 %	8.47 %	11.37 %
2005	2007	5.00 %	1.00 %	4.81 %	10.81 %	3.00 %	0.00 %	8.56 %	11.56 %
2006	2008	5.00 %	1.00 %	4.79 %	10.79 %	3.00 %	0.00 %	8.56 %	11.56 %
2007	2009	5.00 %	0.90 %	4.68 %	10.58 %	3.00 %	0.00 %	8.55 %	11.55 %
2008	2010	5.00 %	1.20 %	4.95 %	11.15 %	3.20 %	0.00 %	8.75 %	11.95 %
2009	2011	5.00 %	1.50 %	5.22 %	11.72 %	3.90 %	0.00 %	9.45 %	13.35 %
2010	2012	5.00 %	1.60 %	5.30 %	11.90 %	4.30 %	0.00 %	9.80 %	14.10 %
2011 <sup>3</sup>	2013	6.65 %	N/A	6.75 %	13.40 %	7.00 %	N/A	7.00 %	14.00 %
2012	2014	7.00 %	N/A	7.00 %	14.00 %	7.75 %	N/A	7.75 %	15.50 %
2013	2015	6.80 %	N/A	6.80 %	13.60 %	7.70 %	N/A	7.70 %	15.40 %
2014	2016	6.60 %	N/A	6.60 %	13.20 %	7.80 %	N/A	7.80 %	15.60 %
2015 <sup>4</sup>	2017	6.80 %	N/A	6.87 %	13.67 %	6.80 %	N/A	6.87 %	13.67 %
2016	2018	6.70 %	N/A	6.73 %	13.43 %	6.70 %	N/A	6.73 %	13.43 %
2017	2019	6.55 %	N/A	6.57 %	13.12 %	6.55 %	N/A	6.57 %	13.12 %

<sup>1</sup> Employer normal cost plus weighted average of unfunded Frozen Initial liability contribution rates.

<sup>2</sup> Act 11 of 1999 was implemented in 2001.

<sup>3</sup> Act 10 and Act 32 were implemented in 2011.

<sup>4</sup> Contribution rates for General and Executive and Elected Officials groups were combined beginning with the 2015 valuation. Actual 2016 Participant and Employer contribution rates for the Executive and Elected Officials group were each 6.6% respectively.



## Comparative Statement of Computed Contribution Rates

Valuation 12/31	Rate Effective 1/1	Protective With Social Security				Protective Without Social Security			
		Participant	Benefit Adj. Contr.	Employer <sup>1</sup>	Total	Participant	Benefit Adj. Contr.	Employer <sup>1</sup>	Total
1993	1995	6.00 %	0.50 %	10.60 %	17.10 %	7.20 %		16.00 %	23.20 %
1994	1996	6.00 %	0.10 %	10.20 %	16.30 %	6.80 %		15.70 %	22.50 %
1995	1997	5.80 %	0.00 %	9.80 %	15.60 %	6.20 %		15.10 %	21.30 %
1996	1998	5.40 %	0.00 %	9.40 %	14.80 %	5.80 %		14.60 %	20.40 %
1997	1999	4.90 %	0.00 %	8.90 %	13.80 %	5.40 %		14.30 %	19.70 %
1998	2000	4.10 %	0.00 %	8.00 %	12.10 %	4.40 %		13.30 %	17.70 %
1999	2001	3.80 %	0.00 %	7.60 %	11.40 %	3.30 %		12.20 %	15.50 %
2000	2002	4.00 %	0.00 %	7.80 %	11.80 %	3.00 %		11.90 %	14.90 %
2001 <sup>2</sup>	2003	4.00 %	0.00 %	7.68 %	11.68 %	2.40 %		11.28 %	13.68 %
2002	2004	4.50 %	0.00 %	8.02 %	12.52 %	3.20 %		11.81 %	15.01 %
2003	2005	4.90 %	0.00 %	8.10 %	13.00 %	3.30 %		11.30 %	14.60 %
2004	2006	5.00 %	0.00 %	8.19 %	13.19 %	3.30 %		11.11 %	14.41 %
2005	2007	5.10 %	0.00 %	8.28 %	13.38 %	3.40 %		11.16 %	14.56 %
2006	2008	5.10 %	0.00 %	8.27 %	13.37 %	3.40 %		11.17 %	14.57 %
2007	2009	5.00 %	0.00 %	8.15 %	13.15 %	3.20 %		10.89 %	14.09 %
2008	2010	5.50 %	0.00 %	8.64 %	14.14 %	3.90 %		11.56 %	15.46 %
2009	2011	5.80 %	0.00 %	8.94 %	14.74 %	4.80 %		12.46 %	17.26 %
2010	2012	5.90 %	0.00 %	9.00 %	14.90 %	4.90 %		12.60 %	17.50 %
2011 <sup>3</sup>	2013	6.65 %	N/A	9.75 %	16.40 %	6.65 %		12.65 %	19.30 %
2012	2014	7.00 %	N/A	10.10 %	17.10 %	7.00 %		14.00 %	21.00 %
2013	2015	6.80 %	N/A	9.50 %	16.30 %	6.80 %		13.40 %	20.20 %
2014	2016	6.60 %	N/A	9.40 %	16.00 %	6.60 %		13.40 %	20.00 %
2015	2017	6.80 %	N/A	10.70 %	17.50 %	6.80 %		15.00 %	21.80 %
2016	2018	6.70 %	N/A	10.73 %	17.43 %	6.70 %		14.95 %	21.65 %
2017	2019	6.55 %	N/A	10.55 %	17.10 %	6.55 %		15.04 %	21.59 %

<sup>1</sup> Employer normal cost plus weighted average of unfunded Frozen Initial liability contribution rates.

<sup>2</sup> Act 11 of 1999 was implemented in 2001.

<sup>3</sup> Act 10 and Act 32 were implemented in 2011.

## Schedule of Funding Progress & Accrued Liabilities (\$ Millions)

### Frozen Initial Liability Method

Valuation Date Dec. 31	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) Frozen Entry Age (b)	Unfunded AAL (UAAL) (b) - (a)	Funded Ratio (a)/(b)	Covered Payroll* (c)	UAAL as a Percent of Covered Payroll [(b) - (a)] / (c)
2008	\$ 77,159.4	\$ 77,412.0	\$ 252.6	99.7 %	\$ 12,289.6	2.1 %
2009	78,911.3	79,104.6	193.3	99.8 %	12,622.2	1.5 %
2010	80,626.9	80,758.8	131.9	99.8 %	12,744.0	1.0 %
2011	78,940.0	79,039.3	99.3	99.9 %	12,855.6	0.8 %
2012	78,613.0	78,682.7	69.7	99.9 %	12,627.6	0.6 %
2013	85,276.1	85,328.7	52.6	99.9 %	12,884.8	0.4 %
2014	89,360.4	89,392.1	31.7	100.0 %	13,219.5	0.2 %
2015	91,502.4	91,526.5	24.1	100.0 %	13,530.5	0.2 %
2016	95,396.2	95,414.0	17.8	100.0 %	13,706.0	0.1 %
2017	100,802.5	100,819.3	16.8	100.0 %	13,943.1	0.1 %

### Entry Age Method

Valuation Date Dec. 31	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) Entry Age (b)	Unfunded AAL (UAAL) (b) - (a)	Funded Ratio (a)/(b)	Covered Payroll* (c)	UAAL as a Percent of Covered Payroll [(b) - (a)] / (c)
2008	\$ 77,159.4	\$ 75,259.6	\$(1,899.8)	102.5 %	\$ 12,289.6	(15.5)%
2009	78,911.3	77,856.5	(1,054.8)	101.4 %	12,622.2	(8.4)%
2010	80,626.9	80,004.4	(622.5)	100.8 %	12,744.0	(4.9)%
2011	78,940.0	79,584.1	644.1	99.2 %	12,855.6	5.0 %
2012	78,613.0	80,225.3	1,612.3	98.0 %	12,627.6	12.8 %
2013	85,276.1	86,055.0	778.9	99.1 %	12,884.8	6.0 %
2014	89,360.4	89,794.0	433.6	99.5 %	13,219.5	3.3 %
2015	91,502.4	92,736.3	1,233.9	98.7 %	13,530.5	9.1 %
2016	95,396.2	96,351.2	955.0	99.0 %	13,706.0	7.0 %
2017	100,802.5	101,321.9	519.4	99.5 %	13,943.1	3.7 %

\* As reported by ETF staff. This figure is intended to represent the total pay upon which contributions were based during the year ended on the valuation date.

## Funding Metrics (\$ Millions)

### Frozen Initial Liability Method

Valuation Date Dec. 31	Actuarial Value of Assets	F-I-L Accrued Liability for				Percent Funded for			
		Annuitants and Beneficiaries	Member Contribs.	Active & Inactive Members	Total	Annuitants and Beneficiaries	Participant Contributions	Active & Inactive Members	Total
2008	\$77,159.4	\$38,372.6	\$16,045.3	\$22,994.1	\$77,412.0	100.0%	100.0%	98.9%	99.7%
2009	78,911.3	39,734.2	16,156.6	23,213.8	79,104.6	100.0%	100.0%	99.2%	99.8%
2010	80,626.9	41,139.0	16,253.6	23,366.2	80,758.8	100.0%	100.0%	99.4%	99.8%
2011	78,940.0	43,609.4	14,434.4	20,995.5	79,039.3	100.0%	100.0%	99.5%	99.9%
2012	78,613.0	44,055.5	14,401.1	20,226.1	78,682.7	100.0%	100.0%	99.7%	99.9%
2013	85,276.1	48,460.5	15,559.2	21,309.0	85,328.7	100.0%	100.0%	99.8%	99.9%
2014	89,360.4	51,131.1	16,259.3	22,001.7	89,392.1	100.0%	100.0%	99.9%	100.0%
2015	91,502.4	52,851.8	16,707.2	21,967.5	91,526.5	100.0%	100.0%	99.9%	100.0%
2016	95,396.2	55,764.0	17,361.7	22,288.3	95,414.0	100.0%	100.0%	99.9%	100.0%
2017	100,802.5	59,224.9	18,434.4	23,160.0	100,819.3	100.0%	100.0%	99.9%	100.0%

### Entry Age Method

Valuation Date Dec. 31	Actuarial Value of Assets	Entry Age Accrued Liability for				Percent Funded for			
		Annuitants and Beneficiaries	Member Contribs.	Active & Inactive Members	Total	Annuitants and Beneficiaries	Participant Contributions	Active & Inactive Members	Total
2008	\$77,159.4	\$38,372.6	\$16,045.3	\$20,841.7	\$75,259.6	100.0%	100.0%	109.1%	102.5%
2009	78,911.3	39,734.2	16,156.6	21,965.7	77,856.5	100.0%	100.0%	104.8%	101.4%
2010	80,626.9	41,139.0	16,253.6	22,611.8	80,004.4	100.0%	100.0%	102.8%	100.8%
2011	78,940.0	43,609.4	14,434.4	21,540.3	79,584.1	100.0%	100.0%	97.0%	99.2%
2012	78,613.0	44,055.5	14,401.1	21,768.7	80,225.3	100.0%	100.0%	92.6%	98.0%
2013	85,276.1	48,460.5	15,559.2	22,035.3	86,055.0	100.0%	100.0%	96.5%	99.1%
2014	89,360.4	51,131.1	16,259.3	22,403.6	89,794.0	100.0%	100.0%	98.1%	99.5%
2015	91,502.4	52,851.8	16,707.2	23,177.3	92,736.3	100.0%	100.0%	94.7%	98.7%
2016	95,396.2	55,764.0	17,361.7	23,225.5	96,351.2	100.0%	100.0%	95.9%	99.0%
2017	100,802.5	59,224.9	18,434.4	23,662.6	101,321.9	100.0%	100.0%	97.8%	99.5%

# Risk/Maturity Measures

\$ Millions									
Valuation Date	(1) Entry Age Accrued Liabilities (AAL)	(2) Market Value of Assets	(3) (Overfunded)/ Unfunded AAL (1) - (2)	(4) Valuation Payroll	(5) Change in Valuation Payroll	(6) Funded Ratio (2)/(1)	(7) Annuitant Liabilities (AnnLiab)	(8) AnnLiab/ AAL (7)/(1)	(9) AAL/ Valuation Payroll (1)/(4)
2017	\$101,321.9	\$104,159.6	(\$2,837.7)	\$13,720.5	1.7%	102.8%	\$ 59,224.9	58.5%	738.5%

*These Risk Measures were based on 7.2% future investment return, Entry Age Normal accrued liabilities and Market Value of Assets. The Risk/Maturity measures shown on this page and on the following page have been developed in response to Actuarial Standard of Practice ("ASOP") No. 51 entitled "Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions." In a maturing plan, the ratio of retiree liabilities to total liabilities increases, and the ratios of both assets and liabilities to payroll increases, and contribution rates tend to become increasingly volatile. The risk/maturity measures and associated commentary are intended to help keep stakeholders informed of some of the risks that the plan faces, and the potential contribution rate volatility. In the WRS, however, contribution volatility is mitigated by the extensive risk sharing features of the plan, including the dividend process, the Money Purchase Effect, the sharing of contribution rate changes, etc. Thus, these measures, while interesting, have somewhat less meaning for the WRS than they do for most systems.*

**Notes:**

The measures shown above provide information in accordance with forthcoming Actuarial Standard of Practice No. 51.

Columns (1) to (4). These columns provide various items for comparison in Columns 5 through 16.

Column (5). When payroll grows at or faster than the assumed rate of 3.2%, funding of unfunded accrued liabilities is likely to proceed at least at the scheduled rate. Payroll growing slower than the assumed rate can lead to underfunding of the plan because expected contributions for unfunded liability may not be received.

Column (6). The Funded ratio is the most widely known measure of a plan's financial strength, but the trend in the funded ratio is much more important than the absolute ratio. The funded ratio should trend to 100%. As it approaches 100%, it is important to re-evaluate the level of investment risk in the portfolio and potentially to re-evaluate the assumed rate of return.

Columns (7) and (8). The ratio of Annuitant liabilities to total accrued liabilities gives an indication of the maturity of the system. As the ratio increases, cash flow needs increase, and the investment policy may need to change. A ratio on the order of 50% indicates a maturing system.

Column (9). The ratio of liabilities to payroll gives an indication of both maturity and volatility. Many systems have ratios between 500% and 700%. Ratios significantly above that range may indicate difficulty in supporting the benefit level as a level % of payroll. In the WRS, this potential difficulty is mitigated by the many risk sharing features inherent in the plan design since liabilities are impacted by the dividend process and the impact on money purchase benefits.

## Risk/Maturity Measures (Concluded)

<b>\$ Millions</b>							
Valuation Date	(10) Assets/ Payroll (2)/(4)	(11) Portfolio StdDev	(12) Std Dev % of Pay (10)x(11)	(13) Unfunded/ Payroll (3)/(4)	(14) Net External Cash Flow (NECF)	(15) NECF/ Assets (14)/(2)	(16) Core Trust Fund NOF Return
<b>2017</b>	<b>759.2%</b>	<b>12.0%</b>	<b>91.1%</b>	<b>-</b>	<b>(3,055.1)</b>	<b>-2.9%</b>	<b>15.8%</b>

**Notes:**

Column (10). The ratio of assets to payroll gives an indication of both maturity and volatility. Many systems have ratios between 500% and 700%. Ratios significantly above that range may indicate difficulty in supporting the benefit level as a level % of payroll. In the WRS, this potential difficulty is mitigated by the many risk sharing features inherent in the plan design.

Columns (11) and (12). The portfolio standard deviation measures the volatility of investment return. When multiplied by the ratio of assets to payroll it gives the effect of a one standard deviation asset move as a percent of payroll. This figure helps users understand the difficulty of dealing with investment volatility and the challenges volatility brings to sustainability. In the WRS, the potential threat to sustainability is mitigated by the many risk sharing features inherent in the plan design.

Column (13). The ratio of unfunded liability to payroll gives an indication of the plan sponsor's ability to actually pay off the unfunded liability. A ratio above approximately 300% or 400% may indicate difficulty in discharging the unfunded liability within a reasonable time frame.

Columns (14) and (15). The ratio of Net External Cash Flow to assets is an important measure of sustainability. Negative ratios are common and expected for a maturing system. In the longer term, this ratio should be on the order of approximately -4%. A ratio that is significantly more negative than that for an extended period could be a leading indicator of potential exhaustion of assets.

Column (16). Investment return is probably the largest single risk that most systems face. The year by year return gives an indicator of the performance of the portfolio versus the system's assumed return.

## Contributions Required and Contributions Made

<b>Year Ended December 31</b>	<b>Annual Required Contribution</b>	<b>Percent Contributed*</b>
2008	\$644.8	105.0%
2009	699.3	108.0%
2010	686.7	108.0%
2011	784.1	104.0%
2012	826.1	100.0%
2013	912.4	100.0%
2014	977.1	100.0%
2015	966.5	100.0%
2016	954.2	100.0%
2017	1,014.9	100.0%

*\*Includes additional UAAL payments when amount is greater than 100%.*

**SECTION C**

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**FUND ASSETS**

## Total Valuation Assets (Reserves)

	Valuation Assets at December 31	
	2017	2016
Non Retired		
Participant Statutory		
Core	\$ 16,379,440,351	\$ 15,615,221,305
Variable	1,857,957,813	1,562,475,992
Total Statutory	18,237,398,164	17,177,697,297
Additional*	196,958,250	184,000,000
Total Participant	18,434,356,414	17,361,697,297
Employer		
Core	21,269,930,952	20,749,884,993
Variable	1,872,710,038	1,542,907,612
Total Employer	23,142,640,990	22,292,792,605
LTDI Reserve	642,452	(22,207,224)
Total Employer Net of LTDI	23,143,283,442	22,270,585,381
<b>Total Non Retired</b>	<b>41,577,639,856</b>	<b>39,632,282,678</b>
Retired Assets		
Core	54,899,948,656	51,972,000,000
Variable	4,324,896,801	3,792,000,000
<b>Total Retired Assets</b>	<b>59,224,845,457</b>	<b>55,764,000,000</b>
<b>Total Assets used in Valuation</b>	<b>100,802,485,313</b>	<b>95,396,282,678</b>

	Valuation Assets at December 31	
	2017	2016
Core Assets	\$ 92,746,920,661	\$ 88,498,899,074
Variable Assets	8,055,564,652	6,897,383,604
<b>Total Assets</b>	<b>100,802,485,313</b>	<b>95,396,282,678</b>

\* Includes employer, employee, and tax deferred additional contributions.



## Reserves for Non-Retired Participants Balances by Valuation Group

	Reserve for Year Ended			
	December 31, 2017			December 31, 2016
	Participant (Statutory)	Employer	Total *	Total
General, Executives & Elected	\$16,589,530,868	\$19,561,581,265	\$36,151,112,133	\$34,454,648,029
Protective with Soc. Sec.	1,384,845,059	2,858,678,647	4,243,523,706	4,064,807,316
Protective w/o Soc. Sec.	263,022,235	722,381,079	985,403,314	951,034,561
<b>Total</b>	<b>\$18,237,398,162</b>	<b>\$23,142,640,991</b>	<b>\$41,380,039,153</b>	<b>\$39,470,489,906</b>

*\* Totals differ slightly from page C-1 due to rounding, additional contributions and LTDI.*

The above schedule shows the distribution of Participant and Employer reserves among the valuation groups according to WRS accounting records. This separation of assets is needed because the valuation groups are separately experience rated. The assets are pooled for investment purposes.

## Development of Participant and Employer Reserves During the Year

	Participant Accumulation			Employer Accumulation			Grand Total
	Core	Variable	Total	Core	Variable	Total	
Ending Balance December 31, 2016	\$15,615,221,305	\$1,562,475,992	\$17,177,697,298	\$20,749,884,993	\$1,542,907,612	\$22,292,792,605	\$39,470,489,903
Closing Adjustments	537,103	(7,152)	529,950	(19,437,724)	19,561,225	123,501	653,452
Beginning Balance January 1, 2017	15,615,758,408	1,562,468,840	17,178,227,248	20,730,447,269	1,562,468,837	22,292,916,106	39,471,143,355
<b>Revenues:</b>							
Employer Contributions	-	-	-	924,264,597	93,420,937	1,017,685,534	1,017,685,534
Participant Contributions	859,211,091	93,849,520	953,060,611	-	-	-	953,060,611
<b>Total Revenues</b>	<b>859,211,091</b>	<b>93,849,520</b>	<b>953,060,611</b>	<b>924,264,597</b>	<b>93,420,937</b>	<b>1,017,685,534</b>	<b>1,970,746,145</b>
<b>Expenditures</b>							
Separations	36,283,824	1,960,231	38,244,055	-	-	-	38,244,055
Retirement Single Sums	24,810,566	864,515	25,675,081	24,940,837	895,837	25,836,674	51,511,755
Death Benefits	18,016,028	1,550,794	19,566,821	9,758,053	687,157	10,445,210	30,012,030
Disability Insurance	-	-	-	58,561,090	-	58,561,090	58,561,090
<b>Total Expenditures</b>	<b>79,110,417</b>	<b>4,375,539</b>	<b>83,485,957</b>	<b>93,259,980</b>	<b>1,582,994</b>	<b>94,842,974</b>	<b>178,328,930</b>
<b>Transfers:</b>							
Earnings Allocation	1,232,097,674	343,280,974	1,575,378,648	1,699,660,068	366,796,693	2,066,456,761	3,641,835,409
Annuities Awarded	(1,310,360,389)	(74,652,509)	(1,385,012,898)	(2,054,775,075)	(85,669,686)	(2,140,444,761)	(3,525,457,660)
Intra-Fund Transfers	(846,000)	76,512	(769,488)	964,494	(94,170)	870,324	100,835
Inter-Fund Transfers	62,689,986	(62,689,986)	-	62,629,579	(62,629,579)	-	-
<b>Net Transfers</b>	<b>(16,418,731)</b>	<b>206,014,992</b>	<b>189,596,261</b>	<b>(291,520,934)</b>	<b>218,403,258</b>	<b>(73,117,676)</b>	<b>116,478,584</b>
<b>Ending December 31, 2017</b>	<b>\$16,379,440,351</b>	<b>\$1,857,957,813</b>	<b>\$18,237,398,164</b>	<b>\$21,269,930,952</b>	<b>\$1,872,710,038</b>	<b>\$23,142,640,990</b>	<b>\$41,380,039,154</b>
Internal Rate of Return	8.0%	22.3%	9.3%	8.4%	23.9%	9.5%	9.4%

This page does not include additional contributions or LTDI assets.

## Development of Retiree Reserves During the Year

	<b>Core</b>	<b>Variable</b>	<b>Total</b>
Balance December 31, 2016	\$ 51,971,957,135	\$ 3,792,038,835	\$ 55,763,995,970
Closing Adjustments	(292,562)	(1,901,073)	(2,193,635)
Variable Terminations	95,896,672	(95,896,672)	-
Beginning Balance	52,067,561,245	3,694,241,090	55,761,802,335
Additions			-
Reserve transfers	\$ 3,373,733,902	\$ 161,098,605	\$ 3,534,832,507
Earnings	4,169,467,604	837,076,800	5,006,544,404
other	-	-	-
Total Additions	7,543,201,506	998,175,405	8,541,376,911
Subtractions			-
Annuities and Lump Sums	\$ 4,710,814,095	\$ 367,519,695	\$ 5,078,333,790
Credit reestablishments	-	-	-
Other	-	-	-
Total Subtractions	4,710,814,095	367,519,695	5,078,333,790
Ending Balance December 31, 2017	\$ 54,899,948,656	\$ 4,324,896,800	\$ 59,224,845,456

## Statement of Net Plan Assets (\$ Thousands) (Market Value)

	2017	2016
<b>Assets</b>		
Cash and Cash Equivalents	\$ 3,550,138	\$ 6,924,872
Securities Lending Collateral	1,576,662	1,004,940
Prepaid Expenses	27,425	6,368
<b>Total Short Term Assets</b>	<b>5,154,225</b>	<b>7,936,180</b>
<b>Receivables</b>		
Contributions	180,032	179,126
Prior Service Contributions	17,199	18,035
Benefits Overpayment	2,571	2,269
Due from Other Trust Funds	448,684	16,382
Due from General Fund	634	0
Miscellaneous	7,488,372	3,438
Interest and Dividends	314,112	244,205
Investment Sales	1,188,399	910,708
<b>Total Receivables</b>	<b>9,640,003</b>	<b>1,374,163</b>
<b>Investments at Fair Value</b>		
Fixed Income	30,709,368	28,622,140
Financial Futures Contracts	47,079	(79,142)
Preferred Securities	241,674	166,542
Convertible Securities	196	639
Stocks	63,241,060	44,963,358
Options	(3,830)	252
Limited Partnerships	12,212,410	11,285,915
Real Estate	1,368,583	1,275,526
Foreign Currency Contracts	(1,131)	67,024
Multi Asset Investments	4,791,880	4,407,772
Investment in Core Fund	0	0
Investment in External Pool	4,171	23,624
Other Investments	95,489	
<b>Total Investments</b>	<b>112,706,949</b>	<b>90,733,650</b>
Capital Assets	33,895	25,774
<b>Total Assets</b>	<b>127,535,072</b>	<b>100,069,767</b>
<b>Liabilities</b>		
Fixed Investment Due Other Programs	4,051,373	3,529,432
Variable Investment Due Other Programs	26,332	21,840
Obligation Under Reverse Repo Agreement	6,114,256	1,831,169
Short Sell Obligations	2,722,194	314,926
Securities Lending Collateral Liability	1,576,662	1,004,940
Collateral Due to Counterparty	2,860	74,340
Benefits Payable	360,605	343,714
Unearned Revenue	41	62
Due to Other Trust Funds	438,003	81,879
Miscellaneous Payables	7,615,939	125,834
Investment Payables	467,189	161,529
<b>Total Liabilities</b>	<b>23,375,454</b>	<b>7,489,665</b>
<b>Net Assets in Trust for Pension Benefits</b>	<b>\$104,159,618</b>	<b>\$92,580,102</b>

## Statement of Changes in Assets (\$ Thousands) (Market Value)

	Activity During Year	
	2017	2016
Additions:		
Contributions:		
Employer Contributions	\$ 1,024,632	\$ 963,122
Employee Contributions	965,453	921,864
Total Contributions	1,990,085	1,884,986
Investment Income:		
Net Appreciation (Depreciation) in Fair Value of Investments	13,831,016	5,861,708
Interest	569,459	568,127
Dividends	1,243,516	1,239,791
Securities Lending Income	37,990	36,529
Other	213,128	242,854
Less		
Current Income Distributed	(528,581)	(283,077)
SWIB Investment Expense	(487,384)	(391,427)
Investment Income Distributed to Securities Lending Rebates and Fees	(8,342)	(2,973)
Net Investment Income	14,870,802	7,271,532
Interest on Prior Service Receivable	1,130	1,198
Miscellaneous Income	227,825	341
Total Additions	17,089,842	9,158,057
Deductions:		
Benefits and Refunds:		
Retirement, Disability, and Beneficiary	5,167,990	4,951,650
Separation Benefits	38,358	39,276
Total Benefits and Refunds	5,206,348	4,990,926
ETF Administrative Expenses	23,142	20,426
Other Expenses	280,837	71,271
Total Deductions	5,510,327	5,082,623
Net Increase (Decrease)	11,579,515	4,075,434
Net Assets Held in Trust:		
Beginning of Year	\$92,580,102	\$88,504,670
<b>End of Year</b>	<b>\$104,159,618</b>	<b>\$92,580,102</b>

The figures on this page do not always reconcile exactly to the amounts used in the valuation.

## Core Investment Trust: Market Recognition Account

	For the Year Ended December 31						
	2015	2016	2017	2018	2019	2020	2021
Beginning of year							
a. Funding value	\$86,109,303,264	\$88,695,483,883	\$92,268,055,484	\$96,694,254,676	\$96,688,843,469	\$96,926,168,861	\$98,507,470,326
b. Market value	88,649,071,976	85,291,480,633	89,181,973,662	99,969,297,184	99,969,297,184	99,969,297,184	99,969,297,184
End of year							
c. Market value	85,291,480,633	89,181,973,662	99,969,297,184				
d. Non-investment cash flow (contributions minus benefits)	(2,738,977,618)	(2,985,477,640)	(3,055,126,228)				
e. Investment income							
e1. Total investment income	(618,613,725)	6,875,970,669	13,842,449,749				
e2. Assumed rate	7.2%	7.2%	7.2%				
e3. Amount for immediate recognition	6,101,266,641	6,278,597,645	6,533,315,451	-	-	-	-
e4. Amount for phased-in recognition: e1-e3	(6,719,880,366)	597,373,024	7,309,134,299	-	-	-	-
f. Phased-in recognition of investment income							
f1. Current year: 0.2 x e4	(1,343,976,073)	119,474,605	1,461,826,860	-	-	-	-
f2. First prior year	(242,736,599)	(1,343,976,073)	119,474,605	1,461,826,860	-	-	-
f3. Second prior year	953,421,177	(242,736,599)	(1,343,976,073)	119,474,605	1,461,826,860	-	-
f4. Third prior year	793,268,488	953,421,177	(242,736,599)	(1,343,976,073)	119,474,605	1,461,826,860	-
f5. Fourth prior year	(936,085,396)	793,268,488	953,421,177	(242,736,599)	(1,343,976,073)	119,474,605	1,461,826,860
f6. Total MRA recognition	(776,108,404)	279,451,597	948,009,969	(5,411,208)	237,325,392	1,581,301,465	1,461,826,860
f7. Amount for MRA recognition	-	-	-	-	-	-	-
f8. Total recognized gain (loss)	(776,108,404)	279,451,597	948,009,969	(5,411,208)	237,325,392	1,581,301,465	1,461,826,860
g. Total recognized investment income: e3 + f8	5,325,158,237	6,558,049,242	7,481,325,420	(5,411,208)	237,325,392	1,581,301,465	1,461,826,860
h. Funding value end of year: a + d + e3 + f8	88,695,483,883	92,268,055,484	96,694,254,676	96,688,843,469	96,926,168,861	98,507,470,326	99,969,297,186
i. Difference between market and funding values	(3,404,003,250)	(3,086,081,822)	3,275,042,509	3,280,453,717	3,043,128,325	1,461,826,860	-
j. Recognized rate of return	6.3%	7.5%	8.2%				
k. Market rate of return (net of fee)	(0.7)%	8.2%	15.8%				

The Core Investment Trust includes all WRS core assets, as well as the assets of certain other programs. The Market Recognition Account is a statutory method applicable to all assets invested in the Core Trust. Considerable additional information would be required to reconcile these figures to other asset figures in this report.

## SECTION D

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**GAIN/LOSS**

## Active Member Gain/Loss Analysis

**Purpose of Gain/Loss Analysis.** Regular actuarial valuations provide information about the composite change in computed contribution rates and total liabilities -- whether or not the rates and related liabilities are increasing or decreasing, and by how much. However, valuations do not show the portion of the change attributable to each risk area within the Wisconsin Retirement System financial mechanism: the rate of recognized investment income on plan assets; the rates of withdrawal of active participants who leave covered employment; the rates of mortality; the rates of disability; the rates of salary increases; and the assumed ages at actual retirement. In an actuarial valuation, assumptions are made as to what these rates will be for the next year and for decades in the future.

**The objective of a gain and loss analysis is to determine the portion of the change that is attributable to each risk area.**

The fact that actual experience differs from assumed experience should be expected. The future cannot be predicted with complete precision. Further, year-to-year statistical fluctuations occur, even in very large groups. This year's report reflects just a single year's experience. Changes in the valuation assumed experience for a risk area should be made only when the differences between assumed and actual experience have been observed to be sizable and persistent. One year's gain and loss analysis may or may not be indicative of **long-term trends, which are the basis of actuarial assumptions.** However, a persistent series of gains and losses can indicate a need for an assumption change or a method change, even if on a demographic basis, the assumptions appear to model reality well. In the Wisconsin Retirement System, longer term trends are reviewed in connection with the regular three-year investigation of experience (the most recent three-year investigation covered the period January 1, 2012 to December 31, 2014). It is the results of the three-year investigation that lead to recommendations for changes in the actuarial assumptions.

### Overall Experience

Overall experience resulted in a net actuarial gain of \$338 million for the 2017 calendar year. The development of this figure is shown on the following page. The gain was primarily attributable to favorable investment performance and pay increases less than assumed. The net result was a decrease in the overall 2019 normal cost rate of 0.3% of payroll.



## Development of Total Actuarial Gain (Loss) – Calendar Year December 31, 2017 (\$ Millions)

	Year Ended December 31, 2017				
	General	Executive & Elected	Protective		Total
			With S.S.	Without S.S.	
(1) Entry Age UAAL at start of year	\$ 637.4	\$ 50.1	\$ 179.0	\$ 19.8	\$ 886.3
(2) Entry Age Normal cost from last valuation	1,626.1	13.5	206.0	46.6	1,892.2
(3) Actual contributions	1,690.1	15.4	217.4	47.8	1,970.7
(4) Interest	43.6	3.5	12.5	1.4	61.0
(5) Expected UAAL before changes: (1) + (2) - (3) + (4)	617.0	51.7	180.1	20.0	868.8
(6) Change in actuarial assumptions	0.0	0.0	0.0	0.0	0.0
(7) Other changes	0.0	0.0	0.0	0.0	0.0
(8) Expected UAAL after changes: (5) + (6) + (7)	617.0	51.7	180.1	20.0	868.8
(9) Actual Entry Age UAAL at end of year	277.6	76.6	153.4	23.1	530.7
<b>(10) Gain (loss): (8) - (9)</b>	<b>\$ 339.4</b>	<b>\$ (24.9)</b>	<b>\$ 26.7</b>	<b>\$ (3.1)</b>	<b>\$ 338.1</b>

The gain/loss analysis is intended to explain the financial effect of differences between actual and assumed experience in basic risk areas: Investment income, pay increases, retirement rates, turnover rates, etc. In order for the gain/loss analysis to proceed, the change in the Entry Age Unfunded Actuarial Accrued Liabilities from one year to the next is analyzed to remove the effect of expected changes. The table above develops this year's gain or loss (line 10) which is added to the Experience Amortization Reserve (EAR). When the EAR increases "unexpectedly", this is favorable experience and downward pressure is exerted on contribution rates. Similarly, an unexpected decrease in the EAR is unfavorable experience and upward pressure is exerted on contribution rates. In addition to the gain or loss described in line 10, non-recurring changes in lines 6 and 7 also may affect contribution rates.

By measuring gains and losses each year and, to the extent possible, determining the "responsible" assumptions, insight is gained into how well the actuarial assumptions estimate WRS liabilities. Such information aids in understanding financial effects of emerging trends and is particularly useful during preparation of the WRS experience study.

## Population Development During Calendar Year 2017

	General	Executive & Elected	Protective		Total	Expected
			With S.S.	Without S.S.		
<b>Beginning Census</b>	232,684	1,347	19,431	2,746	256,208	
(-) Normal Retirement	3,420	70	510	84	4,084	4,141
(-) Early Retirement	3,320	18	96	6	3,440	4,138
(-) Death	95	0	12	0	107	251
(-) Disability Retirement						
-Total disabilities approved	94	0	10	0	104	192
-Less pending at beginning of year	22	0	6	0	28	
-Net new from active status	72	0	4	0	76	
(-) Other Separations	14,591	52	857	27	15,527	12,384
(-) Transfers Out	1,619	27	289	8	1,943	
(+) Transfers In	1,607	78	227	31	1,943	
(+) New Entrants	21,700	77	1,541	91	23,409	
<b>Ending Census</b>	232,874	1,335	19,431	2,743	256,383	

This schedule reconciles the active member populations reported in connection with the December 31, 2017 and the prior year valuations. Assumptions related to population development are a primary focus of the gain/loss analysis. They generally tend to be more stable than economic assumptions, and therefore, measurements have more meaning. Please note also that the table above represents changes in actual and expected counts of members. Beginning with the 2009 valuations, some of the actuarial assumptions (retirement, turnover, etc.) are based on liability weighted rates. Therefore, comparing actual to expected number counts alone may not form the basis for our conclusions.

Transfers for the General group include transfer between subgroups (teachers, university, general employees, etc.).

# Gain (Loss) Overview

## Population Results

**Normal Retirements** varied by group and gender. Overall normal retirements were slightly less than expected. In general, more normal retirements than assumed often creates a loss. However, looking at counts alone is not always an accurate predictor of whether a gain or loss occurs. If there are fewer retirements in shorter service, lower paid groups and more retirements than expected in longer service, higher paid groups, there will be a net loss to the System even if the actual total counts might be equal to or less than expected. In order to account for this, retirement rates are now developed partially on a liability weighted methodology. The net result for this past year was a small loss.

**Early Retirements** were less than expected, overall producing a small loss.

**Disabilities** were less than expected and produced a gain. This means that the reserves needed for the disability benefit were slightly smaller than the reserves that had been held for retirement benefits.

**Deaths** among active participants were less than expected. The net result for the past year was a small loss.

**Other Separations** varied by group, gender, and service but were overall higher than expected. The net result for the past year was a small gain.

**In total**, the population risk areas (retirement, death, disability, and other separations) produced gains and losses that almost entirely offset each other, producing a small net loss during 2017.

## Economic Results

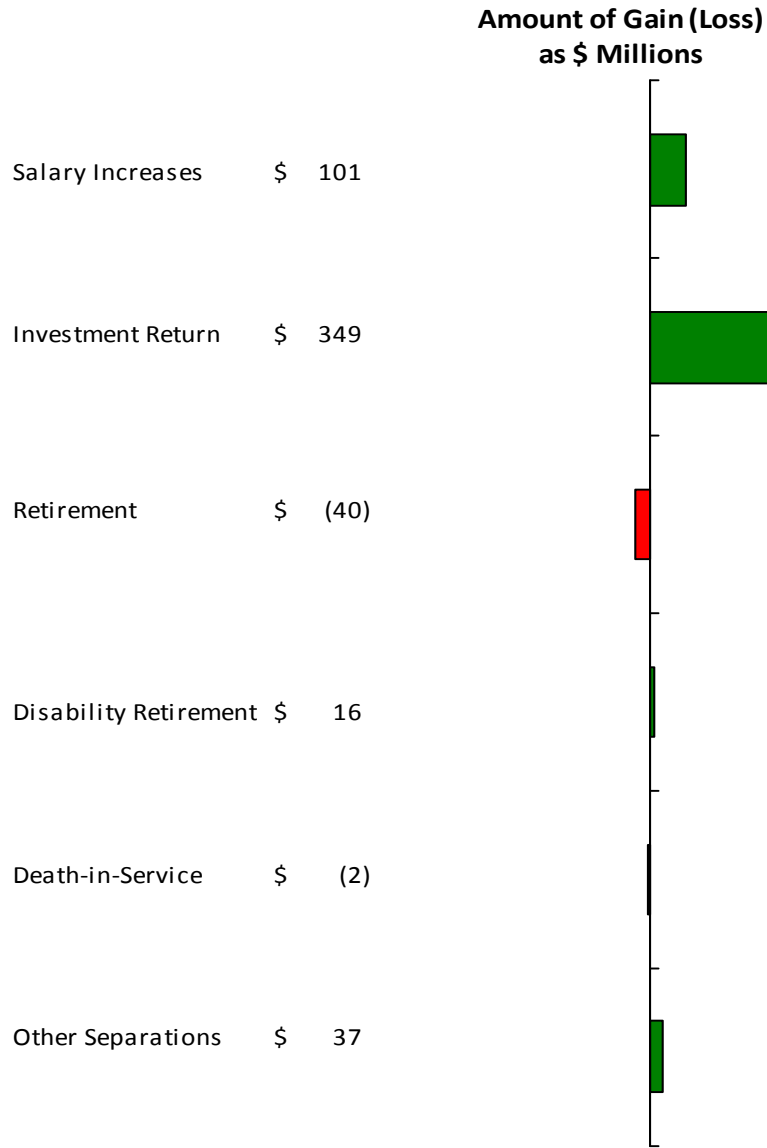
On a market recognition account basis net of fee **investment return** was 8.2% and investment activity produced a gain for all groups due to the combined effect of this year's gain and the continued recognition of prior gains and losses. The total recognized investment gain of \$862 million was partially offset by a \$513 million increase in the combined value of variable excess benefits and money purchase benefits (as shown on page D-7), resulting in a net recognized investment gain of about \$349 million.

**Pay Increases** were overall less than expected, producing a gain.

## Gain (Loss) Detail (\$ Millions)

Type of Activity	General	Executive & Elected	Protective		Total	Prior Year
			With S.S.	Without S.S.		
<b>Decrement Risk Areas</b>						
Normal Retirement	\$ (7.7)	\$ (1.1)	\$ (16.6)	\$ (1.6)	\$ (27.0)	\$ (33.1)
Early Retirement	(11.3)	(1.4)	(1.0)	0.3	(13.4)	(18.5)
Disability Retirement	14.3	0.1	0.8	0.7	15.9	17.2
Death with Benefit	(2.5)	0.0	0.2	(0.1)	(2.4)	(0.2)
Other Separations	36.6	0.3	1.1	(0.6)	37.4	20.0
<b>Economic Risk Areas</b>						
Salary Increases	114.0	(14.7)	3.9	(2.2)	101.0	298.2
Investment Return	287.8	0.1	48.6	12.5	349.0	138.1
<b>Other Activity</b>	(91.8)	(8.2)	(10.3)	(12.1)	(122.4)	(19.6)
<b>Total Gain (Loss)</b>	<b>\$ 339.4</b>	<b>\$ (24.9)</b>	<b>\$ 26.7</b>	<b>\$ (3.1)</b>	<b>\$ 338.1</b>	<b>\$ 402.1</b>
<b>-% of Accrued Liability</b>	<b>0.9%</b>	<b>(12.2)%</b>	<b>0.6%</b>	<b>(0.3)%</b>	<b>0.8%</b>	<b>1.0%</b>

# Gain/Loss Analysis 2017 Experience Divisions Combined



## Gain (Loss) from Investment Income During Calendar Year (\$ Millions)

	General	Executive & Elected	Protective		Total
			With SS	Without SS	
(1) Beginning of Year Active Participant Assets					
(a) Participant Accumulation Reserve	\$15,534.8	\$ 46.2	\$1,334.9	\$261.9	\$17,177.8
(b) PAR Closing Adjustment	0.5	0.0	0.0	0.0	0.5
(c) Employer Accumulation Reserve	18,699.2	174.5	2,729.9	689.2	22,292.8
(d) EAR Closing Adjustment	0.7	(0.1)	(0.3)	(0.1)	0.2
(e) Total	34,235.2	220.6	4,064.5	951.0	39,471.3
(2) End of Year Active Participant Assets					
(a) Participant Accumulation Reserve	16,552.1	37.5	1,384.8	263.0	18,237.4
(b) Employer Accumulation Reserve	19,395.7	165.9	2,858.7	722.4	23,142.7
(c) Total	35,947.8	203.4	4,243.5	985.4	41,380.1
(3) Investment Earnings Credited					
(a) Participant Accumulation Reserve	1,420.7	3.2	126.5	25.1	1,575.5
(b) Employer Accumulation Reserve	1,740.3	14.5	249.4	62.2	2,066.4
(c) Total	3,161.0	17.7	375.9	87.3	3,641.9
(4) Average Balance: $.5 \times \{(1e)+(2c)-(3c)\}$	33,511.0	203.2	3,966.1	924.6	38,604.9
(5) Expected Earnings: $.072 \times (4)$	2,412.8	14.6	285.6	66.6	2,779.6
(6) Gain (Loss) for Year from Investment Experience: $(3c)-(5)$	748.2	3.1	90.3	20.7	862.3
(7) Portion applied to Change in Variable Excess Reserve and Money Purchase Minimum Benefit	460.4	3.0	41.8	8.3	513.4
<b>(8) Remaining Gain (Loss): (6)-(7)</b>	<b>\$ 287.8</b>	<b>\$ 0.1</b>	<b>\$ 48.6</b>	<b>\$ 12.5</b>	<b>\$ 349.0</b>

## Analysis of “Other” Activity (\$ Millions)

“Other” activity refers to gain or loss activity that is not directly related to the main actuarial assumptions. Other activity this year resulted in a loss of \$122.4 million as shown on page D-5. The schedule below analyzes this activity. The **Reserve Difference** produced a loss of about \$76 million. There are two identifiable sources for this loss. The first relates to cases where the service credit or final average salary at retirement differed from what was expected based upon the prior valuation. The second relates to final computations of annuities that were originally based on estimates. The **Re-established Liability** represents the liability for new or rehired active members who were not active in the prior year. Typically, it is expected that a new hire will have very little liability. However, often new members appear with more than one year of service or with liability greater than contributions made on their behalf. Although this amount is difficult to determine accurately due to the timing of contribution amounts, we estimate the Re-established Liability loss at about \$78 million.

	General	Executive & Elected	Protective		Total
			With S.S.	Without S.S.	
Expected Reserve Transfers					
Normal Retirement	\$1,620	\$31	\$ 306	\$76	\$2,033
Early Retirement	958	6	55	5	1,024
Death	15	0	1	0	16
Disability Retirement	30	0	3	0	33
Deferred Retirement	312	5	27	8	352
Expected Total Reserve Transfers	2,935	42	392	89	3,458
Actual Reserve Transfer (From Retiree Report)	2,993	49	396	96	3,534
<b>Reserve Difference</b>	(58)	(7)	(4)	(7)	(76)
Expected Refunds	65	0	3	0	68
Actual Refunds	35	0	3	1	39
<b>Refund Difference</b>	30	0	0	(1)	29
<b>Re-established Liability</b>	(71)	0	(6)	(1)	(78)
Total Explained Difference	(99)	(7)	(10)	(9)	(125)
Unknown Difference	7	(1)	0	(3)	3
Total Other Activity	(92)	(8)	(10)	(12)	(122)
Other Activity as % of Liabilities	(0.26)%	(3.93)%	(0.24)%	(1.22)%	(0.29)%

## Comparative Schedule of Experience 5-Year History of Gains and Losses (\$ Millions)

Year	Retmt.	Disability Retmt.	Other Separations*	Salary Increases	Investment Return	Other	Total
<b>GENERAL</b>							
2013	\$ (32.2)	\$ 16.8	\$ 27.2	\$ 250.8	\$ 624.2	\$ (125.0)	\$ 761.8
2014	(25.5)	18.1	24.5	14.5	269.0	(111.0)	189.6
2015	(33.3)	13.5	20.8	74.5	(163.0)	(11.8)	(99.3)
2016	(32.6)	15.3	18.2	268.1	112.8	(40.9)	340.9
2017	<b>(19.0)</b>	<b>14.3</b>	<b>34.1</b>	<b>114.0</b>	<b>287.8</b>	<b>(91.8)</b>	<b>339.4</b>
<b>EXECUTIVE &amp; ELECTED</b>							
2013	\$ (1.1)	\$ 0.1	\$ -	\$ 1.6	\$ 2.1	\$ (1.4)	\$ 1.3
2014	1.8	0.1	(0.7)	(0.7)	2.1	(6.4)	(3.8)
2015	2.2	0.1	(1.2)	2.8	(0.7)	(4.4)	(1.2)
2016	(0.5)	0.1	(1.2)	14.0	0.7	1.5	14.6
2017	<b>(2.5)</b>	<b>0.1</b>	<b>0.3</b>	<b>(14.7)</b>	<b>0.1</b>	<b>(8.2)</b>	<b>(24.9)</b>
<b>PROTECTIVE WITH SOCIAL SECURITY</b>							
2013	\$ (8.6)	\$ 1.6	\$ 1.0	\$ 52.2	\$ 106.1	\$ (7.5)	\$ 144.8
2014	(6.1)	1.5	0.3	13.0	42.6	(14.9)	36.4
2015	(15.9)	0.6	1.4	(11.1)	(30.3)	3.3	(52.0)
2016	(17.4)	1.2	4.0	8.5	19.0	17.8	33.1
2017	<b>(17.6)</b>	<b>0.8</b>	<b>1.3</b>	<b>3.9</b>	<b>48.6</b>	<b>(10.3)</b>	<b>26.7</b>
<b>PROTECTIVE WITHOUT SOCIAL SECURITY</b>							
2013	\$ (2.6)	\$ 0.6	\$ (1.7)	\$ 3.6	\$ 31.5	\$ (3.7)	\$ 27.7
2014	(0.3)	0.6	(0.7)	(3.3)	11.8	(7.4)	0.7
2015	(1.8)	0.2	(1.4)	(5.5)	(7.8)	(6.1)	(22.4)
2016	(1.1)	0.6	(1.2)	7.6	5.6	2.0	13.5
2017	<b>(1.3)</b>	<b>0.7</b>	<b>(0.7)</b>	<b>(2.2)</b>	<b>12.5</b>	<b>(12.1)</b>	<b>(3.1)</b>

\* Includes separation due to death.



## **SECTION E**

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### **CENSUS DATA**

## Total Participants Included in Valuations December 31, 2017

Valuation Group	Number	Average Annual Earnings/Benefits*
Actives	256,383	\$53,515
Inactives	165,051	\$15,774
Retirees & Beneficiaries	203,202	\$25,181
<b>Total Participants</b>	<b>624,636</b>	

*\* For inactives, average money purchase balance.*

## Active Participants Included in Valuations December 31, 2017

**Active participants** included in the valuations totaled 256,383 with an annual payroll totaling \$13,720.5 million, as follows:

Valuation Group	Number	Annual Earnings (\$Millions)	Group Averages			
			Earnings	Age	Years of Service	Contribs.
General	232,874	\$12,167.4	\$52,249	45.5	11.3	\$57,538
Executive Group & Elected Officials	1,335	107.3	80,366	55.1	13.5	103,845
Protective Occupation with Social Security	19,431	1,227.0	63,145	40.2	12.5	67,493
Protective Occupation without Social Security	2,743	218.8	79,753	41.0	14.1	83,856
<b>Total Active Participants</b>	<b>256,383</b>	<b>\$13,720.5</b>	<b>\$53,515</b>	<b>45.1</b>	<b>11.5</b>	<b>\$58,815</b>
Prior Year	256,208	\$13,486.0	\$52,637	45.2	11.5	\$56,427

Group averages are not used in the valuation, but are shown here for their general interest.

## Inactive Participants Included in Valuations December 31, 2017

**Inactive participants** included in the valuations totaled 165,051 as follows:

Valuation Group	Number	Group Averages		
		Age	Service	Money Purchase Balance
General	157,757	47.5	3.3	\$15,527
Executive Group & Elected Officials	606	54.9	4.4	30,298
Protective Occupation with Social Security	6,467	41.7	4.3	19,749
Protective Occupation without Social Security	221	43.1	6.5	35,954
<b>Total Inactive Participants</b>	<b>165,051</b>	<b>47.3</b>	<b>3.3</b>	<b>\$15,774</b>
Prior Year	160,897	47.4	3.2	\$14,865

The valuations also included 4,017 Qualified Domestic Relations Order cases whose average age was 52.5 years. These accounts for divorced spouses of WRS participants have been established in accordance with Wisconsin Domestic Relations Law.

## General Participants as of December 31, 2017 by Attained Age and Years of Service

Attained Ages	Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	No.	Valuation Payroll
15-19	95							95	\$ 2,069,694
20-24	5,238	5						5,243	168,527,924
25-29	17,624	1,835	8					19,467	794,695,238
30-34	13,271	9,849	1,520	9				24,649	1,140,537,526
35-39	10,788	7,268	8,572	1,641	12			28,281	1,458,207,088
40-44	8,375	5,264	5,639	8,312	1,022	2		28,614	1,589,244,339
45-49	7,578	5,245	4,820	6,502	6,562	1,140	15	31,862	1,821,535,560
50-54	6,404	4,933	4,763	5,709	5,197	5,991	1,045	34,042	1,936,266,361
55	1,131	985	952	1,161	932	1,059	771	6,991	390,888,759
56	1,150	900	1,014	1,080	917	940	817	6,818	375,986,505
57	1,102	903	961	1,125	873	909	940	6,813	371,643,843
58	989	785	933	1,065	796	783	816	6,167	335,928,035
59	858	766	914	1,062	752	760	784	5,896	322,020,941
60	856	669	781	971	686	635	695	5,293	281,570,023
61	732	674	656	849	631	600	664	4,806	253,701,789
62	665	522	572	724	548	443	578	4,052	213,366,201
63	485	434	480	638	476	347	458	3,318	176,820,056
64	431	408	360	489	383	289	412	2,772	147,092,790
65	318	259	297	366	269	254	297	2,060	109,520,494
66	261	216	210	260	170	130	207	1,454	78,036,496
67	220	159	119	164	96	87	145	990	51,320,348
68	179	110	122	105	66	72	103	757	38,662,222
69	142	81	57	85	45	40	76	526	25,959,817
70	139	69	44	53	37	44	55	441	21,833,094
71	107	39	61	51	30	30	50	368	17,714,260
72	68	37	19	28	19	12	41	224	10,972,067
73	64	37	16	16	11	19	33	196	7,930,232
74	57	26	20	17	8	5	21	154	5,841,767
75 & Up	194	112	54	34	33	25	73	525	19,501,911
<b>Totals</b>	<b>79,521</b>	<b>42,590</b>	<b>33,964</b>	<b>32,516</b>	<b>20,571</b>	<b>14,616</b>	<b>9,096</b>	<b>232,874</b>	<b>\$12,167,395,380</b>

**Executive Group and Elected Officials  
as of December 31, 2017  
by Attained Age and Years of Service**

Attained Ages	Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	No.	Valuation Payroll
15-19									
20-24	1							1	10,909
25-29	11	1						12	908,987
30-34	30	19	2					51	3,239,642
35-39	20	20	12	2				54	4,109,430
40-44	29	24	19	25	4			101	7,672,677
45-49	43	32	24	26	26	7		158	13,075,803
50-54	55	47	31	36	20	31	7	227	18,529,804
55	10	7	6	5	5	8	2	43	3,988,560
56	12	12	3	6	6	7	3	49	4,045,496
57	9	13	4	6	7	8	11	58	4,787,710
58	15	4	6	8	5	8	13	59	5,478,231
59	13	8	5	3	10	5	15	59	5,271,990
60	13	6	8	9	6	5	8	55	4,859,676
61	12	2	4	4		5	9	36	2,700,480
62	9	5	3	4	5	6	9	41	4,557,590
63	5	10	2		4	6	6	33	2,373,070
64	13	7	7	4	6	6	9	52	4,288,445
65	4	6	3	5	2	4	3	27	2,279,837
66	12	8	3	7	2	3	7	42	3,316,088
67	7	4	3	1	4	1	9	29	2,286,902
68	1	8	1	3	2	3	3	21	1,855,082
69	11	3	1	4			3	22	1,613,623
70	6	4	3	2	1	1	3	20	1,624,618
71	2	3	3	2	2	1	3	16	1,293,120
72	6	1				1	1	9	407,075
73	4	3		1	1			9	735,907
74	2	1		1		3	1	8	448,044
75 & Up	18	14	3	3	1	2	2	43	1,529,862
<b>Totals</b>	<b>373</b>	<b>272</b>	<b>156</b>	<b>167</b>	<b>119</b>	<b>121</b>	<b>127</b>	<b>1,335</b>	<b>\$107,288,658</b>

## Protective Occupation Participants with Social Security as of December 31, 2017 by Attained Age and Years of Service

Attained Ages	Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	No.	Valuation Payroll
15-19	10							10	\$ 339,878
20-24	892	5						897	38,213,078
25-29	2,187	400	6					2,593	135,032,954
30-34	1,064	1,282	543	3				2,892	172,578,533
35-39	521	585	1,258	595	4			2,963	186,954,326
40-44	276	278	559	1,402	382	2		2,899	193,590,721
45-49	204	187	337	874	1,404	346		3,352	233,895,546
50	26	27	44	99	184	195	8	583	42,621,009
51	37	26	37	85	136	206	13	540	40,140,512
52	23	22	46	92	111	174	25	493	35,284,377
53	13	20	39	73	78	132	36	391	29,017,049
54	19	23	27	55	70	82	35	311	21,425,138
55	26	20	30	51	53	59	44	283	19,786,914
56	15	24	35	43	46	41	28	232	15,486,279
57	15	13	24	49	31	35	33	200	13,426,423
58	10	7	17	36	28	30	28	156	10,615,047
59	6	10	22	34	23	15	28	138	9,529,845
60	7	9	20	32	10	14	16	108	6,747,062
61	12	7	16	27	6	14	18	100	6,015,321
62	10	6	18	20	15	6	16	91	5,416,577
63	9	9	10	10	7	10	16	71	4,481,594
64	5	4	9	5	6	5	8	42	2,439,212
65	3	4	2	10	3	3	6	31	1,708,145
66	2	1		7	1	3	4	18	1,016,640
67		4	3	1	1	1	1	11	434,016
68	2		1					3	103,400
69	3	1				2	1	7	276,387
70 & Up	10	1	3		2			16	402,863
<b>Totals</b>	<b>5,407</b>	<b>2,975</b>	<b>3,106</b>	<b>3,603</b>	<b>2,601</b>	<b>1,375</b>	<b>364</b>	<b>19,431</b>	<b>\$1,226,978,846</b>

**Protective Occupation Participants without Social Security  
as of December 31, 2017  
by Attained Age and Years of Service**

Attained Ages	Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	No.	Valuation Payroll
20-24	65							65	\$ 3,215,088
25-29	217	66						283	18,274,822
30-34	121	227	73					421	30,513,830
35-39	69	132	189	61				451	34,305,797
40-44	19	50	85	220	60			434	35,554,045
45-49	9	16	54	167	203	63		512	44,339,643
50		3	4	17	33	21	1	79	7,066,799
51	1	3	3	26	20	32	2	87	7,884,548
52	1	1	5	16	35	32	4	94	8,601,816
53			2	11	25	29	8	75	6,664,995
54		1	2	4	22	28	10	67	6,042,407
55	1	2	1	5	7	16	6	38	3,621,491
56		1	2	6	11	12	9	41	3,832,297
57			2	2	5	11	8	28	2,688,447
58	2	1		4	10	5	2	24	2,021,556
59	1		3	1	3	8	1	17	1,557,524
60			1		2	2	2	7	642,742
61		2			1	3	2	8	778,047
62						2		2	228,168
63					1	1	2	4	362,723
64			2		1		1	4	384,789
65	1							1	79,921
67							1	1	100,368
<b>Totals</b>	<b>507</b>	<b>505</b>	<b>428</b>	<b>540</b>	<b>439</b>	<b>265</b>	<b>59</b>	<b>2,743</b>	<b>\$218,761,863</b>



## Active Participants as of December 31, 2017 by Years of Service and Gender

Completed Years of Service	Males	Females	Totals	Valuation Payroll	
				Total	Average
0	6,865	14,696	21,561	\$ 653,051,881	\$30,289
1	6,925	12,730	19,655	772,795,767	39,318
2	5,813	10,357	16,170	686,637,178	42,464
3	5,410	9,581	14,991	667,655,727	44,537
4	4,920	8,511	13,431	629,856,853	46,896
5	4,515	7,275	11,790	567,306,421	48,118
6	3,716	6,405	10,121	500,403,080	49,442
7	2,993	5,333	8,326	420,013,300	50,446
8	2,566	4,957	7,523	387,639,331	51,527
9	3,103	5,479	8,582	460,212,914	53,625
10	3,186	5,398	8,584	474,615,253	55,291
11	2,845	5,063	7,908	442,581,201	55,966
12	2,590	4,800	7,390	419,268,506	56,735
13	2,561	4,539	7,100	414,683,511	58,406
14	2,395	4,277	6,672	392,750,775	58,866
15 & Up	36,249	50,330	86,579	5,830,953,052	67,348
<b>Totals</b>	<b>96,652</b>	<b>159,731</b>	<b>256,383</b>	<b>\$13,720,424,750</b>	<b>\$53,515</b>

Average			
Age	45.2	45.0	45.1
Service	12.2	11.0	11.5

## Comparative Statement of Active Participants in Valuations

Valuation 12/31	General				Executive and Elected			
	No.	Earnings			No.	Earnings		
		\$ Millions	Average	% Incr.		\$ Millions	Average	% Incr.
1993	210,627	\$ 6,084	\$ 28,886	4.5%	1,452	\$ 60	\$41,476	4.7 %
1994	214,280	6,342	29,595	2.5%	1,450	63	43,528	4.9 %
1995	216,434	6,597	30,479	3.0%	1,475	67	45,135	3.7 %
1996	219,265	6,832	31,160	2.2%	1,459	67	45,967	1.8 %
1997	222,888	7,128	31,980	2.6%	1,455	71	48,881	6.3 %
1998	227,017	7,457	32,847	2.7%	1,450	73	50,664	3.6 %
1999*	229,657	7,704	34,445	4.9%	1,468	77	53,263	5.1 %
2000	234,076	8,335	35,610	3.4%	1,486	83	55,582	4.4 %
2001	238,944	8,746	36,605	2.8%	1,486	85	57,060	2.7 %
2002	240,990	9,007	37,377	2.1%	1,476	87	58,865	3.2 %
2003	239,696	9,273	38,686	3.5%	1,468	86	58,336	(0.9)%
2004	238,943	9,501	39,764	2.8%	1,469	89	60,379	3.5 %
2005	237,501	9,661	40,678	2.3%	1,452	90	61,788	2.3 %
2006	236,877	9,933	41,935	3.1%	1,436	93	64,480	4.4 %
2007	237,124	10,278	43,344	3.4%	1,427	95	66,320	2.9 %
2008**	238,994	10,806	45,216	4.3%	1,430	101	70,316	6.0 %
2009	240,401	11,098	46,165	2.1%	1,427	101	70,786	0.7 %
2010	239,959	11,195	46,655	1.1%	1,418	101	71,394	0.9 %
2011	232,518	10,947	47,080	0.9%	1,393	99	70,802	(0.8)%
2012	231,765	11,041	47,639	1.2%	1,408	104	73,968	4.5 %
2013	231,973	11,270	48,584	2.0%	1,397	106	76,125	2.9 %
2014	232,433	11,574	49,794	2.5%	1,401	109	77,998	2.5 %
2015	231,631	11,786	50,881	2.2%	1,380	108	78,230	0.3 %
2016	232,684	11,964	51,417	1.1%	1,347	106	78,667	0.6 %
2017	232,874	12,167	52,249	1.6%	1,335	107	80,366	2.2 %

\* After change in method of calculating average pay.

\*\* Some groups had a 27 period payroll during 2008.

## Comparative Statement of Active Participants in Valuations

Valuation 12/31	Protective with Social Security				Protective without Social Security			
	No.	Earnings			No.	Earnings		
		\$ Millions	Average	% Incr.		\$ Millions	Average	% Incr.
1993	12,388	\$ 408	\$ 32,928	2.7%	2,611	\$103	\$39,371	3.6 %
1994	12,825	436	34,005	3.3%	2,612	106	40,633	3.2 %
1995	13,434	467	34,747	2.2%	2,630	112	42,478	4.5 %
1996	13,820	495	35,807	3.1%	2,625	116	44,063	3.7 %
1997	14,232	536	37,625	5.1%	2,654	121	45,568	3.4 %
1998	14,810	570	38,509	2.3%	2,658	127	47,733	4.8 %
1999*	16,483	649	39,864	3.5%	2,691	131	48,947	2.5 %
2000*	16,970	717	42,263	6.0%	2,685	135	50,423	3.0 %
2001	17,981	772	42,914	1.5%	2,715	142	52,339	3.8 %
2002	18,325	804	43,871	2.2%	2,709	148	54,603	4.3 %
2003	18,660	856	45,891	4.6%	2,714	154	56,673	3.8 %
2004	18,964	896	47,266	3.0%	2,709	159	58,546	3.3 %
2005	19,036	920	48,330	2.3%	2,689	162	60,241	2.9 %
2006	19,297	977	50,622	4.7%	2,692	167	62,153	3.2 %
2007	19,757	1,036	52,419	3.5%	2,695	174	64,449	3.7 %
2008**	20,038	1,099	54,859	4.7%	2,724	181	66,502	3.2 %
2009	20,205	1,124	55,636	1.4%	2,733	189	69,149	4.0 %
2010	20,019	1,125	56,184	1.0%	2,754	189	68,559	(0.9)%
2011	19,610	1,119	57,065	1.6%	2,711	189	69,898	2.0 %
2012	19,353	1,105	57,104	0.1%	2,727	193	70,949	1.5 %
2013	19,290	1,121	58,127	1.8%	2,736	197	71,960	1.4 %
2014	19,533	1,151	58,916	1.4%	2,733	204	74,487	3.5 %
2015	19,273	1,171	60,755	3.1%	2,730	209	76,376	2.5 %
2016	19,431	1,203	61,924	1.9%	2,746	213	77,553	1.5 %
2017	19,431	1,227	63,145	2.0%	2,743	219	79,753	2.8 %

\* After change in method of calculating average pay.

\*\* Some groups had a 27 period payroll during 2008.

## Core Annuities Being Paid Tabulated by Attained Ages

Attained Ages	Regular		Disability		Death-in-Service		Totals	
	No.	Annual Amount	No.	Annual Amount	No.	Annual Amount	No.	Annual Amount
Under 20	0	\$ 0	2	\$ 24,023	3	\$ 68,966	5	\$ 92,989
20-24	0	0	5	87,146	14	76,396	19	163,542
25-29	0	0	10	120,345	18	106,102	28	226,447
30-34	1	4,420	14	118,499	19	164,001	34	286,920
35-39	1	8,170	26	206,421	39	258,696	66	473,287
40-44	8	132,679	19	186,330	22	174,688	49	493,697
45-49	51	2,342,036	58	1,877,809	44	392,527	153	4,612,372
50-54	1,285	68,064,194	280	9,954,196	67	958,381	1,632	78,976,771
55-59	12,193	463,306,920	610	18,633,391	133	2,159,708	12,936	484,100,019
60-64	30,807	874,717,444	1,102	27,593,036	201	3,758,316	32,110	906,068,796
65-69	48,560	1,188,021,607	1,234	27,735,745	221	4,039,521	50,015	1,219,796,873
70-74	40,134	813,428,389	1,005	19,317,412	177	2,682,211	41,316	835,428,012
75-79	26,027	500,045,130	739	13,235,970	116	1,761,771	26,882	515,042,871
80-84	17,550	344,247,667	544	8,798,164	96	1,047,917	18,190	354,093,748
85-89	11,340	216,713,943	293	4,029,662	74	834,337	11,707	221,577,942
90-94	5,052	82,063,647	123	1,517,361	48	564,732	5,223	84,145,740
95& Up	1,589	19,182,601	27	272,952	19	90,713	1,635	19,546,266
Certain Only*	1,164	21,351,865	0	0	38	487,387	1,202	21,839,252
<b>Totals</b>	<b>195,762</b>	<b>\$4,593,630,712</b>	<b>6,091</b>	<b>\$133,708,462</b>	<b>1,349</b>	<b>\$19,626,370</b>	<b>203,202</b>	<b>\$4,746,965,544</b>

### Averages in Years

Age at retirement	59.7	52.0	51.7	59.5
Attained age	70.6	68.3	67.7	70.6

\* Certain only category consists of continuations of 5, 10, and 15 year certain and life annuities to beneficiaries of deceased annuitants.

## Variable Annuities Being Paid Tabulated by Attained Ages

Attained Ages	Regular		Disability		Death-in-Service		Totals	
	No.	Annual Amount	No.	Annual Amount	No.	Annual Amount	No.	Annual Amount
20-24	0	\$ 0	2	\$ 5,419	5	\$ 2,750	7	\$ 8,169
25-29	0	0	3	1,586	3	3,215	6	4,801
30-34	0	0	8	3,181	4	1,764	12	4,945
35-39	1	256	12	27,237	9	9,326	22	36,819
40-44	4	32,974	7	9,189	7	18,577	18	60,740
45-49	11	178,571	21	81,573	16	53,319	48	313,463
50-54	313	2,499,162	86	273,471	15	36,844	414	2,809,477
55-59	2,593	17,038,582	152	460,397	38	160,954	2,783	17,659,933
60-64	6,137	33,154,083	233	720,170	44	209,801	6,414	34,084,054
65-69	9,381	69,318,408	209	1,113,113	54	257,335	9,644	70,688,856
70-74	8,233	78,051,297	187	1,373,730	46	335,649	8,466	79,760,676
75-79	4,712	61,315,266	136	1,163,899	30	238,153	4,878	62,717,318
80-84	3,406	48,116,733	102	710,725	24	219,868	3,532	49,047,326
85-89	2,546	32,955,771	58	297,077	19	124,905	2,623	33,377,753
90-94	1,247	13,846,211	25	115,580	20	119,348	1,292	14,081,139
95 & Up	448	3,543,516	7	17,762	8	53,997	463	3,615,275
Certain Only*	251	1,572,251	0	7	4	67,007	255	1,639,265
<b>Totals</b>	<b>39,283</b>	<b>\$361,623,081</b>	<b>1,248</b>	<b>\$6,374,116</b>	<b>346</b>	<b>\$1,912,812</b>	<b>40,877</b>	<b>\$369,910,009</b>

Averages in Years

Age at retirement	59.2	52.6	51.3	59.0
Attained age	70.5	66.7	67.7	70.4

\* Certain only category consists of continuations of 5, 10, and 15 year certain and life annuities to beneficiaries of deceased annuitants.

## **SECTION F**

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### **METHODS AND ASSUMPTIONS**

## Summary of Actuarial Assumptions and Methods

Valuation Date	December 31, 2017
Actuarial Cost Method	Frozen Entry Age
Amortization Method	Level Percent -- Closed Period
Amortization Period	30-Year closed from date of participation in WRS
Asset Valuation Method	5-Year Smoothed Market (Closed)
Actuarial Assumptions	
Net Investment Rate of Return	5.5%
Weighted based on assumed rate for:	
Retired participants	5.0%
Post-retirement active participants	5.0%
Pre-retirement active participants	7.2%
Projected Salary Increases*	3.3% to 8.8%
Payroll Growth Rate	3.2%
Population Growth Rate	0.0%

\* Includes merit and seniority increases that vary by service plus wage inflation of 3.2%/year.

# Financial Principles and Operational Techniques of the Wisconsin Retirement System

**Benefit Promises Made Which Must Be Paid For.** A retirement program is an orderly means of handing out, keeping track of, and financing contingent retirement promises. As each participant of the Retirement System acquires a unit of service credit he is, in effect, handed an "IOU" which reads: "The Wisconsin Retirement System promises to pay you one unit of annuity benefits, payments in cash commencing when you retire."

The principal related financial question is: ***When shall the money required to cover the "IOU" be contributed?*** This year, when the benefit of the participant's unit of service is received? Or, some future year, when the "IOU" becomes a cash demand?

***The law governing the Wisconsin Retirement System financing intends that the money to cover an "IOU" is contributed in the year the "IOU" is handed out.*** In this way contribution rates expressed as percents of participant payroll can be determined so as to remain approximately level from year to year and decade to decade as long as the basic experience and make-up of the group of participants does not change significantly. This means that for equivalent benefits each generation of Wisconsin taxpayers will contribute at approximately the same payroll rates.

Translated into actuarial terminology, the level percent-of-payroll contribution objective means that the contribution rate must total at least:

**Normal Cost** (the current discounted value of benefits likely to be paid on account of participants' service rendered in the current year)

... plus ...

**Interest on Unfunded Actuarial Accrued Liabilities** (unfunded actuarial accrued liabilities are the difference between (i) the present value of future benefits and (ii) the present value of future normal costs, and reduced by the assets on hand at the valuation date).



If contributions to the system are less than the preceding amount, the difference, **plus investment earnings not realized thereon**, will have to be contributed at some later time, or benefits will have to be reduced, to satisfy the fundamental equation under which all retirement programs must operate; that is:

$$B = C + I - E$$

Benefit payments to any group of participants and their beneficiaries cannot exceed

Contributions received on behalf of the group  
... plus ...  
Ivestment earnings on those contributions  
... minus ...  
Expenses incurred in operating the program.

There are retirement programs (Social Security is an example) designed to defer the bulk of contributions far into the future. The present contribution rate for such systems is artificially low, but is destined to increase relentlessly to a level which may be greatly in excess of the level percent-of-payroll rate.

A by-product of a level percent-of-payroll contribution objective is the accumulation of invested assets for varying periods of time. Investment income becomes the third and largest contributor to the retirement system and the amount is directly related to the amount of contributions and investment performance.

**Computing Contribution Rates to Finance Benefits.** From a given schedule of benefits and from the data furnished, the actuary calculates the contribution rates **by means of an actuarial valuation** – the technique of assigning monetary values to the risks assumed in operating a retirement program.

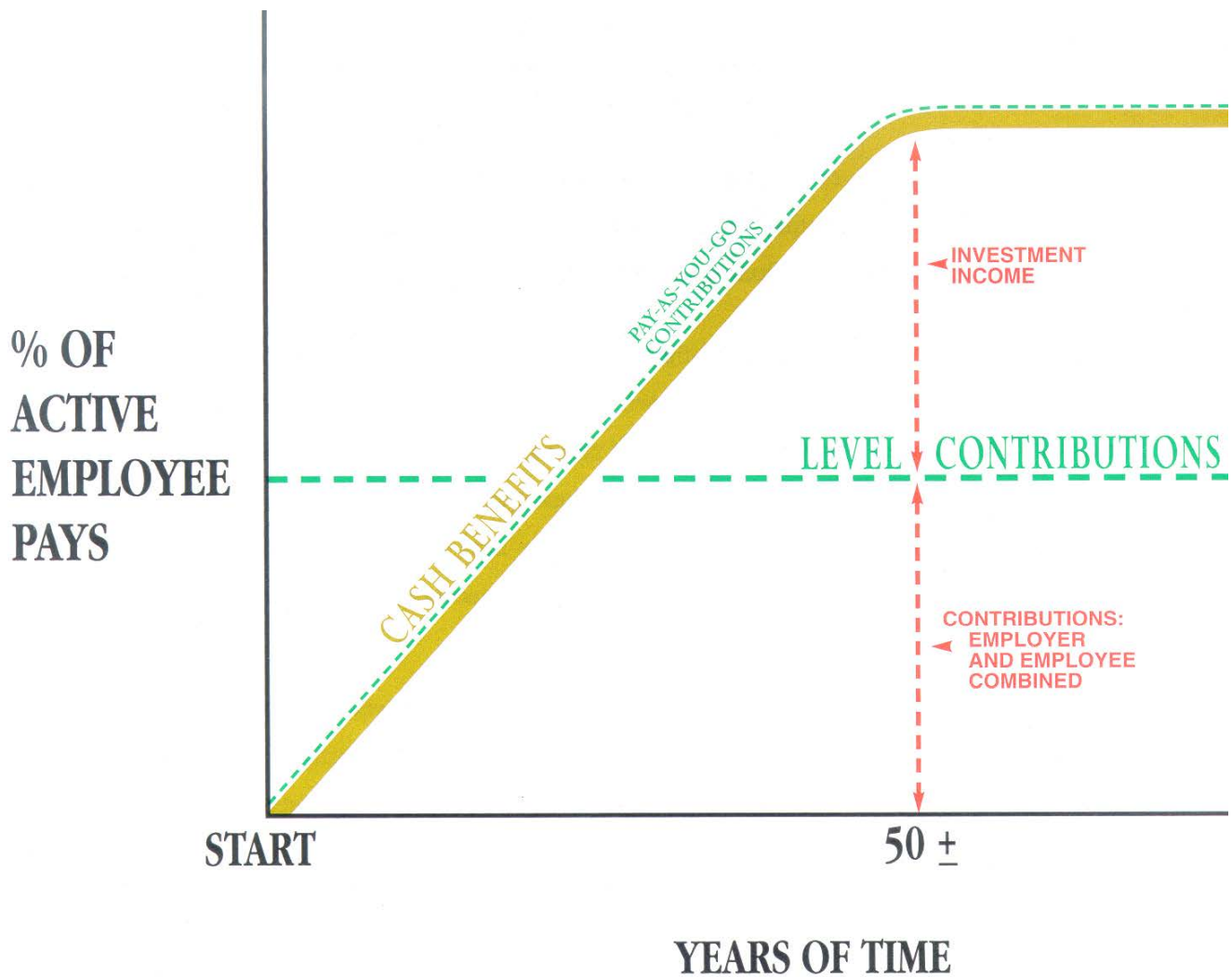
# Actuarial Method and Assumptions Used in Valuations

The principal actuarial assumptions relate to:

- long-term **rates of investment income** likely to be generated by system assets
- **rates of mortality** among participants, retirants and beneficiaries
- **rates of withdrawal** of active participants
- **rates of disability** among participants
- **patterns of salary increases** to be experienced by participants
- the age and service **distribution of actual retirements**

In an actuarial valuation, the actuary projects the monetary effect of each assumption for each distinct experience group, for the next year and for each year over the next half-century or longer.

Once actual risk experience has occurred and been observed, it will not coincide exactly with assumed risk experience, regardless of the skill of the actuary, the completeness of the data, and the precision of the calculations. Each valuation provides a complete recalculation of assumed future risk experience and takes into account all past differences between assumed and actual risk experience. The result is a continual series of small adjustments to the computed contribution rate. From time to time it becomes necessary to adjust the package of risk measurements to reflect basic experience trends – but not random year-to-year fluctuations.



**CASH BENEFITS LINE.** This relentlessly increasing line is the fundamental reality of retirement plan financing. It happens each time a new benefit is added for future retirements (and happens regardless of the design for contributing for benefits).

**LEVEL CONTRIBUTION LINE.** Determining the level contribution line requires detailed assumptions concerning a variety of experiences in future decades, including:

Economic Risk Areas

- Rates of investment return
- Rates of pay increase
- Changes in active member group size

Non-Economic Risk Areas

- Ages at actual retirement
- Rates of mortality
- Rates of withdrawal of active members (turnover)
- Rates of disability

## Actuarial Valuation Method

The actuarial funding method prescribed in the statute for WRS is the Frozen Entry Age Method which is also referred to as the Frozen Initial Liability (FIL) method in this report. Under this method, the amount of remaining unfunded actuarial accrued liabilities at any valuation date is affected only by the monthly amortization payments, compound interest, the added liability created by new employer units, and any added liabilities caused by changes in benefit provisions.

Actuarial gains or losses arising from the difference between actual and assumed experience are reflected in the determination of the normal cost. In this manner, experience gains or losses in any year are amortized (spread) over the average future working lifetime of the active participant group - a period of approximately 12 years. Hence, the computed normal cost is made up of two parts:

- The pure entry-age normal cost (EANC) determined without regard to past gains or losses, and
- An experience amortization component.

Section 40.04(1) of the Wisconsin Statutes provides authority to maintain accounts and reserves determined to be “useful in achieving the funds’ purposes - -”. A fundamental WRS objective is stable contribution rates. Accordingly, based on the authority granted under Section 40.04, the experience portion of the normal cost is separately calculated each year and the amortization period is varied upward or downward in order to minimize short-term rate fluctuations. The policy regarding the EAR amortization period is described below:

- The standard period is set 20 years.
- The standard period is reconsidered as part of each triennial experience study (no changes were made with the most recent experience study).
- Temporary interim changes in the period are made only when there are large, but mostly offsetting market gains and losses known to be flowing through the MRA that would otherwise result in contribution rate volatility. Large changes would be defined as those which, over a 2-year period, were expected to result in contribution rate changes of at least 0.4% of payroll.
- The minimum and maximum EAR amortization periods are 10 years and 30 years respectively.
- The amortization policy will be applied in the same manner to market gains and losses flowing through the MRA.
- For 2017, a 20-year period was used.

## Asset Valuation Method

An essential step in the valuation process is comparing valuation assets with computed liabilities. Computed liabilities result from actuarial calculations involving the covered population, the benefits, and actuarial assumptions. Valuation assets are those assets that are recognized and available to fund the System's liabilities. WRS assets are invested in the Core Investment Trust, and in the Variable Investment Trust, both of which are managed by the State of Wisconsin Investment Board (SWIB). Assets in the Variable Investment Trust are marked to market each year. Assets in the Core Investment Trust (most of the assets) are valued (or recognized) using an "asset valuation method."

Asset valuation methods are distinguished by the timing of the recognition of investment return. Total investment return is the sum of ordinary income and capital value changes. Under a book value approach, ordinary income is recognized immediately and capital gains (or losses) are recognized only when securities are sold. Book value investment return is directly affected by the timing of sales activity and underlying experience may be distorted. Under a pure market value approach, ordinary investment income and all capital value changes are recognized immediately. Because of market volatility, use of pure market values in retirement funding can result in volatile contribution rates and unstable financial ratios, contrary to WRS objectives.

The asset valuation method used for WRS valuations is statutory, and is referred to as the "Market Recognition Account" or MRA. Act 11 of 1999 closed the former Transaction Amortization Account (TAA) and created the Market Recognition Account (MRA). The MRA recognizes assumed returns fully each year. Differences between actual and assumed returns are phased-in over a closed five-year period. The objective is to give recognition to long-term changes in asset values while minimizing the effect of short-term fluctuations in the capital markets. In accordance with its smoothing objective, the MRA will tend to exceed the market value when the markets are doing poorly, and will fall short of the market value when markets are doing well. Some retirement systems set limits on the amount by which the recognized value of assets can differ from the market value.

# Annual Actuarial Valuations Assumptions Adopted by ETF Board After Consulting with Actuary

## ECONOMIC ASSUMPTIONS

The rationale for these assumptions is based upon an experience study covering the period 2012-2014.

For determining plan liabilities, the discount rate is 5.0% for retired participants, 5.0% for active and inactive participants following retirement, and 7.2% for active and inactive participants prior to their retirement. A valuation performed assuming a 5.5% discount rate for all participants at all stages of life, reproduces the results of an actuarial valuation using the 5.0% post-retirement and 7.2% pre-retirement assumptions. Thus, it can be said that **the net discount rate assumed in the valuations was 5.5% per year, compounded annually (net after administrative expenses).**

The **Wage Inflation Rate** assumed in this valuation was 3.2% per year. The wage inflation rate is defined to be the portion of total pay increases for an individual that are due to macroeconomic forces including productivity, price inflation, and labor market conditions. The wage inflation rate does not include pay changes rated to individual merit and seniority effects.

No specific **Price Inflation** assumption is required to perform this valuation. The price inflation assumption used to evaluate the investment return assumption is 2.7%.

The assumed **Real Rate of Return** over wage inflation is defined to be the portion of total investment return that is more than the assumed total wage growth rate. Considering other economic assumptions, the 7.2% pre-retirement investment return rate translates to an assumed real rate of return over wage inflation of 4.0%. The assumed real rate of return over price inflation is 4.5% considering an inflation assumption of 2.7%.

**Merit and Longevity pay increase assumptions** for individual active members are shown for sample services below. An additional 3.2% recognizes wage inflation, including price inflation, productivity increases, and other macroeconomic forces.

% Merit and Longevity Increase Next Year						
Service	Gen.	University Teachers	Public School Teachers	Protective		Exec. & Elec.
				With S.S.	W/O S.S.	
1	3.5 %	3.0 %	5.6 %	4.8 %	5.5 %	2.5 %
2	3.5 %	3.0 %	5.6 %	4.8 %	5.5 %	2.5 %
3	3.1 %	2.9 %	5.2 %	4.1 %	4.7 %	2.0 %
4	2.8 %	2.8 %	4.7 %	3.5 %	3.8 %	1.6 %
5	2.5 %	2.7 %	4.3 %	2.8 %	3.0 %	1.1 %
10	1.5 %	2.2 %	2.6 %	1.1 %	0.9 %	0.2 %
15	1.1 %	1.7 %	1.4 %	0.8 %	0.5 %	0.2 %
20	0.9 %	1.2 %	0.6 %	0.7 %	0.4 %	0.2 %
25	0.6 %	0.9 %	0.3 %	0.6 %	0.3 %	0.2 %
30	0.4 %	0.7 %	0.2 %	0.5 %	0.2 %	0.2 %

## Decrement Probabilities

The Active Member Population is assumed to remain constant. For purposes of financing the unfunded liabilities and amortizing the EAR, total payroll is assumed to grow at the wage inflation rate – 3.20% per year.

**The mortality table** used to measure mortality for retired participants was the Wisconsin 2012 Mortality Table. The rates in this table were based on actual WRS experience adjusted for future mortality improvements using the MP-2015 fully generational improvement scale (multiplied by 50%). This mortality assumption was adopted by the Board in connection with the 2012-2014 Experience Study. Sample retirement values from this table are shown below. This assumption is used to measure the probabilities of participants dying before retirement and the probabilities of each benefit payment being made after retirement.

### Single Life Retirement Values Wisconsin 2012 Mortality Table with 5% Interest

Sample Attained Ages in 2017	Present Value of \$1 Monthly for Life*		Future Life Expectancy (years)*		Mortality Rates*	
	Males	Females	Males	Females	Males	Females
40	\$212.26	\$217.36	44.7	47.9	0.000948	0.000590
45	203.68	209.93	39.7	42.8	0.001247	0.000914
50	192.96	200.73	34.7	37.8	0.001684	0.001357
55	180.13	189.56	29.9	32.9	0.003963	0.002431
60	165.76	176.25	25.3	28.2	0.005668	0.003490
65	148.55	160.13	20.9	23.5	0.008629	0.005295
70	129.00	141.01	16.7	19.0	0.014193	0.008956
75	107.29	119.37	12.8	14.8	0.024118	0.016265
80	84.55	96.13	9.4	11.0	0.044374	0.030495
85	63.32	73.03	6.5	7.8	0.082894	0.061073

\* With a fully generational mortality table, the mortality rate depends on the year of birth. Later years of birth will correspond to a lower mortality rate at a given age.

The values shown above are for non-disabled participants in 2017. For disabled participants, the following table was used:

Sample Attained Ages in 2017	Present Value of \$1 Monthly for Life		Future Life Expectancy (years)		Mortality Rates*	
	Males	Females	Males	Females	Males	Females
40	\$198.79	\$207.55	37.2	41.5	0.000963	0.000599
45	186.85	197.77	32.3	36.5	0.001266	0.000928
50	173.07	185.91	27.5	31.6	0.001710	0.001378
55	157.06	171.77	23.0	26.8	0.004022	0.002492
60	138.40	154.89	18.6	22.2	0.005871	0.003669
65	117.92	135.14	14.6	17.8	0.009167	0.005624
70	95.73	113.02	11.0	13.7	0.015308	0.009513
75	73.46	89.53	7.9	10.1	0.026012	0.017277
80	53.99	67.03	5.4	7.0	0.047857	0.032392
85	38.26	48.95	3.7	4.9	0.089402	0.064873

\* With a fully generational mortality table, the mortality rate depends on the year of birth. Later years of birth will correspond to a lower mortality rate at a given age.

## Active Participant Mortality Rates

Sample Attained Ages in 2017	Mortality Rates*	
	Males	Females
20	0.000132	0.000077
25	0.000159	0.000085
30	0.000201	0.000117
35	0.000353	0.000210
40	0.000474	0.000295
45	0.000624	0.000457
50	0.000842	0.000679
55	0.001982	0.001216
60	0.002834	0.001745
65	0.004315	0.002648
70	0.007097	0.004478
75	0.012059	0.008133
80	0.022187	0.015248

*\* With a fully generational mortality table, the mortality rate depends on the year of birth. Later years of birth will correspond to a lower mortality rate at a given age.*



# Rates of Retirement for Those Eligible to Retire

## Normal Retirement

Age	General		Public School		University		Protective*		Exec. & Elected
	Male	Female	Male	Female	Male	Female	With S.S.	W/O S.S.	
50							6%	4%	
51							7%	4%	
52							9%	5%	
53							23%	17%	
54							19%	25%	
55							19%	21%	
56							19%	27%	
57	18%	15%	36%	28%	12%	14%	19%	30%	12%
58	18%	15%	31%	28%	12%	12%	18%	30%	12%
59	18%	15%	24%	28%	12%	10%	16%	30%	12%
60	18%	15%	30%	28%	12%	12%	20%	26%	12%
61	18%	15%	28%	28%	12%	16%	20%	15%	12%
62	25%	25%	37%	36%	12%	14%	22%	20%	12%
63	30%	25%	32%	30%	12%	19%	26%	40%	12%
64	25%	25%	27%	27%	12%	13%	17%	40%	12%
65	25%	28%	29%	35%	15%	18%	30%	40%	12%
66	32%	32%	33%	35%	17%	22%	25%	40%	20%
67	26%	26%	27%	30%	16%	17%	30%	40%	15%
68	19%	22%	24%	30%	16%	16%	30%	40%	15%
69	19%	20%	24%	30%	16%	14%	30%	40%	10%
70	19%	20%	20%	35%	16%	18%	100%	100%	10%
71	19%	20%	20%	30%	18%	18%	100%	100%	10%
72	19%	20%	20%	22%	14%	18%	100%	100%	15%
73	19%	20%	20%	22%	14%	18%	100%	100%	15%
74	19%	20%	20%	22%	10%	18%	100%	100%	15%
75	100%	100%	100%	100%	100%	100%	100%	100%	100%

\* Includes reduced retirements for protective with 20+ years of service.

## Reduced Retirement

Age	% Retiring Next Year							Exec. & Elected
	General		Public School		University			
	Male	Female	Male	Female	Male	Female		
55	9.0%	7.0%	13.0%	12.0%	4.0%	5.5%	3.0%	
56	9.0%	7.0%	13.0%	12.0%	3.0%	5.5%	3.0%	
57	4.8%	5.0%	12.0%	12.0%	2.5%	4.0%	3.0%	
58	5.8%	6.0%	13.0%	12.0%	2.5%	5.5%	3.0%	
59	6.5%	6.0%	14.0%	13.0%	3.0%	6.5%	3.0%	
60	8.5%	8.5%	14.0%	17.0%	4.3%	8.0%	5.0%	
61	8.5%	8.5%	15.0%	17.0%	5.0%	6.0%	5.0%	
62	16.0%	16.0%	21.0%	23.0%	6.0%	12.0%		
63	17.0%	16.0%	21.0%	23.0%	7.0%	12.0%		
64	17.0%	16.0%	21.0%	23.0%	7.0%	12.0%		

The assumed rates of separation from employment prior to service retirement due to disability and other causes are shown below for sample ages. For other terminations it was assumed that a percentage, depending on age of participants terminating after age 35 with 5 or more years service, will leave their contributions on deposit and be paid a benefit at normal retirement age and that the remaining participants would take a separation benefit. The percentage taking a separation benefit is 25% at age 35, grading downward to 0% at retirement eligibility. All participants terminating prior to normal retirement age with less than five years of service were assumed to take a separation benefit.

### Assumed Termination Rates by Attained Age and Years of Service

Age	Service	% of Active Participants Terminating								
		Protective		Public Schools		University		Exec. & Elected	General	
		With Soc. Sec.	Without Soc. Sec.	Males	Females	Males	Females		Males	Females
		Sec.	Sec.							
	0	17.0%	4.0%	18.3%	16.0%	16.0%	16.0%	18.0%	16.8%	20.0%
	1	8.0%	3.5%	11.0%	10.8%	14.0%	15.0%	14.0%	12.7%	14.1%
	2	5.0%	1.5%	7.8%	7.7%	12.0%	13.0%	12.0%	9.0%	11.0%
	3	4.3%	1.3%	5.9%	5.8%	10.0%	10.0%	10.0%	7.3%	8.9%
	4	3.8%	1.2%	4.9%	5.0%	8.5%	9.9%	10.0%	7.0%	8.5%
	5	3.1%	1.1%	3.6%	4.3%	8.0%	8.4%	8.0%	4.8%	6.7%
	6	3.0%	1.0%	3.2%	3.8%	7.5%	6.4%	7.0%	4.3%	5.6%
	7	2.9%	0.9%	2.6%	3.4%	5.7%	5.7%	6.0%	4.2%	5.0%
	8	2.5%	0.8%	2.6%	2.8%	4.6%	4.7%	6.0%	3.4%	4.7%
	9	2.2%	0.7%	2.4%	2.5%	4.0%	4.2%	6.0%	3.1%	4.5%
25	10 & Over	2.0%	0.7%	1.3%	2.2%	4.0%	5.0%	6.0%	2.5%	4.5%
30		1.8%	0.7%	1.3%	1.9%	3.9%	4.6%	5.1%	2.5%	4.3%
35		1.6%	0.7%	1.3%	1.6%	3.6%	4.2%	4.3%	2.4%	3.5%
40		1.3%	0.6%	1.3%	1.3%	3.1%	3.4%	4.1%	2.1%	2.7%
45		1.1%	0.6%	1.3%	1.1%	2.3%	2.6%	3.2%	1.8%	2.2%
50		1.0%	0.5%	1.3%	1.0%	1.9%	2.1%	2.5%	1.5%	1.9%
55		1.0%	0.5%	1.3%	1.0%	1.8%	2.0%	2.4%	1.5%	1.8%
60		1.0%	0.5%	1.3%	1.0%	1.8%	2.0%	2.4%	1.5%	1.8%

### Disability Rates

Age	% of Active Participants Becoming Disabled									
	Protective		Public Schools		University		Exec. & Elected		General	
	With SS	W/O SS	Males	Females	Males	Females	Males	Females	Males	Females
20	0.01%	0.04%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%
25	0.01%	0.04%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%
30	0.01%	0.04%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.01%	0.02%
35	0.02%	0.04%	0.01%	0.01%	0.00%	0.02%	0.01%	0.01%	0.01%	0.03%
40	0.02%	0.06%	0.01%	0.02%	0.01%	0.03%	0.01%	0.01%	0.03%	0.04%
45	0.03%	0.11%	0.03%	0.05%	0.01%	0.03%	0.01%	0.01%	0.06%	0.06%
50	0.06%	0.64%	0.08%	0.10%	0.02%	0.06%	0.02%	0.02%	0.13%	0.09%
55	0.87%	0.48%	0.16%	0.14%	0.05%	0.09%	0.09%	0.09%	0.24%	0.16%
60	1.46%	0.14%	0.26%	0.21%	0.07%	0.13%	0.11%	0.11%	0.43%	0.23%

## Miscellaneous and Technical Assumptions

<b>Expenses:</b>	Assumed investment return is net of administrative and investment expenses.
<b>Marriage Assumption:</b>	80% of males and 70% of females are assumed to be married for purposes of death-in-service benefits. Male spouses are assumed to be three years older than female spouses.
<b>Pay Increase Timing:</b>	Beginning of (calendar) year for most people. Middle of calendar year for teachers.
<b>Pay Annualization:</b>	Reported pay for members with less than twelve contributing months was annualized by the ratio of 12 to the number of contributing months in the year.
<b>Final Average Salary:</b>	For present value of future benefit purposes, final average salary was calculated in accordance with pay increase assumptions, but was not permitted to fall below the final average salary reported in the data.
<b>Decrement Timing:</b>	Decrements of all types are assumed to occur mid-year.
<b>Decrement Operation:</b>	Disability operates during the retirement pattern.
<b>Decrement Relativity:</b>	Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.
<b>Eligibility Testing:</b>	Eligibility for benefits is determined based upon the age nearest birthday and total service (in all benefit groups) nearest whole year on the date the decrement is assumed to occur.
<b>Benefit Service:</b>	Exact fractional service on the decrement date is used to determine the amount of benefit payable.
<b>Non-Benefit Service:</b>	Liabilities for service in divisions other than the division in which the individual is currently active are calculated as indexed deferred vested benefits. Benefits are indexed in accordance with the salary adjustment factors for the division where the member was formerly employed. People are assumed to retire at the earliest age that full benefits will become available. The liabilities are assigned to the division in which the service was rendered.
<b>Service Credit Accruals:</b>	It is assumed that members accrue one year of service credit per year.

## Miscellaneous and Technical Assumptions (Concluded)

<b>Incidence of Contributions:</b>	Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made.
<b>Assumed Retirement for Deferred Members:</b>	Members with a deferred vested benefit were assumed to retire at age 65 for General members, age 54 for Protective members and age 62 for Executive and Elected members.
<b>Normal Form of Benefit:</b>	The assumed normal form of benefit is a straight life benefit, except where otherwise noted.
<b>Disability Valuation:</b>	<p>The Post-10/15/92 Disability benefit consists of one benefit payable to age 65 (10% of FAE) plus another benefit payable on and after age 65 (WRS benefit accrued to date of disability plus 7% of FAE during disability). For valuation purposes, the 7% of FAE portion of the post 65 benefit was added to the 40% of FAE benefit prior to age 65.</p> <p>Additionally, there are certain cases in which the disability benefit at the member's normal retirement age is larger than the member's benefit under the normal retirement benefit formula. To account for this, an adjustment is made to the member's normal retirement benefit present value calculation which is equal to 15% of the difference between the present values of the LTDI benefit and the normal retirement benefit.</p>
<b>Variable Excess Benefits:</b>	These benefits are valued by increasing the otherwise calculated liabilities by an amount equal to twice the value of the variable excess. (The variable excess is the difference between the variable account and the variable at core account, summed over all participants.)
<b>Liability Adjustments:</b>	Final Average Salaries were increased 2.5% (3.0% for Executive and Elected and 3.5% for Protectives) to account for additional contingencies in actual benefit amount calculated at the time of retirement.
<b>Amortization Payoff Reserve:</b>	Additional reserves in the amount of \$12,465,887 (discounted from the year 2029 to the current valuation date) were added to general group liabilities to account for the possibility that some non-state employers may never be able to pay off their unfunded actuarial accrued liability.

## **SECTION G**

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### **PLAN PROVISIONS**

# Summary of Benefit Provisions Evaluated December 31, 2017 Actuarial Valuation

## Normal Retirement Eligibility

The age a participant becomes eligible for an unreduced age and service annuity is:

General		Protective		Executive & Elected <sup>#</sup>	
Age	Service	Age	Service	Age	Service
65	Any*	54	Any*	62	Any*
57	30	53	25	57	30

\* Participants first employed after 1989 and terminated before April 24, 1998 must have creditable service in five calendar years.

# These conditions apply to those people hired on or before December 31, 2016. For others, the General eligibility conditions apply.

## Normal Retirement Annuity

The age and service annuity payable at Normal Retirement Age is based on Final Average Earnings (FAE) and Creditable Service (CS) as follows:

Multiplier for Service Rendered			Group
Before 2000	Between 2000 and 2011	After 2011	
2.165%	2.0%	1.6%	Executive group and elected officials
2.165%	2.0%	2.0%	Protective occupation participants covered by Social Security
2.665%	2.5%	2.5%	Protective occupation participants not covered by Social Security
1.765%	1.6%	1.6%	All other participants

FAE is generally the average of the three highest years of earnings (July 1 - June 30 for teachers, educational support staff, and judges; calendar year for others) preceding retirement. These years do not have to be consecutive. For legislators and state constitutional officers who are ineligible to receive pay increases during their term, FAE is the statutory rate of earnings at termination.

Maximum formula annuity is 85% of FAE for protective occupation participants not covered by Social Security, 65% of FAE for protectives covered by Social Security, and 70% for all other participants. If greater than the formula amount, an annuity equal to the actuarial equivalent of two times the required accumulated contributions is paid in lieu of the formula amount.

**Reduced Retirement.** Any participant who has attained age 55 and any Protective occupation participant who has attained age 50 may apply for an early retirement annuity. The benefit is reduced 0.4% for each month that the annuity effective date precedes the Normal Retirement Age. For Non-Protective participants terminating after 6/30/90, the 0.4% is reduced for months after the attainment of age 57 and before the annuity effective date by .001111% for each month of creditable service.

**Voluntary Termination Before Immediate Benefit Eligibility.** Participant may either (i) receive a refund of accumulated contributions, or (ii) leave contributions on deposit and apply for a retirement annuity on or after the minimum retirement age based upon age and accrued service at time of termination.

**Post-Retirement Adjustments.** Annuities are increased annually if the investment income credited to retired life funds is in excess of the assumed benefit rate (presently 5%), other plan experiences are within projected ranges, and the resulting adjustment would be at least 0.5% (2.0% for the variable fund).

**Disability Annuity.** Eligibility: generally total and permanent incapacity to engage in gainful employment. Participant must have completed at least six months of creditable service (in at least five out of the last seven calendar years) preceding application for disability. Service requirement is waived if disability is from service-related causes.

For Protective occupations, eligibility also can be met if a member has 15 years of service, is between the ages of 50 and 55 and unable to safely and efficiently perform one's duties.

**Disability Amounts.** Amounts payable in case of disability depend upon the plan from which payment is made and are described below.

	<b>Pre-10/16/1992 WRS Plan</b>	<b>Post-10/15/1992 LTDI Plan</b>
<b>Participants covered</b>	Participants hired before 10/16/1992 who do not elect LTDI coverage.	Participants entering after 10/15/1992 and participants on 10/15/1992 who elect LTDI coverage.
<b>Benefit to age 65*</b>	WRS formula benefit based on service projected to normal retirement age.	40% of FAE for participants covered by Social Security; 50% of FAE for non-covered participants who cannot qualify for Social Security disability benefits.
<b>Benefit at age 65*</b>	Continuation of pre-65 amount.	WRS benefit accrued to date of disability plus 7% of FAE money purchase benefit during disability period, both of which are adjusted in accordance with dividend rate.

\* Conversion age is later for participants becoming disabled after age 61. The Post-1992 LTD plan was closed to new disabilities effective January 1, 2018. The Pre-1992 plan was reinstated for all new disabilities after that point.

**Death-in-Service.**

- (a) Prior to age 50 for Protective participants, age 55 for others, the benefit is the equivalent of twice the accumulated employee contributions required and all additional contributions and employer amounts contributed prior to 1974 for teachers, or 1966 for others.
- (b) After age 50 for Protective participants, age 55 for others, the benefit is the amount that would have been paid if participant had retired and elected 100% survivor option. Benefit is payable to any natural living person.

**Interest Credits.** For years after 1999, and for people with some active service after 1999, participant core accounts (including the variable at core accounts) are credited with interest at the full (core) effective rate. For others, accounts are credited with interest as follows:

<b>Date of Participation</b>	<b>Rate Credited for Purpose of</b>	
	<b>Money Purchase Minimum</b>	<b>Refunds</b>
Prior to 1982	Actual	Actual
January 1, 1982 & Later	5%	3%

Participant variable accounts are credited with interest based on the earnings in the variable portfolio.

**Contribution Rates.** The financial objective of WRS is to establish and receive contributions that will remain level from year to year and decade to decade.

Statutory required participant contributions prior to July 1, 2011 were as follows:

General	5.0%
Executives & Elected Officials	5.5
Protectives	
- With Social Security	6.0
- Without Social Security	8.0

Statutory required participant contributions after July 1, 2011 are set equal to one-half of the actuarially determined rate for General participants and Executive and Elected Officials. Participant contributions for Protective participants are set equal to the participant contribution for General members.



**Normal Form of Benefit.** The normal form of benefit is a straight life annuity with no death benefits. Optional forms of benefit which are actuarially reduced are listed below:

- A life annuity with 60 or 180 monthly payments guaranteed.
- A joint survivorship annuity with 75% continued to beneficiary.
- A joint survivorship annuity with 100% continued to beneficiary.
- A joint survivorship annuity reduced 25% upon either your death or your beneficiary's death.
- A joint survivorship annuity with 100% continued to beneficiary combined with 180 monthly payments guaranteed.

For formula benefit calculations, optional forms are calculated at the lower of the current age or age 62 (Normal Retirement Age for Protective occupations).

**Vesting.** Participants hired prior to July 1, 2011 vest immediately. After July 1, 2011, participants vest after five years of service.

## SECTION H

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### GAIN/LOSS STATISTICAL SUMMARY

## General Males Withdrawal Experience During Calendar Year 2017

### Male Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	423	2,214	0.1911	0.1680	372
2	584	4,037	0.1447	0.1270	513
3	417	3,640	0.1146	0.0900	328
4	266	3,149	0.0845	0.0730	230
5	215	2,635	0.0816	0.0700	184
6	178	2,394	0.0744	0.0480	115
7	103	1,718	0.0600	0.0430	74
8	71	1,326	0.0535	0.0420	56
9	67	1,417	0.0473	0.0340	48
10	71	1,598	0.0444	0.0310	50
Totals	2,395	24,128	0.0993	0.0816	1,970

### Male Age-Based Withdrawals 10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	8	0.0000	0.0250	-
30-34	9	301	0.0299	0.0250	8
35-39	41	1,355	0.0303	0.0225	30
40-44	76	2,215	0.0343	0.0200	44
45-49	92	3,287	0.0280	0.0160	53
50-54	102	4,563	0.0224	0.0150	68
Over 54	112	10,900	0.0103		112
Totals	432	22,629	0.0191	0.0139	315

## General Females Withdrawal Experience During Calendar Year 2017

### Female Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	1,138	5,528	0.2059	0.2000	1,106
2	1,625	9,133	0.1779	0.1410	1,288
3	995	7,096	0.1402	0.1100	781
4	678	5,828	0.1163	0.0890	519
5	597	5,044	0.1184	0.0850	429
6	443	4,266	0.1038	0.0670	286
7	366	3,500	0.1046	0.0560	196
8	279	3,060	0.0912	0.0500	153
9	263	3,129	0.0841	0.0470	147
10	200	3,036	0.0659	0.0450	137
Totals	6,584	49,620	0.1327	0.1016	5,042

### Female Age-Based Withdrawals 10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	1	4	0.2500	0.0450	-
30-34	31	504	0.0615	0.0420	21
35-39	121	2,109	0.0574	0.0300	63
40-44	164	3,269	0.0502	0.0250	82
45-49	211	4,648	0.0454	0.0200	93
50-54	279	7,293	0.0383	0.0175	128
Over 54	263	18,874	0.0139		263
Totals	1,070	36,701	0.0292	0.0177	650

## Public Schools Males Withdrawal Experience During Calendar Year 2017

### Male Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	51	518	0.0985	0.1830	95
2	103	983	0.1048	0.1100	108
3	83	1,004	0.0827	0.0780	78
4	64	966	0.0663	0.0590	57
5	58	957	0.0606	0.0490	47
6	35	869	0.0403	0.0360	31
7	21	720	0.0292	0.0320	23
8	20	591	0.0338	0.0260	15
9	19	598	0.0318	0.0260	16
10	24	654	0.0367	0.0240	16
Totals	478	7,860	0.0608	0.0618	486

### Male Age-Based Withdrawals 10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	-	N/A	0.0125	-
30-34	5	180	0.0278	0.0125	2
35-39	32	1,670	0.0192	0.0125	21
40-44	40	2,501	0.0160	0.0125	31
45-49	61	2,858	0.0213	0.0125	36
50-54	49	2,641	0.0186	0.0125	33
Over 54	32	2,968	0.0108		32
Totals	219	12,818	0.0171	0.0121	155

## Public Schools Females Withdrawal Experience During Calendar Year 2017

### Female Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	145	1,571	0.0923	0.1600	251
2	292	2,848	0.1025	0.1080	308
3	230	3,119	0.0737	0.0770	240
4	207	3,032	0.0683	0.0580	176
5	178	2,811	0.0633	0.0500	141
6	137	2,511	0.0546	0.0430	108
7	87	2,146	0.0405	0.0380	82
8	90	1,891	0.0476	0.0340	64
9	78	1,955	0.0399	0.0280	55
10	82	2,150	0.0381	0.0250	54
Totals	1,526	24,034	0.0635	0.0615	1,479

### Female Age-Based Withdrawals 10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	-	N/A	0.0220	-
30-34	20	611	0.0327	0.0175	11
35-39	102	4,706	0.0217	0.0150	71
40-44	107	5,984	0.0179	0.0120	72
45-49	112	6,949	0.0161	0.0110	76
50-54	102	6,825	0.0149	0.0100	68
Over 54	77	8,297	0.0093		77
Totals	520	33,372	0.0156	0.0112	375

## University Males Withdrawal Experience During Calendar Year 2017

### Male Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	56	362	0.1547	0.1600	58
2	125	680	0.1838	0.1400	95
3	104	648	0.1605	0.1200	78
4	75	612	0.1225	0.1000	61
5	45	563	0.0799	0.0850	48
6	34	515	0.0660	0.0800	41
7	33	407	0.0811	0.0750	31
8	17	361	0.0471	0.0570	21
9	12	326	0.0368	0.0460	15
10	10	365	0.0274	0.0400	15
Totals	511	4,839	0.1056	0.0957	463

### Male Age-Based Withdrawals 10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	-	N/A	0.0400	-
30-34	1	22	0.0455	0.0375	1
35-39	9	179	0.0503	0.0350	6
40-44	7	426	0.0164	0.0275	12
45-49	22	788	0.0279	0.0200	16
50-54	22	890	0.0247	0.0175	16
Over 54	17	2,566	0.0066		17
Totals	78	4,871	0.0160	0.0140	68

## University Females Withdrawal Experience During Calendar Year 2017

### Female Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	66	434	0.1521	0.1600	69
2	138	890	0.1551	0.1500	134
3	134	919	0.1458	0.1300	119
4	85	772	0.1101	0.1000	77
5	84	746	0.1126	0.0990	74
6	52	597	0.0871	0.0840	50
7	37	529	0.0699	0.0640	34
8	24	437	0.0549	0.0570	25
9	17	464	0.0366	0.0470	22
10	22	479	0.0459	0.0420	20
Totals	659	6,267	0.1052	0.0996	624

### Female Age-Based Withdrawals 10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	-	N/A	0.0500	-
30-34	2	38	0.0526	0.0440	2
35-39	14	333	0.0420	0.0400	13
40-44	25	622	0.0402	0.0300	19
45-49	28	838	0.0334	0.0230	19
50-54	31	967	0.0321	0.0200	19
Over 54	19	2,157	0.0088		19
Totals	119	4,955	0.0240	0.0184	91



## Protective with Social Security Withdrawal Experience During Calendar Year 2017

### Male and Female Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	154	678	0.2271	0.1700	115
2	180	1,344	0.1339	0.0800	108
3	71	1,005	0.0706	0.0500	50
4	51	948	0.0538	0.0430	41
5	54	830	0.0651	0.0380	32
6	38	744	0.0511	0.0310	23
7	23	564	0.0408	0.0300	17
8	21	462	0.0455	0.0290	13
9	23	600	0.0383	0.0250	15
10	26	770	0.0338	0.0220	17
Totals	641	7,945	0.0807	0.0542	431

### Male and Female Age-Based Withdrawals 10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	9	0.0000	0.0200	-
30-34	17	501	0.0339	0.0170	9
35-39	53	1,878	0.0282	0.0150	28
40-44	53	2,392	0.0222	0.0120	29
45-49	60	3,012	0.0199	0.0110	33
50-54	20	2,256	0.0089	0.0100	23
Over 54	13	1,424	0.0091		13
Totals	216	11,472	0.0188	0.0118	135

**Protective without Social Security  
Withdrawal Experience  
During Calendar Year 2017**

**Male and Female Service-Based Withdrawals  
All Ages**

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	-	38	0.0000	0.0400	2
2	2	106	0.0189	0.0350	4
3	2	104	0.0192	0.0150	2
4	5	115	0.0435	0.0130	1
5	-	116	0.0000	0.0120	1
6	1	100	0.0100	0.0110	1
7	4	97	0.0412	0.0100	1
8	-	95	0.0000	0.0090	1
9	-	95	0.0000	0.0080	1
10	-	105	0.0000	0.0070	1
Totals	14	971	0.0144	0.0154	15

**Male and Female Age-Based Withdrawals  
10+ Years of Service**

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	1	0.0000	0.0070	-
30-34	-	64	0.0000	0.0070	-
35-39	-	244	0.0000	0.0065	2
40-44	2	369	0.0054	0.0060	2
45-49	5	483	0.0104	0.0055	3
50-54	5	415	0.0120	0.0050	2
Totals	12	1,576	0.0076	0.0057	9

## Executive and Elected Males Withdrawal Experience During Calendar Year 2017

### Male and Female Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	7	91	0.0769	0.1800	16
2	5	77	0.0649	0.1400	11
3	5	78	0.0641	0.1200	9
4	6	53	0.1132	0.1000	5
5	6	79	0.0759	0.1000	8
6	2	52	0.0385	0.0800	4
7	4	70	0.0571	0.0700	5
8	1	34	0.0294	0.0600	2
9	-	31	0.0000	0.0600	2
10	2	31	0.0645	0.0600	2
Totals	38	596	0.0638	0.1074	64

### Male and Female Age-Based Withdrawals 10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	-	N/A	0.0600	-
30-34	-	2	0.0000	0.0450	-
35-39	-	16	0.0000	0.0420	1
40-44	2	46	0.0435	0.0400	2
45-49	2	76	0.0263	0.0260	2
50-54	6	114	0.0526	0.0240	3
Over 54	4	440	0.0091		4
Totals	14	694	0.0202	0.0173	12

# General Disability Experience During Calendar Year 2017

## Male Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0001	-
20-24	-	9	0.0000	0.0001	-
25-29	-	527	0.0000	0.0001	-
30-34	-	1,950	0.0000	0.0001	-
35-39	-	2,916	0.0000	0.0002	-
40-44	-	3,435	0.0000	0.0005	2
45-49	4	4,524	0.0009	0.0006	3
50-54	4	5,743	0.0007	0.0017	9
55-59	11	6,052	0.0018	0.0030	18
60-64	7	3,690	0.0019	0.0059	22
65-69	-	1,046	0.0000	0.0023	2
70-74	-	238	0.0000	0.0020	-
75 and over	-	-	N/A	0.0020	-
Totals	26	30,130	0.0009	0.0019	56

## Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0001	-
20-24	-	20	0.0000	0.0001	-
25-29	-	816	0.0000	0.0001	-
30-34	-	3,243	0.0000	0.0002	1
35-39	-	4,641	0.0000	0.0003	1
40-44	-	5,499	0.0000	0.0004	2
45-49	2	7,431	0.0003	0.0006	4
50-54	7	10,420	0.0007	0.0010	11
55-59	8	11,472	0.0007	0.0020	23
60-64	8	7,516	0.0011	0.0025	19
65-69	1	1,921	0.0005	0.0020	4
70-74	-	347	0.0000	0.0017	1
75 and over	-	-	N/A	0.0017	-
Totals	26	53,326	0.0005	0.0012	66

The people shown on this page are cases involving \$40.63 disability benefits and includes those who were either active or inactive with pending benefits at the beginning of the year. The LTDI plan is described in a separate report.

# Public Schools Disability Experience During Calendar Year 2017

## Male Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0001	-
20-24	-	-	N/A	0.0001	-
25-29	-	302	0.0000	0.0001	-
30-34	-	1,643	0.0000	0.0001	-
35-39	-	2,530	0.0000	0.0001	-
40-44	-	2,922	0.0000	0.0002	1
45-49	-	3,167	0.0000	0.0004	1
50-54	-	2,859	0.0000	0.0013	4
55-59	2	1,816	0.0011	0.0017	3
60-64	2	600	0.0033	0.0031	2
65-69	-	194	0.0000	0.0043	1
70-74	-	36	0.0000	0.0045	-
75 and over	-	-	N/A	0.0045	-
Totals	4	16,069	0.0002	0.0007	12

## Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0001	-
20-24	-	-	N/A	0.0001	-
25-29	-	1,184	0.0000	0.0001	-
30-34	-	5,194	0.0000	0.0001	-
35-39	-	6,931	0.0000	0.0001	1
40-44	-	7,186	0.0000	0.0002	2
45-49	-	8,023	0.0000	0.0008	7
50-54	8	7,649	0.0010	0.0011	9
55-59	5	5,162	0.0010	0.0017	9
60-64	2	2,001	0.0010	0.0024	5
65-69	-	442	0.0000	0.0014	1
70-74	-	75	0.0000	0.0011	-
75 and over	-	-	N/A	0.0011	-
Totals	15	43,847	0.0003	0.0008	34

The people shown on this page are cases involving \$40.63 disability benefits and includes those who were either active or inactive with pending benefits at the beginning of the year. The LTDI plan is described in a separate report prepared by a different actuarial firm.

## University Disability Experience During Calendar Year 2017

### Male Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0000	-
20-24	-	-	N/A	0.0000	-
25-29	-	34	0.0000	0.0000	-
30-34	-	293	0.0000	0.0000	-
35-39	-	648	0.0000	0.0000	-
40-44	-	952	0.0000	0.0001	-
45-49	-	1,176	0.0000	0.0001	-
50-54	-	1,102	0.0000	0.0002	-
55-59	-	1,026	0.0000	0.0007	1
60-64	-	831	0.0000	0.0007	1
65-69	-	251	0.0000	0.0009	-
70-74	-	78	0.0000	0.0008	-
75 and over	-	-	N/A	0.0008	-
Totals	-	6,391	0.0000	0.0003	2

### Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0000	-
20-24	-	-	N/A	0.0000	-
25-29	-	66	0.0000	0.0000	-
30-34	-	518	0.0000	0.0000	-
35-39	-	1,000	0.0000	0.0003	-
40-44	-	1,163	0.0000	0.0004	-
45-49	-	1,229	0.0000	0.0003	-
50-54	-	1,249	0.0000	0.0007	1
55-59	1	1,098	0.0009	0.0010	1
60-64	-	757	0.0000	0.0015	1
65-69	-	219	0.0000	0.0010	-
70-74	-	30	0.0000	0.0009	-
75 and over	-	-	N/A	0.0009	-
Totals	1	7,329	0.0001	0.0004	3

The people shown on this page are cases involving \$40.63 disability benefits and includes those who were either active or inactive with pending benefits at the beginning of the year. The LTDI plan is described in a separate report prepared by a different actuarial firm.

## Protective with Social Security Disability Experience During Calendar Year 2017

### Male and Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0004	-
20-24	-	-	N/A	0.0004	-
25-29	-	93	0.0000	0.0004	-
30-34	-	312	0.0000	0.0004	-
35-39	-	385	0.0000	0.0004	-
40-44	-	423	0.0000	0.0007	-
45-49	-	500	0.0000	0.0014	1
50-54	-	250	0.0000	0.0098	2
55-59	-	52	0.0000	0.0014	-
60-64	-	8	0.0000	0.0014	-
65-69	-	-	N/A	0.0014	-
70-74	-	-	N/A	0.0014	-
75 and over	-	-	N/A	0.0014	-
Totals	-	2,023	0.0000	0.0015	3

The people shown on this page are cases involving \$40.63 disability benefits and includes those who were either active or inactive with pending benefits at the beginning of the year. The LTDI plan is described in a separate report prepared by a different actuarial firm.

## Protective without Social Security Disability Experience During Calendar Year 2017

### Male and Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0001	-
20-24	-	9	0.0000	0.0001	-
25-29	-	570	0.0000	0.0001	-
30-34	-	2,000	0.0000	0.0001	-
35-39	-	2,575	0.0000	0.0002	1
40-44	-	2,720	0.0000	0.0003	1
45-49	-	3,230	0.0000	0.0004	1
50-54	4	1,788	0.0022	0.0007	1
55-59	-	589	0.0000	0.0140	8
60-64	-	276	0.0000	0.0150	4
65-69	-	43	0.0000	0.0010	-
70-74	-	-	N/A	0.0010	-
75 and over	-	-	N/A	0.0010	-
Totals	4	13,800	0.0003	0.0012	16

The people shown on this page are cases involving \$40.63 disability benefits and includes those who were either active or inactive with pending benefits at the beginning of the year. The LTDI plan is described in a separate report prepared by a different actuarial firm.



## Executive and Elected Disability Experience During Calendar Year 2017

### Male and Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0000	-
20-24	-	-	N/A	0.0000	-
25-29	-	2	0.0000	0.0000	-
30-34	-	24	0.0000	0.0000	-
35-39	-	33	0.0000	0.0001	-
40-44	-	70	0.0000	0.0001	-
45-49	-	116	0.0000	0.0002	-
50-54	-	158	0.0000	0.0003	-
55-59	-	174	0.0000	0.0012	-
60-64	-	115	0.0000	0.0011	-
65-69	-	88	0.0000	0.0009	-
70-74	-	34	0.0000	0.0009	-
75 and over	-	-	N/A	0.0009	-
Totals	-	814	N/A	N/A	-

The people shown on this page are cases involving \$40.63 disability benefits and includes those who were either active or inactive with pending benefits at the beginning of the year. The LTDI plan is described in a separate report prepared by a different actuarial firm.

## General Pay Increase Assumption During Calendar Year 2017

### Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	40,837	9.15 %	7.45 %
6-10	22,858	3.62 %	5.90 %
11-15	17,153	2.85 %	5.25 %
16-20	15,918	2.31 %	5.00 %
21-25	9,003	1.78 %	4.75 %
26-30	6,793	1.59 %	4.50 %
31-35	3,084	1.54 %	4.30 %
36-40	1,373	1.40 %	4.20 %
Over 40	327	1.29 %	4.10 %
Total	117,346		

# Public Schools Pay Increase Assumption During Calendar Year 2017

## Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	16,321	9.71 %	9.60 %
6-10	13,395	4.41 %	7.40 %
11-15	12,820	3.10 %	6.10 %
16-20	13,230	1.92 %	5.00 %
21-25	9,105	1.54 %	4.35 %
26-30	5,911	1.24 %	4.20 %
31-35	2,093	1.10 %	4.15 %
36-40	384	1.13 %	4.10 %
Over 40	72	0.34 %	4.05 %
Total	73,331		

# University Pay Increase Assumption During Calendar Year 2017

## Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	5,643	15.15 %	7.00 %
6-10	4,149	4.10 %	6.50 %
11-15	3,052	3.19 %	6.00 %
16-20	2,677	2.51 %	5.50 %
21-25	1,433	2.11 %	4.95 %
26-30	1,102	1.60 %	4.80 %
31-35	546	1.31 %	4.60 %
36-40	196	(0.19)%	4.20 %
Over 40	92	0.89 %	4.10 %
Total	18,890		

## Protective with Social Security Pay Increase Assumption During Calendar Year 2017

### Male and Female Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	4,164	13.87 %	8.75 %
6-10	2,947	3.76 %	5.50 %
11-15	2,959	2.80 %	4.90 %
16-20	3,581	2.43 %	4.80 %
21-25	2,448	2.40 %	4.70 %
26-30	1,257	2.42 %	4.60 %
31-35	231	3.55 %	4.50 %
36-40	66	3.09 %	4.40 %
Over 40	10	2.12 %	4.20 %
Total	17,663		

## Protective without Social Security Pay Increase Assumption During Calendar Year 2017

### Male and Female Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	469	13.45 %	9.50 %
6-10	482	5.00 %	5.30 %
11-15	426	4.00 %	4.60 %
16-20	528	4.16 %	4.50 %
21-25	411	3.76 %	4.40 %
26-30	259	3.62 %	4.30 %
31-35	41	4.77 %	4.20 %
36-40	5	2.92 %	4.10 %
Over 40	-	N/A	4.05 %
Total	2,621		

## Executive and Elected Pay Increase Assumption During Calendar Year 2017

### Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	375	12.05 %	6.50 %
6-10	208	2.40 %	4.20 %
11-15	141	1.35 %	4.20 %
16-20	153	1.58 %	4.20 %
21-25	105	2.07 %	4.20 %
26-30	96	1.70 %	4.20 %
31-35	60	1.64 %	4.20 %
36-40	31	1.90 %	4.20 %
Over 40	11	1.24 %	4.20 %
Total	1,180		

**General Males**  
**Normal Retirement Experience**  
**During Calendar Year 2017**

**Male Age-Based Retirement Experience**

<b>Age</b>	<b>Retirements</b>	<b>Exposure</b>	<b>Crude Rates</b>	<b>Current Rates</b>	<b>Expected Retirements</b>
57	53	257	0.2062	0.1800	46
58	57	252	0.2262	0.1800	45
59	47	247	0.1903	0.1800	44
60	57	242	0.2355	0.1800	44
61	42	255	0.1647	0.1800	46
62	65	228	0.2851	0.2500	57
63	49	176	0.2784	0.3000	53
64	40	161	0.2484	0.2500	40
65	184	687	0.2678	0.2500	172
66	130	461	0.2820	0.3200	148
67	66	323	0.2043	0.2600	84
68	44	213	0.2066	0.1900	40
69	30	171	0.1754	0.1900	32
70	23	152	0.1513	0.1900	29
71	21	105	0.2000	0.1900	20
72	2	63	0.0317	0.1900	12
73	6	72	0.0833	0.1900	14
74	6	54	0.1111	0.1900	10
Totals	922	4,119	0.2238	0.2272	936
75 & Over	23	201			201
Totals	945	4,320			1,137



**General Males  
Early Retirement Experience  
During Calendar Year 2017**

**Male Age-Based Reduced Retirement Experience**

<b>Age</b>	<b>Retirements</b>	<b>Exposure</b>	<b>Crude Rates</b>	<b>Current Rates</b>	<b>Expected Retirements</b>
55	59	1,423	0.0415	0.0900	128
56	66	1,413	0.0467	0.0900	127
57	33	1,108	0.0298	0.0475	53
58	53	1,060	0.0500	0.0580	61
59	60	1,048	0.0573	0.0650	68
60	63	936	0.0673	0.0850	80
61	60	818	0.0733	0.0850	70
62	104	784	0.1327	0.1600	125
63	95	646	0.1471	0.1700	110
64	70	506	0.1383	0.1700	86
<b>Totals</b>	<b>663</b>	<b>9,742</b>	<b>0.0681</b>	<b>0.0932</b>	<b>908</b>

**General Females  
Normal Retirement Experience  
During Calendar Year 2017**

**Female Age-Based Retirement Experience**

<b>Age</b>	<b>Retirements</b>	<b>Exposure</b>	<b>Crude Rates</b>	<b>Current Rates</b>	<b>Expected Retirements</b>
57	63	336	0.1875	0.1500	50
58	56	344	0.1628	0.1500	52
59	67	352	0.1903	0.1500	53
60	71	339	0.2094	0.1500	51
61	65	273	0.2381	0.1500	41
62	65	244	0.2664	0.2500	61
63	67	220	0.3045	0.2500	55
64	43	171	0.2515	0.2500	43
65	296	1,070	0.2766	0.2800	300
66	210	721	0.2913	0.3200	231
67	120	488	0.2459	0.2600	127
68	55	302	0.1821	0.2200	66
69	54	269	0.2007	0.2000	54
70	43	188	0.2287	0.2000	38
71	27	148	0.1824	0.2000	30
72	9	92	0.0978	0.2000	18
73	10	77	0.1299	0.2000	15
74	9	84	0.1071	0.2000	17
Totals	1,330	5,718	0.2326	0.2277	1,302
75 & Over	22	234			234
Totals	1,352	5,952			1,536

## General Females Early Retirement Experience During Calendar Year 2017

### Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	105	2,490	0.0422	0.0700	174
56	111	2,541	0.0437	0.0700	178
57	103	2,257	0.0456	0.0500	113
58	112	2,165	0.0517	0.0600	130
59	108	2,019	0.0535	0.0600	121
60	155	1,944	0.0797	0.0850	165
61	129	1,701	0.0758	0.0850	145
62	197	1,539	0.1280	0.1600	246
63	227	1,298	0.1749	0.1600	208
64	161	1,034	0.1557	0.1600	165
Totals	1,408	18,988	0.0742	0.0866	1,645

**Public School Males  
Normal Retirement Experience  
During Calendar Year 2017**

**Male Age-Based Retirement Experience**

<b>Age</b>	<b>Retirements</b>	<b>Exposure</b>	<b>Crude Rates</b>	<b>Current Rates</b>	<b>Expected Retirements</b>
57	29	132	0.2197	0.3600	48
58	25	103	0.2427	0.3100	32
59	15	92	0.1630	0.2400	22
60	15	80	0.1875	0.3000	24
61	12	46	0.2609	0.2800	13
62	22	61	0.3607	0.3700	23
63	10	31	0.3226	0.3200	10
64	4	22	0.1818	0.2700	6
65	23	118	0.1949	0.2900	34
66	18	90	0.2000	0.3300	30
67	12	53	0.2264	0.2700	14
68	6	42	0.1429	0.2400	10
69	7	37	0.1892	0.2400	9
70	6	29	0.2069	0.2000	6
71	4	17	0.2353	0.2000	3
72	2	19	0.1053	0.2000	4
73	-	15	0.0000	0.2000	3
74	-	2	0.0000	0.2000	-
Totals	210	989	0.2123	0.2942	291
75 & Over	3	24			24
Totals	213	1,013			315

## Public School Males Early Retirement Experience During Calendar Year 2017

### Male Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	48	540	0.0889	0.1300	70
56	32	476	0.0672	0.1300	62
57	34	299	0.1137	0.1200	36
58	24	270	0.0889	0.1300	35
59	17	231	0.0736	0.1400	32
60	17	168	0.1012	0.1400	24
61	15	133	0.1128	0.1500	20
62	15	118	0.1271	0.2100	25
63	18	107	0.1682	0.2100	22
64	8	74	0.1081	0.2100	16
Totals	228	2,416	0.0944	0.1416	342

**Public School Females  
Normal Retirement Experience  
During Calendar Year 2017**

**Female Age-Based Retirement Experience**

<b>Age</b>	<b>Retirements</b>	<b>Exposure</b>	<b>Crude Rates</b>	<b>Current Rates</b>	<b>Expected Retirements</b>
57	79	307	0.2573	0.2800	86
58	60	273	0.2198	0.2800	76
59	51	193	0.2642	0.2800	54
60	40	158	0.2532	0.2800	44
61	40	136	0.2941	0.2800	38
62	47	120	0.3917	0.3600	43
63	22	73	0.3014	0.3000	22
64	14	51	0.2745	0.2700	14
65	86	298	0.2886	0.3500	104
66	48	168	0.2857	0.3500	59
67	31	113	0.2743	0.3000	34
68	15	78	0.1923	0.3000	23
69	10	57	0.1754	0.3000	17
70	10	51	0.1961	0.3500	18
71	3	26	0.1154	0.3000	8
72	1	23	0.0435	0.2200	5
73	1	14	0.0714	0.2200	3
74	2	11	0.1818	0.2200	2
Totals	560	2,150	0.2605	0.3023	650
75 & Over	6	42			42
Totals	566	2,192			692

## Public School Females Early Retirement Experience During Calendar Year 2017

### Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	121	1,423	0.0850	0.1200	171
56	113	1,305	0.0866	0.1200	157
57	66	888	0.0743	0.1200	107
58	69	841	0.0820	0.1200	101
59	86	705	0.1220	0.1300	92
60	80	556	0.1439	0.1700	95
61	63	507	0.1243	0.1700	86
62	67	347	0.1931	0.2300	80
63	66	332	0.1988	0.2300	76
64	53	259	0.2046	0.2300	60
Totals	784	7,163	0.1095	0.1431	1,025

**University Males  
Normal Retirement Experience  
During Calendar Year 2017**

**Male Age-Based Retirement Experience**

<b>Age</b>	<b>Retirements</b>	<b>Exposure</b>	<b>Crude Rates</b>	<b>Current Rates</b>	<b>Expected Retirements</b>
57	1	16	0.0625	0.1200	2
58	1	13	0.0769	0.1200	2
59	5	30	0.1667	0.1200	4
60	1	32	0.0313	0.1200	4
61	4	38	0.1053	0.1200	5
62	8	46	0.1739	0.1200	6
63	8	56	0.1429	0.1200	7
64	5	58	0.0862	0.1200	7
65	30	168	0.1786	0.1500	25
66	31	159	0.1950	0.1700	27
67	24	120	0.2000	0.1600	19
68	10	83	0.1205	0.1600	13
69	8	62	0.1290	0.1600	10
70	17	75	0.2267	0.1600	12
71	6	48	0.1250	0.1800	9
72	7	39	0.1795	0.1400	5
73	13	30	0.4333	0.1400	4
74	3	22	0.1364	0.1000	2
Totals	182	1,095	0.1662	0.1489	163
75 & Over	9	64			64
Totals	191	1,159			227



## University Males Early Retirement Experience During Calendar Year 2017

### Male Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	9	219	0.0411	0.0400	9
56	10	210	0.0476	0.0300	6
57	7	196	0.0357	0.0250	5
58	6	209	0.0287	0.0250	5
59	11	192	0.0573	0.0300	6
60	16	208	0.0769	0.0425	9
61	7	178	0.0393	0.0500	9
62	9	170	0.0529	0.0600	10
63	12	150	0.0800	0.0700	11
64	15	125	0.1200	0.0700	9
Totals	102	1,857	0.0549	0.0425	79

**University Females  
Normal Retirement Experience  
During Calendar Year 2017**

**Female Age-Based Retirement Experience**

<b>Age</b>	<b>Retirements</b>	<b>Exposure</b>	<b>Crude Rates</b>	<b>Current Rates</b>	<b>Expected Retirements</b>
57	7	29	0.2414	0.1400	4
58	6	31	0.1935	0.1200	4
59	5	24	0.2083	0.1000	2
60	2	24	0.0833	0.1150	3
61	4	32	0.1250	0.1600	5
62	2	31	0.0645	0.1400	4
63	10	34	0.2941	0.1850	6
64	5	26	0.1923	0.1300	3
65	27	132	0.2045	0.1800	24
66	30	110	0.2727	0.2200	24
67	16	72	0.2222	0.1700	12
68	14	55	0.2545	0.1550	9
69	8	38	0.2105	0.1350	5
70	8	32	0.2500	0.1800	6
71	2	19	0.1053	0.1800	3
72	2	17	0.1176	0.1800	3
73	-	8	0.0000	0.1800	1
74	-	7	0.0000	0.1800	1
Totals	148	721	0.2053	0.1650	119
75 & Over	5	25			25
Totals	153	746			144

## University Females Early Retirement Experience During Calendar Year 2017

### Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	4	257	0.0156	0.0550	14
56	10	244	0.0410	0.0550	13
57	14	222	0.0631	0.0400	9
58	13	217	0.0599	0.0550	12
59	6	158	0.0380	0.0650	10
60	15	187	0.0802	0.0800	15
61	18	153	0.1176	0.0600	9
62	11	143	0.0769	0.1200	17
63	24	152	0.1579	0.1200	18
64	20	122	0.1639	0.1200	15
Totals	135	1,855	0.0728	0.0712	132

**Protective with Social Security  
Normal Retirement Experience  
During Calendar Year 2017**

**Male and Female Age-Based Retirement Experience**

<b>Age</b>	<b>Retirements</b>	<b>Exposure</b>	<b>Crude Rates</b>	<b>Current Rates</b>	<b>Expected Retirements</b>
50	28	406	0.0690	0.0575	23
51	31	356	0.0871	0.0700	25
52	45	339	0.1327	0.0900	31
53	86	303	0.2838	0.2300	70
54	86	360	0.2389	0.1900	68
55	59	292	0.2021	0.1900	55
56	50	254	0.1969	0.1900	48
57	28	194	0.1443	0.1900	37
58	32	169	0.1893	0.1750	30
59	23	152	0.1513	0.1600	24
60	23	113	0.2035	0.2000	23
61	28	114	0.2456	0.2000	23
62	30	100	0.3000	0.2200	22
63	13	70	0.1857	0.2600	18
64	11	44	0.2500	0.1700	7
65	11	30	0.3667	0.3000	9
66	8	23	0.3478	0.2500	6
67	4	11	0.3636	0.3000	3
68	3	5	0.6000	0.3000	2
69	4	8	0.5000	0.3000	2
70	1	2	0.5000	1.0000	2
71	1	3	0.3333	1.0000	3
72	-	-	N/A	1.0000	-
73	1	2	0.5000	1.0000	2
74	-	1	0.0000	1.0000	1
<b>Totals</b>	<b>606</b>	<b>3,351</b>	<b>0.1808</b>	<b>0.1594</b>	<b>534</b>
<b>75 &amp; Over</b>	<b>-</b>	<b>6</b>			<b>6</b>
<b>Totals</b>	<b>606</b>	<b>3,357</b>			<b>540</b>

**Protective without Social Security  
Normal Retirement Experience  
During Calendar Year 2017**

**Male and Female Age-Based Retirement Experience**

<b>Age</b>	<b>Retirements</b>	<b>Exposure</b>	<b>Crude Rates</b>	<b>Current Rates</b>	<b>Expected Retirements</b>
50	1	53	0.0189	0.0350	2
51	4	68	0.0588	0.0375	3
52	1	72	0.0139	0.0450	3
53	13	85	0.1529	0.1700	14
54	14	64	0.2188	0.2500	16
55	11	53	0.2075	0.2100	11
56	11	40	0.2750	0.2700	11
57	9	37	0.2432	0.3000	11
58	9	25	0.3600	0.3000	8
59	4	12	0.3333	0.3000	4
60	4	14	0.2857	0.2600	4
61	2	6	0.3333	0.1500	1
62	3	9	0.3333	0.2000	2
63	2	4	0.5000	0.4000	2
64	2	4	0.5000	0.4000	2
65	-	1	0.0000	0.4000	-
66	-	1	0.0000	0.4000	-
67	-	-	N/A	0.4000	-
68	-	-	N/A	0.4000	-
69	-	-	N/A	0.4000	-
70	-	-	N/A	1.0000	-
71	-	-	N/A	1.0000	-
72	-	-	N/A	1.0000	-
73	-	-	N/A	1.0000	-
74	-	-	N/A	1.0000	-
<b>Totals</b>	<b>90</b>	<b>548</b>	<b>0.1642</b>	<b>0.1715</b>	<b>94</b>
75 & Over	-	-	N/A		-
<b>Totals</b>	<b>90</b>	<b>548</b>			<b>94</b>

## Executive and Elected Normal Retirement Experience During Calendar Year 2017

### Male and Female Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	1	15	0.0667	0.1200	2
58	-	8	0.0000	0.1200	1
59	-	12	0.0000	0.1200	1
60	8	14	0.5714	0.1200	2
61	1	10	0.1000	0.1200	1
62	2	23	0.0870	0.1200	3
63	9	46	0.1957	0.1200	6
64	6	33	0.1818	0.1200	4
65	6	34	0.1765	0.1200	4
66	9	33	0.2727	0.2000	7
67	3	30	0.1000	0.1500	5
68	5	15	0.3333	0.1500	2
69	4	18	0.2222	0.1000	2
70	9	23	0.3913	0.1000	2
71	1	7	0.1429	0.1000	1
72	1	7	0.1429	0.1500	1
73	-	3	0.0000	0.1500	-
74	2	10	0.2000	0.1500	2
Totals	67	341	0.1965	0.1349	46
75 & Over	3	21			21
Totals	70	362			67

## Executive and Elected Early Retirement Experience During Calendar Year 2017

### Male and Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	-	29	0.0000	0.0300	1
56	3	45	0.0667	0.0300	1
57	-	36	0.0000	0.0300	1
58	3	27	0.1111	0.0300	1
59	1	37	0.0270	0.0300	1
60	2	29	0.0690	0.0500	1
61	5	24	0.2083	0.0500	1
62	-	12	0.0000	0.0200	-
63	-	7	0.0000	0.0200	-
64	1	12	0.0833	0.0200	-
Over 64	3	78	0.0385		
Totals	18	336			7

## Death-in-Service During Calendar Year 2017

### Male

Age	Deaths	Exposure	Crude Rates	Current Rates	Expected Deaths
Under 20	-	20	0.0000	0.0001	-
20-24	-	1,518	0.0000	0.0002	-
25-29	4	7,424	0.0005	0.0002	1
30-34	3	10,385	0.0003	0.0003	3
35-39	2	12,092	0.0002	0.0004	5
40-44	7	12,203	0.0006	0.0005	7
45-49	5	13,903	0.0004	0.0007	10
50-54	9	13,856	0.0006	0.0012	17
55-59	16	12,626	0.0013	0.0024	31
60-64	10	8,246	0.0012	0.0032	26
65-69	3	2,982	0.0010	0.0054	16
70-74	-	790	0.0000	0.0088	7
75 and over	1	2	0.5000	0.0154	-
Totals	60	96,047	0.0006	0.0013	123

### Female

Age	Deaths	Exposure	Crude Rates	Current Rates	Expected Deaths
Under 20	-	49	0.0000	0.0001	-
20-24	-	2,816	0.0000	0.0001	-
25-29	-	13,666	0.0000	0.0001	1
30-34	1	16,871	0.0001	0.0002	3
35-39	-	19,015	0.0000	0.0002	5
40-44	3	19,434	0.0002	0.0004	7
45-49	6	22,148	0.0003	0.0005	12
50-54	7	23,631	0.0003	0.0009	20
55-59	15	22,975	0.0007	0.0014	33
60-64	8	14,055	0.0006	0.0021	29
65-69	1	4,032	0.0002	0.0032	13
70-74	2	808	0.0025	0.0058	5
75 and over	4	-	N/A	0.0106	-
Totals	47	159,500	0.0003	0.0008	128



## **APPENDIX**

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### **GLOSSARY**

## Glossary

**Actuarial Accrued Liability.** The difference between (i) the actuarial present value of future plan benefits, and (ii) the actuarial present value of future normal cost. Sometimes referred to as “accrued liability” or “past service liability.”

**Accrued Service.** The service credited under the plan which was rendered before the date of the actuarial valuation.

**Actuarial Assumptions.** Estimates of future plan experience with respect to rates of mortality, disability, turnover, retirement, rate or rates of investment income and salary increases. Decrement assumptions (rates of mortality, disability, turnover and retirement) are generally based on past experience, often modified for projected changes in conditions. Economic assumptions (salary increases and investment income) consist of an underlying rate in an inflation-free environment plus a provision for a long-term average rate of inflation.

**Actuarial Cost Method.** A mathematical budgeting procedure for allocating the dollar amount of the “actuarial present value of future plan benefits” between the actuarial present value of future normal cost and the actuarial accrued liability. Sometimes referred to as the “actuarial funding method.”

**Actuarial Equivalent.** A series of payments is called an actuarial equivalent of another series of payments if the two series have the same actuarial present value.

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

**Amortization.** Paying off an interest-bearing liability by means of periodic payments of interest and principal, as opposed to paying it off with a lump sum payment.

**Experience Gain (Loss).** A measure of the difference between actual experience and that expected based upon a set of actuarial assumptions during the period between two actuarial valuation dates, in accordance with the actuarial cost method being used.

## Glossary (Concluded)

**Normal Cost.** The annual cost assumed, under the actuarial funding method, for current and subsequent plan years. Sometimes referred to as “current service cost.” Any payment toward the unfunded actuarial accrued liability is not part of the normal cost.

**Plan Termination Liability.** The actuarial present value of future plan benefits based on the assumption that there will be no future accruals for future service and salary. The termination liability will generally be less than the liabilities computed on a “going-concern” basis and is not normally determined in a routine actuarial valuation.

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

**Unfunded Actuarial Accrued Liability.** The difference between the actuarial accrued liability and valuation assets. Sometimes referred to as “unfunded accrued liability.”

**Valuation Assets.** The value of current plan assets recognized for valuation purposes. Generally based on book value plus a portion of unrealized appreciation or depreciation.