

Middlesex County Retirement System

Governmental Accounting Standards Board (GASB)
Statements No. 67 and 68 Accounting Valuation Report
as of December 31, 2016





116 Huntington Ave., 8th Floor Boston, MA02116
T 617.424.7300 www.segalco.com

June 16, 2017

*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, 2016 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 reports. This valuation report may not otherwise be copied or reproduced in any form without the consent of the Board and may only be provided to other parties in its entirety. The census and financial information on which our calculations were based was provided by 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.

An actuarial valuation is a measurement at a specific date – it is not a prediction of a plan's future financial condition. We have not been retained to perform an analysis of the potential range of financial measurements, except where otherwise noted.

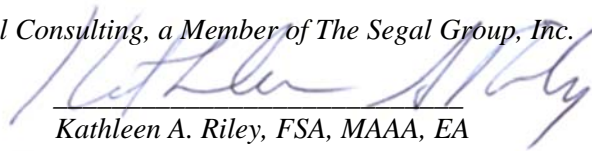
The actuarial calculations were directed under my supervision. I am a member of the American Academy of Actuaries and I meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein. To the best of my knowledge, the information supplied in the actuarial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

We 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: Valuation Summary for the Middlesex County Retirement System

Important Information About Actuarial Valuations

An actuarial valuation is a budgeting tool with respect to the financing of future projected obligations of a pension plan. It is an estimated forecast – 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.

In order to prepare a 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. Even where they appear precise, outside factors may change how they operate. It is important to keep Segal informed with respect to plan provisions and administrative procedures, and to review the plan summary included in our 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.

SECTION 1: Valuation Summary for the Middlesex County Retirement System

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

- The actuarial valuation is prepared at the request of the Middlesex County Retirement System. 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 Middlesex County Retirement System 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 System, it is not a fiduciary in its capacity as actuaries and consultants with respect to the System.

SECTION 1: Valuation Summary for the Middlesex County Retirement System

Purpose

This report has been prepared by Segal Consulting to present certain disclosure information required by Governmental Accounting Standards Board Statements No. 67 and 68 as of December 31, 2016. This report is based on financial information as of December 31, 2016 provided by the Retirement System and the Middlesex County Retirement System Actuarial Valuation and Review as of January 1, 2016, dated December 14, 2016, which reflects:

- The benefit provisions of Massachusetts General Laws Chapter 32;
- The characteristics of covered active participants, inactive participants, and retired participants and beneficiaries as of January 1, 2016;
- The assets of the System as of December 31, 2015;
- Economic assumptions regarding future salary increases and investment earnings; and
- Other actuarial assumptions, regarding employee terminations, retirement, death, etc.

Significant Issues in Valuation Year

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's 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 \$1.29 billion as of December 31, 2015 to \$1.42 billion as of December 31, 2016 and the Plan's Fiduciary Net Position as a percent of the TPL decreased from 46.13% to 45.49%.
- The NPL was measured as of December 31, 2016 and 2015 and was determined based upon the results of the actuarial valuations as of January 1, 2016 and January 1, 2014, respectively.
- The discount rate used to determine the TPL and NPL was 7.75% as of December 31, 2016 and 7.875% as of December 31, 2015.

SECTION 2: Accounting Information for the Middlesex County Retirement System

EXHIBIT 1

Net Pension Liability

The components of the net pension liability of the Middlesex County Retirement System are as follows:

	December 31, 2016	December 31, 2015
Total pension liability	\$2,599,296,751	\$2,394,501,842
Plan fiduciary net position	1,182,420,196	1,104,482,897
System's net pension liability	1,416,876,555	1,290,018,945
Plan fiduciary net position as a percentage of the total pension liability*	45.49%	46.13%

* *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, 2016 was based on an actuarial valuation as of December 31, 2015, using the following actuarial assumptions:

Inflation	3.50% (previously, 4.00%)
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.
Investment rate of return	7.75% (previously, 7.875%), net of pension plan investment expense, including inflation
Cost of Living Adjustment	3% of first \$14,000
Pre-retirement:	RP-2000 Employee Mortality Table projected generationally from 2009 using Scale BB2D (previously, RP-2000 Employee Mortality Table projected 22 years with Scale AA)
Healthy Retiree:	RP-2000 Healthy Annuitant Mortality Table projected generationally from 2009 using Scale BB2D (previously, RP-2000 Healthy Annuitant Mortality Table projected 17 years with Scale AA)
Disabled Retiree:	RP-2000 Healthy Annuitant Mortality Table projected generationally from 2015 using Scale BB2D (previously, RP-2000 Healthy Annuitant Mortality Table set forward three years projected 17 years with Scale AA)

SECTION 2: Accounting Information for the Middlesex County Retirement System

The long-term expected rate of return on pension plan investments was determined using a building-block method in which best-estimate ranges of expected future real rates of return (expected returns, net of pension plan investment expense and inflation) are developed for each major asset class. These ranges 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 and by adding expected inflation. Best estimates of arithmetic real rates of return for each major asset class included in the pension plan's target asset allocation as of December 31, 2016 and the target allocation as of December 31, 2016 are summarized in the following table:

Asset Class	Target Allocation	Long-Term Expected Real Rate of Return
Domestic equity	18.00%	6.44%
International developed markets equity	16.00%	7.40%
International emerging markets equity	6.00%	9.42%
Core fixed income	13.00%	2.02%
High-yield fixed income	10.00%	4.43%
Real estate	10.00%	5.00%
Commodities	4.00%	4.43%
Hedge fund, GTAA, Risk parity	13.00%	3.75%
Private equity	<u>10.00%</u>	10.47%
	100.00%	

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

Discount rate: The discount rate used to measure the total pension liability was 7.75%. 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 contributions will be made at rates equal to the actuarially determined contribution rates. Based on those assumptions, the pension plan's fiduciary net position was projected to be available to make all projected future benefit payments of 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 total pension liability.

SECTION 2: Accounting Information for the Middlesex County Retirement System

Sensitivity of the net pension liability to changes in the discount rate. The following presents the net pension liability, calculated using the discount rate of 7.75%, as well as what the net pension liability would be if it were calculated using a discount rate that is 1-percentage-point lower (6.75%) or 1-percentage-point higher (8.75%) than the current rate:

	1% Decrease (6.75%)	Current Discount (7.75%)	1% Increase (8.75%)
Middlesex County Retirement System's net pension liability as of December 31, 2016	\$1,711,007,052	\$1,416,876,555	\$1,168,296,041

SECTION 2: Accounting Information for the Middlesex County Retirement System

EXHIBIT 2

Schedule of Changes in the Net Pension Liability – Last Ten Years

	Year End December 31,									
	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
Total pension liability										
Service cost	\$56,386,392	\$54,217,685	\$52,132,389							
Interest	187,359,946	179,703,272	172,094,226							
Differences between expected and actual experience	7,976,453	0	0							
Changes of assumptions	96,500,754	0	0							
Changes of benefit terms	0	0	0							
Benefit payments, including refunds of employee contributions	<u>-143,428,636</u>	<u>-134,295,504</u>	<u>-125,082,678</u>							
Net change in total pension liability	\$204,794,909	\$99,625,453	\$99,143,937							
Total pension liability - beginning	<u>2,394,501,842</u>	<u>2,294,876,389</u>	<u>2,195,732,452</u>							
Total pension liability - ending (a)	\$2,599,296,751	\$2,394,501,842	\$2,294,876,389							
Plan fiduciary net position										
Contributions - employer	\$107,067,707	\$99,820,481	\$93,400,946							
Contributions - employee	42,841,461	40,870,163	39,806,980							
Net investment income	74,917,549	7,817,250	74,962,895							
Benefit payments, including refunds of employee contributions	<u>-143,428,636</u>	<u>-134,295,504</u>	<u>-125,082,678</u>							
Administrative expenses	<u>-3,460,782</u>	<u>-3,290,167</u>	<u>-3,540,884</u>							
Net change in fiduciary net position	\$77,937,299	\$10,922,223	\$79,547,259							
Plan fiduciary net position - beginning	<u>1,104,482,897</u>	<u>1,093,560,674</u>	<u>1,014,013,415</u>							
Plan fiduciary net position - ending (b)	\$1,182,420,196	\$1,104,482,897	\$1,093,560,674							
Net pension liability – ending: (a)-(b)	\$1,416,876,555	\$1,290,018,945	\$1,201,315,715							
Plan's fiduciary net position as a percentage of the total pension liability	45.49%	46.13%	47.65%							
Covered-employee payroll	\$439,644,322	\$432,382,921	\$415,752,810							
Net pension liability as a percentage of covered-employee payroll	322.28%	298.35%	288.95%							

(Historical information prior to implementation of GASB 67/68 is not required)

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Notes: Covered-employee payroll for 2016 as estimated in the January 1, 2016 funding valuation report.
Covered-employee payroll for 2015 and 2014 as estimated in the January 1, 2014 funding valuation report.

SECTION 2: Accounting Information for the Middlesex County Retirement System

Notes to Schedule:

Changes in Assumptions and Methods: The following changes were effective January 1, 2014:

- The actuarial cost method was changed to better reflect the impact of the plan changes effective for employees hired on or after April 2, 2012.
- The pre-retirement mortality assumption was changed from the RP-2000 Employee Mortality Table projected 12 years with Scale AA to the RP-2000 Employee Mortality Table projected 22 years with Scale AA.
- The mortality assumption for non-disabled retirees was changed from the RP-2000 Healthy Annuitant Mortality Table projected 12 years with Scale AA to the RP-2000 Healthy Annuitant Mortality Table projected 17 years with Scale AA.
- The mortality assumption for disabled participants was changed from the RP-2000 Healthy Annuitant Mortality Table set forward two years to the RP-2000 Healthy Annuitant Mortality Table set forward three years projected 17 years with Scale AA.
- The investment return assumption was lowered from 8.00% to 7.875%.
- The salary increase assumption was changed from level rates of 4.75% per year for Group 1 and Group 2 members and 5.25% per year for Group 4 members, including an allowance for inflation of 4.5% per year, to rates based on years of service with ultimate rates of 4.25% per year for Group 1 members, 4.5% per year for Group 2 members and 4.75% per year for Group 4 members, including an allowance for inflation of 4.0% per year.
- The assumed retirement age for inactive vested participants was changed from age 65 to age 60 for Group 1 and 2 members and remained the same at age 55 for Group 4 members hired prior to April 2, 2012. For participants hired April 2, 2012 or later, the assumption is 60 for Group 1 members, 55 for Group 2 members, and 50 for Group 4 members.
- The administrative expense assumption was increased from \$3,100,000 for calendar 2012 to \$3,400,000 for calendar 2014.

SECTION 2: Accounting Information for the Middlesex County Retirement System

The following changes were 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.

Changes in Plan Provisions:

The following change was reflected in the January 1, 2014 actuarial valuation:

- Members hired on or after April 2, 2012 are covered by the provisions of Chapter 32 as amended by of Chapter 176 of the Acts of 2011 and Chapter 139 of the Acts of 2012.

The following change was reflected in the January 1, 2016 actuarial valuation:

- 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.

SECTION 2: Accounting Information for the Middlesex County Retirement System

EXHIBIT 3

Schedule of Contributions – Last Ten Years

	Year End December 31,									
	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
Actuarially determined contribution	\$105,246,797	\$98,792,642	\$92,826,743							
Contributions in relation to the actuarially determined contribution	<u>107,067,707</u>	<u>99,820,481</u>	<u>93,400,946</u>							
Contribution deficiency (excess)	-\$1,820,910	-\$1,027,839	-\$574,203							
Covered-employee payroll	\$439,644,322	\$432,382,921	\$415,752,810							
Contributions as a percentage of covered-employee payroll	24.35%	23.09%	22.47%							(Historical information prior to implementation of GASB 67/68 is not required)

*Notes: Actuarially determined contributions for 2016 and 2015 are based on results from the January 1, 2014 actuarial valuation.
Actuarially determined contribution for 2014 is based on results from the January 1, 2012 actuarial valuation.*

SECTION 2: Accounting Information for the Middlesex County Retirement System

EXHIBIT 4

Pension Expense and Deferred Outflows/Inflows of Resources Related to Pensions

A. Pension expense for the year ended June 30, 2017

Service cost	\$56,386,392
Interest	187,359,946
Contributions – employee	-42,841,461
Projected earnings on pension plan investments	-87,096,931
Administrative expenses	3,460,782
Recognized portion of current-period difference between expected and actual experience	1,595,291
Recognized portion of current-period difference between projected and actual earnings on pension plan investments	2,435,876
Recognized portion of current year period assumption change	19,300,151
Recognized portion of current year period plan change	0
Recognition of deferred outflows of resources	16,698,816
Recognition of deferred inflows of resources	0
Pension expense for fiscal year ended June 30, 2017	\$157,298,862

B. Deferred outflows/inflows of resources related to pensions

	Deferred Outflows of Resources	Deferred Inflows of Resources
Differences between expected and actual experience	\$6,381,162	\$0
Changes of assumptions	77,200,603	0
Net difference between projected and actual earnings on pension plan investments	<u>58,825,722</u>	<u>0</u>
Total	\$142,407,487	\$0

C. Projected recognition of deferred outflows/(inflows)

	Year Ended June 30,	Recognition
	2018	\$40,030,134
	2019	40,030,135
	2020	39,015,901
	2021	23,331,317
	Thereafter	0

SECTION 2: Accounting Information for the Middlesex County Retirement System

EXHIBIT 5

Determination of Proportionate Share

Employer Name	2016				2017			
	FY 2016 Total Appropriation	Percent of FY 2016 Total Appropriation as of January 1, 2016	Share of NPL as of January 1, 2016	Percent of Total NPL as of January 1, 2016	FY 2017 Total Appropriation	Percent of FY 2017 Total Appropriation as of January 1, 2017	Share of NPL as of January 1, 2017	Percent of Total NPL as of January 1, 2017
Middlesex County Retirement Board	\$311,767	0.312328%	\$0	0.000000%	\$331,856	0.309950%	\$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	3,243,883	3.249717%	44,369,446	3.439441%	3,462,510	3.233943%	45,680,759	3.224046%
Town of Ashby	163,640	0.163934%	1,611,292	0.124905%	173,361	0.161917%	1,387,848	0.097951%
Town of Ashland	2,311,579	2.315736%	26,910,611	2.086063%	2,447,482	2.285920%	31,797,911	2.244226%
Town of Ayer	1,343,292	1.345708%	17,086,573	1.324521%	1,429,491	1.335128%	17,032,643	1.202126%
Town of Bedford	3,481,523	3.487784%	47,296,776	3.666363%	3,715,207	3.469960%	50,282,391	3.548819%
Town of Billerica	9,204,554	9.221108%	127,076,615	9.850756%	9,826,635	9.177962%	143,712,635	10.142918%
Town of Boxborough	629,903	0.631036%	7,963,070	0.617283%	671,055	0.626758%	9,977,149	0.704165%
Town of Burlington	7,895,297	7.909496%	104,556,462	8.105033%	8,404,267	7.849488%	114,929,674	8.111481%
Town of Carlisle	771,117	0.772504%	8,912,755	0.690901%	820,032	0.765900%	9,988,584	0.704972%
Town of Chelmsford	7,096,040	7.108802%	93,051,442	7.213184%	7,552,208	7.053675%	100,190,226	7.071204%
Town of Dracut	3,970,321	3.977461%	52,368,527	4.059516%	4,233,672	3.954201%	57,818,789	4.080722%
Town of Dunstable	215,351	0.215738%	2,389,144	0.185202%	228,686	0.213590%	2,199,339	0.155224%
Town of Groton	1,737,842	1.740967%	20,586,198	1.595806%	1,839,040	1.717642%	22,421,400	1.582453%
Town of Holliston	1,861,516	1.864864%	23,403,449	1.814194%	2,064,334	1.928064%	24,188,374	1.707162%
Town of Hopkinton	1,728,744	1.731853%	19,499,185	1.511543%	1,836,364	1.715143%	21,332,499	1.505600%
Town of Hudson	4,397,249	4.405157%	56,963,462	4.415707%	4,686,376	4.377021%	62,417,388	4.405281%

SECTION 2: Accounting Information for the Middlesex County Retirement System

Employer Name	2016				2017			
	FY 2016 Total Appropriation	Percent of FY 2016 Total Appropriation as of January 1, 2016	Share of NPL as of January 1, 2016	Percent of Total NPL as of January 1, 2016	FY 2017 Total Appropriation	Percent of FY 2017 Total Appropriation as of January 1, 2017	Share of NPL as of January 1, 2017	Percent of Total NPL as of January 1, 2017
Town of Lincoln	1,802,909	1.806151%	23,666,611	1.834594%	1,922,136	1.795253%	25,563,964	1.804248%
Town of Littleton	1,762,316	1.765485%	21,397,309	1.658682%	2,575,271	2.405273%	23,959,114	1.690981%
Town of North Reading	3,283,343	3.289248%	44,145,145	3.422054%	3,499,063	3.268084%	47,493,109	3.351958%
Town of Pepperell	1,009,146	1.010961%	12,706,598	0.984993%	1,074,825	1.003874%	16,537,163	1.167156%
Town of Sherborn	821,360	0.822837%	10,262,053	0.795496%	880,589	0.822460%	10,736,551	0.757762%
Town of Shirley	710,468	0.711746%	9,134,041	0.708055%	754,746	0.704924%	8,912,285	0.629009%
Town of Stow	702,159	0.703422%	9,234,186	0.715818%	748,612	0.699195%	10,493,658	0.740619%
Town of Sudbury	3,710,907	3.717581%	51,874,232	4.021199%	3,961,686	3.700169%	56,372,784	3.978666%
Town of Tewksbury	6,586,336	6.598181%	85,301,248	6.612403%	6,993,838	6.532164%	93,491,923	6.598452%
Town of Townsend	650,040	0.651209%	7,475,618	0.579497%	690,007	0.644459%	9,167,760	0.647040%
Town of Tyngsborough	1,437,048	1.439632%	17,982,560	1.393976%	1,530,059	1.429057%	22,745,937	1.605358%
Town of Wayland	3,971,988	3.979131%	53,154,605	4.120452%	4,235,414	3.955828%	55,492,666	3.916549%
Town of Westford	3,993,806	4.000989%	47,358,134	3.671119%	4,238,879	3.959064%	52,904,581	3.733888%
Town of Weston	4,270,242	4.277922%	58,678,679	4.548668%	4,557,886	4.257013%	63,418,247	4.475919%
Town of Wilmington	5,342,251	5.351859%	74,403,164	5.767602%	6,204,192	5.794644%	82,103,885	5.794710%
Acton-Boxborough RSD	1,961,424	1.964951%	23,515,180	1.822855%	2,086,065	1.948361%	27,434,445	1.936262%
Acton Water Supply	165,791	0.166089%	2,784,648	0.215861%	177,725	0.165993%	3,319,310	0.234270%
Bedford Housing Authority	26,527	0.026575%	263,833	0.020452%	27,786	0.025952%	312,414	0.022049%
Billerica Housing Authority	82,988	0.083137%	1,068,744	0.082847%	87,992	0.082184%	1,343,792	0.094842%
Chelmsford Housing Authority	93,720	0.093889%	1,138,990	0.088293%	99,778	0.093191%	1,193,547	0.084238%
Chelmsford Water District	1,186,049	1.188182%	1,402,613	0.108728%	699,317	0.653154%	1,165,154	0.082234%

SECTION 2: Accounting Information for the Middlesex County Retirement System

Employer Name	2016				2017			
	FY 2016 Total Appropriation	Percent of FY 2016 Total Appropriation as of January 1, 2016	Share of NPL as of January 1, 2016	Percent of Total NPL as of January 1, 2016	FY 2017 Total Appropriation	Percent of FY 2017 Total Appropriation as of January 1, 2017	Share of NPL as of January 1, 2017	Percent of Total NPL as of January 1, 2017
Dracut Housing Authority	110,203	0.110401%	1,785,743	0.138428%	118,166	0.110366%	1,903,315	0.134332%
Dracut Water Supply	147,603	0.147868%	2,428,037	0.188217%	158,353	0.147900%	2,550,634	0.180018%
E. Chelmsford Water	24,608	0.024652%	286,759	0.022229%	26,158	0.024431%	321,683	0.022704%
E. Middlesex Mosq Control	37,103	0.037170%	496,144	0.038460%	39,549	0.036938%	585,986	0.041358%
Greater Lowell RVTSD	1,128,497	1.130527%	14,784,348	1.146057%	1,195,581	1.116659%	14,939,992	1.054431%
Groton-Dunstable RSD	707,990	0.709263%	8,509,375	0.659632%	752,342	0.702679%	10,353,378	0.730718%
Hudson Housing Authority	89,676	0.089837%	1,399,262	0.108468%	96,064	0.089723%	1,432,356	0.101093%
Lincoln Sudbury	548,534	0.549520%	7,913,832	0.613466%	586,204	0.547508%	8,168,982	0.576549%
Nashoba Vally THSD	230,992	0.231407%	3,156,315	0.244672%	246,363	0.230100%	3,254,718	0.229711%
N. Chelmsford Water	39,106	0.039176%	748,681	0.058036%	42,129	0.039348%	707,192	0.049912%
North Middlesex RSD	836,323	0.837827%	10,991,588	0.852049%	890,539	0.831753%	11,779,471	0.831369%
Shawsheen Valley RVS	520,323	0.521259%	7,364,846	0.570910%	554,980	0.518345%	8,457,396	0.596904%
South Middlesex RVTS	490,299	0.491181%	6,481,194	0.502411%	523,099	0.488568%	7,274,785	0.513438%
Sudbury Water District	82,136	0.082284%	1,446,469	0.112128%	88,372	0.082538%	2,003,371	0.141393%
Tewksbury Housing Authority	99,575	0.099754%	1,248,093	0.096750%	105,697	0.098720%	1,495,958	0.105581%
Wayland Housing Authority	30,339	0.030394%	447,164	0.034663%	32,430	0.030289%	609,217	0.042997%
Hopkinton Housing Authority	28,891	0.028943%	442,908	0.034333%	31,500	0.029421%	514,197	0.036291%
Sudbury Housing Authority	22,778	0.022819%	266,258	0.020640%	24,229	0.022630%	367,971	0.025971%
Wilmington Housing Authority	24,091	0.024134%	271,567	0.021051%	24,960	0.023312%	319,057	0.022518%

SECTION 2: Accounting Information for the Middlesex County Retirement System

Employer Name	2016				2017			
	FY 2016 Total Appropriation	Percent of FY 2016 Total Appropriation as of January 1, 2016	Share of NPL as of January 1, 2016	Percent of Total NPL as of January 1, 2016	FY 2017 Total Appropriation	Percent of FY 2017 Total Appropriation as of January 1, 2017	Share of NPL as of January 1, 2017	Percent of Total NPL as of January 1, 2017
Acton Housing Authority	65,147	0.065264%	827,882	0.064176%	69,434	0.064851%	990,778	0.069927%
Burlington Housing Authority	15,190	0.015217%	119,574	0.009269%	15,711	0.014674%	54,061	0.003816%
Ayer Housing Authority	16,010	0.016039%	441,841	0.034251%	49,993	0.046693%	1,891,747	0.133515%
Holliston Housing Authority	20,105	0.020141%	214,474	0.016626%	21,320	0.019913%	226,087	0.015957%
Littleton Housing Authority	29,540	0.029593%	367,115	0.028458%	31,258	0.029195%	454,776	0.032097%
Westford Housing Authority	35,704	0.035768%	427,017	0.033102%	37,649	0.035164%	478,025	0.033738%
Shirley Water District	17,865	0.017897%	358,461	0.027787%	19,279	0.018006%	359,871	0.025399%
Tyngsboro Housing Authority	31,734	0.031791%	399,306	0.030953%	33,609	0.031390%	455,142	0.032123%
Pepperell Housing Authority	8,913	0.008929%	100,348	0.007779%	9,474	0.008849%	159,347	0.011246%
Groton Housing Authority	2,247	0.002251%	12,029	0.000932%	2,363	0.002207%	13,516	0.000954%
Tyngsboro Water District	28,014	0.028064%	372,014	0.028838%	29,869	0.027897%	405,503	0.028620%
North Reading Housing Authority	10,459	0.010478%	84,100	0.006519%	10,855	0.010138%	147,057	0.010379%
West Groton Water	5,603	0.005613%	24,760	0.001919%	5,849	0.005463%	13,002	0.000918%
Ayer-Shirley RSD	400,447	0.401167%	4,808,243	0.372727%	425,887	0.397774%	4,668,086	0.329463%
Grand Totals:	\$99,820,481	100.000000%	\$1,290,018,945	100.000000%	\$107,067,707	100.000000%	\$1,416,876,555	100.000000%

Notes: Net Pension Liability for each employer was determined on an individual basis by rolling forward the Total Pension Liability from December 31, 2015 to December 31, 2016 for each employer and allocating the market value of assets as of December 31, 2016 to each employer based on detailed cash flow information provided by the Retirement System. 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.

SECTION 3: Supplemental Information for the Middlesex County Retirement System

EXHIBIT 6

Determination of Pension Amounts by Employer as of June 30, 2017

Employer Name	Employer's Proportionate Share Allocation (1)	Net Pension Liability (2)	Covered Employee Payroll (3)	Discount Rate Sensitivity		
				1% Decrease (6.75%) (4)	Current Discount (7.75%) (5)	1% Increase (8.75%) (6)
Middlesex County Retirement Board	0.000000%	\$0	\$1,320,310	\$0	\$0	\$0
Middlesex County	0.000000%	0	0	0	0	0
Middlesex Hospital	0.000000%	0	0	0	0	0
Town of Acton	3.224046%	45,680,759	13,020,403	55,163,653	45,680,759	37,666,402
Town of Ashby	0.097951%	1,387,848	892,435	1,675,949	1,387,848	1,144,358
Town of Ashland	2.244226%	31,797,911	11,348,608	38,398,865	31,797,911	26,219,204
Town of Ayer	1.202126%	17,032,643	5,317,592	20,568,461	17,032,643	14,044,390
Town of Bedford	3.548819%	50,282,391	18,150,929	60,720,543	50,282,391	41,460,712
Town of Billerica	10.142918%	143,712,635	33,403,976	173,546,042	143,712,635	118,499,309
Town of Boxborough	0.704165%	9,977,149	2,804,223	12,048,313	9,977,149	8,226,732
Town of Burlington	8.111481%	114,929,674	31,361,657	138,788,012	114,929,674	94,766,111
Town of Carlisle	0.704972%	9,988,584	5,103,107	12,062,121	9,988,584	8,236,160
Town of Chelmsford	7.071204%	100,190,226	23,331,173	120,988,799	100,190,226	82,612,596
Town of Dracut	4.080722%	57,818,789	14,484,571	69,821,441	57,818,789	47,674,914
Town of Dunstable	0.155224%	2,199,339	1,189,485	2,655,894	2,199,339	1,813,476
Town of Groton	1.582453%	22,421,400	7,051,413	27,075,882	22,421,400	18,487,736
Town of Holliston	1.707162%	24,188,374	10,294,366	29,209,662	24,188,374	19,944,706
Town of Hopkinton	1.505600%	21,332,499	13,435,811	25,760,922	21,332,499	17,589,865
Town of Hudson	4.405281%	62,417,388	21,333,104	75,374,669	62,417,388	51,466,724

SECTION 3: Supplemental Information for the Middlesex County Retirement System

Employer Name	Employer's Proportionate Share Allocation (1)	Net Pension Liability (2)	Covered Employee Payroll (3)	Discount Rate Sensitivity		
				1% Decrease (6.75%) (4)	Current Discount (7.75%) (5)	1% Increase (8.75%) (6)
Town of Lincoln	1.804248%	25,563,964	9,468,363	30,870,811	25,563,964	21,078,958
Town of Littleton	1.690981%	23,959,114	11,081,928	28,932,804	23,959,114	19,755,664
Town of North Reading	3.351958%	47,493,109	12,853,424	57,352,238	47,493,109	39,160,793
Town of Pepperell	1.167156%	16,537,163	4,404,857	19,970,121	16,537,163	13,635,837
Town of Sherborn	0.757762%	10,736,551	4,009,692	12,965,361	10,736,551	8,852,903
Town of Shirley	0.629009%	8,912,285	2,005,444	10,762,388	8,912,285	7,348,687
Town of Stow	0.740619%	10,493,658	3,375,342	12,672,043	10,493,658	8,652,622
Town of Sudbury	3.978666%	56,372,784	15,254,095	68,075,256	56,372,784	46,482,597
Town of Tewksbury	6.598452%	93,491,923	20,571,433	112,899,979	93,491,923	77,089,453
Town of Townsend	0.647040%	9,167,760	2,866,064	11,070,900	9,167,760	7,559,343
Town of Tyngsborough	1.605358%	22,745,937	7,396,732	27,467,789	22,745,937	18,755,334
Town of Wayland	3.916549%	55,492,666	18,058,289	67,012,430	55,492,666	45,756,887
Town of Westford	3.733888%	52,904,581	24,100,833	63,887,087	52,904,581	43,622,866
Town of Weston	4.475919%	63,418,247	19,031,657	76,583,290	63,418,247	52,291,984
Town of Wilmington	5.794710%	82,103,885	21,440,286	99,147,897	82,103,885	67,699,368
Acton-Boxborough RSD	1.936262%	27,434,445	12,732,786	33,129,579	27,434,445	22,621,272
Acton Water Supply	0.234270%	3,319,310	1,136,133	4,008,376	3,319,310	2,736,967
Bedford Housing Authority	0.022049%	312,414	113,686	377,260	312,414	257,598
Billerica Housing Authority	0.094842%	1,343,792	293,891	1,622,753	1,343,792	1,108,035
Chelmsford Housing Authority	0.084238%	1,193,547	1,482,827	1,441,318	1,193,547	984,149
Chelmsford Water District	0.082234%	1,165,154	1,282,932	1,407,030	1,165,154	960,737

SECTION 3: Supplemental Information for the Middlesex County Retirement System

Employer Name	Employer's Proportionate Share Allocation (1)	Net Pension Liability (2)	Covered Employee Payroll (3)	Discount Rate Sensitivity		
				1% Decrease (6.75%) (4)	Current Discount (7.75%) (5)	1% Increase (8.75%) (6)
Dracut Housing Authority	0.134332%	1,903,315	303,854	2,298,430	1,903,315	1,569,395
Dracut Water Supply	0.180018%	2,550,634	656,312	3,080,121	2,550,634	2,103,143
E. Chelmsford Water	0.022704%	321,683	192,343	388,467	321,683	265,250
E. Middlesex Mosq Control	0.041358%	585,986	395,837	707,638	585,986	483,184
Greater Lowell RVTSD	1.054431%	14,939,992	4,776,265	18,041,389	14,939,992	12,318,876
Groton-Dunstable RSD	0.730718%	10,353,378	4,767,494	12,502,637	10,353,378	8,536,949
Hudson Housing Authority	0.101093%	1,432,356	325,812	1,729,708	1,432,356	1,181,066
Lincoln Sudbury	0.576549%	8,168,982	2,873,324	9,864,794	8,168,982	6,735,799
Nashoba Vally THSD	0.229711%	3,254,718	891,111	3,930,371	3,254,718	2,683,705
N. Chelmsford Water	0.049912%	707,192	525,584	853,998	707,192	583,120
North Middlesex RSD	0.831369%	11,779,471	4,638,161	14,224,782	11,779,471	9,712,851
Shawsheen Valley RVS	0.596904%	8,457,396	2,792,305	10,213,070	8,457,396	6,973,606
South Middlesex RVTS	0.513438%	7,274,785	2,528,429	8,784,960	7,274,785	5,998,476
Sudbury Water District	0.141393%	2,003,371	792,652	2,419,244	2,003,371	1,651,889
Tewksbury Housing Authority	0.105581%	1,495,958	414,768	1,806,498	1,495,958	1,233,499
Wayland Housing Authority	0.042997%	609,217	271,439	735,682	609,217	502,332
Hopkinton Housing Authority	0.036291%	514,197	67,814	620,942	514,197	423,986
Sudbury Housing Authority	0.025971%	367,971	96,925	444,366	367,971	303,418
Wilmington Housing Authority	0.022518%	319,057	128,435	385,285	319,057	263,077

SECTION 3: Supplemental Information for the Middlesex County Retirement System

Employer Name	Employer's Proportionate Share Allocation (1)	Net Pension Liability (2)	Covered Employee Payroll (3)	Discount Rate Sensitivity		
				1% Decrease (6.75%) (4)	Current Discount (7.75%) (5)	1% Increase (8.75%) (6)
Acton Housing Authority	0.069927%	990,778	362,090	1,196,456	990,778	816,954
Burlington Housing Authority	0.003816%	54,061	106,507	65,292	54,061	44,582
Ayer Housing Authority	0.133515%	1,891,747	109,512	2,284,451	1,891,747	1,559,850
Holliston Housing Authority	0.015957%	226,087	55,583	273,025	226,087	186,425
Littleton Housing Authority	0.032097%	454,776	71,123	549,182	454,776	374,988
Westford Housing Authority	0.033738%	478,025	109,535	577,260	478,025	394,160
Shirley Water District	0.025399%	359,871	192,611	434,579	359,871	296,736
Tyngsboro Housing Authority	0.032123%	455,142	150,333	549,627	455,142	375,292
Pepperell Housing Authority	0.011246%	159,347	85,370	192,420	159,347	131,387
Groton Housing Authority	0.000954%	13,516	27,446	16,323	13,516	11,146
Tyngsboro Water District	0.028620%	405,503	193,260	489,690	405,503	334,366
North Reading Housing Authority	0.010379%	147,057	93,493	177,585	147,057	121,257
West Groton Water	0.000918%	13,002	113,366	15,707	13,002	10,725
Ayer-Shirley RSD	0.329463%	4,668,086	3,731,372	5,637,135	4,668,086	3,849,103
Grand Totals:	100.000000%	\$1,416,876,555	\$439,644,322	\$1,711,007,052	\$1,416,876,555	\$1,168,296,041

SECTION 3: Supplemental Information for the Middlesex County Retirement System

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	\$331,856	-\$331,856	\$0	25.13%	\$331,856	\$0	\$331,856
Middlesex County	0	0	0	N/A	0	0	0
Middlesex Hospital	0	0	0	N/A	0	0	0
Town of Acton	3,462,510	-3,462,510	0	26.59%	5,060,689	-505,394	4,555,295
Town of Ashby	173,361	-173,361	0	19.43%	153,750	-29,872	123,878
Town of Ashland	2,417,928	-2,447,482	-29,555	21.57%	3,522,694	545,326	4,068,020
Town of Ayer	1,429,491	-1,429,491	0	26.88%	1,886,942	-237,881	1,649,061
Town of Bedford	3,715,207	-3,715,207	0	20.47%	5,570,475	-314,827	5,255,648
Town of Billerica	9,826,635	-9,826,635	0	29.42%	15,921,035	87,166	16,008,201
Town of Boxborough	671,055	-671,055	0	23.93%	1,105,307	214,879	1,320,186
Town of Burlington	8,404,267	-8,404,267	0	26.80%	12,732,349	-205,684	12,526,665
Town of Carlisle	820,032	-820,032	0	16.07%	1,106,574	127,553	1,234,127
Town of Chelmsford	7,552,208	-7,552,208	0	32.37%	11,099,458	-651,330	10,448,128
Town of Dracut	4,233,672	-4,233,672	0	29.23%	6,405,387	26,790	6,432,177
Town of Dunstable	228,686	-228,686	0	19.23%	243,651	-47,699	195,952
Town of Groton	1,839,040	-1,839,040	0	26.08%	2,483,929	-37,541	2,446,388
Town of Holliston	1,978,920	-2,064,334	-85,414	20.05%	2,679,681	-89,025	2,590,656
Town of Hopkinton	1,836,364	-1,836,364	0	13.67%	2,363,296	341,256	2,704,552
Town of Hudson	4,686,376	-4,686,376	0	21.97%	6,914,837	30,051	6,944,888

SECTION 3: Supplemental Information for the Middlesex County Retirement System

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 Lincoln	1,922,136	-1,922,136	0	20.30%	2,832,073	-19,793	2,812,280
Town of Littleton	1,875,271	-2,575,271	-700,000	23.24%	2,654,282	435,791	3,090,073
Town of North Reading	3,499,063	-3,499,063	0	27.22%	5,261,468	-269,018	4,992,450
Town of Pepperell	1,074,825	-1,074,825	0	24.40%	1,832,050	467,999	2,300,049
Town of Sherborn	874,648	-880,589	-5,941	21.96%	1,189,436	-53,712	1,135,724
Town of Shirley	754,746	-754,746	0	37.63%	987,337	-184,385	802,952
Town of Stow	748,612	-748,612	0	22.18%	1,162,526	66,263	1,228,789
Town of Sudbury	3,961,686	-3,961,686	0	25.97%	6,245,193	-284,733	5,960,460
Town of Tewksbury	6,993,838	-6,993,838	0	34.00%	10,357,393	-367,309	9,990,084
Town of Townsend	690,007	-690,007	0	24.08%	1,015,640	223,541	1,239,181
Town of Tyngsborough	1,530,059	-1,530,059	0	20.69%	2,519,882	571,020	3,090,902
Town of Wayland	4,235,414	-4,235,414	0	23.45%	6,147,689	-482,325	5,665,364
Town of Westford	4,238,879	-4,238,879	0	17.59%	5,860,972	492,616	6,353,588
Town of Weston	4,557,886	-4,557,886	0	23.95%	7,025,716	-332,076	6,693,640
Town of Wilmington	5,704,192	-6,204,192	-500,000	28.94%	9,095,783	-111,217	8,984,566
Acton-Boxborough RSD	2,086,065	-2,086,065	0	16.38%	3,039,292	334,242	3,373,534
Acton Water Supply	177,725	-177,725	0	15.64%	367,727	27,005	394,732
Bedford Housing Authority	27,786	-27,786	0	24.44%	34,609	6,404	41,013
Billerica Housing Authority	87,992	-87,992	0	29.94%	148,870	23,420	172,290
Chelmsford Housing Authority	99,778	-99,778	0	6.73%	132,225	4,900	137,125
Chelmsford Water District	199,317	-699,317	-500,000	54.51%	129,080	113,519	242,599

SECTION 3: Supplemental Information for the Middlesex County Retirement System

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)
Dracut Housing Authority	118,166	-118,166	0	38.89%	210,857	-30,604	180,253
Dracut Water Supply	158,353	-158,353	0	24.13%	282,569	-40,749	241,820
E. Chelmsford Water	26,158	-26,158	0	13.60%	35,639	5,344	40,983
E. Middlesex Mosq Control	39,549	-39,549	0	9.99%	64,919	17,500	82,419
Greater Lowell RVTSD	1,195,581	-1,195,581	0	25.03%	1,655,109	-250,131	1,404,978
Groton-Dunstable RSD	752,342	-752,342	0	15.78%	1,146,986	244,745	1,391,731
Hudson Housing Authority	96,064	-96,064	0	29.48%	158,683	-29,434	129,249
Lincoln Sudbury	586,204	-586,204	0	20.40%	904,992	-120,178	784,814
Nashoba Vally THSD	246,363	-246,363	0	27.65%	360,570	-62,938	297,632
N. Chelmsford Water	42,129	-42,129	0	8.02%	78,345	-11,523	66,822
North Middlesex RSD	890,539	-890,539	0	19.20%	1,304,975	-26,630	1,278,345
Shawsheen Valley RVS	554,980	-554,980	0	19.88%	936,941	21,349	958,290
South Middlesex RVTS	523,099	-523,099	0	20.69%	805,928	20,161	826,089
Sudbury Water District	88,372	-88,372	0	11.15%	221,940	56,228	278,168
Tewksbury Housing Authority	105,697	-105,697	0	25.48%	165,727	19,307	185,034
Wayland Housing Authority	32,430	-32,430	0	11.95%	67,491	22,490	89,981
Hopkinton Housing Authority	31,500	-31,500	0	46.45%	56,965	6,596	63,561
Sudbury Housing Authority	24,229	-24,229	0	25.00%	40,766	16,740	57,506
Wilmington Housing Authority	24,960	-24,960	0	19.43%	35,345	4,185	39,530

SECTION 3: Supplemental Information for the Middlesex County Retirement System

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)
Acton Housing Authority	69,434	-69,434	0	19.18%	109,762	16,810	126,572
Burlington Housing Authority	15,711	-15,711	0	14.75%	5,990	817	6,807
Ayer Housing Authority	49,993	-49,993	0	45.65%	209,574	224,363	433,937
Holliston Housing Authority	21,320	-21,320	0	38.36%	25,047	2,472	27,519
Littleton Housing Authority	31,258	-31,258	0	43.95%	50,381	6,097	56,478
Westford Housing Authority	37,649	-37,649	0	34.37%	52,958	4,317	57,275
Shirley Water District	19,279	-19,279	0	10.01%	39,868	-6,158	33,710
Tyngsboro Housing Authority	33,609	-33,609	0	22.36%	50,423	-186	50,237
Pepperell Housing Authority	9,474	-9,474	0	11.10%	17,654	8,832	26,486
Groton Housing Authority	2,363	-2,363	0	8.61%	1,497	1,221	2,718
Tyngsboro Water District	29,869	-29,869	0	15.46%	44,924	3,187	48,111
North Reading Housing Authority	10,855	-10,855	0	11.61%	16,293	10,605	26,898
West Groton Water	5,849	-5,849	0	5.16%	1,442	1,758	3,200
Ayer-Shirley RSD	425,887	-425,887	0	11.41%	517,149	-52,513	464,636
Grand Totals:	\$105,246,797	-\$107,067,707	-\$1,820,910	24.35%	\$157,298,862	\$0	\$157,298,862

SECTION 3: Supplemental Information for the Middlesex County Retirement System

Employer Name	Deferred Outflows of Resources					Deferred Inflows of Resources				
	Differences Between Expected and Actual Experience (14)	Net Difference Between Projected and Actual Investment Earnings on Pension Plan Investments (15)	Changes of Assumptions (16)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (17)	Total Deferred Outflows of Resources (18)	Differences Between Expected and Actual Experience (19)	Net Difference Between Projected and Actual Investment Earnings on Pension Plan Investments (20)	Changes of Assumptions (21)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (22)	Total Deferred Inflows of Resources (23)
Middlesex County Retirement Board	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Middlesex County	0	0	0	0	0	0	0	0	0	0
Middlesex Hospital	0	0	0	0	0	0	0	0	0	0
Town of Acton	205,732	1,896,570	2,488,985	177,428	4,768,715	0	0	0	2,216,755	2,216,755
Town of Ashby	6,250	57,620	75,619	122,130	261,619	0	0	0	263,980	263,980
Town of Ashland	143,208	1,320,182	1,732,556	2,033,650	5,229,596	0	0	0	0	0
Town of Ayer	76,710	707,159	928,049	214,679	1,926,597	0	0	0	1,198,726	1,198,726
Town of Bedford	226,456	2,087,618	2,739,710	62,623	5,116,407	0	0	0	1,309,434	1,309,434
Town of Billerica	647,236	5,966,645	7,830,394	2,861,413	17,305,688	0	0	0	2,084,460	2,084,460
Town of Boxborough	44,934	414,230	543,620	905,686	1,908,470	0	0	0	64,434	64,434
Town of Burlington	517,607	4,771,637	6,262,112	63,150	11,614,506	0	0	0	715,135	715,135
Town of Carlisle	44,985	414,705	544,243	430,628	1,434,561	0	0	0	0	0
Town of Chelmsford	451,225	4,159,687	5,459,012	3,758	10,073,682	0	0	0	2,304,447	2,304,447
Town of Dracut	260,397	2,400,514	3,150,342	246,996	6,058,249	0	0	0	139,088	139,088
Town of Dunstable	9,905	91,312	119,834	89,707	310,758	0	0	0	293,604	293,604
Town of Groton	100,979	930,889	1,221,663	209,922	2,463,453	0	0	0	325,239	325,239
Town of Holliston	108,937	1,004,250	1,317,939	567,559	2,998,685	0	0	0	1,048,263	1,048,263
Town of Hopkinton	96,075	885,680	1,162,332	1,113,291	3,257,378	0	0	0	58,200	58,200
Town of Hudson	281,108	2,591,438	3,400,903	176,123	6,449,572	0	0	0	114,625	114,625

SECTION 3: Supplemental Information for the Middlesex County Retirement System

Employer Name	Deferred Outflows of Resources					Deferred Inflows of Resources				
	Differences Between Expected and Actual Experience (14)	Net Difference Between Projected and Actual Investment Earnings on Pension Plan (15)	Changes of Assumptions (16)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (17)	Total Deferred Outflows of Resources (18)	Differences Between Expected and Actual Experience (19)	Net Difference Between Projected and Actual Investment Earnings on Pension Plan (20)	Changes of Assumptions (21)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (22)	Total Deferred Inflows of Resources (23)
Town of Lincoln	115,132	1,061,362	1,392,890	179,315	2,748,699	0	0	0	313,724	313,724
Town of Littleton	107,904	994,732	1,305,448	1,540,528	3,948,612	0	0	0	0	0
Town of North Reading	213,894	1,971,813	2,587,732	0	4,773,439	0	0	0	994,412	994,412
Town of Pepperell	74,478	686,588	901,051	1,952,591	3,614,708	0	0	0	136,759	136,759
Town of Sherborn	48,354	445,759	584,997	130,400	1,209,510	0	0	0	369,567	369,567
Town of Shirley	40,138	370,019	485,599	70,230	965,986	0	0	0	800,253	800,253
Town of Stow	47,260	435,674	571,762	290,735	1,345,431	0	0	0	39,601	39,601
Town of Sudbury	253,885	2,340,479	3,071,554	0	5,665,918	0	0	0	1,015,336	1,015,336
Town of Tewksbury	421,058	3,881,587	5,094,045	3,851	9,400,541	0	0	0	1,149,751	1,149,751
Town of Townsend	41,289	380,626	499,519	836,372	1,757,806	0	0	0	494	494
Town of Tyngsborough	102,440	944,363	1,239,346	2,340,683	4,626,832	0	0	0	146,747	146,747
Town of Wayland	249,921	2,303,938	3,023,599	138,717	5,716,175	0	0	0	2,073,934	2,073,934
Town of Westford	238,265	2,196,487	2,882,584	1,682,233	6,999,569	0	0	0	0	0
Town of Weston	285,616	2,632,992	3,455,436	0	6,374,044	0	0	0	1,218,258	1,218,258
Town of Wilmington	369,770	3,408,780	4,473,551	280,816	8,532,917	0	0	0	544,262	544,262
Acton-Boxborough RSD	123,556	1,139,020	1,494,806	1,284,273	4,041,655	0	0	0	0	0
Acton Water Supply	14,949	137,811	180,858	198,888	532,506	0	0	0	87,266	87,266
Bedford Housing Authority	1,407	12,970	17,022	23,971	55,370	0	0	0	0	0
Billerica Housing Authority	6,052	55,791	73,219	117,805	252,867	0	0	0	20,821	20,821
Chelmsford Housing Authority	5,375	49,554	65,032	46,456	166,417	0	0	0	39,710	39,710
Chelmsford Water District	5,247	48,375	63,485	1,135,948	1,253,055	0	0	0	737,955	737,955

SECTION 3: Supplemental Information for the Middlesex County Retirement System

Employer Name	Deferred Outflows of Resources					Deferred Inflows of Resources				
	Differences Between Expected and Actual Experience (14)	Net Difference Between Projected and Actual Investment Earnings on Pension Plan (15)	Changes of Assumptions (16)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (17)	Total Deferred Outflows of Resources (18)	Differences Between Expected and Actual Experience (19)	Net Difference Between Projected and Actual Investment Earnings on Pension Plan (20)	Changes of Assumptions (21)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (22)	Total Deferred Inflows of Resources (23)
Dracut Housing Authority	8,572	79,022	103,705	0	191,299	0	0	0	106,881	106,881
Dracut Water Supply	11,487	105,897	138,975	0	256,359	0	0	0	149,078	149,078
E. Chelmsford Water	1,449	13,356	17,528	17,575	49,908	0	0	0	0	0
E. Middlesex Mosq Control	2,639	24,329	31,929	63,052	121,949	0	0	0	4,376	4,376
Greater Lowell RVTSD	67,285	620,277	814,027	56,100	1,557,689	0	0	0	1,016,814	1,016,814
Groton-Dunstable RSD	46,628	429,850	564,119	924,844	1,965,441	0	0	0	22,077	22,077
Hudson Housing Authority	6,451	59,469	78,044	0	143,964	0	0	0	108,729	108,729
Lincoln Sudbury	36,791	339,159	445,099	0	821,049	0	0	0	456,759	456,759
Nashoba Vally THSD	14,658	135,129	177,338	943	328,068	0	0	0	226,151	226,151
N. Chelmsford Water	3,185	29,361	38,532	42,984	114,062	0	0	0	99,673	99,673
North Middlesex RSD	53,051	489,059	641,822	79,569	1,263,501	0	0	0	209,457	209,457
Shawsheen Valley RVS	38,089	351,133	460,813	254,583	1,104,618	0	0	0	143,320	143,320
South Middlesex RVTS	32,763	302,034	396,377	108,222	839,396	0	0	0	25,724	25,724
Sudbury Water District	9,023	83,175	109,156	295,530	496,884	0	0	0	67,701	67,701
Tewksbury Housing Authority	6,737	62,109	81,509	88,470	238,825	0	0	0	10,329	10,329
Wayland Housing Authority	2,744	25,293	33,194	98,444	159,675	0	0	0	13,262	13,262
Hopkinton Housing Authority	2,316	21,348	28,017	32,086	83,767	0	0	0	8,952	8,952
Sudbury Housing Authority	1,657	15,278	20,050	65,366	102,351	0	0	0	2,793	2,793
Wilmington Housing Authority	1,437	13,246	17,384	16,988	49,055	0	0	0	659	659

SECTION 3: Supplemental Information for the Middlesex County Retirement System

Employer Name	Deferred Outflows of Resources					Deferred Inflows of Resources				
	Differences Between Expected and Actual Experience (14)	Net Difference Between Projected and Actual Investment Earnings on Pension Plan (15)	Changes of Assumptions (16)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (17)	Total Deferred Outflows of Resources (18)	Differences Between Expected and Actual Experience (19)	Net Difference Between Projected and Actual Investment Earnings on Pension Plan (20)	Changes of Assumptions (21)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (22)	Total Deferred Inflows of Resources (23)
Acton Housing Authority	4,462	41,135	53,984	67,635	167,216	0	0	0	4,162	4,162
Burlington Housing Authority	244	2,245	2,946	44,837	50,272	0	0	0	53,408	53,408
Ayer Housing Authority	8,520	78,541	103,074	982,492	1,172,627	0	0	0	84,855	84,855
Holliston Housing Authority	1,018	9,387	12,319	13,186	35,910	0	0	0	6,549	6,549
Littleton Housing Authority	2,048	18,881	24,779	36,372	82,080	0	0	0	9,770	9,770
Westford Housing Authority	2,153	19,847	26,046	14,836	62,882	0	0	0	0	0
Shirley Water District	1,621	14,941	19,608	9,640	45,810	0	0	0	35,526	35,526
Tyngsboro Housing Authority	2,050	18,897	24,799	12,013	57,759	0	0	0	9,841	9,841
Pepperell Housing Authority	718	6,616	8,682	36,509	52,525	0	0	0	2,024	2,024
Groton Housing Authority	61	561	736	3,983	5,341	0	0	0	0	0
Tyngsboro Water District	1,826	16,836	22,095	11,979	52,736	0	0	0	3,087	3,087
North Reading Housing Authority	662	6,106	8,013	41,405	56,186	0	0	0	178	178
West Groton Water	59	540	709	13,603	14,911	0	0	0	9,808	9,808
Ayer-Shirley RSD	21,024	193,809	254,347	175,100	644,280	0	0	0	423,718	423,718
Grand Totals:	\$6,381,162	\$58,825,722	\$77,200,603	\$25,140,901	\$167,548,388	\$0	\$0	\$0	\$25,140,901	\$25,140,901

SECTION 3: Supplemental Information for the Middlesex County Retirement System

Deferred Inflows/(Outflows) Recognized In Future Pension Expense (Year Ended June 30):						
Employer Name	2018 (24)	2019 (25)	2020 (26)	2021 (27)	2022 (28)	Thereafter (29)
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	785,197	785,197	752,488	229,078	0	0
Town of Ashby	9,338	9,338	8,341	-29,378	0	0
Town of Ashland	1,443,693	1,443,693	1,420,930	921,280	0	0
Town of Ayer	243,332	243,332	231,138	10,069	0	0
Town of Bedford	1,105,770	1,105,770	1,069,780	525,653	0	0
Town of Billerica	4,147,390	4,147,390	4,044,517	2,881,931	0	0
Town of Boxborough	496,757	496,757	489,612	360,910	0	0
Town of Burlington	3,041,353	3,041,353	2,959,083	1,857,582	0	0
Town of Carlisle	409,754	409,754	402,606	212,447	0	0
Town of Chelmsford	2,179,282	2,179,283	2,107,562	1,303,108	0	0
Town of Dracut	1,660,308	1,660,309	1,618,920	979,624	0	0
Town of Dunstable	14,437	14,437	12,862	-24,582	0	0
Town of Groton	595,917	595,917	579,869	366,511	0	0
Town of Holliston	594,354	594,354	577,040	184,674	0	0
Town of Hopkinton	943,950	943,950	928,683	382,595	0	0
Town of Hudson	1,793,492	1,793,492	1,748,811	999,152	0	0

SECTION 3: Supplemental Information for the Middlesex County Retirement System

Employer Name	Deferred Inflows/(Outflows) Recognized In Future Pension Expense (Year Ended June 30):					
	2018 (24)	2019 (25)	2020 (26)	2021 (27)	2022 (28)	Thereafter (29)
Town of Lincoln	702,450	702,450	684,148	345,927	0	0
Town of Littleton	1,112,694	1,112,693	1,095,538	627,687	0	0
Town of North Reading	1,072,775	1,072,775	1,038,782	594,695	0	0
Town of Pepperell	935,213	935,213	923,379	684,144	0	0
Town of Sherborn	249,621	249,621	241,939	98,762	0	0
Town of Shirley	67,408	67,408	61,030	-30,113	0	0
Town of Stow	362,734	362,734	355,221	225,141	0	0
Town of Sudbury	1,307,932	1,307,932	1,267,580	767,138	0	0
Town of Tewksbury	2,274,060	2,274,060	2,207,137	1,495,533	0	0
Town of Townsend	482,552	482,552	475,991	316,217	0	0
Town of Tyngsborough	1,213,647	1,213,647	1,197,366	855,425	0	0
Town of Wayland	1,085,475	1,085,475	1,045,749	425,542	0	0
Town of Westford	1,987,296	1,987,296	1,949,426	1,075,551	0	0
Town of Weston	1,459,641	1,459,641	1,414,243	822,261	0	0
Town of Wilmington	2,208,413	2,208,413	2,149,642	1,422,187	0	0
Acton-Boxborough RSD	1,109,330	1,109,330	1,089,689	733,306	0	0
Acton Water Supply	120,784	120,784	118,406	85,266	0	0
Bedford Housing Authority	15,230	15,230	15,005	9,905	0	0
Billerica Housing Authority	61,385	61,385	60,423	48,853	0	0
Chelmsford Housing Authority	38,621	38,621	37,767	11,698	0	0
Chelmsford Water District	146,437	146,437	145,602	76,624	0	0

SECTION 3: Supplemental Information for the Middlesex County Retirement System

Employer Name	Deferred Inflows/(Outflows) Recognized In Future Pension Expense (Year Ended June 30):					
	2018 (24)	2019 (25)	2020 (26)	2021 (27)	2022 (28)	Thereafter (29)
Dracut Housing Authority	23,169	23,169	21,809	16,271	0	0
Dracut Water Supply	31,312	31,312	29,489	15,168	0	0
E. Chelmsford Water	14,432	14,432	14,198	6,846	0	0
E. Middlesex Mosq Control	34,056	34,056	33,636	15,825	0	0
Greater Lowell RVTSD	171,959	171,959	161,263	35,694	0	0
Groton-Dunstable RSD	537,252	537,252	529,840	339,020	0	0
Hudson Housing Authority	11,034	11,034	10,007	3,160	0	0
Lincoln Sudbury	110,615	110,615	104,772	38,288	0	0
Nashoba Vally THSD	29,016	29,016	26,687	17,198	0	0
N. Chelmsford Water	8,457	8,457	7,951	-10,476	0	0
North Middlesex RSD	306,168	306,168	297,738	143,970	0	0
Shawsheen Valley RVS	260,290	260,290	254,234	186,484	0	0
South Middlesex RVTS	225,691	225,691	220,482	141,808	0	0
Sudbury Water District	112,828	112,828	111,392	92,135	0	0
Tewksbury Housing Authority	61,571	61,571	60,499	44,855	0	0
Wayland Housing Authority	39,702	39,702	39,266	27,743	0	0
Hopkinton Housing Authority	21,123	21,123	20,756	11,813	0	0
Sudbury Housing Authority	27,136	27,136	26,871	18,415	0	0
Wilmington Housing Authority	13,199	13,199	12,970	9,028	0	0

SECTION 3: Supplemental Information for the Middlesex County Retirement System

Employer Name	Deferred Inflows/(Outflows) Recognized In Future Pension Expense (Year Ended June 30):					
	2018 (24)	2019 (25)	2020 (26)	2021 (27)	2022 (28)	Thereafter (29)
Acton Housing Authority	44,802	44,802	44,092	29,358	0	0
Burlington Housing Authority	2,345	2,345	2,310	-10,136	0	0
Ayer Housing Authority	277,809	277,809	276,459	255,695	0	0
Holliston Housing Authority	8,860	8,860	8,701	2,940	0	0
Littleton Housing Authority	18,945	18,945	18,624	15,796	0	0
Westford Housing Authority	17,822	17,822	17,479	9,759	0	0
Shirley Water District	4,009	4,009	3,753	-1,487	0	0
Tyngsboro Housing Authority	12,673	12,673	12,346	10,226	0	0
Pepperell Housing Authority	13,334	13,334	13,224	10,609	0	0
Groton Housing Authority	1,603	1,603	1,593	542	0	0
Tyngsboro Water District	14,644	14,644	14,351	6,010	0	0
North Reading Housing Authority	14,760	14,760	14,657	11,831	0	0
West Groton Water	2,125	2,125	2,116	-1,263	0	0
Ayer-Shirley RSD	79,371	79,371	76,031	-14,211	0	0
Grand Totals:	\$40,030,134	\$40,030,135	\$39,015,901	\$23,331,317	\$0	\$0

SECTION 3: Supplemental Information for the Middlesex County Retirement System

EXHIBIT 7

Notes to Required Supplementary Information

Valuation date	Actuarial determined contributions for fiscal 2016 and 2017 are determined with the January 1, 2014 actuarial valuation.
Actuarial cost method	Entry Age Normal Cost Method
Amortization method	Prior year's total contribution increased by 6.5% for fiscal 2016 through fiscal 2020, 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, 2014, 5 years remaining for 2002 ERI liability, 6 years remaining for 2003 ERI liability, 8 years remaining for 2010 ERI liability and 21 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	7.875%
Discount rate	7.875%
Inflation rate	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	3.00% of first \$14,000 of retirement income
Plan membership:	
Retired participants and beneficiaries in pay status or with suspended benefits	5,077
Inactive participants entitled to a return of their employee contributions	2,632
Inactive participants with a vested right to a deferred or immediate benefit	384
Active participants	<u>9,082</u>
Total	17,175

SECTION 3: Supplemental Information for the Middlesex County Retirement System

EXHIBIT I

Actuarial Assumptions and Actuarial Cost Method*

Mortality Rates:

<i>Pre-Retirement:</i>	RP-2000 Employee Mortality Table projected generationally from 2009 with Scale BB2D (Previously, RP-2000 Employee Mortality Table projected 22 years with Scale AA)
<i>Healthy Retiree:</i>	RP-2000 Healthy Annuitant Mortality Table projected generationally from 2009 with Scale BB2D (Previously, RP-2000 Healthy Annuitant Mortality Table projected 17 years with Scale AA)
<i>Disabled Retiree:</i>	RP-2000 Healthy Annuitant Mortality Table projected generationally from 2015 with Scale BB2D (Previously, RP-2000 Healthy Annuitant Mortality Table set forward 3 years projected 17 years with Scale AA)

The underlying tables with generational projection to the ages of participants as of the measurement date reasonably reflect the 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 years' assumption over the most recent six years. The mortality tables were then adjusted to future years using the generational projection to reflect future mortality improvement between the measurement date and those years.

* Same assumptions used in the January 1, 2016 Actuarial Valuation and Review.

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Termination Rates before Retirement:	Groups 1 and 2 - Rate (%)				
	Mortality				Disability
	Age	Current		Previous	
Male		Female	Male	Female	
20	0.03	0.02	0.02	0.01	0.02
25	0.04	0.02	0.03	0.02	0.02
30	0.04	0.03	0.04	0.02	0.03
35	0.08	0.05	0.07	0.04	0.06
40	0.11	0.07	0.09	0.05	0.10
45	0.15	0.11	0.11	0.08	0.15
50	0.21	0.17	0.14	0.11	0.19
55	0.30	0.25	0.20	0.21	0.24
60	0.49	0.39	0.34	0.35	0.28

*Notes: Mortality rates do not reflect generational projections.
 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.*

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Group 4 – Rate (%)					
Mortality					
Age	Current		Previous		Disability
	Male	Female	Male	Female	
20	0.03	0.02	0.02	0.01	0.20
25	0.04	0.02	0.03	0.02	0.20
30	0.04	0.03	0.04	0.02	0.30
35	0.08	0.05	0.07	0.04	0.30
40	0.11	0.07	0.09	0.05	0.30
45	0.15	0.11	0.11	0.08	1.00
50	0.21	0.17	0.14	0.11	1.25
55	0.30	0.25	0.20	0.21	1.20
60	0.49	0.39	0.34	0.35	0.85

*Notes: Mortality rates do not reflect generational projections.
 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.*

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Withdrawal Rates:

Years of Service	Rate per year (%)	
	Groups 1 and 2	Years of Service
0	15.0	0 – 10
1	12.0	11+
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 six years.

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Retirement Rates:	Rate per year (%)			
	Groups 1 and 2			
	Age	Male	Female	Group 4
	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 six years.

Retirement Age for Inactive Vested Participants:

Age 60 for Group 1 and Group 2 members and age 55 for Group 4 members hired prior to April 2, 2012. For members hired April 2, 2012 or later, age 60 for Group 1 members, age 55 for Group 2 members and age 50 for Group 4 members.

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 spouses.

Benefit Election:

All participants are assumed to elect Option A. The benefit election reflects the fact that all benefit options are actuarially equivalent.

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Net Investment Return: 7.75% (previously, 7.875%)

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.

Interest on Employee Contributions: 3.5%

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%	4.75%
9+	4.25%	4.50%	4.75%

Includes an allowance for inflation of 3.5% per year (previously, 4.0%).

The salary scale assumption is a long-term estimate derived from historical data, current and recent market expectations, and professional judgment.

Administrative Expenses: \$3,500,000 for calendar year 2016, increasing 3.5% per year (previously, \$3,400,000 for calendar year 2014, increasing 4.0% per year).

The administrative expense assumption is based on information on expenses provided by the Retirement System.

2015 Salary: 2015 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.

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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 at 20% per year 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 age of the participant less total creditable service. Normal Cost and Actuarial Accrued Liability are calculated on an individual basis and are allocated by salary. Normal Cost is determined by using the plan of benefits applicable to each participant.

**Justification for
Changes in Assumptions:**

This valuation reflects the following:

- 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 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.

SECTION 3: Supplemental Information for the Middlesex County Retirement System

EXHIBIT II
Summary of Plan Provisions

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

Plan Year: January 1 – December 31

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:

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

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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.

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

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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

<u>Date of Hire</u>	<u>Contribution Rate</u>
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%

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%.

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.

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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 Benefits

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.

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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 (previously, \$9,000) 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.

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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

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.

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Appendix A

Glossary

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's 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.

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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.

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Collective pension expense:	Pension expense arising from certain changes in the collective net pension liability.
Contributions:	Additions to a pension plan's fiduciary net position for amounts from employers, nonemployer 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.

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- 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's 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.

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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 <i>normal cost</i> . 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 <i>actuarial accrued liability</i> .
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:	The liability of employers and nonemployer contributing entities to employees for benefits provided through a defined benefit pension plan.
Nonemployer 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 nonemployer 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.

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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:	<p>Circumstances in which a nonemployer 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:</p> <p>The amount of contributions for which the nonemployer entity legally is responsible is <i>not</i> dependent upon one or more events or circumstances unrelated to the pensions.</p> <p>The nonemployer entity is the only entity with a legal obligation to make contributions directly to a pension plan.</p>

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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:

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.

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