



Middlesex County Retirement System

**Governmental Accounting Standards Board
(GASB) Statements No. 67 and 68
Accounting Valuation Report
as of December 31, 2017**

This report has been prepared at the request of the Middlesex County Retirement Board to assist the Board and the member units in preparing their financial report for their liabilities associated with the Middlesex County Retirement System. This valuation report may not otherwise be copied or reproduced in any form without the consent of the Middlesex County Retirement Board and may only be provided to other parties in its entirety. The measurements shown in this actuarial valuation may not be applicable for other purposes.

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116 Huntington Ave., 8th Floor Boston, MA 02116
T 617.424.7300 www.segalco.com

June 29, 2018

Retirement Board
Middlesex County Retirement System
25 Linnell Circle
Billerica, MA 01865

Dear Board Members:

We are pleased to submit this Governmental Accounting Standards Board (GASB) Statements No. 67 and 68 Accounting Valuation as of December 31, 2017 for the Middlesex County Retirement System, a cost-sharing multiple employer defined benefit pension plan. It contains the actuarial information that will need to be disclosed in order to comply with GASB 67 and 68.

This report was prepared in accordance with generally accepted actuarial principles and practices at the request of the Board to assist the Board and the member units in preparing their financial report for their liabilities associated with the Middlesex County Retirement System pension plan. The census and financial information on which our calculations were based were provided by the staff of the Middlesex County Retirement System. That assistance is gratefully acknowledged.

The measurements shown in this actuarial valuation may not be applicable for other purposes. 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; and changes in plan provisions or applicable law.

The actuarial calculations were completed under my supervision. I am a member of the American Academy of Actuaries and I meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein. To the best of my knowledge, the information supplied in the actuarial valuation is complete and accurate. Further, in my opinion, the assumptions as approved by the Board are reasonably related to the experience of and expectations for the Middlesex County Retirement System.

I look forward to reviewing this report with you and to answering any questions.

Sincerely,

Segal Consulting, a Member of The Segal Group, Inc.

By: 
Kathleen A. Riley, FSA, MAAA, EA
Senior Vice President and Actuary

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Section 1: Actuarial Valuation Summary

Purpose

This report has been prepared by Segal Consulting to present certain disclosure information required by Governmental Accounting Standards Board (GASB) Statements No. 67 and 68 as of December 31, 2017. This report is based on the Middlesex County Retirement System Actuarial Valuation and Review as of January 1, 2018, which reflects:

- The benefit provisions of Massachusetts General Law Chapter 32;
- The characteristics of covered active participants, inactive participants, and retired participants and beneficiaries as of December 31, 2017;
- The assets of the System as of December 31, 2017;
- Economic assumptions regarding future salary increases and investment earnings; and
- Other actuarial assumptions, regarding employee terminations, retirement, death, etc.

Significant Issues

The following key findings were the result of this actuarial valuation:

- The Net Pension Liability (NPL) is equal to the difference between the Total Pension Liability (TPL) and the Plan's Fiduciary Net Position. The Plan Fiduciary Net Position is equal to the market value of assets and therefore, the NPL measure is very similar to an Unfunded Actuarial Accrued Liability (UAAL) on a market value basis. The NPL increased from \$1.417 billion as of December 31, 2016 to \$1.419 billion as of December 31, 2017 and the Plan's Fiduciary Net Position as a percent of the TPL increased from 45.49% to 49.27%.
- The NPL measured as of December 31, 2017 and December 31, 2016 was determined based upon the results of the actuarial valuations as of January 1, 2018 and January 1, 2016, respectively.
- The discount rates used to measure the TPL and NPL as of December 31, 2017 and December 31, 2016 were 7.50% and 7.75%, respectively.

Important Information about Actuarial Valuations

In order to prepare an actuarial valuation, Segal Consulting (“Segal”) relies on a number of input items. These include:

Plan of Benefits:	Plan provisions define the rules that will be used to determine benefit payments, and those rules, or the interpretation of them, may change over time. It is important to keep Segal informed with respect to plan provisions and administrative procedures, and to review the plan description in this report (as well as the plan summary included in our funding valuation report) to confirm that Segal has correctly interpreted the plan of benefits.
Participant Data:	An actuarial valuation for a plan is based on data provided to the actuary by the Middlesex County Retirement System. Segal does not audit such data for completeness or accuracy, other than reviewing it for obvious inconsistencies compared to prior data and other information that appears unreasonable. It is important for Segal to receive the best possible data and to be informed about any known incomplete or inaccurate data.
Assets:	The valuation is based on the market value of assets as of the valuation date, as provided by the Middlesex County Retirement System. The Middlesex County Retirement System uses an “actuarial value of assets” that differs from market value to gradually reflect year-to-year changes in the market value of assets in determining the contribution requirements.
Actuarial Assumptions:	In preparing an actuarial valuation, Segal projects the benefits to be paid to existing plan participants for the rest of their lives and the lives of their beneficiaries. This projection requires actuarial assumptions as to the probability of death, disability, withdrawal, and retirement of each participant for each year. In addition, the benefits projected to be paid for each of those events in each future year reflect actuarial assumptions as to salary increases and cost-of-living adjustments. The projected benefits are then discounted to a present value, based on the assumed rate of return that is expected to be achieved on the plan’s assets. There is a reasonable range for each assumption used in the projection and the results may vary materially based on which assumptions are selected. It is important for any user of an actuarial valuation to understand this concept. Actuarial assumptions are periodically reviewed to ensure that future valuations reflect emerging plan experience. While future changes in actuarial assumptions may have a significant impact on the reported results, that does not mean that the previous assumptions were unreasonable.

The user of Segal's actuarial valuation (or other actuarial calculations) should keep the following in mind:

- The valuation is prepared at the request of the Middlesex County Retirement System to assist the Board and the member units in preparing items related to the pension plan in their financial reports. Segal is not responsible for the use or misuse of its report, particularly by any other party.
- An actuarial valuation is a measurement of the plan's assets and liabilities at a specific date. Accordingly, except where otherwise noted, Segal did not perform an analysis of the potential range of future financial measures. The actual long-term cost of the plan will be determined by the actual benefits and expenses paid and the actual investment experience of the plan.
- Sections of this report may include actuarial results that are not rounded, but that does not imply precision.
- If the Middlesex County Retirement System is aware of any event or trend that was not considered in this valuation that may materially change the results of the valuation, Segal should be advised, so that we can evaluate it.
- Segal does not provide investment, legal, accounting, or tax advice. Segal's valuation is based on our understanding of applicable guidance in these areas and of the plan's provisions, but they may be subject to alternative interpretations. The Board should look to their other advisors for expertise in these areas.

As Segal Consulting has no discretionary authority with respect to the management or assets of the Middlesex County Retirement System, it is not a fiduciary in its capacity as actuaries and consultants with respect to the Middlesex County Retirement System.



Section 2: GASB Information

Exhibit 1 – Net Pension Liability

	December 31, 2017	December 31, 2016
Components of the Net Pension Liability		
Total Pension Liability	\$2,797,535,970	\$2,599,296,751
Plan Fiduciary Net Position	1,378,351,219	1,182,420,196
Net Pension Liability	1,419,184,751	1,416,876,555
Plan Fiduciary Net Position as a percentage of the Total Pension Liability*	49.27%	45.49%

* These funded percentages are not necessarily appropriate for assessing the sufficiency of Plan assets to cover the estimated cost of settling the Plan's benefit obligation or the need for or the amount of future contributions.

Actuarial assumptions. The total pension liability as of December 31, 2017 was measured by an actuarial valuation as of December 31, 2017, using the following actuarial assumptions, applied to all periods included in the measurement:

Inflation:	3.25% (previously, 3.50%)
Salary Increases:	Varies by length of service with ultimate rates of 4.00% for Group 1, 4.25% for Group 2 and 4.50% for Group 4 (previously, 4.25% for Group 1, 4.50% for Group 2 and 4.75% for Group 4).
Net Investment Return:	7.50% (previously, 7.75%).
Cost of Living Adjustment:	3% of first \$14,000
Mortality Rates:	<i>Pre-Retirement:</i> RP-2014 Blue Collar Employee Mortality Table projected generationally with Scale MP-2017 (previously, RP-2000 Employee Mortality Table projected generationally from 2009 with Scale BB2D) <i>Healthy Retiree:</i> RP-2014 Blue Collar Healthy Annuitant Mortality Table projected generationally with Scale MP-2017 (previously, RP-2000 Healthy Annuitant Mortality Table projected generationally from 2009 with Scale BB2D) <i>Disabled Retiree:</i> RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2017 (previously, RP-2000 Healthy Annuitant Mortality Table projected generationally from 2015 with Scale BB2D)

Target Asset Allocation

The long-term expected rate of return on pension plan investments was determined using a building-block method in which expected future real rates of return (expected returns, net of inflation) are developed for each major asset class. These returns are combined to produce the long-term expected rate of return by weighting the expected future real rates of return by the target asset allocation percentage, adding expected inflation and subtracting expected investment expenses and a risk margin. The target allocation (approved by the Board) and projected arithmetic real rates of return for each major asset class, after deducting inflation, but before investment expenses, used in the derivation of the long-term expected investment rate of return assumption are summarized in the following table:

Asset Class	Target Allocation	Long-Term Expected Real Rate of Return
Domestic equity	17.50%	6.15%
International developed markets equity	15.50%	7.11%
International emerging markets equity	6.00%	9.41%
Core fixed income	12.00%	1.68%
High-yield fixed income	10.00%	4.13%
Real estate	10.00%	4.90%
Commodities	4.00%	4.71%
Hedge fund, GTAA, Risk parity	13.00%	3.94%
Private equity	<u>12.00%</u>	10.28%
Total	100.00%	

Note: Some asset classes included in the pension plan's target asset allocation have been combined.

Discount rate. The discount rates used to measure the Total Pension Liability (TPL) were 7.50% and 7.75% as of December 31, 2017 and December 31, 2016, respectively. The projection of cash flows used to determine the discount rate assumed plan member contributions will be made at the current contribution rate and that employer contributions will be made at rates equal to the actuarially determined contribution rates. For this purpose, only employer contributions that are intended to fund benefits for current plan members and their beneficiaries are included. Projected employer contributions that are intended to fund the service costs for future plan members and their beneficiaries, as well as projected contributions from future plan members, are not included. Based on those assumptions, the Plan Fiduciary Net Position (FNP) was projected to be available to make all projected future benefit payments for current plan members. Therefore, the long-term expected rate of return on pension plan investments was applied to all periods of projected benefit payments to determine the TPL as of both December 31, 2017 and December 31, 2016.

Discount Rate Sensitivity

Sensitivity of the Net Pension Liability to changes in the discount rate. The following presents the Net Pension Liability (NPL) of the Middlesex County Retirement System as of December 31, 2017 calculated using the discount rate of 7.50%, as well as what the Middlesex County Retirement System's NPL would be if it were calculated using a discount rate that is 1-percentage-point lower (6.50%) or 1-percentage-point higher (8.50%) than the current rate.

Net Pension Liability	1% Decrease (6.50%)	Current Discount Rate (7.50%)	1% Increase (8.50%)
Middlesex County Retirement System's net pension liability as of December 31, 2017	\$1,741,812,266	\$1,419,184,751	\$1,147,166,823

Exhibit 2 – Schedule of Changes in Net Pension Liability – Last Two Fiscal Years

	December 31, 2017	December 31, 2016
Total Pension Liability		
Service cost	\$60,585,598	\$56,386,392
Interest	200,298,121	187,359,946
Change of benefit terms	0	0
Differences between expected and actual experience	-9,059,393	7,976,453
Changes of assumptions	97,195,824	96,500,754
Benefit payments, including refunds of member contributions	-150,780,931	-143,428,636
Net change in Total Pension Liability	\$198,239,219	\$204,794,909
Total Pension Liability – beginning	<u>2,599,296,751</u>	<u>2,394,501,842</u>
Total Pension Liability – ending	\$2,797,535,970	\$2,599,296,751
Plan Fiduciary Net Position		
Contributions – employer	\$115,426,815	\$107,067,707
Contributions – employee	44,841,008	42,841,461
Net investment income	189,678,278	74,917,549
Benefit payments, including refunds of member contributions	-150,780,931	-143,428,636
Administrative expense	-3,234,147	-3,460,782
Net change in Plan Fiduciary Net Position	\$195,931,023	\$77,937,299
Plan Fiduciary Net Position – beginning	<u>1,182,420,196</u>	<u>1,104,482,897</u>
Plan Fiduciary Net Position – ending	\$1,378,351,219	\$1,182,420,196
Net Pension Liability – ending	\$1,419,184,751	\$1,416,876,555
Plan Fiduciary Net Position as a percentage of the Total Pension Liability	49.27%	45.49%
Covered employee payroll ¹	\$451,777,105	\$439,644,322
Plan Net Pension Liability as percentage of covered employee payroll	314.13%	322.28%

¹ Covered employee payroll for 2017 and 2016 as estimated in the January 1, 2018 and January 1, 2016 funding valuation reports, respectively.

Notes to Schedule:

Changes in Actuarial Assumptions:	Effective January 1, 2016: • The pre-retirement mortality assumption was changed from the RP-2000 Employee Mortality Table projected 22 years with Scale AA to the RP-2000 Employee Mortality Table projected generationally from 2009 with Scale BB2D. • The mortality assumption for non-disabled retirees was changed from the RP-2000 Healthy Annuitant Mortality Table projected 17 years with Scale AA to RP-2000 Employee Mortality Table projected generationally from 2009 with Scale BB2D. • The mortality assumption for disabled participants was changed from the RP-2000 Healthy Annuitant Mortality Table set forward three years projected 17 years with Scale AA to the RP-2000 Healthy Annuitant Mortality Table projected generationally from 2015 with Scale BB2D. • The investment return assumption was lowered from 7.875% to 7.75%. • The inflation allowance in the salary increase assumption was lowered from 4.0% to 3.5%. • The administrative expense assumption was increased from \$3,400,000 for calendar 2014, increasing 4.0% per year, to \$3,500,000 for calendar 2016, increasing 3.5% per year. Effective January 1, 2018: • The mortality tables for non-disabled participants were changed from the RP-2000 Employee and Healthy Annuitant Mortality Tables projected generationally using Scale BB2D from 2009 to the RP-2014 Blue Collar Employee and Healthy Annuitant Mortality Tables projected generationally using Scale MP-2017. • The mortality tables for disabled participants were changed from the RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale BB2D from 2015 to the RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward 1 year projected generationally using Scale MP-2017. • The long-term salary increase assumption was lowered by 0.25%, to 4.00% for Group 1 participants, 4.25% for Group 2 participants, and 4.50% for Group 4 participants. • The investment rate of return assumption was lowered from 7.75% to 7.5%.
Changes in Plan Provisions:	Effective January 1, 2016: • As permitted by Section 63 of Chapter 139 of the Acts of 2012, the Board has increased the Section 101 annual allowance from \$9,000 to \$12,000.

Exhibit 3 – Schedule of Contributions – Last Four Fiscal Years

Year Ended December 31	Actuarially Determined Contributions ¹	Contributions in Relation to the Actuarially Determined Contributions	Contribution Deficiency / (Excess)	Covered-Employee Payroll	Contributions as a Percentage of Covered Employee Payroll
2014	\$92,826,743	\$93,400,946	-\$574,203	\$415,752,810	22.47%
2015	98,792,642	99,820,481	-1,027,839	432,382,921	23.09%
2016	105,246,797	107,067,707	-1,820,910	439,644,322	24.35%
2017	112,017,087	115,426,815	-3,409,728	451,777,105	25.55%

Notes to Schedule:

Valuation date:	Actuarially Determined Contribution for 2017 is determined with the January 1, 2016 actuarial valuation.
Actuarial cost method:	Entry Age Normal Cost Method
Amortization method:	Prior year's total contribution increased by 6.5% for fiscal 2018 through fiscal 2024, and thereafter the remaining unfunded liability will be amortized on a 4.0% annual increasing basis; ERI liability amortized in level payments
Remaining amortization period:	As of July 1, 2016, 3 years remaining for 2002 ERI liability, 4 years remaining for 2003 ERI liability, 6 years remaining for 2010 ERI liability and 19 years for remaining unfunded liability.
Asset valuation method:	The difference between the expected return and the actual investment return on a market value basis is recognized over a five-year period. Asset value is adjusted as necessary to be within 20% of the market value.
Actuarial assumptions:	
• Investment rate of return	7.75% (previously, 7.875%)
• Discount rate	7.75% (previously, 7.875%)
• Inflation rate	3.50% (previously, 4.00%)
• Projected salary increases	Varies by length of service with ultimate rates of 4.25% for Group 1, 4.50% for Group 2, and 4.75% for Group 4
• Cost of living adjustments	3% of first \$14,000
Plan membership:	
• Retired participants and beneficiaries receiving benefits	5,327
• Inactive participants entitled to a return of their employee contributions	2,640
• Inactive participants with a vested right to a deferred or immediate benefit	321
• Active participants	<u>9,072</u>
• Total	17,360

¹ The Actuarially Determined Contribution for 2017 is based on the results of the January 1, 2016 actuarial valuation. The Actuarially Determined Contributions for 2016 and 2015 are based on the results of the January 1, 2014 actuarial valuation. The Actuarially Determined Contribution for 2014 is based on the results of the January 1, 2012 actuarial valuation.

Exhibit 4 – Pension Expense

Reporting Date for Employer under GASB 68	June 30, 2018	June 30, 2017
Measurement Date for Employer under GASB 68	December 31, 2017	December 31, 2016
Components of Pension Expense		
Service cost	\$60,585,598	\$56,386,392
Interest on the Total Pension Liability	200,298,121	187,359,946
Expensed portion of current-period changes in proportion and differences between employer's contributions and proportionate share of contributions	0	0
Expensed portion of current-period benefit changes	0	0
Expensed portion of current-period difference between expected and actual experience in the Total Pension Liability	-1,811,879	1,595,291
Expensed portion of current-period changes of assumptions or other inputs	19,439,165	19,300,151
Member contributions	-44,841,008	-42,841,461
Projected earnings on plan investments	-91,879,859	-87,096,931
Expensed portion of current-period differences between actual and projected earnings on plan investments	-19,559,684	2,435,876
Administrative expense	3,234,147	3,460,782
Other	0	0
Recognition of beginning of year deferred outflows of resources as pension expense	40,030,134	16,698,816
Recognition of beginning of year deferred inflows of resources as pension expense	0	0
Net amortization of deferred amounts from changes in proportion and differences between employer's contributions and proportionate share of contributions	0	0
Pension Expense	\$165,494,735	\$157,298,862

Deferred Outflows of Resources and Deferred Inflows of Resources

Reporting Date for Employer under GASB 68	June 30, 2018	June 30, 2017
Measurement Date for Employer under GASB 68	December 31, 2017	December 31, 2016
Deferred Outflows of Resources		
Changes in proportion and differences between employer's contributions and proportionate share of contributions ¹	\$40,343,902	\$25,140,901
Changes of assumptions or other inputs	135,657,111	77,200,603
Net difference between projected and actual earnings on pension plan investments	0	58,825,722
Difference between expected and actual experience in the Total Pension Liability	<u>4,785,871</u>	<u>6,381,162</u>
Total Deferred Outflows of Resources	\$180,786,884	\$167,548,388
Deferred Inflows of Resources		
Changes in proportion and differences between employer's contributions and proportionate share of contributions ¹	\$40,343,902	\$25,140,901
Changes of assumptions or other inputs	0	0
Net difference between projected and actual earnings on pension plan investments	38,547,705	0
Difference between expected and actual experience in the Total Pension Liability	<u>7,247,514</u>	<u>0</u>
Total Deferred Inflows of Resources	\$86,139,121	\$25,140,901
Deferred outflows of resources and deferred inflows of resources related to pension will be recognized as follows:		
Reporting Date for Employer under GASB 68 Year Ended June 30:		
2018	N/A	\$40,030,134
2019	\$38,097,737	40,030,135
2020	37,083,503	39,015,901
2021	21,398,919	23,331,317
2022	-1,932,396	0
Thereafter	0	0

¹ Calculated in accordance with Paragraphs 54 and 55 of GASB 68.

Exhibit 5 – Determination of Proportionate Share

Employer Name	FY 2017 Total Appropriation	Percent of FY 2017 Total Appropriation	Share of NPL as of January 1, 2017	Percent of Total NPL as of January 1, 2017	FY 2018 Total Appropriation	Percent of FY 2018 Total Appropriation	Share of NPL as of January 1, 2018	Percent of Total NPL as of January 1, 2018
Middlesex County Retirement Board	\$331,856	0.309950%	\$0	0.000000%	\$345,861	0.299637%	\$0	0.000000%
Middlesex County	0	0.000000%	0	0.000000%	0	0.000000%	0	0.000000%
Middlesex Hospital	0	0.000000%	0	0.000000%	0	0.000000%	0	0.000000%
Town of Acton	3,462,510	3.233943%	45,680,759	3.224046%	3,454,129	2.992484%	48,182,609	3.395091%
Town of Ashby	173,361	0.161917%	1,387,848	0.097951%	147,365	0.127670%	1,780,532	0.125462%
Town of Ashland	2,447,482	2.285920%	31,797,911	2.244226%	2,787,173	2.414667%	32,308,841	2.276578%
Town of Ayer	1,429,491	1.335128%	17,032,643	1.202126%	1,363,375	1.181160%	17,999,043	1.268266%
Town of Bedford	3,715,207	3.469960%	50,282,391	3.548819%	3,920,935	3.396901%	49,661,979	3.499331%
Town of Billerica	9,826,635	9.177962%	143,712,635	10.142918%	10,790,894	9.348688%	140,303,356	9.886195%
Town of Boxborough	671,055	0.626758%	9,977,149	0.704165%	791,841	0.686011%	10,225,882	0.720546%
Town of Burlington	8,404,267	7.849488%	114,929,674	8.111481%	8,877,933	7.691395%	117,368,093	8.270108%
Town of Carlisle	820,032	0.765900%	9,988,584	0.704972%	877,464	0.760191%	9,435,767	0.664872%
Town of Chelmsford	7,552,208	7.053675%	100,190,226	7.071204%	8,022,651	6.950422%	103,993,778	7.327713%
Town of Dracut	4,233,672	3.954201%	57,818,789	4.080722%	4,506,526	3.904228%	60,106,114	4.235256%
Town of Dunstable	228,686	0.213590%	2,199,339	0.155224%	206,969	0.179308%	2,563,856	0.180657%
Town of Groton	1,839,040	1.717642%	22,421,400	1.582453%	1,966,279	1.703485%	21,402,700	1.508098%
Town of Holliston	2,064,334	1.928064%	24,188,374	1.707162%	2,132,624	1.847598%	23,773,972	1.675185%
Town of Hopkinton	1,836,364	1.715143%	21,332,499	1.505600%	1,984,635	1.719388%	20,653,839	1.455331%
Town of Hudson	4,686,376	4.377021%	62,417,388	4.405281%	5,016,882	4.346375%	63,161,014	4.450514%
Town of Lincoln	1,922,136	1.795253%	25,563,964	1.804248%	2,015,466	1.746099%	24,841,810	1.750428%
Town of Littleton	2,575,271	2.405273%	23,959,114	1.690981%	3,555,064	3.079929%	21,432,789	1.510218%
Town of North Reading	3,499,063	3.268084%	47,493,109	3.351958%	3,627,495	3.142680%	48,035,495	3.384725%

Employer Name	FY 2017 Total Appropriation	Percent of FY 2017 Total Appropriation	Share of NPL as of January 1, 2017	Percent of Total NPL as of January 1, 2017	FY 2018 Total Appropriation	Percent of FY 2018 Total Appropriation	Share of NPL as of January 1, 2018	Percent of Total NPL as of January 1, 2018
Town of Pepperell	1,074,825	1.003874%	16,537,163	1.167156%	1,254,044	1.086441%	16,341,195	1.151449%
Town of Sherborn	880,589	0.822460%	10,736,551	0.757762%	916,985	0.794430%	10,500,304	0.739883%
Town of Shirley	754,746	0.704924%	8,912,285	0.629009%	755,576	0.654593%	8,406,745	0.592364%
Town of Stow	748,612	0.699195%	10,493,658	0.740619%	826,612	0.716135%	10,459,477	0.737006%
Town of Sudbury	3,961,686	3.700169%	56,372,784	3.978666%	4,191,182	3.631030%	58,772,716	4.141301%
Town of Tewksbury	6,993,838	6.532164%	93,491,923	6.598452%	7,504,649	6.501651%	98,006,180	6.905808%
Town of Townsend	690,007	0.644459%	9,167,760	0.647040%	764,434	0.662267%	8,090,096	0.570052%
Town of Tyngsborough	1,530,059	1.429057%	22,745,937	1.605358%	1,832,388	1.587489%	20,897,452	1.472497%
Town of Wayland	4,235,414	3.955828%	55,492,666	3.916549%	4,364,388	3.781087%	53,697,606	3.783694%
Town of Westford	4,238,879	3.959064%	52,904,581	3.733888%	4,619,903	4.002452%	51,698,881	3.642858%
Town of Weston	4,557,886	4.257013%	63,418,247	4.475919%	4,792,481	4.151965%	61,375,790	4.324722%
Town of Wilmington	6,204,192	5.794644%	82,103,885	5.794710%	7,120,056	6.168459%	83,422,615	5.878207%
Acton-Boxborough RSD	2,086,065	1.948361%	27,434,445	1.936262%	2,318,753	2.008851%	27,084,083	1.908425%
Acton Water Supply	177,725	0.165993%	3,319,310	0.234270%	203,213	0.176054%	3,370,594	0.237502%
Bedford Housing Authority	27,786	0.025952%	312,414	0.022049%	29,026	0.025147%	313,455	0.022087%
Billerica Housing Authority	87,992	0.082184%	1,343,792	0.094842%	101,238	0.087708%	1,359,538	0.095797%
Chelmsford Housing Authority	99,778	0.093191%	1,193,547	0.084238%	194,843	0.168802%	2,029,608	0.143012%
Chelmsford Water District	699,317	0.653154%	1,165,154	0.082234%	607,500	0.526308%	391,160	0.027562%
Dracut Housing Authority	118,166	0.110366%	1,903,315	0.134332%	122,310	0.105963%	2,055,364	0.144827%
Dracut Water Supply	158,353	0.147900%	2,550,634	0.180018%	162,034	0.140378%	3,031,987	0.213643%
E. Chelmsford Water	26,158	0.024431%	321,683	0.022704%	28,517	0.024706%	317,151	0.022347%
E. Middlesex Mosq Control	39,549	0.036938%	585,986	0.041358%	43,626	0.037795%	509,331	0.035889%

Employer Name	FY 2017 Total Appropriation	Percent of FY 2017 Total Appropriation	Share of NPL as of January 1, 2017	Percent of Total NPL as of January 1, 2017	FY 2018 Total Appropriation	Percent of FY 2018 Total Appropriation	Share of NPL as of January 1, 2018	Percent of Total NPL as of January 1, 2018
Greater Lowell RVTSD	1,195,581	1.116659%	14,939,992	1.054431%	1,179,775	1.022098%	15,614,520	1.100246%
Groton-Dunstable RSD	752,342	0.702679%	10,353,378	0.730718%	859,466	0.744598%	10,714,454	0.754972%
Hudson Housing Authority	96,064	0.089723%	1,432,356	0.101093%	100,489	0.087059%	1,155,540	0.081423%
Lincoln Sudbury	586,204	0.547508%	8,168,982	0.576549%	605,786	0.524823%	8,466,429	0.596570%
Nashoba Vally THSD	246,363	0.230100%	3,254,718	0.229711%	254,429	0.220425%	3,512,891	0.247529%
N. Chelmsford Water	42,129	0.039348%	707,192	0.049912%	41,187	0.035682%	814,336	0.057381%
North Middlesex RSD	890,539	0.831753%	11,779,471	0.831369%	914,940	0.792658%	11,610,214	0.818090%
Shawsheen Valley RVS	554,980	0.518345%	8,457,396	0.596904%	619,993	0.537131%	7,940,619	0.559520%
South Middlesex RVTs	523,099	0.488568%	7,274,785	0.513438%	540,790	0.468513%	6,492,906	0.457510%
Sudbury Water District	88,372	0.082538%	2,003,371	0.141393%	119,483	0.103514%	1,701,694	0.119906%
Tewksbury Housing Authority	105,697	0.098720%	1,495,958	0.105581%	123,408	0.106914%	1,527,710	0.107647%
Wayland Housing Authority	32,430	0.030289%	609,217	0.042997%	42,233	0.036589%	611,202	0.043067%
Hopkinton Housing Authority	31,500	0.029421%	514,197	0.036291%	35,639	0.030876%	458,176	0.032284%
Sudbury Housing Authority	24,229	0.022630%	367,971	0.025971%	28,513	0.024702%	436,617	0.030765%
Wilmington Housing Authority	24,960	0.023312%	319,057	0.022518%	28,468	0.024663%	335,690	0.023654%
Acton Housing Authority	69,434	0.064851%	990,778	0.069927%	69,639	0.060332%	741,792	0.052269%
Burlington Housing Authority	15,711	0.014674%	54,061	0.003816%	6,473	0.005608%	56,771	0.004000%
Ayer Housing Authority	49,993	0.046693%	1,891,747	0.133515%	68,956	0.059740%	792,328	0.055830%
Holliston Housing Authority	21,320	0.019913%	226,087	0.015957%	18,523	0.016047%	142,446	0.010037%
Littleton Housing Authority	31,258	0.029195%	454,776	0.032097%	38,079	0.032990%	465,317	0.032788%
Westford Housing Authority	37,649	0.035164%	478,025	0.033738%	43,578	0.037754%	517,839	0.036488%

Employer Name	FY 2017 Total Appropriation	Percent of FY 2017 Total Appropriation	Share of NPL as of January 1, 2017	Percent of Total NPL as of January 1, 2017	FY 2018 Total Appropriation	Percent of FY 2018 Total Appropriation	Share of NPL as of January 1, 2018	Percent of Total NPL as of January 1, 2018
Shirley Water District	19,279	0.018006%	359,871	0.025399%	19,480	0.016876%	335,341	0.023629%
Tyngsboro Housing Authority	33,609	0.031390%	455,142	0.032123%	37,587	0.032563%	496,440	0.034981%
Pepperell Housing Authority	9,474	0.008849%	159,347	0.011246%	13,494	0.011691%	175,037	0.012334%
Groton Housing Authority	2,363	0.002207%	13,516	0.000954%	3,071	0.002661%	-15,094	-0.001064%
Tyngsboro Water District	29,869	0.027897%	405,503	0.028620%	31,677	0.027443%	380,399	0.026804%
North Reading Housing Authority	10,855	0.010138%	147,057	0.010379%	15,481	0.013412%	139,940	0.009861%
West Groton Water	5,849	0.005463%	13,002	0.000918%	967	0.000838%	21,871	0.001541%
Ayer-Shirley RSD	425,887	0.397774%	4,668,086	0.329463%	419,892	0.363773%	4,178,529	0.294432%
Grand Totals:	\$107,067,707	100.000000%	\$1,416,876,555	100.000000%	\$115,426,815	100.000000%	\$1,419,184,751	100.000000%

Notes: Net Pension Liability for each employer was determined on an individual basis.

The NPL for the Middlesex County Retirement Board, Middlesex County and the Middlesex Hospital has been allocated amongst the other units in the System in proportion to the remaining units' NPL because the obligation to fund these units is a shared responsibility of these other units.

Exhibit 6 – Determination of Proportionate Share

Employer Name	2018 Share of Cost Allocator (1)	Net Pension Liability (2)	Covered Employee Payroll (3)	Discount Rate Sensitivity		
				1% Decrease (6.50%) (4)	Current Discount Rate (7.50%) (5)	1% Increase (8.50%) (6)
Middlesex County Retirement Board	0.000000%	\$0	\$1,184,239	\$0	\$0	\$0
Middlesex County	0.000000%	0	0	0	0	0
Middlesex Hospital	0.000000%	0	0	0	0	0
Town of Acton	3.395091%	48,182,609	14,091,030	59,136,110	48,182,609	38,947,361
Town of Ashby	0.125462%	1,780,532	1,102,061	2,185,313	1,780,532	1,439,258
Town of Ashland	2.276578%	32,308,841	12,705,217	39,653,715	32,308,841	26,116,148
Town of Ayer	1.268266%	17,999,043	6,354,563	22,090,813	17,999,043	14,549,127
Town of Bedford	3.499331%	49,661,979	18,836,700	60,951,777	49,661,979	40,143,164
Town of Billerica	9.886195%	140,303,356	32,623,751	172,198,957	140,303,356	113,411,149
Town of Boxborough	0.720546%	10,225,882	2,844,512	12,550,559	10,225,882	8,265,865
Town of Burlington	8.270108%	117,368,093	32,393,793	144,049,756	117,368,093	94,871,935
Town of Carlisle	0.664872%	9,435,767	5,141,785	11,580,822	9,435,767	7,627,191
Town of Chelmsford	7.327713%	103,993,778	25,052,394	127,635,004	103,993,778	84,061,092
Town of Dracut	4.235256%	60,106,114	14,681,016	73,770,209	60,106,114	48,585,452
Town of Dunstable	0.180657%	2,563,856	1,204,830	3,146,706	2,563,856	2,072,437
Town of Groton	1.508098%	21,402,700	7,236,359	26,268,236	21,402,700	17,300,400
Town of Holliston	1.675185%	23,773,972	10,339,394	29,178,578	23,773,972	19,217,167
Town of Hopkinton	1.455331%	20,653,839	13,910,712	25,349,134	20,653,839	16,695,074
Town of Hudson	4.450514%	63,161,014	21,363,646	77,519,599	63,161,014	51,054,820
Town of Lincoln	1.750428%	24,841,810	9,736,776	30,489,170	24,841,810	20,080,329
Town of Littleton	1.510218%	21,432,789	11,686,136	26,305,162	21,432,789	17,324,720
Town of North Reading	3.384725%	48,035,495	12,602,469	58,955,555	48,035,495	38,828,442

Employer Name	2018 Share of Cost Allocator (1)	Net Pension Liability (2)	Covered Employee Payroll (3)	Discount Rate Sensitivity		
				1% Decrease (6.50%) (4)	Current Discount Rate (7.50%) (5)	1% Increase (8.50%) (6)
Town of Pepperell	1.151449%	16,341,195	4,479,949	20,056,080	16,341,195	13,209,041
Town of Sherborn	0.739883%	10,500,304	3,961,023	12,887,373	10,500,304	8,487,692
Town of Shirley	0.592364%	8,406,745	1,693,751	10,317,869	8,406,745	6,795,403
Town of Stow	0.737006%	10,459,477	3,575,149	12,837,261	10,459,477	8,454,688
Town of Sudbury	4.141301%	58,772,716	15,869,459	72,133,689	58,772,716	47,507,631
Town of Tewksbury	6.905808%	98,006,180	21,795,849	120,286,211	98,006,180	79,221,138
Town of Townsend	0.570052%	8,090,096	3,057,294	9,929,236	8,090,096	6,539,447
Town of Tyngsborough	1.472497%	20,897,452	8,131,921	25,648,133	20,897,452	16,891,997
Town of Wayland	3.783694%	53,697,606	18,372,533	65,904,846	53,697,606	43,405,282
Town of Westford	3.642858%	51,698,881	24,255,608	63,451,747	51,698,881	41,789,658
Town of Weston	4.324722%	61,375,790	18,905,798	75,328,538	61,375,790	49,611,776
Town of Wilmington	5.878207%	83,422,615	22,562,358	102,387,331	83,422,615	67,432,840
Acton-Boxborough RSD	1.908425%	27,084,083	12,887,573	33,241,181	27,084,083	21,892,818
Acton Water Supply	0.237502%	3,370,594	1,141,452	4,136,839	3,370,594	2,724,544
Bedford Housing Authority	0.022087%	313,455	160,096	384,714	313,455	253,375
Billerica Housing Authority	0.095797%	1,359,538	291,582	1,668,604	1,359,538	1,098,951
Chelmsford Housing Authority	0.143012%	2,029,608	2,380,023	2,491,001	2,029,608	1,640,586
Chelmsford Water District	0.027562%	391,160	1,333,719	480,078	391,160	316,182
Dracut Housing Authority	0.144827%	2,055,364	373,534	2,522,614	2,055,364	1,661,407
Dracut Water Supply	0.213643%	3,031,987	613,589	3,721,260	3,031,987	2,450,842
E. Chelmsford Water	0.022347%	317,151	193,307	389,243	317,151	256,357
E. Middlesex Mosq Control	0.035889%	509,331	317,832	625,119	509,331	411,707

Employer Name	2018 Share of Cost Allocator (1)	Net Pension Liability (2)	Covered Employee Payroll (3)	Discount Rate Sensitivity		
				1% Decrease (6.50%) (4)	Current Discount Rate (7.50%) (5)	1% Increase (8.50%) (6)
Greater Lowell RVTSD	1.100246%	15,614,520	4,282,960	19,164,220	15,614,520	12,621,657
Groton-Dunstable RSD	0.754972%	10,714,454	4,338,293	13,150,195	10,714,454	8,660,788
Hudson Housing Authority	0.081423%	1,155,540	257,663	1,418,236	1,155,540	934,058
Lincoln Sudbury	0.596570%	8,466,429	2,949,693	10,391,129	8,466,429	6,843,653
Nashoba Vally THSD	0.247529%	3,512,891	984,562	4,311,490	3,512,891	2,839,571
N. Chelmsford Water	0.057381%	814,336	558,955	999,469	814,336	658,256
North Middlesex RSD	0.818090%	11,610,214	4,866,639	14,249,592	11,610,214	9,384,857
Shawsheen Valley RVS	0.559520%	7,940,619	2,556,591	9,745,788	7,940,619	6,418,628
South Middlesex RVTs	0.457510%	6,492,906	2,333,768	7,968,965	6,492,906	5,248,403
Sudbury Water District	0.119906%	1,701,694	846,401	2,088,537	1,701,694	1,375,522
Tewksbury Housing Authority	0.107647%	1,527,710	433,785	1,875,009	1,527,710	1,234,891
Wayland Housing Authority	0.043067%	611,202	282,427	750,146	611,202	494,050
Hopkinton Housing Authority	0.032284%	458,176	68,604	562,327	458,176	370,351
Sudbury Housing Authority	0.030765%	436,617	140,067	535,869	436,617	352,926
Wilmington Housing Authority	0.023654%	335,690	124,945	412,008	335,690	271,351
Acton Housing Authority	0.052269%	741,792	367,987	910,428	741,792	599,613
Burlington Housing Authority	0.004000%	56,771	125,843	69,672	56,771	45,887
Ayer Housing Authority	0.055830%	792,328	109,841	972,454	792,328	640,463
Holliston Housing Authority	0.010037%	142,446	57,183	174,826	142,446	115,141
Littleton Housing Authority	0.032788%	465,317	84,100	571,105	465,317	376,133
Westford Housing Authority	0.036488%	517,839	119,617	635,552	517,839	418,578

Employer Name	2018 Share of Cost Allocator (1)	Net Pension Liability (2)	Covered Employee Payroll (3)	Discount Rate Sensitivity		
				1% Decrease (6.50%) (4)	Current Discount Rate (7.50%) (5)	1% Increase (8.50%) (6)
Shirley Water District	0.023629%	335,341	197,738	411,573	335,341	271,064
Tyngsboro Housing Authority	0.034981%	496,440	154,567	609,303	496,440	401,290
Pepperell Housing Authority	0.012334%	175,037	92,703	214,835	175,037	141,492
Groton Housing Authority	-0.001064%	-15,094	31,394	-18,533	-15,094	-12,206
Tyngsboro Water District	0.026804%	380,399	198,543	466,875	380,399	307,487
North Reading Housing Authority	0.009861%	139,940	83,875	171,760	139,940	113,122
West Groton Water	0.001541%	21,871	113,682	26,841	21,871	17,678
Ayer-Shirley RSD	0.294432%	4,178,529	3,569,897	5,128,453	4,178,529	3,377,626
Grand Totals:	100.000000%	\$1,419,184,751	\$451,777,105	\$1,741,812,266	\$1,419,184,751	\$1,147,166,823

Notes: Net Pension Liability for each employer was determined on an individual basis.

The NPL for the Middlesex County Retirement Board, Middlesex County and the Middlesex Hospital has been allocated amongst the other units in the System in proportion to the remaining units' NPL because the obligation to fund these units is a shared responsibility of these other units.

Employer Name	Schedule of Contributions					Pension Expense	
	Statutory Required Contribution (7)	Contributions In Relation to the Statutory Required Contribution (8)	Contribution Deficiency/ (Excess) (9)	Contributions as a Percentage of Covered Employee Payroll (10)	Proportionate Share of Plan Pension Expense (11)	Net Amortization of Deferred Amounts from Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (12)	Total Employer Pension Expense (13)
Middlesex County Retirement Board	\$345,861	-\$345,861	\$0	29.21%	\$345,861	\$0	\$345,861
Middlesex County	0	0	0	0.00%	0	0	0
Middlesex Hospital	0	0	0	0.00%	0	0	0
Town of Acton	3,454,129	-3,454,129	0	24.51%	5,606,955	-160,007	5,446,948
Town of Ashby	147,365	-147,365	0	13.37%	207,199	40,847	248,046
Town of Ashland	2,757,454	-2,787,173	-29,719	21.94%	3,759,743	661,243	4,420,986
Town of Ayer	1,363,375	-1,363,375	0	21.46%	2,094,527	-88,526	2,006,001
Town of Bedford	3,920,935	-3,920,935	0	20.82%	5,779,106	-462,196	5,316,910
Town of Billerica	10,782,713	-10,790,894	-8,181	33.08%	16,326,939	-684,453	15,642,486
Town of Boxborough	791,841	-791,841	0	27.84%	1,189,974	249,159	1,439,133
Town of Burlington	8,877,933	-8,877,933	0	27.41%	13,657,990	70,770	13,728,760
Town of Carlisle	877,464	-877,464	0	17.07%	1,098,028	47,804	1,145,832
Town of Chelmsford	7,822,651	-8,022,651	-200,000	32.02%	12,101,635	-79,532	12,022,103
Town of Dracut	4,506,526	-4,506,526	0	30.70%	6,994,478	347,199	7,341,677
Town of Dunstable	206,969	-206,969	0	17.18%	298,353	16,940	315,293
Town of Groton	1,966,279	-1,966,279	0	27.17%	2,490,607	-180,917	2,309,690
Town of Holliston	2,056,036	-2,132,624	-76,588	20.63%	2,766,549	-129,571	2,636,978
Town of Hopkinton	1,984,635	-1,984,635	0	14.27%	2,403,463	275,087	2,678,550
Town of Hudson	5,016,882	-5,016,882	0	23.48%	7,349,973	124,386	7,474,359
Town of Lincoln	2,015,466	-2,015,466	0	20.70%	2,890,812	-156,765	2,734,047
Town of Littleton	2,054,283	-3,555,064	-1,500,781	30.42%	2,494,108	338,455	2,832,563
Town of North Reading	3,623,078	-3,627,495	-4,417	28.78%	5,589,836	-239,033	5,350,803

Employer Name	Schedule of Contributions					Pension Expense	
	Statutory Required Contribution (7)	Contributions In Relation to the Statutory Required Contribution (8)	Contribution Deficiency/ (Excess) (9)	Contributions as a Percentage of Covered Employee Payroll (10)	Proportionate Share of Plan Pension Expense (11)	Net Amortization of Deferred Amounts from Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (12)	Total Employer Pension Expense (13)
Town of Pepperell	1,254,044	-1,254,044	0	27.99%	1,901,605	413,751	2,315,356
Town of Sherborn	916,985	-916,985	0	23.15%	1,221,908	-86,180	1,135,728
Town of Shirley	755,576	-755,576	0	44.61%	978,282	-263,016	715,266
Town of Stow	826,612	-826,612	0	23.12%	1,217,157	52,745	1,269,902
Town of Sudbury	4,185,908	-4,191,182	-5,274	26.41%	6,839,312	14,881	6,854,193
Town of Tewksbury	7,504,649	-7,504,649	0	34.43%	11,404,865	327,598	11,732,463
Town of Townsend	764,434	-764,434	0	25.00%	941,434	48,986	990,420
Town of Tyngsborough	1,832,388	-1,832,388	0	22.53%	2,431,812	259,931	2,691,743
Town of Wayland	4,362,369	-4,364,388	-2,019	23.75%	6,248,728	-818,950	5,429,778
Town of Westford	4,619,903	-4,619,903	0	19.05%	6,016,139	346,120	6,362,259
Town of Weston	4,792,481	-4,792,481	0	25.35%	7,142,229	-754,358	6,387,871
Town of Wilmington	6,120,056	-7,120,056	-1,000,000	31.56%	9,707,793	172,684	9,880,477
Acton-Boxborough RSD	2,318,753	-2,318,753	0	17.99%	3,151,743	287,791	3,439,534
Acton Water Supply	203,213	-203,213	0	17.80%	392,232	21,223	413,455
Bedford Housing Authority	29,026	-29,026	0	18.13%	36,477	7,221	43,698
Billerica Housing Authority	101,238	-101,238	0	34.72%	158,208	24,054	182,262
Chelmsford Housing Authority	112,094	-194,843	-82,749	8.19%	236,182	160,764	396,946
Chelmsford Water District	107,500	-607,500	-500,000	45.55%	45,519	89,320	134,839
Dracut Housing Authority	122,310	-122,310	0	32.74%	239,180	-12,724	226,456
Dracut Water Supply	162,034	-162,034	0	26.41%	352,829	28,193	381,022
E. Chelmsford Water	28,517	-28,517	0	14.75%	36,906	4,995	41,901
E. Middlesex Mosq Control	43,626	-43,626	0	13.73%	59,270	4,026	63,296

Employer Name	Schedule of Contributions					Pension Expense	
	Statutory Required Contribution (7)	Contributions In Relation to the Statutory Required Contribution (8)	Contribution Deficiency/ (Excess) (9)	Contributions as a Percentage of Covered Employee Payroll (10)	Proportionate Share of Plan Pension Expense (11)	Net Amortization of Deferred Amounts from Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (12)	Total Employer Pension Expense (13)
Greater Lowell RVTSD	1,179,775	-1,179,775	0	27.55%	1,817,044	-150,633	1,666,411
Groton-Dunstable RSD	859,466	-859,466	0	19.81%	1,246,828	304,693	1,551,521
Hudson Housing Authority	100,489	-100,489	0	39.00%	134,469	-78,213	56,256
Lincoln Sudbury	605,786	-605,786	0	20.54%	985,229	-85,295	899,934
Nashoba Vally THSD	254,429	-254,429	0	25.84%	408,791	-23,607	385,184
N. Chelmsford Water	41,187	-41,187	0	7.37%	94,765	2,545	97,310
North Middlesex RSD	914,940	-914,940	0	18.80%	1,351,067	-65,782	1,285,285
Shawsheen Valley RVS	619,993	-619,993	0	24.25%	924,041	-78,723	845,318
South Middlesex RVTs	540,790	-540,790	0	23.17%	755,573	-119,539	636,034
Sudbury Water District	119,483	-119,483	0	14.12%	198,023	-2,243	195,780
Tewksbury Housing Authority	123,408	-123,408	0	28.45%	177,778	24,477	202,255
Wayland Housing Authority	42,233	-42,233	0	14.95%	71,125	21,202	92,327
Hopkinton Housing Authority	35,639	-35,639	0	51.95%	53,316	-3,920	49,396
Sudbury Housing Authority	28,513	-28,513	0	20.36%	50,808	27,583	78,391
Wilmington Housing Authority	28,468	-28,468	0	22.78%	39,064	7,329	46,393
Acton Housing Authority	69,639	-69,639	0	18.92%	86,321	-26,302	60,019
Burlington Housing Authority	6,473	-6,473	0	5.14%	6,606	1,662	8,268
Ayer Housing Authority	68,956	-68,956	0	62.78%	92,203	27,289	119,492
Holliston Housing Authority	18,523	-18,523	0	32.39%	16,576	-11,223	5,353
Littleton Housing Authority	38,079	-38,079	0	45.28%	54,149	7,927	62,076
Westford Housing Authority	43,578	-43,578	0	36.43%	60,260	11,644	71,904

Employer Name	Schedule of Contributions					Pension Expense	
	Statutory Required Contribution (7)	Contributions In Relation to the Statutory Required Contribution (8)	Contribution Deficiency/ (Excess) (9)	Contributions as a Percentage of Covered Employee Payroll (10)	Proportionate Share of Plan Pension Expense (11)	Net Amortization of Deferred Amounts from Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (12)	Total Employer Pension Expense (13)
Shirley Water District	19,480	-19,480	0	9.85%	39,023	-12,211	26,812
Tyngsboro Housing Authority	37,587	-37,587	0	24.32%	57,771	6,565	64,336
Pepperell Housing Authority	13,494	-13,494	0	14.56%	20,369	11,464	31,833
Groton Housing Authority	3,071	-3,071	0	9.78%	-1,757	-3,064	-4,821
Tyngsboro Water District	31,677	-31,677	0	15.95%	44,266	-1,274	42,992
North Reading Housing Authority	15,481	-15,481	0	18.46%	16,285	10,112	26,397
West Groton Water	967	-967	0	0.85%	2,545	3,186	5,731
Ayer-Shirley RSD	419,892	-419,892	0	11.76%	486,251	-125,594	360,657
Grand Totals:	\$112,017,087	-\$115,426,815	-\$3,409,728	25.55%	\$165,494,735	\$0	\$165,494,735

Employer Name	Deferred Outflows of Resources				Deferred Inflows of Resources				
	Differences Between Expected and Actual Experience (14)	Changes of Assumptions (15)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (16)	Total Deferred Outflows of Resources (17)	Differences Between Expected and Actual Experience (18)	Net Difference Between Projected and Actual Investment Earnings on Pension Plan Investments (19)	Changes of Assumptions (20)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (21)	Total Deferred Inflows of Resources (22)
Middlesex County Retirement Board	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Middlesex County	0	0	0	0	0	0	0	0	0
Middlesex Hospital	0	0	0	0	0	0	0	0	0
Town of Acton	162,485	4,605,682	1,863,631	6,631,798	246,059	1,308,731	0	2,016,011	3,570,801
Town of Ashby	6,004	170,198	368,886	545,088	9,093	48,363	0	197,985	255,441
Town of Ashland	108,954	3,088,340	1,951,990	5,149,284	164,995	877,569	0	0	1,042,564
Town of Ayer	60,698	1,720,493	827,225	2,608,416	91,918	488,887	0	975,971	1,556,776
Town of Bedford	167,473	4,747,091	41,749	4,956,313	253,615	1,348,912	0	1,563,207	3,165,734
Town of Billerica	473,141	13,411,327	2,146,060	16,030,528	716,503	3,810,902	0	4,542,749	9,070,154
Town of Boxborough	34,484	977,472	841,716	1,853,672	52,222	277,754	0	78,222	408,198
Town of Burlington	395,797	11,218,990	1,664,683	13,279,470	599,377	3,187,938	0	1,005,173	4,792,488
Town of Carlisle	31,820	901,946	392,933	1,326,699	48,187	256,293	0	408,850	713,330
Town of Chelmsford	350,695	9,940,564	2,618,126	12,909,385	531,077	2,824,665	0	1,980,299	5,336,041
Town of Dracut	202,694	5,745,426	1,757,566	7,705,686	306,951	1,632,594	0	394,812	2,334,357
Town of Dunstable	8,646	245,074	323,309	577,029	13,093	69,639	0	220,949	303,681
Town of Groton	72,176	2,045,842	334,544	2,452,562	109,300	581,337	0	985,825	1,676,462
Town of Holliston	80,172	2,272,508	558,362	2,911,042	121,409	645,745	0	1,112,223	1,879,377
Town of Hopkinton	69,650	1,974,260	1,005,346	3,049,256	105,475	560,997	0	556,184	1,222,656
Town of Hudson	212,996	6,037,439	578,603	6,829,038	322,552	1,715,571	0	169,818	2,207,941
Town of Lincoln	83,773	2,374,580	120,389	2,578,742	126,863	674,750	0	782,893	1,584,506
Town of Littleton	72,277	2,048,718	2,558,410	4,679,405	109,453	582,154	0	1,843,015	2,534,622
Town of North Reading	161,989	4,591,620	334,082	5,087,691	245,308	1,304,734	0	939,537	2,489,579

Employer Name	Deferred Outflows of Resources				Deferred Inflows of Resources				
	Differences Between Expected and Actual Experience (14)	Changes of Assumptions (15)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (16)	Total Deferred Outflows of Resources (17)	Differences Between Expected and Actual Experience (18)	Net Difference Between Projected and Actual Investment Earnings on Pension Plan Investments (19)	Changes of Assumptions (20)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (21)	Total Deferred Inflows of Resources (22)
Town of Pepperell	55,107	1,562,022	1,450,402	3,067,531	83,451	443,857	0	319,560	846,868
Town of Sherborn	35,410	1,003,704	144,137	1,183,251	53,623	285,208	0	459,464	798,295
Town of Shirley	28,350	803,584	111,480	943,414	42,932	228,343	0	971,642	1,242,917
Town of Stow	35,272	999,801	214,065	1,249,138	53,415	284,099	0	83,267	420,781
Town of Sudbury	198,197	5,617,969	1,658,187	7,474,353	300,141	1,596,376	0	1,190,337	3,086,854
Town of Tewksbury	330,503	9,368,220	3,136,289	12,835,012	500,499	2,662,030	0	1,135,255	4,297,784
Town of Townsend	27,282	773,316	699,438	1,500,036	41,315	219,742	0	785,323	1,046,380
Town of Tyngsborough	70,472	1,997,547	1,843,235	3,911,254	106,719	567,614	0	1,464,675	2,139,008
Town of Wayland	181,083	5,132,850	104,210	5,418,143	274,224	1,458,527	0	2,903,599	4,636,350
Town of Westford	174,342	4,941,796	1,531,751	6,647,889	264,017	1,404,238	0	928,118	2,596,373
Town of Weston	206,976	5,866,793	0	6,073,769	313,435	1,667,081	0	2,575,309	4,555,825
Town of Wilmington	281,323	7,974,206	1,346,216	9,601,745	426,024	2,265,914	0	362,841	3,054,779
Acton-Boxborough RSD	91,335	2,588,914	1,048,046	3,728,295	138,313	735,654	0	283,822	1,157,789
Acton Water Supply	11,367	322,188	180,574	514,129	17,213	91,552	0	119,085	227,850
Bedford Housing Authority	1,057	29,963	20,835	51,855	1,601	8,514	0	0	10,115
Billerica Housing Authority	4,585	129,955	98,064	232,604	6,943	36,928	0	21,967	65,838
Chelmsford Housing Authority	6,844	194,006	655,085	855,935	10,365	55,128	0	29,783	95,276
Chelmsford Water District	1,319	37,390	1,258,693	1,297,402	1,998	10,625	0	1,071,016	1,083,639
Dracut Housing Authority	6,931	196,468	107,008	310,407	10,496	55,827	0	111,763	178,086
Dracut Water Supply	10,225	289,822	342,831	642,878	15,484	82,354	0	175,391	273,229
E. Chelmsford Water	1,069	30,315	14,471	45,855	1,620	8,614	0	3,636	13,870
E. Middlesex Mosq Control	1,718	48,686	46,259	96,663	2,601	13,834	0	58,979	75,414

Employer Name	Deferred Outflows of Resources				Deferred Inflows of Resources				
	Differences Between Expected and Actual Experience (14)	Changes of Assumptions (15)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (16)	Total Deferred Outflows of Resources (17)	Differences Between Expected and Actual Experience (18)	Net Difference Between Projected and Actual Investment Earnings on Pension Plan Investments (19)	Changes of Assumptions (20)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (21)	Total Deferred Inflows of Resources (22)
Greater Lowell RVTSD	52,656	1,492,562	509,189	2,054,407	79,740	424,120	0	821,777	1,325,637
Groton-Dunstable RSD	36,132	1,024,173	921,862	1,982,167	54,717	291,024	0	24,048	369,789
Hudson Housing Authority	3,897	110,456	5,430	119,783	5,901	31,387	0	279,840	317,128
Lincoln Sudbury	28,551	809,290	204,134	1,041,975	43,236	229,964	0	401,183	674,383
Nashoba Vally THSD	11,846	335,791	182,377	530,014	17,940	95,417	0	187,321	300,678
N. Chelmsford Water	2,746	77,841	104,807	185,394	4,159	22,119	0	93,700	119,978
North Middlesex RSD	39,153	1,109,797	53,258	1,202,208	59,291	315,355	0	313,125	687,771
Shawsheen Valley RVS	26,778	759,029	190,937	976,744	40,551	215,682	0	501,310	757,543
South Middlesex RVTS	21,896	620,645	92,573	735,114	33,158	176,360	0	589,040	798,558
Sudbury Water District	5,739	162,661	220,905	389,305	8,690	46,221	0	283,191	338,102
Tewksbury Housing Authority	5,152	146,031	87,247	238,430	7,802	41,495	0	7,731	57,028
Wayland Housing Authority	2,061	58,423	73,141	133,625	3,121	16,601	0	15,601	35,323
Hopkinton Housing Authority	1,545	43,796	22,988	68,329	2,340	12,445	0	48,515	63,300
Sudbury Housing Authority	1,472	41,735	96,811	140,018	2,230	11,859	0	7,609	21,698
Wilmington Housing Authority	1,132	32,088	25,159	58,379	1,714	9,118	0	439	11,271
Acton Housing Authority	2,502	70,907	57,374	130,783	3,788	20,148	0	183,157	207,093
Burlington Housing Authority	191	5,426	34,046	39,663	290	1,542	0	40,056	41,888
Ayer Housing Authority	2,672	75,737	739,776	818,185	4,046	21,521	0	854,798	880,365
Holliston Housing Authority	480	13,616	14,655	28,751	727	3,869	0	65,267	69,863
Littleton Housing Authority	1,569	44,479	34,538	80,586	2,376	12,639	0	6,713	21,728
Westford Housing Authority	1,746	49,499	39,828	91,073	2,644	14,065	0	0	16,709

Employer Name	Deferred Outflows of Resources				Deferred Inflows of Resources				
	Differences Between Expected and Actual Experience (14)	Changes of Assumptions (15)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (16)	Total Deferred Outflows of Resources (17)	Differences Between Expected and Actual Experience (18)	Net Difference Between Projected and Actual Investment Earnings on Pension Plan Investments (19)	Changes of Assumptions (20)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (21)	Total Deferred Inflows of Resources (22)
Shirley Water District	1,131	32,054	6,427	39,612	1,713	9,108	0	50,370	61,191
Tyngsboro Housing Authority	1,674	47,454	38,104	87,232	2,535	13,484	0	8,740	24,759
Pepperell Housing Authority	590	16,732	38,261	55,583	894	4,754	0	2,078	7,726
Groton Housing Authority	-51	-1,443	6,198	4,704	-77	-410	0	20,575	20,088
Tyngsboro Water District	1,283	36,362	8,651	46,296	1,943	10,332	0	20,791	33,066
North Reading Housing Authority	472	13,377	34,061	47,910	715	3,801	0	5,414	9,930
West Groton Water	74	2,090	15,750	17,914	112	594	0	8,001	8,707
Ayer-Shirley RSD	14,091	399,418	186,529	600,038	21,339	113,497	0	674,957	809,793
Grand Totals:	\$4,785,871	\$135,657,111	\$40,343,902	\$180,786,884	\$7,247,514	\$38,547,705	\$0	\$40,343,902	\$86,139,121

Employer Name	Deferred Inflows/(Outflows) Recognized In Future Pension Expense (Year Ended June 30)					
	2019 (23)	2020 (24)	2021 (25)	2022 (26)	2023 (27)	Thereafter (28)
Middlesex County Retirement Board	\$0	\$0	\$0	\$0	\$0	\$0
Middlesex County	0	0	0	0	0	0
Middlesex Hospital	0	0	0	0	0	0
Town of Acton	1,133,445	1,099,000	548,766	279,786	0	0
Town of Ashby	88,645	87,370	45,336	68,296	0	0
Town of Ashland	1,528,568	1,505,477	1,000,753	71,922	0	0
Town of Ayer	394,655	381,790	150,347	124,848	0	0
Town of Bedford	870,969	835,482	299,117	-214,989	0	0
Town of Billerica	3,081,964	2,981,694	1,859,375	-962,659	0	0
Town of Boxborough	523,671	516,360	385,087	20,356	0	0
Town of Burlington	3,221,494	3,137,616	2,011,235	116,637	0	0
Town of Carlisle	301,105	294,364	110,493	-92,593	0	0
Town of Chelmsford	2,712,161	2,637,839	1,793,152	430,192	0	0
Town of Dracut	1,960,736	1,917,780	1,254,246	238,567	0	0
Town of Dunstable	85,766	83,933	42,499	61,150	0	0
Town of Groton	393,634	378,341	176,645	-172,520	0	0
Town of Holliston	508,637	491,646	104,296	-72,914	0	0
Town of Hopkinton	829,535	814,779	276,575	-94,289	0	0
Town of Hudson	1,819,931	1,774,791	1,018,043	8,332	0	0
Town of Lincoln	510,108	492,352	162,574	-170,798	0	0
Town of Littleton	913,814	898,493	458,993	-126,517	0	0
Town of North Reading	1,050,471	1,016,145	566,919	-35,423	0	0

Employer Name	Deferred Inflows/(Outflows) Recognized In Future Pension Expense (Year Ended June 30)					
	2019 (23)	2020 (24)	2021 (25)	2022 (26)	2023 (27)	Thereafter (28)
Town of Pepperell	852,427	840,753	603,981	-76,498	0	0
Town of Sherborn	195,699	188,198	47,825	-46,766	0	0
Town of Shirley	-37,339	-43,346	-128,741	-90,077	0	0
Town of Stow	333,528	326,052	196,539	-27,762	0	0
Town of Sudbury	1,592,623	1,550,621	1,024,670	219,585	0	0
Town of Tewksbury	2,958,555	2,888,515	2,128,701	561,457	0	0
Town of Townsend	266,163	260,383	112,683	-185,573	0	0
Town of Tyngsborough	820,919	805,985	484,884	-339,542	0	0
Town of Wayland	622,552	584,173	-15,194	-409,738	0	0
Town of Westford	1,733,966	1,697,019	837,421	-216,890	0	0
Town of Weston	893,263	849,399	281,133	-505,851	0	0
Town of Wilmington	2,412,148	2,352,530	1,611,978	170,310	0	0
Acton-Boxborough RSD	1,014,858	995,499	643,481	-83,332	0	0
Acton Water Supply	111,706	109,295	75,650	-10,372	0	0
Bedford Housing Authority	15,636	15,410	10,304	390	0	0
Billerica Housing Authority	60,550	59,579	47,858	-1,221	0	0
Chelmsford Housing Authority	215,248	213,799	178,512	153,100	0	0
Chelmsford Water District	99,820	99,540	39,136	-24,733	0	0
Dracut Housing Authority	42,452	40,985	33,800	15,084	0	0
Dracut Water Supply	109,586	107,421	87,826	64,816	0	0
E. Chelmsford Water	13,509	13,278	5,980	-782	0	0
E. Middlesex Mosq Control	17,699	17,335	382	-14,167	0	0

Employer Name	Deferred Inflows/(Outflows) Recognized In Future Pension Expense (Year Ended June 30)					
	2019 (23)	2020 (24)	2021 (25)	2022 (26)	2023 (27)	Thereafter (28)
Greater Lowell RVTSD	268,536	257,375	124,620	78,239	0	0
Groton-Dunstable RSD	592,320	584,662	390,037	45,359	0	0
Hudson Housing Authority	-47,193	-48,019	-51,781	-50,352	0	0
Lincoln Sudbury	141,985	135,938	66,314	23,355	0	0
Nashoba Vally THSD	70,696	68,186	55,905	34,549	0	0
N. Chelmsford Water	24,406	23,824	4,227	12,959	0	0
North Middlesex RSD	245,892	237,596	85,910	-54,961	0	0
Shawsheen Valley RVS	134,441	128,765	66,877	-110,882	0	0
South Middlesex RVTs	54,762	50,121	-19,782	-148,545	0	0
Sudbury Water District	43,438	42,220	26,335	-60,790	0	0
Tewksbury Housing Authority	65,488	64,395	48,426	3,093	0	0
Wayland Housing Authority	37,610	37,173	25,640	-2,121	0	0
Hopkinton Housing Authority	8,379	8,053	-263	-11,140	0	0
Sudbury Housing Authority	39,304	38,990	29,781	10,245	0	0
Wilmington Housing Authority	16,341	16,100	11,981	2,686	0	0
Acton Housing Authority	-6,389	-6,920	-18,883	-44,118	0	0
Burlington Housing Authority	3,186	3,149	-9,325	765	0	0
Ayer Housing Authority	48,559	47,997	39,417	-198,153	0	0
Holliston Housing Authority	-7,399	-7,498	-12,329	-13,886	0	0
Littleton Housing Authority	20,418	20,090	17,153	1,197	0	0
Westford Housing Authority	25,545	25,174	17,021	6,624	0	0

Employer Name	Deferred Inflows/(Outflows) Recognized In Future Pension Expense (Year Ended June 30)					
	2019 (23)	2020 (24)	2021 (25)	2022 (26)	2023 (27)	Thereafter (28)
Shirley Water District	-3,209	-3,448	-8,410	-6,512	0	0
Tyngsboro Housing Authority	19,892	19,536	16,968	6,077	0	0
Pepperell Housing Authority	16,163	16,042	13,256	2,396	0	0
Groton Housing Authority	-3,469	-3,459	-4,193	-4,263	0	0
Tyngsboro Water District	8,938	8,664	608	-4,980	0	0
North Reading Housing Authority	13,869	13,772	11,026	-687	0	0
West Groton Water	3,773	3,757	279	1,398	0	0
Ayer-Shirley RSD	-13,422	-16,407	-101,156	-78,770	0	0
Grand Totals:	\$38,097,737	\$37,083,503	\$21,398,919	-\$1,932,396	\$0	\$0

Section 3: Supplemental Information

EXHIBIT I – ACTUARIAL ASSUMPTIONS AND ACTUARIAL COST METHOD

Net Investment Return:	7.50% (previously, 7.75%). The net investment return assumption is a long-term estimate derived from historical data, current and recent market expectations, and professional judgment. As part of the analysis, a building block approach was used that reflects inflation expectations and anticipated risk premiums for each of the portfolio's asset classes, as well as the Plan's target asset allocation.			
Salary Increases:	Years of Service	Group 1	Group 2	Group 4
	0	6.00%	6.00%	7.00%
	1	5.50%	5.50%	6.50%
	2	5.50%	5.50%	6.00%
	3	5.25%	5.25%	5.75%
	4	5.25%	5.25%	5.25%
	5	4.75%	4.75%	5.25%
	6	4.75%	4.75%	4.75%
	7	4.50%	4.50%	4.75%
	8	4.50%	4.50%	4.50%
	9	4.25%	4.25%	4.50%
	10	4.25%	4.25%	4.50%
	11	4.00%	4.25%	4.50%
	12+	4.00%	4.25%	4.50%
	Includes an allowance for inflation of 3.25% (previously, 3.5%). Previously, ultimate rates of 4.25% for Group 1, 4.5% for Group 2 and 4.75% for Group 4. The salary scale assumption is a long-term estimate derived from historical data, current and recent market expectations, and professional judgment.			

Interest on Employee Contributions:	3.5%
Administrative Expenses:	\$3,500,000 for calendar 2018, increasing 3.25% per year (previously, \$3,500,000 for calendar 2016, increasing 3.5% per year) The administrative expense assumption is based on information on expected expenses provided by the Retirement System.
Mortality Rates:	<i>Pre-Retirement:</i> RP-2014 Blue Collar Employee Mortality Table projected generationally with Scale MP-2017 (previously, RP-2000 Employee Mortality Table projected generationally from 2009 with Scale BB2D) <i>Healthy Retiree:</i> RP-2014 Blue Collar Healthy Annuitant Mortality Table projected generationally with Scale MP-2017 (previously, RP-2000 Healthy Annuitant Mortality Table projected generationally from 2009 with Scale BB2D) <i>Disabled Retiree:</i> RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2017 (previously, RP-2000 Healthy Annuitant Mortality Table projected generationally from 2015 with Scale BB2D) The mortality tables reasonably reflect the projected mortality experience of the Plan as of the measurement date based on historical and current demographic data. As part of the analysis, a comparison was made between the actual number of retiree deaths and the projected number based on the prior year's assumptions over the most recent eight years. The mortality tables were then adjusted to future years using generational projection under Scale MP-2017 to reflect future mortality improvement.

Termination Rates before Retirement:	Groups 1 and 2 - Rate (%)					
	Mortality					Disability
	Current		Previous			
	Age	Male	Female	Male	Female	
	20	0.05	0.02	0.03	0.02	0.02
	25	0.06	0.02	0.04	0.02	0.02
	30	0.06	0.02	0.04	0.03	0.03
	35	0.07	0.03	0.08	0.05	0.06
	40	0.08	0.04	0.11	0.07	0.10
	45	0.13	0.07	0.15	0.11	0.15
	50	0.22	0.12	0.21	0.17	0.19
	55	0.36	0.19	0.30	0.25	0.24
	60	0.61	0.27	0.49	0.39	0.28
Notes: Mortality rates do not reflect generational projection. 55% of the disability rates shown represent accidental disability. 20% of the accidental disabilities will die from the same cause as the disability. 55% of the death rates shown represent accidental death.						

Age	Group 4 - Rate (%)					Disability
	Mortality					
	Current		Previous			
	Male	Female	Male	Female		
20	0.05	0.02	0.03	0.02	0.20	
25	0.06	0.02	0.04	0.02	0.20	
30	0.06	0.02	0.04	0.03	0.30	
35	0.07	0.03	0.08	0.05	0.30	
40	0.08	0.04	0.11	0.07	0.30	
45	0.13	0.07	0.15	0.11	1.00	
50	0.22	0.12	0.21	0.17	1.25	
55	0.36	0.19	0.30	0.25	1.20	
60	0.61	0.27	0.49	0.39	0.85	

Notes: Mortality rates do not reflect generational projection.

90% of the disability rates shown represent accidental disability.

60% of the accidental disabilities will die from the same cause as the disability.

90% of the death rates shown represent accidental death.

The termination rates and disability rates were based on historical and current demographic data, adjusted to reflect economic conditions of the area and estimated future experience and professional judgment. As part of the analysis, a comparison was made between the actual number of terminations and disability retirements and the projected number based on the prior year's assumptions over the past eight years.

Withdrawal Rates:	Rate per year (%)			
	Years of Service	Groups 1 and 2	Years of Service	Group 4
	0	15.0	0 – 10	1.5
	1	12.0	11+	0.0
	2	10.0		
	3	9.0		
	4	8.0		
	5 – 9	7.6		
	10 – 14	5.4		
	15 – 19	3.3		
	20 – 24	2.0		
	25 - 29	1.0		
	30+	0.0		
The termination rates and disability rates were based on historical and current demographic data, adjusted to reflect economic conditions of the area and estimated future experience and professional judgment. As part of the analysis, a comparison was made between the actual number of terminations and disability retirements and the projected number based on the prior years' assumption over the most recent eight years.				

Retirement Rates:	Rate per year (%)			
	Groups 1 and 2			Group 4
	Age	Male	Female	
	45 – 49	--	--	1.0
	50 – 54	--	--	2.0
	55 – 59	2.0	5.5	15.0
	60 – 61	12.0	5.0	20.0
	62 – 64	30.0	15.0	25.0
	65 – 68	40.0	15.0	100.0
	69	50.0	20.0	--
	70	100.0	100.0	--
	The retirement rates were based on historical and current demographic data, adjusted to reflect economic conditions of the area and estimated future experience and professional judgment. As part of the analysis, a comparison was made between the actual number of retirements by age and the projected number based on the prior years' assumption over the most recent eight years.			
Retirement Rates for Inactive Vested Participants:	Age 60 for Group 1 and Group 2 members and age 55 for participants hired prior to April 2, 2012. For participants hired April 2, 2012 or later, 60 for Group 1, 55 for Group 2 and 50 for Group 4. The retirement age for inactive vested participants was based on historical and current demographic data, adjusted to reflect economic conditions of the area and estimated future experience and professional judgment.			
Unknown Data for Participants:	Same as those exhibited by participants with similar known characteristics. If not specified, participants are assumed to be male.			
Family Composition:	75% of participants are assumed to be married. None are assumed to have dependent children. Females are assumed to be three years younger than their male spouses.			
Benefit Election:	All participants are assumed to elect Option A. The benefit election reflects the fact that all benefit options are actuarially equivalent.			
2017 Salary:	2017 salaries are equal to salaries provided in the data, except for actives missing salary and employees with less than one year of service, where salaries are calculated from annualized contributions divided by the contribution rates provided.			
Total Service:	Total creditable service reported in the data.			
Net 3(8)(c) Liability:	No liability is valued for benefits paid to or received from other municipal systems.			

Actuarial Value of Assets:	Market value of assets as reported in the System's Annual Statement less unrecognized return in each of the last five years. Unrecognized return is equal to the difference between the actual market value return and the expected market value return and is recognized over a five-year period, further adjusted, if necessary, to be within 20% of the market value.
Actuarial Cost Method:	Entry Age Normal Actuarial Cost Method. Entry Age is the attained age of the participant less Total Service as defined above. Normal Cost and Actuarial Accrued Liability are calculated on an individual basis and are allocated by salary. Normal Cost is determined using the plan of benefits applicable to each participant.
Justification for Change in Actuarial Assumptions:	Based on past experience and future expectations, the following actuarial assumption were changed as of January 1, 2018: • The investment return assumption was lowered from 7.75% to 7.50%. • The mortality assumption for non-disabled participants was updated from the RP-2000 Employee and Healthy Annuitant Mortality Tables projected generationally from 2009 with Scale BB2D to the RP-2014 Blue Collar Employee and Healthy Annuitant Mortality Tables projected generationally with Scale MP-2017. • The mortality assumption for disabled participants was updated from the RP-2000 Healthy Annuitant Mortality Table projected generationally from 2015 with Scale BB2D to the RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2017. • The ultimate salary increase assumption was lowered from 4.25% to 4.00% for Group 1, from 4.50% to 4.25% for Group 2 and from 4.75% to 4.50% for Group 4. • The administrative expense assumption was changed from \$3,500,000 for calendar 2016, increasing 3.5% per year, to \$3,500,000 for calendar 2018, increasing 3.25% per year.

EXHIBIT II – SUMMARY OF PLAN PROVISIONS

This exhibit summarizes the major provisions of Chapter 32 of the Laws of Massachusetts.

Plan Year:	January 1 through December 31																																																							
Plan Status:	Ongoing																																																							
Retirement Benefits:	Employees covered by the Contributory Retirement Law are classified into one of four groups depending on job classification. Group 1 comprises most positions in state and local government. It is the general category of public employees. Group 4 comprises mainly police and firefighters. Group 2 is for other specified hazardous occupations. (Officers and inspectors of the State Police are classified as Group 3.) For employees hired prior to April 2, 2012, the annual amount of the retirement allowance is based on the member's final three-year average salary multiplied by the number of years and full months of creditable service at the time of retirement and multiplied by a percentage according to the following table based on the age of the member at retirement: <table><tr><th colspan="4">Age Last Birthday at Date of Retirement</th></tr><tr><th>Percent</th><th>Group 1</th><th>Group 2</th><th>Group 4</th></tr><tr><td>2.5</td><td>65 or over</td><td>60 or over</td><td>55 or over</td></tr><tr><td>2.4</td><td>64</td><td>59</td><td>54</td></tr><tr><td>2.3</td><td>63</td><td>58</td><td>53</td></tr><tr><td>2.2</td><td>62</td><td>57</td><td>52</td></tr><tr><td>2.1</td><td>61</td><td>56</td><td>51</td></tr><tr><td>2.0</td><td>60</td><td>55</td><td>50</td></tr><tr><td>1.9</td><td>59</td><td>--</td><td>49</td></tr><tr><td>1.8</td><td>58</td><td>--</td><td>48</td></tr><tr><td>1.7</td><td>57</td><td>--</td><td>47</td></tr><tr><td>1.6</td><td>56</td><td>--</td><td>46</td></tr><tr><td>1.5</td><td>55</td><td>--</td><td>45</td></tr></table> A member's final three-year average salary is defined as the greater of the highest consecutive three-year average annual rate of regular compensation and the average annual rate of regular compensation received during the last three years of creditable service prior to retirement.				Age Last Birthday at Date of Retirement				Percent	Group 1	Group 2	Group 4	2.5	65 or over	60 or over	55 or over	2.4	64	59	54	2.3	63	58	53	2.2	62	57	52	2.1	61	56	51	2.0	60	55	50	1.9	59	--	49	1.8	58	--	48	1.7	57	--	47	1.6	56	--	46	1.5	55	--	45
Age Last Birthday at Date of Retirement																																																								
Percent	Group 1	Group 2	Group 4																																																					
2.5	65 or over	60 or over	55 or over																																																					
2.4	64	59	54																																																					
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2.0	60	55	50																																																					
1.9	59	--	49																																																					
1.8	58	--	48																																																					
1.7	57	--	47																																																					
1.6	56	--	46																																																					
1.5	55	--	45																																																					

For employees hired on April 2, 2012 or later, the annual amount of the retirement allowance is based on the member's final five-year average salary multiplied by the number of years and full months of creditable service at the time of retirement and multiplied by a percentage according to the following tables based on the age and years of creditable service of the member at retirement:

For members with less than 30 years of creditable service: Age Last Birthday at Date of Retirement			
Percent	Group 1	Group 2	Group 4
2.50	67 or over	62 or over	57 or over
2.35	66	61	56
2.20	65	60	55
2.05	64	59	54
1.90	63	58	53
1.75	62	57	52
1.60	61	56	51
1.45	60	55	50

For members with 30 years of creditable service or greater: Age Last Birthday at Date of Retirement			
Percent	Group 1	Group 2	Group 4
2.500	67 or over	62 or over	57 or over
2.375	66	61	56
2.250	65	60	55
2.125	64	59	54
2.000	63	58	53
1.875	62	57	52
1.750	61	56	51
1.625	60	55	50

A member's final five-year average salary is defined as the greater of the highest consecutive five-year average annual rate of regular compensation and the average annual rate of regular compensation received during the last five years of creditable service prior to retirement.

	For employees who became members after January 1, 2011, regular compensation is limited to 64% of the federal limit found in 26 U.S.C. 401(a)(17). In addition, regular compensation for members who retire after April 2, 2012 will be limited to prohibit “spiking” of a member’s salary to increase the retirement benefit. For all employees, the maximum annual amount of the retirement allowance is 80 percent of the member’s final average salary. Any member who is a veteran also receives an additional yearly retirement allowance of \$15 per year of creditable service, not exceeding \$300. The veteran allowance is paid in addition to the 80 percent maximum.										
Employee Contributions:	<table> <tr> <th>Date of Hire</th><th>Contribution Rate</th></tr> <tr> <td>Prior to January 1, 1975</td><td>5%</td></tr> <tr> <td>January 1, 1975 – December 31, 1983</td><td>7%</td></tr> <tr> <td>January 1, 1984 – June 30, 1996</td><td>8%</td></tr> <tr> <td>July 1, 1996 onward</td><td>9%</td></tr> </table> In addition, employees hired after December 31, 1978 contribute an additional 2 percent of salary in excess of \$30,000. Employees hired after 1983 who voluntarily withdraw their contributions with less than 10 ten years of credited service receive 3% interest on their contributions. Employees in Group 1 hired on or after April 2, 2012 with 30 years of creditable service or greater will pay a base contribution rate of 6%.	Date of Hire	Contribution Rate	Prior to January 1, 1975	5%	January 1, 1975 – December 31, 1983	7%	January 1, 1984 – June 30, 1996	8%	July 1, 1996 onward	9%
Date of Hire	Contribution Rate										
Prior to January 1, 1975	5%										
January 1, 1975 – December 31, 1983	7%										
January 1, 1984 – June 30, 1996	8%										
July 1, 1996 onward	9%										
Retirement Benefits (Superannuation):	Members of Group 1, 2 or 4 hired prior to April 2, 2012 may retire upon the attainment of age 55. For retirement at ages below 55, twenty years of creditable service is required. Members hired prior to April 2, 2012 who terminate before age 55 with ten or more years of creditable service are eligible for a retirement allowance upon the attainment of age 55 (provided they have not withdrawn their accumulated deductions from the Annuity Savings Fund of the System). Members of Group 1 hired April 2, 2012 or later may retire upon the attainment of age 60. Members of Group 2 or 4 hired April 2, 2012 or later may retire upon the attainment of age 55. Members of Group 4 may retire upon attainment of age 50 with ten years of creditable service. Members hired April 2, 2012 or later who terminate before age 55 (60 for members of Group 1) with ten or more years of creditable service are eligible for a retirement allowance upon the attainment of age 55 (60 for members of Group 1) provided they have not withdrawn their accumulated deductions from the Annuity Savings Fund of the System.										
Ordinary Disability Benefit:	A member who is unable to perform his or her job due to a non-occupational disability will receive a retirement allowance if he or she has ten or more years of creditable service and has not reached age 55. The annual amount of such allowance shall be determined as if the member retired for superannuation at age 55 (age 60 for Group 1 members hired on or after April 2, 2012), based on the amount of creditable service at the date of										

	disability. For veterans, there is a minimum benefit of 50 percent of the member's most recent year's pay plus an annuity based on his or her own contributions.
Accidental Disability Benefit:	For a job-connected disability, the benefit is 72 percent of the member's most recent annual pay plus an annuity based on his or her own contributions, plus additional amounts for surviving children. Benefits are capped at 75 percent of annual rate of regular compensation for employees who become members after January 1, 1988.
Death Benefits:	In general, the beneficiary of an employee who dies in active service will receive a refund of the employee's own contributions. Alternatively, if the employee were eligible to retire on the date of death, a spouse's benefit will be paid equal to the amount the employee would have received under Option C. The surviving spouse of a member who dies with two or more years of credited service has the option of a refund of the employee's contributions or a monthly benefit regardless of eligibility to retire, if they were married for at least one year. There is also a minimum widow's pension of \$500 per month, and there are additional amounts for surviving children. If an employee's death is job-connected, the spouse will receive 72 percent of the member's most recent annual pay, in addition to a refund of the member's accumulated deductions, plus additional amounts for surviving children. However, in accordance with Section 100 of Chapter 32, the surviving spouse of a police officer, firefighter or corrections officer is killed in the line of duty will be eligible to receive an annual benefit equal to the maximum salary held by the member at the time of death. Upon the death of a job-connected disability retiree who retired prior to November 7, 1996 and could not elect an Option C benefit, a surviving spouse will receive an allowance of \$12,000 per year if the member dies for a reason unrelated to cause of disability.
"Heart And Lung Law" And Cancer Presumption:	Any case of hypertension or heart disease resulting in total or partial disability or death to a uniformed fireman, permanent member of a police department, or certain employees of a county correctional facility is presumed to have been suffered in the line of duty, unless the contrary is shown by competent evidence. Any case of disease of the lungs or respiratory tract resulting in total disability or death to a uniformed fireman is presumed to have been suffered in the line of duty, unless the contrary is shown by competent evidence. There is an additional presumption for uniformed firemen that certain types of cancer are job-related if onset occurs while actively employed or within five years of retirement.
Options:	Members may elect to receive a full retirement allowance payable for life under Option A. Under Option B a member may elect to receive a lower monthly allowance in exchange for a guarantee that at the time of death any contributions not expended for annuity payments will be refunded to the beneficiary. Option C allows the member to take a lesser retirement allowance in exchange for providing a survivor with two-thirds of the lesser amount. Option C pensioners will have benefits converted from a reduced to a full retirement if the beneficiary predeceases the retiree.

Post-Retirement Benefits:	The Board has adopted the provisions of Section 51 of Chapter 127 of the Acts of 1999, which provide that the Retirement Board may approve an annual COLA in excess of the Consumer Price Index but not to exceed a 3% COLA on the first \$14,000 of a retirement allowance. Cost-of-living increases granted prior to July 1, 1998 are reimbursed by the Commonwealth and not reflected in this report.
Changes in Plan Provisions:	None.

APPENDIX – GLOSSARY OF TERMS

Definitions of certain terms *as they are used in Statement 68*. The terms may have different meanings in other contexts.

Active Employees:	Individuals employed at the end of the reporting or measurement period, as applicable.
Actual Contributions:	Cash contributions recognized as additions to a pension Plan Fiduciary Net Position.
Actuarial Present Value of Projected Benefit Payments:	Projected benefit payments discounted to reflect the expected effects of the time value (present value) of money and the probabilities of payment.
Actuarial Valuation:	The determination, as of a point in time (the actuarial valuation date), of the service cost, Total Pension Liability, and related actuarial present value of projected benefit payments for pensions performed in conformity with Actuarial Standards of Practice unless otherwise specified by the GASB.
Actuarial Valuation Date:	The date as of which an actuarial valuation is performed.
Actuarially Determined Contribution:	A target or recommended contribution to a defined benefit pension plan for the reporting period, determined in conformity with Actuarial Standards of Practice based on the most recent measurement available when the contribution for the reporting period was adopted.
Ad Hoc Cost-of-Living Adjustments (Ad Hoc COLAs):	Cost-of-living adjustments that require a decision to grant by the authority responsible for making such decisions.
Ad Hoc Postemployment Benefit Changes:	Postemployment benefit changes that require a decision to grant by the authority responsible for making such decisions.
Agent Employer:	An employer whose employees are provided with pensions through an agent multiple-employer defined benefit pension plan.
Agent Multiple-Employer Defined Benefit Pension Plan (Agent Pension Plan):	A multiple-employer defined benefit pension plan in which pension plan assets are pooled for investment purposes but separate accounts are maintained for each individual employer so that each employer's share of the pooled assets is legally available to pay the benefits of only its employees.
Allocated Insurance Contract:	A contract with an insurance company under which related payments to the insurance company are currently used to purchase immediate or deferred annuities for individual employees. Also may be referred to as an annuity contract.
Automatic Cost-of-Living Adjustments (Automatic COLAs):	Cost-of-living adjustments that occur without a requirement for a decision to grant by a responsible authority, including those for which the amounts are determined by reference to a specified experience factor (such as the earnings experience of the pension plan) or to another variable (such as an increase in the consumer price index).

Automatic Postemployment Benefit Changes:	Postemployment benefit changes that occur without a requirement for a decision to grant by a responsible authority, including those for which the amounts are determined by reference to a specified experience factor (such as the earnings experience of the pension plan) or to another variable (such as an increase in the consumer price index).
Closed Period:	A specific number of years that is counted from one date and declines to zero with the passage of time. For example, if the recognition period initially is five years on a closed basis, four years remain after the first year, three years after the second year, and so forth.
Collective Deferred Outflows of Resources and Deferred Inflows of Resources Related to Pensions:	Deferred outflows of resources and deferred inflows of resources related to pensions arising from certain changes in the collective Net Pension Liability.
Collective Net Pension Liability:	The Net Pension Liability for benefits provided through (1) a cost-sharing pension plan or (2) a single-employer or agent pension plan in circumstances in which there is a special funding situation.
Collective Pension Expense:	Pension expense arising from certain changes in the collective Net Pension Liability.
Contributions:	Additions to a pension Plan Fiduciary Net Position for amounts from employers, non-employer contributing entities (for example, state government contributions to a local government pension plan), or employees. Contributions can result from cash receipts by the pension plan or from recognition by the pension plan of a receivable from one of these sources.
Cost-of-Living Adjustments:	Postemployment benefit changes intended to adjust benefit payments for the effects of inflation.
Cost-Sharing Employer:	An employer whose employees are provided with pensions through a cost-sharing multiple-employer defined benefit pension plan.
Cost-Sharing Multiple-Employer Defined Benefit Pension Plan (Cost-Sharing Pension Plan):	A multiple-employer defined benefit pension plan in which the pension obligations to the employees of more than one employer are pooled and pension plan assets can be used to pay the benefits of the employees of any employer that provides pensions through the pension plan.
Covered-Employee Payroll:	The payroll of employees that are provided with pensions through the pension plan.
Deferred Retirement Option Program (DROP):	A program that permits an employee to elect a calculation of benefit payments based on service credits and salary, as applicable, as of the DROP entry date. The employee continues to provide service to the employer and is paid for that service by the employer after the DROP entry date; however, the pensions that would have been paid to the employee (if the employee had retired and not entered the DROP) are credited to an individual employee account within the defined benefit pension plan until the end of the DROP period.
Defined Benefit Pension Plans:	Pension plans that are used to provide defined benefit pensions.

Defined Benefit Pensions:	Pensions for which the income or other benefits that the employee will receive at or after separation from employment are defined by the benefit terms. The pensions may be stated as a specified dollar amount or as an amount that is calculated based on one or more factors such as age, years of service, and compensation. (A pension that does not meet the criteria of a defined contribution pension is classified as a defined benefit pension for purposes of Statement 68.)
Defined Contribution Pension Plans:	Pension plans that are used to provide defined contribution pensions.
Defined Contribution Pensions:	Pensions having terms that (1) provide an individual account for each employee; (2) define the contributions that an employer is required to make (or the credits that it is required to provide) to an active employee's account for periods in which that employee renders service; and (3) provide that the pensions an employee will receive will depend only on the contributions (or credits) to the employee's account, actual earnings on investments of those contributions (or credits), and the effects of forfeitures of contributions (or credits) made for other employees, as well as pension plan administrative costs, that are allocated to the employee's account.
Discount Rate:	The single rate of return that, when applied to all projected benefit payments, results in an actuarial present value of projected benefit payments equal to the total of the following: 1. The actuarial present value of benefit payments projected to be made in future periods in which (a) the amount of the pension Plan Fiduciary Net Position is projected (under the requirements of Statement 68) to be greater than the benefit payments that are projected to be made in that period and (b) pension plan assets up to that point are expected to be invested using a strategy to achieve the long-term expected rate of return, calculated using the long-term expected rate of return on pension plan investments. 2. The actuarial present value of projected benefit payments not included in (1), calculated using the municipal bond rate.
Entry Age Actuarial Cost Method:	A method under which the actuarial present value of the projected benefits of each individual included in an actuarial valuation is allocated on a level basis over the earnings or service of the individual between entry age and assumed exit age(s). The portion of this actuarial present value allocated to a valuation year is called the normal cost. The portion of this actuarial present value not provided for at a valuation date by the actuarial present value of future normal costs is called the actuarial accrued liability.
Inactive Employees:	Terminated individuals that have accumulated benefits but are not yet receiving them, and retirees or their beneficiaries currently receiving benefits.
Measurement Period:	The period between the prior and the current measurement dates.
Multiple-Employer Defined Benefit Pension Plan:	A defined benefit pension plan that is used to provide pensions to the employees of more than one employer.
Net Pension Liability (NPL):	The liability of employers and non-employer contributing entities to employees for benefits provided through a defined benefit pension plan.

Non-Employer Contributing Entities:	Entities that make contributions to a pension plan that is used to provide pensions to the employees of other entities. For purposes of Statement 68, employees are not considered non-employer contributing entities.
Other Postemployment Benefits:	All postemployment benefits other than retirement income (such as death benefits, life insurance, disability, and long-term care) that are provided separately from a pension plan, as well as postemployment healthcare benefits, regardless of the manner in which they are provided. Other postemployment benefits do not include termination benefits.
Pension Plans:	Arrangements through which pensions are determined, assets dedicated for pensions are accumulated and managed and benefits are paid as they come due.
Pensions:	Retirement income and, if provided through a pension plan, postemployment benefits other than retirement income (such as death benefits, life insurance, and disability benefits). Pensions do not include postemployment healthcare benefits and termination benefits.
Plan Members:	Individuals that are covered under the terms of a pension plan. Plan members generally include (1) employees in active service (active plan members) and (2) terminated employees who have accumulated benefits but are not yet receiving them and retirees or their beneficiaries currently receiving benefits (inactive plan members).
Postemployment:	The period after employment.
Postemployment Benefit Changes:	Adjustments to the pension of an inactive employee.
Postemployment Healthcare Benefits:	Medical, dental, vision, and other health-related benefits paid subsequent to the termination of employment.
Projected Benefit Payments:	All benefits estimated to be payable through the pension plan to current active and inactive employees as a result of their past service and their expected future service.
Public Employee Retirement System:	A special-purpose government that administers one or more pension plans; also may administer other types of employee benefit plans, including postemployment healthcare plans and deferred compensation plans.
Real Rate of Return:	The rate of return on an investment after adjustment to eliminate inflation.
Service Costs:	The portions of the actuarial present value of projected benefit payments that are attributed to valuation years.
Single Employer:	An employer whose employees are provided with pensions through a single-employer defined benefit pension plan.
Single-Employer Defined Benefit Pension Plan (Single-Employer Pension Plan):	A defined benefit pension plan that is used to provide pensions to employees of only one employer.

Special Funding Situations:	Circumstances in which a non-employer entity is legally responsible for making contributions directly to a pension plan that is used to provide pensions to the employees of another entity or entities and either of the following conditions exists: 1. The amount of contributions for which the non-employer entity legally is responsible is not dependent upon one or more events or circumstances unrelated to the pensions. 2. The non-employer entity is the only entity with a legal obligation to make contributions directly to a pension plan.
Termination Benefits:	Inducements offered by employers to active employees to hasten the termination of services, or payments made in consequence of the early termination of services. Termination benefits include early-retirement incentives, severance benefits, and other termination-related benefits.
Total Pension Liability (TPL):	The portion of the actuarial present value of projected benefit payments that is attributed to past periods of employee service in conformity with the requirements of Statement 68.

