Michigan State Employees' Retirement System

Annual Actuarial Valuation Report

September 30, 2018

GRS

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May 2, 2019

Retirement Board
Michigan State Employees' Retirement System
530 W. Allegan
Lansing, Michigan 48933

Re: Michigan State Employees' Retirement System - Actuarial Valuation as of September 30, 2018

Dear Board Members:

The results of the September 30, 2018 actuarial valuation of the Michigan State Employees' Retirement System (SERS) pension benefits are presented in this report. The purpose of the valuation was to measure the System's funding progress and to determine the employer contribution for the 2020-2021 fiscal year and to provide actuarial information for the System's financial report. The report should not be relied upon for any other purpose. This report may be provided to parties other than the Office of Retirement Services (ORS) only in its entirety and only with the permission of the Office of Retirement Services. GRS is not responsible for unauthorized use of this report.

The valuation was based upon information, furnished by the Office of Retirement Services, concerning Retirement System benefits, financial transactions, and active members, terminated members, retirees and beneficiaries. Data was checked for internal and year-to-year consistency, but was not audited by us. As a result, we are unable to assume responsibility for the accuracy or completeness of the data provided. Year 2005 and prior years' valuation results back to 1993 were not prepared by GRS and are presented for comparison with the current year's results.

The valuation summarized in this report involves actuarial calculations that require making assumptions about future events. We believe that the assumptions and methods used in this report are reasonable and appropriate. However, other assumptions and methods could also be reasonable and could result in materially different results. Some of the numbers in this report are rounded. The use of the rounded numbers for plan liabilities should not imply a lack of precision. In addition, because it is not possible or practical to consider every possible contingency, we may use summary information, estimates or simplifications or calculations to facilitate the modeling of future events. We may also exclude factors or data that we deem to be immaterial.

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Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law. Due to the limited scope of this assignment, we did not perform an analysis of the potential range of future measurements. This valuation was based on the assumption that the plan sponsor will continue to be able to make any contributions necessary to fund the plan in the future. A determination of the plan sponsor's ability to make the necessary contributions in the future is beyond the scope of our expertise and was not performed by us.

To the best of our knowledge, this report is accurate and fairly presents the actuarial position of the Retirement System. The valuation was conducted in accordance with standards of practice prescribed by the Actuarial Standards Board and in compliance with the applicable State statutes. Mita D. Drazilov and Louise M. Gates are independent of the plan sponsor and are Members of the American Academy of Actuaries (MAAA) who meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. It is our opinion that the actuarial assumptions used for the valuation produce results which are reasonable.

Sincerely,

Mita Drazilov

Mita D. Drazilov, ASA, FCA, MAAA

Louise Gates

Louise M. Gates, ASA, FCA, MAAA

MDD/LMG:rmn

Table of Contents

Executive Summary/Board Summary

1. Required Employer Contributions to Support Retirement Benefits

The computed employer contribution for fiscal year 2021 is shown below. Computed contributions are displayed as annual dollar amounts. The Retirement System is closed to new members and as a result, contributions expressed as percentages of active member payroll are not useful. We understand that the current policy is to contribute on the basis of the dollar amount shown below plus any reconciliation payments established by subsection 38(5) of the SERS statute.

Contribution $
$665,141,237

2. Contribution Comparison

The chart below compares the results of this valuation of the Retirement System with the results of the prior year's valuation.

Valuation Date	9/30/2017	9/30/2018
Contribution $	$600,597,510	$665,141,237

3. Dedicated Gains Policy

In 2017, the Board adopted a Dedicated Gains Policy. The purpose of the Policy is to reduce the investment return assumption for actuarial valuation purposes if the fiscal year's net market value rate of return exceeds a certain amount. The immediate recognition of the market value return is expected to offset the increase in the computed employer contribution from where it otherwise would have been.

For SERS, the following is applicable:

- For normal cost purposes, the amount of excess investment return is sufficient to cover the increase in the employer normal cost for the first year only.
- The actuarial assumptions used in the Dedicated Gains Policy analysis were the same as those adopted by the Board in connection with the 2012-2017 experience studies (unless otherwise noted).

For the September 30, 2018 valuation, the investment return assumption was reduced from 7.00% to 6.70% as a result of the Policy. Please see page C-3 for additional detail.

4. Reasons for Change

There are three general reasons why contributions 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 predict future occurrences and valuation methods. The third is the difference during the year between the plan's actual experience and what the assumptions predicted.

No benefit changes were reported to the actuary for the year ended September 30, 2018. Assumption and method changes are reflected in this valuation of the System. These changes were made based on the results of the recently completed 5-year Experience Study (2012-2017). These changes are identified in Section E of this report.

Additionally, in accordance with the Dedicated Gains policy, the investment return assumption was lowered from 7.00% to 6.70%. This resulted in an increase in computed liabilities and employer contribution requirements. Finally, System experience for the year was overall favorable and is described in more detail in Section B of this report.

SECTION A

INTRODUCTION

Contribution Requirements

Development of Employer Contributions for the Indicated Valuation Date

	Contributions for	September 30 2017	September 30 2018
(1)	Fiscal Year Ending September 30,	2020	2021
(2)	Total Normal Cost of Benefits (as a % of member pay)	9.39%	9.29%
(3)	Member Contribution %	4.00%	4.00%
(4)	Employer Normal Cost % = (2) - (3)	5.39%	5.29%
(5)	Projected Tier 1 Active Member Payroll for Applicable Fiscal Year	$ 642,890,906	$ 549,109,948
(6)	Employer Normal Cost $ = (4) x (5)	34,651,820	29,047,916
	a. Tier 2 Employer Normal Cost $	10,925,523	8,556,213
	b. Administrative Expenses	0	6,500,000
	c. Total Employer Normal Cost $ = (6) + (6a) + (6b)	$ 45,577,343	$ 44,104,129
(7)	Total Accrued Liability	17,880,548,907	18,995,243,989
(8)	Funding Value of Assets	11,883,784,188	12,494,360,972
(9)	Unfunded Actuarial Accrued Liabilities (UAAL) = (7) - (8)	$ 5,996,764,719	$ 6,500,883,017
	a. Present Value of Future Reconciliation Payments	31,212,180	21,425,910
	b. Net UAAL to be Amortized = (9) - (9a)	$ 5,965,552,539	$ 6,479,457,107
(10)	Amortization Period (years)	17	16
(11)	Amortization Factor (level dollar payments)	10.10108279	9.95669759
(12)	Amortization Payment (Credit)	$ 555,020,167	$ 621,037,108
(13)	Total Computed Employer Contribution = (6c) + (12)	**$ 600,597,510**	**$ 665,141,237**

Computed Employer Contributions

Based on the assumptions outlined in report Section E, the long term employer contribution rate for Tier 1 members of the Michigan State Employees' Retirement System is expected to be 5.29% of payroll (the employer normal cost rate) until the last active member retires. However, there is also an employer normal cost contribution needed to fund the disability and death-in-service benefits for the Tier 2 member population. For the current year, a contribution is also needed to fund the unfunded actuarial accrued liability (UAAL). The sum of these contributions is the computed employer contribution.

The employer contribution determined in this valuation of the System is the computed employer contribution for the fiscal year ended September 30, 2021.

Contribution Requirements

Determining Employer Dollar Contributions

For any period of time, the percent-of-payroll contribution rate needs to be converted to dollars, then promptly contributed to the Retirement System. The employer normal cost rate (expressed as a % of active member payroll) is 5.29%. Applying the employer normal cost contribution rate of 5.29% to the projected payroll for the 2021 fiscal year produces annual employer normal cost contributions of $29,047,916. The Tier 2 annual employer normal cost contributions are $8,556,213. The normal cost contribution for administrative expenses is $6,500,000. The amortization payment for funding the UAAL, $621,037,108, when added together produces a total employer contribution of $665,141,237. This contribution requirement is needed in addition to the reconciliation payment required by subsection 38(5) of the SERS statute.

Disability and Death-In-Service Benefits for Tier 2 Participants

Section 67a of the SERS statute provides that if a Tier 2 participant (defined contribution plan) becomes disabled or dies in employment, there may be a disability pension or survivor pension payable from the defined benefit plan. The pension amount would be based on the regular disability and death-in-service provisions of the defined benefit plan (Tier 1), but would be reduced to reflect the value of the distribution from the participant's defined contribution account. Beginning with the September 30, 2010 annual actuarial valuation, this Tier 2 benefit provision is included in the calculation of liabilities and the employer contribution requirement. In prior years, there was no advance funding for this benefit provision. When a Tier 2 participant became disabled or died in employment and a defined benefit pension was payable, an actuarial loss occurred and future employer contribution requirements were increased.

Discussion of Changes

Revisions in Benefits

There have been no material revisions in plan benefits reported to GRS in connection with this valuation of the Retirement System.

Revisions in Actuarial Assumptions or Methods

Assumption and method changes are reflected in this valuation. These changes were made based on the adoption of the findings of the recently completed 5-year Experience Study (2012-2017) which increased the computed liabilities and contribution requirements. The adoption of the Experience Study assumptions increased the actuarial accrued liability by $632 million as of the valuation date.

Additionally, in accordance with the Dedicated Gains Policy, the investment return assumption was lowered from 7.00% to 6.70% effective with this valuation of SERS. This assumption change increased the actuarial accrued liability by $527 million as of the valuation date.

Actuarial Experience

Actuarial experience during the year ended September 30, 2018 was overall, more favorable than anticipated by the actuarial assumptions. The net actuarial gain was approximately $448 million. The gain was due primarily to recognized investment gains during the last plan year. Pages B-2 and B-3 describe this in detail.

Comment on the Investment Markets

Investment markets continue to be volatile. The actuarial value of assets (funding value), used to determine both the funded status and the required employer contribution, is based on a 5-year smoothed value of assets. This helps to reduce the volatility of the valuation results.

As of September 30, 2018, the actuarial value of assets was approximately 100.8% of the market value of assets. If the September 30, 2018 results were based on the market value of assets instead of the actuarial value of assets, the funded percent of the plan would be 65.3% (instead of 65.8%).

Measures of Financial Soundness

The purpose of this section of the report is to provide certain measures which indicate the financial soundness of the program. These measures relate to long term solvency and level funding.

The various percentages listed in this section as of a single valuation date are not overly significant standing alone. What is more significant is the trend of the rates over a period of years. It is also important to keep in mind that each time benefits or assumptions are revised actuarial liabilities are created or diminished. Any newly created liabilities are financed systematically over a period of future years. All actuarially computed values in this analysis are based on the actuarial assumptions utilized in the respective years' actuarial valuations.

Long Term Solvency

Over the longer term, the solvency of an ongoing plan can be measured by comparing the actuarial value of assets to an amount known as the actuarial accrued liability (AAL) under the Entry Age actuarial cost method. This item has often been called the "past service liability." The AAL may be affected immediately by any revisions in benefits or assumptions. The accumulation of assets to equal the AAL can be considered a long range funding goal. Largely because of periodic benefit increases and poor investment experience since the early 2000's very few retirement programs have attained this goal.

Valuation Date	Actuarial Value of Assets	Actuarial Accrued Liability	% of AAL Covered by Assets
9/30/2018 *	$ 12,494,360,972	$18,995,243,989	65.8%
9/30/2018	12,149,373,822	17,836,467,529	68.1
9/30/2017 *	11,883,784,188	17,880,548,907	66.5
9/30/2017	11,407,392,836	17,107,524,207	66.7

** Revised actuarial assumptions and/or methods.*

The chart above illustrates that the funded percent has decreased since the prior year. Page B-7 of this report shows the funded percent for a longer period and in greater detail. In particular, the funded percent for current benefit recipients is now 80.2% (compared to 82.5% last year).

Measures of Financial Soundness

Level Contributions

The actuarial assumptions and cost methods have been chosen with the intent of producing required employer contributions which remain fairly level. In a closed plan, the normal cost dollar amount will eventually decline as active members retire and terminate employment.

Valuation Date	Employer Normal Cost	Amortization Payment	Total Contribution
9/30/2018 *	$ 44,104,129	$621,037,108	$665,141,237
9/30/2018	42,206,490	541,263,648	583,470,138
9/30/2017 *	45,577,343	555,020,167	600,597,510
9/30/2017	37,300,163	543,945,907	581,246,070

** Revised actuarial assumptions and/or methods.*

A major factor affecting the stability of the contribution requirements shown above is how well the actual plan experience compares to the actuarial assumptions. The value of the difference between what actually occurred and what was assumed to occur is called the actuarial gain or loss. Gains tend to lower the subsequent cost of the program while losses tend to cause subsequent costs to rise.

Year Ending	Actuarial Gain/(Loss)
9/30/2018	$448,265,002
9/30/2017	618,769,225

The experience gain for the year ending September 30, 2018 was 2.5% of the beginning of year actuarial accrued liability.

Analysis of all the benchmarks listed above, over a period of years, will provide an indication of whether the program is becoming financially stronger or weaker.

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 6.70% on the actuarial value of assets), it is expected that:

(1) employer normal cost dollar amounts will eventually decrease as active payroll declines due to the closed nature of the plan,
(2) amortization payment dollar amounts will remain level from fiscal year 2021 through fiscal year 2036,
(3) the unfunded actuarial accrued liability will be fully amortized by September 30, 2036, and
(4) the funded status of the plan will increase gradually towards a 100% funded ratio.

When selecting a contribution allocation procedure, the following three items should be considered, including the balance amongst the three items:

(1) Benefit security,
(2) Intergenerational equity, and
(3) Contribution stability and predictability.

Generally, given the nature of public employee retirement systems (e.g., level contribution financing objective and perceived ongoing nature of the plan or plan sponsor), intergenerational equity and contribution stability and predictability have received more consideration than benefit security when contribution allocation procedures are selected. However, given the importance of benefit security to any retirement system, we suggest that contributions to the System in excess of those presented in this report be considered.

Limitations of Funded Status Measurements

Unless otherwise indicated, a funded status measurement presented in this report is based upon the actuarial accrued liability and the actuarial value of assets. Unless otherwise indicated, with regards 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.
(2) The measurement is inappropriate for assessing the need for or the amount of future employer contributions.
(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.

SECTION B

FUNDING RESULTS

Present Value of Future Benefits and Accrued Liability

Determination of Unfunded Accrued Liability
as of September 30, 2018

	All Divisions
A. Accrued Liability	
1. For retirees and beneficiaries	$ 15,259,101,501
2. For vested and other terminated members[#]	446,094,112
3. For other inactive members*	58,453,014
4. For present active members	
a. Value of expected future benefit payments	3,640,762,696
b. Value of future normal costs	409,167,334
c. Active member accrued liability: (a) - (b)	3,231,595,362
5. Total accrued liability	18,995,243,989
B. Present Valuation Assets (Funding Value)	12,494,360,972
C. Unfunded Accrued Liability: (A.5) - (B)	$ 6,500,883,017
D. Funding Ratio: (B) / (A.5)	65.8%

Includes pending refunds.
* *Liability for employees who transferred to the DC pension plan in connection with PA 264 of 2011.*

Experience Gain/(Loss)

A. Derivation of Actuarial Gain/(Loss):

1.	Unfunded Actuarial Accrued Liability (UAAL) - Previous Valuation	$ 5,996,764,719
2.	Total Normal Cost (employer plus member) for Year Ending 9/30/2018	81,345,915
3.	Total Contributions (employer plus member) for Year Ending 9/30/2018	686,337,886
4.	Interest at 7.0% on:	
	a. UAAL: .07 x (1)	419,773,530
	b. Normal Cost and Contributions: .035 x [(2) - (3)]	(21,174,719)
	c. Net Total: (a) + (b)	398,598,811
5.	Change in UAAL due to Benefit Changes	0
6.	Change in UAAL due to Assumption Changes	1,158,776,460
7.	Expected UAAL Current Year:	
	(1) + (2) - (3) + (4c) + (5) + (6)	6,949,148,019
8.	Actual UAAL Current Year	6,500,883,017
9.	Experience Gain/(Loss): (7) - (8)	$ 448,265,002

B. Approximate Portion of Gain/(Loss) due to Investments $ 478,519,687

C. Approximate Portion of Gain/(Loss) due to Liabilities: (A.9) - (B) $ (30,254,685)

The schedule above shows the net aggregate experience for the System. The next page shows this experience in detail.

Detailed Experience Gain/(Loss)

Gains/(Losses) during the Year Ended September 30, 2018
Resulting from Differences between Assumed and Actual Experience

TYPE OF ACTIVITY

	Gain/(Loss)
1. **Retirements** (including disability retirement). If members retire at older ages or with lower final average pay than assumed, there is a gain. If younger ages or higher average pays, a loss.	$ (25,423,458)
2. **Withdrawal from Employment** (including death-in-service). If more liabilities are released by withdrawals and deaths than assumed, there is a gain. If smaller releases, a loss.	(921,198)
3. **Pay Increases.** If there are smaller pay increases than assumed, there is a gain. If greater increases, a loss.	3,291,228
4. **Investment Income.** If there is greater investment income than assumed, there is a gain. If less income, a loss.	478,519,687
5. **Death After Retirement.** If retirants and inactive vested members live longer than assumed, there is a loss. If not as long, a gain.	(2,674,259)
6. **Rehires.** Rehires into the System will generally result in an actuarial loss.	-
7. **Other.** Miscellaneous gains and losses resulting from data adjustments, timing of financial transactions, etc.	(4,526,998)
8. **Composite Gain/(Loss) During Year.**	**$ 448,265,002**

Experience Gain/(Loss)

Five-Year History
(Amounts Shown in Thousands)

Plan Year Ending September 30	Experience Gain/(Loss)	Gain/(Loss) Due to Investments	Actuarial Value of Investments	Investment Gain/(Loss) as % of Assets
2018	$ 448,265	$ 478,520	$ 12,494,361	3.83%
2017	618,769	726,398	11,883,784	6.11
2016	216,873	235,036	10,937,446	2.15
2015	142,773	145,960	10,416,577	1.40
2014	202,925	258,487	9,961,903	2.59

Plan Year Ending September 30	Gain/(Loss) Due to Liabilities	Actuarial Accrued Liability	Liability Gain/(Loss) as % of Accrued Liability
2018	$ (30,255)	$ 18,995,244	(0.16)%
2017	(107,629)	17,880,549	(0.60)
2016	(18,163)	17,015,799	(0.11)
2015	(3,187)	16,237,490	(0.02)
2014	(55,562)	16,172,938	(0.34)

Historical Funding Levels for Actuarial Accrued Liabilities

(Dollar Amounts Shown in Thousands)

Valuation Date September 30	Actuarial Accrued Liability	Actuarial Value of Assets	Funded Ratio	Unfunded/ (Overfunded) Accrued Liability	Active Member Reported Payroll	Unfunded/(Overfunded) As % of Active Payroll
2005	$12,400,361	$ 9,896,760	79.8%	$ 2,503,601	$ 1,880,179	133.2 %
2006	12,798,520	10,110,658	79.0	2,687,861	1,847,653	145.5
2006 [1]	12,798,520	10,889,925	85.1	1,908,595	1,847,653	103.3
2007	13,161,656	11,343,529	86.2	1,818,126	1,825,889	99.6
2008	13,765,638	11,402,861	82.8	2,362,777	1,763,672	134.0
2009	14,233,710	11,106,969	78.0	3,126,741	1,734,325	180.3
2010	14,527,692	10,782,287	74.2	3,745,405	1,621,709	231.0
2010 [2]	14,860,375	10,782,287	72.6	4,078,088	1,621,709	251.5
2011	15,596,984	10,212,036	65.5	5,384,948	1,276,058	422.0
2012	15,654,138	9,447,057	60.3	6,207,081	1,155,591	537.1
2013	15,647,718	9,437,627	60.3	6,210,091	1,081,729	574.1
2014	15,770,544	9,961,903	63.2	5,808,641	1,010,987	574.6
2014 [2]	16,172,938	9,961,903	61.6	6,211,035	1,010,987	614.4
2015	16,237,490	10,416,577	64.2	5,820,913	922,093	631.3
2016	16,290,506	10,937,446	67.1	5,353,060	850,584	629.3
2016 [2]	17,015,799	10,937,446	64.3	6,078,353	850,584	714.6
2017	17,107,524	11,407,393	66.7	5,700,131	780,135	730.7
2017 [2]	17,880,549	11,883,784	66.5	5,996,765	780,135	768.7
2018	17,836,468	12,149,374	68.1	5,687,094	702,141	810.0
2018 [2]	18,995,244	12,494,361	65.8	6,500,883	702,141	925.9

[1] *Revised asset valuation method,* [2] *Revised actuarial assumptions and/or methods.*

Note that in a closed retirement system the unfunded actuarial accrued liability expressed as a percentage of payroll is expected to increase over time due to the reduction in payroll.

Computed and Actual State Contributions
Historical Comparison

Fiscal Year Ending September 30	Valuation Date September 30	Contribution Rates As Percents of Valuation Payroll	Actual Payroll	Employer Contribution for Fiscal Year	
				Computed [9]	Actual
2007	2006 [7]	N/A	$ 1,783,386,714	$ 238,929,773	$ 192,162,537 [8]
2008	2007	N/A	1,775,357,906	308,019,761	355,732,115
2009	2008	N/A	1,698,833,836	351,646,663	343,787,486
2010	2009	N/A	1,603,842,498	418,427,738	369,952,868
2011	2010	N/A	1,321,472,297	467,008,177	-
2011	2010 [2]	N/A	1,321,472,297	447,924,105	424,546,805
2012	2011	N/A	1,155,756,859	512,615,918	419,926,997
2013	2012 [3]	N/A	1,104,669,153	611,132,218	604,845,495
2014	2013	N/A	1,006,632,785	624,467,122	705,100,454
2015	2014	N/A	946,976,960	614,805,786	-
2015	2014 [2]	N/A	946,976,960	654,515,057	749,332,013
2016	2015	N/A	872,358,155	645,508,641	716,464,627
2017	2015	N/A	792,083,793	645,508,641	703,130,797
2018	2016	N/A	712,450,393	602,196,668	650,739,520
2019 [5]	2016	N/A		537,402,616	
2019 [5]	2016 [2]	N/A		602,196,668	
2020 [5]	2017	N/A		581,246,070	
2020 [5]	2017 [2]	N/A		600,597,510	
2021 [5]	2018	N/A		583,470,138	
2021 [5]	2018 [2]	N/A		665,141,237	

2 *Revised actuarial assumptions and/or methods.*
3 *Revised benefit provisions.*
5 *For the years ending September 30, 2019, September 30, 2020, and September 30, 2021 the actual payroll and actual contributions are not yet known.*
7 *Interest-only funding adopted for one year only.*
8 *Includes transfer from the Health Advance Funding Subaccount.*
9 *Computed amounts do not include reconciliation payments required by subsection 38(5) of the SERS Statute.*

Historical Funding Levels for Prioritized Actuarial Accrued Liability

Valuation Date September 30	Actuarial Accrued Liability ($ in Millions) (1) Active Member Contributions	(2) Retirants and Beneficiaries	(3) Active and Inactive Members (Employer Financed Portion)	Valuation Assets ($ in Millions)	Portion of Actuarial Accrued Liability Covered by Assets (1)	(2)	(3)	(4) [3]
2005	$ 97	$ 7,607	$ 4,696	$ 9,896	100%	100.0%	46.7%	79.8%
2006	107	7,607	5,085	10,111	100	100.0	47.1	79.0
2006 [1]	107	7,607	5,085	10,890	100	100.0	62.5	85.1
2007	116	7,847	5,199	11,344	100	100.0	65.0	86.2
2008	119	8,361	5,286	11,403	100	100.0	55.3	82.8
2009	127	8,681	5,426	11,107	100	100.0	42.4	78.0
2010	138	9,151	5,239	10,782	100	100.0	28.5	74.2
2010 [2]	138	9,265	5,457	10,782	100	100.0	25.3	72.6
2011	93	11,197	4,307	10,212	100	90.4	0.0	65.5
2012	121	11,392	4,141	9,447	100	81.9	0.0	60.3
2013	162	11,612	3,874	9,438	100	79.9	0.0	60.3
2014	195	11,869	3,707	9,962	100	82.3	0.0	63.2
2014 [2]	195	12,149	3,829	9,962	100	80.4	0.0	61.6
2015	220	12,483	3,534	10,417	100	81.7	0.0	64.2
2016	239	12,732	3,320	10,937	100	84.0	0.0	67.1
2016 [2]	239	13,240	3,537	10,937	100	80.8	0.0	64.3
2017	246	13,549	3,313	11,407	100	82.4	0.0	66.7
2017 [2]	246	14,104	3,531	11,884	100	82.5	0.0	66.5
2018	250	14,337	3,249	12,149	100	83.0	0.0	68.1
2018 [2]	250	15,259	3,486	12,494	100	80.2	0.0	65.8

[1] *Revised asset valuation method.*
[2] *Revised actuarial assumptions and/or methods.*
[3] *Percent funded on a total valuation asset and total actuarial accrued liability basis.*

Financial Objective Achievement Indicators
Historical Comparison
(Dollar Amounts in Thousands)

Valuation September 30	Valuation Assets	Termination Indicator [3] Actuarial Present Value of Vested Benefits	Termination Indicator [3] Funded Ratio	Experience Indicator Actuarial Gain/(Loss)
2005	$ 9,896,760	$ 10,886,913	90.9 %	$ (600,525)
2006	10,110,658	12,122,695	83.4	26,951
2006 [1]	10,889,925	12,122,695	89.8	806,218
2007	11,343,529	12,516,362	90.6	181,987
2008	11,402,861	13,144,428	86.8	(436,904)
2009	11,106,969	13,638,715	81.4	(787,953)
2010	10,782,287	13,976,277	77.1	(631,285)
2010 [2]	10,782,287	14,361,594	75.1	(631,285)
2011	10,212,036	15,193,088	67.2	(1,004,765)
2012	9,447,057	15,318,309	61.7	(807,610)
2013	9,437,627	15,338,434	61.5	(96,787)
2014	9,961,903	15,487,041	64.3	202,925
2014 [2]	9,961,903	15,880,526	62.7	202,925
2015	10,416,577	15,971,116	65.2	142,773
2016	10,937,446	16,051,342	68.1	216,873
2016 [2]	10,937,446	16,781,070	65.2	216,873
2017	11,407,393	16,897,115	67.5	618,769
2017 [2]	11,883,784	17,678,267	67.2	618,769
2018	12,149,374	17,659,402	68.8	448,265
2018 [2]	12,494,361	18,792,368	66.5	448,265

[1] *Revised asset valuation method.*

[2] *Revised actuarial assumptions and/or method.*

[3] *Based upon the actuarial assumptions used for funding purposes, including the assumed rate of investment return.*

SECTION C

FUND ASSETS

Statement of Plan Net Assets
(Assets at Market or Fair Value)

	As of September 30th	
	2017	**2018**
Cash	$ 57,817,453	$ 26,072,991
Total Receivables	55,684,732	51,388,655
Short Term Investment Pools	426,591,578	276,698,675
Fixed Income Pools	1,453,061,735	1,492,614,602
Domestic Equity Pools	2,917,490,683	3,249,424,952
Real Estate Pool	1,142,072,540	1,300,164,113
Alternative Investment Pools	1,842,586,252	2,024,051,677
International Equity Pools	2,151,517,016	2,123,880,859
Absolute Return Pools	1,760,540,972	1,855,947,813
Securities Lending Collateral less Obligations	420,409	(150,439)
Total Assets	11,807,783,370	12,400,093,898
Other Liabilities	(724,238)	(2,092,381)
Net Assets Held in Trust for Pension Benefits	**$11,807,059,132**	**$12,398,001,517**

Note: Asset amounts exclude assets held for health benefits.

Reconciliation of Plan Net Assets

	Fiscal Year Ending	
	September 30, 2017	September 30, 2018
Market Value, Beginning of Year	$10,980,342,752	$11,807,059,132
Additions		
Member Contributions	40,838,900	35,598,366
Employer Contributions	703,130,797	650,739,520
Net Investment Income	1,411,669,258	1,273,573,537
Audit Adjustment	0	0
Total Additions	$2,155,638,955	$1,959,911,423
Deductions		
Benefit Payments	1,322,339,410	1,362,275,563
Contribution Refunds/Transfers	298,192	205,121
Administrative Expenses	6,284,973	6,488,354
Total Deductions	1,328,922,575	1,368,969,038
Market Value, End of Year	**$11,807,059,132**	**$12,398,001,517**

Development of Valuation Assets

Year Ended September 30	2018	2019	2020	2021	2022
A. Funding Value Beginning of Year	$ 11,883,784,188				
B. Market Value					
B1. Market Value End of Year	12,398,001,517				
B2. Market Value Beginning of Year	11,807,059,132				
B3. Audit Adjustment	-				
C. Non-Investment Net Cash Flow					
C1. Member Contributions	35,598,366				
C2. Employer Contributions	650,739,520				
C3. Benefit Payments	(1,362,275,563)				
C4. Contribution Refunds / Transfers	(205,121)				
C5. Administrative Expenses	Included in D1				
C6. Total Net Cash Flow: C1 + C2 + C3 + C4 + C5	(676,142,798)				
D. Investment Return					
D1. Market Return Total: B1 - B2 - B3 - C6	1,267,085,183				
D2. Assumed Rate of Return	7.00%	6.70%			
D3. Market Rate of Return	11.05%				
D4. Dedicated Gains Policy Trigger (Excess Return %)	3.76%				
D5. Market Return for Immediate Recognition: D4 x (B2 + B3 + C6/2)	431,233,939				
D6. Assumed Amount of Return: D2 x (A + B3 + C6/2)	808,199,895				
D7. Amount Subject to Phase-In: D1 - D5 - D6	27,651,349				
E. Phased-In Recognition of Investment Return					
E1. Current Year: 0.20 x D7	5,530,270				
E2. First Prior Year	2,257,338	$ 5,530,270			
E3. Second Prior Year	(7,450,439)	2,257,338	$ 5,530,270		
E4. Third Prior Year	(110,351,671)	(7,450,439)	2,257,338	$ 5,530,270	
E5. Fourth Prior Year	157,300,250	(110,351,673)	(7,450,437)	2,257,338	$ 5,530,269
E6. Total Phase-Ins	47,285,748	(110,014,504)	337,171	7,787,608	5,530,269
F. Funding Value End of Year					
F1. Preliminary Funding Value End of Year: A + B3 + C6 + D5 + D6 + E6	$ 12,494,360,972				
F2. Corridor Percent	30%				
F3. Upper Corridor Limit: (100% + F2) x B1	16,117,401,972				
F4. Lower Corridor Limit: (100% - F2) x B1	8,678,601,062				
F5. Funding Value End of Year	$ 12,494,360,972				
G. Difference Between Market and Funding Value	(96,359,455)				
H. Recognized Rate of Return	11.14 %				
I. Market Rate of Return	11.05 %				
J. Ratio of Funding Value to Market Value	1.0078				

Development of Valuation Assets

Year Ended September 30	2013	2014	2015	2016	2017
A. Funding Value Beginning of Year	$ 9,447,057,129	$ 9,437,627,369	$ 9,961,903,019	$ 10,416,577,282	$ 10,937,446,017
B. Market Value					
B1. Market Value End of Year	9,922,516,197	10,974,806,091	10,731,762,400	10,980,342,752	11,807,059,132
B2. Market Value Beginning of Year	9,272,335,930	9,922,516,197	10,974,806,091	10,731,762,400	10,980,342,752
B3. Audit Adjustment	-	-	-	155,455	-
C. Non-Investment Net Cash Flow					
C1. Member Contributions	53,035,321	47,527,233	46,688,372	46,665,882	40,838,900
C2. Employer Contributions	604,845,495	705,100,454	749,332,013	716,464,627	703,130,797
C3. Benefit Payments	(1,187,911,357)	(1,222,881,091)	(1,265,335,477)	(1,289,597,875)	(1,322,339,410)
C4. Contribution Refunds / Transfers	(113,038)	(151,929)	(144,115)	(130,258)	(298,192)
C5. Administrative Expenses	Included in D1	Included in D1	Included in D1	Included in D1	Included in D1
C6. Total Net Cash Flow: C1 + C2 + C3 + C4 + C5	(530,143,579)	(470,405,333)	(469,459,207)	(526,597,624)	(578,667,905)
D. Investment Return					
D1. Market Return Total: B1 - B2 - B3 - C6	1,180,323,846	1,522,695,227	226,415,516	775,022,521	1,405,384,285
D2. Assumed Rate of Return	8.00%	8.00%	8.00%	8.00%	7.50%
D3. Market Rate of Return	13.10%	15.72%	2.11%	7.40%	13.15%
D4. Dedicated Gains Policy Trigger (Excess Return %)	0.00%	0.00%	0.00%	0.00%	5.57%
D5. Market Return for Immediate Recognition: D4 x (B2 + B3 + C6/2)	-	-	-	-	595,489,190
D6. Assumed Amount of Return: D2 x (A + B3 + C6/2)	734,558,827	736,193,976	778,173,873	812,274,714	798,608,405
D7. Amount Subject to Phase-In: D1 - D5 - D6	445,765,019	786,501,251	(551,758,357)	(37,252,193)	11,286,690
E. Phased-In Recognition of Investment Return					
E1. Current Year: 0.20 x D7	89,153,004	157,300,250	(110,351,671)	(7,450,439)	2,257,338
E2. First Prior Year	106,385,047	89,153,004	157,300,250	(110,351,671)	(7,450,439)
E3. Second Prior Year	(96,527,032)	106,385,047	89,153,004	157,300,250	(110,351,671)
E4. Third Prior Year	2,175,737	(96,527,032)	106,385,047	89,153,004	157,300,250
E5. Fourth Prior Year	(315,031,764)	2,175,738	(96,527,033)	106,385,046	89,153,003
E6. Total Phase-Ins	(213,845,008)	258,487,007	145,959,597	235,036,190	130,908,481
F. Funding Value End of Year					
F1. Preliminary Funding Value End of Year: A + B3 + C6 + D5 + D6 + E6	$ 9,437,627,369	$ 9,961,903,019	$ 10,416,577,282	$ 10,937,446,017	$ 11,883,784,188
F2. Corridor Percent		30%	30%	30%	30%
F3. Upper Corridor Limit: (100% + F2) x B1		14,267,247,918	13,951,291,120	14,274,445,578	15,349,176,872
F4. Lower Corridor Limit: (100% - F2) x B1		7,682,364,264	7,512,233,680	7,686,239,926	8,264,941,392
F5. Funding Value End of Year	$ 9,437,627,369	$ 9,961,903,019	$ 10,416,577,282	$ 10,937,446,017	$ 11,883,784,188
G. Difference Between Market and Funding Value	484,888,828	1,012,903,072	315,185,118	42,896,735	(76,725,056)
H. Recognized Rate of Return	5.67 %	10.81 %	9.50 %	10.31 %	14.32 %
I. Market Rate of Return	13.10 %	15.72 %	2.11 %	7.40 %	13.15 %
J. Ratio of Funding Value to Market Value	0.9511	0.9077	0.9706	0.9961	1.0065

History of Approximate Investment Return Rates

Plan Year Ending September 30	Approximate Rate of Return [1] Market	Approximate Rate of Return [1] Actuarial
2009	(7.17) %	1.96 %
2010	10.56	1.82
2011	4.11	0.67
2012	15.91	(0.63)
2013	13.10	5.67
2014	15.72	10.81
2015	2.11	9.50
2016	7.40	10.31
2017	13.15	14.32
2018	11.05	11.14
Average Returns:		
Last five years:	9.78 %	11.20 %
Last ten years:	8.37 %	6.44 %

[1] *Approximate return based on ratio of total investment return to average asset value, using an assumed beginning-of-year timing of audit adjustments (if any) and an assumed mid-year timing of other asset flows (see previous two pages).*

Historical Growth of Assets at Market Value

Fiscal Year Ended September	Revenues by Source: Member Contributions	Employer Contributions	Net Investment Income [1]	Expenses by Type: Retirement Benefits	Return of Contributions and Transfers	Administrative Expenses	Market Value of Assets
1999	$ 6,186,018	$ 121,119,857	$ 1,465,196,232	$ 446,219,254	$728,366	$ 4,330,623	$ 10,224,880,606
2000	4,606,662	121,817,366	1,359,608,718	458,803,774	222,163	3,954,992	11,247,932,423
2001	3,341,381	112,299,808	(1,264,290,456)	478,525,328	91,699	4,149,284	9,616,516,845
2002	173,232,835	87,486,128	(1,005,732,436)	503,453,879	87,504,459 [2]	6,432,819	8,274,112,215
2003	80,185,475	79,291,845	1,215,018,189	701,664,432	17,484,652 [2]	5,192,039	8,924,266,601
2004	37,682,883	103,873,294	1,073,759,972	731,009,109	(24,206,316) [2]	4,316,433	9,428,463,524
2005	30,395,040	256,433,052	1,168,692,344	746,673,263	187,049	4,297,985	10,132,825,663
2006	9,434,310	270,705,017	1,248,722,460	767,000,706	133,474	4,628,043	10,889,925,227
2007	19,696,132	150,858,506	1,802,354,022	795,842,013	(41,180,003) [2]	5,115,226	12,103,056,651
2008	5,643,805	355,732,115	(1,840,403,196)	832,553,176	183,559	5,048,737	9,786,243,903
2009	6,994,975	343,787,486	(678,455,022)	870,278,863	272,631	4,865,232	8,583,154,616
2010	26,055,668	369,952,868	883,646,242	917,328,820	265,155	5,073,446	8,940,141,973
2011	25,830,556	424,546,805	360,430,046	1,089,822,880	472,818	6,079,017	8,654,574,665
2012	33,290,784	419,926,997	1,330,021,741	1,156,035,451	188,926	9,253,880	9,272,335,930
2013	53,035,321	604,845,495	1,185,982,164	1,187,911,357	113,038	5,658,318	9,922,516,197
2014	47,527,233	705,100,454	1,529,625,883	1,222,881,091	151,929	6,930,656	10,974,806,091
2015	46,688,372	749,332,013	232,643,264	1,265,335,477	144,115	6,227,748	10,731,762,400
2016	46,665,882	716,464,627	781,806,695	1,289,597,875	130,258	6,628,719	10,980,342,752
2017	40,838,900	703,130,797	1,411,669,258	1,322,339,410	298,192	6,284,973	11,807,059,132
2018	35,598,366	650,739,520	1,273,573,537	1,362,275,563	205,121	6,488,354	12,398,001,517

[1] *Includes miscellaneous income and is net of investment expenses.*

[2] *Includes transfers to/from the Health Advance Funding Subaccount.*

Note: Data for the year 2007 and prior years was provided by the State of Michigan Department of Technology, Management and Budget - Financial Services.

SECTION D

CENSUS DATA

Summary of Participant Data by Category

	As of September 30	
	2017	**2018**
Retirees and beneficiaries currently receiving benefits:		
Regular benefits	48,987	49,385
Survivor benefits	7,377	7,364
Disability benefits	3,320	3,261
Total	59,684	60,010
Current Employees:		
Vested	10,319	9,025
Non-vested	140	103
Total	10,459	9,128
Inactive participants entitled to benefits and not yet receiving them*:	3,986	3,817
Total Participants	74,129	72,955

* *Includes members who have chosen to participate in Group 3 (DB/DC Blend) and have not yet commenced their pension benefits.*

Retirees and Beneficiaries – Historical Comparison

Year Ended September 30	Number Added	Number Removed	Rolls End of Year: Number	Rolls End of Year: Annual Benefit [1]	% Increase in Annual Benefits	Average Annual Benefit
1999	1,409	1,248	36,346	$ 444,167	2.7 %	$ 12,221
2000	1,540	1,181	36,705	463,969	4.5	12,640
2001	1,648	1,242	37,111	471,407	1.6	12,703
2002 [2]	3,806	1,251	39,666	546,968	16.0	13,789
2003 [2]	6,448	623	45,491	708,607	29.6	15,577
2004	1,561	1,433	45,619	729,087	2.9	15,982
2005	1,542	1,360	45,801	747,428	2.5	16,319
2006	1,728	1,549	45,980	769,096	2.9	16,727
2007	2,206	1,300	46,886	802,018	4.3	17,106
2008	2,653	1,461	48,078	842,612	5.1	17,526
2009	2,423	1,472	49,029	880,763	4.5	17,964
2010	2,937	1,504	50,462	934,092	6.1	18,511
2011 [2]	6,656	1,470	55,648	1,113,963	19.3	20,018
2012	2,186	1,546	56,288	1,143,400	2.6	20,313
2013	2,181	1,615	56,854	1,175,329	2.8	20,673
2014	2,421	1,660	57,615	1,212,333	3.1	21,042
2015	2,490	1,652	58,453	1,254,602	3.5	21,463
2016	2,306	1,721	59,038	1,290,760	2.9	21,863
2017	2,452	1,806	59,684	1,331,385	3.1	22,307
2018	2,224	1,898	60,010	1,366,045	2.6	22,764

[1] *Amounts shown in thousands of dollars.*
[2] *Early Retirement Incentive (ERI) program*

Retirees and Beneficiaries
as of September 30, 2018
By Type of Retirement and Selected Option

Amount of Monthly Benefit	Number of Retirees	Type of Retirement*							
		1	2	3	4	5	6	7	8
$ 1 - 200	322	226	56	1	24	5	4	3	3
201 - 400	1,739	1,263	224	9	160	2	44	3	34
401 - 600	3,081	2,059	398	22	367	0	115	8	112
601 - 800	4,012	2,373	528	72	605	12	185	27	210
801 - 1,000	4,173	2,504	654	10	534	1	195	48	227
1,001 - 1,200	4,192	2,573	483	13	550	1	179	141	252
1,201 - 1,400	4,096	2,525	381	8	530	2	186	250	214
1,401 - 1,600	4,228	2,660	424	11	470	1	178	340	144
1,601 - 1,800	4,469	2,954	431	10	331	0	143	502	98
1,801 - 2,000	4,346	3,149	326	8	174	1	95	540	53
Over 2,000	25,352	19,623	992	10	225	0	235	4,162	105
Totals	**60,010**	**41,909**	**4,897**	**174**	**3,970**	**25**	**1,559**	**6,024**	**1,452**

Amount of Monthly Benefit	Number of Retirees	Selected Option**							
		Reg.	Opt. A	Opt. B	Opt. C	Opt. E	Opt. E1	Opt. E2	Opt. E3
$ 1 - 200	322	118	92	74	8	20	6	4	0
201 - 400	1,739	730	495	332	47	76	31	26	2
401 - 600	3,081	1,340	891	493	85	143	45	75	9
601 - 800	4,012	1,709	1,090	631	115	255	82	122	8
801 - 1,000	4,173	1,504	1,076	739	116	413	103	205	17
1,001 - 1,200	4,192	1,543	1,085	642	134	459	99	195	35
1,201 - 1,400	4,096	1,675	1,132	522	165	342	72	153	35
1,401 - 1,600	4,228	1,810	1,245	545	183	260	80	82	23
1,601 - 1,800	4,469	1,840	1,442	676	238	151	66	43	13
1,801 - 2,000	4,346	1,821	1,318	723	260	115	58	40	11
Over 2,000	25,352	10,712	7,231	4,356	1,933	556	242	222	100
Totals	**60,010**	**24,802**	**17,097**	**9,733**	**3,284**	**2,790**	**884**	**1,167**	**253**

*** Type of Retirement**

1 – Normal retirement for age & service
2 – Survivor payment – normal or early retirement
3 – Duty disability retirement (incl. survivors)
4 – Non-duty disability retirement (incl. survivors)
5 – Survivor payment – duty death in service
6 – Survivor payment – non-duty death in service
7 – Retirees with supplemental benefits for early retirement incentive factors
8 – Retirees with reduced benefits for early retirement reduction factors

**** Selected Option**

Reg. – Straight life allowance
Opt. A – 100% survivor option
Opt. B – 50% survivor option
Opt. C – 75% survivor option
Opt. E – Social Security equated
Opt. E1 – Social Security equated w/100% survivor option
Opt. E2 – Social Security equated w/50% survivor option
Opt. E3 – Social Security equated w/75% survivor option

Active Members by Classification

	September 30, 2017	September 30, 2018
Conservation Officers		
Number	42	33
Average Age	49.4	49.0
Average Service	23.2	23.3
Reported Payroll	$ 3,885,458	$ 2,856,540
Average Annual Payroll	92,511	86,562
Corrections Officers		
Number	2,382	1,975
Average Age	51.6	52.0
Average Service	25.7	26.3
Reported Payroll	$ 171,412,497	$ 147,792,444
Average Annual Payroll	71,962	74,832
All Other		
Number	8,035	7,120
Average Age	56.2	56.7
Average Service	28.5	29.2
Reported Payroll	$604,836,569	$ 551,492,347
Average Annual Payroll	75,275	77,457
Total		
Number	10,459	9,128
Average Age	55.1	55.6
Average Service	27.8	28.5
Reported Payroll	$780,134,524	$702,141,331
Average Annual Payroll	74,590	76,922

Active Members

Members in Active Service as of September 30, 2018
by Age and Years of Service

Age	Years of Service 0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 & up	Total Count	Total Payroll[1]	Average Pay
Less than 30	-	-	-	-	-	-	-	-	$ -	$ -
30 - 34	-	-	-	-	-	-	-	-	-	-
35 - 39	-	-	2	-	-	-	-	2	153,000	76,500
40 - 44	1	14	25	43	121	31	-	235	17,548,608	74,675
45 - 49	2	28	37	90	767	405	69	1,398	106,368,308	76,086
50 - 54	-	26	32	76	712	956	634	2,436	189,534,951	77,806
55 - 59	-	18	32	70	452	814	1,162	2,548	194,194,842	76,215
60 - 64	-	11	28	49	227	368	1,077	1,760	133,465,251	75,833
65 - 69	-	3	9	8	56	121	388	585	47,663,821	81,477
70 & up	-	-	3	4	14	21	122	164	13,212,550	80,564
Total	**3**	**100**	**168**	**340**	**2,349**	**2,716**	**3,452**	**9,128**	**$ 702,141,331**	**$76,922**

[1] *Total payroll for Group 1 active members is $691,111,108 and total payroll for Group 2 active members is $11,030,223.*

Active and Inactive Members Reported for Valuation
Historical Comparison

Valuation Date September 30	Number of Inactive Vested Members[2]	Active Members					
				Average			
		Number	Reported Payroll[1]	Annual Pay	% Increase	Age	Years of Service
1999	7,376	49,612	$ 2,213,851	$ 44,623	5.2 %	45.9	15.8
2000	7,556	47,778	2,253,818	47,173	5.7	46.7	16.7
2001	8,809	45,852	2,230,562	48,647	3.1	47.4	17.7
2002	7,917	43,064	2,133,477	49,542	1.8	48.0	18.6
2003	7,528	36,536	1,859,555	50,897	2.7	47.7	17.9
2004	7,397	34,749	1,889,410	54,373	6.8	48.4	19.0
2005	7,200	33,770	1,880,179	55,676	2.4	49.3	20.0
2006	7,217	32,575	1,847,653	56,720	1.9	50.1	21.0
2007	6,663	30,864	1,825,889	59,159	4.3	50.8	21.8
2008	6,912	28,568	1,763,672	61,736	4.4	51.4	22.7
2009	6,613	27,455	1,734,325	63,170	2.3	52.1	23.5
2010	6,243	25,478	1,621,709	63,651	0.8	52.6	24.1
2011	6,094	19,650	1,276,058	64,939	2.0	51.9	23.3
2012	6,271	17,860	1,155,591	64,703	(0.4)	52.5	24.2
2013	5,343	16,466	1,081,729	65,695	1.5	53.2	25.0
2014	5,007	14,985	1,010,987	67,467	2.7	53.7	25.8
2015	4,606	13,404	922,093	68,792	2.0	54.2	26.5
2016	4,295	11,965	850,584	71,089	3.3	54.7	27.2
2017	3,986	10,459	780,135	74,590	4.9	55.1	27.8
2018	3,817	9,128	702,141	76,922	3.1	55.6	28.5

1 *Amounts shown in thousands of dollars.*
2 *Includes Group 3 members.*

SECTION E

METHODS AND ASSUMPTIONS

Valuation Methods

Actuarial Cost Method - Normal cost and the allocation of benefit values between service rendered before and after the valuation date was determined using an Individual Entry-Age Actuarial Cost Method having the following characteristics:

(i) the annual normal cost for each individual active member, payable from the date of employment to the date of retirement, is sufficient to accumulate the value of the member's benefit at the time of retirement; and

(ii) each annual normal cost is a constant percentage of the member's year by year projected covered pay.

Actuarial gains (losses), as they occur, reduce (increase) the Unfunded Actuarial Accrued Liability.

Financing of Unfunded Actuarial Accrued Liabilities - Unfunded actuarial accrued liabilities (full funding credit if assets exceed liabilities) were amortized by level (principal and interest combined) dollar contributions over a reasonable period of future years.

Present Value of Future Reconciliation Payments – Subsection 38(5) of the SERS statute provides for a process to reconcile actual employer contributions to the required employer contribution requirements. In order to avoid duplication of the employer contributions, the present value of future reconciliation payments is subtracted from the unfunded actuarial accrued liability. The net unfunded actuarial accrued liability is then amortized, resulting in the required amortization payment. Please refer to page A-1 and page E-8 for additional information.

Actuarial Value of System Assets - The actuarial value of assets recognizes assumed investment income fully each year. Differences between actual and assumed investment income are phased in over a closed five-year period. During periods when investment performance exceeds the assumed rate, actuarial value of assets will tend to be less than market value. During periods when investment performance is less than the assumed rate, actuarial value of assets will tend to be greater than market value. The actuarial value of assets is not permitted to deviate from the market value of assets by more than 30%.

Valuation Assumptions

In accordance with section 38(1) of the SERS statute (Act 240 of the Public Acts of 1943, as amended), the actuarial assumptions are adopted by the Retirement Board and the Department of Management and Budget after consultation with the actuary and investment counsel. The actuarial assumptions were based upon the results of an Experience Study for SERS covering the period October 1, 2012 through September 30, 2017. A report dated June 29, 2018 presented the results of the Experience Study. In addition, the investment return assumption was updated again beginning with the September 30, 2018 valuation in accordance with the Dedicated Gains Policy adopted by the Board of Trustees. The actuarial assumptions represent estimates of future experience.

The rate of investment return was 6.70% a year, compounded annually net of investment expenses. The 6.70% assumption was first used for the September 30, 2018 valuation of the System. The assumed real rate of investment return is the rate of investment return in excess of either wage inflation or price inflation. Considering a wage inflation assumption of 2.75% and a price inflation assumption of 2.25%, the 6.70% nominal rate of investment return translates into a real rate of investment return of 3.95% over wage inflation and 4.45% over price inflation.

The rates of salary increase used for individual members are in accordance with the table below. This assumption is used to project a member's current pay to the pay upon which System benefits will be based. These rates were first used for the September 30, 2018 valuation of the System.

	Salary Increase Assumptions For an Individual Member		
Sample Ages	**Merit & Seniority**	**Base (Economy)**	**Increase Next Year**
20	9.00%	2.75%	11.75%
25	6.00	2.75	8.75
30	2.60	2.75	5.35
35	1.20	2.75	3.95
40	0.80	2.75	3.55
45	0.50	2.75	3.25
50	0.40	2.75	3.15
55	0.40	2.75	3.15
60	0.00	2.75	2.75
65	0.00	2.75	2.75
Ref	326		

The charts shown in this section of the report may include a reference number (for example, 326 is used above). These reference numbers are used by GRS to track and identify assumption tables.

Valuation Assumptions

The mortality tables: The mortality tables used in this valuation of the System are described below:

Healthy Male Retirees:	RP-2014 Male Healthy Annuitant Mortality Table scaled by 93% and adjusted for mortality improvements using projection scale MP-2017 from 2006.
Healthy Female Retirees:	RP-2014 Female Healthy Annuitant Mortality Table scaled by 98% and adjusted for mortality improvements using projection scale MP-2017 from 2006.
Disabled Male Retirees:	RP-2014 Male Disabled Annuitant Mortality Table scaled by 100% and adjusted for mortality improvements using projection scale MP-2017 from 2006.
Disabled Female Retirees:	RP-2014 Female Disabled Annuitant Mortality Table scaled by 100% and adjusted for mortality improvements using projection scale MP-2017 from 2006.
Male Active Members:	RP-2014 Male Employee Mortality Table scaled by 100% and adjusted for mortality improvements using projection scale MP-2017 from 2006.
Female Active Members:	RP-2014 Female Employee Mortality Table scaled by 100% and adjusted for mortality improvements using projection scale MP-2017 from 2006.

Sample Attained Ages	Future Life Expectancy (years)*					
	Healthy Pre-Retirement		Healthy Post-Retirement		Disabled Retirement	
	Men	Women	Men	Women	Men	Women
45	41.38	45.66	39.97	42.09	27.46	32.68
50	36.17	40.46	35.04	37.08	24.23	28.67
55	31.08	35.34	30.26	32.14	21.11	24.86
60	26.16	30.34	25.68	27.39	18.11	21.36
65	21.54	25.45	21.33	22.85	15.28	17.97
70	17.26	20.68	17.22	18.52	12.55	14.59
75	13.30	16.12	13.39	14.48	9.93	11.44
80	9.75	11.82	9.97	10.85	7.56	8.71

* *Life expectancy in future years is determined by the fully generational MP-2017 projection scale. The sample values shown are for individuals with the indicated attained ages in 2018.*

Valuation Assumptions

The rates of regular retirement used to measure the probability of eligible members retiring with an unreduced benefit during the next year are shown below. The corrections officers assumption was first used for the September 30, 2018 valuation of the System.

Retirement Ages	Percent of Eligible Members Retiring		
	Conservation Officers	Corrections Officers	Others
45	28%		
46	28		
47	28		
48	28		
49	28		
50	28		
51	28	35%	
52	28	30	
53	28	20	
54	28	20	
55	28	23	15%
56	28	25	14
57	28	25	10
58	28	18	10
59	28	18	11
60	28	18	14
61	28	18	13
62	50	32	22
63	40	24	19
64	40	22	16
65	60	25	25
66	50	50	22
67	50	50	21
68	50	50	20
69	50	50	22
70	100	100	50
71	100	100	60
72	100	100	70
73	100	100	80
74	100	100	90
75	100	100	100
Ref	1603	2840	1605

Note: For Conservation Officers, 40% are assumed to retire in their first year of eligibility for unreduced benefits (completion of 25 years of service).

Valuation Assumptions

The rates of early retirement used to measure the probability of eligible members retiring with reduced retirement benefits during the next year are shown below. These rates were first used for the September 30, 2018 valuation of the System.

Retirement Ages	Percent of Eligible Members Retiring
55	3.0%
56	3.0
57	3.0
58	3.5
59	3.5
Ref	2839

The rates of separation from active membership used in the valuation are shown below (rates do not apply to members eligible to retire and do not include separation on account of death or disability). This assumption measures the probabilities of members remaining in employment, and was first used for the September 30, 2018 actuarial valuation of the System.

Sample Ages	Years of Service	Percent Separating Within Next Year
All	0	17.00 %
	1	12.00
	2	8.00
	3	5.50
	4	4.50
20	5 & Over	4.00
25		3.50
30		2.82
35		2.38
40		2.06
45		1.84
50		1.68
55		1.60
60		1.60
Ref	1138	1291

Valuation Assumptions

Rates of disability among active members used in the valuation are shown below, and were first used for the September 30, 2010 valuation of the System.

Sample Ages	Percent Becoming Disabled Within Next Year	
	Non-Duty Disability	Duty Disability
25	0.03%	0.00%
30	0.05	0.01
35	0.10	0.01
40	0.20	0.02
45	0.34	0.04
50	0.47	0.06
55	0.92	0.08
60	2.10	0.11
65	2.30	0.16
Ref.	571	14 x .20

Unknown Data:

- Retired members with unknown gender were assumed to be female.
- Active members with unknown dates of birth were assumed to have an entry-age equal to 27.
- Active members with non-zero service who were reported without any annual pay were assumed to have pay equal to the average pay of the remaining active group.
- Frozen defined benefit amounts were estimated for active members who elected to participate in the DC Plan prospectively as a result of PA 264, when not supplied.
- Accrued benefits were estimated for inactive participants based upon the service and final average compensation provided in the data. If final average compensation was not supplied, the member was assumed to have a final average compensation equal to that of the average of the remaining group.
- Service amounts for Inactive members reported with zero service were assumed to have 10 years of service, the minimum requirement to vest.

Miscellaneous and Technical Assumptions

Administrative Expenses	Administrative expenses are funded through an addition to the normal cost (approximately $6.5 million).
Benefit Service	Exact fractional service is used to determine the amount of benefit.
Decrement Operation	Disability and withdrawal decrements do not operate during retirement eligibility.
Decrement Timing	Decrements of all types are assumed to occur mid-year.
Defined Contribution (DC) Member Account Balance	For purposes of determining the Tier 2 death and disability benefit contribution for the DC member account balance of Tier 2 members, a total contribution rate (employer and employee combined) of 9.40% per year was used. In addition, for valuation purposes, the interest rate credited on the DC member account balance is set equal to the valuation interest rate assumption.
Eligibility Testing	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
Employee Contributions	Employee contributions were credited with interest at 3.5% per year.
Forfeitures	For vested separations from service, it is assumed that 0% of members separating will withdraw their contributions and forfeit an employer financed benefit. It was further assumed that the liability at termination is the greater of the vested deferred benefit (if any) or the member's accumulated contributions.
Incidence of Contributions	Contributions are assumed to be received continuously throughout the year.
Liability Adjustments	Retirement liabilities were increased by 1% to account for unused vacation time. Inactive vested member liabilities were increased by 2% to reflect the value of the death benefit provision.
Marriage Assumption	75% of males and 60% of females were assumed to be married for purposes of death-in-service benefits. Male spouses are assumed to be three years older than female spouses for active member valuation purposes.
Normal Form of Benefit	A straight life benefit is the normal form of benefit.
Pay Increase Timing	Pay increases were assumed to be at the beginning of the fiscal year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.

Miscellaneous and Technical Assumptions

Reconciliation Payments

ORS provided the following schedule of reconciliation payments. For purposes of determining the present value of the reconciliation payments, it was assumed that payments occur in the middle of the fiscal year.

Fiscal Year	Reconciliation Payment/(Credit)
2019	$ 4,003,464
2020	5,327,740
2021	5,025,880
2022	4,724,021
2023	3,335,264
2024	3,123,980

Service Credit Accruals

Members were assumed to accrue 1 year of service credit per year.

Service Purchase Load

Per ORS, $7,176,899 has been reported for purchased service that has not been paid for yet by the members. This amount was included in the accrued liability, to account for the amounts included in the plan's reported assets for purchased service

SECTION F

PLAN PROVISIONS

Plan Provisions as of September 30, 2018

On December 15, 2011, the Governor signed Public Act 264 of 2011 into law. The legislation granted members a one-time opportunity to choose their future retirement plan which resulted in three distinct benefit groups within the State Employees' Retirement System Defined Benefit (DB) pension plan.

Group 1: DB Classified: Members who elected to remain in the DB plan for future years of service and contribute 4% of their annual compensation to the pension fund until they terminate state employment. The 4% member contributions began on April 1, 2012.

Group 2: DB 30: Members who elected to remain in the DB plan for future years of service and contribute 4% of pay until they complete 30 years of service. When they complete 30 years of service, they will switch to the State's Defined Contribution (DC) pension plan. The 4% member contributions began on April 1, 2012, and will continue until they switch to the DC plan or terminate state employment, whichever comes first.

Group 3: DB/DC Blend: Members who chose not to pay the 4% contributions and therefore became active participants in the DC pension plan for future years of service beginning April 1, 2012.

Group 2 and Group 3 members may be eligible to receive a pension benefit from the SERS DB plan based on service, compensation and the retirement benefit formula in effect as of their date of transfer into the DC plan. This benefit is payable upon meeting the retirement or other eligibility conditions of the DB plan.

<u>Regular Retirement</u> (no reduction factor for age):

<u>Eligibility</u> - Age 55 with 30 years of service; or age 60 with 10 or more years of service. Unclassified Legislative employees, Executive Branch employees, or Judicial Branch employees are eligible for full retirement at age 60 with 5 or more years of service. Corrections Officers may retire at age 51 with 25 or more years of service; or age 56 with 10 or more years of service (the last 3 years must be in a covered position). Conservation Officers may retire after 25 years of service regardless of age. If a Conservation Officer is hired before 4/1/1991, 20 of the 25 years must be as a Conservation Officer. For those hired after 4/1/1991, 23 of the 25 years must be as a Conservation Officer (the last 2 years must be as a Conservation Officer).

<u>Final Average Compensation</u> - Regular retirement benefit is based on Final Average Compensation (FAC), which is usually the average of highest 3 consecutive years (2 years for Conservation Officers).

<u>Annual Amount</u> - Total service times 1.5% of FAC. For members with 20 or more years of service, a $3,000 minimum annual benefit is payable. Corrections Officers receive an additional temporary supplement to age 62 equal to the product of supplemental service times 0.5% of FAC. Conservation Officers retiring after 25 years receive a benefit equal to 60% of FAC. For eligible Group 2 and Group 3 members, the benefit amount (regular retirement and any supplemental benefit) is determined as of the date of transfer to the DC pension plan, based on FAC and service at the time of transfer.

Plan Provisions as of September 30, 2018

Early Retirement (age reduction factor used):

Eligibility - Age 55 with 15 or more years of service.

Annual Amount - Computed as described above under "regular retirement" but reduced by ½ % for each month under age 60.

Deferred Retirement (vested benefit):

Eligibility - 10 years of service (5 years for unclassified persons in the executive or legislative branch). Benefit commences at age 60.

Annual Amount - Computed as described above under "regular retirement" based on service and FAC at termination of State employment for Group 1.

Duty Disability Retirement:

Eligibility - No age or service requirement.

Annual Amount - Disability age 60+: Computed as a regular retirement benefit with minimum benefit based on 10 years of service. Disability prior to age 60: To age 60, benefit is computed as a regular retirement benefit using service at the time of disability retirement with a minimum benefit of $6,000 per year. Additional limitation such that benefit plus workers' compensation does not exceed final compensation. At age 60, benefit is recomputed as a regular retirement benefit with service granted for period in receipt of disability benefit before age 60. If the member dies before age 60, benefits are payable to a surviving spouse computed as a regular retirement benefit but based on service at time of disability retirement plus elapsed time between date of retirement and death. Eligible Group 2 and Group 3 members may elect this benefit (in lieu of PA 264 benefits).

Non-Duty Disability Retirement:

Eligibility - 10 years of service.

Annual Amount - Computed as regular retirement benefit based on service and FAC at time of disability. Minimum annual benefit is $600. Eligible Group 2 and Group 3 members may elect this benefit (in lieu of PA 264 benefits).

Plan Provisions as of September 30, 2018

<u>Duty Death Before Retirement</u>:

<u>Eligibility</u> - No age or service requirement.

<u>Annual Amount</u> - Surviving spouse receives annual benefit computed as a regular retirement benefit as if the deceased member retired the day before date of death and elected Option A. Benefit is based on member's service at time of death, or 10 years of service, whichever is greater. A minimum benefit of $6,000 per year is payable. Children under age 21 each receive an equal share of 1/2 of the benefit payable (surviving spouse receives the other 1/2), to a maximum of 1/2 for all children. A given child's share of benefits terminates upon the child's marriage, death or attainment of age 21. In the event that there is no surviving spouse, the benefit is allocated equally among all children subject to the limitations described above. In the event that there is no surviving spouse or eligible children, benefits may be paid to an eligible, dependent parent. Benefits end upon the marriage or death of the surviving parent. Additional limitation such that benefit plus workers' compensation does not exceed final compensation. Eligible Group 2 and Group 3 members may elect this benefit (in lieu of PA 264 benefits).

<u>Non-Duty Death Before Retirement</u>:

<u>Eligibility</u> - 10 years of service. In the case of a deceased vested former member, the survivor benefit commences when the deceased former member would have attained age 60.

<u>Annual Amount</u> - Computed as a regular retirement benefit but reduced in accordance with a 100% Joint and Survivor form of payment. Eligible Group 2 and Group 3 members may elect this benefit (in lieu of PA 264 benefits).

<u>Post Retirement Cost-of-Living Adjustments (COLA)</u>:

One-time upward adjustments have been made in 1972, 1974, 1976, 1977, and 1987. Beginning in 1983 some benefit recipients share in a distribution of a portion of investment income earned in excess of 8% annually (supplemental payment). Beginning in 1988 all benefit recipients are eligible for automatic 3% annual (non-compounded) benefit increases, with a maximum $300 annual increase. Eligibility for the above benefits:

Retired before October 1, 1987 - Greater of supplemental payment or the combination of the 1987 one-time adjustment and the automatic increases.
Retired on or after October 1, 1987 - Automatic increases only.

Eligible members of Groups 1, 2 and 3 receive automatic post retirement COLA.

Plan Provisions as of September 30, 2018

Member Contributions:

Group 1 Members: 4% of annual pay effective April 1, 2012.

Group 2 Members: 4% of annual pay effective April 1, 2012 until the date of transfer to DC pension plan.

Group 3 Members: N/A

Defined Contribution Legislation (Public Act 487 of 1996):

New state employees hired on or after March 31, 1997 become participants in Tier 2 (*i.e.*, a defined contribution plan) rather than Tier 1 (*i.e.*, the above described defined benefit plan).

Active members on March 30, 1997 could irrevocably elect to terminate membership in Tier 1 and become participants in Tier 2. Elections had to be in writing and submitted between January 2, 1998 and April 30, 1998. Such members became Tier 2 participants on June 1, 1998, and had the actuarial present value of their Tier 1 accrued benefit transferred into Tier 2 by November 30, 1998.

An actuarially calculated supplemental disability or death-in-service benefit may be payable if a Tier 2 participant becomes disabled or dies in service.

Former Tier 1 Members:

A former non-vested member who is reemployed on or after January 1, 2014 is not eligible for membership in Tier 1. This type of member shall become a qualified participant in Tier 2, and shall be treated as being first employed by the State as of his or her date of reemployment.

Optional Forms of Payment:

The normal form of payment for a member is a straight life annuity.

Section 31 of the SERS statute gives retiring plan members the opportunity to elect an optional form of payment including:

- 100% Joint and survivor annuity with pop-up
- 75% joint and survivor annuity with pop-up
- 50% joint and survivor annuity with pop-up

Section 20 of the SERS statute permits a retiring plan member to elect a Social Security Equated optional form of payment.

The optional forms of payment are actuarially equivalent to the straight life annuity. Option factors are based upon the following: (1) investment return assumption 6.75%, (2) valuation morality assumptions for healthy retirees, (3) unisex percent 60% (i.e., retiree assumed to be 60% male; beneficiary the opposite) and (4) calculation year of 2021. The pop-up provision is reflected in the factors.

SECTION G

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 single amount or series of amounts of equal value to another single amount or series of amounts, computed on the basis of the rate(s) of interest and mortality tables used by the plan.
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

Normal Cost	The annual cost assigned, under the actuarial funding method, to 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.
Reserve Account	An account used to indicate that funds have been set aside for a specific purpose and is 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 market value plus a portion of unrealized appreciation or depreciation.